FY00

Department of the Interior Aviation Accident Review

Robert Galloway
Larry Brosnan
Steve Rauch
Office of Aircraft Services

Ground Rules

The National Transportation Safety Board

- **NTSB 831.13 Flow and dissemination of accident or incident information.**

  (b) … Parties to the investigation may relay to their respective organizations information necessary for purposes of prevention or remedial action.

  … However, no (release of) information… without prior consultation and approval of the NTSB.

Ground Rules

The National Transportation Safety Board

- Avoid discussion of "Probable Cause", unless determined and published by the NTSB
- This presentation is provided for accident prevention purposes only

Ground Rules

Each accident is unique

Although the results may be very similar the causal factors leading up to an accident are seldom exactly alike.

Therefore it is unlikely that any two sets of findings, recommendations, or presentations will ever be the same.

It is imperative that you focus your attention on the underlying "root" causes for each unique accident and avoid comparing one investigation or presentation against another.

"The PROCESS"

Accident Investigation involves asking three questions

What happened?

(gather facts)

Why did it happen?

(causal analysis)

What can we do to prevent it?

(develop recommendations)

The 3W's of accident investigation

Aviation Accident Review

Cessna 185

Loveland, CO

February 7, 2000

Mission	Pilot training
Weather	VMC
Damage	Substantial
Injuries	One minor
Procurement	Fleet
NTSB ID	DEN00TA049

During a flight review, the flight instructor, who was at the controls, failed to maintain directional control as the aircraft touched down and the aircraft spun to the right (ground loop) striking the left wing on the runway.

The pilot-in-command allowed the flight instructor to make the landing without ensuring that he was current in the aircraft and current in tail wheel aircraft.


N721

NTSB Probable Cause
Loveland, CO, February 7, 2000

The National Transportation Safety Board

The National Transportation Safety Board determined that the probable cause of this accident was …

Probable Cause

- **The failure of the pilot-in-command to maintain directional control, resulting in an inadvertent ground loop.**

  A factor was the crosswind.

OAS Observations
Loveland, CO, February 7, 2000

Issue

Pilot-in-command did not know the flight instructor was not current in either tail wheel aircraft or this model of aircraft

Crew Resource Management

- Are thorough pre-mission briefings being conducted for all missions?
- Do pilots routinely check crewmembers
  - qualifications
  - skill-level
  - physical and mental state
- Does everyone feel comfortable halting unsafe operations?

Supervision

- Do you know what you're getting into when you approve a mission?

OAS Observations
Loveland, CO, February 7, 2000

Issue

Pilot in left seat received minor head injury when his headset hit the door

Aviation Life Support Equipment

- Should DOI require the install of dual shoulder harness restraint systems ?
- Should DOI require the use of flight helmets instead of headsets ?

OAS Observations
Loveland, CO, February 7, 2000

Issue

Informal flight plan with pilot who drove crew to airport

Mission Planning

- Why do pilots fail to comply with OPM 00-2 requirements for:
  - flight plans (FAA, ICAO, Bureau approved, or an OAS approved vendor program)
  - flight following
- How can DOI improve compliance with OPM 00-2 ?

OAS Observations
Loveland, CO, February 7, 2000

Issue

Aircraft inspection overdue

Mission Planning

- Do pilots commonly overlook required inspections (i.e. 100 hour inspections)?

Aviation Accident Review

Talkeetna, AK

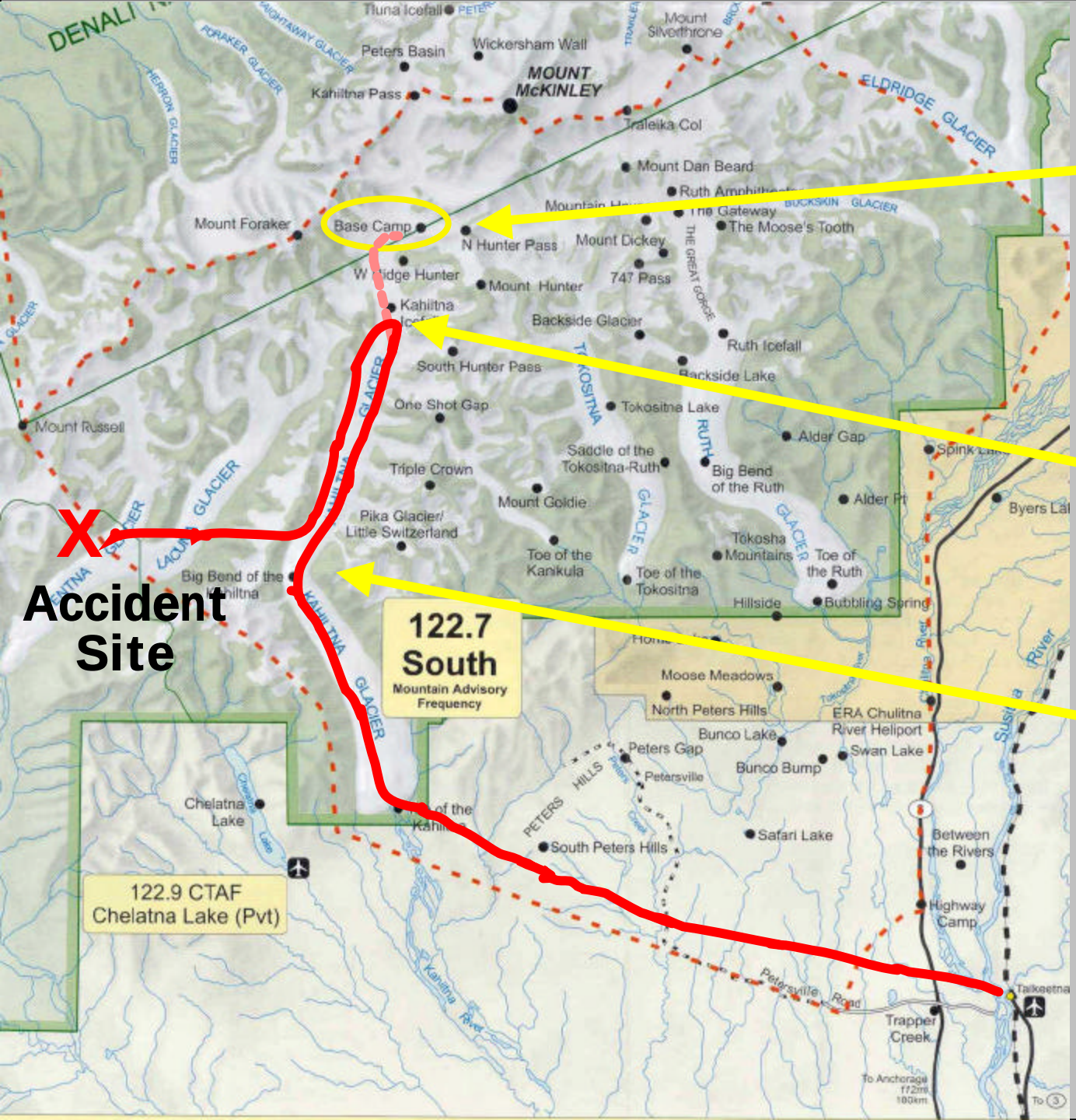
June 19, 2000

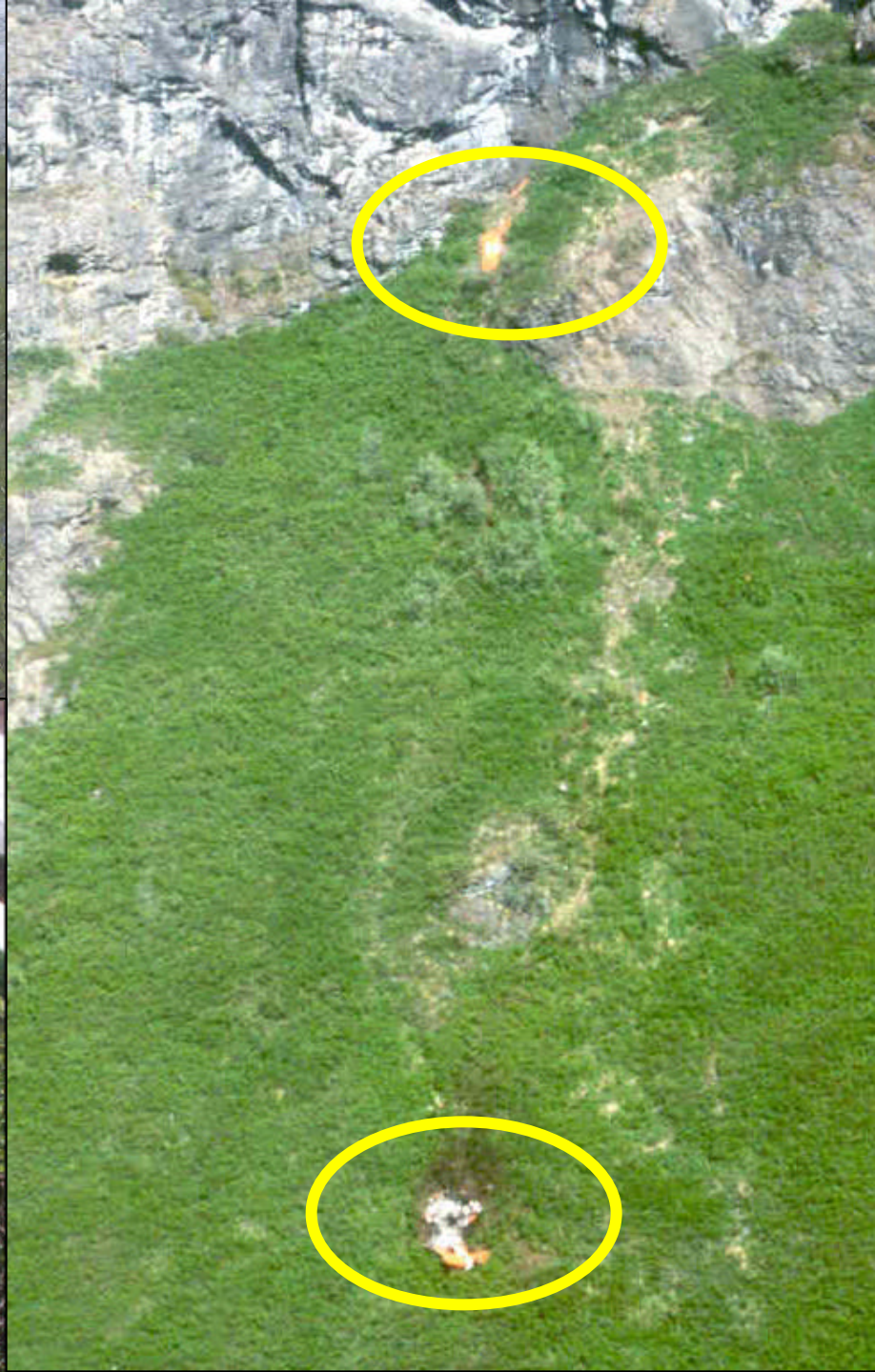
Cessna 185

Mission	Passenger transport
Weather	VMC (to IMC w/ thunderstorms)
Damage	Destroyed
Injuries	Four fatal
Procurement	Rental
NTSB ID	ANC00GA071

During a mission to transport three people to a basecamp in Denali NP the pilot encountered adverse weather. The pilot turned the aircraft around and found his retreat blocked by the weather. After an extensive search the wreckage was located.

There were no survivors.


Destination:
Denali
Basecamp
Kahiltna Ice
Falls
Big Bend of
the Kahiltna
Talkeetna
Accident
Site
122.7
South
Mountain Advisory
Frequency
122.9 CTAF
Chelatna Lake (Pvt)
MOUNT
McKINLEY
Base Camp
Kahiltna Pass
Peters Basin
Wickersham Wall
Mount Foraker
N Hunter Pass
Mount Dickey
747 Pass
Mount Hunter
Kahiltna
Backside Glacier
Ruth Icefall
Backside Lake
South Hunter Pass
Tokositna Lake
One Shot Gap
Mount Russell
Alder Gap
Saddle of the
Tokositna-Ruth
Big Bend
of the Ruth
Triple Crown
Mount Goldie
Alder Pt
Pika Glacier/
Little Switzerland
Toe of the
Kanikula
Toe of the
Tokositna
Tokosha
Mountains
Toe of
the Ruth
Hillside
Bubbling Spring
Moose Meadows
North Peters Hills
ERA Chulitna
River Heliport
Bunco Lake
Swan Lake
Peters Gap
Bunco Bump
Petersville
Chelatna
Lake
Safari Lake
South Peters Hills
Between
the Rivers
Highway
Camp
Trapper
Creek
Talkeetna
Petersville Road
Kahiltna River
Eldridge Glacier
Buckskin Glacier
The Great Gorge
Tokositna Glacier
Ruth Glacier
Kahiltna Glacier
Lacuna Glacier
Peters Hills
Byers Lake
Susitna River



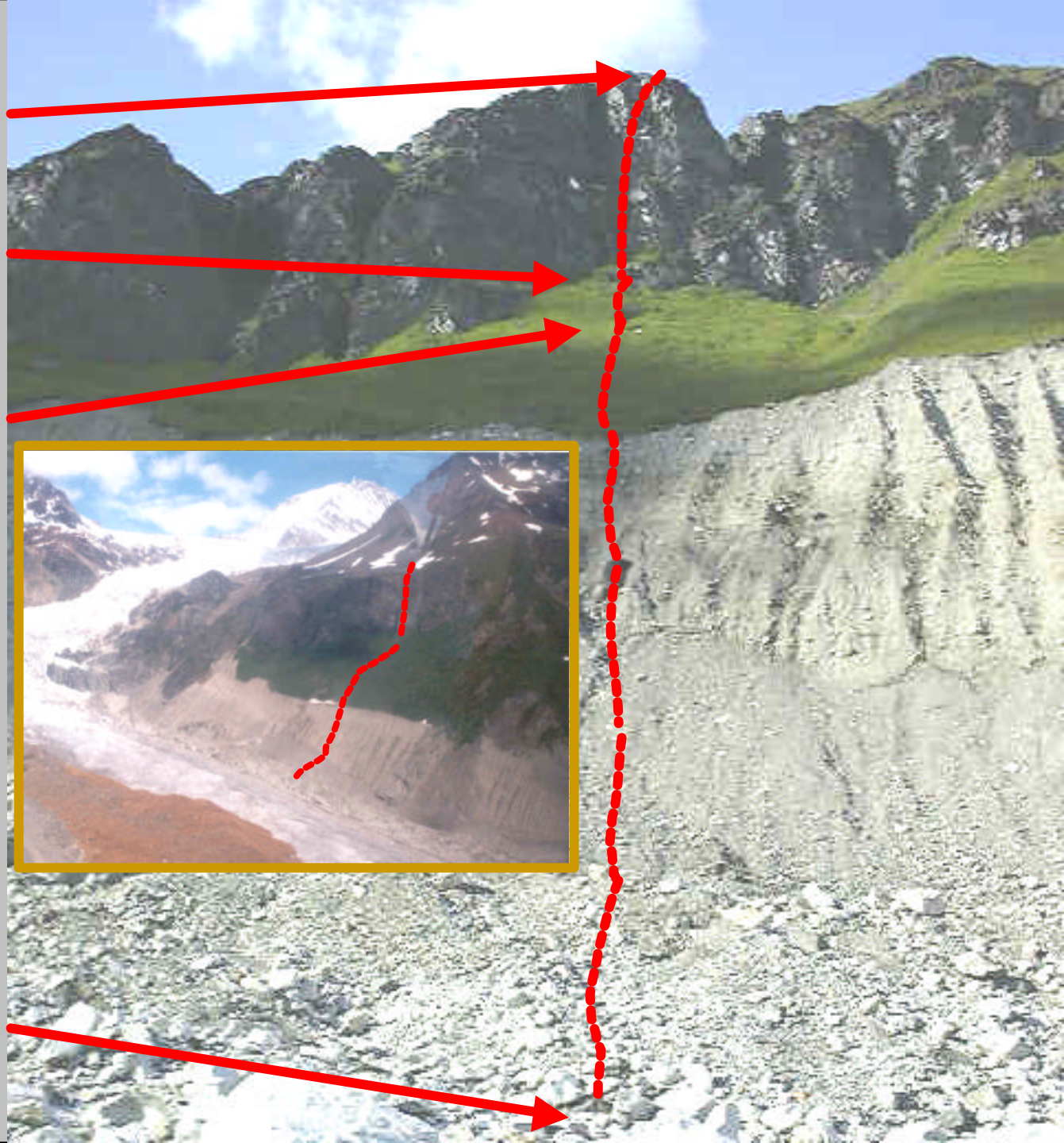
Debris

Left wing

Main fuselage

Approx 3000’
>45° slope

Engine



NTSB Probable Cause
Talkeetna, AK, June 19, 2000

The National Transportation Safety Board

The National Transportation Safety Board determined that the probable cause of this accident was …

Probable Cause

- **The pilot's continued flight into known adverse weather conditions and subsequent in-flight break-up.**

Factors in the accident were weather conditions consisting of low ceilings, turbulence, and and an occluded front with convective activity, and inadequate oversight of the flight by company management.

