Introduction

- U.S. HEMS safety research project
- Comprehensive review of HEMS accidents
- Root cause analysis
  - > 140 HEMS accidents with final reports
  - 1998 through 2009
- Concrete recommendations that can
  - Prevent HEMS accidents
  - Reduce the impact of accidents that do occur
Introduction

- HEMS Industry/Community research project and working group
- Represents disciplines within the air medical and aviation communities
- Not part of US JHSAT (US Joint Helicopter Safety Analysis Team)
- “OSI-HEMS” research group
  - Several JHSAT colleagues are part of our group
  - Utilizing a modified version of the US JHSAT spreadsheet

Research Team

- >40 aviation and air medical professionals
- Representing
  - Associations
  - Air medical operators
  - Manufacturers
  - FAA
  - Aviation training
  - Aviation insurance
Research Team

Associations
- Air & Surface Transport Nurses Association (ASTNA)
- Air Medical Physician Association (AMPA)
- Air Medical Safety Advisory Committee (AMSAC)
- American Association for Respiratory Care (AARC)
- Association of Air Medical Services (AAMS)
- Commission on Accreditation of Medical Transport Services (CAMTS)
- Helicopter Association International (HAI)
- International Association of Flight Paramedics (IAFP)
- National Association of Air Medical Communication Specialists (NAACCS)
- National EMS Pilots Association (NEMSPA)

Helicopter operators
- Air Evac Lifeteam
- Air Methods Corporation
- CareFlite (Dallas/Fort Worth)
- EraMed
- Intermountain Life Flight
- Keystone Medflight
- Maryland State Police Aviation
- Med-Trans Corporation
- Metro Aviation
- Omniflight Helicopter, Inc
- PHI Air Medical
- Palm Beach County, Trauma Hawk
Research Team

- Manufacturers
  - American Eurocopter
  - Bell Helicopter
  - Turbomeca USA
- Federal Aviation Administration
- Aviation training (FlightSafety International)
- Aviation insurance (AirSure Limited)

Timeline: 2008-2009

- January 2008: first group meeting
- 2008-2009: 13 meetings (~ every two months)
- September 2009: Initial reviews completed for 140 accidents
- Present initial raw data: IHSS and AMTC
- November 2009: begin weighted analysis and scoring
Accident Analysis

The Process

U.S. HEMS Accidents and Fatal Accidents

*Dedicated and dual-purpose through September 28, 2009*
Focus: 1998-2009

- 150 HEMS accidents
  - 144 dedicated HEMS
  - 6 dual purpose
  - 50 (of 149) fatal
  - 47 HEMS
  - 3 dual purpose

OSI-HEMS Accident Analysis:

<table>
<thead>
<tr>
<th>Date/Time</th>
<th>Event, Action, Condition</th>
<th>Contributing Factor</th>
<th>Contributed Code</th>
<th>Contributed Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998-01-01</td>
<td>Departure/Approach</td>
<td>Final approach</td>
<td>Code 1</td>
<td>Code 2</td>
</tr>
</tbody>
</table>

- Analysis of 150 HEMS accidents
- 144 dedicated HEMS
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IHSS 2009, Montreal
© Ira Blumen, 2009
Timeline of the Accident

- Events
- Actions
- Conditions
- What happened
- Contributing factors

“Problem Statements”

- Standard Problem Statements (SPS)
- Modified and revised US JHSAT format
  - 16 major categories (SPS Level 1)
  - Over 70 sub-categories (SPS Level 2)
  - Over 460 individual SPS
  - Some overlap
- Modified US JHSAT format
“Problem Statements”

- Added over 110 new Standard Problem Statements
- New Level 1 categories
  - Medical crew
  - Communications specialists
- Expanded Level 2 Categories (>40% increase)
  - Equipment/safety management
  - Safety program
  - Performance of maintenance duties
  - Inadequate procedures (communications)
  - Mission risk environment
  - Lack of real time data

Confidence Level

- Factors
  - Validity (V)
  - Importance (I)
  - Probability (P)
- Range: 1 to 5
  - 1 = poor (just a guess on our part)
  - 2 = weak
  - 3 = average
  - 4 = good
  - 5 = excellent (absolutely sure)
“Interventions”

- Intervention/Mitigation Strategies (IMS)
- Modified US JHSAT format
  - 8 major categories (IMS Level 1)
  - 42 sub-categories (IMS Level 2)
  - > 425 specific interventions
  - Some overlap
- Modified US JHSAT format...
“Interventions”

- Added over 150 interventions
- Expanded Level 2 Categories (>40% increase)
  - Investigation
  - Aircraft components
  - Post incident survivability
  - Infrastructure - Communications
  - Infrastructure – Ground support
  - Regulatory – Regulations/standards
  - Safety management – Capital Investment (added)
  - Safety management – Risk Assessment
  - Safety Culture
  - SOP – Mission Specific
  - SOP – Ops Maintenance

