Transformational Tools and Technologies (T^3) Project

AIRVUE (Crowdsourcing)

Airborne Instrumentation for Real-world Video of Urban Environments

Nelson Brown

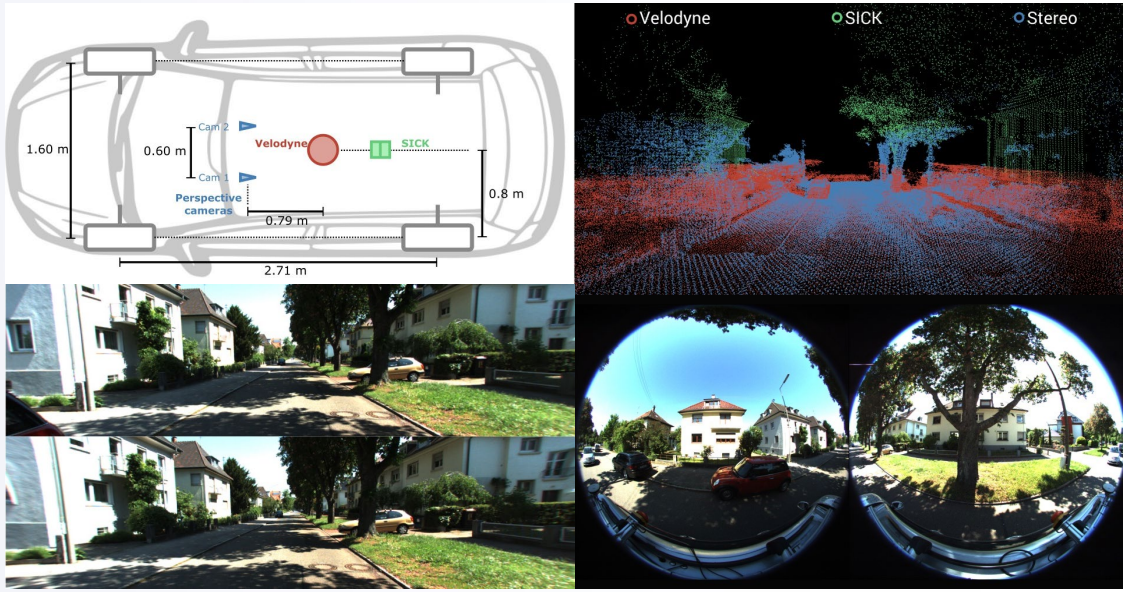
Motivation

Advances in computer vision are fueled by data

We hope to inspire autonomous aviation advances by creating large, diverse, open datasets in an AAM context.

ImageNet

KITTI-360



AIRVUE

Airborne Instrumentation for Real-world Video of Urban Environments

- Build and publish datasets to accelerate autonomy perception research toward UML4+
- Integrate cameras and other sensors into a ride-along pods and install the pods on fleet helicopters as surrogates for eVTOL
- Accumulate and curate the video & sensor data in online repositories accessible to researchers across NASA and beyond

Potential Commercial Data Consumer Stakeholders

- Skyryse
- Reliable Robotics
- Daedalean
- Near Earth Autonomy
- Xwing
- Iris Automation

Active envelope protection

Our system integrates with fly by wire technology and is designed to deliver commercial airline level safety to all aircraft. The aircraft is able to conduct multivariate analysis and make the split-second adjustments needed to keep the aircraft within safe flight parameters as they complete their

