

# **Wallops Flight Facility Support for Instrument & Mission Development**

**From the perspective of a gamma-ray scientist not associated  
with WFF in any way**

**Carolyn Kierans, NASA GSFC - Jan 10th, 2023**

# Overview

- What/where is WFF
- Suborbital Opportunities
  - Balloon Program Office
  - Sounding Rocket Program Office
- SmallSat Office
- Integrated Design Center
- How to access resources

# What/Where is WFF?

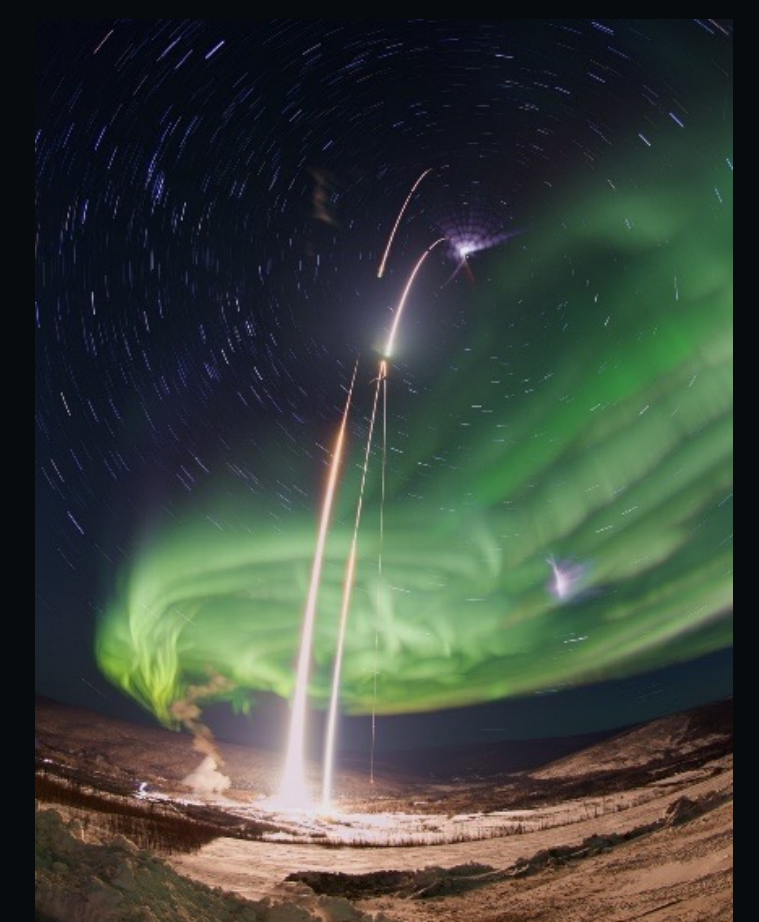
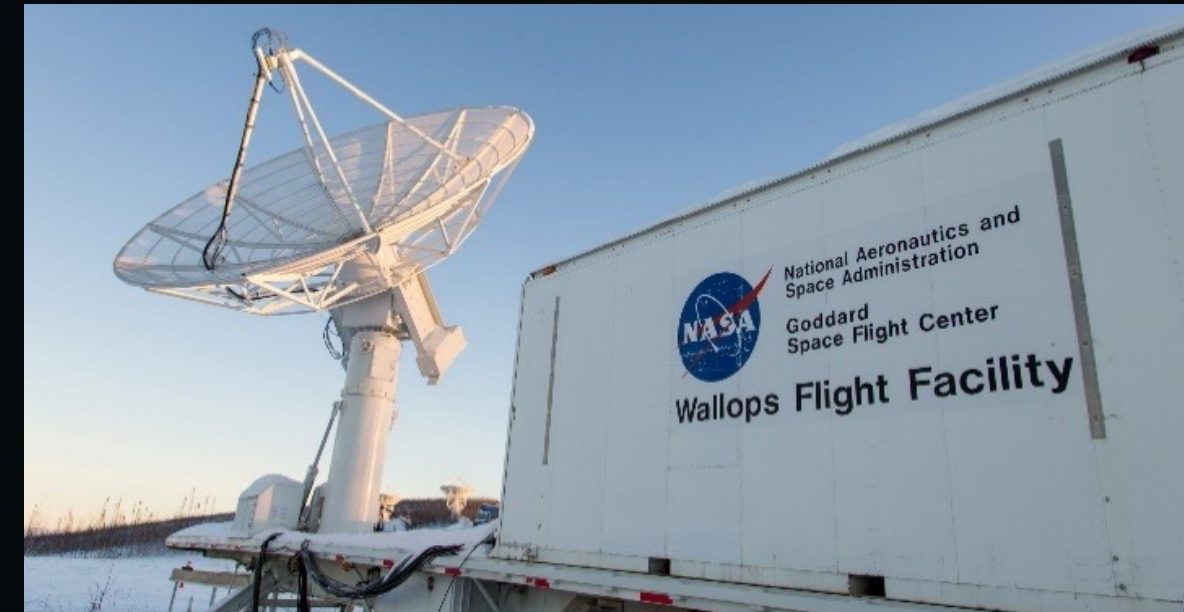
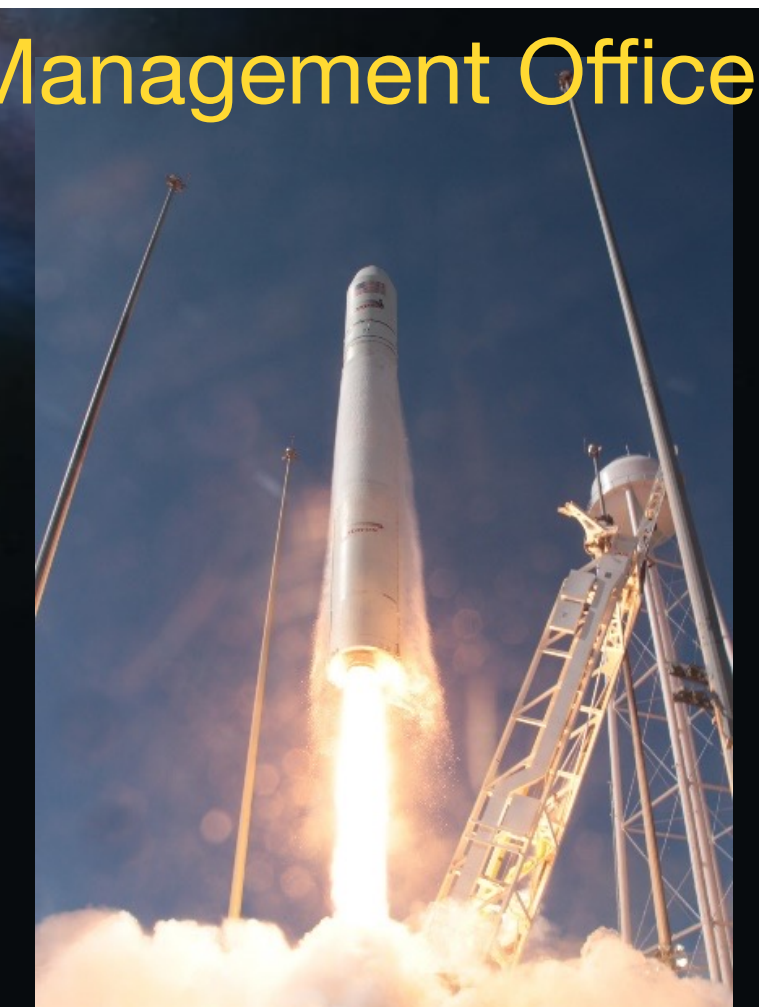
• NASA Goddard Space Flight Center's  
Wallops Flight Facility

