SAFETY MANAGEMENT SYSTEMS
AND
DECISION MAKING
Current Active Members:

Don Arendt - FAA SMS Office
Rick Christoffersen - The Squadron
Dan Deutermann - The Squadron
Mike Franz - Helicopter SBT
Katherine Hilst - Safety Design Consulting
Sunshine McCarthy - Baldwin Aviation
Chris Young - PRISM
Susan Tolle-Bryan - PRISM
Glenn Daley - NYPD (ret)
Bryan Smith - ALEA
Keith Cianfrani - Aviation Safety Consultants/ Rotor&Wing
WHO’S THIS GUY?

Bryan Smith

Airborne Law Enforcement Association
Safety Program Manager

Lee County Sheriff’s Office (FL)

USHST SMS Committee Chair

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239-938-6144
SETTING THE GAUGES

- Who is with us today?

- Who currently works with an established SMS?

- Who is working on establishing an SMS?
Another Safety Class?

• How about,
  “Learning how to minimize the risks that hold you back from doing our job more…” class
“If you had one superpower, what would it be?”

“Luck.”

Speaker’s notes: We cannot hold out on luck keeping us safe, we need something better. SMS is the best answer.
FLIGHT PLAN...

1. SMS OVERVIEW
2. PRACTICAL APPLICATIONS
3. DECISION MAKING AND SMS
4. ROARING APPLAUSE
5. LUNCH

“The safety of the operator is more important than any other point. Greater prudence is needed rather than greater skill.

~Wilbur Wright
1. SMS OVERVIEW

Why change?

Traditional Safety Program…

“Insanity is doing the same thing over and over again, and expecting different results.”

~Albert Einstein
1. **SMS OVERVIEW**

Why change?

**Traditional Safety Program…**

1. Hazard ID only

2. Tracks lag data *(final link)*

3. Assumption of risk

4. Assumption of performance

5. Isolated

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1. SMS OVERVIEW

Why change?

Traditional Safety Program…
1. Hazard ID only
2. Tracks lag data *(final link)*
3. Assumption of risk
4. Assumption of performance
5. Isolated

Safety Management System…
1. Hazard ID + Hazard and Risk Assessment
2. Lead and lag *(entire chain)*
3. Quantification and Prioritization
4. Quantified tracking *(assurance)*
5. Integrated with Ops and Training

“Insanity is doing the same thing over and over again, and expecting different results.”

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1. **SMS OVERVIEW**

   Why change?

1. Hazard ID + Hazard and Risk Assessment
2. Lead and lag *(entire chain)*
3. Quantification and Prioritization
4. Quantified tracking *(assurance)*
5. Integrated with Ops and Training
1. Cost savings
2. Increased efficiency
3. Industry standard
4. Legal ramifications
5. It WORKS = lives saved

1. Hazard ID + Hazard and Risk Assessment
2. Lead and lag (entire chain)
3. Quantification and Prioritization
4. Quantified tracking (assurance)
5. Integrated with Ops and Training
1. SMS OVERVIEW

Figure 14. Standard Problem Statements (SPSs) Level 1
1. SMS OVERVIEW

Why change?

![Bar chart showing intervention recommendations for Level 1 accidents]

**Intervention Recommendations (IRs), Level 1**

- Training/Instructional: 79%
- Data/Information: 76%
- Safety Management: 64%
- Systems and Equipment: 37%
- Maintenance: 23%
- Regulatory: 18%
- Infrastructure: 9%

**Note:** Each of the 523 accidents analyzed typically had multiple intervention recommendations.
1. SMS OVERVIEW

COMMON GROUND...

- **Definition of SMS:** The formal, top-down approach to managing safety risk. It includes systematic procedures, practices, and policies for the management of safety.

- **The pillars of a Safety Management System:**
  1. Policy
  2. Risk Management
  3. Assurance
  4. Promotion


| 1. Hazard ID + Hazard and Risk Assessment |
| 2. Lead and lag (entire chain) |
| 3. Quantification and Prioritization |
| 4. Quantified tracking (assurance) |
| 5. Integrated with Ops and Training |

“*Incomprehensible jargon is the hallmark of a profession.*”

~Kingman Brewster Jr.

