

National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594



ANC24LA017

AIRWORTHINESS

Group Chair's Factual Report

August 6, 2025

A ACCIDENT

Location: Kekaha, HI
Date: February 27, 2024
Time: 1330 Hawaii-Aleutian standard time
Helicopter: MD Helicopters 369E, registration N633JH

B AIRWORTHINESS GROUP

Group Chair	Chihoon Shin National Transportation Safety Board Washington, District of Columbia
Group Member	Jeff Chang Federal Aviation Administration Los Angeles, California
Group Member	Casey Riemer Jack Harter Helicopters Lihue, Hawaii
Group Member	Mac Johnson MD Helicopters Mesa, Arizona
Group Member	Dave Riser Rolls-Royce Indianapolis, Indiana

C SUMMARY

On February 27, 2024, about 1330 Hawaii-Aleutian standard time, an MD Helicopter 369E, N633JH, was substantially damaged when it was involved in an accident on a remote beach about 14 miles north of Kekaha, Hawaii, on the island of Kauai. The pilot and three passengers sustained minor injuries, and one passenger sustained serious injuries. The helicopter was operated as a Title 14 *Code of Federal Regulations* Part 135 sightseeing flight.

According to the pilot, while conducting a doors-off, helicopter sightseeing flight near the northern shoreline on the island of Kauai, the pilot said he initially smelled smoke and he immediately began flying to an area known as Kalalau Beach, which is the operator's predetermined helicopter emergency landing zone along the

prearranged tour route. He reported that very shortly thereafter, he heard a loud “pop”, followed by the engine out aural warning tone. The pilot immediately lowered the collective control and entered an autorotation to land at a nearby smaller, remote beach, known as Honopu Beach, as an emergency landing site. As the helicopter touched down on the sand-covered beach, it rocked forward and nosed down into the sand. The helicopter then rolled to the right and came to rest on its side which resulted in substantial damage to the tail boom, fuselage, and main rotor system.

The helicopter wreckage was subsequently recovered from the remote beach site and transported to a secured hangar in Lihue, Hawaii (HI). An initial Federal Aviation Administration postaccident examination revealed that the overrunning clutch and engine-to-transmission driveshaft were fractured.

D DETAILS OF THE INVESTIGATION

1.0 Helicopter Information

1.1 Helicopter Description

The MD Helicopters 369E has a five-bladed, fully-articulated main rotor system that provides helicopter lift and thrust. The 369E has a two-bladed teetering tail rotor system that provides lateral thrust to counteract main rotor torque and for directional control of the helicopter. The helicopter is equipped with one Rolls-Royce 250-C20B turboshaft engine. The helicopter is type certificated under FAA type certificate data sheet No. H3WE.

All left, right, up, and down orientations as well as clock positions referenced in this report are in the aft-looking-forward frame of reference unless otherwise specified.

1.2 Overrunning Clutch Description

On the 369-series helicopter, the overrunning clutch assembly is a sprag-type clutch that is installed between the power output pad of the engine gearbox and the engine-to-transmission (Kaflex) driveshaft. During normal engine operation, the clutch transmits power from the engine to the Kaflex driveshaft. The clutch allows the rotor system to disengage from the engine in the event of a loss of engine power or during an autorotation, such that rotor speed (N_r) can be greater than the engine power turbine speed (N_2).

According to the MD Helicopters 369-series maintenance manual No. CSP-HMI-2, the overrunning clutch subassembly can be replaced in lieu of replacing its next higher level assembly, the overrunning clutch assembly. Major components of the clutch subassembly include the outer race, inner race, sprag assembly, forward

and aft sprag bearings, and the output bearing (**figure 1**). Adding the clutch housing and retaining ring to the clutch subassembly creates the next higher level assembly, the overrunning clutch assembly.

