Bell Helicopter TEXTRON

Bell Helicopter Textron Inc.
A Subsidiary of Textron Inc.

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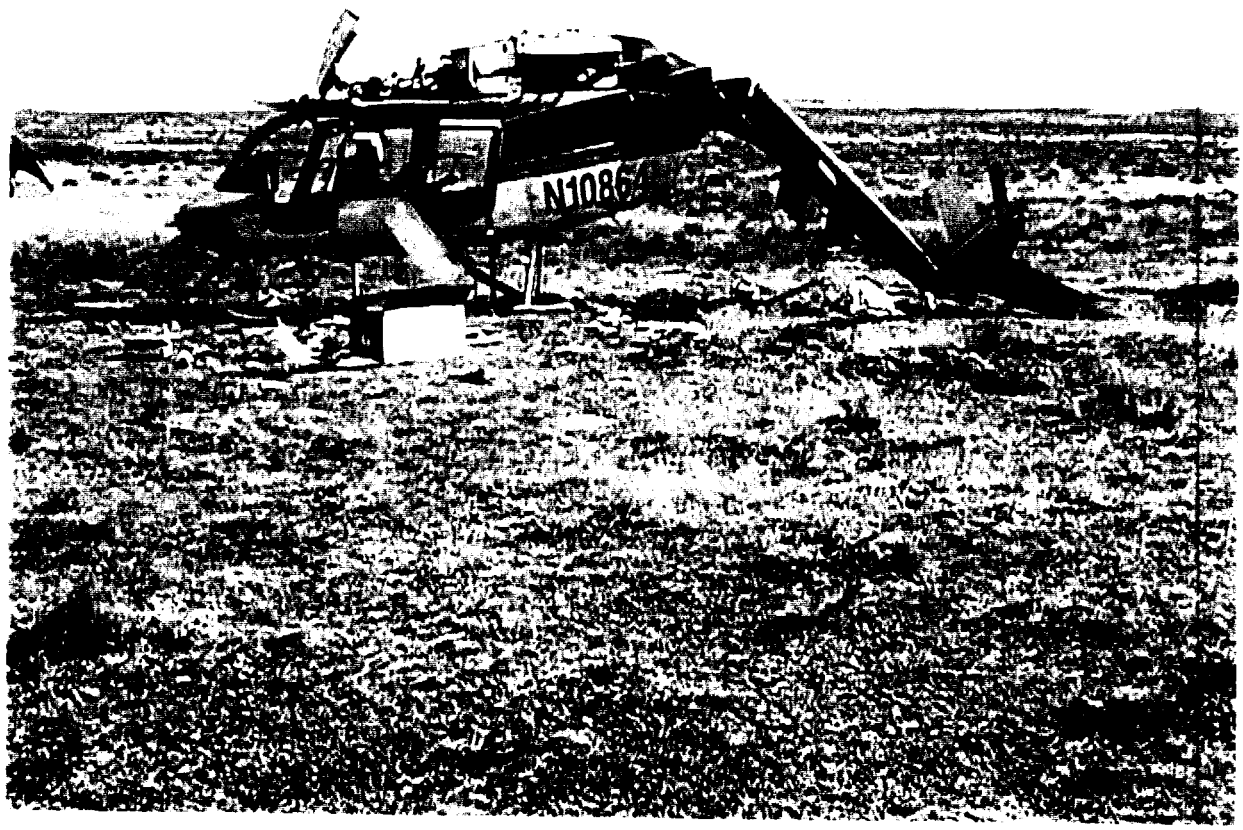
FACTUAL OBSERVATIONS OF AIRCRAFT MISHAP ROGERS HELICOPTERS 206L-1 S/N 45434 N10864 MONTELLO, NEVADA 3 AUGUST 2000



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National Transportation Safety Board
Richard Parker
1515 West 190th St.
Gardena, CA 90248-4916

21 August 2000

FACTUAL OBSERVATIONS OF AIRCRAFT MISHAP
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I. Introduction

On August 3, 2000, at approximately 18:57 local time, a Bell 206L-1 helicopter S/N 45434, registration N10864 was destroyed in an aircraft mishap. The aircraft was owned and operated by Rogers Helicopters. Aircraft records indicate the airframe had accumulated a total of 5532.2 flight hours. The aircraft was involved in fire fighting support under a Bureau of Land Management (BLM) contract at the time of the mishap

On August 4, 2000 this writer traveled to Montello, Nevada acting as a technical advisor to the NTSB.

II. On-Scene Examination

The accident site was located near Montello, Nevada. The helicopter was observed resting upright on it's skids with the nose of the on an approximate magnetic heading of 290 degrees. All primary aircraft components were observed. The main rotor and mast had separated from the aircraft and were in close proximity to the aircraft. The nearby terrain exhibited ground scars, which appeared typical of a main rotor blade strike. One tip section of main rotor blade was observed approximately 450ft to the northeast of the main wreckage and a tip section from the other main rotor blade was observed approximately 525ft to the southwest of the main wreckage. See attached wreckage diagram for a component layout. Paint transfer evidence on the main rotor blades and the left side upper fuselage structure appears to indicate that the main rotor blade intruded into the fuselage structure during the impact sequence. The observed damage appears to indicate the helicopter impacted the ground on the upper left side at some point during the

impact sequence. The tail boom was observed securely attached at the fuselage mounting point. The tail boom from boom station (BS) 55 aft was observed partially separated and resting inverted. The tail rotor drive/control system was observed securely attached to the tail boom structure.

III. Wreckage Examination

A. Main Fuselage

The fuselage was observed primarily intact. The majority of damage was observed on the left side of the aircraft. See photo 3.0 The forward windscreens and chin bubbles had been broken and were observed scattered throughout the wreckage area. The forward and aft doorframes and doors on the left side had been separated from the fuselage during the impact sequence. The forward left door had separated from the aircraft and was observed lying aft of the main wreckage. The left aft cabin door had been partially separated with only the lower half remaining attached to the fuselage structure.

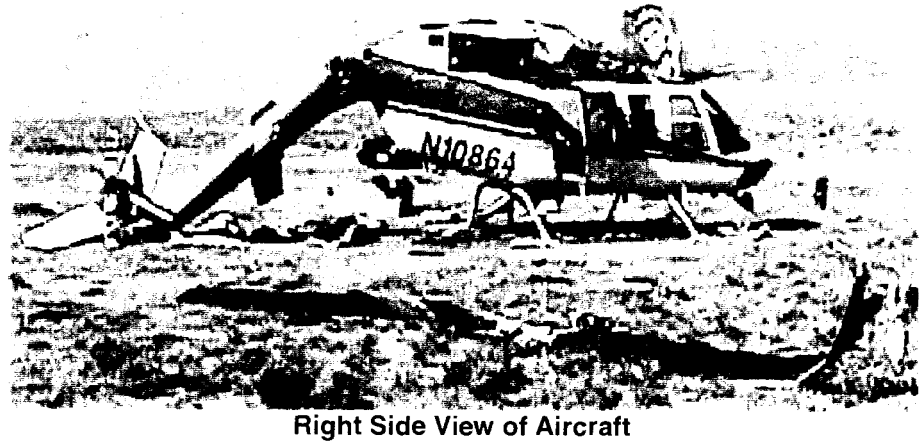
Left Side View of Aircraft
Photo 3.0

The aft fuselage on the left side exhibited minimal deformation. The lower fuselage skin below the baggage door had been punctured/cut during the impact sequence. The aft fuselage section had been deformed to the extent that the only baggage door latch that would secure was the upper latch.

The upper portion of the fuselage had been deformed from the left to the right. The forward fairing had been deformed inward and to the right. The forward fairing had pulled from it's attach points and pushed open by the separated right cyclic hydraulic actuator. The forward induction fairing was observed lying on the ground in close proximity to the aircraft. The "dog-house" exhibited extensive deformation. The aft portion of the engine cowling was attached to the fuselage structure and the engine air particle separator. Both exhibited significant deformation. The engine cowling had been had been deformed inward, the side doors had been popped open, and the left side engine exhaust stack had been crushed. The aft

fairing around the oil cooler had been partially separated from its mounting with minimal damage. The cabin roof and was primarily intact the aft pylon mounts had been partially torn from the roof structure on the left side.

The right side of the aircraft was intact and exhibited minimal damage. See photo 3.1 The aft fuselage had been deformed to the point that the aft door would not securely latch.



