University Contest: US TEAMS ONLY

UAS Design Challenge – Firefighting Unmanned System

Scenario: The year is 2030. A severe drought covers a large swath of the continental United States. Wildfires have been commonplace and firefighting resources, both personnel and equipment, have been stretched to their limits. Another large fire has broken out and is expanding, threatening nearby homes, schools, and businesses. The incident commander has called for the use of unmanned systems to help battle the blaze. The challenge is to design an unmanned aerial firefighting system to put out the fire.

Design Considerations: The fire has spread to the point where it now encompasses an area of 250,000 acres. (While the actual shape is irregular, for purposes of this challenge, it can be assumed to be circular.) The actual flame boundary is over 100 m wide and is expanding outward at 1.5 km/hour. The winds exacerbate the problem and have been forecast to continue at 10-15 kts, gusting to 30 kts at times. There has been widespread damage from the fire and for every additional acre burned, another $1000 in direct damage, clean-up, and rehabilitation costs are likely. The incident commander has determined that if the basic flame boundary can be doused with water quickly, the available manned resources can extinguish the remaining remnants and smoldering embers.

Operational environment: In the 2030 era, the FAA has determined that Unmanned Aerial Systems (UAS) are allowed to operate in the National Airspace System (NAS) if they meet certain conditions. First, like all aircraft of the NextGen era, they must be equipped with situational awareness technology. Second, the aircraft must be equipped with some form of autonomous secondary system so that in the event of a lost link to the ground station, the UAS will still be able to avert a collision with other aircraft. Operating UAS over open-air assemblies of people and/or residential areas requires additional reliability/redundancy in primary systems.

By 2030 the FAA has also determined, through extensive NASA research, that one ground station operator may safely operate up to 6 autonomous air vehicles simultaneously for vehicles under 25 kg, 2 air vehicles per operator if they are between 25 and 150 kg, and one operator per aircraft for those systems larger than 150 kg.

Water is available via lake roughly 100 km from the center of the fire both to the North and South. It is also available at airfields via tanker truck. Each tanker truck carries 19,000 liters of water and can pump at a rate of 4500 liters/min. The cost to the fire departments for each tanker truck is $1500/day. Water cost is not considered.

Airfields are available, depending on runway length needed, based on the following table:

< 300 m, four grass strip airfields are available within 30 km

< 1000 m, two paved strip airfields are available within 100 km, one to the East & one to the West

< 3000 m, one major airfield is available within 300 km and is also near a major body of water

Roads may also be used for Vertical Take off and Landing (V/TOL) or Extremely Short Take off and Landing (ES/TOL) operations with eight two-lane paved roads available at 30 km from the center of the fire. However, these roads generally only have 100 m of clear space at any point along their length. Biofuel versions of Jet-A are available at the medium and large airfields. Biodiesel is available via truck at the grass strips and via roadway. Fuel cost is $1 per liter.

Assessment: Evaluation criteria will include innovation and creativity, cost and effectiveness of the system, ease of use and operations, and NAS integration impact. This challenge requires an integrated systems approach. Successful design teams will be multi disciplinary.

Due dates and questions: Send questions to Elizabeth.B.Ward@nasa.gov

Letters of Intent are required by January 15, 2013. Entries are due May 3, 2013.