National Transportation Safety Board
Washington, D.C. 20594

Aircraft Accident Investigative Update

On September 4, 2022, about 1509 Pacific daylight time, a De Havilland Canada DHC-3, N725TH, was destroyed when it impacted Mutiny Bay, near Freeland, Washington, and sank. The pilot and nine passengers were fatally injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 135 scheduled flight. The US Coast Guard and Good Samaritans responded to the accident site.

The NTSB traveled to the scene of the accident, and the following investigative groups were formed: Operational Factors, Systems, Structures, Maintenance Records, Meteorology, and Aircraft Performance. Parties to the investigation are the Federal Aviation Administration (FAA) and the operator, Northwest Seaplanes, dba Friday Harbor Seaplanes. The airplane was designed and manufactured in Canada, and pursuant to International Civil Aviation Organization Annex 13, the Transportation Safety Board of Canada has assigned an Accredited Representative to the investigation and designated staff from Viking Air Limited (the current type certificate holder) as their technical advisors.

The wreckage recovery operation was completed by the US Navy's Supervisor of Salvage and Diving on September 30, with about 85% of the airplane recovered from the sea floor (see figure 1). The Systems group performed a field examination of the wreckage during the week of October 3, with follow-up activities in the NTSB Materials Laboratory October 18-19. The horizontal stabilizer actuator (also referred to as the trim jack) and both elevators were shipped to the NTSB's Materials Laboratory for further examination.

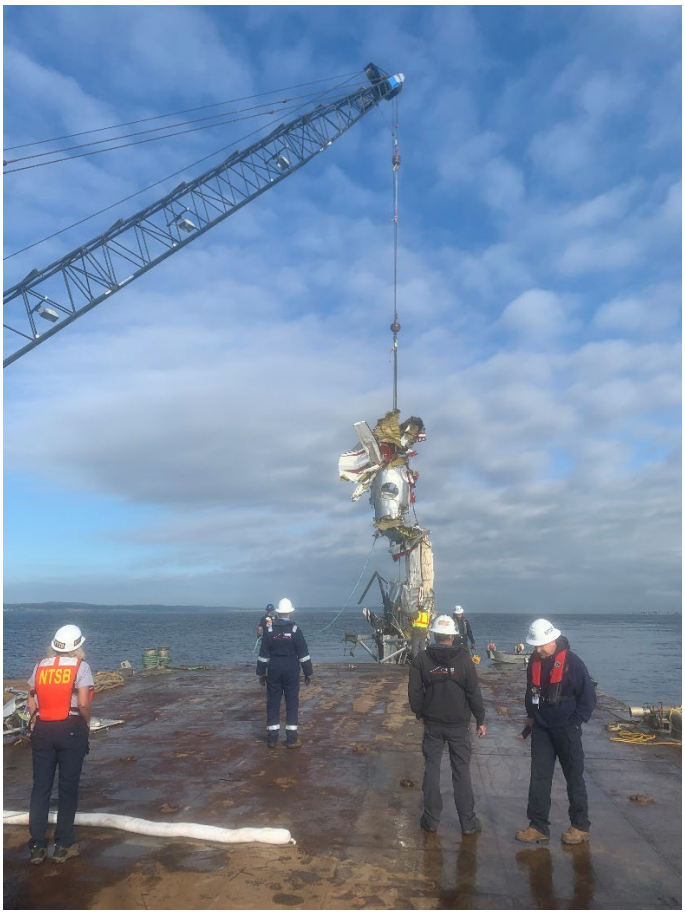

Figure 1. Main wreckage lift.

The airplane wreckage was heavily damaged due to water impact. Figure 2 depicts what was positively identified during the wreckage examination. The right horizontal stabilizer and the left wing were not recovered. Both were visually identified by a camera located on the remotely operated vehicle during the recovery operation, but both pieces shifted during one of the lifts and were unable to be located afterwards.