Right Side View of Aircraft
Photo 3.1

The aircraft cabin appeared predominately intact. The restraint system in the aircraft appeared old and faded. It was reported that the left front seat passenger restraints were unlatch and right rear seat passengers were cut during extrication. The pilot's shoulder harness reported failed, the pilot's shoulder harness was not observed. The pilots lap belt was observed, the lap belt appeared to operate normally. The restraint system for the three occupied seats was removed and will be analyzed by US Army Laboratories. Neither the frame of the occupied seats nor seat pans exhibited any deformation during the impact sequence.

The aircraft performance cockpit instrument readings at the time of this writer's examination were as follows:

Engine Oil PSI/Temp----------0/0
Transmission PSI/Temp----------0/0
Fuel Qty ----------0
Load Mtr ----------0
N1 ----------0
TOT ----------0
Tq ----------4%
Airspeed----------0
Nr ----------0
N2----------0
Altimeter ----------4,900
Fuel Valve ----------OFF
Hydraulic Switch ----------
Engine Anti-Ice ----------OFF

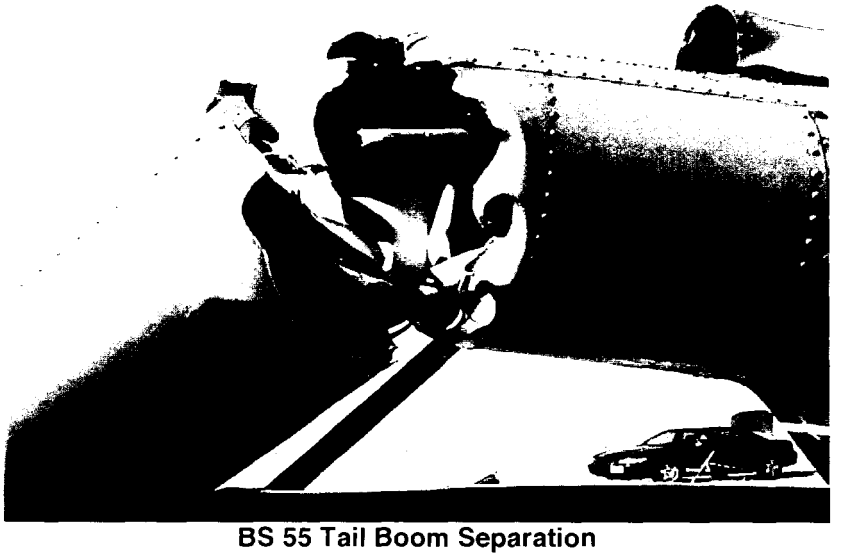
The following circuit breakers were observed "popped" or open position.

Hydraulics ---------- Open
Caution Lights ---------- Open
Engine Overspd.---------- Tied Open

No pre-impact abnormalities were observed with the fuselage.

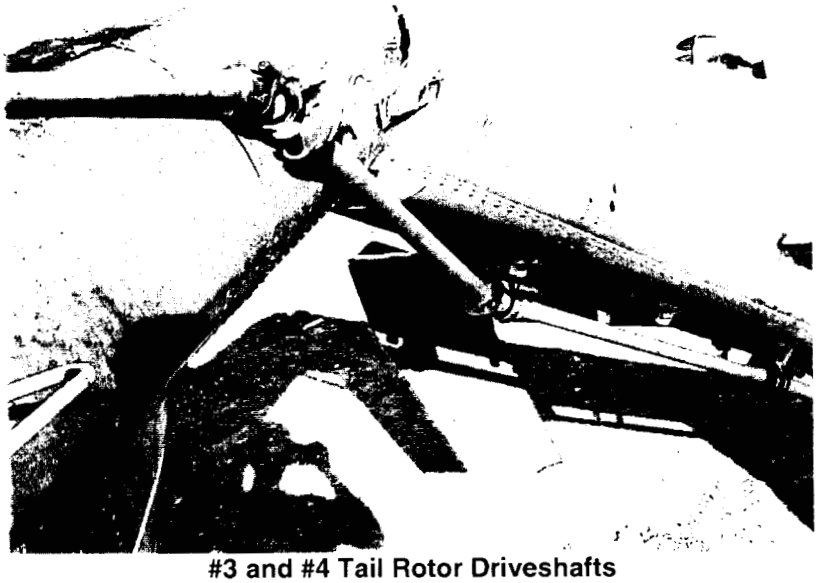
B. Tail Boom

The tail boom was observed separated in two sections. The forward section of tail boom was observed securely attached to the aft fuselage section at the tail boom attach-point and extended aft to approximate boom station (BS) 55. The forward separation exhibited indications of compression and bending type failure. See photo 3.2 The first tail boom hanger bearing support had been torn from its mounting point. A portion of this hanger bearing and the corresponding driveshafts had been pulled to the left away from the tail boom. These driveshafts remained connected and the corresponding Thomas couplings had been deformed. See photo 3.3

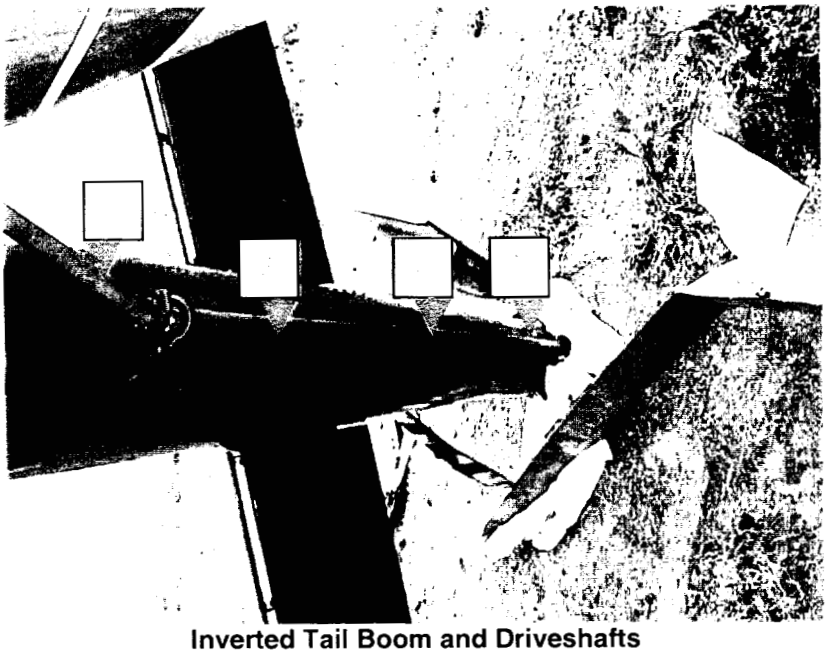


BS 55 Tail Boom Separation
Photo 3.2

The aft section of tail boom extended from the separation at BS 55 aft to tail rotor system. The aft portion of the tail boom had been inverted during the impact sequence. See photo 3.4 The number 5, 6, and 7 tail rotor drive shafts did not exhibit any indications of a pre-impact abnormality. The number 8 tail rotor driveshaft exhibited a significant bend that corresponded to a bend in the tail boom at approximate BS 150. See photo 3.5 This bend exhibited paint transfer evidence of possible contact with the main rotor blade. The tail rotor drive shaft cover exhibited rotational scoring in several places throughout the tail rotor drive system.

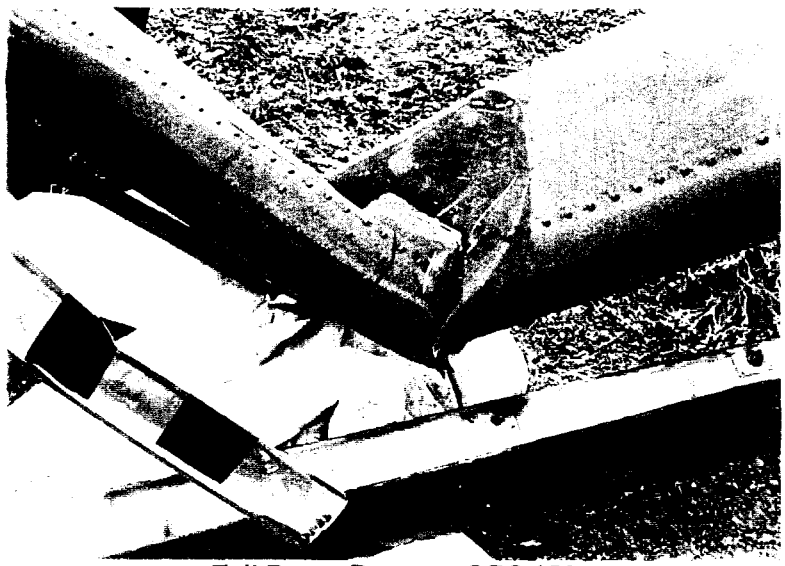


#3 and #4 Tail Rotor Driveshafts
Photo 3.3



Inverted Tail Boom and Driveshafts
Photo 3.4

The tail rotor pitch control tube and elevator trim tab tubes were manually exercised verifying continuity. The horizontal stabilizer was securely mounted to the tail boom. The right stabilizer vertical fin exhibited some minor impact damage to the top of the fin. The top of the left stabilizer vertical fin had been deformed inward during the impact sequence. The tail rotor gearbox and vertical fin were observed securely mounted to the tail boom. The anti-collision light mounted to the top of the vertical fin was observed separated and lying in a ground scar that appeared to dimensionally match the top of the vertical fin. See photo 3.6



