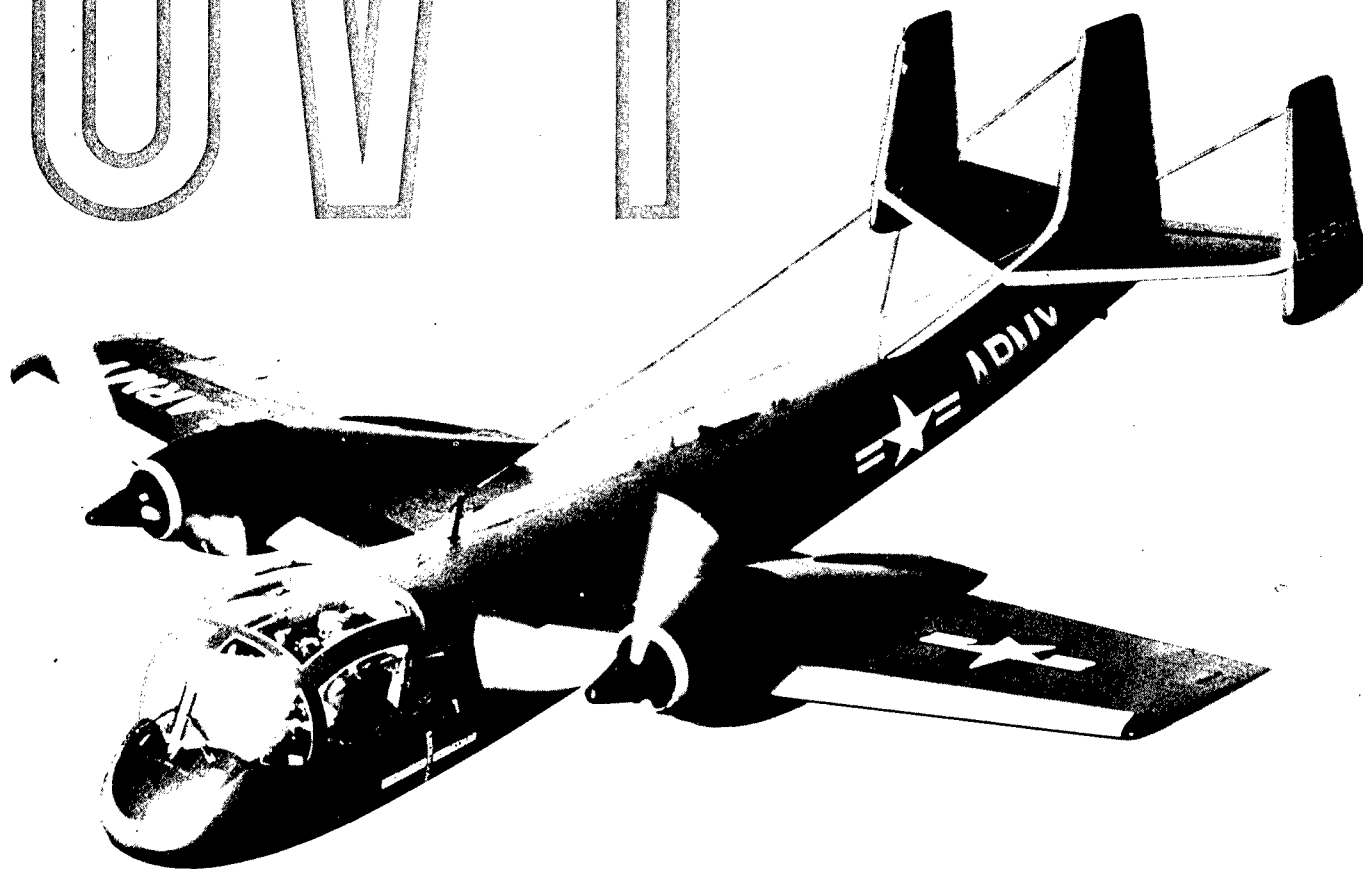


JANUARY 1964

OV-1

DISTRIBUTION STATEMENT A  
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Distribution Unlimited



# ACCIDENT SUMMARY

MAJORS • MINORS • INCIDENTS • FORCED LANDINGS

NOVEMBER 1, 1961 TO OCTOBER 31, 1963

2000 1013 146

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**NOTE:** *All accidents, incidents, and forced landings are preceded by the USABAAR log number so that queries may be directed to USABAAR by these numbers.*

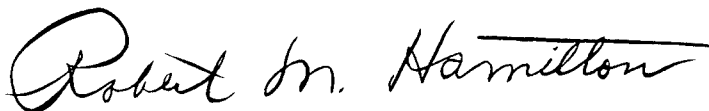
## FOREWORD

This is a summary of OV-1 accidents, incidents, and forced landings for the two year period ending 31 October 1963. It was compiled, published, and distributed to Army commands for accident prevention purposes ONLY. This summary is specifically prohibited for use for punitive purposes or for matters of liability, litigation, or competition.

Factor charts are presented in percentages of total cause factors and bear no relation to the total number of accidents, incidents, or forced landings.

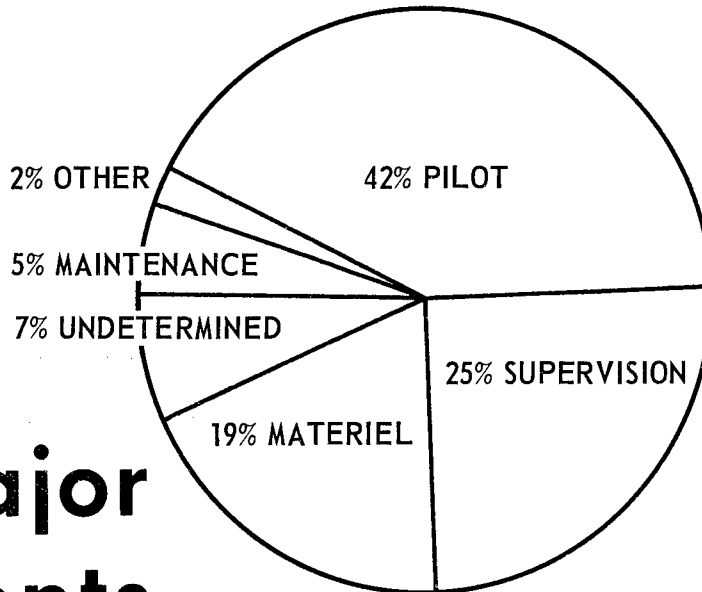
The data in this summary all point to a need for greater quality control in personnel selection, training, and supervision. The majority of major accidents reflect poor judgment, improper technique, and lack of knowledge on the part of aircrews.

It is hoped that all OV-1 users will study this summary and relate it to their training and operational programs in the interest of accident prevention.



ROBERT M. HAMILTON  
Colonel, Infantry  
Director, USABAAR

# Major Accidents



DISTRIBUTION OF ALL FACTORS

03270

THE ACCIDENT: Aircraft crashed during attempted low level roll across airport. Pilot and instructor pilot killed. Aircraft destroyed.

THE CAUSE: Roll was attempted at 150-200 feet with speed brakes extended and estimated airspeed of 160-180 knots. Nose fell through from inverted position and aircraft crashed while still rolling. Flight was in violation of AR 95-2.

02791

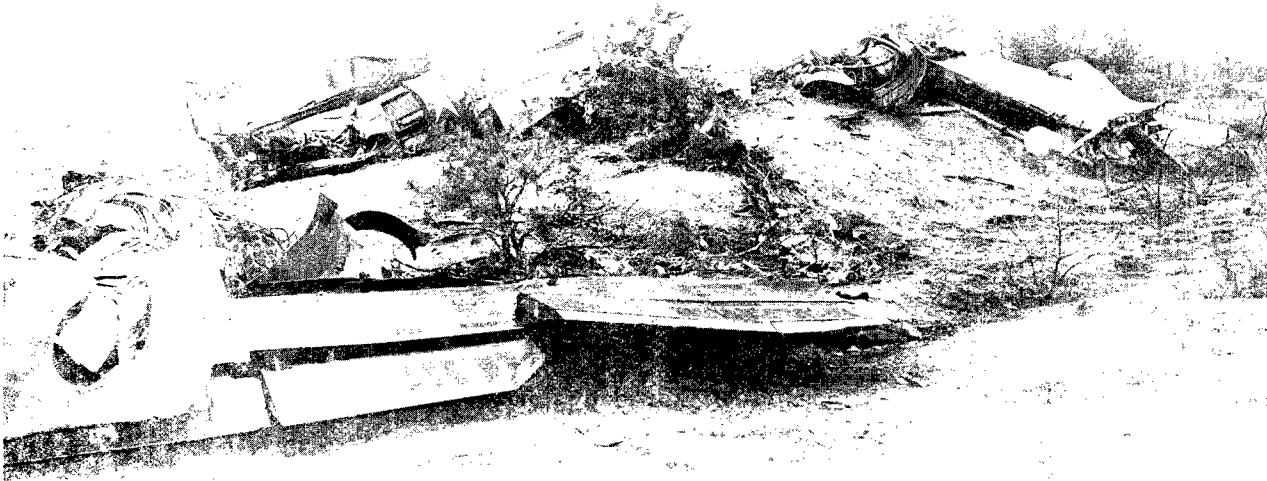
THE ACCIDENT: Aircraft landed with high sink rate in nose-high attitude.

