04/08/1970

Canadair ~~CL~~ CL44 Modified
"Guppy"

+++++++++++++++++++++++++++++++++++++++

+ DATA REPORT CANADAIR - CL44 ACCIDENT +

+ EVENTS I PHASES: AIRFRAME FAILURE I AERIAL WORK +

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<--------------- OPERATION --------------->++<--------------- FILE DATA --------------->

TYPE : MISCELLANEOUS - TEST/EXPERIMENTAL ++ ICAO FILE : 70/1419-0

++ FROM STATE : UNITED STATES

++

<-------------------- WHEN -------------------->++<------------- AIRCRAFT DATA ------------->

DATE : 70-04-08 ++ MASS CATEGORY : 27 001 - 272 000 KG

TIME : 15:00 ++ STATE OF REGISTRY : UNITED STATES

LIGHT : DAYLIGHT ++ REGISTRATION : N447T

++

<-------------------- WHERE -------------------->++<-------- DAMAGE, INJURY AND TOTAL ON BOARD -------->

LOCATION : NEAR SANTA BARBARA,CAL ++ A/C DAMAGE : SUBSTANTIAL

STATE/AREA : UNITED STATES ++ INJURY : FATAL SERIOUS MINOR NONE UNKNOWN TOTAL

DEPARTED : SANTA BARBARA,CAL ++ CREW :

DESTINATION : LOCAL ++ PAX :

OTHER DAMAGE :

REMARK: FAA CERTIFICATION VD MD FLIGHT TEST. BUFFETING CAUSED DAMAGE TO BOTH HORIZONTAL AND VERTICAL STABILIZER.

----------------- EVENTS AND FACTORS -----------------

1. EVENT I PHASE: AIRFRAME FAILURE I AERIAL WORK

"Conroy 103"

"Skymonster"

Conroy Aircraft Corp

05/12
~~12/05~~/1970

B 377 Modified

"Pregnant Guppy

5/12/70

AviationSafetyNetwork

The AviationSafety Network ••••••••••••••••••• Accident Description

Home
Accident reports
Accident specials
Airline safety
CVR / FDR
Database
Mailing list
News
Other sites
Pictures
Publications
Safety issues
Statistics
Forum
Guestbook
E-mail
About ASN...

Accident description

Date:	**12.05.1970**
Type:	Boeing 377 Pregnant Guppy PG
Operator:	Aero Spacelines
Registration:	N111AS
C/n:	0001
Year built:	
Crew:	4 fatalities / 4 on board
Passengers:	0 fatalities / 0 on board
Total:	4 fatalities / 4 on board
Location:	Mojave (USA)
Phase:	Take-off
Nature:	Test
Flight:	- (Flightnumber)

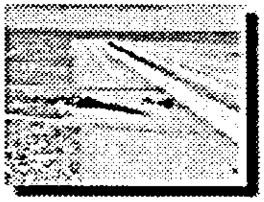
Remarks:
The wingtip struck the ground during a 3-engined take-off. The aircraft cartwheeled and caught fire.

Source: (also check out sources used for every accident)

WDAC

[legenda] [disclaimer]

377MGT-1 Accident



The accident occurred during the sixth takeoff of Flight Number 12 following the scheduled cut of the number one engine at an indicated airspeed of about 109 knots. The takeoff was being made on Runway Number 22 and the wind was from approximately 200 degrees at about 10 knots.

Rotation occured at about 114 knots and several seconds after rotation, according to one witness, the aircraft turned and rolled to the left, settling as it did so. The left wingtip subsequently contacted the ground which resulted in the aircraft being forcibly yawed from an initial magnetic heading of about 245 degrees, according to the flight data recorder, to a final heading measured as about 020 degrees. As a result of this cartwheeling action, the forward section ot the aircraft was rammed into the ground and was demolished, killing the four crewmembers.
(35K JPG image)

Lost in the accident was Pilot Van Shepard (ASI VP), Co-Pilot Hal Hanson (ASI Chief Pilot), Flight Engineer Travis Hodges and Flight Test Engineer Warren (Sam) Walker. The takeoff roll and scheduled engine cut were apparently routinely accomplished. The engine cut was scheduled to be made at a calibrated air speed of 112 knots, but was actually cut at about 108 knots at about 3 seconds preceding rotation.

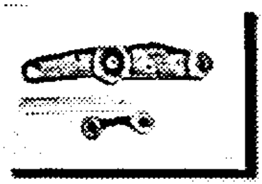
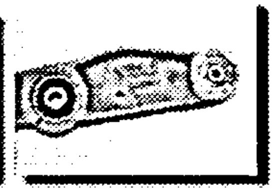
The test was to be conducted with the rudder boost on and according to data gathered from the flight data recorder, the right rudder pedal force utilized throughout the latter portion of the takeoff roll, as well as just following rotation, appeared normal and apparently effected the desired or required right rudder position.

One second after rotation there was a rapid reversal in rudder direction from right to left followed by an apparent divergence in directional sense between rudder pedal force and rudder position actually commanded, i.e., an increasing pedal force to the left is associated with an increasing right rudder position.
(40K JPG image)

A check of available parts of the engines and propellers did not find any abnormal operations of either the propellers or engines. The propeller blade shims were checked at the accident site by a representive from Hamilton Standard, manufacturers of the propellers. The propeller blade shims indicates the No.1 propeller was in a feathered position and Nos.2,3 and 4 were in normal operating positions.

The engines were taken to the Aero Spacelines' facilities at Santa Barbara Airport for disassembly and inspection. This inspection showed that the FOD damage found was caused at the time of impact and there was still some sand in the compressor section. There was some build up of aluminum on the thermocouples of Nos. 2, 3 and 4 engines, which is normal since the engines were operating at normal temperatures at the time of impact causing the blades to rub the case, throwing aluminum to the rear of the engines. Since the thermocouples were hot, the aluminum melted and stuck to them. The No.1 engine was shut down, therefore, the thermocouples were cool and the aluminum did not adhere to them. It was determined that the engines were operating normally at the time of impact.

(66K JPG image)

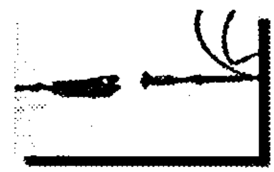
  

Examination of the Rudder System revealed the the Rudder Bell Crank Arm Assembly, Boeing P/N 15-23765 and the Rudder Boost Control Link Assembly, Boeing P/N 6-38900 were broken. The broken assemblies were removed and forwarded to the NTSB Metallurgist for fracture analysis. The fractures were typical of bending overload breaks.

A functional test of some of the Rudder Boost Package components after its removal, was performed at Hydro-Aire, Burbank, California. Under the direction of a Boeing expert hired under a contract with Boeing, an overall system check was performed at ASI in Santa Barbara, California. Upon completion of the functional testing, disassembly inspection of all components of the package was performed. There was nothing of significance found.

(17K JPG image)

The rudder cable system suffered severe impact and fire damage. The right rudder cable quick-disconnect was found unlatched and disconnected. Examination of all other cable disconnects revealed them to be latched and safety-wired. It could not be determined if the right rudder quick-disconnect was safety-wired prior to the accident, however it was the only latch found disconnected in the aircraft's quick-disconnect cable system.



The latch mechanism was forwarded to the NTSB for determination of safety wire installation prior to impact. It was noted that the latch handle portion of the disconnect assembly was subjected to severe heat and fire damage, but that the attaching clevis portion of the assembly was not.

(18K JPG image)

The pilot's rudder pedal assembly was not recovered. Only the co-pilot's rudder pedal assembly was recovered and its rudder pedal adjustment levers were found to be intact. Reviewing the maintenance records and pilot remarks noted in the aircraft logbook, there were several remarks written up regarding erratic rudder operation.

On March 18, 1970, prior to test flight No.2, the crew reported that the rudder moved sharply when the Gust Lock was released and hit the rudder stop hard. The crew was unable to activate the rudder boost system and elected to take off with the system inoperative. One quarter rudder was observed and the rudder could not be centered.

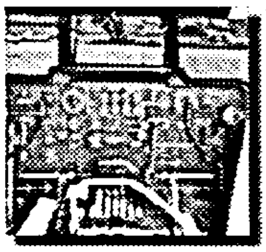
As the aircraft reached approximately 50 knots, an increased scrub of the nosewheel was felt by the pilots as increased right steering was needed as speed increased to counteract an apparent locked rudder. The takeoff was aborted when the aircraft left the centerline of the runway. High right rudder force would not move the rudder pedal. Inspection of the entire rudder system did not reveal any discrepancy; however, the inoperative rudder boost system was corrected by adjusting the Gust Lock switch and the cable system quick-disconnect latches were taped over to prevent possible interference with adjacent latches.

(14K JPG image)

On March 19, 1970, No.3 test flight the pilot reported directional control problems on a Post Summary Status Report Sheet and the Pilot Discrepancy Sheet. He remarked that "No.1 engine reduced to flight idle at V1. No problems encountered with VMCG; however, difficulty was encountered in maintaining directional control in flight at 121 knots. Trouble could have been in that the wing was allowed to drop excessively in the initial climb".

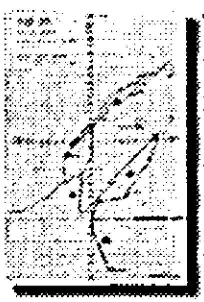
On March 20, 1970, No.4 test flight, the pilot remarked that at 120 knots the amount of rudder available varied from 9 to 21 degrees with rudder boost on and full rudder pedal. The corrective action written up was "bled excessive air from system, operation checks OK".

On a Pilot Summary Status Report Sheet dated March 25, 1970, it was noted that "No.1 engine to flight idle at V1, and no difficulty was encountered because of varying rudder position with full pedal. Shortly after takeoff, it was found that rudder control was normal with boost off. 20 to 23 degrees was available with approximately 200 lbs. of force. However, generally only 9 to 10 degrees of rudder deflection was available the majority of the time. With constant full pedal, rudder position was erratic above 10 degrees part of the time".
(18K JPG image)



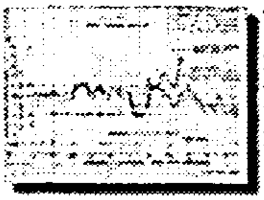
The recovery of the Photo Instrument Panel film made it possible to obtain complete data of the last flight of N111AS. This data included No.1 engine RPM, angle of attack, "g" load factor, side slip in degrees, elevator stick forces and elevator deflection, rudder position and forces, airspeed and aileron position. Two seperate tests were performed in an attempt to duplicate the traces of this data using the 377SGT N211AS nearing completion at ASI in Santa Barbara, California.

The first test was done on June 3, 1970. As no hydraulic power was available, the tests were made with the Rudder Boost System inoperative. Consequently, these tests were inconclusive. Test No.2 was performed on July 1, 1970 using the same aircraft. This test was made with the Rudder Boost System operating and produced traces with some simularity to the accident traces.
(11K JPG image)



This graph is a cross plot of rudder pedal force and rudder angle for flight 23, takeoff number 6, from counter number 8799 through time of impact. The dashed line represents the force vs. position relationship as defined by special calibration on May 7, 1970. The line is a bit misleading because it does not fully show the wide hysteresis band that exists with rudder boost on. In studying the data time histories and this cross plot, test engineers at ASI considered many possibilities such as cable binding, quick disconnect release, hydraulic problems, rudder boost system failures, etc.

After considering all possibilities it was concluded that the portions of the large plot marked "A" and "C" are periods during which the pilot's rudder pedals were jammed in a near-neutral position and the copilot was applying right pedal inputs. The section marked "B" appears to be a temporary release of the jammed condition with both pilot and copilot applying right rudder and then backing off. At counter 8801 the pedals get back to the position at which the jam occurred before. They then appear to bind again and remain that way until impact.
(109K JPG image)



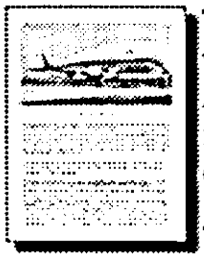
This graph is the time history of rudder position and pedal force for takeoff number 6. Superimposed on the flight test data are two additional calculated time histories. The green dashed line is the pedal force required to produce the measured rudder deflections assuming operation per the May 7 calibrations of force vs. position. The red dashed line is the calculated copilot's rudder pedal force input which, when added to the indicated force will yield the required force for measured rudder deflection. The calculated copilot rudder pedal forces are logical and consistent with the concept of a binding or jam in the pilot's pedals. ASI test engineers concluded that other types of failures did not fit the data.

An unlatched cable disconnect would have precluded the possibility of any further rudder movement; yet some rudder movement continued up to counter 8803. Cable binding, hydraulic problems, rudder boost system failures, etc. would not have generated the left force indications. Of the many tests and analyses performed, only a binding of the pilot's pedals and copilot right rudder inputs were able to produce the left force indications. This is what was reported to the NTSB. The actual cause of the accident remains undetermined.
(77K JPG image)

Comments or QuestionsEmail me

The Super Guppy had some operational problems. One was encountered during the terminal dive testing at Edwards AFB when the forward fuselage above the cockpit was crushed by the air pressure. The pilot looked up to see nothing but blue sky and a gaping hole the size of a barn door. If not for the fact that an aft entrance door blew out, equalizing the pressure, allowing the pilot to effect a safe landing. Internal bracing was added to strengthen that section of the fuslage as seen in this photo.

Shortly after take-off one day in 1967, the crew flying the Super Guppy heard an ominous noise coming from the rear of the cockpit. After making a hasty landing, while preparing to unload the S-IVB stage, they found a gap of almost a foot wide in the nose/fuselage joint resulting in a partial redesign in the hinge latching mechanism.
(44K JPG image)

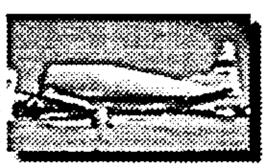


This promotional flyer was printed during Aero Spacelines' heyday. It promotes the virtues of the Super Guppy, but also contains interesting facts regarding the direction ASI was heading as a company, and the intended uses for the Guppy fleet which at first was to total six aircraft. Three built (the Mini Guppy had recently become commercially available), and three planned.

The new improved Super Guppy was going to be utilized ferrying Douglas DC-10 fuselage sections from San Diego, California and wing section from Toronto to Douglas' final assembly plant in Long Beach, California. It also was intended to carry Lockheed L-1011 wing sections from Nashville, Tennessee to the Lockheed final assembly plant in Palmdale, California.
(69K JPG image)


This is the NASA Super Guppy as it stands today. All wrapped for storage at Pima AFB in Arizona. For the purpose of scale, note the T-34 in the foreground under the Super Guppy's wing. The Super Guppy line of aircraft all had a larger internal volume than the Lockheed C-5 Galaxy! The Galaxy does though, have a greater lifting capacity in terms of weight.

(25K & 41K JPG images)


These pictures show better detail of the effort taken to preserve the 377SG. Note the tape sealing all joints. Even on the landing gear doors. The nacelles and entire propeller assembly are also wrapped. NASA did consider bringing the 377SG back into service for use ferrying components for the International Space Station Program. The problem they encountered was the shortage of available parts to maintain it's propellers.
(43K, 40K & 41K JPG images)

Movies

4

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+ DATA REPORT MISCELLANEOUS - EXPERIMENTAL ACCIDENT +

+ EVENTS I PHASES: POWER LOSS -FIRST ENGINE I TAKE-OFF RUN +

+ COLLISION WITH TERRAIN I INITIAL CLIMB +

++

<--------------- OPERATION ---------------> ++ <--------------- FILE DATA ---------------->

TYPE : MISCELLANEOUS - TEST/EXPERIMENTAL ++ ICAO FILE : 70/1473-0

++ FROM STATE : UNITED STATES

<------------------- WHEN -------------------> ++ <----------- AIRCRAFT DATA ------------>

DATE : 70-05-12 ++ MASS CATEGORY :

TIME : 07:19 ++ STATE OF REGISTRY : UNITED STATES

LIGHT : DAYLIGHT ++ REGISTRATION : N111AS

<------------------- WHERE -------------------> ++ <------- DAMAGE, INJURY AND TOTAL ON BOARD -------->

LOCATION : EDWARDS AFB,CALIF ++ A/C DAMAGE : DESTROYED

STATE/AREA : UNITED STATES ++ INJURY : FATAL SERIOUS MINOR NONE UNKNOWN TOTAL

DEPARTED : EDWARDS AFB,CALIF ++ CREW :

DESTINATION : LOCAL ++ PAX :

OTHER DAMAGE :

REMARK: PLANNED 3 ENGINE TAKE-OFF ON TEST FLIGHT. MISCELLANEOUS-CONTROL LOSS AT CRITICAL TIME - CAUSE UNDETERMINED

---------------- EVENTS AND FACTORS ----------------

1. EVENT I PHASE: POWER LOSS -FIRST ENGINE I TAKE-OFF RUN
2. EVENT I PHASE: COLLISION WITH TERRAIN I INITIAL CLIMB

05/22/1970

++ 05/22/70 6

+ DATA REPORT NORTH AMERICAN - 1121 JET COMMANDER
INCIDENT +
+ EVENTS | PHASES: MAIN GEAR COLLAPSED/RETRACTED | ABORTED TAKE-OFF
+

++

++

<--------------- OPERATION ---------------> ++ <--------------- FILE DATA --------------->

TYPE : MISCELLANEOUS - TEST/EXPERIMENTAL ++ ICAO FILE : 70/1584-0
++ FROM STATE : UNITED STATES
++

<-------------------- WHEN --------------------> ++ <------------ AIRCRAFT DATA ------------>

DATE : 70-05-22 ++ MASS CATEGORY : 2251 - 5700 KG
TIME : 10:09 ++ STATE OF REGISTRY :
LIGHT : DAYLIGHT ++ REGISTRATION :
++

<------------------- WHERE -------------------> ++ <------- DAMAGE, INJURY AND TOTAL ON BOARD -------->

LOCATION : POMONA,NJ ++ A/C DAMAGE : SUBSTANTIAL
STATE/AREA : UNITED STATES ++ INJURY : FATAL SERIOUS MINOR NONE UNKNOWN TOTAL
DEPARTED : POMONA,NJ ++ CREW :
DESTINATION : LOCAL ++ PAX :
OTHER DAMAGE :
REMARK: LEFT MAIN GEAR STRUT BROKE DURING REJECTED TAKE-OFF TESTS.

----------------- EVENTS AND FACTORS -----------------

1. EVENT | PHASE: MAIN GEAR COLLAPSED/RETRACTED | ABORTED TAKE-OFF

05/25/1970
&
10/17/1970

C-5

Electric YTF39-GE-1s being fitted for initial trials, and 182.8kN; [41,100lb] military thrust, TF39-GE-1s powering C-5As);

- an air-refueling receptacle mounted atop the fuselage immediately aft the cockpit (the C-5 becoming the first transport to incorporate this feature in its design);
- a high-flotation landing gear with four-wheel nose unit and 4 six-wheel main trucks, with two aft trucks slewing to improve crosswind sterring; and
- installation of a computerised Malfunction Detection, Analyis and Recording (MADAR) system to monitor 800 test points on the ground and in the air.

However, full-scale ground fatigue testing showed early wing cracking; notably, the C-5 wing was found to have a fatigue life of barely 25% of the design goal of 30,000 flying hours and payload had to be restricted under normal peacetime operations to only 22,680kg (50,000lb) or less than a third of the desgin payload. (Wartime load, however, was never reduced.) Although Lockheed devised a number of corrective measures, the air force lacked funds for their implementation and full resolution of these deficiencies had to await implementation of Pacer Wing modifiaction programmes.

As if structual deficiencies and peacetime restictions were not bad enough, the aif force and the manufacture had to contend with alarming programme cost overruns and ensuing sereve critcisms from the media and Congress. These overruns could partially be attritubured to Lockheed - to win the CX-HLS competiton it had submitted an overly optimistic bid - and to the Department of Defense. After inviting manufactures to submit bids based on 5 RDT&E aicraft, 53-aircraft production 'Run A' and 57-aircraft production 'Run B', the DoD was forced to limit 'Run B' to 23 aircraft to free funds for war operations in South East Asia, thus forcing Lockheed to recover development cost on a smaller production run. Overruns, however, were maimly beyond control of either contractor or customer as during the mid-1960's inflation was pmapant in the US ecomony. Inflation was even greater in the aircraft industry as lack of tooling and a shortage of skilled labour brought about by rapid increase in both military and commercial production forced all manufactures to pay premiums for materials, tools, and staff.