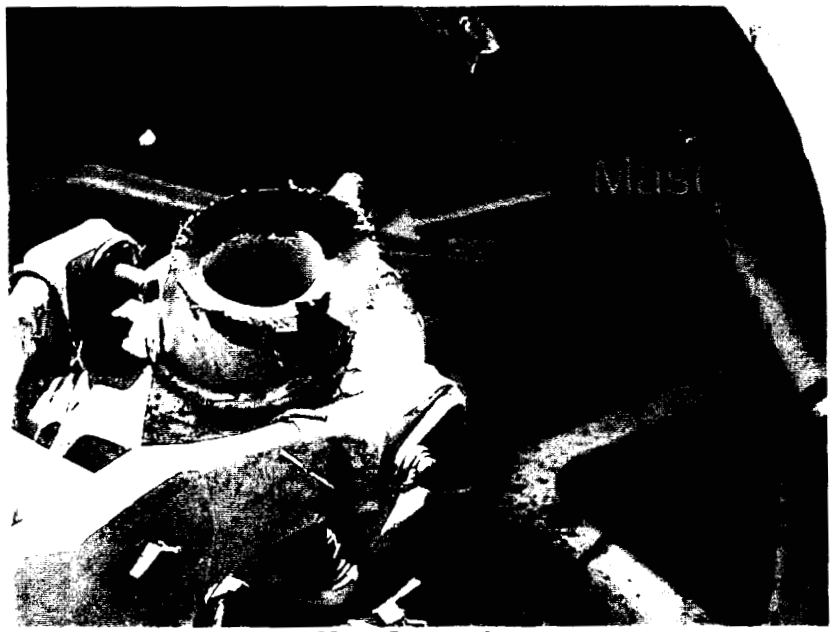
Tail Boom Damage @BS 150
Photo 3.5

Vertical Fin Anti-Collision Light
Photo 3.6

C. Transmission and Drive System

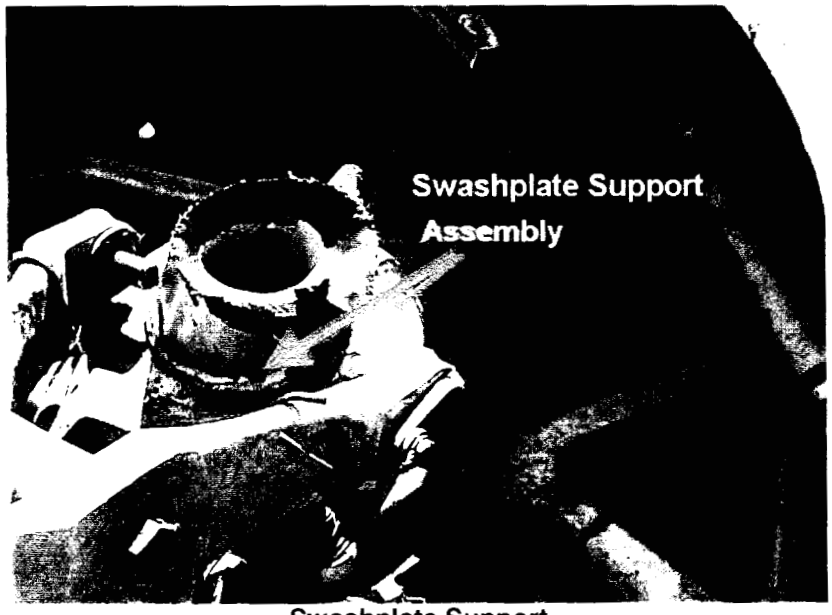
The transmission appeared to be securely mounted to the aircraft. The transmission did not exhibit any external damage. Three of the four pylon roof mounts appeared to be secured. The left aft roof mount appeared to have initiated separation from the roof. The drag pin on the bottom of the transmission had separated. The main drive shaft was connected to the transmission. The main drive shaft had been pulled out of the freewheeling side coupling. Evidence of grease being slung was visible in the immediate coupling area and the main driveshaft exhibited rotational scoring. The coupling temperature indicator strips did not exhibit any indications of pre-impact abnormality. Both the transmission and main drive shaft rotated freely when rotated by hand. The transmission chip plugs and freewheeling

chip plug were examined and observed to be free of debris. The mast had been sheared during the impact sequence. The separation appears typical of an overload condition. See photo 3.7



Mast Separation
Photo 3.7

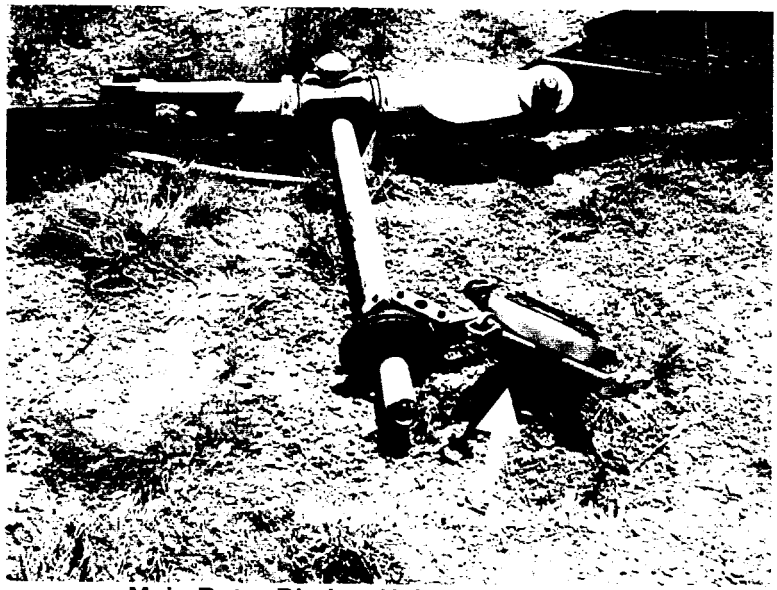
The swashplate support, which bolts to the top of the transmission case, was observed fractured. The fracture appears to correspond to the mast displacement and fracture. See photo 3.8 The NTSB expressed a interest in possibly sending this component to the NTSB laboratory for a metallurgical examination. A decision as to the disposition of this component is pending as of the time of this report.



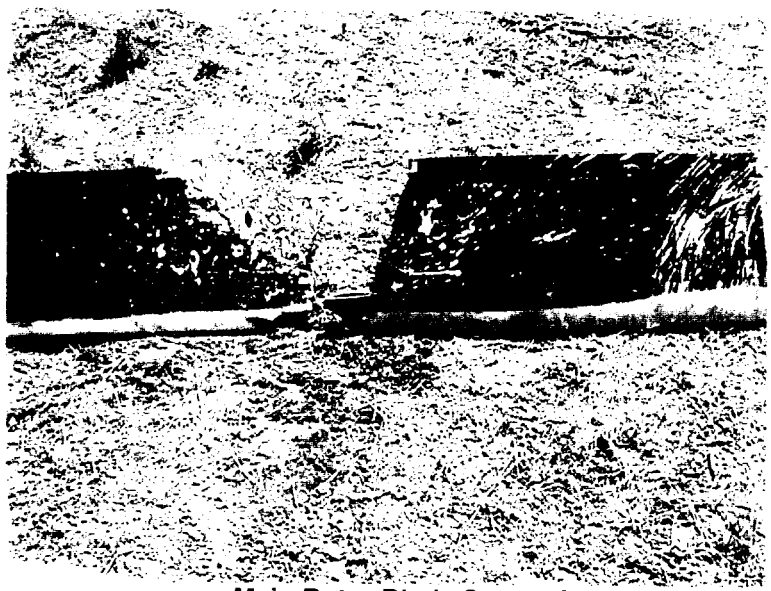
Swashplate Support
Photo 3.8

D. Main Rotor System

The main rotor blades and hub had separated with the mast during the impact sequence. See photo 3.9 The blade designated the [redacted] main rotor blade exhibited a spar separation approximately two feet from the tip end of the blade. The separated portion of the [redacted] blade exhibited paint transfer evidence and scoring. The separation appears to be typical of a main rotor blade ground strike See photo 3.10