• On the East Coast of Virginia,  
with launch facilities on Island Base



# What We Do...

- **Sounding Rockets**
  - ✓ Suborbital science rockets from worldwide launch sites
- **Scientific Balloons**
  - ✓ Upper atmosphere science missions from worldwide sites
- **Airborne Science**
  - ✓ Earth Science research using piloted and unmanned aircraft
- **Special Projects**
  - ✓ Small satellite development and operations
  - ✓ Hybrid flight projects that leverage our unique capabilities
- **Research Range and On-Orbit Operations**
  - ✓ Launch range supporting rocket/missile missions
  - ✓ Research airfield supporting aircraft/UAS operations and research
  - ✓ Mobile range enabling remote campaign missions
  - ✓ Satellite tracking of NASA spacecraft
- **Earth Science Research**
  - ✓ Precipitation, coastal processes, and ice sheet research
- **STEM Education Activities**
  - ✓ Hands-on flight projects for students and researcher training



# Suborbital Programs

- Suborbital offices are run out of WFF
- Balloons and sounding rockets are ideal programs for instrument development
  - “Free rides”
- Suborbital projects funded through APRA
  - WFF can provide feasibility letter in proposal
  - WFF support during formulation



# Balloon Program Office

Provides suborbital launch vehicles, payload development, and field operations support.

Advantages:

- Low cost, long duration
- Highly flexible and agile, quick turnaround
- Great learning environment for students

e.g. COSI (PI Boggs) started as balloon borne instrument first launched in 2005

Full payloads and piggybacks

Interested parties should contact **Debbie Fairbrother** at BPO

2023 Scientific Balloon Technologies Workshop <https://balloontech.umn.edu/>



# Sounding Rocket Program Office

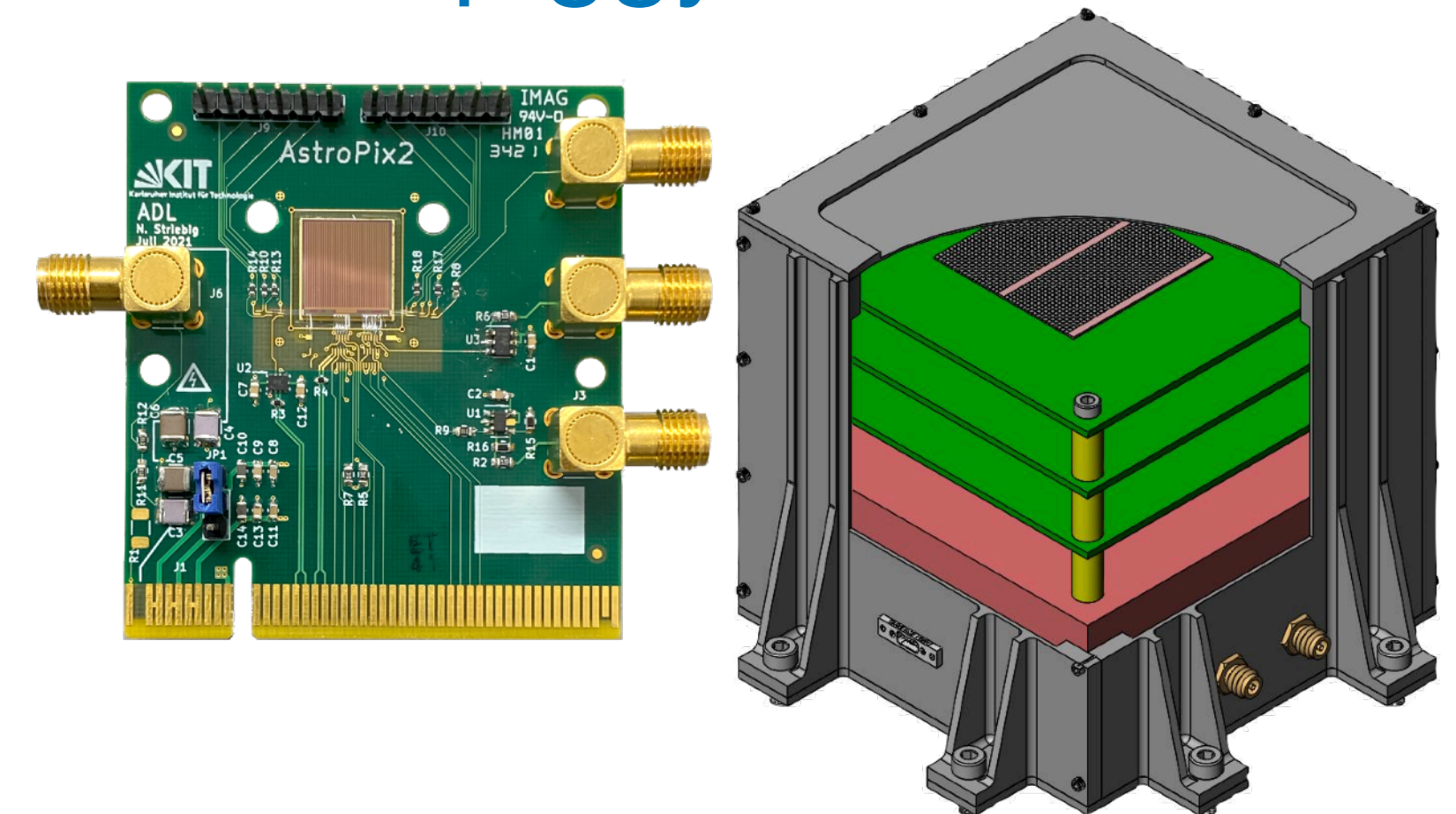
Provides suborbital launch vehicles, payload development, and field operations support.

