National Transportation Safety Board

Is “Rotorcraft Safety” a Contradiction in Terms?

Robert L. Sumwalt

NTSB is an Independent Federal Agency

Not part of US Department of Transportation

Our mission: Investigate transportation accidents, determine probable cause, issue safety recommendations

We do not have regulatory authority

Is “Rotorcraft Safety”
a Contradiction in Terms?

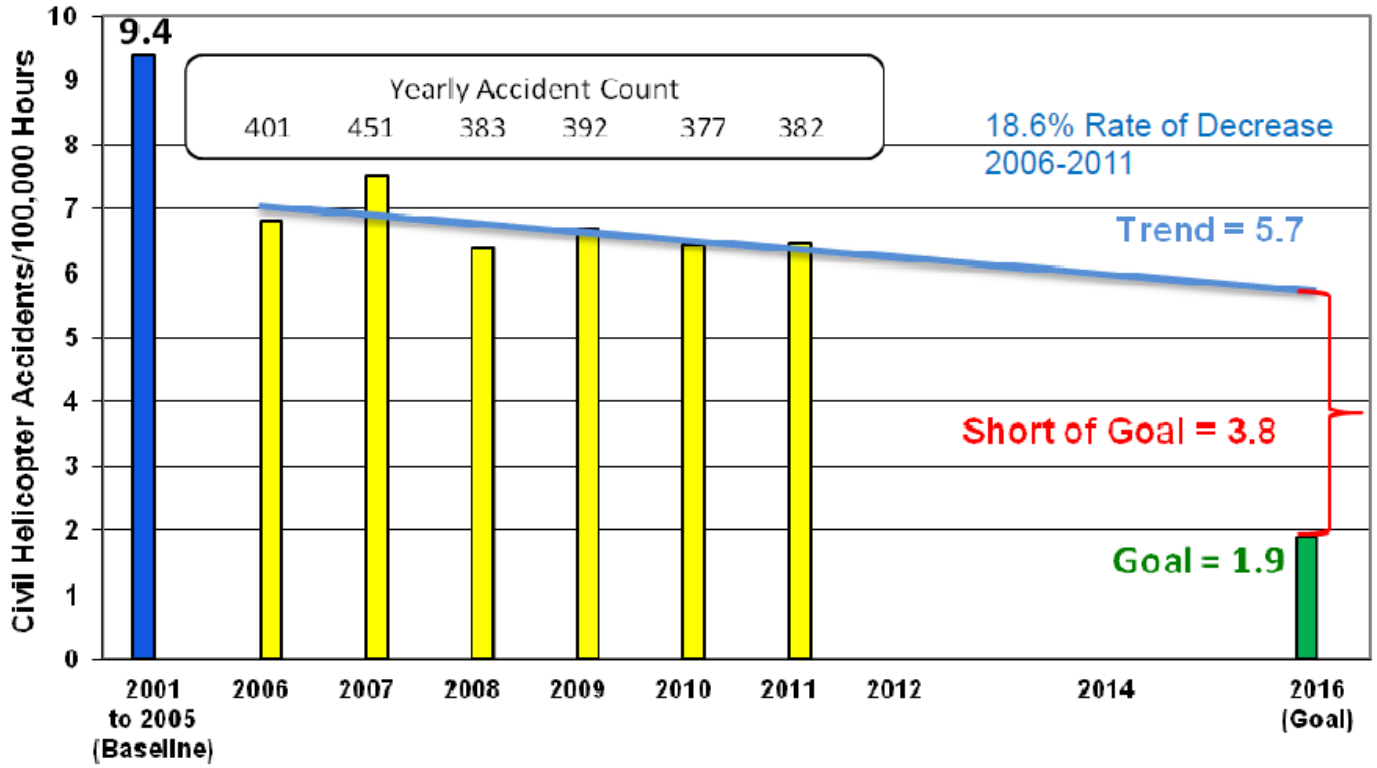
Can safety be improved?

IHST International Helicopter Safety Team

Our Goal is to Reduce the Civil Helicopter Accident Rate by 80% by 2016.

Worldwide:

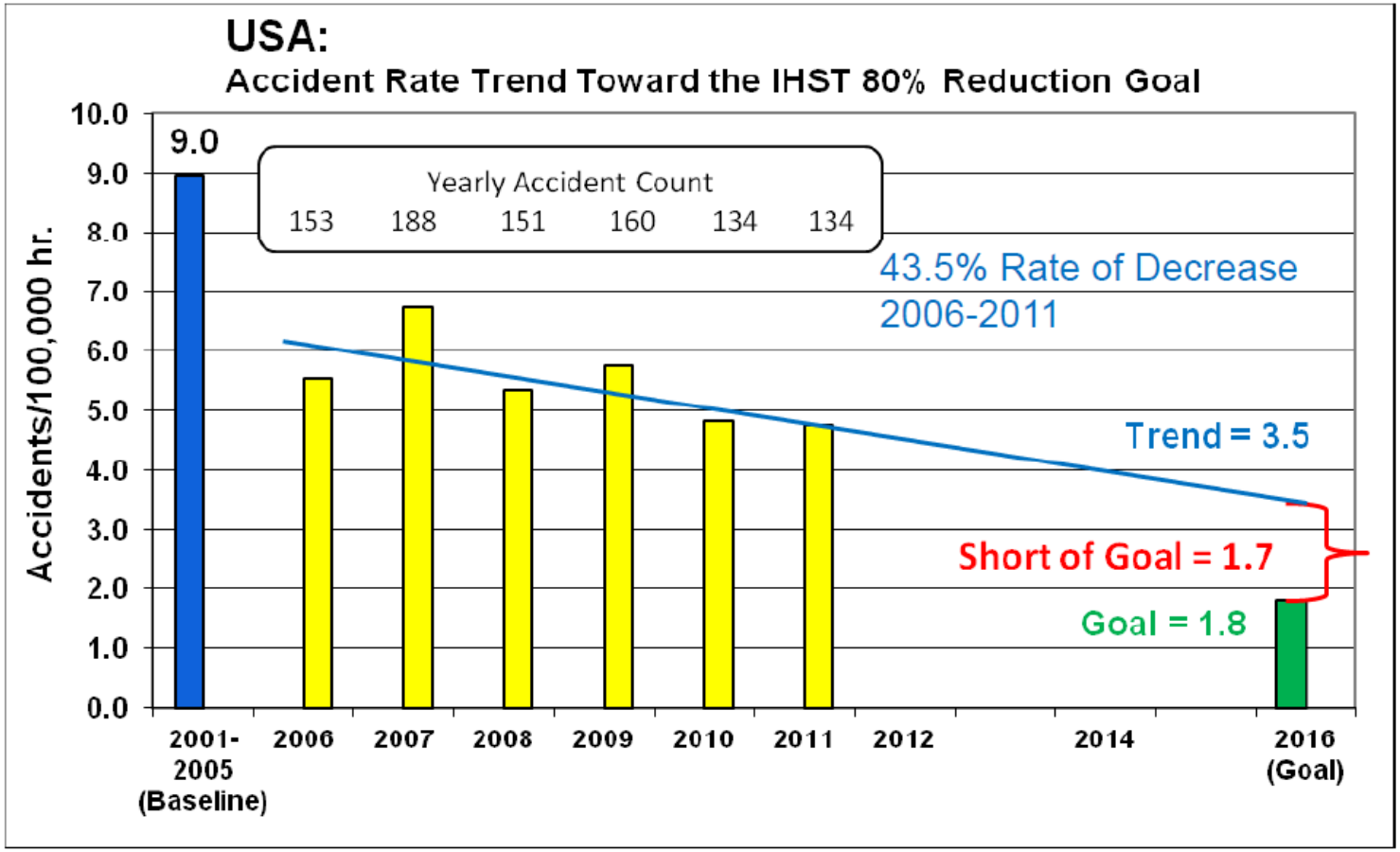
Accident Rate Trend Toward the IHST 80% Reduction Goal



IHST

International Helicopter Safety Team

Our Goal is to Reduce the Civil Helicopter Accident Rate by 80% by 2016.