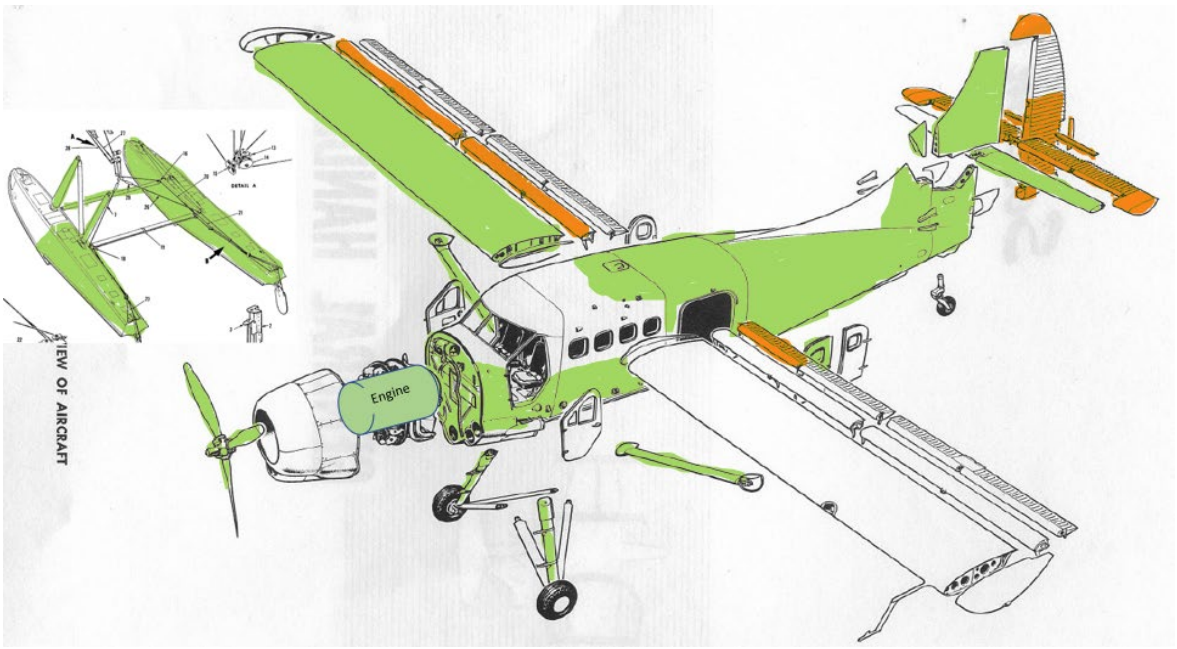

Figure 2. Recovered wreckage highlighted in green. Recovered flight controls highlighted in orange.

The Systems group found the horizontal stabilizer actuator (see figure 3) had separated into two pieces at a threaded assembly fitting. The actuator is part of the airplane's pitch trim control system. The pitch trim wheel, located in the cockpit, is used to manipulate the actuator through control cables that rotate the actuator, extending (lengthening) or retracting (shortening) the overall length of the actuator. This extension or retraction changes the incidence of the horizontal stabilizer, thereby providing a mechanism for the pilot to relieve elevator control force pressure.