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66-8303/8307    Lockheed C-5A
                        c/n 500-0001/0005
                      8303 w/o Oct 17, 1970 in ground fire
67-0167/0174    Lockheed C-5A
                        c/n 500-0006/0013
                      0172 w/o in ground fire May 25, 1970
68-0211/0228    Lockheed C-5A
                        c/n 500-0014/0031
                      0213 converted to C-5C
                      0216 converted to C-5C
                      0218 w/o April 4, 1975 near Saigon.
                      0227 w/o Sept 27, 1974 in ground fire
                      0228 w/o Aug 29, 1990 at Ramstein
69-0001/0027    Lockheed C-5A
                        c/n 500-0032/0058
70-0445/0467    Lockheed C-5A
                        c/n 500-0059/0081
70-0468         Cancelled contract for Lockheed C-5A Galaxy
71-0180/0212    Cancelled contract for Lockheed C-5A Galaxy
72-0099/0112    Cancelled contract for Lockheed C-5A Galaxy
```

Past Service

So pressing were the requirments for heavy lift generated by combat operations in South East Asia and so

11/11/1970

11

+++
+ DATA REPORT CESSNA - 421 ACCIDENT +
+ EVENTS | PHASES: COLLISION WITH TREE | FINAL APPROACH

11/11/70

+

+++
++++++++++++++++++++++++++++++

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<------------ OPERATION ------------> ++ <------------ FILE DATA ------------>

TYPE : MISCELLANEOUS - TEST/EXPERIMENTAL ++ ICAO FILE : 70/1495-0

++ FROM STATE : UNITED STATES

++

<------------ WHEN ------------> ++ <------------ AIRCRAFT DATA ------------>

DATE : 70-11-11 ++ MASS CATEGORY : 2251 - 5700 KG

TIME : 11:56 ++ STATE OF REGISTRY : UNITED STATES

LIGHT : DAYLIGHT ++ REGISTRATION : N3155K

++

<------------ WHERE ------------> ++ <------- DAMAGE, INJURY AND TOTAL ON BOARD ------->

LOCATION : BATH,PA ++ A/C DAMAGE : DESTROYED

STATE/AREA : UNITED STATES ++ INJURY : FATAL SERIOUS MINOR NONE UNKNOWN TOTAL

DEPARTED : AMBLER,PA ++ CREW :

DESTINATION : LOCAL ++ PAX :

OTHER DAMAGE :

REMARK: VFR DAY ONLY, FAA AUTOPILOT CERTIFICATE TEST FLIGHT. VOR APP DESCENDED BELOW MDA. NO A/C, ENGINE OR SYSTEM MALFUNCTION FOUND.

------------ EVENTS AND FACTORS ------------

1. EVENT | PHASE: COLLISION WITH TREE | FINAL APPROACH

11/19/1970

11/19/70

AviationSafetyNetwork

Accident Description

Accident description

Date:	**19.11.1970**
Type:	IAI Arava 101
Operator:	Israeli Aircraft Industries - IAI
Registration:	4X-IAI
C/n:	002
Year built:	1969
Crew:	3 fatalities / 4 on board
Passengers:	0 fatalities / 0 on board
Total:	3 fatalities / 4 on board
Location:	Tulkarm; nr. (Israel)
Phase:	
Nature:	Test
Flight:	- (Flightnumber)
Remarks:	
Source:	

[disclaimer]

12/30/1970
&
06/30/1972
&
06/20/1973

F-14

12/30/70
6/30/72
6/20/73

F-14A in service with US Navy

The first F-14A was finally ready for rollout in late 1970. Taxi trials of the first F-14A Tomcat (BuNo 157980) began at Calverton on December 14, 1970. On December 21, project test pilot William (Bob) Millar and company chief test pilot Robert Smythe made the first flight, which was a short hop with the wings kept in the fully-forward position. This flight was uneventful.

Disaster struck on the second test flight on December 30. During this flight, the aircraft suffered a primary hydraulic system failure and began to trail smoke. Millar and Smythe immediately turned the plane back to the Calverton field, and used the emergency nitrogen bottle to blow down the landing gear in preparation for an emergency landing. However, just before reaching the end of the runway, the secondary hydraulic system also failed and both crewmen were forced to eject. Both Millar and Smythe survived with only minor injuries, but the aircraft was destroyed.

The second Tomcat (157981) went aloft for the first time on May 24, 1971, piloted by Robert Smythe. Twenty Tomcats were built in the initial run for flight trials. Tomcat #2 (157981) was assigned the job of the exploration of the low-speed flight regime and also was to carry out the stall/spin trials. It had its wings locked in the 20-degree (fully-open) position and the air intakes locked in the fully-open configuration. Tomcat #3 (157982) was to explore the outer reaches of the performance envelope and flew trials with steadily increasing loads and speeds. Tomcats Nos. 4, 5, and 6 (157983, 157984, and 157985) went to NAS Point Mugu, California for weapons system integration work. No. 7 (157986) later became the test ship for the F-14B with F401 engines. Nos. 9 and 11 (157988 and 157991) went to Point Mugu for radar evaluation and auxiliary weapons trials, respectively.

Tomcat #10 (157989) was delivered to the Naval Air Test Center at Patuxent River, Maryland for structural trials and carrier compatibility work. On June 30, 1972, it crashed into the water while preparing for an airshow at Patuxent, killing test pilot Bob Millar, who had survived the crash of the first F-14. It was replaced on carrier-compatibility tests by No. 17. No. 12 replaced the lost No. 1 on high speed flight trials. Completing the trials fleet were No. 8 (aerodynamic trials and production configuration), No. 13 (anechoic chamber work for compatibility of the electromagnetic systems), No. 14 (maintenance and reliability work), No. 20 (climatic trials at Point Mugu), and Nos. 15, 16, 18, and 19 (initial pilot conversion).

157984, Tomcat #5 assigned to Point Mugu for armament trials, had the rather dubious honor of shooting itself down on June 20, 1973. A AIM-7E-2 Sparrow missile pitched up moments after being launched, striking the Tomcat. The crew ejected safely.

Block 70 (beginning with 159978) introduced the production standard wing glove fairing with shorter outboard wing fences on the top.

The beaver tail and air brake were modified from BuNo 159241 onward (the first Block 75 Tomcat). Earlier aircraft had their beaver tails cut down (with dielectric fairings removed) to a similar shape. The last Block 85 aircraft (159588) introduced the new AN/ARC-159 UHF radio in place of the AN/ARC-51A.

From 159825 (the first Block 90), a small angle of attack probe was added to the tip of the nose radome. High angle of attack performance was also improved by the provision for automated maneuvering flaps.

~1971

Concorde

Icing Trials

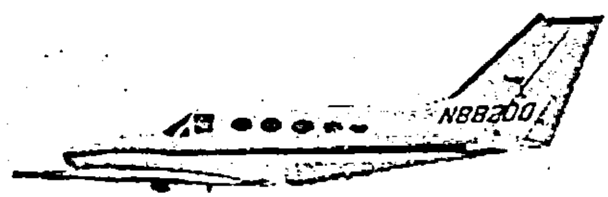
AVweb

Landing an Iced-Up Airframe

If you fly in honest-to-god weather, sooner or later you'll have to do it. Here's a survival guide from a 12,000-hour veteran test pilot.

by Leo Janssens (71333.3202@compuserve.com)

This article originally appeared in December 1994 issue of IFR magazine, and is reprinted by permission of Belvoir Publications.



As the prime winter icing season once again approaches, many of us will be confronted with this sinister hazard. Every year, almost without fail, there are between 30 and 40 accidents involving icing, about half of them fatal. As we've pointed out in previous issues, by heeding the pireps and taking decisive action at the first sign of ice, the icing risk is manageable, especially if you accept the notion that on some winter days, you'll simply have to cancel your flying. The risk of serious icing will be too great.

But what about on those gray, overcast days when ice may or may not be present and the forecasts and pireps offer no useful information? Sure, you can always cancel when cold clouds are present or plan your flight to avoid potentially ice bearing layers, but how realistic is that? If you fly during the winter at all, sooner or later, you'll pick up a load of ice. Maybe a lot of ice. The question then becomes: Now what?

In this article, we'll examine some of the aerodynamic considerations of flying and landing an iced up airframe. But don't get the impression that I'm suggesting these techniques make it safe to fly in ice. Far from it. I'm offering these observations strictly as a survival guide if you have to put an ice-laden airplane onto a runway some day.

The Great Unknown

Most pilots have heard this caution: When your airplane is carrying ice, you're a test pilot. If you've accumulated a lot of experience in flying iced up airplanes -- whether certified for known icing or not -- you might not take this warning too seriously. After all, if you've had ice dozens or even hundreds of times and survived it, the warning must surely be an overstatement. Maybe. But I wouldn't count on it.

Permit me a war story. In my flying career, I've been both a giver and a receiver of airframe and engine ice. Back in my Air Force test pilot days, around 1971, I flew the KC-135 water spray tanker, which we used to douse various airplanes to study the effect of airframe icing. The object was to control the amount of ice build-up up on the receiver aircraft to determine its flying characteristics and to see how well it would shed ice. Even though these tests were done under carefully controlled conditions and flown by real test pilots, the results were sometimes unpredictable.

We had been asked to fly the spray tanker over to England, to help the Brits with icing certification of the Concorde. Our flight trials were going well until about the fifth flight, when the British team was trying to determine the maximum amount of ice the engines could handle. We were at 16,000 feet, with the water spray giving them a good load right into the number two engine when suddenly, we heard, "Uh-oh, we have a slight problem here in the Concorde."

The engine had stalled and surged and the crew decided to shut it down. A ground inspection revealed several of the compressor guide vanes had sheared off and gone through the engine. Even 25 years ago, that was a $2 million engine and I doubt if the consortium had budgeted for that. The Brits decided they'd had enough icing tests, thank you. They later certified the airplane using natural icing. The point is, the outcome of that icing test was entirely unexpected, even though it was done under controlled conditions. If you pick up more than a trace of ice, the same may be true for your airplane.

Act Fast

Obviously, the best way to avoid an unpredictable outcome is to stay out of ice in the first place. When the pireps confirm that it's widely present, stay home, drive or go commercial if your only other choice is to fly an unprotected airplane. If you do encounter ice that continues to accumulate, don't hang around waiting for it to stop accreting. Formulate a plan right now. A couple of years ago, when we reviewed 170 icing accidents for an article, we found that many pilots underestimated both the rate of accretion and how it would affect aircraft performance.

In more than a few of these accidents, pilots reported icing to ATC then declined to divert or declare an emergency until it was too late. The accident data strongly suggests that once ice has accumulated to the point that the airplane will no longer maintain altitude, the chances of making it safely to an on-airport landing are poor. Given that the majority of icing accidents seem to involve experienced pilots, it's reasonable to assume that pilots fall into the trap of concluding that one icing event is just like the next. The facts suggest otherwise. Ice – and its effects on airframe and engine – is extremely variable. Just because you've survived 99 icing events, doesn't mean you'll survive the next. Resist the instinct to tell the controller you don't have a problem. If you've got ice, you've got a problem.

Drag and AOA

Even pilots with lots of experience flying in ice don't always understand the aerodynamic penalties of hauling around a load of it. Ice adds both weight and, more significantly, tremendous drag; cleaner airfoils on high performance airplanes may be more efficient collectors of ice and will suffer more from its effects.

Attaching meaningful numbers to the damage ice does to lift and drag is difficult, since it varies with airplane and airfoil. However, icing research done by Dennis Newton and reported in his excellent book Severe Weather Flying, revealed that typically, even a small

02/01/1972

VFW/Fokker VFW 614

VFW Fokker 614 Crash

Aircraft description from Wikipedia, https://en.wikipedia.org/wiki/VFW-Fokker_614

VFW 614

Muk Air VFW-614

Role	Regional airliner
Manufacturer	Fokker VFW
First flight	14 July 1971
Introduction	August 1975
Retired	7 December 2012

The **VFW-Fokker 614** (also **VFW 614**) was a twin-engined jetliner designed and constructed by West German aviation company VFW-Fokker. It holds the distinction of being the first jet-powered passenger liner to be developed and produced in West Germany (the East German Baade 152 being the first German jet airliner), as well as the first German-built civil aircraft to have been manufactured for a decade.[4]

The VFW 614 was originally proposed during the early 1960s as the E.614, which was a concept for a 36–40 seat aircraft by a consortium of West German aircraft companies, who were soon re-organised into Vereinigte Flugtechnische Werke (VFW). It was originally intended as a Douglas DC-3 replacement; its most distinctive feature was that its engines were mounted in pods on pylons above the wing. The VFW 614 was produced in small numbers during the early- to mid-1970s by VFW-Fokker, a company resulting from a merger between VFW and the Dutch aircraft company Fokker. However, the program was officially cancelled in 1977, the anticipated sales and thus production having not been achieved.

(Source Unknown) The crash:
But before it was that far, the airworthyness certification test programme had to be performed. It was planned to fly some 1200 hours divided over three prototypes.

The G01 had become damaged in October 1971 during a so-called flutter test. Small rockets at the tip of the horizontal stabiliser are ignited in opposite directions. Thus that part of the plane is brought into a short vibration. The result of the test has to be, that the stabiliser itself has to dampen the vibrations. Unfortunately this did not occur; during a short period the vibrations increased, the plane started to flutter. Luckily it passed soon; test pilot Leif Nielsen got the plane back under control. After the landing the matter was investigated and it appeared that the stabiliser was broken at three places. The plane had to be repaired and the tail had to be re-inforced. A flutter damper was mounted as well.

Meanwhile, the second prototype, G02, D-BABB, made its first flight on January 14, 1972.
On February 1, 1972 a simple verification flight was planned. It was the intention to see what the effect of the alterations of the tail would have on the airworthyness. The two hour lasting flight was executed by Leif Nielsen, Captain, with Hans Bardill as Copilot and Jurgen Hammer as Flight Engineer.

Towards the end of the flight, during the approach to the airport, the plane started unexpectedly to flutter severely. It was that serious, that after a short attempt to try to get the plane under control, Leif gave the order: "get out!" All three were able to abandon the plane via the slide/emergency exit. Bardill's parachute did not open; unfortunately he fell to his death. The G01 dove down with high speed and disappeared in a large crater that it made in the middle of the field.

Because of the crash of the first prototype and the investigation for its cause, the certification flights were halted for about six months. Both prototypes were flown to Fokker, Schiphol in 1972. The G01 arrived there in August, 1972. The third prototype, the G03 D-BABC, made its maiden flight October 10, 1972.

Continue or stop?
Solution for the flutter problem was, amongst others, further re-inforcement at the tail and the addition of hydraulic power operation of the elevator. These modifications were for a part built in at Schiphol. In addition both planes were subjected by Fokker experts to a thorough investigation, in co-operation with the German engineers.

After that it was up to Chief test pilot Jas Moll, together with his German colleague test pilots, to test it for flutter once more.

His opinion, if the VFW 614 was airworthy (or could be made airworthy), was crucial. After about a hundred flights came his oké: from an aeronautical point of view was it a good plane! He was full of praise for the nice flight characteristics. No cause was found to halt the programme! The extensive flight certification programme was completed in Torejon, Spain under German jurisdiction. On August 23, 1974 the airworthyness certificate was handed to VFW by the German LBA (Luftfahrtbundesamt, the same as in de US the FAA). FAA certification followed a year later.

History (Also source unknown):
Finally it appeared the tide had turned for the VFW 614, things were looking up again.

Although Lycoming abandoned the PLF1, development continued as using the Rolls-Royce/SNECMA M45H turbofan, which was developed specially for the VFW 614. In 1968, the project was given the go-ahead,[2] with 80 percent of the backing coming from the West German Government. Full scale production was approved in 1970, by which time VFW had merged with Fokker (a somewhat unhappy arrangement which lasted for only ten years). Also risk sharing agreements had been concluded with SIAT in Germany, Fairey and SABCA in Belgium and Shorts in the UK. Final assembly of the aircraft would be done in Bremen.

overwing pylon mounted Rolls Royce powerplant

The first of three prototypes flew on July 14, 1971.[3] The aircraft was revealed to be of unconventional configuration, with two quiet, smoke-free, but untested M45H turbofans mounted on pylons above the wings. This arrangement was used to avoid the structural weight penalties of rear mounted engines and the potential ingestion problems of engines mounted under the wings, and allowed a short and sturdy undercarriage, specially suited for operations from poorly prepared runways.

Development of the aircraft was protracted and orders slow to materialise, despite a strong marketing campaign. The orders situation was not helped by Rolls-Royce's bankruptcy in 1971 which threatened the supply of engines.[4] Also, the first prototype was lost on 1 February 1972 due to elevator flutter,[5] worsening the order situation. By February 1975 only 10 had been ordered. The first production VFW-614 flew in April 1975 and was delivered to Denmark's Cimber airlines 4 months later.[5]

AviationSafetyNetwork

The AviationSafety Network ••••••••••••••••••• Accident Description

Accident description

Date:	01 FEB 1972
Type:	VFW/Fokker VFW.614
Operator:	VFW-Fokker
Registration:	D-BABA
C/n:	G001
Year built:	1971
Crew:	1 fatalities / 3 on board
Passengers:	0 fatalities / 0 on board
Total:	1 fatalities / 3 on board
Location:	Bremen (Germany)
Phase:	Cruise
Nature:	Test
Flight:	- (Flightnumber)

Remarks:

The aircraft was at 300m at a speed of 405kmh when it entered a vertical dive during a flight test. The crew members parachuted from the plane, but the parachute of one of them didn't open. The accident was caused by tab flutter.

Source: (also check out sources used for every accident)

[legenda] [disclaimer]

AviationSafetyNetwork

The AviationSafetyNetwork

- Home
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- CVR / FDR
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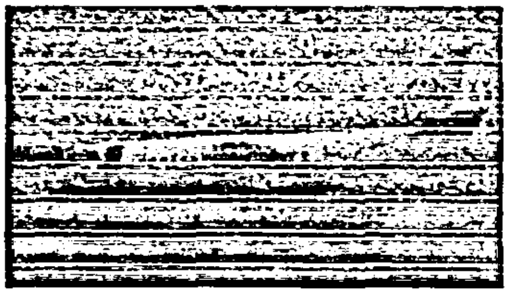
- Mailing list
- News
- Other sites
- Pictures
- Publications
- Safety issues
- Statistics
- Forum
- Guestbook
- E-mail
- About ASN...

Accident Database | Type index

VFW-614



VFW-614
- 1st flight: 1971
- Series:
- 2 jet engines
- max. passengers
- 19 built
- prod. ended: 1978

Relevant VFW-614 safety related information on the internet:

-

Listing of all accidents in which the aircraft involved was damaged beyond repair:

01 FEB 1972	VFW-614	D-BABA	1(3)
	VFW-Fokker	Bremen	

[disclaimer]

09/12/1972

REQUEST 075/98, REPORT 1

PRELIMINARY REPORT — SHORT-SC.7 (SKYVAN) SRS 1 TO 3 — INCIDENT

EVENTS|PHASES — LOSS OF DIRECTIONAL CONTROL-LANDING ROLL

OPERATION

TYPE : MISCELLANEOUS - TEST/EXPERIMENTAL

FINAL REP

DATE, TIME AND METEOROLOGICAL DATA

DATE : 72-09-12
TIME : 12:50
LIGHT : DAYLIGHT
GEN WEATHER :

LOCATION

LOCATION : PELABUHAN RATU
STATE/AREA : INDONESIA
DEPARTED : DJAKARTA
DESTINATION : PELABUHAN RATU

FILE DATA

ICAO FILE : 72/0645-0
FROM STATE : INDONESIA

AIRCRAFT DATA

MASS CATEGORY : 2250 - 5700 KG
STATE OF REGISTRY :
REGISTRATION :

DAMAGE, INJURY AND TOTAL ON BOARD

A/C DAMAGE : MINOR

INJURY :	FATAL	SERIOUS	MINOR	NONE	UNKNOWN	TOTAL
CREW :	0	0	0	3	0	3
PAX :	0	0	0	0	0	0

NARRATIVE

THE A/C WAS CARRYING OUT A RWY TEST ON A NEW AIRSTRIP AT PELABUHAN RATU, APPROX. 130 KM (80 MI) SSW OF DJAKARTA. THE FIRST LANDING WAS PERFORMED SUCCESSFULLY, DURING THE SECOND LANDING ON RWY 35 THE A/C TOUCHED THE GROUND ON THE CENTRELINE. AFTER TOUCHDOWN THE PROPELLERS WERE REVERSED AND AT THAT MOMENT THE A/C SWUNG TO THE RIGHT AND WENT OFF THE RWY. THE NOSE WHEEL STRUT AND THE FRONT SECTION OF THE FUSELAGE WERE DAMAGED.

06/03/1973

Russian SST Crash
@ Paris Airshow

AviationSafetyNetwork

Accident Description

Home
Accident reports
Accident specials
Aviation safety
CVR / FDR
Database
Mailing list
News
Other sites
Pictures
Publications
Safety issues
Statistics
UBB.classic™Forum
Guestbook
E-mail
About ASN...

Homepage > ASN Safety Database

Accident Description

Status: [legenda]

Date:	03 JUN 1973
Type:	Tupolev 144S
Operator:	Tupolev
Registration:	CCCP-77102
Msn / C/n:	01-2
Year built:	1972
Crew:	6 fatalities / 6 on board
Passengers:	0 fatalities / 0 on board
Total:	6 fatalities / 6 on board
Ground casualties:	8 fatalities
Airplane damage:	Written off
Location:	Goussainville (France)
Phase:	Initial climb
Nature:	Demonstration
Departure airport:	Paris-Le Bourget Airport (LBG)
Destination airport:	Paris-Le Bourget Airport (LBG)

Narrative:
During a demonstration flight at the Paris Air Show '73 a low pass was made over runway 06. At the end of the runway the aircraft entered a steep climb. During this maneuver, the left canard-wing separated, struck the wing and punctured the fuel tank. The Tupolev crashed in flames into the small town of Goussainville.
Airplane - Airframe - Wing

Source: (also check out sources used for every accident)
Soviet Transports

SSSR-77102 during the flypast at the Paris Air Show just prior to the crash.

[disclaimer]

record last updated: 2004-08-01 (Minor update)

01/21/1974

YF-16

Unintentional F.F

01/21/74

made to size the aircraft to carry heat-seeking Sidewinder missiles plus an M61 cannon, but to make provisions to allow Sparrow radar-homing missiles to be carried at a later date should this be required.

The original specification had called for a load factor of 7.33 g while carrying 80 percent internal fuel. General Dynamics engineers decided to increase this figure to 9g at full internal fuel and to increase the service life of the airframe from 4000 hours to 8000 hours.

Recognizing that the YF-16 pilot would use externally-carried fuel on the outbound trip to the combat zone and then return on the internal fuel, the design team allocated internal fuel volume accordingly, reducing the airframe size and shaving 1470 pounds off the empty weight and reducing the loaded weight by 3300 pounds. By doing this, the turning rate could be increased by ten percent and acceleration by 30 percent.

Costs were reduced by using interchangeable left- and right-handed tailplanes and flaperons. Most of the undercarriage structure was also common to either side. Avionics were simple and armament consisted of one 20-mm M61A1 rotary cannon and two AIM-9 Sidewinder missiles on the wingtips, plus stores on two external hardpoints underneath each wing.

YF-16

The prototype YF-16 (serial number 72-1567) was rolled out at Fort Worth on December 13, 1973 and was air freighted by C-5A to Edwards AFB on January 8, 1974. Its first flight was an unintended short hop around the pattern on January 21, 1974 at the hands of test pilot Phil Oestricher. During high-speed ground tests at Edwards, Oestricher had inadvertently scraped the tailplane on the runway as the nose was raised, and a violent lateral oscillation set in. He decided to take off and regain control in the air. He stayed up for six minutes and landed uneventfully. The scheduled first flight was delayed until a new right stabilator could be fitted. The first official flight took place February 2, 1974, again with Phil Oestricher at the controls. He reached 400 mph and 30,000 feet.

YF-16 no 2 (72-1568) was flown for the first time on March 9, 1974 with test pilot Neil Anderson at the controls.

On two occasions during these early test flights, the F100 engine went uncommanded idle while in flight, forcing a dead-stick landing. Temporary flying restrictions were imposed on the YF-16 until the problem could be corrected. The fault was traced to contamination of the fuel-control valve which caused the valve to jam in the idle position, but while the curbs were in effect the YF-16 had to remain within dead-stick landing distance of the airfield.

The flyoff between the YF-16 and the Northrop YF-17 began as soon as flight testing started. The two YF-16s reached speeds of over Mach 2.0, maneuvers achieving 9g, and altitudes above 60,000 feet. There was an attempt to get as many pilots as possible to fly both the YF-16 and YF-17. The Lightweight Fighter prototypes never flew against each other, but they did fly against all current USAF fighters as well as against MiG-17s and MiG-21s that had been "acquired" by the USAF.

Within the Air Force staff, there was a strong institutional bias against the LWF, since they perceived it to be a threat to the F-15 program. To head off some of this suspicion, the program was renamed Air Combat Fighter (ACF) by the Defense Department. In the meantime, the governments of Belgium, Netherlands, Denmark, and Norway had begun to consider possible replacements for the Lockheed F-104 Starfighter. They formed the Multinational Fighter Program Group to choose the successor. The prime

50th Anniversary of the Air Force Flight Test Center

THIS WEEK IN HISTORY...

Edwards Air Force Base

50s
60s
70s
80s
90s

FEB. 2, 1974 - JAN. 1975

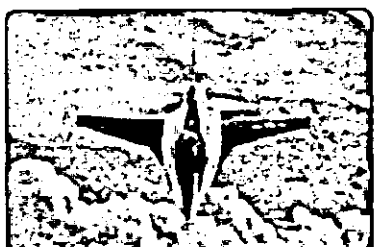
To commemorate the 50th Anniversary of the Air Force Flight Test Center, which was established on June 25, 1951, the AFFTC History Office will recall some of the milestones in flight which have taken place here during the last half century. These articles will appear on a weekly basis throughout the year 2001.

YF-16 Fighting Falcon's First Flight

By Dr. Raymond L. Puffer
Air Force Flight Center historian

The YF-16, General Dynamics' entry into the Air Force's lightweight fighter competition, was a sharklike fighter, powered by a single F100-PW-100 turbofan engine

Twenty-seven years ago, on Feb. 2, 1974, the General Dynamics YF-16 made its "official" first flight. That 90-minute flight was completely successful, and the prototype went on to be developed into one of the world's most accomplished fighter planes. The plane's actual first flight, however, had already taken place nearly two weeks earlier. On Jan. 20, General Dynamics test pilot Philip F. Oestricher was conducting a series of high-speed taxi runs on the main runway. Suddenly the red-white-and-blue fighter (s/n 72-01567) developed a series of roll oscillations that grew worse until its right horizontal stabilizer dragged along the runway. Oestricher quickly decided to take off and prevent further damage. The YF-16 quickly reached flying speed and wobbled into the air for an uneventful six-minute flight to a normal landing. Subsequent investigation revealed a high sensitivity in the roll channel of the fly-by-wire control system that was corrected by installing an automatic gain switch.



In 1975, the YF-16 suited the needs of the Air Force, which chose the small, state-of-the-art air combat fighter with limited avionics, built to demonstrate energy maneuverability and new aerodynamic technologies

The sharklike fighter, powered by a single F100-PW-100 turbofan engine, was General Dynamics' entry into the Air Force lightweight fighter (LWF) competition for a small, state-of-the-art air combat fighter with limited avionics, built to demonstrate energy maneuverability and new aerodynamic technologies. Its opponent in the competitive flight evaluation was Northrop's YF-17 Cobra. The Northrop fighter made its first flight four months later, on June 9, 1974, but to no avail. The Air Force selected the F-16 January 1975 to complement the F-15 Eagle and the rest, as they say, is history. Five months later, a consortium of four European nations — Belgium, Denmark, the

03/23/1976

++ REQUEST 140/94, REPORT # 60
++
+ DATA REPORT MISCELLANEOUS - EXPERIMENTAL
ACCIDENT +
+ EVENTS I PHASES: UNDERSHOOT I FINAL APPROACH +
+ GEAR COLLAPSED/RETRACTED I LANDING ROLL +

++
+++++++++++++++++++++++++++++++++++
++
<--------------- OPERATION ---------------> ++ <--------------- FILE DATA --------------->
TYPE : MISCELLANEOUS - TEST/EXPERIMENTAL ++ ICAO FILE : 76/1060-0
++ FROM STATE : UNITED STATES
++
<------------------- WHEN -------------------> ++ <------------ AIRCRAFT DATA ------------>
DATE : 76-03-23 ++ MASS CATEGORY :
TIME : 14:00 ++ STATE OF REGISTRY : UNITED STATES
LIGHT : DAYLIGHT ++ REGISTRATION : N8544
++
<------------------- WHERE -------------------> ++ <-------- DAMAGE, INJURY AND TOTAL ON BOARD -------->
LOCATION : MOJAVE,CA ++ A/C DAMAGE : DESTROYED
STATE/AREA : UNITED STATES ++ INJURY : FATAL SERIOUS MINOR NONE UNKNOWN TOTAL
DEPARTED : MOJAVE,CA ++ CREW :
DESTINATION : LOCAL ++ PAX :
OTHER DAMAGE :
REMARK: GUSTING TO 25K.

--------------- EVENTS AND FACTORS ---------------
1. EVENT I PHASE: UNDERSHOOT I FINAL APPROACH
2. EVENT I PHASE: GEAR COLLAPSED/RETRACTED I LANDING ROLL

05/08/1976

++ REQUEST 140/94, REPORT # 62
++
+ DATA REPORT SMITH, TED - AEROSTAR 600 ACCIDENT +
+ EVENTS I PHASES: POWER LOSS -FIRST ENGINE I AERIAL WORK
+
+ SPIN I AERIAL WORK +

++
++++++++++++++++++++++++++++++++++
++
<-------------- OPERATION --------------> ++ <-------------- FILE DATA --------------->
TYPE : MISCELLANEOUS - TEST/EXPERIMENTAL ++ ICAO FILE : 76/1159-0
++ FROM STATE : UNITED STATES
++
<------------------- WHEN -------------------> ++ <----------- AIRCRAFT DATA ------------>
DATE : 76-05-08 ++ MASS CATEGORY : 2251 - 5700 KG
TIME : 13:26 ++ STATE OF REGISTRY : UNITED STATES
LIGHT : DAYLIGHT ++ REGISTRATION : N7549S
++
<----------------- WHERE -----------------> ++ <------- DAMAGE, INJURY AND TOTAL ON
BOARD -------->
LOCATION : MORGANFIELD,KY ++ A/C DAMAGE : DESTROYED
STATE/AREA : UNITED STATES ++ INJURY : FATAL SERIOUS MINOR NONE
UNKNOWN TOTAL
DEPARTED : MORGANFIELD,KY ++ CREW :
DESTINATION : LOCAL ++ PAX :
OTHER DAMAGE :
REMARK: PARAPLEGIC RUDDER CONTROL DEVICE INSTALLED ON LEFT RUDDER PEDALS.
RIGHT ENGINE MAGNETO SWITCH IN
OFF POSITION.

--------------- EVENTS AND FACTORS ---------------
1. EVENT I PHASE: POWER LOSS -FIRST ENGINE I AERIAL WORK
2. EVENT I PHASE: SPIN I AERIAL WORK

01/?/1976
10/04/1976
06/12/1979
04/16/1980
(P07) ?/?/?

European Tornado
Multi National Strike
Fighter

ii

P.05

Up | P.05 Images

Prototype P.05 - X586 MM586

- First flight 05.12.1975

- P.05 was due to be used for flutter and airframe load trials but was extensively damaged during a landing accident at Caselle during January 1976. After extensive refurbishment including a new forward section, it rejoined the trials fleet in 1978. It was also used for weapons release trials.

- This was the last prototype to wear the red & white colour scheme.

- Delivered in Panavia color scheme,

- Used for load surveys with stores.

This page was last updated :06/02/2011

P.03

Prototype P.03 - XX947

P.03 was the first airframe to be fitted with dual controls.

- First flight 05.08.1975

- Delivered in British camouflaged scheme.

- It was also the first to have a production standard radome.

- This airframe was also used in the spinning and stalling trials and was later used for higher weight performance trials.

- P.03 was involved in an incident on the 4th October 1976 when it aquaplaned off the runway at Warton. Various modifications were introduced after this incident including changes to the main gear attachment points and modifications to the thrust reverser system to try and minimize wandering on landing due to the reversed airflow being distributed unevenly .

- This airframe was the first to be finished in a camouflage paint scheme.

- This airframe was also instrumented to study in flight loads.

- It was later fitted with a Sundstrand EPU and anti-spin parachute during 1978.

- XX947 is now located at Shoreham Airport, prior to being placed here is was at Everett Aero, (images available from navigation bar at top of page)

This page was last updated :06/02/2011

P.08

Up | P.08 Images

Prototype P.08 - XX950

- P.08 was the second dual control aircraft and join P.03 in the clearance trials of the systems.

- First flight 15.07.1976

- Delivered in British camouflaged scheme.

- P.08 was the static display during Farnborough 1976, surrounded by a wide selection of weapons.

- Unfortunately P.08 was lost with both crew on the 12th June 1979 during simulated weapons release trials over the Irish Sea killing both crew, Russ Pengelly (Pilot) & Sqn Ldr J S Gray (Navigator)

This page was last updated :06/02/2011

P.04

Up

Prototype P.04 - D9592 later 98+05

- P.04 was the first airframe to include an almost full avionics suite and was used to test this extensively.

- First flight 02.09.1975

- Navigation, Ground Mapping and autopilot.

- It was used for weapons release trials and some low level testing of the terrain following radar.

- First to carry Kormoran missiles.

- P.04 was lost in an accident on the 16th April 1980 killing both crew, Ludwig Obermeier(Pilot) & Kurt Schreiber(Navigator)

- Delivered in Panavia color scheme, later Marineflieger sea grey & white.

This page was last updated :06/02/2011

P.07

Up

Prototype P.07 - 98+06

- First Flight 30.03.1976

- P.07 was the first to have a full avionics fit and joined P.04 to complete the clearance trials for the systems.

- A/C P.07 was damaged in the Test Area near Manching when the aircraft struck a 2m high "knoll of earth" trying to pull out of a high-G dive. The aircraft had just completed a test mission when the Pilot decided that there was enough fuel available to practice for the Hanover airshow. He performed a "Split-S" manoeuvre at about 10,000 ft but neglected to reduce power right away, which meant there was too much energy going into the manoeuvre (or not enough altitude) preventing a safe recovery.(incident update provided by Harry Bonet, many thanks)

This page was last updated :06/02/2011

Bundesstelle für Flugunfalluntersuchung
Hermann-Blenk-Straße 16
D-38108 Braunschweig

15

Datensatz

Unfall eines deutschen Lfz. im Inland
ohne Verletzte

Luftfahrzeugart	: Flugzeug
Luftfahrzeughersteller	: DASA
Muster/Typ	: FR06
Eintragungsstaat	: Deutschland
Datum der Störung	: 29/04/1993
Uhrzeit der Störung	: 17.10 Uhr
Störungsort Location	: Manching
Regierungsbezirk/Staat	: Oberbayern (BY)

1.0 Tatsachenermittlung

1.1 Flugverlauf

Betriebsart - Allgemeine Luftfahrt	: verschiedene Betriebsarten
	: - Versuchs-, Forschungs-, Erprobungsflug
Art des Halters - Allgm. Luftfahrt	: Hersteller
FS-Flugplan/Freigabe	: ohne Flugplan
Letzter Abflugort	: Manching
Zielort	: Manching
1. Betriebsphase	: Flugphase
	: - Reiseflug
1. Art der Störung	: Ausfall der Fahrwerksanlage, ATA 32
2. Betriebsphase	: Landephase
	: - Abfangen/Aufsetzen
2. Art der Störung	: Landung mit nicht/teilw. ausgefahrenem Fahrw.
Art der Notlage	: vermutete oder bemerkte Schäden am Lfz.
	: Fahrwerkfehlfunktion
Notlandung / Vorsorgliche Landung	: Notlandung auf einem Flugplatz
Geschwindigkeit bei Störungsbeginn	: 375 kt
Flughöhe bei Eintritt der Störung	: 20000 Fuß ü.NN

1.2 Personenschäden

keine Verletzten

1.3 Schaden am Luftfahrzeug

Luftfahrzeug : schwer beschädigt

1.4 Sachschaden Dritter

keiner

...

08/08/1976

++ REQUEST 140/94, REPORT # 67
++
+ DATA REPORT GOVERNMENT A/C FACTORY - N22B NOMAD ACCIDENT +
+ EVENTS | PHASES: EMPENNAGE FAILURE | CLIMB TO CRUISE +
+ LOSS OF CONTROL -OTHER | FINAL APPROACH +

+++
++

<--------------- OPERATION ---------------> ++ <--------------- FILE DATA --------------->

TYPE : MISCELLANEOUS - TEST/EXPERIMENTAL ++ ICAO FILE : 76/0474-0
++ FROM STATE : AUSTRALIA
++

<------------------- WHEN -------------------> ++ <------------ AIRCRAFT DATA ------------>

DATE : 76-08-06 ++ MASS CATEGORY : 2251 - 5700 KG
TIME : 11:03 ++ STATE OF REGISTRY :
LIGHT : DAYLIGHT ++ REGISTRATION :
++

<------------------- WHERE -------------------> ++ <------- DAMAGE, INJURY AND TOTAL ON BOARD -------->

LOCATION : AVALON ++ A/C DAMAGE : DESTROYED
STATE/AREA : AUSTRALIA ++ INJURY : FATAL SERIOUS MINOR NONE UNKNOWN TOTAL
DEPARTED : AVALON ++ CREW : 2 1 0 0 0 3
DESTINATION : AVALON ++ PAX :
OTHER DAMAGE : YES

IT WAS THE FIRST FLIGHT OF PROTOTYPE N24, A DEVELOPMENT OF THE N22 NOMAD. TO IMPROVE THE STICK FORCE GRADIENT WHEN OPERATING IN THE 20 DEG FLAP CONFIGURATION, FULL-SPAN TABS WITH FULL-SPAN 50 MM T STRIPS HAD BEEN FITTED TO A STANDARD TAILPLANE. CLEARANCE FROM FLUTTER UP TO 120 KTS EAS HAD BEEN CALCULATED USING SIMPLIFIED DESIGN CRITERIA. AFTER A NORMAL TAKE-OFF THE A/C CLIMBED STRAIGHT AHEAD; AT NEARLY 950 FT AND ABOUT 110 KTS, SEVERE TAILPLANE FLUTTER OCCURRED. THE ONSET WAS SUDDEN AND SEVERE, THE TAILPLANE WAS SUBSTANTIALLY DAMAGED, AND THE CONTROLLABILITY OF THE A/C WAS SERIOUSLY DEGRADED. THE A/C ENTERED A LEFT DESCENDING TURN THROUGH ABOUT 175 DEG AND STRUCK THE GROUND. THE FLUTTER RESULTED FROM AERODYNAMIC AND INERTIA EFFECTS OF THE T STRIPS ON THE TRIM TAB TRAILING EDGE. IT WAS FOUND THAT THE SIMPLIFIED FLIGHT TESTING DESIGN CRITERION USED FOR TAILPLANE MODIFICATIONS WAS NOT VALID FOR TAB TRAILING EDGE T STRIPS.

A SUMMARY OF THE FINAL REPORT IS PLANNED.

---------------- EVENTS AND FACTORS ----------------

1. EVENT | PHASE: EMPENNAGE FAILURE | CLIMB TO CRUISE
2. EVENT | PHASE: LOSS OF CONTROL -OTHER | FINAL APPROACH

77-1

ACCIDENT INVESTIGATION REPORT

Nomad N24 Aircraft Serial Number 10 at Avalon, Victoria, on 6 August 1976

With Compliments...

Mr Dave Houle

Best regards

Nadal

10·08·2000

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Department of Transport and Regional Services

Special Investigation Report 77-1

AIR SAFETY INVESTIGATION BRANCH

Accident Investigation Report

Government Aircraft Factories Nomad N24 Aircraft Serial Number 10 at Avalon, Victoria, on 6 August 1976

The Secretary to the Department of Transport authorised the investigation of this accident and the publication of this report pursuant to the powers conferred by Air Navigation Regulations 278 and 283 respectively.

Prepared by Air Safety Investigation Branch

August 1977

AUSTRALIAN GOVERNMENT PUBLISHING SERVICE
CANBERRA 1977

Contents

Note 1: All times are Eastern Standard Time and are based on the 24-hour clock. Where applicable, seconds are shown using a six figure time group.

Note 2: Metric units are used except for airspeed and wind speed which are given in knots; and for elevation, height and altitude which are given in feet.

THE ACCIDENT

At approximately 1103 hours Eastern Standard Time (EST) on 6 August 1976 the pilot of Nomad N24 aircraft Serial Number 10 encountered control difficulty at a height of about 950 feet immediately after taking off at Avalon aerodrome. The aircraft entered a descending turn to the left through about 175 degrees and struck the ground. The pilot was killed; the occupant of the other pilot seat, an observer, sustained injuries which resulted in his death two days later; and the third occupant, the flight test engineer, was seriously injured.

1 FACTUAL INFORMATION

1.1 HISTORY OF THE FLIGHT

Nomad N24-10 was owned by the Government Aircraft Factories (GAF) and was the prototype of the N24 aircraft, a lengthened version of the previously certificated Nomad N22 type aircraft. For some months it had been engaged on test flying in the standard N24 production configuration in preparation for Department of Transport certification flight tests.

GAF were also conducting developmental work, in parallel with but separate from the N24 certification program, for a proposed N24A model which was to have an increased gross weight and configuration changes which included the availability of a 20 degree flap setting for take-off. As N24-10 was the only aircraft available it was being used as the test vehicle for both programs.

At the time of the accident N24-10 was engaged in the N24A development program, and the normal tailplane with part-span tabs had been removed and a modified tailplane with full-span tabs and trailing edge T strips had been fitted.

The purpose of the flight on which the accident occurred was to examine the effect of these tailplane modifications on the longitudinal stability of the aircraft in the 20 degree flap configuration required for the N24A model. It was intended that, after take-off, the aircraft would proceed to a designated flight test area where, at a safe altitude, the tests would be carried out. The aircraft was not to be flown at a speed in excess of 120 knots equivalent airspeed (EAS).

For the flight on which the accident occurred the aircraft carried the trade-plate registration VH-SUZ, and at 1033 hours the pilot telephoned Avalon Tower, discussed the weather and submitted a verbal flight plan. He was told that the wind velocity at the time was 240 to 260 degrees at 20 knots gusting to 35 knots and that there was 'a bit of weather coming through, the cloud to the south is about fifteen hundred and there's a shower over Geelong at the moment'. The pilot informed the tower that he planned to depart at 1045 hours for a 60-minute flight in N24-10, the flight to be conducted under the visual flight rules (VFR) in Restricted Area 326B (see Appendix A) at varying altitudes to a maximum of 10 000 feet. He nominated the fuel endurance as 300 minutes and indicated that the aircraft would take off from one of the grass strips on the eastern section of the aerodrome (see Section 1.10). Also he stated that it was his intention to 'go out and have a look and if it's no good come back and we'll give it a break for an hour or two'.

At 1051 hours the pilot of N24-10, using his personal radio callsign GAF ONE, contacted Avalon Tower by radio and advised that he had received the current aerodrome terminal information and was taxiing. The aircraft then taxied to the east–west grass strip.

At 1058 hours Avalon Tower advised N24-10 of the local weather and that there were aircraft reports of extensive cloud and build-ups to the south-west moving in a north-easterly direction. The pilot of N24-10 acknowledged this information and advised that he would attempt to operate in the northern half of Restricted Area 326B. At 1059 hours N24-10 requested an airways clearance and was cleared by Avalon Tower to operate in area R326B not above 10 000 feet.

At 1100 hours N24-10 notified that it was ready for take-off and the controller advised that there would be a short delay, which was due to other traffic landing on the runway. At 1100:23 hours N24-10 was cleared for take-off and an unrestricted climb.

The aircraft took off into the west from the grass strip and, immediately it became airborne, the pilot applied a series of 'push-pull' control inputs to the tailplane after which the aircraft commenced its initial climb. Data on the take-off and initial climb were obtained from the flight test recorder (see Section 1.11).

The aircraft climbed straight ahead in a normal manner and reached a height of about 950 feet when over or just past the runway. At this point three witnesses on the ground, who had observed the whole of the take-off, and who were located some 400 metres north of the aircraft's flight path and 600 metres east of the runway, observed the trailing edge of the aircraft's tailplane fluttering; one described it as being 'like a rag flapping in a strong wind', and he saw a dark object fall from the aircraft to the ground. At about this time the aerodrome controller, located in the control tower some 1250 metres south-east of the aircraft, saw it adopt a steep nose-down attitude and asked whether operations were normal. The pilot replied 'negative negative', and the aerodrome controller then initiated emergency procedures and the crash alarm was sounded.

The aircraft then turned left onto a southerly heading while still descending, and may have maintained this heading briefly before continuing to turn left onto an easterly heading. Just prior to contact with the ground, the left wing and the nose dropped, and after impact the aircraft rotated through 120 degrees in the horizontal plane and skidded rearwards for a distance of some 70 metres before coming to rest. An illustration of the flight path of the aircraft is shown at Appendix B.

The flight test engineer, who was seated in approximately the mid-cabin area of the aircraft during the flight, was unable to observe any cockpit instrument readings or any actions taken by the pilot. He stated that the take-off roll and lift-off were normal and that, after the pilot had exercised the tailplane with 'push-pull' control inputs, the landing gear and flaps were retracted and the aircraft was climbed towards the west apparently accelerating to normal climbing speed. Additionally he reported that he operated the trace recorder at high speed during the take-off and that he turned it off after the landing gear and flaps had been retracted. No abnormality was apparent to him until the aircraft reached a height which he estimated as 1000 to 1200 feet when a buzz type vibration occurred and the nose pitched down positively. He recalls that shortly after the onset of the vibration the pilot said 'I don't think we're going to make it'. The engineer then decided to abandon the aircraft, released his safety harness, and went to the parachute pack stowage. As he was about to remove his parachute pack from its stowage he heard the pilot say that he thought he had regained control, and at this time the nose-down pitch attitude reduced. He returned to his seat and refastened his safety harness. The aircraft then entered a descending turn to the left and the vibration continued intermittently until, at a height he estimated as about 100 feet, the pilot appeared to be no longer able to maintain any control and the aircraft side-slipped to the ground.

The duration of the flight from the commencement of the take-off roll until the aircraft struck the ground was about 1 minute 34 seconds.

The accident occurred during daylight at latitude 38° 02′ 28″ South, longitude 144° 28′ 12″ East.

1.2 INJURIES TO PERSONS

Injuries	Crew	Passengers	Others
Fatal	1	—	1
Non-fatal	1	—	—
None	—	—	

1.3 DAMAGE TO AIRCRAFT

The aircraft was destroyed by impact forces.

1.4 OTHER DAMAGE

A short section of post and wire fencing was demolished.

1.5 PERSONNEL INFORMATION

1.5.1 Aircraft

For flight test purposes the aircraft normally has a basic crew of a pilot and a flight test engineer. This crew may be supplemented as necessary by additional specialist personnel, depending upon the nature of the test to be carried out. The aircraft is equipped to be operated as a single-pilot aircraft and there is no requirement for personnel other than the pilot to be licensed.

On the flight on which the accident occurred, in addition to the basic crew, the Senior Designer Structures and Mechanical who, at the time of the accident, was also the acting Chief Designer of GAF, was on board the aircraft for the purpose of observing the effect of the modifications which had been carried out on the tailplane.

PILOT Stuart Graham Pearce—aged 39 years—left-hand pilot seat

Mr Pearce was a graduate of the Empire Test Pilot's School, Farnborough, U.K., and prior to being employed by GAF he had extensive test pilot experience in the Royal Air Force. His pilot licence was endorsed for a number of single and multi-engined aircraft types.

Licence	:	Senior Commercial Pilot Licence—valid until 31 October 1976
Ratings	:	Class One Instrument Rating—valid until 28 February 1977
Last medical examination	:	15 April 1976
Total pilot hours	:	4483
Total hours in command N22	:	1377
Total hours in command N24	:	73

FLIGHT TEST ENGINEER Philip Patrick Larcey—aged 36 years

Mr Larcey had been employed as a flight test engineer for the past 12 years during which time he had logged 2042 hours of flying experience in this role in a variety of aircraft. In addition he was a licensed pilot.

Licence	:	Private Pilot Licence—valid until 31 May 1978
Last medical examination	:	4 May 1976
Total pilot hours	:	approx. 360 (includes both aeroplanes and gliders)

OBSERVER David Roy Hooper—aged 47 years—right-hand pilot seat

Mr Hooper was a qualified aeronautical engineer. In addition he was a licensed pilot.

Licence	:	Private Pilot Licence—valid until 28 February 1977
Last medical examination	:	24 January 1975
Total pilot hours	:	approx. 2000 (includes both aeroplanes and gliders)

1.5.2 Air Traffic Control

An air traffic control unit is established in the Avalon Tower with provision for two operating positions, an aerodrome/approach controller and a co-ordinator. At the time of the accident both positions were manned by appropriately rated personnel; additionally a trainee air traffic controller was receiving instruction from the co-ordinator, and a Royal Australian Air Force air traffic controller was present in the tower on a familiarisation visit.

1.6 AIRCRAFT INFORMATION

The Government Aircraft Factories Nomad N24 is a twin-engined, high wing, light transport aircraft, powered by two Allison 250-B17B turbo-prop engines.

A Certificate of Type Approval had not yet been issued and consequently there was no requirement for Certificates of Registration or Airworthiness for N24-10. It was operating for the purpose of ferry and flight testing to an approved flight test program under the authority of a Permit to Fly which had been issued by the Department of Transport on 11 May 1976, and which was valid until 11 August 1976. The aircraft was being maintained and certified in accordance with GAF Quality Assurance Instruction No. 1-3-6. Its total time in service at the time of the accident was 139 hours. The aircraft records indicate that prior to the commencement of the flight there were no maintenance deficiencies.

As the certification testing had not been completed for the N24 type, the maximum permissible take-off weight and the centre of gravity range had not been specified finally; the design limits were the same as those for which the N22 type had been certificated, i.e. a maximum take-off weight of 3855 kg (8500 lb) and centre of gravity limits of 21.5 to 38.5 per cent mean aerodynamic chord (MAC). The Permit to Fly for N24-10 specified a maximum take-off weight of 3855 kg.

The Configuration Requirement for the flight on which the accident occurred specified a start-up weight of 3855 kg and a centre of gravity position of 35.15 per cent MAC. The load sheet which was prepared for the flight, using nominal personnel weights of 91 kg per person, indicated that these specifications were met. The N24 aircraft had previously been flown at this and similar weights and centre of gravity positions with no difficulties having been experienced.

Subsequent to the accident it was established that at take-off the all-up weight was 3862 kg (8517 lb) and the centre of gravity position was 35.02 per cent MAC. This minor exceedence of the permissible all-up weight, which would not have affected the performance or handling of the aircraft, arose as a result of the use of nominal personnel weights instead of actual weights, and from a small difference in the actual weight of the ballast compared with that used for the original calculation.

The aircraft was fuelled with aviation turbine kerosene (AVTUR).

1.7 METEOROLOGICAL INFORMATION

The Avalon aerodrome forecast which was current at the time of the accident was originated by the Melbourne Regional Forecasting Centre at 0440 hours and covered the period from 0800 hours to 1800 hours.

Avalon aerodrome forecast:

Wind	:	220 degrees at 15 knots
Visibility	:	20 kilometres
Weather	:	Rain showers
Cloud	:	6/8 Cumulus, 2000 feet
Temperature	:	6, 9, 11, 12 degrees Celsius
QNH	:	1006, 1007, 1008, 1009 millibars

The Air Traffic Control Unit in Avalon Tower made weather observations at 0930 hours and 1200 hours which were passed to Melbourne Airport Weather Service Office.

Observation at 0930 hours:

Wind	:	260 degrees at 25 knots gusting to 35 knots
Visibility	:	In excess of 10 kilometres
Cloud	:	4/8 strato-cumulus, 3000 feet
Temperature	:	10 degrees Celsius
Dewpoint	:	5 degrees Celsius
QNH	:	1007 millibars

Observation at 1200 hours:

Wind	:	250 degrees at 20 knots gusting to 40 knots
Visibility	:	In excess of 10 kilometres
Weather	:	Rain
Cloud	:	5/8 strato-cumulus, 1500 feet
Temperature	:	11 degrees Celsius
Dewpoint	:	6 degrees Celsius
QNH	:	1007 millibars

The aerodrome terminal information service (ATIS) which the pilot of N24-10 advised having received prior to taxiing was designated 'DELTA'. It was first broadcast at 1036 hours and remained current until 1236 hours. It contained the following information:

> . . . wind two six zero, two five gusting three five, all crosswind, QNH one zero zero seven, temperature one zero, cloud five octas one five zero zero, showers in area . . .

The anemometer head for the recording of wind velocity at the aerodrome is located 12.5 metres above the ground, adjacent to the flight strip of the runway, almost directly beneath the flight path of N24-10. The evidence from this source indicates that the wind direction at the time of the flight was 270 degrees (True) at a mean speed of 23 knots varying between 16 and 31 knots.

The accident occurred in conditions of good visibility.

1.8 AIDS TO NAVIGATION

The availability and use of navigation aids was not relevant to the accident.

1.9 COMMUNICATIONS

Communications between civil aircraft and Avalon Tower are conducted on VHF radio frequencies and are recorded on continuously running magnetic tape. Communications were normal. A transcript of the communications between N24-10 and Avalon Tower is at Appendix C.

1.10 AERODROME INFORMATION

Avalon aerodrome contains one sealed runway which is aligned 360/180 degrees magnetic and is 3048 metres in length. Adjacent to the eastern boundary of the aerodrome the Government Aircraft Factories has prepared and maintains four grass strips. The use of these strips is restricted to GAF test pilots operating Nomad aircraft. The strip which was used for the take-off on the flight on which the accident occurred is aligned 270 degrees magnetic and is 640 metres in length and 30 metres in width. The western end of the strip is 890 metres east of the centreline of the runway. The aerodrome elevation is 23 feet.

1.11 FLIGHT RECORDERS

For the purpose of recording test data during development flights, the aircraft was equipped with an Ateliers de Construction de Bagneux (ACB) Type A1322 flight data recorder which uses light-sensitive paper as the recording medium. The recorder was mounted on the floor of the aircraft at approximately the mid-cabin position adjacent to the seat of the flight test engineer who controlled its operation by means of a hand-held switchbox which was connected to the recorder by a flexible cable. A condition specified in the Permit to Fly was that 'All test flying shall be conducted in accordance with GAF Project Note N2/44'. This Project Note specified that an ACB photographic trace recorder be fitted and that it be running continuously during all development flights. There was no requirement for a cockpit voice recorder to be fitted to this aircraft.

Data were recorded from the commencement of the take-off roll for a period of 28 seconds, following which the flight test engineer switched the recorder off to conserve recording paper until the aircraft had reached the flight test area. The following parameters were recorded:

Elapsed time	Tailplane control force
Indicated airspeed	Rudder angle
Altitude	Pitch attitude
Normal acceleration	Yaw attitude
Tailplane angle	Pitch angle
Tailplane tab angle	Roll angle

The readout of the record indicates that some 10 seconds after commencing its take-off roll the aircraft became airborne and almost immediately there were 'push-pull' control inputs for the next 5 seconds. During and subsequent to this period the aircraft was accelerating steadily and it then began to climb at a normal rate. When the record terminated the aircraft had reached an indicated airspeed of 106 knots and its altitude was 220 feet.

1.12 WRECKAGE AND IMPACT INFORMATION

The aircraft struck the ground at a point 1140 metres beyond the western end of the grass strip and 720 metres to the south of the extended centreline of that strip, having turned to the left through approximately 175 degrees after take-off. At the initial impact the aircraft was in a 20 degrees nose-down, 45 degrees left-wing-down attitude, and was yawed about 30 degrees to the left. The left wing tip struck the ground first, followed almost immediately by the impact of the left landing gear pod and the nose of the aircraft, after which the aircraft slid along the ground for about 70 metres and came to rest facing back along its approach path.

The cockpit area, the forward half of the cabin and the left stub wing had disintegrated as a result of the ground impact. Both wings were with the main wreckage, still attached to the remains of the mid-cabin structure. The engines remained attached to their respective wings but both propellers had separated. The left propeller came to rest to the rear and right of the aircraft; the right propeller, with portion of the reduction gear box, was in the main wreckage close to the left engine, having passed through the cabin during the ground slide. The rear fuselage structure was distorted in a manner consistent with the effects of the heavy ground impact.

A trail of small items of wreckage extended from the initial impact point to about 50 metres beyond the main wreckage, over a width of some 50 metres at the widest point. With the exception of five items of wreckage, all of the aircraft was contained within this general area. The five separate items were all from the left-hand tailplane and comprised three sections of lower skin from the second rib bay outboard of the root, part of the root rib at the trailing edge, and a 1.47 metre long inboard section of the T strip. They were found some 700 metres distant, close to the extended centreline of the grass strip which had been used for the take-off and about 1000 metres from its western end.

Both engines had been operating at impact and the initial marks made by the left-hand propeller indicated that the aircraft had a ground speed of 105 knots at that time. Using the mean wind as recorded by the aerodrome anemometer at the time of the accident, this ground speed corresponds to an indicated airspeed of 82 knots.

