



# Joint Cargo UAS

## Mono Tiltrotor (MTR)

Presentation for:

**HQ Air Mobility Command**  
**Scott AFB**

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Baldwin Technology Company, LLC  
[www.baldwintechology.com](http://www.baldwintechology.com)



# Outline of presentation

- A material and operational innovation
- Mono Tiltrotor (MTR) features
  - Cargo/Utility
  - Attack
- Mono Tiltrotor advantages & benefits
- BTC business model
- Timeline
- Next steps
- References



# Technical innovation

- Suspend cargo about the aircraft pitch axis
  - Eliminates an accepted design constraint
  - Stabilizes aircraft during conversion
- Permits an efficient cargo VTOL design
  - Large diameter rotary wing for hover
  - Large span fixed wing for cruise
  - Structural weight fraction of a helicopter
  - Other key criteria
    - Minimal download in hover
    - Rotor operates as propeller in cruise



# Operational innovation



- Breakthrough in theater delivery and retrograde
  - Mountainous and urban combat support
  - From sea or land based distribution node
  - No need for MHE at the destination
  - 200kts / 375nm ROA / 20k ft altitude
  - Up to four delivery sites per sortie
- Small and flexible footprint
  - Folds and fits in MILVAN
  - Operates from sloped and rugged terrain
  - Reconfigure for attack, CASEVAC,...



# Chronology of our findings



- 2004: MTR Concept Study (ONR)
  - Breakthrough performance possible
- '05/06: 3000lbs payload design (AATD)
  - Point design created
- '07/08: Demonstrate and Assess (AATD)
  - Function demonstrated on RC flight models
  - Point design independently assessed
- '09/10: Cargo UAS Operations Study (ONR)
  - Shipboard capable (ongoing work)