IHST SMS Toolkit p.6, 96
“Just having a gun doesn’t make you armed anymore than having a guitar makes you a musician”

– Lt. Col. Jeff Cooper
2. PRACTICAL APPLICATIONS

- WHAT is to be done, as opposed to 'HOW'
- OBJECTIVES, SAFETY COMMITMENT, etc.
- WHO Authority, Responsibility, Roles
- Set by management
- Documentation and Records
- Emergency Preparedness

IHST SMS Toolkit     p. 7, 9, 15

2. POLICY

POLICY

1. Hazard ID + Hazard and Risk Assessment
2. Lead and lag (entire chain)
3. Quantification and Prioritization
4. Quantified tracking (assurance)
5. Integrated with Ops and Training
2. **PRACTICAL APPLICATIONS**

- **“What”** is to be done, as opposed to ‘How” objectives, safety commitment, etc.
- **“Who”** Authority, Responsibility, Roles
- Set by management
- Documentation and Records
- Emergency Preparedness

IHST SMS Toolkit  p. 7, 9, 15

2. **POLICY**

1. Hazard ID + Hazard and Risk Assessment
2. Lead and lag (entire chain)
3. Quantification and Prioritization
4. Quantified tracking (assurance)
5. Integrated with Ops and Training
2. PRACTICAL APPLICATIONS

Tips:

- Make your **Safety Policy** and your **Operational Policy** the same document, not two separate binders.

- Have a **Safety Statement** signed by the accountable executive... every year.

- The Safety Statement needs to include a reference to **Just Culture** (to be codified later).

- **Training** and **Safety** need to work together, on par. Establish this in your Policy.

IHST SMS Toolkit  p. 7, 9, 15
## 2. PRACTICAL APPLICATIONS

### Tips:

- It’s fine to have a ‘vision’ statement…”Zero accidents…” You need intermediate, measurable goals to define the path and verify progress. **Safety** is a goal, what are you going to do to get there?

- Get input from the line level employees
- Get input from the line level employees
- Get input from the line level employees
- Get input from the line level employees

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2. PRACTICAL APPLICATIONS

Tips:

- It's fine to have a 'vision' statement..."Zero accidents..." You need goals to define the path...is a goal, what are you going to do to get there?

- Get input from the line level employees
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1. Hazard ID + Hazard and Risk Assessment
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2. PRACTICAL APPLICATIONS

POLICY
2. PRACTICAL APPLICATIONS

POLICY

SMS Safety Bulletin
How to Get Started for the Small Operator

Contact: Bryan Smith
Phone: (239) 938-6144
Email: safety@ala.org

Getting Started

With all the information about Safety Management System (SMS) available today, getting started for a small operation can be overwhelming. It doesn't have to be, and in fact, you are probably well along at establishing a formal SMS. In most operations the following key elements already exist:

- Operations Manual
- Standard Operating Procedures (SOP)
- Operational Control of Aircraft Policies
- Training Objectives
- Aircraft Maintenance Procedures
- Risk Management

Additionally, you are aware of personal safety in the workplace, environmental concerns, the dangers of carrying hazardous materials, and security concerns both domestic and abroad. Through your training and your professional experience you are well prepared to recognize situations that would elevate risk on the job, e.g. fatigue, lousy weather, pressure from others. All of this is included in an SMS and you have it covered.

An SMS allows you to build a formal process around what you are already doing. Start with just two vital important components of an SMS and then build from there. Each of these components can be accomplished very simply.

Step 1: Management Commitment

Draft a letter stating what your organization is committed to doing to ensure the safety of the operation. This can be a one-page document, and should be signed by an accountable executive, such as the owner or CEO.

The statement should include the following four elements and may begin like this:

SAFETY STATEMENT

All employees are responsible to conduct all operations at Bob's Helicopter Service in the correct manner. Compliance with company polices is so important as to require devotion from safety precautions, facility maintenance, or the prudent judgment of our employees. Our Just Culture approach provides an environment where safety operations are always the priority in every task we undertake.

Key Elements of a Safety Statement:
1. What are you committed to?
2. How will you fulfill the commitment?
3. Who is responsible?
4. Non-punitive reporting culture

What are you committed to?
This could include statements such as "provide a safe and healthy workplace by preventing injuries and property damage" or "meet or exceed all flight, maintenance, occupational safety and health standards and regulations."

How will you fulfill the commitment?
Include statements such as:
- "Management to commit the necessary resources" and
- "Create and maintain an environment of trust and unrestricted communication."

Who's responsible?
Everyone is responsible and is fully accountable under a "Just Culture" when there is a knowing disregard for policies and procedures.

Why do I need this?
A written statement from the accountable executive is very powerful in giving validity and establishing expectations of the company. Without management's specific delegation of authority in the SMS program, those tasked with implementing safety initiatives could be undermined.