At the time of impact all doors and windows were closed and latched, and the landing gear and wing flaps were in the fully retracted position.

A detailed examination of the tailplane and its trim tabs disclosed that they had undergone violent oscillation in flight, in the course of which they had sustained severe structural damage. The most severe damage to the tailplane had occurred on the left-hand side, including a general failure of the structure aft of the main spar characterised by the collapse of the first five ribs due to repeated reversals of chordwise bending loads. The rib and skin failures had initiated immediately aft of the main spar, the degree of damage being more severe in the inboard areas.

There were several partial bending failures of the rear spar in the outboard half of the left-hand tailplane, and a partial downward bending failure of the main spar inboard of the leading edge mass balance location. A small section of the inboard end of the left-hand tab had broken away, but remained attached to the control rod; subsequent to this failure the inboard section of T strip had peeled off, starting from the inboard end. All of the major tailplane and tab structural failures showed evidence of repeated reversals of loading.

The right-hand tailplane and tab showed deformations and partial failures virtually identical with those of the left-hand side, although none had progressed to the same extent of damage.

Apart from the in-flight failures of the tailplane and tabs, all damage to the aircraft was consistent with the effects of ground impact. The wreckage examination disclosed no evidence of any other defect or malfunction.

1.13 MEDICAL AND PATHOLOGICAL INFORMATION

Post mortem examinations of the pilot and the observer indicated that both died as the result of injuries received during the impact of the aircraft with the ground. There was no evidence of pilot incapacitation or that his health was in any way impaired prior to or during the flight.

1.14 FIRE

No fire occurred in flight. The first person to reach the aircraft after it came to rest observed a small fire under the starboard wing, but it was blown out by the wind before he reached it. Paint blistering and staining on the inside of the starboard engine nacelle indicated that a low intensity, short duration fire had existed adjacent to the inboard exhaust duct.

1.15 SURVIVAL ASPECTS

The wreckage of the aircraft was located 560 metres from the Airport Fire Station and, as the crash alarm had been sounded prior to the aircraft striking the ground, the airport emergency vehicles were being manned before the aircraft came to rest. It is estimated that the rescue services were at the accident site one minute and twenty seconds after impact. The pilot was killed on impact and his body was located in the wreckage. He was strapped to his seat which had collapsed as a result of impact forces. The occupant of the right-hand pilot seat was ejected from the aircraft still attached to his seat; he died two days later as a result of the injuries he had sustained. The flight test engineer seated in the mid-cabin area suffered severe spinal injuries as a result of the collapse of his seat. The nature of his injuries was appreciated by the rescue personnel and he was not moved from the wreckage until personnel properly trained and equipped for handling this type of injury arrived at the scene.

The pilot and the flight test engineer wore protective helmets and sustained no significant head injuries although both helmets showed impact markings. The occupant of the right-hand pilot seat wore only a head-set and suffered fatal head injuries; however, the nature of his head injuries in toto was such that it is uncertain whether the wearing of a helmet would have improved his chances of survival.

1.16 TESTS AND RESEARCH

As both the wreckage examination and the witness reports indicated that some form of tailplane flutter had occurred in flight, a group was formed to investigate the flutter characteristics of the aircraft in the accident configuration. This group comprised appropriate specialists from the Department of Transport, the Aeronautical Research Laboratories and the Government Aircraft Factories.

Prior to the accident a flutter program had been developed by GAF and had been made use of during the design and certification of the N22 in order to study its flutter characteristics; this program was also being used for the same purposes in the case of the N24. As a first step in the investigation of the flutter phenomenon in the accident configuration, this program was modified by factoring the inertial and aerodynamic terms appropriate to the tabs by the ratio of the spans of the full-span and standard tabs, including an additional inertial contribution appropriate to the T strips but ignoring their effect on aerodynamics.

The results of the flutter calculations made with this modified program suggested that there could have been a critical flutter speed in the region of 120 to 130 knots for zero structural damping but, because of the approximations involved in the simplifying assumptions, this finding could not be considered as conclusive. Accordingly a research program was undertaken by the investigation group to establish better structural and aerodynamic representations of the modified tailplane installed on N24-10 at the time of the accident.

A comprehensive series of ground resonance tests was carried out on a new tailplane modified to incorporate the full-span tabs both with and without 50 mm T strips as fitted at the time of the accident. Difficulties were encountered during laboratory testing in accurately simulating the tab control circuit stiffness; therefore additional ground resonance tests were carried out with this modified tailplane fitted to a production N24 aircraft and the results obtained were used to correct the laboratory test results where necessary. These resonance tests showed that the tab frequencies for use in the flutter analysis would lie within the limits of 19–26 Hz.

It was considered that the available unsteady aerodynamic data were not suitable for the reliable prediction of the forces on a surface with trailing edge T strips. Therefore the investigation undertook a series of wind tunnel tests using a standard tailplane modified to make a two-dimensional wind tunnel model.

The tests were run at two tunnel speeds, 80 and 100 knots, and the tab was oscillated by shakers at frequencies of 5, 10, 20 and 30 Hz through an amplitude of ± 1 degree. The initial tests were carried out without T strips fitted, and showed good agreement with theoretical values over a frequency parameter range of 1.6 to 4.8. The tests were then repeated with 50 mm T strips fitted to the tabs. The results obtained enabled the preparation of a correction matrix to modify the theoretical pressure distributions so as to agree with the measured values. The aerodynamic coefficients used in the flutter calculations were derived from these values by applying a factor to account for viscous and three-dimensional effects. Based on previous experience the most likely value of this factor, referred to in the flutter program as FT, is 0.5 but the flutter calculations took account of the effect of variations in this parameter by allowing FT to vary between 0.5 and 1.0.

Tests carried out with 25 mm T strips fitted to the tabs instead of the 50 mm strips gave similar results, showing that the resulting aerodynamic effects were not sensitive to T strip width in the range 25–50 mm.

Measurements which had been made during earlier ground resonance tests on the standard N24 tailplane had shown that a structural damping level of between 2 and 4 per cent of the critical damping could be expected for the tailplane, and about 6 per cent for the standard tab. The full-span tab fitted at the time of the accident, with the greater friction generated by its longer piano hinge, would not be expected to have less structural damping than this. Nominal values of 2 per cent and 5 per cent respectively were used in the flutter calculations and these values were factored by a structural damping factor (SDF) which was varied between zero and 2.0 in order to study the effect of possible variations in structural damping.

The post-accident flutter analysis took account of a number of flutter models, and the results showed that flutter could occur in the case of a model comprising tailplane antisymmetric torsion at 33.8 Hz with antisymmetric rotation of the tabs at varying frequency. Critical flutter speeds were calculated for the full range of parameter variations referred to above and the results showed that flutter would occur at a speed within the range of 73 to 132 knots. The calculations indicated that the most likely value of the flutter speed, corresponding to SDF = 1.0, FT = 0.5, and the mid-range tab frequency of 22 Hz, was 103 knots EAS.

The mode of flutter revealed by the analysis was compatible with the damage observed on the tailplane and tabs. For the range of possible flutter speeds the frequency parameters were in the range of 4.0 to 6.4, these values all being well above the limiting figure of 2.5 specified by the Broadbent Criterion for cases of tab flutter (see Section 1.17.2).

A study of the damping ratios appropriate to various sets of parameter values over the range which could produce flutter showed that the onset of flutter would have been very rapid. At the most likely critical flutter speed of 103 knots EAS, a speed increment of 2 knots produces a growth rate of 1 per cent: this corresponds to a doubling of amplitude in each successive 11 cycles and, as the flutter frequency in this case is 29 Hz, the time to double amplitude would be about 0.4 seconds. Thus the time from the onset of flutter to its reaching catastrophic proportions would be very short—of the order of a few seconds.

Flutter speeds were calculated for other tab configurations incorporating the various tab spans with and without 25 mm and 50 mm T strips. Some of these configurations had been flown during the flight test program and the calculations thus provided a partial check on the validity of the mathematical model used, and also an indication of the flutter margins which had existed during the various stages of tab modification. In Appendix D, which summarises these results, the flutter speeds quoted are those corresponding to the most likely parameter values, i.e. SDF = 1.0 and FT = 0.5, with the appropriate mid-range tab frequency in each case.

1.17 ADDITIONAL INFORMATION

1.17.1 Tailplane and tab modifications

The N22 and N24 aircraft are fitted with an all-moving tailplane pivoted at 22.9 per cent of its chord. Aerodynamic 'feel' is provided by two geared trailing edge anti-balance tabs, each of which has a semi-span of 1.75 metres. The tabs are also controllable from the cockpit to provide longitudinal trim.

During the development flight testing of the N24 it had been judged that the stick force gradient when operating with 20 degrees of flap was not acceptable for certification purposes. Positive gradients had been measured but they were very small at low speeds and were not sufficient, in the opinion of the Company's Senior Test Pilot, to meet the certification requirement that 'the stick force must vary with speed so that any substantial speed change results in a stick force clearly perceptible to the pilot'.

A number of modifications were made by the manufacturer in attempts to improve the stick force gradient in the 20 degree flap configuration. These included various combinations of tailplane fences, vortex generators, leading edge extensions, a change in the tailplane pivot location, and a series of changes in the configuration of the tabs. As these modifications had not achieved the desired result, the manufacturer decided to submit the N24 for certification without a 20 degree flap position, and to examine the situation further during the development of the proposed N24A model of the aircraft.

The modifications of principal concern to this investigation are those which involved the sequence of changes to the tab configuration, and these are listed below in the order in which they were flown. The 25 mm and 50 mm T strips referred to are illustrated in Appendix E. Apart from these additions and the changes in span of the tabs, the tailplane structure and installation was not altered.

Flight 93, 20 May 1976

This flight used standard length tabs (of 1.75 m semi-span) with 25 mm T strips fitted to the tab trailing edges.

Flight 94, 21 May 1976

The same tab configuration, but with 25 mm T strips also fitted to the tailplane trailing edges outboard of each tab.

Flight 96, 25 May 1976

The T strips were removed from the tabs, but were retained on the tailplane trailing edges.

Flight 97, 26 May 1976

The tailplane trailing edges were fitted with 50 mm T strips, still with none on the tabs.

Flight 100, 3 June 1976

The tab length was increased by 0.41 m to a semi-span of 2.16 m. There were no T strips on the tabs or the tailplane.

Flight 101, 4 June 1976

The tab length was increased by a further 0.41 m to encompass the full span of the tailplane. No T strips were fitted.

Flight 128, 6 August 1976 (accident flight)

The full-span tabs were fitted with 50 mm T strips.

1.17.2 The Broadbent Criterion

In the case of a new aircraft design, the development program is usually such that the initial flight tests are scheduled before the flutter computations, which of necessity are lengthy, have been completed; therefore, a preliminary flutter clearance, usually to a restricted airspeed, is required to enable flight testing to proceed. To determine freedom from flutter without carrying out a detailed flutter analysis, there are several simplified design criteria which may be used. One of these is the Broadbent Criterion ('The elementary theory of aero-elasticity', E. G. Broadbent, *Aircraft Engineering*, March–June 1954). This criterion includes a safety factor; therefore a speed derived from its application is not a flutter speed, but is a speed at which past experience has shown that a conventional aircraft can be operated without risk of flutter.

The Broadbent Criterion specifies that:

(1) main surface flutter does not occur at frequency parameters greater than unity

(2) control surface flutter (no tabs) does not occur at frequency parameters greater than 1.5

(3) tab flutter does not occur at frequency parameters greater than 2.5

The frequency parameter is given by:

$$v = \frac{\omega c}{V}$$

where ω = flutter frequency, radians/second
c = chord of the main surface, feet
V = equivalent air speed, feet/second

2 ANALYSIS

The investigation has revealed that after a normal take-off, as the aircraft was climbing on its departure for the flight test area, tailplane flutter occurred at a height of about 950 feet. The post-accident flutter calculations have shown that the critical flutter speed would have been in the vicinity of 103 knots, and the flight recorder evidence is that the aircraft had achieved a speed of 106 knots some 30 seconds before the flutter occurred. There is no evidence of the precise speed at which flutter occurred, but the normal climbing speed is in the vicinity of 110 knots and there is evidence from the flight test engineer that the climb was normal.

It has been calculated that, at the most likely value of the critical flutter speed, the amplitude of the oscillations would double in each successive 0.4 seconds and thus the onset of flutter would have been sudden and very severe. Such a rapid build-up could be expected to produce substantial damage within a few seconds, and the nature of the damage to the tailplane and tabs was consistent with the mode of flutter revealed by the calculations. The close grouping of the five pieces of tailplane wreckage which were recovered on the ground below the flight path confirms that the partial destruction took place during a short time interval; their location on the ground was consistent with the position at which witnesses had observed the tailplane fluttering as the aircraft was climbing after take-off and also the position at which the flight test engineer stated that vibration commenced.

The extent of the damage to the tailplane and trim tabs indicates that subsequent controllability of the aircraft in the pitching plane would have been seriously degraded. The aileron and rudder controls were intact and it is possible that the turn back towards the aerodrome was initiated by the pilot, but there is no certainty of this. Whether or not the turn was intentional, it is considered that an uncontrolled or at best a partially controlled ground impact became inevitable at the time that the tailplane and trim tabs suffered severe structural damage, thus virtually depriving the pilot of longitudinal control of the aircraft; consequently the causal factors for the accident must be sought in the circumstances which led to the occurrence of this damage.

The aircraft was properly crewed and there was no evidence that incapacitation, loading or weather contributed to the accident. The examination of the wreckage disclosed no evidence of any defect or malfunction with the exception of the in-flight failures of the tailplane and trim tabs. All other damage was consistent with the effects of impact with the ground.

The tailplane and trim tabs fitted to the N24 type were the same as those fitted to the N22 type, which had been demonstrated by calculations and flight testing to be free from flutter throughout its flight envelope. The tailplane modifications which were carried out on N24-10 with a view to improving the stick force gradient at the 20 degree flap setting proposed for use on the N24A were progressive in nature. First, 25 mm T strips were attached to the trim tabs and then to the entire trailing edge without significant effect on the stick force gradient. Tests were then carried out with 25 mm and, later, 50 mm T strips attached to the tailplane trailing edge, but not the trim tabs, again without significant effect. A different approach was then made, in which the T strips were discarded and the size of the trim tabs was increased in two steps until they extended over the entire trailing edge of the tailplane; once again there was no discernible effect on the stick force gradient with 20 degrees of flap extended. It was then that the decision was made to install full-span trim tabs with full-span 50 mm T strips attached to their trailing edges.

The sequence of modifications of the tailplane and trim tabs had been initiated by the acting Chief Designer, and an airspeed limitation of 120 knots had been imposed for all test flights. The responsibility for ensuring structural integrity, including freedom from flutter, rested with the position of Senior Designer Structures and Mechanical. Freedom from flutter at 120 knots was checked by the use of the Broadbent Criterion (see Section 1.17.2) with the known N24 tailplane and tab frequencies adjusted to account for the effect of the various modifications. There is direct evidence that this procedure was applied to all modifications preceding the final one.

The investigation has established that the static structural strength of the final tab and T strip configuration was not a factor in the accident, the T strip having remained intact until destructive loads had been generated by flutter. As far as flutter clearance for the final flight is concerned there is some evidence to suggest that the acting Chief Designer, who at the time of this particular flight was also carrying out the duties of Senior Designer Structures and Mechanical, had used the Broadbent Criterion in order to verify that 120 knots remained a safe airspeed limitation but no record has been found of any flutter calculations which he may have made. Calculations made subsequently have shown that the information then available would have resulted in a calculated tab frequency of 20.0 Hz (compared with 19.2 Hz measured as the lowest tab frequency during the post-accident tests). On the basis of the limiting frequency parameter of 2.5 for tab flutter, the safe flight test speed calculated in accordance with the Broadbent Criterion is 129 knots EAS. For the case of tailplane flutter, using the known tailplane rotation frequency of 11.1 Hz and the appropriate frequency parameter of 1.5, the safe speed would have been calculated as 119 knots EAS.

The Broadbent Criterion is an empirical rule the application of which is limited to aircraft which do not represent a radical departure from conventional practice. A speed determined from the application of this criterion would normally be expected to embody a substantial safety factor which would ensure that there was no possibility of flutter provided the speed was not exceeded. The investigation has shown, however, that destructive flutter occurred at a speed less than the 120 knots EAS established by the Broadbent Criterion as a safe speed; and the most likely value of the critical flutter speed revealed by the post-accident flutter analysis is 103 knots EAS in the accident configuration. Similarly, the most probable flutter speed for the standard tabs fitted with 25 mm T strips is 125 knots EAS (see Appendix D). It is evident, therefore, that the addition of even the smaller T strips to the N24 standard tailplane tabs produced a design for which the application of the Broadbent Criterion did not provide an adequate safety margin.

The decision to use the Broadbent Criterion to check that the aircraft would be free from flutter at the maximum flight test speed of 120 knots to be used during the tailplane modification program was taken by the GAF design personnel with the benefit of extensive experience and knowledge of the flutter characteristics of the N22 and N24 aircraft. The alternatives which were available to them at each step of the program were to apply one of the simplified design criteria or to carry out complete flutter analysis. No theory was available which could reliably predict the additional aerodynamic forces generated by the trailing edge T strips, and thus any flutter analysis made for the various configurations of the development program would have had to be based on conventional aerodynamic theories, using parameter variations to assess the effects of increased aerodynamic forces.

The principle of using trailing edge T strips to modify the control force characteristics was not a radical departure from accepted practice. Furthermore, with the knowledge then available the designers' decision to apply the Broadbent Criterion was not unreasonable. It was only as a result of the extensive and detailed flutter test program, which was undertaken as part of the accident investigation, that it was determined that the use of T strips, in this case, resulted in aerodynamic forces substantially in excess of those which could reasonably have been expected. The magnitude of the aerodynamic changes thus invalidated the Broadbent Criterion as a determinant of freedom from flutter.

The mode of flutter which gave rise to this accident was a combination of tailplane antisymmetric torsion and tab rotation which occurred at a relatively high frequency and with a frequency parameter in excess of that indicated by previous experience. The addition of T strips to the trailing edges of the tailplane trim tabs resulted in aerodynamic and inertia effects which led to an essentially flutter-free structure becoming flutter critical.

3 CONCLUSIONS

1. After a normal take-off, at a height of about 950 feet and at an airspeed of about 110 knots, flutter of the tailplane and trim tabs occurred; they sustained structural damage to the extent that the pilot was deprived of effective control of the aircraft in the pitching plane.

2. The aircraft entered a descending turn to the left; at a low height, all control was lost and it struck the ground.

3. The purpose of the flight was to carry out tests to determine the stick force gradient after full-span trim tabs with trailing edge T strips had been fitted to the tailplane. This was the first flight with this modification.

4. The pilot was appropriately qualified and licensed.

5. Weather conditions were not a factor in the accident.

6. The aircraft was loaded within safe limits.

7. The aircraft was appropriately maintained and certified. With the exception of in-flight failures of the tailplane and trim tabs, there was no evidence of any defect or malfunction which could have contributed to the accident.

8. The flutter occurred as a result of the aerodynamic and inertia effects of the T strips which were attached to the trailing edges of the trim tabs.

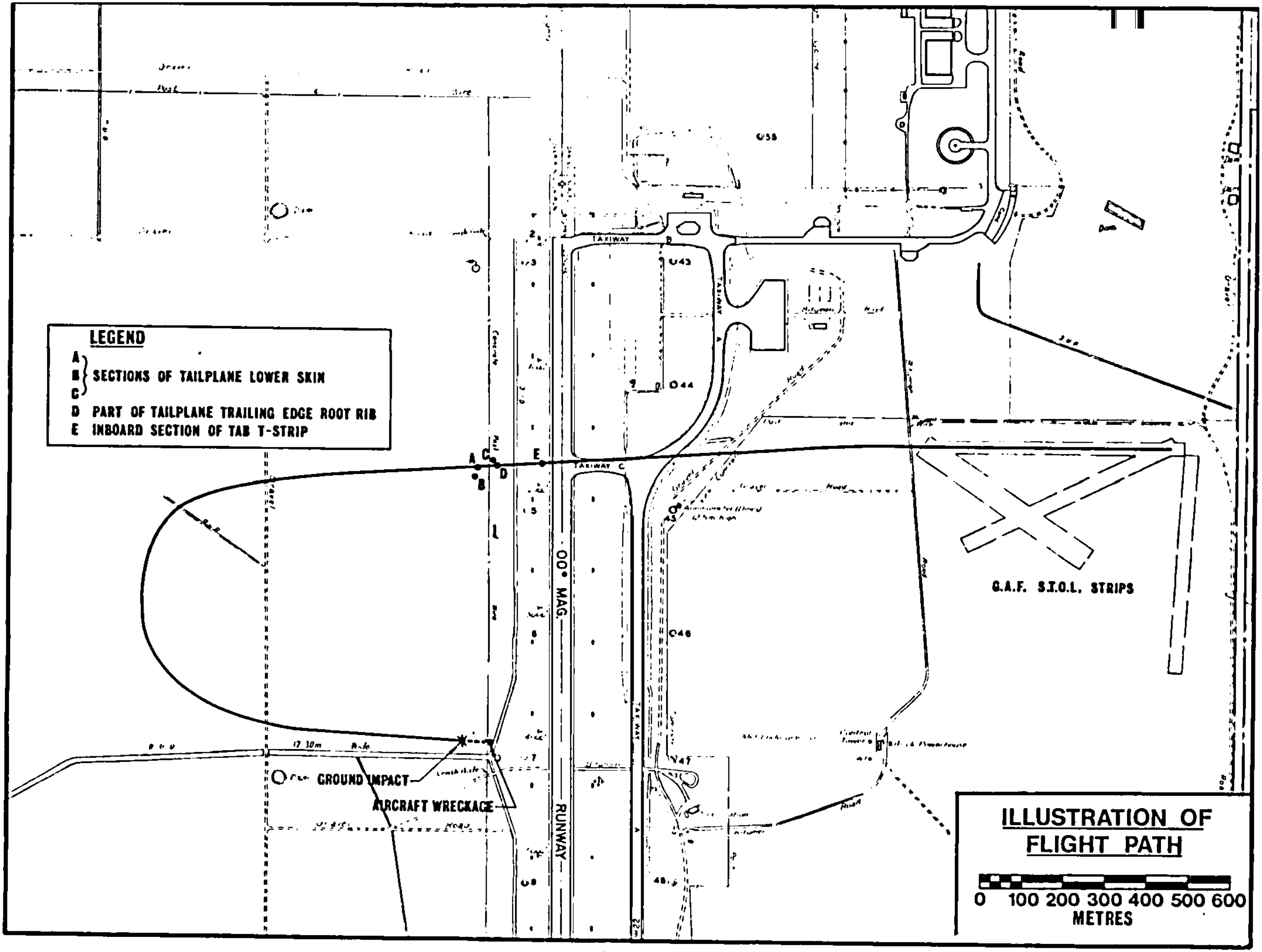
9. The modification of the tailplane and trim tabs was authorised by the manufacturer's design staff who were appropriately qualified.

10. A simplified design criterion was used to determine that, up to a maximum flight test speed of 120 knots, the modified tailplane and trim tabs would be free from flutter.

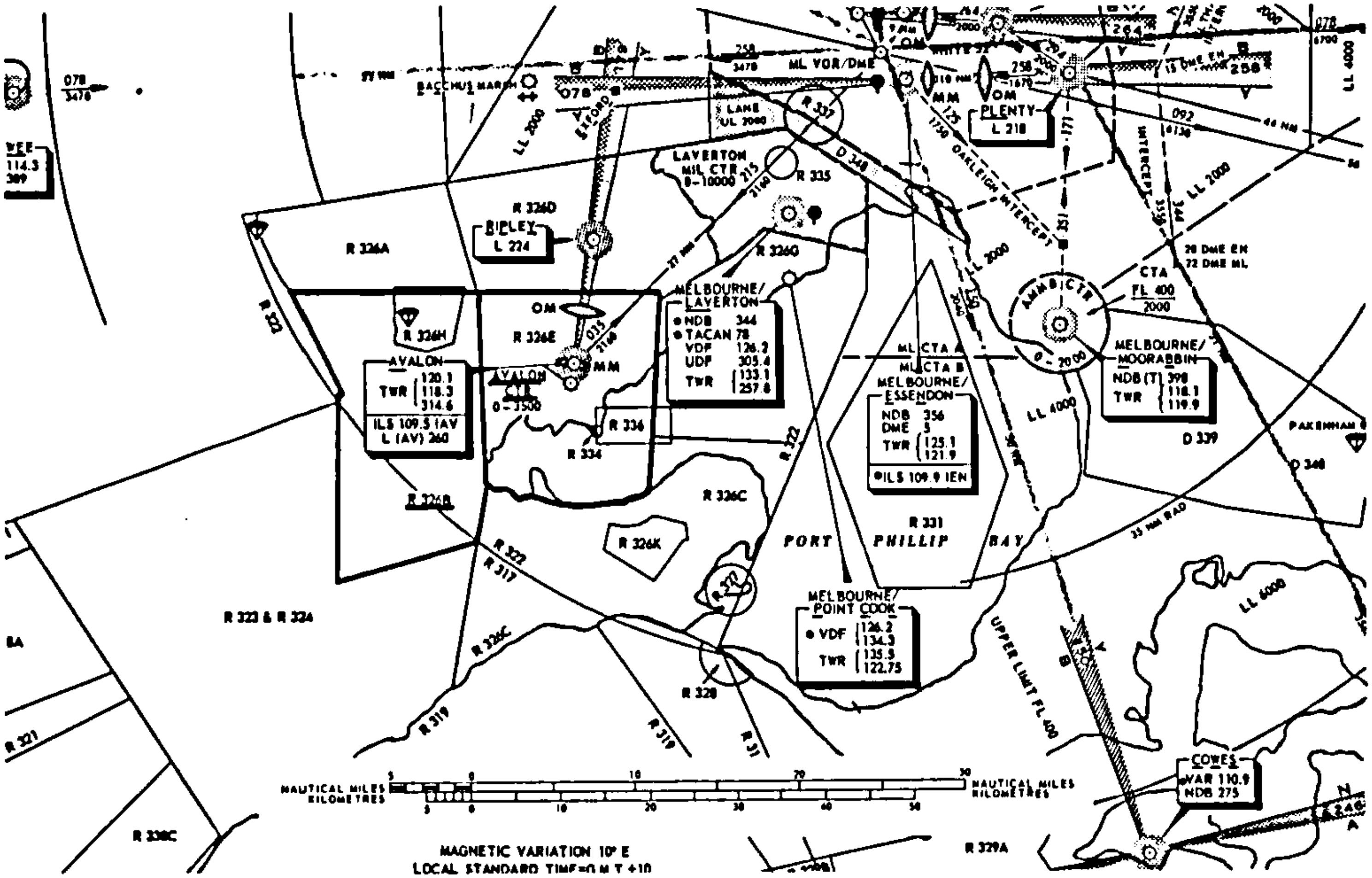
11. Post-accident research has shown that the tailplane modification resulted in a design to which the simplified design criterion did not apply.

CAUSE

The cause of the accident was that the simplified design criterion which was used to justify freedom from flutter during the flight testing of various tailplane modifications was not valid for a design which included tab trailing edge T strips.



LEGEND
A
B SECTIONS OF TAILPLANE LOWER SKIN
C
D PART OF TAILPLANE TRAILING EDGE ROOT RIB
E INBOARD SECTION OF TAB T-STRIP
A
B
C
D
E
TAXIWAY
TAXIWAY C
00° MAG.
RUNWAY
GROUND IMPACT
AIRCRAFT WRECKAGE
G.A.F. S.T.O.L. STRIPS
ILLUSTRATION OF FLIGHT PATH
0 100 200 300 400 500 600
METRES


ML VOR/DME
BACCHUS MARSH
LAVERTON
MIL CTR
B-10000
R 335
R 337
R 326A
R 326D
RIPLEY
L 224
R 326G
MELBOURNE/
LAVERTON
NDB 344
TACAN 78
VDF 126.2
UDF 305.4
TWR 133.1 257.8
R 326H
R 326E
AVALON
TWR 120.1 118.3 314.6
ILS 109.5 IAV
L (AV) 260
0 - 3500
R 334
R 322
R 326B
R 326C
R 326K
R 317
R 319
R 328
R 323 & R 324
R 321
R 330C
PLENTY
L 218
OAKLEIGH INTERCEPT
AMB CTR
CTA
FL 400
2000
MELBOURNE/
MOORABBIN
NDB (T) 398
TWR 118.1 119.9
ML CTA A
ML CTA B
MELBOURNE/
ESSENDON
NDB 356
DME 5
TWR 125.1 121.9
ILS 109.9 IEN
R 331
PORT PHILLIP BAY
LL 4000
LL 2000
LL 6000
D 339
D 348
PAKENHAM
35 NM RAD
MELBOURNE/
POINT COOK
VDF 126.2 134.3
TWR 135.5 122.75
UPPER LIMIT FL 400
COWES
VAR 110.9
NDB 275
R 329A
NAUTICAL MILES
KILOMETRES
MAGNETIC VARIATION 10° E
LOCAL STANDARD TIME=G.M.T +10

APPENDIX C

TRANSCRIPT OF COMMUNICATIONS CONCERNING NOMAD AIRCRAFT N24-10 RECORDED AT AVALON TOWER BETWEEN 1051 HOURS AND 1103 HOURS ON 6 AUGUST 1976

Legend

GAF 1	Nomad aircraft N24-10 callsign GAF ONE
GAF 2	Nomad aircraft N2-01 callsign GAF TWO
TWR	Avalon Tower (Aerodrome/approach controller)
SEC	Sector 1 Melbourne AACC
CAR 62	Radio-equipped airport vehicle callsign CAR SIX TWO
AFS	Avalon Fire and Rescue Service Unit
(?)	Unidentified source
—	Unintelligible word(s)
// //	Editorial insertion

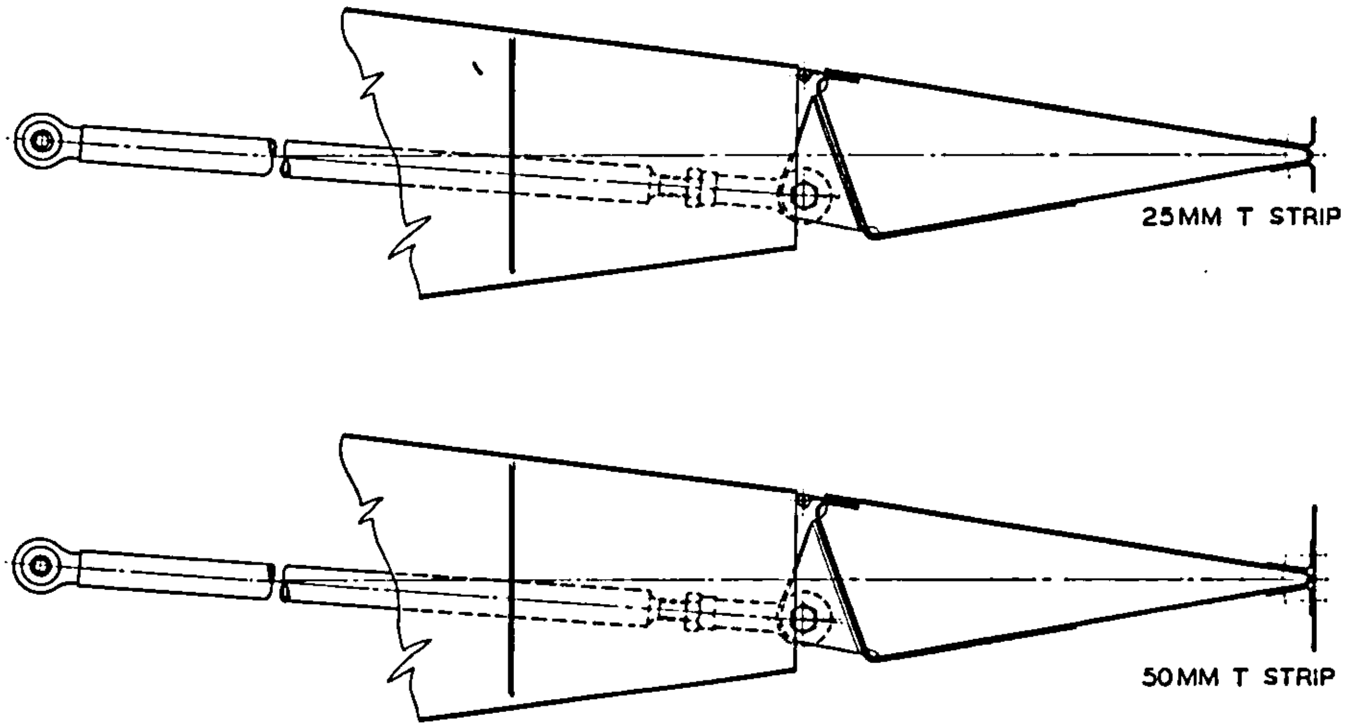
Time h/min/s	*From*	*To*	*Text*
1051:00			
1051:08	GAF 1	TWR	GAF ONE ah AVALON received ah DELTA taxi
:15	TWR	GAF 1	GAF ONE AVALON TOWER confirms for the stol strip
	GAF 1	TWR	Affirmative
:20	TWR	GAF 1	GAF ONE roger taxi the time is five one a half
	GAF 1	TWR	Roger GAF ONE
1052:00			
:23	TWR	GAF 2	GAF TWO your big brother's on the way up to the stol strip
:28	GAF 2	TWR	- - TWO ah roger
:35	GAF 1	GAF 2	Ah TWO I'll hold down here in the stol strip area
:51	GAF 1	GAF 2	Ah TWO from ONE you can come on up the road if you like umm I just wanna have a chat with this fellow with this aeroplane on the compass base here
	GAF 2	GAF 1	Roger
1053:00			
:41	GAF 1	GAF 2	Mind the wing Pete
:46	GAF 2	GAF 1	Too much camber on this road
:48	GAF 1	GAF 2	The wind's a bit strong too I think
	(?)	(?)	- -
1054:00			
1055:00			
:53	GAF 1	GAF 2	Ah TWO from ONE can you go to one two zero zero for a minute

1056:00			
1057:00			
1058:00			
:45	TWR	GAF 1	GAF ONE just for information there's light cloud coming through now it's er one five zero zero feet with lower patches and aircraft report extensive ah cloud and build-ups extending right down to Torquay and drifting through on a north-easterly heading
1059:00			
:01	GAF 1	TWR	Roger GAF ONE thanks very much er I'll take a quick look at it and er see if ah we can er operate in that area in the in the northern half of BRAVO
:12	TWR	GAF 1	GAF ONE ah roger it looks as though its okay at the moment but I don't think it'll last
:15	GAF 1	TWR	No roger we'll keep an eye on it thanks
:53	GAF 1	TWR	GAF ONE request clearance
:57	TWR	GAF 1	GAF ONE your clearance operate ROMEO three two six BRAVO not above one zero thousand
1100:00			
:01	GAF 1	TWR	GAF ONE BRAVO up to ten ready
:04	TWR	GAF 1	GAF ONE short delay
:23	TWR	GAF 1	GAF ONE climb unrestricted clear for take-off
:26	GAF 1	TWR	GAF ONE thank you
1101:00			
:25	TWR	SEC	GAF ONE is airborne to the north end of runway one eight and er heading west
:42	TWR	GAF 1	GAF ONE just confirm confirming that you can
:48			/ /4.5 second pause/ / GAF ONE ops normal?
:50	GAF 1	TWR	Negative negative
1102:00			
:02	TWR	GAF 1	GAF ONE crosswind on runway gusting three five clear to land
:05	TWR	CAR 62	CAR SIX TWO vacate immediately
:09	AFS	TWR	Hello
	TWR	AFS	Get the fireys there he's had a — —
	AFS	TWR	Yeah I know about it
	(?)	(?)	Okay
	(?)	(?)	— —
	(?)	(?)	Okay
:28	TWR		Standby police standby hospital standby fire brigade

APPENDIX D

Summary of calculated flutter speeds and the speeds achieved in flight tests

Tab configuration	*Most probable flutter speed—knots*	*Speed to which aircraft was flown—knots*
Standard (1.75 m)		
—no T strips	no flutter	218
—25 mm T strips	125	120
—50 mm T strips	115	not flown
Extended (2.16 m)		
—no T strips	no flutter	120
Full span (2.57 m)		
—no T strips	no flutter	118
—25 mm T strips	106	not flown
—50 mm T strips	103	approx. 110



TAB TRAILING EDGE T STRIPS

RM77/30005 Cat. No. 77 36936

10/18/1977

HS748 AVRO

++ REQUEST 140/94, REPORT # 86
++
+ PRELIMINARY REPORT HAWKER SIDDELEY - HS748/AVRO 748
ACCIDENT +
+ EVENTS I PHASES: COLLISION WITH BUILDING I MISSED APPROACH/GO-AROUND
+

++
+++++++++++++++++++++++++++++++++++

++
<-------------- OPERATION --------------> ++ <-------------- FILE DATA -------------->
TYPE : MISCELLANEOUS - TEST/EXPERIMENTAL ++ ICAO FILE : 77/0415-0
++ FROM STATE : INDONESIA
++
<-------------- WHEN --------------> ++ <---------- AIRCRAFT DATA ---------->
DATE : 77-10-18 ++ MASS CATEGORY : 5701 - 27 000 KG
TIME : 13:32 ++ STATE OF REGISTRY : INDONESIA
LIGHT : DAYLIGHT ++ REGISTRATION : PK-RHS
++
<-------------- WHERE --------------> ++ <------- DAMAGE, INJURY AND TOTAL ON BOARD ------->
LOCATION : MANILA AIRPORT ++ A/C DAMAGE : DESTROYED
STATE/AREA : PHILIPPINES ++ INJURY : FATAL SERIOUS MINOR NONE UNKNOWN TOTAL
DEPARTED : MANILA AIRPORT ++ CREW : 2 1 1 1 0 5
DESTINATION : MANILA AIRPORT ++ PAX :
OTHER DAMAGE : ++ GROUND : 3 0 0

INVESTIGATION CARRIED OUT BY THE PHILIPPINES ACCIDENT/INCIDENT INVESTIGATION BOARD.

-------------- EVENTS AND FACTORS --------------
1. EVENT I PHASE: COLLISION WITH BUILDING I MISSED APPROACH/GO-AROUND

05/04/1978
&
07/?/1979

HAVE BLUE

bay nor any sort of tactical equipment at all was fitted.

The *Have Blue* aircraft were equipped with fly-by-wire (FBW) flight controls which were adapted from the F-16 system. However, the system had to be modified to handle an aircraft that was unstable about all three axes (the F-16 is unstable only about the pitch axis). The problem of designing a stealthy system for airspeed measurement had not yet been solved, and the aircraft were equipped with a conventional pitot tube which was retracted when they were being tested for radar reflections. The inertial navigation system provided enough speed data for test purposes when the probe was retracted.

Two prototypes were built at a cost of $37 million for both aircraft. Lockheed workers assembled the two *Have Blue* aircraft in a cordoned-off area in Lockheed's Plant 10 facility housed at the USAF Plant 42 in Palmdale, California. Neither aircraft ever received an official DoD designation, or did they get a USAF serial number. However, Lockheed did give the aircraft its own manufacturer's serial numbers --- 1001 and 1002, meaning Plant 10, aircraft numbers 1 and 2.

The first example (1001) was finished in November of 1977. In order to keep the project away from prying eyes, the *Have Blue* prototype was shipped out to the Groom Lake Test Facility in Nevada in high secrecy for the test flights. Groom Lake is located in a particularly remote area of the Nellis test range complex, and is a good location for the testing of secret aircraft. A camouflage paint scheme was applied to make it hard for unwanted observers at Groom Lake to determine the aircraft's shape.

The first flight of the *Have Blue* took place in January or February of 1978 (the exact date is still classified), veteran Lockheed test pilot William M. "Bill" Park being at the controls. At an early stage, Bill Park was assisted in the flight test program by Lt. Col. Norman Kenneth "Ken" Dyson of the USAF.

Flight test of the *Have Blue* initially went fairly smoothly, and the fly-by-wire system functioned well. The landing speed was quite high (160 knots), as expected because of the lack of flaps or speed brakes. However, on May 4, 1978, *Have Blue* prototype number 1001 was landing after a routine test flight when it hit the ground excessively hard, jamming the right main landing gear in a semi-retracted position. Pilot Bill Park pulled the aircraft back into the air, and repeatedly tried to shake the gear back down again. After his third attempt failed, he was ordered to take the aircraft up to 10,000 feet and eject. Park ejected successfully, but he hit his head and was knocked unconscious. Since he was unable to control his parachute during descent or landing, his back was severely injured on impact. He survived, but was forced to retire from flying. The *Have Blue* aircraft was destroyed in the crash. The wreckage was secretely buried somewhere on the Nellis test range complex.

Have Blue 1002 arrived at Groom Lake shortly after the loss of number 1. It took to the air for the first time in June of 1978, Lt.Col. Ken Dyson being at the controls. From mid-1978 until early 1890, Lt.Col. Dyson flew more than 65 test sorties, testing the response of the aircraft to various types of radar threats. The *Have Blue* prototype 1002 proved to be essentially undetectable by all airborne radars except the Boeing E-3 AWACS, which could only acquire the aircraft at short ranges. Most ground-based missile tracking radars could detect the *Have Blue* only after it was well inside the minimum range for the surface-to-air missiles with which they were associated. Neither ground-based radars nor air-to-air missile guidance radars could lock onto the aircraft. It was found that the best tactic to avoid radar detection was to approach the radar site head on, presenting the *Have Blue*'s small nose-on signature.

It was found that the application of the RAM was rather tricky, and that ground crews had to be careful to seal all joints thoroughly before each flight. RAM came in linoleum-like sheets which was cut to shape and bonded to the skin to cover large areas. Doors and access panels had to be carefully checked and adjusted for a tight fit between flights and all gaps had to be filled in with conductive tape and then covered over with RAM. Paint-type RAM was available, but it had to be built up by hand, coat by coat. Even the gaps around the canopy and the fuel-filler door had to be filled with paint-type RAM before each flight. Ground crews had to even make sure that all surface screws were completely tight, since even one loose screw for an access panel could make the aircraft show up like a "barn door coming over the horizon" during radar signature tests.

Have Blue number 1002 was lost in July of 1979. During its 52nd flight, with Lt.Col. Dyson at the controls, one of its J85 engines caught fire. The subsequent fire got so intense that the hydraulic fluid lines were burned through. Lt.Col. Dyson was forced to eject, and 1002 was a total loss. It too was secretely buried somewhere on the Nellis test range complex.

No further *Have Blue* aircraft were built, since the general concept had been proven.

Specification of the *Have Blue* (approximate):

Two non-afterburning General Electric J85 turbojets. Maximum speed: 600 mph at sea level. Dimensions: wingspan 22 feet 0 inches, length 38 feet 0 inches, height 7 feet 6 inches. Gross weight 12,000 pounds. No armament was carried. Most other details are still classified.

F-117A

The F-117A stealth fighter had the same general configuration of the *Have Blue* test aircraft, but was much larger and heavier and was provided with an offensive military capability.

The structure of the F-117A is constructed mainly of aluminum, with some titanium being used in the engine and in the exhaust systems. The main facets of the outer skin are separately fastened to a rather complex skeletal frame. Since the accurate shaping and placement of these facets is critical to achieving a low radar cross section (RCS), production tooling had to be ten times more precise than the tooling used to build conventional aircraft.

The entire outer skin of the F-117A is covered by radar absorption material (RAM). The exact composition of the RAM is classified, but it is believed to consist of a matrix of magnetic iron particles held in place by a polymer binder. Originally, RAM came in large flexible sheets, and was bonded to a metal wire mesh which was in turn glued to the airframe of the F-117A. Later, when the aircraft entered service, the Air Force built a special facility for the application of the RAM. In order to provide for uniform and accurate application, as well as to prevent people from coming into contact with the highly toxic solvents which make the RAM liquid, the process is completely automated. During the application of the RAM, the F-117A is held like some sort of gigantic chicken being roasted on an spit, and is slowly turned as the RAM is sprayed on by computer-controlled nozzles. However, minor touch-ups can be made in the field by using a hand-held spray gun.

The engines powering the F-117A are a pair of non-afterburning General Electric F404-GE-F1D2 turbofans. These were derivatives of the afterburning F404-GE-400 turbofans which power the McDonnell Douglas F/A-18 Hornet. They are housed in broad nacelles which are attached to the sides of the angular fuselage.

The General Electric turbofans are fed by a pair of air intakes (one on each side of the fuselage). Two gratings with rectangular openings cover each intake. The purpose of these gratings is to prevent radar

June 16, 1978

Falcon 10
Dassault-Breguet

++ REQUEST 140/94, REPORT # 91
++
+ DATA REPORT DASSAULT-BREGUET - FALCON 10 INCIDENT
+
+ EVENTS | PHASES: MUSH/STALL | CRUISE +

++
++++++++++++++++++++++++++++++++++
++
<-------------- OPERATION --------------> ++ <-------------- FILE DATA -------------->
TYPE : MISCELLANEOUS - TEST/EXPERIMENTAL ++ ICAO FILE : 78/0600-0
++ FROM STATE : GERMANY
++
<-------------- WHEN --------------> ++ <---------- AIRCRAFT DATA ---------->
DATE : 78-06-16 ++ MASS CATEGORY : 5701 - 27 000 KG
TIME : 14:35 ++ STATE OF REGISTRY :
LIGHT : DAYLIGHT ++ REGISTRATION :
++
<-------------- WHERE --------------> ++ <------- DAMAGE, INJURY AND TOTAL ON BOARD ------->
LOCATION : ENROUTE ++ A/C DAMAGE : NONE
STATE/AREA : GERMANY ++ INJURY : FATAL SERIOUS MINOR NONE UNKNOWN TOTAL
DEPARTED : FRANKFURT ++ CREW : 0 0 0 4 0 4
DESTINATION : OBERPFAFFENHOFEN ++ PAX : 0
OTHER DAMAGE :

-------------- EVENTS AND FACTORS --------------
1. EVENT | PHASE: MUSH/STALL | CRUISE

---------------------- SECTION - 00 ---------------------->

FILING INFORMATION
ICAO FILE NUMBER : 78 / 0600 - 0
- STATE REPORTING : GERMANY
- STATE FILE NUMBER : 7X0001

WHERE
- STATE/AREA : GERMANY
- LOCATION : ENROUTE
WHEN
- DATE : 78-6-16
- TIME : 14:35

AIRCRAFT
REGISTRATION :
STATE OF REGISTRY : GERMANY
OPERATOR :

<------------------ 01 - HISTORY OF FLIGHT ------------------>

GENERAL AVIATION
- TYPE OF OPERATION : MISCELLANEOUS - TEST/EXPERIMENTAL
- TYPE OF OPERATOR : CORPORATE/EXECUTIVE

ITINERARY
DEPARTURE POINT : FRANKFURT
PLANNED DESTINATION : OBERPFAFFENHOFEN
ATC INFORMATION
- TYPE OF FLIGHT PLAN : IFR
- TYPE OF CLEARANCE : EN-ROUTE/AIRWAYS CLEARANCE
[redacted]LTITUDE : 7247 METRES
[redacted]LTITUDE TYPE :

FORCED/PRECAUTIONARY LANDING
- TYPE OF : FORCED LANDING
- LOCATION : ON AERODROME

<----------------- 02 - INJURIES TO PERSONS ----------------->

HIGHEST DEGREE OF INJURY: NONE

NUMBER OF PERSONS INVOLVED

	FATAL	SERIOUS	MINOR	NONE	UNKNOWN	TOTAL
PILOT	0	0	0	1	0	1
CO-PILOT	0	0	0	1	0	1
FL.CREW	0	0	0	2	0	2
CREW (TOT)	0	0	0	4	0	4
PAX	0	0	0	0	0	0
GROUND						

<--------------------- 03/04 - DAMAGE ---------------------->

- TO AIRCRAFT : NONE

<---------------------- 05 - PERSONNEL ---------------------->

PERSON AT CONTROLS : PILOT-IN-COMMAND

PILOT-IN-COMMAND
- AGE : 31

- SEX :

LICENCE
- TYPE (AEROPLANE) : AIRLINE TRANSPORT PILOT
- MEDICAL VALIDITY : VALID/NO MEDICAL WAIVERS
- CLASS/TYPE RATINGS : HELD REQUIRED RATING
- INSTRUMENT RATING : YES
- INSTRUCTOR RATING : YES

FLYING EXPERIENCE

	LAST 24 H	LAST 90 DAYS	TOTAL
THIS TYPE :			100
ALL TYPES :			4500

<--------------------- 06 - AIRCRAFT --------------------->

GENERAL
- YEAR OF MANUFACTURE :
- SERIAL NUMBER : 098
- TOTAL TIME : 310

DOCUMENTATION

DESCRIPTION OF AIRCRAFT
- TYPE : FIXED WING
- TYPE OF POWER : TURBOFAN
- TYPE OF LDNG GEAR :
ENGINE INFORMATION
- MANUFACTURER :
- MODEL (GENERAL) :
(SPECIFIC :

<------------------- 07 - METEOROLOGICAL ------------------->

BRIEFING AND FORECAST
GENERAL
- PHASE OF FLIGHT TO WHICH THE METEOROLOGICAL INFORMATION PERTAINS:
- GENERAL WEATHER : VMC
- LIGHT CONDITIONS : DAYLIGHT

- VISIBILITY : METRES

- VISIBILITY RESTRICTED BY : SMOKE
CLOUDS
- SKY CONDITION : BROKEN (5/8 TO 7/8)
- CEILING : METRES

PRECIPITATION/OTHER WEATHER PHENOMENA
- TYPE OF :

- INTENSITY :

TEMPERATURE : DEGREES

ICING
- INTENSITY :

TURBULENCE
- TYPE :
- INTENSITY :

WIND INFORMATION FOR TAKE-OFF/LANDING OCCURRENCES
- RELATIVE DIRECTION :

- ELEVATION : METRES
- DEPTH OF WATER : METRES

GROUND IMPACT INFORMATION
- SPEED AT IMPACT : KM/H
- ESTIMATED SPEED :
- RATE OF DESCENT :
- IMPACT ANGLE :
- ROLL ATTITUDE :
- PITCH ATTITUDE :
- A/C BREAKUP :

RECOVERY OF THE WRECKAGE
- RECOVERED :

<---------------- 13 - MEDICAL/PATHOLOGICAL ---------------->

INCAPACITATION
- PERSONS INCAPACITATED
 :
- TYPE OF :
- REASONS FOR :

AUTOPSY
- PERFORMED ON :

<------------------------ 14 - FIRE ------------------------>

FIRE STARTED
- WHEN :
- FUEL SOURCE :
- SOURCE OF IGNITION :
- INITIAL LOCATION :

FIRE WARNING SYSTEM
- INSTALLATION :
- OPERATION :

OTHER FIRE WARNING RECEIVED
 :

AIRCRAFT FIRE SUPPRESSION SYSTEMS
- INSTALLATION :
- EFFECTIVENESS :
- WHICH SYSTEM USED :
- EXTINGUISHANT USED :

SMOKE PROTECTION
- FLIGHT CREW :

AERODROME RESCUE AND FIRE FIGHTING OPERATIONS

- AVAILABILITY :
- TIME BETWEEN INITIAL CALL AND FIRST INTERVENTION
 : MINUTES

- EFFECTIVENESS :
- REASONS FOR INEFFECTIVENESS OF RESCUE/FIRE FIGHTING

EXTINGUISHANT AGENT USED
- PRINCIPLE TYPE :
- AMOUNT OF WATER : LITRES

FUEL FIRE
- QUANTITY ON BOARD : LITRES
- TYPE OF FUEL :

DANGEROUS GOODS
- INVOLVED :

<------------------ 15 - SURVIVAL ASPECTS ------------------>

SEARCH AND RESCUE
- SEARCH METHOD :
- SEARCH SUCCESS :
- SEARCH DIFFICULTIES:
- TIME TO LOCATE A/C : DAYS HOURS
- METHOD OF LOCATING :
- ELT EFFECTIVENESS :

SURVIVABILITY OF THE OCCURRENCE
- GENERAL :

NUMBER OF FATAL INJURIES FROM SPECIAL CAUSES
- IMPACT :
- BURNS :
- FUMES/GASES :
- SHOCK/EXPOSURE :
- DROWNING :
- OTHER REASONS :
- UNKNOWN CAUSES :

NUMBER OF NON-FATAL INJURIES FROM SPECIAL CAUSES
- IMPACT :
- BURNS :
- FUMES/GASES :
- SHOCK/EXPOSURE :
- OTHER CAUSES :
- UNKNOWN CAUSES :

EVACUATION
- NUMBER OF PERSONS EVACUATED/ESCAPED
 :
- EVACUATION TIME : MINUTES SECONDS
- EVACUATION HAMPERED BY
 :

EVACUATION SLIDES/CHUTES
- INSTALLED :
- EFFECTIVENESS :
- REASON NOT EFFECTV.:

EMERGENCY LIGHTING
- INSTALLATION :
- OPERATION :

RESTRAINT SYSTEMS
- PILOT :
- CO-PILOT :
- PASSENGER :
- NR OF FAILURES :

SEATS
- NR OF FAILURES .:

<------------------- 17 - MID-AIR COLLISION ------------------->

INFORMATION RELATED TO THE FLIGHT PATH
- SPEED : KM/H
- BANK ANGLE :
- DIRECTION OF BANK :
- VERTICAL MOVEMENT :

VISIBILITY
ESTRICTIONS :

- USE OF LIGHTING :

- OTHER A/C SIGHTED :

ATC INFORMATION
- WARNING ISSUED :
- TRAFFIC ADVISORY :
- RADAR CONTACT :

OTHER
- EVASIVE ACTION :
- A/C LANDED SAFELY :
- MILITARY INVOLVED :
- OTHER A/C REGISTR. :

NEAR MIDAIR COLLISION - CLOSEST DISTANCE
- HORIZONTAL : METRES
- VERTICAL : METRES

N A R R A T I V E

S E Q E N C E O F E V E N T S

EVENT 1 MUSH/STALL - CRUISE
1.AC GENERATOR/ALTERNATOR - NOT DONE
2.MET WEATHER OBSERVATION - INADEQUATE

CROSS WIND COMP. : M/S
- WINDSHEAR/MICRO BURST
:

<------------------- 08 - AIDS TO NAVIGATION ----------------->

EN-ROUTE AIDS
- AIDS USED :

LANDING AIDS USED
- ELETRONIC AIDS :

- APPROACH LIGHTING :
- STROBE LIGHTS :
- TYPE OF VASI USED :

<--------------- 09 - AIR-GROUND COMMUNICATION --------------->

LAST GROUND STATION IN CONTACT WITH THE A/C
:

RECORDING OF COMMUNICATION AVAILABLE
:

<---------------------- 10 - AERODROME ---------------------->

GENERAL
AME :
LOCATION INDICATOR :
TYPE :
- ELEVATION : METRES

RUNWAY IN USE
- IDENTIFIER :
- AVAILABLE LENGTH : METRES
- AVAILABLE WIDTH : METRES
- LENGTH OF OVERRUN : METRES
- SLOPE :

RUNWAY SURFACE
- TYPE :
- SURFACE TYPE :
- SURFACE TREATMENT :
- BRAKING ACTION :
DETERMINED BY :

AERODROME LIGHTING
- RUNWAY
EDGE/END/THRESHOLD :
CENTRE LINE :
TOUCHDOWN ZONE :

- TAXIWAY
EDGE :
CENTRE LINE :
HOLDING POSITION :

- STOPWAY LIGHTING :
- STOP BARS (LIGHTS) :

CATEGORY OF RUNWAY USED

HELIPORT/HELICOPTER LANDING AREA
- TYPE :
- SURFACE TYPE :
- SITE CONFIGURATION :

WATER LANDING AREA CONDITION
- WATER CONDITION :
- WAVE HEIGHT :
- LANDING/TAKE-OFF DIRECTION RELATIVE TO SWELL
:
- OBTSRUCTIONS :

<------------------- 11 - FLIGHT RECORDERS ------------------->

FLIGHT DATA RECORDER
- LOCATION :
- TYPE :
- RECORDING MEDIUM :
- NR OF PARAMETERS :
- UNDERWATER LOCATOR BEACON
:
- RECOVERY OF RECORDER
:
- RECOVERY OF DATA :
- REASON FOR DATA LOSS
:
- USEFULLNESS OF THE RECOVERED DATA

COCKPIT VOICE RECORDER

- LOCATION :
- TYPE OF MEDIUM :
- NR OF CHANNELS :
- DURATION OF REC. : MINUTES
- HOT MIC INSTALLED :
- RECORDER RECOVERED :
- UNDERWATER LOCATOR BEACON
- QUALITY OF REC. :
- REASON WHY THE RECORDING WAS NOT RECOVERED
:

<----------------- 12 - WRECKAGE AND IMPACT ----------------->

LOCATION OF WRECKAGE
- GENERAL : ON AERODROME/AIRSTRIP
- SPECIFIC :
IN RELATION TO THE THRESHOLD
- DISTANCE : METRES
- BEARING : DEGREES

AIRCRAFT LEFT THE RUNWAY
- DIRECTION :
- DISTANCE : METRES

INFORMATION ON THE TERRAIN WHERE THE A/C CAME TO REST
- TYPE :
- SURFACE TYPE :

(2)

Bundesstelle für Flugunfalluntersuchung
Hermann-Blenk-Straße 16
D-38108 Braunschweig

Datensatz

Störung eines deutschen Lfz. im Inland
ohne Verletzte

Luftfahrzeugart	: Flugzeug
Luftfahrzeughersteller	: Dassault
Muster/Typ	: Falcon
Eintragungsstaat	: Deutschland
Datum der Störung	: 16/06/1978
Uhrzeit der Störung	: 14.35 Uhr
Störungsort	: Reiseflug
Regierungsbezirk/Staat	: Oberbayern (BY)

1.0 Tatsachenermittlung

1.1 Flugverlauf

Betriebsart - Allgemeine Luftfahrt	: verschiedene Betriebsarten
	: - Werkstattflug, Prüfflug
Art des Halters - Allgm. Luftfahrt	: Geschäftsflugbetrieb
FS-Flugplan/Freigabe	: IFR-Flugplan/Freigabe
Letzter Abflugort	: FRANKFURT
Zielort	: OBERPFAFFENHOFEN
Betriebsphase	: Flugphase
	: - Reiseflug
Art der Störung	: unkontrollierte Abweichung von der Flughöhe
Art der Notlage	: Fluglagestörung - Querachse
	: vermutete technische Störung am Luftfahrzeug
Notlandung / Vorsorgliche Landung	: Notlandung auf einem Flugplatz

1.2 Personenschäden

keine Verletzten

1.3 Schaden am Luftfahrzeug

Luftfahrzeug beschädigt

April 29, 1993

1.4 Sachschaden Dritter

keiner

1.5 Angaben zur Besatzung

July 24, 1985

Luftfahrzeugführer - verantwortlicher Luftfahrzeugführer

Verantwortlicher Luftfahrzeugführer
Lebensalter

March 26, 82

June 16, 78

(1)

(3)

Erlaubnis	: Verkehrsluftfahrzeugführer
Gültigkeit der Erlaubnis	: am Unfalltage gültig
Berechtigungen - Kategorie u.Klasse	: mehrmotorige Land-Flugzeuge - über 5700 kg
Musterberechtigung	: erforderliche Berechtigung vorhanden
Instrumentenflugberechtigung	: vorhanden
Gültigkeit der maßgebl. Berechtig.	: Berechtigung gültig
Gesamtflugerfahrung	: 4500 Stunden
Flugerfahrung auf dem Muster	: 100 Stunden
Landungen auf dem Muster - in den letzten 90 Tagen	: 26 bis 50
Fliegerärztl. Tauglichkeitsklasse	: tauglich ohne Auflagen und Beschränkungen
Erlaubnis	: Berufsluftfahrzeugführer
Gültigkeit der Erlaubnis	: am Unfalltage gültig
Berechtigungen - Kategorie u.Klasse	: mehrmotorige Land-Flugzeuge - über 5700 kg
Musterberechtigung	: erforderliche Berechtigung vorhanden
Fliegerärztl. Tauglichkeitsklasse	: tauglich ohne Auflagen und Beschränkungen

1.6 Angaben zum Luftfahrzeug

Luftfahrzeughersteller	: Dassault
Muster/Typ	: Falcon
Luftfahrzeug-Werknummer	: 098
Luftfahrzeugart	: Flugzeug
Flugmasse	: über 5 700 kg - 14 000 kg
Fluggewicht	: innerhalb der zulässigen Grenzen
Schwerpunktlage	: innerhalb der zulässigen Grenzen
Triebwerksart	: Zweikreis-Turbinen-Strahltriebwerk
Gesamt-Betriebszeit des Lfz.	: 310 Stunden
Nachprüfungs- und Wartungskontrolle	
Nachprüfung erfolgte	: in Zeitabständen
Art der letzten maßgeb. Nachprüfung	: Jahresnachprüfung
Betriebszeit seitdem	: 0 Stunden
Art der letzten Wartungskontrolle	: B-Check
Betriebszeit seitdem	: 0 Stunden
Instrumentenflugausrüstung	: Luftfahrzeug für IFR-Flüge ausgerüstet

1.7 Meteorologische Informationen

Lichtverhältnisse	: Tageslicht
Sicht am Boden	: mehr als 10 km
Örtliche Sichtbehinderung	: keine
Bewölkung	: bewölkt - 5/8 bis 7/8
Hauptwolkenuntergrenze	: 5000 Fuß
Niederschlag	: keiner
Flugwetterbedingungen	: Sichtwetterbedingungen

1.8 Navigationshilfen

1.9 Funkverkehr

Sprechfunkverbindg.m.Bodenfunkstel.	: vorhanden und zufriedenstellend
Bodenfunkstelle	: An-/Abflugkontrolle
Aufzeichnung des Sprechfunkverkehrs	: Umschrift gefertigt

...

(2)

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1.2 Personenschäden

keine Verletzten

1.3 Schaden am Luftfahrzeug

Luftfahrzeug beschädigt

1.4 Sachschaden Dritter

keiner

1.5 Angaben zur Besatzung

Luftfahrzeugführer u. Steuerer : verantwortlicher Luftfahrzeugführer

Verantwortlicher Luftfahrzeugführer

Lebensalter

(1)

Ultrakurzbericht Thema : Four Accidents/Incidents in test-flight insgesamt: 4 Fälle Seite 1

Aktenz.	Datum Zeit	Hersteller Muster	Störungsort Abflugort Zielort Bemerkungen	Sachschaden Anzahl verl. Personen	Betriebsart 1. Betriebsphase 1. Art der Störung
June 16, 78 7X001-0/78	16.06 14.35	Dassault Falcon	Reiseflug FRANKFURT OBERPFAFFENHOFEN WEGLAUFEN DER HOEHENTRIMMUNG IN EINE ENDLAGE DURCH NICHT ABSCHALTBAREN STROMFLUSS VOM AUTOPILOT UEBER DEN TRIMMSCHALTER ZUM TRIMM-MOTOR.	nicht beschädigt T S L 0 0 0	- Werkstattflug, Prüfflug - Reiseflug unkontrollierte Abweichung von der Flughöhe
March 26, 82 3X039-0/82	26.03 18.23	DORNIER 28D	Aichach OBERPFAFFENHOFEN OBERPFAFFENHOFEN BEI TESTFL.ZUR ERLANG.D.ENGL.ZULASSUNG WURDE LFZ VOLL KOPFLASTIG VERTRIMMT.VERLUST D.STEUERBARKEIT INF.HOHER HANDKRAEFTE.RUECKTRIMMEN W.ERFOLGLOS.	zerstört T S L 3 0 0	- Versuchs-, Forschungs-, Erprobungsflug - Reiseflug sonstige unkontrollierte Fluglage
July, 24, 1985 3X317-0/85	24.07 14.45	[illegible] CD01	Friedrichshafen FRIEDRICHSHAFEN FRIEDRICHSHAFEN BEI DER DURCHF. DES NOTVERF.HAETTE DIE BESATZ. ERKENNEN KOENNEN, DASS DIE FAHRWERKE AUSGEFAHREN WAREN U. SOMIT EINE NORMALE LANDUNG MOEGLICH WAR	schwer beschädigt T S L 0 0 0	- Versuchs-, Forschungs-, Erprobungsflug - Abfangen/Aufsetzen Wasserung mit ausgefahrenem Fahrwerk
April 29, 1993 3X117-0/93	29.04 17.10	DASA FA06	Manching Manching Manching Die Landung des einstrahligen Flugzeuges erfolgte auf dem linken Hauptfahrwerk und dem Bugfahrwerk und das rechte Hauptfahrwerk infolge eines Hydraulikschadens nicht ausgefahren waren.	schwer beschädigt T S L 0 0 0	- Versuchs-, Forschungs-, Erprobungsflug - Reiseflug Ausfall der Fahrwerksanlage, ATA 32

(4)

1.10 Angaben zum Flugplatz

1.11 Flugschreiber

1.12 Angaben über Wrack und Aufprall

1.13 Medizinische und pathologische Angaben

1.14 Brand

Entstehung/Fortsetzung des Brandes : Brand nicht entstanden

1.15 Überlebensmöglichkeiten

2.0 Auswertung

Von den möglichen Ursachen sind ermittelt	: Bordsysteme durch
	: - Aussage des verantw. Lfzf. / des Halters
	: - Befund am Luftfahrzeug
	: - Flugschreiber und/oder Tonbandaufzeichnung
	: sonstiges Luftfahrtpersonal durch
	: - Zeugenaussagen
	: - Befund am Luftfahrzeug

3.0 Schlußfolgerungen

Betriebsphase	: Flugphase
	: - Reiseflug
Art der Störung	: unkontrollierte Abweichung von der Flughöhe
Notlandung / Vorsorgliche Landung	: Notlandung auf einem Flugplatz
Ursachen	
- der 1. Störungsart	: Systeme
	: Steuerungsanlage
	: - Höhenruder und Höhenrudertrimmbetätigung
	: - Fehlfunktion
	: sonstiges Personal
	: Entwicklungs-/Fertigungspersonal
	: - Herstellungsmängel

Bemerkungen:

WEGLAUFEN DER HOEHENTRIMMUNG IN EINE ENDLAGE
DURCH NICHT ABSCHALTBAREN STROMFLUSS VOM AUTOPILOT
UEBER DEN TRIMMSCHALTER ZUM TRIMM-MOTOR.

Autopilot
Trim Motor

4.0 Empfehlungen

Empfehlungen	: Luftfahrzeug - Lufttüchtigkeitsanweisung
Sofortmaßnahmen	: nicht eingeleitet

...

5

Verteiler : Bundesminister für Verkehr
: Luftfahrt-Bundesamt
Abt. Technik, Betrieb und Gruppe Recht

Braunschweig, den 08/06/1979

gez. (Friedrich)

02/22/1979

2/22/79

FAA INCIDENT DATA SYSTEM REPORT
Report Number: 19790222006789G

General Information

Local Date:	02/22/1979
Local Time:	16:00
City:	FORT SMITH
State:	AR
Airport Name:	
Airport Id:	

Aircraft Information

Aircraft Damage:	SUBSTANTIAL
Phase of Flight:	NORMAL CRUISE
Aircraft Make/Model:	NAMER NA-265-60
Airframe Hours:	
Operator Code:	
Operator:	
Owner Name:	

Narrative

SEVERE HAIL ENCOUNTERED WHILE SEARCHING FOR SEVERE ICING DURING FAA ENGINEERING FLIGHT TEST.

Detail

Primary Flight Type:	INDUSTRIAL/SPECIAL
Secondary Flight Type:	EXPERIMENTAL TEST FLIGHT
Type of Operation:	GENERAL OPERATING RULES
Registration Number:	605RG
Total Aboard:	3
Fatalities:	0
Injuries:	0

Landing Gear:	
Aircraft Weight Class:	OVER 12500 LBS
Engine Make:	
Engine Model:	
Engine Group:	
Number of Engines:	2
Engine Type:	

Environmental/Operations Information

Primary Flight Conditions:	UNKNOWN
Secondary Flight Conditions:	OTHER
Wind Direction (deg):	
Wind Speed (mph):	
Visibility (mi):	
Visibility Restrictions:	
Light Condition:	DAY
Flight Plan Filed:	INSTRUMENT FLIGHT RULES
Approach Type:	

Pilot-in-Command

Pilot Certificates:	AIRLINE TRANSPORT
Pilot Rating:	
Pilot Qualification:	QUALIFIED

Flight Time (Hours)

Total Hours:	4200
Total in Make/Model:	2200
Total Last 90 Days:	0
Total Last 90 Days Make/Model:	0

02/26/1979

2-26-79

++ REQUEST 140/94, REPORT # 105
++
+ DATA REPORT SWEARINGEN - MERLIN IIA/SA-26T ACCIDENT
+
+ EVENTS | PHASES: COMPLETE GEAR COLLAPSED/RETRACTED | ABORTED TAKE-OFF
+

++
++

<--------------- OPERATION ---------------> ++ <--------------- FILE DATA --------------->
TYPE : MISCELLANEOUS - TEST/EXPERIMENTAL ++ ICAO FILE : 79/0314-0
++ FROM STATE : UNITED STATES
++
<-------------------- WHEN --------------------> ++ <------------ AIRCRAFT DATA ------------>
DATE : 79-02-26 ++ MASS CATEGORY : 2251 - 5700 KG
TIME : 09:22 ++ STATE OF REGISTRY : UNITED STATES
LIGHT : DAYLIGHT ++ REGISTRATION : N345T
++
<------------------- WHERE -------------------> ++ <-------- DAMAGE, INJURY AND TOTAL ON BOARD -------->
LOCATION : HOUSTON,TX ++ A/C DAMAGE : SUBSTANTIAL
STATE/AREA : UNITED STATES ++ INJURY : FATAL SERIOUS MINOR NONE UNKNOWN TOTAL
DEPARTED : HOUSTON,TX ++ CREW : 0 0 0 2 0 2
DESTINATION : LOCAL ++ PAX :
OTHER DAMAGE : YES

CREW ATTEMPTED TAKE-OFF WITH FULL FLAPS. THE A/C "WHEEL BARROWED" AND WAS PREMATURELY ROTATED. GEAR WAS RETRACTED AND THE A/C SETTLED BACK ONTO RWY.

---------------- EVENTS AND FACTORS ----------------
1. EVENT | PHASE: COMPLETE GEAR COLLAPSED/RETRACTED | ABORTED TAKE-OFF

05/31/1979

5-31-79

++ REQUEST 140/94, REPORT # 114
++
+ DATA REPORT SWEARINGEN - SA-226 TC METRO II ACCIDENT
+
+ EVENTS I PHASES: HARD LANDING I LEVEL OFF/TOUCHDOWN
+
+ GEAR COLLAPSED/RETRACTED I LANDING ROLL +

++

++

<--------------- OPERATION ---------------> ++ <--------------- FILE DATA --------------->

TYPE : MISCELLANEOUS - TEST/EXPERIMENTAL ++ ICAO FILE : 79/0218-0
++ FROM STATE : UNITED STATES
++

<------------------- WHEN -------------------> ++ <------------ AIRCRAFT DATA ------------->

DATE : 79-05-31 ++ MASS CATEGORY : 2251 - 5700 KG
TIME : 10:42 ++ STATE OF REGISTRY : UNITED STATES
LIGHT : DAYLIGHT ++ REGISTRATION : N5654M
++

<------------------- WHERE -------------------> ++ <-------- DAMAGE, INJURY AND TOTAL ON BOARD -------->

LOCATION : SAN MARCOS,TX ++ A/C DAMAGE : SUBSTANTIAL
STATE/AREA : UNITED STATES ++ INJURY : FATAL SERIOUS MINOR NONE UNKNOWN TOTAL
DEPARTED : SAN MARCOS,TX ++ CREW : 0 0 1 3 0 4
DESTINATION : LOCAL ++ PAX :
OTHER DAMAGE :

THE A/C WAS ON A CERTIFICATION FLIGHT TEST. AN FAA FLIGHT TEST PILOT WAS AT THE CONTROLS AND A SWEARINGEN ENGINEERING TEST PILOT WAS IN THE RIGHT SEAT. THE RIGHT ENGINE HAD BEEN FEATHERED TO CONDUCT HEAVY WEIGHT FORWARD CENTER OF GRAVITY TAKE-OFF AND LANDINGS. AT ABOUT 50 FT AGL, AS POWER WAS REDUCED FOR LANDING, THE LEFT PROPELLER WENT INTO THE BETA RANGE. THE A/C LANDED HARD AND THE LANDING GEAR COLLAPSED. NO MALFUNCTION OF THE A/C WAS FOUND.

REMARK: FAA FLIGHT TEST PILOT AT CONTROLS.

---------------- EVENTS AND FACTORS ----------------

1. EVENT I PHASE: HARD LANDING I LEVEL OFF/TOUCHDOWN
2. EVENT I PHASE: GEAR COLLAPSED/RETRACTED I LANDING ROLL

11/12/1979

Pilatus PC-7

11-12-79

+++ REQUEST 140/94, REPORT # 121
+++
+ DATA REPORT PILATUS - PC-7 ACCIDENT +
+ EVENTS | PHASES: SPIN | NORMAL DESCENT +
+ COLLISION WITH HILL/MOUNTAIN | NORMAL DESCENT
+

++

++
<---------------- OPERATION ---------------> ++ <---------------- FILE DATA ---------------->
TYPE : MISCELLANEOUS - TEST/EXPERIMENTAL ++ ICAO FILE : 79/0470-0
++ FROM STATE : SWITZERLAND
++
<------------------ WHEN ------------------> ++ <------------ AIRCRAFT DATA ------------->
DATE : 79-11-12 ++ MASS CATEGORY : 2251 - 5700 KG
TIME : 11:26 ++ STATE OF REGISTRY : SWITZERLAND
LIGHT : DAYLIGHT ++ REGISTRATION : HB-HCN
++
<------------------- WHERE -------------------> ++ <------- DAMAGE, INJURY AND TOTAL ON BOARD -------->
LOCATION : NEAR WOLFENSCHIESSEN ++ A/C DAMAGE : DESTROYED
STATE/AREA : SWITZERLAND ++ INJURY : FATAL SERIOUS MINOR NONE UNKNOWN TOTAL
DEPARTED : BUOCHS ++ CREW : 2 0 0 0 0 2
DESTINATION : BUOCHS ++ PAX : 0 0 0 0 0 0
OTHER DAMAGE : YES ++ GROUND : 0 0 0

DRN: DURING A TEST FLIGHT, THE A/C WAS TWICE CLIMBED TO 10 000 FT BEFORE RETURNING TO THE AIRPORT. IN ORDER TO LOSE ALTITUDE VERY QUICKLY, THE PILOT INITIATED A SPIN AT 10 000 FT. THE PILOT FAILED TO STOP THE SPIN IN TIME AND THE A/C COLLIDED WITH MOUNTAINOUS TERRAIN. THE PILOT APPARENTLY INITIATED A HIGH SPEED STALL DURING THE ATTEMPTED SPIN RECOVERY.

