

14 – Aerial Firefighter 'CHEETAH'

Wildfires have become an increasingly severe global issue. Current data shows that forest fires now burn nearly twice as much tree coverage than they did 20 years ago.¹ The annual emissions from wildfires in 2022 surpassed the yearly emissions of the entire aerospace industry nearly twice.^{2 3} Aerial firefighting operations are crucial in combating these wildfires. However, current aerial firefighting fleets consist of aging designs, such as the Canadair CL-415, or retrofitted aircraft not originally intended for this role. Additionally, existing aerial firefighting aircraft are either large airplanes with high cruise speeds that carry substantial payloads but can only refill at base, or smaller, more versatile aircraft that are slower and carry smaller tanks. These aircraft typically serve a single purpose, necessitating a large fleet of specialized aircraft to meet various firefighting needs.

Mission Objective

To fill the gap in performance and versatility for aerial firefighting fleets, CHEETAH (Compound High-performance Emergency Extinguishing, Transport and Aid Helicopter) was designed. CHEETAH is a compound helicopter, i.e. a helicopter with wings and forward propulsion. It will be able to reach speeds of more than 400 km/h, carry 10 000 L of water, and take off and land vertically. Its modular cargo bay can be customized for multiple purposes, including water and retardant dropping, search and rescue, medical evacuation, and personnel/cargo transport. Reconfiguring for different roles will take less than one hour. Therefore, CHEETAH will be able to make the largest possible impact on any firefighting

System Design

One of the key challenges for this design is accommodating the large payload within a VTOL system. CHEETAH will match the payload capacity of the Sikorsky CH-53 Sea Stallion while operating at speeds 100 km/h faster. Additionally, the CHEETAH's structures must withstand the forces and vibrations induced by dropping several tons of water simultaneously. Following consultations with firefighting experts from all over the world, more emphasis was also put on maneuverability in the extreme environments the pilots have to deal with, such as the turbulence that originates from the heat convection.

CHEETAHs design primarily makes use of proven design concepts. Therefore the design process is currently focusing on assessing the feasibility of the remaining unconventional aspects of the aircraft. These include the interaction between the main rotor and the wings,

the box wing design, and the water tank. Every element of the CHEETAH is engineered to endure the demanding conditions of aerial firefighting.

In the last weeks, the design will be verified and validated. A feasibility analysis will also be performed to find out if the project is worth expanding upon. Furthermore, a multi-year planning of research, design, and production will be constructed.



¹World Resources Institute, <https://www.wri.org/insights/global-trends-forest-fires>

²Statista, <https://www.statista.com/statistics/1270034/wildfire-carbon-emissions-worldwide>

³International Energy Agency, <https://www.iea.org/energy-system/transport/aviation>