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Require Fuel Minimums for Class C Rotorcraft External Load Operations

Introduction

The National Transportation Safety Board (NTSB) is providing the following information to urge the Federal Aviation Administration (FAA) to take action on the safety recommendation in this report. It is derived from our investigations of accidents involving helicopters that experienced an in-flight loss of engine power due to fuel starvation as the pilots maneuvered during Class C rotorcraft-load combination (RLC) operations conducted under Title 14 *Code of Federal Regulations* (*CFR*) Part 133, "Rotorcraft External Load Operations."[1] The NTSB is issuing one safety recommendation to the FAA.

Background and Analysis

Title 14 *CFR* Part 133 RLC operations inherently entail risks and considerations concerning fuel management. A review of five previous accidents involving helicopters conducting Class C RLC operations indicates that, because of the high pitch and roll attitudes that can occur while maneuvering, Class C RLC operations are particularly vulnerable to fuel unporting, which can occur when an aircraft is operated in certain flight profiles that result in fuel flowing away from ports and lines that deliver it to the engine. Fuel starvation can result if this type of flight is conducted with fuel levels that do not adequately compensate for the helicopter attitudes unique to

[1] Title 14 CFR 1.1 defines RLC as "the combination of a rotorcraft and an external load, including the external-load attaching means. [RLCs] are designated as Class A, Class B, Class C, and Class D." A Class C RLC is defined as "one in which the external load is jettisonable and remains in contact with land or water during the rotorcraft operation."

the operation.[2] However, neither Part 133 regulations nor guidance in Advisory Circular 133-1B, "Rotorcraft External-Load Operations," specifies minimum fuel standards based on the class of RLC operation being flown. The only fuel minimum requirement applicable to any class of RLC operation is that contained in 14 *CFR* 91.151, "Fuel Requirements for Flight in VFR Conditions."[3]

However, for all five of the accidents that we reviewed, the investigations found that unporting occurred at a fuel level much higher than that required by 14 *CFR* 91.151. Specifically, in four accidents, all involving an MD 369-series helicopter performing a Class C RLC operation, the helicopter experienced fuel starvation at fuel loads between 94-146 pounds. For the MD 369-series helicopter, about 78 pounds of fuel would be required to meet the 14 *CFR* 91.151 regulations, and three of these operators required a landing fuel minimum of 100 pounds. Further, testing performed by the Australian Transport Safety Bureau during its investigation of a 2008 fuel starvation accident involving an MD 369-series helicopter indicated that unporting could occur at a fuel load of 151 pounds at attitudes that could be achieved during normal operation (the helicopter was conducting an operation analogous to a Class C RLC operation at the time of the accident).

The NTSB recognizes that the primary intent of 14 *CFR* 91.151 is to mitigate the risk of fuel exhaustion during normal operations in cruise flight and that the regulation does not account for anticipated helicopter pitch and roll attitudes. Although, as demonstrated in three of the accidents reviewed, operators may require landing fuel minimums that exceed that required by Part 91, helicopters may still experience fuel starvation due to unporting because of the flight characteristics associated with Class C RLC operations.

We note that the FAA requires each operator applying for a Part 133 Rotorcraft External-Load Operator Certificate to create its own RLC flight manual (RLCFM) because "the manufacturer's calculation of performance data and operating

[2] More information about these accidents, NTSB case numbers LAX91LA054, WPR12LA328, ERA17LA209, ERA20LA160, and Australian Transport Safety Bureau Investigation AO-2008-025, is available in the final reports for these investigations. The original NTSB reports are accessible using our CAROL (Case Analysis and Reporting Online) query tool on www.ntsb.gov; the ATSB's report can be found on its website, www.atsb.gov.au.

[3] Title 14 *CFR* 91.151(b) states that "no person may begin a flight in a rotorcraft under VFR conditions unless (considering wind and forecast weather conditions) there is enough fuel to fly to the first point of intended landing and, assuming normal cruising speed, to fly after that for at least 20 minutes."

limitations may be unique for each rotorcraft."[4] As stated in FAA Order 8900.1, *Flight Standards Information Management System*, RLCFMs must include operating limitations, procedures, performance, and other information established under Part 133 (which, again, does not contain a regulation regarding minimum fuel levels), and operators should place information that is not included in the manufacturer's rotorcraft flight manual into the RLCFM.[5] Requiring an RLCFM allows the FAA to ensure that specific helicopters are suited to perform the requested RLC class operation.

Because fuel minimums specific to Class C RLC operations are not required to be included in operators' RLCFMs, there is a risk of fuel starvation due to unporting in nonstatic operations if sufficient fuel is not onboard. Developing these fuel minimum requirements would be a joint effort between operators, who understand the types of maneuvers that will be performed, and manufacturers, who fully understand the capabilities and limitations of their helicopters. The NTSB concludes that the dynamic flight profiles that may be encountered during Class C RLC operations can cause fuel to become unported at fuel levels higher than that required by 14 *CFR* 91.151, which can result in fuel starvation. Therefore, the NTSB recommends that the FAA require operators approved for Part 133 Class C RLC operations to work with manufacturers to develop fuel minimums that address the risk of fuel starvation during these operations and to incorporate these fuel minimums into their RLCFMs and any other documentation that references fuel minimums for RLC operations.

Conclusion

Finding

The dynamic flight profiles that may be encountered during Class C RLC operations can cause fuel to become unported at fuel levels higher than that required by 14 *Code of Federal Regulations* 91.151, which can result in fuel starvation.

[4] According to Order 8900.1, RLCFMs must cover each RLC class for each approved helicopter, even if some makes and models are similar. Applicants are also required to indicate each helicopter make/model and registration number they desire to use for the operation, as well as the specific class(es) of operation they want approved for each registered helicopter.

[5] The manufacturers' approved RFMs are not required to provide limitations unique to specific classes of Part 133 RLC operations unless they apply for certification of equipment used in an external load operation.

Recommendation

To the Federal Aviation Administration:

Require operators approved for Title 14 *Code of Federal Regulations* Part 133 Class C rotorcraft-load combination (RLC) operations to work with manufacturers to develop fuel minimums that address the risk of fuel starvation during these operations and to incorporate the fuel minimums into their RLC flight manuals and any other documentation that references fuel minimums for RLC operations. (A-21-56)

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