



# An Integrated Process for the Manufacture of On-Demand Small Unmanned Aircraft Systems

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- **Introduction**
- **The Tactical 3D printing (Tac3D) digital catalog**
- **The Tac3D process**
  - The technical data package
  - The parametric model
  - Use of additive manufacturing
- **Future work**
- **Questions and discussion**

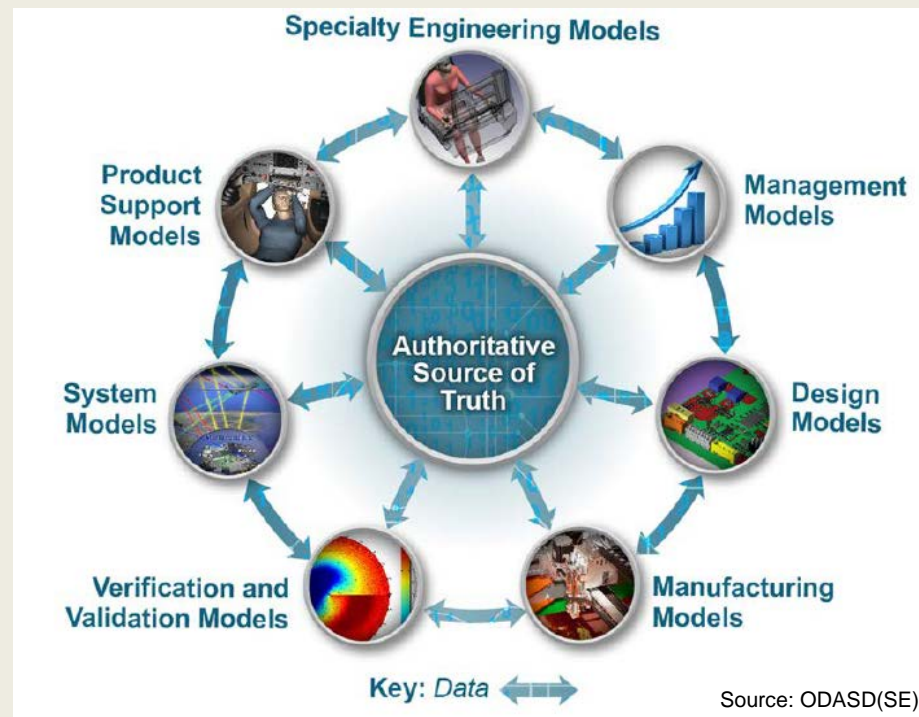


- **Current state**

- Operational and threat environments are **dynamic**
- Current process of acquiring materiel system solutions is **incompatible**

- **Need**

- Deliver advanced capabilities to the Warfighter, **more quickly and affordably**
- Changes in infrastructure, people, processes, and culture



*Shared models inform design and decision-making*

**Digital Engineering Strategy intends to transform the way the DoD innovates and operates**



U.S. ARMY  
**RDECOM**

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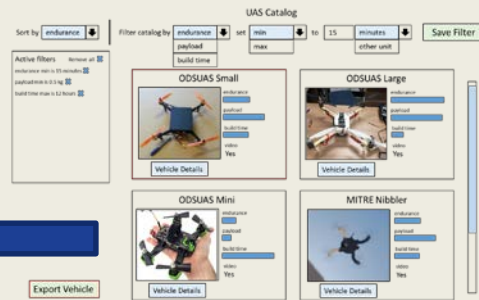
# Introduction: The On-Demand Process



Start with user in need

Check-out and fly

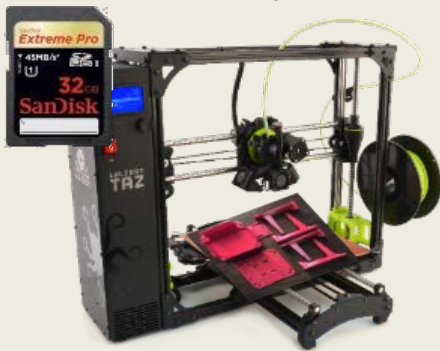
Select UAS from a catalog



User  
receives  
UAS



Download 3D print files;  
print body and arms



Assemble



Gather subassembly kits



UAS = Unmanned Aircraft System



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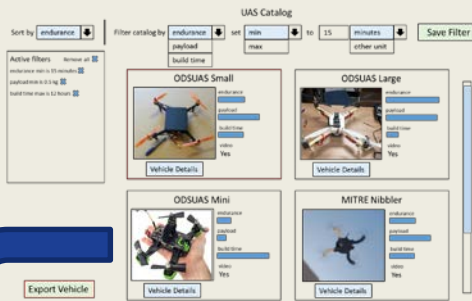
# Model-based portion of the integrated process



