ABSTRACT

As the tiltrotor concept continues to be operationally validated and commercially certified, the stage is set to produce a viable and reliable vehicle to bridge the gap between existing rotary-wing and fixed-wing capabilities regarding speed, payload, and range to inaccessible areas, particularly for rescue operations. Current helicopter technology, with its efficient vertical flight and hover capability, provides unsurpassed effectiveness in short to medium range rescue operations into inaccessible or remote areas, saving lives which would otherwise be lost. Similarly, fixed-wing aircraft are highly efficient at rapidly moving critical payloads over long distances, although prepared landing surfaces are typically required.

Without attempting to replace either of these proven platforms, an amphibious tiltrotor promises a blend of the range and speed of a standard fixed wing aircraft with the vertical capabilities of a helicopter, adding flexibility to disaster relief and rescue operations. To be effective, this vehicle must be an adaptable workhorse to fill a large variety of needs throughout a lengthy service life, and be robust and reliable enough to ensure that it can perform as needed, when needed. It should act as an enabler to Incident Commanders, as an economical resource with minimal restrictions on its employment or service environment.

In answer to this call, the Georgia Institute of Technology presents the Civilian Aid, Emergency Search and Rescue (CAESAR) aircraft, an amphibious Quad-Tiltrotor (QTR) capable of worldwide self-deployment and operations in Sea-State 3. With the ability to carry up to 50+ personnel or 10,000+ lbs of payload in excess of 800 nm at speeds of 300 knots, this aircraft is specifically designed as a rescue aircraft that can respond more quickly and rescue more people per mission than anything else available.

Being intended for certification and low rate initial production within 10 years and designed for reliability and maintainability as key design factors, complex, unreliable, overly-optimistic, impractical, and cost-prohibitive design options were ruled out. Conservative estimates were applied throughout the conceptual design process to ensure the validity of the concept as it progresses to detailed design. Preliminary design of some systems was achieved, confirming conceptual estimates. Innovative technologies were inserted where needed primarily due to lack of current data or inadequate performance. The basic intent of this design was to merge current or near-term state of the art technologies into a practical solution to today’s disaster relief requirements.

Primary design trade-offs involved performance versus cost and reliability, disk-loading versus vehicle size, amphibious stability versus aerodynamic performance, and corrosion resistance versus cost. A major focus of this study was to validate the handling qualities of the medium-lift QTR configuration for a search and rescue, disaster relief platform. This was accomplished through FLIGHTLAB analysis with real-time flight simulation conducted by Liverpool University.