THE CAUSE: Student pilot performed power-off approach with low airspeed. IP failed to take corrective action in time.

03477

THE ACCIDENT: Landing gear retracted prematurely during takeoff roll. Aircraft settled on runway and skidded 1775 feet before stopping.

THE CAUSE: Suspect pilot inadvertently retracted landing gear by accidentally moving gear handle forward one-half inch during takeoff power application.



03270

03844

THE ACCIDENT: Landing gear inadvertently retracted on landing.

THE CAUSE: IP accidentally moved gear handle instead of flaps lever during roll of touch and go landing.

04106

THE ACCIDENT: Pilot made high, fast downwind approach. In an effort to reduce speed, he retarded the power control levers abruptly, causing them to go beyond the ground idle stop into the reverse thrust position. The aircraft dropped to runway and slid to a halt.

THE CAUSE: High, fast downwind approach and use of reverse thrust before touchdown.

04200

THE ACCIDENT: Nose gear collapsed during landing roll on sod strip. Pilot applied full reverse thrust at touchdown and nose gear drag brace failed, allowing wheel to retract.

THE CAUSE: Materiel failure.

04400

THE ACCIDENT: Nr. 1 engine propeller feathered during single engine go-around demonstration and airspeed dropped below single engine speed. Power was applied to Nr. 2 engine and flaps were raised. Aircraft went into shallow left turn, stalled, and crashed in nose-low attitude. Pilot and instructor pilot killed.

THE CAUSE: IP allowed airspeed to drop excessively and then raised the flaps. This caused loss of inboard ailerons which further reduced controllability of aircraft. External loads were not jettisoned. Cause of propeller feathering undetermined.

04876

THE ACCIDENT: Aircraft dropped in from approximately 50 feet, landed hard, bounced, and skidded to stop.

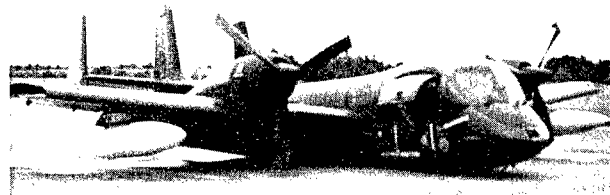
THE CAUSE: Power control levers were inadvertently moved to reverse thrust during approach.



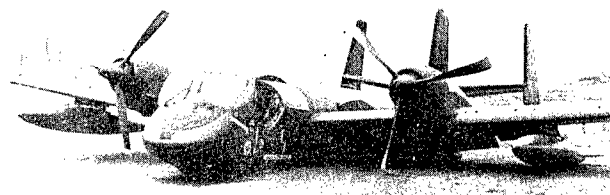
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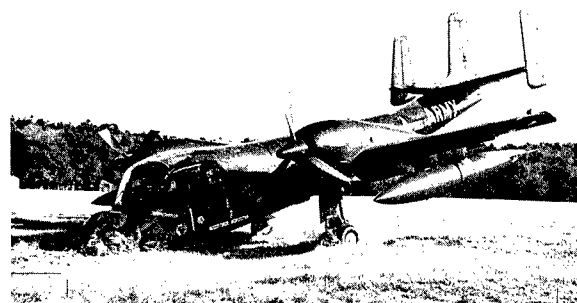
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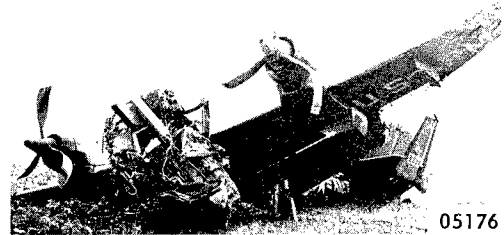
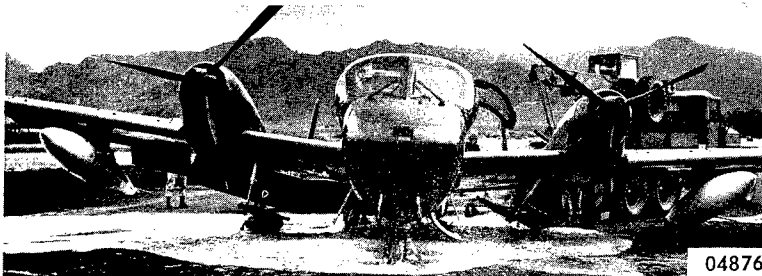
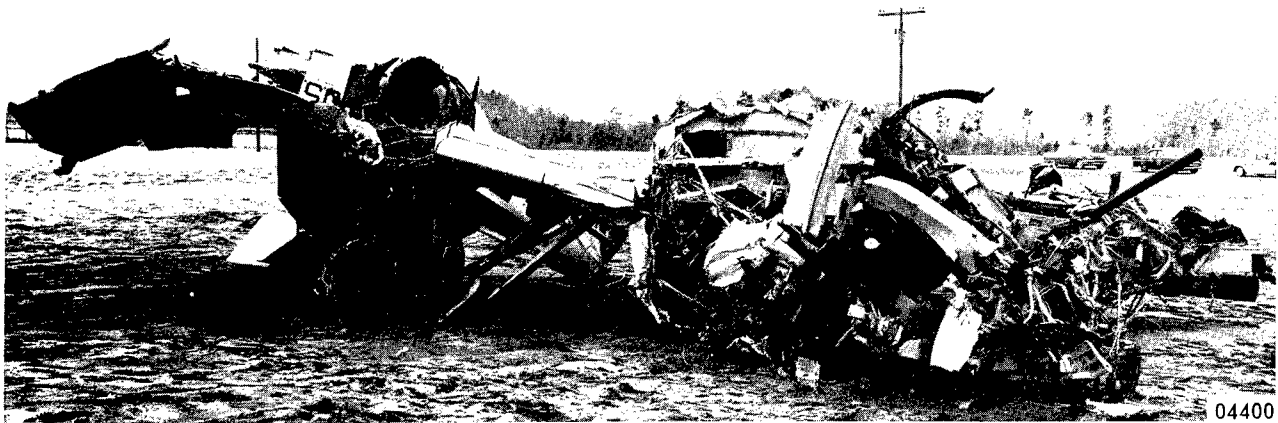
03844



04106



04200



04878

THE ACCIDENT: The aircraft was seen performing a series of coordinated turns at 800-1000 feet during routine training flight. It then made a violent, steep climbing left turn to 1,000-2,000 feet, completed 180 degree turn in an almost inverted position, nosed over and crashed. Two fatalities.

THE CAUSE: Undetermined.

05176

THE ACCIDENT: Aircraft yawed to left during landing approach. A loud noise was heard, and it immediately rolled to the left and crashed. One fatality.

THE CAUSE: Torque pressure switch of the Nr. 1 engine was improperly adjusted, causing accidental feathering of the Nr. 1 propeller.

05648

THE ACCIDENT: Pilot executed a go-around and jammed the power control levers full forward, causing autofeathering of the right propeller.

THE CAUSE: Abrupt use of power control levers.

05787

THE ACCIDENT: Aircraft landed with gear retracted.

THE CAUSE: Failure to lower gear.

06300

THE ACCIDENT: Aircraft was seen to perform two loops at 4,000-5,000 feet. It was held in a dive from the back side of the second loop, pulled out at low altitude over trees, contour flew for a short distance, then pitched up and started a roll to the right. The nose fell through from inverted position and the aircraft crashed into the trees while still rolling. Pilot and instructor pilot killed.

THE CAUSE: Nose fell through during attempted roll. Low level altitude did not allow room for recovery. Low level roll was in violation of AR 95-2.

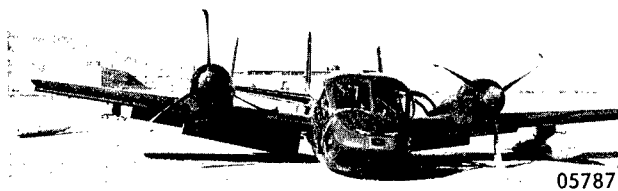
06617

THE ACCIDENT: Aircraft struck water during simulated tactical infrared mission over lake. Pilot recovered, pulled up, and returned to home field without further incident.

THE CAUSE: Loss of depth perception over smooth water in bright haze.

06672

THE ACCIDENT: Explosion occurred next to



fuselage in vicinity of flare pod when remaining flares were salvoed in completion of night photo mission. Fuselage broke in two and aircraft crashed. Pilot ejected and sustained minor injuries. Copilot failed to eject and sustained fatal injuries.

**THE CAUSE:** The most probable cause of this accident was premature firing of one or more flares which caused an explosion in the flare pod.