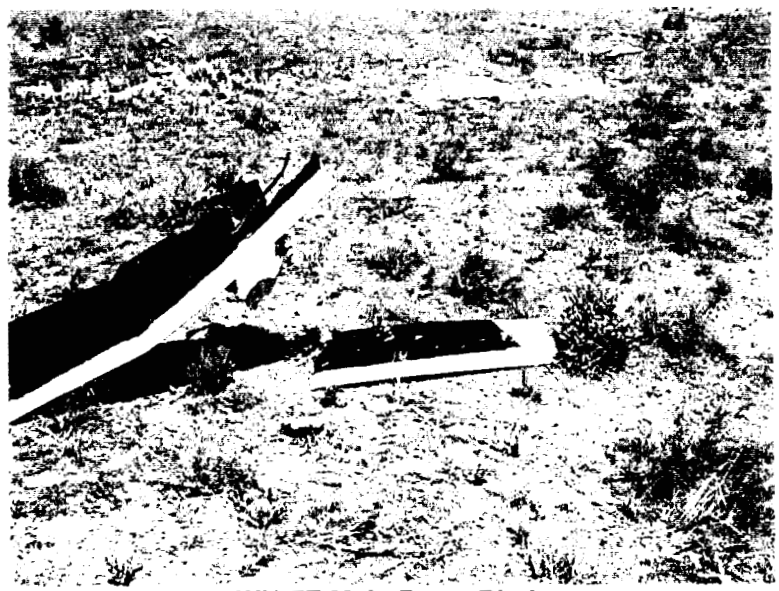
Main Rotor Blades, Hub, and Upper Mast
Photo 3.9



Main Rotor Blade Separation
Photo 3.10

The remaining portion of the [redacted] was securely attached to the rotor hub.

The blade designated the WHITE main rotor blade exhibited a spar separation approximately two feet from the tip end of the blade. The separated portion of the WHITE blade exhibited paint transfer evidence and scoring. The separation appears to be typical of a main rotor blade ground strike. The WHITE blade did exhibit significant downward bending. See photo 3.11

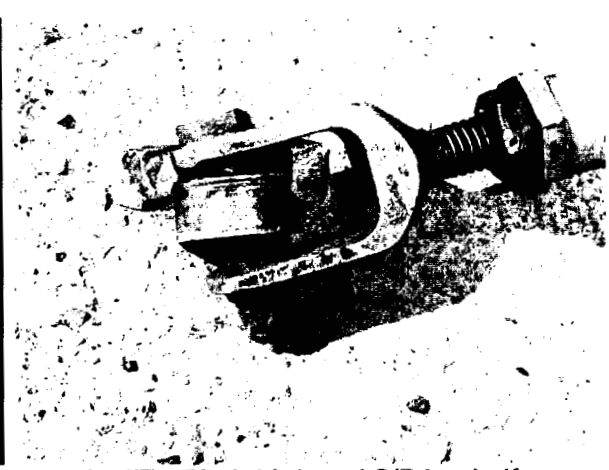


WHITE Main Rotor Blade
Photo 3.11

The main rotor hub assembly did not exhibit any external damage. The main rotor blades were observed secured to the hub assembly. The static stops appeared normal and did not exhibit any indications of excessive main rotor flapping.

The swashplate assembly separated with the mast and was observed attached to the mast. See photo 3.9 The WHITE pitch link attach point on the rotating swashplate was observed fractured. The WHITE pitch link had been broken about mid-span of the pitch link. See photos 3.12

WHITE Rotating Swashplate Lug



WHITE Pitch Link and S/P lug half.

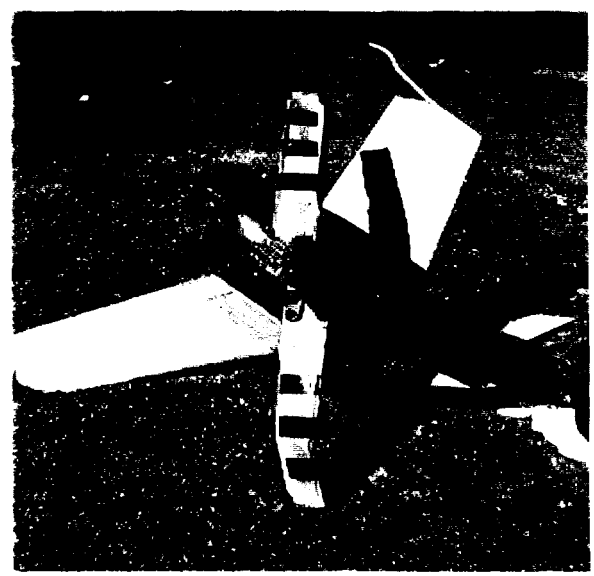
Photos 3.12

The NTSB made the determination to remove these components for metallurgical examination by the NTSB laboratory. As of the date of this report a report has not been released.

The RED pitch link was attached to the RED pitch horn. The lower clevis had been fractured. The fractured end of the pitch link was observed attached to the swashplate. The fracture appears typical of an overload condition.

E. Tail Rotor System

The tail rotor system was observed securely mounted to the aft portion of the tail boom. The 90 degree gearbox fairing was intact and the aft section of tail rotor driveshafting was still connected to the input of the gearbox. See photo 3.12 Hand rotation of the tail rotor produced smooth rotation. The tail rotor pitch control system was manually exercised to verify continuity. Impact damage produced two separations within the pitch control system. Continuity was established from fracture point to fracture point. The fractures appeared consistent with overload separations.



Tail Rotor System
Photo 3.12

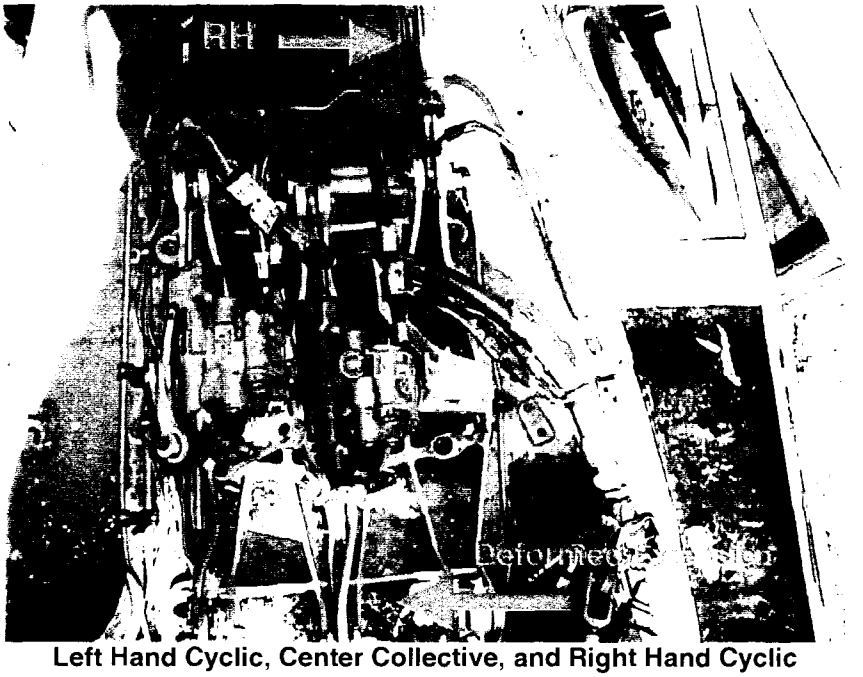
The tail rotor blades were securely attached to the tail rotor hub assembly. The one tail rotor blade had been slightly bent approximately eight inches from the tip end. The second tail rotor appeared normal and exhibited minimal damage.

No pre-impact abnormalities were observed with the tail rotor system.

F. Flight Control Systems

The right seat controls were the only controls installed. The cyclic was observed in the neutral or center position. The collective was observed In the full down position. The anti-torque pedals were observed with the right pedal slightly forward.