# MTR Cargo/Utility Features

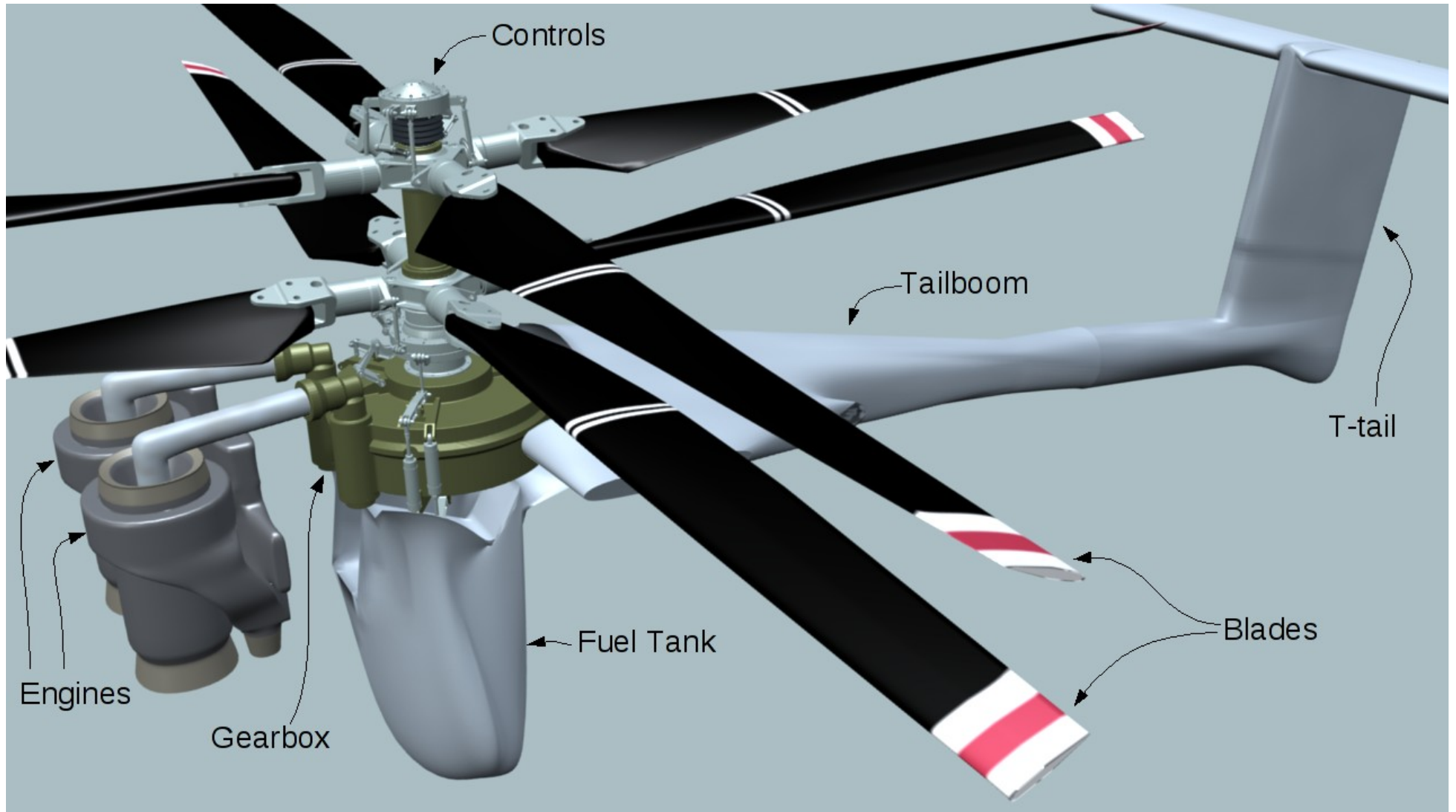


- Common drive system and tail assembly built from mature components & technologies
- Modular cargo pod
  - Joint Modular Intermodal Container
  - Pallet, cargo net, other...
- Modular, hinged, dry (no fuel) wing panels
  - Droop for maximum performance takeoff
  - Deploy for efficient cruise

