National Aeronautics and Space Administration

Sounding Rockets Program Office Quarterly Newsletter

Rocket Report

3 2020

INSIDE

Cover photo:
36.365 GB DUST–2 Nuth team at White Sands Missile Range, NM.
Photo by: Visual Information Branch/WSMR

Integration pictures taken prior to Covid–19.

36.365 GB Launch from White Sands Missile Range, NM on September 8, 2020.
Photo by: Visual Information Branch/WSMR

Missions Launched and other Mission Milestones

During the Covid–19 pandemic the Sounding Rockets Program Office (SRPO) and NASA Sounding Rocket Operations Contract (NSROC) staff have been teleworking in the third quarter of 2020. Electrical and mechanical manufacturing staff have returned to on–site work during this quarter.

One mission, DUST–2, was flown from White Sands Missile Range, NM on September 8, 2020. Several mission re–start packages for future missions have been prepared and presented.

Mission preparations, such as mission milestone meetings, have been performed as scheduled for future flights. Facility inspections have also been performed on a regular basis.

36.365 GB Nuth/NASA Goddard Space Flight Center - Determining Unknown yet Significant Traits (DUST) 2- launched September 8, 2020

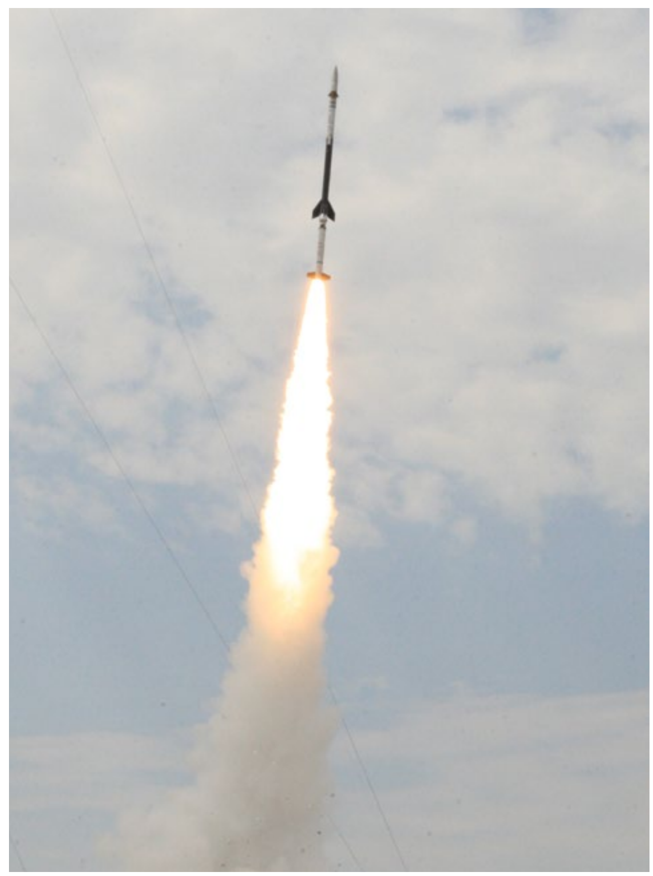
This was a re–flight of 36.343 Nuth which flew from White Sands Missile Range (WSMR) in October of 2019.

The purpose of the DUST–2 experiment was to measure important variables in the end–to–end process of grain formation in circumstellar outflows around AGB stars and model the physical and chemical properties of the dust.

The scientific goal was to determine the most important physical properties controlling dust production and measure the infrared spectrum of the analog dust grains during formation and agglomeration in the laboratory and in microgravity. The DUST–2 instrumentation included four double wavelength interferometers and two in–situ IR spectrometers of free–flying dust.

