

Sikorsky's Flight Test Safety Risk Management and Culture

Improving Flight Test Safety through Enhanced Safety Risk Management

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Preview

- SRM is a key to reducing risk
- SRM alone can't identify all risks
- A culture of safety fills the gaps
- Culture & characteristics of a mature/risk averse flight test org
- Sikorsky's culture
- SRM example
- What did SRM miss, what did our culture miss?
- What we did to fix it
- Managing a culture of safety to enhance SRM



Safety Risk Management – Good but porous

- SRM – Deliberate framework for capturing and mitigating risk
- SRM alone can't identify all risk – people must fill the gaps
- SRM *and* culture provide a layered defense
- Aircraft checklists & procedures are akin to SRM on the ground
- Just as checklists and EPs can't cover every situation ...
- Well trained crews (aircrews, FTE, engineers/maintainers etc.) fill the gaps where procedures fall short



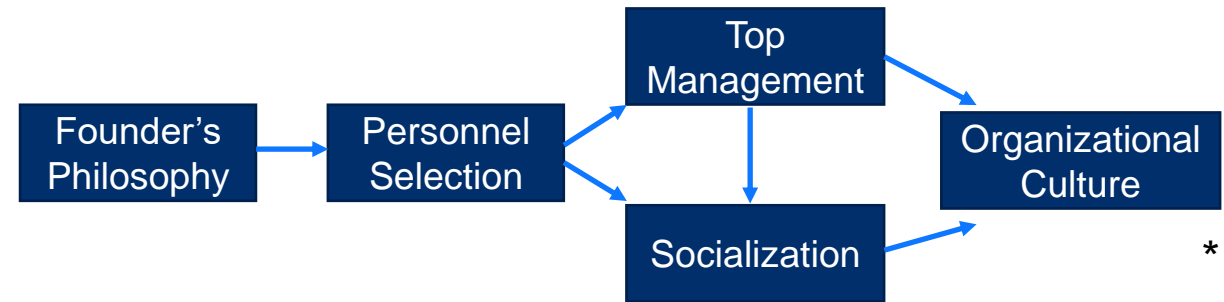
SRM can't cover every situation

A culture of safety fills the gaps for SRM to be most effective

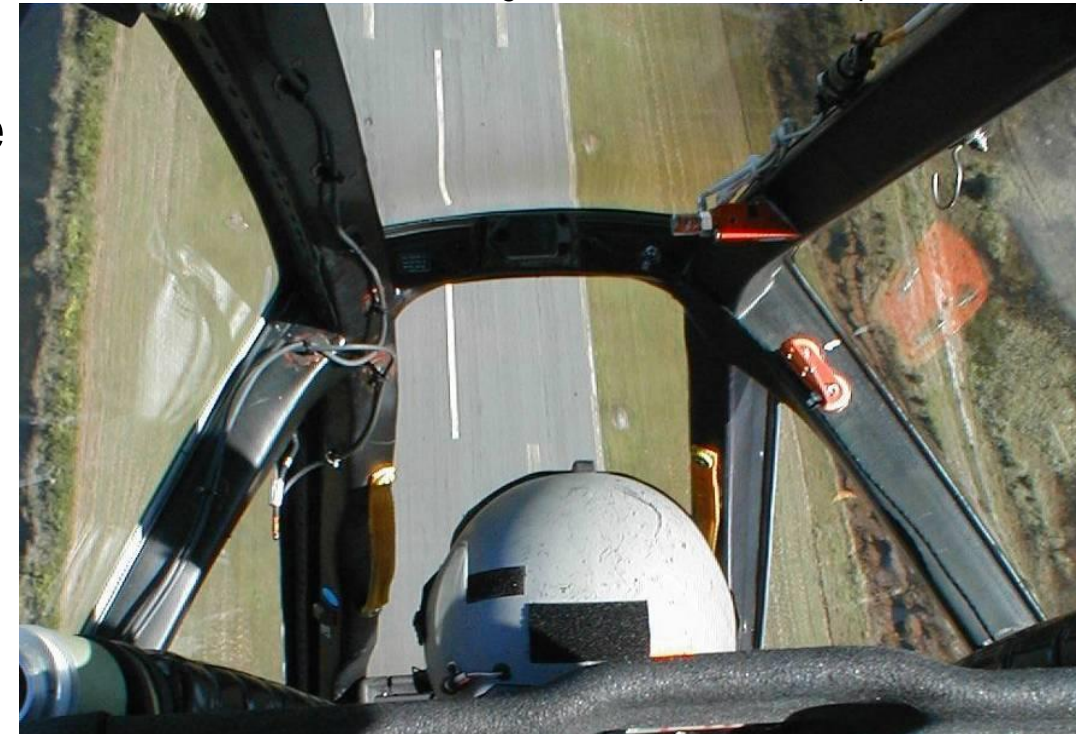
Flying and SRM depend on adequate systems knowledge and warnings