See videos and illustrations

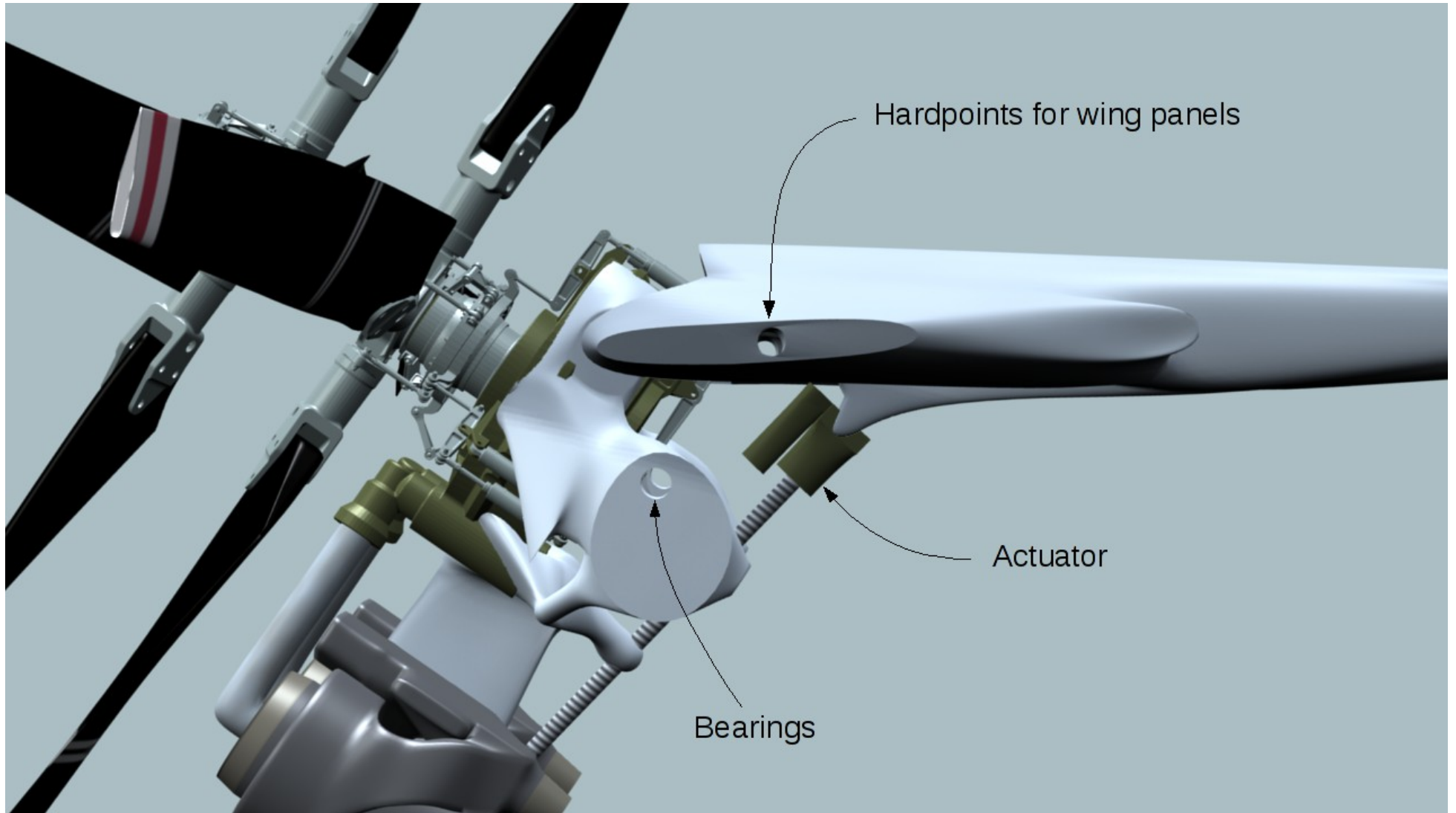


# MTR Common Features



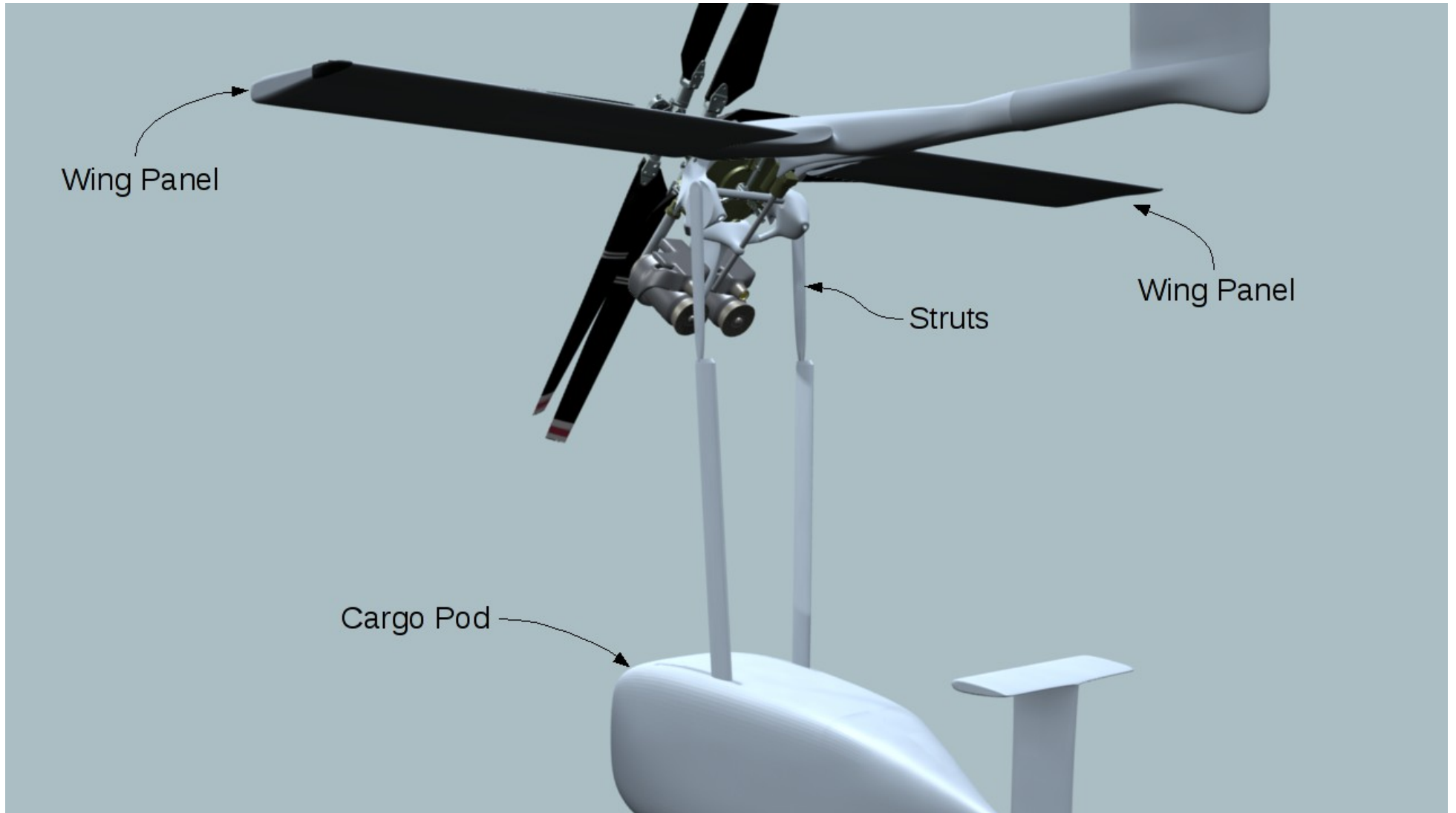


# MTR Unique Features





# MTR Cargo Features





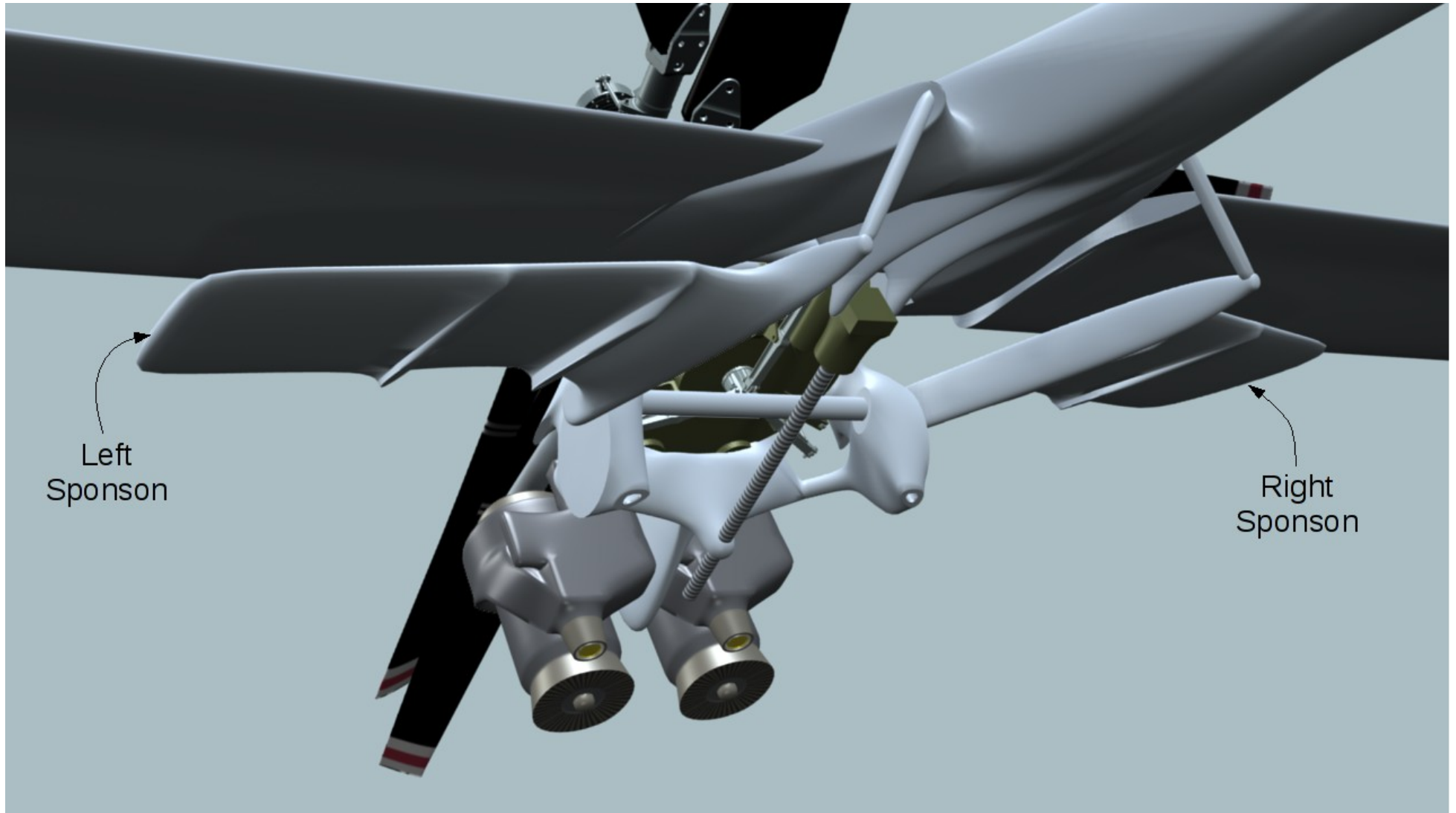
# MTR Attack Features

- Common drive system and tail assembly built from mature components & technologies
- Fixed, wet (fuel) wing with tip mounted AAM
- Eliminate cargo pod assembly
- Armaments supported by strut hardpoints
  - AGM
  - Cannons
  - Rockets