Recovery operations at WSMR. Photos by: Visual Information Branch/WSMR

DUST–2 integration at WSMR. Photo by: Ahmed Ghalib/NSROC



DUST–2 launch. Photo by: Visual Information Branch/WSMR

36.360 UE Kaeppler/Clemson University - Ion-Neutral during Active Aurora (INCAA)

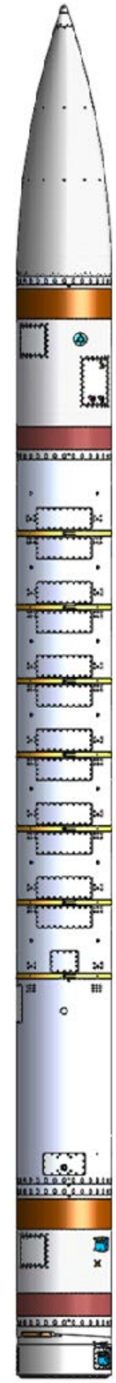
A Design Review for this payload was held on July 2, 2020. The INCAA mission includes two payloads, 36.360 and 46.031. A separate Design Review will be held for 46.031.

The science objective for the INCAA sounding rocket mission is to understand the interactions between the plasma and the neutral atmosphere during active aurora, and how this interaction affects energy deposition in the E–region ionosphere. The measurement strategy is to measure the ion demagnetization altitude and altitude resolved Joule heating rate. The mission will measure all terms in the ion momentum equation with altitude resolution of less than one kilometer, and will also use complimentary groundbased instrumentation from incoherent scatter radar and Fabry Perot interferometers to quantify the local ionospheric state parameters and regional neutral wind morphology, respectively. The objective is to understand a single event with many measurements and use this event as a representative case.

To accomplish these science objectives, the mission will use two sounding rocket payloads that will launch from Poker Flat Research Range, AK: an instrumented payload (46.031) that will contain a suite of plasma and neutral instrumentation and the vapor trail payload (36.360). The vapor trails include Barium, Strontium, and Trimethylaluminum (TMA). The plan is to launch both payloads within 10 minutes of each other.

The tentative launch window opens in April 2022 during the early morning local time, to capture dawn twilight conditions but to be as near to magnetic midnight as possible to launch into an active event.

In addition to ground–based imagers and magnetometers, FPI network and, to the extent possible, the Poker Flat Incoherent Scatter Radar (PFISR) to assist in the launch decision.



INCAA payload model.
Credit:Graham Taylor/NSROC ME

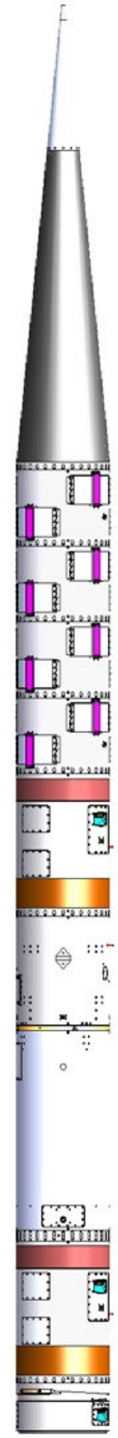
36.361 & 36.362 UE Lehmacher/Clemson University- Vorticity Experiment (VortEx)

A Design Review for these payloads was held on August 13, 2020. The VortEx mission includes two additional payloads, 41.127 and 41.128, which will have a separate Design Review.

The goal of this new investigation is to better understand gravity waves and their interactions as they propagate from the mesosphere into the lower thermosphere, to characterize the mesoscale wind field, and to identify regions of divergence, vorticity, and stratified turbulence. The rockets will observe horizontally spaced wind profiles, neutral density and temperature profiles, and plasma densities. Additional information about the background conditions and mesoscale dynamics will be obtained by lidars, meteor radars and a hydroxyl temperature mapper. The observational data will be combined with numerical modeling for a comprehensive look at gravity wave propagation, instability and turbulence generation.

The Black Brant IX payloads, 36.361 and 36.362, will deploy vapor trails of Trimethylaluminum (TMA), and the Terrier–Improved Orion payloads, 41.127 and 41.128, will carry instruments such as ionization gauges, a multi–needle electron probe and a positive ion probe. VortEx will comprise two salvoes which include one payload of each type.

VortEx is currently scheduled to be launched from Andøya Space Center, Norway in January 2023.



VortEx payload model.
Credit:Matt Tobin/NSROC ME

36.367 UH McEntaffer/Penn State University - The Rockets for Extended-source X-ray Spectroscopy (tREXS)

A Requirements Definition Meeting for the tREXS was held on August 18, 2020.

