SMS Overview

SMS Origins

- Very similar conceptually to Quality Management Systems – think ISO 9000
- QMS took off in 1970's-80's – a means of having a structured, documented, and process-oriented approach to managing quality in manufacturing
- Idea that you had to manufacture quality in, not just inspect a product after it was made
- Total Quality Management – idea of using statistical process control throughout the manufacturing process; was revolutionary to American manufacturing

SMS Origins

- New Zealand and EASA started using QMS as part of their accident prevention programs in 1980's; other agencies worldwide started embracing through ICAO interaction
- In 1995, FAA held an Aviation Safety Summit - 950 representatives from airlines, unions, regulators, and various other aviation organizations
- The Summit resulted in:
  - 540 "issues" that were identified by the participants
  - FAA creation of an "Office of System Safety"
  - The FAA issuing an Aviation Safety Action Plan (173 initiatives)
- Seems to be the first "proactive" approach to safety by the FAA

How things have progressed over time

From: https://www.faa.gov/about/initiatives/sms/explained/basis/

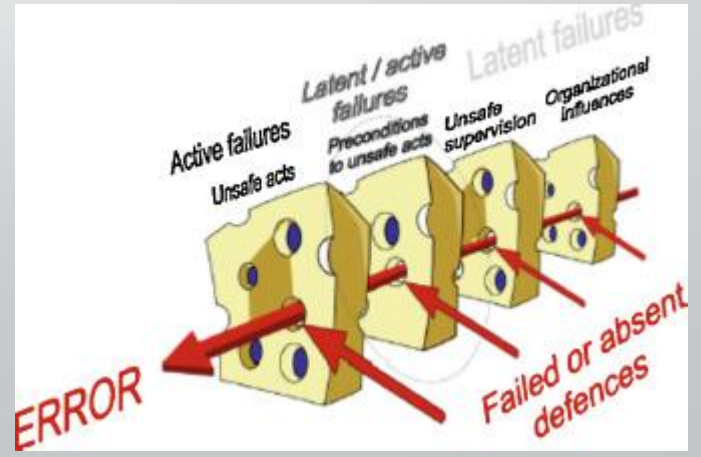
Behavioral Approach to Safety

Historically…safety was viewed as a result of "active failures"

- **Active failures** – typically an unsafe act committed by people at "sharp end" of the system (pilots, ATC, mechanics)
- This is where accident investigation used to stop (X person did Y wrong, let's penalize them, design a procedure or make a rule so doesn't happen again).
- In last 25 years or so, it's become evident that this often does little to solve the problem, unless the individual was being intentionally negligent; instead, it results in people "sweeping problems under the rug" and just trying to not get caught

Organizational approach to safety

- **Latent conditions** – now, it has become clear that many "active failures" are the result of a number of latent conditions, or organizational factors that exist behind the scenes; people aren't trying to cause accidents/incidents
- James Reason swiss cheese model
- People working in complex systems make errors or violate procedures for reasons beyond the scope of individual (behavioral) psychology
- Examples of latent conditions – poor design, poor supervision, manufacturing defects, maintenance failure, poor training, unworkable procedures, inadequate tools and equipment, poor allocation of resources.



Regulatory Perspective for SMS

- Becoming a standard throughout the aviation industry worldwide, as well as in other high-consequence industries (health care, maritime, nuclear)
- ICAO first mandated member states start down SMS path in 2006
- Australia and Canada took this path quickly; FAA took much longer to fully embrace
  - The FAA filed "differences" with ICAO, a process by which nations can postpone implementation of ICAO regulations
- FAA published first AC, *AC-120-92A Safety Management Systems for Aviation Service Providers* in 2010
- Part 139 Airports and ATC have worked since 2010 to integrate the concepts into their operating policies and procedures; for airports, likely will be required at some subset of 139 certificated airports in near future

Regulatory Perspective for SMS

- In January 2015, the FAA mandated implementation of SMS for 121 operators, along with a new section of regulations for this - Part 5 of 14 CFR
- Also updated the AC to *AC 120-92B*
- Carriers had until 1/18 (now!) to be fully implemented
- Maintenance repair stations and training providers are voluntary at this point
- Many 135 and corporate operators have implemented SMS as part of achieving ARGUS Platinum designation, because they operate internationally, or due to insurance company discounts