Step 2: Flight Risk Assessment Tool (FRAT)

In addition to a commitment letter, begin using a risk assessment tool. Every flight has an element of risk associated with it. It is critical that operators and pilots are able to objectively differentiate, in advance, between a low risk flight and a high risk flight. A simple risk assessment tool can help to determine the risk level of a flight or duty period in its planning stages.

Each operator should determine an acceptable level of risk for its flights based on the type of operation/mission, environment, aircraft used, crew training, and experience. When the risk for a flight exceeds the acceptable level, the hazards associated with that risk should be further evaluated and the risk mitigated (reduced).

Definition of Key Words:
- Hazard - something that might cause injury or damage, or an undesirable event.
- Risk - The product of the likelihood that an event will occur and the severity of the consequences of that event.
- Mitigation - A way to reduce the level of risk.

The risk assessment tool does not have to be complicated. It can be as simple as a checklist. It can be on paper or an electronic version. It should include areas to think about such as:
- Mission - routine or out of the ordinary; unusual; area of operation; flight type (passenger, repositioning, training); NOTAMs, TFRs; etc.
- Personnel - Experience level of the crew
- Human Factors - fatigue assessment; hours on duty; flight time; consecutive days on duty; >30 days since last operating equipment; etc.
- Aircraft - open MELs; unscheduled maintenance since last flight
- Environment - weather; terrain; time of day; inflight hazards
- Landing Zones - hazards; airport conditions, runway conditions; approach type

Example Risk Assessment Form:

The above FRAT can be obtained at no cost from the European Aviation Safety Agency (EASA). https://easa.europa.eu/ith/pest/201206/pre-departure-check-list

Retain copies of all risk assessments in one place (i.e. Risk Register). Periodically review and look for reoccurring risks within your operation. By doing this you have begun the process of data gathering and analysis for ongoing improvement.

This document is peer reviewed publication by an expert panel of the USHST SMS Committee. More information about the USHST SMS Toolkit, their reports, safety tools, and presentations can be obtained at the website: www.USHST.org.

2. PRACTICAL APPLICATIONS

POLICY

Speaker’s notes: Safety Bulletins from IHST are available for free at: www.ihst.org
2. PRACTICAL APPLICATIONS

POLICY

Just Culture must be codified in policy so it can be universally implemented.

Without a written commitment it is unlikely that employees will have faith in it.
2. PRACTICAL APPLICATIONS

POLICY

* Indicates a ‘System’ induced error. Manager/supervisor must evaluate what part of the system failed and what corrective and preventative action is required. Corrective and preventative action shall be documented for management review.
2. PRACTICAL APPLICATIONS

Just Culture must be codified in policy so it can be universally implemented. Without a written commitment it is unlikely that employees will have faith in it.

Without a written commitment it is unlikely that employees will have faith in it.

- Was the job understood?
- Knowingly violated procedures?
- Was the action as intended?
- Were the results as intended?
- Are the procedures clear?
- Pass substitution test?
- Defective training or selection experience?
- History of violating procedures?
- Sabotage or Malevolent Act
- Reckless Violation
- Negligent Error
- No Blame Error
- Repeatings Incident With Similar Root Cause
- Repeated Incident With Similar Root Cause

* Indicates a 'System' induced error. Manager/supervisor must evaluate what part of the system failed and what corrective and preventative action is required. Corrective and preventative action shall be documented for management review.

Documented for the purpose of accident prevention awareness and training will suffice.

- First written warning: Coaching / Increased Supervision until behavior is corrected.
- Final warning and negative performance appraisal.
Concern for man himself and his fate must form the chief interest for all technical endeavors. Never forget this in the midst of your diagrams and equations.

~ Albert Einstein
Safety Statement a reflection of reality?

What is “Safer”? 

Normalized deviation:

Policy ≠ Normal Procedure
2. PRACTICAL APPLICATIONS

Safety Statement a reflection of reality?

What is “Safer”? 

Normalized deviation:

Policy ≠ Normal Procedure

Assumption vs Knowledge:

Be in love with the results, not the policy
2. **PRACTICAL APPLICATIONS**

**POLICY**

Safety Statement a reflection of reality?

What is “Safer”?

Normalized deviation:

\[ \text{Policy} \neq \text{Normal Procedure} \]

Assumption vs Knowledge:

Be in love with the results, not the policy
Safety Statement

a reflection of reality?