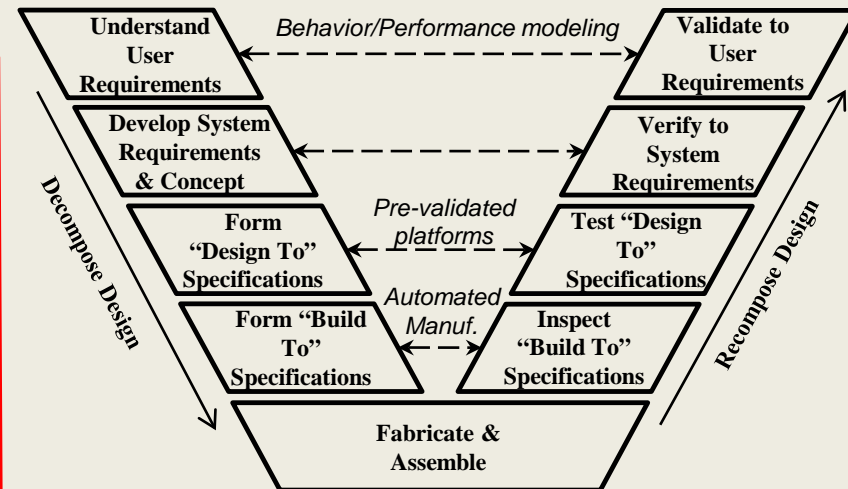
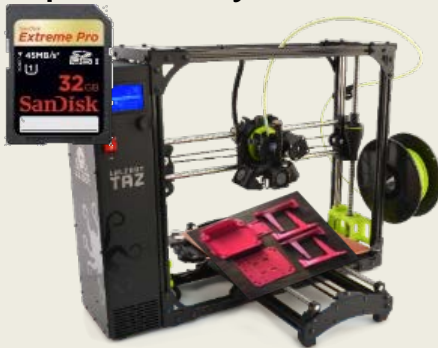
This presentation will focus on:

- 1) The Tac3D digital catalog
- 2) The vehicle parametric model
- 3) The technical data package
- 4) Use of additive manufacturing

