

Manual Flight Operations

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Finding 2:

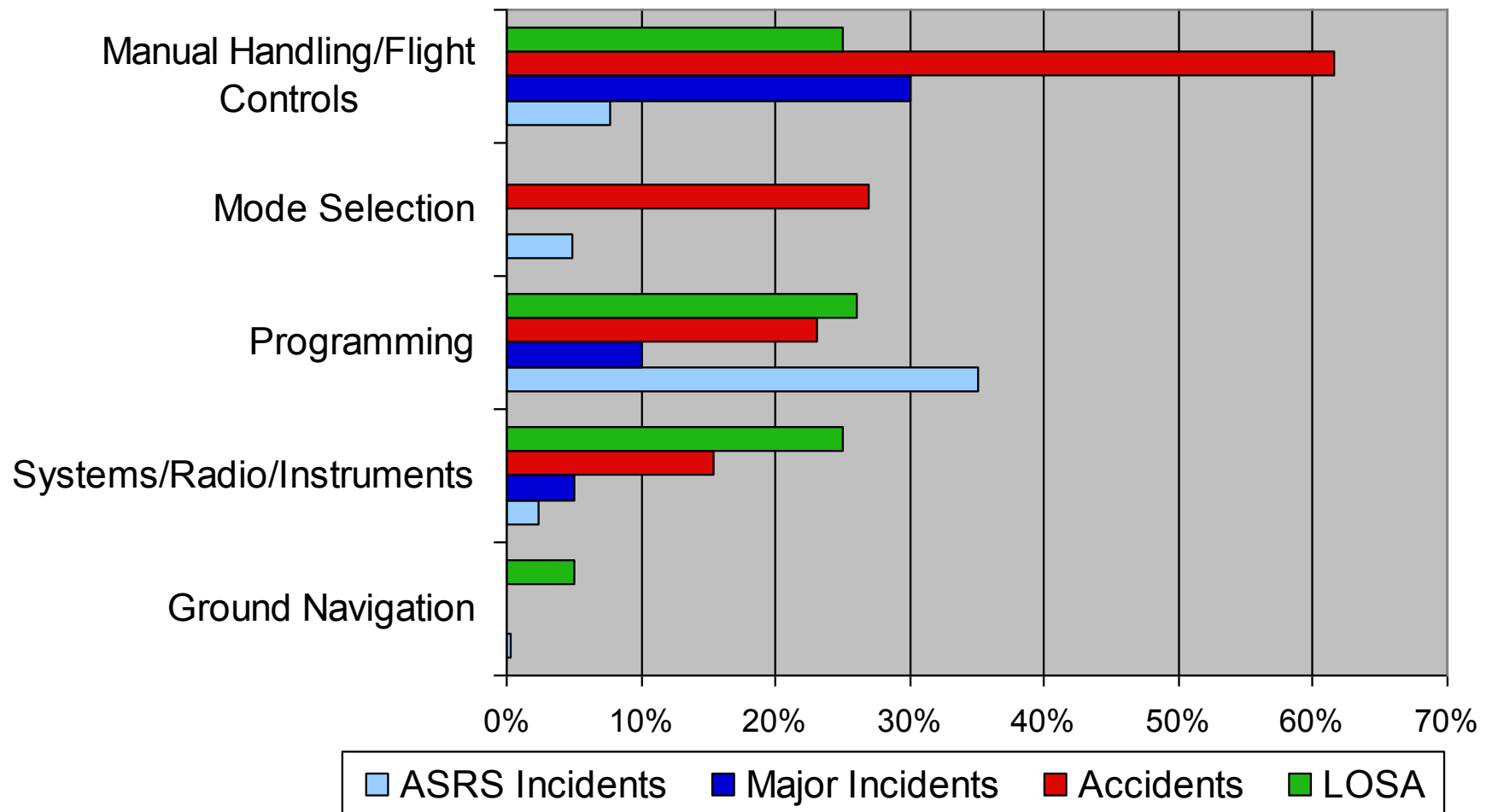
Manual Flight Operations

Significant instances of vulnerabilities were found in pilot knowledge and skills for manual flight operations. Areas of concern included:

- Prevention, detection and recovery from upset conditions, stalls or unusual attitudes;**
- Appropriate manual handling after transition from automated control;**
- Inadequate energy management;**
- Inappropriate control inputs for the situation;**
- Crew coordination;**
- Definition, development, and retention of such skills**



Handling/Input Errors



Manual Handling / Flight Control Errors

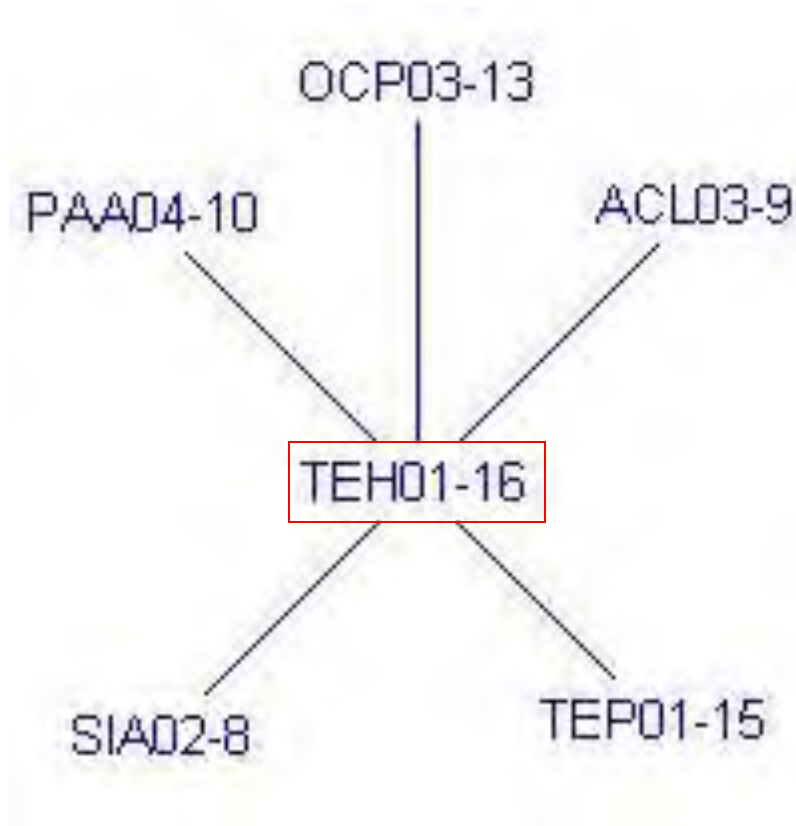
- ➔ Hand Flying vertical, lateral, or speed deviations
- ➔ Approach deviations by choice (e.g., flying below the Glideslope)
- ➔ Incorrect flaps, speed brake, autobrake, thrust
- ➔ Missed runway/taxiway, failure to hold short, taxi above speed limit



Types of Handling Errors (accidents/major incidents)

- ➔ Incorrect manual handling after lack of recognition of autopilot or autothrottle disconnect
- ➔ Lack of monitoring/maintaining energy/speed
- ➔ Incorrect upset recovery
- ➔ Inappropriate control inputs

Accidents TEH01: Error: Manual Handling/Flight Controls



Code	Factor Name
TEH01	Error: Manual Handling/Flight Controls
ACL03	Issue: manual operation may be difficult after transition from automated control (Issue 055)
OCP03	Issue: training may be inadequate (Issue 133)
PAA04	Issue: behavior of automation may not be apparent (Issue 083)
SIA02	System: A/T and Associated Controls
TEP01	Error: SOP Cross-verification

Manual Flight Operations

Manual flight operations include more than “stick and rudder” motor skills

There are many cognitive skills needed for manual flight operations.