IMS Scoring

- Factors
  - Effectiveness (E)
  - Feasibility (F)
- Range: 1 to 5
  - 1 = poor (poorly effective or utilized)
  - 2 = weak
  - 3 = average
  - 4 = good
  - 5 = excellent (absolutely effective / 100% utilized)
Accident Analysis

Initial Results:
Standard Problem Statements (SPS)

Standard Problem Statements: Level 1
Top SPS Level 2s

- Human Factors - Pilot's Decision
- Inadequate information in report
- External Environment Awareness
- Mission/Flight Planning
- Safety Program
- Visibility/Weather
- Flight Profile
- Procedure Implementation
- Landing Procedures
- Management (Safety Management)
- Human Factors - Pilot/Aircraft Interface
- Lack of real-time data
- Performance of MX Duties
- MX Procedures/Management
- Part/-system Failure - Aircraft
- Pilot (Safety Management)

Top 10 “Specific” Standard Problem Statements

- Information missing/incomplete in report (76-100)
- Aircraft position and hazards (51-75)
- Disregarded cues that should have led to termination of current course of action or maneuver [Human Factors – Pilot Decision Making] (51-75)
- Failed to recognize cues to terminate current course of action or maneuver [External Environment Awareness] (51-75)
- Lack of real-time data available (51-75)
- Pilot misjudged own limitations/capabilities (41-50)
Top 10 “Specific” Standard Problem Statements

Range: 31-40
- Pilot decision making
- Risk Management inadequate
- Inadequate and/or untimely intervention by medical crew member
- Diverted attention, distraction (tie)
- Management policies/oversight inadequate (tie)

Accident Analysis

Initial Results: Intervention / Mitigation Strategies (IMS)
Intervention Strategy: Level 1

- Training/Instructional
- Safety Management
- Data/Information
- Systems and Equipment
- Maintenance
- Infrastructure
- Regulatory
- No recommendation

Top 10 IMS: Level 2

- Safety Training
- Basic Training
- Risk Assessment/Management
- Advanced Maneuver Training
- Recorder
- Safety culture
- Mission specific
- Investigation
- SOP - Ops Mgt
- Situational Awareness Enhancers
Top 10 “Specific” Interventions

- AMRM training and utilization (Range: 76-101)
- Improve quality and depth of NTSB investigation and reporting (76-101)
- Install data recording devices (51-75)
- Simulator Training - Advanced Maneuvers (26-50)
- Training emphasis for maintaining awareness of cues critical to safe flight (26-50)
- Install cockpit recording devices (audio) (26-50)

Top 10 “Specific” Interventions

- Establish/Comply with programs to encourage culture of conservative safety decisions (26-50)
- Establish/Comply with procedures or risk assessment program to eliminate culture of non-compliance (26-50)
- Ground Hazard Awareness/Proximity Training (26-50)
- Emergency Procedures Training (26-50, tie)
- Establish/Improve Company Risk Management Program (26-50, tie)
The End Product

Recommendations

- Based upon
  - Anticipated benefits
    - Lives that could be saved
    - Accidents that could be prevented
  - Cost
  - Effectiveness
  - Feasibility
**LACED Scoring**

- Lives that may be saved
- Accidents that may be prevented
- Cost
- Effectiveness
- Doable (Feasibility)

**Example: LACED Scoring**

<table>
<thead>
<tr>
<th>Factor</th>
<th>Score</th>
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<tbody>
<tr>
<td>Lives Saved</td>
<td>1</td>
</tr>
<tr>
<td>Accidents Prevented</td>
<td>5</td>
</tr>
<tr>
<td>Cost</td>
<td>3</td>
</tr>
<tr>
<td>Effectiveness</td>
<td>3</td>
</tr>
<tr>
<td>Doable (feasible)</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>16</strong></td>
</tr>
</tbody>
</table>
LACED Score.

- Determine a LACED Score for the various intervention
- Allow a direct *quantitative* comparison between recommended interventions

In conclusion.

- Evaluate a lot of data
- Identify the problems specific to HEMS
- Identify interventions that will help the HEMS community
- Make recommendations that will make a difference
- Justify our recommendations
- Provide a mechanism for evaluation and comparison
Grant Support and Funding

- MedEvac Foundation International (formerly Foundation for Air-Medical Research and Education)
- Flight Safety Foundation
- American Eurocopter Vision Zero Safety Award
- Air Medical Physician Association
- Air Methods Corporation
- PHI Air Medical
- Metro Aviation
- Omnilight Helicopter Corporation
- Turbomeca USA
- Flight Safety International
- Air Medical Memorial Wings
- Sikorsky Aircraft Corporation

Thank you