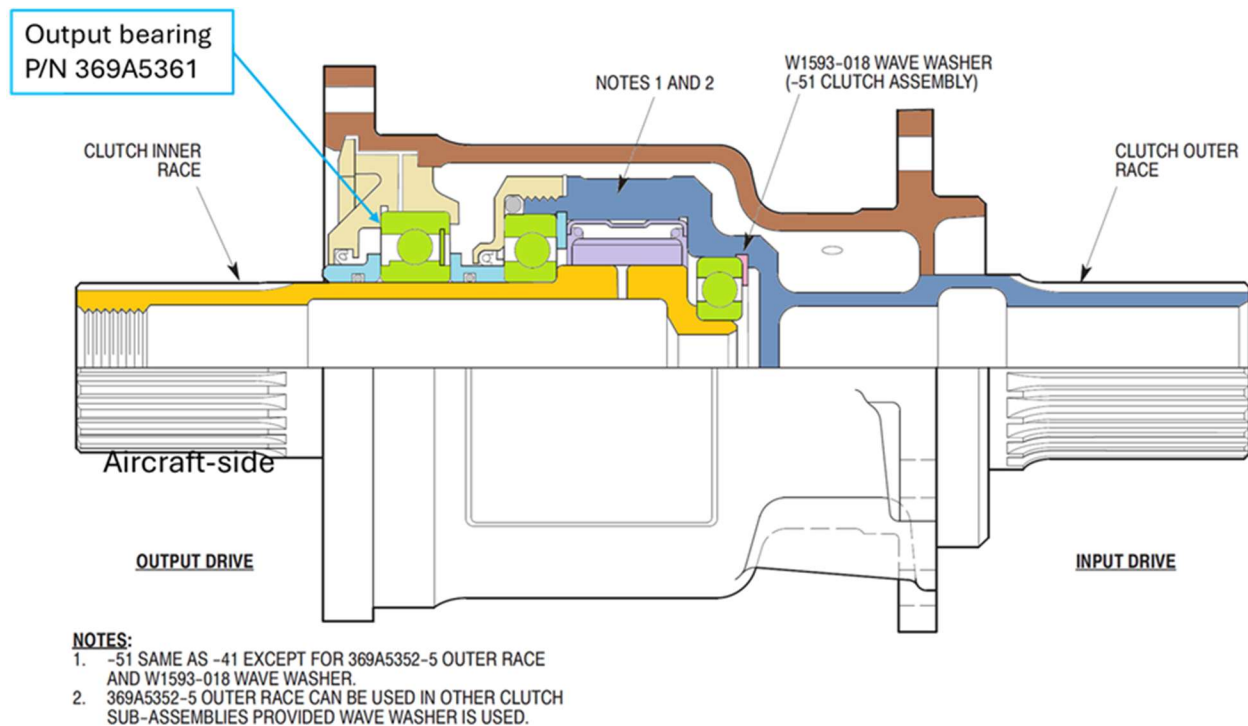


Figure 1. A cutaway view showing the internal components of the overrunning clutch assembly. The input drive (right side) is driven by the engine. The output drive (left side) transmits engine power to the Kaflex driveshaft. (Image courtesy of MD Helicopters)

According to the MD Helicopters 369-series illustrated parts catalogue No. CSP-IPC-4, for the MD 369D helicopter, the overrunning clutch assembly is part number (P/N) 369A5350-603 and the clutch subassembly is P/N 369A5350-41. Additionally, clutch subassembly P/N 369A5350-51, used on overrunning clutch assembly P/N 369A5350-605, is listed as a preferred part for the MD 369E, 369FF, and MD 500 helicopters. According to the MD Helicopters 369-series maintenance manual No. CSP-HMI-2, sprag assembly P/Ns 369A5364, 369D25351, and 369F5456 do not have a life limit when no cargo hook is attached. However, when a cargo hook is attached the sprag assembly has a life limit of 1,800 hours.¹ The sprag assembly has a mandatory inspection interval of 300 hours.²

¹ A note in the airworthiness limitations allows for a life limit of 1,800 hours of external load operating time when it is logged separately.

² FAA Airworthiness Directive (AD) No. 90-19-02 contains several required actions for certain overrunning clutch assemblies, including a recurrent inspection of the inner race, outer race, and sprag assembly at intervals not to exceed 300 hours time in service or at an annual inspection, whichever occurs first.

1.3 Accident Helicopter History

The accident helicopter, N633JH, was serial number (S/N) 0230E and was manufactured in 1987. At the time of the accident, the helicopter had accumulated an aircraft total time (ATT) of 25,086.8 hours.

2.0 Accident Helicopter Wreckage Examination

After the accident occurred, the operator took photos and videos of the accident site and provided them to the NTSB. On March 13-14, 2024, members of the Airworthiness Group convened at Lihue Airport in Lihue, HI to examine the recovered wreckage.