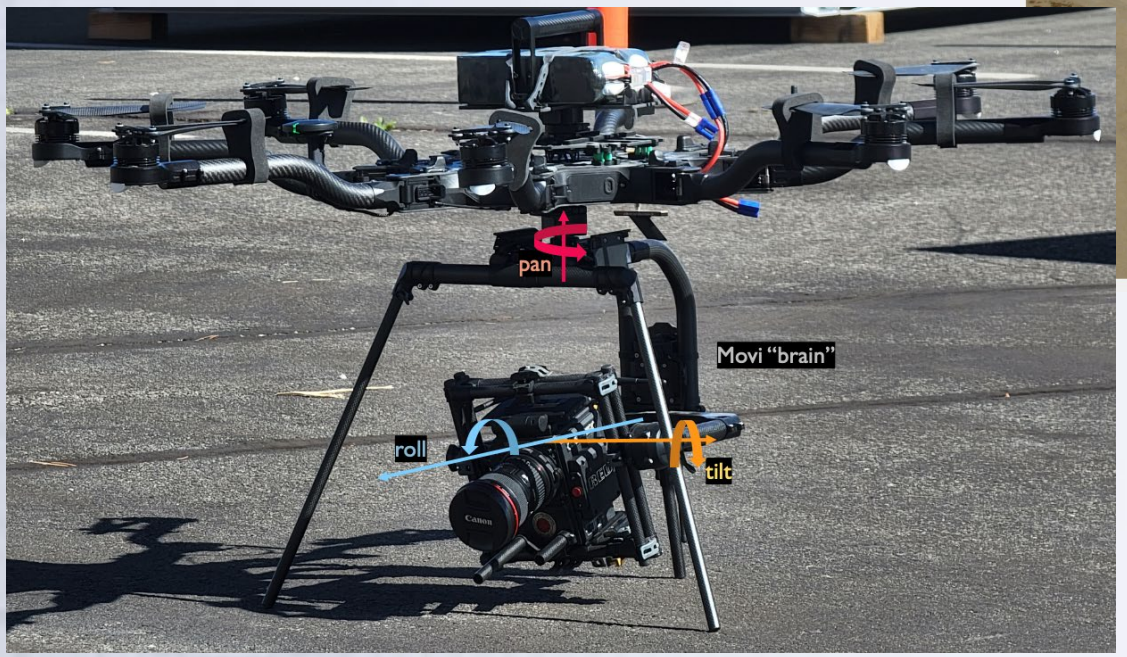
Visual Traffic Detection

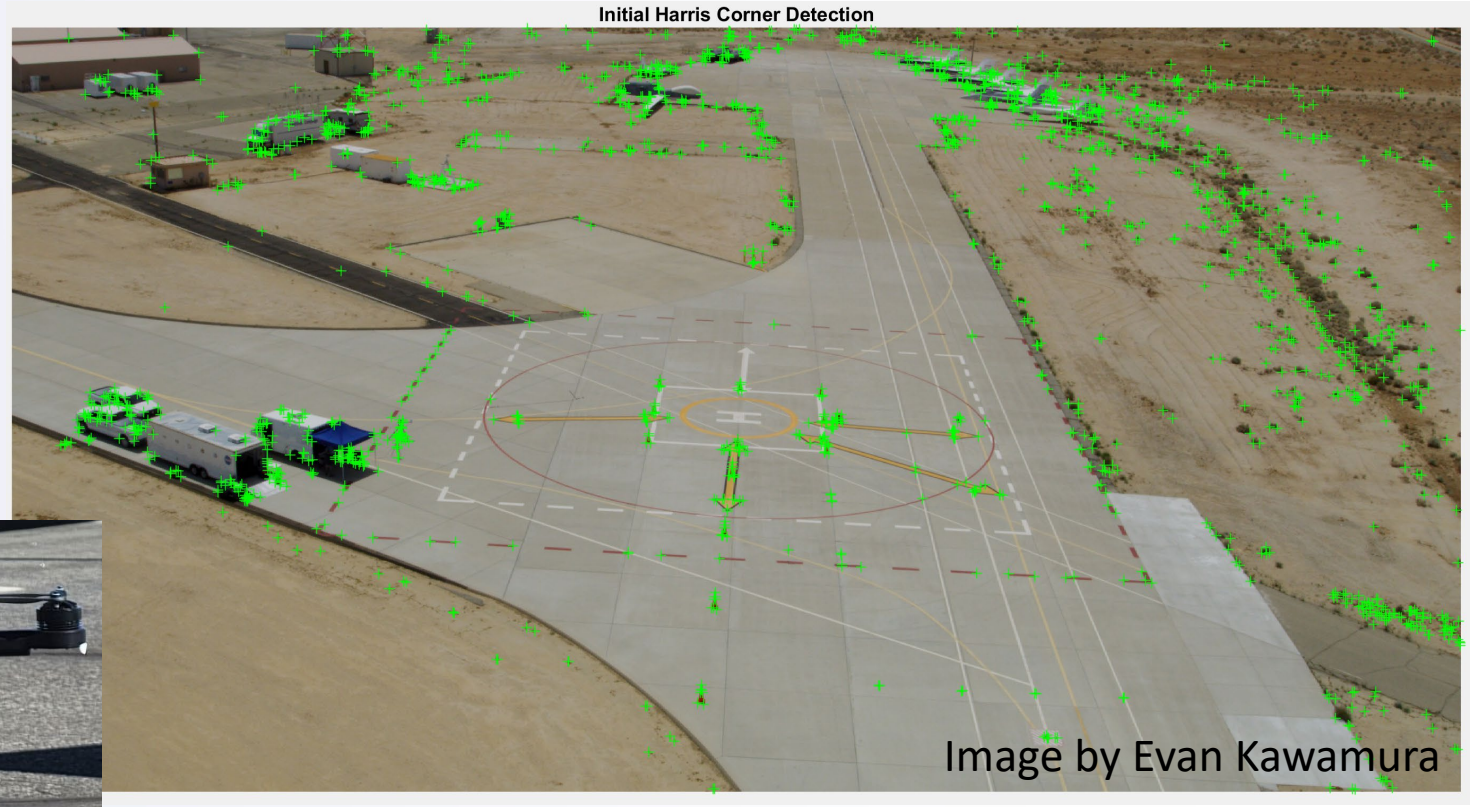
Visual Landing Guidance

Visual Positioning