Observations
Talkeetna, AK, June 19, 2000

Issue

Pilot encountered unanticipated adverse weather enroute to Denali Base Camp

Mission Planning

- Were available resources fully utilized ?
  - time for planning
  - FSS weather
  - PIREPSs
- Were alternate routes planned and emergency landing areas identified ?

Observations
Talkeetna, AK, June 19, 2000

Issue

Pilot encountered unanticipated adverse weather enroute to Denali Base Camp

Crew Resource Management

- Do pilots use available personnel?
  - clearing aircraft
  - reading checklists
- Do passengers know they can say NO ?

Communications

- Would more VHF / FM repeaters increase PIREPS and enhance safety in this area?

Observations
Talkeetna, AK, June 19, 2000

Issue

Contract pilots and organizations would benefit from, but generally do not participate in, DOI conducted briefings

Education

- **Should contract organizations and personnel be involved in aviation safety training events such as:**
  - **mishap reviews**
  - **hazard reporting procedures**
  - **safety policies**

Aviation Accident Review

Cessna 337

Mission	Pax Transport
Weather	VMC
Damage	Substantial
Injuries	None
Procurement	Rental
NTSB ID	LAX00TA263

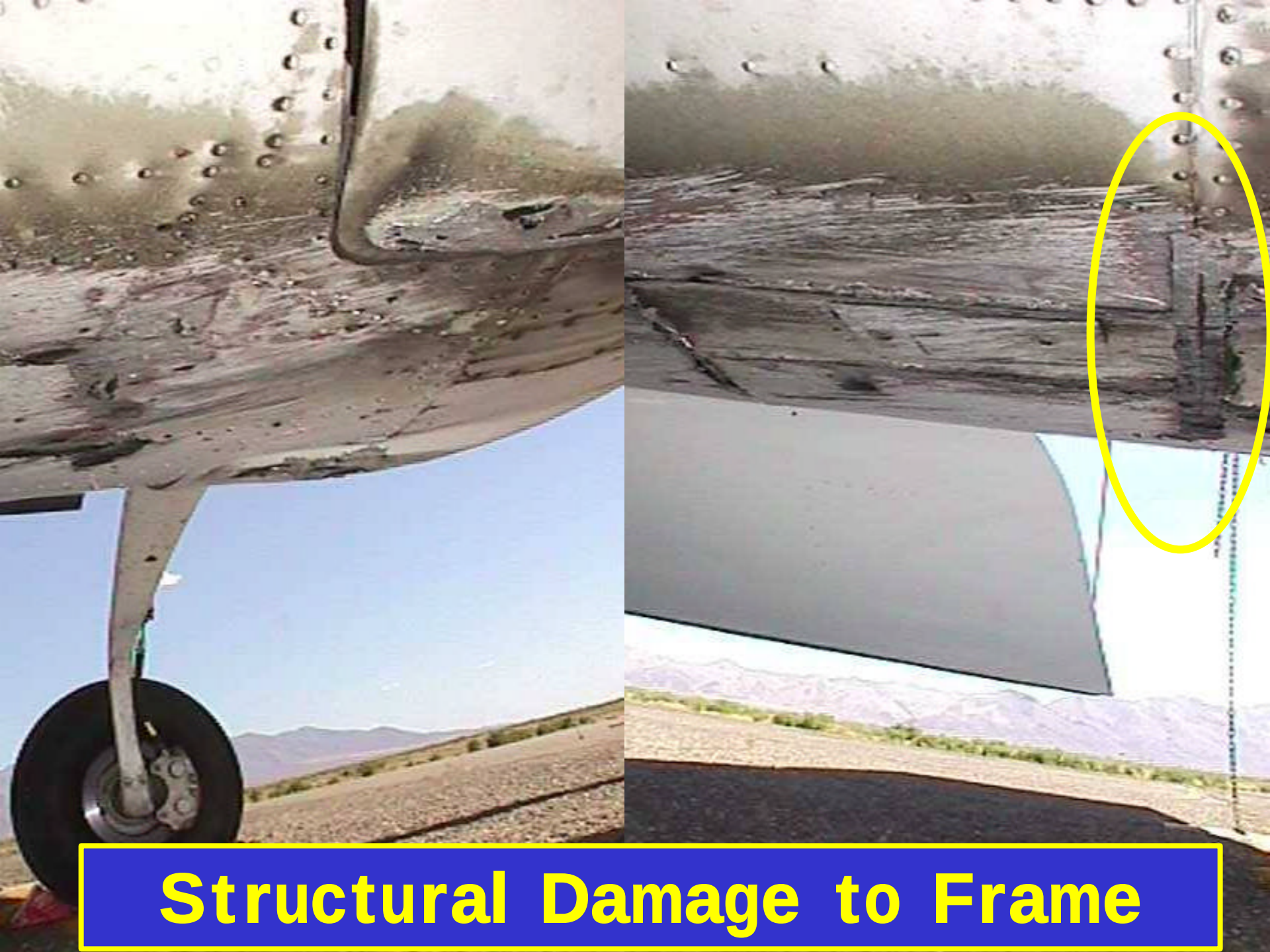
Battle Mountain, NV

July 12, 2000

Aircraft landed with the gear retracted at the Battle Mountain airport.

The pilot was focused on the wind and his airspeed and failed to extend the gear.

The pilot did not use available aids to ensure the gear was extended, i.e. a checklist, other crewmembers, the warning horn or the mirrors.


Structural Damage to Frame

NTSB Probable Cause
Battle Mountain, NV, July 12, 2000

The National Transportation Safety Board

The National Transportation Safety Board determined that the probable cause of this accident was …

Probable Cause

- **The failure of the pilot to extend the landing gear, and his failure to follow the published before landing checklist concerning extension of the landing gear.**

OAS Observations
Battle Mountain, NV, July 12, 2000

Issue

Pilot-in-command did not use a checklist and forgot to lower the landing gear

Procedures

- How do we ensure pilots properly prioritize actions and maintain situational awareness ?
- Would use of a checklist have prevented this accident ?
- What should DOI do for failure to use a checklist ?
- How can DOI ensure pilots conduct thorough pre-mission briefings ?

OAS Observations
Battle Mountain, NV, July 12, 2000

Issue

Pilot-in-command did not use a checklist and forgot to lower the landing gear

Crew Resource Management

- Should DOI require all aircrewmembers to be trained on CRM

- Why do pilots fail to use available personnel to…
  - read checklists
  - ensure landing gear is extended

Aviation Accident Review

Bell 206L-1/C30P

Mission	Pax Transport
Weather	VMC
Damage	Destroyed
Injuries	One fatal
	One serious
	One minor
Procurement	Exclusive use
NTSB ID	LAX00GA286

Montello, NV

August 3, 2000

While on a mission to transport two firefighters, the helicopter was at a 2'-3' hover when it suddenly and violently rolled to the right. The main rotor separated and the aircraft came to rest on its skids. The passenger in the front left seat was seriously injured and the passenger in the left rear seat was fatally injured.

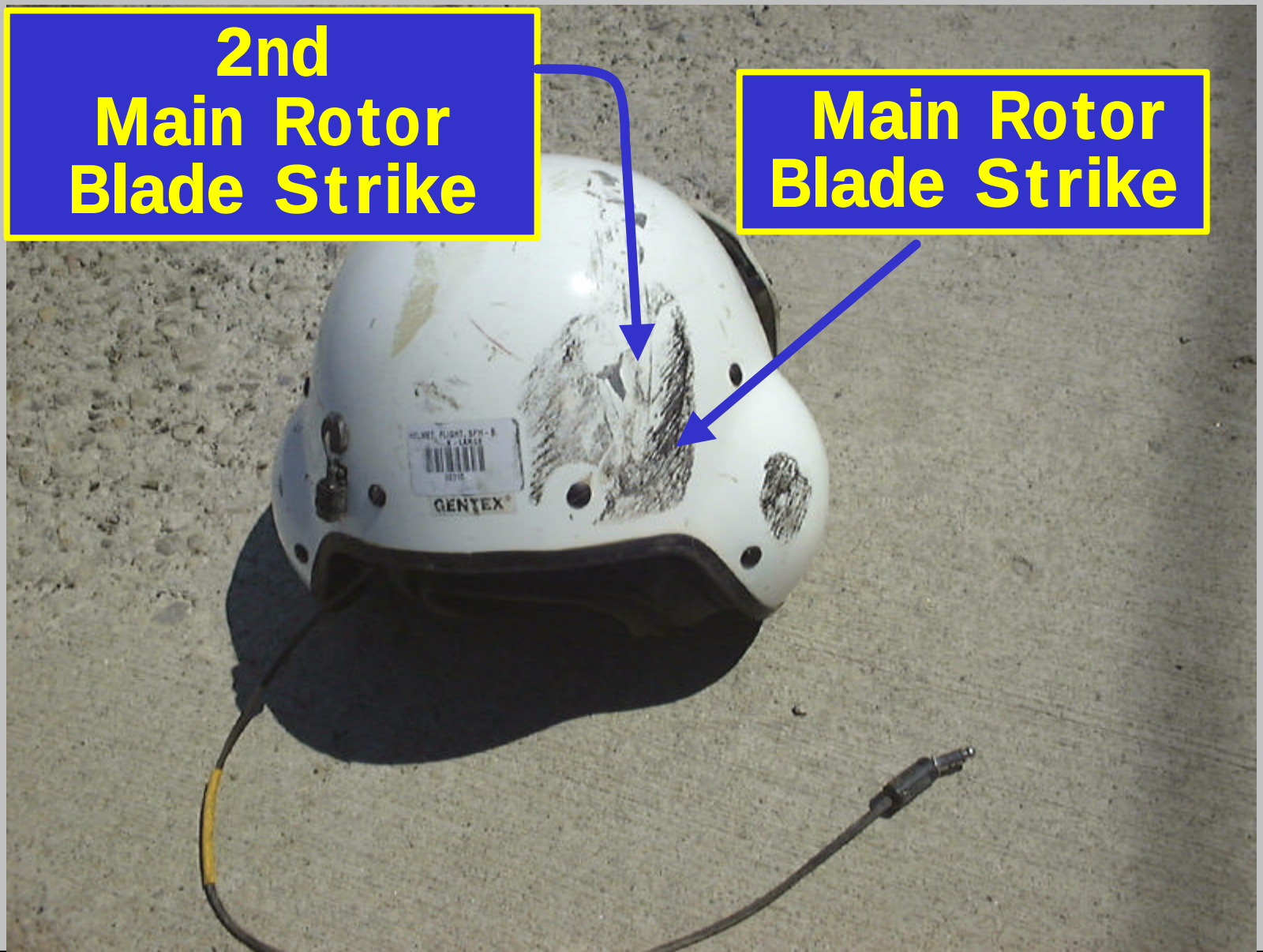

N10864


N108Z64


N10864

Aviation Life Support Equipment

Left Front Passenger

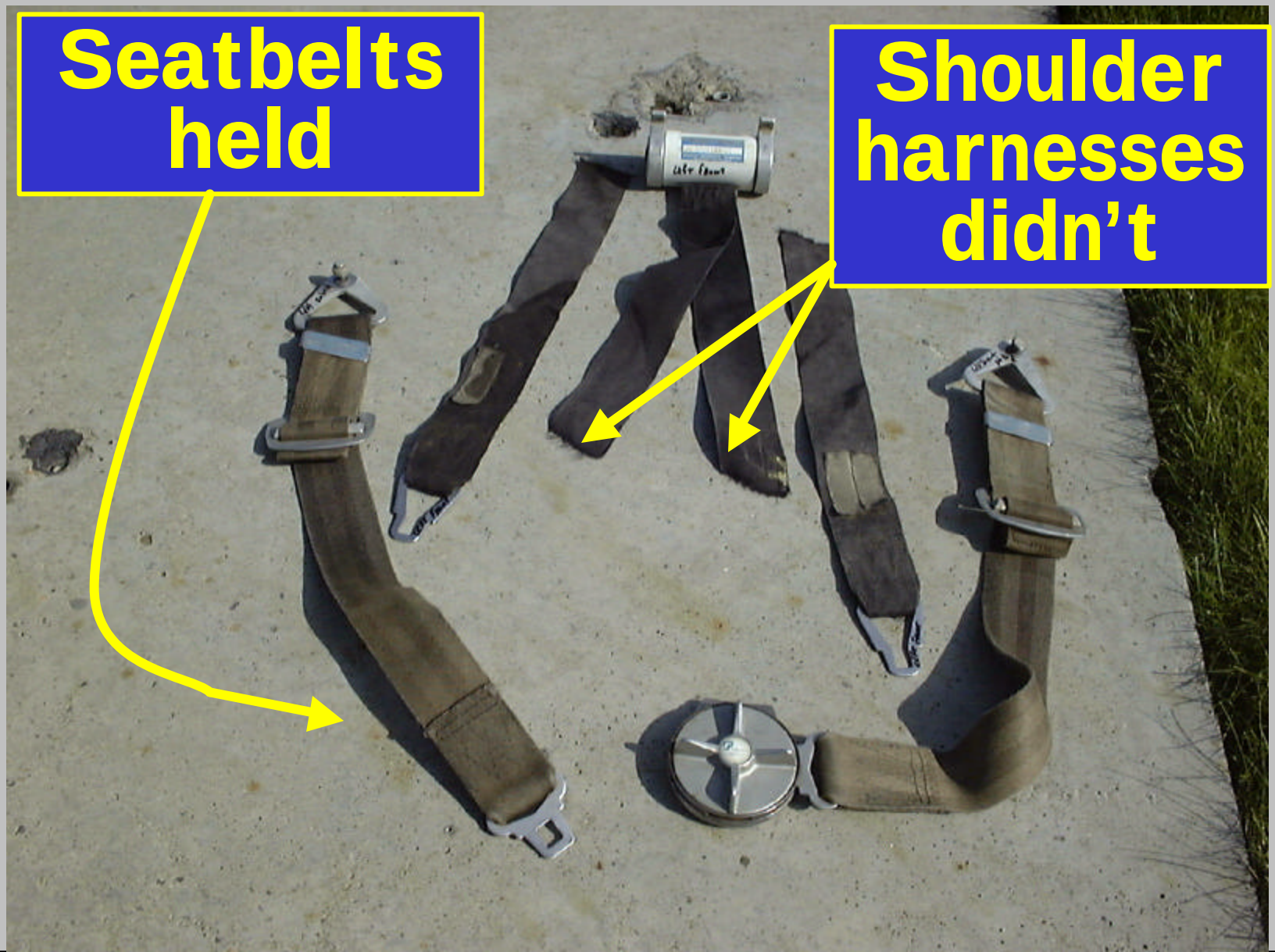


Left Front Passenger

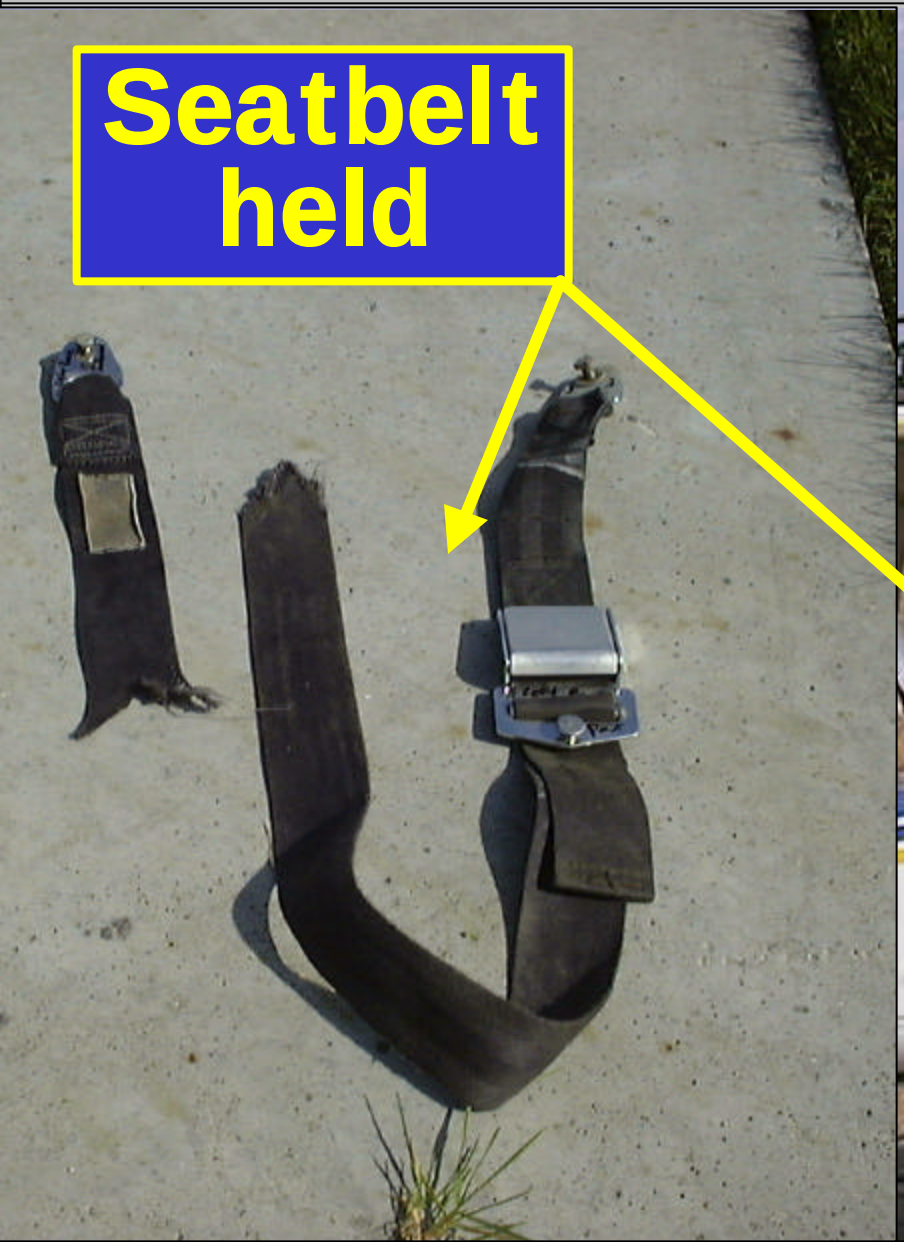
Left Front Passenger

This helmet SAVED a life !!!

