



WFF UHF Ground Station Informational Brief August 2021

An aging but valuable asset

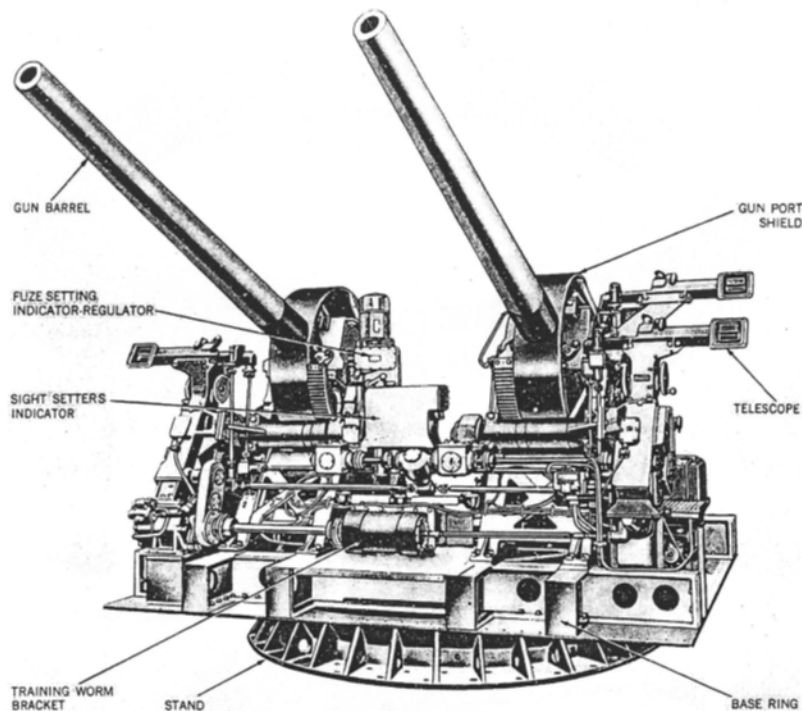


FIGURE 3 5-inch Mount Mk 32 Mod 2. Shield Removed—Front View.



Azimuth and Elevation drives began life as Navy 5-inch gun turret (circa late 1940's)