## Advantages:

- Low cost
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Full payloads  
and piggybacks

e.g. AstroPix (PI Caputo) will launch as piggyback in 2024



NASA Sounding Rockets User Handbook  
Sounding Rockets Program Office  
Sub-orbital and Special Orbital Projects Directorate

NASA Goddard Space Flight Center  
Wallops Flight Facility  
Wallops Island, VA 23337  
July 2015

Interested parties should contact **Libby West** at SRPO  
NASA Sounding Rocket Users Handbook  
<https://sites.wff.nasa.gov/code810/files/SRHB.pdf>

# SmallSat Office

Provides a bridge between suborbital projects at WFF and the larger spacecraft missions

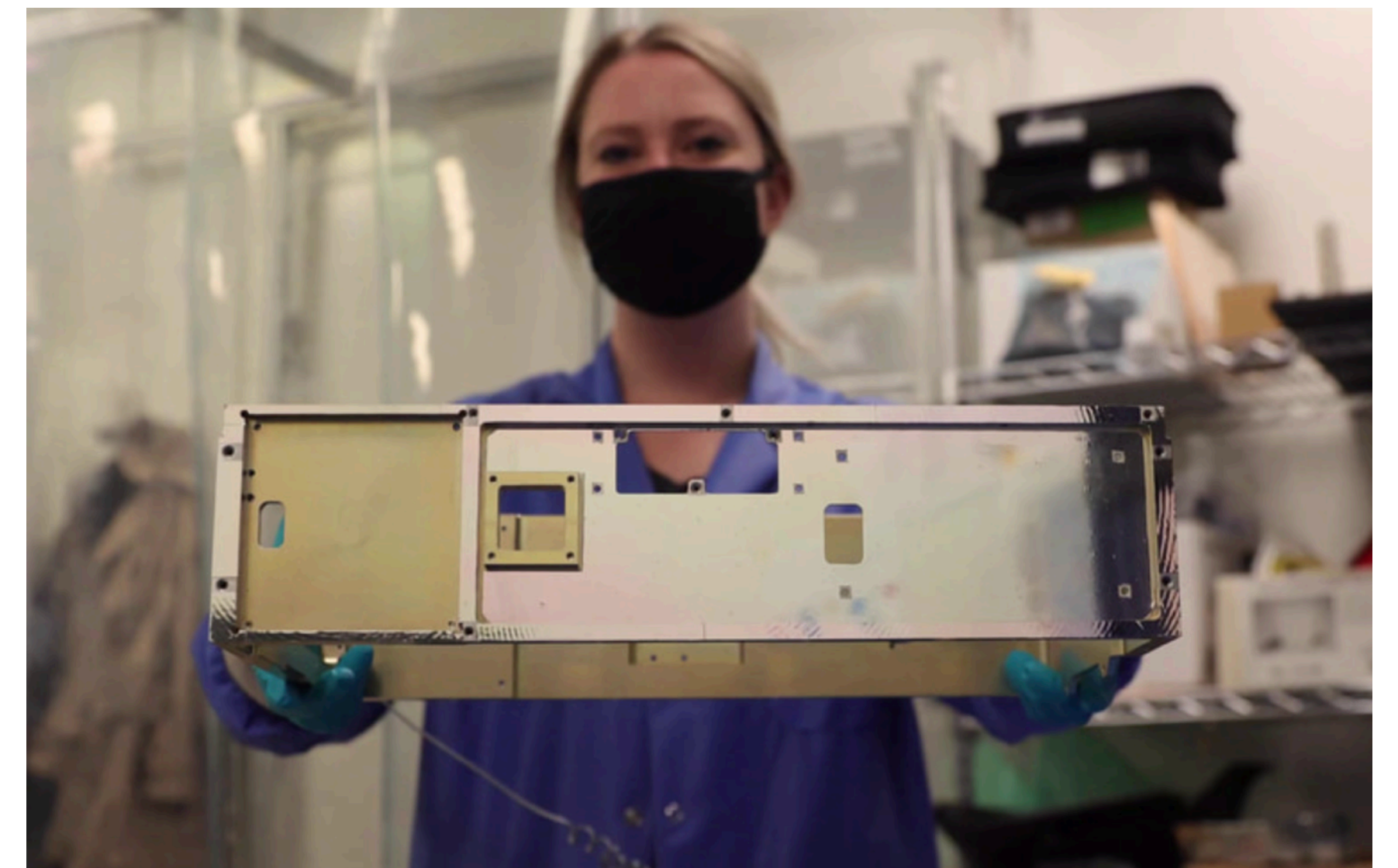
Manages:

- CubeSats
- Smaller Satellite Missions
- Unique and complex projects implemented at WFF that don't fit the typical program tiers

e.g. BurstCube (PI Perkins)  
will launch as cubesat 2023!