Select SUAS from a catalog



Download 3D print files;  
print body and arms





## Small UAS Catalog

Sort by **endurance**

Filter catalog by **build time** set **max** to **10** **hr**

Save Filter

### Active filters

Remove all



endurance min is 13.000 min



build time max is 10.000 hr



### ARDEC Opus



endurance  
30.0 min  
payload  
40.0 lbf  
build time  
1.0 hr  
video  
Yes

Vehicle Details Performance

### ARDEC Amelia



endurance  
28.0 min  
payload  
9.0 lbf  
build time  
1.0 hr  
video  
Yes

Vehicle Details Performance

### ODSUAS Large



endurance  
25.0 min  
payload  
1.2 lbf  
build time  
10.0 hr  
video  
Yes

Vehicle Details **Performance**

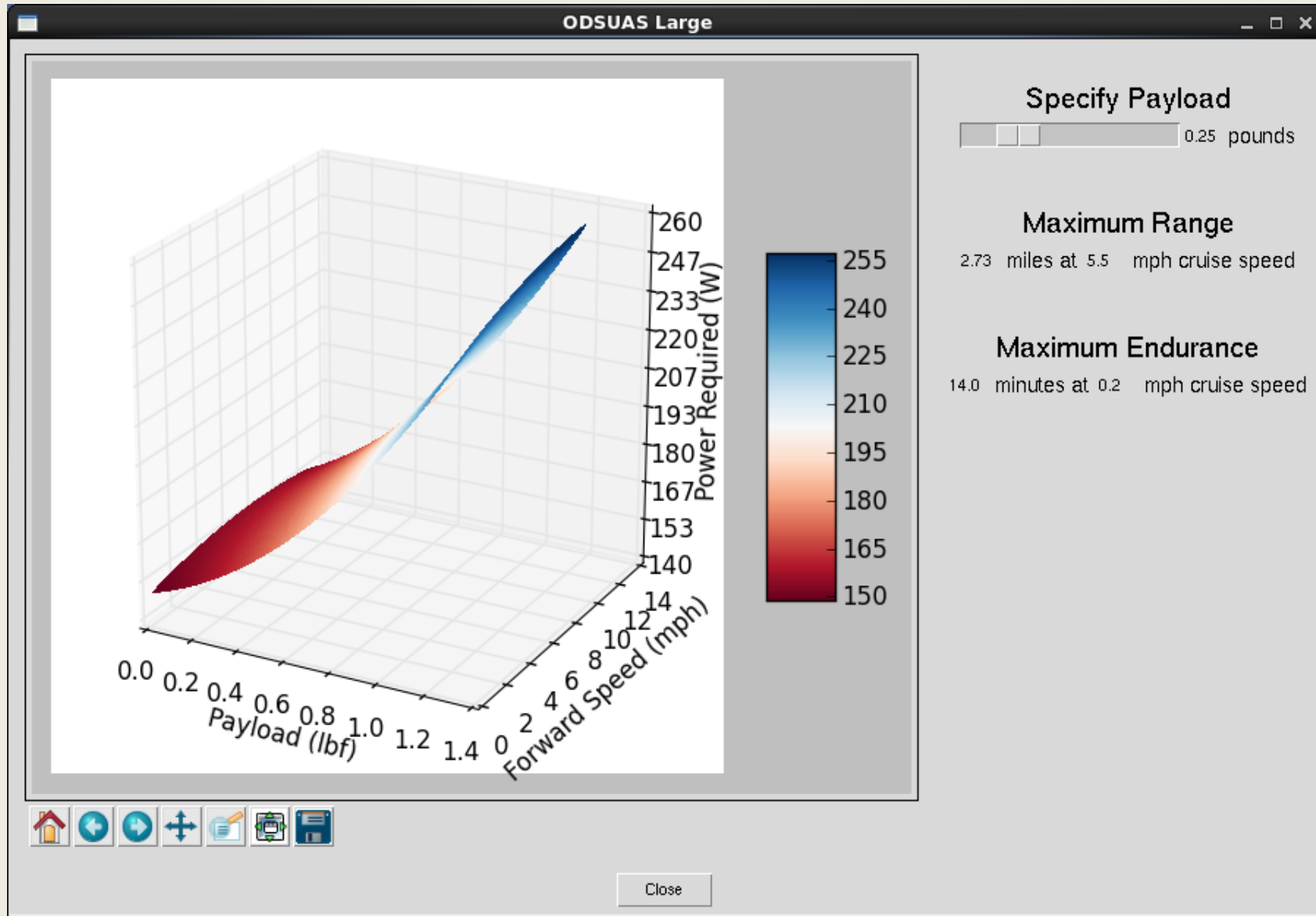
### ARDEC Wilbur



endurance  
16.0 min  
payload  
4.0 lbf  
