Spring 2022

2021-2022 NASA ARMD UNIVERSITY AERONAUTICS LANGLEY CHALLENGE

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
PROJECT REPORT

Team Lead – Colin Fischer

Submitted – June 15, 2022

Team H2AERO

VIRGINIA TECH

Team Members: Kevin Carey, Corbin Deaver, Colin Fischer, Chris Hollandsworth, Nicholas Kline, Austin Merrill, Anthony Mistichelli, Xavier Nguyen, Emily Sellards

Faculty Advisors: Dr. Michael Butler, Dr. Pradeep Raj **Teaching Assistant:** Mr. Steve Farmer

Executive Summary

H2AERO is excited to present our turbo-electric hybrid, VSTOL, low-noise, singly piloted aircraft for firefighting scenarios in response to the 2021-2022 ARMD University Aeronautics Langley Challenge Request For Proposal [1]. H2AERO's design focuses on maximizing water delivery and minimizing take-off distance while maintaining energy usage, cost, and noise standards appropriate for Regional Air Mobility. The aircraft's VSTOL capabilities allow it to bridge the gap between the Forest Service's CTOL fixed wing aircraft and VTOL helicopters. The fleet of four aircraft can access small bodies of water through their unique scoop tube and high lift producing distributed electric propulsion devices, delivering 750 gallons of water per vehicle and 3,000 gallons per pass. Moreover, the WATR RAM is fully compliant with FAR Part 23, Part 36, and Part 137 regulations and will achieve certification for an entry into service of 2030.

The WATR RAM seen in Figure 1 utilizes a turbo-electric hybrid design to achieve a 491 ft takeoff distance and 360-nautical mile operational radius. Two turboshaft engines drive electric generators and are mounted towards the top rear of the fuselage, providing improved airflow during scoop maneuvers. This powertrain drives the ten DEP motors and two cruise motors utilized by the WATR RAM. Additionally, the generators charge a set of high-discharge batteries for use during VSTOL operations. H2AERO's turbo-electric design thus pairs the higher specific energy density of fuel with the efficiency, noise, and throttle-response benefits of electric motors.

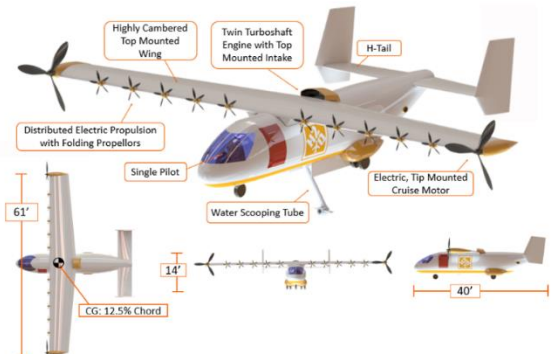

Figure 1. WATR RAM 3-View with isometric.

H2AERO's fleet of four vehicles can deliver 144,000 gallons of water to the fire lines over a 24-hour period due to its optimized water tank capacity and IFR capable avionics system. The aircraft sale cost is $5.8 million. Specifics as to the compliance of the fleet as per the system requirements are shown in Table 1.

Table 1. WATR RAM compliance matrix.

Requirement	Threshold	WATR RAM System Compliance
Payload	3,000 gallons	3,000 gallons
Operational Radius	240 nmi	360 nmi
Takeoff / Landing Distance	VSTOL	VSTOL
IFR / Low Vis	Night / Low Vis	Night / Low Vis
Wind Autocorrection	Capable	Capable
Service Ceiling	> 8,000 ft MSL	21,700 ft MSL
Noise	< 105 dB	87 dB
Crew	1 or Remotely Piloted	1

H2AERO considered modularity, commonality, and retrofit for the civilian regional transport market by designing the fuselage to accommodate up to eight passengers. Moreover, our vehicle can be utilized for multiple roles for the United States Forest Service such as search and rescue operations, wildlife transplants, and land surveying due to its large payload bay and sensors.