Need to propose for funding  
through APRA or Pioneers



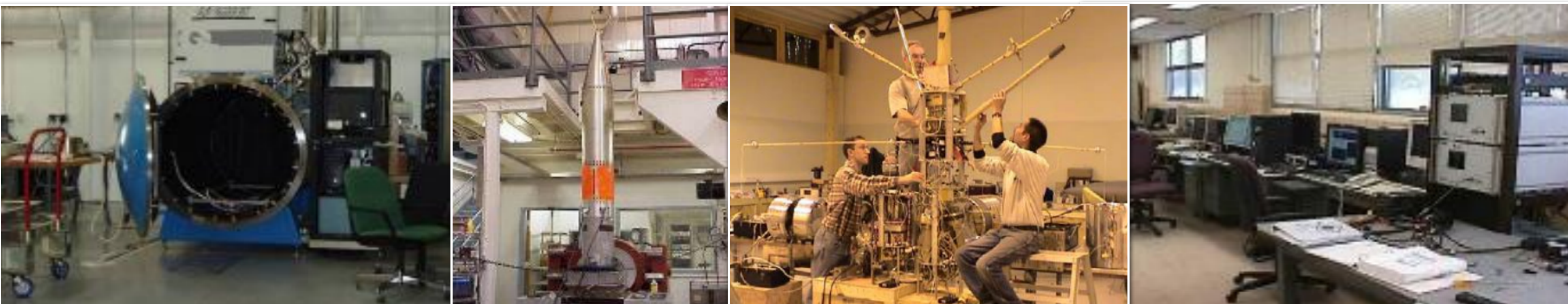
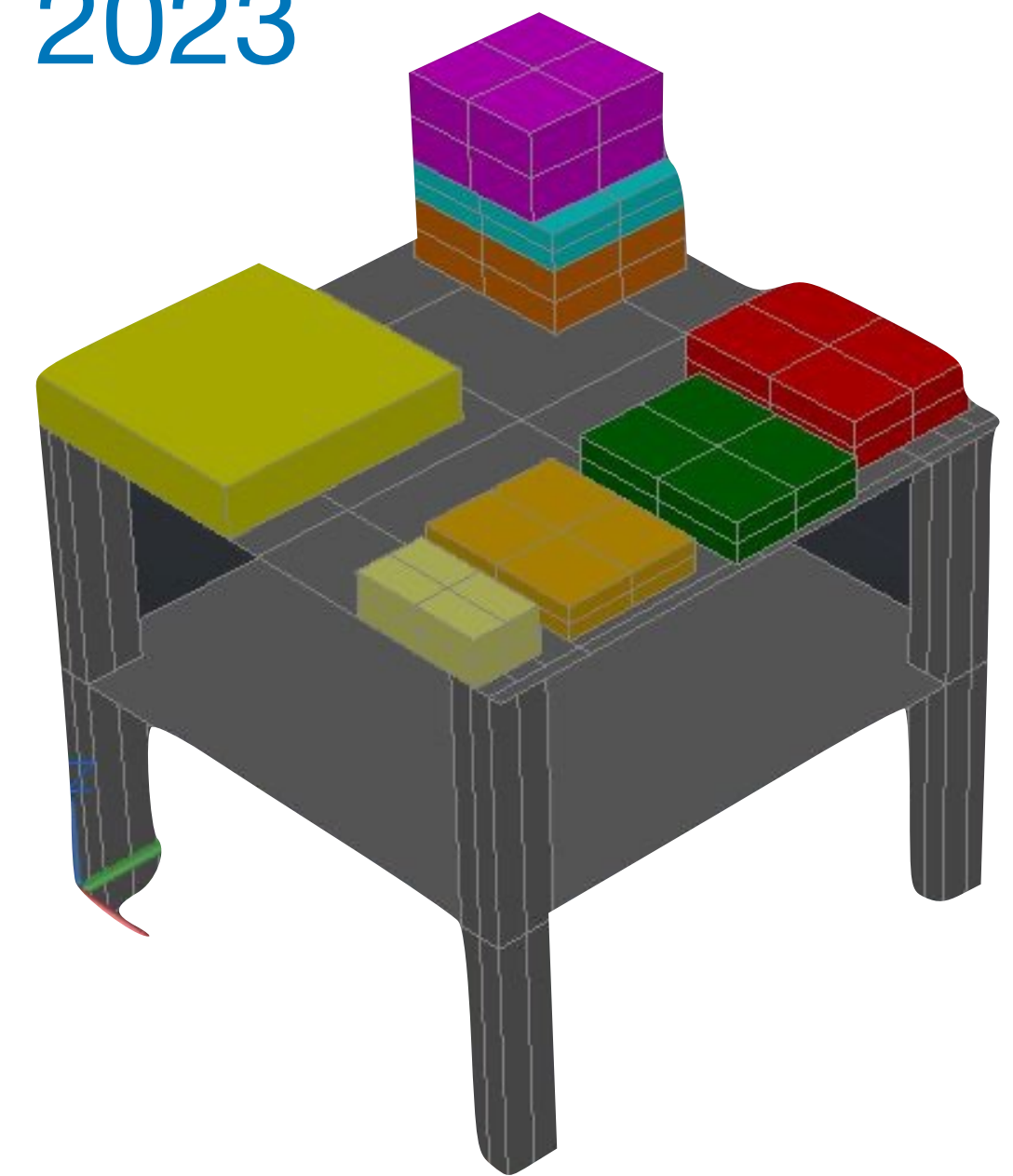
Interested parties can go to <https://smallsat.wff.nasa.gov/contact/>



# Testing Facilities

- In-house vibration tables, thermal vacuum chambers, and other testing facilities
  - Various sizes and capabilities
  - Balloon Research and Development Lab has new chamber coming online

e.g. ComPair (PI Kierans) plan to use WFF TVAC chamber in 2023



# GSFC Integrated Design Center @WFF

5-day study/design:

- All required engineering disciplines work simultaneously for study duration
- Customer team integrated into design process
- Instrument Design Lab, Mission Design Lab, Mission Planning Lab

Cost estimate ~\$50-100K for full study



What you get out is as much as you put in!