Big takeaway

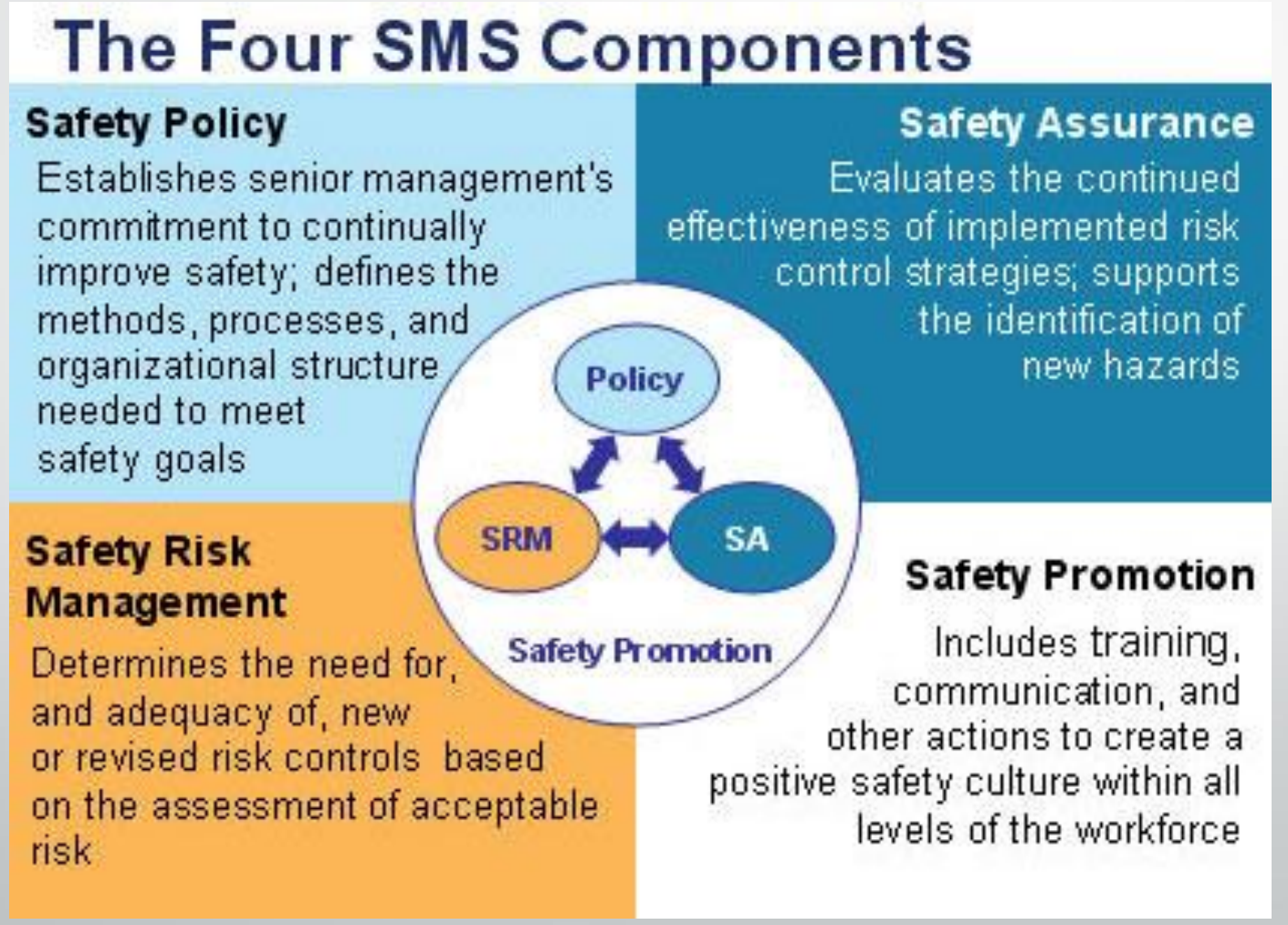
- Industry has shifted from a reactive and punitive approach at the individual operator level, to a proactive and non-punitive approach at the organizational level, and to a systemic view of safety
- Our Industry Advisory Board and employers of our graduates tell us our students are not prepared to deal with SMS procedures when they start work with them
- At some point, it's likely 141 and 147 programs will be mandated to comply with FAA; already mandated by AABI

4 Pillars of SMS

- Safety Policy
- Safety Assurance
- Safety Risk Management
- Safety Promotion

- These were evidently first developed by Transport Canada in concert with ALPA, but seem to have been adopted widely over time; Part 5 is written specifically based on these

Whole SMS System:



Safety Policy

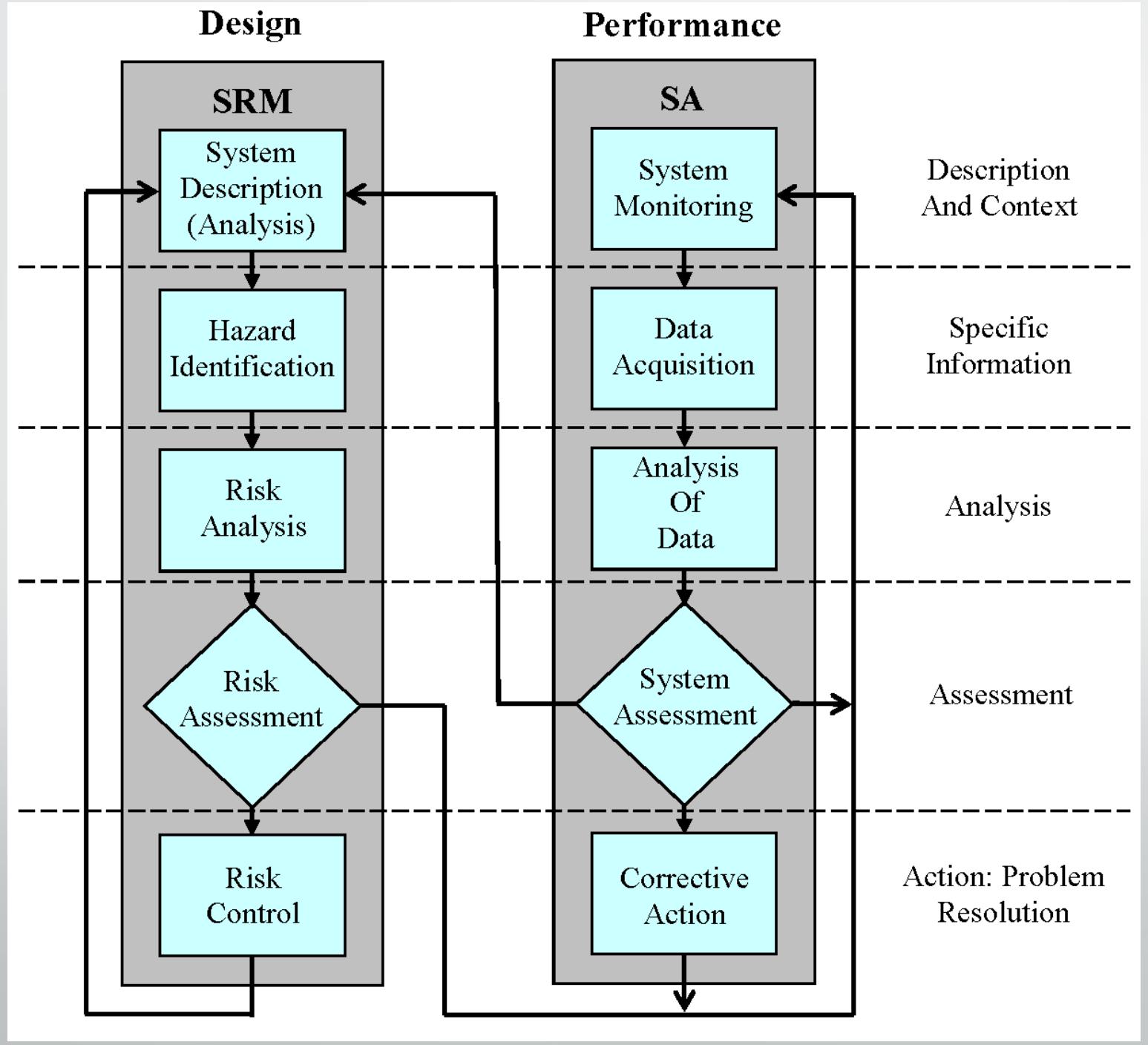
- "Safety policy is where you set objectives, assign responsibilities, and set standards. It is also where management conveys its commitment to the safety performance of the organization to its employees."
- Us as an example:
  - We have established the Safety Committee, the Flight School has extensive guidance in its Safety Practices and Procedures Manual, and other areas (Maintenance, Technology, UAS) are working on writing their own versions
  - Really need to update the management statement (was done by Dornan)

Safety Assurance

- "Processes within the SMS that function systematically to ensure the performance and effectiveness of safety risk controls and that the organization meets or exceeds its safety objectives through the collection, analysis, and assessment of information"
- All of the legacy safety efforts (AQP, CASS, LOSA, FOQA, ASAP, ASRS) actually fall under this umbrella
- Here…
  - We have our voluntary safety reporting system; safety committee to review/recommend and consider any other safety items
  - Need to start doing periodic audits of all operational areas

Safety Risk Management

- "A process within the SMS composed of describing the system, identifying the hazards, and analyzing, assessing, and controlling risk"
- Sounds simple enough, but really pretty involved; interacts very heavily with Safety Assessment
- Here…
  - We have identified and mitigated many risks in the flight training environment through our Safety Practices and Procedures: i.e., no alcohol 12 hours before scheduled flight, more strict weather mins than FAA requires, requiring W&B and performance to be submitted to dispatch, no recording devices without Chief/Asst Chief approve, etc.
  - Where we still have work remaining is doing a more formal risk assessment of the hazards that are identified (whether by safety report or otherwise)