See videos and illustrations

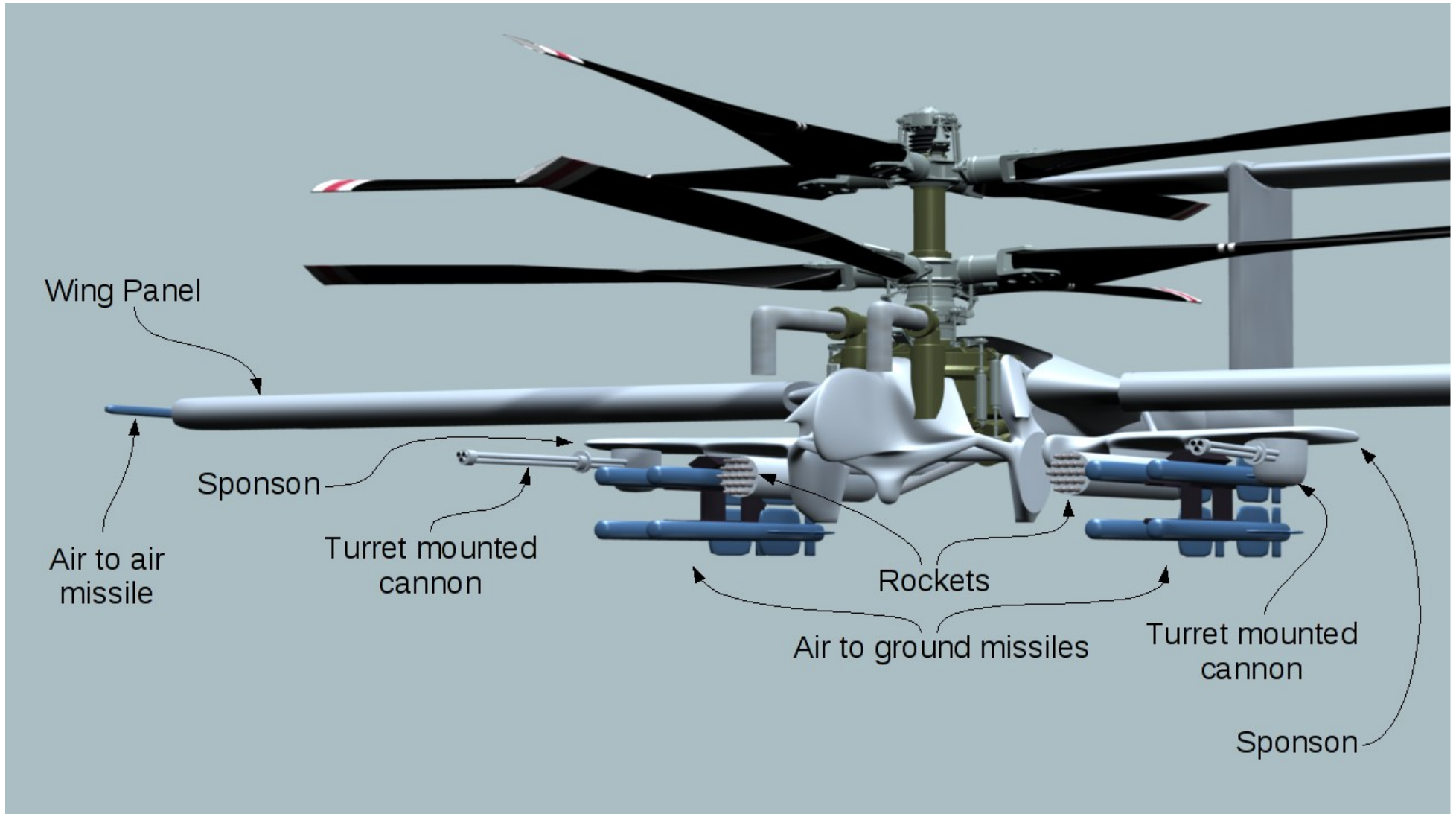


# MTR Attack Features





# MTR Armaments





# MTR Advantages

- In comparison to legacy helicopters for long range (750nm to 1000nm) cargo missions:
  - 1/3<sup>rd</sup> of the baseline structural weight
  - 1/3<sup>rd</sup> of the fuel burn
  - 1/2 of the size (i.e. rotor diameter)
  - Nearly twice the speed
- Performance advantage due to system level architecture [not due to subsystem advances]
  - Large disk with minimal download in hover
  - Optimal wing and small frontal area in cruise