Hybrid environment

Self-funded and managed Slide from Doug Voss

- Non-Profit, Flat-Rate, One Study - per lab - per month

Established Customer Base:

- **GSFC** IRAD (IDC core work), LOB, NOO
- **HQ** Decadal Survey Studies, AO formulation
- Other NASA, Gov, DoD, Academic partners

Tailored Study Products

- Concept, Architecture, Early Trade Studies
- End to End Mission/ Instrument design
- Targeted design, Technology evaluation

Proven tools and resources

- Experienced Lab Leads and Processes
- Staffed with GSFC Engineers, Specialists, and tools
- Partners in Industry, Academia, other NASA & Gov

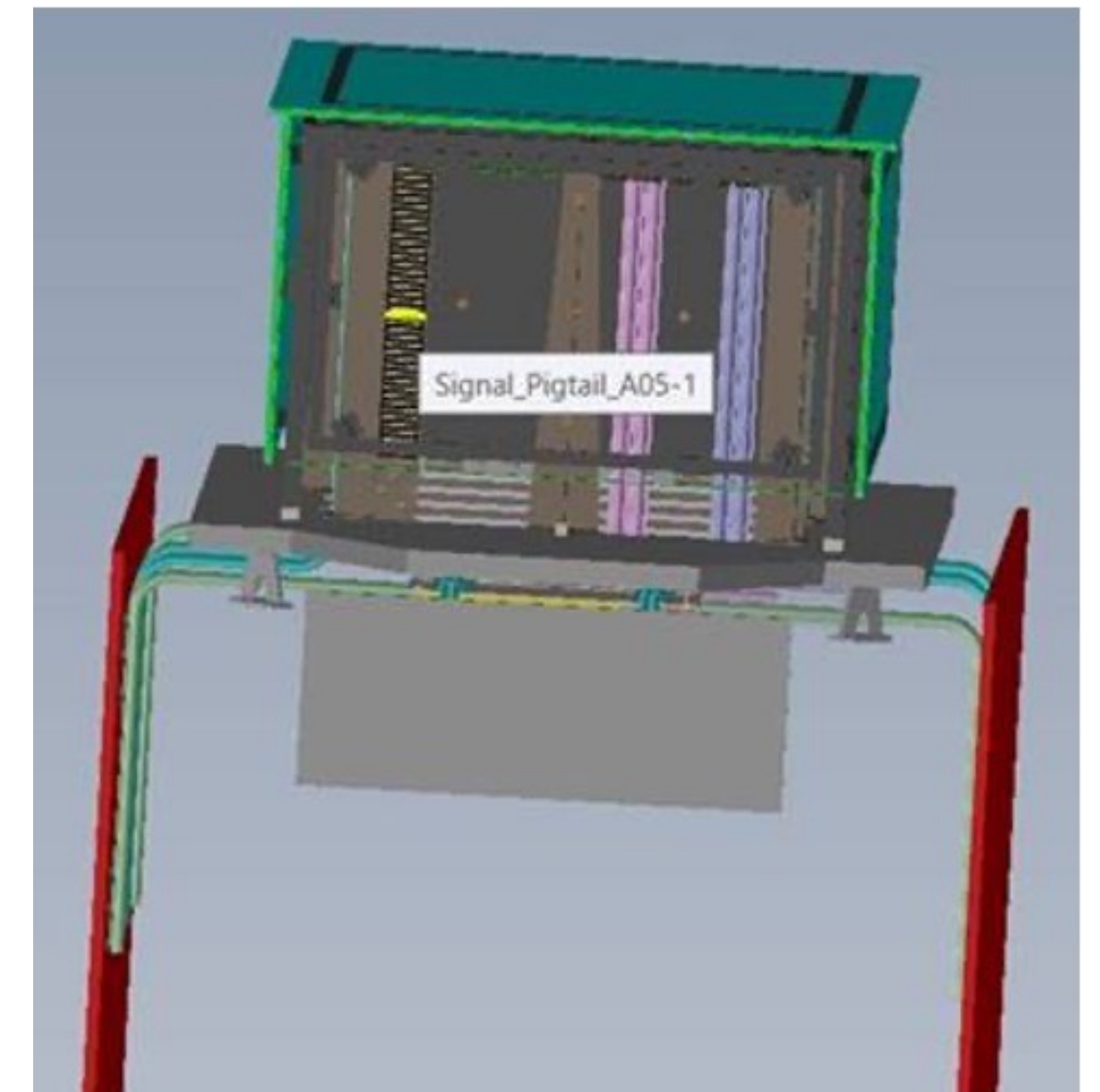
Flexible Format and Facilities

- Studies conducted fully remote or hybrid
- Modern collaboration tools and facilities
- Continuously taking feedback, Improving and adapting