---------------- EVENTS AND FACTORS ----------------
1. EVENT | PHASE: SPIN | NORMAL DESCENT
2. EVENT | PHASE: COLLISION WITH HILL/MOUNTAIN | NORMAL DESCENT

?/?/1980

C130
Rocket Assist
T/O & Ldg

1980

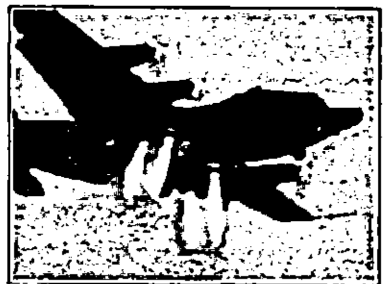
CNN interactive
CNN.com

HOME
U.S.
WORLD
LOCAL
WEATHER
SPORTS
SCI-TECH
TRAVEL
STYLE
SHOWBIZ
HEALTH
EARTH
CNNfn
allpolitics
CONTENTS
HELP!
FEEDBACK
SEARCH

U.S. NEWS
STORY PAGE

How many rockets can make plane land like a chopper?

Jane's reveals Iran hostage crisis engineering feat


(Courtesy Jane's Defense Weekly)

March 3, 1997
Web posted at: 11:50 p.m. EST

From Correspondent Richard Blystone

LONDON (CNN) -- Desperate times breed desperate measures, and the 1980 Iran hostage crisis was a desperate time for the United States, especially after one rescue mission in the Iranian desert met with disaster.

It's now known that the U.S. planned a second rescue attempt. For it, the U.S. military made radical modifications to a transport plane to make it take off and land almost like a helicopter, Jane's Defense Weekly disclosed Monday.

The military modified a huge C-130 Hercules, adding rockets so that it could take off and land in little more than its own length. At the time of the project, 53 Americans were being held hostage in Tehran, and the first rescue mission, "Eagle Claw," had ended with an aircraft collision that killed eight U.S. soldiers.

Thus began a near-miracle of hastily organized high-tech tinkering called "Credible Sport."


Cook (CNN)

"It was a desperate response to a very desperate situation," said Nick Cook of Jane's Defense Weekly.

His periodical has obtained films and documents on that response, classified for the last 16 years, which describe how hundreds of Navy and Air Force service members worked with Lockheed aircraft engineers to festoon the old C-130 workhorse with rockets, stuff it with new electronics, and carve the fuselage into a hot rod.

Jane's won't say where the black-and-white footage came from, but the narration is unmistakably American military-speak. (8 sec./128K AIFF or WAV sound)

The plane was equipped with lift rockets slanting downward, slowdown rockets facing forward, missile motors facing backward, and still more rockets to stabilize the plane as it touched down, in a Tehran soccer stadium -- so the plan went. Delta Force commandos would bring rescued hostages to the stadium, then everybody would brace for a leap to liberty.

"It was an extreme measure. Bear in mind 150 people would have been sitting in this thing as it would have blasted off, literally like a rocket, to get out of the stadium," Cook said.


The plane had rockets to stop it in a short distance (Courtesy Jane's Defense Weekly)

The first modified plane, created in just a couple of months, crashed on the runway after a rocket went off prematurely and ripped off one of the plane's wings. Engineers never had to use the second modified plane they were working on: For good or ill, before it could be tried, Iran announced plans to free the hostages. "Credible Sport" stayed in the test phase.

The film makes clear that the program went on, as the narrator discusses "future flight test programs" to "further define aerodynamic performance." But by any measure, the technology is obsolete now.

"The time for its secrecy is past," said Cook. "It's time for it to come into the light," as a triumph of impromptu engineering and a risk that didn't have to be taken.

Related sites:

Note: Pages will open in a new browser window

- IRAN Net
- Welcome To NetIran

External sites are not endorsed by CNN Interactive.

Tell us what you think!

You said it...

BACK TO TOP

04/03/1980

Canadair CL-600

4-3-80

++++++++++++++++++++++++++++++++++++++ REQUEST 140/94, REPORT # 128
++++++++++++++++++++++++++++++++++++++
+ DATA REPORT CANADAIR - CL-600 ACCIDENT +
+ EVENTS | PHASES: MUSH/STALL | EMERGENCY/UNCONTROLLED DESCENT
+
+ COLLISION WITH LEVEL TERRAIN/WATER | EMERGENCY/UNCONTROLLED DESCENT +

+++
++

<--------------- OPERATION ---------------> ++ <--------------- FILE DATA --------------->
TYPE : MISCELLANEOUS - TEST/EXPERIMENTAL ++ ICAO FILE : 80/0139-0
++ FROM STATE : UNITED STATES
++

<-------------------- WHEN --------------------> ++ <------------ AIRCRAFT DATA ------------->
DATE : 80-04-03 ++ MASS CATEGORY : 5701 - 27 000 KG
TIME : 09:10 ++ STATE OF REGISTRY : CANADA
LIGHT : DAYLIGHT ++ REGISTRATION : C-GCGRX
++

<-------------------- WHERE --------------------> ++ <-------- DAMAGE, INJURY AND TOTAL ON BOARD -------->
LOCATION : NEAR CALIF. CITY,CA ++ A/C DAMAGE : DESTROYED
STATE/AREA : UNITED STATES ++ INJURY : FATAL SERIOUS MINOR NONE UNKNOWN TOTAL
DEPARTED : MOJAVE,CA ++ CREW : 1 1 0 1 0 3
DESTINATION : LCL ++ PAX :
OTHER DAMAGE :

THE A/C DEPARTED THE MOJAVE AIRPORT AT ABOUT 0809 FOR A TEST FLIGHT ABOVE THE DESERT. THE STALL WARNING STICK SHAKER AND PUSHER WERE DISCONNECTED FOR THE TEST. AT ABOUT 0908 THE CREW REPORTED THAT THE TESTS WERE COMPLETED AND THEY WERE RETURNING TO BASE. AT ABOUT 0910 THE COMPANY RADIO OPERATOR RECEIVED THE FOLLOWING TRANSMISSION: "MAY DAY, MAY DAY, MAY DAY, CHALLENGER ONE IS BAILING OUT".

ACCORDING TO THE TWO SURVIVING CREWMEMBERS, A NON-SCHEDULED STALL WAS CONDUCTED AFTER THE SCHEDULED TESTS WERE COMPLETED, IN AN ATTEMPT TO LOCATE THE SOURCE OF A BANGING NOISE THAT OCCASIONALLY OCCURRED DURING STALL BUFFETING.

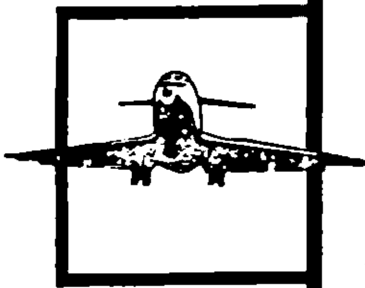
DURING THE STALL THE ANGLE OF ATTACK INCREASED TO 20 DEG, THEN RAPIDLY INCREASED PAST MAXIMUM SCALE OF 34 DEG. THE A/C ROLLED RIGHT INTO A WINGS ALMOST LEVEL, AND NOSE UP ATTITUDE. THE PILOT AND CO-PILOT PUSHED FORWARD ON THE CONTROL WHEEL BUT WERE UNSUCCESSFUL IN REDUCING THE ANGLE OF ATTACK. DURING THIS TIME THE CREW OBSERVED THE ILLUMINATION OF THE RIGHT ENGINE GENERATOR FAIL LAMP AND HEARD THE ENGINE SPOOL DOWN.

IN AN EFFORT TO REGAIN CONTROL OF THE A/C, THE SPIN CHUTE WAS DEPLOYED. AFTER CONTROL WAS REGAINED THREE UNSUCCESSFUL ATTEMPTS WERE MADE TO JETTISON THE CHUTE. AS THE A/C DESCENDED THROUGH 6000 FT MSL, THE PILOT COMMANDED DEPLOY BEFORE HE IMPACTED THE GROUND.

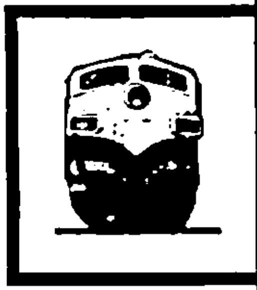
05/02/1990

MD80 Ship #1

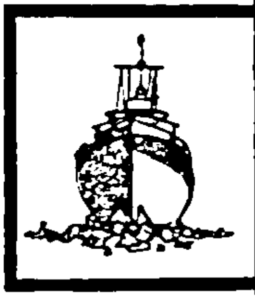
Hard Landing



NATIONAL TRANSPORTATION SAFETY BOARD

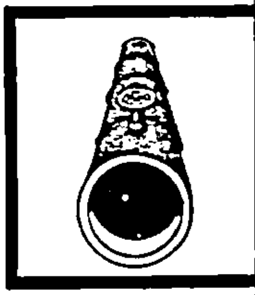


WASHINGTON, D.C. 20594



AIRCRAFT ACCIDENT REPORT

McDONNELL DOUGLAS CORPORATION
DC-9-80, N980DC,
EDWARDS AIR FORCE BASE, CALIFORNIA
MAY 2, 1980



NTSB-AAR-82-2

UNITED STATES GOVERNMENT

TECHNICAL PB82-910402 E

1. Report No. NTSB-AAR-82-2	2. Government Accession No. PB82-910402	
4. Title and Subtitle Aircraft Accident Report-- McDonnell-Douglas Corporation, DC-9-80, N980DC, Edwards Air Force Base, California, May 2, 1980.		5. Report Date February 9, 1982
		6. Performing Organization Code
7. Author(s)		8. Performing Organization Report No.
9. Performing Organization Name and Address National Transportation Safety Board Bureau of Accident Investigation Washington, D.C. 20594		10. Work Unit No. 3454
		11. Contract or Grant No.
12. Sponsoring Agency Name and Address NATIONAL TRANSPORTATION SAFETY BOARD Washington, D. C. 20594		13. Type of Report and Period Covered Aircraft Accident Report May 2, 1980
		14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

About 0634 P.d.t, May 2, 1980, a McDonnell-Douglas, Inc., DC-9-80, N980DC, crashed while trying to land on runway 22 at Edwards Air Force Base, California.

The aircraft was on a certification test flight to determine the horizontal distance required to land and bring the aircraft to a full stop as required by 14 CFR 25.125 when the accident occurred.

The aircraft touched down about 2,298 feet beyond the runway threshold. The descent rate at touchdown exceeded the aircraft's structural limitations; the empennage separated from the aircraft and fell to the runway. The aircraft came to rest about 5,634 feet beyond the landing threshold of runway 22 and was damaged substantially. Seven crewmembers were on board; one crewmember, a flight test engineer, broke his left ankle when the aircraft touched down.

The National Transportation Safety Board determines that the probable cause of this accident was the pilot's failure to stabilize the approach as prescribed by the manufacturer's flight test procedures. Contributing to the cause of the accident was the lack of a requirement in the flight test procedures for other flight crewmembers to monitor and call out the critical flight parameters. Also contributing to this accident were the flight test procedures prescribed by the manufacturer for demonstrating the aircraft's landing performance which involved vertical descent rates approaching the design load limits of the aircraft.

17. Key Words Certification test flight, minimum horizontal landing distance, thrust management, rate of descent, stabilized approach.	18. Distribution Statement This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161

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UNCLASSIFIED	UNCLASSIFIED	23	

NTSB Form 1765.2 (Rev. 9/74)

CONTENTS

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

AIRCRAFT ACCIDENT REPORT

Adopted: February 9, 1982

MCDONNELL-DOUGLAS CORPORATION, DC-9-80; N980DC EDWARDS AIR FORCE BASE, CALIFORNIA MAY 2, 1980

SYNOPSIS

About 0634 P.d.t, May 2, 1980, a McDonnell-Douglas, Inc., DC-9-80, N980DC, crashed while trying to land on runway 22 at Edwards Air Force Base, California.

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1. FACTUAL INFORMATION

1.1 History of the Flight

About 0634 P.d.t. 1/, May 2, 1980, a McDonnell-Douglas, Inc., DC-9-80, N980DC, crashed while trying to land on runway 22 at Edwards Air Force Base (AFB), California.

The aircraft had flown to Edwards AFB from Yuma, Arizona. After ground crew personnel and test equipment were unloaded, the aircraft took off to conduct a certification test flight. The flight was to be conducted to determine the aircraft's required landing distances pursuant to the provisions of 14 CFR 25.125.

1/ All times herein are Pacific daylight time based on the 24-hour clock.

The flightcrew consisted of the following personnel: a McDonnell-Douglas engineering test pilot who flew the aircraft and was in command of the flight; an FAA engineering test pilot who was in the right seat and performed the copilot's duties; a McDonnell-Douglas flight test engineer who was in the observer's seat to observe the flight test instrumentation and record critical data; a McDonnell-Douglas and an FAA flight test engineer who were standing behind the observer's seat to help gather test data; and two McDonnell-Douglas technicians who were seated at an instrument console in the cabin to monitor the test flight instrumentation.

The procedures used during this certification test landing were contained on a McDonnell-Douglas flight card and were, in part, as follows: based on a landing weight of about 132,500 pounds, the approach speed (Vref) was to be 1.3 Vs (30 percent above stall speed) and was to be held until 50 feet above the ground (AGL); 2/ at 50 feet, the target descent rate was to be 700 feet per minute (fpm) to 800 fpm and the thrust was to be reduced to idle; at 25 feet, the landing flare was to be started; and at 0.5 seconds to 0.75 seconds after main landing gear touchdown, full wheel brakes were to be applied. The target elapsed time to descend from 50 feet to main gear touchdown was to be 4.5 seconds to 5 seconds. The flap setting and computed Vref speed for this landing were 40 degrees and 133 knots indicated airspeed (KIAS), respectively.

About 452 feet, the pilot aligned the aircraft on the final approach course and began to stabilize the aircraft at the target descent rate and airspeed. Since the aircraft's head-up-display (HUD) portrayed airspeed, slow fast airspeed error, vertical speed, and radio altitude, the pilot said that he used the HUD exclusively during the approach. The pilot said that at 100 feet, the decision height to continue the approach, his maximum acceptable descent rate and airspeed were 720 fpm and Vref ± 2 KIAS, respectively. According to the pilot, at 100 feet his sink rate was between 710 fpm and 720 fpm and his airspeed was 132 KIAS; therefore, he decided to continue the approach and land.

Because the thrust had to be retarded to idle at 50 feet, the pilot said that after descending through 100 feet, he primarily concentrated on his radio altimeter readings. However, at about 55 feet, the pilot "perceived" a slight increase in the descent rate, and therefore he decided to delay the thrust reduction. He said that he thought he reduced the thrust to idle at about 37 feet and that he began his landing flare at about 20 feet. Based on his previous practice on this maneuver, the pilot said that the flare required definite "...back elevator...maybe half the available travel" of the control column. However, because he still "...had a perception of a slightly higher sink speed," he applied more back elevator force on the control column. The aircraft landed very hard, and as a result, the nose fell through and the nose wheel tires blew out. The pilot applied reverse thrust and wheel brakes, stopped the aircraft, and then shut the engines down and secured the aircraft. After he left the aircraft, the pilot saw that the empennage had separated and was lying on the runway.

The aircraft stopped about 5,634 feet beyond the landing threshold of the runway and about 28 feet left of the runway centerline. The accident occurred during daylight hours at coordinates 35° 54' 30" N latitude, and 117° 53' W longitude.

2/ All altitudes herein are height above the ground unless otherwise specified.

1.1.1 Flightcrew Observations

Because there was no HUD at the copilot's position, the copilot's recollection of performance data was based on his observations of the aircraft's instruments. He said that the pilot began to stabilize the aircraft on the approach below 500 feet. He thought the approach was "reasonably stable" to 100 feet, and at 100 feet, he said that he "....remembered seeing about 800 (fpm) minute rate of descent and about 135 KIAS. At that point I went outside (visually) and was not watching airspeed and descent rates." Thereafter, since there were no big changes of either aircraft attitude or thrust, the copilot believed that the approach remained as stable below 100 feet as it was above that height.

The copilot thought that the pilot reduced the thrust to idle at 50 feet, and that he "...pulled pretty hard...," on the control column when he rotated the aircraft. The copilot thought he saw "...a pretty pronounced rotation...," and he estimated that the aircraft's pitch attitude was about 6° to 8° nose up at main gear touchdown.

The flight test engineer in the observer's seat could not see the pilot's HUD. Because she "...was watching other things...," she could not provide specific airspeed and descent rate readings during the last 100 feet of the approach. Her duties required her to record certain specified data on the flight card for this maneuver. According to the annotations she made on the flight card, at 200 feet, the airspeed looked "normal;" at 100 feet, the airspeed was 134 KIAS; at 25 feet, the thrust was reduced to idle; the time to descend from 50 feet to main gear touchdown was 3.4 seconds; and the touchdown was "...very hard."

Two other flight test engineers were on board. One was required to record fuel readings and to time the descent from 50 feet AGL to touchdown. He was standing on the right side of the aircraft behind the flight test instrument console. During the approach, he moved to where he could see the radio altimeter, and at 50 feet he started his stop watch. He then returned to his position and looked out of one of the side windows. Based on his previous experience, the flight test engineer stated that he realized "...we were descending a bit faster than we had on the previous approaches..." and that the aircraft was going to land "...a lot harder than we had on the previous runs."

The other of these two flight test engineers was standing behind the observer's seat during the approach and was able to observe the aircraft's airspeed and vertical speed instruments. According to him, between 300 feet and 400 feet, the rate of descent was about 400 fpm and the airspeed was 135 KIAS. He said that at about 250 feet the pilot reduced thrust slightly "...presumably to decrease airspeed...and to increase (the) rate of descent toward the target..." descent rate. Thereafter, he stated that the pilot did not touch the thrust levers until just before landing, and during that time "...the airspeed was continually decreasing and the rate of sink increasing." The engineer remembered that at 100 feet, the airspeed was 132 KIAS; at 50 feet, it was about 130 KIAS and the rate of descent was about 800 fpm. The engineer stated that immediately after passing through 50 feet, the descent rate increased and the airspeed began to decrease rapidly. The last rate of descent he recalled seeing was about 1,000 fpm; he was not sure at what height he saw this, but it was immediately before touchdown.

The two technicians at the instrument console in the cabin were on board to insure that the flight test instrumentation systems were functioning properly during the flight. They said they had not observed any relevant performance data during the flight.

1.2 Injuries to Persons

Injuries	Crew	Passengers	Others
Fatal	0	0	0
Serious	1	0	0
Minor/None	6	0	0
Total	7	0	0

When the aircraft landed, one of the flight test engineers was standing behind the observer's seat, and his left foot was resting on the sloping surface (45°) of an instrument console channel flange on the floor of the aircraft. His left ankle was broken when the aircraft touched down.

1.3 Damage to the Aircraft

The aircraft was damaged substantially.

1.4 Other Damage

None.

1.5 Personnel Information

Both pilots were certificated in accordance with current regulations. (See appendix B.)

1.6 Aircraft Information

N980DC was the first DC-9-80 aircraft built. It was manufactured September 13, 1979, and was being operated by the McDonnell-Douglas Corporation under an experimental certificate. At the time of the accident, the aircraft had been flown 364.1 hours, and 64.1 hours since its last 100-hour inspection. The aircraft's maintenance history did not disclose any discrepancies or malfunctions which were relevant to the accident.

The aircraft was powered by two Pratt and Whitney JT8D-209 engines which have a normal takeoff static thrust rating of 18,500 pounds and a maximum takeoff thrust rating of 19,250 pounds. The total time on the engines was 364.1 hours.

The aircraft's maximum takeoff and landing gross weights were 142,000 pounds and 130,000 pounds, respectively. The forward and aft center of gravity (c.g.) limits were -0.8 percent M.A.C. and 33 percent M.A.C., respectively. At the time of the accident, the aircraft was about 2,500 pounds over its maximum allowable landing weight, and its c.g. was -0.8 percent M.A.C. The aircraft was operating under an experimental certificate for the purpose of showing compliance with airworthiness regulations, and the certification test being conducted involved a critical item affected by weight. Pursuant to 14 CFR 25.21(d), the allowable weight tolerance for this test was +5 percent, -1 percent.

1.7 Meteorological Information

The 0639 Edwards AFB surface weather observation was as follows: clear, visibility--45 miles; temperature--45 ° F; dew point--43° F; winds--calm; altimeter setting--30.08 inHg; fog bank north through southeast.

The pertinent winds aloft were as follows:

3,000 feet m.s.l. -- 240 at 4 knots
4,000 feet m.s.l. -- 280 at 4 knots
6,000 feet m.s.l. -- 020 at 8 knots

1.8 Aids to Navigation

Not relevant.

1.9 Communications

There were no reported communications difficulties.

1.10 Aerodrome Information

Edwards AFB, the United States Air Force (USAF) Flight Test Center, is located 60 nmi north of Los Angeles, California. Because of the facilities available at the base, commercial aircraft manufacturers use the base for testing pursuant to agreements made with the USAF. The landing runway, runway 22, is 15,000 feet long, 300 feet wide, and the elevation of the landing threshold is 2,288 feet m.s.l.

1.11 Flight Recorders

The aircraft was equipped with a Sunstrand Data Control Cockpit Voice Recorder (CVR), Serial No. 9126. The portion of the CVR tape which contained the final takeoff, traffic pattern, and landing were auditioned by Safety Board, FAA, and McDonnell-Douglas personnel at McDonnell-Douglas' Long Beach, California facility. During the flight, the flightcrew spoke only a few words and these pertained to required checklist actions. The tape revealed that no callouts of altitude, airspeed, or descent rates were made during the final approach; the tape corroborated the flightcrew's testimony that these callouts were not made. Since a transcript of the tape for this portion of the flight would have served no useful purpose, none was made.

The aircraft was equipped with an Inertial Navigation System (INS), test flight instrumentation, and a Sundstrand Digital Flight Data Recorder (DFDR), Serial No. 2862. The data from these systems were read out at the manufacturer's Long Beach, California facility in the presence of Safety Board personnel. The test flight instrumentation data were consistent with the DFDR data.

The DFDR and test flight instrumentation data revealed that the pilot made a descending left turn to the final approach course with the aircraft configured for landing. About 37 seconds before touchdown, at about 450 feet, the turn to the final approach course was completed; the airspeed was 131 KIAS and the rate of descent was about 910 fpm. The stabilizer trim setting was 11.17° aircraft noseup and it remained at, or within, 0.2° of that position throughout the final approach and landing.

During the descent from 450 feet to 225 feet, the pitch attitude of the aircraft increased from 4.1° noseup to about 6° noseup. At 450 feet, the engine pressure ratios (EPR) were 1.31 EPR on the left engine and 1.30 EPR on the right engine and at this point began to increase. At 275 feet, the left engine was at 1.45 EPR and the right engine was at 1.44 EPR. Thereafter, the thrust began to decrease, and at 228 feet, both engines were at 1.25 EPR. During this part of the approach, the descent rate decreased from 910 fpm to 400 fpm and the airspeed increased from 131 KIAS to the maximum value recorded—137 KIAS at 250 feet AGL. Thereafter, the airspeed began to decrease.

At 225 feet, engine thrust began another decrease, and at 150 feet AGL, the left and right engines were at 1.15 EPR and 1.14 EPR, respectively. These settings were maintained down to about 50 feet. Between 225 feet and 50 feet, the pitch attitude decreased from about 6° noseup and remained fairly constant between 5° noseup and 5.3° noseup. At 225 feet, the rate of descent began to increase. At 100 feet, the descent rate was about 840 fpm; at 50 feet, it was about 950 fpm. At 100 feet and 50 feet, the airspeed was 132 KIAS and 128 KIAS, respectively.

Shortly after descending through 50 feet, the engine pressure ratios began to decrease, and at 10 feet, both engines were at 1.1 EPR. When the aircraft touched down, the airspeed was 125 KIAS and the descent rate was 990 fpm (16.5 fps). About 2 seconds before touchdown, the trailing edges of the left and right elevators began deflecting upward, and at touchdown, they had been moved to 17° trailing edge up (TEU)--the maximum deflection available under these conditions. In response to this noseup input command, the aircraft began to rotate. Its pitch attitude increased from 5.01° noseup to 6.07° noseup and the pitch rate was increasing at touchdown.

Calculations based on the aircraft's landing weight and configuration indicated that at a constant 133 KIAS, a net thrust of 10,700 pounds would have been required to establish a constant descent rate of 720 fpm. Analysis of the flight data revealed that, between 450 feet and 260 feet, the net thrust (Net Thrust = Gross Thrust minus Ram Drag and Engine Bleed Loss) produced by the engines increased from 11,500 pounds to 16,600 pounds. Between 260 feet and 150 feet, the net thrust was reduced to about 5,800 pounds and remained at that value until it was reduced to idle after descending through about 42 feet. Calculations showed that 5,800 pounds net thrust would have increased the descent rate—at a constant 133 KIAS--to about 1,145 fpm.

The calculated descent rates cited above were based on both a constant thrust setting and airspeed. However, the dynamic relationship between acceleration and vertical speed is such that if the pilot maintained constant thrust and varied the pitch attitude to accelerate along the descending flight path, the rate of descent would increase; conversely, if the pilot decelerated the aircraft, the descent rate would decrease. However, the change in descent rate would only persist while the aircraft was accelerating or decelerating. Since the aircraft drag when in the landing configuration is at a minimum at or near Vref speed, the drag would begin to increase when the aircraft is decelerated below Vref. Consequently, if the deceleration is stopped and the aircraft is stabilized below Vref, the aircraft's rate of descent would increase rapidly unless an immediate addition to thrust is applied.

1.12 Wreckage and Impact Information

The aircraft's landing gear touched down about 2,298 feet beyond the landing threshold of runway 22; the aircraft then rolled an additional 3,336 feet along the runway and was brought to a stop about 28 feet to the left of the runway centerline. The nosewheels and nosewheel tires failed during the landing sequence and roll.

The empennage separated from the aircraft at fuselage station (FS) 1429, fell to the runway, and came to rest 18 feet right of the runway centerline and about 3,690 feet beyond the landing threshold of the runway. The vertical stabilizer and elevator were damaged when they struck the runway.

The top and side of the fuselage between FS 520 and FS 540 were buckled substantially, and various other locations on the fuselage sustained compression type buckling damage. Similar damage, but to a lesser degree, occurred at FS 1183 over the right cargo door and in the backup structure of the nose gear.

There was no visible damage to the main landing gear, wings, or interior of the aircraft. There were no fuel leaks.

1.13 Medical and Pathological Information

Not relevant.

1.14 Fire

There were about 32,400 pounds of jet-A fuel on board at landing. There was no fire.

1.15 Survival Aspects

The accident was survivable. After the aircraft stopped, the flightcrew opened the forward main entry door, extended the airstairs, and evacuated the aircraft.

1.16 Tests and Research

1.16.1 Landing Performance Tests

As a result of this accident, the Safety Board requested that McDonnell-Douglas assess the controllability and performance of the aircraft under the accident conditions either by simulation or by engineering analysis. Specifically, the Board asked that McDonnell-Douglas determine:

a. The minimum altitude at which the pilot could have introduced maximum longitudinal control input (up to but not beyond the angle of attack that would activate the stall warning stick shaker) with no increase in thrust which would reduce the descent rate at ground contact to the target value of less than 10 fps.

b. The minimum altitude at which the pilot could have made a longitudinal control input and thrust increase to cause the descent rate to decrease to zero and avoid ground contact.

McDonnell-Douglas performed these engineering analyses. The actual elevator and thrust lever (EPR settings) inputs during the accident sequence (starting at a radio altitude of 100 feet) were used. Existing aerodynamic data were modified to provide for ground effect.

The analysis of the first condition revealed that a flare initiated at 45 feet with full up-elevator input at a maximum rate could have reduced the descent rate to less than 10 fps (600 fpm) at touchdown. However, the data also indicated that the elevator input required complex management in order to avoid striking the tail on touchdown; with the main landing gear struts compressed, a tail strike will occur at a noseup pitch attitude of about 8.3°. The initial full up-elevator input (17.6° TEU) produced a 9° noseup pitch attitude; consequently, it could only be held for 0.75 seconds. Over the next 0.6 seconds, the elevator position was reduced to 5.4 TEU and this permitted the aircraft to rotate downward to an 8.03° noseup pitch attitude at touchdown. Although the target descent rate could have been attained, the analysis data indicated that the maneuver also exposed the aircraft to a potential tail strike at touchdown. Nevertheless, the data showed that the estimated pitch response and flare capability of the aircraft were adequate for the maneuver to have been performed.

The analysis of the go-around capability showed that if the go-around had been started at 50 feet it would have been completed successfully. During the engineering analysis, as the aircraft descended through 50 feet, the go-around was initiated with a 13.8° TEU elevator deflection followed 0.5 seconds later by the application of go-around thrust. With the elevators held at the position noted above, the aircraft rotated to a 11.8° noseup pitch attitude. The data showed that the aircraft would have descended 43 feet during the maneuver and cleared the runway by 7 feet.

During the DC-9-80 landing performance tests, a test pilot had made an actual go-around from 50 feet because of an excessive rate of descent (912 fpm) at that height. The aircraft was in the 40° flap landing configuration, its landing weight was 124,030 pounds, Vref was 128 KIAS, and the engine EPR's were 1.28 when the pilot began the go-around. At 50 feet, the pilot applied up-elevator and the elevators were deflected to 10 TEU. About 0.5 seconds after the elevator input, the thrust was increased to the go-around thrust, and the aircraft was rotated to a 8° noseup pitch attitude. Comparison of these data with the data derived in the go-around analysis above showed that the test aircraft's engines' thrust was slightly higher at the beginning of the maneuver. The elevator deflection on the test aircraft was the same as that used for the analysis; however, its noseup pitch attitude was 3.8° lower. During the actual go-around, the test aircraft descended 45 feet and it cleared the runway by about 5 feet. The data derived from the actual maneuver in conjunction with the data derived from the engineering analysis indicated that a successful go-around could have been made on the accident approach if the pilot had begun the maneuver at 50 feet.

1.16.2 Abused Landing Controllability Tests

At 25 feet and about 1 second before touchdown, the accident flight's test data showed that the pilot started a flare maneuver by deflecting the elevators to almost their full TEU position. The data revealed that this input occurred too late to reduce the descent rate although it did reduce the rate of increase in the descent rate. The landing performance demonstrations did not constitute a demonstration of elevator effectiveness under conditions of minimum speeds. Therefore, after the accident, the FAA, pursuant to the conditions contained in 14 CFR 25.143(a)(5), required McDonnell-Douglas to conduct abused landing maneuvers to demonstrate adequate elevator effectiveness. 14 CFR 25.143 (a)(5) requires the manufacturer to demonstrate, in part, that "The airplane must be safely controllable and maneuverable during...landing."

The abused landing demonstrations were to show that the DC-9-80 did not have unsafe control characteristics on the landing approach at speeds below 1.3 Vs. In order to satisfy this requirement, the same procedures used in the landing distance tests were used for this demonstration with the following exceptions: at 50 feet, the target speed was 1.3 Vs minus 5 KIAS; the pilot could start the landing flare maneuver at any height below 50 feet; and the pilot could reduce the thrust at any altitude below 50 feet that would produce a touchdown speed that was 5 KIAS below the landing speeds used for the landing distance tests.

Two abused landing demonstrations were flown. The aircraft's landing gross weights were about 13,000 pounds below that of the accident aircraft. The test data recorded on the two demonstrations showed that the target speeds were met at 50 feet; the descent rates at 50 feet were 768 fpm and 648 fpm, respectively; the flare maneuvers were started at 23 feet and 31.8 feet, respectively, with up-elevator inputs of about 10 TEU and 12 TEU, respectively; engine thrust was reduced to idle at 9.9 feet and 1.4 feet, respectively; and the descent rates at touchdown were 240 fpm and 300 fpm, respectively. The tests met the FAA certification requirements for demonstrating acceptable flight characteristics during a landing flare maneuver.

Following the completion of the abused landing controllability tests, the landing performance demonstrations were conducted. Twelve landings were made at gross weights between 129,000 pounds and 109,200 pounds at the forward c.g. limit of -0.8 percent M.A.C. Six landings were made with a 40° flap setting and six landings were made with the flaps set at 23°. The aircraft's anti-skid system was on, the auto-spoiler system was armed, the hydraulic and pneumatic systems were normal, and the landings were made on a dry runway. The tests were accepted by the FAA and the resultant data were used to determine the landing distances for the Airplane Flight Manual.

1.17 Other Information

1.17.1 Regulations and FAA Orders

14 CFR 25.125 (see appendix C) requires the applicant for an airworthiness certificate to determine the horizontal distance necessary to land the aircraft and bring it to a complete stop from a point 50 feet above the landing surface. The regulation establishes the weights and altitudes at which this distance must be determined and how the certification demonstration must be conducted. According to the regulation, the applicant must place the aircraft in its landing configuration and establish and maintain a "steady gliding approach with a calibrated airspeed of not less than 1.3 Vs..." down to 50 feet. Changes in configuration, thrust, and speed must be made in accordance with procedures established for service operation. The regulation prohibits the use of reverse thrust during the landing and roll and also states that, "The landings may not require exceptional piloting skills or alertness."

The maximum rate of descent at touchdown for the design landing weight was established by the structural requirements in 14 CFR 25.473 (ii), as 10 fps (600 fpm).

FAA Order 8110.8. Engineering Flight Test Guide for Transport Category Aircraft, paragraph 59 (b)(3) repeats the requirement to establish a steady 1.3 Vs airspeed, and then states, "The landing speed should be compatible with landings under expected service conditions within the level of skill anticipated from the crew in service. Once these conditions have been established, there should be no appreciable change in the power, attitude, or rate of descent prior to reaching a height of 50 feet above the landing surface. No changes in configuration, addition of thrust, or nose depression should be made after reaching the 50 feet height."

14 CFR 121.195 (see appendix C) establishes the operational limitations for landing and are based on the landing distances determined during the certification test flights. This regulation states, in part, that no person may land a turbine engine powered transport category aircraft unless landing weight would allow a full stop landing within 60 percent of the effective length of the runway "...from a point 50 feet above the intersection of the obstruction clearance plane and the runway." 14 CFR 121.197 similarly concerns alternate airports, and the landing distance requirements cited therein are identical to those contained in 14 CFR 121.195. Thus, an air carrier must, in conducting its airport analyses, compute allowable landing weights which will permit the aircraft to be stopped within 60 percent of the effective length of the runway selected for landing.

1.17.2 Head Up Display (HUD)

The accident aircraft was equipped with a Sundstrand, Inc., DLU 601, HUD. The HUD provided guidance information, centered about the predicted touchdown point, focused at infinity, and displayed on a combiner coincident with the pilot's forward field of view. The combiner optics, whether in use or in the stowed position, are designed so as not to obstruct either pilot's field of view. The system is designed to provide essential information to the pilot during ILS and non-ILS approaches.

During this non-ILS approach, the following pertinent data were displayed on the combiner optics for the pilot's use: an aircraft guidance symbol (above 100 feet the symbol is a straight line, and at 100 feet, the straight line is changed to a miniature aircraft symbol); a digital readout of indicated airspeed and radio altitude; a digital readout of descent rate in 10 fpm increments available down to 45 feet, thereafter it is deleted from the presentation; and a slow/fast airspeed error indicator (speed worm). The slow/fast airspeed error is referenced to the speed selected by the pilot and set in the speed command window of the autothrottle system. The airspeed error is depicted by a barber pole symbol which either rises (fast) or descends (slow) from the airplane symbol.

The instrument data displayed by the HUD are inserted in the HUD computers from the aircraft's flight guidance and central air data computers (CADC). Data portrayed by the HUD during the accident flight was compared with data from other flight test instruments. Except for the fact that the radio altimeter read 7 feet higher than the tapeline altitude (this was determined during the build-ups before the accident, therefore, the thrust was to be reduced to idle when the radio altimeter read 57 feet instead of 50 feet), the comparison indicated that the HUD system functioned normally.

1.17.3 Flightcrew Procedures

During the 3 weeks before the accident, 25 to 30 practice approaches and landings--build-ups--were flown by the test pilot. In addition to providing the test pilots practice in performing the maneuver, the build-ups were performed to determine the highest height at which the thrust could be retarded to idle and the lowest height at which the flare could be started and still achieve touchdown at a sink rate between 600 fpm (10 fps) and 480 fpm (8 fps). The overall purpose of the build-ups was to develop procedures and pilot techniques which would produce a touchdown within the target sink rates with the engines spooled down to idle thrust and to provide the minimum air distance from 50 feet to touchdown. During these build-ups, the flight card procedures used for the certification test flight were developed.

According to the pilot, the descent rate was controlled by thrust, and if the airspeed was stabilized, he would use thrust to vary the descent rate. The entire approach and landing, once stabilized, was flown at the same pitch attitude which remained the same throughout the landing flare.

The purpose of the flare maneuver was to counteract the pitch down moment encountered as the aircraft entered ground effect. Essentially, an aircraft begins to encounter the aerodynamic influences of ground effect when it descends below a height equal to its wingspan--the DC-9-80's wingspan is 107.8 feet. According to the pilot, the flare maneuver, if accomplished properly, merely counteracted the nose-down pitch and kept the aircraft at the same pitch attitude. Based on the previous build-ups, that attitude was generally about 5° noseup.

The pilot said that if at 100 feet the aircraft was stabilized at the desired speed and descent rate, it would touchdown within the desired parameters provided the thrust and pitch attitude were maintained down to 50 feet. All that had to be done thereafter was to reduce the thrust and begin the flare at the proper heights. Therefore, after 100 feet, he primarily concentrated on the radio altimeter to insure that the thrust was reduced and that the flare was started at the correct altitudes. In addition, the pilot said that because of a change in position error caused by ground effect in the airspeed and vertical velocity indicators, their readings were apt to be unreliable as the aircraft descended below 100 feet.

The procedure developed during these build-ups did not require the non-flying pilot to call out altitudes, airspeeds, or any deviation of these two parameters from the desired values. However, the pilot stated that he had briefed the crewmembers that "anytime anybody sees something they don't like, they are to speak up, and if I don't agree with them, then I said we'll stop with whatever we're doing and we'll talk about it on the ground. I will not continue a test if everybody on board is not satisfied with what we are doing."

Finally, the entire build-up series was flown with the same FAA test pilot serving as one of the flightcrew. After the series had been completed, this pilot was assigned a new task. The replacement FAA pilot on the accident flight had flown this maneuver in other type aircraft, but he had never flown it in a DC-9 type aircraft. He said that he was trying to learn how it was done so he could perform some of the later certification landings. He was not familiar with what he was seeing, and he said that had he been more familiar, he "...might have been of more help..." to the pilot.

2. ANALYSIS

The aircraft was maintained in accordance with prescribed regulations and procedures. Both pilots were qualified in accordance with prescribed regulations.

Since the tests conducted after the accident demonstrated that the aircraft's control capability throughout the landing regime of flight was satisfactory, the main thrust of the inquiry was directed to the procedures and pilot techniques used during the landing demonstrations and the certification regulations under which they were performed.

The practice build-up maneuvers conducted before the certification test flight served two purposes. In addition to establishing the procedures which would provide the shortest landing distance, they provided training for the flightcrew. Essentially, the pilot was trained to establish and to stabilize his aircraft at Vref and at a 700 to 800 fpm descent rate. Once the aircraft was stabilized at this speed and descent rate, the pilot could establish a sight picture of his projected touchdown point on the runway, and coupled with this visual picture and the instrument readings, the pilot could maintain the required "steady gliding approach" to 50 feet. Once stabilized, speed could be controlled with small pitch variations and sink rate could be controlled with small thrust corrections.

Because of the change in the position errors of the airspeed and vertical velocity indicators as the aircraft descended into ground effect, the pilot said these instruments could not be relied upon for precise guidance during the last 50 feet of the approach. Therefore, it was imperative that the aircraft be stablized at the target descent rate and airspeed before reaching 100 feet -- the decision altitude. Assuming that the aircraft descended through 100 feet with its descent rate, airspeed, and thrust stabilized, there was no need for the pilot to direct a high level of concentration to his airspeed and vertical velocity indicators as the aircraft entered ground effect. Since the thrust levers were to be retarded at 50 feet, with a 700 fpm descent rate, the aircraft would reach that height within 3.6 to 3.7 seconds after leaving 100 feet. Therefore, little, if any, perturbations from the target airspeed and descent rate could occur if a constant pitch attitude were maintained during this interval. Finally, as shown during the build-ups, if the thrust reduction and flare were performed at the target altitudes, touchdown would occur within the desired parameters. Consequently, the success of the maneuver was predicated on the following: before reaching 100 feet, the thrust had to be stabilized at or near the values which would produce and maintain the target descent rate and airspeed, and these parameters had to remain stabilized as the aircraft descended through 100 feet.

The performance data recorded on the accident flight showed that the pilot established his aircraft on the landing runway heading as it was descending through 452 feet, and the aircraft touched down 37 seconds later. Since the aircraft's thrust, airspeed, and descent rate had to be established before reaching 100 feet, assuming that he was able to establish a 700-fpm descent rate, the pilot had less than 30 seconds to stabilize his aircraft at the desired paramenters. The data showed that he did not do this.

During the descent, one of the most important, if not the most important, tasks for the test pilot was to establish the thrust setting that would provide a constant 700 fpm to 800 fpm rate of descent at 133 KIAS. Performance calculations showed that about 10,700 pounds net thrust would produce this rate. At 452 feet, when the pilot finally aligned the aircraft with the landing runway, the aircraft's rate of descent was 920 fpm, its airspeed was 131 KIAS, and its net thrust was 11,500 pounds. Thereafter, the pilot began to increase thrust, and at 260 feet, the net thrust had been increased to 16,600 pounds. Had the pilot stabilized his aircraft at and maintained Vref, this thrust level would have resulted in a descent rate of 100 fpm. However, since at 452 feet, the airspeed was below Vref, the pilot also permitted the aircraft to accelerate along the flight path. This acceleration resulted in the rate of descent decreasing more slowly. As a result of this acceleration and the thrust increase, when the aircraft reached 250 feet, the airspeed had increased to Vref plus 4 KIAS and the descent rate had decreased to 400 fpm. Another thrust correction was required if the targeted values of descent and airspeed were to be met at 100 feet.

At 260 feet, the pilot reduced the net thrust to about 6,000 pounds, and began to increase the descent rate and, at the same time, decrease the indicated airspeed. At a constant Vref, this thrust setting would have produced about a 1,250-fpm descent rate. However, since the aircraft was decelerating, the descent rate increased at a slower rate. At about 160 feet, Vref was reached; however, the pilot continued to allow the aircraft to decelerate below this speed. Between 160 feet and 110 feet, although the descent rate continued to increase, the rate of increase was slower than before. In addition, the rate at which the airspeed was decreasing had also slowed.

At 100 feet, the decision altitude, the transient descent rate was 800 fpm and the transient airspeed was 131 KIAS. These data showed that the indicated airspeed and descent rate were within 1 KIAS and 80 fpm, respectively, of what the pilot said his instruments were reading at that altitude. However, both parameters were changing as the approach was not stabilized. At 100 feet, the net thrust was about 5,000 pounds below the thrust needed to maintain a stabilized 720 fpm descent at Vref; the airspeed was 2 KIAS below Vref and decreasing while the descent rate exceeded 720 fpm and was increasing. In addition, since the airspeed was now below Vref and decreasing, the aircraft's drag was increasing. The effects of the thrust deficiency and increasing drag were now predominant, and, unless the thrust was increased, the aircraft would continue to decelerate and the rate of descent would keep increasing.

At 40 feet, despite the decreasing airspeed and increasing descent rate, the pilot reduced the thrust to idle. At 25 feet, about 2 seconds before touchdown, the pilot began the flare maneuver and within 1.5 seconds he had applied almost full up-elevator. At this time, the airspeed was 126 KIAS and the descent rate was 990 fpm. During the last 20 feet of the descent, the elevator input produced a noseup rotation, and at touchdown, the aircraft's pitch attitude had increased about 1° to a 6° noseup pitch altitude. This rotation stopped the aircraft's vertical acceleration, but it did not produce a decrease in the rate of descent.

Based on INS vertical speed data, at main gear touchdown, the sink rate was about 16.2 fps. The main gear became airborne about 0.5 seconds after touchdown; 0.2 seconds later the nose gear touched down, and 0.4 seconds after the nose gear touched down the main gear touched down again. The sink rate at touchdown exceeded the aircraft's ultimate vertical speed limitation for landing (12.25 fps) and initiated failures at the fuselage locations described in this report.

In summary, the evidence indicated that the pilot did not allow sufficient time, distance, and altitude on the final approach to stabilize his aircraft before reaching the decision height. Correlation of the pilot's statement with performance data indicated that, based on the temporary decrease in the rates of change in both descent rate and airspeed as the aircraft approached the decision altitude, the pilot believed that the approach was stabilizing and decided to land. Although the aircraft reached 100 feet with its indicated airspeed and descent rate within the parameters established to continue the approach, the aircraft was not stabilized on the descent. In particular, the net thrust was 5,000 pounds below the thrust required to maintain the desired descent rate and airspeed. The pilot did not recognize that the approach was not stabilized. Although he sensed the increasing sink rate, he did not perceive its magnitude and he did not try to verify its magnitude by cross checking his vertical velocity indicator readout. The Safety Board believes that the pilot's failure to recognize that his aircraft was not stabilized on the descent at or before reaching 100 feet was the precipitating factor of this accident.

The Safety Board also noted that, despite the criticality of airspeed and descent rate during the maneuver, the manufacturer's procedures developed for this test did not assign any crewmember the responsibility of monitoring these parameters as a backup to the pilot. Almost every air carrier procedure assigns the task of calling out variations in airspeed and sink rate to the non-flying pilot during the landing; however, these procedures were not required of the non-flying pilot during these tests. Since the investigation showed that a missed approach capability existed down to 50 feet, the Safety Board believes that if the procedure had required this back-up function and if it had been performed properly the accident might have been avoided.

After checking to see that the aircraft and descent rate were within the prescribed limits at the decision altitude, the copilot transferred his attention outside the aircraft to familiarize himself with the visual picture of the final phases of the approach and landing. The procedures did not prescribe any precise monitoring duties for him.

The pilot said he had instructed the crewmembers to "...speak up..." if they saw anything they did not like and he would then discontinue the test flight. With regard to the flight test engineers, it would appear that they interpreted the instructions to mean instrument malfunctions or reading errors that would invalidate the test results. Nevertheless, had any of the test flight engineers noticed and called the increasing descent rate to the pilot, his subsequent conduct of the flight might have changed.

As previously stated, these landing distance tests are required by the aircraft certification regulations. The provisions of 14 CFR 25.125 and the applicable sections of FAA Order 8110.8 cited herein established the aircraft's landing configuration; how the approach was to be flown down to 50 feet; and the limitations applicable to changes of thrust, speed, and aircraft configuration. With regard to the descent from 50 feet to touchdown, FAA Order 8110.8 states, "No changes in configuration, addition of thrust, or nose depression should be made after reaching the 50 feet height." Except for the requirement that "....the landing must be made without excessive vertical acceleration...," no further specific limitation concerning procedures or performance are imposed upon the applicant for certification. With regard to what constituted "excessive vertical acceleration," the maximum rate of descent for the design landing weight is 10 fps; therefore, McDonnell-Douglas established 10 fps as the maximum allowable sink rate at which the landing data were acceptable. Thus, within these performance and procedural constraints, McDonnell-Douglas developed and established procedures and pilot techniques which would provide the shortest landing distance.

In addition to the performance and procedural constraints discussed above, 14 CFR 25.125(a)(5) states "The landings may not require exceptional piloting skill or alertness." The question then is whether the procedures used during these tests exceeded the subjective limitation imposed by this paragraph. The procedures used for the test can be divided into two phases: the approach to 50 feet, and the approach from 50 feet to landing. Since the approach procedure of almost every air carrier states that the only permissible additive to Vref speed that may be carried over the landing threshold of the runway is the wind gust correction factor, the test procedures used during the descent to 50 feet were essentialy the same as those used during the line operations of most air carriers.

On the other hand, the techniques used after leaving 50 feet require precise action by the pilot; thus, this portion of the maneuver required practice and repetition in order for the test pilots to acquire the needed proficiency and skill to perform the maneuver correctly. However, line pilots are not required nor encouraged to land their aircraft in a manner in which limit structural loads can be imposed on the aircraft because minimum landing distances, as established during the test landings, are not used for line operations, but rather as the baseline for determination of operational runway requirements. The required operational runway length for landing at any given landing weight is derived by multiplying the certification landing distances obtained using these test techniques by 1.667; or stated another way, the aircraft can be stopped within 60 percent of the effective length of the required landing runway length. Thus, a line pilot has a safety margin and is not required to replicate the stopping distances derived from these certification tests.

Although the procedures used for the certification test are not representative of the manner in which the aircraft is landed during routine line operations, the Safety Board is also aware that similar, if not identical, pilot procedures have been used to demonstrate the landing distances of almost all turbine jet engine powered aircraft certificated in the United States. The fact that these procedures have been used successfully during the certification of these aircraft indicated that, with practice, the test pilots have and can perform this maneuver successfully. Despite this, the Board remains concerned about the risks associated with the test maneuver. In order to produce the minimum air distance from 50 feet, the test pilot must land his aircraft at sink rates which are close to the aircraft's limit loads and which can, if the pilot is imprecise, approach the aircraft's ultimate load limits; certainly a procedure which cannot be endorsed for any line operation. Under these circumstances, it would appear logical, and certainly safer, that these landing distances be determined in a different manner. The Safety Board believes that the landing distance determination should be conducted using procedures which are more representative of the way the aircraft is landed during line operations. If the use of such procedures unnecessarily restricts the operational limitations of an aircraft beyond the present limitations required by 14 CFR 121.195, the Safety Board believes that both the certification demonstration techniques and the operational landing distance requirements should be reviewed to ensure that they provide safety during both certification and operation of the aircraft.

3. CONCLUSIONS

3.1 Findings

1. The accident occurred during a certification test flight.

2. The purpose of the certification test flight was to demonstrate the horizontal distance required to land and bring the aircraft to a full stop as prescribed by 14 CFR 25.125.

3. The pilot techniques developed during the build-up flights were designed to provide the minimum landing distances.

4. The pilot used the aircraft's HUD exclusively to monitor critical performance parameters during the approach and landing. The HUD system functioned normally during the accident.

5. The decision height for continuing the approach to a landing was 100 feet.

6. The success of the maneuver was predicated on the the airspeed, descent rate, and engine thrust being stabilized before reaching 100 feet and then maintaining these stabilized values through 100 feet until the thrust was retarded to idle at 50 feet.

7. At 100 feet, the airspeed and rate of descent were reading at or very near the values established for continuing the landing approach; therefore, the pilot did not perceive the need to start a go around.

8. The pilot did not stabilize the aircraft at the targeted airspeed, descent rate, and engine thrust before reaching 100 feet. At 100 feet, the descent rate was increasing, the airspeed was decreasing and the thrust level was too low to sustain the aircraft at or below the maximum allowable sink rates.

9. The pilot failed to perceive the magnitude of the sink rate and therefore did not execute either a go-around or apply additional thrust during the flare to arrest and decrease the descent rate.

10 The aircraft touched down at a sink rate which exceeded its structural limits and as a result was substantially damaged.

11. The procedures and techniques used for the maneuver required a high degree of skill and alertness on the part of the test pilot.

12. The minimum landing distances derived during the landing distance certification tests are multiplied by 1.667 to establish the operational

runway lengths required by the FAR for normal line operational landings; therefore, line pilots do not have occasion to use the procedures used during the landing distance certification test flight.