build time  
0.3 hr  
video  
Yes

Vehicle Details Performance

Export Vehicle





## Small UAS Catalog

Sort by  Filter catalog by  set  to

**Active filters** Remove all

endurance min is 13.000 min

build time max is 10.000 hr

### ARDEC Opus



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### ODSUAS Large



endurance  
25.0 min  
payload  
1.2 lbf  
build time  
10.0 hr  
video  
Yes

**Down-select  
to a single  
vehicle**

### ARDEC Wilbur



endurance  
16.0 min  
payload  
4.0 lbf  
build time  
0.3 hr  
video  
Yes

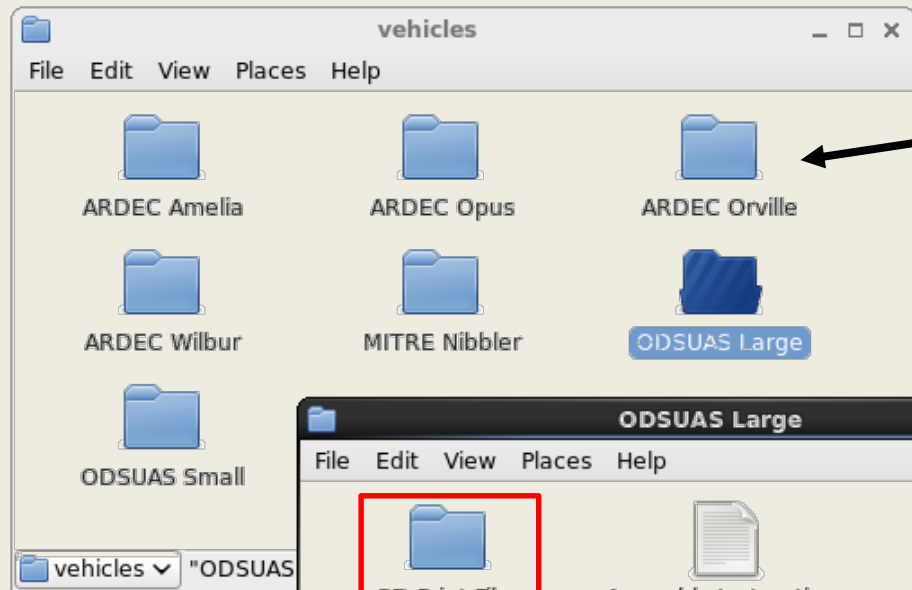
**Export the  
technical  
data package**







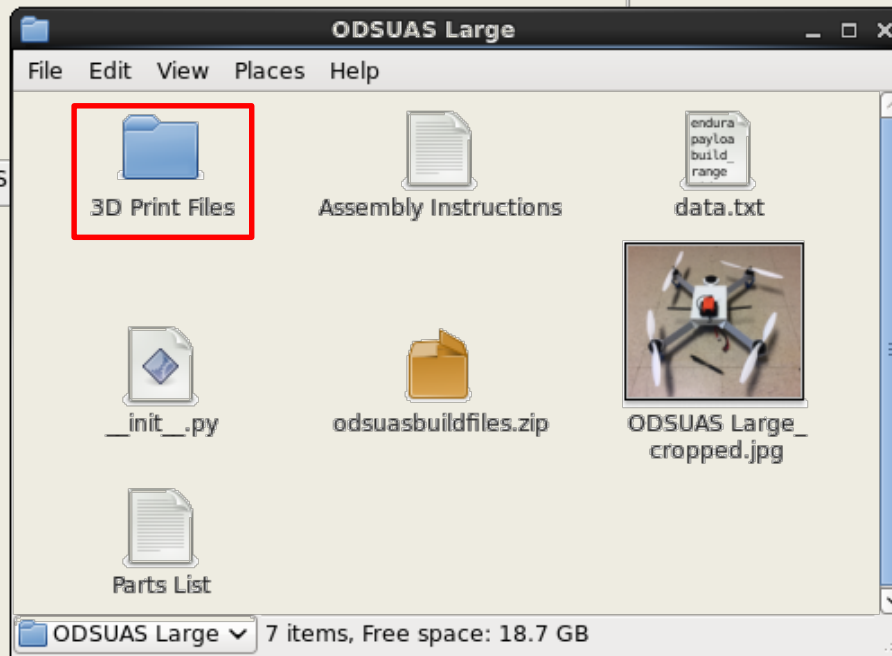
## Directory containing all of the information about a vehicle



All vehicles require a tech data package (TDP)