2.1 General Accident Scene Observations³

The operator took videos documenting the accident site prior to recovery of the wreckage. The helicopter came to rest on its right side. The right skid tube had separated from the landing gear and was upright in the sand behind the fuselage. The empennage, containing the vertical fin, horizontal stabilizer, and tail rotor, was found about 25 feet ahead of the fuselage (**figure 2**).



Figure 2. The main fuselage and the separated empennage containing the vertical fin, horizontal stabilizer, and tail rotor. (Image courtesy of Jack Harter Helicopter)

³ NTSB investigators did not travel to the accident site for this investigation.

The wreckage was recovered and subsequently stored in a secured hangar in Lihue, HI. After recovery of the helicopter, the NTSB investigator-in-charge authorized removal of the Kaflex driveshaft cover. Once the Kaflex driveshaft cover was removed, the flex plates on both ends of the Kaflex driveshaft were found fractured (**figure 3**). Additionally, the clutch inner race's splined shaft had fractured aft of the splines and exhibited thermal deformation.



Figure 3. The Kaflex driveshaft as found in the wreckage after removal of the driveshaft cover. (Image courtesy of the FAA)

2.2 Wreckage Examination in Lihue

2.2.1 Structures

The helicopter fuselage exhibited impact damage from the hard landing (**figure 4**). The right skid tube was separated from the skid struts. The left skid tube remained attached to the fuselage via its struts, the latter of which remained attached to the fuselage. The tail boom was fractured and separated about 28 inches forward of the tail gearbox mounting face. The remainder of the tail boom was attached to the fuselage and exhibited a left-ward deformation.



Figure 4. The recovered wreckage at a hangar in Lihue.

2.2.2 Main Rotor

The main rotor blades were partially attached to the main rotor hub. The main rotor blades did not exhibit fragmentation and exhibited limited deformation from ground impact.

2.2.3 Main Rotor Drive System

The main gearbox remained installed on the airframe and its attaching hardware remained intact with no evidence of looseness. The main gearbox could not be manually rotated due to damage to the main rotor head. The main gearbox input flange remained installed and the drive belt for the blower was intact.

The Kaflex driveshaft had fractured and separated at both ends of its flex plates (**figure 5**). The Kaflex driveshaft tube was continuous and did not exhibit torsional deformation or fractures. The forward flex plate assembly had fractured at its aft plate. The aft flex plate assembly had fractured at its forward plate. All fasteners for the Kaflex driveshaft installation remained installed and their torque stripes were present with no evidence of torque stripe misalignments. The Kaflex driveshaft was P/N SKCP2910-1 and S/N 0197. The forward splined flange, attaching to the main gearbox input pinion, and the aft splined flange, attaching to the splined output shaft of the overrunning clutch, did not exhibit cracks, fractures, or deformation.



Figure 5. The Kaflex driveshaft after removal from the wreckage.

The overrunning clutch subassembly and the clutch housing remained installed on the engine gearbox housing but the clutch inner race splined shaft had fractured aft of the splines, with the fracture exhibiting a spiral and partially melted appearance (**figure 6**). The overrunning clutch assembly was P/N 369A5350-605. The forward portion of the fractured clutch inner race splined shaft remained attached to the aft splined flange that was attached to the aft end of the Kaflex driveshaft (**figure 7**). A portion of the clutch output bearing (P/N 369A5361, see **figure 1**), normally installed immediately adjacent to the clutch inner race's splines, was found in its normally installed location but had separated from the clutch. However, the clutch output bearing found was composed only of the bearing outer race with three roller (ball) elements adhered to the outer race and exhibited thermal damage (**figure 8**). A circular metal piece, which exhibited thermal damage and deformation, was found with the output bearing.



Figure 6. The fractured and thermally deformed clutch inner race.



Figure 7. The forward portion of the clutch inner race still within the flanged connection attached to the aft flex plates of the Kaflex driveshaft.



Figure 8. The clutch output bearing outer race with the three roller (ball) elements adhered.