06734

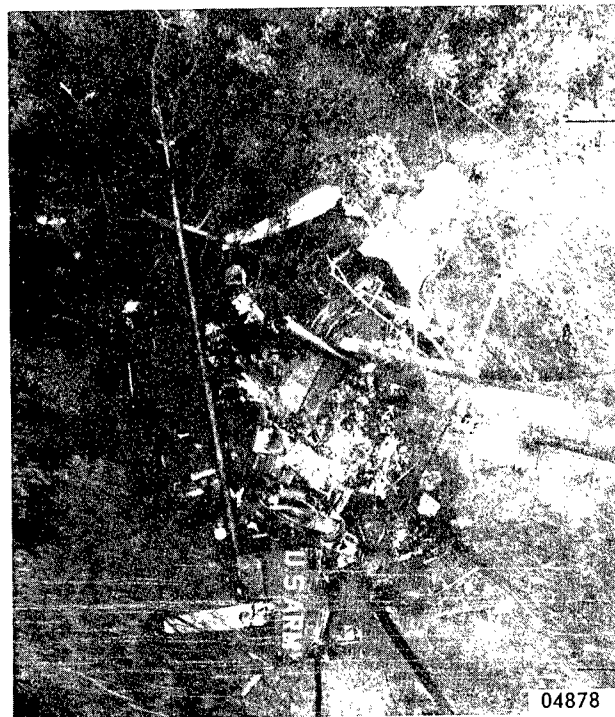
**THE ACCIDENT:** Explosion occurred next to fuselage in vicinity of flare pod after three flares had been fired during night photo mission. Fuselage broke in two and aircraft crashed. Pilot ejected and sustained minor injuries. Observer failed to eject and sustained fatal injuries.

**THE CAUSE:** The most probable cause of this accident was premature firing of one or more flares which caused an explosion in the flare pod.

06738

**THE ACCIDENT:** Aircraft struck power lines during low level visual surveillance mission. Major damage to empennage, fuselage, wings, and propellers.

**THE CAUSE:** Failure to see and avoid wires. Low



visibility at early dawn in light rain considered possible contributing factor.

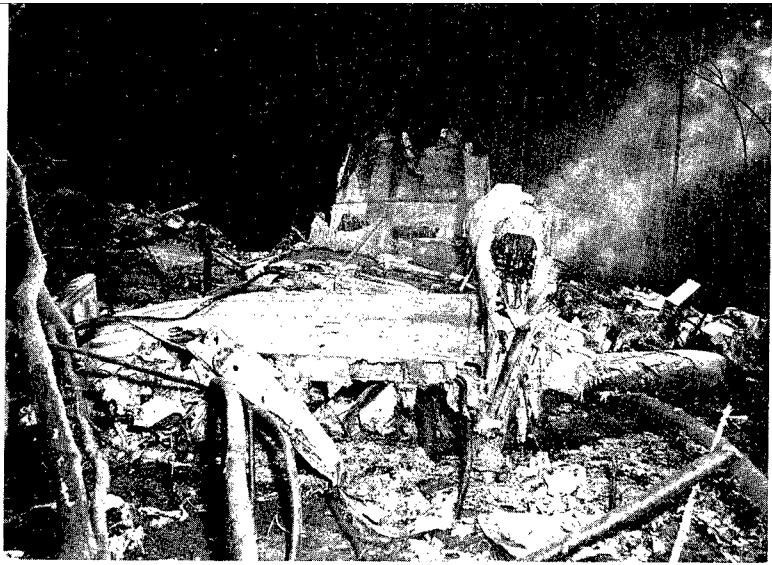
06759

**THE ACCIDENT:** Right main gear failed during landing roll on tactical strip.

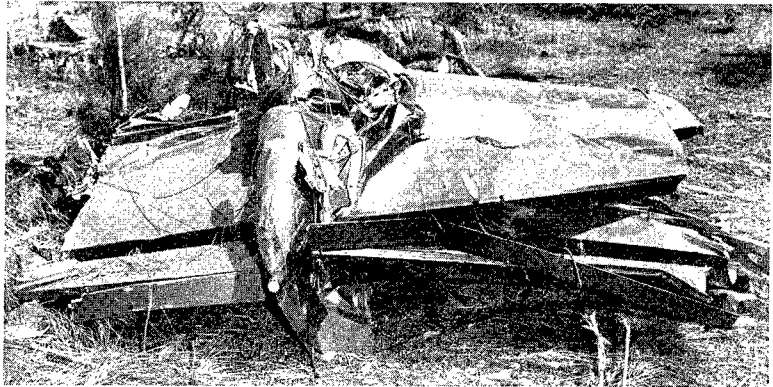
**THE CAUSE:** Materiel failure. Investigation revealed that a crack, caused by previous stresses, existed on the trunnion pin prior to the accident. Further tests conducted by Grumman showed that a critical area exists in undulating fields with undulation separations of 20-24 inches and a frequency range of 19 cycles per second. In this area, the gear will fail at 23 knots ground speed. Failures occurred in the right gear because engine torque loads during prop reversal are mainly absorbed by the left gear. This lightens vertical loads on the right gear and subjects the right gear assembly to higher drag loads induced by furrows or regularly undulated terrain. Recommend inspection and continued improvement of OV-1 landing strips.

06847

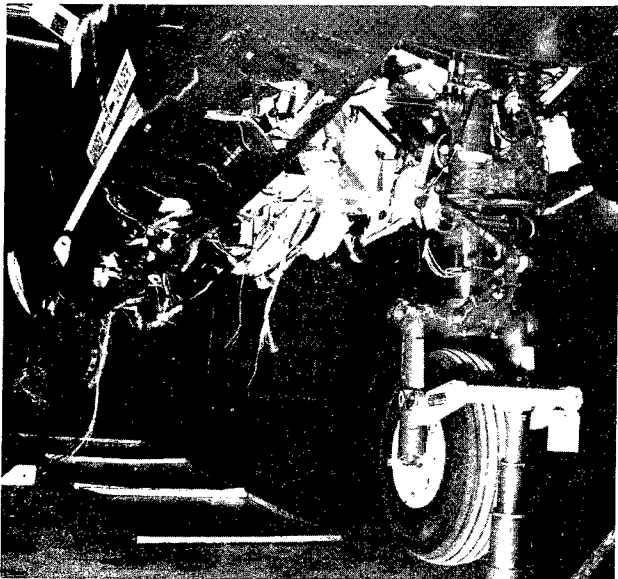
**THE ACCIDENT:** Nr. 2 engine failed in flight. Propeller was feathered. Pilot was unable to jettison auxiliary fuel tanks electrically and elected not to attempt manual jettison. Aircraft lost altitude and



06847



06300



06617

airspeed en route to airfield. Pilot and passenger ejected at approximately 150 feet. Aircraft crashed and burned. Pilot sustained compression fractures of vertebrae and abrasions. Passenger sustained compression fractures of vertebrae, second degree burns on hand, minimal burns of face, and abrasions. Burns caused by descent through flames of burning aircraft.

THE CAUSE: Engine failed (cause undetermined); auxiliary fuel tanks failed to jettison by electrical means (cause undetermined); and pilot failed to manually jettison auxiliary fuel tanks (emergency procedure outlined in -10).

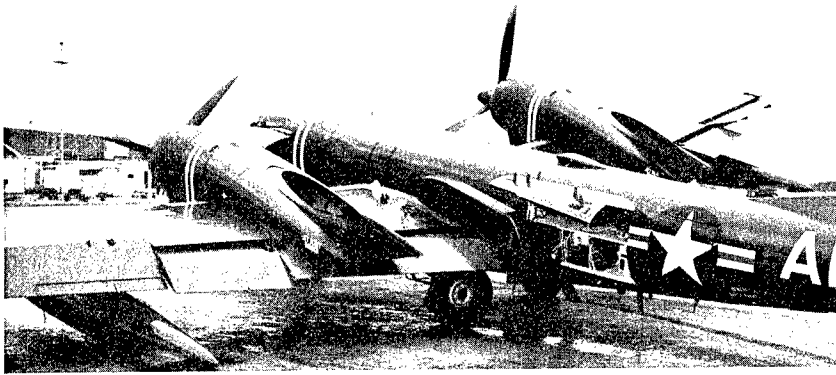
06244

THE ACCIDENT: Aircraft landed short of runway. Left gear struck ridge and collapsed.

THE CAUSE: Short landing made by pilot. Instructor pilot failed to take corrective action in time to prevent short landing.

05430

THE ACCIDENT: Nose wheel struck loose rocks,



06244



06672

causing blowout of nose wheel tire as propellers were reversed during strip landing. Nose gear collapsed. Major damage to wing, center section, fuselage, landing gear, flaps, propellers, and engine.

THE CAUSE: Presence of loose rocks on runway.

07058

THE ACCIDENT: Right main gear failed during landing and aircraft settled on right wing.

THE CAUSE: Dynamic "shaker" tests were conducted by Grumman and revealed that a critical area exists in undulating fields with undulation separations of 20-24 inches and a frequency range of 19 cycles per second. In this area, the gear will fail at 23 knots ground speed. Failures occurred in the right gear because engine torque loads during prop reversal are mainly absorbed by the left gear. This lightens vertical loads on the right gear and subjects the right gear assembly to higher drag loads induced by furrows or regularly undulated terrain. Recommend inspection and continued improvement of OV-1 landing strips.



