

Sounding Rockets Program Office Quarterly Newsletter

# ROCKET REPORT

4 1  
3 2 2022





## INSIDE

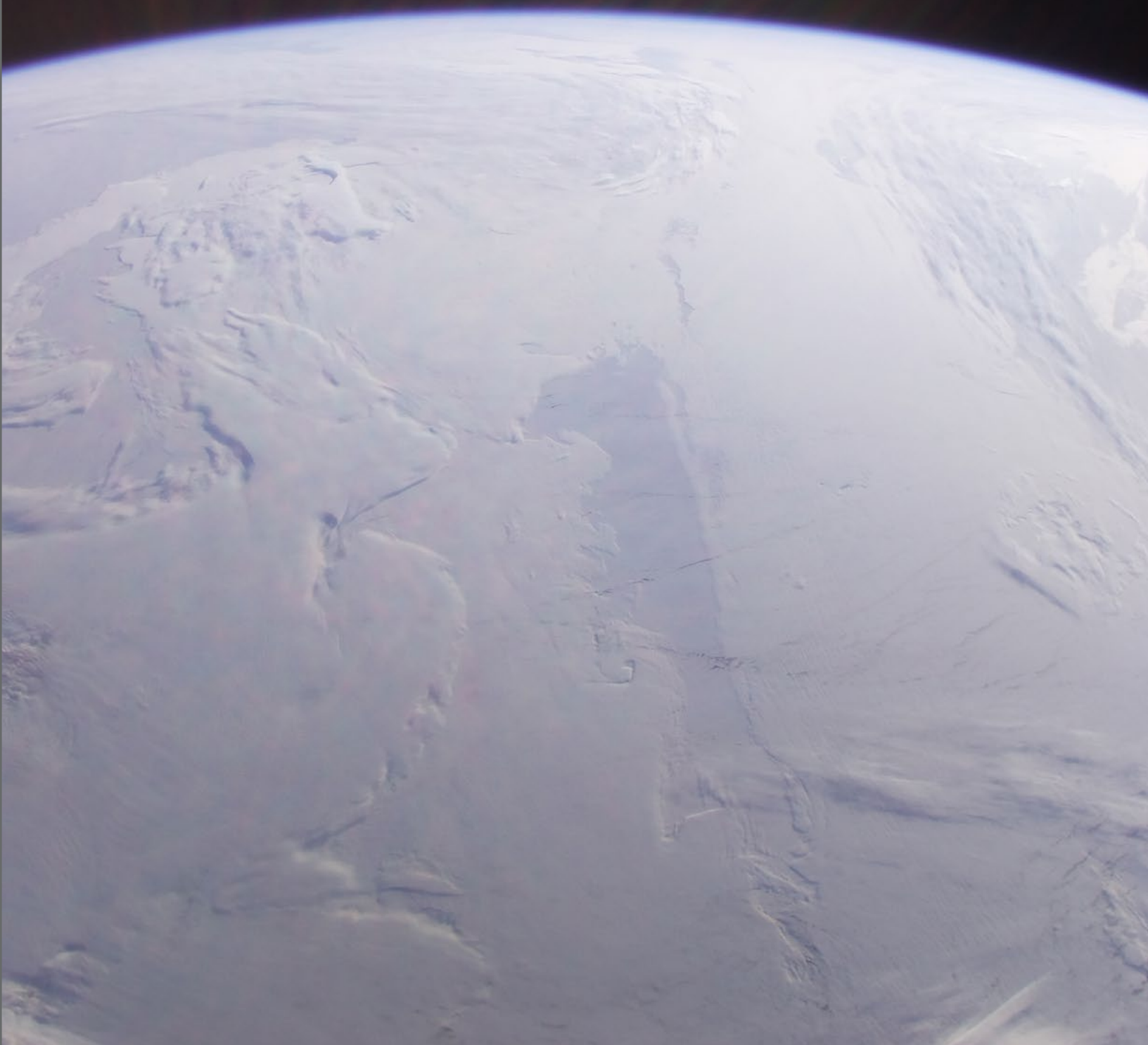
- 3 Picture of the Quarter
- 4 Program Overview
- 5 Missions Launched
- 9 Picture Place
- 10 Integration and Testing
- 11 From the Archives
- 12 Schedule & Miscellanea

Cover photo:  
47.001 GE Endurance launch from  
Svalbard, Norway. Photo by Brian  
Bonsteel/Wallops Imaging Lab.

← RockOn mission ops 2022.

Earth from Space from the Endur-  
ance mission taken at an altitude  
of 764.5 km. Image courtesy of  
Ahmed Ghalib/NSROC. →





---

## Program News

Four missions were launched during the second quarter of 2022. The Ion–Neutral during Active Aurora (INCAA) mission included two payloads launched from Poker Flat Research Range in Alaska. Endurance flew on a three–stage Terrier–Oriole–Nihka from Svalbard Norway. RockOn, a student mission, was launched from Wallops Island, Virginia. The X–ray Quantum Calorimeter Experiment (XQC) was the first mission to launch from the newly established Arnhem Space Center in Australia. All flights were successful.

Giovanni Rosanova, Chief, Sounding Rockets Program Office presented a program overview at the bi–annual ESA–PAC meeting held in Biarritz, France.

The first inaugural **Sounding Rocket Symposium** will be held August 17 – 19, 2022 at NASA Wallops Flight Facility. The symposium provides a common venue for researchers and engineers to interact, share ideas, and discover the ever–increasing capabilities and advances within the Sounding Rocket program. For more information and registration, see: <https://sites.wff.nasa.gov/code810/Symposium/Sounding–Rocket–Symposium.html>

The Australia campaign is ongoing, with the first mission, XQC, launched on June 26, 2022. The two remaining missions, Suborbital Imaging Spectrograph for Transition region Irradiance from Nearby Exoplanet host stars (SISTINE) and Dual–channel Extreme Ultraviolet Continuum Experiment (DEUCE) are scheduled for launch in July.