3.2 Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was the pilot's failure to stabilize the approach as prescribed by the manufacturer's flight test procedures. Contributing to the cause of the accident was the lack of a requirement in the flight test procedures for other flight crewmembers to monitor and call out the critical flight parameters. Also contributing to this accident were the flight test procedures prescribed by the manufacturer for demonstrating the aircraft's landing performance which involved vertical descent rates approaching the design load limits of the aircraft.

4. RECOMMENDATIONS

As a result of its investigation of this accident, the National Transportation Safety Board recommended that the Federal Aviation Administration:

> Revise the procedures which are currently being used to demonstrate minimum landing distances for compliance with 14 CFR 25.125 for certification of transport category airplanes to: (a) provide a higher margin of safety during certification and (b) establish landing distances which are more representative of those encountered when an airplane is operated during air carrier service. (Class II, Priority Action) (A-82-24)

> Upon adoption of revised procedures for demonstrating operational landing distances for compliance with 14 CFR 25.125, review the operational runway length limitations in 14 CFR 121.195 which are applied to certification landing distances so that they do not unjustifiably penalize the operational specifications of airplanes. (Class II, Priority Action) (A-82-25)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JAMES E. BURNETT, JR.
Acting Chairman

/s/ FRANCIS H. McADAMS
Member

/s/ PATRICIA A. GOLDMAN
Member

/s/ G. H. PATRICK BURSLEY
Member

February 9, 1982

5. APPENDIXES

APPENDIX A

INVESTIGATION AND HEARING

1. Investigation

The Los Angeles Office of the National Transportation Safety Board was notified of the accident at 0730, on May 7, 1980. Two investigators were immediately dispatched to the scene, and were later joined by a performance specialist from the Board's Bureau of Technology in Washington, D.C.

Parties to the investigation were the FAA and the McDonnell-Douglas Corporation. USAF Safety Officers provided assistance during the documenting of the aircraft wreckage.

2. Public Hearing and Depositions

There was no public hearing and depositions were not taken.

APPENDIX B

PERSONNEL INFORMATION

Pilot

Pilot John P. Lane, 57, was employed by the McDonnell-Douglas Corporation as an engineering flight test pilot. He held Airline Transport Pilot Certificate No. 1433558 with airplane multiengine land, single engine land, and helicopter ratings. He was type rated in the McDonnell-Douglas DC-9 aircraft. Mr. Lane's first class medical certificate was issued October 8, 1979, and he was required to wear corrective lenses while exercising his airman's privileges. His medical certification had been issued more than 6 months before the flight; therefore, he was exercising the commercial privileges of his Airline Transport Pilot Certificate. According to the pilot, he was wearing his glasses during the flight.

Mr. Lane had flown about 6,000 hours. He had flown 700 hours in DC-9 aircraft, 265 of which were in the DC-9-80. He had been off duty more than 12 hours before reporting for this flight.

Copilot

Copilot Donald A. Alexander, 46, was employed by the FAA as a flight test pilot. He held Airline Transport Pilot Certificate No. 1310586 with airplane multiengine land, single engine land, and single engine sea ratings. He was type rated in Boeing 377, 727, Lockheed 300, and McDonnell-Douglas DC-9 aircraft. Mr. Alexander's first class medical certificate was issued April 29, 1980, with no limitations.

Mr. Alexander had flown 6,500 hours. He had flown 40 hours in DC-9 aircraft, 25 of which were in the DC-9-80. Mr. Alexander had been off duty for more than 12 hours before reporting for this flight.

APPENDIX C

PERTINENT FEDERAL AVIATION REGULATIONS

14 CFR 25.125 Landing

(a) The horizontal distance necessary to land and to come to a complete stop (or to a speed of approximately 3 knots for water landings) from a point 50 feet above the landing surface must be determined (for standard temperatures, at each weight, altitude, and wind within the operational limits established by the applicant for the airplane) as follows:

(1) The airplane must be in the landing configuration.

(2) A steady gliding approach, with a calibrated airspeed of not less than 1.3 Vs must be maintained down to the 50-foot height.

(3) Changes in configuration, power or thrust, and speed, must be made in accordance with the established procedures for service operation.

(4) The landing must be made without excessive vertical acceleration, tendency to bounce, nose over, ground loop, porpoise, or water loop.

(5) The landings may not require exceptional piloting skill or alertness.

(b) For landplanes and amphibians, the landing distance on land must be determined on a level, smooth, dry, hard-surfaced runway. In addition--

(1) The pressure on the wheel braking systems may not exceed those specified by the brake manufacturer.

(2) The brakes may not be used so as to cause excessive wear of brakes or tires; and

(3) Means other than wheel brakes may be used if that means--

(i) Is safe and reliable;

(ii) Is used so that consistent results can be expected in service; and

(iii) Is such that exceptional skill is not required to control the airplane.

(c) For seaplanes and amphibians, the landing distance on water must be determined on smooth water.

(d) For skiplanes, the landing distance on snow must be determined on smooth, dry, snow.

(e) The landing distance data must include correction factors for not more than 50 percent of the nominal wind components along the landing path opposite to the direction of landing, and not less than 150 percent of the nominal wind components along the landing path in the direction of landing.

(f) If any device is used that depends on the operation of any engine, and if the landing distance would be noticeably increased when a landing is made with that engine inoperative, the landing distance must be determined with that engine inoperative unless the use of compensating means will result in a landing distance not more than that with each engine operating.

14 CFR 121.195 Transport category airplanes: Turbine engine powered: Landing limitations: Destination airports.

(a) No person operating a turbine engine powered transport category airplane may take off that airplane at such a weight that (allowing for normal consumption of fuel and oil in flight to the destination for alternate airport) the weight of the airplane on arrival would exceed the landing weight set forth in the Airplane Flight Manual for the elevation of the destination or alternate airport and the ambient temperature anticipated at the time of landing.

(b) Except as provided in paragraphs (c), (d), or (e) of this section, no person operating a turbine engine powered transport category airplane may take off that airplane unless its weight on arrival, allowing for normal consumption of fuel and oil in flight (in accordance with the landing distance set forth in the Airplane Flight Manual for the elevation of the destination airport and the wind conditions anticipated there at the time of landing), would allow a full stop landing at the intended destination airport within 60 percent of the effective length of each runway described below from a point 50 feet above the intersection of the obstruction clearance plane and the runway. For the pupose of determining the allowable landing weight at the destination airport the following is assumed:

(1) The airplane is landed on the most favorable runway and in the most favorable direction, in still air.

(2) The airplane is landed on the most suitable runway considering the probable wind velocity and direction and the ground handling characteristics of the airplane, and considering other conditions such as landing aids and terrain.

(c) A turbopropeller powered airplane that would be prohibited from being taken off because it could not meet the requirements of paragraph (b)(2) of this section, may be taken off if an alternate airport is specified that meets all requirements of this section except that the airplane can accomplish a full stop landing within 70 percent of the effective length of the runway.

(d) Unless, based on a showing of actual operating landing techniques on wet runways, a shorter landing distance (but never less than that required by paragraph (b) of this section) has been approved for a specific type and model airplane and included in the Airplane Flight Manual, no person may take off a turbojet powered airplane when the appropriate weather reports and forecasts, or a combination thereof, indicate that the runways at the destination airport may be wet or slippery at the estimated time of arrival unless the effective runway length at the destination airport is at least 115 percent of the runway length required under paragraph (b) of this section.

(e) A turbojet powered airplane that would be prohibited from being taken off because it could not meet the requirements of paragraph (b)(2) of this section may be taken off if an alternate airport is specified that meets all the requirements of paragraph (b) of this section.

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++ REQUEST 140/94, REPORT # 130
++
+ DATA REPORT MCDONNELL-DOUGLAS - MD80 SERIES ACCIDENT +
+ EVENTS | PHASES: HARD LANDING | LEVEL OFF/TOUCHDOWN +
+ FIRE | POST-IMPACT +

++
++
<---------------- OPERATION ----------------> ++ <---------------- FILE DATA ---------------->
TYPE : MISCELLANEOUS - TEST/EXPERIMENTAL ++ ICAO FILE : 80/0119-0
++ FROM STATE : UNITED STATES
++
<-------------------- WHEN --------------------> ++ <------------ AIRCRAFT DATA ------------->
DATE : 80-05-02 ++ MASS CATEGORY : 27 001 - 272 000 KG
TIME : 06:41 ++ STATE OF REGISTRY : UNITED STATES
LIGHT : DAYLIGHT ++ REGISTRATION : N980DC
++
<------------------- WHERE -------------------> ++ <-------- DAMAGE, INJURY AND TOTAL ON BOARD -------->
LOCATION : EDWARDS AFB ++ A/C DAMAGE : SUBSTANTIAL
STATE/AREA : UNITED STATES ++ INJURY : FATAL SERIOUS MINOR NONE UNKNOWN TOTAL
DEPARTED : EDWARDS AFB ++ CREW : 0 1 0 6 0 7
DESTINATION : EDWARDS AFB ++ PAX : 0 0 0 0 0 0
OTHER DAMAGE : NO

THE A/C WAS MAKING A PERFORMANCE LANDING AS PART OF FAA CERTIFICATION TESTING. ON TOUCHDOWN THE EMPENNAGE SEPARATED AFT OF THE REAR PRESSURE BULKHEAD. THE FUSELAGE BUCKLED MIDWAY BETWEEN THE NOSE GEAR AND WING. THE NOSE GEAR AND TIRES FAILED ON IMPACT. FIRE WAS LIMITED TO THE NOSE GEAR ASSEMBLY.

AN ENGINEER STANDING IN THE COCKPIT BROKE HIS ANKLE.

DRN: THE APP WAS NOT STABILIZED AND THE CREW FAILED TO CALL OUT CRITICAL FLIGHT PARAMETERS. THE TEST FLIGHT INVOLVED DESCENT RATES APPROACHING THE A/C DESIGN LOAD LIMITS.

---------------- EVENTS AND FACTORS ----------------
1. EVENT | PHASE: HARD LANDING | LEVEL OFF/TOUCHDOWN
2. EVENT | PHASE: FIRE | POST-IMPACT

MD-80 #2

NTSB AAR-81-16

NTIS PB81-910416

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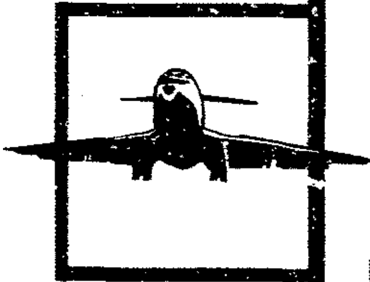

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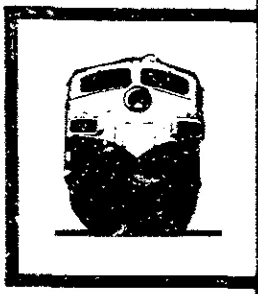

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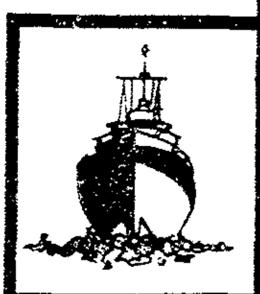
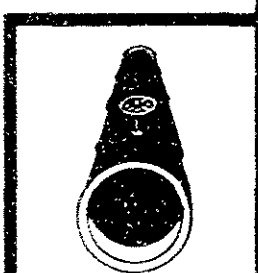


AIRCRAFT ACCIDENT REPORT

McDONNELL DOUGLAS CORPORATION,
DC-9-80, N1002G,
YUMA, ARIZONA,
JUNE 19, 1980.



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16. Abstract About 1849 m.s.t., June 19, 1980, a McDonnell Douglas DC-9-80, N1002G, skidded off the right side of runway 21R while attempting simulated hydraulic-systems-inoperative landing at the Yuma International Airport, Yuma, Arizona. The aircraft came to rest about 6,700 feet beyond the landing threshold of the runway. The aircraft was damaged substantially, however the three flightcrew members were not injured. There were no passengers. The weather was clear.

The aircraft was on a certification test flight. The purpose of the flight was to show that the aircraft could be controlled adequately and landed safely with a complete failure of its hydraulic systems The aircraft landed abut 1,735 feet beyond the threshold of runway 21R, and the pilot deployed the thrust reversers and applied reverse thrust before the nosewheel touched down. The aircraft began to yaw, continued to yaw after the nosewheel touched down, and then ground looped to the right and slid off the right side of the runway.

The National Transportation Safety Board determines thst the probable cause of this accident was the inadequate procedure established for the certification test flight, end the pilot's mismanagement of thrust following the initial loss of directional control.

17. Key Words Certification test flight; increased reverse thrust; use of reverse thrust; rudder control effectiveness; inadequate flight test procedures.	18. Distribution Statement This document is available to the public through the National Technical Information Service-Springfield, Virginia 22161 (Always refer to number listed in item 2)

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CONTEXTS

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

AIRCRAFT ACCIDENT REPORT

Adopted: September 15, 1981

McDONNELL DOUGLAS CORPORATION
DC-9-80, N1002G
YUMA, ARIZONA
JUNE 19, 1980

SYNOPSIS

About 1849 mountain standard time, June 19, 1980, a McDonnell Douglas DC-9-80, N1002G, skidded off the right side of runway 21R while attempting a simulated hydraulic-systems-inoperative landing at the Yuma International Airport, Yuma, Arizona. The aircraft came to rest about 6,700 feet beyond the landing threshold of the runway. Although the aircraft was damaged substantially the three flightcrew members were not injured. There were no passengers. The weather was clear, and the runway was dry.

The aircraft was on an FAA certification test flight to demonstrate compliance with a special condition to 14 CFR Part 25. The purpose of the flight was to show that the aircraft could be controlled adequately and landed safely with a complete failure of its hydraulic systems. The aircraft landed about 1,735 feet beyond the threshold of runway 21R, and the pilot deployed the thrust reversers and applied reverse thrust before the nosewheel touched down. The aircraft began to yaw, continued to yaw after the nosewheel touched down, it then ground looped to the right, and slid off the right side of the runway.

The National Transportation Safety Board determines that the probable cause of this accident was the inadequate procedure established for the certification test flight, and the pilot's mismanagement of thrust following the initial loss of directional control.

1. FACTUAL INFORMATION

1.1 History of the Flight

About 1820 m.s.t., 1/ June 19, 1980, a McDonnell Douglas Corporation, DC-9-80, N1002G, took off from the Yuma International Airport, Yuma, Arizona, on an FAA certification test flight required by a special condition to 14 CFR Part 25. The purpose of the flight was to demonstrate that the aircraft could be flown and landed safely with a complete failure of its hydraulic systems. The flightcrew consisted of a Federal Aviation Administration (FAA) project pilot, referred to herein as the pilot, who occupied the cockpit's left seat and flew the aircraft; a McDonnell Douglas engineering test pilot, referred to herein as the copilot, who occupied the right seat and performed the copilot's duties but was designated as pilot-in-command by McDonnell Douglas; and a McDonnell Douglas flight test engineer assigned to monitor the aircraft's flight test instrumentation.

The certification test flight profile required the flightcrew to perform a low approach and go-around followed by another approach and full-stop landing. Both maneuvers were to be flown without hydraulic pressure. The purpose of the go-around

1/ All times herein are mountain standard time based on the 24-hour clock.

was to verify that the aircraft was controllable and stable in ground effect with the landing gear doors open.

According to the flightcrew, a standard preflight briefing was conducted. In addition to the flightcrew, the briefing was attended by McDonnell Douglas' chief engineering test pilot, various McDonnell Douglas maintenance personnel, and FAA and McDonnell Douglas engineering personnel. The purpose of the flight and the maneuvers to be performed were briefed from the applicable flight card. According to the pilots, since the aircraft was to be landed with its rudder hydraulic boost, antiskid, and nosewheel steering systems deactivated, their principal areas of concern during the landing were: (1) to insure that reverse thrust was applied symmetrically; (2) to obtain good nosewheel tracking since only the manual rudder would be available for directional control; and (3) to apply wheel brakes gently since there would be no locked-wheel protection. The copilot also stated that, if an overrun appeared imminent, he was prepared to turn on the electric auxiliary hydraulic pump ". ..for use in the brakes if we were to run out of accumulator pressure." The cockpit voice recorder (CVR) transcript showed that the copilot told the pilot that he would turn the auxiliary hydraulic pump on anytime the pilot wanted it or anytime he (the copilot) felt it was needed.

The engine thrust reversers were checked and found to be operable before the engines were started. The nosewheel steering and centering systems were checked during taxi and all systems operated satisfactorily. The takeoff was uneventful.

The low approach and go-around were flown, the hydraulic systems were turned off, pressure was bled down, the rudder power switch was turned off, and the landing gear was extended using the alternate extension system. According to the pilots, the flight characteristics of the aircraft with, the landing gear doors open during these maneuvers were "excellent" and flightpath control was accomplished "easily." A missed approach was then made during which the hydraulic systems were turned on and the landing gear was retracted. After the missed approach was completed, the lending gear was extended, the aircraft was reconfigured for the hydraulic systems inoperative landing, the hydraulic systems were turned off, and the pressure bled down. The first attempt to land without hydraulic pressure was rejected about 800 ieet above the ground (AGL) because the warning light for "parking brakes set" was lit. The flightcrew asked the company's chief engineering test pilot about this indication and were told that this is a normal indication when the antiskid system is turned off. The test flight was continued.

A normal traffic pattern was flown, and the airccaft was aligned with runway 21R €or the approach and landing. The aircraft was configured as follows the landing gear was down and locked and the landing gear doors were closed; the leading edge slats and trailing edge flaps were retracted; the rudder power selector lever was in the manual position; the automatic spoiler extension system was disarmed; the left and right engine hydraulic pumps were off; the auxiliary hydraulic pump and hydraulic power transfer unit switches were off; the left and right hydraulic systems had been depressurized and their pressure gauges read zero; and the left and right brake pressure gauges indicated brake accumulator pressure--2,900 psi. Based on this configuration, the aircraft's hydraulic systems were inoperative for the approach and landing. The landing would be made without trailing edge flaps and leading edge slats; the spoilers would not extend automatically at touchdown nor could they be extended manually. With the rudder in the manual operation mode, rudder movement would be generated by aerodynamic forces on the rudder control tab. However, brakes and thrust reversers could be operated through each system's accumulstor pressures.

The aircraft's estimated landing gross weight was 1'13,700 pounds; the estimated center of gravity was 33.4 percent mean aerodynamic chord; and the reference indicated airspeed (V_{ref}) for the approach was 183 knots (KIAS). The final approach was flcwn on the ILS glidepath. According to the pilot, about 20 feet AGL, he retarded the thrust levers to the flight-idle position and a "soft touchdown" Was made just past the wresting cable, 1,831 feet beyond the landing threshold of the runway. The copilot confirmed the estimate of the landing point and also said that the aircraft landed at 175 KIAS.

According to the pilot, he selected reverse thrust at touchdown by rotating the piggyback reverse thrust levers to their "10 or 11 o'clock position." He said he "noted symmetric deployment of the reversers and lowered the nose to the runway." The pilot said that he did not notice any asymmetrical reverse thrust tendencies or any directional deviation of the aircraft until the nosewheel had touched down. When the nosewheel touched down, the aircreft began an immediate deflection to the left.

During an interview after the accident, the copilot stated that reverse thrust was selected when the main landing gear touched down, and the aircraft began to drift to the left when the nosewheel touched down. However, during a later interview, he said that in retrospect he "sort of decided that it (the aircraft's leftward drift) happened between main gear and nose gear touchdown. . . ."

The pilot said that, as the nosewheel touched down and the aircraft began to drift toward the left side of the runway, he depressed the right rudder pedal fully to correct the drift. He said that within a few seconds it became obvious that the use of just the rudder was not going to prevent the aircraft from running off the left side of the runway. He then tapped the right brake pedal, the right tires failed, and the aircraft began to yaw to the right "strongly."

The copilot said that when he saw that the left drift was not being corrected, he placed the auxiliary hydraulic pump snitch to the "on" position and notified the pilot of his action. Shortly thereafter, he "heard a right mair wheel ti-e blow out and the aircraft began to turn to the right."

The pilot said that he tried to stop the right turn and yaw with left rudder and then left brake, but ". . .the airplane continued to yaw and track to the right." He said that he tried to stow the reverse thrust levers at the first indication that the use of the left rudder and left wheel brake "was now insufficient to counteract the right yawing action."

According to the copilot, after the right tire blew out, the aircraft turned to the right, began a left skid, and with the nose pointing about 15° to the right of the runway heading, it began to drift toward the right edge of the runway. He heard a left tire blow out as the skid and yaw continued. The aircraft continued to rotate to the right and ran off the right side of the runway with its nose pointed about 90° to the right of the runway heading. Tie copilot said that to his knowledge he did not ". . .touch the rudder pedals, brakes, or control wheel during the accident."

After the aircraft left the pavement, the left main gear collapsed and the right main gear and the nose gear separated from the aircraft. The aircraft came to rest on its lower fuselage about 50 feet beyond the right edge of the runway and on a magnetic heading of 19°. The wreckage site was about 6,700 feet beyond the landing threshold of runway 21R; the coordinates of the site were 32°39'N, and 114°37'W.

Witnesses to the accident confirmed the pilots' description of the landing. The consensus of their statements indicated that the thrust reversers began to deploy when the main landing gear touched down, and they deployed fully before the nosewheel was lowered to the runway.

1.2 Injuries to Persons

Injuries	Crew	Passengers	Others
Fatal	0	0	0
Serious	0	0	0
Minor/None	3	0	0
Total	3	0	0

1.3 Damage to Aircraft

The aircraft was damaged substantially.

1.4 Other Damages

Not applicable.

1.5 Personnel Information

Both pilots were qualified in accordance with existing regulations. (see appendix B.) Both pilots stated that this was the first time they had ever attempted this test flight maneuver. This was the first flight of the day for the copilot; the pilot had flown earlier on the day of the accident, and the flight was made in the accident aircraft. Both pilots had been off duty more than 12 hours before reporting for duty on the day of the accident.

1.6 Aircraft Information

The aircraft, a McDonnell Douglas DC-9-80, was owned and operated by the compeny, and was an experimental certificated aircraft. The aircraft was maintained in accordance with prescribed maintenance regulations and procedures and had flown 6 hrs 16 min at the time of the accident.

The aircraft was powered by two Pratt & Whitney JT8D-209 engines which have a normal static takeoff thrust rating of 18,500 pounds and a maximum takeoff thrust rating of 19,250 pounds. The aircraft was within the prescribed weight and balance limitations for the flight.

The review of the aircraft's meintensnce records revealed several Pilot Flight Inspection Report entries (Douglas Form 92-17-1) relating to reverse thrust discrepancies. These entries concerned malfunction of the system's indicator lights and thrust lever alignment problems. The maintenance records disclcsed that actions to correct these writeups had been taken.

On June 19, 1980, the Form 92-17-1 for the flight before the accident contained the following writeup: "Item 1, Airplane pulls left during high speed taxi after left steering input." and, "Item 4, Right reverser hangs up going into reverse at the interlock position."

The aircraft's rudder pedal steering mechanism had been disconnected in order to perform a certification demonstration on the previous flight. The Inspection Discrepancy Report--Corrective Action (Douglas Form 92-42) contained 'the following entry with regard to item No. 1: "Pilot item No. I, Engn Act (Engineering Action). Reconnected per F4040A, Flight Development Engineering Order." This entry showed that the rudder pedal steering mechanism had been reconnected in accordance with the provisions and procedures of the cited order. The Form 92-42 contained the following entry with regard to item No. 4: "Item 4, NTDF No. 251 (Not to delay flight No. 251)." .

After the preflight briefing, the copilot met with the McDonnell Douglas chief engineering test pilot, During this meeting, the nosewheel tracking problem on the previous flight was discussed. The chief engineering pilot asked that an additional check be made to ascertain whether the aircraft would taxi straight ahead without hydraulic power. The copilot said that he informed the pilot of this request; however, the test was not performed. According to the copilot, he forgot about the request until after the aircraft had taxied into the takeoff position. At that time he asked the pilot if he wanted to perform the check, and the pilot said he did not.

The copilot also said that he did not discuss the writeup concerning the right reverser with the pilot. He said that this malfunction was pointed out during tine preflight briefing and that the pilot had flown the aircraft on that flight. Therefare, he assumed that the pilot was "as aware of these discrepancies as I was."

1.7 Meteorological Information

The reported weather at the time of the accident was as follows: clear; visibility -- 7 miles; temperature — 102.8° F; wind — 280° at 7 kns; altimeter setting -- 29.73 inHg.

1.8 Aids to Navigation

Not relevant.

1.9 Communications

Not relevant.

1.10 Aerodrome Information

Yuma International Airport, elevation 213 feet m.s.l., is located 3 miles southeast of Yuma, Arizona. The airport is served by five runways. Runway 21R is concrete surfaced, 13,300 feet long and 200 feet wide. The pavement was dry at the time of the accident.

1.11 Flight Recorders

The aircraf? was equipped with a Sundstrand Data Control digital flight data recorder (DFDR), serial No. 2862, and a Sundstrand Data Control cockpit voice recorder, serial No. 9194. Neither recorder was damaged. Their recording media were read out at the manufacturer's Long Beach, California, facility and the pertinent portions of the media were transcribed, examined, and verified by the Safety Board.

The CVR readout was conducted under the supervision of Safety Board personnel. The shuttle-type CVR records forward for 15 minutes, then reverses and records in reverse for 15 minutes. About 8.5 seconds after landing, the CVR went into the self-test mode. In this mode, a short 400 Hz tone is applied, the recorder reverses, another tone is applied to test the reverse track, and the recorder co-tinues in reverse. The self-test reversal takes place about 2.5 minutes from the recorder's reverse point, thus leaving about 5 minutes of old data on the tape. A complete CVR transcript was made by playing the tape to the first tone, then advancing the tape to the next tone--about a 5-minute interval--which signaled the continuation of the recording.

In addition, the aircraft was equipped with an inertial navigation system (INS) and on-board flight test instrumentation which recorded the following performance parameters: nosewheel and main landing gear wheel touchdown; aircraft yaw rate and yaw acceleration; engine reverser operation; forward and reverse thrust expressed in engine pressure ratios (EPR); wheel brake system operation; flight control deflectiors; and a time baseline. Because of the availability of additional data, the flight test instrumentation was used instead of the DFDR data to correlate the various performance parameters. However, the DFDR was used to validate the on-board flight test instrumentation data.

The on-board instrumentation data, INS data, and the tire marks on the runway--which began upon application of the right brake--were used to reconstruct the groundtrack and timing of the landing roll. In order to locate the touchdown point, it was necessary to use INS data. The INS velocities were used to obtain a calculated aircraft groundtrack. With some minor adjustments to these velocities, the integration produced a track which closely matched the actual ground track after brake application. Since the known groundtrack was matched so well, the Safety Board assumed that the calculated groundtrack from touchdown time to the time of the right brake application was a valid reconstruction of the actual ground-track. The data showed that between 1848:47.8 and 1848:48, the main landing gear struts compressed slightly, returned to their neutral position, then compressed again. Thereafter, the struts did not return to their neutral position. Simultaneous with the slight initial compression of the main landing gear struts, the aircraft's longitudinal accelerometer depicted a longitudinal deceleration, indicating that a slight skip had occurred. The final compression of the main landing gear struts occurred at 1848:48.9, and this time was used as the time of main landing gear touchdown for the groundtrack calculations. The INS data showed that the aircraft traveled about 4,785 feet along the runway before its center of gravity crossed the right edge of the runway. Since the physical evidence showed that the aircraft center of gravity left the runway about 6,520 feet beyond the landing threshold, main landing gear touchdown occurred about 1,735 feet beyond the landing threshold of runway 21R. The calculated point 'was within 96 feet of arresting cable and closely approximated the pilot's and copilot's estimate of main landing gear touchdown. (See appendix C.)

During the simulated hydraulic failure established for the test flight, the following aircraft controls and systems were available to the pilot for use during the landing and rollout: manual rudder, main wheel braking (limited by hydraulic accumulator pressure), reverse thrust, and limited nosewheel steering after the auxiliary hydraulic pump was turned on. In addition, the nosewheel was castering during the initial portion of the landing roll, thus providing some directional stability. 'Therefore, the instrumentation data cited herein reflect either the operation of these systems or the operation of systems which affect these systems. Unless otherwise noted, all times cited hereafter represent the time in seconds after main landing gear touchdown; the distances, in parentheses, represent the distance in feet beyond the runway's landing threshold; and unless otherwise specified, the amount of movement of the rudder and rudder control tab are expressed as hingewise angular deflections. Their direction of movement is depicted by the position of their trailing edges either left or right of the centerlines of the vertical stabilizer and rudder, respectively.

These data showed that the aircraft approached the runway with its nose aligned about 4° right of the runway heading. About **3** seconds before touchdown, the rudder was deflected about 2° left and the aircraft **began** to yaw left about 1°/second toward the runway heading. At **15** feet **AGL**, the thrust levers were retarded to their forward **idle** position. The aircraft **landed** near the runway centerline, about 173 KIAS, and its descent rate was less than **100** fpm. The aircraft's attitude at touchdown was as follows: pitch--5° aircraft noseup; roll--0.5° left wing down; heading--2° right of runway heading correcting back toward runway heading; and sideslip--2° left. Beginning at **main** landing gear touchdown, a 20-pound push force was exerted on the elevator column, and this force remained relatively constant until **4** seconds after the nosewheel touched down. About **1** second after touchdown, the rudder **was** returned to neutral **as** the aircraft continued to correct toward the runway heading.

About **1** second after main landing gear touchdown, reverse thrust began to increase on both engines; however, about **1** second later the thrust on each engine began increasing at different rates. **Six** seconds after main landing gear touchdown (at **3,470** feet) and coincident with nosewheel touchdown, reverse thrust had reached **1.60** EPR *on* the left engine and **1.38** EPR on the right engine. These levels created a 2,725-pound thrust differential and a nose left yawing moment of **37,800** foot-pounds. The aircraft had decelerated to 155 KIAS, and about 2 seconds to 2.5 seconds before the nosewheel touched down it had developed a yaw acceleration **of** 2°/second^2 to the left. About **1** second after the left yaw **began,** the pilot applied full right rudder pedal. The rudder control tab was deflected **20° to 22°** left, and the rudder was deflected 12° to 13° right.

When the nosewheel touched down, the aircraft's nose was 1° left of the runway heading; the rudder was still deflected **12° to 13°** right, and the yaw acceleration had stopped. However, the aircraft continued to yaw left at 2°/ second. The pilot applied the right brake for **0.5** second, released it, and then almost immediately reapplied the brake with continuous **2,350** psi right brake pressure. Since the antiskid had been turned off, the right main gear wheels **(Nos. 3** and **4)** locked up and began to skid, leaving marks on the runway. Two seconds later, **8** seconds after touchdown (at **4,000** feet)), the **No. 3** tire blew out.

When the **No. 3** tire failed, the rudder was deflected 13° right; the aircraft was yawed **about 4°** left **of** the runway heading. About 0.1 second earlier the copilot had turned the auxiliary hydraulic **pump** on. Almost simultaneously with the tire failure, the right engine's reverse thrust began to increase, and shortly thereafter, the left engine's reverse thrust began to decrease.

At 8.8 seconds after touchdown (at **4,180** feet), the **No. 4** tire blew out. The rudder was still **13°** right, the reverse thrust on the left engine had decreased to **1.39** EPR while on the right engine it had increased to **1.63** EPR. The aircraft had yawed about 5° left of the runway heading. Within 0.5 seconds after the **No. 4** tire failed, forward thrust was restored on the left engine, and the thrust decreased to forward idle.

When the No. **4** tire blew out, the aircraft had decelerated to 139 KIAS. Almost simultaneously, the aircraft began to yaw right, and within **1** second the **yaw** rate wes 7°/second. Shortly after the onset of the right yaw, the rudder began to move left and the reverse thrust on the right engine began to decrease.

At 11 *seconds* after touchdown (at **4,680** feet), the aircraft had decelerated to **130** KIAS, the rudder control tab was deflected 22° right, and the rudder **was** deflected about 10° left. The right reverser was out of the engine's exhaust and the engine was producing 1.28 EPR forward thrust. The aircraft's nose was 3° right of the runway heading and it was yawing right about 6°/second. Although the rudder control tab remained at 22° right deflection, as the aircraft continued to yaw right and decelerate the rudder began to move right. About 1.5 second after the right reverser had been removed from the exhaust, the engine's thrust had decreased to forward idle where it remained until the aircraft came to rest.

Shortly after the aircraft started to yaw right, the pilot applied the left brake for about 1 second and then released it. About 12 seconds after touchdown (at 4,920 feet), the pilot reapplied 1,500 psi of left brake pressure. The aircraft had decelerated to about 129 MAS, the nose was 11° right of the runway heading, and the yaw rate began to decrease, At 14.6 seconds after touchdown (at 5,480 feet and at 118 KIAS), the tires on the two left main gear wheels (Nos. 1 and 2) blew out. The aircraft's nose was about 21° right of the runway heading. The right yaw rate had decreased; however, after the Nos. i and 2 tires blew out the right yaw rate began to increase.

Between 12 seconds and 18.6 seconds after touchdown, the aircraft decelerated from 129 KIAS to about 36 KIAS and its nose rotated from 11° right to about 43° right of the runway heading. During this interval, the rudder control tab remained deflected about 24° to 26° right; however, the rudder began to trail in the streamwise direction. At 18 seconds after touchdown, when the aircraft's nose was about 38° right of the runway heading and at 80 KIAS, the rudder had deflected to about 23° right.

The aircraft continued down tine runway skidding to the left and rotating to the right. At 21 seconds after touchdown (6,565 feet), the aircraft's main landing gear skidded off the right edge of the runway. The aircraft's nose pointed 78° right of the runway heading when the landing gear left the pavement. After it left the runway, the aircraft continued to slide and rotate to the right until it came to rest.

In addition to the data retrieval systems, the aircraft also was equipped with a cockpit camera operating at a film speed of 1 frame per second. The cockpit camera log disclosed that at touchdown the pilot was moving the reverse thrust levers eft and both engine reverser unlock lights were on. One second after touchdown, both engine reverse thrust lights were on and both engine EPR gauges read about 1.05 EPR. At 3 seconds after touchdown, the EPR readings on both engine have increased to 1.13 EPR. At 5 seconds after touchdown, the reverse thrust readings cn the left and right engines were 1.58 EPR and 1.35 EPR, respectively. The camera data corroborate the other instrumentation data concerning this part of tine flight, and both sources corroborate witness statements concerning the operation of the reversers.

1.12 Wreckage and Impact Information

The first tire marks attributable to the accident aircraft were located about 1,900 feet beyond the landing threshold of runway 21R. (All distances herein are expressed in feet beyond the landing threshold of runway 21R.) Starting at 4,000 feet, the first pieces of tire rubber and carcasses were found along the right side of the runway, and at 5,500 feet, pieces of tire rubber and carcass were found along the left side of the runway. About 3,500 feet, ?he rubber and wheel markings showed that the aircraft began to drift left. of the runway centerline. At 5,500 feet, the centerline of the aircraft's fuselage was displaced about 10 feet left of the runway centerline. Thereafter, the aircraft. began to track toward the right side of the runway and its rate of movement to the right increased as the landing roll continued. During this movement, the aircrsft began rotating to the right and it entered a left skid.

About 6,310 feet, the nosewheel left the runway pavement with the aircraft's nose pointing about 54° to the right of the runway centerline. About 6,565 feet, the main gear left the pavement. The aircraft continued skidding left and rotating to the right in the sandy soil and came to rest with its nose pointing almost 180° from the direction of landing. During its off-runway movement, the aircraft sank into the soil, the left main landing gear collapsed into its wheel well, the right main gear separated in an outward direction from its main attach points, and the nose gear strut and wheel twisted off the nosewheel assembly.

The main landing gear wheels were damaged by contact with the runway surface after the tires failed. The blown out Nos. 1 and 2 tires remained on their respective wheel rims. Small sections of the outboard rim edges were broken out on both sides of each wheel.

The Nos. 3 and 4 tires separated from the wheel rims. The No. 3 wheel rim was worn flat for about 3 inches. The No. 4 wheel rim was worn flat for about 5 inches, and a 10-inch edge of the rim was broken out on the opposite side of the wheel from the worn spot.

All four brake assemblies were tested on the aircraft's left and right hydraulic systems and were found to function normally; no hydraulic fluid leakage was observed at any of the pistons. The brake assemblies were disassembled and the rotating discs, pressure plates, and back plates examined. Examination revealed no evidence of any preexisting malfunction or failure. The examination revealed evidence of discoloration, grooving, smearing;, and the transfer of friction material from the rotating to the stationary discs. Some of the drive links on the rotating discs of the Nos. 3 and 4 brake assemblies had been milled down to the point of failure.

Except for the damage to the landing gear and main gear wheels and tires, the remainder of the damage to the aircraft was inflicted after the landing gear separated from the aircraft. The undersides of the fuselage and wings were damaged as the aircraft slid along the ground and the fuselage skin and longerons had buckled on the lower fuselage between fuselage stations (FS)-484 snd -588, and between FS-1174 and -1307.

Examination of the empennage disclosed missing fasteners, skin separation, and minor skin buckles in the area of the vertical stabilizer. The horizontal stabilizers, elevators, and trim surfaces were not damaged; however, there was interference between the surfaces of the upper tailcone and adder, which was caused by structural damage to the tailcone after the landing gear failed.

The examination of the engines disclosed that the No. 1 engine reverser was stowed, and the No. 2 engine reverser was deployed. The thrust reverser system was examined after both engines were removed from the aircraft, and both thrust levers and reverse thrust levers operated freely from the cockpit. Their continuity to their respective engines was intact. The examination of the linkages and actuators of both thrust reversers did not reveal any evidence of preexisting malfunction or failure. Both thrust reversers were connected to a hydraulic power test panel and they operated normally; there was no evidence of any binding at the interlock position.

Both fuel controi units were removed and tested at Hamilton Standard, Inc., Long Beach, California. The tests were conducted under the supervision of the Safety Board and in accordance with the manufacturer's acceptance test procedures. The calibration and operational parameters of both units were found to be within the manufacturer's specifications. The tests did not disclose any evidence of failure or malfunction.

The cockpit controls and instruments were documented after the accident. The following pertinent readings and control positions were noted.

Control/Instrument		Position/Setting
Engine fire handles	--	Both pulled
Landing gear handle	--	Down
Stabilizer trim	--	1° noseup, switch–normal
Spoiler/speed brake lever	--	Retracted position
Rudder power lever	--	Manual
Thrust levers	--	idle
Reverse thrust levers (Piggybacks)	--	Stowed
Left engine hydraulic pump switch	--	Oif
Right engine hydraulic ptimp switch	--	Low
Hydraulic power transfer unit pump switch	--	Off
Hydraulic auxiliary pump switch	--	On
Hydraulic pressure gauge, left	--	Zero
Hydraulic pressure gauge., right	--	2,700 psi
Antiskid system	--	Off

1.13 Medical and Pathological Information

Not relevant.

1.14 Fire

At 1834, 15 minutes before the accident, there was 28,985 pounds of jet–A fuel on–board the aircraft distributed as follows: left main tank––8,195 pounds, center wing tank--12,760 pounds; and right main tank--8,030 pounds. Despite the damage to the underside of the wings and the bottom of the fuselage, there was no evidence of any spilled fuel and there was no fire. The airport fire department arrived on scene as the flightcrew exited the aircraft.

1.15 Survival Aspects

The integrity *of* the cockpit and cabin areas **was** not compromised during the accident sequence. After the aircraft stopped, the pilot shut down the engines and the flight test engineer opened the forward passenger entry door ***on*** the left side **of** the aircraft. All three flightcrew members exited through the open forward passenger door. It was not necessary ***to*** use the evacuation slides.

1.16 Tests and Research

During the investigation, tert maneuvers Were conducted to determine ruddar control effectiveness under varying levels **of forward** and reverse engine thrust. In addition, the capability of the brake accumulator to sustain antiskid on braking operation **with all** hydraulic systems inoperative was evaluated.

1.16.1 Rudder Effectiveness

The rudder system of the **DC-9-80** aircraft has two modes *of* operation––powered and manual. The right hydraulic system supplies hydraulic pressure to the rudder for the powered operation. **If** the No. 2 engine driven pump fails, the electric auxiliary hydraulic pump **is** available to pressurize the right system, and finally, if the pressure in the right system is lost, the left system can pressurize the right. system through the operation of the hydraulic power transfer unit pumps.

During powered rudder operation, the rudder control tab is locked hydraulically. Rudder pedal movement activates the rudder and the locked control tab is faired with and moves with the rudder. Hydraulic power to the rudder may be shut off by placing the rudder power control handle on the control pedestal in the **manual** position. When hydraulic power to the rudder control unit is shut off or when the hydraulic pressure drops to about 950 psi, the rudder automatically reverts to manual operation, unlocking the rudder control tab. *3* light on the cockpit overhead annunciator panel comes on to indicate manual rudder operation.

During manual rudder operation, rudder pedal movement operates the rudder control tab. Aerodynamic force on the control tab moves the rudder; thus, in order to deflect the trailing edge of the rudder to the left, the control tab's trailing edge is deflected right. Performance data showed that when the rudder pedal is depressed to its full travel position, the control tab is deflected at least 22°.

in order to protect the empennage from overload in case **of** an inadvertent application of excessive rudder control, a rudder throw limiter **is** installed. **As** the aircraft's airspeed increases, the system decreases the amount of rudder travel available from abut 22° to about. 2.5°. During acceleration, rudder throw is unrestricted to **176 knots** then will gradually reduce until reaching **2.5°** at **300** knots. On deceleraticn, the throw will increase until reaching 22° **at 157** knots.

The inputs to the rudder system are total air pressure from a pitot tube on the vertical stabilizer and static pressure inside the tailcone. Since the tailcone **is** vented **by** side louvers located in an area of ambient pressure during **all** fcrward thrust conditions, the static pressure inside the cone is also ambient under these conditions. The difference between the total and ambient air pressures--which is proportional to airspeed--operates the rudder throw limiter.

After the accident, the effectiveness of the rudder systems during ground operations was evaluated. The data herein were obrained either from test flights conducted before and after the accident or extrapolated from the data recorded on the-e test flights. The control capability of the rudder during both powered and manual operatior. was evaluated for various symmetric and asymmetric thrust conditions as well as the forward idle thrust condition. Yawing acceleration was derived and correlated with airspeed, rudder deflection angles, and reverse thrust EPR settings.

Directional controllability at various levels of symmetric forward and reverse thrust was determined by performing left and right turns with rudder pedal nosewheel steering rendered inoperative. Heading changes were made by rudder inputs alone. The values recorded during the tests were corrected to represent the yaw acceleration that would have been generated at maximum rudder deflection. The following table shows the yaw accelerations generated by the powered rudder at **140** knots equivalent airspeed 2/(KEAS) and at 90 **KEAS:**

2/ Calibrated airspeed corrected for compressibility.

Thrust	140 KEAS (degrees/second^2)	90 KEAS (degrees/second^2)
Forward Idle	3.5	1.5
Reverse Idle	2.5	1.1
1.3 EPR Reverse	1.7	0.35

The manually operated rudder generated the following yaw accelerations:

Thrust	140 KEAS (degrees/second^2)	90 KEAS (degrees/second^2)
Forward Idle	2.9	1.3
Reverse Idle	2.55	1.1
1.3 EPR Reverse	1.75	0.35

The curves between the 140 KEAS and 90 KEAS points were essentially linear for both modes of rudder operation.

The flight test data showed that at 1.6 EPR symmetric reverse thrust and at 109 KEAS, the powered rudder control effectiveness was zero. Deta for this thrust level were not obtained for higher speeds. Tests were not conducted to obtain data for the manual rudder at 1.6 EPR symmetric reverse thrust.

Directional control capability of the aircraft for the powered and manual modes of rudder operation with asymmetric thrust applied was determined with one engine at forward idle thrust and the other at various reverse thrust EPR settings. Rudder pedal nosewheel steering was rendered inoperative and the airspeed was decreased until full rudder input was required to maintain the aircraft's heading for that particular thrust level. The tests disclosed that in the powered mode at 140 KEAS directional control could be maintained with 1.52 EPR asymmetrical reverse thrust, while at 90 KEAS directional control could be maintained at 1.23 EPR reverse thrust. In the manual mode, directional control at 140 KEAS and 90 KEAS could be maintained at 1.45 EPR and 1.2 EPR reverse thrust, respectively. These tests were conducted to evaluate rudder effectiveness during an engine-out condition and to depict a conservative level of rudder effectiveness since the tests were conducted with the opposite engine at forward idle thrust. However, because of the nature of these asymmetric reverse thrust tests, the rudder was deflected away from the disturbing effects of the reversed engine; this was not true in the case of the accident aircraft, since both engines were delivering reverse thrust during the rollout.

During the powered rudder portion of the symmetric reverse thrust tests, the operation of the rudder limiter was evaluated at the following levels of symmetric reverse thrust: 1.3 EPR, 1.6 EPR, and 1.8 EPR. The test data indicate that as the level of reverse thrust increases, the static pressure inside and outside the tailcone decreases below ambient pressure while total pressure remains essentially the same. Thus, the differential pressure sensed by the rudder throw limiter is increased, since the pressure differential sensed by the limiter is a function of the level of the applied reverse thrust and airspeed. The test data indicate that at speeds between 138 KIAS to 180 KIAS and during symmetrical. reverse thrust operation, the rudder limiter system restricted the rudder deflections from 15.4° to 17.4°, or about 2° to 5° less than the design limits.

The rudder limiter affects both the powered and manual modes of the rudder operation. The data retrieved from the accident aircraft showed that with about 1.3 EPR (right engine) and 1.6 EPR (left engine) reverse thrust applied and between 158 KIAS and

140 KIAS, full rudder pedal application produced a right rudder deflection of 11° to 12.5° hingewise. Thus, the data indicate that the manual rudder deflections during the accident were restricted, compared to the deflections of the powered rudder, by about 4.4° to 4.9°. However, based on the available data, the Safety Board cannot determine if this resulted from the operation of the rudder limiter or a degradation in aerodynamic hinge moment caused by the effect of thrust reverser outflow on the rudder control tab.

These data show that vertical stabilizer and rudder effectiveness increase as airspeed increases; thus, yawing acceleration generated by rudder deflection varies directly with airspeed. While interference caused by reverse thrust operation (tail blanking) decreases the effectiveness of the rudder, the magnitude of the interference at a given level of reverse thrust will vary directly with airspeed. The degree of tail blanking is a function of reverse thrust levels and airspeed, and is dependent on thrust reverser geometry and its relative position to the vertical fin and rudder.

In addition, test results also showed the effect of speed on runway directional control. These data were expressed as available control moments derived from the manual rudder, nosewheel steering, and differential wheel braking (antiskid system operative) at various speeds between 0 and 150 knots with no reverse thrust applied. The data showed that the available rudder control moments deceased from about 300,000 foot-pounds at 150 knots to about 36,000 foot-pounds at 50 knots. Differential wheel braking produced a control moment of about 200,000 foot-pounds at 150 knots and this increased to about 290,000 foot-pounds at 10 knots. The nosewheel steering produced a control moment of about 200,000 foot-pounds throughout the cited speed range.

Data also depicted the available control moments with symmetric 1.9 EPR reverse thrust on a wet runway. Since the runway was dry at the time of the accident, the data concerning nosewheel steering and differential braking would not be particularly relevant. However, the available control moment developed by the manual rudder was 150,000 foot-pounds at 150 knots, and this decreased to zero at 70 knots.

1.16.2 Antiskid System and Hydraulic Accumulators

After the accident, the brake accumulator was evaluated to determine if it would permit antiskid system operation during the landing roll with the hydraulic systems inoperative. The test showed that the accumulator's capacity was sufficient to sustain a steady application of the brakes with the antiskid system in operation and that the aircraft could be stopped safely in this configuration.

1.17 Other Information

1.17.1 Engine Thrust Reverser System

The left and right engine thrust reversers operate on pressure supplied by their respective hydraulic systems. Each reverser system is equipped with an eccumulator to supply operating pressure in the event of a total loss of hydraulic system pressure. When the thrust reverser levers are moved toward the reverse thrust pcsition, the reversers unlatch and start to extend. As the thrust reverser unlatches, a latch switch allows the engine reverser unlock light to illuminate. An interlock prevents the thrust reverser levers from being moved beyond the idle thrust position while the reversers are in transit. When the reversers are extended, a reverse-extended switch turns on the engine reverse thrust light, the interlock is removed, and reverse thrust can be applied as desired. Thrust reverser actuation time is about 2 seconds.

All DC–3 aircraft have essentially identical empennage configurations, engine locations, and thrust configurations. However, the JT8D-209 engine installations on the series 80 aircraft are larger than those on previous series DC-9 aircraft. Its target reversers are abut 1.5 feet farther aft than those on the previous series, and the reversers are rotated 15° inboard. Extrapolation of test flight data showed that at the same levels of symmetrical reverse thrust, the yawing acceleration produced by maximum rudder deflection was similar for the series 80 aircraft and previous DC–9 aircraft. The data showed that the level of reverse thrust was the major variable affecting the effectiveness of the vertical stabilizer and rudder cf any DC–9 aircraft.

The JTSD-209 engine produces about 2,000 to 1,500 lbs more thrust than the engines on the earlier DC-9's. Despite the increase in engine thrust for tile DC–9–80 aircraft, the total amount of thrust reverser lever travel available to the pilot has remained the same as in the earlier DC–9 series. This has increased the gain or sensitivity of the thrust reverser levers since smaller lever deflections command greater change-, in thrust levels.

Flight test data on previous DC–9–80 flights indicated that asymmetric reverse thrust encounters were a problem. After the accident, the thrust reverser rigging procedures (production and maintenance) were modified. Although the modifications dc not change the sensitivity of the thrust !ever system, they were designed to reduce the likelihood of asymmetry encounters during the application of reverse thrust.

1.17.2 Nosewheel Steering System

The nosewheel steering system consists of two independent control valves and two actuating cylinders--left and right––that are supplied hydraulic pressure from separate sources. The left and right actuating or steering cylinders receive pressure from their respective hydraulic systems. Except for slight reduction in steering angle, the steering system will function normally with one hydraulic system operating. Nosewheel steering is controlled by either the steering wheel or the rudder pedal. The nosewheel can be turned 82° left or right by the steering wheel and 17° left or right by the rudder pedals. When the auxiliary eiectric hydraulic pump was turned on, the right system was pressurized and both steering wheel and rudder pedal steering became avaiiable.

1.17.3 DC–9–80 Certification Procedures