U.S. Helicopter Accidents 2014*

	Number of Accidents	Fatal Accidents	Fatalities
General Aviation	117	20	31
Charter (including HEMS)	12	3	8
Public Operators	15	1	2
Totals	**144**	**24**	**41**

* Preliminary data

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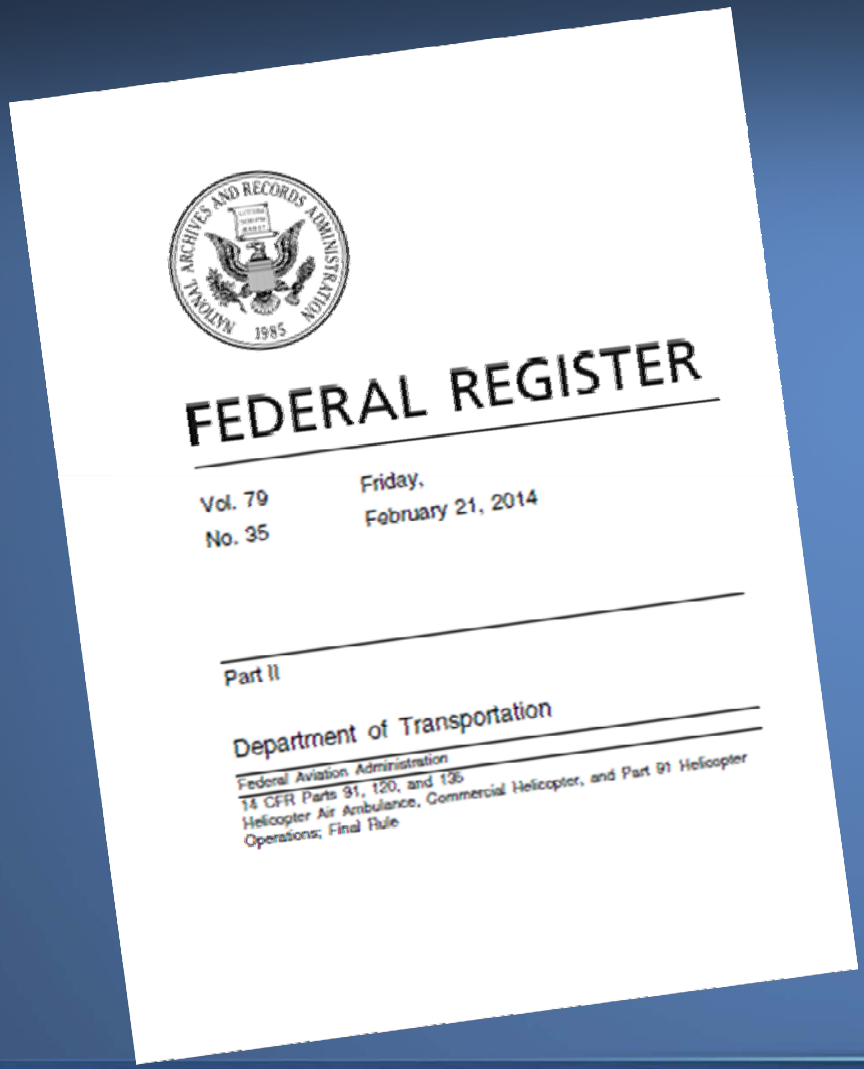
Helicopter Air Ambulance, Commercial Helicopter, and Part 91 Final rule



FEDERAL REGISTER

Vol. 79 No. 35 Friday, February 21, 2014

Part II

Department of Transportation

Federal Aviation Administration

14 CFR Parts 91, 120, and 135

Helicopter Air Ambulance, Commercial Helicopter, and Part 91 Helicopter Operations; Final Rule

FAA analysis of 20 years of helicopter accidents reveals that 62 accidents could have been prevented and 125 lives saved through the measures contained in this rule.

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Some Highlights of Helicopter Rule

All Part 135 helicopter operators are required to:

- Equip their helicopters with radio altimeters.
- Require that pilots are tested to handle flat-light, whiteout, and brownout conditions
- Require that pilots demonstrate competency in recovery from an inadvertent encounter with instrument meteorological conditions.
- Have occupants wear life preservers and equip helicopters with a 406 MHz Emergency Locator Transmitter (ELT) when a helicopter is operated beyond power-off glide distance from the shore.

More Highlights of Helicopter Rule

All helicopter air ambulance operators are required to:

- Equip with Helicopter Terrain Awareness and Warning Systems (HTAWS).
- Equip with a flight data monitoring system within four years.
- Establish operations control centers (for operators with 10 or more helicopter air ambulances).
- Institute pre-flight risk-analysis programs.
- Ensure their pilots in command hold an instrument rating.
- Conduct the flight using Part 135 weather requirements and flight crew time limitation and rest requirements when medical personnel are on board.

Where do you want to be?

- **World class**
  - Top 3 - 5 percent of the industry
  - Organization thrives in seeking to be the very best
- **Best practices**
  - Adopts and implements procedures above and beyond regulatory requirements
- **Basic regulatory compliance**
  - Meets spirit of regulations, but no higher
- **Sub-standard performance**
  - non-adherence to regulations, cutting corners are the norm

Adopted from Pete Agur

Enhancing Safety through Accident Investigation

Public Helicopters

Between 2004 and 2014

- Over 130 crashes with public helicopters
  - 52 fatalities
  - More than 40 serious injuries

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- As public operators, many Federal Aviation Regulations don’t apply.
- Safety net may be missing.

NTSB 2015
MOST WANTED
LIST OF TRANSPORTATION
SAFETY IMPROVEMENTS
Critical changes needed to reduce transportation accidents and save lives
Education
www.ntsb.gov/mostwanted

NTSB

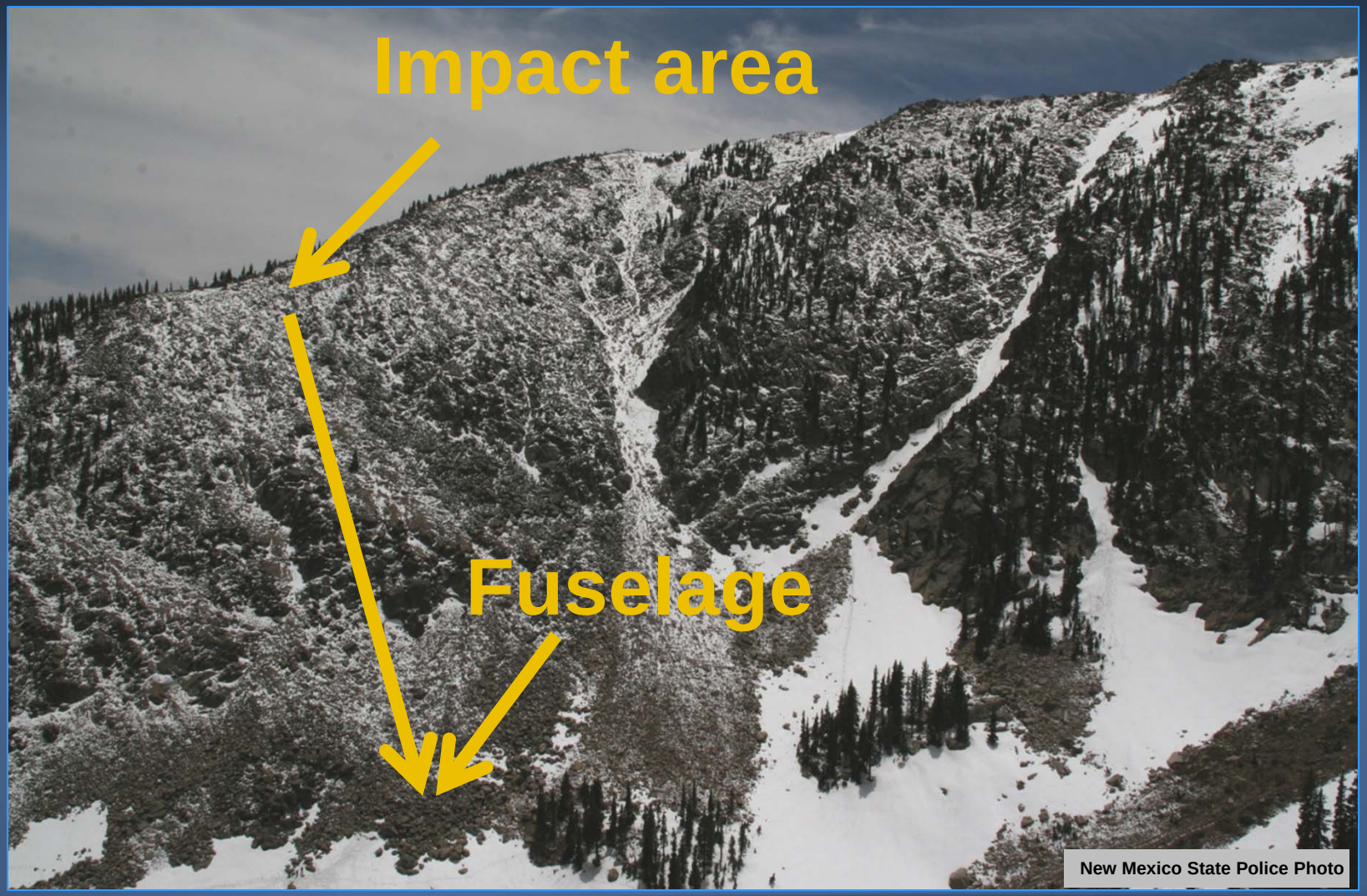
Maryland State Police

- September 27, 2008
- Aerospatiale SA365N1
- Air Ambulance Flight
- Near Washington, DC.
- 4 Fatal; 1 serious injury

New Mexico State Police

- June 9, 2009
- Agusta A-109E
- Search and rescue flight
- Near Santa Fe, New Mexico
- Pilot and passenger killed
  - spotter seriously injured