**Speaker’s notes:** Many safety policies and procedures are considered sacred once put in place and are never questioned. For example this shark repellent was used for decades before it was discovered that it not only didn’t work, but may attract sharks. Also, some polices are put in place but are not followed in daily operations. Fatigue policy is often a example of this kind of normalized deviation. We need a means of making sure policy is actually being implemented on a daily basis, and that the policy/procedure is producing real results.
2. PRACTICAL APPLICATIONS

Emergency Response Plans:

Weak Points:

- When to initiate
- Poor tracking system
- Location of plan
- Contact list outdated
- Organization family contact slower than media
- Survivor/Responder mental health care
What is a significant hazard at your operation?

**Speaker’s notes:** In class exercise conducted at this point
Risk Management

1. Context (scope of inquiry, limits of risk, **POLICY**)
2. ID Hazards (reports, audits, lag data, observation)
3. Analyze Risk (likelihood vs. consequence)
4. Evaluate Risk (Prioritize, compare to accepted risk limits)
5. Treat the Risks (policy/procedure, training, equipment)
6. Monitor and Review
Hazard Identification Exercise
2. PRACTICAL APPLICATIONS

HAZARD IDENTIFICATION

Traditional Sources

- Accident Reports
- Annual Reports, Statistics and Studies
- War Stories
HAZARD IDENTIFICATION

Hazard ID Forms

- Keep them simple
- Make them easy to fill out
- Follow up can be done later
2. PRACTICAL APPLICATIONS

RISK MANAGEMENT

IHST SMS Toolkit p. 7, 27
2. PRACTICAL APPLICATIONS

HAZARD IDENTIFICATION

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- Keep them simple
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HUMS/HFDM
FRAT
Audits and Inspections
Surveys

IHST SMS Toolkit  p. 7, 27
2. PRACTICAL APPLICATIONS

RISK MANAGEMENT

Hazard Identification

Hazard identification is the act of classifying any condition with the potential of causing injury to personnel, damage to equipment or structures, loss of material, or reduction of the ability to perform a prescribed function. This includes any condition contributing to the release of a non-airworthy aircraft or to the operation of aircraft in an unsafe manner.

Any safety concern an employee has should be reported. Some examples include:

- High workload
- Rushing critical tasks
- Missing checklist items
- Parts issues
- Inadequate tool control
- Feeling fatigued
- Unsafe ground movement
- Improper equipment or tools
- Poorly developed or outdated procedures

A functioning SMS helps to identify hazards and develops processes to manage the associated risks. This can be achieved through several internal reporting mechanisms. Some key elements of hazard identification programs include:

- Incident/Event/Near Miss Reports
- Safety Surveys
- Inspection/Audits
- FDM Systems
- Training Programs
- Maintenance Interruption Reports
- Crew/Mission Pre-Flight Briefing (FRAT)
- Flight and Maintenance Logs
- Employee Interviews

The identification of a hazard provides an opportunity to learn how to prevent accidents and incidents it might cause. Procedures need to be in place for internal reporting of hazards. Timely collection of information allows the organization to react to the information. A hazard reporting form should be simple, convenient, and available to all employees.

Important hazard reporting elements include:

- Feedback to the reporting person
- A non-punitive discipline policy for individuals who report hazards (i.e., “Just Culture” or treat those who report issues fairly)
- Provisions for anonymous reporting of hazards
- All personnel know their primary contact for safety related matters.
- There is a process for the dissemination of safety information throughout the organization.
- Communication processes are commensurate with the size and scope of the organization. (Written documents, meetings, electronic, etc.)

During the hazard identification process, do not confuse ‘Hazards’ with ‘Consequences of Hazards’. ‘Hazards’ are situations, conditions, elements, environments that naturally exist, which we normally work with, which are a source of danger but do not necessarily result in incidents or accidents. They can nevertheless lead to negative outcomes called ‘Hazard Consequences’.

Examples of Hazards and Their Effects:

<table>
<thead>
<tr>
<th>Workplace Hazard</th>
<th>Example of Hazard</th>
<th>Example of Hazard Consequence (Harm Caused)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tools</td>
<td>Knife</td>
<td>Cut</td>
</tr>
<tr>
<td>Substances</td>
<td>Benzo[a]pyrene</td>
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<td>Mesothelioma</td>
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<td>Sources of Energy</td>
<td>Electricity</td>
<td>Shock, electrocution</td>
</tr>
<tr>
<td>Conditions</td>
<td>Heat Stress</td>
<td>Skin burns, heat stroke</td>
</tr>
</tbody>
</table>

This document is a peer-reviewed publication by an expert panel of the USHST SMS Committee. More information about the USHST SMS can be found at the USHST website. www.ushst.org
Now we have identified the hazards
Do we want to address them all?
Now we have identified the hazards

Do we want to address them all?