The tREXS missions include a series of suborbital rocket flights to measure the most highly–resolved spectra of diffuse soft X–ray emission from the Cygnus Loop and Vela supernova remnants. The first tREXS launch is anticipated for 2021, with a second launch in 2022. The tREXS science instrument is a soft X–ray grating spectrometer that will provide a large field–of–view and unmatched spectral resolving power for extended sources. Each instrument channel consists of a passive, mechanical focusing optic and an array of reflection gratings. The focal plane consists of an array of CIS113 CMOS sensors.

46.033 AR Leathe/Sandia National Laboratory - High Operational Tempo (HOTSHOT)

A Mission Initiation Conference was held for the HOTSHOT mission on September 24, 2020.

For the HOTSHOT mission, the Sandia National Laboratory is providing the payload with a host of experiments onboard and NSROC is providing the Terrier–Improved Malemute launch vehicle and recovery system. Additional NSROC payload support requirements are being evaluated.

This mission is currently scheduled for launch in April 2021.

49.005 DR Ganguli/Naval Research Laboratory - Space Measurement of Rocket-released Turbulence (SMART)

A Requirements Definition Meeting for the SMART mission was held on August 25, 2020.

The science objective of the SMART mission is to understand the evolution of plasma turbulence. The SMART mission will attempt to inject a high–speed beam of neutral barium atoms. The kinetic energy of these photoionized barium atoms will seed electrostatic waves and induce weak turbulence. The kinetic energy from the barium atoms will introduce whistlers and affect the space environment. The payload consists of a main and sub payload

The SMART mission is currently scheduled to launch in September 2021.

36.366 US Kankelborg/Montana State University - Full-Sun Ultraviolet Rocket SpecTrograph (FURST)

A Requirements Definition Meeting for the FURST mission was held on September 29, 2020.

FURST will obtain the first high resolution (R > 20,000), radiometrically calibrated VUV spectra of the Sun as a star, from 120–180 nm. FURST spectra will have applications to solar and stellar physics, climate science, and the interaction of solar UV radiation with comets, moons, and planets

FURST is currently scheduled for launch in August 2022.

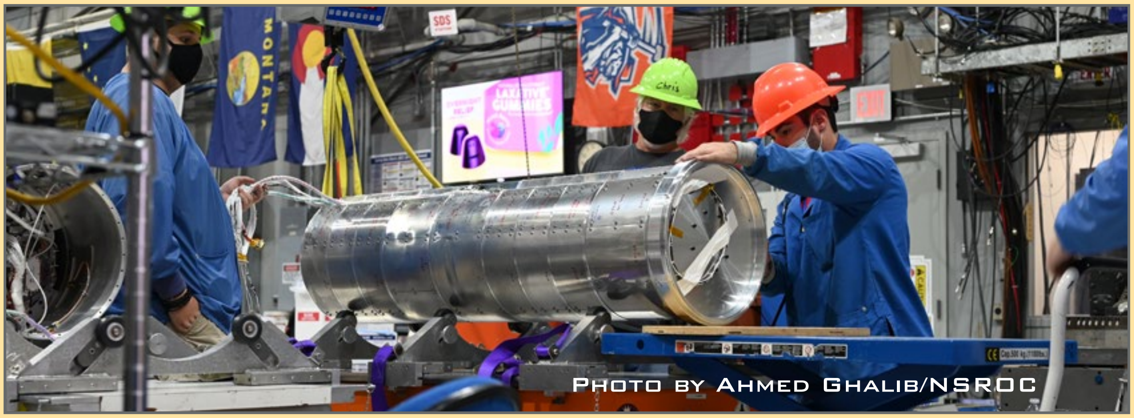


Photo by Ahmed Ghalib/NSROC

36.365 GB DUST-2 AT WSMR

Photos by Visual Information Branch/WSMR unless otherwise noted.

From the Archives: NLC-91

Noctilucent clouds (NLCs), the highest clouds in our atmosphere, occur at the cold mesopause near 83 km altitude during the polar summer.


Noctilucent clouds from the International Space Station. Credit: ISS Crew 62.

In situ studies of NLCs are only feasible with sounding rockets. Aircraft and Ballons fly to low, and satellites orbit too high.