The earlier DC–9 series aircraft were certificated under Part 4b of the Civii Air Regulations (CAR) and Special Conditions thereto issued by the FAA. One of these special conditions required that "The airplane must be shown by test night to be capable of continued safe flight and landing with a complete failure of the hydraulic? system." This demonstration was performed successfully with the DC–9–10 and -30 series aircraft.

With regard to the DC–9–80, McDonnell Douglas elected to show compliance with the later airworthiness standards of 14 CFR Part 25. The FAA then issued Special Conditions No. 25-95-WE-27. One of the special conditions contained therein required that McDonnell Douglas show by flight test that the aircraft was "...capable of continued safe flight and landing with a complete failure of the hydraulic system." This special condition only requires McDonnell Douglas to demonstrate that the aircraft can be flown and landed safely with this malfunction. There is no requirement to stop the aircraft within a specified distance; however, according to the FAA, the aircraft must be stopped within the confines of a runway of reasonable length.

In addition, the certification regulations required McDonnell Douglas to demonstrate ". . .by analysis or test, or both. . ." that the aircraft was capable of continued safe flight and landing under any possible condition of the thrust reverser. This was demonstrated on the earlier series aircraft with and without nosewkeel steering, and the tests were completed with no reported difficulties. On the DC–9–30 aircraft, the landings were made with the rudder pedal steering mechanism disconnected. Two landings were made with the rudder in powered mode, and one landing was made with the rudder in manual mode. After main gear touchdown, both engines were placed in reverse thrust, takeoff thrust was then applied and the fuel to one engine was cut off. The test flight report stated, "Directional control was appiied by the pilot until the aircraft began to deviate with full rudder as the speed decreased. The rate of deviation was not considered excessive and the airplane was controlled by reducing power on the operative engine." All that the regulations required was a subjective judgment by the test pilots that the aircraft could be controlled safely, and they concluded that it was. As a result of these demonstrations, McDonnell Douglas included a caution note in the Airplane Flight Manuals (AFM) of all DC-9's to reduce reverse thrust if directional control difficulties were encountered while operating with reverse thrust applied.

With regard to the DC–9–80, Special Conditions No. 25–95–WE–27 required McDonnell Douglas to establish ". . .by night and ground tests . . ." that the DC-9-80 could be ". . .safely landed and stopped with a critical engine reverser deployed." These tests were underway but had not been completed at the time of the accident. However, the tests conducted after the accident showed that the aircraft could maintain directional control with reverse thrust settings ranging from 1.52 EPR to 1.2 EPR on one engine and the other engine in forward idle thrust.

The results of the compiete hydraulic system failure demonstrations on the earlier DC-9's were as follows: The DC–9–10 report stated, "The lateral control characteristics during the approach were normal. The touchdown speed was 150 knots. The airplane was controllable during landing with no difficulties experienced during the landing roll–out. There was a slight directional sensitivity experienced which was caused by slight asymmetrical thrust being applied. This was controllable when the pilot concentrated on the EPK (engine pressure ratio). With the brake system on manual (anti–skid off) there was braking available to tine end of the landing roll with 6,000 feet of runway used. Under these conditions the airplane controllability was considered satisfactory."

The DC-9-30 comments were as follows: "The airplane touched down at 155 KIAS. Light to moderate braking and reverse thrust were used during the roll–out utilizing approximately 6,800 feet of runway. Controllability during the approach and landing was normal and no unusual characteristics were experienced during the demonstration."

Neither the certification regulations nor the special conditions required a quantitative measurement of the precise amount of yawing acceleration produced by the vertical stabilizer and rudder; all that was required was a subjective evaluation that the aircraft could be controlled safely. According to the test pilots who had Clown thase engineering certification test flights, the aircraft could be controlled safely.

According to McDonnell Douglas, the data obtained during these certification demonstrations were evaluated before they conducted the DC-9-80's complete hydraulic system failure demonstration. These data did not disclose anjj problem that indicated a need to conduct a more extensive evaluation of the aircraft's controllability during the landing roll, and they did not consider it to be a high risk factor. Accordingly, the flight cards for the DC-9-80's complete hydraulic system failure demonstration were prepared, based on the same procedures used successfully in the demonstrations conducted with the series –10 and –30 aircraft.

1.17.4 Flightcrew Procedures

At the time of the accident, the aircraft was operating pursuant to an experimental certificate; therefcre there was no approved AFM in existence. The procedures to be used on the hydraulic system inoperative landing were contained on the flight card prepared by McDonnell Dougias. This card contained the procedures which would enable the pilots to conduct the flight in a manner that would insure that regulatory compliance would be demonstrated.

According to McDonnell Douglas, one of the purposes of the certification program was to determine if the procedures and pilot techniques that were applicable to the DC–9–50 could be used to fly the DC–9–80. While there was no approved DC–9–80 AFM in existence, a preliminary –80 AFM was being developed and evaluated as the certification program progressed. The preliminary AFM contained procedures and pilot techniques for the DC–9–80, as well as FAA–approved DC-9-50 information. McDonnell Douglas stated that the pilots conducting the PAA certification test program were briefed that these –50 pilot techniques applied to the DC–9–83, and that, unless otherwise briefed, the pilot techniques outlined in the preliminary AFM and in previous series PC–9 AFM's should apply. In addition, the pilots were briefed that these proeedures were, until shown otherwise, She best guidelines for proper pilot technique. With regard to the technique to reduce reverse thrust if directional control problems were encountered during reverse thrust operation, this cautionary note was contained in the AFM of every DC–9 series aircraft. In addition, two FAA engineering test pilots stated that it was common knowlege that the application of reverse thrust on. tail–mounted engines can create directional control problems; therefore, if this occurs, reverse thrust should be reduced.

The flight card prepared for this demonstration contained the airspeeds to be flown, the procedures required to configure the aircraft for the test properly, the system gages and warning lights that were to be monitored, and then directed "Use reverse thrust and minimum braking." The approved procedures in previous DC–3 AFM's concerning the application of reverse thrust after landing stated, in part, "Reverse thrust may be used as soon as practical after touchdown."

At the preflight briefing before the accident flight, the procedures contained on the flight test card were amplified. The briefing covered brake application technique, the necessity to apply reverse thrust symmetrically and to establish nosewheel tracking. During the briefing the copilot also advised the pilot that he would turn the electric auxiliary hydraulic pump on if there was any doubt about stopping the aircraft. However, the briefing did not discuss or establish crew coordination techniques to monitor the engine acceleration during the application of reverse thrust; it did not establish any order of priority for the application of reverse thrust and nosewheel touchdown; and it did not include any review of pilot techniques or crew coordination items to be used in the went they encountered any directional controi problems during the landing roll.

With regard to the use of reverse thrust, the pilot stated that he applied it after the main landing gear touchdown, that he "...noted symmetric deployment of the reversers and lowered the nose to the runway." He said that, after the Nos. 3 and 4 tires failed and the aircraft began to yaw to the right, he applied ieft rudder and brakes to counteract the right yaw. "The aircraft continued to yaw to the right and track to the right, I attempted to stow the reverse thrust levers at the first indication that the use of left. rudder and brake was now insufficient to counteract the right yawing action."

1.17.5 Postaccident Actions

On August 21, 1980, ?he hydraulic-systems-inoperative certification test flight which resulted in the accident was reflown. However, as a result of the investigation conducted after the, accident, the flightcrew procedures were revised. Also, since the DC-9-80 has larger wheel brake accumulators and a more advanced antiskid system than the DC-9-10 and DC-9-30, the DC-9-80, with a complete failure of its hydraulic system, could be stopped safely with its antiskid system in operation; therefore the revised procedures required the antiskid system to be on for landing. The procedures used during the second test were as follows:

> Make positive main gear touchdown to minimize float;
>
> Lower the nose immediately after main gear touchdown and after nosewheel touchdown apply the brakes smoothly to full pedal deflection;
>
> Set thrust symmetrically to the idle reverse detent. Do not use asymmetrical reverse thrust to maintain directional control;
>
> Use rudder and differential braking as required for directional control. Maintain the maximum possible steady brake pedal deflection to minimize accumulator pressure loss;
>
> Maintain symmetrical idle reverse thrust until the aircraft is stopped, unless higher symmetrical reverse thrust is required by existing conditions;
>
> Maintain maximum possible breking until the aircraft is stopped. Do not try to taxi the aircraft.

In addition, a card, containing procedures to be used in the event directional controls problems cccurred after landing, was developed end inserted in the Eight card package. The card contained pilot techniques concerning the activation of the hydraulic systems, the antiskid system, and thrust management. The procedures and pilot techniques were designed to enable the flightcrew to regain directional control and either stop the aircraft or reject the landing, reconfigure the aircraft and then takeoff.

The subsequent Certification test flight was conducted without incident and met certification standards. As a result of this test, the hydsauiic-systems-inoperative landing procedures for DC-9-80 flighterews were changed. The new procedures incorporate the techniques used on the second test flight. In addition, the flightcrew procedures concerning the use of reverse thrust on normal landing were amplified. The new procedure reads as follows:

> <u>REVERSE THRUST - GROUND OPERATION</u>
>
> Reverse thrust may be applied to the idle reverse thrust detent when the nose gear is firmly on the ground. When reverse thrust is verified, proceed as follows:
>
> > Set thrust symmetrically above 60 knots to 1.6 EPR and below 60 knots to idle reverse thrust detent unless higher thrust is dictated by existing conditions.

> During reverse thrust operation, should difficulty be experienced in maintaining directional control, reduce thrust as required. Do not attempt to maintain directional control by using asymmetric reverse thrust.

Reverse thrust operation when operating on wet/slippery runways or with one engine in reverse.

> After nose gear contact, apply down elevator and apply reverse thrust to idle reverse thrust detent. After reverse thrust is verified, gradually increase reverse thrust as required.
>
> During reverse thrust operation, should difficulty be experienced in maintaining directional control, reduce reverse thrust as required. Do not attempt to maintain directional control by using asymmetric reverse thrust.

2. ANALYSIS

The aircraft was maintained in accordance with prescribed regulations and procedures. The review of the maintenance records disclosed two pilot discrepancy reports which were relevant to the accident maneuver. One stated that the right engine's reverser "hangs up" at the interlock position when "going into reverse"; the second stated that the aircraft pulled to the left "after left steering input." The camera log disclosed that both engine reverse thrust lights illuminated at the same time and the onboard flight instruments showed that reverse thrust began increasing on both engines simultaneously. Since neither of these actions could have occurred with the right engine interlock in place, the Safety Board concludes that the interlock operated properly when reverse thrust levers were placed in the reverse position.

Although the copilot had been asked to check the aircraft's nosewheel tracking with the hydraulic system turned off, this check was not performed. The postaccident examination of the nosewheel steering system did not disclose any evidence of any preexisting malfunction or failure; however, the nosewheel's tracking capability could not be determined.

The flightcrew was certificated properly and was qualified for the flight; however, neither pilot had performed a hydraulics-systems-inoperative landing.

Investigation revealed thst the sequence of events which led to the accident began with the application of reverse thrust on landing. Despite the fact that both pilots understood that two principal areas of concern were to establish good nosewheel tracking and to insure the reverse thrust was applied symmetrically, these objectives were not accomplished. The pilot's statements and the evidence showed that they monitored the reverser system indicator lights and assured themselves that both lights on both engines were lit. However, the evidence showed that they did not monitor the reverse thrust increase after the interlock cleared and reverse thrust was applied to the engines. The asymmetric thrust increase went unnoticed. As a result, the asymmetric reverse thrust produced a left yaw moment of 37,800 foot-pounds and a left yaw acceleration of $2^\circ/\text{second}^2$.

About 1.5 seconds before the nosewheel touched down, the pilot applied hard right rudder pedal and held this input for 5 seconds. During this time interval, the aircraft decelerated from 160 KIAS to 136 KIAS and the rudder deflection was about 12°

to 13° right. The test data showed that, either due to the action oi the rudder limiter or a degradation in aerodynamic hinge moment caused by the effect of reverse efflux on the rudder control tab, the rudder deflections were about 7° to 9° less than the design limits of the rudder. The yaw acceleration stopped after the rudder was applied, but the aircraft continued to yaw to the left at 2°/second.

Although the pilot attempted to correct the yaw with opposite rudder and then wheel braking, the source of the yawing moment was not reduced until tine No. 3 tire blew out. At, or just before, the time the No. 3 tire blew out and about 2 seconds after he began to apply differential braking, the pilot began to increase reverse thrust on the right engine. During this period the aircraft was decelerating from about 155 KIAS. The test data showed that at 140 KEAS, the manual rudder could produce yaw accelerations of 1.75°/second^2 at 13 EPR symmetric reverse thrust; 2.6°/second^2 at reverse idle thrust; and 2.9°/second^2 at forward idle thrust. These yaw accelerations increase with increased speed, Thus, had the reverse thrust Seen decreased, the potential to restore directional control would have been increased. The date indicated that had the pilot reduced the reverse thrust on both engines to idle there was sufficient rudder control effectiveness to develop a yaw acceleration to the right and, based on the timeliness of this corrective action, directional control of the aircraft might have been regained. Because of the variables involved in this action--the speed at which the thrust levers were retarded, the amount of the thrust reduction, and engine spool down rates--it is difficult to state with certainty that this action would have been successful. However, the data indicated that had the reverse thrust been reduced to idle at the time the pilot first resorted to differential braking it was highly probable that he could have regained directional control and kept the aircraft on the runway. While the data also indicated that this capability existed up to the time the Nos. 3 and 4 tires blew out, the probability of regaining control would have been reduced because the aircraft had yawed farther to the left and was clcser to the side of the runway.

Although there were no FAA-approved procedures in existence governing the proper pilot techniques for the management of reverse thrust on the DC-9-80 in this situation, the evidence showed that the procedures and pilot techniques used on the DC-9-50 and earlier DC-9 aircraft unless otherwise briefed, applied to the DC-9-80. The AFM's of the previous series DC-9's ceutioned the pilot to reduce reverse thrust if he encountered directional control difficulties while in reverse thrust and the evidence disclosed that this recommended pilot technique had not been countermanded. Considering the pilot's experience in both DC-4 and other aircraft with tail-mounted engines, the onset of the directional control difficulty should have suggested that the reverse thrust be reduced, if not before, then certainly coincident with the application of differential braking.

However, instead of reducing the reverse thrust, the pilot tried to augment his rudder and brake inputs by manipulating reverse thrust. Just before the No. 3 tire Slew out, he increased reverse thrust on the right engine, and 1 second later he retarded tne left reverse thrust lever and then placed it in the forward thrust position. Therefore, after the No. 3 and 4 tires had failed and the aircraft began to track toward the right side of the runway, the left engine was producing 1.14 EPR forward thrust while the right engine was producing 1.67 EPR reverse thrust and a right yawing moment had been generated. In addition, the copilot turned the auxiliary hydraulic pump switch on and restored full pressure to the right hydraulic system. At that moment, the right rudder pedal was depressed fully and the nosewheel turned to' the right. The evidence showed that the copilot inadvertently placed the adjacent engine driven hydraulic pump switch on the right engine to the low position when he activated the auxiliary pump switch; however, since the auxiliary pump restored full pressure to the right system, the activation of the engine driven pump switch had no effect on the system.

Therefore, the pilot's mismanagement of the reverse thrust application was the precipitating factor which produced the accident; however, the reasons why he did so need to be examined.

The procedures for the hydraulics-systems-inoperative landing for the series 80 aircraft were essentially the same as those used with the series 10 and series 30 aircraft. However, because of the increased thrust capability of the -209 engines, their reverse thrust output at any given EPR setting was higher than thst produced at similar EPR settings in the earlier aireraft. The effect of this increased reverse thrust on the directional control capability of the rudder had not been quantitatively determined before the accident; therefore, neither the manufacturer nor the pilots were aware of the decrease in rudder control effectiveness at the higher reverse thrust levels generated by the -209 engine. Once the aircraft had landed, directional control of the landing roll was to be maintained by the rudder and wheel brakes. In addition, some directional stability was afforded by the castering nosewheel after it touched down. The flight card stated that the pilot was to use "reverse thrust and minimum braking," and it did not restrict the amount of reverse thrust he could use. Once reverse thrust was applied, the effectiveness of one of the two main methods of maintaining directional control was decreased in direct proportion to the amount of reverse thrust applied. Since the antiskid system was inoperative, using wheel braking to maintain directional control, particularly at high speeds, would have required a high degree of alertness and skill in order to obtain a change in heading without destroying the tires.

The pilot techniques required to carry out the procedures on the flight card were discussed at the preflight briefing. As a result of the briefing, the pilots stated that they knew thst it was important to establish good nosewheel tracking and to insure that the reverse thrust was applied symmetrically. However, the lack of knowledge concerning the effect of reverse thrust on the vertical stabilizer and rudder affected the adequacy of the briefing. The degradation of rudder control effectiveness at high reverse thrust levels made the amount of reverse thrust applied and the manner and timing of the reverse thrust application critical. The briefing did not alert the pilots to this fact nor did it establish techniques to insure that these objectives could be carried out. The briefing did not limit the amount of reverse thrust the pilot could use and it did not establish an order of priority between the increase of reverse thrust above idle and nosewheel touchdown. Had the procedure required that the nosewheel be lowered to the runway before reverse thrust was increased above idle, nosewheel tracking would have been established which would have helped counteract the effects of the asymmetric reverse thrust and perhaps limited the yaw acceleration and resultant yaw rate.

The procedures used during this demonstration were essentially the same as those used during the successful DC-9-10 and DC-9-30 demonstrations. These were successful because, except for the slight reverse thrust asymmetry which occurred during the DC-9-10 demonstration, little or no reverse thrust asymmetry was introduced during the landing rolls. Despite the fact that the preflight briefing before this demonstration emphasized the importance of applying reverse thrust symmetrically, this objective was not accomplished. If this had been. done and the initial reverse thrust asymmetry had not been introduced, the DC-9-80 demonstration would have been completed successfully.

The tests which identified and quantified the control effectiveness of the vertical stabilizer and rudder at various levels of reverse thrust were nor conducted until after the eccident. Despite the fact that the applicable certificaticn regulations did not require the manufacturer to conduct this type of testing, the Safety Board was concerned as to whether the data obtained during the Certification of the earlier DC-3 series aircraft should have alerted McDonnell Douglas to a need tu go beyond the evaluation standards contained in the applicable certification regulations and perform quantitative testing before the accident occurred. The DC-9's certification history contained only one demonstration wherein the effects of reverse thrust on the aircraft's directional control elicited a comment from a test pilot. The test report concerning the DC-9-10's hydraulic-system-inoperative certification test flight noted that a ". .. slight directional sensitivity. .." was experienced and that it was caused by the application of " . . .slight asymmetrical reverse thrust." However, the remainder of the report noted that the test pilot did not experience any control difficulties during the landing roll, and he stated that the aircraft's " . . .controllability was considered satisfactcry." The remainder of the certification data, concerning the aircraft's performance with a complete hydraulic system failure and during landings with one engine thrust reverser deployed an5 the other stowed, showed that the test pilots considered the aircraft to be controllable under those conditions. According to McDonnell Douglas, the certification data did not indicate a problem area; therefore, they did not believe there was any necessity to conduct a more extensive evaluation of the effects cf reverse thrust on the control capability of the vertical stabilizer and rudder. Given the evidence available to McDonnell Douglas, the Safety Board does not believe that this decision was imprudent.

In summary, because of the lack of data at the time of the accident concerning the effect of high levels of reverse thrust on the control effectiveness of the rudder, the test flight procedure did not limit the amount of reverse thrust the pilot could use and thereby insure that some degree of rudder effeetiveness was retained during the landing roll. In addition, the procedure did no6 require. that the nosewheel be lowered to the runway before the pilot was permitted *to* increase reverse thrust above reverse idle. With regard *to* the latter requirement, we believe that even without the data obtained during subsequent testing the procedure should have established this sequence. During the preflight briefing the pilots were apprised of the necessity to establish good nosewheel tracking. Considering the landing configuration of the aircraft, the briefing should have established pilot techniques which insured that the nosewheel was down and tracking before exposing the aircraft to the possibility of an asymmetric thrust occurrence.

The Safety Board also believes that even without the results of the postaccident tests the procedures used for the certification test flight were inadequate in two other srees. Given the earlier encounters with thrust asymmetry during the DC-9-80 certification testing program, flightcrew coordination procedures to monitor the engine acceleration during the application of reverse thrust should have been formulated and incorporated in the procedure to guard against this occurrence. Finally, there was no procedure or briefing which discussed, reviewed, or established pilot techniques to be used in the event directional contra1 was compromised during the landing oll. Since the aircraft wes *to* be landed without nosewheel steering and without the powered rudder, the possibilities of encountering directional control problems during the landing roll were not remote. Procedures and pilot techniques to recognize and then recover from an encounter of this type should have been discussed and established.

The Safety Board, therefore, concludes that the procedures used for the certification flight were not adequate and were causal to the accident. While the failure to limit the amount of reverse thrust to be used after touchdown can be attributed to the lack of quantitative data concerning rudder performance, the other areas discussed above were foreseeable before the accident flight and the procedures developed for the certification test flight should have incorporated pilot techniques to protect the flightcrew *and* aircraft from their occurrence. Notwithstanding the inadequacy of the procedures, the Safety Board believes that the pilot's attempt *to* retrieve directional control of the aircraft by using esymmetrical reverse thrust was a causal factor to the accident. Once the yaw developed, despite the fact that the applicable procedures required that reverse thrust be reduced, the pilot did not reduce reverse thrust. Instead he attempted to regain directional control of the aircraft by applying asymmetrical reverse thrust and aggravated the out-of-control condition of the aircraft. This was the final factor that made the accident inevitible.

As a result of the tests conducted after the accident, the procedures for landing without hydraulic system pressure were revised. According to the procedures developed after the accident, the initial action required of the pilot on landing is to 'lower the nose immediately after main gear touchdown.. . ." The two major differences between the new procedures and the old involve the use of reverse thrust and main wheel braking. Under the new procedures, the operation of the reversers is prohibited until after the nosewheel contacts the runway, and thereafter reverse thrust will be maintained at idle ". . . unless higher symmetrical reverse thrust is dictated by existing conditions." This change either removes or decreases the possibility of any pilot action adversely affecting the directional stability of the aircraft during the landing roll. It also enhances the rudder effectiveness during the high speed portions of the landing roll since it lessens the reverser efflux in the vicinity of the empennage.

The original procedure required the pilot to use wheel braking without antiskid protection, if necessary, for directional control. However, the revised procedures require the antiskid system to be on. The pilot can now apply full brake pedal deflection to stop the aircraft and, if necessary, to maintain directional control. With the antiskid system operative, the risk of a tire blowout is removed almost completely. On August 20, 1980, the certification test flight was reflown using the new procedures. The test flight was completed successfully.

The Safety Board also notes that as a result of the tests conducted during the investigation of this accident, the procedures concerning the normal landing of the DC-9-80 aircraft have been modified. The revised procedures delay the application of reverse thrust until after the nosewheel is on the ground and specify limits on the amount of reverse thrust to be applied and the indicated airspeed during the landing roll at which reverse thrust must he reduced to idle.

In conclusion, the Safety Board notes that. one of the purposes of the certification procedure is to identify aircraft handling characteristics which can cause problems for the flightcrews. In this instance, the certification testing served a good purpose. The accident, though unfortunate, highlighted an aircraft control characteristic which required additional examination and led to appropriate testing. The additional investigation quantified the effect reverse thrust had on the control capability of the vertical stabilizer and rudder. As a result of this additional data, the emergency procedures for landing the DC-9-80 with a complete hydraulic system failure were changed; the DC-9-80's normal landing procedure was changed; and, most important, these positive benefits were accrued before the aircraft entered line operations.

3. CONCLUSIONS

3.1 Findings

1 When the accident occurred, the aircraft was on an certificaticn test flight to demonstrate that the aircraft could be controlled adequately and landed safely with a complete hydraulics system failure.

2. This was the first time either pilot had performed a hydraulics-systems-inoperative landing.

3. The manufacturer had not conducted tests to determine the precise effect the increased level of reverse thrust of the JT8D-209 engine had on rudder' control effectiveness; therefore, there was no quantitative information available on the effect this increased thrust would have on the directional control capability of the DC-9-80's rudder.

4. The preflight briefing and flight cards used for the test maneuver were inadequate. They did not include.the steps to be taken to insure that good nosewheel tracking was obtained; did not limit the use of reverse thrust; and did not assign the copilot the specific task of monitoring the engines while they were accelerating to their commanded levels of reverse thrust.

5. Reverse thrust was applied within 2 seconds after the main landing gear touched down and before the nosewheel touched down; the engines did not accelerate at the same rate, and neither pilot observed the asymmetric levels of reverse thrust.

6. The aircraft was yawing left at 2°/second before the nosewheel touched down, and this rate continued sfter the nosewheel touched down even though the pilot applied full right rudder pedal.

7. The pilot used asymmetrical reverse thrust ,to assist the rudder in *an* attempt io restore directional control. The use of asymmetrical reverse thrust under the existing conditions was contrary to the prescribed procedures in the preliminary airplane flight manual.

8. The pilot applied the right wheel *brakes to* regain directional control, and the Nos. 3 and 4 tires blew out.

9. Performance data indicated that directional controi of the aircraft might have been recovered if thrust had been reduced to reverse idle before the Nos. 3 and 4 tires blew out.

10. The revised procedures for landing with the hydraulics systems inoperative require the nosewheel to be lowered to the runway before applying reverse thrust, the use *of* reverse thrust to be limited to reverse idle unless higher is required, and the antiskid system to be left operative.

3.2 Probable Cause

The National Transportation Safety Boar5 determines that the probable cause of this accident was the inadequate procedure established for the certification test night, and the pilot's mismanagement of thrust following the initial loss *of* directional control.

4. RECOMMENDATIONS

Accordingly, the National Transportation Safety Board recommends that the Federal Aviation Administration:

Incorporate the following information into the DC-9-80 Aircraft Flight Manual under the abnormal hydraulics-out landing section and the normal landings on wet/slippery runways section:

The maximum rudder effectiveness available is substantially reduced during reverse thrust operation as follows:

Engine Thrust Setting	Maximum Rudder Effectiveness Available (percent)*/
Forward Idle	100
Reverse Idle	65
1.3 EPR (Reverse)	25
1.6 EPR (Reverse!	minimal

*/Rudder effectiveness also decreases with decreasing airspeed.

When reverse thrast levels above reverse idle are **used,** carefully monitor and maintain symmetric revers: thrust to avoid adverse yawing moments. (Class II, Priority Action) **(A-81-104)**

Incorporate the following information into tine **DC-9-80** training manuals and training program under the flight control and landing **sections:**

When thrust reversers (located just forward of the vertical stabilizer) are used during landing rollout, the exhaust gases from the engines are deflected by the thrust reverser buckets in such a manner that the free-stream airflow over the vertical stabilizer and rudder is blocked, reducing the effectiveness of these surfaces. **At** a nominal airspeed *02* 100 KIAS, the reduction in rudder effectiveness with increasing symmetric reverse **thrust** levels is shown below.

Engine Thrust Setting	Maximum Rudder Effectiveness Available (percent)*/
Forward idle	100
Reverse Idle	65
1.3 EPR (Reverse)	25
1.6 EPR (Reverse)	minimal

*/Rudder effectiveness also decreases with decreasing airspeed.

On. a dry runway, directional control is easily maintained by differential antiskid braking and nosewheel steering. However, under adverse conditions such as a slippery runway with **rain,** snow, or ice, when crosswinds reduce the braking effectiveness of the gear on the upwind wing, or when a high speed landing **is** made with both hydraulics systems out (i.e., flaps/slats retracted, ground spoilers, rudder hydraulic boost, nosewheel steering all rendered inoperative, and brake antiskid systems limited by hydraulic accumulator pressure), the vertical stabilizer and rudder will be the primary source of directional stability and control during the high speed portion of the Landing rollout. Under these conditions, it is important to make allowance for the adverse effects of reverse thrust on the effectiveness of the vertical stabilizer and rudder.

The cockpit thrust reverser levers in the DC-9-80 are more sensitive (i.e., command increased amounts of thrust per degree of movement) than previous DC-9 models because of the greater thrust range of the engines on the DC-9-80. The higher sensitivity of the cockpit thrust reverser levers make selection of symmetric reverse thrust more difficult than on previous models; therefore, careful attention should be given to selecting and maintaining symmetric reverse thrust levels to avoid sdverse yawing moments. (Class II, Priority Action) (A-81-105)

Require that DC-9-80 landing-approved simulators incorporate actual aircraft characteristics including the decrease in vertical stabilizer and rudder control effectiveness as a function of engine reverse thrust levels. The flight test data used should be taken from McDonnell Douglas report MDC-J9005. Figure 14, Yawing Acceleration Due to Maximum Rudder, Power ON, and figure 15, Yawing Acceleration Due to Maximum Rudder, Manual, should be used for symmetric reverser configurations for thrust values from forward idle to 1.3 EPR reverse. Data similar to that in figure 71, Effect of Reverse Thrust on Directional Controi, should be derived and used for all speeds and symmetric reverse thrust settings. Control effectiveness from a syminetric 1.3 EPR to a symmetric 1.6 EPR should decrease to zero. For asymmetric reverse thrust conditions, the data in figure 20, Controllability with Asymmetric Reverse Thrust, should be used. (Class II, Priority Action) (A-81-106)

incorporate the following information in the DC-9 series -10 through -50 Aircraft Flight Manuals under the abnormal hydraulics-out landing section and the normal landings on wet/slippery runways section:

The maximum rudder effectiveness available is substantially reduced during reverse thrust operation as follows.

Engine Thrust Setting	Maximum Rudder Effectiveness Available (percent)*/
Forward Idle	100
Reverse idle	65
1.3 EPR (Reverse)	45
1.6 EPR (Reverse)	15

*/ Rudder effectiveness also decreases with decreasing airspeed.

(Class II, Priority Action) (A-81-107)

Incorporate the following information in the DC-9 series -10 through -50 Training Manuals and Programs under the flight control and landing sections:

When thrust reversers (located just forward of the vertical stabilizer) are used during landing rollout, the exhaust gases from the engines are deflected by the thrust reverser buckets in such a manner that the free stream airflow over the vertical stabilizer and rudder is blocked, reducing the effectiveness of these surfaces. At a nominal airspeed of 100 KIAS, the reduction in rudder effectiveness with increasing symmetric reverse thrust levels is shown below,

Engine Thrust Setting	Maximum Rudder Effectiveness Available (percent)*/
Forward Idle	100
Reverse Idle	65
1.3 EPR (Reverse)	45
1.6 EPR (Reverse)	15

*/ Rudder effectiveness also decreases with decreasing airspeed.

On a dry runway, directional control is easily maintained by differential antiskid braking and nose-ahee? steering. However, under adverse conditions such as rain, snow, or ice making the runway slippery, when crosswinds reduce the braking effectiveness of the gear on the upwind wing, or when a high speed landing is made with both hydraulic systems failed (i.e., flaps/slats retracted; ground spoilers, rudder hydraulic boost, nosewheel steering, brake antiskid all rendered inoperative; manual brake system limited by hydraulic accumulator pressure), the vertical stabilizer and rudder will be the primary source of directional stability and control during the high speed portion of the landing rollout. Under these conditions it is important to make allowance for the adverse effects of reverse thrust on the effectiveness of the vertical stabilizer and rudder. (Class II, Priority Action) (A-81-108)

Require that DC-9 series -10 through -50 lending-approved simulators incorporate actual aircraft characteristics including the decrease in vertical stabilizer and rudder control effectiveness as a function of engine reverse thrust levels. The flight test data to be used should be taken from McDonnell Douglas Corporation report MDC-J9005. Data similar to that in figure 71, Effect of Reverse Thrust on Directional Control, should be derived and used for all speeds and symmetric reverse thrust settings. (Class II, Priority Action) (A-81-159)

Conduct an engineering evaluation of the DC-9 series -10 through -50 brake hydraulic accumulators and antiskid systems to determine if the brake antiskid systems can be left on during hydraulics-out landings. Revise where applicable the hydraulics-our landing procedures for the DC-9 series -10 through -50 airplanes to correspond with those deveioped for the DC-9-80 within the capabilities of the respective brake hydraulic accumulators and antiskid systems. (Class II, Priority Action) (A-81-110)

Examine all aircraft models with aft pod-mounted engine/thrust reversers to determine if vertical stabilizer and rudder effectiveness is lost or reduced when reverse thrust is used during landing rollout. If this adverse characteristic occurs, revise landing procedures, appropriate manuals, and training materials as necessary to assure that maximum directional control is maintained during the landing rollout. (Class II, Priority Action) (A-61-111)

Revise certification requirements for those aircraft for which safe flight and landing following a partial or total hydraulic system failure must be demonstrated to: (a) include a quantified level of directional control following touchdown in terms of yawing moment or yaw acceleration for appropriate rollout speeds; (b) require that the applicant demonstrate that these values can be obtained, using those controls which are available and using the procedures which are to be specified for this condition in the aircraft's approved flight manual; and (c) demonstrate or calculate landing distances for this special condition and include them in the aircraft's flight manual. (Class II, Priority Action) (A-81-112)

Ensure that Phase I, II, and III simulator requirements for other model aircraft as defined in 14 CFR Part 121, Appendix H, specifically include the representative degradation of directional control associated with the effect of reverse thrust on the aerodynamic control surfaces if the simulated aircraft has such characteristics for normal and abnormal configurations or systems condition, and revise Advisory Circular 121-14C accordingly. (Class II, Priority Action) (A-81-122)

Ensure that air carrier training and proficiency check programs required by 14 CFR Part 121 include a demonstrstion of directional control characteristics during landing rollout when conducted in accordance with the training and checking permitted, using a Phase I, II, or III simulator as provided for in 14 CFR Part 121, Appendix H. (Class II, Priority Action) (A-81-123)

BY THE NATIONAL TRANSPORTATION SAPETY BOARD

/s/ JAMES B. KING
Chairman

/s/ ELWOOD T. DRIVER
Vice Chairman

/s/ PATRICIA A. GOLDMAN
Member

/s/ G. H. PATRICK BURSLEY
Member

FRANCIS H. McADAMS, Member, did *not* participate.

September 15, 1981

APPENDIXES

APPENDIX A

INVESTIGATION AND HEARING

1. Investigation

The National Transportation Safety Board was notified of the accident about 1900 on June 19, 1980. The Safety Board dispatched a partial investigation team to the scene. Investigation groups were established for operations, structures, systems, maintenance records, and performance. Parties to the investigation were the Federal Aviation Administration and McDonnell Douglas Corporation.

2. Public Hearing

A public hearing was not held, and depositions were not taken.

APPENDIX B

PERSONNEL INFORMATION

Piot George H. Lyddane

The pilot, George H. Lyddane, 40, was employed by the FAA, on April 1974, and has been assigned to their Western Region Flight Test Branch since that date. Mr. Lyddane holds an Airline Transport Pilot Certificate No. 1567896, with an airplane multiengine land rating and commercial privileges in airplane single-engine land, sea, and gliders. He has type-ratings in Learjet, Boeing 127, and McDonnell Douglas DC-9 aircraft. His first-class medical certificate was issued August 6, 1979, with no waivers OF limitations.

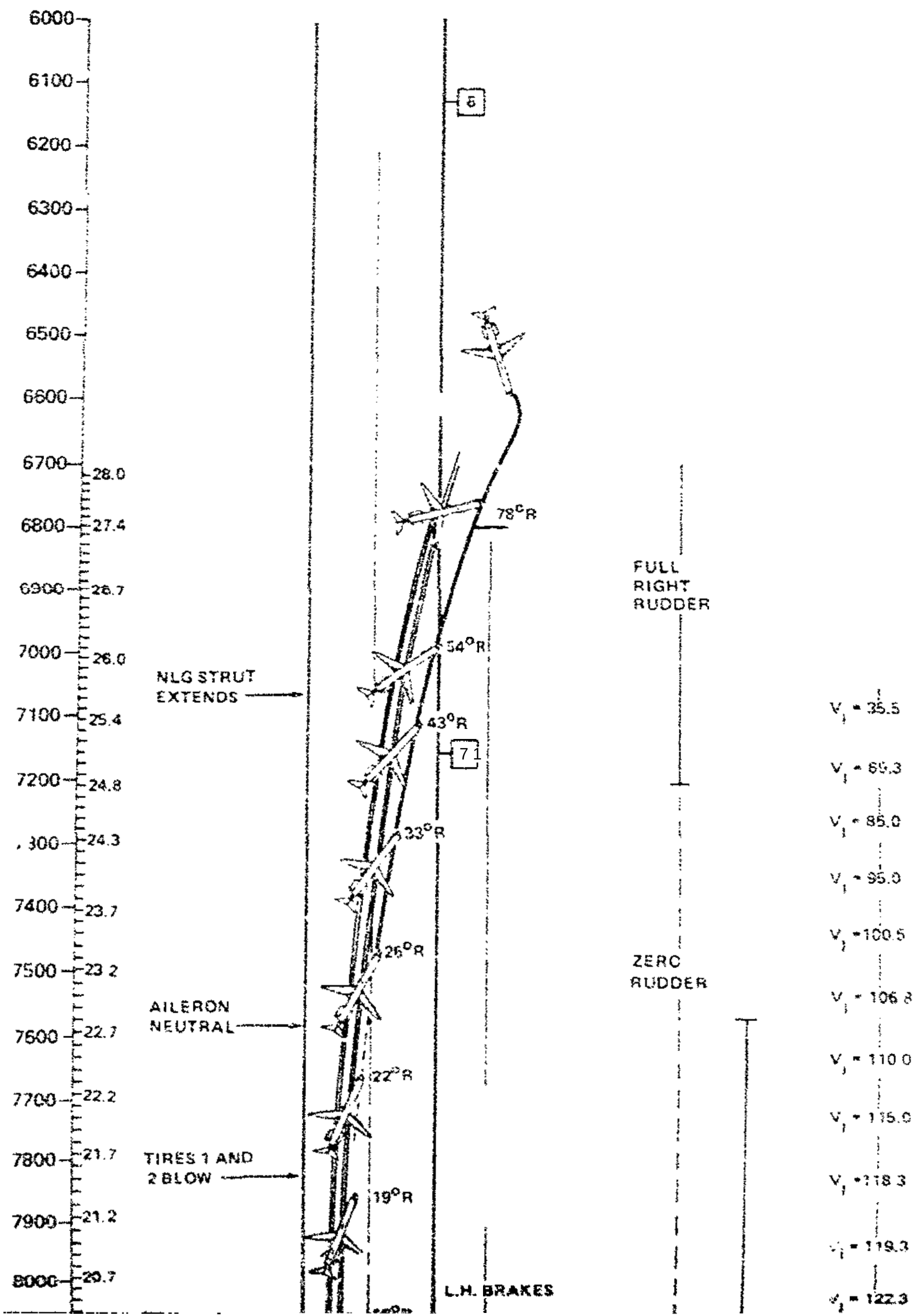
Mr. Lyddane was a graduate of the United States Air Force Test Pilot School, and he has flown 8,200 hours. He has flown 210 hours in DC-9 aircraft, 150 hours of which were in the series 80.

Copilot Fred W. Hamilton

The copilot, Fred W. Hamilton, 42, was employed by McDonnell Douglas on March 1970, and is assigned as an engineering test pilot. Mr. Hamilton holds an Airline Transport Pilot Certificate No. 1525987 with an airplane multiengine land rating and commercial privileges in airplane single-engine land. He has a type-rating in the McDonnell Douglas DC-9 aircraft. His first-class medical certificate was issued August 14, 1979, with the following Iimitation: The airman ". .shall wear correcting glasses while exercising the privileges of his airman's certificate."

Mr. Hamilton has flown 3,199 hours. He has flown 509 hours in DC-9 type aircraft, 223 hours of which were in the series 80.

Both pilots' medical certificates had Seen issued more than 6 months before the accident flight, therefore they were exercising the commercial privileges of their Airline Transport Pilot Certificates.



6000
6100
6200
6300
6400
6500
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6900
7000
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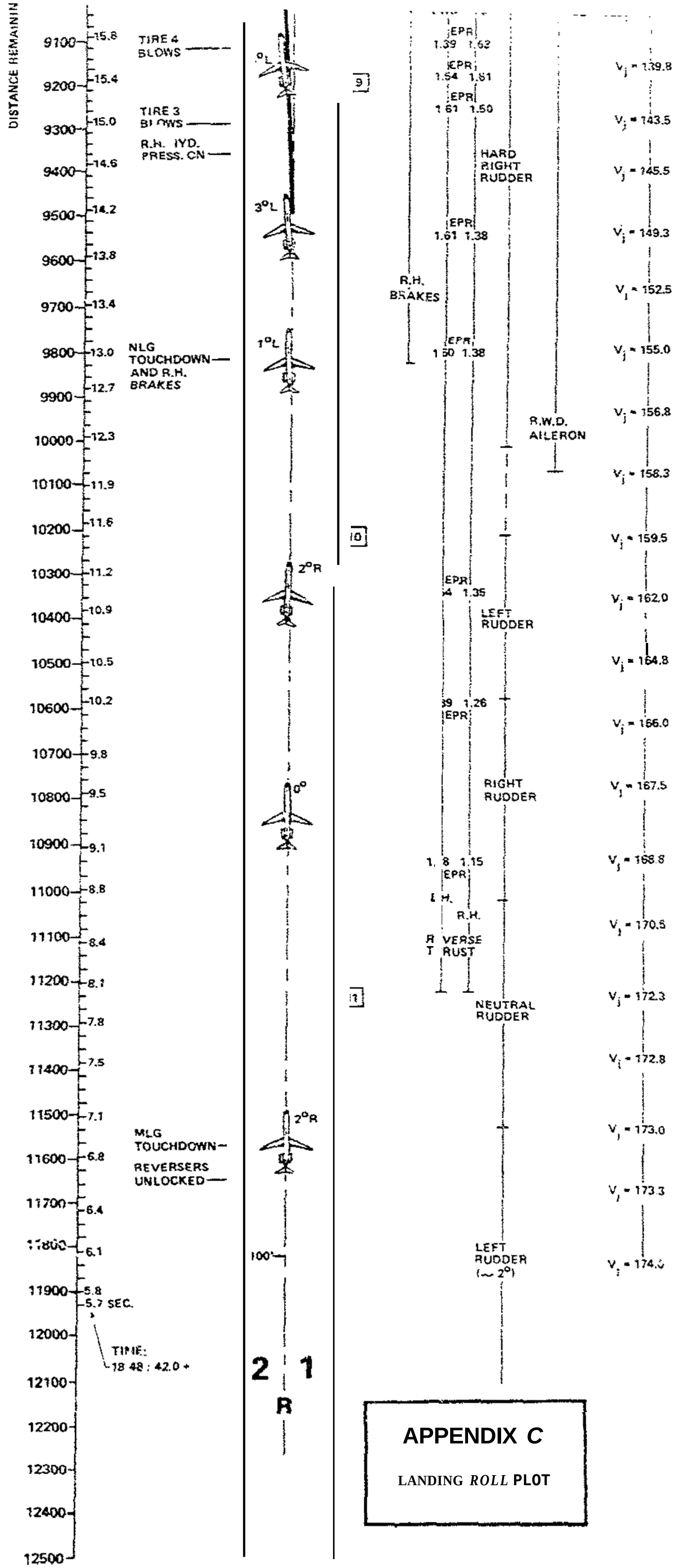
7500
7600
7700
7800
7900
8000
28.0
27.4
26.7
26.0
25.4
24.8
24.3
23.7
23.2
22.7
22.2
21.7
21.2
20.7
6
71
78°R
54°R
43°R
33°R
26°R
22°R
19°R
NLG STRUT EXTENDS
AILERON NEUTRAL
TIRES 1 AND 2 BLOW
FULL RIGHT RUDDER
ZERO RUDDER
L.H. BRAKES
V = 35.5
V = 69.3
V = 85.0
V = 95.0
V = 100.5
V = 106.8
V = 110.0
V = 115.0
V = 118.3
V = 119.3
V = 122.3



APPENDIX C

LANDING ROLL PLOT

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

AIRCRAFT ACCIDENT REPORT

UNIVERSAL AIRWAYS, INC.
BEECH 65-A80/EXCALIBUR CONVERSION, N100UV
NEAR MADISONVILLE, TEXAS

JULY 2, 1981

NTSB-AAR-81-17

UNITED STATES GOVERNMENT

APPENDIX B

PERSONNEL INFORMATION

Robert Marion Allen

~~07/11/1986~~

03/24/1981

03/24/81

++ REQUEST 140/94, REPORT # 142

++

+ DATA REPORT SWEARINGEN - MERLIN III ACCIDENT +

+ EVENTS | PHASES: HARD LANDING | LEVEL OFF/TOUCHDOWN

+

++

++

<--------------- OPERATION ---------------> ++ <--------------- FILE DATA ---------------->

TYPE : MISCELLANEOUS - TEST/EXPERIMENTAL ++ ICAO FILE : 81/0072-0

++ FROM STATE : UNITED STATES

++

<-------------------- WHEN --------------------> ++ <------------ AIRCRAFT DATA ------------->

DATE : 81-03-24 ++ MASS CATEGORY : 2251 - 5700 KG

TIME : 11:00 ++ STATE OF REGISTRY : UNITED STATES

LIGHT : DAYLIGHT ++ REGISTRATION : N1011R

++

<------------------ WHERE -------------------> ++ <-------- DAMAGE, INJURY AND TOTAL ON BOARD -------->

LOCATION : SAN MARCOS,TX ++ A/C DAMAGE : SUBSTANTIAL

STATE/AREA : UNITED STATES ++ INJURY : FATAL SERIOUS MINOR NONE UNKNOWN TOTAL

DEPARTED : S ++ CREW : 0 0 0 4 0 4

DESTINATION : LOCAL ++ PAX :

OTHER DAMAGE :

THE A/C WAS ON A FLIGHT TEST. THE RIGHT PROPELLER FEATHERED. WHEN THE PILOT RETARDED THE LEFT POWER LEVER TO FLIGHT IDLE FOR TOUCHDOWN THE A/C ROLLED LEFT AND TOUCHED DOWN HARD, CAUSING SUBSTANTIAL STRUCTURAL DAMAGE TO THE LEFT WING AND THE LEFT MAIN AND NOSE GEARS.

DRN: FAA CO-PILOT AT CONTROLS.

---------------- EVENTS AND FACTORS -----------------

1. EVENT | PHASE: HARD LANDING | LEVEL OFF/TOUCHDOWN

March 26, 1982

2802 Skyservant

++ REQUEST 140/94, REPORT # 151
++

+ DATA REPORT DORNIER - 28D2 SKYSERVANT ACCIDENT
+
+ EVENTS | PHASES: LOSS OF CONTROL -OTHER | CRUISE +

++

<———— OPERATION ————> ++ <———— FILE DATA ————>

TYPE : MISCELLANEOUS - TEST/EXPERIMENTAL ++ ICAO FILE : 82/0048-0
++ FROM STATE : GERMANY

<———— WHEN ————> ++ <———— AIRCRAFT DATA ————>

DATE : 82-03-26 ++ MASS CATEGORY : 2251 - 5700 KG
TIME : 18:24 ++ STATE OF REGISTRY : GERMANY
LIGHT : DAYLIGHT ++ REGISTRATION : D-IFNS

<———— WHERE ————> ++ <———— DAMAGE, INJURY AND TOTAL ON BOARD ————>

LOCATION : NEAR AICHACH ++ A/C DAMAGE : DESTROYED
STATE/AREA : GERMANY
DEPARTED : OBERPFAFFENHOFEN
DESTINATION : OBERPFAFFENHOFEN
OTHER DAMAGE : YES

++ INJURY :	FATAL	SERIOUS	MINOR	NONE	UNKNOWN	TOTAL
++ CREW :	3	0	0	0	0	3
++ PAX :	0	0	0	0	0	0

DURING A TEST FLIGHT THE A/C WAS TRIMMED INTO A FULL NOSE DOWN POSITION TO SIMULATE A HORIZONTAL STABILIZER TRIM-RUNAWAY. BOTH PILOTS WERE UNABLE TO MAINTAIN PITCH CONTROL DUE TO THE EXCESSIVE STICK FORCES. FOR UNKNOWN REASONS A RETRIM COULD NOT BE INITIATED.

THE A/C DISINTEGRATED IN A NOSE DOWN ATTITUDE ABOUT 1 200 FT AGL.

DRN: STICK FORCES IN EXCESS OF 50 DECA-NEWTON WERE PULLED TO COUNTERACT THE MISTRIMMED CONDITION. THIS DISENGAGED THE PITCH TRIM ACTUATOR CLUTCH PREVENTING ANY STABILIZER MOVEMENT IN NOSE-UP RETRIM ATTEMPTS.

THE PILOT MAY HAVE BEEN DISTRACTED BY THE NEED TO COMMUNICATE WITH THE TELEMETRY STATION. ON BECOMING AWARE OF THE CRITICAL FLIGHT SITUATION HE ASSISTED THE OTHER PILOT ON THE CONTROLS, BUT BY THIS STAGE THEIR JOINT STRENGTH WAS INSUFFICIENT TO EFFECT RECOVERY.

RECOMMENDATION: OPERATORS SHOULD BE WARNED IN THE OPERATING HANDBOOK OF THE POSSIBILITY OF THE ELEVATOR TRIM MOTOR STALLING IN SOME CIRCUMSTANCES.

———— EVENTS AND FACTORS ————

1. EVENT | PHASE: LOSS OF CONTROL -OTHER | CRUISE
   FACTORS: OPERATION OF FLIGHT CONTROLS -IMPROPER USE /INCORRECT SETTING
   : FLIGHT SUPERVISION -INADEQUATE

REQUEST ~~075/98~~, REPORT # 3

DATA REPORT — DORNIER-2802 SKYSERVANT — ACCIDENT

EVENTS|PHASES — LOSS OF CONTROL-OTHER-CRUISE

SECTION - 00

FILING INFORMATION
ICAO FILE NUMBER : 82 / 0048 - 0
- STATE REPORTING : GERMANY
- STATE FILE NUMBER : 3X0039

WHERE
- STATE/AREA : GERMANY
- LOCATION : AICHACH
- LATITUDE : 48 DEG 28 MIN N
- LONGITUDE : 011 DEG 03 MIN E

WHEN
- DATE : 82-3-26
- TIME : 18:24

AIRCRAFT
REGISTRATION : D-IFNS
STATE OF REGISTRY : GERMANY
OPERATOR : DORNIER

01 - HISTORY OF FLIGHT

GENERAL AVIATION
- TYPE OF OPERATION : MISCELLANEOUS - TEST/EXPERIMENTAL
- TYPE OF OPERATOR : OTHER

ITINERARY
DEPARTURE POINT : OBERPFAFFENHOFEN
PLANNED DESTINATION : OBERPFAFFENHOFEN
TIME AIRBORNE : 0:56

INFORMATION
- TYPE OF FLIGHT PLAN : NONE
- CONTROLLING AGENCY : OPERATOR

- ALTITUDE : 1811 METRES
- ALTITUDE TYPE :

02 - INJURIES TO PERSONS

HIGHEST DEGREE OF INJURY: FATAL

NUMBER OF PERSONS INVOLVED

	FATAL	SERIOUS	MINOR	NONE	UNKNOWN	TOTAL
PILOT	1	0	0	0	0	1
CO-PILOT	1	0	0	0	0	1
FL.CREW	1	0	0	0	0	1
CREW (TOT)	3	0	0	0	0	3
PAX	0	0	0	0	0	0
GROUND						

03/04 - DAMAGE

- TO AIRCRAFT : DESTROYED
- THIRD PARTY : YES

05 - PERSONNEL

PERSON AT CONTROLS : CO-PILOT

PILOT-IN-COMMAND
- AGE : 43

- SEX :

LICENCE
- TYPE (AEROPLANE) : COMMERCIAL PILOT
- MEDICAL VALIDITY : VALID/NO MEDICAL WAIVERS
- CLASS/TYPE RATINGS : HELD REQUIRED RATING
- INSTRUMENT RATING : YES
- INSTRUCTOR RATING : YES

FLYING EXPERIENCE

	LAST 24 H	LAST 90 DAYS	TOTAL
THIS TYPE :			217
ALL TYPES :			5897

OTHER FLIGHT CREW MEMBER
- POSITION : CO-PILOT
- AGE : 41

LICENCE
- TYPE (AEROPLANE) : AIRLINE TRANSPORT PILOT
- MEDICAL VALIDITY : VALID/NO MEDICAL WAIVERS
- CLASS/TYPE RATINGS : HELD REQUIRED RATING

FLYING EXPERIENCE

	LAST 24 H	LAST 90 DAYS	TOTAL
THIS TYPE			3
ALL TYPES			2329

OTHER PERSONNEL INVOLVED
- PERSON INVOLVED : OTHER FLIGHT CREW MEMBER
- AGE : 30

06 - AIRCRAFT

GENERAL
- YEAR OF MANUFACTURE :
- SERIAL NUMBER : 4358
- TOTAL TIME : 188

DOCUMENTATION

DESCRIPTION OF AIRCRAFT
- TYPE : FIXED WING
- TYPE OF POWER : RECIPROCATING
- TYPE OF LDNG GEAR : TAILWHEEL

ENGINE INFORMATION
- MANUFACTURER :
- MODEL (GENERAL) :
  (SPECIFIC : TPE-331/TSE-331 SERIES

07 - METEOROLOGICAL

BRIEFING AND FORECAST
GENERAL
- PHASE OF FLIGHT TO WHICH THE METEOROLOGICAL INFORMATION PERTAINS:
- GENERAL WEATHER : VMC
- LIGHT CONDITIONS : DAYLIGHT

- VISIBILITY : METRES

- VISIBILITY RESTRICTED BY : NONE

CLOUDS

SKY CONDITION : SCATTERED (1/8 TO 4/8)
- CEILING : METRES

PRECIPITATION/OTHER WEATHER PHENOMENA
- TYPE OF :

- INTENSITY :

TEMPERATURE : DEGREES

ICING
- INTENSITY :

TURBULENCE
- TYPE :
- INTENSITY :

WIND INFORMATION FOR TAKE-OFF/LANDING OCCURRENCES
- RELATIVE DIRECTION :
- CROSS WIND COMP. : M/S
- WINDSHEAR/MICRO BURST
:

<------------------- 08 - AIDS TO NAVIGATION ------------------->

EN-ROUTE AIDS
- AIDS USED :

ING AIDS USED
LETRONIC AIDS :

- APPROACH LIGHTING :
- STROBE LIGHTS :
- TYPE OF VASI USED :

<--------------- 09 - AIR-GROUND COMMUNICATION --------------->

LAST GROUND STATION IN CONTACT WITH THE A/C
: OPERATOR GROUND STATION
RECORDING OF COMMUNICATION AVAILABLE
:

<---------------------- 10 - AERODROME ---------------------->

GENERAL
- NAME :
- LOCATION INDICATOR :
- TYPE :
- ELEVATION : METRES

RUNWAY IN USE
- IDENTIFIER :
- AVAILABLE LENGTH : METRES
- AVAILABLE WIDTH : METRES
- LENGTH OF OVERRUN : METRES
- SLOPE :

RUNWAY SURFACE
- TYPE :
- SURFACE TYPE :
- SURFACE TREATMENT :
- BRAKING ACTION :
DETERMINED BY :

AERODROME LIGHTING
- RUNWAY
EDGE/END/THRESHOLD :
CENTRE LINE :
TOUCHDOWN ZONE :

- TAXIWAY
EDGE :
CENTRE LINE :
HOLDING POSITION :

- STOPWAY LIGHTING :
- STOP BARS (LIGHTS) :

CATEGORY OF RUNWAY USED

HELIPORT/HELICOPTER LANDING AREA
- TYPE :
- SURFACE TYPE :
- SITE CONFIGURATION :

WATER LANDING AREA CONDITION
- WATER CONDITION :
- WAVE HEIGHT :
- LANDING/TAKE-OFF DIRECTION RELATIVE TO SWELL
:
- OBTSRUCTIONS :

<------------------- 11 - FLIGHT RECORDERS ------------------->

FLIGHT DATA RECORDER
- LOCATION :
- TYPE : DIGITAL (DFDR)
- RECORDING MEDIUM :
- NR OF PARAMETERS :
- UNDERWATER LOCATOR BEACON
:
- RECOVERY OF RECORDER
:
- RECOVERY OF DATA :
- REASON FOR DATA LOSS
:
- USEFULLNESS OF THE RECOVERED DATA

COCKPIT VOICE RECORDER

- LOCATION :
- TYPE OF MEDIUM :
- NR OF CHANNELS :
- DURATION OF REC. : MINUTES
- HOT MIC INSTALLED :
- RECORDER RECOVERED :
- UNDERWATER LOCATOR BEACON
- QUALITY OF REC. :

REASON WHY THE RECORDING WAS NOT RECOVERED
:

<------------------ 12 - WRECKAGE AND IMPACT ------------------>

LOCATION OF WRECKAGE
- GENERAL : OFF AERODR BEYOND 10 KM FROM RWY CENTRE
- SPECIFIC :
IN RELATION TO THE THRESHOLD
- DISTANCE : METRES
- BEARING : DEGREES

AIRCRAFT LEFT THE RUNWAY
- DIRECTION :
- DISTANCE : METRES

INFORMATION ON THE TERRAIN WHERE THE A/C CAME TO REST
- TYPE : HILLY
- SURFACE TYPE : WOODED/TREE COVERED

- ELEVATION : 500 METRES
- DEPTH OF WATER : METRES

GROUND IMPACT INFORMATION
- SPEED AT IMPACT : KM/H
- ESTIMATED SPEED :
- RATE OF DESCENT :
- IMPACT ANGLE :
- ROLL ATTITUDE :
- PITCH ATTITUDE :
- A/C BREAKUP :

RECOVERY OF THE WRECKAGE
- RECOVERED : COMPLETE

<------------------ 13 - MEDICAL/PATHOLOGICAL ------------------>

INCAPACITATION
- PERSONS INCAPACITATED
:

- TYPE OF :
- REASONS FOR :

AUTOPSY
- PERFORMED ON : FLIGHT CREW

<------------------------- 14 - FIRE ------------------------->

FIRE STARTED
- WHEN :
- FUEL SOURCE :
- SOURCE OF IGNITION :
- INITIAL LOCATION :

FIRE WARNING SYSTEM
- INSTALLATION :
- OPERATION :

OTHER FIRE WARNING RECEIVED
:

AIRCRAFT FIRE SUPPRESSION SYSTEMS
- INSTALLATION :
- EFFECTIVENESS :
- WHICH SYSTEM USED :
- EXTINGUISHANT USED :

SMOKE PROTECTION
- FLIGHT CREW :

AERODROME RESCUE AND FIRE FIGHTING OPERATIONS

- AVAILABILITY :
- TIME BETWEEN INITIAL CALL AND FIRST INTERVENTION
: MINUTES
- EFFECTIVENESS :
- REASONS FOR INEFFECTIVENESS OF RESCUE/FIRE FIGHTING

EXTINGUISHANT AGENT USED
- PRINCIPLE TYPE :
- AMOUNT OF WATER : LITRES

FUEL FIRE
- QUANTITY ON BOARD : LITRES
- TYPE OF FUEL : JET-A (KEROSENE)

DANGEROUS GOODS
- INVOLVED :

<------------------- 15 - SURVIVAL ASPECTS ------------------->

SEARCH AND RESCUE
- SEARCH METHOD :

- SEARCH SUCCESS :
- SEARCH DIFFICULTIES:

- TIME TO LOCATE A/C : DAYS HOURS
- METHOD OF LOCATING :
- ELT EFFECTIVENESS :

SURVIVABILITY OF THE OCCURRENCE
- GENERAL :

NUMBER OF FATAL INJURIES FROM SPECIAL CAUSES
- IMPACT :
- BURNS :
- FUMES/GASES :
- SHOCK/EXPOSURE :
- DROWNING :

REQUEST 075/98, REPORT # 3

+ DATA REPORT
DORNIER-2802 SKYSERVANT
ACCIDENT

+ EVENTS|PHASES
LOSS OF CONTROL-OTHER-CRUISE

- OTHER REASONS :
- UNKNOWN CAUSES :

NUMBER OF NON-FATAL INJURIES FROM SPECIAL CAUSES
- IMPACT :
- BURNS :
- FUMES/GASES :
- SHOCK/EXPOSURE :
- OTHER CAUSES :
- UNKNOWN CAUSES :

EVACUATION
- NUMBER OF PERSONS EVACUATED/ESCAPED
:
- EVACUATION TIME : MINUTES SECONDS
- EVACUATION HAMPERED BY
:

EVACUATION SLIDES/CHUTES
- INSTALLED :
- EFFECTIVENESS :
- REASON NOT EFFECTV.:

EMERGENCY LIGHTING
NSTALLATION :
PERATION :

RESTRAINT SYSTEMS
- PILOT :
- CO-PILOT :
- PASSENGER :
- NR OF FAILURES :

SEATS
- NR OF FAILURES :

- TRAFFIC ADVISORY :
- RADAR CONTACT :

OTHER
- EVASIVE ACTION :
- A/C LANDED SAFELY :
- MILITARY INVOLVED :
- OTHER A/C REGISTR. :

NEAR MIDAIR COLLISION - CLOSEST DISTANCE
- HORIZONTAL : METRES
- VERTICAL : METRES

<------------------- 17 - MID-AIR COLLISION ------------------->

INFORMATION RELATED TO THE FLIGHT PATH
- SPEED : KM/H
- BANK ANGLE :
- DIRECTION OF BANK :
- VERTICAL MOVEMENT :

VISIBILITY
- RESTRICTIONS :

- USE OF LIGHTING :

- OTHER A/C SIGHTED :

ATC INFORMATION
- WARNING ISSUED :

N A R R A T I V E

ING A TEST FLIGHT THE A/C WAS TRIMMED INTO A FULL NOSE DOWN POSITION TO SIMULATE A HORIZONTAL STABILIZER TRIM-RUNAWAY. BOTH OTS WERE UNABLE TO MAINTAIN PITCH CONTROL DUE TO THE EXCESSIVE STICK FORCES. FOR UNKNOWN REASONS A RETRIM COULD NOT BE INITIATED.
THE A/C DISINTEGRATED IN A NOSE DOWN ATTITUDE ABOUT 1 200 FT AGL.
DRN: STICK FORCES IN EXCESS OF 50 DECA-NEWTON WERE PULLED TO COUNTERACT THE MISTRIMMED CONDITION. THIS DISENGAGED THE PITCH TRIM ACTUATOR CLUTCH PREVENTING ANY STABILIZER MOVEMENT IN NOSE-UP RETRIM ATTEMPTS.

[illegible] PILOT MAY HAVE BEEN DISTRACTED BY THE NEED TO COMMUNICATE WITH THE TELEMETRY STATION. ON BECOMING AWARE OF THE CRITICAL [redacted]GHT SITUATION HE ASSISTED THE OTHER PILOT ON THE CONTROLS, BUT BY THIS STAGE THEIR JOINT STRENGTH WAS INSUFFICIENT TO EFFECT RECOVERY.
RECOMMENDATION: OPERATORS SHOULD BE WARNED IN THE OPERATING HANDBOOK OF THE POSSIBILITY OF THE ELEVATOR TRIM MOTOR STALLING IN SOME CIRCUMSTANCES.

S E Q E N C E O F E V E N T S

EVENT 1 LOSS OF CONTROL-OTHER - CRUISE
1.OPERATION OF FLIGHT CONTROLS - IMPROPER USE/INCORRECT SETTING
2.FLIGHT SUPERVISION - INADEQUATE

Bundesstelle für Flugunfalluntersuchung
Hermann-Blenk-Straße 16
D-38108 Braunschweig

6

Datensatz

Unfall eines deutschen Lfz. im Inland
mit tödlich Verletzten

Luftfahrzeugart	: Flugzeug
Luftfahrzeughersteller	: DORNIER
Muster/Typ	: 28D
Eintragungsstaat	: Deutschland
Datum der Störung	: 26/03/1982
Uhrzeit der Störung	: 18.23 Uhr
Störungsort	: nahe Aichach
Regierungsbezirk/Staat	: Oberbayern (BY)

1.0 Tatsachenermittlung

1.1 Flugverlauf

Betriebsart - Allgemeine Luftfahrt	: verschiedene Betriebsarten
	: - Versuchs-, Forschungs-, Erprobungsflug
Art des Halters - Allgm. Luftfahrt	: Hersteller
FS-Flugplan/Freigabe	: VFR-Flugplan/Freigabe
Flugsicherungsberatung	: Beratung verfügbar und eingeholt
	- Angaben zutreffend