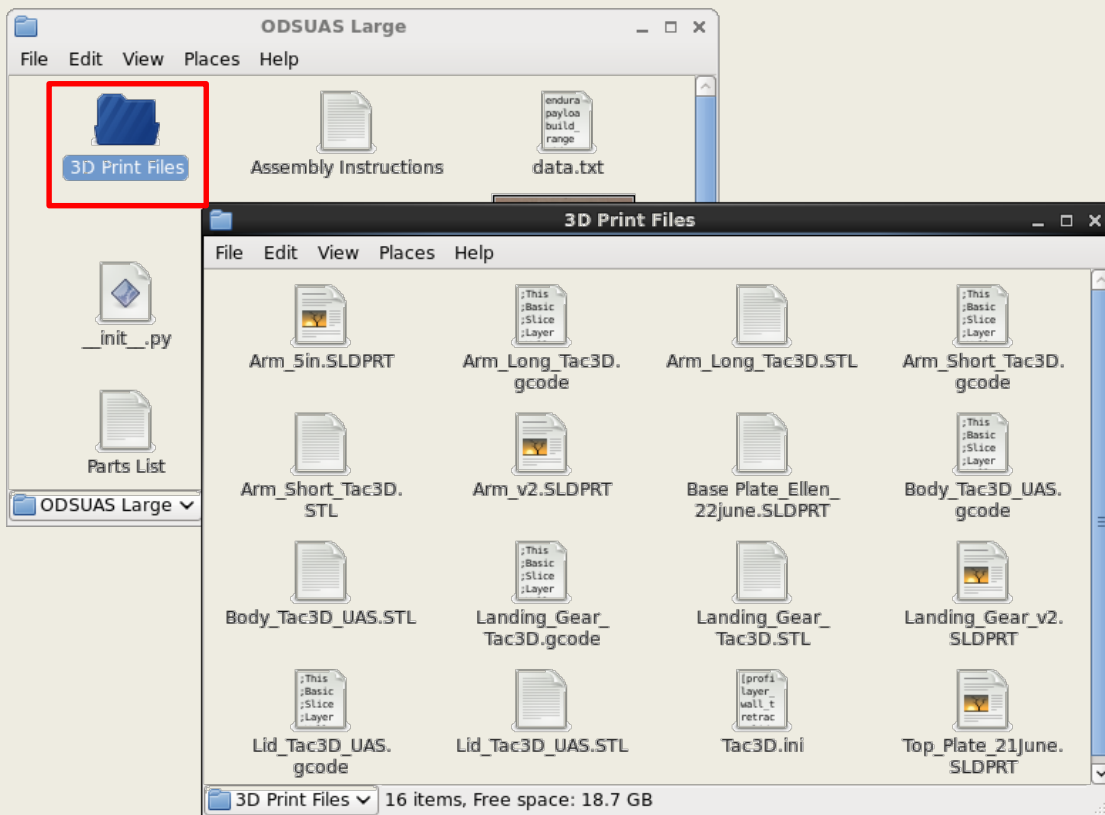
### TDP contains:

- Performance data
- Parts list
- Photographs
- Assembly instructions
- 3D print files





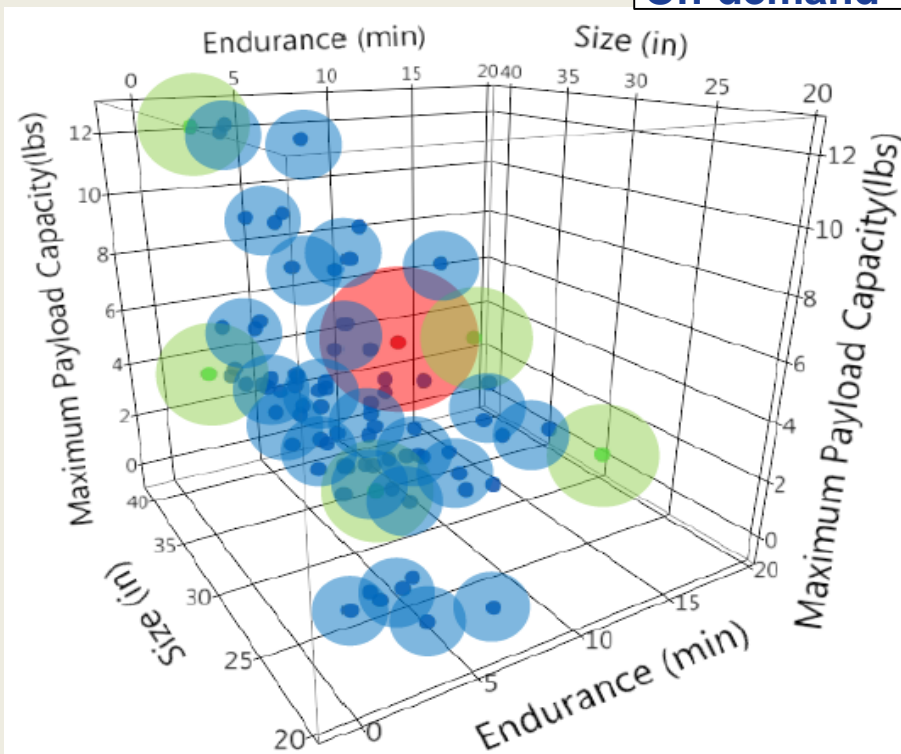
- **Tech data package 3D print files come with recommended printer settings**
- **Settings can be modified before printing**
- **Currently, one TDP represents one size/snapshot of the parametric model**
  - In the future, real-time scaling of vehicle families