06734

07149

THE ACCIDENT: Student pilot was given simulated single-engine in traffic pattern. Student went through single engine procedure, retracting landing gear. Approach was continued and aircraft landed wheels-up. Major damage to fuselage, flaps, propellers, and possible damage to both engines.

THE CAUSE: Failure to extend landing gear. Instructor pilot failed to take corrective action in time to prevent accident.

05960

THE ACCIDENT: Nr. 2 engine failed during low level flight up dead end valley at low airspeed. Pilot made successful ejection with no injury.

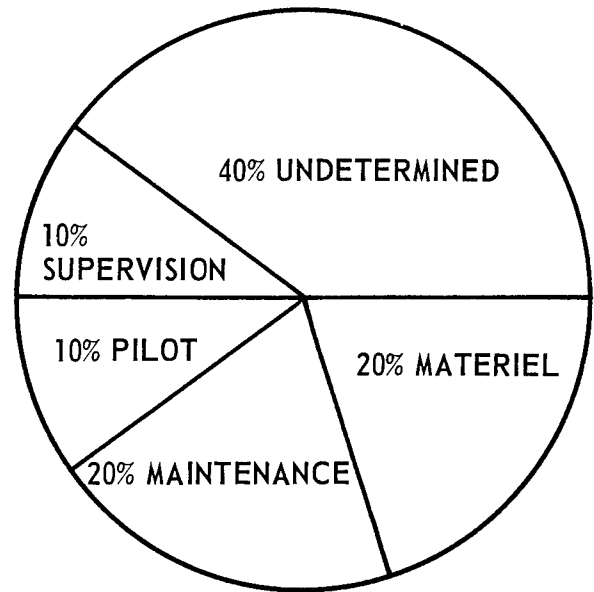
THE CAUSE: Undetermined.

06880

THE ACCIDENT: Hydraulic system failed in flight. Landing gear was extended by emergency means, but right main gear failed to extend. Pilot and observer ejected successfully with no injury.

THE CAUSE: Undetermined.

# Minor Accidents



DISTRIBUTION OF ALL FACTORS

03394

THE ACCIDENT: Pilot saw flames emitting from trailing edge of right engine nacelle after takeoff. Instructor pilot landed at nearby airport and fire was extinguished. Right wheel assembly, right wheel well, right flap and right engine nacelle burned.

THE CAUSE: Undetermined. Suspect hot brake caused hydraulic lines to separate and catch fire.

04555

THE ACCIDENT: Aircraft veered to right during landing roll, blowing main landing gear tires, and causing minor damage to right propeller.

THE CAUSE: Undetermined. Suspect uneven propeller reversal, or dragging right brake.

04671

THE ACCIDENT: Aircraft struck trees during takeoff from confined area, damaging tank stabilizer fin, landing gear door, and antenna wires.

THE CAUSE: Cause factors not reported.

05043

THE ACCIDENT: Landing gear handle was placed in up position while aircraft was taxiing. Gear retracted. Minor damage to propeller of Nr. 1 engine, antennas, nose wheel door, and possible damage to underside of fuselage.

THE CAUSE: Inadvertent movement of landing gear handle. Shoulder of lever assembly of landing gear lock found worn and rounded. This permitted gear handle to be placed in up position with lever lock in locked position.

06069

THE ACCIDENT: Sod was picked up and thrown

into propeller blades during propeller reversal for short field landing. Minor damage to propeller tips.

THE CAUSE: Cause factors not reported. Suspect unsuitable strip surface.

05853

THE ACCIDENT: Nr. 2 engine cowling came off in flight and struck tail section. Minor damage to cowling, engine, right elevator, and de-icer boot.

THE CAUSE: Caused by materiel failure of cowling fastener.

06464

THE ACCIDENT: Canopy came off and struck dorsal fin, center vertical stabilizer, and right vertical stabilizer during takeoff. Takeoff was aborted. Minor damage to vertical stabilizers and canopy.

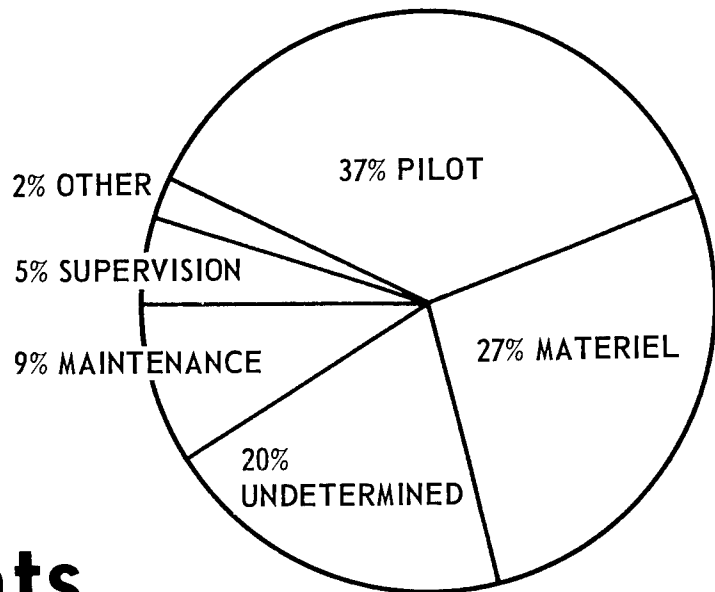
THE CAUSE: Caused by improper canopy alignment.

06431

THE ACCIDENT: Right main tire blew out during landing. Aircraft left runway. Right main gear and nose gear buried in sand. Minor damage to gear doors and right propeller.

THE CAUSE: Cause of tire failure not reported.

# Incidents



DISTRIBUTION OF ALL FACTORS

03164

Both main tires blew out during landing. Caused by excessive use of brakes.

03230

Inboard cowl to Nr. 1 engine torn off during flight. Cause undetermined.

03387

Private motor vehicle ran across runway during OV-1 landing. Pilot executed heavy braking action to avoid vehicle. Main gear tires blew out. Caused by presence of motor vehicle on runway.

03423

Nr. 1 propeller failed to reverse during landing. Aircraft swerved and pilot used heavy braking action to maintain directional control. Left tire blew out. Caused by broken Nr. 3 wire in pedestal which failed to activate reversal auxiliary motor.

03469

Nr. 1 propeller failed to reverse during landing. Aircraft swerved and pilot used heavy braking action to maintain directional control. Two main tires blew out. Nose wheel struck runway light and nose wheel tire blew out. Caused by broken Nr. 3 wire in pedestal which failed to activate reversal auxiliary motor.

03586

Aircraft flew through trees during low level flight.

Incident damage to left wing tip, navigation light, and slat. Caused by failure to maintain sufficient altitude to clear trees.

03647

Aft nacelle cowl on Nr. 1 engine tore loose in flight. Caused by materiel failure of lower forward stud assembly.

03715

Aircraft pitched up and tail cone struck ground while aircraft was braking. Incident damage to tail cone, skin, and two bulkheads. Caused by excessive use of brakes.

03726

Aircraft swerved sharply to left during landing roll. Right tire blew out. Caused by failure to simultaneously reverse propellers.

03776

Right tire blew out during landing. Incident damage to right wheel assembly. Caused by excessive use of brakes.

03865

Nr. 1 engine aft cowl stripped off during entry into loop. Incident damage to cowl, left flap, left rudder and vertical stabilizer. Caused by materiel failure of all but two studs.

03954

Left side door came open during takeoff roll. Incident damage to door bracket and canopy. Investigation showed side door locking handle subject to accidental opening.

04090

Nr. 2 propeller delayed going into reverse pitch during landing. Aircraft swerved to left. Right tire blew out. Caused by improperly secured propeller control cover.

04178

Nose tire blew out during landing. Caused by materiel failure of tire.

04226

Nr. 2 propeller failed to reverse during landing. Aircraft swerved. Both main tires blew out. Caused by materiel failure of Nr. 3 wire in pedestal.

04250

Nose wheel assembly damaged during landing due to flat nose wheel tire. Undetermined whether tire was flat prior to takeoff or blew out during landing.

04262

Instructor pilot was inadvertently ejected during training flight. Student pilot returned aircraft to home field and landed without further incident. Instructor pilot sustained fractured vertebrae and facial cuts. Caused by uncocked drogue gun. Course threads of loose drogue gun barrell permitted small amount of movement and the firing pin of the uncocked gun pressed against the soft copper primer cap of the cartridge under 10-15 pounds of spring tension. Constant vibration of the cartridge in the loose barrell against the firing pin caused it to penetrate the firing cap and fire the seat.

04336

Tire blew out while aircraft was taxiing. Caused by running over unknown object.

04360

Pilot's window flew open during flight. Cause undetermined. Suspect latching handle not placed in fully secured position.

04613

Nr. 2 propeller failed to reverse during landing and aircraft swerved. Heavy braking action to correct

swerve caused right tire to blow out. Caused by materiel failure of propeller control.

04657

Left wing struck barrier pole during maximum performance takeoff demonstration. Caused by failure to maintain directional control.

04821

Aircraft rocked back and tail cone struck ground during sod landing. Incident damage to tail cone. Caused by use of excessive reverse thrust after aircraft had slowed during landing roll.