History of Flight



New Mexico State Police Photo

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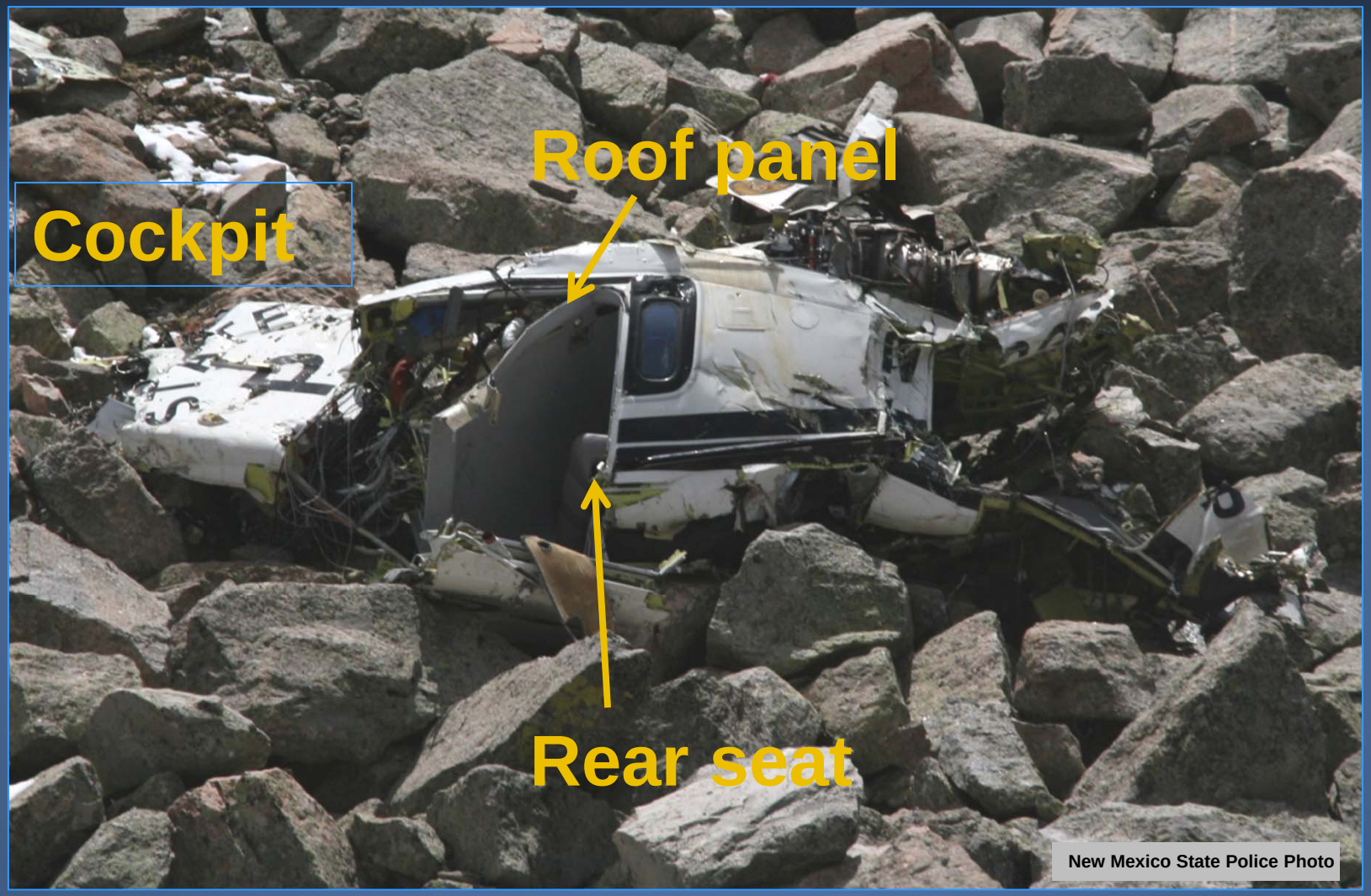
Fuselage



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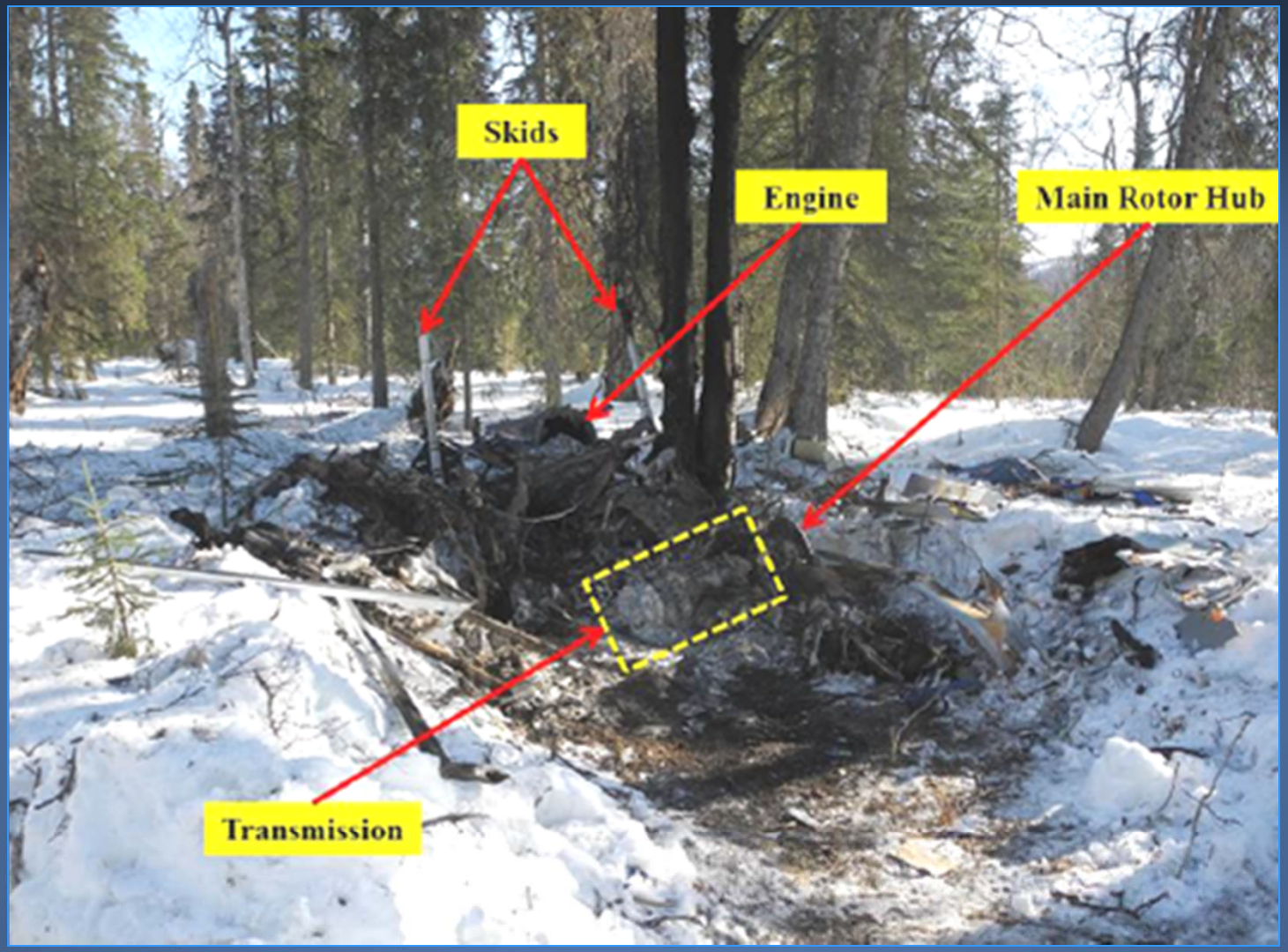
Alaska DPS

- March 30, 2013
- Eurocopter AS350
- SAR flight
- Talkeetna, Alaska
- 3 fatalities



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Crash Following Encounter with Instrument Meteorological Conditions

Alaska Department of Public Safety
Eurocopter AS350 B3, N911AA
Talkeetna, Alaska
March 30, 2013

00:11.10

00:00.00

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National Transportation Safety Board

Crash Following Encounter with Instrument Meteorological Conditions

Alaska Department of Public Safety
Eurocopter AS350 B3, N911AA
Talkeetna, Alaska
March 30, 2013

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Same accident, different day

- Lack of effective preflight risk assessment
- Lack of proficiency with instrument flight

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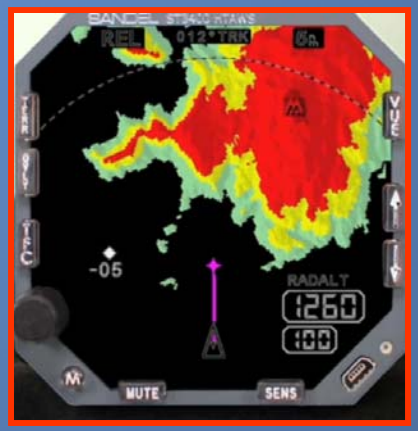
What's needed:

Training

- IIMC training
- Scenario-based simulator training

Technology

- NVIS
- TAWS

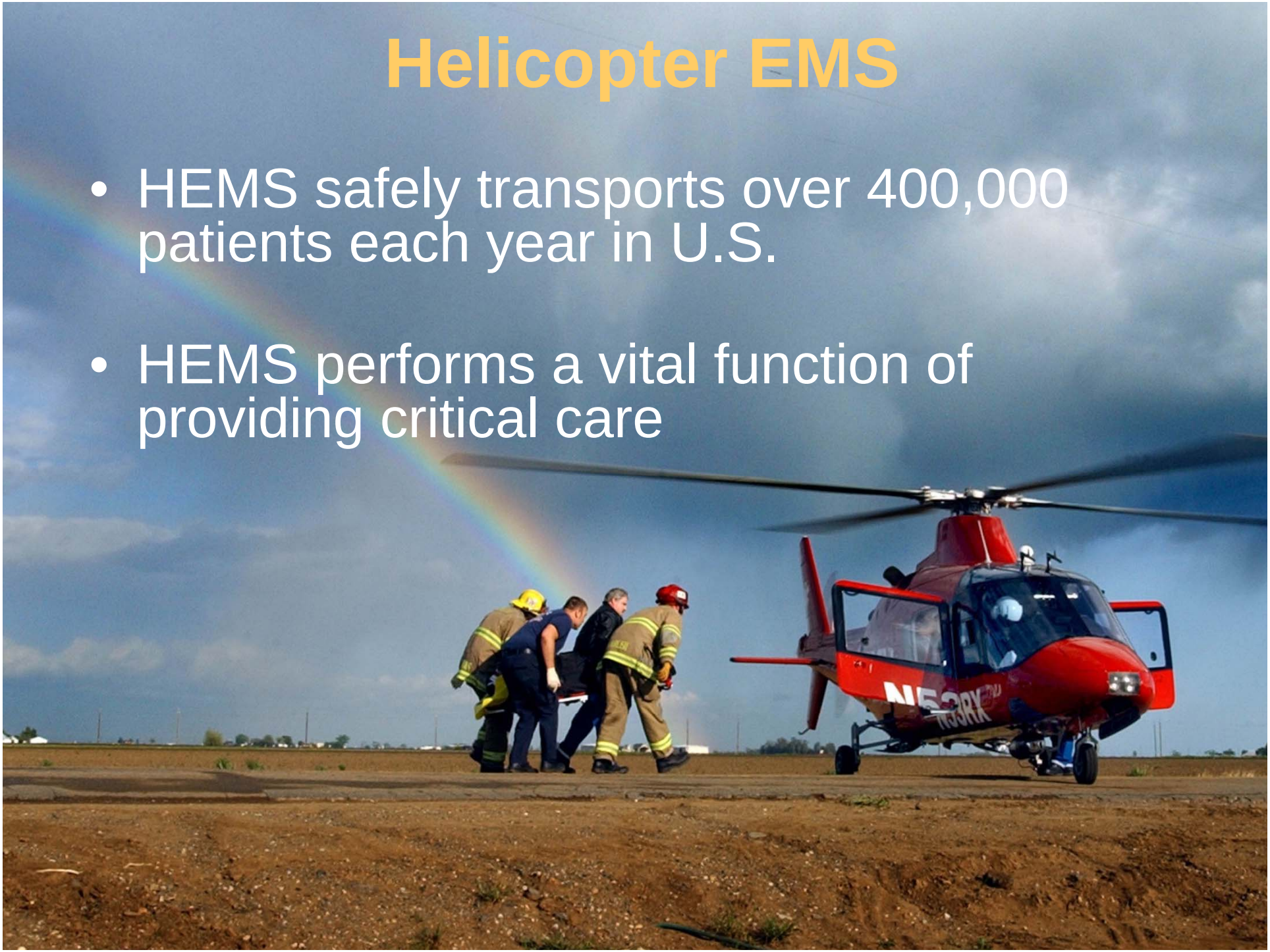


Procedures

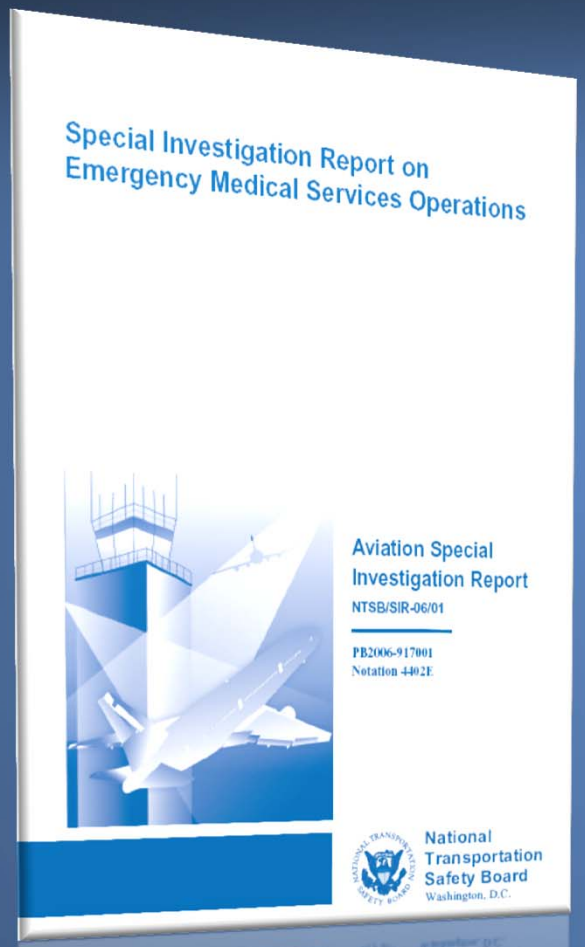
- SMS
- Risk assessment

Helicopter EMS

- HEMS safely transports over 400,000 patients each year in U.S.
- HEMS performs a vital function of providing critical care



2006 Special Investigation Report



- Analyzed 55 EMS Accidents
  - 14 Airplane
  - 41 Helicopter
- Determined that <u>29 of the 55 accidents</u> could have been prevented
  - if corrective actions in the report had been implemented

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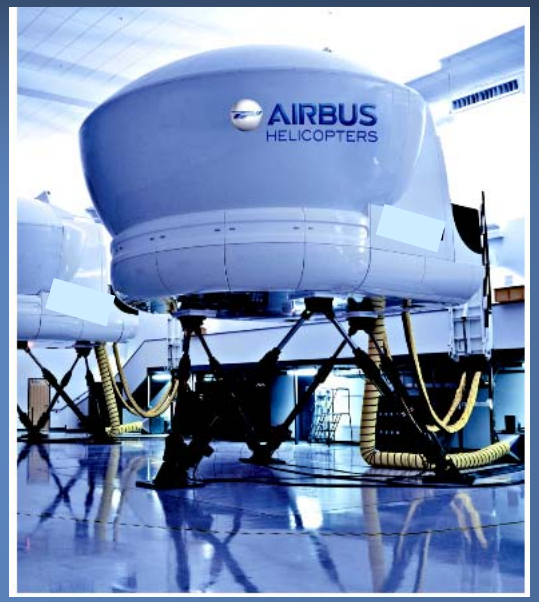
2006 Safety Recommendations to FAA

- Require operations under Part 135 for all legs of EMS missions.
- Require flight risk evaluation for all EMS missions.
- Require EMS operators to utilize flight dispatch procedures.
- Require that EMS operators use TAWS.

CLOSED – ACCEPTBLE ACTION

What else is needed:

NVIS

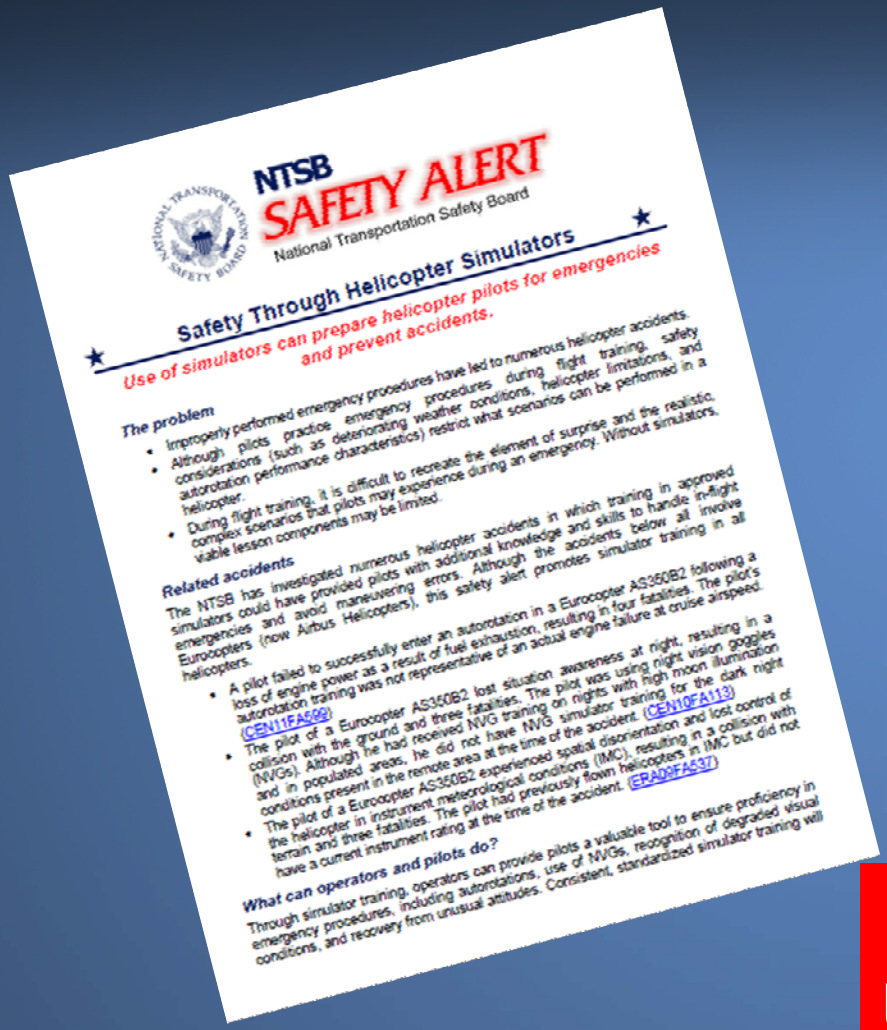


Scenario-based simulator training

Requirement for Safety Management System (SMS).