After the engine was removed from the airframe, the overrunning clutch was observed to be installed normally on its engine gearbox mounting studs. The overrunning clutch assembly was removed from the engine gearbox, revealing the clutch outer race splines which did not exhibit anomalous wear (**figure 9**). Dark brown-colored material, similar in consistency to grease mixed with oil, was present on the forward face of the clutch mounting pad of the engine gearbox. The dark brown-colored material had metallic-colored specks within the mixture. A sample of the dark brown-colored material was retained by the NTSB for further evaluation. Functionality of the clutch's sprags was confirmed upon manual rotation of the clutch's input splines: in the drive direction, the sprags engaged, and in the freewheeling direction, the sprags disengaged; rotation of the clutch shaft was difficult to accomplish.



Figure 9. The clutch outer race splines after removal of the overrunning clutch assembly from the engine.

The overrunning clutch assembly and the Kaflex driveshaft were retained by the NTSB for further evaluation. Samples of the grease used by the operator for greasing the overrunning clutch splines and the output bearing were obtained.

2.2.4 Tail Rotor Drive System

The forward end of the tail rotor drive shaft remained connected to the main gearbox. The aft end of the tail rotor drive shaft remained connected to the tail rotor gearbox, which remained installed on the aft end of the tail boom. The tail rotor drive shaft had cracked and fractured in multiple locations that were co-located with tail boom fractures and deformation. Manual rotation of the tail rotor resulted in smooth rotation of the remnant tail rotor drive shaft attached to the tail rotor gearbox input flange; the rotation was smooth with no evidence of binding.

2.2.5 Tail Rotor

The tail rotor remained installed on the tail rotor hub and the tail rotor gearbox output shaft. The tail rotor blades were whole and did not exhibit fragmentation. The tail rotor blades exhibited slight deformation.

2.2.6 Flight Control System

The left-seat cyclic control, collective control, and pedals remained installed. The right-seat cockpit flight controls were not installed. The control tubes and bellcranks between the cyclic and collective flight controls to the swashplate assembly were present and exhibited deformation and fractures. The control tubes for tail rotor control were present within the fuselage and the forward tail boom section, but exhibited deformation and was fractured at the tail boom separation. The tail rotor control tube had separated from the aft tail boom section, but the input rod to the tail rotor control bellcrank, installed on the tail rotor gearbox, remained installed. Pitch changes to the tail rotor could be accomplished manually, but exhibited stiffness. Control continuity was established between the tail rotor control bellcrank and the tail rotor blades.

2.2.7 Engine

The engine remained installed on the airframe. The left, right, and center engine mounts remained attached between the airframe and the engine. The right engine mount exhibited a slight deformation at its lower threaded connection between the tube and the [lower] rod end. There was no evidence of looseness of the engine mounting to the airframe except for: 1) on the left mount's upper end, the aft-lower jam nut was not jammed against the mount tube but the threaded connection was not loose in the longitudinal direction and 2) on the right mount's lower end, the mount pad rotated relative to the tube in the area of deformation on the lower threaded connection, but the threaded connection was not loose in the longitudinal direction.

Electrical power was applied to the helicopter and the governor beep trim switch was manipulated and exhibited normal functionality. Mechanical continuity between the collective-mounted twist grip to the engine fuel control unit was confirmed. The power turbine governor setting was found about 65° as observed during this examination; the setting is typically about 63° during ground idle setting. The fuel control unit setting was found about 7° as observed during this examination.⁴ (The twist grip throttle had been previously manipulated after recovery of the helicopter by an FAA inspector to check for control continuity at that time.)

⁴ The setting for engine cutoff is typically about 5-7°.

Manual rotation of the stage 4 power turbine wheel resulted in rotation of the remnant output shaft of the overrunning clutch, confirming continuity of the power turbine drivetrain. Manual rotation of the compressor resulted in rotation of the starter/generator, confirming continuity of the gas generator drivetrain. During rotation of the power turbine wheel and the compressor, light drag and abnormal noises, likely from the presence of sand in the engine, were heard. All the first stage compressor blades were present and their leading edges did not exhibit evidence of deformation due to foreign object debris ingestion. The fourth stage power turbine blades were all present and did not exhibit anomalous damage.

The bleed valve did not exhibit anomalous damage. The poppet valve was able to be manually actuated. A pneumatic check was conducted in accordance with the Rolls-Royce maintenance manual and no leaks were detected. The upper and lower chip detectors were removed. Both chip detectors had a small magnetic flake present that did not bridge the gap, but no other substantial debris was present on the chip detectors. The engine oil exhibited a color typical of normal service operation and exhibited neither an acrid odor nor abnormal discoloration. The engine fuel line at the fuel nozzle was removed and contained remnant fuel. Removal of the input and output lines for the fuel pump, as well as the fuel pump itself, revealed remnant fuel within.