Both Front Passengers



Left Rear Passenger



NTSB Probable Cause
Montello, NV, August 3, 2000

The National Transportation Safety Board

The National Transportation Safety Board determined that the probable cause of this accident was …

Probable Cause

- **The loss of control in hovering flight and impact with terrain for undetermined reasons.**

OAS Observations
Montello, NV, August 3, 2000

Issue

Use of flight helmets saved one life

Aviation Life Support Equipment

- How should DOI encourage maximum use of available ALSE (i.e helmets) ?
- Should DOI require the installation of dual shoulder harness restraint systems ?

Aviation Accident Review

Bell 412

Mission	Fire Suppression
Weather	VMC
Damage	Destroyed
Injuries	One fatal
Procurement	CWN
NTSB ID	LAX00GA297

Cold Springs, NV
August 13, 2000

NTSB Investigation On-Going
Preliminary Information

On a fire suppression mission a Bell 412 using a Bambi Bucket crashed on a rocky hillside. The single occupant, the pilot, was fatally injured.

Aviation Accident Review

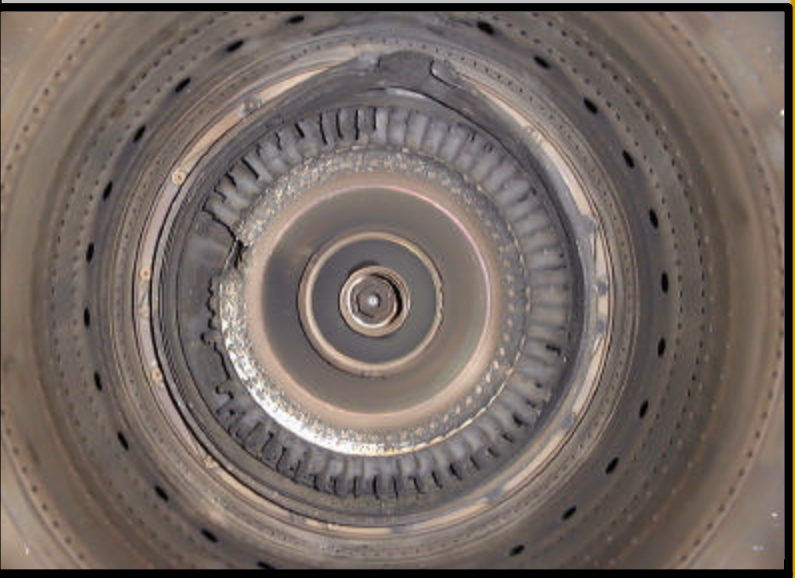
On August 13, 2000, at 1646 hours Pacific daylight time, a Bell 412, N174EH, was destroyed when it collided with mountainous terrain while conducting a water drop on a wildfire along a ridgeline near Cold Springs, Nevada.

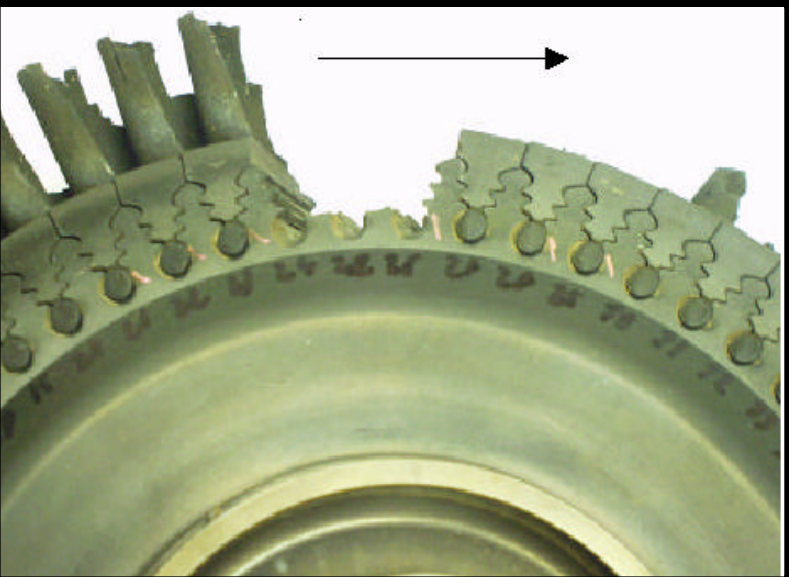
The helicopter was operated by the Bureau of Land Management as a public-use firefighting mission under the provisions of FAR Part 91

The airline transport pilot sustained fatal injuries.

Visual meteorological conditions prevailed for the accident flight.

Aviation Accident Review



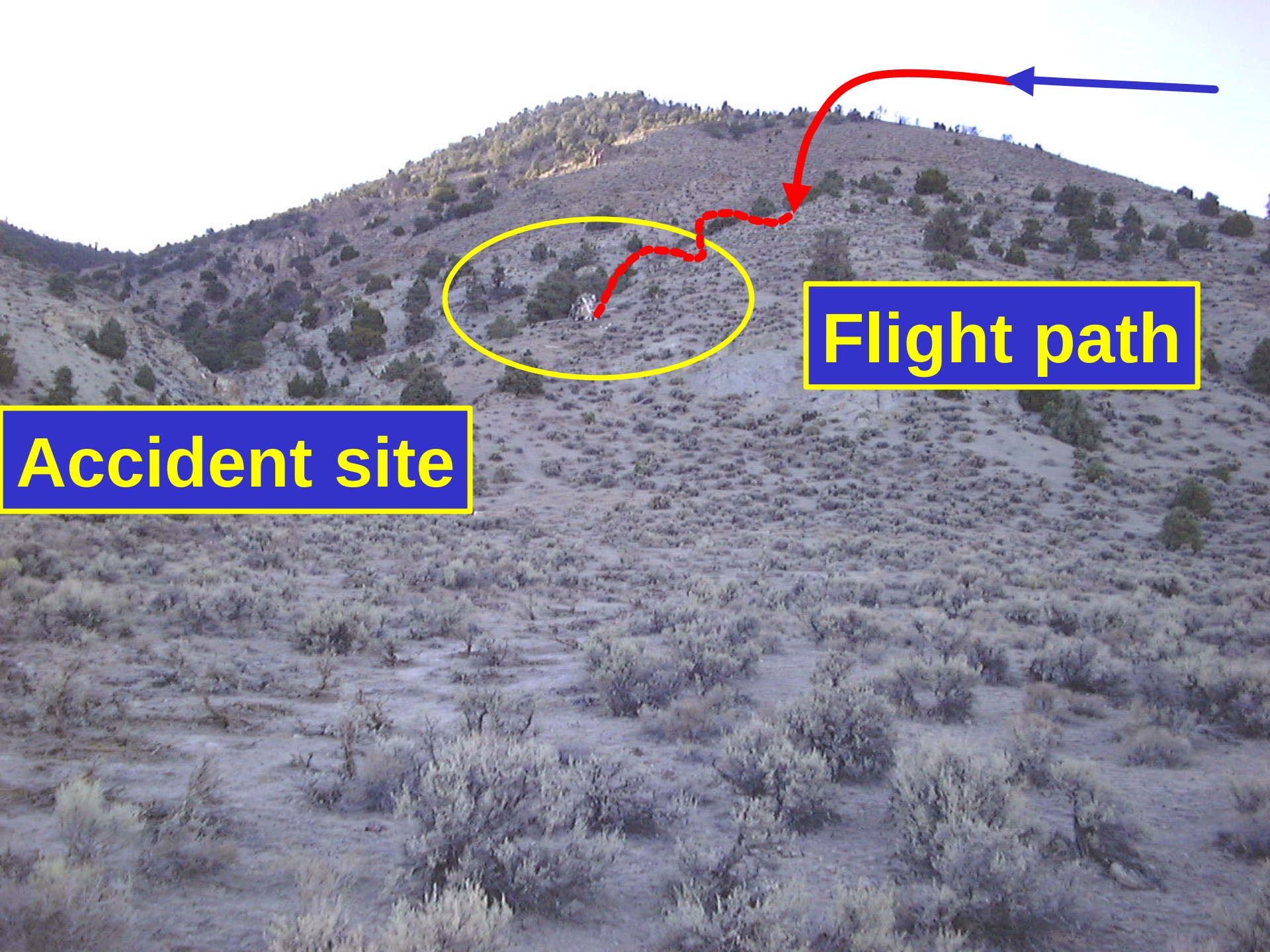


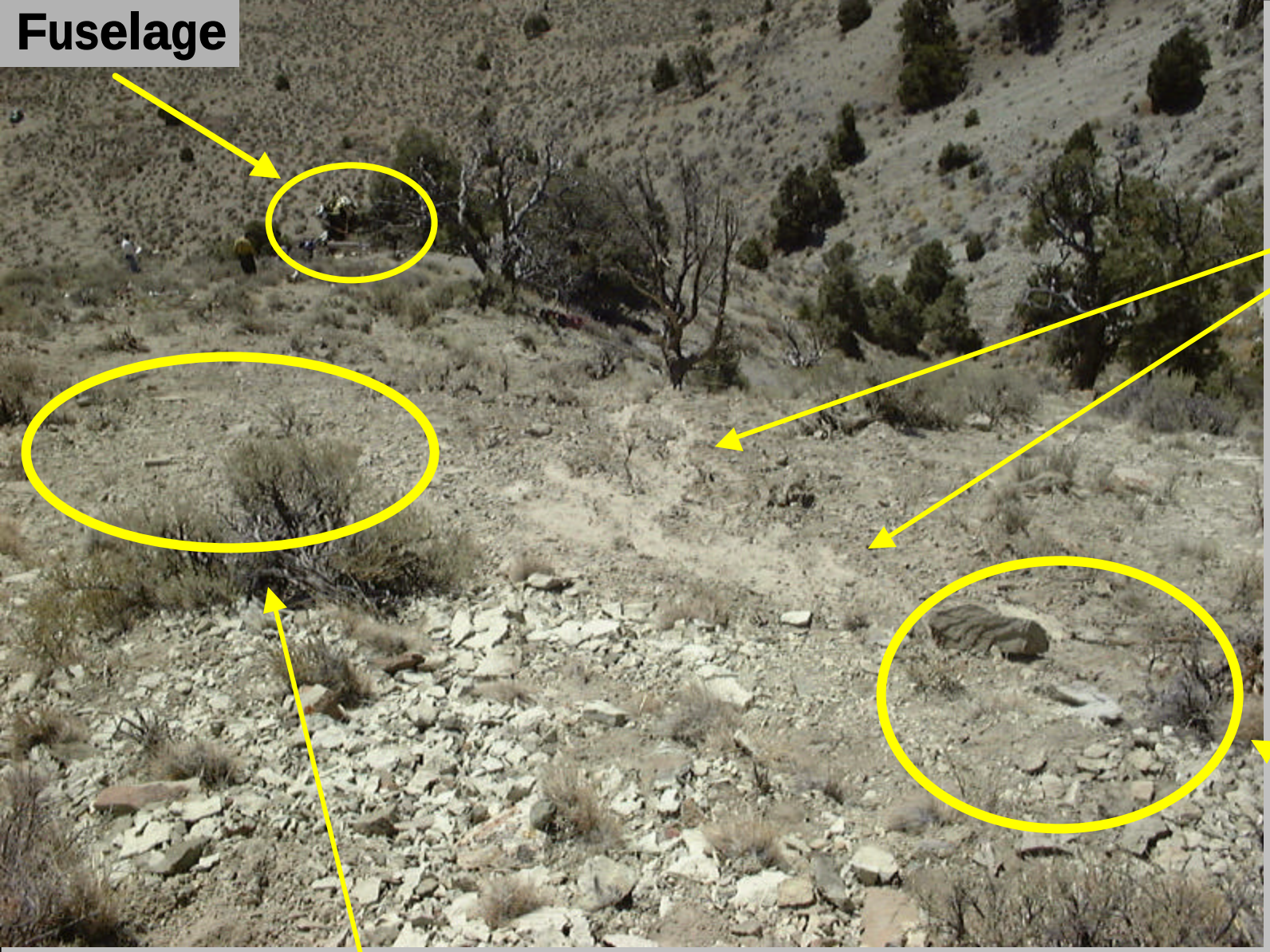
The investigation has revealed that the crash sequence began with a catastrophic failure in the #1 engine's compressor turbine (CT) section.

Detailed metallurgical analysis indicates the fracture of the #1 CT disc occurred as a result of cyclic stress rupture *(a phenomenon where at high temperature a material's strain resistance is compromised).*

"In summary, the CT disc failed due to stress rupture brought about by sustained operation near or above acceptable limits. No material or design deficiencies were identified." (Sidla, TSB)


N174EH


Flight path
Accident site


Fuselage
Water Trail
Initial Impact of Fuselage
Initial Impact of Bucket

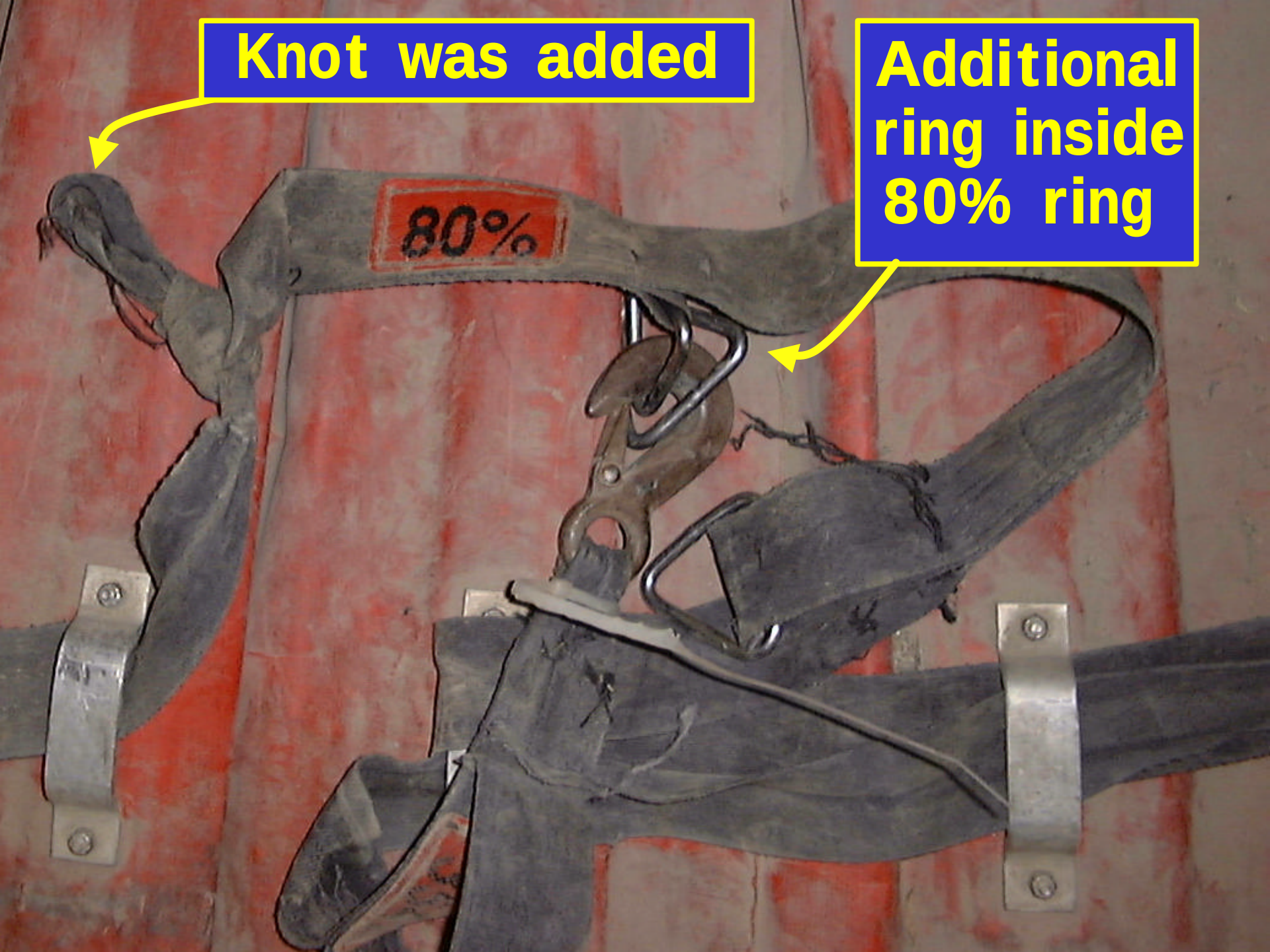

Debris Field


Main Rotor Blade

Main Rotor Blade

Tail Rotor

Indications of low rotor RPM at impact


Knot was added
Additional ring inside 80% ring
80%

Oversight by Helicopter Managers

AIRCRAFT CONTRACT DAILY DIARY

PAGE 1 OF 1

DATE: 7-26-06

FS 5602A092039
AS 1406998A970

1. CONTRACTOR	2. CONTRACT NO. / ITEM NO.	3. HOME BASE	4. CURRENT LOCATION OF AIRCRAFT
			WALL FIRE J-946 NEVADA
4. AIRCRAFT NO. AND MAKE/MODEL	5. GOVT. REPRESENTATIVE ON SITE		6. CONTRACTOR REP. ON SITE
N174EH BELL 412			
7. PILOT(S) ON DUTY (X) REGULAR ( ) RELIEF	8. MECHANIC(S) ON DUTY (X) REGULAR ( ) RELIEF		9. DRIVER ON DUTY ( ) REGULAR (X) RELIEF
CLEAR			
10. WEATHER	11. FUEL PRICE	12. OTHER AIRCRAFT ON BASE	