# Instrument Design Laboratory

- Services:
  - End-to-end instrument concept development
  - Existing instrument/concept architecture evaluations
  - Trade studies and engineering evaluations
  - Technology, risk, and independent assessments
  - Mass, power, data resource allocation
  - Cost estimation
  - etc.
- 298 completed studies (as of 2022)
- Need funding, but the experienced IDL team\* provides invaluable help for instrument design

e.g. AMEGO-X (PI Caputo)  
concept submitted in 2021

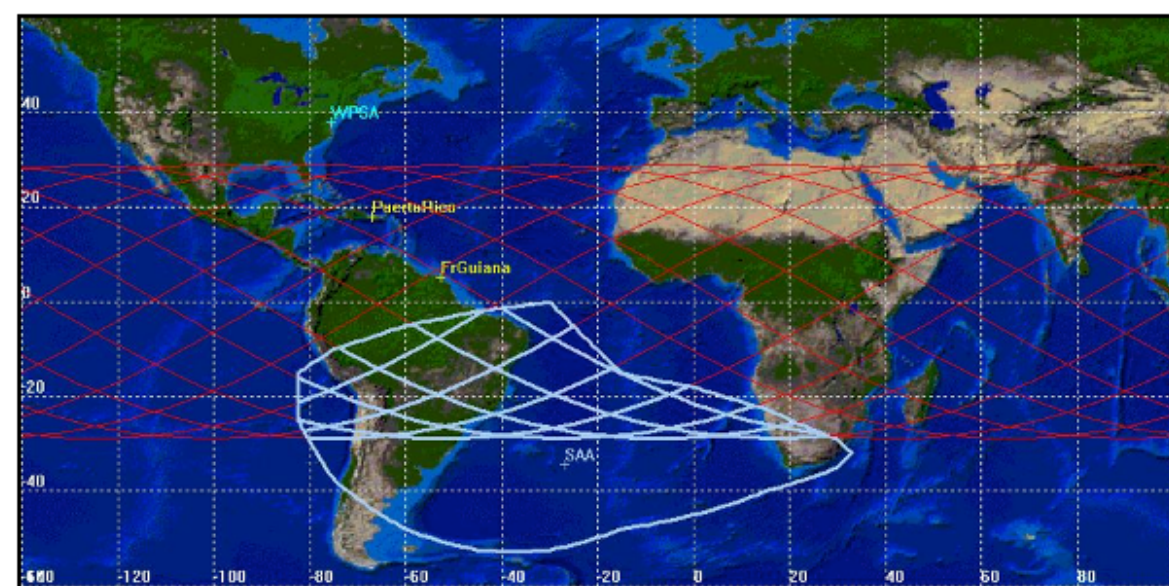
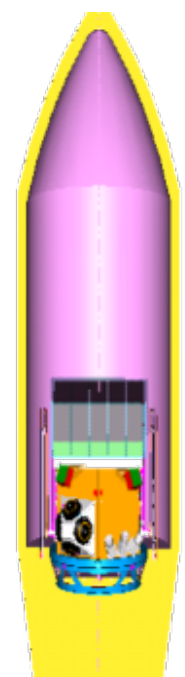
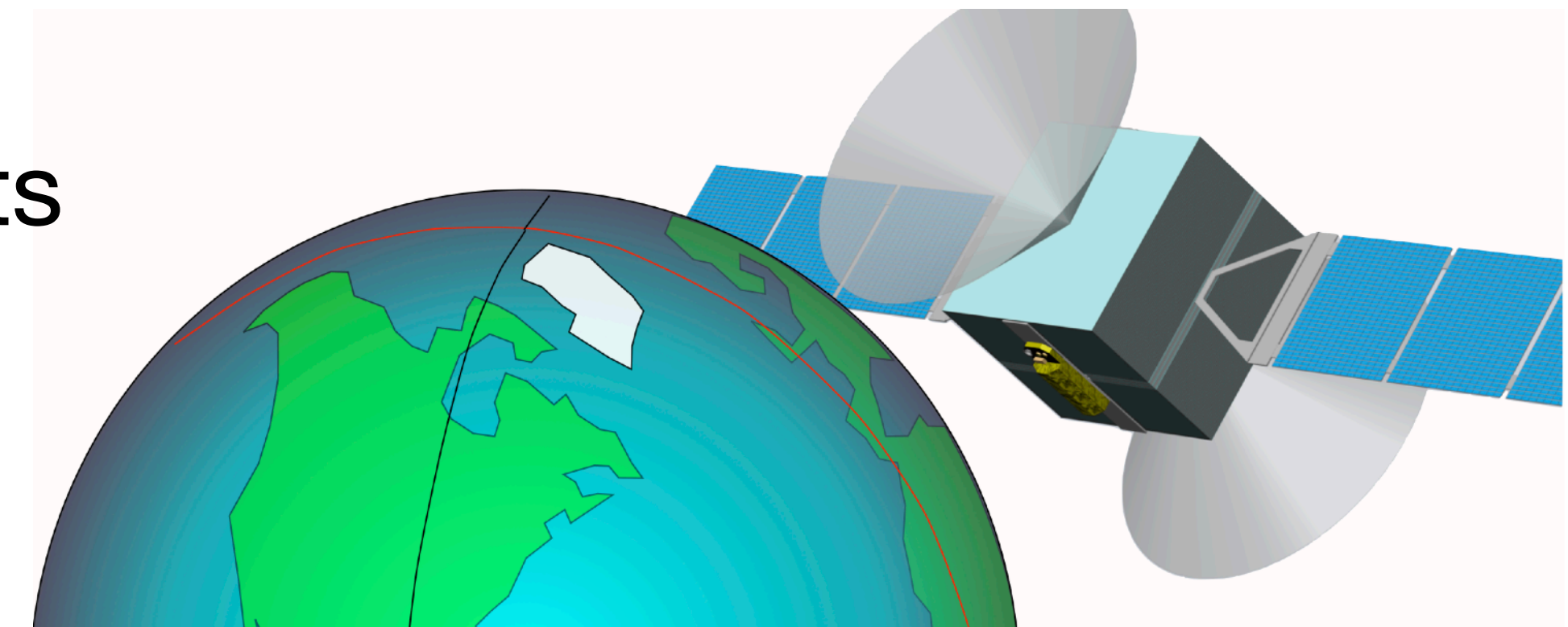