Data Collection for Distributed Sensing in FY22

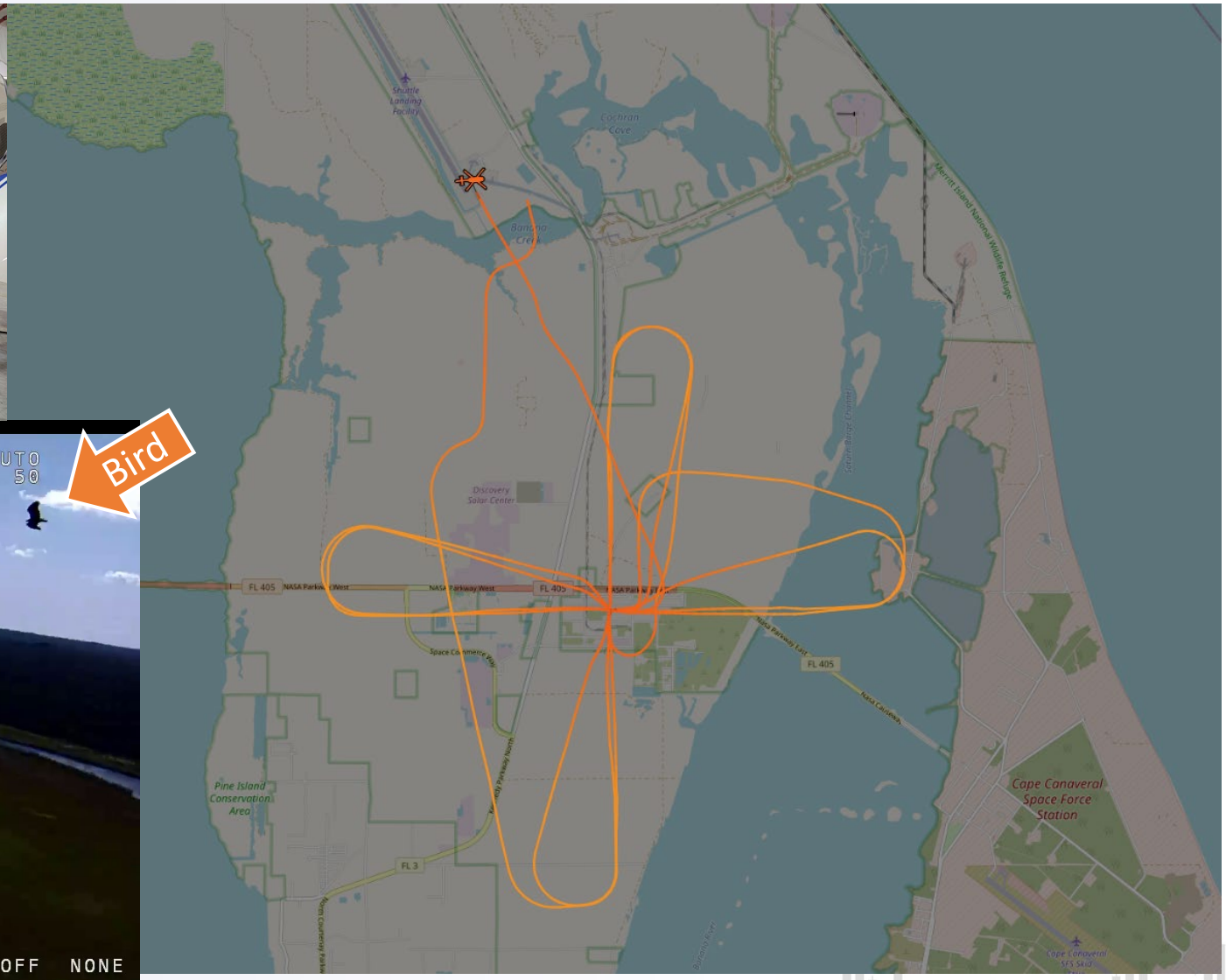
- Alta8 with RED camera
- TTT-AS evaluating ORB-SLAM algorithm
- Upcoming AIAA Sci-Tech papers





