



Open eVTOL: RAVEN Research Aircraft for eVTOL Enabling technologies

Michael Vincent, Deputy Subproject Manager – AIAA Aviation 2026, 8 June 2026

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Mission Need

There is an imminent need for publicly available flight test data relevant to:

- research
- development of design and analysis methods
- workforce competency

...to further U.S. leadership in technology development for safe, quiet, and efficient eVTOL aircraft for Advanced Air Mobility (AAM).

Open eVTOL

Establish NASA capability to perform open eVTOL flight research

RAVEN

Mid-scale eVTOL flight research platform





Open eVTOL Research Customers

Near-Term Research Focus:

Acoustics

- Acoustics prediction tool development
- Noise metrics studies

Flight Dynamics

- Improve model development techniques
- Accelerate design cycles; reduce ground and flight test

Flight Controls

- Advanced control algorithms, autonomy
- Improve safety, performance, noise

Enduring Research Capability:

Electrified Aircraft Propulsion

- Integrate and swap propulsion components

Autonomous Operations

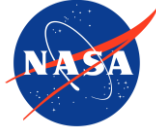
- Novel operational paradigms
- Acoustically aware flight
- Autonomy-enabling technologies

System Safety and Hazard Identification

- Integrated software and avionics
- Failure identification; contingency management
- Vehicle health management

And more...

AAM-relevant flight test asset with known, public data, with ability to accept higher risk research, and ability to invasively integrate hardware and software



RAVEN: Research Aircraft for eVTOL Enabling techNologies

Development

Build Asset

Ground
System
Testing

Flight Testing

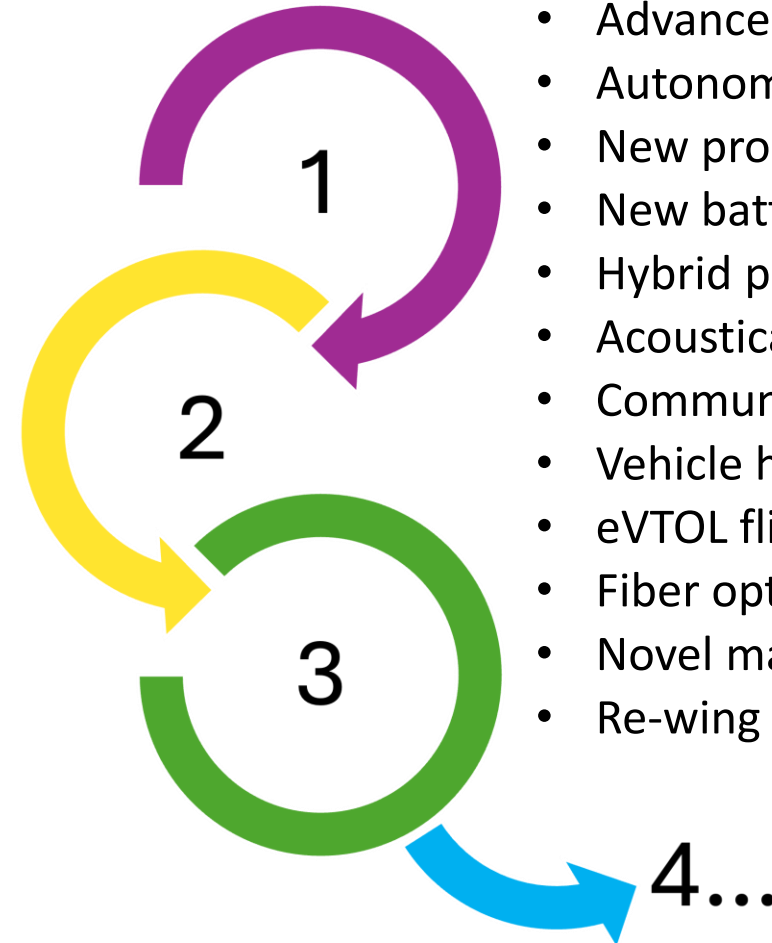
Research Flight
Controls and
Dynamics Flights

Research Acoustic
Flights

NASA Testbed

Future Spirals:

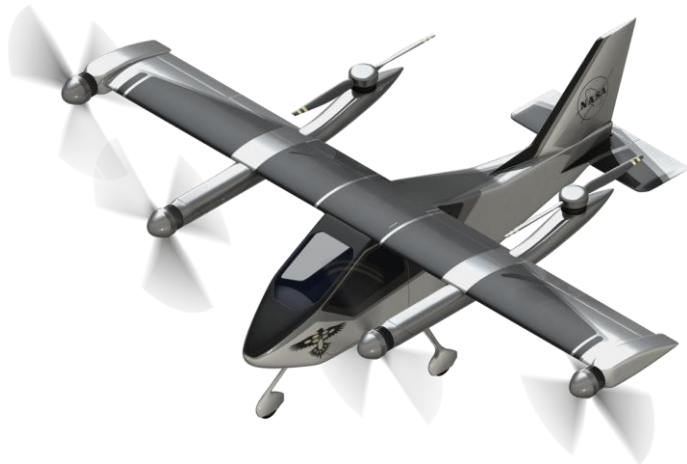
- Advanced flight controls
- Autonomy
- New proprotor designs
- New batteries, motors, inverters
- Hybrid powertrain
- Acoustically aware operations
- Communications technologies
- Vehicle health management
- eVTOL flight procedures
- Fiber optic sensing techniques
- Novel materials
- Re-wing options





RAVEN: Research Aircraft for eVTOL Enabling techNologies

- 1000-lb class UAS
- Multi-tiltrotor aircraft with 6 variable-pitch proprotors
 - 4 tilting proprotors (forward and tip)
 - 2 non-tilting proprotors (rear)
- Electric powertrain
- Open (publishable) parameters, based on BD-6 airframe
- Onboard research flight control system
- Multiple aircraft planned



Wing-borne configuration



Rotor-borne configuration

Anticipated/target characteristics

Wingspan	21 ft
Length	17 ft
Proprotor diameter	~6 ft
Hover disk loading	8 lb/ft ²
Tip speed: hover	Mach 0.35-0.5
Tip speed: cruise and conversion	≤ hover tip speed
Gross weight	≤ 1320 lb
Research payload	30 lb, 2 ft ³
Hover endurance	5 mins
VTOL, CTOL range	≥ 20 nmi

Why this configuration?

- Industry is narrowing on multi-tiltrotors as one of the most popular solutions for Urban Air Mobility

Why this size?

- 1000 lb-class vehicle is sufficiently large to provide **representative flight physics** for passenger-carrying AAM vehicles: similar conversion flight characteristics and acoustics
 - Wing loading, disk loading, wake interactions, transition flight are all similar to full scale
 - Proprotor diameter, tip Mach number, and aerodynamic interactions are representative size for studying noise (and full geometry definition enables tool validation)



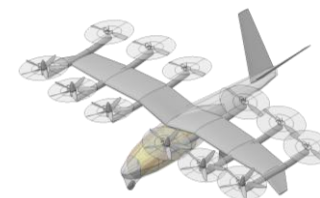
Many small UAS
0 – 20 lb

Some slightly larger UAS
30 – 55 lb

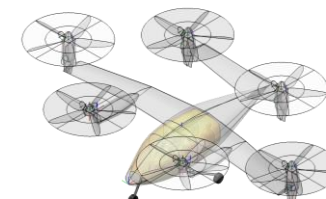


RAVEN (1000 lb-class)

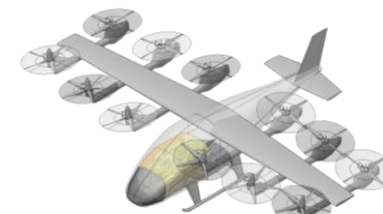
IP-restricted industry demonstrators
500 – 1000 lb



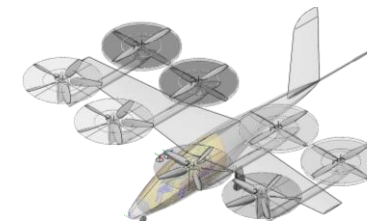
Archer Midnight



Joby S4



Wisk Gen 6



Vertical Aerospace VX4

IP-restricted industry eVTOLs
5,000 – 10,000 lb

RAVEN: 1000 lb-Class eVTOL Flying Laboratory

- Provides **open flight data** to accelerate the emerging AAM market
- **Relevant scale** to address “real world” issues in eVTOL design and development for AAM
- Adequate size to accommodate larger **research payloads** (avionics, sensors, flight computers)
- Configuration **representative of industry eVTOLs**, with relevant challenges in aerodynamics, propulsion integration, acoustics, and flight control
- Leverages off-the-shelf airframe and components for **modest cost** and **reduced development risk**
- Resulting aircraft will be available as a **“flying laboratory” for enduring research and technology development**