13. STANDBY/AVAILABILITY: BEGIN: _____ END: _____ TOTAL: _____

14. EXTENDED AVAILABILITY: BEGIN: _____ END: _____ TOTAL: _____

15. SERVICE TRUCK MILEAGE BEGIN: _____ END: _____ TOTAL: _____

16. WORK ORDER ISSUED (Include Suspend/Resume)

17. INCIDENT/HAZARD REPORT(S) ISSUED?
( ) YES (Attach Copy) ( ) NO

18. LIST MATERIALS FURNISHED TO JOB SITE
(Furnished By: G - Govt; C - Contractor; S - Subcontractor)

Item	Hours Used	Furnished By

19. LIST EQUIPMENT ON SITE
(Furnished By: G - Govt; C - Contractor; S - Subcontractor)

Item	Hours Used	Furnished By

AIR CRAFT WORKED WELL, PILOT IS VERY GOOD. OLD NAM VET. MEDIVAC PILOT. SHUTTLED CREWS IN A.M. BUCKET WORK PERFORMED IN THE AFTERNOON. WENT OVER AGAIN THAT WE AS AN AGENCY DON'T WANT THEM OVER TORQUING (SP) THE SHIP BECAUSE HE HAS TWO BIG OF A BUCKET.

CWN Helicopter Contract Load Calculation Requirements

1999 - 2000 - 2001

INTERAGENCY

CALL-WHEN-NEEDED

HELICOPTERS

PROJECT: CALL-WHEN-NEEDED MEDIUM AND HEAVY-LIFT HELICOPTER SERVICES

LOCATION: NATION-WIDE

CONTRACTOR: VARIOUS

AWARDING OFFICE: USDA FOREST SERVICE AND OFFICE OF AIRCRAFT SERVICES NIFC

U.S. DEPARTENT OF THE INTERIOR
HELICOPTER LOAD CALCULATION

HELICOPTER MODEL _____
NO. _____

Pilot / Project		Date / Time
1. Departure Base		Pressure ALT / Temperature
2. Destination Base		Pressure ALT / Temperature
3. Helicopter Equipped Weight		
4. Flight Crew Weight		
5. Fuel (Gals. X lbs.)		
6. Operating Weight		
	IGE	OGE
7. Computed Gross Weight		
8. Fixed Weight Reduction		
9. Adjusted Weight (7 Minus 8)		
10. Takeoff/Landing Limits (Handbook Limitation Section)		
11. Selected Weight (Lowest of 9 or 10 for Nonjettisonable)		
12. Operating Weight (Line 6)		
13. Allowable Payload		
14. Passengers and/or Cargo		
Names / Weight		
15. Actual Payload		
16. Actual Gross Weight (12 Plus 15) (Must Not Exceed Line 11)		

Pilot Foreman

OAS-67 (02/81)

CWN Helicopter Contract Load Calculation Requirements

IFB 49-99-02 Page 146

J.11 STANDARD INTERAGENCY LOAD CALCULATION INSTRUCTIONS

(1) PURPOSE. The purpose is to ensure that the aircraft is capable of carrying a specified identified elevation at a given density altitude.

Pilot is required to complete Blocks 1-13

HEMG is responsible to check the pilot

The Pilot must utilize the applicable charts in the aircraft flight manual, referencing them each time a is initiated. The Helicopter Manager is responsible for ensuring that the Pilot does this.

U.S. DEPARTENT OF THE INTERIOR
HELICOPTER LOAD CALCULATION

HELICOPTER MODEL _____
NO. _____

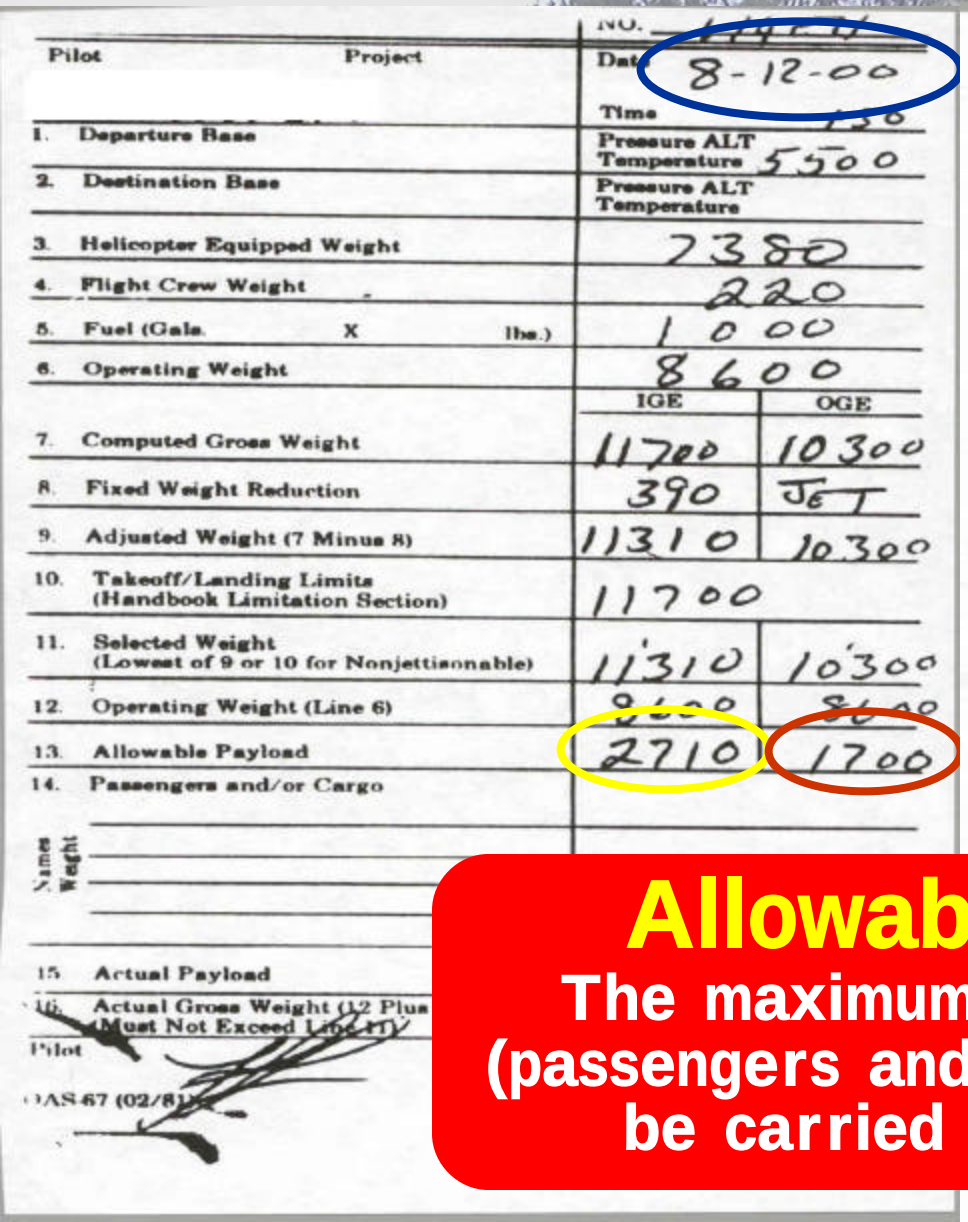
Pilot	Project	Date / Time
1. Departure Base		Pressure ALT / Temperature
2. Destination Base		Pressure ALT / Temperature
3. Helicopter Equipped Weight		
4. Flight Crew Weight		
5. Fuel (Gals. X lbs.)		
6. Operating Weight		
		IGE / OGE
7. Computed Gross Weight		
8. Fixed Weight Reduction		
9. Adjusted Weight (7 Minus 8)		
10. Takeoff/Landing Limits (Handbook Limitation Section)		
11. Selected Weight (Lowest of 9 or 10 for Nonjettisonable)		
12. Operating Weight (Line 6)		

For USDI agencies, the Pilot is required to complete Blocks 1-13. For USDA-FS, the Pilot is required to complete Blocks 1-11.

The Pilot must utilize the applicable charts in the aircraft flight manual, referencing them each time a load calculation is initiated. The Helicopter Manager is responsible for ensuring that the Pilot does this.

The Pilot signs after the Helicopter Manager has completed the remainder of the form.

Load Calculation - Allowable Payload



Pilot / Project	NO. 44EN
	Date 8-12-00
	Time 130
1. Departure Base	Pressure ALT 5500 Temperature
2. Destination Base	Pressure ALT Temperature
3. Helicopter Equipped Weight	7380
4. Flight Crew Weight	220
5. Fuel (Gals. X lbs.)	1000
6. Operating Weight	8600

	IGE	OGE
7. Computed Gross Weight	11700	10300
8. Fixed Weight Reduction	390	JET
9. Adjusted Weight (7 Minus 8)	11310	10300
10. Takeoff/Landing Limits (Handbook Limitation Section)	11700	
11. Selected Weight (Lowest of 9 or 10 for Nonjettisonable)	11310	10300
12. Operating Weight (Line 6)	8600	8600
13. Allowable Payload	2710	1700
14. Passengers and/or Cargo		

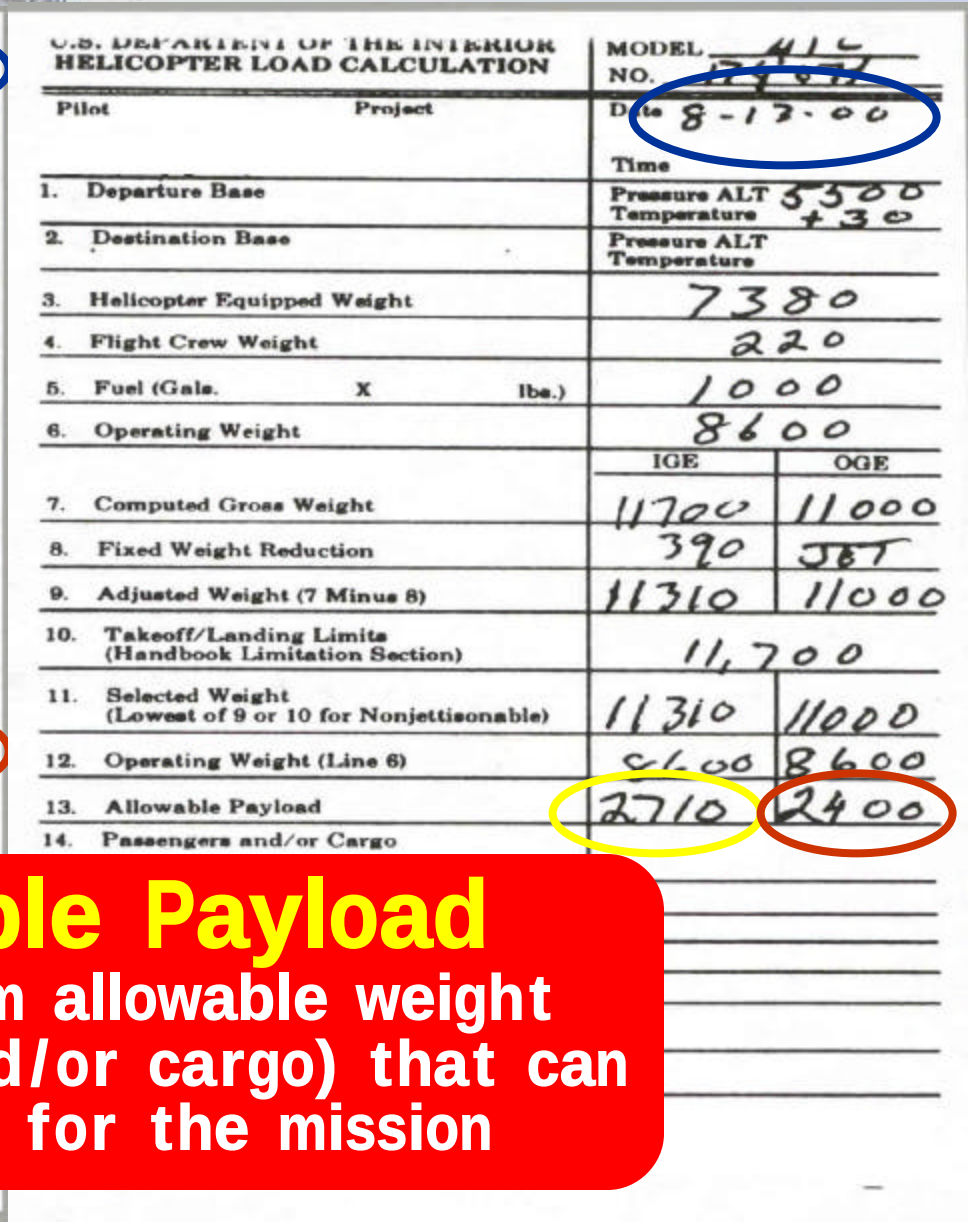
Name / Weight

15. Actual Payload

16. Actual Gross Weight (12 Plus [illegible] Must Not Exceed Line 11)

Pilot

OAS-67 (02/81)



U.S. DEPARTMENT OF THE INTERIOR
HELICOPTER LOAD CALCULATION

MODEL 412
NO. 44EN

Pilot / Project	Date 8-17-00
	Time
1. Departure Base	Pressure ALT 5300 Temperature +30
2. Destination Base	Pressure ALT Temperature
3. Helicopter Equipped Weight	7380
4. Flight Crew Weight	220
5. Fuel (Gals. X lbs.)	1000
6. Operating Weight	8600

	IGE	OGE
7. Computed Gross Weight	11700	11000
8. Fixed Weight Reduction	390	JET
9. Adjusted Weight (7 Minus 8)	11310	11000
10. Takeoff/Landing Limits (Handbook Limitation Section)	11,700	
11. Selected Weight (Lowest of 9 or 10 for Nonjettisonable)	11310	11000
12. Operating Weight (Line 6)	8600	8600
13. Allowable Payload	2710	2400
14. Passengers and/or Cargo		

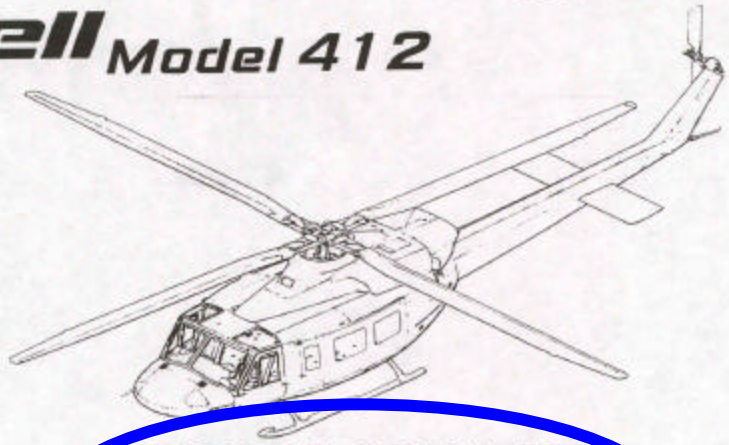
Allowable Payload

The maximum allowable weight (passengers and/or cargo) that can be carried for the mission

Aircraft Performance Planning

BHT-412-FM-1

Bell Model 412



ROTORCRAFT FLIGHT MANUAL

S/N 33001 — 33107

TYPE CERTIFICATION H4SW

REGISTRATION NO. _____

APPROVED BY Don P. Watson

MANAGER
ROTORCRAFT CERTIFICATION OFFICE
FEDERAL AVIATION ADMINISTRATION
FT. WORTH, TEXAS 76193-0170

DATE JANUARY 9, 1981

THIS MANUAL SHALL BE IN THE HELICOPTER DURING ALL OPERATIONS

Bell Helicopter TEXTRON
A Subsidiary of Textron Inc.
POST OFFICE BOX 482 • FORT WORTH, TEXAS 76101

9 JANUARY 1981
REVISION 18 — 26 MARCH 1998

BHT-412-FMS-35.2

Bell MODEL 412

ROTORCRAFT FLIGHT MANUAL

SUPPLEMENT
CATEGORY B OPERATIONS WHEN CONFIGURED WITH NINE OR LESS PASSENGER SEATS

33108 — 33213
34001 — 34024
36001 — 36019
AND
33001 — 33107
WHEN 412-075-008-111
TORQUEMETER IS INSTALLED
(BHT-412-FMS-19.1)

CERTIFIED
10 APRIL 1991

This supplement shall be attached to Model 412 Flight Manual when helicopter is configured with nine or less passengers seat configuration.