No!

- Some may not have a significant influence on safety at our operation (i.e. Risk of a meteor strike, freezing rain in Florida, etc.)
- Some may have a more significant impact than others
- Some may be difficult or impossible to mitigate
- What is the RISK of this HAZARD causing an unfavorable outcome?
- Addressing Hazards without consideration for Risk is one of the biggest failures of safety systems in our world
2. PRACTICAL APPLICATIONS

RISK MANAGEMENT

Now we have identified the hazards.

Do we want to address them all?

• Some may not have a significant influence on safety at our operation (i.e. Risk of a meteor strike, freezing rain in Florida, etc.)

• Some may have a more significant impact than others.

• Some may be difficult or impossible to mitigate.

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Now we have identified the hazards

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Addressing Hazards without consideration for Risk is one of the biggest failures of safety systems in our world.

**Speaker’s notes:** Addressing every possible hazard without regard for actual risk is what makes people dislike safety programs. Don’t be ‘chicken little’—run hazard information through a risk analysis process to uncover actual risk, prioritize them, and have a means of tracking improvements over time.
### Practical Applications: Risk Management

<table>
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<th>Likelihood</th>
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<tr>
<td>I-Catastrophic</td>
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<tr>
<td>III-Marginal</td>
<td>7</td>
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<tr>
<td>IV-Negligible</td>
<td>13</td>
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</tbody>
</table>
2. **PRACTICAL APPLICATIONS**

**RISK MANAGEMENT**

- Spend limited resources where you will get the biggest safety ‘bang for the buck’
- Respond to hazard reports that are warrantless ‘venting’
- Allows you to track performance (initial values set)

---

**LIKELIHOOD**

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<th></th>
<th>Frequency</th>
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2. PRACTICAL APPLICATIONS

RISK MANAGEMENT

- The helicopter landed hard during a forced landing.
- The student pilot’s delayed throttle application during the practice autorotation and the flight instructor’s lack of immediate remedial action.
- The pilot’s failure to maintain clearance with a telephone pole during a low-level maneuver.
2. PRACTICAL APPLICATIONS

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2. **PRACTICAL APPLICATIONS**

**RISK MANAGEMENT**

- The helicopter landed hard during a forced landing.

- The student pilot’s delayed throttle application during the practice autorotation and the flight instructor’s lack of immediate remedial action.

- The pilot’s failure to maintain clearance with a telephone pole during a low-level maneuver.

**Speaker’s notes:** These bullets are probable cause statements from accident reports. Usually our investigation only addresses the last couple links in the chain of errors. This limits our ability to prevent future incidents.
Rule of “5-Why’s”
2. PRACTICAL APPLICATIONS

RISK MANAGEMENT

Rule of “5-Why’s”

1. “Why did Thunder Pig hit the side of the hangar with the tailboom?”
   “He lost control during a landing.”

2. “Why did he lose control?”
   “He put the tail in the wind (downwind hover) when heavy and got into LTE.”

3. “Why did he not put in enough control input more quickly or hover into the wind?”
   “He had not flown in those conditions for several months and was ‘rusty’.”

4. “Why had he not flown in unit SOP approved wind conditions in several months?”
   “He set personal minimums that were below the conditions on the day of the accident and turned down flights if the winds exceeded those.”

5. “Why did he take a flight in conditions that exceeded those personal limits on the day of the accident?”
   “The call was for a missing 2 year-old and he felt compelled to go.”
2. PRACTICAL APPLICATIONS

RISK MANAGEMENT

Rule of “5-Why’s”

1. “Why did Thunder Pig hit the side of the hangar with the tailboom?”
   - Landing area proximity to hangar

2. “Why did he lose control?”
   - Operational procedures for landing during high winds.

3. “Why did he not put in enough control input more quickly or hover into the wind?”
   - Possible training deficiency. Possible conflict in proficiency and wx limitations

4. “Why had he not flown in unit SOP approved wind conditions in several months?”
   - Pilot skills possibly not maintained to standards between training/check rides.