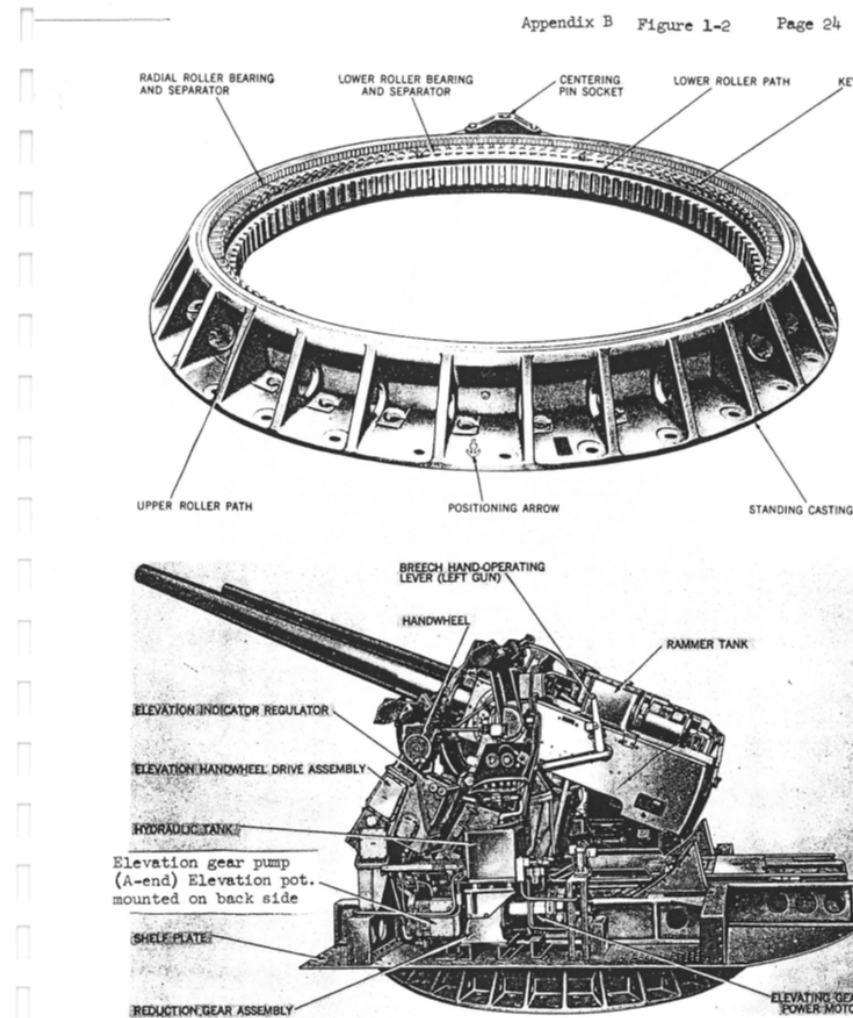


FIGURE 2 5-inch Mount Mk 32 Mod 2. Shield Removed—Left Side.

- The WFF UHF Ground Station has been providing tracking for UHF-based Cubesats since the mid-2000's, when an agreement was established with the National Science Foundation (NSF) for support
- The station experienced a surge of use in the 2018-2020 timeframe, with over a dozen spacecraft on the roster and heavy pass schedules, taxing the aging hardware
- After a 5-month period of being out of service due to significant maintenance issues, in some cases requiring manufacture of long-obsolete and unavailable parts, the station was returned to service in late March, utilizing a reduced pass schedule to mitigate risk
- The WFF Range and Mission Management Office, as the owner and operator, is now working with MIT to develop an agreement for use of their Haystack dish as a backup ground station so that additional long-term maintenance and upgrades can be completed for the obsolete drive systems
- While the Smallsat/Cubesat market is shifting to other frequency bands to achieve greater data throughput as the technologies for those capabilities catch up, the WFF UHF station will remain available for UHF-based missions for the foreseeable future...

- The WFF UHF Ground Station served as the downlink for several key NASA missions in recent years. These missions have now re-entered but all made significant contributions to NASA science:



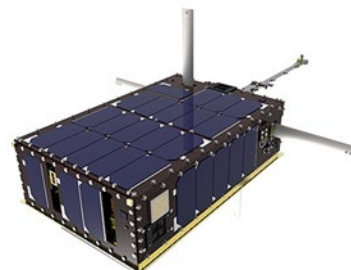
Halosat
(U. Iowa/GSFC)
Measured soft X-ray emissions from the halo of the Milky Way galaxy



Tempest-D
(JPL/Colorado State)
Demonstrated atmospheric monitoring by small satellites

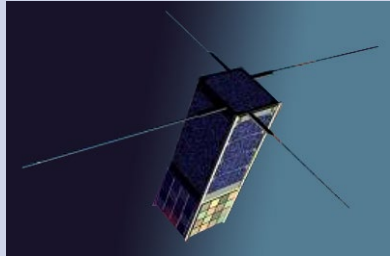

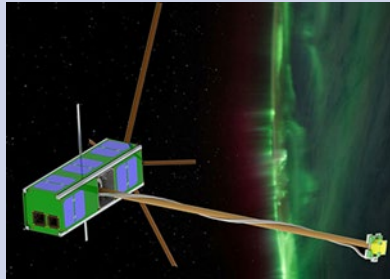


CubeRRT
(Ohio State)
Demonstrated on-board, real-time RFI processing



Dellinger
(GSFC)
Pathfinder for GSFC Cubesat development, technology and instrument demonstration

Current Missions Tracked (1 of 3)