- No single vehicle can satisfy all regions of the design space simultaneously
- Users want, but cannot achieve
- **Min**
  - Size
  - Weight
- **Max**
  - Range
  - Endurance
  - Payload
- **Solution:**
  - Scale a baseline vehicle up or down to meet a wide range of performance and geometric requirements
- **How?**
  - Parametric CAD model

**Multi-mission**  
**Optimized**  
**On-demand**



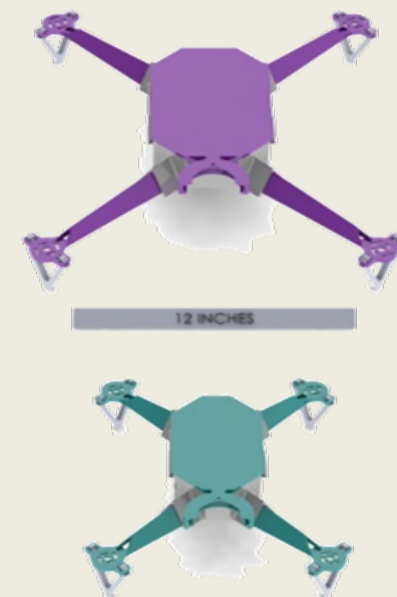
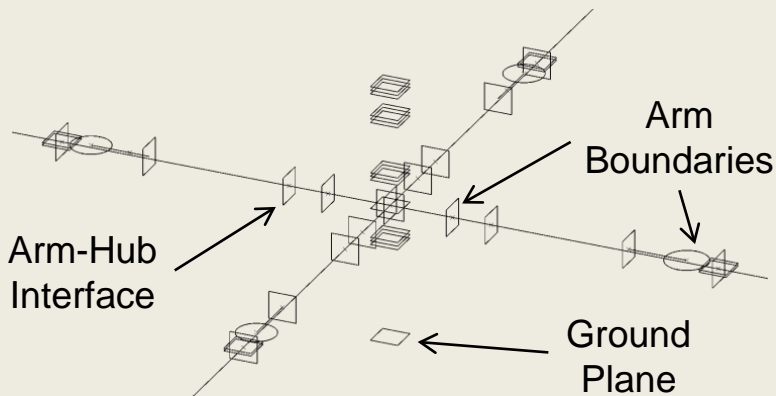
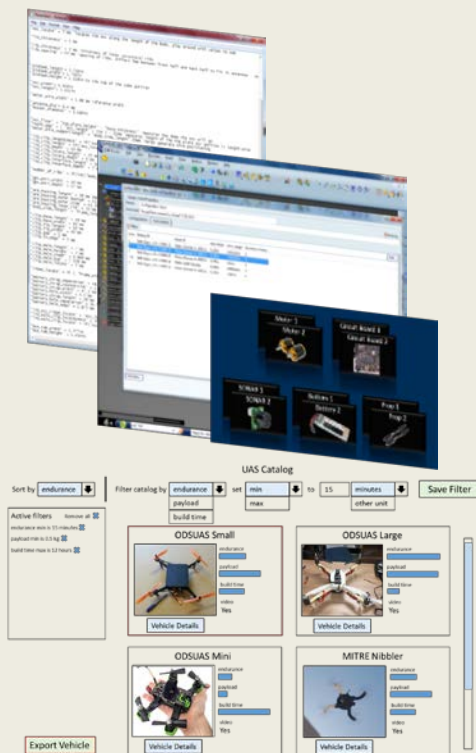
*Requirement combination leads to a mission-driven solution*