Requirement for an autopilot (if a second pilot is not available).

Scenario-Based Simulator Training



NTSB SAFETY ALERT

National Transportation Safety Board

Safety Through Helicopter Simulators

Use of simulators can prepare helicopter pilots for emergencies and prevent accidents.

The problem

- Improperly performed emergency procedures have led to numerous helicopter accidents.
- Although pilots practice emergency procedures during flight training, safety considerations (such as deteriorating weather conditions, helicopter limitations, and autorotation performance characteristics) restrict what scenarios can be performed in a helicopter.
- During flight training, it is difficult to recreate the element of surprise and the realistic, complex scenarios that pilots may experience during an emergency. Without simulators, viable lesson components may be limited.

Related accidents

The NTSB has investigated numerous helicopter accidents in which training in approved simulators could have provided pilots with additional knowledge and skills to handle in-flight emergencies and avoid maneuvering errors. Although the accidents below all involve Eurocopters (now Airbus Helicopters), this safety alert promotes simulator training in all helicopters.

- A pilot failed to successfully enter an autorotation in a Eurocopter AS350B2 following a loss of engine power as a result of fuel exhaustion, resulting in four fatalities. The pilot's autorotation training was not representative of an actual engine failure at cruise airspeed. (CEN11FA599)
- The pilot of a Eurocopter AS350B2 lost situation awareness at night, resulting in a collision with the ground and three fatalities. The pilot was using night vision goggles (NVGs). Although he had received NVG training on nights with high moon illumination and in populated areas, he did not have NVG simulator training for the dark night conditions present in the remote area at the time of the accident. (CEN10FA113)
- The pilot of a Eurocopter AS350B2 experienced spatial disorientation and lost control of the helicopter in instrument meteorological conditions (IMC), resulting in a collision with terrain and three fatalities. The pilot had previously flown helicopters in IMC but did not have a current instrument rating at the time of the accident. (ERA09FA537)

What can operators and pilots do?

Through simulator training, operators can provide pilots a valuable tool to ensure proficiency in emergency procedures, including autorotations, use of NVGs, recognition of degraded visual conditions, and recovery from unusual attitudes. Consistent, standardized simulator training will

CLOSED – UNACCEPTABLE ACTION.

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Disconnect from Deadly Distractions

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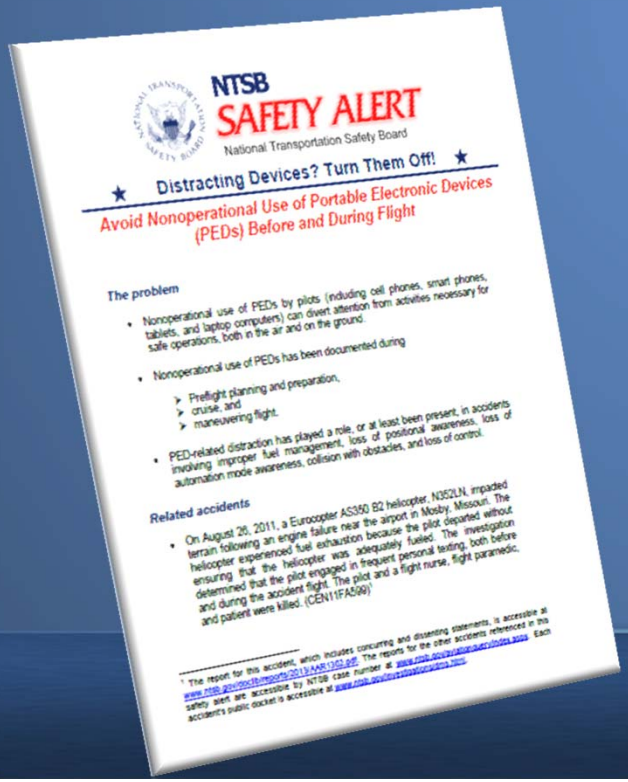

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SAFETY ALERT
National Transportation Safety Board

★ Distracting Devices? Turn Them Off! ★

Avoid Nonoperational Use of Portable Electronic Devices (PEDs) Before and During Flight

The problem

- Nonoperational use of PEDs by pilots (including cell phones, smart phones, tablets, and laptop computers) can divert attention from activities necessary for safe operations, both in the air and on the ground.
- Nonoperational use of PEDs has been documented during
  - Preflight planning and preparation,
  - cruise, and
  - maneuvering flight.
- PED-related distraction has played a role, or at least been present, in accidents involving improper fuel management, loss of positional awareness, loss of automation mode awareness, collision with obstacles, and loss of control.

Related accidents

- On August 26, 2011, a Eurocopter AS350 B2 helicopter, N352LN, impacted terrain following an engine failure near the airport in Mosby, Missouri. The helicopter experienced fuel exhaustion because the pilot departed without ensuring that the helicopter was adequately fueled. The investigation determined that the pilot engaged in frequent personal texting, both before and during the accident flight. The pilot and a flight nurse, flight paramedic, and patient were killed. (CEN11FA599)

[1] The report for this accident, which includes concurring and dissenting statements, is accessible at www.ntsb.gov/investigations/2013/AAR1302.pdf. The reports for the other accidents referenced in this safety alert are accessible by NTSB case number at www.ntsb.gov/aviation/aviation.htm. Each accident's public docket is accessible at www.ntsb.gov/investigations.htm.

NTSB Recommendation:

Prohibit flight crewmembers from using a portable electronic device for nonoperational use while at their duty station on the flight deck while the aircraft is being operated, and during safety-critical ground activities, such as flight planning and preflight inspection.