Letzter Abflugort	: OBERPFAFFENHOFEN
Zielort	: OBERPFAFFENHOFEN
Time Airborne Flugzeit bis Eintritt der Störung	: 00.56 Std/Min
Betriebsphase	: Flugphase
	: - Reiseflug
Art der Störung	: sonstige unkontrollierte Fluglage
Geschwindigkeit bei Störungsbeginn	: 200 kt
Flughöhe bei Eintritt der Störung	: 6000 Fuß ü.NN
Luftraum der Störungsstelle	: kontrollierter Luftraum

1.2 Personenschäden

Verletzte	:	tödlich	schwer	leicht
Verantw. Luftfahrzeugführer Pilot	:	1	0	0
Zweiter Luftfahrzeugführer Copilot	:	1	0	0
Zusätzl. Besatzungsmitglieder Crew	:	1	0	0
Gesamt Total	:	3	0	0

1.3 Schaden an Luftfahrzeug Damage

Luftfahrzeug to A/C : zerstört destroyed

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1.4 Sachschaden Dritter

Drittschaden : Flurschaden/Forstschaden

1.5 Angaben zur Besatzung

Luftfahrzeugführer am Steuer : zweiter Luftfahrzeugführer

Verantwortlicher Luftfahrzeugführer
Lebensalter Age : 43 Jahre
Erlaubnis : Berufsluftfahrzeugführer
Luftfahrerschein - erstmal.Ausstllg: Bayern
- Jahr der Ausstellung : 67
Gültigkeit der Erlaubnis : am Unfalltage gültig
Berechtigungen - Kategorie u.Klasse: mehrmotorige Land-Flugzeuge - bis 5700 kg
Musterberechtigung : erforderliche Berechtigung vorhanden
Instrumentenflugberechtigung : vorhanden
Sonstige Berechtigungen : Testflug-Berechtigung
Gültigkeit der maßgebl. Berechtig. : Berechtigung gültig

Gesamtflugerfahrung All Types : 5837 Stunden
Flugerfahrung auf dem Muster this type : 217 Stunden
Landungen auf dem Muster
- Gesamt : 101 bis 500
- in den letzten 90 Tagen : 26 bis 50
Fliegerärztl. Tauglichkeitsklasse : tauglich ohne Auflagen und Beschränkungen

Zweiter Luftfahrzeugführer
Lebensalter copilot age : 41 Jahre
Erlaubnis : Verkehrsluftfahrzeugführer
Luftfahrerschein - erstmal.Austllg.: ausländische Luftfahrtbehörde
- Jahr der Ausstellung : 67
Gültigkeit der Erlaubnis : am Unfalltage gültig
Berechtigungen - Kategorie u.Klasse: mehrmotorige Land-Flugzeuge - bis 5700 kg
Musterberechtigung : keine Musterberechtigung erforderlich
Instrumentenflugberechtigung : vorhanden
Sonstige Berechtigungen : Testflug-Berechtigung
Gültigkeit der maßgebl. Berechtig. : Berechtigung gültig

Gesamtflugerfahrung All types : 2329 Stunden
Flugerfahrung auf dem Muster this type : 3 Stunden
Fliegerärztl. Tauglichkeitsklasse : tauglich ohne Auflagen und Beschränkungen

Sonstige Besatzungsmitglieder : Flugingenieur/Bordwart
Lebensalter Other flt crew member age : 30 Jahre

1.6 Angaben zum Luftfahrzeug

Luftfahrzeughersteller : DORNIER
Muster/Typ : 28D
A/C Luftfahrzeug-Werknummer S/N : 4358
Luftfahrzeugart : Flugzeug
Flugmasse : über 2 000 kg - 5 700 kg
Fluggewicht : innerhalb der zulässigen Grenzen
Schwerpunktlage : innerhalb der zulässigen Grenzen
Fahrwerksart : einziehbares Bugradfahrwerk
Engine Triebwerkshersteller/Muster : Airesearch - TPE 331

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8

Anzahl der Triebwerke	: zwei Triebwerke
Triebwerksart	: Propellerturbinentriebwerk
Kraftstoffart *Fuel*	: Jet A-1
Gesamt-Betriebszeit des Lfz.	: 188 Stunden
Nachprüfungs- und Wartungskontrolle	
Nachprüfung erfolgte	: in Zeitabständen

1.7 Meteorologische Informationen *Meteorological Info*

Lichtverhältnisse	: Tageslicht
Windrichtung *wind direction*	: 060 Grad
Windgeschwindigkeit *wind speed*	: 10 kt
Sicht am Boden	: 6,5 km bis 10 km
Örtliche Sichtbehinderung	: keine
Bewölkung	: heiter - 1/8 bis 4/8 über 1 000 ft
Hauptwolkenuntergrenze	: 20000 Fuß
Niederschlag	: keiner
Besondere Wettererscheinungen	: keine
Temperatur	: 13 Grad C
Höhenmessereinstellung (QNH)	: 1025 hPa
Flugwetterbedingungen	: Sichtwetterbedingungen

1.8 Navigationshilfen *Aids to Navigation*

1.9 Funkverkehr *Air-Ground Communication*

Sprechfunkverbindg.m.Bodenfunkstel.	: vorhanden und zufriedenstellend
Bodenfunkstelle	: Bodenfunkstelle des Halters
Aufzeichnung des Sprechfunkverkehrs	: zur Verfügung stehend
	: Umschrift gefertigt
Aufzeichnung d. Gegensprechverkehrs	: zur Verfügung stehend

1.10 Angaben zum Flugplatz

1.11 Flugschreiber *Flight Recorders*

Unfalldatenschreiber	: Digital-Flugschreiber (nicht aufschlagsicher)

1.12 Angaben über Wrack und Aufprall *Wreckage and Impact*

Bergung des Wracks	: geborgen
Geländeart - Allgemein	: hügelig
Geländeart - Bodenbeschaffenheit	: Baum bestanden
Geländeart - Oberflächenzustand	: fester Boden
Höhe der Aufschlagstelle über NN	: 1650 Fuß

1.13 Medizinische und pathologische Angaben *Medical/Pathological*

Obduktion/Toxikolg. Untersuchung	: Obduktion durchgeführt - verantw. Lfz-Führer - und/oder sonstige Besatzungsmitglieder
Verantwortl. Luftfahrzeugführer	
Ergebnis der toxikolog. Untersuchg.	: Kohlenmonoxyd - 10 % oder weniger
	: Alkohol - Untersuchung negativ

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Zweiter Luftfahrzeugführer
Ergebnis der toxikolog. Untersuchg.: Kohlenmonoxyd - 10 % oder weniger
: Alkohol - Untersuchung negativ

1.14 Brand Fire

Entstehung/Fortsetzung des Brandes : Brand nicht entstanden

1.15 Überlebensmöglichkeiten Survival Aspects

Zerstörungsgrad durch Aufschlag
- Führer- und Fluggastraum : sehr schwer

2.0 Auswertung

Von den möglichen Ursachen sind ermittelt
: verantwortlicher Luftfahrzeugführer durch
: - Flugschreiber und/oder Tonbandaufzeichnung
: sonstige Besatzungsmitglieder durch
: - Befund am Luftfahrzeug
: - Flugwegrekonstruktion / Spuren am Boden
: - Flugschreiber und/oder Tonbandaufzeichnung

3.0 Schlußfolgerungen

Betriebsphase : Flugphase
: - Reiseflug

Art der Störung : sonstige unkontrollierte Fluglage
Ursachen
- der 1. Störungsart : zweiter Luftfahrzeugführer
: - Steuerung nicht oder falsch betätigt im Fluge
: - Trimmstellung fehlerhaft
: verantwortlicher Luftfahrzeugführer
: - Überwachung der Besatzung unzureichend
: - abgelenkte Aufmerksamkeit
: - durch äußere Einflüsse

Bemerkungen: Narrative

BEI TESTFL.ZUR ERLANG.D.ENGL.ZULASSUNG WURDE LFZ
VOLL KOPFLASTIG VERTRIMMT.VERLUST D.STEUERBARKEIT
INF.HOHER HANDKRAEFTE.RUECKTRIMMEN W.ERFOLGLOS.

4.0 Empfehlungen

Empfehlungen : Überprüfung - Betriebsanweisungen

Sofortmaßnahmen : nicht eingeleitet

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10

Verteiler : Bundesminister für Verkehr
: Luftfahrt-Bundesamt
Abt. Technik und Gruppe Recht
: Bayerisches Staatsministerium für Wirtschaft
und Verkehr
: Deutscher Aero-Club
: Leiter der Voruntersuchung
: Gerling-Konzern

Braunschweig, den 31/01/1983

gez. (Kruse)

(11)

Bundesstelle für Flugunfalluntersuchung
Hermann-Blenk-Straße 16
D-38108 Braunschweig

Datensatz

Unfall eines deutschen Lfz. im Inland
ohne Verletzte

Luftfahrzeugart	: Flugzeug
Luftfahrzeughersteller	: Dornier
Muster/Typ	: CD01
Eintragungsstaat	: Deutschland
Datum der Störung	: 24/07/1985
Uhrzeit der Störung	: 14.45 Uhr
Störungsort	: nahe Friedrichshafen
Regierungsbezirk/Staat	: Tübingen (BW)

1.0 Tatsachenermittlung

1.1 Flugverlauf

Betriebsart - Allgemeine Luftfahrt	: verschiedene Betriebsarten
	: - Versuchs-, Forschungs-, Erprobungsflug
Art des Halters - Allgm. Luftfahrt	: Hersteller
FS-Flugplan/Freigabe	: ohne Flugplan
Letzter Abflugort	: FRIEDRICHSHAFEN
Zielort	: FRIEDRICHSHAFEN
Betriebsphase	: Landephase
	: - Abfangen/Aufsetzen
1. Art der Störung	: Wasserung mit ausgefahrenem Fahrwerk
2. Art der Störung	: Kopfstand/Überschlag
Art der Notlage	: vermutete technische Störung am Luftfahrzeug

1.2 Personenschäden

keine Verletzten

1.3 Schaden am Luftfahrzeug

Luftfahrzeug : schwer beschädigt

1.4 Sachschaden Dritter

keiner

1.5 Angaben zur Besatzung

Luftfahrzeugführer am Steuer : verantwortlicher Luftfahrzeugführer

Verantwortlicher Luftfahrzeugführer

Lebensalter	: 58 Jahre
Erlaubnis	: Berufsluftfahrzeugführer

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04/20/1982
&
07/11/1986

10/14/1987

"~~Have Blue~~"
F-117
preproduction/FSD

Blackbird Family Losses List

Last revised: 4 October 1997

If you've ever wondered about the Lockheed A-12, YF-12, SR-71 planes that were lost, this list is for you! The information in this list is a combination of information in five books:

- *Lockheed Skunk Works: The First 50 Years* by Jay Miller
- *Lockheed SR-71: The Secret Missions Exposed* by Paul F. Crickmore
- *Lockheed SR-71 Blackbird* by Paul F. Crickmore
- *Aerofax Minigraph 1: SR-71 (A-12/YF-12/D-21)* by Jay Miller
- Lockheed Blackbirds by Anthony Thornborough and Peter Davies

All aircraft are listed by their original Air Force serial numbers.

60-6926: A-12

This was the second A-12 to fly but the first to crash. On 24 May 1963, CIA pilot Ken Collins was flying an inertial navigation system test mission. After entering clouds, frozen water fouled the pitot-static boom and prevented correct information from reaching the stand-by flight instruments and the Triple Display Indicator. The aircraft subsequently entered a stall and control was lost completely followed by the onset of an inverted flat spin. The pilot ejected safely. The wreckage was recovered in two days and persons at the scene were identified and requested to sign secrecy agreements. A cover story for the press described the accident as occurring to an F-105, and is still listed in this way on official records.

60-6928: A-12

This aircraft was lost on 5 January 1967 during a training sortie flown from Groom Lake. Following the onset of a fuel emergency caused by a failing fuel gauge, the aircraft ran out of fuel only minutes before landing. CIA pilot Walter Ray was forced to eject. Unfortunately, the ejection seat man-seat separation sequence malfunctioned, and Ray was killed on impact with the ground, still strapped to his seat.

60-6929: A-12

This aircraft was lost on 28 December 1967 seven seconds into an FCF (Functional Check Flight) from Groom Lake performed by CIA pilot Mel Vojvodich. The SAS (Stability Augmentation System) had been incorrectly wired up, and the pilot was unable to control the aircraft 100 feet above the runway. The pilot ejected safely. A similar accident occurred when the first production Lockheed F-117 was flown on 20 April 1982 by Bill Park. It's control system had been hooked up incorrectly. Bill Park survived the accident but had injuries serious enough to remove him from flight status.

60-6932: A-12

This aircraft was lost in the South China Sea on 5 June 1968. CIA pilot Jack Weeks was flying what was to be the last operational A-12 mission from the overseas A-12 base at Kadena AB, Okinawa. The loss was due to an inflight emergency, and the pilot did not survive. Once again, the official news release identified the lost aircraft as an SR-71 and security was maintained. A few days later the two remaining planes on Okinawa flew to the US and were stored with the remainder of the OXCART family.

60-6934: YF-12A

This aircraft, the 1st YF-12A, was seriously damaged on 14 August 1966 during a landing accident at Edwards AFB. The rear half was later used to build the SR-71C (64-17981) which flew for the first time on March 14, 1969.

60-6936: YF-12A

This aircraft, the third YF-12A, was lost on 24 June 1971 in an accident at Edwards AFB. Lt. Col. Ronald J. Layton and systems operator William A. Curtis were approaching the traffic pattern when a fire broke out due to a fuel line fracture caused by metal fatigue. The flames quickly enveloped the entire

The results of the *Have Blue* testing were sufficiently encouraging that William Perry, who was at that time Under-Secretary of Defense for Research and Engineering in the Carter Administration, urged that the Air Force apply the technology to an operational aircraft. During November of 1978, Lockheed was awarded a go-ahead contract to begin full-scale development of the project. This was a "Special Access", i.e. black, program, and the code name *Senior Trend* was applied to the project.

The *Senior Trend* aircraft came to be defined as a single-seat night strike fighter with no radar, but with an electro-optic system for navigation and weapons delivery. No air-to-air capability was envisaged.

The first five *Senior Trend* aircraft built by Lockheed were to be preproduction full scale development (FSD) aircraft. The *Senior Trend* aircraft had the same general configuration as the *Have Blue* test aircraft, but was much larger and heavier. The engines were a pair of non-afterburning General Electric F404-GE-F1D2 turbofans. These were derivatives of the afterburning F404-GE-400 turbofans which power the McDonnell Douglas F/A-18 Hornet.

In early June of 1981, the first *Senior Trend* service test aircraft (tail number 780) was delivered to Groom Lake for testing. On June 18, 1981, Lockheed test pilot Harold C "Hal" Farley made a successful first flight in number 780. During mid-1981 and early 1982, the other four FSD *Senior Trend* aircraft joined the program. They bore tail numbers 781 through 784 respectively.

The first production *Senior Trend* (#785) arrived at Groom Lake in April of 1982. It differed from the pre-production *Senior Trend* aircraft in having a pair of enlarged fin/rudder assemblies, with three facets rather than just two. Aircraft number 785 was ready for its first flight on April 20, with Lockheed test pilot Robert L. Ridenauer was scheduled to make the first flight. However, unbeknownst to anyone, the fly-by-wire system had been hooked up incorrectly (pitch was yaw and vice versa). Upon liftoff, Ridenauer's plane immediately went out of control. Instead of the nose pitching up, it went horizontal. The aircraft went inverted and ended up traveling backwards through the air. Riedenauer had no time to eject, and the aircraft flew into the ground. Bob Riedenauer survived the crash but was severely injured and was forced to retire from flying. The aircraft was damaged beyond repair, but some of its parts could be salvaged. Since this aircraft crashed prior to USAF/TAC acceptance, it was not counted in the production total.

When it came time for the establishment of the first operational unit for the stealth fighter, the Air Force was faced with a problem. Groom Lake was too small to be useful as the base for an operational unit. In addition, there were security concerns because an operational unit based at Groom Lake would involve many more people who could now see things that they should not be seeing. Therefore, the USAF decided to build a new secret base for the stealth fighter on the Tonopah Test Range, which sits on the northwestern corner of the Nellis complex. The facility is not perfect from a security standpoint, since it is overlooked by public land and is 32 miles from the town of Tonopah itself. However, the security surrounding the Tonopah Test Range was so effective that the new base was not public reported until 1985, after it had been operating for nearly two years.

The 4450th Tactical Group was secretly established as the initial operator of the stealth fighter. The cover for the 4450th was that it was a Nellis-based outfit flying LTV A-7Ds, which was not entirely inaccurate since the outfit did use these planes for support training. The group received its first production stealth aircraft on September 2, 1982. The 4450th moved to Tonopah in 1983, equipped with a partial squadron of stealth fighters plus a few A-7Ds. The group achieved initial operational capability on October 28, 1983, with a total of 14 production aircraft on hand. In order to avoid having the 4450th's aircraft seen by curious observers, all flying had to take place at night. During the day, the aircraft were always kept behind closed doors inside special hangars.

The stealth fighter turned out to be quite easy to fly, and it was concluded that no two-seat trainer version was required. However, there was a training simulator.

The Air Force considered using the stealth fighter in the invasion of Grenada during Operation *Nickel Grass* in 1983. However, the operation was so swift that the action lasted only a couple of days, and the combat debut of the stealth was put off.

In October of 1983 the US government considered using the stealth fighter in a retaliatory attack on Hezbollah terrorist forces based in southern Lebanon in response to the destruction of the Marine barracks in Beirut. In anticipation of action, the 4450th TG at Tonopah was put on alert. Five or seven stealth fighters were armed and had their INS systems aligned for attacks on targets in Lebanon. The plan was for these planes to fly from Tonopah to Myrtle Beach, South Carolina where they would be put in secure hangars. They would then wait for 48 hours for the crews to rest before being given the order to take off for a nonstop flight to Lebanon. However, Defense Secretary Casper Weinberger scrubbed the mission 45 minutes before the aircraft were to take off for South Carolina.

On April 4, 1986, during Operation *El Dorado Canyon*, the United States attacked Libya in retaliation for state-sponsored terrorism. During the initial planning for the raid, the use of the still-secret stealth fighter in the operation was seriously considered. However, once again, the operation was short-lived and the stealth fighter was not used.

In spite of the extreme security, some bits and pieces of the stealth fighter story did manage to leak to the press. In October of 1981, *Aviation Week* reported that an operational stealth fighter was in development. Several people reported catching some fleeting glimpses of a rather odd-looking aircraft flying at night out in the western desert. More and more stuff leaked to the media, so that all through the 1980s it had been sort of an open secret that the USAF was operating a "stealth fighter" which was invisible to conventional radar. However, questions directed to the Pentagon by the press about the stealth fighter were met either with official denials or by a curt "no comment", which only served to whet peoples' curiosity even further.

The official designation of the rumored stealth fighter was assumed by just about everyone to be F-19, since that number had had not been assigned to any known aircraft. The novelist Tom Clancy placed the stealth fighter (named "F-19 Ghostrider" by him) in a key role in his technothriller novel "Red Storm Rising", published in 1986. The Testors plastic model airplane company marketed a kit which purported to the true configuration of the "stealth" fighter.

In the meantime, training continued out in the Nevada desert. On July 11, 1986, Major Ross E. Mulhare flew into a mountain near Bakersfield, California while flying production aircraft number seven (tail number 792). Major Mulhare seems to have made no attempt to eject and was killed instantly, his aircraft disintegrating upon impact. A recovery team was immediately dispatched to the crash site, and the entire area was cordoned off. Every identifiable piece of the crashed plane was found and removed from the area to prevent them from falling into the wrong hands. The doomed aircraft had reportedly carried a flight data recorder, which is sort of unusual for a USAF fighter. Even though not much was found that was any bigger than a beer can, the flight recorder was supposedly recovered intact. In order to throw scavengers, the media, and the merely curious off the track, the recovery crew took the remains of a crashed F-101A Voodoo that had been at Groom Lake for over twenty years, broke them up, and scattered them throughout the area. The cause of the crash has never been officially revealed, but fatigue and disorientation during night flying has been identified as a probable cause.

On October 14, 1987, while flying production aircraft number 30 (tail number 815), Major Michael C. Stewart crashed in the Nellis range just east of Tonopah. He too apparently made no attempt to eject, and was killed instantly. Again, the official cause was never revealed, but fatigue and disorientation may have both played a role. There was no moon that night, and there were no lights out on the Nellis range to help the pilot to distinguish the ground. Reportedly, the mission included certain requirements that were deleted from the final accident report. It is possible that Stewart was going supersonic when he crashed and that he had become disoriented during high-speed maneuvers and had simply flown his plane into the ground.

These two accidents, along with a need to better integrate the still-secret stealth fighter into its regular operations, forced the Air Force to consider flying the aircraft during daytime hours. This would in turn force the Air Force to reveal the existence of the aircraft. This announcement was originally scheduled to take place in early 1988, but internal Pentagon pressure forced a ten-month delay.

On November 10, 1988, the long-rumored existence of the "stealth fighter" was finally officially confirmed by the Pentagon, and a poor-quality photograph was released. The stealth fighter was kept secret for over ten years, the security and deception being so effective that all descriptions which had "leaked" to the media were completely inaccurate.

On the same day, the Air Force confirmed that the official designation of the stealth fighter was F-117A, which surprised just about everyone. The official designation of the stealth fighter had long been assumed by just about everyone to be F-19, since that number had apparently been skipped in the new fighter designation sequence which was introduced in 1962. In addition, it had always been assumed that the designation F-111 had been the last in the old series of fighter designations which been abandoned in 1962 when the Defense Department restarted the whole sequence over again from F-1. This led to a seeming endless round of rumors and speculation about aircraft designation gaps and secret projects, which continue to the present day. If the stealth fighter was not designated F-19, then just what was F-19? If the F-117A was part of the old F-sequence, then what happened to F-112 through F-116?

The true answer is not yet known, but I think that the most likely explanation is that the 117 number is NOT in the old F-sequence that ended in 1962 but instead originated from the radio call signs used by the Stealth pilots when they were flying out of Groom Lake and Tonopah, two of the black planes' bases. Those are the same airfields that supposedly secretely operated Soviet- bloc aircraft such as the MiG-15, MiG-19, MiG-21, and MiG-23 that the US had "acquired" by various means from such sources as Egypt, Israel, Romania, etc. While in flight, these aircraft were distinguished from each other by three-digit radio call signs (generally 11x). After a while, these radio call signs came to be sort of unofficial designations for these aircraft, and even later, F-prefixes began to be attached to these designations. The F-112 to F-116 are often speculated to be Soviet aircraft such as Su-22, MiG-19, MiG-21, MiG-23, or MiG-25. There is even a rumor that there exists a F-116A, which is a US-built version of the MiG-25 constructed to see what kind of threat the MiG-25 could be if the Soviets were able to build it using Western techniques. There is also thought to be an F-118, which might be a Mig-29 that was purchased before the fall of the USSR. Since the stealth fighter was operating in the same general area in Nevada, it came to be known by the radio call sign of 117. The number 117 became so closely associated with the stealth fighter that when Lockheed printed up the first Dash One Pilot Manual, it had "F-117A" on the cover. Since the Air Force didn't want to pay millions of dollars to re-do all the manuals, the aircraft became the F-117A officially. It may have even been initially designated F-19 in the early stages of the project, and might well have continued to be known as the F-19 had this mistake not been made. A similar mistake was made when LBJ announced the existence of the "Blackbird". It was supposed to have been designated RS-71, but LBJ announced it as SR-71 and noone had the guts to tell LBJ that he had goofed. The designation stuck.

Published on 08/13/1986, SEATTLE POST-INTELLIGENCER

NASA UNVEILS A NEW SHUTTLE ROCKET DESIGN

NASA said yesterday it will begin tests later this year on a new booster rocket design that uses a third rubberized O-ring and a metal brace to prevent leaks like the one blamed for the Challenger disaster.

John Thomas, the manager of a solid rocket motor redesign team, said that if the hot-fire tests this fall and full-scale tests next year succeed, the space shuttle should be able to resume flights in early 1988.

Your search terms appear 10 times in this article.

Complete Article, 277 words ($1.95 to download)

Published on 07/28/1986, SEATTLE POST-INTELLIGENCER

STEALTH GOOF-UP

Just how secret is the "Stealth fighter"? Secret enough that when one of the aircraft allegedly crashed near Bakersfield, Calif., on July 11, the Air Force caused several thousand acres around the crash site to disappear as well.

From what is known about stealth technology from open sources, the Air Force was justified in sealing off the area, presumably to protect the fighter program from disclosure. Since the "stealth" in the Air Force's Stealth fighter is a broad combination of design

Your search terms appear 3 times in this article.

Complete Article, 285 words ($1.95 to download)

Published on 07/15/1986, SEATTLE POST-INTELLIGENCER

NO SHUTTLE FLIGHTS TILL AT LEAST '88

The space agency said yesterday that the earliest date the space shuttle could resume flying would be in early 1988, a substantial delay from the previous goal of July 1987.

In a report requested by President Reagan, the agency also indicated it hoped to redesign the booster rockets so that existing hardware can be used. Problems with the booster rockets caused the Jan. 28 Challenger accident in which the crew of seven died.

Your search terms appear 9 times in this article.

Complete Article, 742 words ($1.95 to download)

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Published on 09/05/1986, SEATTLE POST-INTELLIGENCER

RADAR FLAWED AT LA AIRPORT, UNION SAYS

The primary radar in use at Los Angeles International Airport when two planes crashed Sunday was not working effectively, producing no images or only faint images of aircraft locations, the president of the airport technicians union charged yesterday.

Howard Johannssen, president of Professional Airways Systems Specialists in Washington, said the secondary radar was working, however, so that the problems probably did not contribute to the crash.

Your search terms appear 5 times in this article.

Complete Article, 340 words ($1.95 to download)

Published on 09/02/1986, SEATTLE POST-INTELLIGENCER

PILOT HAD HEART ATTACK BEFORE COLLISION

FORMER SPOKANE FAMILY BELIEVED ON SMALL PLANE

The pilot of the small plane that collided with a jetliner, killing all 67 people on the two planes, suffered a heart attack minutes before the collision, a coroner's spokesman says.

The pilot of the small plane in the collision Sunday may have been William Kramer, who recently moved to Los Angeles from Spokane.

Your search terms appear 7 times in this article.

Complete Article, 1538 words ($1.95 to download)

Published on 08/28/1986, SEATTLE POST-INTELLIGENCER

THE LESSONS OF FLIGHT 007

Controversy over the 1983 Korean Air Lines incident has been renewed as the result of a forthcoming book and magazine excerpt by former New York Times corresponent Seymour Hersh. The most striking, and discomforting, aspect of Hersh's findings is what appears to have been a monumental blunder by the Soviet Union.

Hersh, following two years of research that included interviews with high-level Soviet officials, has concluded that KAL Flight 007 with 269 persons aboard was shot down by the Sovie

Your search terms appear 5 times in this article.

Complete Article, 382 words ($1.95 to download)

7/2/86
7/11/86

[redacted]
Published on 07/12/1986, SEATTLE POST-INTELLIGENCER

SECRECY CLOAKS MILITARY AIR CRASH

A mysterious Air Force plane crashed in Sequoia National Forest early yesterday, killing the pilot, igniting a 150-acre brush fire and triggering a cordon of Air Force secrecy.

The Air Force refused to say what type of airplane crashed or whether it was an experimental craft from the flight test center at Edwards Air Force Base, about 80 miles southeast of the crash site.

Your search terms appear 9 times in this article.

Complete Article, 605 words ($1.95 to download)

[redacted]
Published on 07/03/1986, SEATTLE POST-INTELLIGENCER

A BRITISH JET CRASHES IN LAST TEST

The only prototype of Britain's new Hawk 200 jet fighter crashed during its final test flight yesterday, killing its British Aerospace pilot, the company said.

The $12 million aircraft was to have been presented to the public today.

Your search terms appear 6 times in this article.

Complete Article, 273 words ($1.95 to download)

[redacted]
Published on 07/02/1986, SEATTLE POST-INTELLIGENCER

FLIER KILLED IN CRASH OF 'BLIMP'

An experimental 343-foot-long airship made from a blimp and parts of four helicopters caught fire and crashed yesterday during a test flight at a Naval center here, killing one of five crew members aboard.

The aircraft, known as the Heli-Stat, crashed at 7 p.m. at the U.S. Naval Air Engineering Center, less than a mile from where the German dirigible Hindenburg caught fire and burned in May 1937, killing 36 people, said Nick Grand, public information officer at the center.

Your search terms appear 7 times in this article.

Complete Article, 299 words ($1.95 to download)

02/09/1983

2/9/83

NTSB AVIATION ACCIDENT/INCIDENT DATABASE
Report Number: LAX83FA096
Micro fiche # 33746

General Information

Local Date:	02/09/1983
Local Time:	11:50 PST
City:State	PACOIMA;CA
Airport Name:Id	WHITEMAN:WHP
Event Type:	ACCIDENT
Injury Severity:	NONE
Report Status:	FINAL

Operations Information

Category of Operation:	GENERAL AVIATION
Aircraft Type:	HELICOPTER
Aircraft Damage:	SUBSTANTIAL
Phase of Flight:	570 LANDING
Aircraft Make/Model:	SNIAS AS-350-XXX
Operator Doing Business As:	
Operator Name:Code:	
Operator:	
Owner Name:	M.S. MOORE

Narrative

THE MAIN ROTOR BLADES SEPARATED THE TAIL BOOM DURING A FORCED LANDING FOLLOWING A TOTAL LOSS OF POWER. THE PLT STATED THE ACFT WAS EQUIPPED WITH AN EXPERIMENTAL ENGINE TORQUE AND TEMPERATURE LIMITING DEVICE AND THIS FLT WAS TO COLLECT DATA CONCERNING ITS OPERATION. THIS DEVICE MALFUNCTIONED AND AN UNCOMMANDED ENGINE SHUTDOWN OCCURRED AT 800 FT AGL. THE ACFT LANDED HARD ON THE SKID HEEL, ROCKED FORWARDED AND CAME TO REST UPRIGHT AFTER TRAVELING 105 FT.

Probable Cause

Aircraft Information

Number of Seats:	6
Aircraft Use:	
Type of Operation:	14 CFR 91
Domestic/International:	
Passenger/Cargo:	
Registration Number:	3605T
Air Carrier Operating Certificates:	
Aircraft Fire:	NONE

Injuries

	Fatal	Serious	Minor	None
Crew	0	0	0	2

Pass	0	0	0	2
Other	0	0	0	0

Landing Gear:	SKID
Certificated Maximum Gross Weight:	4190
Engine Make:	LYCOMING
Engine Model:	LTS-010-600A2
Number of Engines:	1
Engine Type:	TURBO SHAFT

Environment/Operations Information

Basic Weather Conditions:	(VMC)
Wind Direction (deg):Speed (knots)	0:0
Visibility (sm):	15
Visibility RVR (ft):	0
Visibility RVV (sm):	0
Cloud Height Above Ground Level (ft):	0
Visibility Restrictions:	HAZE (H)
Precipitation Type:	NONE
Light Condition:	DAYLIGHT
Departure Airport Id:	BUR
Departure City:State	BURBANK:CA
Destination Airport Id:City:State	
Flight Plan Filed:	NONE
ATC Clearance:	NONE
VFR Approach/Landing:	FORCED LANDING
Event Location:	ON AIRPORT

Pilot-in-Command

Certificates: COMMERCIAL, FLIGHT INSTRUCTOR

Ratings:

Plane: SINGLE ENGINE LAND, MULTIENGINE LAND, SINGLE ENGINE SEA

Non-Plane: HELICOPTER, GLIDER

Instrument: AIRPLANE

Had Current BFR: YES

Months Since Last BFR: 9

Medical Certificate:Validity CLASS 1: VALID MEDICAL-NO WAIVERS/LIMITATIONS

Flight Time (Hours)

Total :	15000	Last 24 Hrs :	3
Make/Model :	54	Last 30 Days:	0
Instrument :	560	Last 90 Days:	60
Multi-Engine:	1000	Rotorcraft :	6000

05/12/1983

5/12/83

NTSB AVIATION ACCIDENT/INCIDENT DATABASE
Report Number: LAX83FA226

General Information

Local Date:Time	05/12/1983:08:11PDT
City: State	TORRANCE:CA
Airport Name:	ZAMPERINI FIELD
Airport Id:	TOA
Event Type:	ACCIDENT
Injury Severity:	NONE

Operations Information

Category of Operation:	GENERAL AVIATION
Aircraft Type:	HELICOPTER
Aircraft Damage:	SUBSTANTIAL
Phase of Flight:	570 LANDING
Aircraft Make/Model:	ROBSIN R-22-XXX
Operator Doing Business As:	
Operator Name:	
Operator Code:	
Operator:	
Owner Name:	ROBINSON HELICOPTER COMPANY

Narrative

THE HELICOPTER WAS ON AN FAA CERTIFICATION TEST FLT WITH A PART-TIME COMPANY EMPLOYEE IN THE LEFT SEAT AS PILOT- IN-COMMAND (PIC). AN FAA TEST PLT WAS IN THE RIGHT SEAT. THE PURPOSE OF THE FLT WAS TO ESTABLISH NEW DATA FOR THE HELICOPTER'S HEIGHT-VELOCITY (HV) CURVE. THE PIC STATED THAT ALL POINTS ALONG THE CURVE HAD BEEN SUCCESSFULLY DEMONSTRATED ON AN EARLIER DATE. AFTER A NUMBER OF AUTOROTAT IONS, THE PIC SUCCESSFULLY DEMONSTRATED A SPECIFIC POINT AT 100 FT & 48 KTS. THE FAA PLT THEN TOOK THE CONTROLS & ATTEMPTED TO DUPLICATE THE POINT IN QUESTIONS. THE FLARE FOR THE LANDING DID NOT ARREST THE DESCENT. SUBSEQUENT LY, THE HELICOPTER LANDED HARD & THE MAIN ROTOR SERVED THE TAIL BOOM. BOTH PLTS ADMITTED THAT THEY DID NOT CLEARLY DEFINE THEIR INDIVIDUAL RESPONSIBILITIES PRIOR TO THE FLT.

Probable Cause

Aircraft Information

Number of Seats:	2
Aircraft Use:	
Type of Operation:	14 CFR 91
Registration Number:	83574
Air Carrier Operating Certificates:	
Aircraft Fire:	NONE

Injuries

	Fatal	Serious	Minor	None
Crew	0	0	0	2
Pass	0	0	0	0
Other	0	0	0	0

Landing Gear: SKID
Certificated Maximum Gross Weight: 1300
Engine Make: LYCOMING
Engine Model: O-320-B2C
Number of Engines: 1
Engine Type: RECIPROCATING-CARBURETOR

Environment/Operations Information
Basic Weather Conditions: VISUAL METEOROLOGICAL CONDITIONS (VMC)
Wind Direction (deg): Speed (knots) 110: 3
Visibility (sm): 5
Visibility RVR (ft): 0
Visibility RVV (sm): 0
Cloud Height Above Ground Level (ft): 0
Visibility Restrictions: HAZE (H), SMOKE (K)
Precipitation Type: NONE
Light Condition: DAYLIGHT
Flight Plan Filed: NONE
ATC Clearance: NONE
VFR Approach/Landing: SIMULATED FORCED LANDING
Event Location: ON AIRPORT

Pilot-in-Command
Certificates: AIRLINE TRANSPORT, FLIGHT INSTRUCTOR, FLIGHT ENGINEER
Ratings:
Plane: SINGLE ENGINE LAND, MULTIENGINE LAND, SINGLE ENGINE SEA
Non-Plane: HELICOPTER
Instrument: AIRPLANE, HELICOPTER
Had Current BFR: YES
Months Since Last BFR: 9
Medical Certificate: CLASS 1
Medical Certificate Validity: VALID MEDICAL-NO WAIVERS/LIMITATIONS

Flight Time (Hours)

Total :	8567	Last 24 Hrs :	0
Make/Model :	1100	Last 30 Days:	0
Instrument :	906	Last 90 Days:	0
Multi-Engine:	3465	Rotorcraft :	2500

11/23/1983

11/23/83

NTSB Identification: **FTW84FA075** For details, refer to NTSB microfiche number **23461A**

Accident occurred NOV-23-83 at EL RENO, OK
Aircraft: GULFSTREAM AEROSPACE PEREGRINE, registration: N600GA
Injuries: 1 Serious.

AT ABOUT 215 KTS THE PLT ROLLED THE ACFT IN ORDER TO EVALUATE NEWLY INSTALLED AILERONS. IT HAD BEEN NOTED EARLIER THAT A DEAD-BAND EXISTED IN THE AILERON NEUTRAL RANGE THAT INCREASED WITH AIRSPEED. THE PLT STATED THAT UPON ROLLOUT THE DEAD-BAND WAS STRONGER & SLOWED THE RECOVERY WHICH RESULTED IN AN ADDITIONAL ROLL. AS THE ACFT CONTINUED ITS ROLL, THE NOSE-DOWN ATTITUDE INCREASED CAUSING THE ACFT TO ACCELERATE AT AN EVER INCREASING RATE. DURING THE ROLLOUT OF THE SECOND ROLL, THE STICK RESISTANCE CAUSED THE PLT TO PUSH CONSIDERABLY HARDER, INADVERTENTLY PUSHING THE STICK THROUGH NEUTRAL TO THE OPPOSITE SIDE. AN IMMEDIATE AND RAPID AILERON ROLL REVERSAL RESULTED & ANY ACTION THAT THE PILOT TOOK WOULD NOT AFFECT THE RATE OF ROLL OR DESCENT. THE PLT EJECTED BELOW 3000 FT MSL WHILE IN INVERTED FLT.

Probable Cause

Flt control syst,aileron control..Inadequate
Acft/equip, inadequate airframe..Manufacturer

Index for Nov 1983 | Index of Months

++ REQUEST 140/94, REPORT # 169
++
+ DATA REPORT GULFSTREAM AEROSPACE - PEREGRINE 11/23/83
ACCIDENT +
+ EVENTS I PHASES: LOSS OF CONTROL -OTHER I AERIAL WORK
+
+ COLLISION WITH LEVEL TERRAIN/WATER I EMERGENCY/UNCONTROLLED DESCENT +

++

++

<--------------- OPERATION ---------------> ++ <--------------- FILE DATA --------------->

TYPE : MISCELLANEOUS - TEST/EXPERIMENTAL ++ ICAO FILE : 83/1185-0
++ FROM STATE : UNITED STATES
++

<------------------- WHEN -------------------> ++ <----------- AIRCRAFT DATA ------------>

DATE : 83-11-23 ++ MASS CATEGORY : 2251 - 5700 KG
TIME : 15:00 ++ STATE OF REGISTRY : UNITED STATES
LIGHT : DAYLIGHT ++ REGISTRATION : N600GA
++

<------------------ WHERE ------------------> ++ <------- DAMAGE, INJURY AND TOTAL ON BOARD ------->

LOCATION : EL RENO,OK ++ A/C DAMAGE : DESTROYED
STATE/AREA : UNITED STATES ++ INJURY : FATAL SERIOUS MINOR NONE UNKNOWN TOTAL
DEPARTED : OKLAHOMA CITY,OK ++ CREW : 0 1 0 0 0 1
DESTINATION : EL RENO,OK ++ PAX : 0 0 0 0 0 0
OTHER DAMAGE : NO

DRN: THE PILOT ROLLED THE A/C TO TEST THE AILERONS. A "DEAD-BAND" HAD BEEN NOTED IN THE AILERON NEUTRAL RANGE, WHICH INCREASED WITH AIRSPEED. ON ROLL-OUT THE "DEAD-BAND" WAS STRONGER AND THE ROLL COULD NOT BE STOPPED. THE NOSE DROPPED AND THE A/C ACCELERATED. THE PILOT PUSHED HARDER AND THE STICK MOVED TO THE OPPOSITE SIDE. AN AILERON ROLL RESULTED AND THE PILOT COULD NOT STOP THE ROLL NOR THE DESCENT. THE PILOT EJECTED.

--------------- EVENTS AND FACTORS ---------------

1. EVENT I PHASE: LOSS OF CONTROL -OTHER I AERIAL WORK
   FACTORS: AILERON SYSTEM -UNSERVICEABLE
2. EVENT I PHASE: COLLISION WITH LEVEL TERRAIN/WATER I EMERGENCY/UNCONTROLLED DESCENT

04/02/1994

4/2/84

NTSB Identification: MKC84FA114 For details, refer to NTSB microfiche number 24506A

Accident occurred APR-02-84 at LITTLE ROCK, AR
Aircraft: CANADAIR CL-600 CHALLENGER, registration: N800CC
Injuries: 8 Uninjured.

THE ACFT WAS ON AN FAA CERTIFICATION FLT (EXPERIMENTAL). DURING THE RECOVERY PHASE, A NON-TYPE RATED FAA PLT WAS IN THE L SEAT & THE PIC WAS IN THE R SEAT. WHILE DESCENDING, A DUCT FAIL LGT & A LEADING EDGE OVERHEAT LGT CAME ON. THE PIC TOOK CORRECTIVE ACTION. THE FAA PLT MADE AN ILS APCH TO RWY 22 WHICH WAS WET. THE APCH WAS MADE WITH THE L ENG AT HI IDLE. THE THRUST REVERSERS WERE NOT ARMED FOR THE LANDING. A TOUCHDOWN WAS MADE ABOUT 2000' DOWN THE RWY & SPOILERS WERE DEPLOYED. WHEN THE FAA PLT REALIZED HE DID NOT HAVE REVERSE THRUST, HE TRIED SLOWING THE ACFT WITH BRAKES; HOWEVER, THE L BRAKE WAS INOP. THE PIC TOOK CONTROL & CYCLED THE ANTI-SKID, BUT STILL HAD NO L BRAKING ACTION. SUBSEQUENTLY, THE ACFT RAN OFF THE END OF THE RWY & THE NOSE GEAR COLLAPSED IN MUDDY TERRAIN. AN INVESTIGATION REVEALED THAT DURING MAINTEN- ANCE, THE SPEED SENSOR HARNESSES FOR THE L MAIN GEAR WERE REVERSED WHICH ELIMINATED ANY BRAKING TO THE L BRAKE WHILE THE ANTI-SKID WAS ON.

Probable Cause

Supervision..Inadequate..Pilot in command

Contributing Factors

Thrust reverser..Not engaged
Checklist..Not followed..no person specified
Diverted attention..Copilot/second pilot
Diverted attention..Pilot in command
Weather condition..Tailwind
Proper touchdown point..Not attained..Copilot/second pilot
Landing gear,anti-skid brake system..Inoperative
Maintenance..Improper..Other maintenance personnel
Airport facilities,runway/landing area condition..Wet
Terrain condition..Soft
Terrain condition..Wet

Index for Apr 1984 | Index of Months □□□□

++ REQUEST 140/94, REPORT # 175
+++

+ DATA REPORT CANADAIR - CL-600 ACCIDENT +
+ EVENTS I PHASES: LOSS OF DIRECTIONAL CONTROL I LANDING ROLL
+
+ OVERRUN I LANDING ROLL +
+ COLLISION WITH OBJECT -OTHER I LANDING ROLL +
+ NOSE GEAR COLLAPSED/RETRACTED I LANDING ROLL
+

+++
++++++++++++++++++++++++++++++++++++

++
<--------------- OPERATION ---------------> ++ <--------------- FILE DATA ---------------->
TYPE : MISCELLANEOUS - TEST/EXPERIMENTAL ++ ICAO FILE : 84/0312-0
++ FROM STATE : UNITED STATES
++
<------------------- WHEN -------------------> ++ <------------ AIRCRAFT DATA ------------>
DATE : 84-04-02 ++ MASS CATEGORY : 5701 - 27 000 KG
TIME : 13:31 ++ STATE OF REGISTRY : UNITED STATES
LIGHT : DAYLIGHT ++ REGISTRATION : N800CC
++
<------------------ WHERE -------------------> ++ <-------- DAMAGE, INJURY AND TOTAL ON BOARD -------->
LOCATION : LITTLE ROCK,AR ++ A/C DAMAGE : SUBSTANTIAL
STATE/AREA : UNITED STATES ++ INJURY : FATAL SERIOUS MINOR NONE UNKNOWN TOTAL
DEPARTED : LITTLE ROCK,AR ++ CREW : 0 0 0 2 0 2
DESTINATION : LITTLE ROCK,AR ++ PAX : 0 0 0 6 0 6
OTHER DAMAGE : YES

THE A/C TOUCHED DOWN 600 M PAST THE THRESHOLD ON A WET, 2190 M RWY. REVERSE THRUST WAS NOT USED. THE RIGHT MAIN WHEELS RAN OFF THE RIGHT SIDE OF THE RWY 120 M BEFORE THE END. THE A/C STOPPED 10 M PAST THE END. THE NOSE GEAR CONTACTED A CONCRETE MANHOLE AND THE NOSE GEAR BROKE AWAY.

DRN: THE APP WAS MADE WITH THE LEFT ENGINE AT HIGH IDLE. THE THRUST REVERSERS WERE DEPLOYED. WHEN THE CO-PILOT REALZED HE DID NOT HAVE REVERSE THRUST, HE TRIED THE BRAKES; HOWEVER, THE LEFT BRAKE WAS INOPERATIVE. THE PILOT TOOK CONTROL AND CYCLED THE ANTI-SKID, TO NO AVAIL.

THE SPEED SENSOR HARNESSES FOR THE LEFT MAIN GEAR WERE REVERSED WHICH ELIMINATED ANY LEFT BRAKING.

---------------- EVENTS AND FACTORS ----------------

1. EVENT I PHASE: LOSS OF DIRECTIONAL CONTROL I LANDING ROLL
FACTORS: FLIGHT SUPERVISION -INADEQUATE
: OPERATION OF POWERPLANT -IMPROPER OPERATION
: FLIGHT CREW PROCEDURES -NOT FOLLOWED
: USE OF CHECK LIST -NOT USED
: ANTISKID SYSTEM -ELECTRICAL FAILURE /MISRIGGED

08/29/1984

B-1A

Doug Benfield

8/29/84

EDITOR'S COLUMN

Doug Benefield, Chief Test pilot for Rockwell International Corp. died in the crash of the B-1 prototype bomber. Doug had been in test flying for most of the 29 years since his graduation from the USAF Test Pilot School in 1955. In those years he was assigned to many different flight test programs with the Air Force, FAA and Aircraft companies. A number of us in the SFTE worked closely with him on those programs. Charlie Johnson, Dick Abrams, Jerry Jones, Pat Sharp, Jim Leasure and Otto Waniczek to name a few. I first became acquainted with Doug in 1956, when he was assigned as the project pilot on the performance and limited stability tests of the SA-16B. Charlie Crawford was the flight test engineer. One couldn't help but be impressed with his flying skill, self confidence and boyish enthusiasm for flying and flight testing. He never lost that enthusiasm. He died doing what he enjoyed doing - flight testing. He was a good friend.

First Production B-1B Rollout

In ceremonies attended by key government, Air Force, and industry officials, Rockwell International Corp. rolled out its first production B-1B Tuesday, Sept. 4 at its Palmdale facility. The bomber, painted in a camouflage of dark greens and grays was rolled out of its hangar and towed in a circle so the crowd could see it from all sides. A Strategic Air Command insignia on the right hand side of the cabin was unveiled by Air Force Secretary Verne Orr, Air Force Chief of Staff Gen. Charles Gabriel and Rockwell Chairman Robert Anderson. Secretary Orr delivered the main address.

The No. 1 B-1B, built on production tooling, rolled out five months ahead of schedule and within the budgeted cost. The Air Force has 100 B-1B's ordered at a cost of approximately 20.5-billion dollars (1981 dollars).

Externally, the B-1B looks similar to the B-1A. Only a simplified engine inlet, modified overwing fairings, redesigned aft radome and a relocated pitot tube will be noticeable. The Air Force said the B-1B has a radar cross section of only about one-hundredth of the B-52, SAC's aging present day bomber. The basic weight of B-1B remains essentially unchanged from that of the B-1A's but the maximum operating weight has been increased from 397,000 pounds to 477,000 pounds. The B-1B is powered by four General Electric F-101-GE-102 turbofan engines developing 30,000 pounds of thrust each. The Boeing Military Airplane is the associate contractor for the offensive avionics and AIL Division of the Eaton Corp. for the defensive avionics.

The No. 4 prototype was temporarily grounded as a precaution after the loss of the No. 2 prototype but is back flying again. The first production B-1B is scheduled to make its first flight in the early part of October.

B-1 Lost On Test Flight

8/29/84

One of the four B-1 prototype bombers, B-1A, No. 2 was lost while on a low-level test flight. One crew member, Tommie D. (Doug) Benefield, 55, chief test pilot for Rockwell International Corp. was killed but the other two crew members, pilot, Major Richard V. Reynolds, 35, of Hoquiam, Wash. and flight test engineer, Capt. Otto J. Waniczek Jr., 30, of Seattle, Wash. survived. An Air Force statement said the crew escape capsule successfully separated from the plane. Doug Benefield reportedly died in the escape capsule. Major Reynolds suffered a compression back injury and Capt. Waniczek suffered a major chest contusion and internal injuries.

Capt. Waniczek is an active member of the SFTE's Antelope Valley Chapter having served on the Board of Directors. He is a graduate of the Flight Test Engineers Course, USAF Test Pilot School and is currently assigned to the Flight Dynamics Division, 6520th Test Group while attached to the B-1 Test Force.

Board of Directors I

5 SEPTEMBER 1984

Attendees:

Ron Hart, Pres.	Jan Howell, I
Jeffrey Posner, Vice Pres.	Roger Jones,
Robert Evans, Past Treas.	Jack Strier, S
James Upton, Director	David Houle,

Absent:

Weneth Painter, Director Lyn

Dianne Van Norman, Executive Director

The meeting was called to order by tl Hart, at 7:45 p.m. Ron Hart introduced th thanked Jan Howell and Bob Evans for th aid in helping make an orderly transition f new Board of Directors.

The minutes of the 1 August 1984 meet approved.

The President made the following st assignments:

Publications - Jack Strier Membe

Ethics - Dave Houle Scholar

Interim committee assignments:

European Symposium (1987 - Jeff Posne (to monitor programs)

Directors Award - James Upton

James Upton will make a recommendati what form the Directors Award should certificate.

Treasurer's Report - No report.

Membership Report - No report.

Publication Report - J. Strier reported cc Test Newsletter" was $489.90.

OLD BUSINESS

James Upton announced he has the S viously ordered and will deliver them to the

Jan Howell, past ethics committee chair draft code of ethics for study and later com

Ron Hart reported on the St. Louis Syn was a well organized and successful sy Louis Chapter is to be congratulated for th

Thirty six papers were presented

Total attendees:

Total registered:

Wives:

Exhibitors:

St. Louis Chapter:

Countries represented:

20 different vendors participated

Sales of SFTE items: $216

Ron Hart reported that 7 caps with tl were all sold at the Symposium. (Bill Fisl up.) The Board agreed to delay ordering ca urer gets a good handle on income and ex forthcoming year. The Board approved tl caps with emblems for sale at an A.V. Chap

The President received a letter from thanking the SFTE for the scholarship awa

Seattle Chapter requested a $1,000 adv Symposium. The Board voted to increm Seattle Chapter as required with an im vance.

Dave Houle proposed that members b write abstracts or summaries of articles or contains information useful in flight test maries would be published in the FLIGH Publications Chairman heartily concurred.

The President proposed and the Board Board of Directors meetings on the first W month at 7:30 p.m. at the Society Office.

Respectfully, Jack Strier, Se

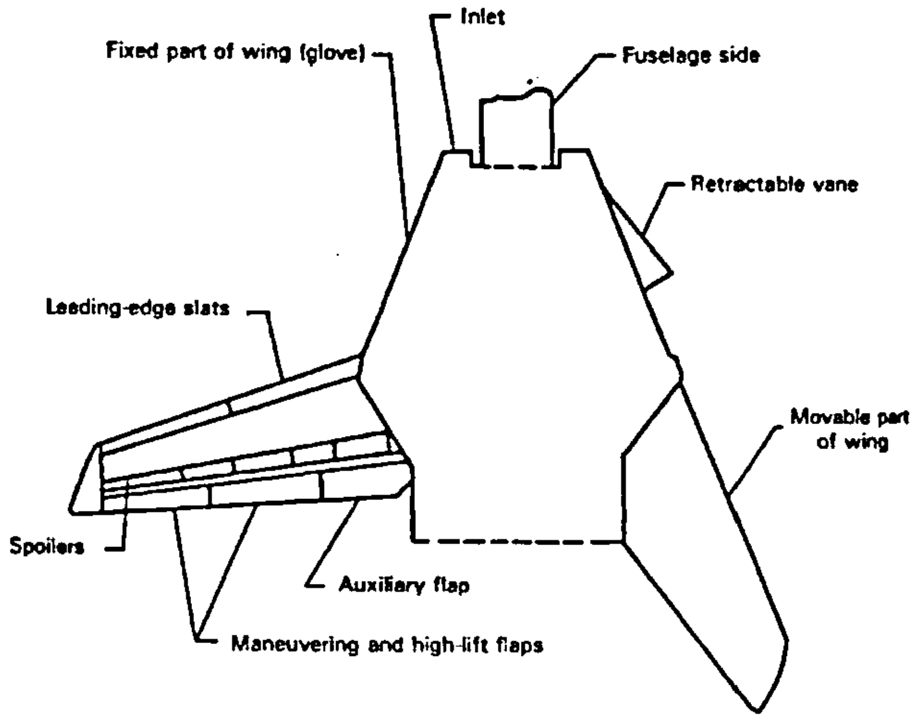

Figure 16.2 The approximate wing planform of the variable-sweep Grumman F-14 Tomcat. The retractable glove vane reduces excessive longitudinal stability with the wings fully swept back. (From Loftin, NASA SP 468, 1985.)

U.S. Air Force airfield in Kansas with a wing stuck in its full aft swept position had to fly to Edwards Air Force Base in California to use its extra-long runways.

The B-1 can have a severe stability problem at the other end of the sweep range, the landing position of 15 degrees. This problem occurs if the wings are swept forward to 15 degrees without waiting for the fuel to be pumped forward as well. This situation was guarded against originally by a warning light that came on if fuel transfer had not been made before unsweeping. According to Paul H. Anderson, a warning light was used originally instead of a positive interlock that would prevent unsweeping until fuel was transferred because of concern that a failure in the interlock system could lock the wing in its aft position.

However, a tragic accident occurred at Edwards when a pilot apparently ignored the warning light and unswept a B-1's wings without the compensating forward center of gravity shift by fuel pumping. The airplane simply became uncontrollably unstable and was lost. A positive interlock replaced the warning light after that accident.

16.6 The Oblique or Skewed Wing

Another rotation-only variable-sweep concept was invented by Robert T. Jones at the NACA Ames Aeronautical Laboratory around 1945 (Figure 16.3). This is the oblique or skewed wing, in which wing sweepback (and sweepforward) is achieved by rotating the

Airplane Stability and Control
Abzug and Larrabee

Rockwell International B-1A during B-1B Flight Test Program

When President Reagan reinstated the B-1 program, in late 1981, Rockwell was authorized to use two B-1A's for flight testing various aircraft systems while construction of the B-1B was getting started. Initial contracts for the conversion of the 2nd (S/N 74-159) and 4th (S/N 76-174) B-1A's were signed in January 1982.

B-1A # 2 was the first aircraft modified with a new flight control system designed for the updated B-1B. The aircraft flew for the first time as a B-1B systems test aircraft on 23 March 1983. Flight testing continued until 29 August 1984 when the aircraft crashed during a stability and control test flight at low level with the aircraft operating at the edge of its performance envelope. This aircraft was equipped with a crew escape module which malfunctioned during the ejection sequence. One member of the crew was killed when the escape module hit the ground and two other crewmen were injured.

The second B-1A (S/N 76-174) modified for testing B-1B systems was ready in mid-1984 and flew for the first time on 30 July 1984. This aircraft was modified with the B-1B defensive and offensive avionics systems and used to test weapons delivery and electronic counter measures (both active and passive) of the aircraft. This B-1A continued as a test aircraft until the B-1B became operational in September 1986. In December 1986, the aircraft made its last flight to the USAF Museum where it was placed on permanent display in the Airpark.

TYPE	Number Built/Converted	Remarks
B-1A	4	Supersonic penetration bomber

Notes:

- Serial numbers: 74-158 to 74-160 & 76-174
- The USAF Museum has the last B-1A (S/N 76-174) in display in the Airpark.
- First flight of the B-1A was on 23 December 1974
- First flight of B-1A #2 after B-1B modifications were complete was on 23 March 1983
- First flight of B-1A #4 after B-1B modifications were complete was on 30 July 1984

SPECIFICATIONS
Span: 136 ft. 8 1/2 in. fully spread; 78 ft. 2 1/2 in. fully swept.
Length: 150 ft. 2 1/2 in.
Height: 33 ft. 7 1/4 in.
Weight: 389,000 lbs. loaded
Armament: 24 AGM-69B short range attack missiles (SRAMS) or 75,000 lbs. of bombs carried internally plus 8 SRAMs or 40,000 lbs. Of bombs carried externally.
Engines: Four General Electric F101-GE-100 afterburning turbofans of 30,000 lbs. thrust ea.

3/5/12 of 12
0002011 A86-12009
B-1B - Born again bomber
Author: LYNN, N.
Source: Flight International (ISSN 0015-3710), vol. 128, Sept. 21, 1985, p. 9-42.
Publication Date: Sep. 1985
Language: English
Country of Origin: United Kingdom Country of Publication: United Kingdom
Document Type: JOURNAL ARTICLE
Documents available from AIAA Technical Library
Journal Announcement: IAA8602

The development of the B-1B bomber is discussed. The production and delivery schedule, and the flight testing of the aircraft are described. The crash of the B-1A aircraft and the new warning light system developed after the crash are explained. The stability enhancement function added to the stability control augmentation system, and the stall inhibitor system added to the aircraft are examined. An example of foreign object damage to the flapper doors of the B-1B bomber is provided. The offensive avionics system is explained and its proposed production and delivery schedule are given. (I.F.)
Source of Abstract/Subfile: AIAA/TIS
Descriptors: *AIRCRAFT PERFORMANCE; *B-1 AIRCRAFT; *REVISIONS; AIRCRAFT ACCIDENTS; AVIONICS; DEVELOPMENT; FLIGHT CONTROL; FLIGHT TESTS; IMPACT DAMAGE; STABILITY AUGMENTATION; WARNING SYSTEMS
Subject Classification: 7505 Aircraft Design, Testing & Performance (1975-)

3/5/1 of 3
NTIS No: AD-A261 376/8/HDM
Title: Proceedings of the Aircraft Wake Vortices Conference Held in Washington, DC on October 29 - 31, 1991. Volume 1; Final rept.,
Author(s): Hallock, J. N.
Performing Organization: John A. Volpe National Transportation Systems Center, Cambridge, MA.
Report No: DOT-VNTSC-FAA-92-7-I; DOT/FAA/SD-92-1-I
Notes: Original contains color plates: All DTIC/NTIS reproductions will be in black and white. See also Volume 2, AD-A261 377.
Date: Jun 92 Pages: 515p NTIS Price Code: PC A22/MF A04
Language: English Country: United States
Document Type: Conference proceeding
Abstract: This volume contains the proceedings of the international conference of Aircraft Wake Vortices held at the Quality Hotel Capitol Hill, Washington, DC, on October 29-31, 1991. The contributed papers discuss technological advances in the knowledge of the phenomenon, its effect on aircraft and airport capacity, detection techniques, and vortex avoidance schemes.... Aircraft wake vortex, Vortices, Vortex hazards, Wake behavior.
Descriptors: *Aircraft; *Airports; Detection; Flight testing; Trailing vortices; Hazards; *Vortices; *Wake; Flow separation; *Air traffic control systems; *Air traffic control terminal areas; Lessons learned; Data bases; Weather; *Aircraft landings; Turbulent flow; *Aviation safety; Turbulence; Aviation accidents; Wing tips; Mixing; Helicopters; Aerodynamic characteristics
Identifiers: *Meetings; NTISDODXA
NTIS Subject Codes: 51A (Aeronautics and Aerodynamics--Aerodynamics); 51B (Aeronautics and Aerodynamics--Aeronautics); 85A (Transportation--Air Transportation); 85D (Transportation--Transportation Safety)

3/5/2 of 3
NTIS No: AD-A248 568/8/HDM
Title: Flight Testing of a Half-Scale Remotely Piloted Vehicle; Master's thesis
Author(s): Koch, P. A.
Performing Organization: Naval Postgraduate School, Monterey, CA.
Date: Mar 92 Pages: 62p NTIS Price Code: PC A04/MF A01

10/09/1984

10/9/84

NTSB Identification: FTW85FA010 For details, refer to NTSB microfiche number 27108A

Accident occurred OCT-09-84 at CHECOTAH, OK
Aircraft: ROCKWELL INTERNATIONAL 695A, registration: N81502
Injuries: 2 Fatal.

THE PILOT ALLOWED THE AIRCRAFT TO STALL AT AN ALTITUDE WHICH WAS TOO LOW TO EFFECT RECOVERY BEFORE GROUND IMPACT OCCURRED. HE WAS IN THE PROCESS OF PERFORMING VMC TEST AND MAXIMUM PERFORMANCE SINGLE ENGINE CLIMBS DURING THE TEST FLIGHT. WITNESS DESCRIPTION OF THE AIRCRAFTS MOVEMENTS AT THE BEGINNING OF THE ACCIDENT SEQUENCE SUGGESTS THAT THE VMC TEST WERE IN PROGRESS IMMEDIATELY BEFORE THE ACCIDENT OCCURRED.

Probable Cause

S/N 96000
Cert issued 5/12/81
GAC A/C, Savannah Ga

Airspeed..Not maintained..Pilot in command
Stall/spin..Inadvertent..Pilot in command

Index for Oct 1984 | Index of Months □□□□

++ REQUEST 140/94, REPORT # 179
++

+ DATA REPORT ROCKWELL - COMMANDER 980 ACCIDENT
+
+ EVENTS I PHASES: SPIN I CRUISE +
+ COLLISION WITH LEVEL TERRAIN/WATER I EMERGENCY/UNCONTROLLED DESCENT +

++
++++++++++++++++++++++++++++++++++++

++
<---------------- OPERATION ---------------> ++ <---------------- FILE DATA ---------------->
TYPE : MISCELLANEOUS - TEST/EXPERIMENTAL ++ ICAO FILE : 84/0187-0
++ FROM STATE : UNITED STATES
++
<-------------------- WHEN --------------------> ++ <------------ AIRCRAFT DATA ------------>
DATE : 84-10-09 ++ MASS CATEGORY : 2251 - 5700 KG
TIME : 11:40 ++ STATE OF REGISTRY : UNITED STATES
LIGHT : DAYLIGHT ++ REGISTRATION : N81502
++
<------------------- WHERE -------------------> ++ <-------- DAMAGE, INJURY AND TOTAL ON BOARD -------->
LOCATION : NEAR CHECOTAH,OK ++ A/C DAMAGE : DESTROYED
STATE/AREA : UNITED STATES ++ INJURY : FATAL SERIOUS MINOR NONE UNKNOWN TOTAL
DEPARTED : BETHANY,OK ++ CREW : 2 0 0 0 0 2
DESTINATION : BETHANY,OK ++ PAX : 0 0 0 0 0 0
OTHER DAMAGE : NO

THE TEST FLIGHT WAS FOR SINGLE ENGINE VMC CHECKS AND SINGLE ENGINE MAXIMUM PERFORMANCE CLIMBS. THE A/C FLEW SLOW WITH A STEEP NOSE UP ATTITUDE WHEN THE NOSE PITCHED DOWN AND THE A/C ENTERED A SPIN FROM AN ALTITUDE OF 1000-1200 FT AGL. THE ENGINE SOUNDS CEASED AND THE A/C CONTINUED TO SPIN UNTIL IMPACT.

---------------- EVENTS AND FACTORS ----------------
1. EVENT I PHASE: SPIN I CRUISE
FACTORS: FLYING SPEED -NOT MAINTAINED
2. EVENT I PHASE: COLLISION WITH LEVEL TERRAIN/WATER I EMERGENCY/UNCONTROLLED DESCENT

12/19/1984

12/19/84

NTSB Identification: SEA85FA034 For details, refer to NTSB microfiche number 26670A

Accident occurred DEC-19-84 at WEST SEATTLE, WA
Aircraft: DEHAVILLAND DHC-3 TURBO, registration: N4247A
Injuries: 1 Serious, 2 Minor.
"Other"

ACFT WAS PERFORMING TEST FLT MANEUVERS WHEN PROBLEMS WITH THE MODIFIED FUEL SYSTEM OCCURRED. ICE BLOCKING A FUEL VENT LINE CAUSED A PARTIAL COLLAPSE OF THE MAIN (ENGINE FEED) FUEL CELL WHICH PRODUCED AN ERROUNEOUS FUEL QUANTITY READING. IN ADDITION, THE MAIN TANK OVERFLOW SHUTOFF VALVE WAS LEAKING, SO TANK OVERFLOW OCCURRED. THE FUEL OVERFLOW CAUTION LIGHT ILLUMINATED AND AUXILIARY TANK FUEL PUMP FEED TO MAIN AUTOMATICALLY SHUT DOWN. DUE TO MISCALIBRATION, THIS SYSTEM OVERRODE PLT ATTEMPTS TO RESTART AUX FUEL PUMPS. PLT REMAINED IN TEST AREA TROUBLESHOOTING RATHER THAN IMMEDIATE RETURN TO BASE, FINALLY NOTED MAIN TANK GAGE CONTINUING TO READ "FULL." EN ROUTE TO BOEING FIELD, FUEL STARVATION OCCURRED. PLT OPTED TO ATTEMPT FORCED LNDG IN SMALL ATHLETIC FIELD IN RESIDENTIAL AREA RATHER THAN DITCH IN PUGET SOUND. THE ACFT TOUCHED DOWN IN INTENDED LNDG AREA, THEN BOUNCED ACROSS AN ADJACENT STREET. THE ARRESTING ACTION OF TELEPHONE WIRES ON THE VERTICAL FIN BROUGHT THE ACFT TO REST IN A RESIDENTIAL BACKYARD.

Probable Cause

MFR date 1964; S/N 421
COX AC Co of Wash, Seattle

Fuel system,vent..Blocked(total)
Fluid,fuel..Starvation

Experimental
R&D
compl w/ FARs

Contributing Factors

Fuel system,tank..Distorted
Engine instruments,fuel quantity gage..False indication
Fuel system,fuel shutoff..Leak
Precautionary landing..Delayed..Pilot in command
Fuel supply..Misjudged..Pilot in command
Terrain condition..None suitable

Index for Dec 1984 | Index of Months □□□□

++ REQUEST 140/94, REPORT # 181
++

+ DATA REPORT DE HAVILLAND - ACCIDENT +
+ EVENTS | PHASES: FUEL SYSTEM FAILURE | CRUISE
+ NON-MECHANICAL FAILURE -FIRST ENGINE | CRUISE
+ COLLISION WITH OBJECT -OTHER | LANDING ROLL

++
++++++++++++++++++++++++++++++++++

++

<--------------- O P E R A T I O N ---------------> ++ <--------------- F I L E D A T A ---------------

TYPE : MISCELLANEOUS - TEST/EXPERIMENTAL ++ ICAO FILE : 84/1306-0
++ FROM STATE : UNITED STATES
++

