Turboprop Propulsion System Malfunction

Recognition and Response

Propulsion System Malfunction Recognition and Response

"The rate of occurrence per airplane departure for Propulsion System Malfunction Plus Inappropriate Crew Response (PSM+ICR) accidents has remained essentially constant for many years. These accidents are still occurring despite the significant improvement in propulsion system reliability, suggesting an increase in rate of inappropriate crew response to propulsion system malfunction."

Introduction to the AIA/AECMA Working Group Report on PSM+ICR

Major Conclusions

Many pilots have difficulty identifying certain propulsion system malfunctions and reacting appropriately.

Pilots are failing to properly control the airplane after a propulsion system malfunction which should have been within their capabilities to handle.

The changing pilot population, coupled with reduced exposure to in-service events due to increased propulsion system reliability, is generating large numbers of flight crews who have little or no prior experience with actual propulsion system failures.

Conclusions - Recommendations

Simulated V_1 engine failures in an airplane have caused a number of hull loss/fatal accidents. It was the Working Group's belief that this specific training could be better effected in simulators. Where suitable simulators are not available, the airplane handling task could then be adequately and much more safely trained at altitude, where recovery can be safely accomplished.

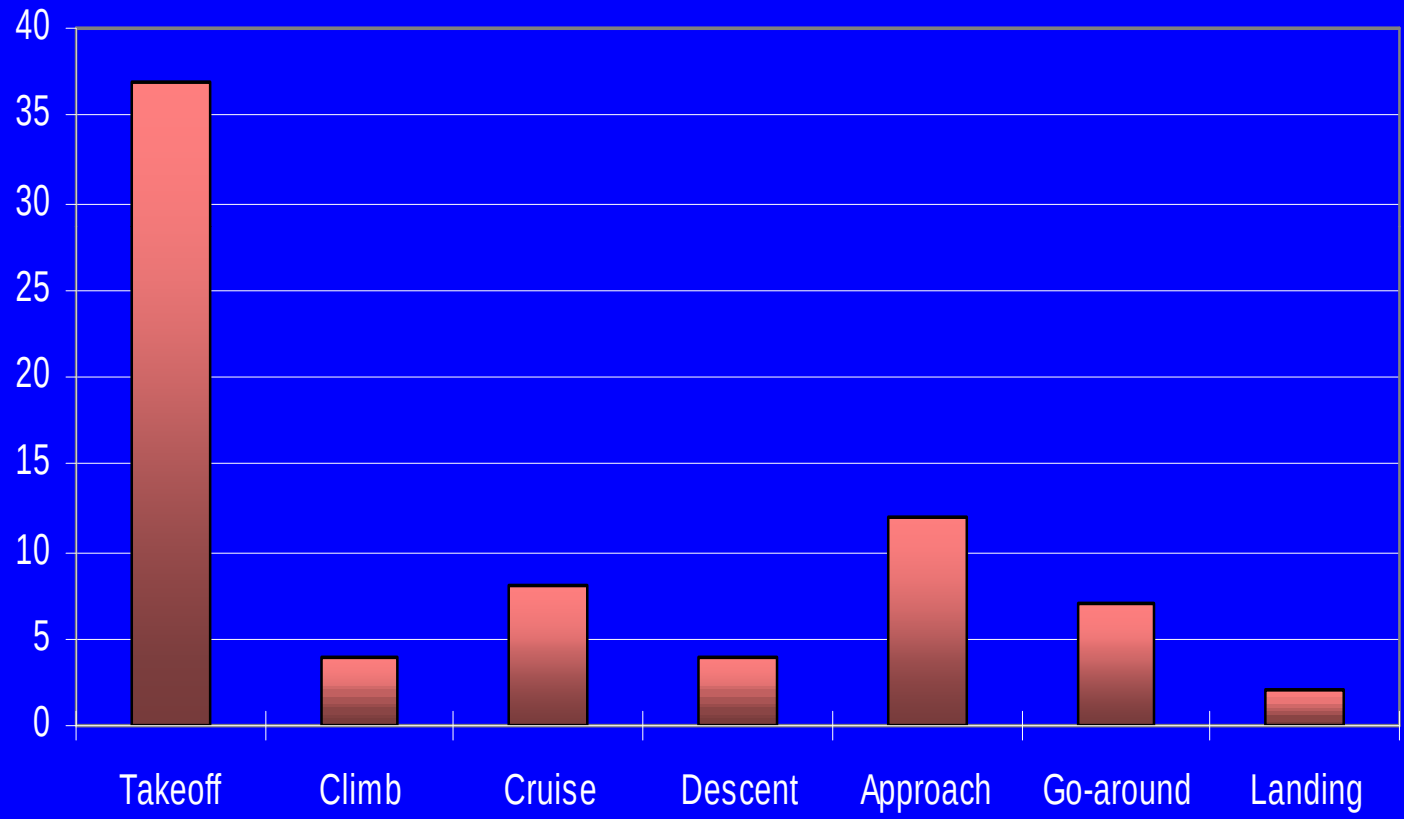
The use of flight idle on turboprop airplanes for simulated engine failures or in the event of a malfunction has been associated with loss of control events if the engine is not shut down.