Risk Reduction Flights – Oct 24-28, 2022

Bird




2022 AUTO
:13:01
C-4.0
SPA
EOW
DL:LL
9
LOW
A-
4
54
18°
55°
:OFF
- DISARM
FT
28:31:17N 011°
80:39:11W
77FT


26OCT2022 MAN
07:40:34
UTC-4.0
SPA
EOW
DL:LL
9
LOW
N
171
-014°
355°
098°
0FT
0.2NM LOS


SPA
EOW
DL:LL
9
AUTO
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15 16 17 18
087° NO TGT
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AUTO
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- DISARM
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53FT
0FT
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SPA
EOW
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LOW
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49
134
OFF
091°
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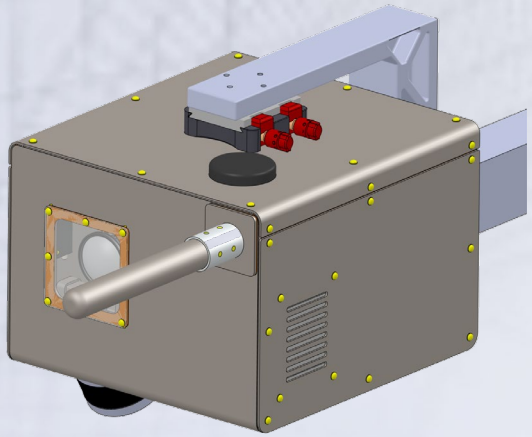
Bespoke & Crowdsourced Data Collection



Development Pod

- Larger mass & volume for prototyping, iteration
- NASA helicopters & drones
- Scripted flight tests
- Auxiliary data
  - AC-compliant helipad markings & lights
  - Weather stations
  - Known intruders & obstacles

Production Pods

- Optimized mass & volume
- External partner fleet helicopters
- Passive data collection
- Energy harvesting turbine
- Seek approval under FAA's NORSEE policy