Cubesat Name/ID# Launch Date Deployment Date	Sponsor PI MOC	Description	Performance	End-of-Life Prediction	
Shields-1 43850 Launched & Deployed 12/16/18 (ELaNa XIX) Rocket Lab Electron Rocket (1 of 10 NASA cubesats)	NASA LaRC funded LaRC managed PI: Larry Thomsen	3U class – development of technologies to increase the lifetime of Cubesat missions from months to years	In Polar Orbit Minimum success: track 1-2 passes per day, 24/7 + passes of opportunity	Earliest: July 2027 Nominal: October 2034 Latest: March 2039	
STF-1 43850 (Simulation to Flight 1) Launched & Deployed 12/16/18 (ELaNa XIX) Rocket Lab Electron Rocket (1 of 10 NASA cubesats)	Collaboration of West Virginia Space Grant Consortium, NASA IV&V	3U class – Demonstrate the capabilities of the software-only simulations of spacecraft.	In Polar Orbit Minimum success: Track 1-2 passes, 24/5 + passes of opportunity	Earliest: November 2023 Nominal: June 2025 Latest: July 2028	
ELFIN A & B 43617/43616 Launched & Deployed: 9/15/18 Delta II (IceSat 2 Mission) ELaNa XVIII	NASA/NSF funded University of California, LA	3U class – Objective is to study space weather, explore loss of relativistic electrons in the radiation belt.	Polar Orbit: Tracking did not start until March 2019, with as many passes as possible	ELFIN-A predicts Nov 2023 ELFIN-B predicts Dec 2023	

Current Missions Tracked (2 of 3)

Cubesat Name/ID# Launch Date Deployment Date	Sponsor PI MOC	Description	Performance	End-of-Life Prediction	
CIRiS 45121 (Compact Infrared Radiometer in Space) Launched: 12/5/19 SpaceX-19 (ELaNa 28) Deployed 2/1/20 External Cygnus Deployer	InVEST funded Ball Aerospace built, MOC: Utah State Space Dynamics Lab (SDL)	6U Class – Technology demonstration for improved on-orbit radiometric calibration.	First contact was 2/2/20. Operating nominally, receiving as many passes as possible M-F, 24/5	Current estimate: Apr 2023	
SORTIE 45264 (Scintillation Observations and Response of the Ionosphere to Electrodynamics) Launched 12/5/19 SpaceX-19 (ELaNa 28) ISS Deployment 2/12/20	H-TIDeS grant funded Led by ASTRA LLC with UNM and COSMIAC	6U Class – Study the complex challenges in discovering the wave-like plasma perturbations in the ionosphere.	First contact was 2/14/20. Operating nominally, receiving as many passes as possible, 24/7	Current estimate: Mar 2022	
HARP 45259 Hyper-Angular Rainbow Polarimeter) Launched: 11/2/19 NG-12 Antares (ELaNA 25A) ISS deployment: 2/12/20	NASA/ESTO funded University of Maryland, Baltimore County MOC: Utah State Space Dynamics Lab (SDL)	3U class – 1.5U volume optimized for 3U spacecraft. Measuring microphysical properties of cloud water & ice particles in the atmosphere.	First contact was 2/24/20. Operating nominally, receiving as many passes as possible, 24/7	Current estimate: Oct 2021	

Current Missions Tracked (3 of 3)

Cubesat Name/ID# Launch Date Deployment Date	Sponsor PI MOC	Description	Performance	End-of-Life Prediction	
<p>DeMi 45916 (Deformable Mirror Demonstration Mission) Launched: 2/15/20 NG-13 Antares ISS Deployment 7/13/20</p>	<p>DARPA funded Blue Canyon Technologies Inc. built for: Massachusetts Institute of Technology (MIT)</p>	<p>6U Class – Technology demonstration of the use of adaptive optics, specifically the MEMS-deformable mirror, in space.</p>	<p>Operating nominally, receiving 2 passes per week M-F, 0800-2300L</p>	<p>MIT prediction: Apr 2023</p>	