Opportunities exist for negative transfer of trained pilot behavior and experience when transitioning between different airplane types.

Turboprop Accidents by Phase of Flight

75 fatal accidents

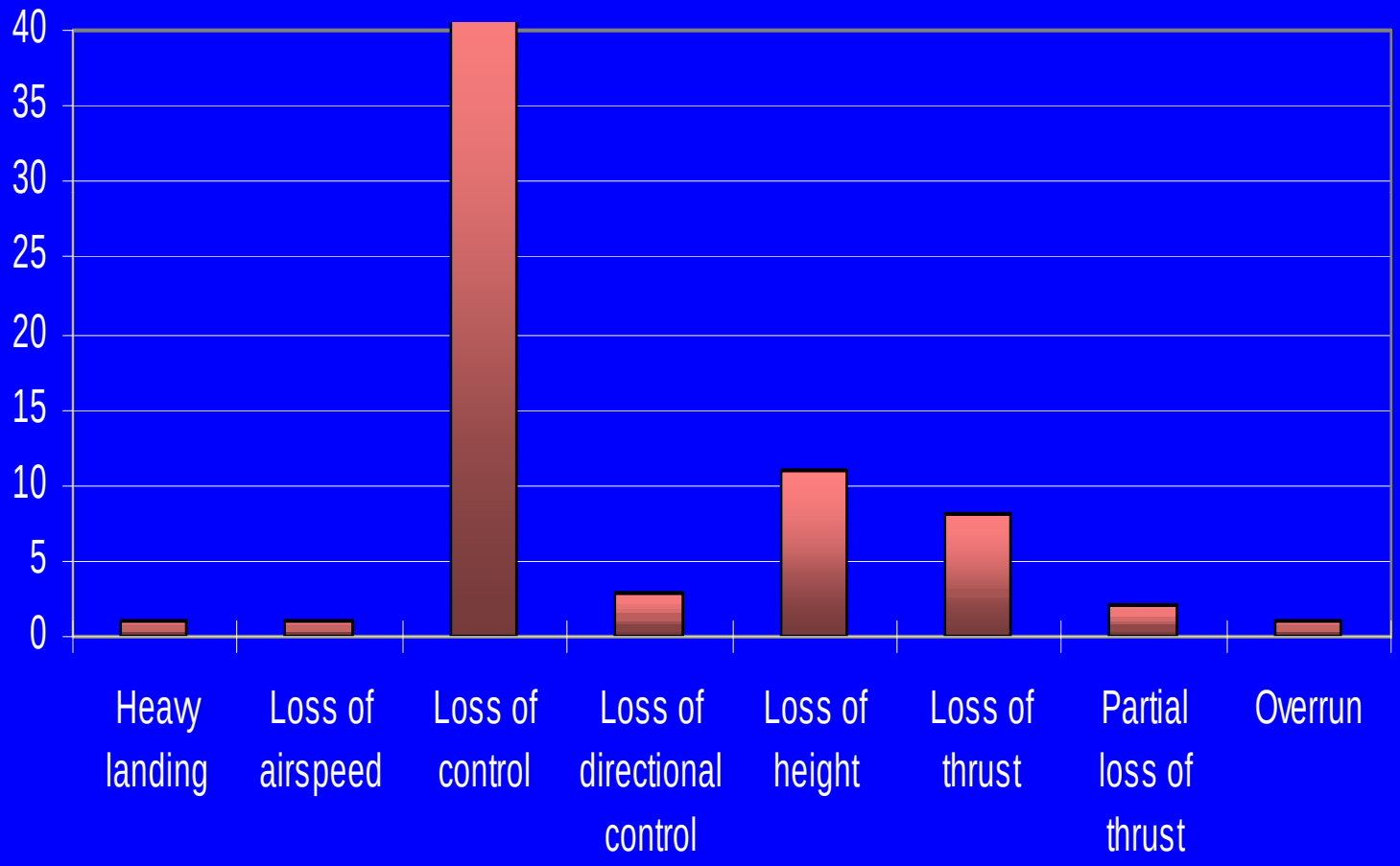
Take-off phase of flight



Primary Cause of Accident