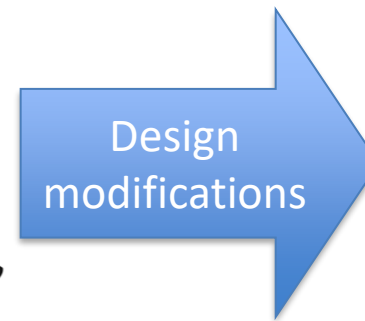
BD-6 experimental
homebuilt airplane



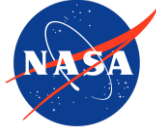
Electric powertrain



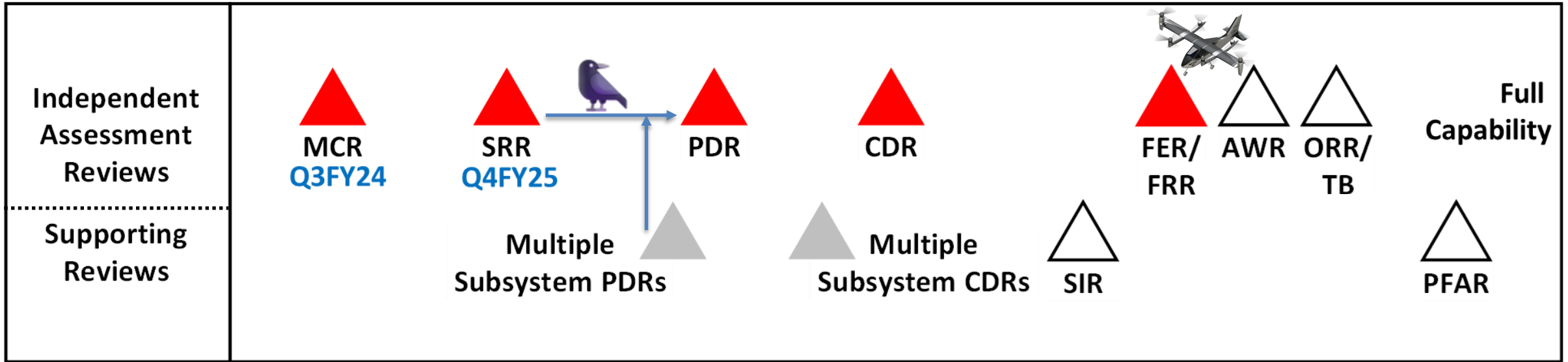
Custom proprotor, tilt
mechanisms, airframe
modifications, control scheme



eVTOL Flying Laboratory



Development Status



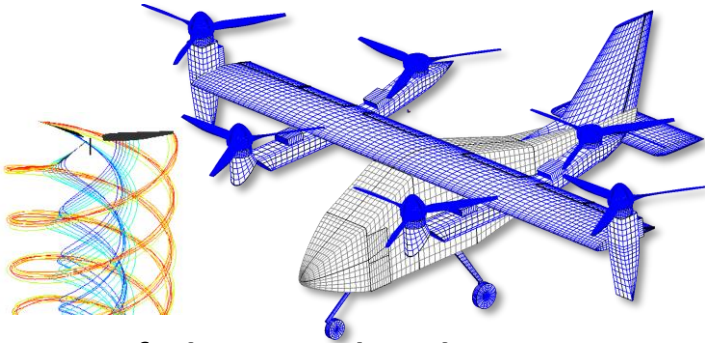
- Mission Concept Review (MCR) and System Requirements Review (SRR) were very successful
- Target full-system Preliminary Design Review (PDR) late summer
- Schedule is being accelerated by NASA Aeronautics Flight Accelerator (AFA)

Acronyms:

AWR – Airworthiness Review*
CDR – Critical Design Review
FER – Final Engineering Review*
FRR – Flight Readiness Review
MCR – Mission Concept Review
PDR – Preliminary Design Review

PFAR – Post Flight Assessment Review*
ORR – Operational Readiness Review*
SIR – System Integration Review*
SRR – System Requirements Review
TB – Technical Brief*

