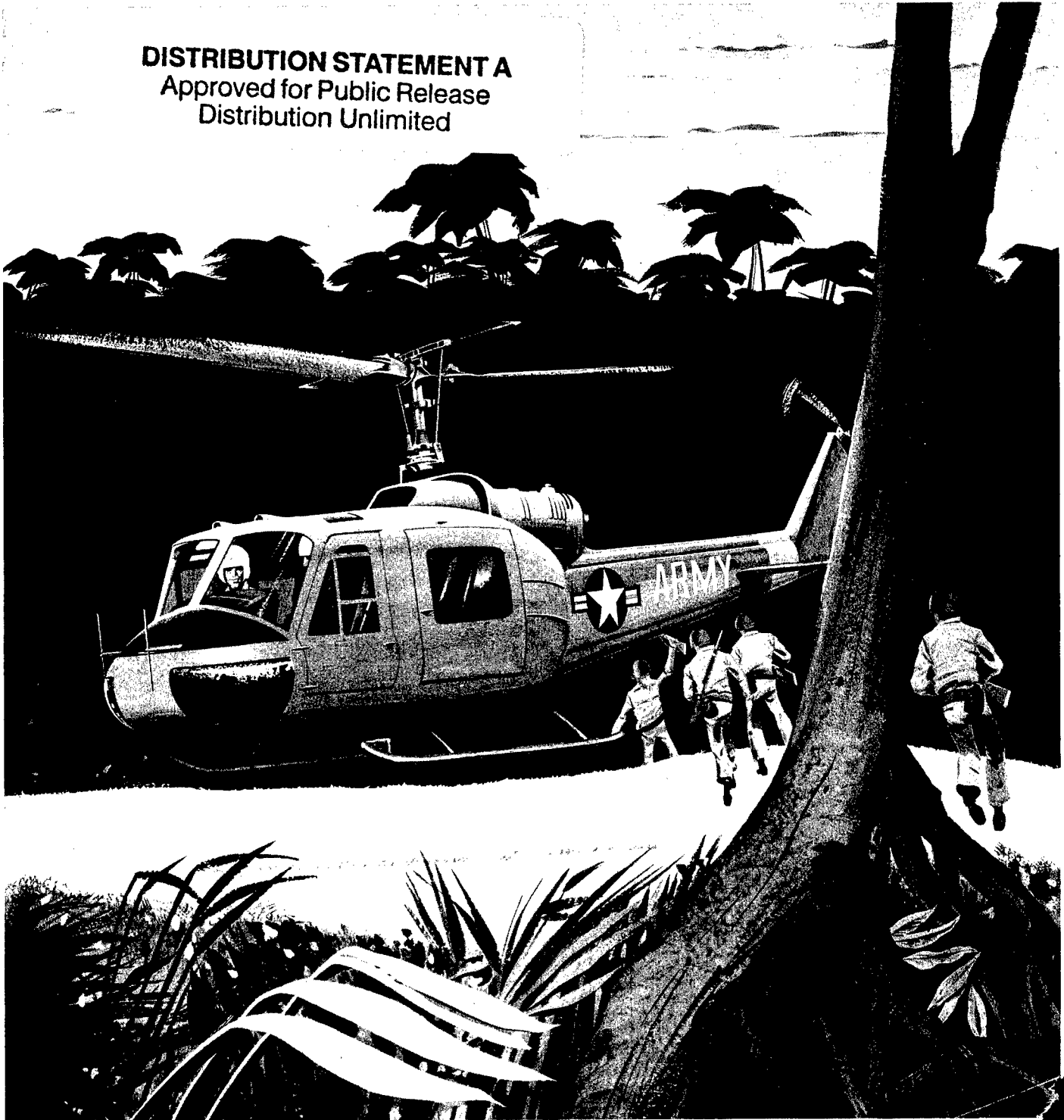


UH-1 ACCIDENT SUMMARY

Majors, Minors,
Incidents,
Forced Landings,
Precautionary Landings

1 JULY 1960 THROUGH
30 JUNE 1965

DISTRIBUTION STATEMENT A
Approved for Public Release
Distribution Unlimited



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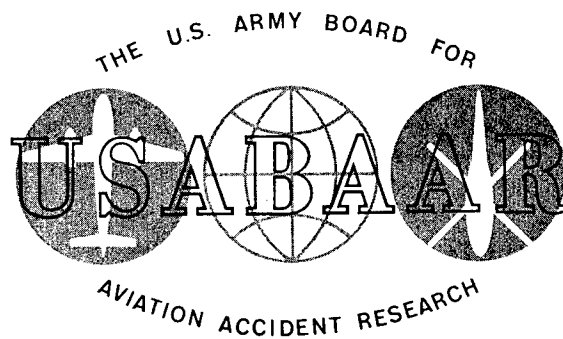
FOREWORD

This summary contains all Army UH-1 accident, incident, forced landing, and precautionary landing experience for the five year period ending 30 June 1965. Charts are used to show the relationship of mishaps to cost, aircraft models, and flying hours. Selected briefs are used to illustrate typical mishaps and cause factors.

It is hoped that commanders and all aviation personnel will use this summary for improving training, maintenance, and operational programs.

Warren R. Williams, Jr.

WARREN R. WILLIAMS, JR.
Colonel, Infantry
Director

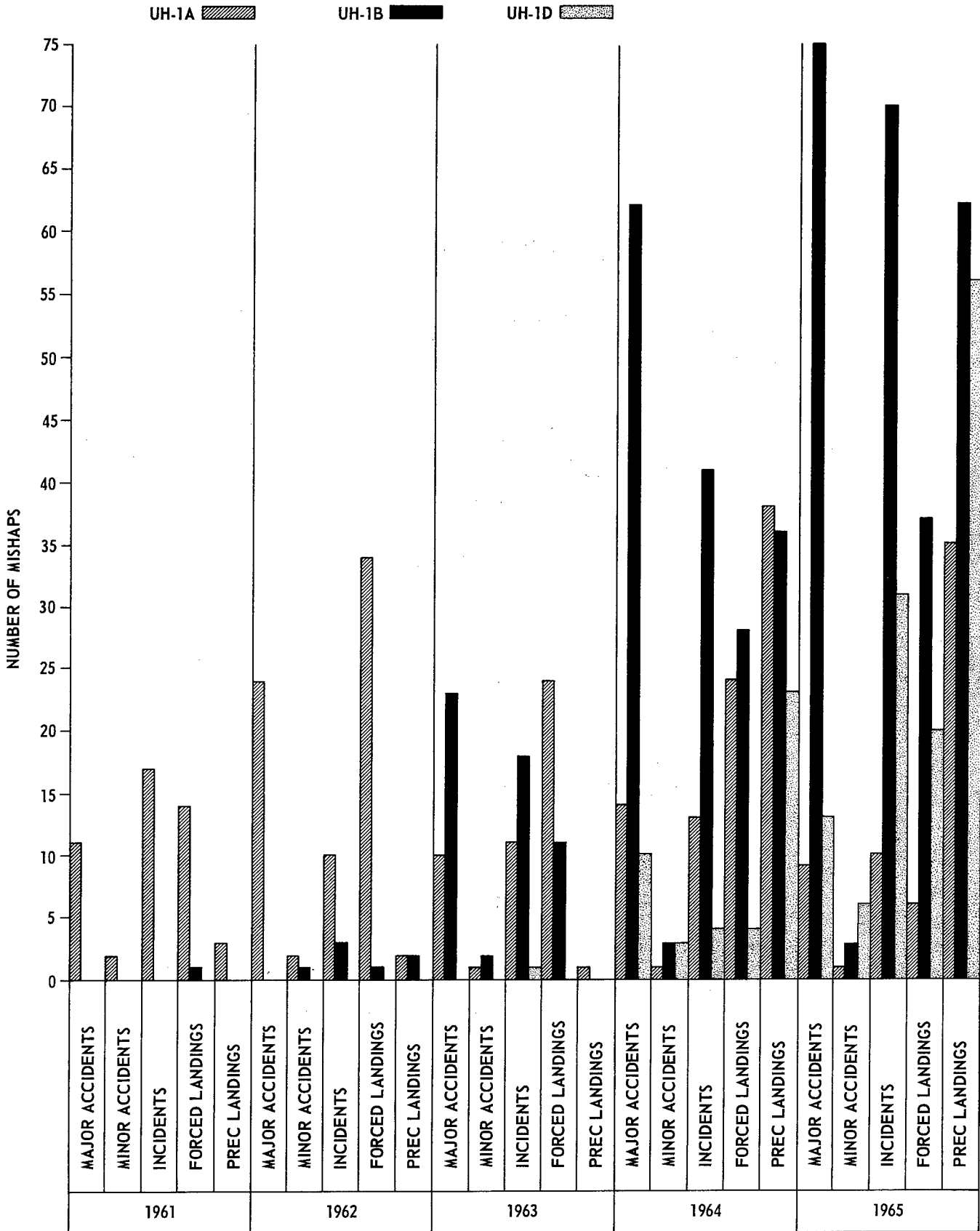


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FIGURE 1
TOTAL MISHAPS BY NUMBER AND TYPE
FY 1961-1965



UH-1 ACCIDENT SUMMARY

1 JULY 1960 THROUGH 30 JUNE 1965

I. PURPOSE: This summary and evaluation was prepared and distributed to furnish information on UH-1 accident and mishap experience to commanders, safety officers, maintenance officers, aviators, and procurement personnel. This information is intended for use in preventing accidents and reducing injuries, accident costs, and equipment losses.

II. SOURCE AND DATA: The information in this summary and evaluation was taken from Army aircraft accident reports and other mishap reports submitted to USABAAR from all Army commands, as required by AR 385-40. Combat losses are not included.