Design
Performance
SRM
SA
System Description (Analysis)
System Monitoring
Description And Context
Hazard Identification
Data Acquisition
Specific Information
Risk Analysis
Analysis Of Data
Analysis
Risk Assessment
System Assessment
Assessment
Risk Control
Corrective Action
Action: Problem Resolution

Safety Promotion

- "To provide employees with effective SMS training commensurate with their safety responsibilities and to create a means to deliver organization-wide safety communication"
- Here…
  - Each flight student signs an acknowledgement of receiving Safety Practices and Procedures and receiving briefing on voluntary reporting system; other concentrations moving toward this as well
  - All flight students receive e-mails from the Assistant Chief with responses to all safety reports
  - Selected safety reports are also displayed at the flight school
  - Where we need to go – more emphasis on safety culture across entire department, not just flight school

A current focus – Safety Culture

- Cultures are the product of the values and actions of the organization's leadership as well as the results of organizational learning. Cultures are not really "created" or "implemented;" they emerge over time and as a result of experience. (From FAA AC120-92B)
- Culture – Chick-Fil-A vs. McDonalds
- Going to do a baseline assessment of department culture this spring

Examples of changes based on safety reports at flight school

- New fuel truck
- Check list changes after several near gear ups
- Procedure changes after night landings by non-night current pilots/instructors
- Procedure changes after flights returning with less than one hour of fuel on board
- Dispatch procedure changes and additional training after dispatching with items noted on discrepancy sheets

Links to Guidance

- 14 CFR Part 5:
  - https://www.ecfr.gov/cgi-bin/text-idx?mc=true&node=pt14.1.5&rgn=div5
- AC 120-92B:
  - https://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/1026670

SMS Hazard Analysis At A University Flight School

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Introduction

- Safety reporting system started at 141 flight school in 2010
- By December of 2016, 176 reports filed
- Department Safety Committee “owns” the database; each report in the database has been reviewed by the committee.
- The primary role of the safety committee is to identify safety hazards, assess the risk associated with a given hazard, and recommend steps to mitigate the hazard.

Examples from Database

Date	Type of Event	Reported By:	Location	Time	Wx Conditions	Event	Initial Action Taken	Further Action?	Further Action Taken / Notes
mm/dd/yyyy	Flying Non-Flying	Instructor Student Dispatch/Line Other	-	-	VFR MVFR IFR	-	-	No Yes	-
04/22/10	Flying	Instructor	M54	10:30am	VFR	Student was perforing simulated engine out procedure and touched down at the far 1,000 foot markers of the runway.	Individual council and group discussion. Implemented safety reporting program.	No	-
06/08/10	Non-Flying	Dispatch/Line	Ramp	-	-	Fuel imbalance more than 10 gallons in a DA-40.	Discussed in instructor meeting.	No	-
06/18/10	Non-Flying	Student	Ramp	2:00pm	VFR	Aircraft taxiing too fast into parking space. Almost hit another aircraft.	Not enough information for proper action to be taken.	No	-
07/09/10	Flying	Instructor	KMBT	11:45am	VFR	During a short field landing, the student grabbed the gear handle instead of the flaps causing the gear to retract. Go around was performed safely with minimal damage.	Individual council and discussed in instructor meeting.	No	Student also made report.
07/21/10	Flying	Student	20-30nm North of KBHM	1:00pm	VFR	Widely scatterted thunderstorms. Possible lightning strike. Immediately landed and checked aircraft.	Spoke with student and instructor. Both acted safely and followed procedures by landing at nearest airport.	No	-

Number of Reports Submitted Per Year

Table 1.

Number of Safety Reports Per Year

Year	Total	Percentage
2010	7	3.98%
2011	12	6.82%
2012	20	11.36%
2013	24	13.64%
2014	20	11.36%
2015	39	22.16%
2016	54	30.68%

Uses of Reports

- The database has been used consistently to inform instructors and students of safety issues and promote safety awareness.
- A synopsis of each report and related recommendations is provided to the flight school community in a timely manner as reports are submitted (posted in flight school and e-mailed)
- However, a lack of manpower has previously halted the systemic analysis of the safety report data available at this point.

Problem Statement

- Assess the information in the database by:
  - 1) identifying and categorizing hazards in a systematic fashion to aid the flight school and the overall airport community
  - 2) developing a data driven understanding of the current condition of the system
  - 3) allowing the ability to more appropriately apply accepted risk management techniques.