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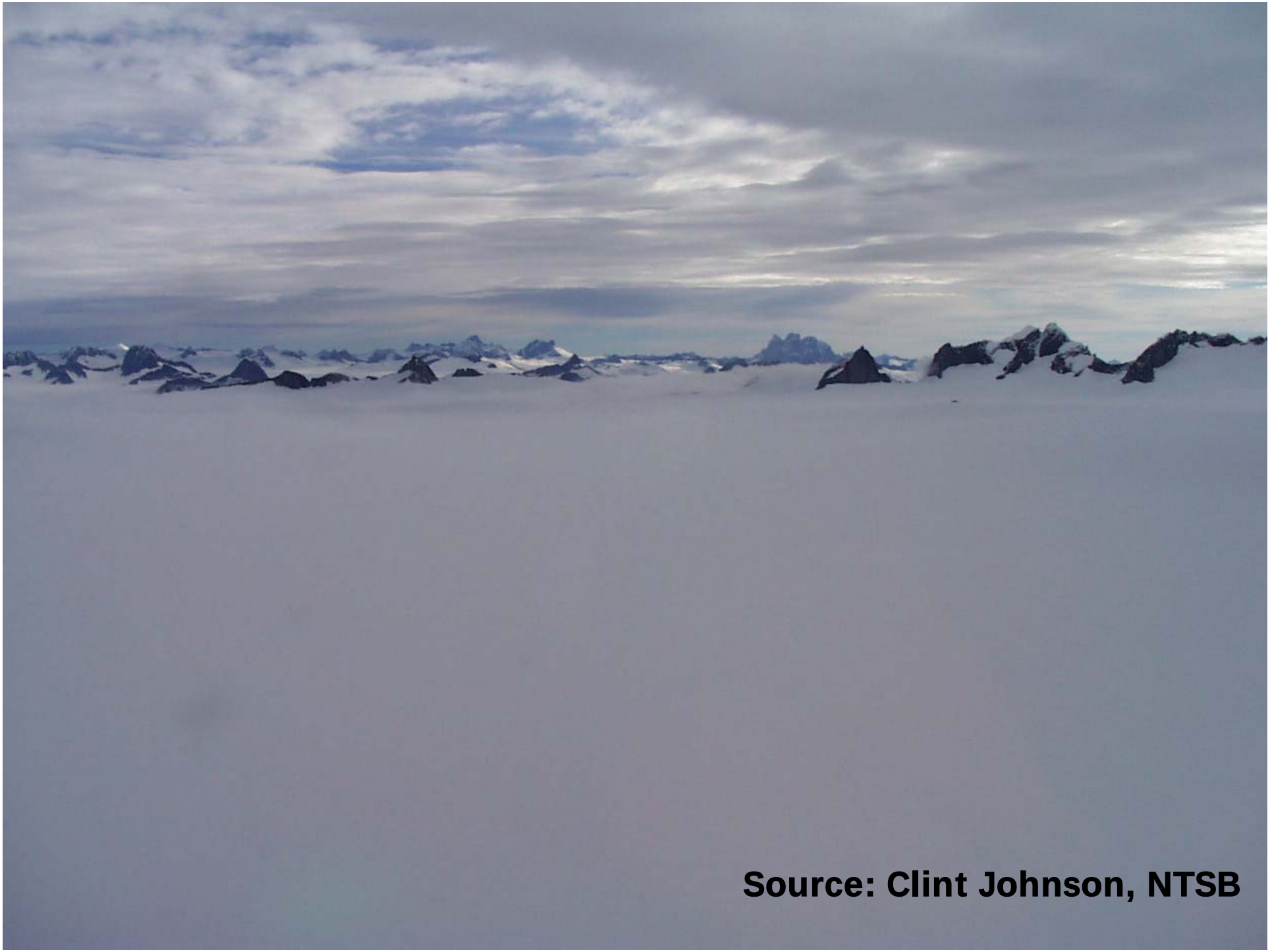
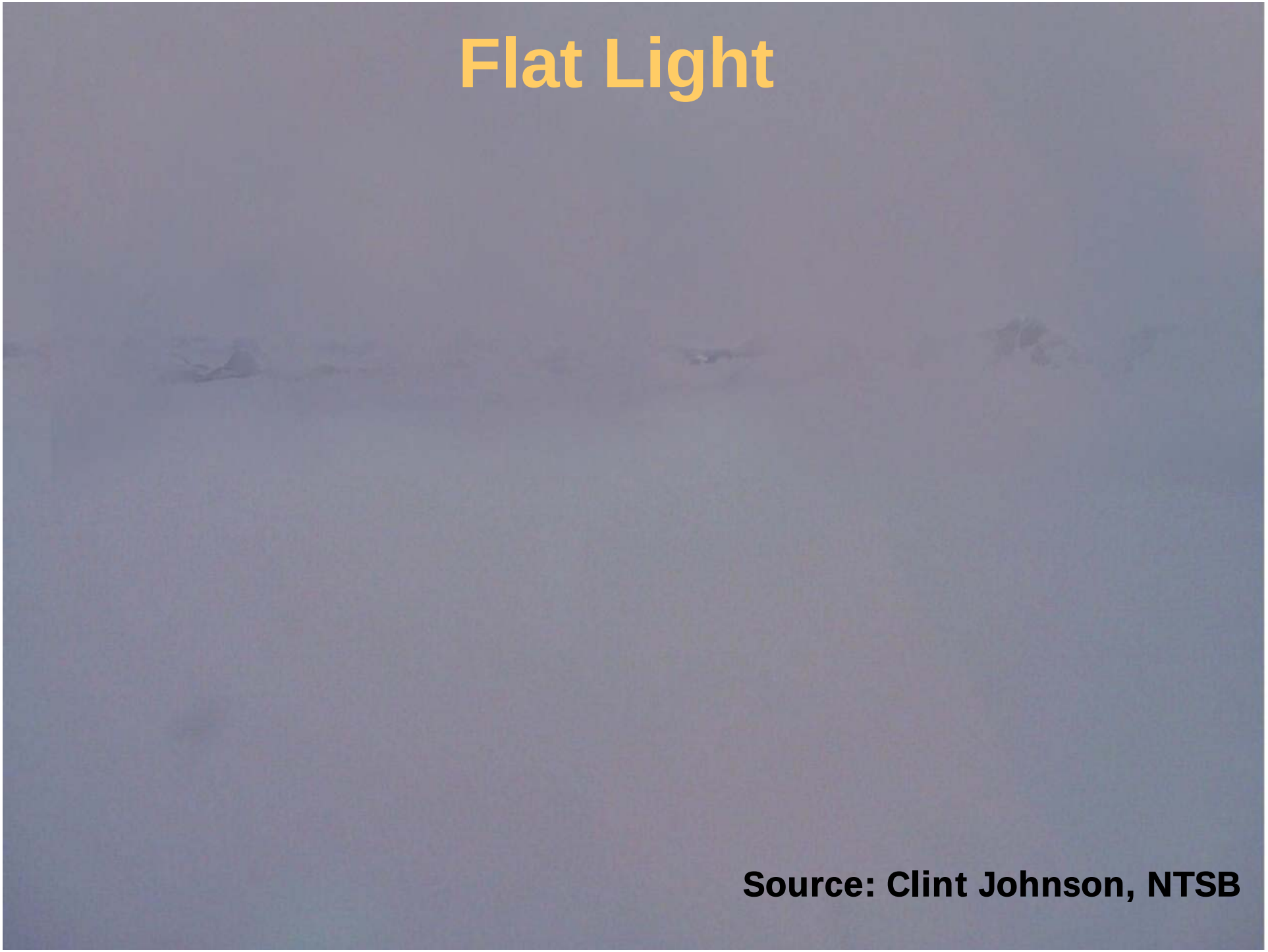
Helicopter Air Tours


Source: Clint Johnson, NTSB

Flat Light



Source: Clint Johnson, NTSB

TEMSCO
46007S

N605RC

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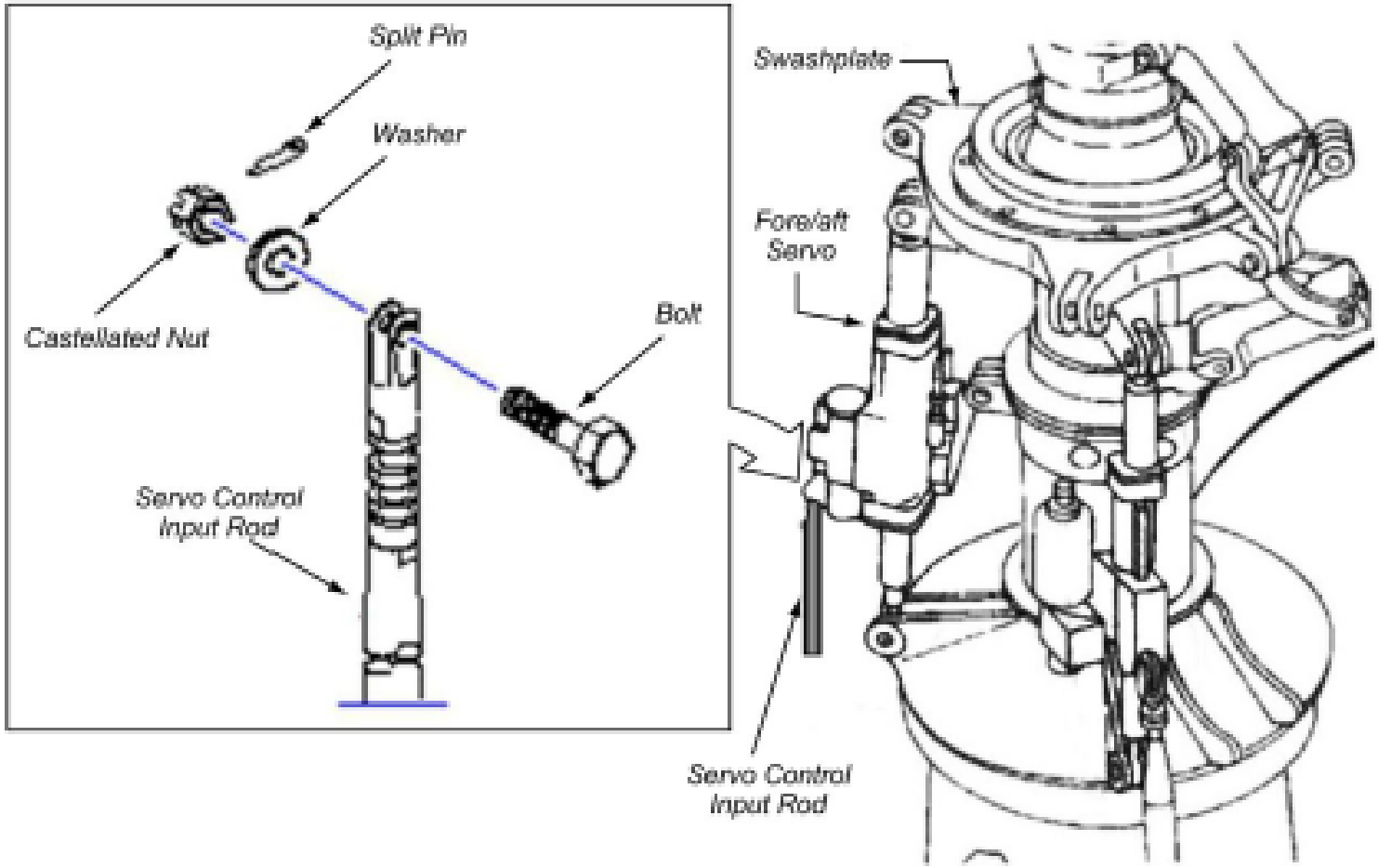
NTSB Recommendation

- Require radio altimeters in all helicopters conducting commercial, passenger-carrying operations in areas where flat light or whiteout conditions routinely occur.