III. MAJOR AND MINOR ACCIDENTS: The UH-1 accident rate per 100,000 flying hours has shown a progressive decline during this period. UH-1 aircraft were involved in 13 major accidents during FY 1961 for a rate of 48.1. The rate for FY 1965 was 22.8. This reduction in rate took place during years in which many new missions and concepts for Army aviation were adopted, resulting in increased flying requirements and an expanded inventory of UH-1 aircraft. The number of fatal accidents per year has also declined since FY 1961. This decrease is attributed to the improvement of personal equipment, restraint systems, and design changes brought about by engineering change proposals, equipment improvement reports, etc.

IV. INCIDENTS, FORCED LANDINGS, AND PRECAUTIONARY LANDINGS: The frequency rate of these mishaps has also sharply declined during this period, from 129.5 during FY 1961 to 69.7 during FY 1965.

V. TOTAL MISHAP EXPERIENCE:

a. Of the 967 mishaps which happened during the five year period shown in figure 1, 840 (approximately 87%) happened during the three year period FY 1963-FY 1965. UH-1B and UH-1D model aircraft were added to the inventory and increased flying requirements, including expanded training, were added to meet the demand of the Vietnam conflict.

b. Figure 2 shows the dollar cost of UH-1 mishaps. The cost of repairing aircraft damaged by accident is directly proportionate to the severity of the accident and the original cost. As equipment becomes more complex, mishap costs rise. This is evidenced by the cost of UH-1B mishaps which rose to more than \$10,000,000 during FY 1965. The cost for all Army aviation mishaps during FY 1965 exceeded \$26,000,000.

c. Approximately 65% of all mishaps occurred in CONUS and 35% in overseas areas. Most of the

overseas mishaps happened in Vietnam during FY 1964 and FY 1965. UH-1B aircraft were involved in approximately 80% of these mishaps.

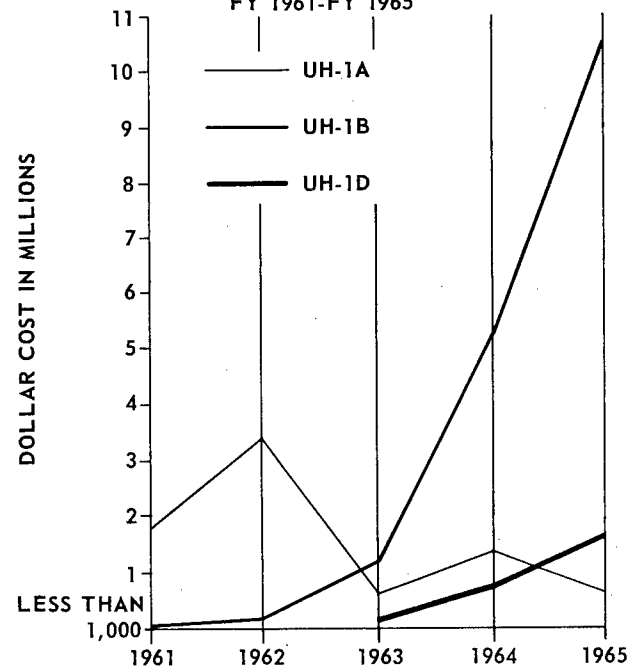
d. Approximately 46% of all mishaps occurred during inflight operations. Autorotations accounted for 17%. The combination of these two phases of flight represents more than 60% of all mishaps reported during this period. Most inflight mishaps were attributed to pilot factors and materiel malfunctions. The majority of autorotation mishaps were due primarily to pilot cause factors.

VI. MISHAP CAUSE FACTORS:

a. Major and minor accident cause factors remained consistent throughout the five year period, with pilot cause factors exceeding materiel failures and malfunctions. Pilot factors in major and minor accidents are associated with poor flight planning, improper technique, improper use of flight controls, and inadequate flight training, particularly at unit levels.

b. For mishaps other than major and minor accidents, the causes were primarily materiel failures or malfunctions. It is suspected that maintenance and supervisory cause factors are responsible for a large portion of the mishaps attributed to materiel failures. Often, the cause for a part failure is listed as materiel malfunction when, in reality, it is

FIGURE 2
DOLLAR COST OF ALL ACCIDENTS AND INCIDENTS
FY 1961-FY 1965



the result of a chain of events beginning with improper maintenance or supervision.

c. Power plant malfunctions accounted for 19% of all major and minor accidents and 28% of all incidents, forced landings, and precautionary landings. All mishaps attributed to power plant failure did not result from materiel malfunction. In some instances, engine failures resulted from pilot induced cause factors, such as fuel starvation and fuel exhaustion.

VII. AUTOROTATIONS: Seventeen percent (165) of all UH-1 mishaps happened during autorotations resulting from inflight emergencies and simulated forced landings. Pilot cause factors were present in more than 50% of these 165 autorotation mishaps.

VIII. INJURIES: There were 30 fatalities and 77 injuries during this five year period. Highest injury and fatality rates occurred in UH-1B aircraft during FY 1964 and FY 1965. Approximately 76% of all fatalities and 83% of all injuries happened during these two years. Though the numbers of injuries and fatalities increased during FY 1964 and FY 1965, the fatality rate per 100,000 flying hours has decreased.

IX. CONCLUSIONS:

a. A study of this summary shows that there is an apparent need for more thorough reporting of all cause factors involved in aircraft accidents and other types of mishaps to reduce the number of mishaps presently classified as "undetermined" or "suspected."

b. There is a need for a more concentrated effort on the part of commanders at unit levels to improve training.

c. There is also a requirement for maintenance and supervisory personnel to take appropriate corrective action to prevent mishaps arising from inadequate maintenance and supervisory cause factors.

SELECTED MAJOR ACCIDENT BRIEFS

07180--Aircraft shuddered and vibrated at approximately 1,500 feet. Pilot heard loud popping noise and lost anti-torque control. Aircraft crashed and was destroyed during attempted autorotation. IP and pilot had minor injuries. Anti-torque failure was caused by separation of tail rotor pitch change link bearing, causing loss of tail rotor blades and gear box. Aircraft damage resulted from improper landing technique.

07256--Engine lost power during low altitude formation flight. Rotor rpm dropped and aircraft crashed. Caused by failure to recognize loss of power and low rpm.

07295--Hovering to sling load downed aircraft, helicopter hit downed aircraft. Contact caused tail rotor failure and UH-1 crashed. Caused by failure to maintain clearance.

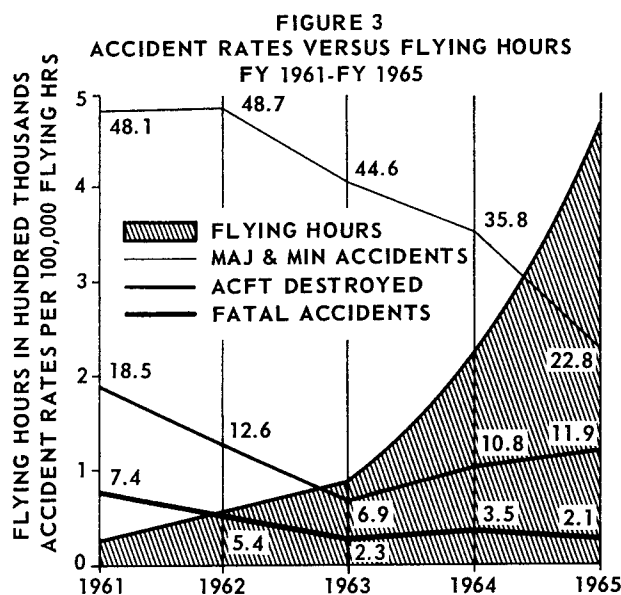
07441--Aircraft crashed into trees and burned during attempted move through dense fog from one heliport to another. Pilot and crewchief killed. Caused by non-instrument rated pilot attempting flight with zero ceiling, totally obscured sky, and 1/16 mile visibility in fog. Crewchief was not wearing protective helmet or gloves.

07452--Loud sharp noise heard from rear of aircraft during runup. Crewchief stepped out and saw that tail rotor hub, tail rotor blades, and tail rotor gear box were gone from pylon. Caused by separation of tail rotor blade and grip due to two fatigue fractures in one spindle of yoke. Suspect previous operation of aircraft with out-of-track rotor imposed severe loads that damaged spindle and resulted in cracks.

07476--Loud bang was heard and aircraft pitched up and to right. Pilot autorotated and aircraft landed in tail low right turn, resulting in major damage. Tail rotor found 1½ miles from wreckage. Caused by failure of tail rotor yoke spindle in threaded area. Failure was in plane of drilled holes used to lock retaining nut.

07574--Aircraft was leveled at 30 feet during approach to avoid children moving onto intended landing site, fell through and landed hard. Caused by high rate of descent, low airspeed, and delayed power application. Heavy internal load was contributing factor.

07747--Pilot attempted right turn during zero airspeed autorotation. Aircraft would not respond to flight controls and pilot lowered nose and applied

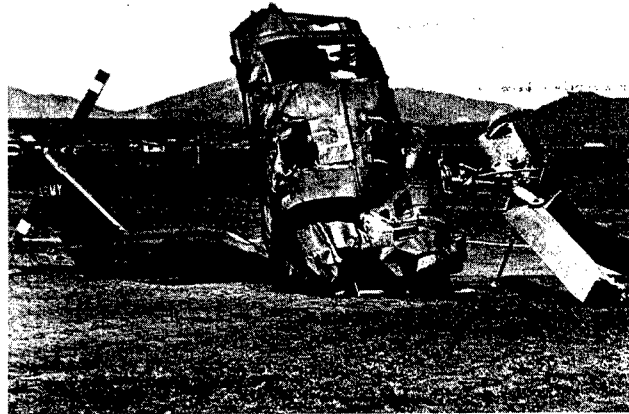


throttle. Engine failed to respond and aircraft landed hard, bounced, and came to rest on right side. Loss of power caused by improper installation of support bearing on left end of throttle linkage torque tube. During installation of support bearing, retaining nut was screwed down too tight, shearing 3/32" rivet and pulling the shaft of torque tube to approximately half its normal engagement.