Organisational Culture

- Shared meaning held by members
 - Uniform interpretation and standards of what is appropriate or inappropriate
 - Shapes attitudes and behaviour
- Org's founder is the ultimate source of culture
 - Provides the vision for the organisation
 - Unconstrained by previous customs
 - The founder's effect is long lasting
- Doing the safe thing when nobody is looking
- How people act in critical situations



* *Essentials of Organizational Behavior* – Stephen P. Robbins



Flight Test Organisational Culture

Mature Flight Test

- Innovative but Risk Averse
- Learning
- Safety Orientation
- Open/Safe Communication
- Trusting and Sharing
- Cautious
- Humble
- Igor Sikorsky's cultural legacy?

**“Culture eats strategy
for breakfast”**

Peter Drucker – management guru, 2006



Igor Sikorsky – Chief Engineer and Pilot

“In those early days, the Chief Engineer was almost always the Chief Pilot as well. This had the automatic result of eliminating poor engineering very early in aviation.” – Igor Sikorsky

The Founder’s Culture:

- Sets the standard for engineering and piloting
- Focus on life saving products
- Engineering innovation
- Prolific writer
- Company logo – “Winged S”
- 100th Anniversary March 2023
 - Sikorsky Aero Engineering Company



Photos: [Sikorsky Archives | Home](https://www.sikorskyarchives.com/) <https://www.sikorskyarchives.com/>



Sikorsky's Test Culture & SRM

- Igor on the challenges of early vertical flight:
“To design a new type of flying machine without knowing how to design it; then build it without really knowing how to build it and then try to test-fly it without ever having flown a helicopter before.”
- Unknown-unknowns can't be covered by SRM
 - People must fill the gaps - “Mind the Gaps”
- 30 years: H-1 (1909) to the VS-300 (1939)
- Methodical Test Process - Cautious and Deliberate
- Culture of safety risk management persists today
 - Flight test requires incredible breadth of understanding
 - A culture of caution and humility
 - Risk averse: Willing to accept lower payoff for more certain results



Photos: Sikorsky Historical Archives

Sikorsky Test Engineering Core Ideology

Core Values

- ***The safety of the people flying our helicopters is our highest priority.***
- ***We are an advocate for the people using our products.***
- ***We respect all people we work with and value their contributions.***
- ***We place high value on both teamwork and individual responsibility.***
- ***Honesty and integrity in everything we say and do.***
- ***We are passionate about developing helicopters and we have fun doing it.***



Photos: [Sikorsky Archives | Home](https://www.sikorskyarchives.com/) <https://www.sikorskyarchives.com/>

Safety Risk Management – People filling the gaps

- Culture must be risk sensitive – actively looking for risk (gaps)
- SRM depends on team members identifying and reporting risks
 - Team members should have the right culture to work in
 - Must feel safe to report – psychological safety
- Train to ID risks and report
 - Like flight training: Identify, analyze and act
 - Everyone can identify
 - Professionals can analyze and act
- SRM and a culture of safety at *every level* of the organisation minimizes the gaps
- Lunch lady SRM



Test Event – SRM Fail?

New Production Helicopter

- Mature and well understood production & flight test process
- First engine starts uneventful
 - Against the rotor brake
- Subsequent engine start
 - No rotor brake
- Transmission grinding noise



SRM Fail?

Troubleshooting finds a rag blocking all oil flow to the main transmission

WHAT happened ?