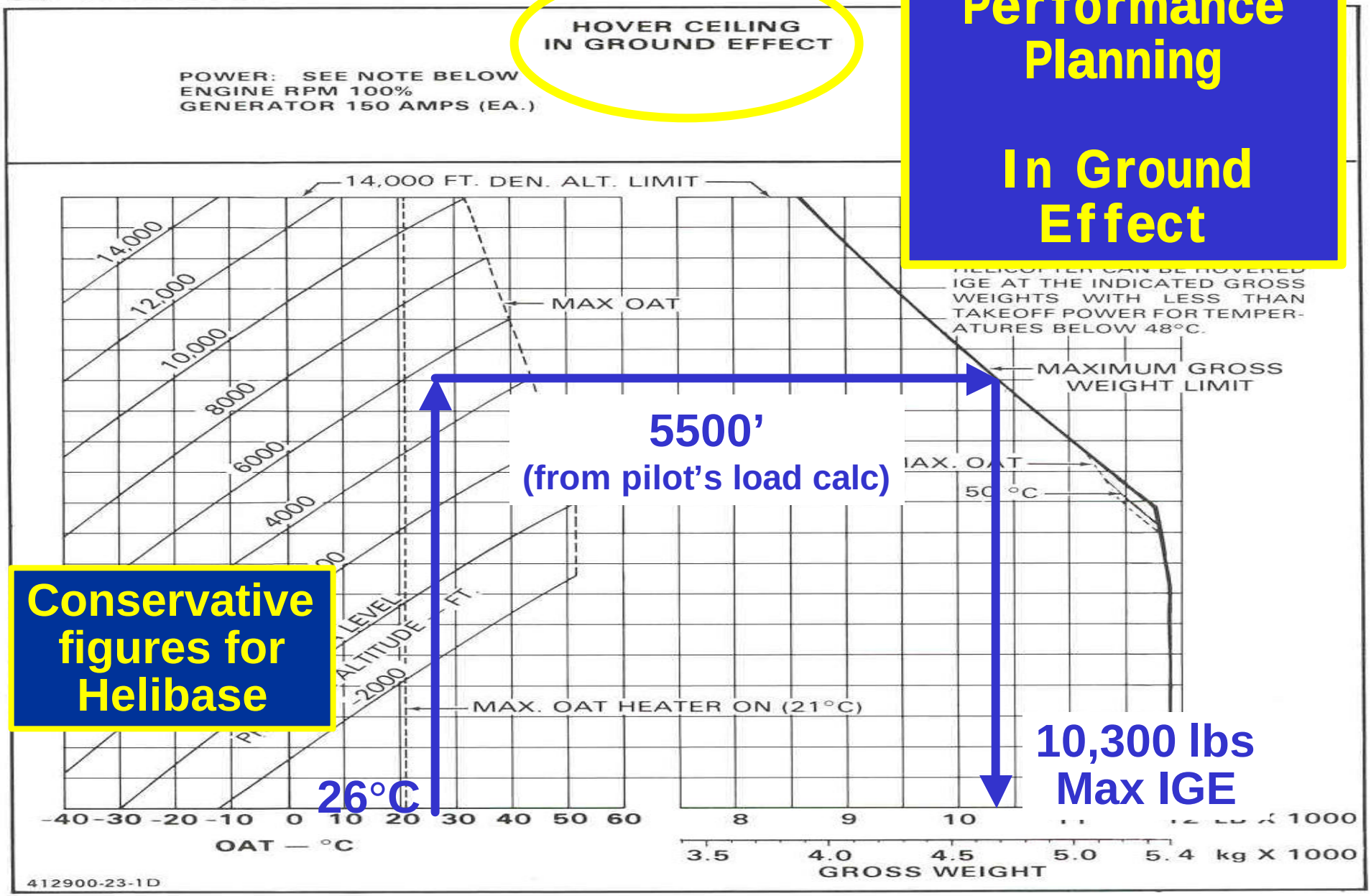
Information contained herein supplements information of basic Flight Manual. For Limitations, Procedures, and **Performance Data not contained in this supplement, or** other applicable supplements, consult basic Flight **Manual.**

Bell Helicopter TEXTRON
A Subsidiary of Textron Inc.
POST OFFICE BOX 482 • FORT WORTH, TEXAS 76101

10 MAY 1996
REVISION 1 — 23 APRIL 1998

Aircraft Performance Planning

In Ground Effect



5500’
(from pilot’s load calc)

Conservative figures for Helibase

26°C

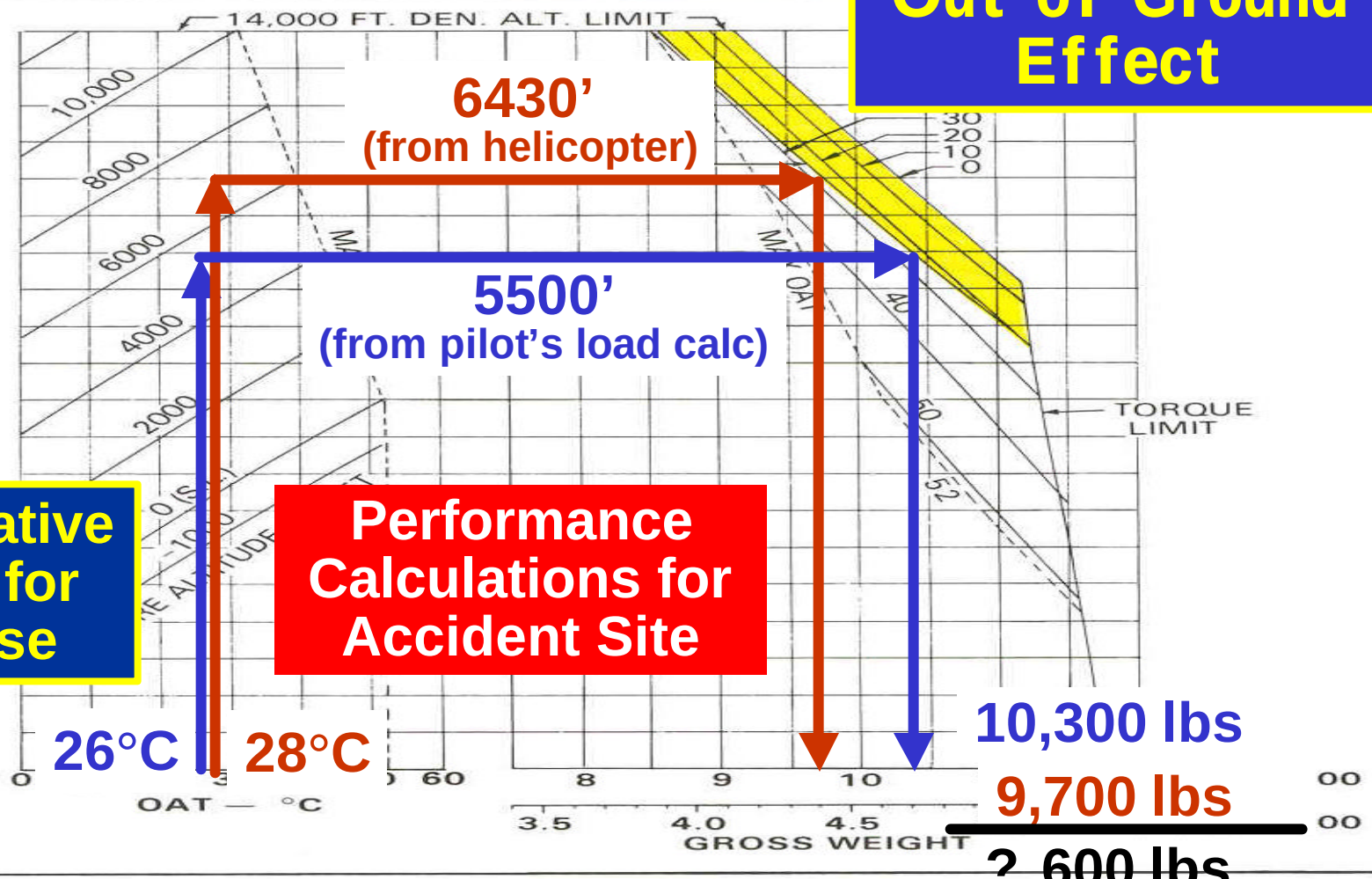
10,300 lbs Max IGE

Figure 4–4. Hover ceiling in ground effect (Sheet 1 of 2)

HOVER CEILING
OUT OF GROUND EFFECT

TAKEOFF POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

CAUTION: OGE HOVER OPERATION MAY RESULT IN VIOLATIO



Aircraft Performance Planning

Out of Ground Effect

6430’
(from helicopter)

5500’
(from pilot’s load calc)

Conservative figures for Helibase

Performance Calculations for Accident Site

26°C **28°C**

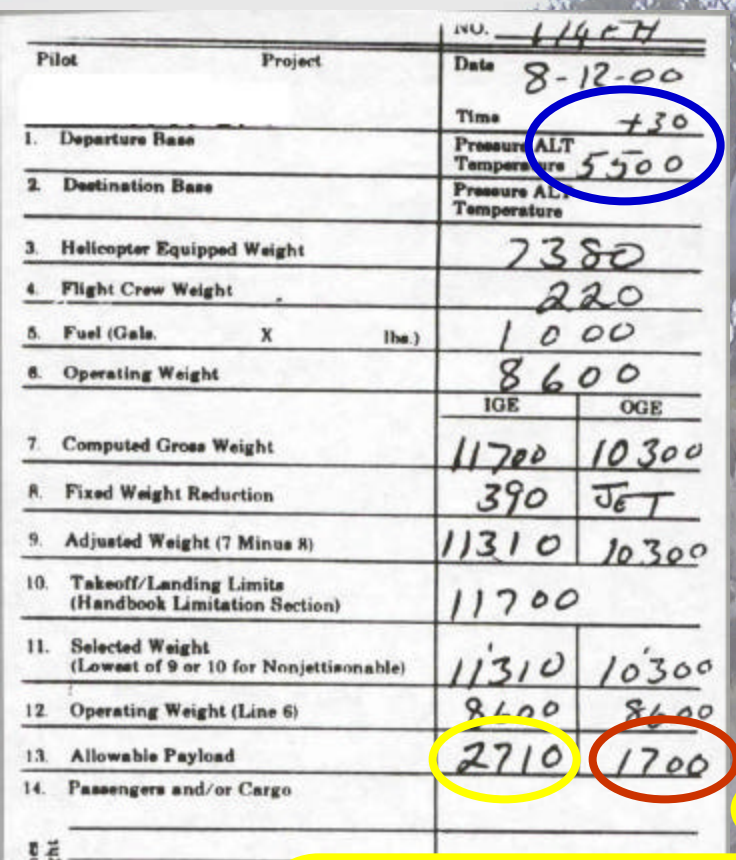
10,300 lbs

9,700 lbs

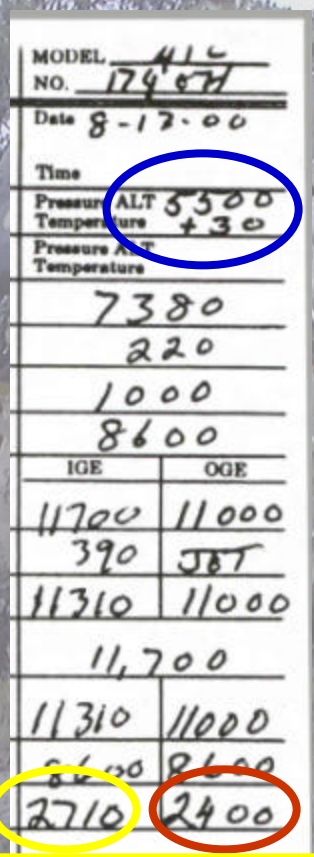
? 600 lbs

Figure 4–5. Hover ceiling out of ground effect (Sheet 1 of 8)

Load Calculation - Allowable Payload



Pilot	Project	NO. 414CH
		Date 8-12-00
		Time +30
1. Departure Base		Pressure ALT / Temperature 5500
2. Destination Base		Pressure ALT / Temperature
3. Helicopter Equipped Weight		7380
4. Flight Crew Weight		220
5. Fuel (Gals. X lbs.)		1000
6. Operating Weight		8600
	IGE	OGE
7. Computed Gross Weight	11700	10300
8. Fixed Weight Reduction	390	JET
9. Adjusted Weight (7 Minus 8)	11310	10300
10. Takeoff/Landing Limits (Handbook Limitation Section)	11700	
11. Selected Weight (Lowest of 9 or 10 for Nonjettisonable)	11310	10300
12. Operating Weight (Line 6)	8600	8600
13. Allowable Payload	2710	1700
14. Passengers and/or Cargo		
Name / Weight		
15. Actual Payload		
16. Actual Gross Weight (Must Not Exceed Li		
Pilot		



MODEL 412	
NO. 174CH	
Date 8-12-00	
Time	
Pressure ALT 5300 / Temperature +30	
Pressure ALT / Temperature	
7380	
220	
1000	
8600	
IGE	OGE
11700	11000
390	JET
11310	11000
11,700	
11310	11000
8600	8600
2710	2400

5500'/26°C

U.S. DEPARTENT OF THE INTERIOR HELICOPTER LOAD CALCULATION	HELICOPTER MODEL Bell 412 NO.
Pilot Project	Date
	Time
	Pressure ALT / Temperature 5500'/26°C
	Pressure ALT / Temperature
3. Helicopter Equipped Weight	7380
4. Flight Crew Weight	300 (287+gear)
5. Fuel (Gals. X lbs.)	1000
6. Operating Weight	8680
	IGE / OGE
7. Computed Gross Weight	10,300 / 10,300
8. Fixed Weight Reduction	390 / JET
9. Adjusted Weight (7 Minus 8)	9,910 / 10,300
10. Takeoff/Landing Limits (Handbook Limitation Section)	11,900 (pg 1-1)
11. Selected Weight (Lowest of 9 or 10 for Nonjettisonable)	9,910 / 10,300
12. Operating Weight (Line 6)	8680 / 8680
13. Allowable Payload	1230 / 1620