Manual Flight Operations

Examples of situations requiring both cognitive and motor skills include:

- ➔ Spatial reasoning needed to successfully conduct visual or non-precision approaches
- ➔ Go-arounds/missed approaches, especially all-engine and at altitudes higher than DA/DH
- ➔ Returning to nominal flight path after a flight path deviation (e.g., being vectored off an arrival, or after responding to a TCAS RA or wind shear alert))



Manual Flight Operations

More examples of situations requiring both cognitive and motor skills include:

- ➔ **Knowing and executing corrective actions (e.g., stall recovery)**
- ➔ **Knowing when/how to intervene when automated systems are not behaving as expected (e.g., dropping from VNAV path to VNAV speed)**
- ➔ **Thrust management (e.g., when autothrottle not available or malfunctioning)**



Manual Flight Operations

Degradation of manual flight operations knowledge and skills are due to lack of practice, often because automated systems are used instead

Once a certain level of expertise is reached, motor skills don't degrade very quickly, even with limited practice. However, cognitive skills will degrade faster, regardless of level of expertise, unless the pilot can practice those skills.



Factors that Influence Manual Flight Operations

- Airline policies for use of automated systems (policies that encourage or require maximum use of automation reduce the opportunities/incentives to practice the knowledge and skills)
- Pilot (lack of) confidence in their knowledge and skills for manual flight operations
- Type of operations (e.g., some airspace procedures require the use of the autopilot; long haul ops)
- Perception that automating the operation is safer/more efficient
- Transition from automated to manual operations is not practiced or trained



Challenges for Maintaining Proficiency

- Not addressing the cognitive aspects of Manual Flight Operations
- Training
- Policies (operator and regulatory)
- Airspace design
- Perception by some that automated systems are safer or better (e.g., more precise, fewer errors, etc.)
- Lack of opportunity to practice (e.g., long haul ops)
- Lack of development of such knowledge and skills (e.g., low time pilots put into highly automated operations may not develop the skills in the first place)



Recommendation 1: Manual Flight Operations

Develop and implement standards and guidance for maintaining and improving knowledge and skills for manual flight operations that include the following:

- Pilots must be provided with opportunities to refine this knowledge and practice the skills;
- Training and checking should directly address this topic; and
- Operators' policies for flight path management must support and be consistent with the training and practice in the aircraft type.

This should be done in an integrated manner with related recommendations.





U.S. Department
of Transportation
**Federal Aviation
Administration**

SAFO

Safety Alert for Operators

SAFO 13002
DATE: 1/4/13

Flight Standards Service
Washington, DC

http://www.faa.gov/other_visit/aviation_industry/airline_operators/airline_safety/safo

A SAFO contains important safety information and may include recommended action. SAFO content should be especially valuable to air carriers in meeting their statutory duty to provide service with the highest possible degree of safety in the public interest. Besides the specific action recommended in a SAFO, an alternative action may be as effective in addressing the safety issue named in the SAFO.

Subject: Manual Flight Operations

Purpose: This SAFO encourages operators to promote manual flight operations when appropriate.

Background: A recent analysis of flight operations data (including normal flight operations, incidents, and accidents) identified an increase in manual handling errors. The Federal Aviation Administration (FAA) believes maintaining and improving the knowledge and skills for manual flight operations is necessary for safe flight operations.

Discussion: Modern aircraft are commonly operated using autoflight systems (e.g., autopilot or autothrottle/autothrust). Unfortunately, continuous use of those systems does not reinforce a pilot's knowledge and skills in manual flight operations. Autoflight systems are useful tools for pilots and have improved safety and workload management, and thus enabled more precise operations. However, continuous use of autoflight systems could lead to degradation of the pilot's ability to quickly recover the aircraft from an undesired state.

Together we are making a difference

THANK YOU

Questions???

