VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

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III. Abstract

The design of the proposed amphibious tiltrotor aircraft was conducted by a team of 10 undergraduate students as a capstone design project. The aircraft was designed to meet requirements specified by the NASA Amphibious Tiltrotor Competition. The aircraft is required to take off and land vertically on both water and land, as well as having an 800 nm range and a cruise speed of 300 kts. The payload is up to 50 passengers or water for firefighting operations. Specifics such as the operational sea state, maximum altitude, and total water capacity were later defined by the study based on currently existing aircraft and technical analysis.

A dual fuselage concept, named the Vertical Transport Rescue Amphibious Firefighting Tiltrotor (V.T. R.A.F.T.) was proposed as the design best suited to fulfill the mission. The aircraft can perform vertical flight operations with a maximum takeoff gross weight (TOGW) of 62,460 lb. The aircraft can accommodate 50 passengers or 12,000 lb of water, in addition to 10,175 lb of fuel. Two 6150 shp turboshaft engines power the aircraft. Each engine is located at the wingtip inside the nacelles, which are capable of rotating at a rate of 3.0°/sec. This allows the aircraft to change from helicopter mode to airplane mode in 30 sec. The main cabin is not pressurized; however, for high altitude operations without passengers oxygen is supplied to the flight crew.

Water stability in a sea state of up to four was a major concern and was instrumental in the choice of a dual fuselage concept. This configuration eliminates the need for pontoons, which reduces drag and aircraft complexity. Additionally, the dual fuselage design reduced aerodynamic loading on the main spar and enhanced aerial rescue capabilities by providing a rescue area shielded from the rotor downwash.

Although not mandated by the competition, the aircraft is designed to be able to receive aerial refueling and perform aero-medical operations. In addition to vertical takeoff and landing the aircraft is designed to perform a short takeoff from land based facilities, increasing the TOGW to 70,000 lb. Future study and analysis should be conducted to determine the engines capacity to avoid the ingestion of water mist while hovering over water as well as further investigation of wing flutter phenomenon for this design.