USA Human Factor Helicopter Mishap Findings and Recommendations

By

Colonel Pete Mapes, USAF, MC, CFS
## USA Human Factor Helicopter Mishap Findings and Recommendations

### Authors
Air Force Research Laboratory, Human Effectiveness Directorate, DUSDR/PR&A, Wright Patterson AFB, OH, 45433

### Distribution/Availability Statement
Approved for public release; distribution unlimited.

### Security Classification
- Report: Unclassified
- Abstract: Unclassified
- This Page: Unclassified

### Pages
- Number of Pages: 46
Statement of Accountability

This brief represents the position of the researcher. It does not represent the position of any other organization including the United States Air Force or the Department of Defense.

Cleared for public release by ASC Public Affairs.
Disposition Date: 29 March 2007
Document Number: AFRL-WS 07-0731
Background

• This study describes all 251 U.S. Army Class A-B Rotary Wing Mishaps ascribed to ‘Human Factors’ from FY 85 to 05

• This data is based on a study of data archived in the mishap files of the USA Combat Readiness Center at Fort Rucker, Alabama

• This data is the second part of a study that will include all rotary wing aircraft in the DoD

• The first part ‘USAF Helicopter Mishap Data’ was publicly released on 18 Sep 2006
Method

• Obtained all U.S. Army Rotary Wing Aircraft Class A & B Mishaps ascribed to ‘Human Factors’ from FY 85 to FY 05 inclusive from the U.S. Army Readiness Center
• Reviewed all 251 mishap reports on 278 helicopters
• Created a data base for initial analysis
• No monetary value is associated with fatalities
• Major injuries resulted in approximately four weeks or more of lost duty time
• Minor injuries resulted in approximately less than four weeks of lost duty time
Outline

• Characterize the force
• Identify major areas of lethality, injury and airframe loss
• Identify injury patterns
• Categorize mishaps by phase of flight
• Summarize mishaps by airframe
• Formulate recommendations
Force Categorization
Current Active Inventory or Average Active Inventory for FY 85 – 05

# TAI

- UH-1*
- AH-1*
- H-6*
- H-47
- OH-58
- H-60
- AH-64
- TH-67

* Mean/year
Major Areas Of Mishaps, Loss Of Life & Injury
% of Inventory, FY 85 – 05, Involved in Class A or B HF Mishaps

- UH-1* (32)
- AH-1* (18)
- H-6* (8)
- H-47 (22)
- OH-58 (65)
- H-60 (73)
- AH-64 (58)
- TH-67 (2)

N = 278
* = Average/21 yrs
HF Mishaps by MDS

- UH-1 (28)
- AH-1 (14)
- H-6 (8)
- H-47 (20)
- OH-58 (61)
- H-60 (65)
- AH-64 (53)
- TH-67 (2)

N = 251
HF Mishap Rates/100K Hrs by MDS

- UH-1
- AH-1
- H-6
- H-47
- OH-58
- H-60
- AH-64
- TH-67
HF Mishaps by Type & Phase

- **CFIT**: 84.46%
- **MIDAIRS**: 12.75%
- **OTHER LANDING**: 2.8%

- **N = 251**
HF White/Brownout (& V-I) Prone Conditions

NIGHT

DAY

Day-Brownout
Day
Night-Brownout
Night

N = 117
HF WHITEOUT/BROWNOUT RATES (/100K Hours) BY SYSTEM

- UH-1
- AH-1
- H-6
- H-47
- H-47
- OH-58
- H-60
- AH-64
- TH-67
Relative Risk of HF Mishaps at Night vs. Day, FY 85 – 05

