



# Fit2Fly Project

NASA's Fit2Fly project wants to make future commercial drone fleet operations routine, safe, and boring. How can future operators of commercial drone fleets know without a doubt that their aircraft are fit to fly? It is a tough problem, because every flight will effectively break the chain of custody for their aircraft, and having technicians do detailed inspections after each flight is not viable for large, busy fleets.

Traditional approaches to airworthiness assessment were developed for aircraft that are roughly 80% hardware and 20% software, whether considering their complexity, their safety processes, or the specific capabilities that let them provide valuable commercial services. Future commercial drones will have more than 80% of their complexity, safety issues, and commercial value residing in software. To complicate things further, an ever-increasing fraction of that software will be running in the cloud, as network services.

To meet these challenges, Fit2Fly is automating traditional aircraft monitoring and inspection activities and integrating them with convergent technologies such as advanced radio spectrum monitoring, cloud-based microservices, and a blockchain-based self-certification process that is specifically designed to create financial incentives that reward those doing the best work.

Fit2Fly is funded by NASA's Convergent Aeronautics Solutions project, leveraging non-aerospace technologies to solve tough aerospace problems.



*Fit2Fly's two generic UAM RF testbed vehicles have been modeled as 25%-scale air taxis to carry large payloads.*

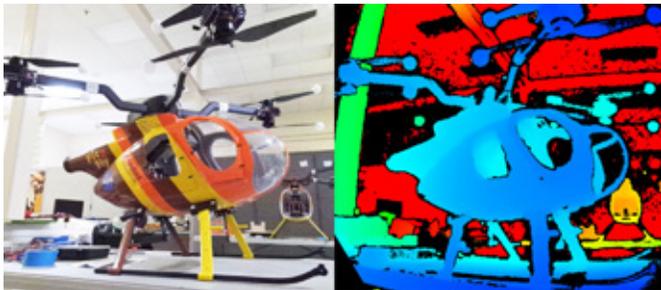
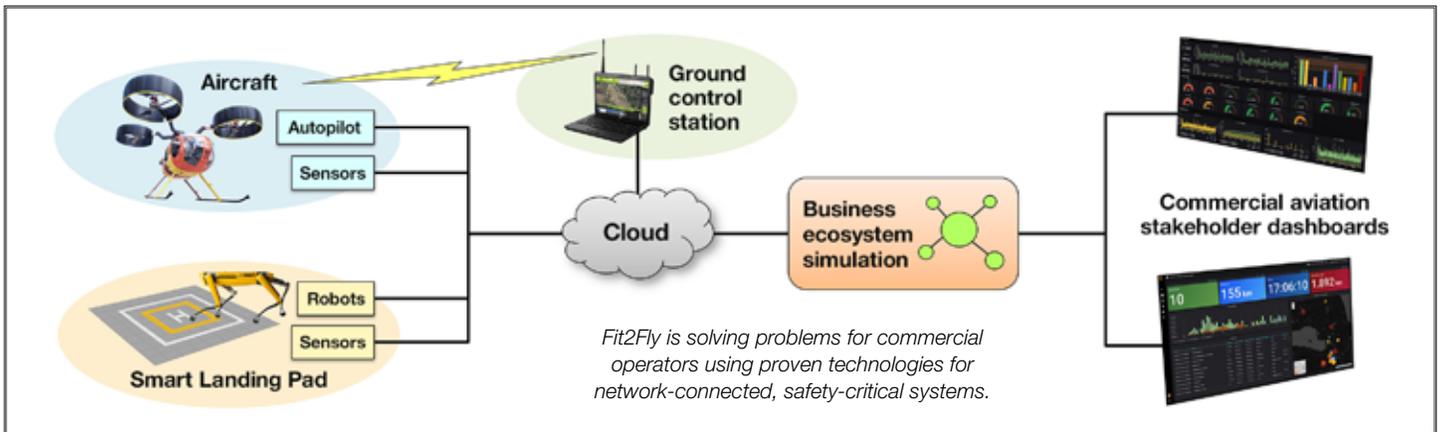


*Fit2Fly is developing scalable solutions that will work for fleets of small drones and fleets of full-scale air taxis.*

## Fit2Fly Solutions

- Digital airworthiness certificate based on a permissioned blockchain, using Smart Contracts
- Digital Commercial Flight Release composed of interlinked, dynamically generated legal contracts
- Harbor Pilot System for managing commercial unmanned aircraft systems (UAS) that minimizes the need for onboard autonomy
- A definition of the requirements UAS should meet to be considered Commercial Grade
- Onboard monitoring systems that support automated postflight security and performance audits
- Smart infrastructure that can fill the safety and operational roles currently performed by humans
- Automated visual, physical, and electronic inspection
- Adapting important chaos engineering, DevOps, and DevSecOps concepts

# NASAfacts



*Indoor test of a sensor system that scans the shapes of objects and tracks movement on the Smart Landing Pad.*



*Flight test images of a UAM testbed vehicle and a smaller fleet vehicle operating in the cage at NASA Langley.*



*Artist concept of two Spot robots conducting a preflight walkaround inspection of an Elroy Air "Chaparral" cargo drone, which has a 250-lb payload capacity and a 26-ft wingspan.*

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## Accomplishments and Activities

### Software and Hardware Development

- Fit2Fly is developing software to coordinate onboard radio monitoring equipment in order to meet the needs of future urban air mobility (UAM) operators with regard to onboard radio mode verification, radio interference detection, vehicle track verification, and cybersecurity.
- A wide variety of sensors are being integrated or developed to enable the automated inspection and testing of vehicles, subsystems, and components. Sensors are being integrated into the vehicles, into infrastructure elements like the Smart Landing Pad, and into mobile robots.
- A business ecosystem simulation is being developed in a private NASA cloud for use in the remaining Fit2Fly flight tests. This simulation will illustrate how data in Fit2Fly is transported, processed, and verified to create and manage trust among business partners, regulators, and customers.

### Feasibility Demonstrations

- Fit2Fly has two milestone flight demonstrations scheduled in FY21. The first will use the larger 25%-scale air taxi vehicles to demonstrate interactions between the vehicle and infrastructure and will include an automated inspection on a Smart Landing Pad. The second milestone flight demonstration will use a fleet of several smaller vehicles to illustrate how Fit2Fly's solutions scale to support continuous multi-vehicle operations.
- A third feasibility demonstration will be performed in collaboration with cargo drone developer Elroy Air as part of a NASA Space Act Agreement.