3.0 Overrunning Clutch Assembly and Kaflex Driveshaft Examination

The overrunning clutch assembly, Kaflex driveshaft, and the grease sample from the engine power output pad were examined by the NTSB Materials Laboratory in Washington, District of Columbia (DC).

Examination of the fracture surfaces on the flex plates of the Kaflex driveshaft showed signatures consistent with overload. No evidence of fatigue was observed on these fracture surfaces.

Examination of the damage to the components at the forward end of the overrunning clutch assembly showed heat tinting, oxidation, and deformation consistent with high heat exposure. The output bearing outer race contained remnant balls (roller elements) and cage pieces that had melted and resolidified to the outer race.

For details and additional findings for the examination of the overrunning clutch assembly, Kaflex driveshaft, and the grease sample, see NTSB Materials Laboratory Factual Report No. 24-062, found in the docket for this investigation.

4.0 Maintenance

4.1 Accident Overrunning Clutch History (S/N 25440)

According to the accident helicopter logbook, overrunning clutch S/N 25440 was installed on April 29, 2023, at an ATT of 24,147.0 hours (939.8 hours prior to the accident) with a time since overhaul (TSO) of 0 hours. According to the authorized release certificate (FAA Form 8130-3) for the accident overrunning clutch, dated October 12, 2021, the clutch was last overhauled at California Aero Components in Irvine, California. The form stated the clutch TSO was 0 hours and also referenced work order No. 8962 for the overhaul. **Table 1** shows the components that were removed according to work order No. 8962.

Table 1. The components that were removed and replaced during the last overhaul of the accident overrunning clutch assembly.

P/N	Reason for Removal	Corrective Action
369A5355	Bearing carrier received with inner diameter oversized	Installed new carrier
369A5360	Spacer received nicked	Installed new spacer
369A5361	Output bearing received spalling	Installed new bearing
369A5362	Bearing received spalling	Installed new bearing
369A5363	Bearing received spalling	Installed new bearing
369D25351	Sprag assembly received deeply scored on cages	Installed new sprag assembly

According to the component log card for the overrunning clutch assembly S/N 25440, the last installation was also on the accident helicopter (N633JH). The overrunning clutch was installed on N633JH on September 1, 2019, at an ATT of 20,928.1 hours. The overrunning clutch was subsequently removed on September 21, 2021, at an ATT of 22,380.2 hours. The component log card showed the listed reason for removal was low oil and overhaul. **Attachment 1** contains the authorized release certificate for the last overhaul of the accident overrunning clutch and its component log card.

4.2 Accident Helicopter Inspections

The accident helicopter's Hobbs meter showed 5,841.9 hours at the time of the accident. According to the operator, the Hobbs meter had already rolled over 10,000 hours once, so the Hobbs meter truly reflected 15,841.9 hours at the time of the accident. According to the maintenance records, the accident helicopter's aircraft total time (ATT) was 25,086.8 hours at the time of the accident.

On February 21, 2024, at an ATT of 25,060.6 hours (26.2 hours prior to the accident), the operator accomplished multiple maintenance actions, including an

airframe 100-hour inspection. On January 19, 2024, at an ATT of 24,961.4 hours (125.4 hours prior to the accident), the operator accomplished multiple maintenance actions, including airframe 100-hour and 300-hour inspections. **Attachment 2** contains excerpts from the aircraft logbook for the entries of the maintenance accomplished on January 19 and February 21, 2024.

On December 5, 2014, at an ATT of 13,095 hours (11,991.8 hours prior to the accident), Kaflex driveshaft S/N 0197 was installed on the accident helicopter.

4.3 Overrunning Clutch Inspections

Chapter 5 of maintenance manual CSP-HMI-2 contains requirements for continued airworthiness. Chapter 5 includes checklists for a 100-hour/annual inspection and a 300-hour inspection.

The 100-hour/annual inspection requires examination of the overrunning clutch for evidence of oil leakage and to verify correct operation of the overrunning clutch's engagement and disengagement. For helicopters equipped with a 369A5350 overrunning clutch, a regrease of the clutch splines is also required. Both of these tasks reference Chapter 63-10-00 of CSP-HMI-2.