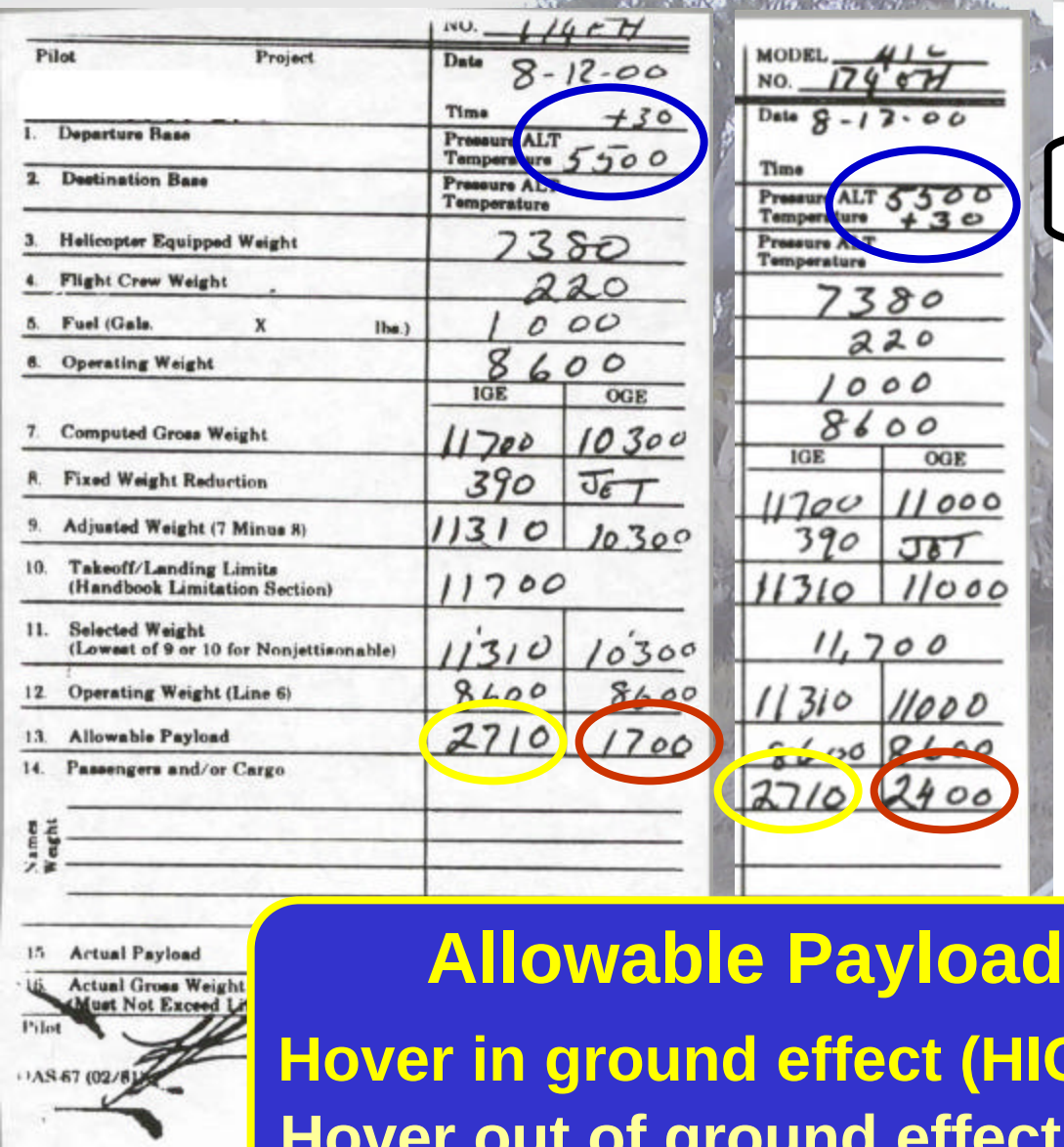
Allowable Payload

The maximum allowable weight (passengers and/or cargo) that can be carried for the mission

Hover in ground effect (HIGE) 1230 lbs

Hover out of ground effect (HOGE) 1620 lbs

Load Calculation - Allowable Payload



Pilot	Project	NO. 414CH
		Date 8-12-00
		Time +30
1. Departure Base		Pressure ALT / Temperature 5500
2. Destination Base		Pressure ALT / Temperature
3. Helicopter Equipped Weight		7380
4. Flight Crew Weight		220
5. Fuel (Gals. X lbs.)		1000
6. Operating Weight		8600
		IGE / OGE
7. Computed Gross Weight		11700 / 10300
8. Fixed Weight Reduction		390 / JET
9. Adjusted Weight (7 Minus 8)		11310 / 10300
10. Takeoff/Landing Limits (Handbook Limitation Section)		11700
11. Selected Weight (Lowest of 9 or 10 for Nonjettisonable)		11310 / 10300
12. Operating Weight (Line 6)		8600 / 8600
13. Allowable Payload		2710 / 1700
14. Passengers and/or Cargo		
Name / Weight		
15. Actual Payload		
16. Actual Gross Weight (Must Not Exceed Li		
Pilot		

AS 67 (02/81)

MODEL 412	
NO. 174CH	
Date 8-12-00	
Time	
Pressure ALT / Temperature 5300 / +30	
Pressure ALT / Temperature	
7380	
220	
1000	
8600	
IGE	OGE
11700	11000
390	JET
11310	11000
11,700	
11310	11000
8600	8600
2710	2400

6430'/28°C

U.S. DEPARTENT OF THE INTERIOR HELICOPTER LOAD CALCULATION	HELICOPTER MODEL Bell 412
Pilot Project	Date
	Time
	Pressure ALT / Temperature 6430'/28°C
	Pressure ALT Temperature
3. Helicopter Equipped Weight	7380
4. Flight Crew Weight	300 (287+gear)
5. Fuel (Gals. X lbs.)	1000
6. Operating Weight	8680
	IGE / OGE
7. Computed Gross Weight	9,800 / 9,700
8. Fixed Weight Reduction	390 / JET
9. Adjusted Weight (7 Minus 8)	9,410 / 9,700
10. Takeoff/Landing Limits (Handbook Limitation Section)	11,900 (pg 1-1)
11. Selected Weight (Lowest of 9 or 10 for Nonjettisonable)	9,410 / 9,700
12. Operating Weight (Line 6)	8680 / 8680
13. Allowable Payload	730 / 1020
14. Passengers and/or Cargo	

Allowable Payload for Dropsite

Hover in ground effect (HIGE)	730 lbs
Hover out of ground effect (HOGE)	1020 lbs

HOVER CEILING OUT OF GROUND EFFECT

TAKEOFF POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

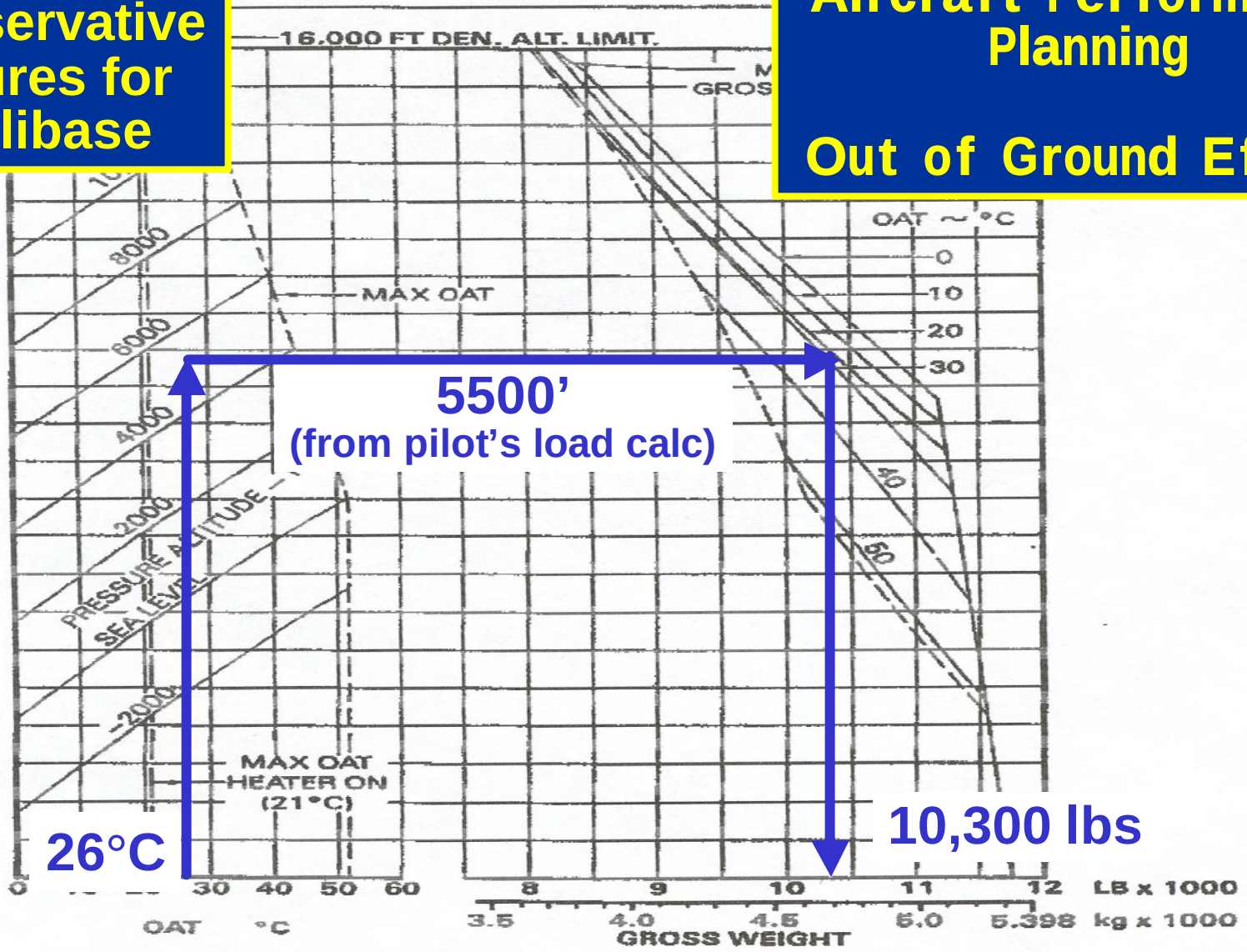
SKID HEIGHT 60 FEET
HEATER ON OR OFF
0°C TO 52°C

NOTE: THESE DATA VALID FOR ZERO WIND OUTSIDE OF THE CRITICAL WIND AZIMUTH AREA (REFER TO FIGURE 4-5)

Conservative figures for Helibase

Aircraft Performance Planning

Out of Ground Effect



Pilot's Flawed Aircraft Performance Planning

MODEL 412
NO. 17407
Date 8-17-00
Time
Pressure ALT 5300
Temperature +30
Pressure ALT
Temperature
7380
220
1000
8600

IGE	OGE
11700	11000
11310	11000
11,700	
11310	11000
8600	8600
2710	2400

412 ROTORCRAFT
FLIGHT MANUAL
33001 THROUGH 33107

HOVER CEILING
IN GROUND EFFECT

EE NOTE BELOW
M 100%
R 150 AMPS (EA.)

14,000 FT. DEN. ALT. LIMIT

MAX OAT

5500' MSL

NOTE: THESE IGE HOVER CEILINGS ARE BASED ON DENSITY ALTITUDE LIMITS FOR TAKEOFF AND LANDING. THIS HELICOPTER CAN BE HOVERED IGE AT THE INDICATED GROSS WEIGHTS WITH LESS THAN TAKEOFF POWER FOR TEMPER-

MAXIMUM GROSS WEIGHT LIMIT

MAX. OAT
50 °C

MAX. OAT HEATER ON (21°C)

30°C

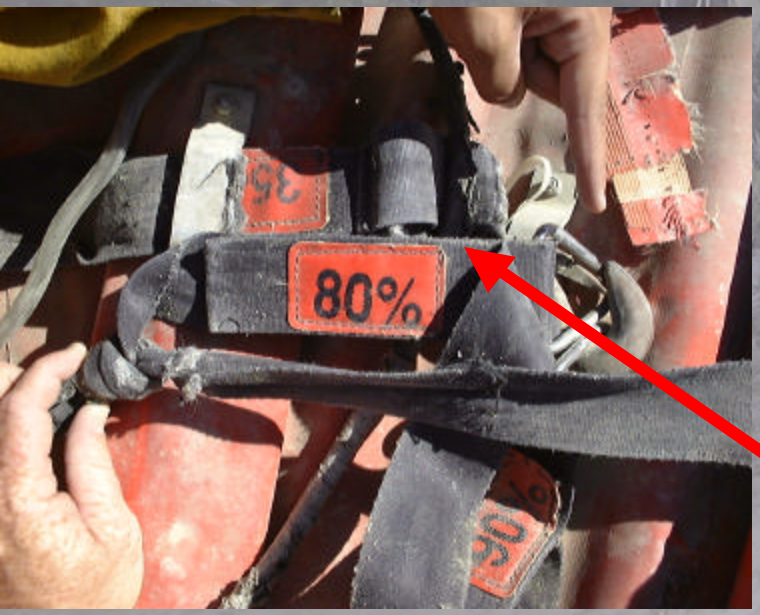
11,700 lbs Calculated IGE

10 20 30 40 50 60
°C

8 9 10 11 12 LB X 1000
3.5 4.0 4.5 5.0 5.4 kg X 1000
GROSS WEIGHT

Figure 4–4. Hover ceiling in ground effect (Sheet 1 of 2)

Bambi Bucket Loading



Model	Capacity			Gross Weight		Empty Weight	
	Imp. Gal	US Gal	Litres	Lbs	Kg	Lbs	Kg
6072	60	72	270	666	303	66	30
8096	80	96	365	870	395	70	32
9011	90	108	410	971	441	70	32
1012	100	120	455	1072	487	72	33
1214	120	144	545	1273	579	73	33
1518	150	180	680	1574	797	75	34
1821	175	210	795	1876	853	76	35
2024	200	240	910	2135	970	135	61
2732	270	324	1225	2853	1300	154	70
3542	350	420	1590	3667	1667	167	76
4453	440	530	2000	4587	2085	170	85

Model 3542

100%	420 gal	3667 lbs
90%	378 gal	3282 lbs
80%	336 gal	2934 lbs
70%	294 gal	2585 lbs

Load Calculation

Pilot / Project	NO. 174CH	MODEL 412 NO. 174CH
Date	8-12-00	8-12-00
Time	+30	
1. Departure Base — Pressure ALT / Temperature	5500	5300 / +30
2. Destination Base — Pressure ALT / Temperature		
3. Helicopter Equipped Weight	7380	7380
4. Flight Crew Weight	220	220
5. Fuel (Gals. X lbs.)	1000	1000
6. Operating Weight	8600	8600
	IGE / OGE	IGE / OGE
7. Computed Gross Weight	11700 / 10300	11700 / 11000
8. Fixed Weight Reduction	390 / JET	390 / JET
9. Adjusted Weight (7 Minus 8)	11310 / 10300	11310 / 11000
10. Takeoff/Landing Limits (Handbook Limitation Section)	11700	11,700
11. Selected Weight (Lowest of 9 or 10 for Nonjettisonable)	11310 / 10300	11310 / 11000
12. Operating Weight (Line 6)	8600 / 8600	8600 / 8600
13. Allowable Payload	2710 / 1700	2710 / 2400
14. Passengers and/or Cargo		

HELICOPTER MODEL Bell 412	
NO.	
Date	
Time	
Pressure ALT Temperature	5500'/26°C
Pressure ALT Temperature	
7380	
300 (287+gear)	
1000	
8680	
IGE	OGE
11,500	10,300
390	JET
11,110	10,300
11,900 (pg 1-1)	
11,110	10,300
8,680	8,680
2,430	1,620

HELICOPTER MODEL Bell 412	
NO.	
Date	
Time	
Pressure ALT Temperature	6430'/28°C
Pressure ALT Temperature	
7380	
300 (287+gear)	
1000	
8680	
IGE	OGE
11,100	9,800
390	JET
10,710	9,800
11,900 (pg 1-1)	
10,710	9,800
8,680	8,680
2,030	1,120

Model 3542

100%	420 gal	3667 lbs
90%	378 gal	3282 lbs
80%	336 gal	2934 lbs
70%	294 gal	2585 lbs

Why?

How big of a bucket could have been carried

16. SPECIFICATIONS

16.2 Suggested Buckets for Different Helicopters

Note: These are guidelines only.
The helicopter operator must make the decision as to which model Bambi Bucket is appropriate.

Bambi Model	Gross Wt (lbs/Kg)	Suggested Helicopters
6072	666/303	Robinson R-44
8096	870/395	Bell 47 & 206A, Enstrom F28F, F280FX, Rogerson
2732	2853/1300	Bell 204, Sikorsky S-76A, S-76B, MD Explorer
3542	3667/1667	Augusta AB 212 & AB 412, Bell 204B, 205, 212 & 412 SP, Huey UH-1H
4453	4487/2085	Aerospatiale Puma, California/Sikorsky S58T, W3 Sokol
5566	5725/2602	Aerospatiale Puma, Bell 214B & 214 St., Kawasaki-Boeing KV107, Sikorsky UH 60-A (Black Hawk), MI-8, MI-17

Suggested Buckets for Different Helicopters

The following is a recommended sizing chart of Bambi Bucket for various helicopters. It should be stressed that this is only a guideline, and the decision is ultimately up to the helicopter operator.