Literature Review

- The FAA's definition of a hazard is, "a condition that could foreseeably cause or contribute to an aircraft accident," (FAA, 2015, p.7)
- The Safety Management International Collaboration Group (SMICG) considers hazard identification the key element in safety risk management (SMICG, 2010)
- The SMICG also is acknowledged as a challenge by the SMICG, as hazards may differ greatly between organizations, depending on their specific processes and procedures (SMICG, 2013)

Literature Review

- However, the need for organizations to attempt to identify the hazards within their activities, and to use this data to develop risk mitigation strategies, is also made clear (SMICG, 2013).
- Bahr (1997) suggests that an effective hazard analysis process should be "…a systematic, comprehensive method to identify, evaluate, and control hazards," (p.72).
- And, the need for organizations to attempt to identify the hazards within their activities, and to use this data to develop risk mitigation strategies, is also made clear (SMICG, 2013).

Methodology

- Each report was reviewed independently by both researchers, with specific hazards experienced in the reported situation identified
- A second pass through the reports was made by both researchers together, comparing notes about the hazards indicated
- The need to define hazard categories was recognized, so subsequent passes through the data were made to identify these categories

Defined Hazard Categories

- ***Procedures*** – flight crew not following documented routines for a particular phase of flight
- ***Judgement/Decision making*** – flight crew not exhibiting proper analysis of inputs, leading to failure to make a timely or correct decision
- ***Situational Awareness*** – flight crew not aware of immediate circumstances or not able to project their circumstances into the future as appropriate
- ***Checklist Use*** – check list not utilized; check list used but items not completed; non-optimal design of checklist
- ***Communications*** – misunderstanding of communication; failure to communicate; communication not successfully transmitted

Defined Hazard Categories

- ***Air Proximity*** – when the PIC of either aircraft involved felt the need to take immediate evasive action to avoid a potential mid-air collision

- ***Maintenance procedure discrepancy*** – an inoperative component was not properly reported by a previous crew, resulting in a flight taking place with this discrepancy; maintenance not being aware of a discrepancy report which has been completed; pilots not checking discrepancy reports prior to flight

- ***Mechanical discrepancy*** – an inoperative aircraft component is identified by a pilot during flight operations

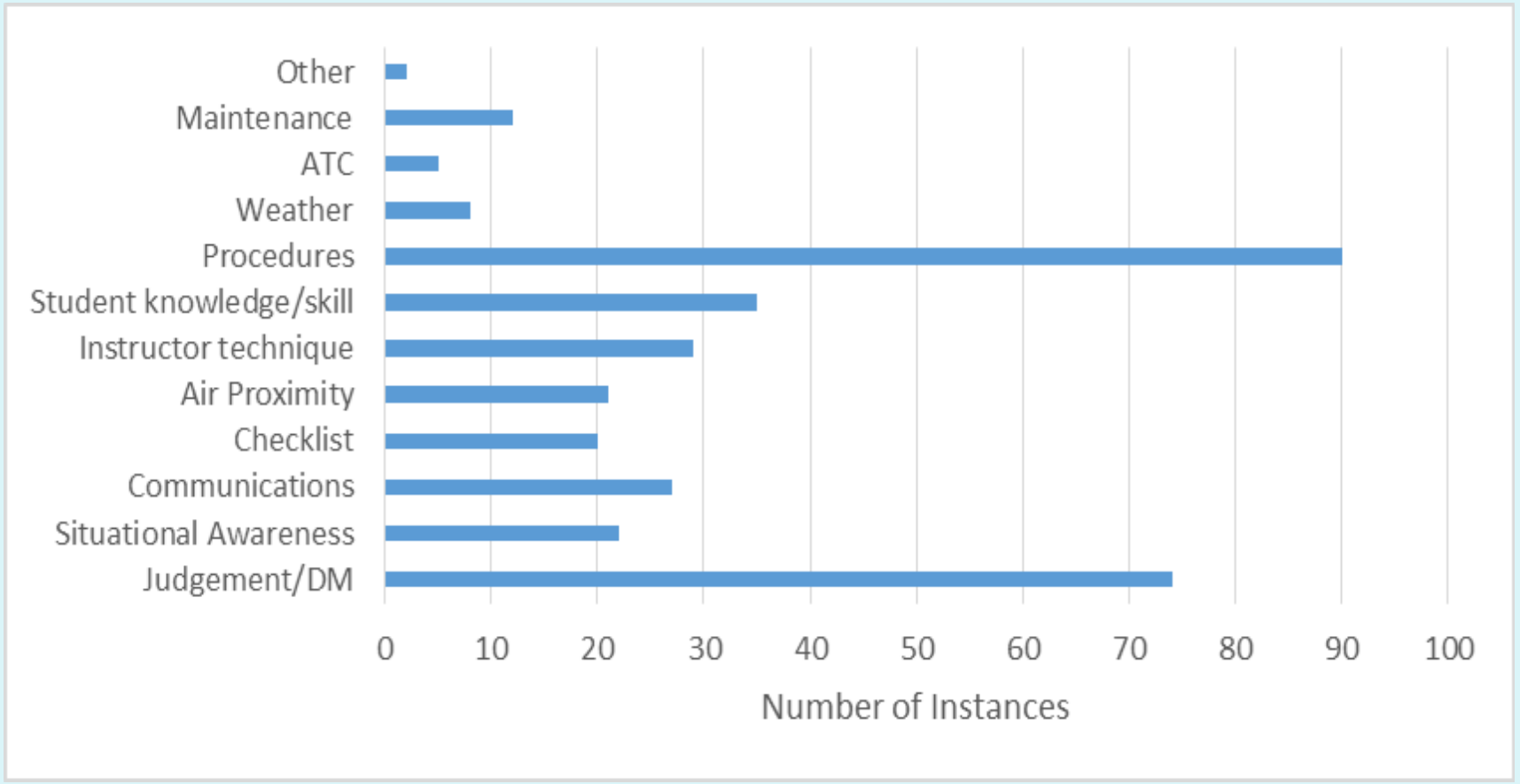
- ***Student knowledge/skill*** – lack of student knowledge/skill that is expected, given the phase of training or experience level of the student