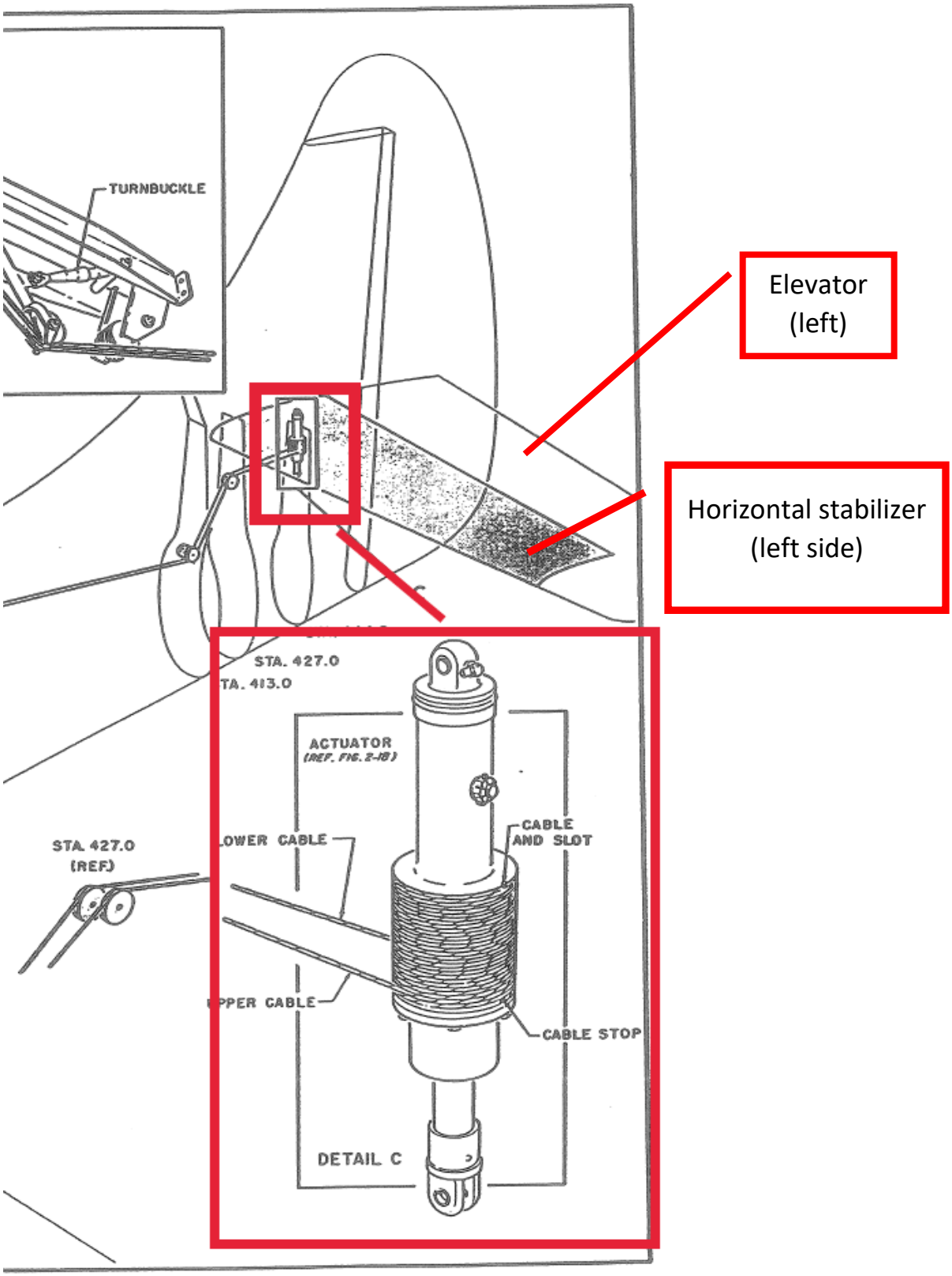

Figure 3. Horizontal stabilizer actuator location (Source: Viking Air Limited).

The actuator was found separated where the clamp nut threads into the barrel section (see figure 4). Examination of the threads inside the barrel and the threads on the clamp nut revealed that the two components separated by unthreading (that is, rotation of the barrel and/or clamp nut) as opposed to being pulled apart in tension. The upper portion of the actuator remained attached to the horizontal stabilizer, and the lower portion remained attached to its mount in the fuselage.