How big of a bucket could have been carried

Model	Capacity			Gross Weight		Empty Weight	
	Imp. Gal	US Gal	Litres	Lbs	Kg	Lbs	Kg
6072	60	72	270	666	303	66	30
8096	80	96	365	870	395	70	32
9011	90	108	410	971	441	70	32
1012	100	120	455	1072	487	72	33
1214	120	144	545	1273	579	73	33
1518	150	180	680	1574	797	75	34
1821	175	210	795	1876	853	76	35
2024	200	240	910	2135	970	135	61
2732	270	324	1225	2853	1300	154	70
3542	350	420	1590	3667	1667	167	76
4453	440	530	2000	4587	2085	170	85
5566HD	550	660	2500	5805	2638	304	138
5870HD	585	700	2655	6170	2805	330	150
6578HD	650	780	2955	6846	3111	356	162
7590	750	900	3405	7775	3534	375	170
HL5000	1100	1320	5000	11390	5177	390	177
HL7600	1667	2000	7570	17115	7780	465	211
HL9800	2167	2600	9840	22180	10081	530	241

Hover out of ground effect at 26° and 5500ft 1620 lbs

Model 3542

100%	420 gal	3667 lbs
90%	378 gal	3304 lbs
80%	336 gal	2956 lbs
70%	294 gal	2607 lbs

Too heavy in all configurations

How big of a bucket could have been carried

Model	Capacity			Gross Weight		Empty Weight	
	Imp. Gal	US Gal	Litres	Lbs	Kg	Lbs	Kg
6072	60	72	270	666	303	66	30
8096	80	96	365	870	395	70	32
9011	90	108	410	971	441	70	32
1012	100	120	455	1072	487	72	33
1214	120	144	545	1273	579	73	33
1518	150	180	680	1574	797	75	34
1821	175	210	795	1876	853	76	35
2024	200	240	910	2135	970	135	61
2732	270	324	1225	2853	1300	154	70
3542	350	420	1590	3667	1667	167	76
4453	440	530	2000	4587	2085	170	85
5566HD	550	660	2500	5805	2638	304	138
5870HD	585	700	2655	6170	2805	330	150
6578HD	650	780	2955	6846	3111	356	162
7590	750	900	3405	7775	3534	375	170
HL5000	1100	1320	5000	11390	5177	390	177
HL7600	1667	2000	7570	17115	7780	465	211
HL9800	2167	2600	9840	22180	10081	530	241

Hover out of ground effect at 26° and 5500ft 1620 lbs

Model 2732

100%	324 gal	2853 lbs
90%	292 gal	2578 lbs
80%	259 gal	2304 lbs
70%	227 gal	2038 lbs

Too heavy in all configurations

How big of a bucket could have been carried

Model	Capacity			Gross Weight		Empty Weight	
	Imp. Gal	US Gal	Litres	Lbs	Kg	Lbs	Kg
6072	60	72	270	666	303	66	30
8096	80	96	365	870	395	70	32
9011	90	108	410	971	441	70	32
1012	100	120	455	1072	487	72	33
1214	120	144	545	1273	579	73	33
1518	150	180	680	1574	797	75	34
1821	175	210	795	1876	853	76	35
2024	200	240	910	2135	970	135	61
2732	270	324	1225	2853	1300	154	70
3542	350	420	1590	3667	1667	167	76
4453	440	530	2000	4587	2085	170	85
5566HD	550	660	2500	5805	2638	304	138
5870HD	585	700	2655	6170	2805	330	150
6578HD	650	780	2955	6846	3111	356	162
7590	750	900	3405	7775	3534	375	170
HL5000	1100	1320	5000	11390	5177	390	177
HL7600	1667	2000	7570	17115	7780	465	211
HL9800	2167	2600	9840	22180	10081	530	241

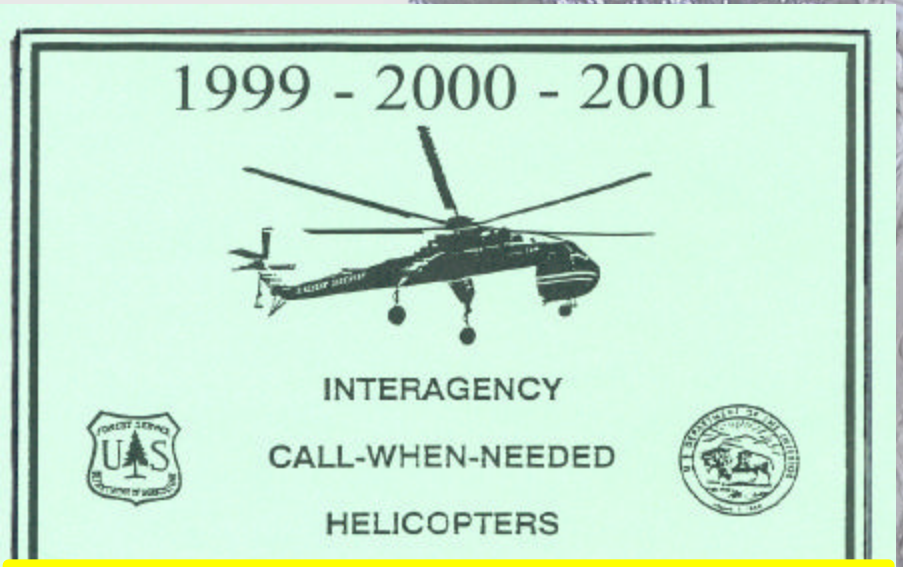
Hover out of ground effect at 26° and 5500ft 1620 lbs

Model 2024

100%	240 gal	2135 lbs
90%	216 gal	1928 lbs
80%	192 gal	1729 lbs
70%	168 gal	1529 lbs

Must be cinched to 70%

Pilot Authority and Responsibility



(A) The Pilot-in-Command is responsible for operating the aircraft within its operating limits, responsible for the safety of the aircraft, its occupants, and cargo…

(2) PILOT AUTHORITY AND RESPONSIBILITY

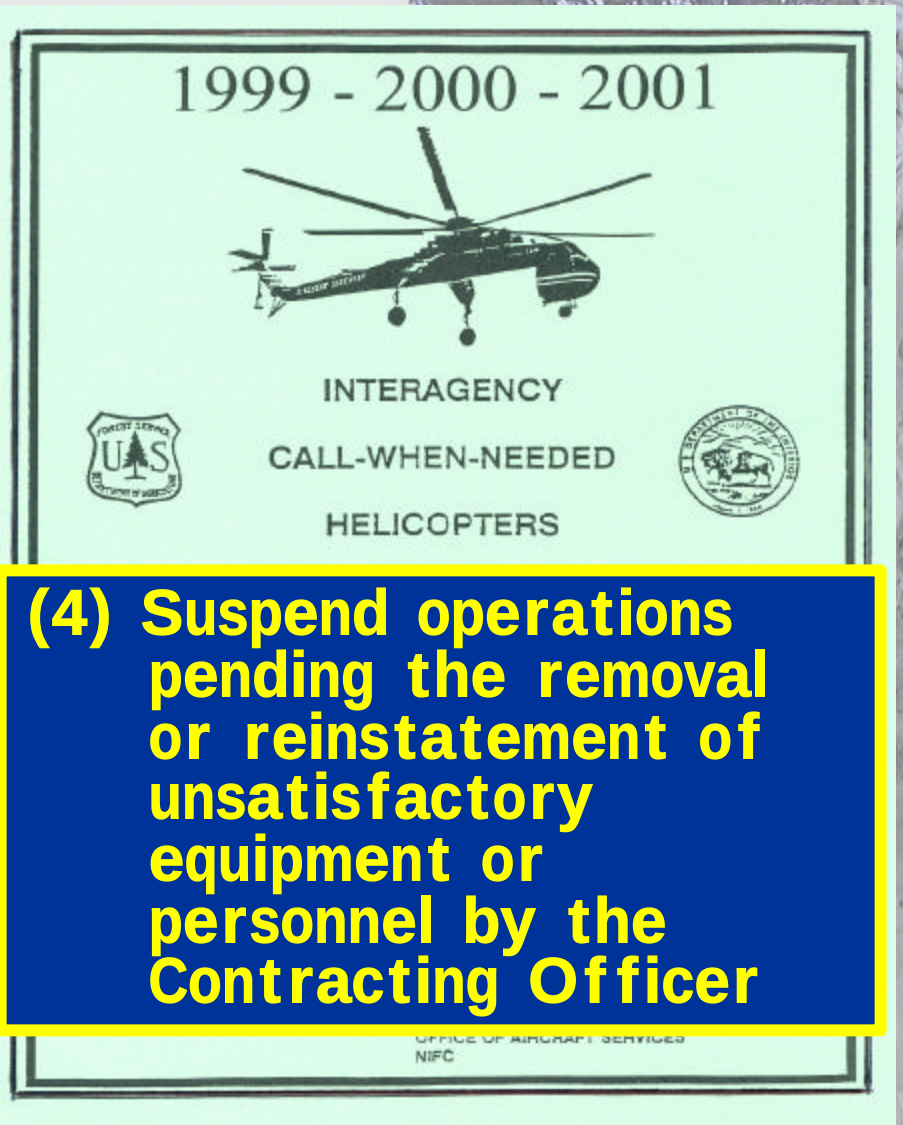
(A) The Pilot-in-Command is responsible for operating the aircraft within its operating limits, responsible for safety of the aircraft, its occupants, and cargo and shall comply with the directions of the Government, except when in his/her judgment, such compliance will be a violation of applicable Federal or State regulations or contracting provisions. The Pilot shall refuse any operation considered hazardous or unsafe.

(B) The Pilot shall not permit any p[illegible] ride in the aircraft or any cargo to be loaded therein unless authorized by the Contrac[illegible] Officer.

(C) Weight and Balance Control:

(1) Standard Use Helicopter Pilots are responsible for weight and balance control. The Stan[illegible]teragency Load Calculation shall be used for this purpose when passengers and/or cargo are/is being transported. Load calculation shall be computed on Form USDA-FS 5700-17 or Form OAS-67. (See Section J, LIST OF ATTACHMENTS).

HEMG Authority and Responsibility



(4) Suspend operations pending the removal or reinstatement of unsatisfactory equipment or personnel by the Contracting Officer

G.19 HELICOPTER MANAGER AUTHORITIES

A Manager will be assigned to each Helicopter furnished. In addition to directing the work of the Helicopter, the Manager has the following contract administration duties and authority:

(1) Order aircraft services as provided in the contract.

(2) Secure compliance with all contract provisions and specifications, and issue Work Orders/Notices of Non-Compliance as needed.

(3) Conduct investigations and prepare Statements of Findings when requested by the Contracting Officer.

(4) Suspend operations pending the removal or reinstatement of unsatisfactory equipment or personnel by the Contracting Officer.

(5) Approve [illegible]porary Helicopter and Pilot substitutions.

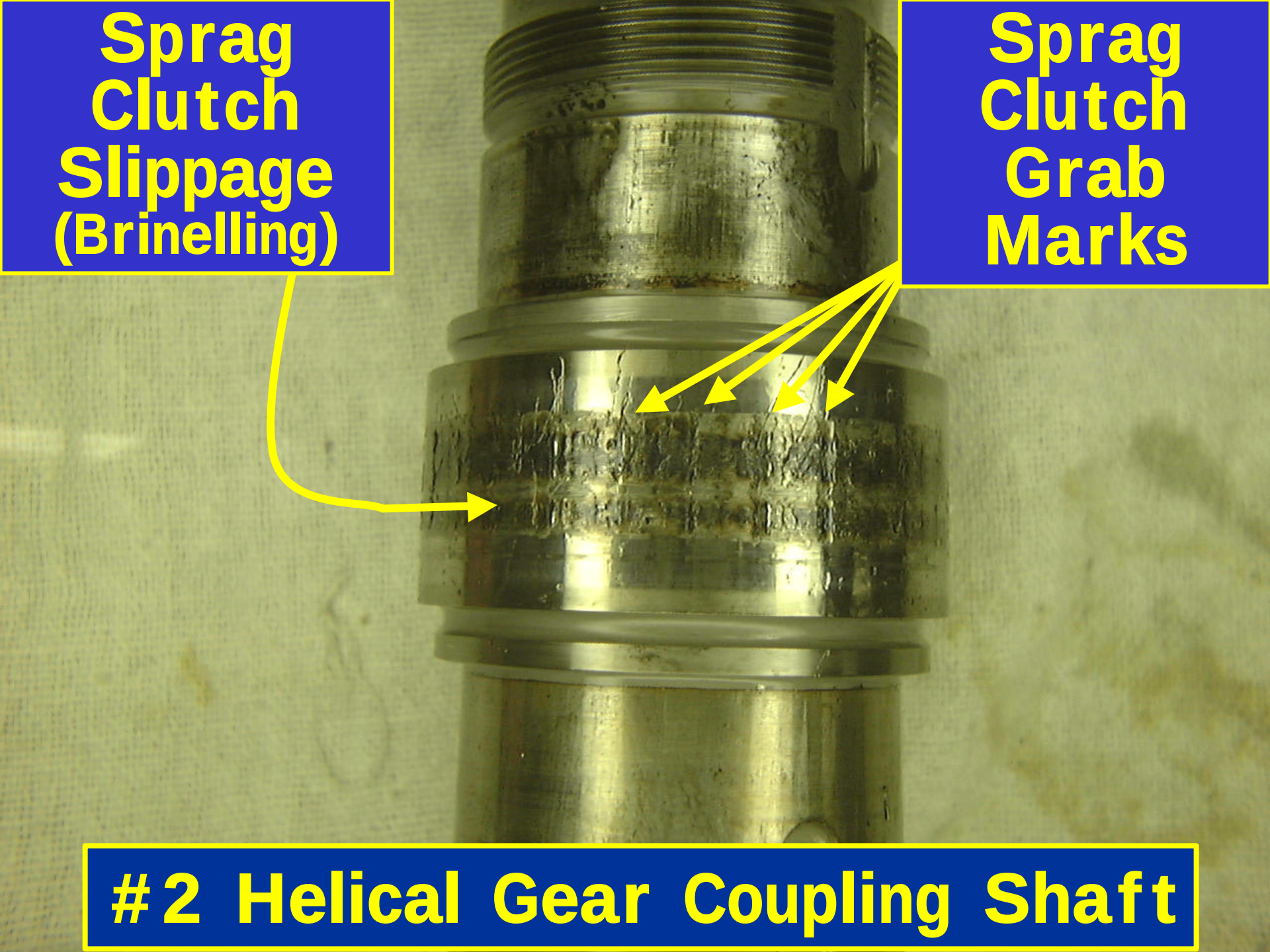
(6) Initiate and sign correspondence and other contract administration documents over the title "Helicopter Manager."

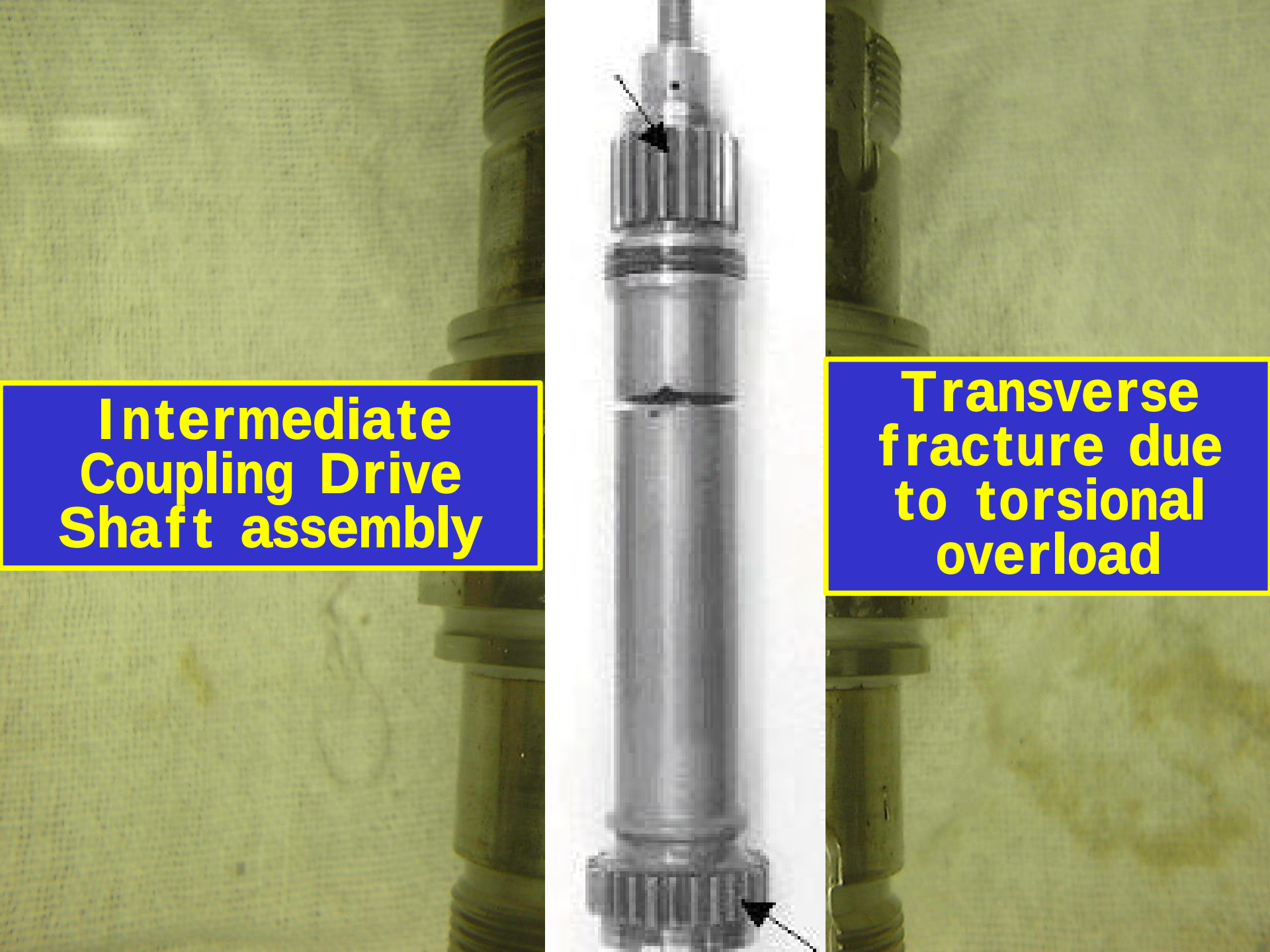
(7) Maintain daily diary of contract activities.