\*IDL team isn't super familiar with gamma-ray instruments

# Mission Design Laboratory

- Services:
  - End-to-end mission concept development
  - Engineering evaluations
  - Requirement refinement and science impact
  - Limited Trade studies
  - Independent technology and risk assessments
  - Mass, power, and data resource allocation
  - Master Equipment Lists for cost modeling
- 435 completed studies

e.g. APT (PI Buckley) Probe concept study at JPL



SUBSYSTEM	ECLIPSE (FYI kg items)				Max Avg	THERM				ATTENA			
	Asst [kg]	Cont [kg]	Mass [kg]	Cont [kg]		Final [kg]	Final [kg]	Final [kg]	Final [kg]	Final [kg]	Final [kg]	Final [kg]	Final [kg]
Bus Structure	200	250	5.9	1.1	24	12	80	508	213	8.5	80.0	42.0	8.4
RF Antenna	5.8	4.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ACU	432	457	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CCM	8.0	216	5.5	2.3	9	7.7	15	3.0	4.2	0.5	0.5	0.0	4.1
Power System	250	257	7.6	4.0	24	8.5	32	80	5.5	0.6	0.6	0.0	16.1
Star Tracker/Star Sensor	10.8	100	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bus Thermal	1.8	1.8	0.0	0.0	0.0	1.2	0.7	0.3	4.2	0.0	0.0	0.0	0.0
Thermal/Heater	210	200	0.1	0.0	0.0	1.6	1.5	0.4	4.7	0.0	0.0	0.0	0.0
RF Communications	45.0	54.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Separation System (contingency)	1.8	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Propulsion	30.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Payload	204.0	204.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NET MASS (BUS ONLY)	141.2	498.7				108.5	168.4	302.5	173.6	286.9	237.2		
NET MASS (BUS ONLY)	438.1	781.1				288.4	281.4	210.5	335.4	341.7	528.1		
MISSION TOTALS:	Actual	Contingent				Assigned	Contingent		Assigned	Contingent			
PAYLOAD TOTAL	88.8	22.5				88.8	22.5		88.8	22.5			
BUS SUBSYSTEMS DRY TOTAL	141.2	498.7				108.5	168.4		173.6	286.9	237.2		
BUS + PAYLOAD DRY TOTAL	204.0	420.2				197.3	190.9		262.4	309.4	264.9		
PROPELLANT	296.4	296.4				0.0	0.0		0.0	0.0	0.0		
LAUNCH MASS (NET BUS + PAYLOAD)	500.4	716.6				197.3	190.9		262.4	309.4	264.9		
Launch Vehicle	700.0	700.0				350.0	350.0		350.0	350.0	350.0		
Net Bus + Payload (kg)	204.0	204.0				197.3	190.9		262.4	309.4	264.9		
Net Bus + Payload (kg)	19.0	19.0				19.0	19.0		19.0	19.0	19.0		
On-Orbit Mass (kg)	185.0	185.0				178.3	171.9		243.4	290.4	245.9		

- Need funding, but the experienced MDL team\* provides invaluable help for mission design