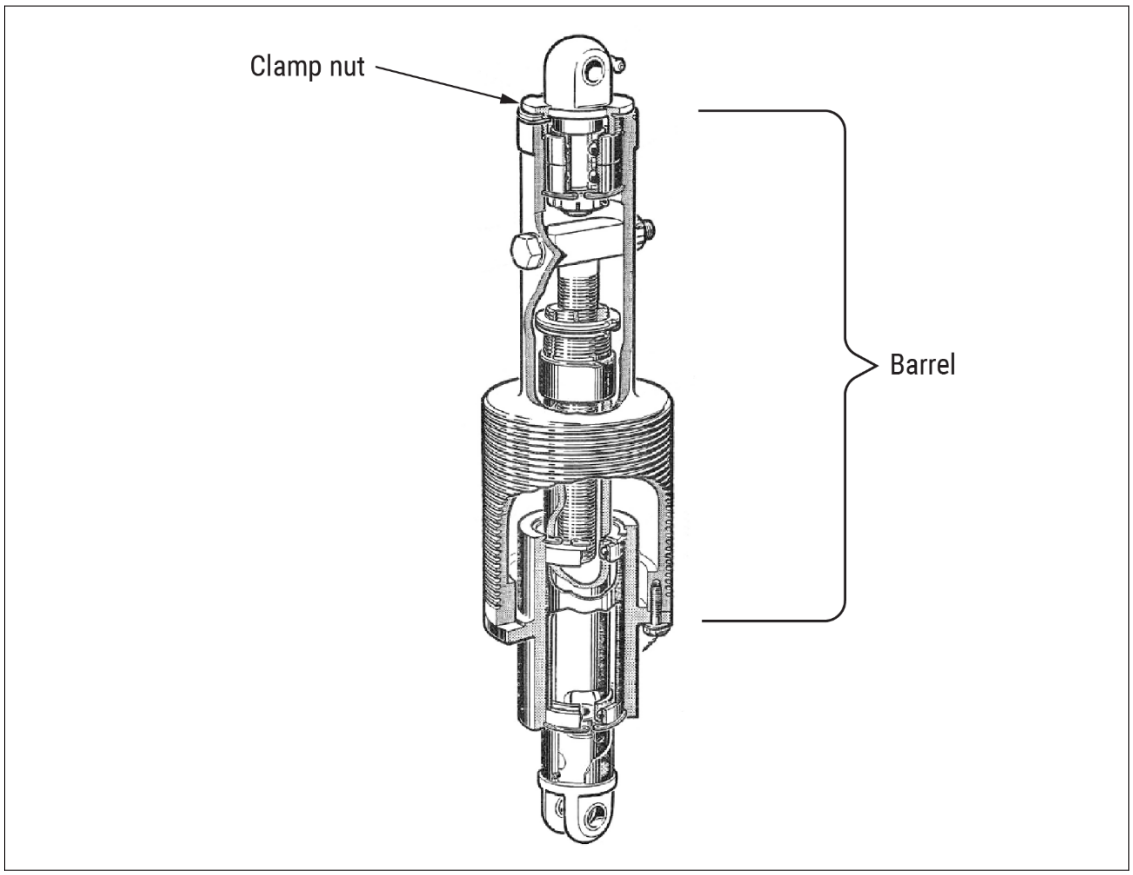

Figure 4. Horizontal stabilizer actuator clamp nut and barrel (Source: Viking Air Limited).

A circular wire lock ring is used to prevent the barrel and clamp nut from unthreading. The lock ring (see figure 6) is normally installed in the lock ring groove (see figure 5) and has a tang or

"pin" at one end (noted in figure 6) that is inserted into a hole in the lock ring groove. The tang continues into another hole in the clamp nut threads. The lock ring was not located in the wreckage.