The forward fairing, which covers the roof mounted hydraulic servos, was observed being held open by the right hand cyclic actuator. The control tubes running from the cyclic and collective inputs were observed with all attaching hardware in-place and secured. Continuity was established from the right seat controls to the top of the "broom closet" where the control tubes were attached to the boost actuators. The hydraulic boost actuators had been deformed to the right. The extension arms on the left cyclic actuator and the center collective actuator had been significantly deformed. The right cyclic actuator had separated from it's mounting and the extension arms had been bent and broken. See photo 3.13

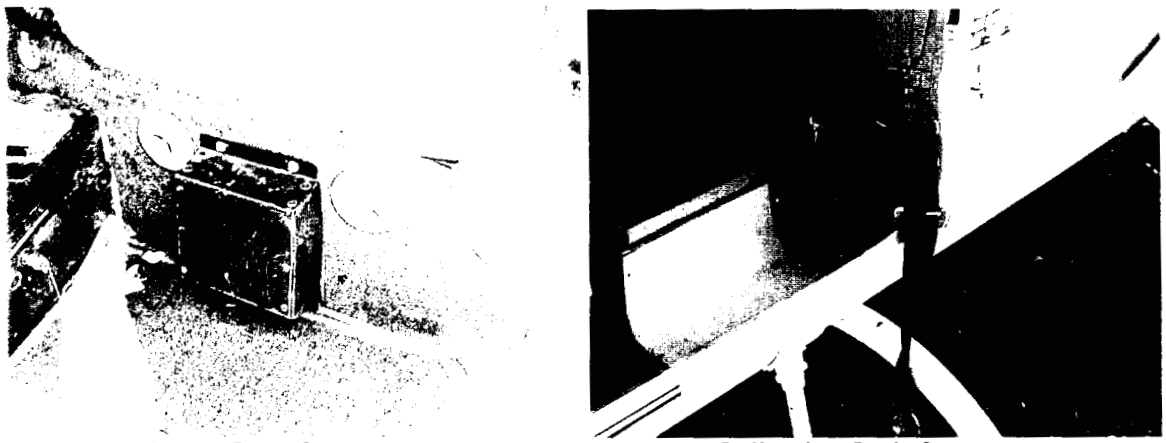


Left Hand Cyclic, Center Collective, and Right Hand Cyclic
Boost Actuators
Photo 3.13

All three hydraulic boost actuators were removed. The NTSB took a hydraulic fluid sample for laboratory analysis. Hydraulic fluid was observed within the reservoir. The NTSB decided to have a metallurgical examination of the actuator extension arms completed, followed by functional testing of the actuators. To date this has not been completed.

The aircraft was equipped for duel controls, but no left seat controls were installed. Cyclic and collective stub covers were observed install over the left seat control stubs. See photos 3.14.

The control tubes/linkage running from the cyclic and collective boost actuators to the swashplates exhibited several separations. The separations appear typical of an overload condition. The NTSB made the determination to remove these components for metallurgical examination by the NTSB laboratory. As of the date of this report a report has not been issued.

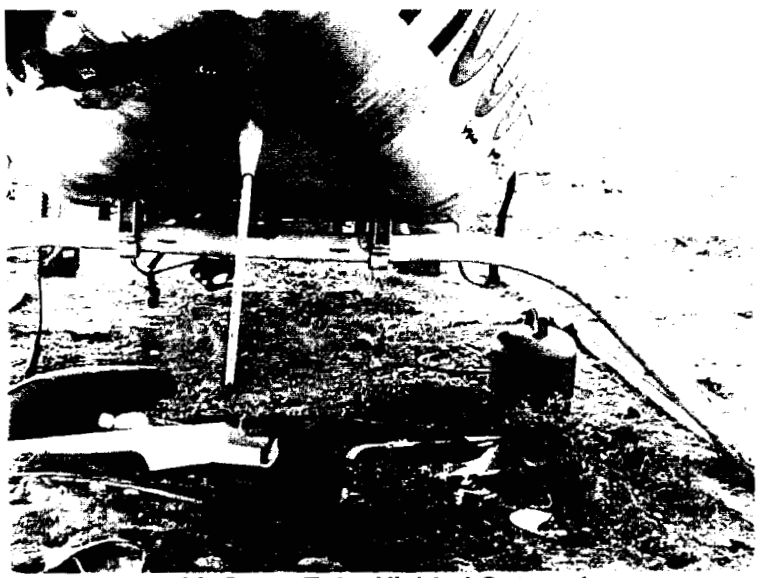


Cyclic Stub Cover Collective Stub Cover

Photos 3.14

G. Landing Gear

The landing gear was a high skid configuration with auxiliary steps installed. The cross tubes had yielded outward a small amount. See photo 3.15 The saddles at all of the cross tube to skid tube attach point had been cracked and partially separated by impact related forces.



Aft Cross Tube Yielded Outward
Photo 3.15

No pre-impact abnormalities were observed with the landing gear.

I. Powerplant System

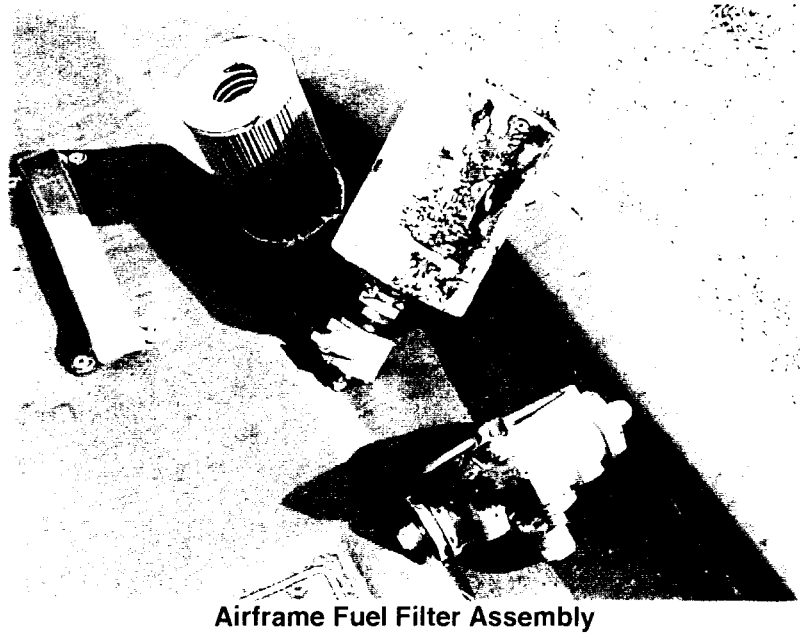
The engine appeared to be securely mounted into the airframe. The left exhaust stack had been crushed. The fuel control pointer was observed resting at approximately 3%, or OFF range. The compressor section and turbine rotated freely when examined on-site. It was reported that the pilot performed and Emergency shutdown before egressing the aircraft.

J. Fuel System

It was reported that at the time of the accident the aircraft had approximately 510 pounds of fuel on-board. Visual inspection inside the tank confirmed the presence of fuel. There were no indications of a fire either before or after the impact. The fuel selector switch in the cockpit was observed in the OFF position. The fuselage structure supporting the fuel bladders was observed, there appeared to be no indications of structural damage that would have impinged upon the bladders resulting in spillage.

The airframe fuel filter was removed and examined. See photo 3.16 The filter element was observed free of debris and the bowl was full of fuel. The side of the filter bowl did have a large amount of grease splatter from the engine side main drive shaft coupling disconnect.

No pre-impact abnormalities were observed with the aircraft fuel system.