07774--Tail rotor failed during power recovery from demonstration autorotation. Aircraft landed hard, resulting in major damage. Tail rotor failure caused by failure of tail rotor drive shaft clamp. Clamp did not have completed weld. It was only tack welded to hold it in place for welding.

07795--Engine failed and aircraft crashed during attempted forced landing. Copilot was killed. Pilot and four gunners sustained serious injuries. One gunner sustained minor injuries. Aircraft was destroyed. Engine failure was caused by fuel starvation. Fuel control pin (P/N 47686) failed. Oil and fuel resistant grease applied to overspeed governor mounting pad entered the fuel control. Grease settling on main governor flyweights in the computer assembly may have caused overspeed condition and failure of pin from overload.

07747



07441



07943--Noise developed in power train. Pilot made powered approach and engine failed at 50-80 feet. Aircraft landed hard. Engine failure caused by disintegration of Nr. 2 bearing. Failure of bearing caused compressor impeller to rub housing, cracking housing through 60% of cross sectional area. Suspect bearing failure was caused by inadequate lubrication. Oil relief valve was set for 1530 pounds per hour. Minimum flow required is 1705.5 gph.

08055--Aircraft was seen starting nose low turn to left when tail boom separated. Aircraft continued spiraling descent, crashed, and burned. Caused by failure of four tail boom attaching points due to static overload.

08145--Engine failed and aircraft was autorotated to hard landing. Caused by fuel exhaustion due to inadequate fuel management and lack of autorotation proficiency.

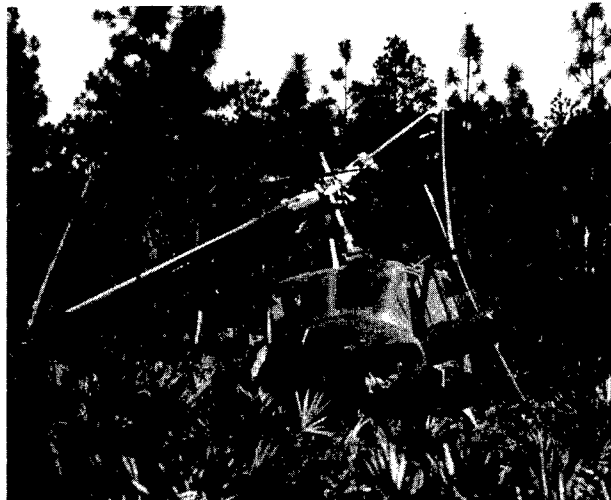
08162--Aircraft disintegrated at approximately 600 feet during test flight, crashed, and burned. Pilot and five passengers killed. Caused by failure of pilot to recognize engine failure in time to prevent excessive decay of main rotor rpm. Loss of rotor rpm resulted in severe resonance of main rotor mast and transmission, allowing main rotor blade to sever tail boom. Main rotor and transmission disintegrated, rupturing fuel cells and causing inflight fire. Engine failure caused by fuel starvation due to improperly seated fuel quick disconnect coupling. Unit test pilot was inexperienced, had received no formal training in aircraft maintenance or procedures involved in test flights, and was not on test pilot orders. Excessive number of passengers was in violation of paragraph 30a, AR 95-1, dated 6 March 1964.

08229--Pilot attempted to slow high rate of descent at 50-75 feet during approach and lost rpm. Aircraft fell through and crashed. Caused by high rate of descent, low airspeed, and delayed power application.

08295--Pilot landed aircraft in confined area and picked up nine passengers during field exercise. Rotor rpm was lost during takeoff and main rotor blades struck trees. Aircraft landed hard, turning 180° to right. Crewchief and four passengers sustained scratches and bruises. Caused by assigning inexperienced pilot to mission beyond his capability, pairing inexperienced pilots, and exerting excessive command pressure on subordinate commanders to fly a maximum number of aircraft for a field exercise. Pilot had not completed transition checkout. Inadequate training of ground personnel resulted in selection of poor landing site.

08331--Aircraft reached treetop level with low rpm and forward speed during confined area takeoff. Helicopter settled into trees and crashed. Caused by failure to use all available takeoff space.

08371--Aircraft drifted left, struck rise in ground, rolled, and came to rest inverted during attempted night landing from hover. Pilot, copilot, and two



08295

passengers sustained minor injuries. Caused by loss of ground reference due to blowing dust. Heavy-left lateral CG due to seating of three passengers on left side and one on right was contributing factor. No ground guide was available.

08400--Rotor rpm dropped at approximately 30 feet during maximum performance takeoff from hover on night practice rocket firing mission. Takeoff was aborted. Ground reference was lost in blowing dust and copilot made steep flare, turning right to avoid trees. Aircraft crashed and was destroyed. Caused by flying into known adverse conditions beyond pilot's experience, relying heavily on copilot, and using poor technique in attempting maximum performance takeoff from hover, then terminating takeoff at high hover in dust. Pilot had received insufficient training in night and dust operation, and was fatigued due to several days of heavy ground and flight scheduling prior to accident. Location of rigidly mounted gun sight obstructed vision and contributed to loss of ground reference.

08446--Engine failed during ferry flight and aircraft sustained major damage during emergency landing. Engine failure caused by failure of Nr. 1 bearing and subsequent destruction of N1 system.

08448--Main rotor blades struck wind sock pole. Caused by failure to maintain outside reference during cockpit distraction. Master caution warning light came on and pilot's attention was diverted.

08574--Tail rotor hub separated during hovering left turn and aircraft landed hard. Caused by failure of tail rotor attachment casting and loss of gear box.

A110--Aircraft landed hard from practice autorotation. Caused by delayed pitch application.

A282--Pilot lost visual reference with ground and aircraft crashed during night ferry mission. It was apparent that preparation for this flight was totally inadequate. Pilot was not instrument qualified and had not received any instrument flying training for two years prior to accident. Weather forecast called for low clouds, ground fog, and rain



08371

over intended flight route. Pilot was obviously unqualified for night flying in such weather.

A315--Aircraft struck high tension wire, crashed, and came to rest inverted during low reconnaissance. Caused by failure to see wire.

A389--Aircraft vibrated and oscillated when lifted to hover, struck ground on rear portion of skids, and rocked forward on nose. Caused by assignment of flight in which aircraft center of gravity was aft of limitation due to assignment of flight with only one pilot seat occupied. Standardization directive required both pilot seats to be occupied to maintain center of gravity within limits.

A420--Aircraft entered high sink rate just prior to touchdown during practice autorotation. Pitch was applied as aft portion of skids touched down. Aircraft bounced and landed hard. Caused by delayed application of pitch and failure to level aircraft.

A575--Engine emitted ball of fire during takeoff. Aircraft swerved to left and settled into trees. Caused by overstress failure of 5th stage compressor disc in dovetail area. Suspect overstress failure was caused by installation of excessively thick lock plate between blade and compressor at time of assembly. Disc failure caused release of two blades into path of remaining blades on 5th stage disc.

A591--Aircraft took off from strip with crew and five passengers aboard. At 100 feet, pilot decided to turn back because of low ragged ceiling and made left climbing turn to avoid high surrounding terrain. Aircraft entered fog bank, assumed excessive nose high attitude, and lost airspeed. Pilot lowered collective at approximately 700 feet. Aircraft began rapid descent and broke out at approximately 75-100 feet. Pilot applied pitch to slow descent and avoid wires. RPM dropped and aircraft struck ground hard, rolled, and came to rest inverted. Pilot, copilot, and crewchief sustained minor injuries. Aircraft was destroyed. Caused by attempted VFR flight in

IFR weather, attempt to transition from VFR to IFR at low altitude under hazardous conditions, and abrupt control movements. In addition, the following discrepancies were noted: Neither pilot performed a preflight, checked weather, or used cockpit checklist. Low rpm audio warning switch was not turned on.

A690--Tail rotor of one UH-1 was hit by main rotor of another UH-1 while the two aircraft were landing on rock piles. Both aircraft had major damage. Caused by failure to maintain adequate clearance between aircraft.

A790--Engine failed after sharp explosion and violent jerk in aft end of aircraft. Aircraft was autorotated, touched down left skid first, and rolled over. Engine failure caused by fatigue failure of three 2nd stage compressor blades.

A791--Engine failed at low level over trees. All forward speed was dissipated and aircraft settled into trees. Engine failure caused by fatigue failure of 2nd stage compressor blades.

A796--Engine failed at 200 feet over trees. Pilot turned toward nearest open field, but lost rotor rpm and aircraft crashed. Engine failure caused by fatigue failure of 2nd stage compressor blade. Fatigue crack originated near apex of blade on convex side near blade root.

A863--Aircraft struck ground, bounced, and landed hard during night approach to lighted "T." Major damage to tail boom, skids, skin, and fuselage. Pilot failed to accurately judge altitude of helicopter above ground while on short final and elected to continue landing with excessive approach speed. Reflection of bright navigation lights on rotor, fixation of attention on lighted "T," and steady lighting system used in landing "T" considered contributing factors. Other discrepancies noted were: Maintenance support personnel inspected and released aircraft for return flight to home station where major damage was discovered;

pilot failed to write up hard landing at time of occurrence; and aircraft records were incorrectly maintained.

A866--Aircraft struck ground, bounced, began to disintegrate, caught fire, and struck ground again in inverted position during low level cross country training flight. Copilot's seat was thrown clear of wreckage during bounce. Pilot was killed and copilot sustained minor injuries. Aircraft was destroyed. Caused by pilot flying too low and striking ground. Unit SOP listed 200 feet as minimum altitude for low level cross country training flights.

B061--Aircraft entered excessive nose low attitude and high rate of descent at termination of 180° turn during practice autorotation. IP flared, but was unable to slow descent and aircraft landed hard. Caused by failure of IP to take corrective action in time to prevent excessive nose low attitude and high rate of descent.

B070--Unusual noise was heard and engine rpm passed red line on high side. Pilot autorotated and aircraft hit and bounced, collapsing right skid. Main rotor hit dirt embankment. Engine overspeed caused by failure of overspeed governor shaft and tachometer drive.