#1 Engine Compressor Turbine

Sprag Clutch Damage

#2 Engine Sprag Clutch


Sprag Clutch Slippage (Brinelling)
Sprag Clutch Grab Marks
#2 Helical Gear Coupling Shaft

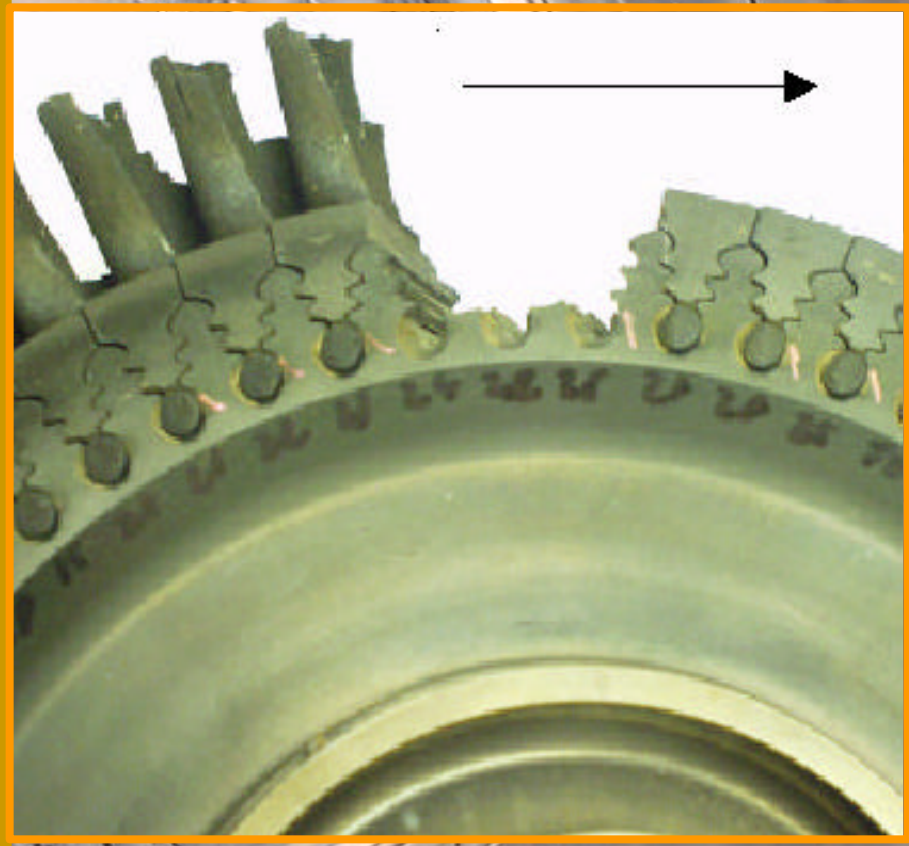

Intermediate Coupling Drive Shaft assembly
Transverse fracture due to torsional overload

Materials Investigation Laboratory Report

"Fracture of two firtrees of the P.S. no.1 CT disc occurred as a result of cyclic stress rupture."

NOTE: *Stress Rupture* or *Cyclic Stress Rupture* refers to a phenomenon of high temperatures where a material's strain resistance is compromised."

"Cracking associated with necking was observed in about a dozen firtrees on the upstream face."

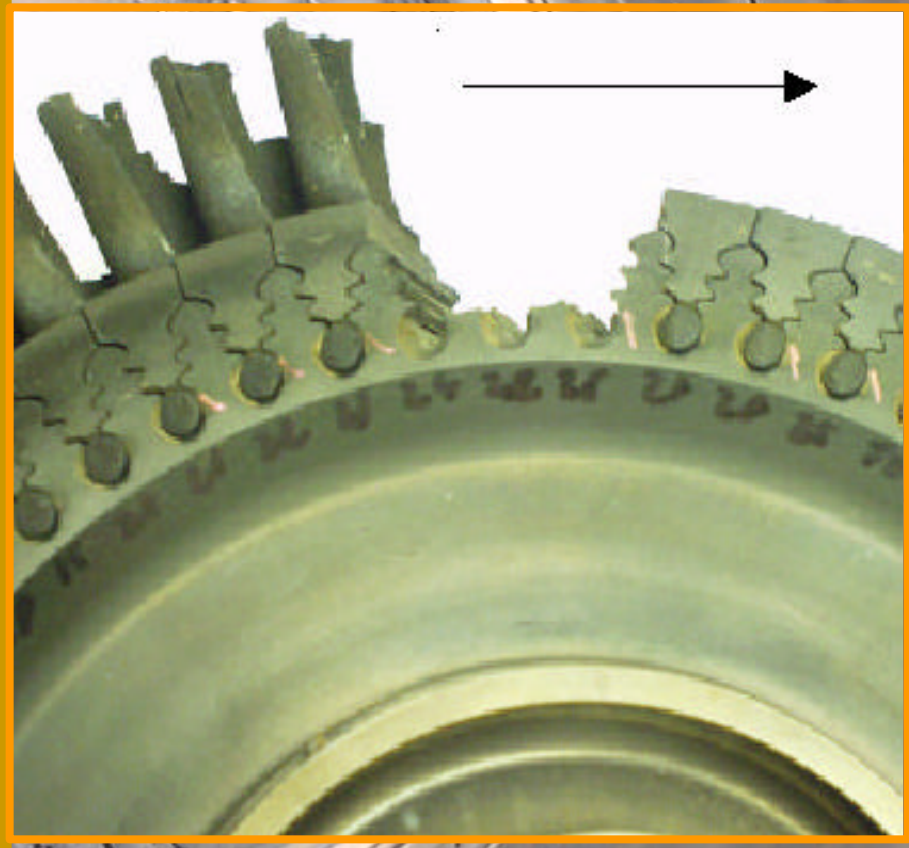


Materials Investigation Laboratory Report

"No microstructure changes were observed in the CT disc firtree."

"Results of dimensional measurements detected growth all around and deformation in the area of the fractures and diametrically opposite, corresponding with the cracking / stretching of the firtrees."

"The CT blades of above disc had fractured by tensile overload promoted by overheating."



Materials Investigation Laboratory Report

"Damage of the clutch drive shaft and the sprag clutch assembly was due to adhesive wear characteristic of sudden seizure."

"Transverse fracture of the coupling shaft, which engages inside the clutch shaft, was due to torsional overload and was secondary."

OAS Observations
Cold Springs, NV, August 13, 2000

Issue

Pilot repeatedly took excessive and unnecessary risk

Helicopter managers failed to identify and correct a hazardous aviation situation

Helicopter Managers

- Why were risks either not identified or not controlled ?
- When aviation safety problems can not be controlled are managers taught to elevate them to the appropriate level ?
- How can DOI ensure that risks are effectively managed ?
- Are managers held accountable for their decisions ?

OAS Observations
Cold Springs, NV, August 13, 2000

Issue

Pilot repeatedly took excessive and unnecessary risk

Helicopter managers failed to identify and correct a hazardous aviation situation

Helicopter Managers

- How can DOI ensure managers and operators understand and enforce
  - aviation policies
  - hazard reporting procedures
  - load calculations
  - other aircraft limitations

OAS Observations
Cold Springs, NV, August 13, 2000

Issue

Pilot repeatedly took excessive and unnecessary risk

Helicopter managers failed to identify and correct a hazardous aviation situation

Helicopter Managers

- How do we ensure managers properly prioritize actions and maintain situational awareness ?
- Should aviation managers be required to periodically observe all aspects of operations under their control (where feasible) ?
- Would use of a checklist have prevented this accident ?

OAS Observations
Cold Springs, NV, August 13, 2000

Issue

OAS and Bureau staff do not regularly provide training for contract pilots and personnel

Education

- How should DOI involve contract organizations and personnel in aviation safety training events ?
  - mishap reviews
  - hazard reporting procedures
  - safety policies

OAS Observations
Cold Springs, NV, August 13, 2000

Issue

The aircraft being utilized may not have been the best tool for the job.

Dispatching Officials

- Do dispatching officials and managers have a functional understanding of aircraft capabilities and limitations ?
  - how can DOI improve this understanding ?
- Should dispatching officials and managers be held accountable for their decisions ?

OAS Observations
Cold Springs, NV, August 13, 2000

Issue

The DOI SAFECOM system failed to identify the hazards prior to the accident

OAS Safety

- Should OAS and Bureau staff re-evaluate the DOI SAFECOM system ?
  - training
  - internal processes
    - tracking
    - follow-up
  - emphasis on human factors
  - timeliness of report submission

OAS Observations
Cold Springs, NV, August 13, 2000

Issue

The DOI SAFECOM system failed to identify the hazards prior to the accident

Helicopter Managers

- How can DOI ensure that all personnel involved in a mission understand the importance of reporting hazards ?
  - refuelers and mechanics
  - military augmentees
- How can managers break down reporting barriers ?

CHANGES
DOI Aircraft Rental Agreement Contracts

Issue

Clarification of DOI ARA Contract language concerning bucket operations and aircraft performance

B8.2.2.1 Water bucket use

- B8.2.2.1 Water Bucket Use. Use of a water bucket at a quantity less than the manufacturer's minimum adjustment level (partial dip) is not authorized. Bucket must be of a size to match the performance capability of the aircraft at the environmental operating conditions during use.

CHANGES
DOI Exclusive Use Contracts

Issue

Clarification of DOI Exclusive-Use Contract language concerning bucket operations and aircraft performance

B2.3.11 Water bucket use

- Use of a water bucket at a quantity less than the manufacturer's adjustment level **(partial dip) is not authorized**.

- Environmental operating conditions may dictate the need for more than one size bucket.

CHANGES
DOI Exclusive Use Contracts

Issue

Clarification of DOI Exclusive-Use Contract language concerning bucket operations and aircraft performance

B4.2.26 (refers to aircraft performance)

- Two (**2**) foldable; electrically operated; cinch-type capacity, adjustable water/retardant buckets shall be furnished under this contract.

CHANGES
DOI Exclusive Use Contracts

Issue

Clarification of DOI Exclusive-Use Contract language concerning bucket operations and aircraft performance

B4.2.26 (refers to aircraft performance)

- The **FIRST** bucket shall be commensurate with the maximum lifting capability of the aircraft using the environmental conditions as specified in section A for aircraft performance.

- The **SECOND** bucket shall be commensurate with the maximum lifting capability of the aircraft using the environmental conditions of 6,000 feet pressure altitude and 25°C.

Aviation Accident Review

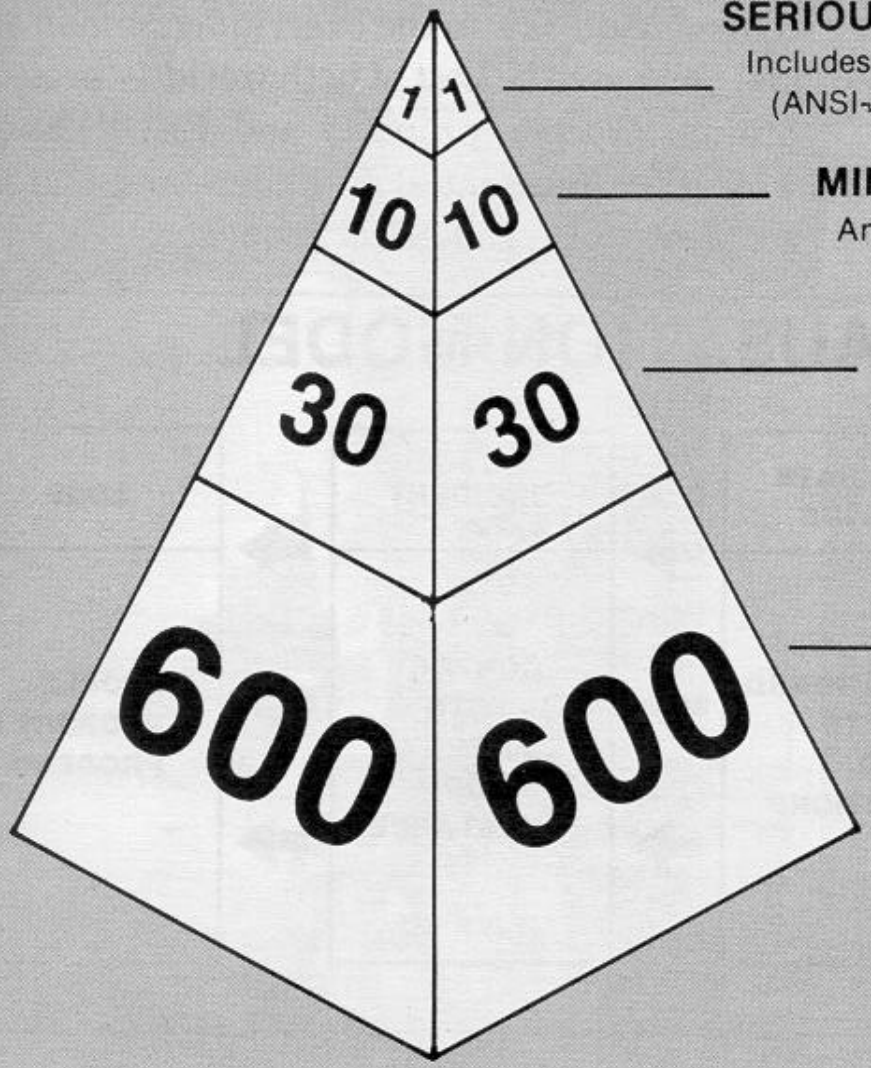
Observations

Helmets
Checklists
Flight Plans
Accountability
Flight Following
Restraint Systems
Situational Awareness
Reduce Risk Tolerance
Improve Hazard Reporting
Crew Resource Management
Use the Right Tool for the Job

BE ASSERTIVE !!!

Frank E. Bird Jr.

ACCIDENT RATIO STUDY

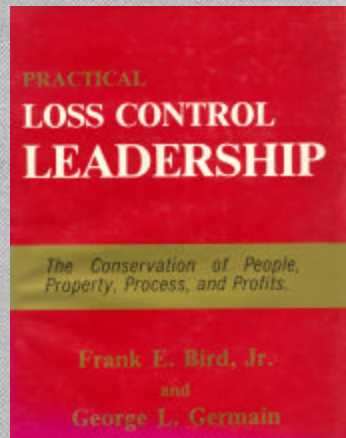


SERIOUS OR MAJOR INJURY
Includes disabling and serious injuries.
(ANSI-Z 16.1, 1967 Revised. Ratio of 1-15.)

MINOR INJURY
Any reported injury less than serious.

PROPERTY DAMAGE ACCIDENTS
All types.

INCIDENTS WITH NO VISIBLE INJURY OR DAMAGE
(Near-Accidents or close calls)



Hazard Reporting

If you think it's wrong question it

If you know it's wrong... STOP IT !!!

Hazard Reporting

Safety Communiqué - SAFECOM

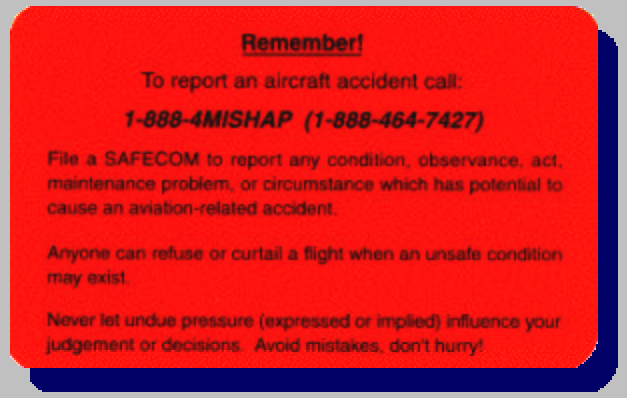
You can drop us a line

www.aviation.fs.fed.us ***www.oas.gov***

Or give us a call  ***1.888.4MISHAP***

Hazard Reporting

For hazards or heroes
Anyone can submit
Anonymous



Remember...

I f you see something... say something !!!

Aviation Accident Review