- UH-1
- AH-1
- H-6
- H-47
- OH-58
- H-60
- AH-64

Relative Risk
Fatality & Injury Patterns
HF Fatality Rates/100K Hours BY MDS

- UH-1
- AH-1
- H-6
- H-47
- OH-58
- H-60
- AH-64
- TH-67
HF Injury Rates/100K Hours By System
<table>
<thead>
<tr>
<th>MISHAP</th>
<th>PILOTS</th>
<th>PAX &amp; CREW</th>
<th>Δ%</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 112</td>
<td>N = 232</td>
<td>N = 431</td>
<td>(p value)</td>
</tr>
<tr>
<td>NOT INJURED</td>
<td>#</td>
<td>#</td>
<td>%</td>
</tr>
<tr>
<td>37.9</td>
<td>140</td>
<td>32.5</td>
<td>- 5.4</td>
</tr>
<tr>
<td></td>
<td>88</td>
<td>140</td>
<td>(.159)</td>
</tr>
<tr>
<td>MINOR INJURY</td>
<td>67</td>
<td>113</td>
<td>- 2.6</td>
</tr>
<tr>
<td></td>
<td>28.9</td>
<td>26.2</td>
<td>(.462)</td>
</tr>
<tr>
<td>MAJOR INJURY</td>
<td>22</td>
<td>70</td>
<td>+ 6.7</td>
</tr>
<tr>
<td></td>
<td>9.5</td>
<td>16.2</td>
<td>(.016)</td>
</tr>
<tr>
<td>DEAD</td>
<td>55</td>
<td>108</td>
<td>+ 1.4</td>
</tr>
<tr>
<td></td>
<td>23.7</td>
<td>25.1</td>
<td>(.699)</td>
</tr>
</tbody>
</table>

\( \Delta \% \) represents the change in percentage from PILOTS to PAX & CREW.
<table>
<thead>
<tr>
<th>MISHAPS N = 207</th>
<th>PILOTS N = 409</th>
<th>PAX &amp; CREW N = 315</th>
<th>Δ%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>#</td>
<td>%</td>
<td>#</td>
</tr>
<tr>
<td>NOT INJURED</td>
<td>218</td>
<td>53.3</td>
<td>132</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MINOR INJURY</td>
<td>99</td>
<td>24.2</td>
<td>67</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAJOR INJURY</td>
<td>23</td>
<td>5.6</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FATAL</td>
<td>69</td>
<td>16.9</td>
<td>95</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Mishaps By Phase Of Flight
HF Fatalities & Injuries by Phase Of Flight - Overview

- **Landing**
  - Minor
  - Uninjured
  - Major
  - Fatal

- **Hover & Taxi**
  - Minor
  - Uninjured
  - Major
  - Fatal

- **T/O & G/A**
  - Minor
  - Uninjured
  - Major
  - Fatal

- **Cruise**
  - Minor
  - Uninjured
  - Major
  - Fatal

N = 740 of 974+
HF Landing Mishaps

- Tailwind
- Excess Sink
- Under
- TR
- Lat - MRB
- Slope - R/O
- Drift - R/O

Legend:
- Day
- Day - Low Vis
- Night
- Night - Low Vis

N = 52
All Fatalities and all major injuries except one occurred in B/O or IFR Visibility

- Minor: 103
- Uninjured: 149
- Major: 20
- Dead: 8

N = 280
HF Hover/Taxi Mishaps

87% occur at night & 33% occur in low visibility

N = 46
All Fatalities (10) and 42 Major Injuries (of 44 – 2 undet.) occurred at night & 16.7% (9) occurred in low visibility.

Of those uninjured or with minor injuries, 6 were day (3 low vis) and 129 were night (3 low vis).
Whiteout, brownout and night are the largest HF risks for takeoff and go-around.
HF T/O & G/A Mishaps

- Aero - PWR
- Lat - A/C
- Lat - MRB
- Drift - R/O
- Wire

Legend:
- Day
- Day - Low Vis
- Night
- Night - Low Vis

N = 26
HF T/O & G/A Injuries
(NO HF FATALITIES OCCURRED DURING T/O & G/A)

- Minor: 29
- Uninjured: 71
- Major: 10

N = 110
HF Cruise Mishaps

- Day
- Day - Low Vis.
- Night
- Night - Low Vis.