B093--Helicopter making 180° practice autorotation collided with fixed wing aircraft taking off. Major damage to both aircraft. Helicopter was monitoring primary tower UHF frequency while fixed wing aircraft was cleared on tower VHF frequency. The two aircraft were operating simultaneously in same traffic pattern on different frequencies. Tower radio was capable of transmitting on only one frequency at a time.

B097--Aircraft lost rpm during takeoff as pilot maneuvered around stone marker. Left skid struck stone and aircraft rolled to left and crashed. Caused by attempted downwind takeoff.

B137--Pilot lost anti-torque control at hover and aircraft landed hard in turn. Loss of anti-torque control caused by failure of 90° gear box.

B218--Aircraft landed 400 feet short of lighted "T," struck tree, and rolled on right side during third landing attempt through fog. Major damage to tail rotor, tail boom, main rotor blades, transmission, and engine. Caused by lack of crew coordination as to who was in control of the aircraft. Shallow approach to "T" under marginal weather conditions caused pilot to lose sight of lighted "T" for short period, contributing to accident. Dense fog and darkness considered factors.

B268--Aircraft pitched down, yawed to right, rolled to left, and landed in shallow water on left skid and main rotor blades. Caused by failure of tail rotor hub assembly due to installation of unauthorized yoke through inadequate maintenance supervision and quality control.

B458--IP noted excessive rate of descent during practice autorotation, took control, flared, and pulled pitch. Tail boom struck ground. Caused by ex-

cessive flare and premature pitch application.

B653--Aircraft crashed in steep right low level turn. Test flight was assigned aviator who was inexperienced in test flight procedures. Aviator had not been adequately briefed on test flight procedures and five passengers were taken on the flight in violation of Army regulations.

B698--Aircraft landed tail low from practice night autorotation, bounced, severed tail boom, and came to rest inverted. Caused by tail low attitude and excessive forward speed.

B813--Aircraft flew into clouds and crashed on hillside approximately 2,400 feet above sea level. Pilot was killed and copilot seriously injured. Caused by attempting VFR flight in IFR weather. Contributing factors were: 1. Filing direct VFR flight plan into forecast instrument conditions. 2. Continued flight under weather conditions below authorized VFR minimums. 3. Low level flight under marginal weather conditions over mountainous terrain not familiar to pilots. 4. Flight into low ceiling and visibility conditions without appropriate reduction of airspeed. 5. Absence of IFR facilities at one station and inoperative VHF radio at another station influenced pilot's decision to proceed VFR. 6. False sense of urgency to complete mission contributed.

B818--Pilot attempted to land on city street after engine failure. Aircraft struck two trees and fell into street. Engine failure caused by fuel starvation due to unsecured fuel line quick disconnect.

B921--Aircraft took off, climbed to approximately 40 feet with rotor rpm decreasing, settled, bounced, and rolled over, coming to rest upright. Caused by failure to monitor rpm and abort takeoff prior to reaching critical rpm.

C058--Severe vibration was followed by loud bang and loss of tail rotor control at 900 feet. Air-



B813

craft hit on tail boom and right skid. Loss of tail rotor control caused by fatigue failure of bolt that connects pitch change link assembly to white tail rotor grip.

C197--Pilot heard loud noise after takeoff for maintenance test flight and aircraft veered to left. Engine rpm was normal, but rotor rpm dropped. Aircraft rolled on side during landing. Caused by reverse installation of engine to transmission short shaft.

C207--Two UH-1's collided and crashed during formation flight. Flight was performed without adequate supervision and control. Pilots were not familiar with directives concerning formation flying.

C255--Platoon leader notified Nr. 2 aircraft of intent to depart from diamond formation of four aircraft to make visual weather check, accelerated, and entered climbing right turn. Nr. 3 aircraft made right turn and collided with Nr. 2 aircraft. Both aircraft were destroyed and all occupants killed. Caused by misinterpretation of platoon leader's intention to depart formation. Platoon leader failed to make his intentions positively known to each aircraft. Nr. 3 aircraft was not equipped with UHF radio being used by platoon leader and crew was unaware of platoon leader's intention. Nr. 3 crew failed to report lack of UHF radio equipment.

C279--Pilot completed pinnacle landing on narrow ridge line and aircraft slid backwards. Tail rotor struck ground. Major damage to aircraft. Pilot sustained bruised back. Caused by improperly executed landing on inadequate pinnacle. Pinnacle surface was 2 feet 10 inches wide and aircraft was landed with CG positioned approximately 3 feet 4 inches aft of touchdown point. Soft clay surface crumbled under weight, allowing aircraft to pivot rearward.

C058



SELECTED MINOR ACCIDENT BRIEFS

07591--Aircraft landed hard on tail skid and heels of main skids during practice autorotation. Main rotor blade flexed into tail rotor drive shaft. Minor damage to drive shaft, tail rotor blade, aft cross tube, and skid heel. Caused by late and too rapid application of power for power recovery.

08442--Left front skid struck ground hard during practice touchdown autorotation, causing minor damage to left landing gear cap assembly. Caused by failure to level aircraft prior to touchdown.

A762--Engine failed and aircraft was autorotated. Main rotor blade flexed and struck tail boom during landing. Tail rotor drive severed and minor damage to tail boom. Engine failure caused by fatigue failure of four second stage compressor blades. Aircraft damage resulted from engine failure over rolling terrain unsuitable for forced landing.

C100--Aircraft landed hard during practice touchdown autorotation. Minor damage to tail cone, skids, and fuselage. Caused by high rate of descent, loss of rotor rpm, and landing short of intended touchdown point.

SELECTED INCIDENT BRIEFS

07019--Tail rotor struck tree during rappelling operation. Incident damage to tail rotor blades.

07023--Tail rotor struck tree during approach to confined area. Incident damage to tail rotor blades and short shaft.

07080--Aircraft landed hard from practice autorotation. Incident damage to aft cross tube. Caused by early pitch application. Density altitude (2,250 feet) considered a factor.

07138--Tail rotor blades did not turn during start. Caused by failure of "T" bolt in tail rotor Marman clamp.

07349--Main rotor blade struck tree during takeoff from confined area. Incident damage to main rotor blade.

07395--Excessive pitch application caused aircraft to rise after practice autorotation touchdown. Aircraft landed hard on second ground contact.

07438--Aircraft vibrated severely in flight. After landing, one blade cap found bowed due to accumulated ice in blade. Bowed blade cap and elongated screw holes required blade change.

07484--Synchronized elevator went into full nose down position at hover. Aircraft landed hard. Caused by failure of elevator aft push-pull tube.

07578--Main rotor blade flexed into and severed tail rotor drive shaft and fairing during practice autorotation touchdown.

07596--Right cargo door came off in flight. Caused by failure of roller retaining bracket (P/N 204-030-696-8).

07735--Troops dismounted aircraft from both sides at hover during transition load checkout. Aircraft hit hard in twisting motion. Incident damage to rear cross tube restraining strut.

07829--Photographer was opening door to take picture. Door separated from aircraft, struck left stabilizer, and fell in ocean. Incident damage to door track and left stabilizer. Door missing. Caused by failure of left cargo door track.

07886--Aircraft struck tree during left bank to avoid bird. Incident damage to plexiglas of lower left chin bubble.

07935--Left forward transmission cowling came off at 150 feet after takeoff. Top cowling latch was not fastened when cowling was found.

08032--Left transmission cowling came loose. Caused by failure to secure cowling.

08118--Right side transmission cowling blew off. Caused by failure to secure top forward locking latch.

08293--Rotor blade struck tree during formation departure from confined area at maximum gross weight and turbulent air. Incident damage to rotor blade.

08542--Main rotor blade struck power line during assault landing. Incident damage to main rotor blades, navigation light, and cargo door.

08677--Main rotor struck debris while aircraft was hovering at low speed to practice laying sand mines. Incident damage to blade.

A303--Aircraft landed hard from practice autorotation. Incident damage to cross tubes. Caused by excessive application of collective pitch too high above ground. IP leveled aircraft prior to touchdown.

A393--Tail boom skid tube struck ground during practice touchdown autorotation. Caused by failure to level aircraft prior to touchdown.

A486--Mirror came loose from mount and lodged against heater purge relay, causing short circuit. Incident damage to bulkhead between main fuel cell and right cargo compartment. Caused by backwards installation of retaining pin.

A659--Tail rotor blades struck wire at night while parking in tactical area. Incident damage to tail rotor blades.

A663--Left cargo door came off in flight and was struck by main and tail rotor blades. Caused by failure of center bottom roller assembly. Crewchief saw door coming loose, but was unable to hold it and prevent separation.

A676--Tail rotor blade struck wire while aircraft was hovering to parking area. Caused by failure to see and avoid wire.

A700--Infantry soldier walked under spinning

main rotor blade after engine was shut down. Main rotor blade struck soldier's radio antenna. Incident damage to blade.

A826--Aircraft flew into ground fog during night takeoff and ground contact was lost. Aircraft hit ground during attempt to regain contact. Incident damage to aft cross tube.

A855--Engine lost power during landing approach. Aircraft struck ground and turned 15° right. Incident damage to former at aft skid connecting point. Caused by plugged fuel manifold.

B013--Pylon struck ground during pinnacle approach. Caused by excessive nose high attitude.

B035--Tail rotor blades struck trees during confined area practice. Caused by failure to maintain clearance.

B064--Aircraft landed tail low from practice autorotation. Stinger struck ground and threw stone into tail rotor. Incident damage to tail rotor blade.

B131--Right cargo door came out at forward bottom edge and slid back six inches. Door was locked prior to takeoff. IP slipped aircraft, causing door to fall away without striking aircraft. Incident damage to door. 2408-14 carried write-up: "Right cargo door upper track worn."

B171--Engine was started with main rotor tie-down block still on blade. Blade made approximately two turns and tie-down block struck tail rotor. Incident damage to tail rotor blades.