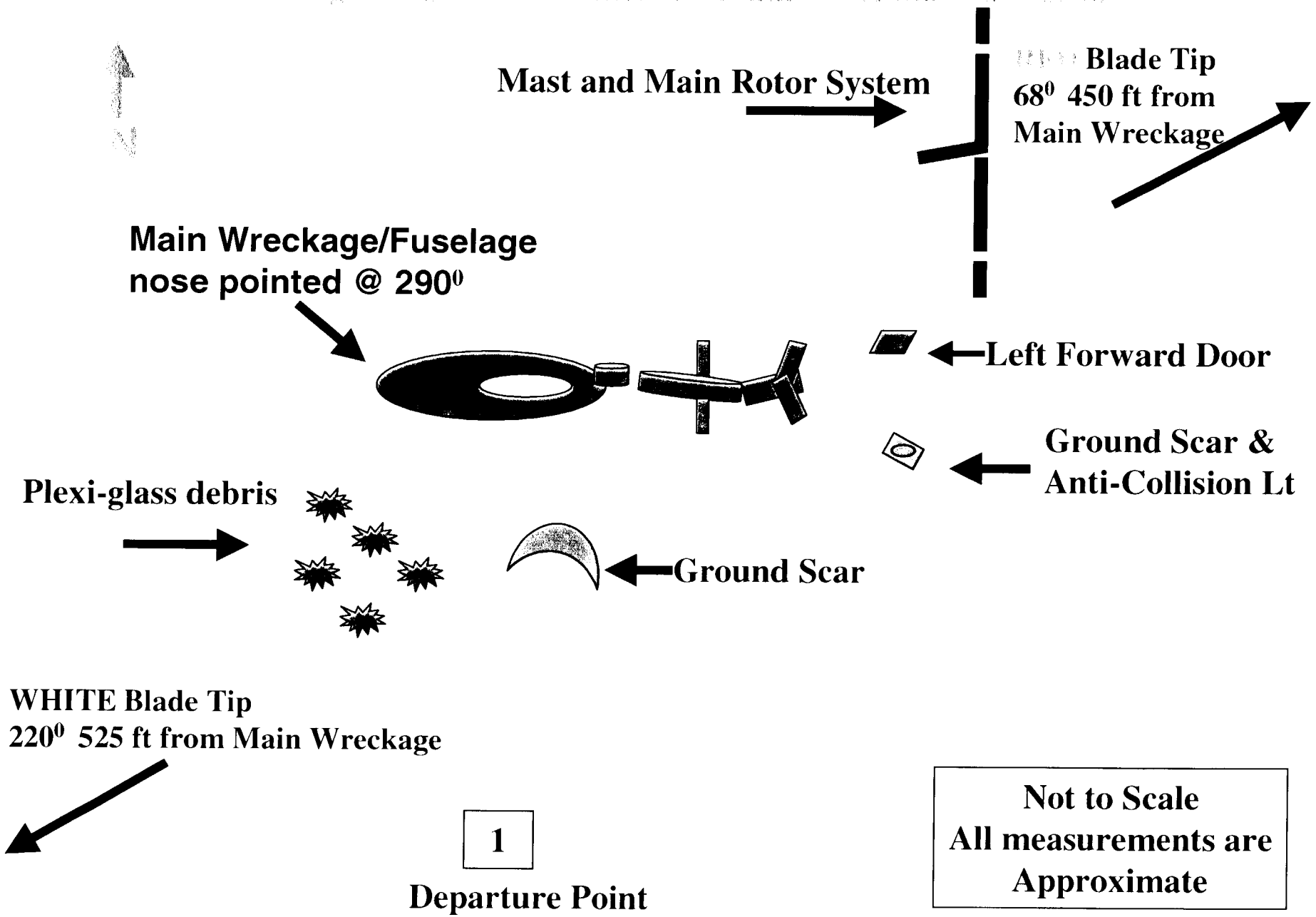


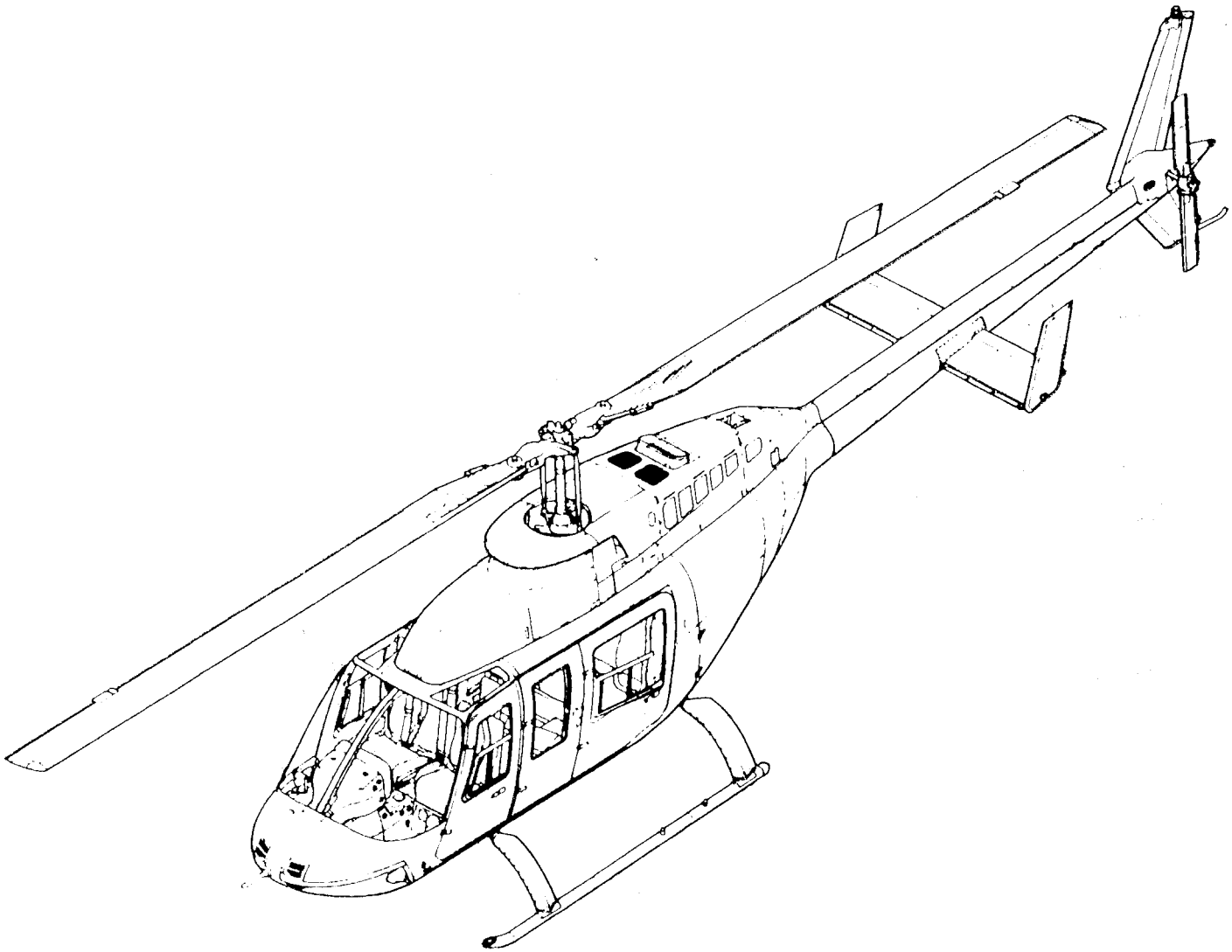
Airframe Fuel Filter Assembly
Photo 3.16

III. Laboratory Examination

As of the date of this the laboratory examinations have not been completed.