5. “Why did he take a flight in conditions that exceeded those personal limits on the day of the accident?”
   - Personal wx minimums not applied when needed
   - Input of mission specifics negatively influenced pilot decision making
2. PRACTICAL APPLICATIONS

RISK MANAGEMENT

Risk Management: **Interventions**

- Training
- Procedures and Policies
- Environmental Controls
- Education (directed at hazard)

“Be Safe”

Target specific hazard elements
Risk Management: **Interventions**

- Training
- Procedures and Policies
- Environmental Controls
- Education (directed at hazard)

**Speaker’s notes:** Safety is what we get at the end of the process, after we’ve used a good risk management program to change operational culture and behavior. If a safety program response to a risk is simply ‘be safe’ we are not doing much to prevent a mishap.
2. PRACTICAL APPLICATIONS

RISK MANAGEMENT

Target specific hazard elements

Design Interventions to lower Likelihood and/or Severity

This will allow you to track the change in risk
2. PRACTICAL APPLICATIONS

Target specific hazard elements

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This will allow you to track the change in risk

Address each intervention with considerations for:

Policy/Procedure

AND

Training
2. PRACTICAL APPLICATIONS

Safety: Promotion

- **Training and Education**
  - ✓ Initial, recurrent, general and specific
  - ✓ Establish proficiency and currency requirements

- **Communications**
  - ✓ SMS program performance, status
  - ✓ Management’s commitment to the program
  - ✓ Safety related information
2. PRACTICAL APPLICATIONS

Safety: **Promotion**

- **Training** and **Testing** must be separated by definitive lines. i.e. If every flight with an IP seems like a test, the pilot will never be comfortable asking for instruction on something they are not 100% sure about.

- **Safety Management and Training cannot operate independently of each other.**
2. PRACTICAL APPLICATIONS

ASSURANCE

Safety: Assurance

- Traditionally, safety interventions are unquestionable once made into policy
- Feedback – Anything without feedback is a guess…at best an educated guess
- Justification: Return on Investment
- Love the results, not the policy or procedure
2. PRACTICAL APPLICATIONS

ASSURANCE

- Traditionally, safety interventions are unquestionable once made into policy
- Feedback – Anything without feedback is a guess…at best an educated guess
- Justification: Return on Investment
- Love the results, not the policy or procedure

Use the metrics set up at the beginning of the process to measure a change in risk.

IHST SMS Toolkit  p. 7, 28, 54, 61
2. PRACTICAL APPLICATIONS

In class exercise
2. PRACTICAL APPLICATIONS

Hazard ID -

In class exercise
2. PRACTICAL APPLICATIONS

In class exercise

Hazard ID -

Risk Analysis -

![Risk Analysis Table]

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</tr>
<tr>
<td>II - CRITICAL</td>
<td>3</td>
</tr>
<tr>
<td>III - MARGINAL</td>
<td>7</td>
</tr>
<tr>
<td>IV - NEGLIGIBLE</td>
<td>13</td>
</tr>
</tbody>
</table>
2. PRACTICAL APPLICATIONS

EXAMPLES

In class exercise

Hazard ID -

Risk Analysis -

Hazard Analysis -

Five Why’s

Latent Factors
2. PRACTICAL APPLICATIONS

Hazard ID -
Risk Analysis -
Hazard Analysis -
Intervention Design -

EXAMPLES

In class exercise

Select Hazard Element(s)

Individual risk factor

Ability to attack risk (money, time, law of nature?)

Quantify it somehow (how often, how close to threshold, etc.)

Target Severity or Likelihood
In class exercise

Hazard ID -

Risk Analysis -

Hazard Analysis -

Intervention Design -

Implementation -

Policy/Procedure

Training
<table>
<thead>
<tr>
<th>2. PRACTICAL APPLICATIONS</th>
<th>EXAMPLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hazard ID -</td>
<td>Measure change in Likelihood or Severity</td>
</tr>
<tr>
<td>Risk Analysis -</td>
<td>Respond to results <em>(continue, change, stop)</em></td>
</tr>
<tr>
<td>Hazard Analysis -</td>
<td>Feed results back into Promotion efforts</td>
</tr>
<tr>
<td>Intervention Design -</td>
<td></td>
</tr>
<tr>
<td>Implementation -</td>
<td></td>
</tr>
<tr>
<td>Assurance -</td>
<td></td>
</tr>
</tbody>
</table>

**In class exercise**
FLIGHT PLAN...

1. SMS OVERVIEW
2. PRACTICAL APPLICATIONS
3. DECISION MAKING AND SMS
4. ROARING APPLAUSE
5. LUNCH

“Just having a gun doesn’t make you armed anymore than having a guitar makes you a musician”

– Lt. Col. Jeff Cooper
DECISION MAKING AND SMS
“MAN – A creature that was created at the end of the week when God was very tired.”

~Mark Twain
MAN – A creature that was created at the end of the week when God was very tired.