- Parts shortage necessitated abnormal process flow for transmission build up and testing
- Filter housing was removed after test stand run
- Gearbox stored in a non-“FOD critical” environment
- Technician stuffed a rag in the housing to stop dripping oil



Borescope inspection revealed blockage in filter housing



Removal of oil filter cap assembly revealed FOD



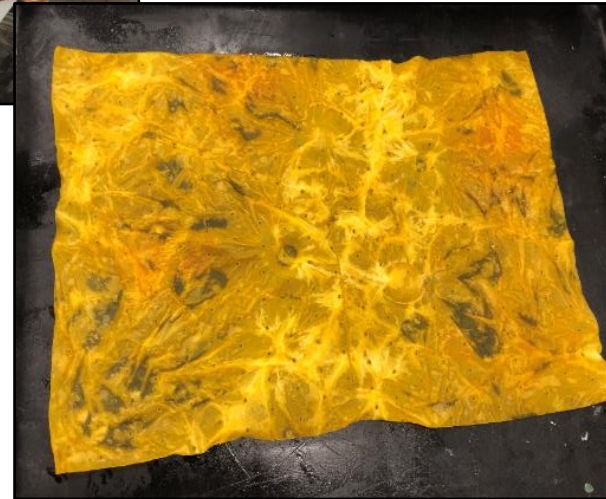
SRM Fail – over \$1M

Gaps

- Out of normal process flow
 - Our “Checklist” of production flow was interrupted
- Management/SRM didn’t recognize or manage this out of normal process flow properly
- Technician didn’t understand the critical nature of transmission FOD
- Layers of SRM mitigation failed
 - Can’t cover every situation
 - People missed simple rules



FOD identified as wadded-up oil absorbent pad



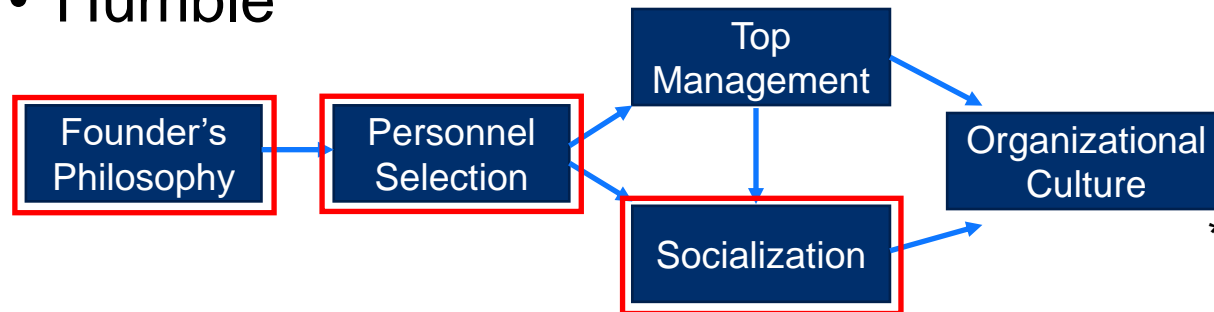
SRM Changes – What we fixed (sort of)

Gaps

- Safety Stand Down (of course)
 - Emphasised FOD policies and Procedures
- Transmission build up instructions clarified – More Quality inspections
- Updated instructions for out of normal flow processes
- Created FOD Critical zones that move with the transmission
- What we missed:
 - Hard look at our management
 - Hard look at our just culture
 - Reinforcing our Culture of Safety
 - Follow on SRM (COVID hampered)
- Depends on adequate system knowledge and warnings – just like flying

Good news - Culture can be managed to enhance SRM

- In flight test, culture is at least as important as policy and procedure
 - Show me your strategy and I'll show you my culture
- Risk averse – disciplined risk
- Safety Orientation
- Open Communication
- Trusting and Sharing
- Learning
- Humble



S-76D(TM) High Altitude Testing Montrose, CO

* *Essentials of Organizational Behavior* – Stephen P. Robbins

Safety Risk Management + Culture of Safety

- SRM *and* culture provide the most effective layered defense
- Well curated safety cultures look for and mitigate risks
- Flying and SRM both depend on systems knowledge & warnings
 - *AND* well trained people in a safe environment
- Culture can be managed



A culture of safety fills the gaps for SRM to be most effective

“The work of the individual still remains the spark which moves mankind ahead.”

Igor I. Sikorsky



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