The 300-hour inspection checklist contains two tasks for the overrunning clutch, depending on which overrunning clutch is installed. One task is for those helicopters equipped with a 369A5350 overrunning clutch and requires the accomplishment of a ball bearing inspection and grease repack. The second task is for those helicopters equipped with a 369D5450 overrunning clutch and requires a ball bearing repack. Both tasks reference the MD Helicopters component inspection manual (COM) CSP-COM-5, specifically the inspection section of this manual vice the start of the COM-5 that encompasses prior parts of the COM-5 manual.

Lastly, Chapter 12 of CSP-HMI-2 contains all servicing instructions and includes a figure of the overrunning clutch showing that the output bearing should be regreased at a 300-hour interval.

4.4 COM Procedures

Chapter 63-10-10 of the MD Helicopters manual No. CSP-COM-5 provide instructions relevant to overrunning clutch P/Ns 369A5350-603 and -605. Within the *Inspection/Check* section, paragraph 2 contained instructions for the ball bearing inspection and grease repack for the 300-hour interval. Removal of the ball bearing is required for its inspection and grease repack. Within these instructions are steps based on whether a riveted cage or open faced ball bearing is installed. **Attachment 3** contains an excerpt of CSP-COM-5 chapter 63-10-10 that contains the ball bearing inspection and grease repack steps.

In COM-5, section 63-10-10 (Revision 1 dated 10/26/23), a section for “cleaning/painting” contains a step to clean all parts that would not be replaced. There was not a cleaning procedure specifically for bearings in the “cleaning/painting” section. For the overrunning clutch inspection/check procedures, there was no specific step to clean the riveted-cage bearing to facilitate inspection or prior to repacking the bearing with grease. For the open-face bearing, a cleaning procedure is to be performed bearing is dry or grease appears caked.

4.5 Mechanic Interviews

NTSB investigators interviewed two mechanics employed at the operator who had previously worked on checklist tasks for the 100-hour and 300-hour inspections, including the [output] ball bearing grease repack task.⁵ Both mechanics had experience performing the 100-hour and the 300-hour inspections. Both mechanics stated that they had not removed the output bearing for the grease repack task. Additionally, one mechanic specified that, after the accident involving N633JH, he recently began to remove the bearing for the grease repack task. One mechanic believed the accident overrunning clutch had a riveted cage ball bearing. The other mechanic recalled that he had never seen the output bearing grease dried out or melted, and that the “old” grease typically looked like “normal” grease.

4.6 Exemplar Output Bearing Regreasing

On August 7, 2024, members of the Airworthiness Group convened at MD Helicopters facilities in Mesa, Arizona to review the overrunning clutch output bearing greasing procedures. Using an exemplar training aid overrunning clutch assembly, the output bearing and its carrier were removed from the clutch subassembly’s inner race. With the output bearing removed, the output bearing was regreased by hand without significant force; there was no evidence of grease coming out of the aft-side of the bearing shield. Then, with the grease being forcefully put into the output bearing by using the palm of a hand, a small amount of excess grease came out of the bearing shield without evidence of the bearing shield becoming dislodged. With the bearing re-installed in its carrier and installed back onto the inner race, a gap would allow for grease to be seen coming out of the aft side of the bearing shield if grease could be forcefully put into the bearing. If the output bearing gets pressed onto the carrier and if the inner race is used to press the bearing into the carrier, it could be possible to preload the bearing, which could potentially press the bearing elements into the shield. Conversely, while disassembling the output bearing from the clutch inner race, if the output bearing outer race and bearing carrier are pressed against for the removal of the output bearing, it could be possible to preload the output bearing through the roller elements. The tool used for removing the output

⁵ The Memorandum of Record for these interviews can be found in the docket for this investigation.

bearing from the training aid was Owatonna Tool Co. (OTC) 952 from Owatonna, Minnesota.

E LIST OF ATTACHMENTS

Attachment 1 - overrunning clutch S/N 25440 FAA Form 8130-3 and Component Log Card from last overhaul

Attachment 2 - N633JH aircraft logbook excerpts for maintenance accomplished on January 19 and February 21, 2024

Attachment 3 - excerpt of CSP-COM-5 chapter 63-10-10

Submitted by:

Chihoon Shin
Aerospace Engineer - Helicopters