B258--Aircraft rocked forward on front of skids and nose struck ground during practice touchdown autorotation. Incident damage to chin bubbles and radio compartment. Caused by over-correction for tail low touchdown.

B283--Skids settled into soft ground during practice touchdown autorotation and aircraft tipped forward. Incident damage to plexiglas.

B308--Aircraft, equipped with 48' rotor, was number 3 of formation of 4. Loud metallic sound was heard and aircraft pitched up and yawed with severe vibrations. IP took control and autorotated from 1,000 feet. Vibration level decreased during autorotation. Aircraft landed in wooded area, causing incident damage to main rotor blades and tail boom. Caused by materiel failure of retention strap assembly bushings. Half moon shaped strap bushings became unbonded and turned to open faced side, allowing main rotor blade grip and main rotor blade to shift outward. Approximately 35% of the internal wires which form the strap were broken or severed.

B354--Hot barrel from XM-6 kit was removed and placed on cargo compartment floor in flight. Apparently, a round cooked-off in the barrel. Bullet struck floor under left pilot's seat, continued forward and left the aircraft through the left chin bubble. Part of cartridge case struck crewchief on arm, causing abrasion.

B343--Tail rotor blades struck FM antenna when engine was started. Caused by backwards installation of antenna.

B512--Pilot heard loud noise during hovering

turn and landed immediately. FM antenna base separated from tail pylon and struck one tail rotor blade and one main rotor blade. Investigation showed that only three screws were installed in the FM antenna base. Two of the screws were the proper size and one screw was too small. None of the screws were completely tightened. Work had been interrupted at this point and the incomplete antenna installation was overlooked when work was resumed.

B651--Aircraft flew into ground during field site landing. Incident damage to skid toe and chin bubble. Caused by late application of collective pitch. Weather (moderate rain shower causing reduced visibility) considered factor.

B675--Right front skid shoe caught on PSP during attempted takeoff and aircraft began to tip to right. Pilot reduced pitch and aircraft turned left, spreading front cross tube. Incident damage to cross tube.

B935--Large bird with four foot wing spread struck right front windshield during formation flight at 100 feet and 90 knots. Incident damage to windshield and wiper motor shaft.

B975--IP started simulated forced landing in traffic pattern. Tail boom stinger struck ground during attempted power recovery. Aircraft was landed and incident damage to tail rotor blades found. Damage caused by foreign object striking blades. Caused by failure of fuel meter system (FSN 2915-740-6505) which caused delay in power response.

B995--Engine failed at 300 feet and aircraft was autorotated to cultivated paddy area, with incident damage to main rotor blades. Caused by fuel starvation due to unsecured quick disconnect.

C014--Right cargo door came unlocked and started to slide back after level off at 4,000 feet. IP started descent and door separated from aircraft and passed through main rotor blades. Lower roller with cargo door assembly found in track and not damaged. Machine screw (FSN 5305-815-5478) found with threads in good condition. Nut and cotter pin were missing. Suspect maintenance personnel failed to install cotter pin.

C077--Rotor rpm dropped and aircraft landed hard during zero airspeed check of anti-torque rotor controls. Caused by delayed power application.

C084--Landing approach was made between tied down UH-1B and CV-2 parked on ramp. Left turn was made during approach to ramp and main rotor blade struck tail rotor blade of parked UH-1B. Caused by failure to maintain clearance.

C131--Pilot heard loud hum from engine and autorotated to plowed field. Aircraft sank approximately six inches and tilted forward, striking left chin window. Aircraft history showed hot start at 100 hours and overspeed at 120 hours.

C308--Main rotor blades struck tail rotor blade of parked aircraft during hover from parking area. Incident damage to main rotor blades of hovering

aircraft and tail rotor blades of parked aircraft. Congested parking and traffic considered contributing factor.

C318--Aircraft veered right, then left while climbing through 2,000 feet at 70 knots. Pilot felt vibration through pedals and recognized anti-torque failure. Pilot made power descent to approximately 50 feet, then applied collective. Aircraft rotated right and touched down in slow right turn. Incident damage to tail boom, chin bubble, and cross head assembly. Caused by loss of control nut with washer (FSN 5310-176-8109, item 4, fig. 8-14, page 8-25, TM 55-1520-211-20). Suspect nut was not properly torqued.

C331--Aircraft settled through during demonstration touchdown autorotation and landed hard. Caused by IP pulling pitch too high.

SELECTED FORCED LANDING BRIEFS

07013--Pilot heard engine noise during test flight. De-icing light came on. Blades found disintegrated from 5th stage compressor rotor assembly.

07077--Low engine oil pressure warning light came on. Caused by ruptured oil pressure line.

07184--Engine tachometer generator failed in flight. Pilot executed normal landing with power.

07203--Fire detection lights came on in flight. Caused by malfunction of fire detection light system.

07443--Engine surged to 7,000 rpm and grinding vibrating noise was heard in flight. Engine rpm returned to 6,600 and engine failed. Aircraft was autorotated to landing. Caused by N1 turbine failure, apparently due to previous hot start.

07527--Loud bang heard from engine at 15 foot hover during test flight. Engine lost power and aircraft was autorotated. Caused by failure of compressor rotor disc.

07755--Restriction of throttle bellcrank assembly caused insufficient power to maintain rotor rpm during power recovery from simulated forced landing. Caused by 2x4 wooden block left unsecured in baggage compartment.

07783--Engine flamed out during GCA training approach. Caused by fuel exhaustion.

07843--Engine oil pressure lost in flight. Caused by failure of oil pump. Oil pump failure caused planetary system in engine to lock and fail.

07883--Engine oil pressure lost in flight. Caused by failure of oil pump (FSN 2995-860-8575).

07934--Loud banging noises heard and compressor stalled as power was applied for power recovery from practice autorotation. Engine failed and autorotation was continued to ground. EGT read 800°C after landing. Caused by sand erosion of compressor section.

07972--Aircraft vibrated severely in flight and autorotative landing was made. Caused by materiel failure of ring gear (P/N 1-030-007-01).

07977--Aircraft vibrated in flight. Caused by burned out bearing (Nr. 3) in tail rotor drive shaft hanger.

08318--Transmission oil pressure lost in flight. Caused by foreign matter wedged in oil drain valve.

08387--High frequency vibration noted and oil temperature rose rapidly. Aircraft was landed with power and engine oil temperature reached 93° at touchdown. Caused by failure of engine oil turbo blower.

08434--Engine oil pressure dropped to 12-15 psi and emergency warning light came on in flight. Caused by failure of oil pump.

08527--Tail rotor failed during hovering turns. Caused by failure to install tail rotor retaining nut during 4th echelon maintenance.

A105--Tail rotor drive shaft quill failed and aircraft made violent right turn at 2,300 feet. Pilot autorotated. Quill failure caused by installation of aluminum washer (AN 960-A516) in place of required steel washer (AN 960-516) on tail rotor drive shaft quill.

A211--Engine failed during landing from hover. Caused by fuel starvation from loose fuel line at output side of fuel filter.

A230--Severe high frequency vibration started in flight. Caused by failure of Nr. 3 drive shaft hanger bearing (FSN 1560-766-8578).

A429--Engine failed during simulated forced landing. Caused by improperly adjusted idle stop and solenoid, which allowed stop to override plunger.

A496--Engine failed. Aircraft was autorotated. Caused by improperly attached quick disconnect of servo overflow line from N2 governor to fuel tank.

A829--Engine failed in flight. Caused by fatigue failure of two first stage compressor blades.

A918--Engine flamed out during landing approach. Caused by fuel starvation due to contaminated fuel blocking fuel filter.

B039--Engine failed. IP took control and autorotated. Caused by fuel starvation. Coupling half of quick disconnect was found loose at main fuel filter. Suspect coupling half was improperly secured.

B222--Engine stopped during demonstration autorotation. IP continued autorotation to ground. Solenoid assembly (FSN 5945-768-2781) slipped down, allowing throttle arm to override solenoid plunger and go into ground idle. Caused by maladjusted solenoid or slippage of solenoid.

B231--Engine rpm decreased to 6,000 during pinnacle approach. Caused by governor overspeed.

B427--IP heard loud noise and engine failed in flight. Caused by fatigue failure of second stage compressor blade.

B485--Engine failed in flight. Caused by malfunction of fuel control unit.

B636--Engine oil pressure fluctuated rapidly

and dropped in flight. Aircraft was landed with power. Oil pressure at shutdown was 20 psi. Caused by failure of O ring seal on main oil screen. Seal was crimped during installation.

B696--Engine failed in flight. Caused by failure of Nr. 3 and 4 engine bearings.

B697--Loud high frequency noise heard in flight, followed by loss of hydraulic pressure. Caused by loose hydraulic lines.

B726--Sudden power loss noted in flight. Caused by failure of splined coupling on finned end of engine to transmission drive shaft.

B757--N1 and N2 tachometers dropped to zero. Aircraft was autorotated. Caused by failure of engine tachometer generator.

B915--Engine failed during pickup to hover. Male splines of engine drive shaft rode over on female splines of engine drive shaft, causing misalignment and whipping effect which caused adaptor curvic coupling shaft to shear. Engine drive shaft splines indicated excessive heat and burn out of grease in coupling.

C036--Engine surged to 6700-6750 rpm at five foot hover and smoke was seen in cockpit. Bluish white smoke seen coming from engine exhaust by witnesses. Suspect failure of Nr. 3 or Nr. 4 main bearing.

C285--Loud whining noise heard in right turn at 200 feet and rotor rpm began decreasing. Engine rpm remained normal. Pilot partially decreased pitch and landed. Spring (P/N 204-040-183-1) backed out of tang hole in nut (P/N 204-040-184-1), allowing nut to back out of drive shaft (P/N 204-040-626-3). This allowed coupling (P/N 204-040-687-3) to slip and damage splines, causing failure of coupling.