In July and August 1991 NASA particpated in an international campaign involving scientists from eight countries to study these high altitude clouds.The campaign was conducted at Esrange, Kiruna, Sweden and at Heiss Island, Russia. A total of 31 rocket flights were coordinated with two radar facilities, European Incoherent Scatter Scientific Association (EISCAT) radar and Cornell University Portable Radar Interferometer (CUPRI), and other groundbased observatories and facilities. The CUPRI instrument provided nearly continuous monitoring of the mesosphere above Esrange.

The NASA sounding rocket portion of the campaing included two Nike–Orions, two Black Brant Vs, and two Arcas rockets. Participating US institutions were NASA Goddard Space Flight Center, Penn State University and Utah State University. Additionally, 10 Viper meteorolgical (MET) rockets were launched.

The prime objective of the campaign was to study the characteristics of noctilucent clouds in both a physical and chemical sense, and to determine their possible relationship to Polar Mesospheric Summer Echoes (PMSEs). To achieve these goals, the European collaborators provided two DECIMALS (Sweden) and two TURBO (Germany/ Norway) payloads, these concentrated on ion composition, particle structure, and mesospheric turbulence. The U.S. collaborators provided six assorted payloads to concentrate on the electrodynamic properties of the atmosphere in the vicinity of NLCs and PMSEs. These included two E–Field mother/ daughter payloads (NASA/ GSFC) to measure vector electric fields and energy deposition, two PEP payloads (Penn State) to study ion mobility, concentration and conductivity, as well as, mesospheric turbulence and two MISTI payloads (Utah State) to study ion conductivity with two alternate techniques. All payloads with the exception of MISTI carried photometric devices to detect the presence of NLCs. In addition, ten MET rockets were flown. Eight of the MET payloads carried the NASA/WFF falling sphere technique, and two payloads carried the chaff ejection technique provided by Germany. Finally, the ten Russian rockets (MK–100B) at Heiss Island were used to measure chemical and electrodynamical porperties of the mesosphere in the polar cap during the Esrange salvo periods.

Source: GEOPHYSICAL RESEARCH LETTERS, VOL. 20, NO. 20, PAGES 2283–2286, OCTOBER 22, 1993, Goldberg et. al.

SCHEDULE

COVID-19 has affected our operational status and all near-term launch dates are preliminary.

MISSION	DISCIPLINE	EXPERIMENTER	ORGANIZATION	PROJECT	RANGE	DATE
36.368 UG	UV/OPTICAL ASTROPHYSICS	GREEN	UNIV OF COLORADO	DEUCE	WS	11/02/20
36.322 GS	SOLAR & HELIOSPHERIC	DAW	NASA/GSFC	EUNIS	WS	12/21/20

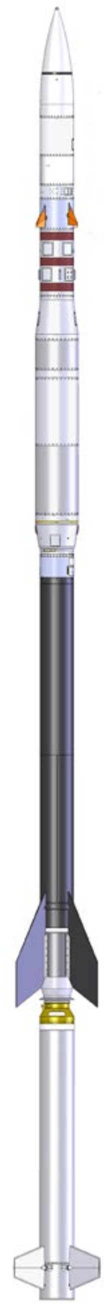
MISCELLANEA

For students

Answer to last quarter's activty:

Active launch sites:
4 - Norway: two launch sites, Andøya Space Center and Svalbard
7- Australia: several launch sites
3 - Poker Flat Research Range, Fairbanks, Alaska
1 - Wallops Flight Facility, Virginia
6 - Kwajalein Atoll, Marshall Islands
8 - Barking Sands, Hawaii
2 - White Sands Missile Range, New Mexico
5 - Esrange, Kiruna, Sweden

Inactive launch sites:
12 - Alcântara, Brazil
9 - Greenland (Søndre Strømfjord, Thule)
11 - Camp Tortuguero, Puerto Rico
13 - Punta Lobos, Peru
10 - Fort Churchill, Canada



Identify the following parts of the rocket:

Fins
Motors
Payload
Nose cone

For more learning activities, download the Sounding Rockets activty handout from:

https://sites.wff.nasa.gov/code810/files/Childrens_handout_web.pdf