Sensor and Component Selection

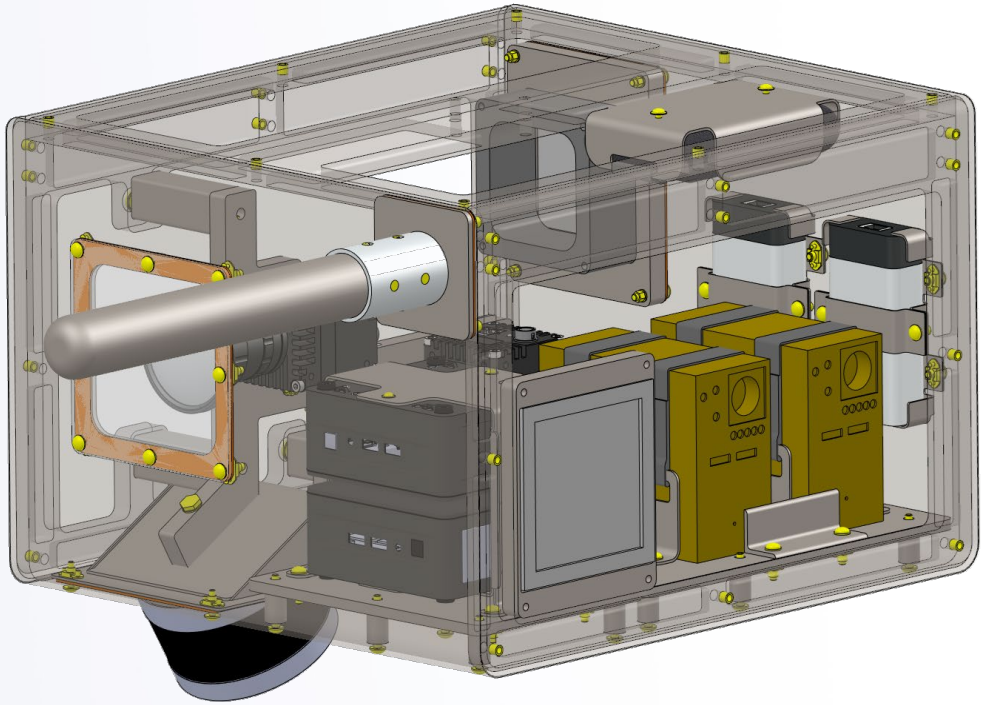
Development Pod

Sensors

- Cameras: FLIR Oryx, 12MP (4K) at 60 fps
- Lidar: Velodyne Puck
- Nav ground truth: Vectornav VN-210
- Meteorological: Vaisala HMP50

Components

- Intel NUC12WSHi7
- Microhard LTECube-CAT12
- Netgear GS105E
- Antennas (modem, GNSS, RemoteID, ADS-B)



Downward camera
200-deg FOV

Pulls for Operator Participation

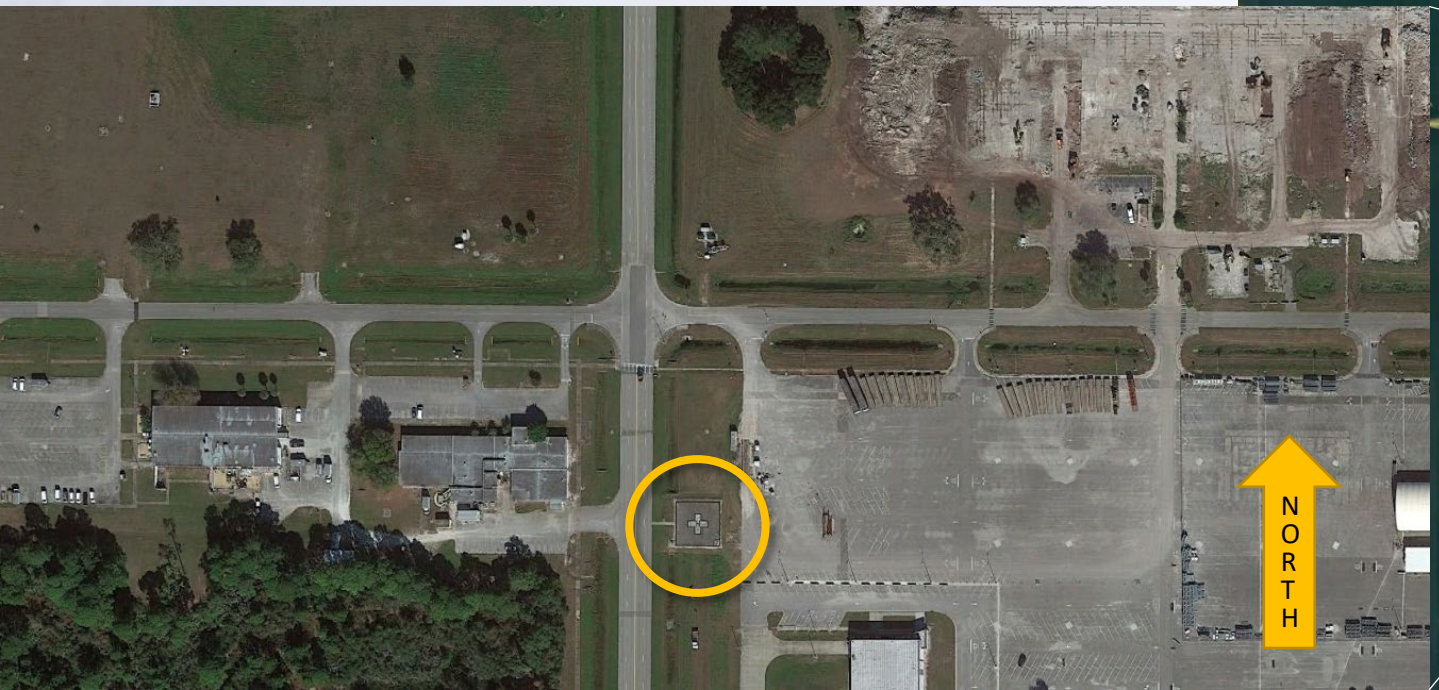
- Automatic laser detection and geolocation (NTR submitted)
- ADS-B and RemoteID monitoring, tablet display for situational awareness