C302--Engine failed. Aircraft was autorotated. Caused by failure to secure fuel line quick disconnect.

SELECTED PRECAUTIONARY LANDING BRIEFS

07274--Unusual odor smelled in flight. Caused by faulty main generator.

07340--Oil pressure dropped. Caused by leak in Nr. 2 power turbine seal.

07406--Fuel pressure dropped three pounds in flight. Caused by failure of fuel boost pump.

07444--Loss of hydraulic control in cyclic system noted in flight. Control loss progressed until aircraft was landed. Caused by leak in right cyclic servo due to worn gasket.

07478--Unusual control pressure noted. Caused by missing pin (FSN 5315-081-7018) which holds cyclic centering spring to swashplate assembly.

07481--Oil pressure warning light came on. Oil pressure gauge showed 10 psi drop during precau-

tionary landing. Caused by failure of oil pressure transmission switch (FSN 5930-778-2780).

07485--Lateral cyclic control lost. Caused by malfunction of hydraulic pump (FSN 1650-702-3559).

07525--Hydraulic servo pressure lost in flight. Caused by malfunction of left internal servo (FSN 1560-776-7053).

07567--Windshield wiper motor smoked in flight. Caused by short in motor converter assembly (FSN 1680-778-6360).

07616--Transmission oil pressure dropped 10 psi and oil temperature rose in flight. Caused by low oil viscosity due to age.

07675--Pilot noted stiff cyclic control in flight. Caused by ruptured servo hydraulic valve O ring.

07691--Loud shrill noise heard and pungent odor detected. Rotor seized after engine was shut down. Suspect failure of mast bearing.

07718--Gas producer dropped to 60% at hover and engine would not respond to throttle movements. Caused by faulty fuel control (FSN 2915-020-6541).

07748--Oil noted on windshield in level flight. Caused by oil leakage in tube assembly (P/N 204-040-375-1), right side top case of main transmission at elbow.

07779--Cyclic control binding excessively in flight. Caused by magnetic brake malfunction.

07936--Transmission oil pressure dropped. Caused by installation of oil jet assembly (FSN 1560-898-6883) in transmission without preformed packing (FSN 530-542-1421 and FSN 530-542-1420). Reference TM 55-1520-211-20P, Figure 154-76, 78, and 79.

07989--Oil pressure fluctuated in flight. Torque pressure oil line T-fitting ruptured.

08009--Cyclic control noted binding in flight. Caused by maladjusted servo.

08016--Engine oil pressure decreased and oil temperature increased. After landing, check showed loss of engine oil. Caused by materiel failure of Nr. 3 carbon-gap seal (FSN 5330-144-9735). Bolts on axial compressor housing found loose. Bolts were safetied, but not tight.

08066--Fuel odor noted in flight. Caused by cracked fuel manifold (FSN 2915-766-8657).

08106--Oil pressure warning light came on. Caused by defective cannon plug.

08119--Fire warning light came on during take-off. Caused by defective left hand fire warning element.

08174--Fuel fumes noted in flight. Caused by fuel filter drain valve stuck in open position.

08289--Strange odor detected in cockpit and controls became sluggish in flight. Master caution and hydraulic low pressure warning light came on. Caused by ruptured hose assembly (FSN 4720-690-3934).

08325--Crew noted odor of smoke and a drop in transmission oil pressure. Caused by transmission oil pressure line chafing and rupturing.

08357--Fuel fumes noted and fuel was seen entering cargo compartment through left cargo door. Caused by hairline crack in main fuel manifold.

08359--Transmission oil pressure fluctuated and dropped. Caused by failure to properly install "O" ring in oil filter during intermediate inspection.

08368--Whining noise heard. Hydraulic warning light flickered on and off with intermittent loss of flight control boost during descent for landing. Caused by failure of hydraulic cyclic flight control upper subassembly seal of left cylinder assembly (FSN 1560-675-1223).

08424--Severe vibration noted in flight. Caused by failure of generator bearings (FSN 6115-725-1790).

08568--Engine made popping noise in flight. Caused by maladjusted bleed band and fuel control.

08569--Engine made popping noise and lost power in flight. Caused by compressor blade erosion and foreign object damage.

08588--Erratic transmission oil pressure readings noted in flight. Caused by leaking oil filter gasket.

08640--Grinding noise heard in flight. Caused by seizure of transmission DC generator.

A118--Loud banging noise heard from engine during landing. Caused by compressor stall.

A120--Servo failed during test flight. Caused by failure of right lateral hydraulic cylinder.

A135--Compressor stalled during hover. Caused by maladjusted bleed band and fuel control.

A144--Compressor stalled during recovery from deceleration maneuver. Caused by defective air bleed valve and maladjusted bleed band.

A166--Pilot noted unusual odor in flight compartment during flight. Hydraulic sight gage for flight controls indicated red and controls became stiff. Caused by left lateral servo line (FSN 4730-966-7490) rupturing due to chafing.

A186--Master warning light came on in flight. Caused by broken master warning light ground wire at terminal.

A441--Engine oil pressure dropped in flight. Caused by cracked oil pressure transmitter union.

A569--Medium frequency vibration noted in flight. Caused by failure of Nr. 1 tail rotor drive shaft hanger bearing.

A583--Chatter in cyclic control noted in flight. Caused by failure of lateral servos.

A599--Strong odor detected in cockpit in flight. Caused by failure of starter generator.

A661--Unusual noise heard from transmission area. Caused by blown right servo seals.

A684--Grinding noise heard from transmission area during night training flight. Brass filings and pieces found on transmission oil screen. Suspect mast bearing failure.

A685--Engine oil pressure and torque pressure lost in flight. Caused by fatigue failure of external oil line to Nr. 2 bearing.

A757--Pilot noted tendency of aircraft nose to dip during flight. Caused by materiel failure of scissors lever bearing (FSN 3110-142-4472).

B012--Engine oil pressure dropped. Caused by failure of "T" fitting at transmitter.

B286--Electrical failure in flight. Caused by missing left wrapping for wiring bundle at station 36. Electrical short traced to wiring bundle.

B357--Engine oil pressure lost during landing approach. Metal found in filter. Caused by improper installation of screw thread insert (helicoil) in accessory gear box where Nr. 3 and Nr. 4 bearing scavenger line T tube is inserted. Piece of helicoil was found in filter and in the engine oil pump, which caused pump shaft to shear.

B526--Transmission oil pressure fluctuated to zero and back to normal. Caused by broken transmission filter gasket.

B539--Excessive feedback noted in cyclic. Hydraulic pressure light did not come on. Feedback became severe when servo switch was turned off. Servo switch was turned on and feedback decreased except for small amount pushing cyclic to left prior to landing. Approximately two teaspoons of water found in each servo. Irreversible valve was set at 9/1000 and maximum was 4/1000.

B732--Fuel pressure warning light came on in flight. Caused by failure of fuel pressure deferential switch.

B773--Engine exceeded red line after landing with governor in emergency position from power approach. Caused by overcontrol of throttle.

B914--Cyclic started to bind in flight. Caused by malfunction of magnetic brake on force trim.

C065--Pilot felt high frequency vibration, landed, found hole in tail rotor drive shaft cover and disintegrated Nr. 3 hanger bearing. Caused by failure of annular ball bearing.

C094--Hydraulic boost lost in flight. Aircraft was landed with power. Caused by leaking hydraulic seal. Leak was previously noted but aircraft was cleared for flight.

C124--Engine made growling noise at hover and emitted burning fuel which set grass afire. Metal found on magnetic plug. Caused by failure of one second stage compressor blade.

C143--Fuel noted entering cockpit. Pilot declared emergency and landed. Caused by improperly installed auxiliary fuel tank filler cap.

C281--Oil temperature rose. Caused by seizure of turbo blower bearings.

C291--Hydraulic pressure lost. Caused by loose nut on tube nipple of multiple connector on safety relief valve.

C304--Aircraft tended to tuck under at hover and pilot reported collective bounce at touchdown. Caused by loose right lateral servo. Nut over lock rod end was safetied, but loose.

C322--Excessive loss of hydraulic fluid noted. Caused by leak in right lateral irreversible valve.

C336--Transmission oil pressure dropped. Caused by malfunction of oil pressure transmitter.

SELECTED ACCIDENT INJURY BRIEFS

08331--A UH-1D, with a pilot, copilot, crewchief, and seven passengers (troops), made a confined area takeoff over a barrier of 70-75 foot trees. RPM was lost during the climb to treetop level and the aircraft was placed in level attitude as it settled into the trees. The main rotor blades struck several trees and the aircraft crashed in a nose down, right bank attitude. The aircraft was damaged beyond economical repair at a cost of \$206,632.

Cause: Improper confined area takeoff technique. Pilot failed to use all available space in order to reduce the angle of climb necessary to clear the barrier of trees.

Injuries: The copilot, crewchief, and two passengers sustained major injuries. The pilot and four passengers sustained minor injuries. One passenger escaped injury.

The pilot sustained lacerations of his face and right knee. His helmet visor was shattered as his helmet came off and the pieces were probably responsible for his face lacerations. His helmet came off because of a defective chin strap buckle. The laceration of his right knee was most likely caused by the edge of the instrument panel.

The copilot sustained a lacerated left leg and multiple abrasions and contusions. He did not remember how his injuries occurred, but the flight surgeon stated that it was worth noting that both the pilot and copilot sustained leg injuries and, in both cases, the leg involved was the one located near the instrument panel.

The crewchief sustained three fractured bones and multiple lacerations to his head and face. Two of the fractures and the multiple lacerations were caused by an unsecured M-14 rifle which struck him during the crash. The other fracture was caused by contact with the back of the pilot seat. The flight surgeon stated that the injuries caused by the M-14 rifle would be less likely to occur if UH-1 aircraft used for troop lift missions were equipped with straps (attached to the floor) designed for tying down weapons.

One passenger sustained two fractured ribs, a lacerated elbow, and multiple contusions. The cause of his injuries was unknown, but the flight surgeon stated that passengers would be more fully protected from injury if they were provided with a shoulder harness and reel.