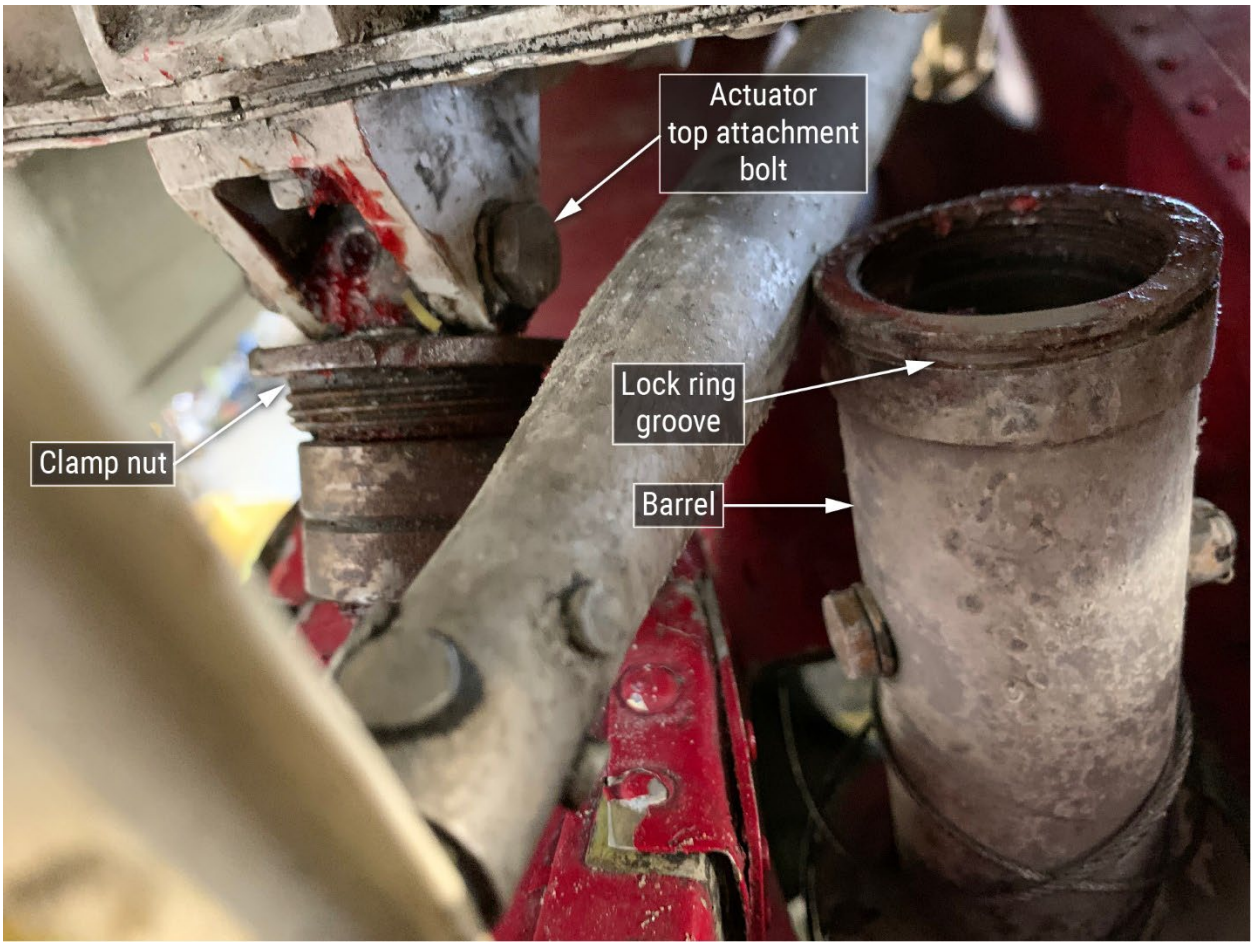

Figure 5. Horizontal stabilizer actuator clamp nut and upper end of barrel section as found in the wreckage.

Figure 6. Exemplar lock ring.

The manufacturer's assembly drawings for the horizontal stabilizer actuator call for a hole to be drilled into the clamp nut to accept the lock ring tang, after it has been threaded into the barrel during assembly. Postaccident examination of the airplane revealed that five holes had been drilled into the clamp nut threads; three holes were damaged such that they would not allow for the full insertion of the lock ring tang (see figure 7). This suggests that it may be possible for a lock ring to be partially installed, with the tang not fully seated in a hole in the clamp nut. Further, it might be difficult to visually determine if the lock ring is fully engaged in the clamp nut hole (depending on conditions such as lighting, viewing angle, and the presence of dirt or grease). Figure 8 shows two exemplar horizontal stabilizer actuators with a lock ring tang fully and partially installed, respectively.