Diagrams

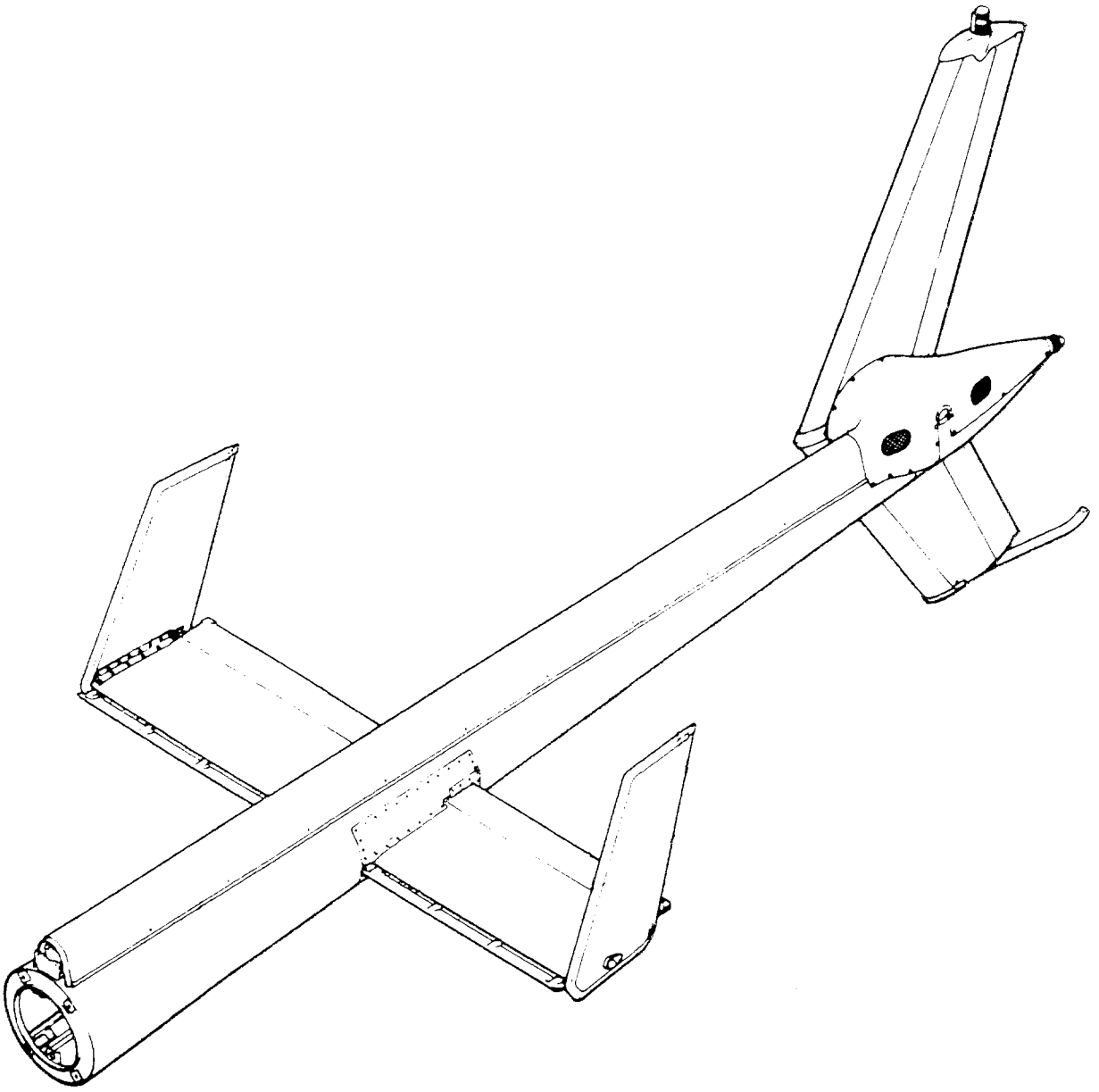

Mast and Main Rotor System
Blade Tip
68⁰ 450 ft from
Main Wreckage
Main Wreckage/Fuselage
nose pointed @ 290⁰
Left Forward Door
Ground Scar &
Anti-Collision Lt
Plexi-glass debris
Ground Scar
WHITE Blade Tip
220⁰ 525 ft from Main Wreckage
1
Departure Point
Not to Scale
All measurements are
Approximate



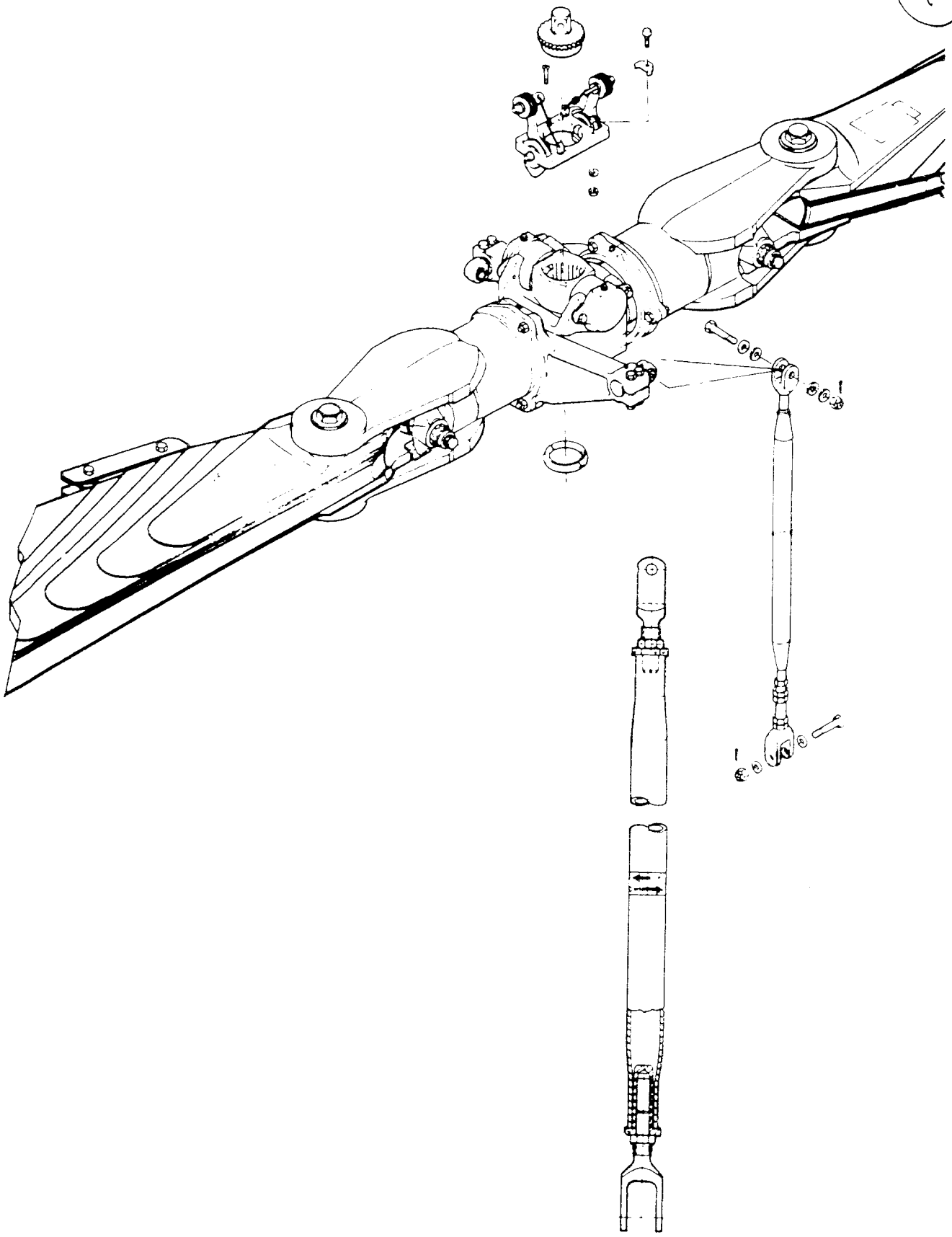
206L-3

TAILBOOM

The tailboom includes a fixed horizontal stabilizer with fixed leading edge slats, a controllable elevator, and a swept-back vertical fin. The horizontal stabilizer is installed on the tailboom and the elevator is installed on the horizontal stabilizer by means of antifriction bearings and bolts. The vertical fin extends from aft end of the tailboom and is canted to relieve tail rotor thrust requirements in forward flight. Auxiliary fins are mounted on the outboard ends of the horizontal stabilizer and are canted to counteract yaw-roll. A tubular type tail skid is installed on the vertical fin to protect the tail rotor blades in the event of tail-low landings.