# MTR Advantages (cont.)



- Common drive system and common hinged tail assembly for all missions and configurations...
  - Engines and gearbox
  - Hubs, blades, and controls
  - Tailboom, stabilizers, and control surfaces
  - Conversion actuator
- No reconfiguration of drive/tail assembly to re-missionize between cargo and attack roles



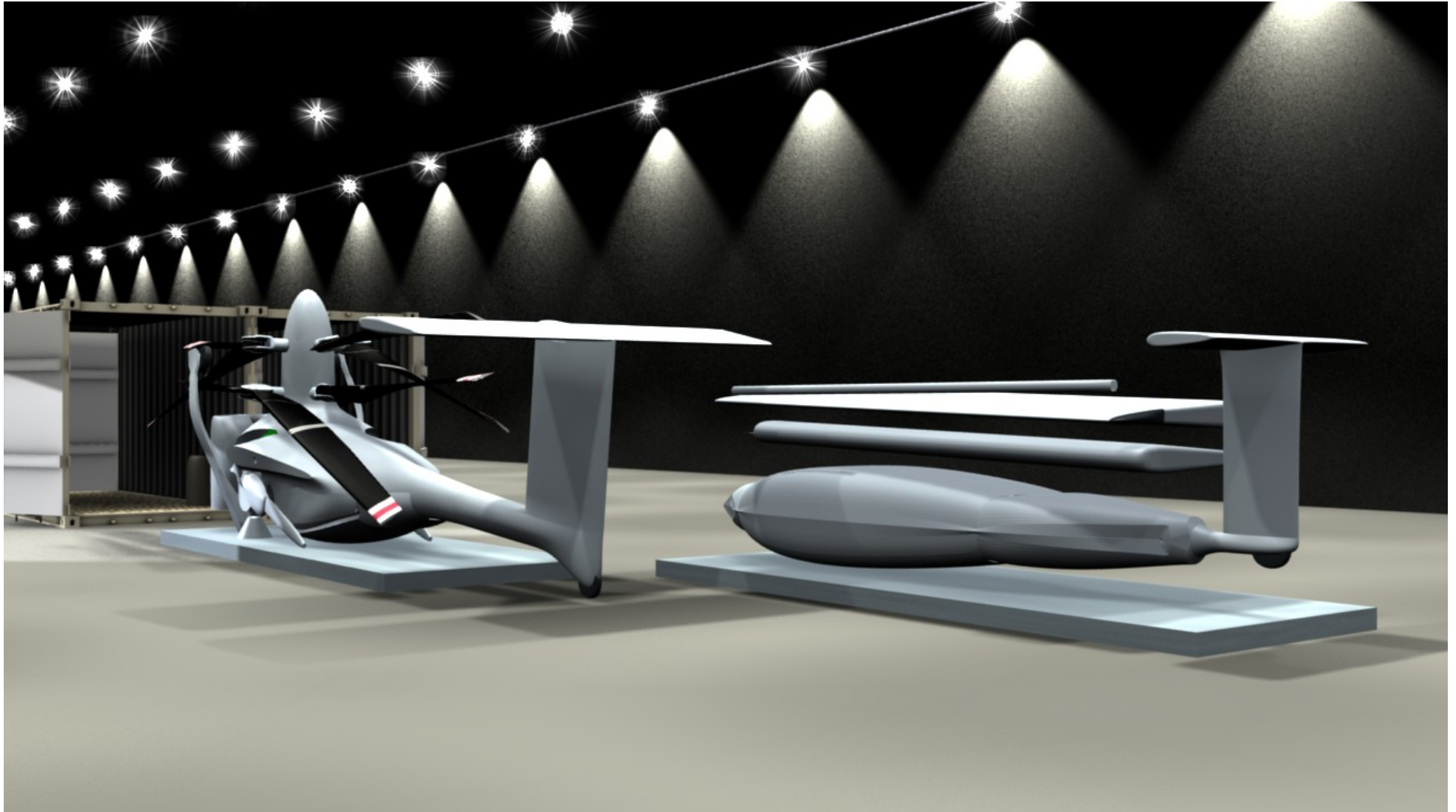
# MTR Advantages (cont. 2)