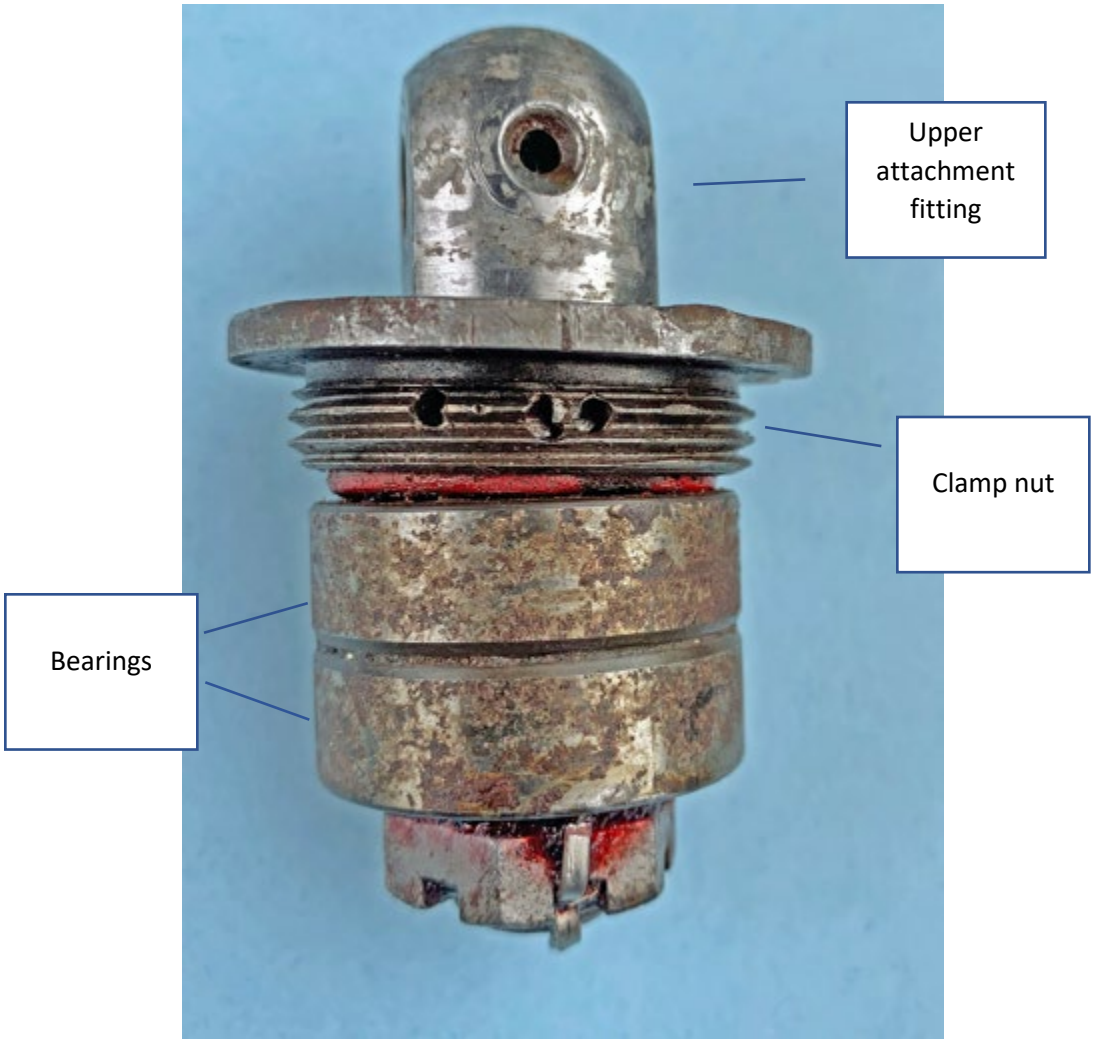

Figure 7. Clamp nut from accident airplane.

Figure 8. Exemplar horizontal stabilizer actuators and lock rings.

According to preliminary information from the operator, the most recent overhaul of the horizontal stabilizer actuator was completed on April 21, 2022. The actuator is the only means to hold the horizontal stabilizer in its position, and the lock ring keeps the assembly from unthreading. Unthreading of the clamp nut and the barrel during flight would result in a free-floating horizontal stabilizer, allowing it to rotate uncontrollably (trailing edge up or down) about its hinge, resulting in a possible loss of airplane control.

At this time, the NTSB does not know whether the lock ring was installed before the airplane impacted the water or why the lock ring was not present during the airplane examination. The NTSB, in coordination with the Transportation Safety Board of Canada, has asked that the manufacturer draft instructions for an inspection of the actuator to ensure that the lock ring is in place and properly engaged to prevent unthreading of the clamp nut. Those instructions will be released and provided to all operators of the DHC-3 airplane worldwide in a Service Letter.

The investigation into this accident will continue with examinations of both elevators in the NTSB Materials Laboratory; interviews of the FAA principal operations and principal maintenance inspectors assigned to the operator; a review of maintenance records, including historical records

for accidents, incidents, and service difficulty reports; and interviews with maintenance personnel. An evaluation of lock ring failure modes and lock ring installation instructions will be accomplished in addition to an aircraft performance study.

Additional information will be released as warranted.