One passenger sustained a scalp laceration and concussion. The flight surgeon stated that this



passenger was probably not wearing his helmet.

One passenger sustained a leg contusion from contact with the edge of the troop seat.

Another passenger had a chest contusion, with the cause listed as unknown.

Of the two other injured passengers, one had a head contusion, and the other had multiple lacerations of the face and chin. The cause for these injuries was also listed as unknown.

One troop seat collapsed and one troop seat belt came loose due to the force of the crash.

It was recommended by the aircraft accident investigation board and USABAAR that action be taken to improve the items which resulted in these injuries.

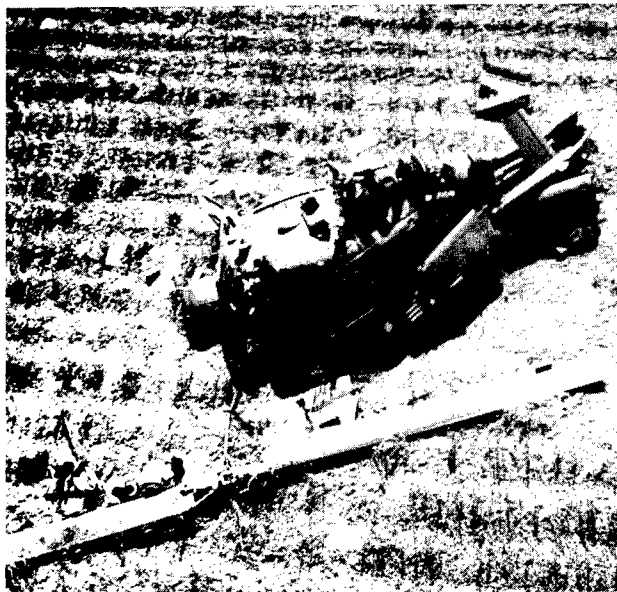
A796--A UH-1B was the lead aircraft of a flight of two returning from a reconnaissance flight at approximately 200 feet. The engine failed and the pilot made a right turn toward the nearest open field. He attempted a forced landing in the open field, but rotor rpm had decayed to a point where the aircraft

crashed in level attitude at approximately 50 knots with an estimated vertical G force of 27.6. The aircraft was destroyed beyond economical repair at a cost of \$193,648.

Cause: Engine failure was caused by fatigue failure of a second stage compressor blade. Cause of the fatigue failure of the blade could not be fully determined, but it was suspected that partial blockage of the inlet guide vanes was a contributing factor. The engine failure took place at a low altitude over a wooded area and the pilot apparently failed to realize that he no longer had full engine power and that the rotor rpm was dropping. As a result, he did not maintain sufficient rotor rpm to cushion the landing.

Injuries: Of the three crewmen aboard at the time of the accident, the pilot sustained fatal injuries, and the copilot and crewchief sustained major injuries.

The pilot's injuries consisted of a ruptured aorta and skull fracture. The aortic rupture was caused



by either the force of the seat belt against his abdomen due to horizontal G force or by his striking the cyclic stick with his abdomen after the seat belt broke. The skull fracture was caused by his head striking the cyclic stick or by the shoulder harness yoke, which was still functional, sliding up the abdomen and thorax and engaging his chin as the pilot's body left the seat and was then thrown forcefully back into the seat head first. His helmet came off during the sequence of the accident due to deceleration forces. The seat belt broke in or near the left cinch buckle, leaving the latch closed with the distal eyes of the shoulder harness within the latch structure, and with the right half of the seat belt anchored to the seat.

The copilot sustained a compression fracture to a vertebra, a fractured ankle, a fractured foot bone, a laceration on his left leg, a bruised right eye, brain concussion, and bruised waist. The vertebral fracture and brain concussion were caused by vertical G forces incident to deceleration. The fractures of his ankle and foot bone and leg laceration were caused by his legs being ejected through the right chin bubble, with the right leg being thrown through the bubble, flexed at the knee, and lying along the right outside portion of the aircraft. His bruised right eye was caused by his head striking the rocket sight and his bruised waist was caused by the seat belt which restrained him from horizontal G forces.

The crewchief sustained a vertebral fracture and brain concussion from the vertical G forces incident to deceleration. He had an abrasion on his left buttock, caused by the broken end of the left leg of the rear troop seat. He also had a bruised waist, caused by the restraint of his seat belt during deceleration. His head went forward during deceleration and struck his knees, causing bruises to his eyes and nose.

The flight surgeon member of the accident investigation board recommended:

Periodic testing of seat belt tensile strength with a mechanical device.

Design of a helmet which will not leave the aviator's head at deceleration.

Replacement of the console XM-3 rocket sight with a hinged overhead sight mount.

Flying with safety belts cinched tight.

A565—A UH-1B test pilot was in cruise flight at 1,500 feet when he felt a vibration so severe that he thought the aircraft had been hit by either another aircraft or a large bird. This was followed by severe buffeting in the area of the tail rotor. The pilot thought he had tail rotor failure and began a gradual descent, with an airspeed of approximately 55 knots. As the aircraft neared his intended landing site, the pilot elected to make a downwind leg and land to the northwest instead of making a straight-in approach due to other traffic taking off. Over the edge of the field on the downwind leg, the aircraft started to turn to the right. At that time the airspeed was 55 knots, altitude approximately 200 feet, and the pilot was using power. The turning rate increased and the aircraft started to descend rapidly in a nose low attitude. Forward speed was dissipated as a result of the sudden right turn, and the aircraft appeared to descend vertically. The pilot immediately entered autorotation, saw that his rpm was low, and increased power in an attempt to regain rotor rpm. He then reduced engine power, applied full collective pitch, and the aircraft hit the ground very hard in a level attitude.

Cause: The primary cause of this accident was found to be tail rotor failure which resulted when the firewall brace assembly struck the drive shaft while enmeshed with a tail rotor blade. Contributing factors listed by the board were:

Failure to install firewall brace assembly locking pins.

Failure to inspect pin locking device for proper operation.

Failure to lubricate locking pins periodically.

Failure to install engine cowlings prior to test flight.

Failure of pilot to immediately enter autorotation and land. The board stated that almost the entire area below the flight path was suitable for a safe emergency landing and tail rotor failure did not occur immediately.

Inadvertent loss of airspeed allowed the aircraft to start turning after the tail rotor failed.

Injuries: The pilot sustained compression vertebrae fractures and a laceration on his right forehead and cheek. The compression fractures to his vertebrae were caused by sudden and severe deceleration forces. The laceration to his right forehead and cheek were probably caused by a loose helmet and microphone.

The crewchief sustained a compression fracture to one vertebra due to the sudden and severe deceleration forces.

TECHNICAL BULLETINS AND MODIFICATION WORK ORDERS

NUMBER	DATE	TITLE CHANGES
MWO 55-1520-208-34/22	20 Feb 64	Installation of transmission oil cooler
TB 55-1520-210-10/1	1 Jul 64	Operating performance and loading data, UH-1D with 48' blades
TB 55-1520-210-20/1	30 Mar 65	Inspection of UH-1D tail boom lower attaching bolts
TB 55-1500-200-20/4	18 May 65	Inspection of transmission oil pump (P/N 8760-UH-1A/B/D)
MWO 55-1520-210-20/2	4 Nov 64	Modification of litter support straps for clearance of cargo doorway
-20/4	15 Jul 64	Addition of oil hose to transmission to provide increased lubrication to the mast bearing
-20/5	30 Sep 64	Replacement of battery sump jar with vent tube assembly
-20/6	6 Apr 65	Relocation of engine de-icer switch
-20/7	16 Sep 64	Replacement of engine bleed air hose and adapter
-20/8	2 Nov 64	Installation of M-6 adapter kit
-20/9		One wheel adapter for loading UH-1D aircraft in transport aircraft
-20/10	6 May 65	Modification of aircraft to incorporate 6 psi governor vent line check valve
-20/11		Gravity type hydraulic system
-20/12		Installation of XM3 adapter kit
-30/2	24 Sep 65	Modification of aircraft to accept armor protection kit (177510) UH-1D
-30/3	17 Jun 65	Alternate battery location to aft fuselage (UH-1D)
-34/1	21 Jul 64	48' rotor blade retrofit installation
-34/2	28 Apr 65	Complete provisions for AN/ARC-102
-34/3	7 Nov 64	Installation of oil jet to the mast assembly
-34/3	25 Mar 65	Airframe universal installation for incorporation of fuel filter modification
-34/5		Modification of tail rotor hub assembly
-34/6	22 Sep 64	Installation of windshield wiper for copilot
-34/7		AC receptacle for T-53 engine vibration test equipment
-34/8		Modification instructions for updating scissors assembly 204-011-406-5 to scissors assembly 204-011-406-9

NUMBER	DATE	TITLE CHANGES
-34/9		Provisions for T366 VHF radio (UH-1D)
MWO 55-1520-211-20/14	12 Oct 64	Installation of leading edge shield on synchronized elevator
-20/17	25 Aug 64	Structural attachment provisions for parachute anchor line cable
-20/18	27 Nov 64	Installation of parachute anchor line cable
-20/21	15 Jul 64	Addition of oil hose to transmission to provide increased lubrication to the mast bearing
-20/22		Installation of XM-22 adapter kit
-20/23	18 Mar 65	Replacement of battery sump jar with vent tube assembly
-20/24	21 Aug 64	Replacement of engine bleed air hose and adapter
-20/25	20 May 64	Installation of AN/ASW-12 adapter kit (204-706-047-1) on UH-1B aircraft
-20/26		One wheel adapter for loading UH-1B aircraft into transport aircraft
-20/27		Modification of litter rack installation (204-070-068-1, -3 and -5)
-20/28	6 May 65	Modification of aircraft to incorporate 6 psi governor vent line check valve
-20/29	7 May 65	Installation of 50 gallon extended range auxiliary fuel tank kit
-34/2	2 Dec 63	Installation of rpm limit warning device
-34/9	17 Mar 64	Transmission oil filter assembly
-34/15	25 Nov 63	Adapter kit, external stores (fuel tank)
-34/20	22 Dec 64	Airframe universal installation for incorporation of fuel filter modification
-34/21	12 Oct 64	Modification of rear view mirror for quick removal
-34/23	1 Apr 65	Complete provisions for AN/ARC-102 radio
-34/25	21 Jul 64	Installation of oil jet to the mast assembly
-34/26	30 Sep 64	Incorporation of a mixing valve in the hot air distribution system
-34/27	30 Sep 64	Modification and sealing of main rotor blades 204-011-001-15
-34/28	2 Sep 64	Installation of tail boom attachment fitting
-34/29	15 Jul 64	Installation of windshield wiper for copilot
-34/30		AC receptacle for T53 engine vibration test equipment
-34/31		Location of center line
-34/32	18 May 65	Installation of XM-14 armament kit
-34/33	20 Jul 65	Installation of M5 grenade launcher