- ***Instructor technique*** – lack of awareness of opportunity to allow students to learn from a situation; or, a lack of intervention when circumstances are beyond a student's skill level

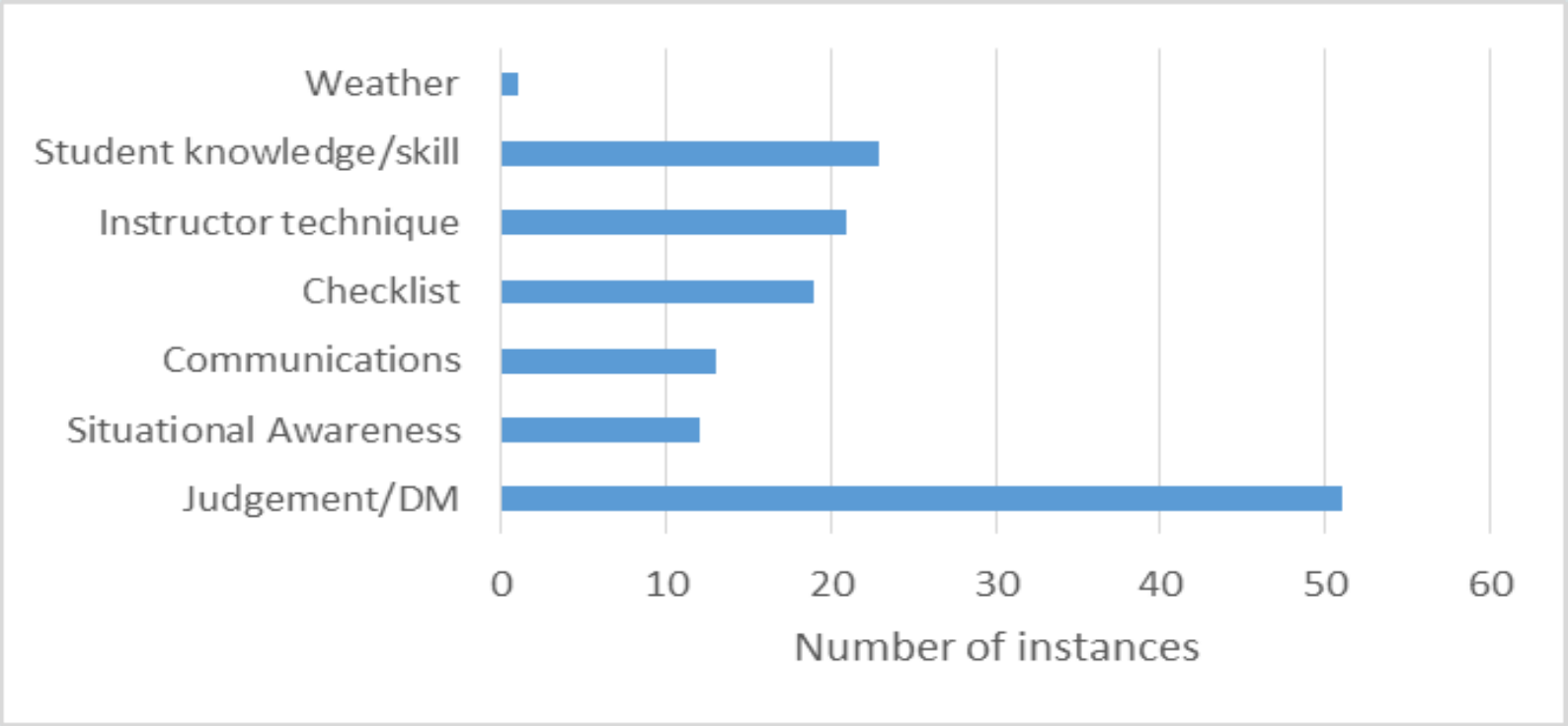
Phase of Flight also Coded

- Pre-flight
- Taxi
- Takeoff
- Departure
- Descent
- Approach
- Landing

Contributing Hazards as Coded from Safety Reports

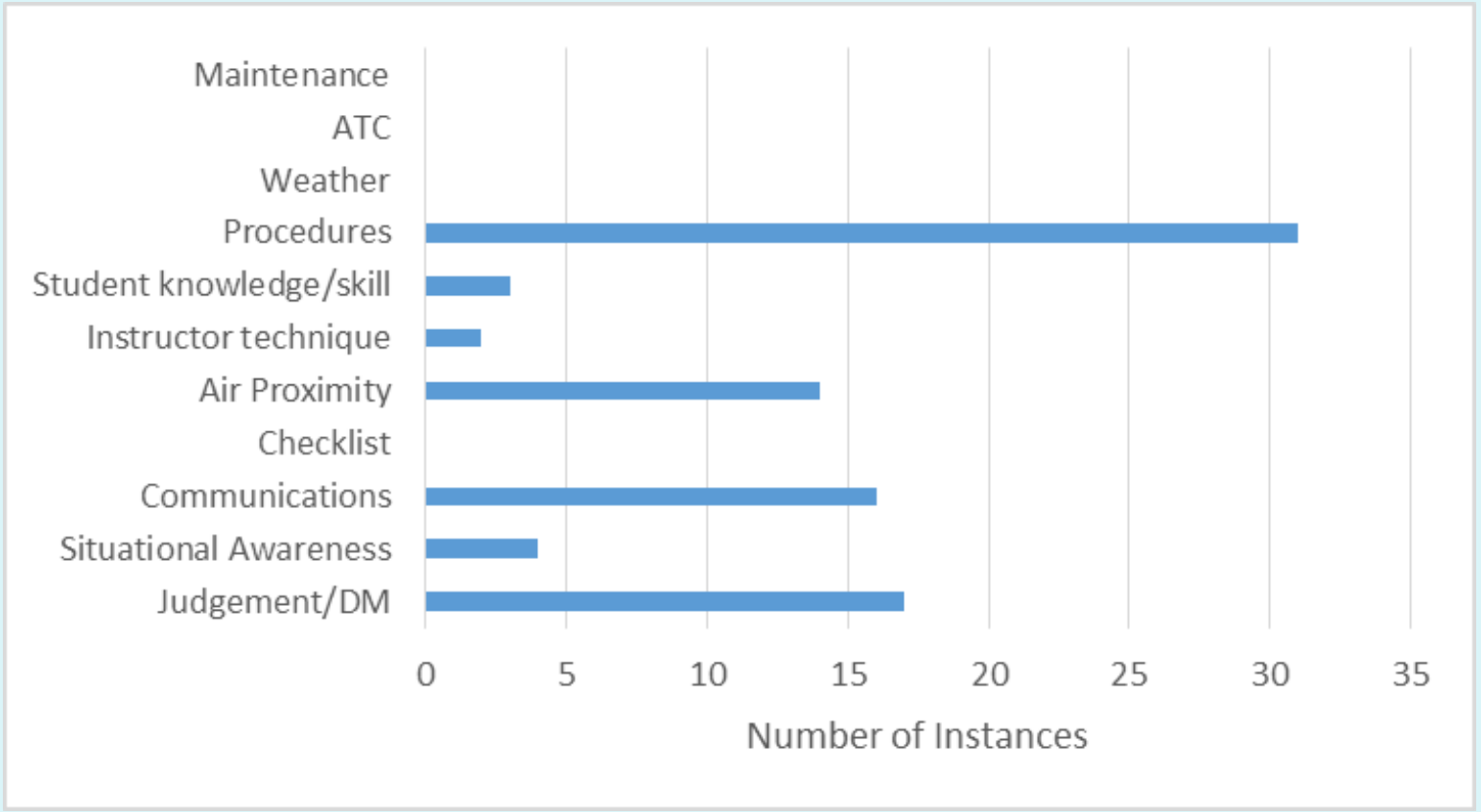


Non-use of Standard Procedures



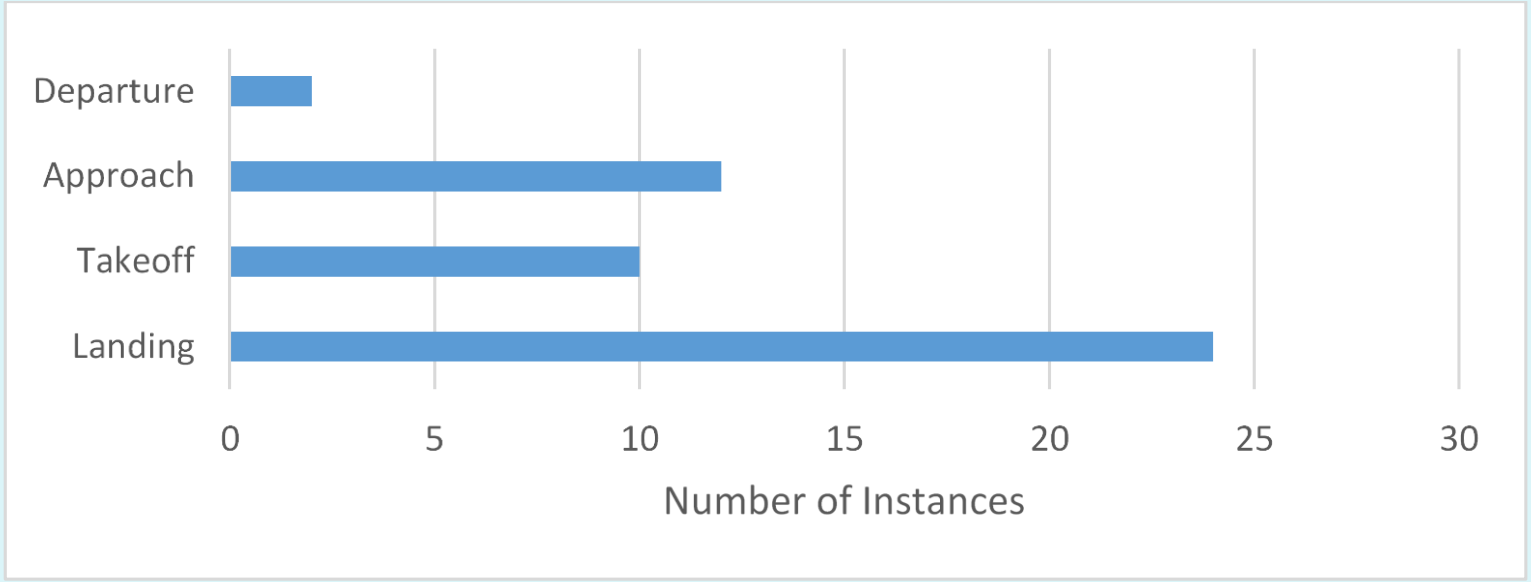
Frequency of occurrence of additional hazards in conjunction with lack of standard procedures usage

Traffic Pattern (non-towered)



Hazards identified within traffic pattern operation safety reports

Specific Phase of Traffic Pattern



Conclusions

Student Knowledge/Skill and Instructor Technique – Training Environment Paradigm

- 33 reports were found to have “student knowledge/skill” as a hazard; 29 were found to have “instructor technique” as a hazard.
- 14 of the reports indicating “instructor technique” were also found to have “student knowledge/skill” as a hazard