04822

Nr. 2 propeller failed to go into reverse thrust during landing roll and aircraft swerved to left. Pilot used heavy braking action to correct for swerve and right tire blew out. Incident damage to right gear. Caused by materiel failure of Nr. 3 wire in pedestal.

04892

Aircraft landed short of runway. Incident damage to left main wheel and strut assembly. Caused by failure to maintain correct approach path.

04928

Aircraft swerved to left during landing roll and right tire blew out. Cause of swerve not reported.

04931

Aft cowl of Nr. 1 engine torn off in flight. Cause undetermined.

05156

Fuel access door came loose in flight. Flapping action caused incident damage to fuselage. Cause undetermined. Suspect failure to fully secure access door prior to flight.

05169

Mid-cowl separated from Nr. 2 engine during takeoff roll. Caused by materiel failure of fasteners.

05202

Aircraft rocked back and tail cone struck ground. Incident damage to tail cone. Caused by attempt to back out of soft sand with propellers reversed.

05331

Nose wheel rolled into surface dip during short field landing and tail scraped ground. Incident damage to

antenna cover, antenna, and skin. Caused by failure to select suitable touchdown and landing roll path.

05243

Left side hatch came open in flight. Incident damage to glass and side of door frame. Cause undetermined. Suspect handle was not in fully locked position during takeoff, or was inadvertently moved to unlocked position in flight.

05674

Left main tire blew out during landing. Cause not reported.

05693

Right wheel dropped off edge of runway during practice back-up taxiing. Aircraft rocked back and tail cone struck ground. Incident damage to tail cone. Caused by failure to remain aligned with runway.

05854

Center panel of Nr. 2 engine lost in flight. Caused by loose fastener.

05580

Right outboard section of engine cowling lost in flight. Caused by materiel failure of fastener.

06471

Heat shroud of left engine lost in flight. Cause not reported.

## Forced Landings

03368

Engine failed in flight. Caused by materiel failure of Nr. 2 turbine wheel.

03452

Fire noted in Nr. 2 engine in flight. Cause undetermined. Suspect compressor stall.

03461

Nr. 2 engine torque surged between 20 and 60 psi in flight. Cause factors not reported.

03462

Fire warning indicator came on in flight. Caused by

06084

Middle section of left engine nacelle lost in flight. Caused by screws vibrating loose in flight.

06005

Nr. 1 engine outboard cowling came off in flight. Cause undetermined. Suspect materiel failure of cowling skin.

06686

Right tire blew out during landing. Cause factors not reported.

06828

Aircraft struck tree during low level training flight. Front canopy dented. Caused by failure to maintain sufficient altitude to clear tree.

06832

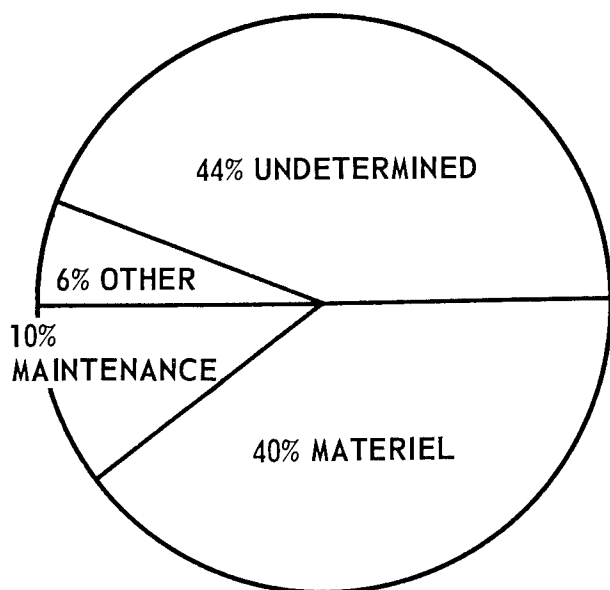
Right tire blew out during landing. Incident damage to tire. Cause factors not reported.

06855

Nr. 2 upper access cowling lost in flight. Cause factors not reported.

06875

Aircraft struck birds during demonstration low altitude, high speed penetration. Incident damage to engine cowling, wing leading edge slat, vertical fin, horizontal stabilizer, and empennage de-icer.



DISTRIBUTION OF ALL FACTORS

defective seal between engine and fire wall. Hot gases escaped around seal, activating fire warning system.

03670

Pilot heard unusual noise from left engine in flight. Engine was shut down and propeller feathered. Cause undetermined. Roller bearing of reduction gear assembly showed signs of excessive heat discoloration. Oil found leaking past seal into combustion chamber.

03681

Engine failed in flight. Cause factors not reported.

03729

Left auxiliary tank dropped off in flight. Caused by improper installation. Installation was made in accordance with manufacturer's training manual. Manufacturer's training manual shows incorrect installation procedure.

03780

Propeller of Nr. 1 engine malfunctioned in flight. Caused by corroded spots in rear and front barrel halves, which allowed hydraulic fluid to leak.

03845

Nr. 2 engine failed during climb after takeoff. Caused by materiel failure of inner cooling shroud on second stage nozzle.

03943

Instructor pilot noted unusual noise and vibration from Nr. 2 engine in flight. Engine was shut down and propeller feathered. Caused by materiel failure of hydraulic line at the filter connection in the right wing.

04096

Pilot heard loud noise from Nr. 2 engine in flight, and noted immediate loss of oil pressure and buildup of EGT. No cause factors reported.

04207

Instructor pilot heard popping noise in Nr. 1 engine and noted fluctuating EGT and high oil pressure in flight. Caused by materiel failure of exhaust diffuser and turbine disc.

04309

Nr. 2 engine cowl fasteners came loose and upper

nose cowl moved forward in flight. Cause factors not reported.

04372

Instructor pilot smelled smoke in flight. Cause undetermined. Suspect electrical failure of forward boost pump.

04481

Aircraft lost hydraulic pressure in flight. Caused by materiel failure of "O" ring seal of Nr. 2 hydraulic pressure line.

04482

Aircraft yawed and rolled to near inverted position when Nr. 2 power lever was placed in ground idle to simulate single engine. Caused by propeller reversal due to maladjusted reversing control.

04525

Nr. 2 engine fire warning light came on in flight. Caused by materiel failure (electrical short) in Nr. 2 "T" handle.

04529

Hydraulic pressure lost in flight. Caused by materiel failure of hydraulic seal on Nr. 2 pump. Landing gear extended by use of air bottle.

04641

Nr. 2 engine failed in flight. Cause factors not reported.

04645

Instructor pilot noted abnormal high torque reading of 80 pounds at 1500 rpm and 90% N1 from Nr. 2 engine. Engine was shut down and propeller feathered. Caused by clogged line.

04690

Electrical system (26 volt DC) failed in flight. Caused by materiel failure of 26 volt electrical system circuit breaker.

04736

Nr. 2 engine failed in flight. Engine was shut down and propeller feathered. Caused by materiel failure of planetary gear bearing.

04738

Nr. 1 engine failed in flight. Engine was shut down and propeller feathered. Cause undetermined. Extensive damage to rear section of engine.

04973

Hydraulic pressure lost in flight. Emergency gear extension used. Caused by materiel failure of hydraulic line at flange connection.

05110

RPM and torque of Nr. 2 engine fluctuated in flight. RPM dropped to 1300. Engine was shut down and propeller feathered. Caused by materiel failure of prop control assembly.

05182

Nr. 1 engine failed during landing approach while simulating Nr. 2 engine-out condition. Cause undetermined. N1 turbine found frozen. N2 turbine found dragging.

05189

Hydraulic pressure lost in flight. Emergency gear extension used. Caused by partially sheared plug on hydraulic pump of Nr. 1 engine. Part of "O" ring found blown out.

05220

Hydraulic pressure lost in flight. Emergency gear extension used. Caused by materiel failure of pump seal. Hydraulic fluid was pumped out drain line.

05350

Oil pressure of Nr. 2 engine lost in flight. Cause undetermined. Suspect failure of N1 compressor.

05494

Oil pressure of Nr. 2 engine lost in flight. Engine was shut down and propeller feathered. Cause undetermined.

05838

Nr. 2 engine lost power in flight. Cause undetermined.

06006

Nr. 2 engine lost oil pressure in flight. Cause undetermined.

06456

Pilot heard loud popping noise from Nr. 2 engine. Caused by materiel failure of N2 turbine. Turbine sheared and passed out tail pipe.

06458

Nr. 2 engine lost power in flight. Cause undetermined.

06601

Aircraft shook violently and pitched up from straight and level flight. Aircraft reached 50 degrees nose high pitch attitude before stabilizing. Pilot was using both hands to apply forward pressure. He regained control and stabilized airspeed at approximately 150 K. Landing was accomplished with reduced power settings. Caused by missing cotter pin from mounting bolts (NAS 1104-21D and NAS 1104-14D) of elevator trim push rod assembly. Condition of zinc chromate indicated cotter pin had never been installed.

06714

Pilot heard loud noise from Nr. 2 engine. Caused by failure of N2 turbine and exhaust diffuser.

06814

Nr. 2 engine failed in flight. Caused by materiel failure of power shaft.