	AFRC Drone Flights	KSC Helicopter RRF	KSC Helicopter DevPod	Production Pod
Vehicle Body Location and Pose Ground Truth	Pixhawk Ulogs	Airbus Flight Data Recorder	RTK GNSS + IMU, Airbus Flight Data Recorder	RTK GNSS + IMU
Camera Pose Relative to Vehicle	Movi Pro Joint Angles	OCR from MX-10 Overlay	Fixed	Fixed
Sensors	RED Camera	MX-10 Camera	FLIR Oryx (forward) FLIR Oryx (downward) Velodyne Puck Lidar Air data probe Humidity ADS-B, RemoteID	TBD

Area of Operations

KSC

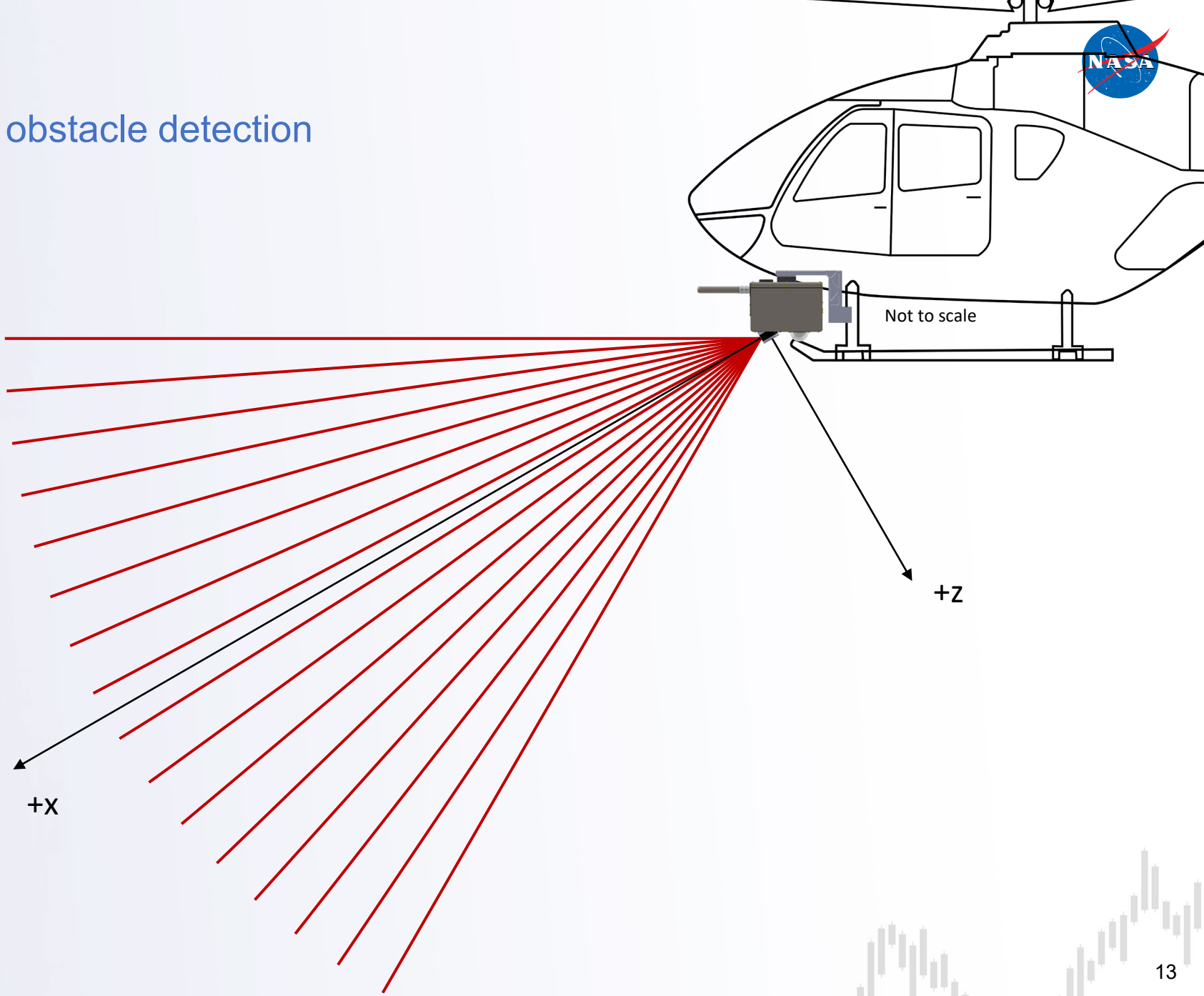
- Base: Shuttle Landing Facility
- Operational Health Facility (OHF) helipad