~Mark Twain!

DECISION MAKING AND SMS

Standard Problem Statements (SPSs) Level 1

- Pilot Judgment & Actions: 84%
- Safety Management: 43%
- Ground Duties: 37%
- Pilot Situational Awareness: 31%
- System Component Failure: 28%
- Maintenance: 20%
- Mission Risk: 19%
- Post-crash survival: 13%
- Regulatory: 9%
- Communications: 9%
- Safety Systems and Equipment: 7%
- Infrastructure: 5%
- Personnel - Non Crew: 2%

Percentage of Accidents (523 Total Accidents)
Decision Making Theory

Analytical Decision Making

Intuitive Methods
Decision Making Theory

Analytical Decision Making

1. Clear goal or outcome
2. Plenty of time
3. All conditions, factors are known
4. Provides the best answers

Intuitive Methods
Decision Making Theory

Analytical Decision Making
1. Clear goal or outcome
2. Plenty of time
3. All conditions, factors are known
4. Provides the best answers

Intuitive Methods
1. Fast
2. Simple
3. Memory based
4. Work with limited information
5. Option chosen probably OK, but not optimal
Analytical Decision Making

Use this process to *create* effective RISK CONTROLS.

Analytical decision making ability is limited in the cockpit or under the tress of a mission scramble.

Intuitive Methods

Build Risk Controls so they can be *utilized*

in an intuitive manner.

They will be ineffective without consistent training.
Analytical Decision Making

The decision maker can:
- Develop wide range of options
- Evaluate and compare options
- Choose the optimal path

Analytical Method Characteristics
- Structured
- Time consuming
- Process breaks down with stress, limited time

Sources: Dave Huntzinger & Fred Brisbois
Naturalistic Decision Making (Intuitive DM process)

- Based on environmental input
- **Conditions constantly changing, both independently and as result of your actions**
- Real time decision making *(not planning)*
- **Goals not well defined**
- Could be competing goals *(safety vs …)*

Sources: Dave Huntzinger & Fred Brisbois
Naturalistic Decision Making (Intuitive DM process)

Potential Solutions:

1. **Rule based** – single, memory based solution
   (experience, training, EP drills, etc.)

2. **Choice based** – Multiple Options

3. **Creative** – No obvious choice, must use substitute experiences

Our SMS Interventions must help employees survive using these three choices

Sources: Dave Huntzinger & Fred Brisbois
Our SMS Interventions must help employees survive using these three choices.

Choice based – Multiple Options

Hicks’s Law

When the number of possible choices increases - reaction time increases

Increase of 1 possible choice to 2 = 58% increase in response time
Training and DM
Training and DM

- How do you train for recognizing dynamic rollover?
- This is an experienced pilot
- Why did he do the one thing every pilot is told not to do from day one?
- Could this happen to us?
- SMS training must be geared to build up Intuitive (Naturalistic) Decision Making Skills.
- These Intuitive DM tools must be cemented with training...continuously
Training and DM

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Training and DM

Speaker's notes: Several videos removed. Videos show experienced pilots having accidents due to basic flight safety errors that are learned on the first training flight. These examples are of errors that are discussed, but rarely practiced in flight. The final picture is the results of an autorotation following an engine failure over a large city. This is an example of how training for the right application can pay off.
Training and DM

- Vasoconstriction
  - Loss of fine motor skills
- Tunnel Vision
- Bilateral Symmetry
  - Both sides of the body act in unison
- Cognitive Shutdown

Emergency checklist items - Preloading
Train to scan - battlefield scan
Emergency Procedures (turns) - Training
Stress Inoculation (LE hit rate increase from 20-90%)
Training and DM

Physiological Barriers - Stress

- Vasoconstriction: loss of fine motor skills
- Tunnel Vision
- Bilateral Symmetry: both sides of the body act in unison
- Cognitive Shutdown

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Stress Inoculation (LE hit rate increase from 20-90%)
Training and DM

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- Bilateral Symmetry - both sides of the body

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Training and DM

Physiological Barriers - Stress

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- **Tunnel Vision**

- **Bilateral Symmetry**
  - Both sides of the body act in unison

- **Cognitive Shutdown**

**Stress Inoculation** (LE hit rate increase from 20-90%)

These concepts are addressed in modern law enforcement training. Considerations for these factors have greatly increased officer performance in high stress scenarios. Once heart rate exceeds around 145 bpm, these same factors will effect a pilot’s performance. Bilateral symmetry can cause an inadvertent control input in one control when the other is moved, for example. Vasoconstriction can make operating avionics (small buttons) difficult to impossible.
Consider these Decision Making factors when developing Interventions