05646

Nr. 1 engine failed in flight. Caused by materiel failure of N2 turbine. Turbine froze.

05641

Nr. 2 engine failed in flight. Cause undetermined. Suspect deterioration of vanes on N1 turbine wheel from high temperatures.

06549

Engine failed in flight. Engine was shut down and propeller feathered. Caused by materiel failure of reduction gear and power shaft.

06527

Nr. 2 engine failed in flight. Cause undetermined.

06410

Instructor pilot was unable to start Nr. 2 engine during demonstration of air start procedures. Cause undetermined.

06391

Nr. 2 engine failed in flight. Cause undetermined.

06079

Hydraulic pressure lost in flight. Caused by materiel failure of seal on pressure line to hydraulic pump of Nr. 1 engine.

06080

Nr. 1 engine failed in flight. Cause undetermined.

06917

Nr. 1 engine froze in flight. Cause undetermined. Suspect failure of engine sun gear.

# Ejections

There were 13 ejections during the period of this study. One was unintentional and the remaining 12 were intentional, arising from inflight emergencies. Nine ejections were successful (occupants survived with non disabling injuries) and four ejections were unsuccessful (occupants sustained fatal injuries).

In all four instances in which ejections were unsuccessful, the seat functioned satisfactorily, but main chute deployment was not attained because the ejections were started outside or on the borderline of the designed limits of altitude, airspeed, and attitude.

Following is a brief account of each ejection:

1. An instructor pilot was inadvertently ejected from the aircraft at an altitude of 4,000 feet in straight and level flight at an airspeed of 180 knots. The cause was found to be an uncocked drogue gun. Course threads of the loose drogue gun barrel permitted a small amount of movement. The firing pin of the uncocked drogue gun pressed against the soft primer cap of the cartridge under 10-15 pounds of spring tension. Movement of the drogue gun barrel from normal vibrations caused the drogue gun cartridge to fire. The drogue cable then pulled the sear from the primary charge, causing the seat to fire. The normal sequence of firing was reversed, but the ejection was successful. The instructor pilot was not properly positioned at the time of ejection and sustained spinal injuries and facial lacerations.

## *Corrective Action*

As a result of this ejection, the seat cables were rerouted to prevent the drogue gun cable from accidentally tripping the firing cable for the main sear (TB 55-1510-204-20/4 and change 1, Revision to Drogue Parachute Packing and Firing Cable Routing, Martin-Baker Mark J-5 Seat). This change

will not prevent the drogue gun from firing under similar circumstances, but if the drogue gun accidentally fires, it will not pull the sear from the primary charge and fire the seat.

To prevent the accidental firing of the drogue gun, MWO 55-1510-204-34/43 (Torquing of Drogue Gun Barrel) was issued 27 April 1962. This calls for inspection of drogue guns for proper cocking and an increase in barrel assembly torque from 30 inch pounds to 160 inch pounds.

2 and 3. The aircraft, with a pilot and crewchief aboard, made several touch-and-go landings, then departed the airfield and flew approximately five miles away. During this time, it was seen to perform a maneuver similar to coordination exercise turns. It then made a violent steep climbing left turn to approximately 1,000-1,200 feet. At this point, a 180 degree turn was made in an almost inverted position. The aircraft nosed down and descended at an angle of approximately 75 degrees in a slight left wing low attitude. The pilot ejected at an altitude of approximately 600-700 feet. The pilot's seat completed its firing sequence and he separated from the seat, but his main chute did not have time to deploy. The crewchief ejected at a lower and undetermined altitude and only the first portion of the ejection sequence—drogue and stabilizer chute—were completed. He was still strapped to the seat and his main chute had not started to deploy. Investigators considered that the pilot may have spent too much time trying to get the crewchief to eject.

## *Corrective Action*

Both seats operated satisfactorily, but the attitude of the aircraft (extreme nose down) did not allow time to complete the ejection sequence. Information about these ejections and a caution to eject within the designed limits of the seat were published in the January 1963 issue of the U. S. ARMY AVIATION DIGEST.

4. The aircraft circled a strip and made a low pass with gear and flaps down. It then climbed out, made a right turn, and entered a left downwind for landing. It passed the marked touchdown point while 3-10 feet in the air, yawed to the left, straightened out, yawed again, and straightened out. It continued approximately 3-5 feet above the ground and a loud engine noise was heard. The aircraft immediately yawed and rolled or banked sharply to the left. The left wing tip struck the ground and the pilot ejected. The seat operated successfully, but the main chute did not fully deploy, and the pilot was killed. This ejection was initiated well below the designed limits of the seat for airspeed, altitude, and attitude.

#### *Corrective Action*

The details of this ejection were also published in the January 1963 issue of the U. S. ARMY AVIATION DIGEST.

5. The aircraft was flying at 130 knots at approximately 100 feet in a dead end canyon. Nr. 2 engine lost power as a climb was initiated to clear the hill at the end of the canyon. The aircraft would not maintain a rate of climb sufficient to clear the hill. As the airspeed dropped to approximately 90 knots, the pilot ejected. This ejection was successful and the pilot sustained minor injuries.

6. The aircraft completed a night photo run at 2,200 feet and 180 knots. At this point, the pilot salvoed the remaining flares. A brilliant light was seen and the aircraft immediately nosed into a steep dive. The pilot pulled the stick all the way back but the aircraft did not respond. He told the copilot to eject and then ejected himself. The ejection was successful and after approximately two oscillations, he landed in brush. The aircraft crashed and exploded. The copilot, a foreign national, failed to eject. It was considered that a language barrier may have played a part in his failure to eject.

7. The aircraft was on a night photo mission, flying at 1,000 feet. The pilot began a photo run, firing flares individually. He saw a white flash as one flare exploded very close, then a bright red flame enveloped the aircraft. At this time, he felt a severe concussion and momentarily lost consciousness. As he regained consciousness, he saw the aircraft was in a steep dive and moved the stick full aft. There was no control response. The pilot

ejected. This ejection was successful and the pilot sustained fractured vertebrae. At first, it was believed the pilot's injuries resulted from the in-flight explosion. However, examination proved his injuries to be compression fractures which could only have come from ejection.

#### *Corrective Action*

As a result of the copilot's failure to eject in the sixth ejection and the observer's failure to eject in the seventh ejection, a rapid production training film showing the use of the Martin-Baker seat was made by the Army Pictorial Center in coordination with USABAAR. This film (TF 420-25458) is scheduled for distribution at an early date.

8 and 9. This emergency evolved from the loss of both engines at an altitude of approximately 400 feet. The observer ejected from an altitude of less than 200 feet and airspeed was less than 100 knots. The aircraft was in a nose low left bank attitude. The observer's seat functioned properly and his main chute deployed immediately prior to his landing. The pilot ejected a few seconds after the observer and only his drogue chute was deployed when he hit the ground still in the seat. There was no apparent malfunction of the seat and the fatality was attributed to ejecting beyond designed limits.

10 and 11. The aircraft was on a photographic test flight, flying at approximately 1,500 feet and 180 knots. Nr. 2 engine lost power and the pilot started a climb. At this point, the Nr. 2 engine failed. The pilot feathered Nr. 2 propeller and advanced the Nr. 1 engine to METO power. He attempted to jettison the auxiliary fuel tanks electrically and was unsuccessful. He elected not to attempt manual jettison and continued flying toward the home field. The aircraft lost altitude and airspeed en route. When the pilot saw that he could not make the home field, he and the photographer passenger ejected. The aircraft was in a slight nose high attitude at approximately 150 feet. Airspeed was 90 knots. The aircraft crashed and burned. The ejection sequences were photographed in slow motion high speed movie film by a photographer in another aircraft. These films show both the pilot and passenger's main chutes blossoming as they descended into the trees. Both sustained fractured vertebrae, and the photographer, who descended through the flames of the burning aircraft, sustained facial and hand burns. These

ejections, though successful, were made at the outermost limits of the designed seat capability.

12 and 13. Hydraulic pressure was lost in flight. The pilot attempted to lower the landing gear using the emergency system, but the right gear would not extend. Both pilot and observer successfully ejected and sustained only minor injuries. Details of altitude, airspeed, and attitude are not available.

### CONCLUSIONS

The four fatalities that have resulted from ejections to date all resulted from attempts to eject at altitudes, airspeeds, and/or attitudes beyond the designed capabilities of the ejection seat.

Four of the successful ejections were made at the extreme limits of altitude, airspeed, and/or attitude.