<-------------------- W H E N --------------------> ++ <------------ A I R C R A F T D A T A ------------

DATE : 84-12-19 ++ MASS CATEGORY :
TIME : 11:08 ++ STATE OF REGISTRY : UNITED STATES
LIGHT : DAYLIGHT ++ REGISTRATION : N4247A
++

<------------------- W H E R E -------------------> ++ <-------- DAMAGE, INJURY AND TOTAL ON BOARD -------->

LOCATION : NEAR WEST SEATTLE,WA ++ A/C DAMAGE : SUBSTANTIAL
STATE/AREA : UNITED STATES ++ INJURY : FATAL SERIOUS MINOR NONE UNKNOWN TOTAL
DEPARTED : SEATTLE,WA ++ CREW : 0 0 1 0 0 1
DESTINATION : WEST SEATTLE,WA ++ PAX : 0 1 1 0 0 2
OTHER DAMAGE : YES

DRN: DURING A TEST FLIGHT, ICE BLOCKED A FUEL LINE CAUSING PARTIAL COLLAPSE O THE MAIN (ENGINE FEED) FUEL
CELL. THE MAIN TANK OVERFLOW SHUT-OFF VALVE WAS LEAKING, SO TANK OVERFLOW OCCURRED. DUE TO MISCALIBRATION, THE SYSTEM
OVERRODE PILOT ATTEMPTS TO RESTART AUXILIARY FUEL PUMPS. THE PILOT FINALLY NOT MAIN TANK GAUGE CONTINUING TO READ
"FULL". EN-ROUTE TO BASE, FUEL STARVATION OCCURRED. HE FORCE LANDED IN AN ATHLETIC FIELD AND BOUNCED ACROSS A STREET.

---------------- E V E N T S A N D F A C T O R S ----------------

1. EVENT | PHASE: FUEL SYSTEM FAILURE | CRUISE
FACTORS: FUEL DISTRIBUTION PIPE -BLOCKED BY ICE
: FUEL TANK -DISTORTED /COLLAPSED
: FUEL QUANTITY-PRESSURE INDICATION -FALSE INDICATION
2. EVENT | PHASE: NON-MECHANICAL FAILURE -FIRST ENGINE | CRUISE
FACTORS: POWERPL FUEL VALVE -LEAK/LEAKED
: FUEL QUANTITY-PRESSURE INDICATION -INATTENTIVE TO
: FUEL -EXHAUSTED/DEPLETED
3. EVENT | PHASE: COLLISION WITH OBJECT -OTHER | LANDING ROLL

05/01/1985

NTSB Identification: LAX85LA235 For details, refer to NTSB microfiche number 29337A

Accident occurred MAY-01-85 at MESA, AZ
Aircraft: LOCKHEED PV-2, registration: N7415C
Injuries: 2 Uninjured.

FOLLOWING A DUAL ENGINE CHANG, THE PLT TEST FLEW THE ACFT. ON INITIAL CLIMB, AT ABOUT 500 FT AGL, BOTH ENGINES BEGAN BACKFIRING VIOLENTLY & LOST POWER. ACCORDING TO THE PLT, POWER SUFFICIENT FOR FLT COULD NOT BE OBTAINED, & A FORCED LDG WAS MADE ABOUT 0.75 MILES FROM THE ARPT. THE LDG OCCURRED IN OPEN DESERT TERRAIN & THE ACFT WAS SUBSTANTIALLY DAMAGED. THE PLT ACKNOWLEDGED THAT HE DID NOT CHECK THE POSITION OF THE CONTROL HANDLES FOR THE SUPERCHARGERS DURING EITHER HIS PRE-FLIGHT OR PRE-TAKEOFF INSPECTIONS. AND THE BLOWERS HAD BEEN INADVERTENTLY LEFT SET TO THE HIGH BLOWER POSITION. ACCORDING TO THE PLT, THE CHECKLIST WHICH HE WAS USING FOR THE ACFT DID NOT ADDRESS THE POSITION OF THE BLOWERS BECAUSE FOR THE PAST 15 YRS IT HAD BEEN COMPANY POLICY TO "WIRE THE BLOWERS TO THE LOW BLOWER POSITION."

Probable Cause

Checklist..Inaccurate..Pilot in command
Powerplant controls..Improper..Pilot in command

Index for May 1985 | Index of Months □□□□□□□□

++ REQUEST 140/94, REPORT # 183
+++

+ DATA REPORT LOCKHEED - HARPOON/PV-2 ACCIDEN
+
+ EVENTS | PHASES: MECHANICAL FAILURE -FIRST ENGINE | TAKE-OFF RUN
+
+ MECHANICAL FAILURE -ADDITIONAL ENGINE | INITIAL CLIMB
+
+ COLLISION WITH OBJECT -OTHER | LANDING ROLL

++

++

<---------------- OPERATION ----------------> ++ <---------------- FILE DATA ----------------

TYPE : MISCELLANEOUS - TEST/EXPERIMENTAL ++ ICAO FILE : 85/0160-0
++ FROM STATE : UNITED STATES
++

<-------------------- WHEN --------------------> ++ <------------ AIRCRAFT DATA ------------

DATE : 85-05-01 ++ MASS CATEGORY : 5701 - 27 000 KG
TIME : 15:57 ++ STATE OF REGISTRY : UNITED STATES
LIGHT : DAYLIGHT ++ REGISTRATION : N7415C
++

<-------------------- WHERE --------------------> ++ <-------- DAMAGE, INJURY AND TOTAL ON BOARD -------->

LOCATION : MESA,AZ ++ A/C DAMAGE : SUBSTANTIAL
STATE/AREA : UNITED STATES ++ INJURY : FATAL SERIOUS MINOR NONE UNKNOWN TOTAL
DEPARTED : MESA,AZ ++ CREW : 0 0 0 2 0 2
DESTINATION : MESA,AZ ++ PAX : 0 0 0 0 0 0
OTHER DAMAGE : NO

THE A/C HAD REACHED 400 FT AGL AFTER TAKE-OFF WHEN THE LEFT ENGINE BACKFIRE BOTH ENGINES THEN LOST POWER.

THE ENGINES HAD BEEN INSTALLED A FEW DAYS PREVIOUSLY. A MANUAL BLOW-BY SWITCH HAD INADVERTENTLY SLIPPED INTO THE
HIGH BLOW-BY POSITION CREATING AN OVER RICH FUEL MIXTURE.

DRN: THE BLOWERS HAD BEEN INADVERTENTLY SET TO THE HIGH BLOWER POSITION. TH CHECKLIST DID NOT ADDRESS THE
SETTING OF THE BLOWERS BECAUSE THEY HAD BEEN WIRED TO THE LOW BLOWER POSITIO FOR 15 YEARS.

Config control

---------------- EVENTS AND FACTORS ----------------

1. EVENT | PHASE: MECHANICAL FAILURE -FIRST ENGINE | TAKE-OFF RUN
   FACTORS: USE OF CHECK LIST -INACCURATE
   : OPERATION OF POWERPLANT -INADEQUATE
2. EVENT | PHASE: MECHANICAL FAILURE -ADDITIONAL ENGINE | INITIAL CLIMB
   FACTORS: FORCED LANDING -PERFORMED
3. EVENT | PHASE: COLLISION WITH OBJECT -OTHER | LANDING ROLL
   FACTORS: RUNWAY SURFACE CONDITION -NOT SUITABLE
   : TERRAIN CONDITION -UNEVEN

05/29/1985

Cessna 425

NTSB Identification: **CHI85FA218** For details, refer to NTSB microfiche number **29274A**

Accident occurred MAY-29-85 at DAYTON, OH
Aircraft: CESSNA 425, registration: N2079A
Injuries: 1 Serious, 3 Uninjured.

THE ACFT INVOLVED WAS EXPERIMENTALLY CONFIGURED WITH 4-BLADED PROPS AND WAS ON A TEST FLT TO DETERMINE HANDLING CHARACTERISTICS FOLLOWING A THROTTLE CHOP TO IDLE POWER AT 50 FT AGL. THIS MANEUVER HAD BEEN ACCOMPLISHED TWICE ON THE TEST FLT WITHOUT INCIDENT. ON THE THIRD LANDING, THE PLT LATER STATED, THAT HE RETARDED THE THROTTLES MORE BRISKLY THAN ON PREVIOUS APPROACHES. OBSERVERS ON THE PLANE AND ON THE GROUND THEN SAW A YAW AND A WING DROP. THE RIGHT GEAR STRUCK THE RWY FIRST, FOLLOWED BY THE LEFT AND NOSE GEARS. ALL THREE GEAR THEN SHEARED OFF. THE ACFT SLID TO A STOP OFF THE RWY 975 FT FROM INITIAL IMPACT. A POST-ACCIDENT TEARDOWN OF THE PROPS REVEALED NO PREEXISTING MISADJUSTMENTS OR ABNORMALITIES.

S/N 4250001

Probable Cause

Proper descent rate..Not maintained..Pilot in command
Remedial action..Delayed..Pilot in command

Contributing Factors

Design stress limits of aircraft..Exceeded..Pilot in command

Index for May 1985 | Index of Months

++ REQUEST 140/94, REPORT # 184
+++

+ DATA REPORT CESSNA - 425 ACCIDENT +
+ EVENTS | PHASES: LOSS OF CONTROL | FINAL APPROACH
+
+ HARD LANDING | LEVEL OFF/TOUCHDOWN +
+ COMPLETE GEAR COLLAPSED/RETRACTED | LANDING ROLL
+

++
++++++++++++++++++++++++++++++++++
++

<--------------- O P E R A T I O N ---------------> ++ <---------------- F I L E D A T A ----------------
TYPE : MISCELLANEOUS - TEST/EXPERIMENTAL ++ ICAO FILE : 85/0186-0
++ FROM STATE : UNITED STATES
++

<-------------------- W H E N --------------------> ++ <------------ A I R C R A F T D A T A ------------
DATE : 85-05-29 ++ MASS CATEGORY : 2251 - 5700 KG
TIME : 18:28 ++ STATE OF REGISTRY : UNITED STATES
LIGHT : DAYLIGHT ++ REGISTRATION : N2079A
++

<------------------ W H E R E ------------------> ++ <-------- DAMAGE, INJURY AND TOTAL ON BOARD -------->
LOCATION : DAYTON,OH ++ A/C DAMAGE : SUBSTANTIAL
STATE/AREA : UNITED STATES ++ INJURY : FATAL SERIOUS MINOR NONE UNKNOWN TOTAL
DEPARTED : DAYTON,OH ++ CREW : 0 1 0 0 0 1
DESTINATION : DAYTON,OH ++ PAX : 0 0 0 3 0 3
OTHER DAMAGE : NO

THE A/C CRASH LANDED AT DAYTON INTL A/P DURING A FLIGHT TEST. WEATHER: VMC. DRN: THE A/C WAS CONFIGURED WITH FOUR-BLADE PROPELLERS. IT WAS ON A TEST FLIG TO DETERMINE HANDLING CHARACTERISTICS FOLLOWING A THROTTLE CUT TO IDLE POWER AT 50 FT AGL. ON THE THI LANDING, THE PILOT RETARDED THE THROTTLES MORE BRISKLY THAN PREVIOUSLY; THE A/C YAWED AND THE WING DROPPED. A GEARS SHEARED OFF AFTER STRIKING THE GROUND. NO MISADJUSTMENT OR ABNORMALITY FOUND WITH THE PROPELLERS.

--------------- E V E N T S A N D F A C T O R S ---------------

1. EVENT | PHASE: LOSS OF CONTROL | FINAL APPROACH
   FACTORS: RATE OF DESCENT -NOT MAINTAINED
   : RECOVERY/REMEDIAL ACTION -DELAYED
2. EVENT | PHASE: HARD LANDING | LEVEL OFF/TOUCHDOWN
3. EVENT | PHASE: COMPLETE GEAR COLLAPSED/RETRACTED | LANDING ROLL
   FACTORS: LANDING GEAR -OVERLOAD FAILURE

July 24, 1985

SEASTAR

2 ENG Turbine Seaplane
Amphibian

7-24-85

DATA REPORT — DORNIER-SEASTAR — ACCIDENT

EVENTS|PHASES — WHEELS-DOWN LANDING ON WATER-LEVEL OFF/TOUCHDOWN
NOSE DOWN/OVERTURNED-LEVEL OFF/TOUCHDOWN

<------------------------ SECTION - 00 ------------------------>

FILING INFORMATION
ICAO FILE NUMBER : 85 / 0159 - 0
- STATE REPORTING : GERMANY
- STATE FILE NUMBER : 3X0317

WHERE
- STATE/AREA : GERMANY
- LOCATION : FRIEDRICHSHAFEN

WHEN
- DATE : 85-7-24
- TIME : 14:45

AIRCRAFT
REGISTRATION : D-ICDS
STATE OF REGISTRY : GERMANY
OPERATOR : SEASTAR GMBH

<------------------- 01 - HISTORY OF FLIGHT ------------------->

GENERAL AVIATION
- TYPE OF OPERATION : MISCELLANEOUS - TEST/EXPERIMENTAL
- TYPE OF OPERATOR : OTHER

ITINERARY
DEPARTURE POINT : FRIEDRICHSHAFEN
PLANNED DESTINATION : FRIEDRICHSHAFEN

ATC INFORMATION
- TYPE OF FLIGHT PLAN : NONE

ED/PRECAUTIONARY LANDING
YPE OF : FORCED LANDING
OCATION : ON WATER

<----------------- 02 - INJURIES TO PERSONS ----------------->

HIGHEST DEGREE OF INJURY: NONE

NUMBER OF PERSONS INVOLVED

	FATAL	SERIOUS	MINOR	NONE	UNKNOWN	TOTAL
PILOT	0	0	0	1	0	1
FL.CREW	0	0	0	1	0	1
CREW (TOT)	0	0	0	2	0	2
PAX	0	0	0	0	0	0
GROUND						

<--------------------- 03/04 - DAMAGE --------------------->

- TO AIRCRAFT : SUBSTANTIAL

<---------------------- 05 - PERSONNEL ---------------------->

PERSON AT CONTROLS : PILOT-IN-COMMAND

PILOT-IN-COMMAND
- AGE : 58
- SEX :

LICENCE
- TYPE (AEROPLANE) : COMMERCIAL PILOT
- MEDICAL VALIDITY : VALID/WITH MEDICAL WAIVERS
- CLASS/TYPE RATINGS : HELD REQUIRED RATING
- INSTRUMENT RATING : YES
- INSTRUCTOR RATING : YES

FLYING EXPERIENCE

	LAST 24 H	LAST 90 DAYS	TOTAL
THIS TYPE :			84
ALL TYPES :			8000

<---------------------- 06 - AIRCRAFT ---------------------->

GENERAL
- YEAR OF MANUFACTURE :
- SERIAL NUMBER : 001
- TOTAL TIME : 84

DOCUMENTATION

DESCRIPTION OF AIRCRAFT
- TYPE : FIXED WING
- TYPE OF POWER : TURBOPROP
- TYPE OF LDNG GEAR :

ENGINE INFORMATION
- MANUFACTURER :
- MODEL (GENERAL) :
(SPECIFIC :

<------------------- 07 - METEOROLOGICAL ------------------->

BRIEFING AND FORECAST

GENERAL
- PHASE OF FLIGHT TO WHICH THE METEOROLOGICAL INFORMATION PERTAINS:
- GENERAL WEATHER : VMC
- LIGHT CONDITIONS : DAYLIGHT
- VISIBILITY : METRES
- VISIBILITY RESTRICTED BY : NONE

CLOUDS
- SKY CONDITION : CLEAR/NO CLOUD
- CEILING : METRES

PRECIPITATION/OTHER WEATHER PHENOMENA
- TYPE OF :
- INTENSITY :

TEMPERATURE : DEGREES

ICING
- INTENSITY :

TURBULENCE
- TYPE :
- INTENSITY :

WIND INFORMATION FOR TAKE-OFF/LANDING OCCURRENCES
- RELATIVE DIRECTION :
- CROSS WIND COMP. : M/S
- WINDSHEAR/MICRO BURST :

<------------------- 08 - AIDS TO NAVIGATION ----------------->

EN-ROUTE AIDS
- AIDS USED :

LANDING AIDS USED
- ELETRONIC AIDS :

- APPROACH LIGHTING :
- STROBE LIGHTS :
- TYPE OF VASI USED :

<--------------- 09 - AIR-GROUND COMMUNICATION --------------->

LAST GROUND STATION IN CONTACT WITH THE A/C
:
RECORDING OF COMMUNICATION AVAILABLE
:

<---------------------- 10 - AERODROME ---------------------->

GENERAL
- NAME :
- LOCATION INDICATOR :
- TYPE :
- ELEVATION : METRES

RUNWAY IN USE
- IDENTIFIER :
- AVAILABLE LENGTH : METRES
- AVAILABLE WIDTH : METRES
- LENGTH OF OVERRUN : METRES
- SLOPE :

RUNWAY SURFACE
- TYPE :
- SURFACE TYPE :
- SURFACE TREATMENT :
- BRAKING ACTION :
DETERMINED BY :

AERODROME LIGHTING
- RUNWAY
EDGE/END/THRESHOLD :
CENTRE LINE :
TOUCHDOWN ZONE :

- TAXIWAY
EDGE :
CENTRE LINE :
HOLDING POSITION :

- STOPWAY LIGHTING :
- STOP BARS (LIGHTS) :

CATEGORY OF RUNWAY USED

HELIPORT/HELICOPTER LANDING AREA
- TYPE :
- SURFACE TYPE :
- SITE CONFIGURATION :

WATER LANDING AREA CONDITION
- WATER CONDITION :
- WAVE HEIGHT :
- LANDING/TAKE-OFF DIRECTION RELATIVE TO SWELL
:
- OBTSRUCTIONS :

<------------------ 11 - FLIGHT RECORDERS ------------------>

FLIGHT DATA RECORDER
- LOCATION :
- TYPE :
- RECORDING MEDIUM :
- NR OF PARAMETERS :
- UNDERWATER LOCATOR BEACON
:
- RECOVERY OF RECORDER
:
- RECOVERY OF DATA :
- REASON FOR DATA LOSS
:
- USEFULLNESS OF THE RECOVERED DATA

COCKPIT VOICE RECORDER

- LOCATION :
- TYPE OF MEDIUM :
- NR OF CHANNELS :
- DURATION OF REC. : MINUTES
- HOT MIC INSTALLED :
- RECORDER RECOVERED :
- UNDERWATER LOCATOR BEACON
- QUALITY OF REC. :
- REASON WHY THE RECORDING WAS NOT RECOVERED
:

<----------------- 12 - WRECKAGE AND IMPACT ----------------->

LOCATION OF WRECKAGE
- GENERAL : ON AERODROME/AIRSTRIP
- SPECIFIC :
IN RELATION TO THE THRESHOLD
- DISTANCE : METRES
- BEARING : DEGREES

AIRCRAFT LEFT THE RUNWAY
- DIRECTION :
- DISTANCE : METRES

INFORMATION ON THE TERRAIN WHERE THE A/C CAME TO REST
- TYPE : WATER
- SURFACE TYPE :

- ELEVATION : METRES
- DEPTH OF WATER : METRES

GROUND IMPACT INFORMATION
- SPEED AT IMPACT : KM/H
- ESTIMATED SPEED :
- RATE OF DESCENT :
- IMPACT ANGLE :
- ROLL ATTITUDE :
- PITCH ATTITUDE :
- A/C BREAKUP :

RECOVERY OF THE WRECKAGE
- RECOVERED : COMPLETE

<------------ 13 - MEDICAL/PATHOLOGICAL ------------>

INCAPACITATION
- PERSONS INCAPACITATED
:

- TYPE OF :
- REASONS FOR :

AUTOPSY
- PERFORMED ON :

------------ 14 - FIRE ------------>

FIRE STARTED
- WHEN :
- FUEL SOURCE :
- SOURCE OF IGNITION :
- INITIAL LOCATION :

FIRE WARNING SYSTEM
- INSTALLATION :
- OPERATION :

OTHER FIRE WARNING RECEIVED
:

AIRCRAFT FIRE SUPPRESSION SYSTEMS
- INSTALLATION :
- EFFECTIVENESS :
- WHICH SYSTEM USED :
- EXTINGUISHANT USED :

SMOKE PROTECTION
- FLIGHT CREW :

AERODROME RESCUE AND FIRE FIGHTING OPERATIONS

- AVAILABILITY :
- TIME BETWEEN INITIAL CALL AND FIRST INTERVENTION
: MINUTES
- EFFECTIVENESS :
- REASONS FOR INEFFECTIVENESS OF RESCUE/FIRE FIGHTING

EXTINGUISHANT AGENT USED
- PRINCIPLE TYPE :
- AMOUNT OF WATER : LITRES

FUEL FIRE
- QUANTITY ON BOARD : LITRES
- TYPE OF FUEL :

DANGEROUS GOODS
- INVOLVED :

<------------ 15 - SURVIVAL ASPECTS ------------>

SEARCH AND RESCUE
- SEARCH METHOD :

- SEARCH SUCCESS :
- SEARCH DIFFICULTIES:

- TIME TO LOCATE A/C : DAYS HOURS
- METHOD OF LOCATING :
- ELT EFFECTIVENESS :

SURVIVABILITY OF THE OCCURRENCE
- GENERAL :

NUMBER OF FATAL INJURIES FROM SPECIAL CAUSES
- IMPACT :
- BURNS :
- FUMES/GASES :
- SHOCK/EXPOSURE :
- DROWNING :
- OTHER REASONS :
- UNKNOWN CAUSES :

NUMBER OF NON-FATAL INJURIES FROM SPECIAL CAUSES
- IMPACT :
- BURNS :
- FUMES/GASES :
- SHOCK/EXPOSURE :
- OTHER CAUSES :
- UNKNOWN CAUSES :

EVACUATION
- NUMBER OF PERSONS EVACUATED/ESCAPED
:
- EVACUATION TIME : MINUTES SECONDS
- EVACUATION HAMPERED BY
:

EVACUATION SLIDES/CHUTES
- INSTALLED :
- EFFECTIVENESS :

- REASON NOT EFFECTV.:

EMERGENCY LIGHTING
- INSTALLATION :
- OPERATION :

RESTRAINT SYSTEMS
- PILOT :
- CO-PILOT :
- PASSENGER :
- NR OF FAILURES :

SEATS
- NR OF FAILURES :

<------------------- 17 - MID-AIR COLLISION ------------------->

INFORMATION RELATED TO THE FLIGHT PATH
- SPEED : KM/H
- BANK ANGLE :
- DIRECTION OF BANK :
- VERTICAL MOVEMENT :

VISIBILITY
- RESTRICTIONS :

[redacted]SE OF LIGHTING :

- OTHER A/C SIGHTED :

ATC INFORMATION
- WARNING ISSUED :
- TRAFFIC ADVISORY :
- RADAR CONTACT :

OTHER
- EVASIVE ACTION :
- A/C LANDED SAFELY :
- MILITARY INVOLVED :
- OTHER A/C REGISTR. :

NEAR MIDAIR COLLISION - CLOSEST DISTANCE
- HORIZONTAL : METRES
- VERTICAL : METRES

N A R R A T I V E

THE AMPHIBIAN A/C LANDED ON THE WATER WITH THE LANDING GEAR EXTENDED.
DRN: FOLLOWING FLIGHT TESTS, THE ELECTRICAL SYSTEM FAILED WHEN THE GEAR WAS DOWN. THE CREW BELIEVED THAT THE GEAR WAS UP AND THAT IT COULD NOT BE LOWERED. ACCORDINGLY, IT WAS DECIDED TO LAND ON THE WATER. THE A/C NOSED OVER.
AFTER THE ELECTRIC FAILURE, THE PILOT HAD NO IDEA OF THE GEAR POSITION AND THE RADIOS DID NOT WORK. ALTHOUGH THE FLIGHT MANUAL SPECIFIES FOR ELECTRIC FAILURE, THAT GEAR EXTENSION CAN ONLY BE DONE WITH THE EMERGENCY SYSTEM, THE PILOT THOUGHT THAT THE PROBLEM WAS NON-ELECTRICAL WHEN HE NOTICED HIGH SYSTEM PRESSURE IN USING THE HAND PUMP.

S E Q E N C E O F E V E N T S

EVENT 1 WHEELS-DOWN LANDING ON WATER - LEVEL OFF/TOUCHDOWN
1.ELECTRICAL POWER - ELECTRICAL FAILURE

++ REQUEST 140/94, REPORT # 185
++

+ DATA REPORT DORNIER - SEASTAR ACCIDENT +
+ EVENTS | PHASES: WHEELS-DOWN LANDING ON WATER | LEVEL OFF/TOUCHDOWN
+
+ NOSE DOWN/OVERTURNED | LEVEL OFF/TOUCHDOWN
+

++
+++++++++++++++++++++++++++++++++++
++

<--------------- OPERATION ---------------> ++ <--------------- FILE DATA ---------------

TYPE : MISCELLANEOUS - TEST/EXPERIMENTAL ++ ICAO FILE : 85/0159-0
++ FROM STATE : GERMANY
++

<-------------------- WHEN --------------------> ++ <------------ AIRCRAFT DATA ------------

DATE : 85-07-24 ++ MASS CATEGORY : 2251 - 5700 KG
TIME : 14:45 ++ STATE OF REGISTRY : GERMANY
LIGHT : DAYLIGHT ++ REGISTRATION : D-ICDS
++

<------------------- WHERE -------------------> ++ <-------- DAMAGE, INJURY AND TOTAL ON BOARD -------->

LOCATION : NEAR FRIEDRICHSHAFEN ++ A/C DAMAGE : SUBSTANTIAL
STATE/AREA : GERMANY ++ INJURY : FATAL SERIOUS MINOR NONE UNKNOWN TOTAL
DEPARTED : FRIEDRICHSHAFEN ++ CREW : 0 0 0 2 0 2
DESTINATION : FRIEDRICHSHAFEN ++ PAX : 0 0 0 0 0 0
OTHER DAMAGE :

THE AMPHIBIAN A/C LANDED ON THE WATER WITH THE LANDING GEAR EXTENDED.

DRN: FOLLOWING FLIGHT TESTS, THE ELECTRICAL SYSTEM FAILED WHEN THE GEAR WAS DOWN. THE CREW BELIEVED THAT THE GEAR
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PILOT THOUGHT THAT THE PROBLEM WAS NON-ELECTRICAL WHEN HE NOTICED HIGH SYSTE PRESSURE IN USING THE HAND PUMP.

--------------- EVENTS AND FACTORS ---------------

1. EVENT | PHASE: WHEELS-DOWN LANDING ON WATER | LEVEL OFF/TOUCHDOWN
FACTORS: ELECTRICAL POWER -ELECTRICAL FAILURE
: FLIGHT CREW DECISIONS -INADEQUATE
: INSTRUCTION (NOT ATC) -MISINTERPRETED
: FLIGHT CREW PROCEDURES -NOT FOLLOWED
PILOT -AIRMANSHIP -POOR
2. EVENT | PHASE: NOSE DOWN/OVERTURNED | LEVEL OFF/TOUCHDOWN

(11)

Bundesstelle für Flugunfalluntersuchung
Hermann-Blenk-Straße 16
D-38108 Braunschweig

Datensatz

Unfall eines deutschen Lfz. im Inland
ohne Verletzte

Luftfahrzeugart	: Flugzeug
Luftfahrzeughersteller	: Dornier
Muster/Typ	: CD01
Eintragungsstaat	: Deutschland
Datum der Störung	: ~~24/07/1985~~
Uhrzeit der Störung	: 14.45 Uhr
Störungsort	: nahe Friedrichshafen
Regierungsbezirk/Staat	: Tübingen (BW)

1.0 Tatsachenermittlung

1.1 Flugverlauf

Betriebsart - Allgemeine Luftfahrt	: verschiedene Betriebsarten
	: - Versuchs-, Forschungs-, Erprobungsflug
Art des Halters - Allgm. Luftfahrt	: Hersteller
FS-Flugplan/Freigabe	: ohne Flugplan
Letzter Abflugort	: FRIEDRICHSHAFEN
Zielort	: FRIEDRICHSHAFEN
Betriebsphase	: Landephase
	: - Abfangen/Aufsetzen
1. Art der Störung	: Wasserung mit ausgefahrenem Fahrwerk
2. Art der Störung	: Kopfstand/Überschlag
Art der Notlage	: vermutete technische Störung am Luftfahrzeug

1.2 Personenschäden

keine Verletzten

1.3 Schaden am Luftfahrzeug

Luftfahrzeug	: schwer beschädigt

1.4 Sachschaden Dritter

keiner

1.5 Angaben zur Besatzung

Luftfahrzeugführer am Steuer	: verantwortlicher Luftfahrzeugführer

Verantwortlicher Luftfahrzeugführer

Lebensalter	: 58 Jahre
Erlaubnis	: Berufsluftfahrzeugführer

...

(12)

Luftfahrerschein - erstmal.Ausstllg	Bayern
- Jahr der Ausstellung	67
Gültigkeit der Erlaubnis	am Unfalltage gültig
Berechtigungen - Kategorie u.Klasse	einmot. See/Amphib.-Flugzeuge - bis 5700 kg
Musterberechtigung	erforderliche Berechtigung vorhanden
Sonstige Berechtigungen	Testflug-Berechtigung
Gültigkeit der maßgebl. Berechtig.	Berechtigung gültig

Gesamtflugerfahrung	8000 Stunden
Flugerfahrung auf dem Muster	84 Stunden
Landungen auf dem Muster	
- Gesamt	51 bis 100
- in den letzten 90 Tagen	21 bis 25
Fliegerärztl. Tauglichkeitsklasse	tauglich mit Auflagen und Beschränkungen

1.6 Angaben zum Luftfahrzeug

Luftfahrzeughersteller	Dornier
Muster/Typ	CD01
Luftfahrzeug-Werknummer	001
Luftfahrzeugart	Flugzeug
Flugmasse	über 2 000 kg - 5 700 kg
Fluggewicht	innerhalb der zulässigen Grenzen
Schwerpunktlage	innerhalb der zulässigen Grenzen
Fahrwerksart	einziehbares Bugradfahrwerk
Anzahl der Triebwerke	zwei Triebwerke
Triebwerksart	Propellerturbinentriebwerk
Gesamt-Betriebszeit des Lfz.	84 Stunden

1.7 Meteorologische Informationen

Lichtverhältnisse	Tageslicht
Windrichtung	240 Grad
Windgeschwindigkeit	5 kt
Sicht am Boden	mehr als 10 km
Örtliche Sichtbehinderung	keine
Bewölkung	wolkenlos
Haupwolkenuntergrenze	keine
Niederschlag	keiner
Flugwetterbedingungen	Sichtwetterbedingungen

1.8 Navigationshilfen

1.9 Funkverkehr

Sprechfunkverbindg.m.Bodenfunkstel.	ja
Bodenfunkstelle	Luftaufsicht/Flugleitung
Aufzeichnung des Sprechfunkverkehrs	zur Verfügung stehend
	Umschrift gefertigt
Aufzeichnung d. Gegensprechverkehrs	zur Verfügung stehend

1.10 Angaben zum Flugplatz

Name des Flugplatzes	BODENSEE
Flugplatzart	sonstige
Höhe des Flugplatzes	1900 Fuß
Bahnart - Start- und Landebahn	sonstige

...

(13)

S/L-Bahn - Richtung : 24

1.11 Flugschreiber

1.12 Angaben über Wrack und Aufprall

Geländeart - Oberflächenzustand : glattes Wasser

1.13 Medizinische und pathologische Angaben

1.14 Brand

Entstehung/Fortsetzung des Brandes : Brand nicht entstanden

1.15 Überlebensmöglichkeiten

2.0 Auswertung

Von den möglichen Ursachen sind ermittelt
: Bordsysteme durch
: - Aussage des verantw. Lfzf. / des Halters
: - Flugwegrekonstruktion / Spuren am Boden
: verantwortlicher Luftfahrzeugführer durch
: - Aussage des verantw. Lfzf. / des Halters
: - Zeugenaussagen
: - Befund am Luftfahrzeug
: - Gutachten und/oder Versuche

3.0 Schlußfolgerungen

Betriebsphase
: Landephase
: - Abfangen/Aufsetzen

1. Art der Störung
: Wasserung mit ausgefahrenem Fahrwerk

Ursachen
- der 1. Störungsart
: Systeme
: elektrische Anlage
: - sonstige
: - Ausfall der elektrischen Stromversorgung

- beider Störungsarten
: verantwortlicher Luftfahrzeugführer
: - Fehlentscheidung oder -planung im Flug
: - Informationen falsch interpretiert
: verantwortlicher Luftfahrzeugführer
: - vorgeschriebene Verfahren, Richtlinien, Anweisungen nicht befolgt
: - Betriebsvorschriften/-gepflogenheiten nicht beachtet

Bemerkungen:
BEI DER DURCHF. DES NOTVERF.HAETTE DIE BESATZ. ERKENNEN KOENNEN, DASS DIE FAHRWERKE AUSGEFAHREN WAREN U. SOMIT EINE NORMALE LANDUNG MOEGLICH WAR

...

(14)

4.0 Empfehlungen

keine

Verteiler	: Bundesminister für Verkehr
	: Luftfahrt-Bundesamt Abt. Technik, Betrieb und Gruppe Recht
	: Deutsche Flugsicherung GmbH
	: Baden-Württemberg - Ministerium für Wirtschaft Mittelstand und Verkehr
	: Bayerisches Staatsministerium für Wirtschaft und Verkehr
	: International Civil Aviation Organization
	: Staatsanwaltschaft
	: Deutscher Aero-Club

Braunschweig, den 17/10/1985

gez. (Büttner)

Bundesstelle für Flugunfalluntersuchung
Hermann-Blenk-Straße 16
D-38108 Braunschweig

(15)

Datensatz

Unfall eines deutschen Lfz. im Inland
ohne Verletzte

Luftfahrzeugart	:	Flugzeug
Luftfahrzeughersteller	:	DASA
Muster/Typ	:	FR06
Eintragungsstaat	:	Deutschland
Datum der Störung	:	29/04/1993
Uhrzeit der Störung	:	17.10 Uhr
Störungsort Location	:	Manching
Regierungsbezirk/Staat	:	Oberbayern (BY)

1.0 Tatsachenermittlung

1.1 Flugverlauf

Betriebsart - Allgemeine Luftfahrt	:	verschiedene Betriebsarten
	:	- Versuchs-, Forschungs-, Erprobungsflug
Art des Halters - Allgm. Luftfahrt	:	Hersteller
FS-Flugplan/Freigabe	:	ohne Flugplan
Letzter Abflugort	:	Manching
Zielort	:	Manching
1. Betriebsphase	:	Flugphase
	:	- Reiseflug
1. Art der Störung	:	Ausfall der Fahrwerksanlage, ATA 32
2. Betriebsphase	:	Landephase
	:	- Abfangen/Aufsetzen
2. Art der Störung	:	Landung mit nicht/teilw. ausgefahrenem Fahrw.
Art der Notlage	:	vermutete oder bemerkte Schäden am Lfz.
	:	Fahrwerkfehlfunktion
Notlandung / Vorsorgliche Landung	:	Notlandung auf einem Flugplatz
Geschwindigkeit bei Störungsbeginn	:	375 kt
Flughöhe bei Eintritt der Störung	:	20000 Fuß ü.NN

1.2 Personenschäden

keine Verletzten

1.3 Schaden am Luftfahrzeug

Luftfahrzeug : schwer beschädigt

1.4 Sachschaden Dritter

keiner

...

5/28/1986

NTSB Identification: FTW86FPA18 For details, refer to NTSB microfiche number 31006A

Accident occurred MAY-28-86 at HOWE, TX
Aircraft: EAGLE AIRCRAFT CO. EAGLE DW-1, registration: N8814G
Injuries: 1 Fatal.

THE ACFT APPEARED TO STALL DURING A SHARP PULL-UP AND TURN DURING A TEST FLT AFTER A LOW PASS OVER THE AIRSTRIP. THE PLT WAS TESTING THE SPRAY EQUIPMENT AND MADE THE LOW PASS SO THE GROUND OBSERVER COULD SEE THE SPRAY PATTERN. NO MALFUNCTIONS IN EQUIPMENT WERE FOUND DURING A POST-ACC INVESTIGATION. THE ACFT HAD CONTACTED THE GROUND IN A STEEP NOSE DOWN ATTITUDE.

Probable Cause

Low pass..Performed..Pilot in command
Maneuver..Excessive..Pilot in command
Stall..Inadvertent..Pilot in command
Altitude..Inadequate..Pilot in command

Index for May 1986 | Index of Months □□□□□

++ REQUEST 140/94, REPORT # 192
++

+ DATA REPORT EAGLE - DW-1 ACCIDENT +
+ EVENTS | PHASES: MUSH/STALL | MANOEUVRING
+ COLLISION WITH LEVEL TERRAIN/WATER | EMERGENCY/UNCONTROLLED DESCENT +

++

++
<---------------- O P E R A T I O N ----------------> ++ <---------------- F I L E D A T A ----------------
TYPE : MISCELLANEOUS - TEST/EXPERIMENTAL ++ ICAO FILE : 86/1094-0
++ FROM STATE : UNITED STATES
++
<------------------- W H E N -------------------> ++ <------------ A I R C R A F T D A T A ------------
DATE : 86-05-28 ++ MASS CATEGORY : 2251 - 5700 KG
TIME : 14:50 ++ STATE OF REGISTRY : UNITED STATES
LIGHT : DAYLIGHT ++ REGISTRATION : N8814G
++
<------------------- W H E R E -------------------> ++ <-------- DAMAGE, INJURY AND TOTAL ON BOARD -------->
LOCATION : HOWE,TX ++ A/C DAMAGE : SUBSTANTIAL
STATE/AREA : UNITED STATES ++ INJURY : FATAL SERIOUS MINOR NONE UNKNOWN TOTAL
DEPARTED : ++ CREW : 1 0 0 0 0 1
DESTINATION : HOWE,TX ++ PAX : 0 0 0 0 0 0
OTHER DAMAGE :

DRN: THE A/C STRUCK THE GROUND IN A NOSE LOW ATTITUDE, FOLLOWING A STALL IN PULL-UP AND TURN DURING A TEST
FLIGHT. THE PILOT WAS TESTING THE SPRAY EQUIPMENT AND MADE A LOW PASS SO A GROUND OBSERVER COULD SEE THE SPRAY
PATTERN. NO FAILURES WERE FOUND.

---------------- E V E N T S A N D F A C T O R S ----------------

1. EVENT | PHASE: MUSH/STALL | MANOEUVRING
FACTORS: LOW FLYING -PERFORMED
: FLIGHT CREW A/C HANDLING -INADEQUATE
: STALL -INADVERTENT
: ALTITUDE -INADEQUATE

2. EVENT | PHASE: COLLISION WITH LEVEL TERRAIN/WATER | EMERGENCY/UNCONTROLLED DESCENT

07/01/1986

Published on 07/12/1988, SEATTLE POST-INTELLIGENCER

SECRECY CLOAKS MILITARY AIR CRASH

A mysterious Air Force plane crashed in Sequoia National Forest early yesterday, killing the pilot, igniting a 150-acre brush fire and triggering a cordon of Air Force secrecy.

The Air Force refused to say what type of airplane crashed or whether it was an experimental craft from the flight test center at Edwards Air Force Base, about 80 miles southeast of the crash site.

Your search terms appear 9 times in this article.

Complete Article, 605 words ($1.95 to download)

Published on 07/03/1988, SEATTLE POST-INTELLIGENCER

A BRITISH JET CRASHES IN LAST TEST

The only prototype of Britain's new Hawk 200 jet fighter crashed during its final test flight yesterday, killing its British Aerospace pilot, the company said.

The $12 million aircraft was to have been presented to the public today.

Your search terms appear 6 times in this article.

Complete Article, 273 words ($1.95 to download)

Published on 07/02/1986, SEATTLE POST-INTELLIGENCER

FLIER KILLED IN CRASH OF 'BLIMP'

An experimental 343-foot-long airship made from a blimp and parts of four helicopters caught fire and crashed yesterday during a test flight at a Naval center here, killing one of five crew members aboard.

The aircraft, known as the Heli-Stat, crashed at 7 p.m. at the U.S. Naval Air Engineering Center, less than a mile from where the German dirigible Hindenburg caught fire and burned in May 1937, killing 36 people, said Nick Grand, public information officer at the center.

Your search terms appear 7 times in this article.

Complete Article, 299 words ($1.95 to download)

7-1-86

NTSB Identification: NYC86FHD01 For details, refer to NTSB microfiche number **32618A**

Accident occurred JUL-01-86 at LAKEHURST, NJ
Aircraft: PIASECKI HELISTAT 97-34J, registration: N1897Z
Injuries: 1 Fatal, 3 Serious, 1 Minor.

THE HELISTAT, A HYBRID A/C WITH 4 H-34 MAIN FUSELAGES ATTACHED TO A FRAME ALONG WITH A ZPG-2 HELIUM FILLED ENVELOPE HAD JUST COMPLETED IT FIRST HOVER TEST FLT SUCCESSFULLY AND LANDED. A PWR LOSS WAS NOTED ON THE NO. 3 HELICOPTER AND THE TEST WAS TERMINATED AND THE MOORING MAST CALLED FOR. PRIOR TO RE-MOORING A WIND SHIFT CAUSED AN UNCOMMANDED LEFT TURN WHICH THE PILOT COULD NOT CONTROL WITH THE FLT CONTROLS. WITH A TAILWIND, NO WHEEL BRAKES OR GND STEERING A TAKEOFF WAS ATTEMPTED. THE 4 MAIN LANDING GEAR WHICH HAD NO SHIMMY DAMPNERS STARTED TO SHIMMY. THE FOUR HELICOPTERS STARTED TO REACT TO THE SHIMMY WITH GROUND RESONANCE. AS THE HELISTAT FINALLY LIFTED OFF, THE FOUR INDIVIDUAL HELICOPTERS BROKE OFF AND FELL TO THE GROUND. ONE PILOT RECEIVED FATAL INJURIES, 3 RECEIVED SERIOUS INJURIES AND ONE MINOR INJURIES. THE HELISTAT WAS DESTROYED. THE PRW LOSS ON THE NO. 3 HELICOPTER WAS TRACED TO A MISSING THROTTLE LINKAGE CORRELATION PIN. WHY THE PIN WAS MISSING WAS NOT DETERMINED.

Probable Cause

Throttle/power lever,linkage..Disconnected
Rotorcraft flight control..Inadequate
Acft/equip, inadequate design..Manufacturer
Acft/equip, inadequate handling/perf capabilities..Manufacturer

Contributing Factors

Landing gear,normal brake system..Lack of
Landing gear,steering system..Lack of
Landing gear,main gear..Vibration
Rotor system..Vibration

Index for Jul 1986 | Index of Months □□□□□□□□

++ REQUEST 140/94, REPORT # 193
++

+ DATA REPORT MISCELLANEOUS - EXPERIMENTAL
ACCIDENT +

+ EVENTS | PHASES: MECHANICAL FAILURE -FIRST ENGINE | TAXIING TO/FROM RUNWAY
+

+ LOSS OF CONTROL -OTHER | TAXIING TO/FROM RUNWAY
+

+ AIRCRAFT GENERAL BREAKUP/DISINTEGRATION | INITIAL CLIMB
+

++

++

<---------------- OPERATION ----------------> ++ <---------------- FILE DATA -----------------

TYPE : MISCELLANEOUS - TEST/EXPERIMENTAL ++ ICAO FILE : 86/1191-0
++ FROM STATE : UNITED STATES
++

<-------------------- WHEN --------------------> ++ <------------ AIRCRAFT DATA ------------

DATE : 86-07-01 ++ MASS CATEGORY :
TIME : 19:00 ++ STATE OF REGISTRY : UNITED STATES
LIGHT : DAYLIGHT ++ REGISTRATION : N1897Z
++

<------------------- WHERE -------------------> ++ <-------- DAMAGE, INJURY AND TOTAL ON BOARD -------->

LOCATION : LAKEHURST,NJ ++ A/C DAMAGE : DESTROYED
STATE/AREA : UNITED STATES ++ INJURY : FATAL SERIOUS MINOR NONE UNKNOWN TOTAL
DEPARTED : ++ CREW : 1 3 1 0 0 5
DESTINATION : LAKEHURST,NJ ++ PAX : 0 0 0 0 0 0
OTHER DAMAGE :

DRN: THE HELISTAT, A HYBRID A/C WITH FOUR H-34 MAIN FUSELAGES ATTACHED TO A FRAME ALONG WITH A ZPG-2 HELIUM FILLED ENVELOPE, HAD COMPLETED ITS FIRST HOVER TEST FLIGHT AND LANDED. THE NO. 3 HELICOPTER LOST POWER, THE TEST WAS TERMINATED AND THE MOORING MAST CALLED FOR. A WIND SHIFT CAUSED AN UNCOMMANDED LEFT TURN WHICH THE PILOT COULD NOT CONTROL. WITH NO WHEEL BRAKES OR GROUND STEERING, A T/O WAS ATTEMPTED. ONE MA LANDING GEAR WHICH HAD NO SHIMMY DAMPERS STARTED TO SHIMMY AND THE FOUR HELICOPTERS WENT INTO GROUND RESONANCE. AS THE HELISTAT LIFTED OFF, ALL FOUR HELICOPTERS BROKE OFF AND FELL TO THE GROUND. THE POWER LOSS ON THE NO. 3 HELICOPTER WAS TRACED TO A MISSING THROTTLE LINKAGE CORRELATION PIN. WHY THE PIN WAS MISSING WAS NOT DETERMINED.

---------------- EVENTS AND FACTORS ----------------

1. EVENT | PHASE: MECHANICAL FAILURE -FIRST ENGINE | TAXIING TO/FROM RUNWAY
   FACTORS: THROTTLE -DISCONNECTED
2. EVENT | PHASE: LOSS OF CONTROL -OTHER | TAXIING TO/FROM RUNWAY
   FACTORS: HELICOPT CONTROL SYSTEMS -INADEQUATE

07/02/1986

Published on 07/12/1986, SEATTLE POST-INTELLIGENCER

SECRECY CLOAKS MILITARY AIR CRASH

A mysterious Air Force plane crashed in Sequoia National Forest early yesterday, killing the pilot, igniting a 150-acre brush fire and triggering a cordon of Air Force secrecy.

The Air Force refused to say what type of airplane crashed or whether it was an experimental craft from the flight test center at Edwards Air Force Base, about 80 miles southeast of the crash site.

Your search terms appear 9 times in this article.

Complete Article, 605 words ($1.95 to download)

Published on 07/03/1986, SEATTLE POST-INTELLIGENCER

A BRITISH JET CRASHES IN LAST TEST

The only prototype of Britain's new Hawk 200 jet fighter crashed during its final test flight yesterday, killing its British Aerospace pilot, the company said.

The $12 million aircraft was to have been presented to the public today.

Your search terms appear 6 times in this article.

Complete Article, 273 words ($1.95 to download)

Published on 07/02/1986, SEATTLE POST-INTELLIGENCER

FLIER KILLED IN CRASH OF 'BLIMP'

An experimental 343-foot-long airship made from a blimp and parts of four helicopters caught fire and crashed yesterday during a test flight at a Naval center here, killing one of five crew members aboard.

The aircraft, known as the Heli-Stat, crashed at 7 p.m. at the U.S. Naval Air Engineering Center, less than a mile from where the German dirigible Hindenburg caught fire and burned in May 1937, killing 36 people, said Nick Grand, public information officer at the center.

Your search terms appear 7 times in this article.

Complete Article, 299 words ($1.95 to download)

07/31/1987

7/31/87

AviationSafetyNetwork

The AviationSafety Network

Accident Description

- Home
- Accident reports
- Accident specials
- Airline safety
- CVR / FDR
- Database
- Mailing list
- News
- Other sites
- Pictures
- Publications
- Safety issues
- Statistics
- Forum
- Guestbook
- E-mail
- About ASN

Incident description

Date:	**31.07.1987**
Type:	Fokker 100
Operator:	Fokker
Registration:	PH-MKH
C/n:	11242
Year built:	
Crew:	0 fatalities / 12 on board
Passengers:	0 fatalities / 0 on board
Total:	0 fatalities / 12 on board
Location:	Amsterdam-Schiphol APT (Netherlands)
Phase:	Landing
Nature:	Test
Flight:	Amsterdam-Schiphol APT - Amsterdam-Schiphol APT (Flightnumber)

Remarks:
The right hand maingear collaped on landing following a high-speed (300km/h) touchdown. No injuries among the 12 crewmembers. The aircraft involved was one of the Fokker 100 prototype aircraft.
Following this accident the torque-links of the maingear legs were lengthened to combat the problem.

Source: (also check out sources used for every accident)

[legenda] [disclaimer]

11/04/1988

11/04/88 ✓

NTSB AVIATION ACCIDENT/INCIDENT DATABASE REPORT
Report Number: LAX89LA035
microfishe 38428

General Information
Fri
Local Date:Time: 11/04/1988:08:00MST
City: CHANDLER, AZ
Airport Name/ID:
Event Type: ACCIDENT
Injury Severity: SERIOUS
Operations Information
Category of Operation: GENERAL AVIATION
Aircraft Type: AIRPLANE
Aircraft Damage: DESTROYED
Phase of Flight: 580 MANEUVERING
Aircraft Make/Model: CESSNA CE-152-XXX
Operator Doing Business As: VENTURE AVAITION
Operator Name: GLAZAR, RICHARD
Operator Code:
Owner Name: RICHARD GLAZAR

Narrative
THE PILOT LOST CONTROL AND COLLIDED WITH THE RUNWAY WHILE MA NEUVERING FOR LANDING. THE PILOT AND PASSENGER WERE TESTING ATMOSPHERIC CONDITIONS WITH METEOROLOGICAL EQUIPMENT IN CONJUNCTION WITH NOISE TESTING OF A BOEING "HUSH" KIT. THE CESSNA TOOKOFF HEADING SE. IT CLIMBED TO 800 FT AGL AND BEGAN DOING DESCENDING RIGHT-HAND TURNS OVER AN UNIDENTIFIED OBJECT ON THE GROUND. AFTER DESCENDING TO ABOUT 50 FT AGL, THE CESSNA CLIMBED TO ABOUT 100 FT AGL. AT THIS POINT THE PILOT ATTEMPTED TO ALIGN THE AIRCRAFT WITH THE RUNWAY. HEADING SE CROSSING OVER THE RUNWAY AT AN ANGLE, THE AIRCRAFT WAS TURNED LEFT TO BE ALIGNED WITH THE RUNWAY. DURING THE LEFT-HAND TURN THE AIRCRAFT STALLED AND ENTERED A LEFT-HAND SPIN. THE AIRCRAFT MADE 1/2 TO 3/4 REVOLUTION PRIOR TO MAKING CONTACT WITH THE GROUND. EXAMINATION OF THE AIRCRAFT DID NOT DISCLOSE ANY EVIDENCE OF MECHANICAL FAILURES OR MALFUNCTIONS. THE AIRCRAFT WAS BEING OPERATED IN AN OVERWEIGHT CONDITION.

Probable Cause

Aircraft Information
Number of Seats: 2
Aircraft Use: BUSINESS
Type of Operation: 14 CFR 91
Registration Number: 4657L
Air Carrier Operating Certificates:
Aircraft Fire: NONE

	Injuries			
	Fatal	Serious	Minor	None
Crew	0	1	0	0
Pass	0	1	0	0
Other	0	0	0	0

Landing Gear:	TRICYCLE-FIXED
Certificated Maximum Gross Weight:	1670
Engine Make/Model:	LYCOMING/0-235-N2C
Number of Engines:	1
Engine Type:	RECIPROCATING-CARBURETOR

Environment/Operations Information

Basic Weather Conditions:	VISUAL METEOROLOGICAL CONDITIONS (VMC)
Wind Direction (deg)/Speed (knots):	100/2
Visibility (sm):	30
Visibility RVR (ft):	0
Visibility RVV (sm):	0
Cloud Height Above Ground Level (ft):	0
Visibility Restrictions:	NONE
Precipitation Type:	NONE
Light Condition:	DAYLIGHT
Flight Plan Filed:	NONE
ATC Clearance:	NONE
VFR Approach/Landing:	FULL STOP
Event Location:	ON AIRPORT

Pilot-in-Command

Certificates:	COMMERCIAL, FLIGHT INSTRUCTOR
Ratings:	
Plane:	SINGLE ENGINE LAND, MULTIENGINE LAND
Non-Plane:	NONE
Instrument:	AIRPLANE
Had Current BFR:	YES
Months Since Last BFR:	5
Medical Certificate:	CLASS 2
Medical Certificate Validity:	VALID MEDICAL-NO

WAIVERS/LIMITATIONS

Flight Time (Hours)

Total :	550	Last 24 Hrs :	5
Make/Model :	0	Last 30 Days:	40
Instrument :	0	Last 90 Days:	100
Multi-Engine:	0	Rotorcraft :	0

11/16/1988

11/16/88
[signature]

NTSB AVIATION ACCIDENT/INCIDENT DATABASE REPORT

Report Number: MIA89IA035

Microfishe 37977

General Information

Local Date:Time	11/16/1988:12:25 EST
City, State:	SANFORD, FL
Airport Name/ID	ORLANDO SANFORD/SFB
Event Type:	INCIDENT
Injury Severity:	NONE

Operations Information

Category of Operation:	GENERAL AVIATION
Aircraft Type:	AIRPLANE
Aircraft Damage:	MINOR
Phase of Flight:	LANDING
Aircraft Make/Model:	BOEING B-707-355C
Operator Doing Business As:	
Operator Name:	NMB, SINGAPORE LTD
Operator Code:	
Operator:	
Owner Name:	NMB SINGAPORE LTD

Narrative

THE NON-TYPE RATED FAA FLIGHT TEST ENGINEER EXECUTED A VISUAL APPROACH AND WAS OBSERVED TO BE ERRATIC AND FLYING AT V-REF WHEN HE CHOPPED THE POWER AT 50 FT AGL AND THE AIRCRAFT LANDED HARD. THE INSTRUCTOR PILOT THEN TOOK CONTROL OF THE AIRCRAFT AND EXECUTED A GO-AROUND. AFTER FLIGHT TO THE FINAL DESTINATION MINOR DAMAGE WAS FOUND ON POST FLIGHT INSPECTION.

Probable Cause

Aircraft Information

Number of Seats:	39
Aircraft Use:	
Type of Operation:	14 CFR 91
Registration Number:	707MB
Air Carrier Operating Certificates:	
Aircraft Fire:	NONE

Injuries

	Fatal	Serious	Minor	None
Crew	0	0	0	3
Pass	0	0	0	9
Other	0	0	0	0

Landing Gear:	TRICYCLE-RETRACTABLE
Certificated Maximum Gross Weight:	322300
Engine Make/Model	P & W/JT3D-3C

Number of Engines: 4
Engine Type: TURBO FAN

Environment/Operations Information
Basic Weather Conditions: VISUAL METEOROLOGICAL CONDITIONS (VMC)
Wind Direction (deg)Speed (Knots): 120/10
Visibility (sm): 10
Visibility RVR (ft): 0
Visibility RVV (sm): 0
Cloud Height Above Ground Level (ft): 2500
Visibility Restrictions: NONE
Precipitation Type: NONE
Light Condition: DAYLIGHT
Departure Airport Id: MCO
Departure City: ORLANDO
Departure State: FL
Flight Plan Filed: INSTRUMENT FLIGHT RULES (IFR)
ATC Clearance: IFR
VFR Approach/Landing: TOUCH AND GO
Event Location: ON AIRPORT

Pilot-in-Command
Certificates: COMMERCIAL, AIRLINE TRANSPORT, FLIGHT INSTRUCTOR
Ratings:
Plane: SINGLE ENGINE LAND, MULTIENGINE LAND
Non-Plane: NONE
Instrument: AIRPLANE
Had Current BFR: YES
Months Since Last BFR: 4
Medical Certificate: CLASS 1
Medical Certificate Validity: VALID MEDICAL-WITH WAIVERS/LIMITATIONS

Flight Time (Hours)

Total	34000	Last 24 Hrs	7
Make/Model	12000	Last 30 Days	58
Instrument	12000	Last 90 Days	94
Multi-Engine	27000	Rotorcraft	0

01/09/1989

1-9-89

NTSB Identification: ATL89MA070 For details, refer to NTSB microfiche number **38326A**

Accident occurred JAN-09-89 at WILMINGTON, OH
Aircraft: SWEARINGEN SX-300, registration: N6Y
Injuries: 2 Fatal.

THIS SX-300 (SA-29) WAS A PROOF-OF-CONCEPT ACFT BEING DEMONSTRATED FOR THE USAF AT WRIGHT-PATTERSON AFB. THE ACFT WAS CLEARED TO RESTRICTED AREA R5503 AT 8000 FT FOR A DEMONSTRATION. RADIO COMMUNICATIONS WITH INDIANAPOLIS ARTCC WERE ROUTINE; THERE WERE NO DISTRESS TRANSMISSIONS. ABOUT 7 MINUTES AFTER TAKEOFF THE ACFT WAS INVOLVED IN AN INFLIGHT BREAKUP. THE WRECKAGE PATH WAS ABOUT 1 MILE IN LENGTH WITH THE RT WING 3000 FEET FROM THE MAIN WRECKAGE. THE RT WING LOWER ATTACHMENT FITTING EXHIBITED A FATIGUE AREA WHICH PROGRESSED TO FAILURE FROM A WELD NUGGET NEAR THE INTERSECTION OF TWO WELD BEADS. PRE-EXISTING CRACKS WERE ALSO PRESENT IN THE LUG WELD AREA OF THE LEFT WING UPPER AND LOWER ATTACHMENT FITTINGS. THE ACFT HAD BEEN IN SVC 571 HRS. IT WAS CERTIFIED AS AN EXPERIMENTAL CATEGORY EXHIBITION ACFT. THE DESIGNER HAD STATIC LOAD TESTED THE WINGS TO 6 G'S & SUSPECTED THE ACFT HAD BEEN SUBJECTED TO FLT LOADS APCHG 6 G'S. THE PLT TOLD AN ACQUAINTANCE THAT HE HAD ROUTINELY EXCEEDED THE "RED LINE" BY 85 MPH.

Probable Cause

FATIGUE AND RESULTING FAILURE OF THE RIGHT WING'S LOWER ATTACHMENT FITTING AND INADEQUATE QUALITY CONTROL BY THE SWEARINGEN SX-300 PRODUCTION/DESIGN PERSONNEL.

Index for Jan 1989 | Index of Months □□□□

SX-300 single-engine turboprop (2 think) sport racing plane in new class started 1998

02/02/1989

02/02/1989

Sweden's JAS 39 Gripen Continued . . .

option for 110 aircraft is included with Swedish Air Force plans to ultimately procure 350-400 machines to replace nearly all types, particularly the aging Draken and Viggens, now in their fleet. Export orders are also being sought in an effort to amortize the overall production costs. The aircraft is designed to perform fighter, attack, and reconnaissance roles equally well. The Swedish defense establishment has already begun a restructuring to accommodate the aircraft with a new basing system and a surveillance, command and control system.

Extensive ground testing has already been done. "Testing of the JAS 39 Gripen was begun long before the first flight and many subsystems have been subjected to exhaustive ground tests. The hydraulic system, for example has been operated for a total of 700 hours in the aircraft. The engine has been run for about 4,000 hours on the test bench and more than 40 hours in test aircraft 1," said Milton Moberg, Saab-Scania's vice president of ground and flight test.

A combination of delta wing and adjustable foreplanes (canards) are intended to provide the short-field take-off and landing performance Sweden demands for operations from its highways. The canards improve maneuverability and offers a redundancy of control surfaces so that the aircraft can continue to fly with one or two control surfaces inoperative. The composite wings for the first aircraft were constructed by British Aerospace with the technology to be transferred to Sweden. The wings have a span of 26 ft. and the overall length is 46 ft. Approximately 30% of the aircraft is composed of composites providing a weight savings of 20% over comparable metallic structure. The use of high pressure hydraulics, which require smaller volume of fluid as well as smaller pipe diameters, has allowed an aircraft of only 17,800 lbs.

The Gripen has statically unstable pitch in certain parts of its flight envelope, expected to be supersonic at all altitudes. As a result, the control surfaces can be made smaller and the loads on them are consequently also smaller. The aircraft is more easily maneuvered, although it can be flown only manually. It is, therefore, equipped with an electric control system which, as well as imparting the expected good maneuverability, also allows wide variations in the external armament. The control system has a high degree of built-in safety with three parallel digital systems as well as three analog back-up systems. The new flight control system has been tested in over 1000 hours of simulation. The major subsystems consisting of more than 30 computers are connected by data buses. The central system computer developed by Ericsson uses software from Saab. This allows a high degree of flexibility and far-reaching development potential.

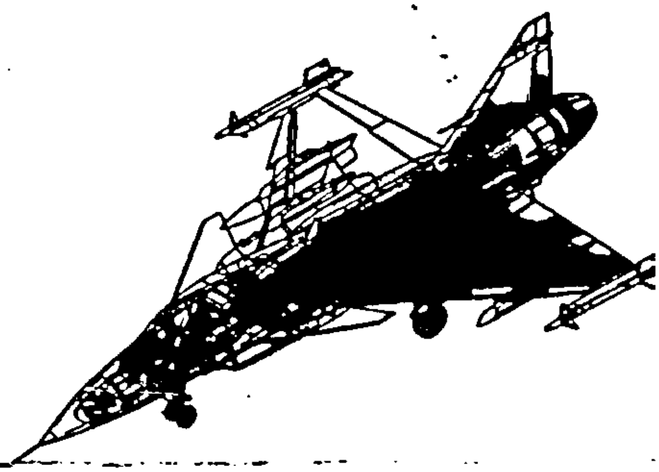
The 17,800 lb. thrust, afterburning RM12 engine is a development of the General Electric F404-400. Volvo Flygmotor in Sweden has developed the Gripen engine in cooperation with G.E. The fighter is equipped with its own power supply and needs no separate apparatus for starting.

The Gripen's armament will be the most extensive that any Swedish combat aircraft has carried. Fixed armament consists of a 27 mm Mauser cannon and, for all mission types, two wingtip Sidewinder air-to-air missiles. In addition, it amy be armed with radar guided air-to-air missiles and a wide variety of alternative weapons. These include the Saab Missiles RBS15 air-to-sea missile and the Air Force's new bomb pod for attack missions as well as different types of pods for reconnaissance. Although the JAS 39 is only half the weight of the Viggen, it can carry the same weapon load.

The flight test program was originally formulated around the five prototypes with aircraft no. 1 slatted for flutter and loads tests and no. 2 for further loads and aeroelastic deformation tests. The two had nearly identical instrumentation, consisting of over 2,500 pressure, temperature, and load to test the production avionics and other subsystems. Approximately 2,500 flights were planned for the flight test effort.

The crash of the first prototype on the second of Februa has prompted a reworking of the test schedule for the fo remaining aircraft to carry the entire program. The destru tion of the plane occurred on its sixth flight after about five total flight hours during a landing by Saab test pilot La Radestrom who suffered a broken arm. First flight of t second test aircraft has been delayed until June of this ye to allow adjustments to test planning.

The crash came just shortly after the program passed major review in Sweden during which the governme decided to continue the project despite an 18 month slip the first flight and a projected cost overrun of about 20 Primary difficulties have been in the development of t digital, fly-by-wire flight controls.



Discovery Channel Presents "Great Planes" Series

The Discovery Channel is presenting a fascinating series programs entitled "Great Planes." Each program featur one of the famous planes in aviation history, covering ea aircraft's inception, development, and operational recor Each episode is first broadcast on Wednesday evenings 9-10 pm, then repeated Friday, 4-5 pm and Saturday, 1-2 a (all times eastern). The schedule for the remainder of tl series is below.

Consolidated B 24 Liberator	Wed., March
Lockheed P 38 Lightning	Wed., March
North American F 86 Sabre	Wed., Apri
Douglas DC-3/C 47	Wed., April
General Dynamics F 16	Wed., April
Convair B 36 Peacemaker	Wed., April

SIAM Conference Slated

The Society of Industrial and Applied Mathematic (SIAM) has set December 11-13, 1989, as the dates for the 4th Conference on Parallel Processing for Scientific Co puting. Topics include massively parallel computin visualization of scientific computation, tools for parall algorithm development, and many other related subject Abstracts are due June 1, 1989. For mailing abstracts an general information write to the address below. The co ference will be held in Chicago.

SIAM Conference Coordinator

Entry 4 of 4 in Applied Sci&Technol Abst 10/83-5/98

TITLE

Gripen crash delays flight test program

SOURCE

Aviation-Week-and-Space-Technology.v. 130 Feb. 13 '89 p. 22.

DESCRIPTORS

Aviation-Accidents; Military-airplanes-Sweden .

Previous 10 | Next 10 | Show Marked | Print... | Save... | Change Display

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Applied Sci&Technol Abst 10/83-5/98

+--- REQUEST 074/98, REPORT 51 ---+

+ DATA REPORT	MITSUBISHI-MU2	ACCIDENT +
+ EVENTS¦PHASES	POWER LOSS-FIRST ENGINE-MANOEUVRING	+
+	LOSS OF CONTROL-CIRCUIT PATTERN/FINAL	+
+	COLLISION WITH TERRAIN-EMERGENCY/UNCONTROLLED DESCENT	+

OPERATION

TYPE : MISCELLANEOUS - TEST/EXPERIMENTAL

FINAL REP

FILE DATA

ICAO FILE : 96/0022-0
FROM STATE : UNITED STATES

DATE, TIME AND METEOROLOGICAL DATA

DATE : 96-01-19
TIME : 09:23
LIGHT : DAYLIGHT
GEN WEATHER : VMC

AIRCRAFT DATA

MASS CATEGORY : 2250 - 5700 KG
STATE OF REGISTRY : UNITED STATES
REGISTRATION : N50KW

LOCATION

LOCATION : WEST COLUMBIA,SC
STATE/AREA : UNITED STATES
DEPARTED : WEST COLUMBIA,SC
DESTINATION : WEST COLUMBIA,SC

DAMAGE, INJURY AND TOTAL ON BOARD

A/C DAMAGE : DESTROYED

INJURY :	FATAL	SERIOUS	MINOR	NONE	UNKNOWN	TOTAL
CREW :	0	1	0	0	0	1
PAX :	0	0	0	0	0	0

NARRATIVE

DURING FINAL APP WITH THE LEFT PROPELLER FEATHERED, THE GEAR EXTENDED AND THE FLAPS PARTIALLY EXTENDED, THE A/C ROLLED LEFT AND STRUCK THE GROUND.
DRN: THE A/C WAS ON A MAINTENANCE TEST FLIGHT WITH REPORTED WIND GUSTS UP TO 27 KT. BEFORE TAKE-OFF THE PILOT PERFORMED AN NTS CHECK ON EACH ENGINE WITH NO DISCREPANCIES NOTED. DURING FLIGHT THE PILOT REPEATED THE NTS CHECK TO THE LEFT ENGINE. TWO ATTEMPTS TO RESTART THE LEFT ENGINE WERE UNSUCCESSFUL. EACH TIME THE PROPELLER CAME OUT OF THE FEATHERED POSITION AND STARTED TO ROTATE BUT THERE WAS NO FUEL FLOW OR IGNITION. THE PILOT RETURNED TO LAND. DURING SHORT FINAL TO RWY 29 WITH THE WIND FROM 250 DEG AT 20 KT, A WITNESS OBSERVED THE A/C PITCH NOSE UP THEN DOWN THEN HEARD THE SOUND OF POWER APPLIED TO THE RIGHT ENGINE. THE A/C THAN ROLLED TO THE LEFT, PITCHED NOSE DOWN AND STRUCK THE GROUND, COMING TO REST NEARLY INVERTED WITH THE WING SECTION SEPARATED. POST-ACCIDENT EXAMINATION OF THE LEFT ENGINE AND ACCESSORIES REVEALED NO EVIDENCE OF PRE-IMPACT FAILURE OR MALFUNCTION. THE LEFT ENGINE FUEL SHUT-OFF VALVE WAS FOUND IN THE CLOSED POSITION AND NO FUEL WAS FOUND BEYOND THE FUEL SHUT-OFF VALVE. THE PILOT STATED THAT HE HAS NO RECOLLECTION OF THE ACCIDENT. THE LEFT AND RIGHT ENGINES HAD JUST BEEN INSTALLED FOLLOWING HOT SECTION WORK TO BOTH AND BOTH HAD BEEN STARTED THE DAY AFTER INSTALLATION WITH NO DISCREPANCIES NOTED BY COMPANY MAINTENANCE PERSONNEL.

SEQUENCE OF EVENTS

EVENT 1 POWER LOSS-FIRST ENGINE - MANOEUVRING
1.ENGINE - FAILED
EVENT 2 LOSS OF CONTROL - CIRCUIT PATTERN/FINAL
1.HORIZONTAL GUSTS - PRESENT
2.AIRSPEED - NOT MAINTAINED
EVENT 3 COLLISION WITH TERRAIN - EMERGENCY/UNCONTROLLED DESCENT

02/16/~~89~~ 1989

&

09/28/1989

09/29/89

[redacted]

Published on 09/29/1989, SEATTLE POST-INTELLIGENCER

BOEING NAVY JET LOSES PART OF TAIL IN TEST

IT WAS THE SECOND TIME IN 7 MONTHS THAT THE SAME PLANE SUFFERED THE

SAME ACCIDENT

For the second time in seven months, a Boeing Navy communications jet lost part of its tail while conducting flight tests yesterday, a Boeing test manager said.

The E-6A TACAMO aircraft was operating over the Olympic Peninsula about 1:57 p.m. when about one-fourth of the tail and a small piece of the right horizontal stabilizer disintegrated, said Stephen M. Brown, an E-6A test manager for Boeing Aerospace and Electronics.

Your search terms appear 20 times in this article.

Complete Article, 607 words ($1.95 to download)

[redacted]

Published on 09/26/1989, SEATTLE POST-INTELLIGENCER

WHEN PLANES CRASH, TRUTH IS OFTEN AMONG THE VICTIMS

One of the major casualties in an airline disaster is often the truth, as a flood of dubious information about the crash on takeoff of USAir Flight 5050 well illustrates.

News organizations have left the strong impression that human error caused the Boeing 737-400 to skid off a wet LaGuardia Airport runway into the East River and break apart Wednesday evening, killing two passengers. In fact, say federal investigators, mechanical problems may still turn out to have been the decisive factor.

Your search terms appear 9 times in this article.

Complete Article, 1020 words ($1.95 to download)

Published on 09/23/1989, SEATTLE POST-INTELLIGENCER

CO-PILOT PUSHED THE WRONG BUTTON, SAFETY BOARD SAYS

The co-pilot of USAir Flight 5050 that crashed on takeoff at La Guardia Airport inadvertently pushed a button that caused the 737-400 to decelerate, federal officials said last night.

And the pilot also erred in failing periodically to call out the speed of the aircraft to help monitor whether it was going fast enough to take off, said James Kolstad, acting administrator of the National Transportation Safety Board.

Your search terms appear 13 times in this article.

Complete Article, 904 words ($1.95 to download)

Published on 09/22/1989, SEATTLE POST-INTELLIGENCER

CRASHED JET'S RECORDER REVEALS NO TALK OF MECHANICAL FAILURE

A study of the cockpit voice recorder recovered from USAir's Flight 5050 that crashed on takeoff at La Guardia Airport yielded no evidence that mechanical failure caused the mishap, Acting National Transportation Safety Board Chairman James Kolstad said yesterday.

He told reporters that the board had asked the pilot and co-pilot of the Boeing 737-400 to take drug and alcohol tests, although he noted they are not required to do so. He said seeking the test was a normal request under the circu

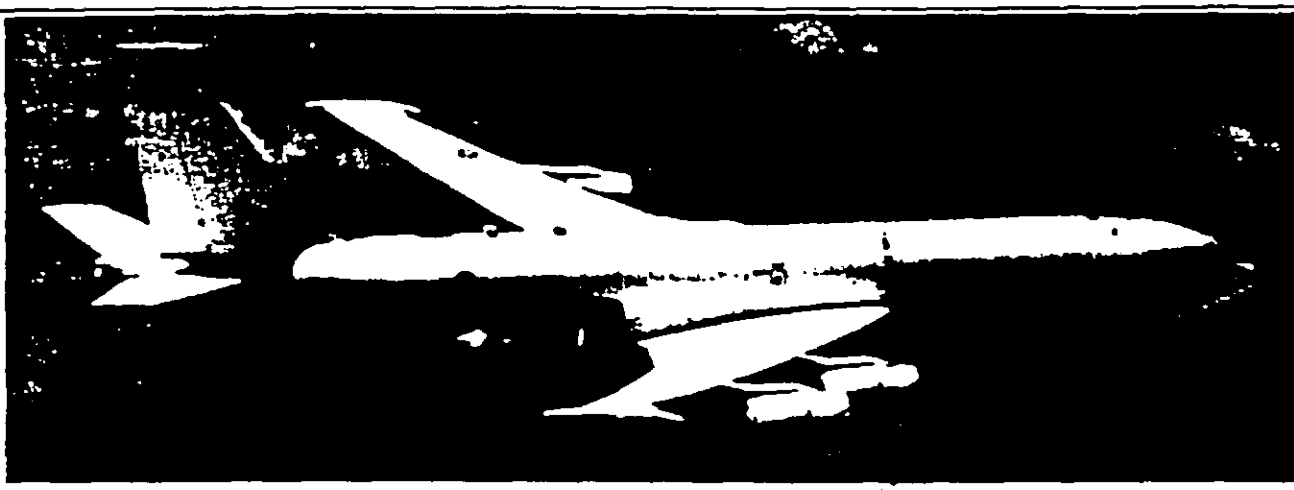
Your search terms appear 10 times in this article.

Complete Article, 1070 words ($1.95 to download)

02/11/89

E-6A Tacamo Tail Damage Prompts Delivery Delay

MICHAEL A. DORNHEIM/LOS ANGELES



Navy/Boeing E-6A Tacamo will unreel a 5-mi.-long antenna and a 1-mi.-long antenna, and fly in tight circles to communicate with submarines. Wingtip pods house surveillance antennas, as well as satellite and high-frequency communications antennas.

The Navy and Boeing Aerospace have agreed to delay delivery of the E-6A Tacamo submarine communications aircraft until there is a better understanding of why about a third of the tail surfaces broke off during flutter testing in February (AW&ST Mar. 6, p. 23). Delivery of the first aircraft was to have taken place on Apr. 28.

The Navy intends to buy 16 E-6As under a firm, fixed-price development and production contract worth nearly $2 billion. The first five production aircraft plus the prototype are already flying. The Navy expects it will be able to meet the January, 1990, initial operational capability milestone of six aircraft delivered, unless major structural changes are required.

The E-6A is a derivative of the Boeing 707-320B commercial transport, which has been in service for over 25 years.

Boeing is repairing the damaged E-6A prototype and plans to highly instrument the tail for further flutter tests set for mid-May. An oscillating flutter vane is to be installed on the vertical tail for the tests to stimulate the structure. The February flight used a strong rudder kick to excite the structure. Ground tests also are being conducted to determine why the tail broke.

Separately, there are several contractual nonconformance items that Boeing and the Navy are trying to resolve. One concern is that the E-6A's 5-mi.-long trailing wire antenna occasionally comes in contact with the elevator when flying near the planned maximum bank angle of 50 deg. This control surface contact is not related to the tail damage in the February flutter test. The wire was not extended during that test.

The tail damage occurred at 460 kt. indicated airspeed at 15,000 ft. A 150-200-lb. pedal force rudder deflection was used to stimulate flutter, and then "the vertical did some unusual things, doubled in frequency, and then left the aircraft," a Navy official said.

Instrumentation indicates the outer portion of the right horizontal stabilizer came off about 0.2 sec after the vertical surface broke. There were impact marks on the remaining horizontal surface, and officials suspect that the vertical tail was tethered momentarily by instrumentation cables, knocking off the horizontal tail instead of separating cleanly aft. There was some speculation that a high-frequency wire antenna strung from the fuselage to the vertical tail may have played a role in the incident, but calculations show it would have broken quickly and its involvement is now discounted.

The flutter tests were being conducted to test reinforcements to the outer wing designed to eliminate wingtip flutter discovered earlier in the test program. The wingtip flutter was encountered during high gross weight, high bank angle, low speed orbit maneuvers peculiar to the submarine communications mission.

The E-6A has wingtip pods housing antennas not found on the commercial 707, but officials said the added pods did not cause the flutter. The conditions under which wingtip flutter occurred are sufficiently outside the commercial operating envelope that commercial aircraft should not be affected. The outer wing modifications consist of local skin thickness increases and stringer stiffening. The E-6As already produced are having the modification installed.

MEASURED STICK FORCE PULSES

The 0.16-in.-dia. trailing wire antenna has touched the elevator trailing edge three times in flight tests, producing stick force pulses in the 20-30-lb. range. Analysis shows the force could be 100 lb. or more, and could bend the elevator control tab slightly. There is no hydraulic boost on the E-6A elevator.

For efficient radio propagation, the antenna should be hanging as vertically as possible behind the aircraft, and in practice over 70% of the wire is hanging vertically. To achieve this, the pilots fly the aircraft in a tight orbit. This drives the E-6A to steep bank angles of 30-50 deg. and low airspeeds of 127-183 kt., often with the flaps extended. The low airspeeds result in pitch attitudes of 7-9 deg. nose-up in level flight. The aft fuselage upsweep angle is about 12 deg.

The antenna wire exits from the bottom center of the fuselage behind the wing, at the point where fuselage upsweep starts. At a 50-deg. bank angle and 9-deg. pitch attitude, the tip of the horizontal stabilizer is about 10 ft. below and roughly 50 ft. behind the point where the antenna exits the aircraft, or about 10 deg. below this point. When in a bank, the antenna does not exit straight behind the aircraft but is pulled toward the inside of the circle, in the direction of the low stabilizer tip. Bank angle is often changed around the orbit circle to account for wind shear along the antenna length and other effects.

The submarine communications mission is now flown by Lockheed EC-130Q turboprop cargo aircraft. They have greater tail clearance geometry and operate at lower speeds than the E-6A. Prediction of wire behavior in new situations has been difficult because wire dynamics were not well understood. The elevator contacts inspired new modelling efforts, which have recently given better understanding. The wire acts as an inverted helical spring with coupled aerodynamic characteristics.

The Navy plans to restrict bank angle to about 40 deg. to prevent wire contact, which may limit the gross weight for orbit maneuvers. Several ideas are being considered to reduce this restriction, including adding a television camera to see when the antenna is about to touch the elevator.

The E-6A has been a controversial program and has been cited as an example of streamlined, off-the-shelf procurement (AWAST Oct. 19, 1987, p. 123; Mar. 11, 1985, p. 26). However, some off-the-shelf equipment has not adapted well to the mission. The wire-elevator contact and the wingtip flutter are two airframe problems caused by the 707-derivative operating in areas for which it was not designed. The ring laser gyro inertial navigation system was not made for prolonged turns and load factor. It meets accuracy requirements after a specified time in orbit, but drifts rapidly when it goes beyond that time.

Likewise, the flight management computer has trouble predicting performance in orbit conditions.

Orbit bank angle and airspeed are to be held within 1 deg. and 1 kt., and the aircraft's vintage analog autopilot is marginal at this task, Navy officials said. □