NUMBER	DATE	TITLE CHANGES
-34/34	17 Dec 64	Modification to provide instruction for installation of scissors assembly grease fittings
-34/35	15 Jan 65	Provisions for T366 UHF radio
-34/36		Modification of UH-1A aircraft to trainer configuration
-34/37		Modification instructions for updating scissors assembly 204-011-406-5 to scissors assembly 204-011-406-9
-34/38	18 Oct 65	Modification of UH-1B aircraft and installation of Decca Navigation System
-40/1	10 Jun 65	Installation of tail boom attachment fittings (UH-1B)
TB 55-1520-211-20/1	30 Mar 65	Inspection of main fuel regulator cover hold down screws
MWO 55-2800-200-20/1	6 Aug 63	Replacement of ignition exciter units
-30/1		Provisions to meter starting fuel
-30/2		Incorporation of new fuel vaporizer assembly T-53-L-7/11 engines
-30/3		New configuration turbine blade retention pins
-30/4		Field replacement blades for the 2nd stage turbine rotor T53-L-3 through L-11 engines
-30/5		Retrofit of a new combustor liner on all T53 engines
-30/6		Introduction of new configuration inline valve for use on T53-L-3/5/7/9/9A/11 engines
-40/1	15 Aug 63	Rework of main lubricating filter assembly (SP933) on T53 engines
-50/1	18 Apr 63	Modification of 2nd stage turbine nozzle (T53 engine)
-50/2	15 Aug 63	Modification of 1st stage turbine blade wedges
-50/4	1 Oct 63	Incorporation of intershaft seal and modified assembly gear box (T53-L-3/5 engine)
-50/5	3 Jun 63	Modification of compressor housing assembly (L-3/5)
-50/6		Modification of installation of hot air valve (P/N 26130071) and installation of improved hot air valve (P/N 26230027)
-50/7		Incorporation of improved ring seal (1-030-016-03) on output shaft bearing spacer
-50/8		Incorporation of scoopless combustor
-50/9		Rework of dual element pump (013973-020-01) to (018973-020-04) configuration (L-3/5/9 engines)
-50/10		Rework of carrier and gear assembly bearing liner sleeve on T53-L-1/1A5/9/9A engines
-50/11		Replacement of position 2 aft control gap seal with a positive contact seal

NUMBER	DATE	TITLE CHANGES
-50/12	13 Feb 64	Modification of the fuel vaporizer assembly to incorporate aluminum sleeves (T53-L-1/1A/3/5/9/9A engines)
MWO 55-2840-201-30/2		Retrofit of T53-L-3 engines with T53-L-7 helical reduction gearing
MWO 55-2840-202-50/1	13 Feb 64	Replacement of rubber quad ring seal with cast iron rings in torque-meter assemblies of T53-L-5 engines
MWO 55-2840-210-30/1	20 Nov 64	Replacement of low pressure fuel lines on T53-L-7 (OV-1)
MWO 55-2840-218-30/2	9 Apr 64	Replacement of the 1st stage nozzle retaining bolts and nuts, the Nr. 2 bearing housing and seal retainer tabwashers
-50/3		Installation of a flexible bearing support for the N1 rotor assembly
MWO 55-2915-253-50/1		Modification of manual control shaft (73321) and CAM (75140) on turbine overspeed governor
-50/2		Installation of an index plate (76064) on governor assemblies 87000-B4 and 87000-B5

APPROVED ENGINEERING CHANGE PROPOSALS

1963

AIRFRAME

UH-1B-95 Improved Servo Cylinder Seals
 UH-1B-127 Internal Provisions for External Fuel Tanks
 UH-1B-199 One-Man Troop Seat Modification
 UH-1D-136 Additional Self-Sealing Material for Fuel Cells
 UH-1D-137 Internal Provisions for External Fuel Cells
 UH-1B-171 Incorporation of Vibration Check Equipment

1964

UH-1B-121 Retrofit Replacement T/R Drive Shaft Clamps
 UH-1B-160 Incorporation of "Bell" Model 540 Rotor
 UH-1B-140 One Wheel Adapter for Ground Handling Wheels
 UH-1B-161 Increased Fuel Capacity
 UH-1B-168 Fuel Control Governor Bleed Vent Valve
 UH-1B-173 Delete Motorized Shut Off Valve
 UH-1D-170 Gravity Type Hydraulic Reservoir
 UH-1-180 4 Pinion Planetary Main Transmission
 UH-1D-182 Less Expensive Fuel Vent Manifold
 UH-1D-183 Less Expensive T/R Drive Shaft Fireshield

1965

UH-1B/D/E-192 Remove Engine Mount Safety Leg
 UH-1D/F-197 Improved M/R Hub Retention Strap
 UH-1D-200 Less Expensive Power Lever Bellcranks
 UH-1D-206 Less Expensive Door Assemblies
 UH-1D-207 Less Expensive Stanchion Assembly
 UH-1D-211 Aft Battery Location
 UH-1B/D-212 Provisions for APX-44 Transponder and T-366 VHF Radio
 UH-1B/E-214 Improved Tail Boom Longeron
 UH-1D-246 Less Expensive Fuel Sump Assembly
 UH-1B/D-253E Cargo Door Retainers

1965

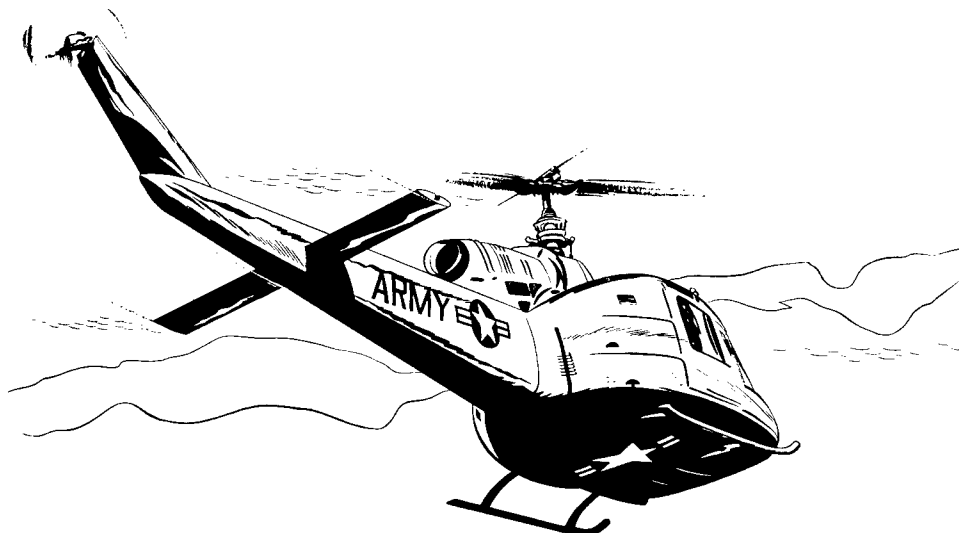
AIRFRAME

UH-1B/D-258E	Swashplate Lugs
UH-1B/D-215	Less Expensive Instrument Panel
UH-1B/D-243	C-1611 Interphones
UH-1B/D-231	Fuel Boost Pump Noise Filter
UH-1A/B/D-189	Modify Fuel Vent System
UH-1A/D/B-196	Transmission Chip Detector
UH-1B/D-217	Servo Cylinder Boots
UH-1D-218	Access Door Assembly
UH-1D-219	Cowl Hold Open Rod
UH-1D-220	Oil Cap Adapter
UH-1B/D-223	Windshield Wiper Motor Guard
UH-1B/D-203	Quick Disconnect-EGT Line
UH-1B/D-222	Internal Personnel Hoist

1965

ENGINE

LY-GT-87	New Engine Data Plate
LY-GT-88	New Turbine Blade Retention Pins
LY-GT-89	New Retainer Assembly in Power Turbine Nozzle and Cylinder Assembly
LY-GT-90	New Shim Forward of Nr. 3 Bearing Impeller
LY-GT-91	Revised Fuel Control Deceleration Schedule
LY-GT-92	Field Replacement N2 Turbine Blades
LY-GT-93	New Combustor Liner with Improved Studs
LY-GT-97	New Configuration Inline Valve
LY-GT-102	Improved Main Reduction Gearing for -11 Engine
LY-GT-104	Torque Reduction of MPRU Cover Screws on Main Fuel Control - All Engines
LY-GT-105	Stainless Steel Compressor Blades -11 Engine
LY-GT-106	Improved Air Bleed Actuator Assembly -11 Engine
LY-GT-107	Conversion of T53-L-3 to L-7 Configuration
LY-GT-35	Improved Planet Gear Bearing Clamp
LY-GT-109	New N1 Nozzle with Integrally Cast Vanes and Inner and Outer Shrouds
LY-GT-111	New Liner Assembly with Improved Vaporizer Seals
LY-GT-112	Large Spline Output Shaft on -11A Engines



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