- Checklists
- ADM
- CRM
- Training
- Policies and Procedures
- Equipment (PPE, avionics, etc.)
- Environment - Cannot program out all human error. Minimize error and build in protective environmental layers
Fatigue
Fatigue

sleep deprivation = unstable cognitive state

consecutive RTs across a 10-min PVT performance task
Fatigue

sleep deprivation = unstable cognitive state

Decreased pilot capabilities and increased workload combine to decrease safety margin during approach and landing phase.
Fatigue

sleep deprivation = unstable cognitive state

consecutive RTs across a 10-min PVT performance task
Fatigue

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Fatigue

sleep deprivation = unstable cognitive state

consecutive RTs across a 10-min PVT performance task
Fatigue

When we are tired we may make an evaluation of our ability to fly during a low level on the top chart (higher response rate) thinking that we will stay at that level throughout the flight. If our response time happens to be quick (low on the top chart) during high pilot tasking, we are fine and the flight goes well. This reinforces the false idea that we can monitor our own performance level when fatigued. If flight tasking gets high when our response rate is high as well...things may not end up so great. The difference is only a matter of luck. Here, human interventions are not enough to keep us safe. An environmental intervention, such as strict crew rest policy, is needed.
• If CRM isn’t present in normal ops it will not magically appear in emergencies

• ADM type triggers and responses based on identified hazards
  “if the ceiling drops another 100’ we’re out of here.”

• Work CRM into any risk you are trying to mitigate

• Define CRM using checklists, training
“Quick! Pull up the on-screen checklist for a display failure!”
Checklists
Checklists

- Use SMS generated lead indicators (interventions) in your checklists
- Develop preflight (post-preflight) and mission checklists
- Stop Checklist at major objective and start new one
- Consider the ‘flow’ of the checklist
- Alternating colors
- Larger print at bottom of list
Checklists

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- Larger print at bottom of list.
Flight Risk Assessment Tool

When analyzing risk factors for an activity, we consider them individually. The interaction of the factors on overall risk is difficult to do in our heads. Personal desire to complete a mission has subliminal influence on this process. Just prior to launch, the pace of operations will start shifting our decision making from analytical to intuitive. Take care of the analytical process independent of these influences.

This FRAT is available for free on the IHST (ESEST) website: [https://easa.europa.eu/essi/ehest/2012/06/pre-departure-check-list/]
Flight Risk Assessment Tool

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- Personal desire to complete a mission has subliminal influence on this process.

- Just prior to launch the pace of operations will start shifting our decision making from analytical to intuitive.

- Take care of the analytical process independent of these influences.
Personal Protective Equipment

- In an emergency if it is not ‘on’ you, you will likely not have it available to you
- Helmets protect from impact, birds, glass and can assist in flotation
- Gloves *(exposed wrists – F-4 example)*
- Survival vest
- HEEDS
- Cutting Tools
- Personal Location Devices
- Mirror
- Quick-clot
- Lighter
- Firearm?
- Police Radio
- Water
- ‘Go To Hell’ Bag
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Aircrew had to tread water waiting for rescue – life jackets hanging on hooks in the cockpit, could not get them out in time.
Personal Protective Equipment

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- Police Radio
- Water
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Bird Strike - Pilot hit in the face – serious injury, blood in eyes, almost lost
Personal Protective Equipment

- In an emergency if it is not ‘on’ you, you will likely not have it available to you
- Helmets protect from impact, birds, glass and can assist in flotation
- **Gloves** (exposed wrists – F-4 example)
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- Lighter
- Firearm?
- Police Radio
- Water
- ‘Go To Hell’ Bag

Emergency landing while doing alligator survey for wildlife commission. Aircraft immediately sank and they had to get out and spend the night on the roof of the aircraft. Unable to retrieve survival kit before sinking.
FLIGHT PLAN…

1. SMS OVERVIEW
2. PRACTICAL APPLICATIONS
3. DECISION MAKING AND SMS
4. ROARING APPLAUSE
5. LUNCH

“The safety of the operator is more important than any other point. Greater prudence is needed rather than greater skill.

~Wilbur Wright
There are no new ways to crash an aircraft…
…but there are new ways to keep people from crashing them…

YOU ARE NOW LEAVING
THE SAFETY OF FLIGHT
PLEASE DRIVE CAREFULLY
There are no new ways to crash an aircraft...

...but there are new ways to keep people from crashing them...

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