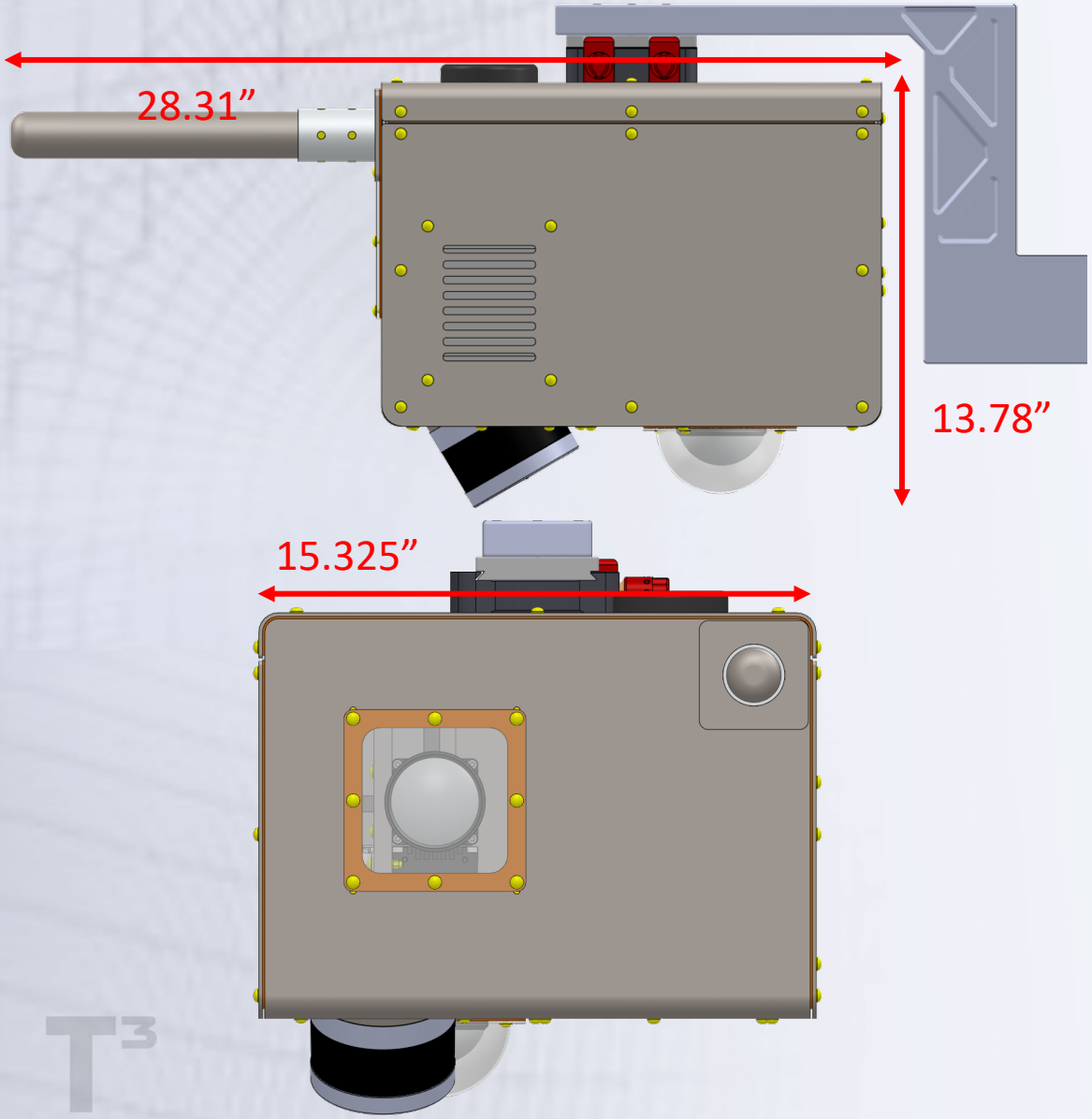
Lidar Orientation

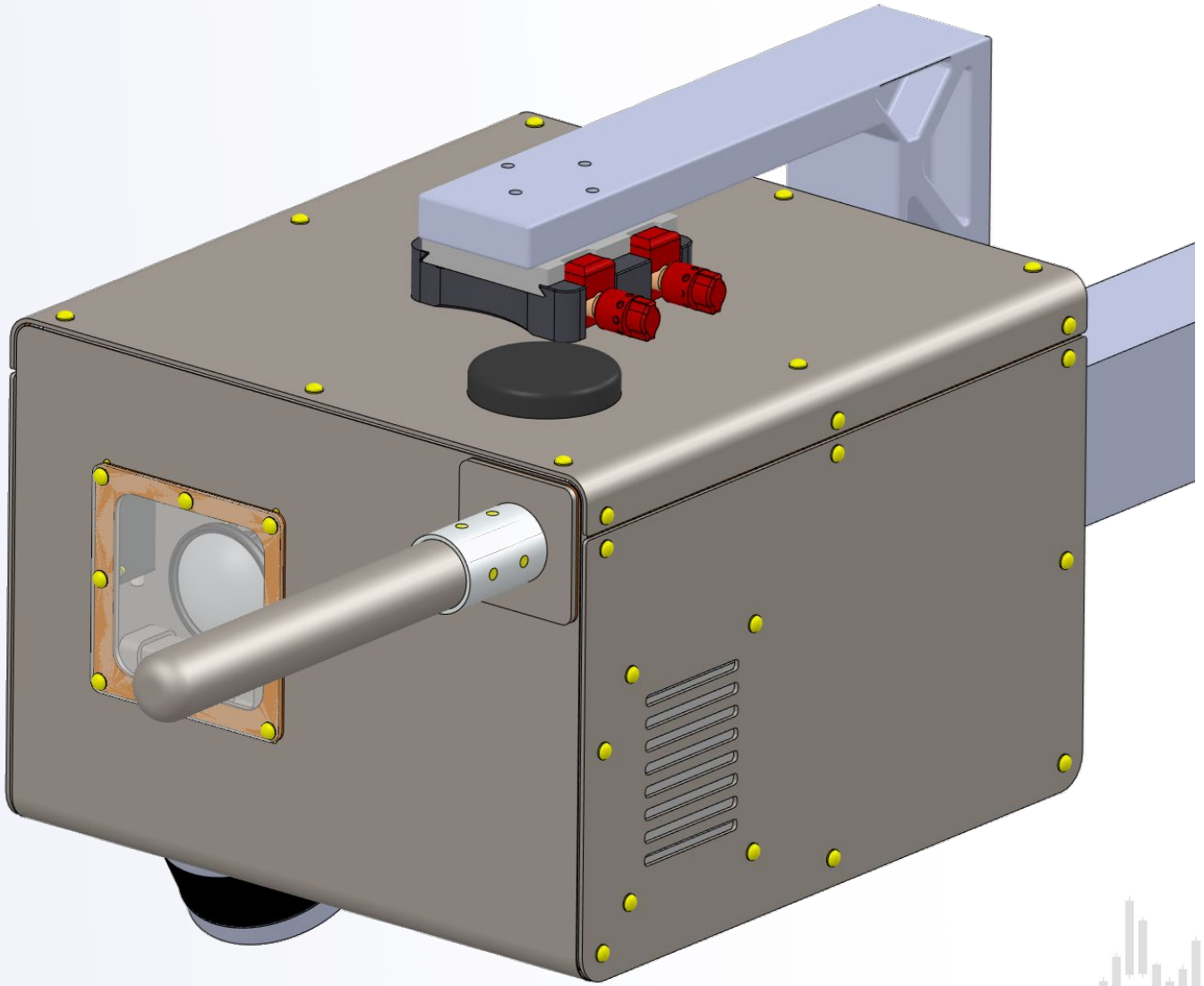
Priority for landing navigation and obstacle detection

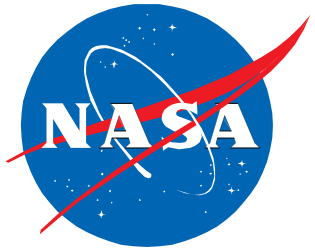
- Puck mounted upside down
- X-axis pitched down 30 deg
- Pod enclosure and landing skids partly obstruct scanning volume



POD Design






NASA