CLOSED – ACCEPTBLE ACTION

Maintenance-Related Accidents



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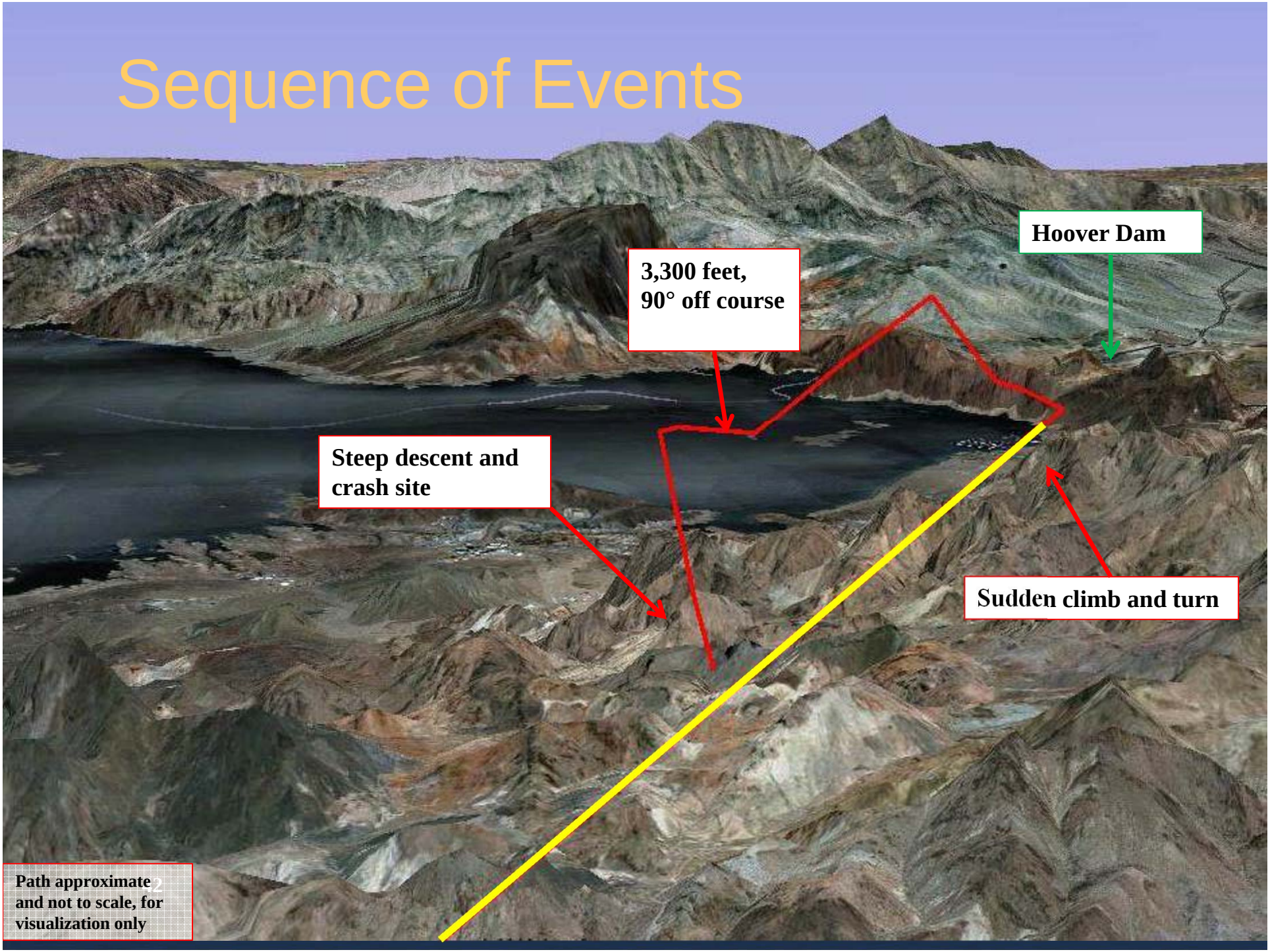
Loss of Control
Eurocopter AS350

Las Vegas, Nevada
December 7, 2011

NTSB

Sequence of Events



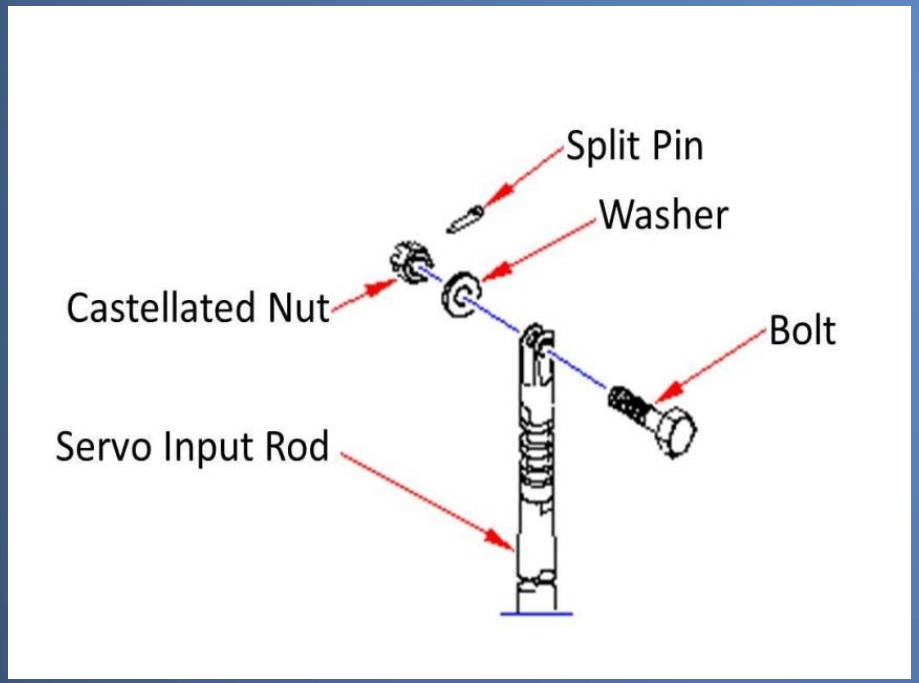
Fuselage
and engine

Events prior to accident

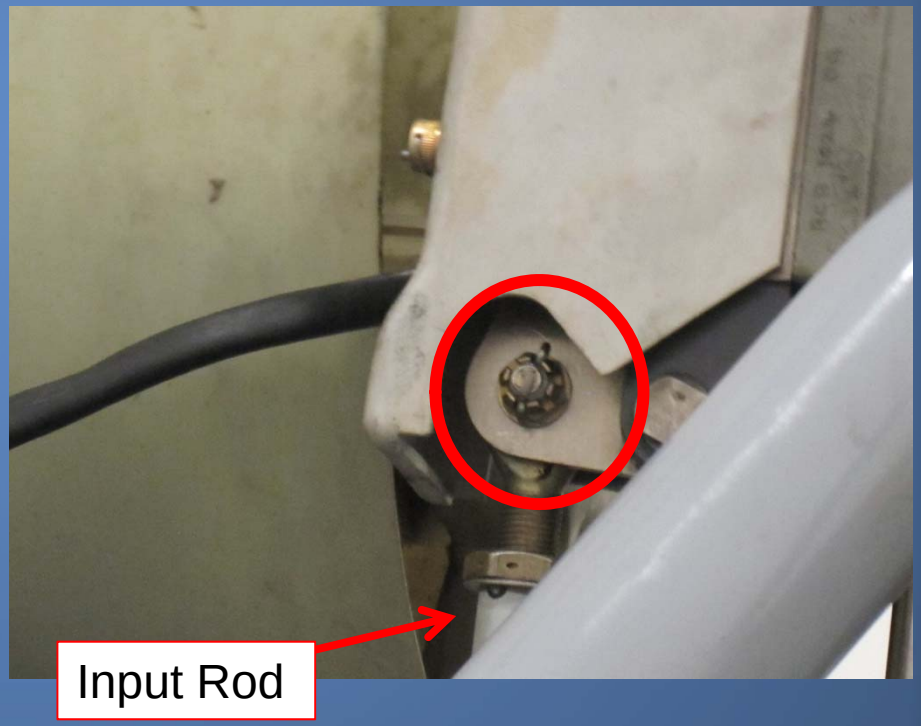
- 100-hour maintenance inspection conducted the day prior
- Fore/aft servo replaced
- Check flight flown
- 2 tour flights flown
- Accident occurred on
  - Third tour flight
  - 3.5 flight hours after maintenance

Hardware

Input rod hardware



Hardware installed



Probable Cause

Sundance Helicopters' inadequate maintenance of the helicopter, including:

(1) the improper reuse of a degraded self-locking nut

(2) the improper or lack of installation of a split pin

(3) inadequate post-maintenance inspections, which resulted in the in-flight separation of the servo control input rod from the fore/aft servo and rendered the helicopter uncontrollable.