- This was not surprising - what caused the hazard was the instructor not realizing and responding to a lack of student knowledge until a situation warranting a safety report was encountered
- 7 of the 14 overlapping reports occurred within the landing phase of flight, when instructor vigilance of and reaction to student actions is obviously much more time sensitive than in other phases of flight.

Conclusions

- Hazards at flight schools are in some respects very different than those at 121 carriers
- However, non-use of or non-standard procedures was a hazard in over 50% of the examined reports, which is also a problem area for other operators
- This indicates the need to emphasize the importance of procedure use from the earliest days of flight training, even in relatively simple aircraft

Mitigation Strategies

- Specific communication to flight school students of the fact that non-adherence to standard procedures is the largest hazard, must continue to be a priority.
- Additional ways of making this point clear, such as during safety meetings and in academic classes, will be investigated.
- As a subset of procedures, checklist compliance must also continue to be emphasized.

“The Traffic Pattern”

- As a non-towered field, most students and instructors would say the traffic pattern is the biggest hazard
- It’s important that they understand it’s the use of non-standard procedures in the traffic pattern that is the actual hazard, coupled with poor judgement and decision-making
- Mitigation - efforts to improve procedural integrity, communication, and pilot judgment and decision making
- Possibly - providing all operators at this field with insight into the nature of the hazard(s) to promote a common approach to traffic pattern procedures

Next Steps

- Need to further refine the safety reporting form that is currently in use.
- Self-selection of the hazards by reporters would be beneficial.
- Safety committee review, oversight, and coding of the reported hazards would be continued, but this initial coding by users will greatly assist in the maintenance of an up to date hazard analysis database.

References

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Questions?