## Design Parameters

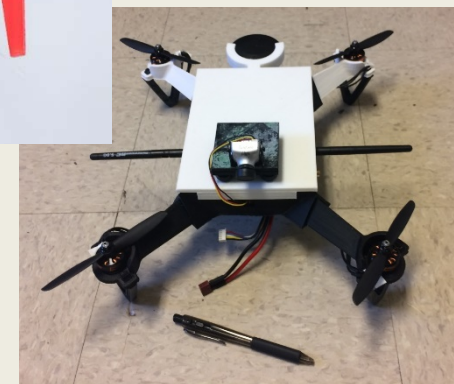
## Controlled Geometry

## Scalable Architectures





- **Vehicles can quickly leverage new improvements in AM materials and technology; stay ahead of obsolescence**
- **Materials are inexpensive**
- **Vehicles can be abandoned after a one-way mission**
- **Vehicles can be manufactured quickly (~5-12 hours)**
- **Vehicles can be designed to leverage AM**
  - Custom accessory mounts
  - Topology optimization
  - Reduced part count





- **Vehicle**

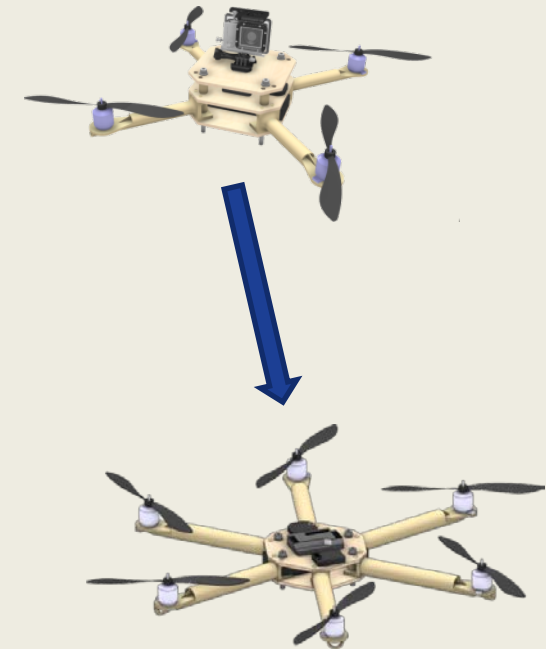
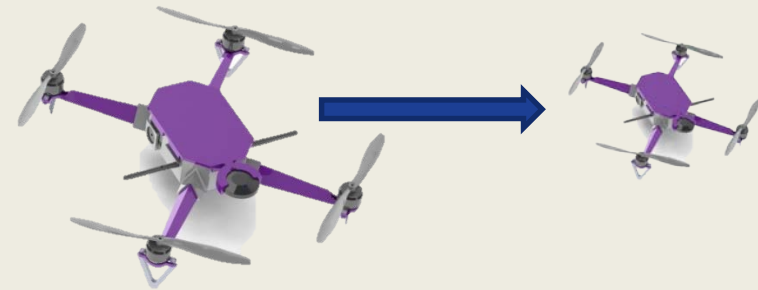
- Modularity (quad, hex, octo)
- Vehicle families replace individual scaled vehicles in the catalog; provide access to more capability space
- Architecture (rotary wing, fixed wing, blended wing)

- **Platform**

- Multi-material (plastic, metal, rubber)
- Integrated electronics (circuits, motors, batteries)

- **Long term research objectives**

- Printed embedded electronics
- All-at-once printed UAS
- Trustworthy UAS that fly as designed



**A model-based approach let's us innovate at the speed of battle**