Probable cause (continued)

- Contributing to the improper or lack of installation of the split pin was the mechanic's fatigue and the lack of clearly delineated maintenance task steps to follow.
- Contributing to the inadequate post-maintenance inspection was the inspector's fatigue and the lack of clearly delineated inspection steps to follow.

Recommendation

Establish duty-time regulations for maintenance personnel which take into consideration factors such as:

- start time
- workload
- shift changes
- circadian rhythms
- other factors shown by recent research and scientific evidence

OPEN – UNACCEPTABLE RESPONSE

Recommendation

Encourage operators and manufacturers to develop and implement best practices for conducting maintenance including, but not limited to the use of work cards for maintenance tasks

- especially those involving safety-critical functions, that promote the recording and verification of delineated steps in the task that, if improperly completed, could lead to a loss of control.

OPEN –ACCEPTABLE RESPONSE

100-Hour Inspection Paperwork

MAKE	Eurocopter	DISCREPANCY LIST	DATE	12/06/11
MODEL	AS350B2	SUNDANCE HELICOPTERS	AF TT	26216.5
S/N	2300	5596 Haven Street	ENG TT	7400.0
REG.	N37SH	Las Vegas, Nevada 89119	PAGE	4 of 10

DISCREPANCY	CORRECTIVE ACTION
No. 15 M/R F/A SERVO PN AC67246 SN RX 187 DUE O/H	RMVD M/R F/A SERVO SN RX 187 TSO: 1959.5 TSN: 14202.3. INST'D O/H UNIT SAME PN SN BX 264 TSO: 0.0 TSN: 21150.9. ALSO REPLACED ALL ORINGS PN 81810-110-24B7 PO 9048. REF AS 350 M/M CH 67 sign off
Name [redacted] Date 12-6-11	Signature [redacted] Cert. No. [redacted] Date 12-6-11 Insp [redacted]
No. 15 M/R F/A SERVO PN AC67246 SN RX 187 DUE O/H	RMVD M/R F/A SERVO SN RX 187 TSO: 1959.5 TSN: 14202.3. INST'D O/H UNIT SAME PN SN BX 264 TSO: 0.0 TSN: 21150.9. ALSO REPLACED ALL ORINGS PN 81810-110-24B7 PO 9048. REF AS 350 M/M CH 67
Name [redacted] Date 12-6-11	Signature [redacted] Cert. No. [redacted] Date 12-6-11 Insp [redacted]
No. 16 T/R SERVO PN AC67032 SN FE 212 DUE O/H	RMVD T/R SERVO SN FE 212 TSO: 1959.5 TSN: 12328.4. INST'D O/H UNIT SAME PN SN DK287 TSO: 0.0 TSN: UNK. ALSO REPLACED ALL ORINGS PN 81810-110-24B7 PO 9048. REF AS 350 M/M CH 67
Name [redacted] Date 12-6-11	Signature [redacted] Cert. No. [redacted] Date 12-6-11 Insp [redacted]
No. 17 Remove Arriel 1D1 Engine S/N *9399* Rental Yes [ ] No [XX]	Removed Arriel 1D1 Engine S/N *9399* Engine TT. *11926.1* Total Ng *13996.03*, Total Np *15499*. Reference AS350B2 AMM Chapter 71-11-00 Para 4-1. Engine tagged appropriately.
Name [redacted] Date 12-6-11	Signature [redacted] Cert. No. [redacted] Date 12-6-11 Insp [redacted]
No. 18 Install Arriel 1D1 Engine S/N *9043* Engine T.T. *7400.0* Total Ng *9667.2* Total Np *7845.3* Rental [XX] Yes [ ] No	Installed serviceable Arriel 1D1 Engine S/N *9043* Reference AS350B2 AMM Chapter 71-11-00 Para 4-2.
Name [redacted] Date 12-6-11	Signature [redacted] Cert. No. [redacted] Date 12-6-11 Insp [redacted]
No. 19 Clean the Air Duct.	Cleaned Air Duct ref. Arriel 1D1 MM 71-01-03-110-801-A01.
Name [redacted] Date 12-6-11	Signature [redacted] Cert. No. [redacted] Date 12-6-11 Insp [redacted]

SDM-002 Revision: Original

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Work Cards With Delineated Steps

Sample work card

DESCRIPTION	MECH	INSP
D. Check trunnion bearings and drag brace bearing for proper installation and freedom of movement.		Insp. Y
3. INSTALL NOSE LANDING GEAR - REFERENCE AMM		
A. Support gear and jack with axle jack to insert trunnion pins in respective spherical bearings (13) on each side of the nose gear wheel well.	Mech. X	Insp. Y
B. Jack gear to proper height and tap trunnion pin into place in each trunnion and trunnion support spherical bearing (13) then remove axle jack. **NOTE:** **NOSE GEAR MUST BE LIFTED INTO POSITION WITH GEAR TRUNNION AXIS PARALLEL TO TRUNNION BEARING AXIS.**	Mech. X	Insp. Y
C. Ascertain that the trunnion pin lockpin holes are in alignment with mating holes in trunnion pin lockpins.	Mech. X	Insp. Y

Recommendation

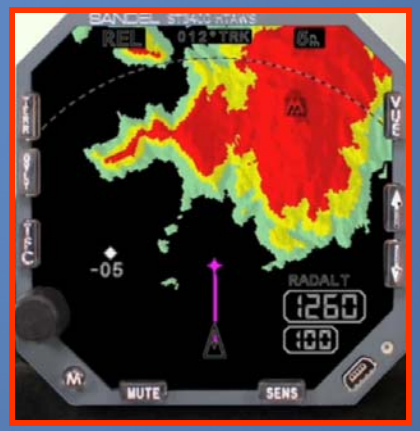
Require that personnel performing maintenance or inspections receive initial and recurrent training on maintenance human factors, including fatigue.

OPEN –ACCEPTABLE RESPONSE

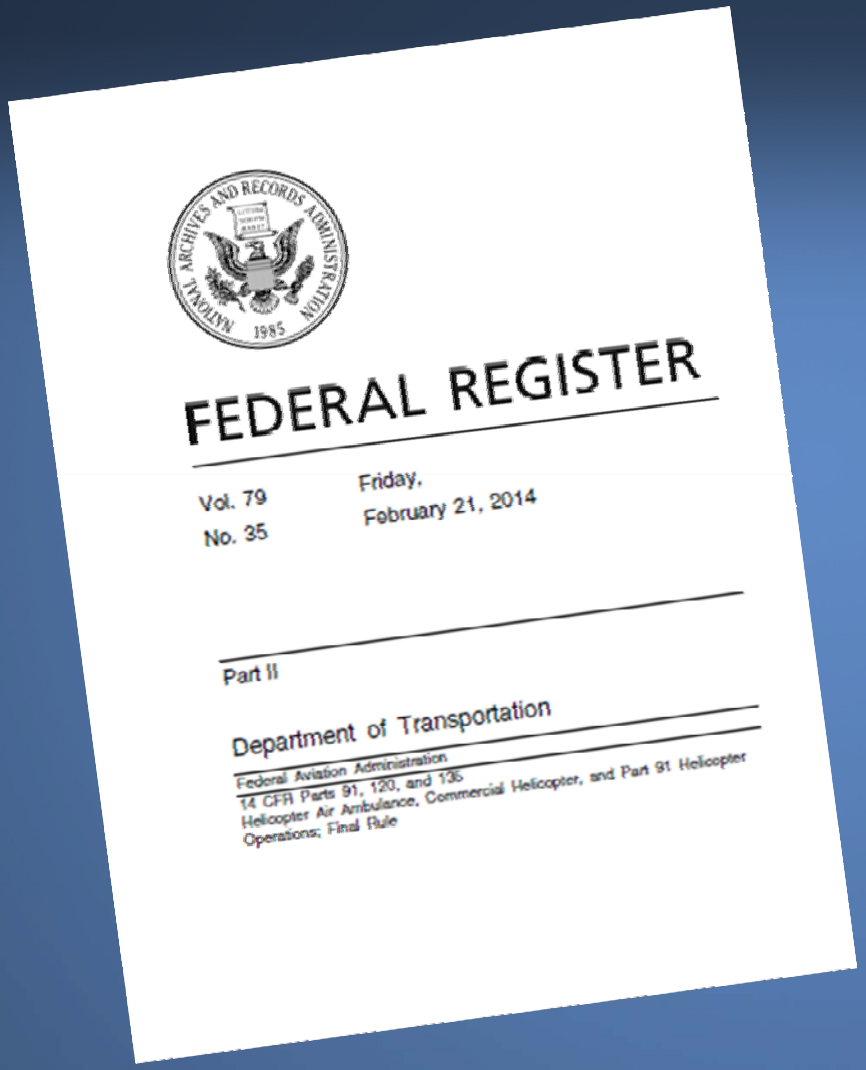
Offshore Oil and Gas Industry

Recommendation

Require for all U.S. registered turbine-powered rotorcraft certified for six or more passengers seats to be equipped with TAWS.



CLOSED – UNACCEPTABLE ACTION.



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The rest is up to you.

NTSB

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a Contradiction in Terms?

Can safety be improved?

Thank you.
Be safe.

National Transportation Safety Board