75 fatal accidents

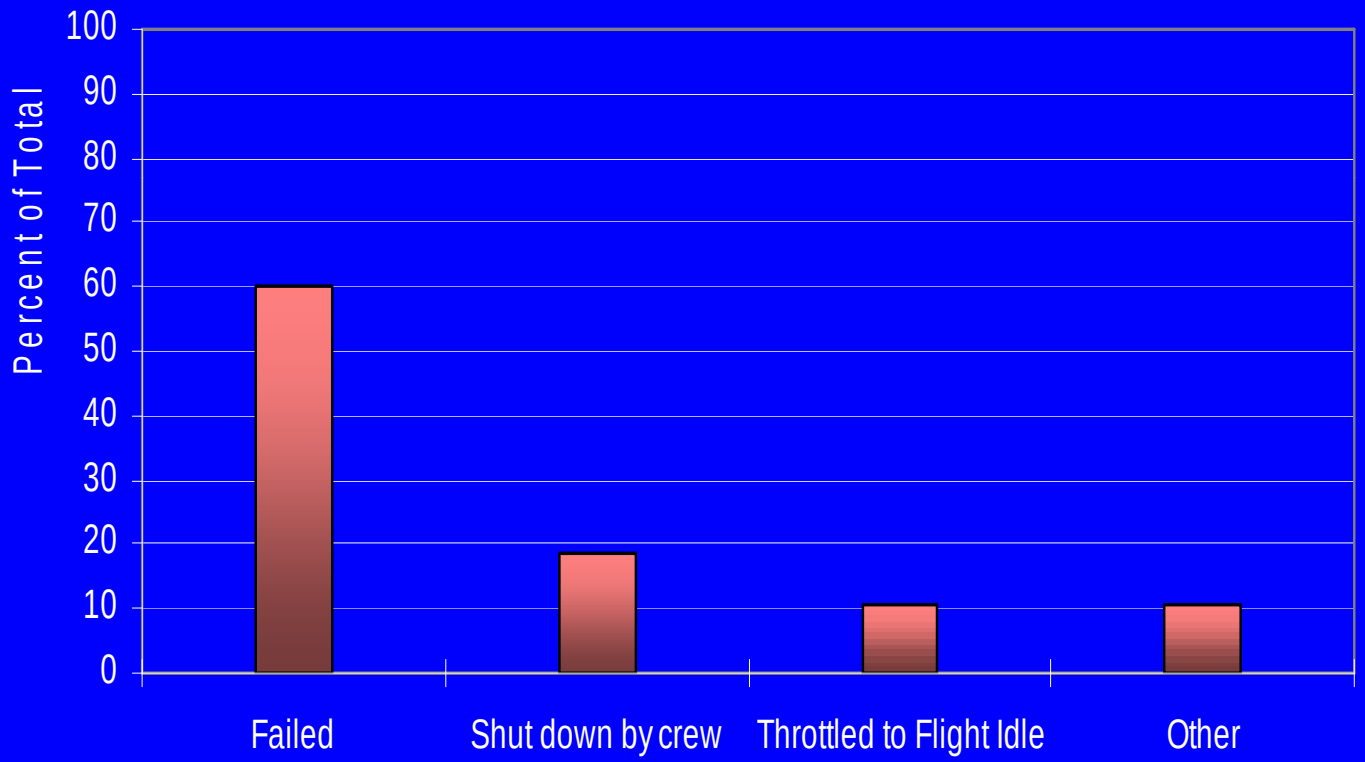
Loss of control



Type of Powerplant Malfunction

% of malfunction

Total Power Loss



How to Handle a Failure

- Control the aircraft.
- Identify the malfunction.
- Confirm and Feather.
- Manage the power, drag, and trim.