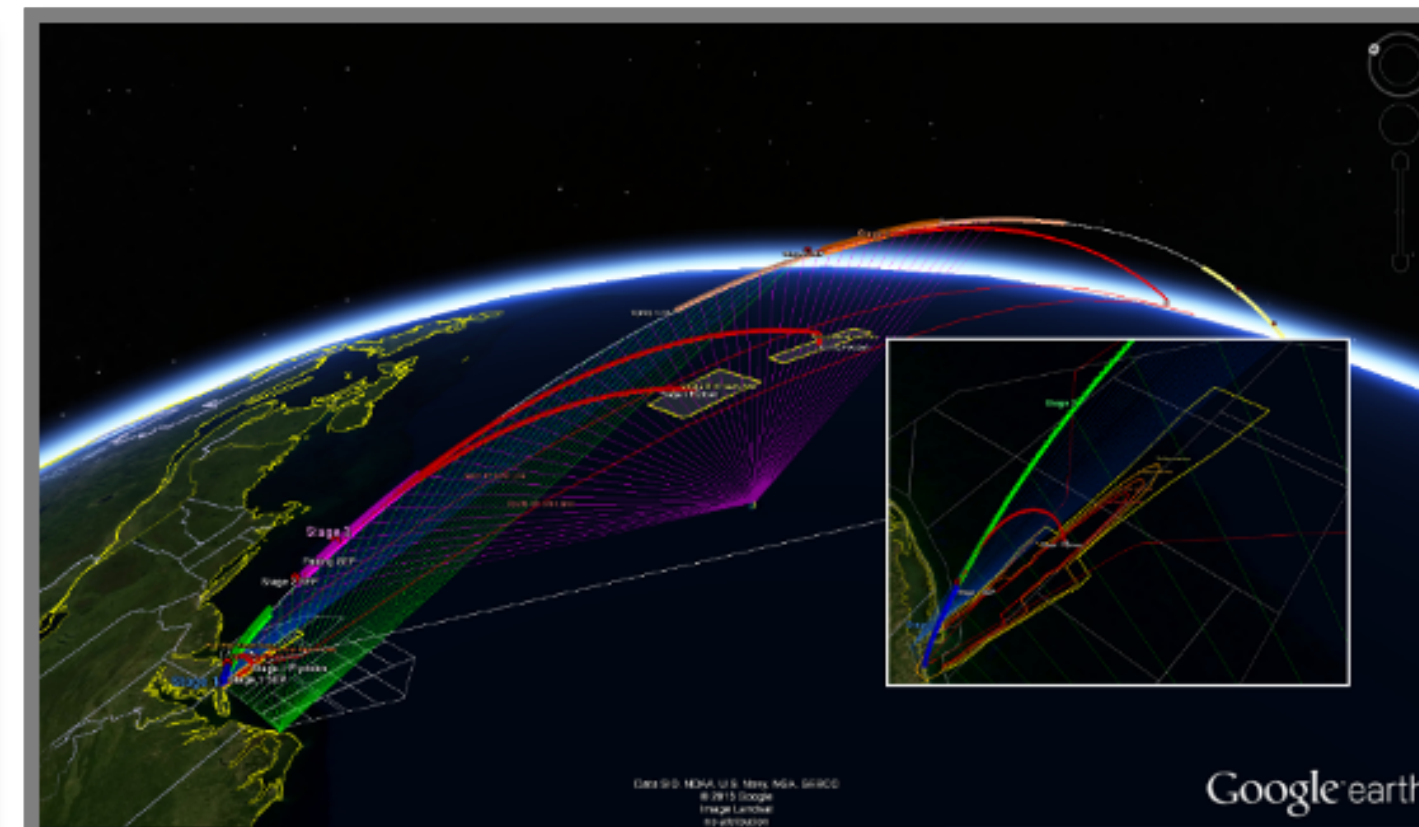
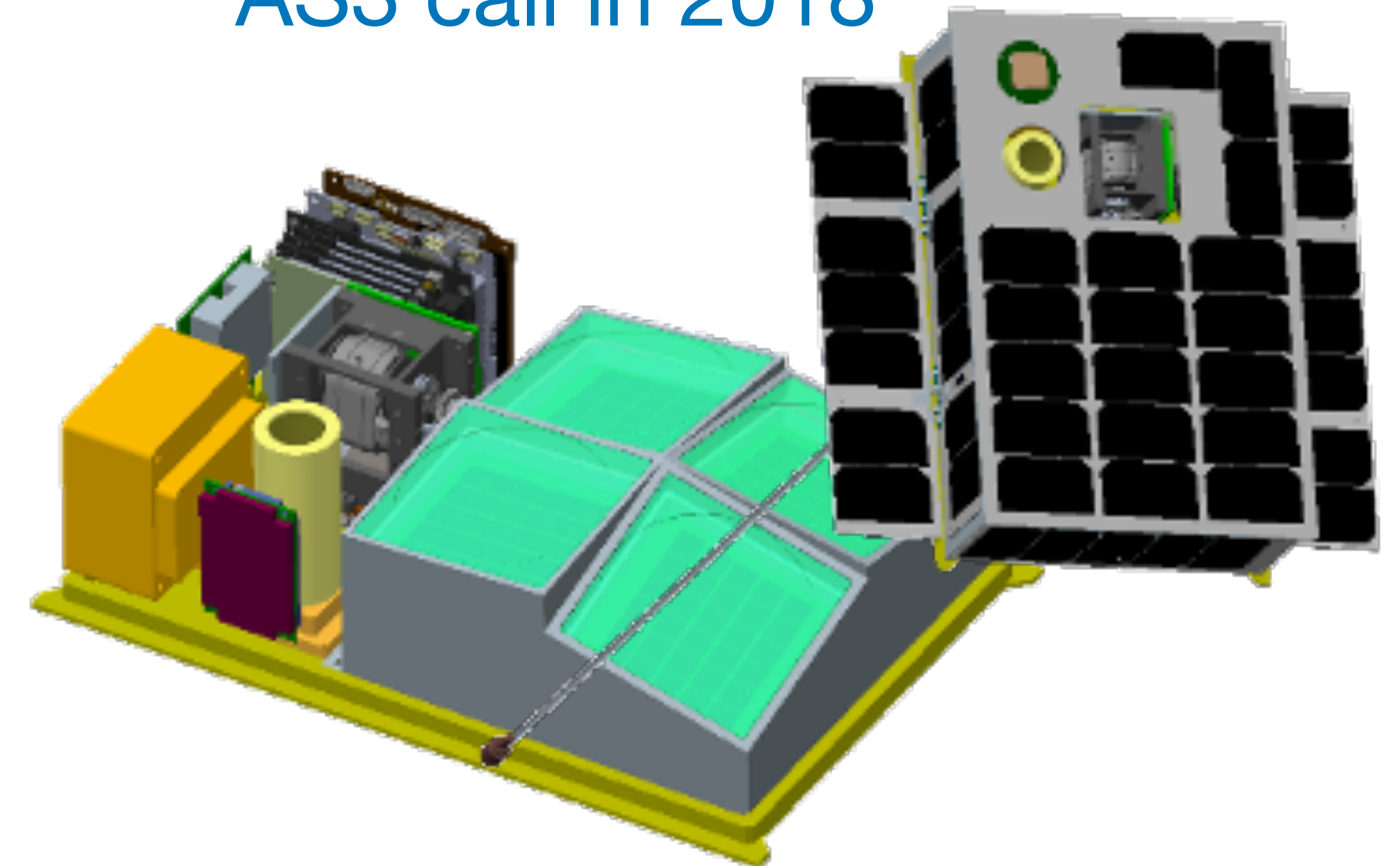
\*MDL costing struggles with big/heavy gamma-ray payloads

# Mission Planning Laboratory



- Similar services and capabilities as MDL, but supports end-to-end mission feasibility design studies for suborbital carriers and CubeSats / Small Satellites
- Created in 2014 - 40 completed studies

e.g. BurstCube, and AS3 call in 2018



# Summary of Resources and POCs

- WFF has many resources to help at different stages of mission proposals and formulation
  - Balloon and Sounding Rockets raise TRL
  - Environmental testing at WFF
  - IDL/MDL for proposal submission or mission design
- If you have funding, and an idea, you should build a relationship with WFF and take advantage of these resources
- **POC:**
  - Balloon Program: **Debbie Fairbrother**, BPO Chief, [debor.a.fairbrother@nasa.gov](mailto:debor.a.fairbrother@nasa.gov)
  - Sounding Rocket Program: **Libby West**, SRPO Projects Manager, [Libby.West@nasa.gov](mailto:Libby.West@nasa.gov)
  - Instrument Design Center: **Will Mast**, IDC Manager, [william.r.mast@nasa.gov](mailto:william.r.mast@nasa.gov)
  - Other: **Ben Cervantes** ETD Business Development Lead, [Benjamin.W.Cervantes@nasa.gov](mailto:Benjamin.W.Cervantes@nasa.gov)