N = 88
HF Cruise Mishaps

Continued VMC into IMC flight accounted for 19/48 Terrain CFITs, 3/30 Wire CFITs and 70/162 fatalities. All but 3 were night events!
Cruise Fatalities and Major Injuries were the largest groups in any phase of flight.

Wire strikes accounted for 42/216 cruise fatalities and 22/63 major injuries.

Midair collisions accounted for 50/216 cruise fatalities and 10/63 major injuries.

N = 458
Mishaps By Airframe
## Comparison of Army Helicopters by Threats & Type

<table>
<thead>
<tr>
<th>MDS</th>
<th>CFIT</th>
<th>MIDAIR</th>
<th>B/O</th>
<th>TR</th>
<th>Night</th>
</tr>
</thead>
<tbody>
<tr>
<td>UH-1</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>AH-1</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>XXX</td>
</tr>
<tr>
<td>H-6</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>H-47</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>OH-58</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td>XXX</td>
</tr>
<tr>
<td>H-60</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>XX</td>
</tr>
<tr>
<td>AH-64</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
Recommendations
Technology Recommendations (Life Saving)

• US Army Helicopters would benefit from a system similar to TAWS
  – Militarize a COTS item to provide this for legacy aircraft
  – Use Navy TAWS when computer present
• Bring datalink weather data into the cockpit
• Provide COTS traffic warning technology to prevent midairs
• All helicopters need wire detection technology
• All occupants should use lap and shoulder restraints
• Airbag use should be evaluated
• Crew positions should be designed to eliminate (minimize) the need for any crewmember to be out of a crashworthy seat below ETL
• All helicopter occupants should be carried in crashworthy seats capable of Gz mitigation with 4-point restraint
Technology Recommendations (Aircraft Saving)

• All helicopters need technology permitting safe flight and the maintenance of situational awareness in brownout/whiteout conditions, particularly at night:
  – Automated hover with instant availability
  – Automated landing systems
  – Sensor based systems

• All helicopters without rearward visibility (AH & OH) should be equipped with technology to prevent tail rotor strikes:
  – Warning systems that notify the pilot when an object is in the proximity of the tail rotor.
  – Automated systems permitting hover in a fixed position without drift.
Policy Recommendations

• No person should be allowed aboard an operating helicopter without wearing a helmet at all times
• All occupants should remain strapped in position when the vehicle is operated below ETL until it has landed or achieved a stabilized hover
• Combat operations may need exceptions to above
• VFR training should cease in IMC for all pilots
  – High Risk Mission, approve at O-6 level
  – Supervisors should actively recall or direct the landing of any assets airborne on VFR missions if weather is forecast to fall below VMC or does
  – Capable aircraft/pilots should use IFR clearances
• Emphasis should be placed on IMC proficiency
Initiatives

• Occupant Protection
  – Navy SBIR on crashworthy passenger seating
  – ARMY Airbags in OH-58 (No stroking seat)
    • STWG white paper commissioned
  – Air Force
    • SBIR on localizing crew functions in back
    • SBIR on crashworthy crew seating
    • SBIR on crashworthy passenger seating
• Terrain, weather & traffic awareness
  – DSOC Dem/Val program with GPS based data
  – Tri-Service
Needed

• Radar Wire Detection
• Tail Warning and/or automated hover for OH & AH aircraft (no rear visibility)
• Wireless Intercom for aft compartment crew
• Collection of adequate data for analysis by all services
  – Night hours by year and aircraft type
  – Instrument hours by year and aircraft type
  – Phase of flight exposure data (MFOQA)
    • Time in various altitudes & flight regimes
    • Man years of exposure
  – Mishap data (MFOQA)
  – Recommend Joint Analysis Center (USUHS)
The material in this presentation represents the opinion of the author and should not be construed to represent the position of the United States Air Force, the Department of Defense or any other organization.

Questions?

Colonel Pete Mapes
DUSDPR/A
(703)604-0482