Photo highlights: progression to PDR



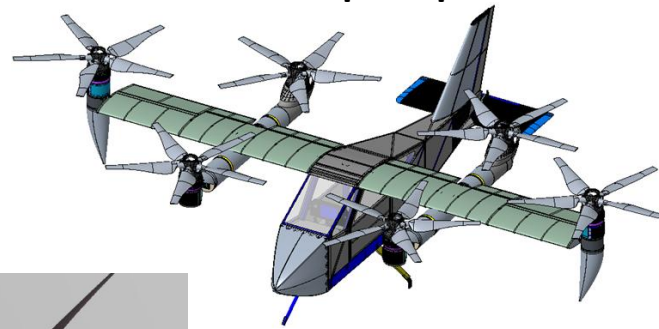
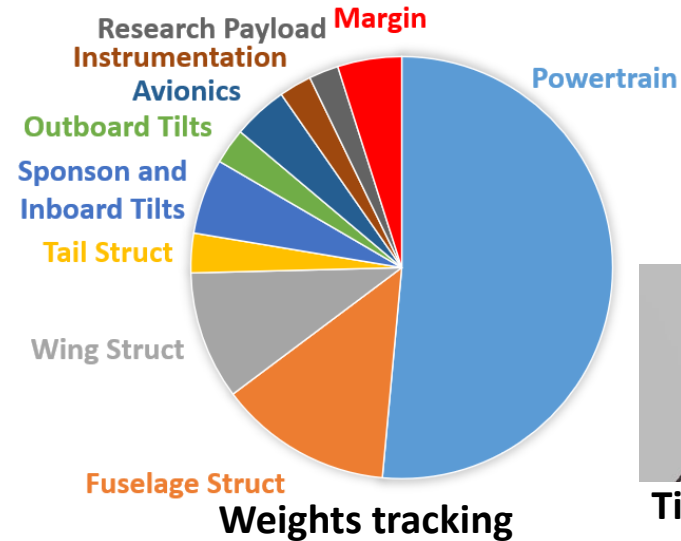
Aircraft design and analysis



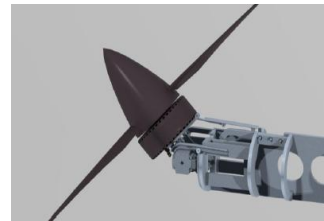
RAVEN SWFT envelope expansion



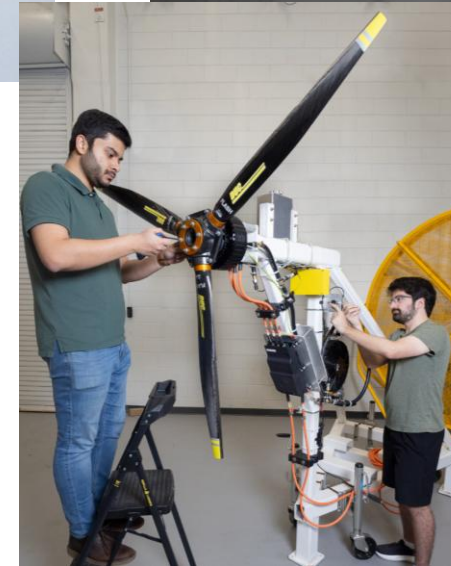
Iron RAVEN, Fulton County Airport



Mechanical design



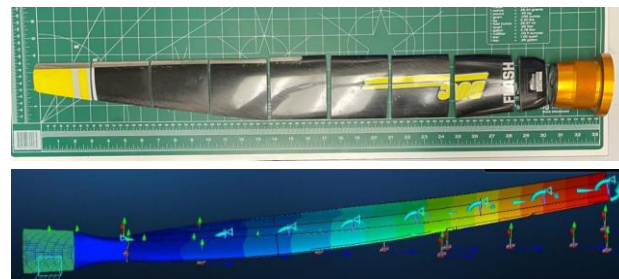
Tilt mechanisms



Single String Test Stand,
Georgia Tech



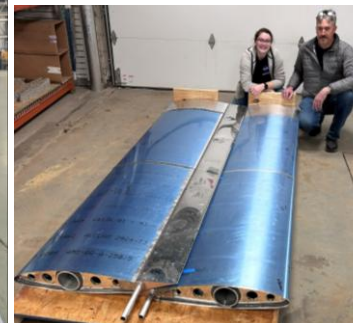
BD-6 airframe, Georgia Tech



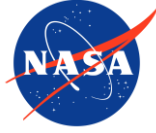
Proprotor design and test



BD-6 airframe assembly



Wing build and structural test, Bede Aero



THANK YOU!



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