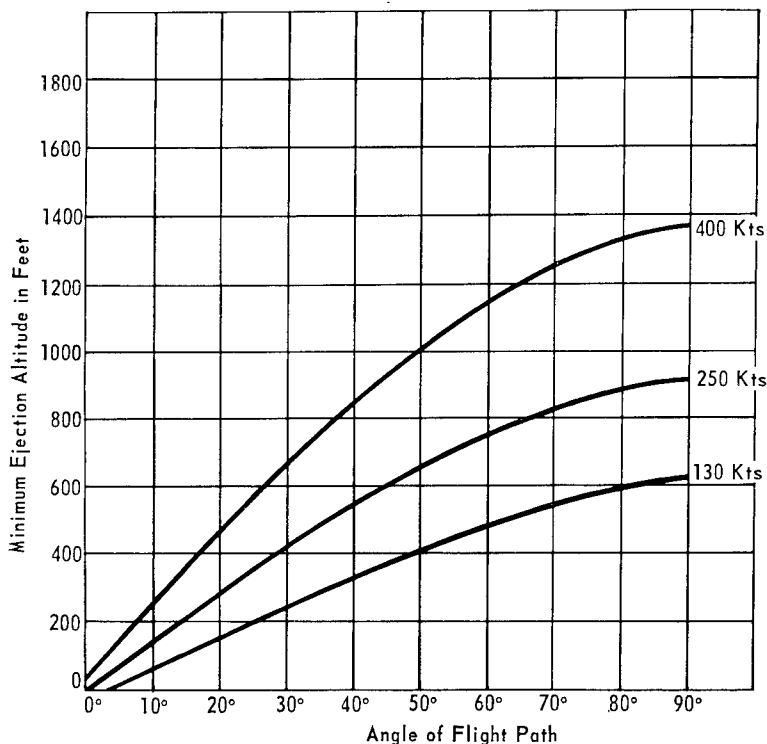
A successful ejection can be made at ground level, provided the aircraft is flying straight and level or in a wings-level, nose-up attitude, with an airspeed of at least 90 knots.

The chart shows how attitude and airspeed determine minimum altitudes for successful ejection. With a 50 degree pitch-down attitude and airspeed of 130 knots, the lowest altitude for successful ejection is 400 feet.

Air Force experience indicates that 40 percent of all ejection fatalities are preventable. The biggest problem is delaying the decision to eject until reaching altitudes too low for success.

What causes delay? Often, it can be traced to uncertainty. And the best way to eliminate uncertainty is to gain a full understanding of the equipment and how it operates, its capabilities and limitations. A complete knowledge of the ejection seat and continuing mental drills of emergency procedures will prepare you to make the right decision in the least possible time for any emergency.

The Army aviator should do his utmost to stay proficient in the entire operation of the seat. He should know and practice the use of the manual escape system. As the infantryman is able to disassemble and reassemble his rifle under all conditions, day or night, the person sitting on a



#### Minimum Ejection Altitudes

Droge Gun Delay	½ sec.
Time Release Delay	1½ sec.
G Stop Mechanism Set At	4 G
Ejection Velocity (Tel. Gun)	83 ft./sec.
Ejected Weight	320 lb.
Installation Angle	65°

#### NOTE:

Altitudes shown were calculated from the time of gun initiation and therefore make no allowance for hood delay or pilot's reaction.

T.O. No. 213

Martin-Baker Aircraft Co. Ltd.  
Higher Denham Nr. Uxbridge.

Martin-Baker seat should know emergency procedures by instinct. Once the emergency happens, it's too late to start learning.

### EJECTION SEAT MAINTENANCE

Nine lives saved from what would have meant certain death prove the value of ejection seats. They also prove these seats must be maintained by thoroughly trained, competent personnel. For once the ejection sequence has started, it must work perfectly or fail. One discrepancy can render the entire system inoperative.

To further emphasize the need for quality control, here are some maintenance boners found in OV-1 ejection seats during the past few months:

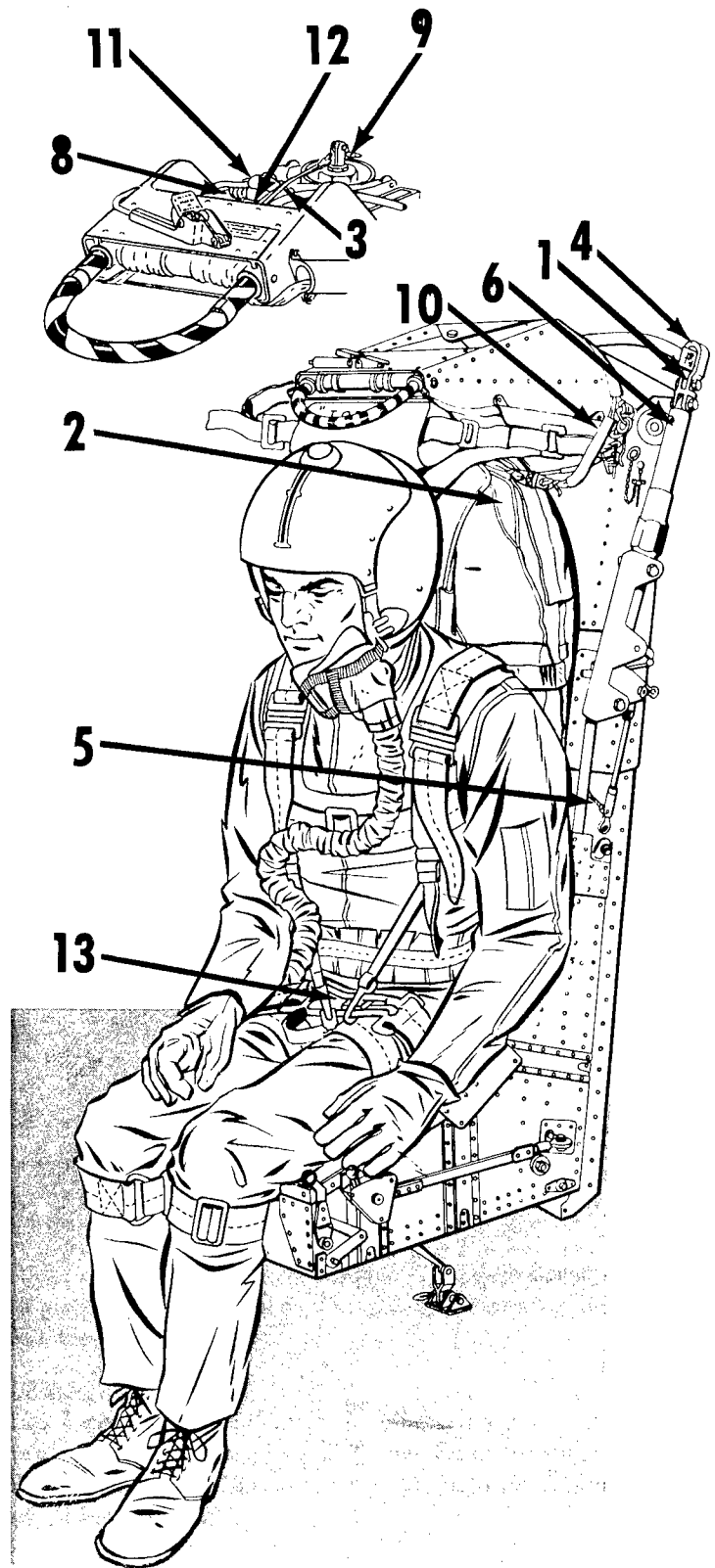
1. Incorrect cotter keys in drogue guns.
2. Withdrawal lines routed wrong.
3. Excessive slack in firing cables.
4. Spacer missing on drogue gun bullet.
5. Bungee cords needed replacing.
6. Wrong type nut and bolt on drogue gun bullet.
7. Safety wire missing from time release.
8. Drogue flap withdrawal pins not safetied.
9. Main gun sear bent.
10. Face blind and personnel retainer straps rigged backwards.
11. Link lines rigged improperly over tops of shackles.
12. Drogue pack safety pin out of packet and seal broken.
13. Harness clips broken.

Small items? Not to the pilot whose life may be at stake!

What is necessary to effect a cure? The cure demands thorough TRAINING, strict SUPERVISION, and absolute ADHERENCE TO APPROPRIATE MANUALS. Now is the time to check the seats in YOUR Mohawks to see how YOU stack up in these areas.

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(Note: A training film, TF 420-25459, Operation of the Martin-Baker J5 Ejection Seat, showing correct rigging and some of the errors in rigging that have been found in recent months, has been completed and will soon be available through your film library.)



# Maintenance and Materiel

This section presents, in outline form, actions taken to prevent recurrence of accidents and correct maintenance deficiencies.

## *Powerplant Malfunctions*

a. *Power Shaft Failures* - Message, TCMAC-AO-1-09-0267, dated 6 Sept 61 was issued changing propeller operating range as follows: Normal operating range 1350-1680 rpm; transient operating range 1000-1350 rpm and unrestricted below 1000 rpm - at minimum pitch or reverse pitch. This was to reduce stresses on power shaft.

b. *Turbine Wheel Failures* - Message, SMOSM-EAO-1 09-02234 dated 20 Sept 62 was issued changing turbine tip clearance and crack limits.

c. *Other Engine Malfunctions* - Message, SMOSM-EOV-1 12-1336 dated 7 Dec 62 listed the following Maintenance Work Orders (MWO's) which should have been complied with:

- (1) MWO 55-1510-204-34 16--modified nozzle assembly.
- (2) MWO 55-2840-201-50 2--inner shaft seal modification.
- (3) MWO 55-2800-200-50 2--turbine wheel assembly.
- (4) MWO 55-2840-201-50 5--modified power shaft.