Fly the Aircraft

- Apply rudder to oppose the yaw.
- Use rudder and aileron to keep straight and initially maintain the wings level. Best control margin comes with 5^{o} bank into the live engine.
- Adjust the pitch attitude to maintain airspeed.
- Carry out any immediate actions to reduce drag.

Airspeed means survival

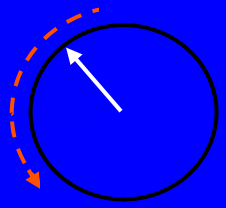
Identify the Malfunction

The best initial indication is -

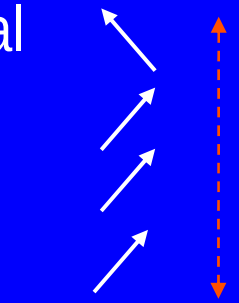
‘Dead leg…Dead engine’

but this assumes you are correctly controlling the airplane.

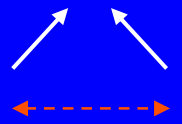
Read the instruments; check the value, direction and rate of change of each parameter.



Scan all parameters, compare with the normal indications.



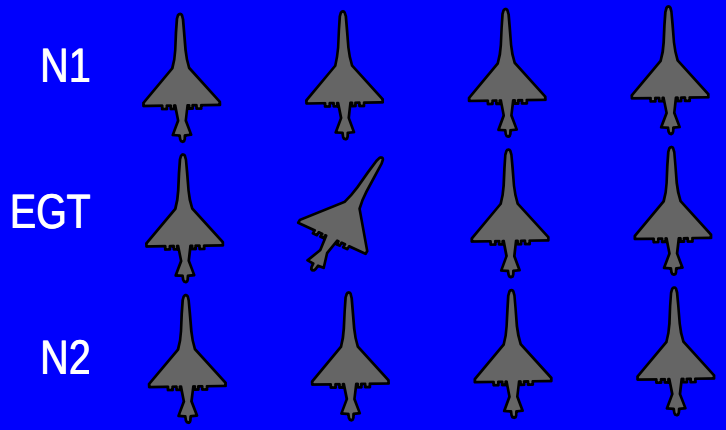
Cross-check against all engines.



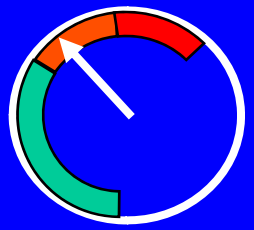
Confirm and Feather

Scan <u>all</u> of the engine instruments

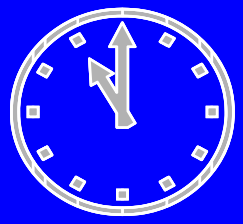
Look for patterns.



Compare with normal values.



Don’t rush the confirmation.



Instructors – Check Airmen

Beware the V_1 cut

- Use simulators where available.
- Demonstrate V_{MCA} at altitude.
- Check engine shut down procedures at altitude.
- Check aircraft handling at a safe height.

If you do cut at V_1

- Only pull back the power to zero thrust.
- Guard the rudder control.
- Take recovery action early.

Train for the Threat

Loss of control is the #1 cause of power-plant accidents.

- Follow basic procedures – fly the airplane.

Do not rush identification or engine shutdown.

- Beware bad habits from previous aircraft.

Flight idle may give negative thrust – know the settings.

- Increased V_{MCA} may lead to loss of control.

Airplanes are safe to fly with one engine shut down.

- Avoid uncertainty – feather and shut down.

Other Problems

Flight Director

Few flight directors are optimized or approved for engine failed at takeoff or go-around.

EFIS speed displays

Do not allow a single instrument to dominate aircraft control. Adjust pitch attitude, then cross check for the required speed change.

Conclusions

Modern power-plants are more reliable

but…accidents still happen.

Power loss resulting in loss of control is the dominant cause.

Train for the threat, beware the V_1 cut.

Flight idle may give negative thrust.

Control, Identify, Confirm, Manage.

Take time to identify the failure.

Use all available information.

Single engine flight is safe.

Rule #1 - Fly the airplane.

Airspeed means survival.


FLY SAFE
Avoid PSM+ICR