- Mission packages are external to airframe
  - Relaxed cube constraints
  - Simple mechanical interface
  - Decouple from airframe program
- Modular airframe architecture
  - Disassembles for stowage and transport
  - Highly accessible components and sub-assemblies for maintenance actions



# MTR Disassembly





# MTR Benefits

- Breakthrough range/speed/payload using COTS components and technologies
- Reduced acquisition costs (weight of airframe)
- Reduced O&S costs (weight of fuel; modular)
- Reduced component S&T costs (COTS)
- Rapid reconfiguration between roles
  - Connect cables for cargo
  - Mount armaments for attack



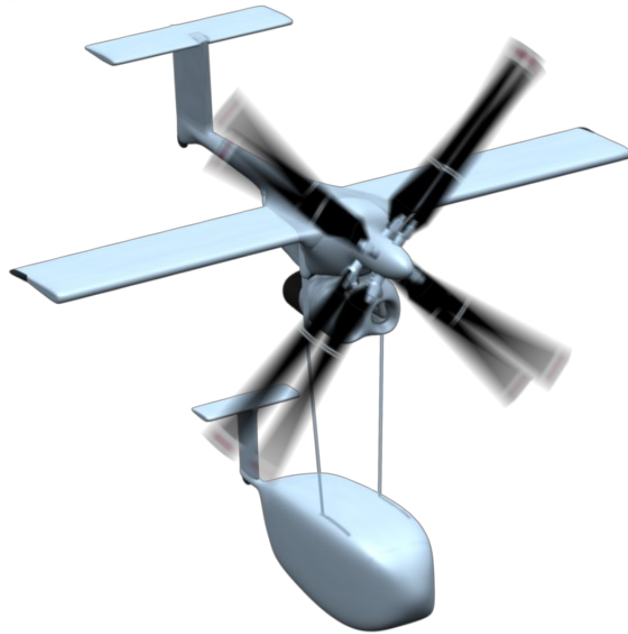
# BTC Business Model

- Licensee of MTR patents for MTR research
- Funded by US Government R&D contracts
  - All deliverable data licensed to US Gov't
  - Preference to publish all reports
- Ad hoc, world-class R&D teams for each SOW
- Primary focus is on MTR technical bona fides
- Responsive to Government needs while advancing the understanding of the MTR
- Positioned for future teaming arrangement(s)

Extreme Development speeds time to market.



# Mono Tiltrotor (MTR)



## Technology [TRL 4]

- Pitch axis suspended load air vehicle
- Efficient hover and cruise connector
- Sustain battlefield from sea or ashore

## Design

- 3000lbs load, 750nm, 200kts, UAS
- 2xT800, 52% struct. eff., Cruise L/D=10
- 25ft rotor, 30ft span
- Sized for MILVAN transportability
- Sized to transport JMIC
- Reconfigures into an attack aircraft

## Participants

- Army AATD – Ft Eustis; ONR
- Baldwin Technology Company (BTC) w/
  - Bell, GT, UMd, ARL, Eagle Aviation

## Status and Plans

- ONR Conceptual Design Study – FY04
- AATD Concept/Prelim Design – FY05-06
- AATD Validation Activities – FY07-08
- ONR Operations Study - FY09-10

## Research Contracts

Amounts (\$K)	FY04	FY05	FY06	FY09	Total
ONR	277			690	967
AATD		810	819		1629

## Benefits

- Breakthrough in vertical sustainment speed, range, and payload using COTS components and technologies
- 1/3 of structural weight & fuel compared to conventional helicopter at same range



# Current Snapshot



- Activities underway
  - Refine understanding of CONOPS
  - Flight dynamic simulation of CONOPS
  - Autonomous flight simulation
- On the radar screen
  - Diverter/diffuser preliminary design
  - Assess landing gear conceptual design
  - Full scale Cargo Pod demonstration
    - Suspended from the pitch axis of a surrogate platform
    - Streamline and transport JMIC



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