An analysis of failed engines revealed that failures occurred in the reduction gear area. Excessive sun gear wear and teeth chippings were evident in all cases. Until a permanent fix is issued, a daily continuity test of engine magnetic sump plugs, and removal of plugs each 25 hours for inspection of accumulated metal particles, is recommended.

## *Propeller Autofeather Malfunctions*

Due to an improperly set torque pressure switch

(FSN 5930-798-5233), a new procedure for the autofeather check was issued by message SC53212 COMZEUR, 2 March 1963.

## *Cockpit Contamination*

A problem arose from smoke and fumes entering the cockpit during operation of the pilot's compartment heater. As a result, heating ducts were blocked off. Later, MWO 55-1510-204-34 18, 17 July 1963, called for installation of catalytic filters for engine bleed lines. These filters are now in use only with the L3 engine. The fix was found to be a new type bearing seal which is now installed in engines during overhaul.

## *Flight Control Malfunctions*

A restricted control malfunction was reported from the Grumman plant and a safety of flight message was issued 22 March 1963 (SMOSM-EUOV-1 03-1452 and SMOSM SDO-3-11) called for inspection of flight control balance weight through bolts. These inspections were made to verify proper installation and satisfactory locking characteristics of the nuts.

Several inboard aileron push rod assemblies have failed. To prevent further failures, a safety of flight message (SMOSM-EOV-1 11-1371, 21 Nov 1962) was issued. This message required inspection and replacement of defective push rods.

Aircraft was in straight and level flight at cruise power and prop settings at approximately 1,500 feet. The aircraft was trimmed for this condition and gave no unusual indications. Suddenly, the aircraft shook violently and the nose pitched up rapidly. Full forward pressure was applied to control stick and the pilot used both hands to stop the nose from going higher. Pitch attitude reached approximately 50 degrees nose high before stabilizing. As the airspeed decreased, the nose began to lower and the aircraft started rolling to the left.

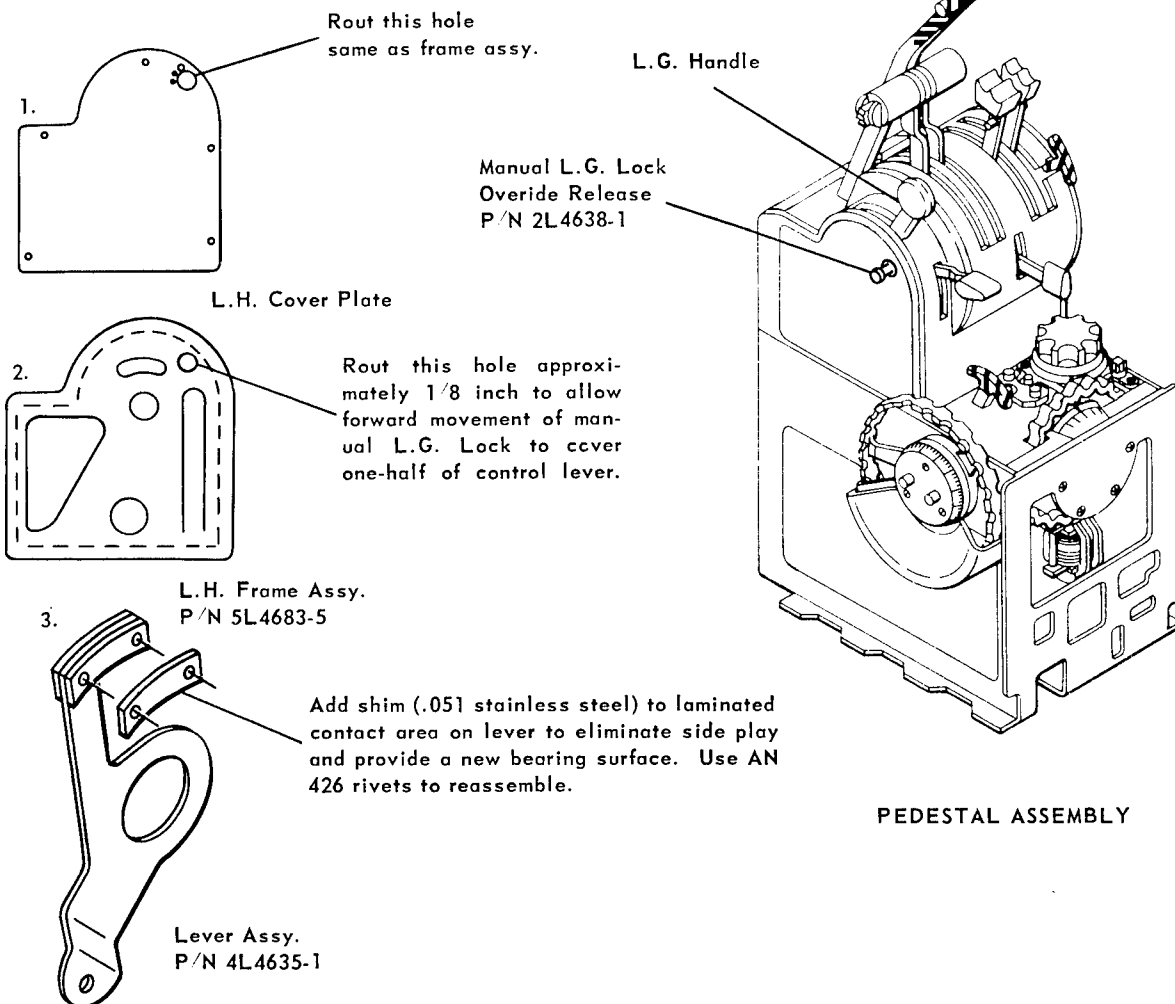
Directional control was maintained with aileron and rudder. Stick pressure was reduced and the pilot was able to hold attitude with one hand as he reduced power to approximately 20 psi and rolled in full nose-down trim. With the aircraft under control, power was increased to 30 psi and the airspeed stabilized at approximately 150 knots. Forward pressure was still necessary but could be held with one hand. The airfield tower was notified and only slight forward stick pressure was necessary to accomplish a normal landing at reduced power settings with no damage to the aircraft. Cotter pin found missing from mounting bolts of elevator trim push rod assembly. Condition of zinc chromate

coating indicated pin had never been installed (parts numbers - elevator trim push rod assembly, 134CZ0029-3; bolt, NAS 1104-21D; bolt, NAS 1104-14D).

### Landing Gear Malfunctions

Due to several inadvertent landing gear retractions, MWO 55-1510-204-34 1, 21 Nov 1961, was issued covering inspection of the landing gear lever. Inadvertent retractions can be caused by wear in various parts of the pedestal assembly. Repair as shown should be incorporated during the next scheduled periodic inspection.

### TO PREVENT INADVERTENT RETRACTION OF LANDING GEAR DUE TO WEAR AND TOLERANCE BUILD UP OF POSITION LOCK, REWORK THE THREE PARTS SHOWN BELOW.



### *Cowling Fastener Malfunctions*

Eight cases of engine cowlings separating from engine nacelles during flight have been recorded. The cause was found to be poorly designed cowling fasteners. To correct this condition, a safety of flight message will soon be issued requiring that all OV-1 cowling fasteners be replaced with a new fastener (P/N 6500 NL 48540-4, receptacle P/N 6500 NL 48051).

### *Oxygen System Problems*

Due to the probability of inflight fire caused by defective oxygen regulators the following safety of flight message (UNCLAS SMOSM-EUOV-1-04-1454) outlining Change 2 to MWO 55-1510-204-20/2 "Revised Operating Pressures For AO-1 Oxygen System" was issued:

"Prior to the next flight, place the MD-2 oxygen regulator switch (regulators 14800-5, -7, -7A, -8) in the 'ON' position and allow to remain in this position unless it becomes absolutely necessary to switch to 'OFF' position during ground maintenance of the system. Do not recharge oxygen system until present pressure is reduced below 450 psi. This pressure limit applies to MD-2 regulators 14800-5, -7, -7A, -8. When necessary to recharge system, DO NOT exceed 450 psi, maintain pressure between 100 psi minimum and 450 psi maximum. Where long duration missions dictate additional oxygen, 1000 psi supply pressure may be used when MD-2 type regulators 14800-7A, -8 *only* are used, provided on-off toggle switch is placed in 'ON' position and allowed to remain in this position until the cause of

oxygen fires can be determined and permanent corrective action provided. All operating activities will exercise extreme caution during servicing of oxygen system and the above procedures will be effective."

## INSPECTIONS

### *Daily*

This consists of visually checking the aircraft and performing operational tests to insure flight readiness. Several accidents, incidents, and forced landings described in this summary could have been avoided with a proper daily inspection.

### *Intermediate*

Evidence of chafing, leaks, and similar conditions should be discovered during intermediate inspections to prevent these defects from developing into major maintenance problems. As with the daily inspection, accidents, incidents, and forced landings should have been prevented by this inspection.

### *Periodic*

This is a combination of daily, intermediate, and periodic requirements for checking and verifying satisfactory operation of all equipment. At least two accidents and one forced landing could have been prevented through this inspection.

Refer to TM 55-1510-204-20, Chapter 3, Inspection Requirements--Follow the book!



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