Tailboom



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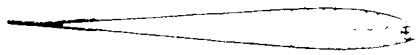
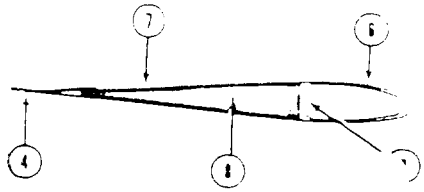
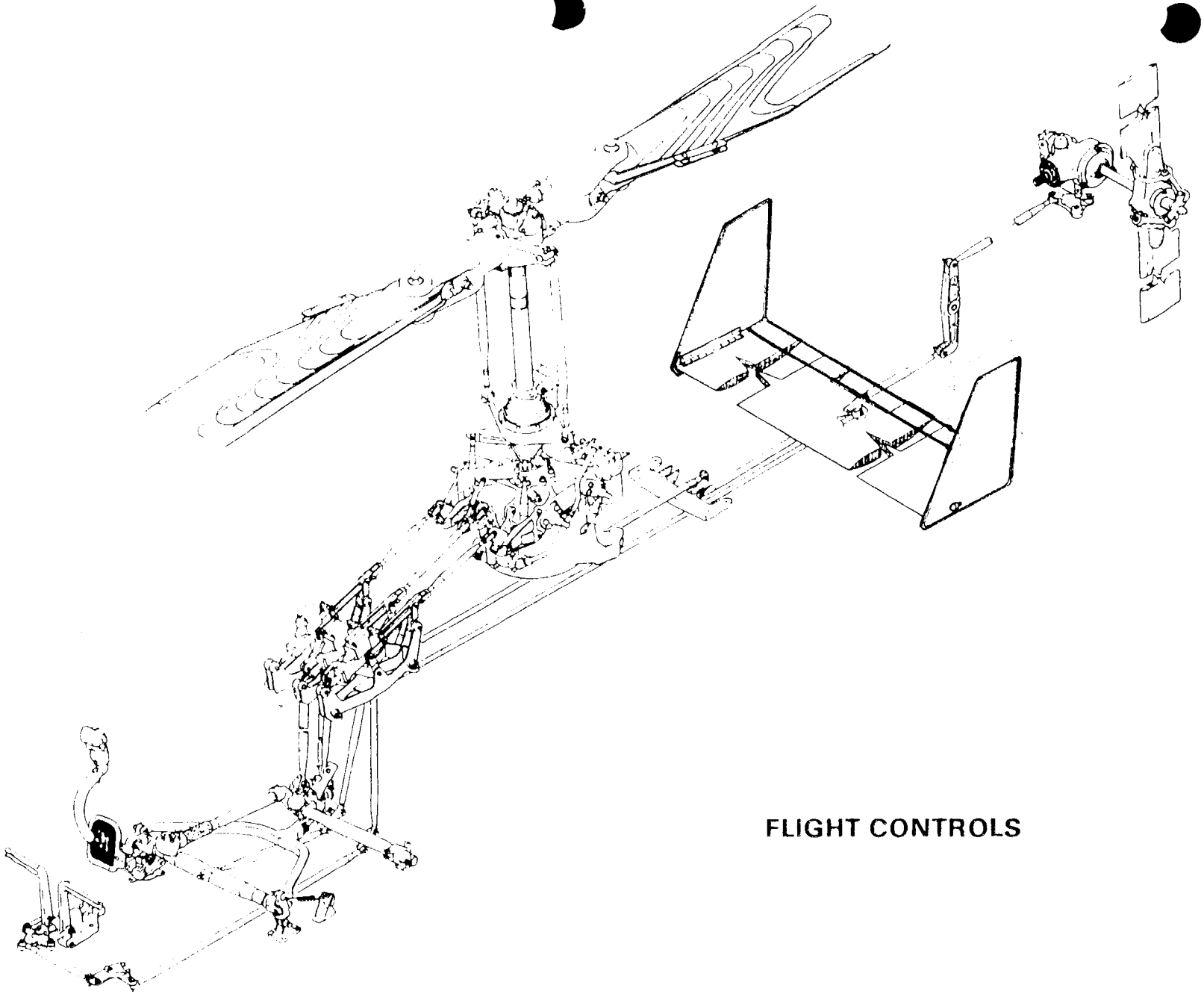
Main Rotor — Removal and Installation



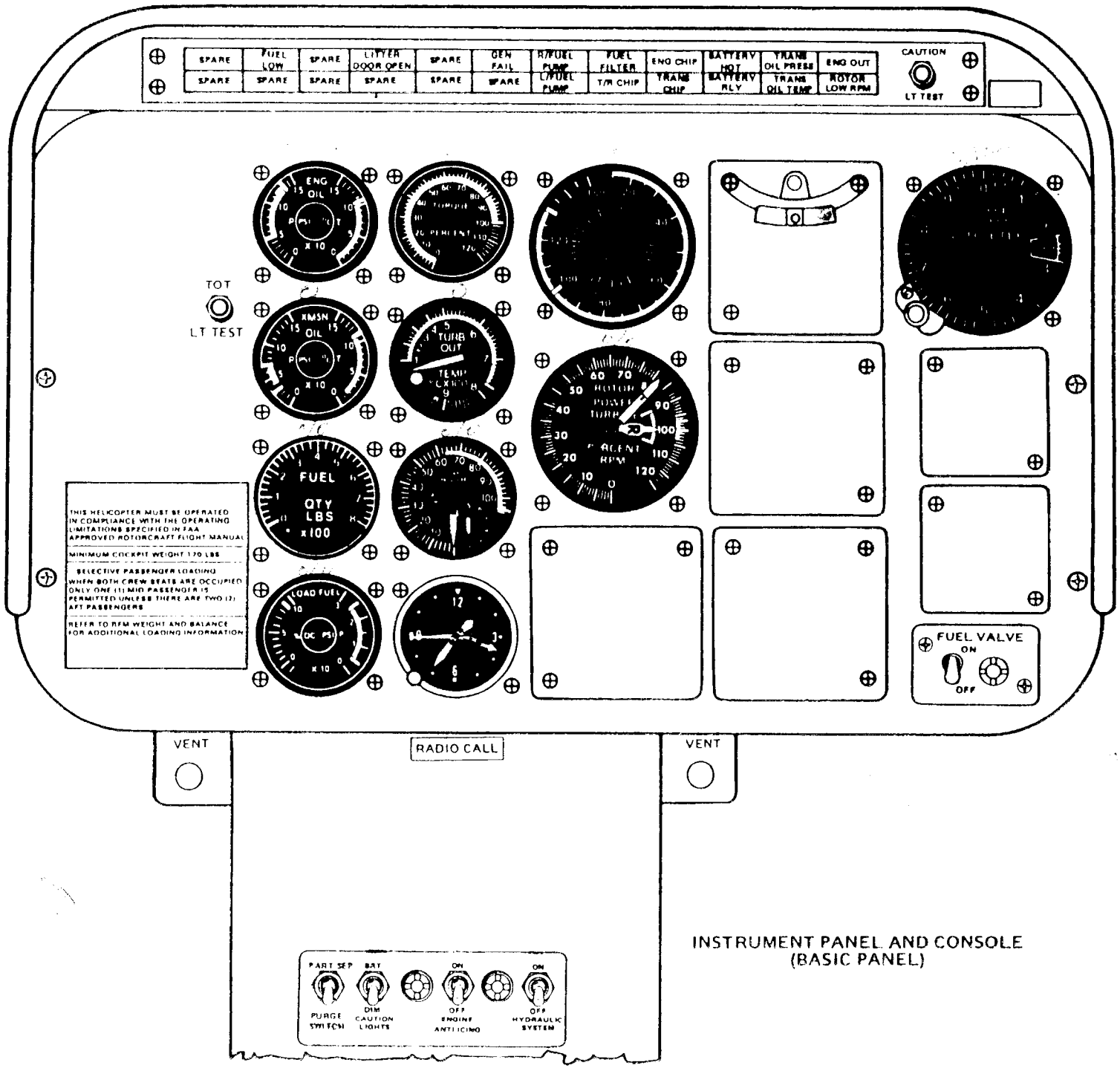
VIEW A



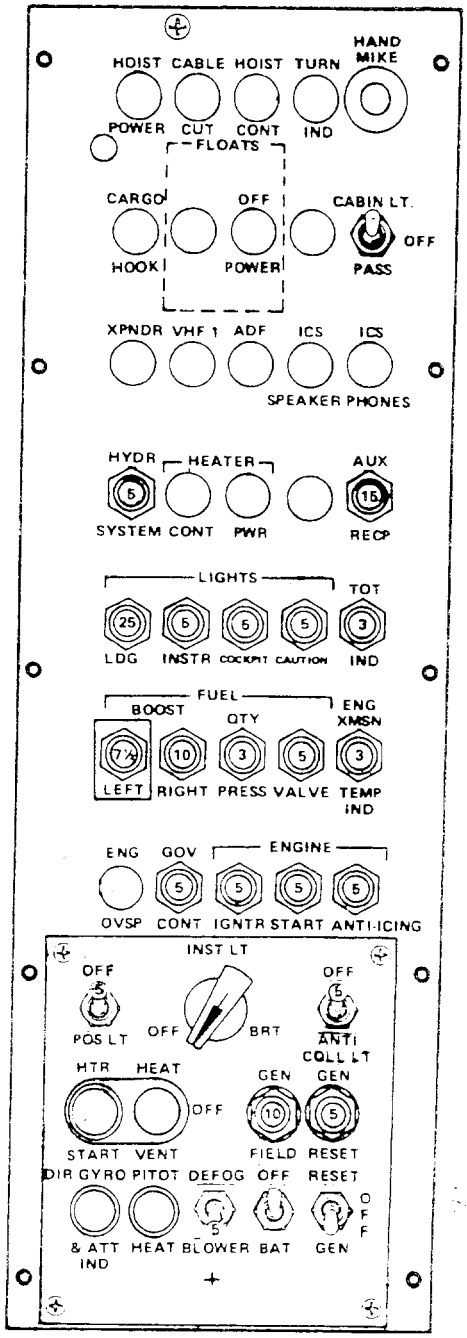
1. Grip Plate
2. Doublers
3. Spanwise Alignment Reference Point
4. Trim Tab
5. Balance Weight
6. Spar
7. Skin
8. Core
9. Spreader Block



FLIGHT CONTROLS



INSTRUMENT PANEL AND CONSOLE
(BASIC PANEL)



OVERHEAD CONSOLE

L206075-358B