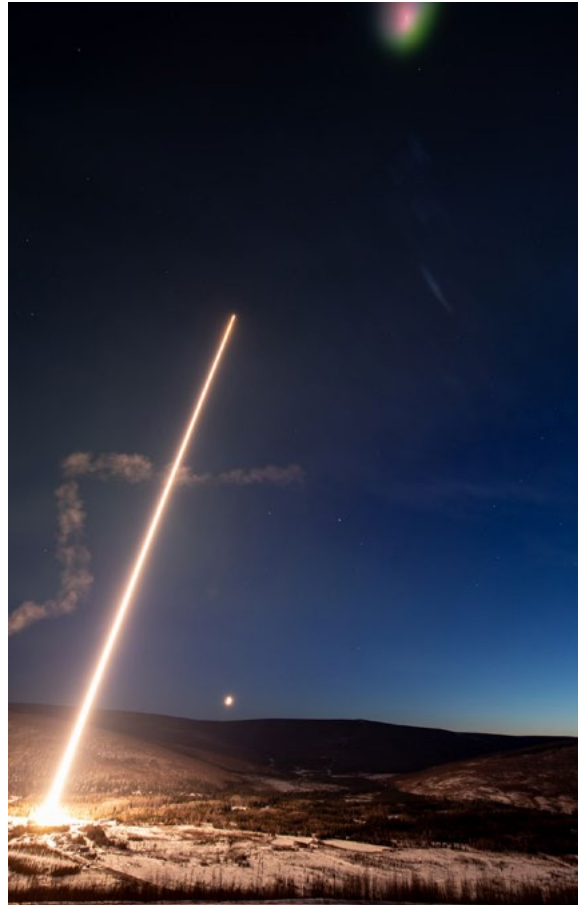
.....  
36.360 & 46.031 UE KAEPLER/CLEMSON UNIVERSITY  
- Ion-Neutral during Active Aurora (INCAA)- launched  
April 7, 2022

## Missions Flown

The science objective for the INCAA sounding rocket mission was 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 was to measure the ion demagnetization altitude and altitude resolved Joule heating rate. The mission was designed to measure terms in the ion momentum equation with altitude resolution of less than one kilometer, and also used 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 used two sounding rocket payloads launched from Poker Flat Research Range, AK: an instrumented payload (46.031) that contained a suite of plasma and neutral instrumentation and the vapor trail payload (36.360). The vapor trails include Barium, Strontium, and Trimethylaluminum (TMA).

The 36.360 payload was launched at 04:47:00 LT and 46.031 at 04:50:00 LT.



INCAA launch.  
Photo by Terry Zaperach/Wallops Imaging Lab.



Vapor trails created by the INCAA (36.360) payload.  
Photo by Terry Zaperach/Wallops Imaging Lab.



Both rockets ready on launchers.  
Photo by Terry Zaperach/Wallops Imaging Lab.

.....  
47.001 GE ENDURANCE NASA GSFC -  
launched May 11, 2022

Endurance, named after Shackleton's ship, was successfully launched from Svalbard, Norway on May 11, 2022.

The purpose of the Endurance experiment was to make the first measurement of the magnitude and structure of the electric field generated by Earth's ionosphere. Endurance directly measured a particular component of Earth's electrical field called the ambipolar electrical field that is generated by Earth's ionosphere, the layer of Earth's atmosphere that contains a high concentration of ions and free electrons.

The requirements to accomplish this objective were as follows: 1) launch into open magnetic field lines, away from the cusp and auroral zones; 2) minimize down-range traverse, flying as vertically as possible to obtain quasi-vertical profiles over a narrow range of flux tubes, location, and SZA; 3) fly above neutral exobase transition region; 4) fly in daytime; 5) launch during geomagnetically quiet time; and 6) launch during low EUV conditions to minimize photoelectron scattering.

The primary instrument is the Photoelectron Spectrometer (PES) consisting of eight Dual Electrostatic Analyzers (DESA).

Endurance was the first science mission to fly on a three-stage Terrier-Oriole-Nihka.

The Principal investigator for Endurance is Dr. Collinson.



Endurance payload during buildup in Svalbard.  
Credit: Brian Bonsteel/NASA Wallops Imaging Lab.



Endurance payload. Credit: Brian Bonsteel/NASA Wallops Imaging Lab.



41.131 UO Koehler/Colorado Space Grant-  
RockOn - launched June 24, 2022

Students were once again invited to attend the launch of the RockOn mission from Wallops Island, VA. RockOn, flying on a Terrier-Improved Orion sounding rocket, reached an altitude of 113.4 kilometers, and the payload was recovered off the coast of Wallops Island, VA and the experiments returned to the students.

Two types of student experiments flew onboard the RockOn mission; workshop experiments that the students built from kits provided by the Colorado Space Grant, and RockSat-C experiments designed and built entirely by the students.

39 RockOn and 7 RockSat-C experiments flew in 2022, with about 140 students attending the launch at Wallops. Additionally, Cubes in Space experiments for middle and high school students were flown in the rocket's nosecone.

The workshop experiments are the first step in the student flight opportunities provided by the Sounding Rockets Program Office in collaboration with the Colorado and Virginia Space Grant Consortia. After completing the workshop experiments, students can participate in RockSat-C and RockSat-X opportunities.



RockSat-C experiment integration.



Canisters ready for integration.



Cubes in Space.



RockOn workshop experiment.



RockOn participants on Wallops Island after launch.

All images on this page by Berit Bland/NSROC.

.....  
36.353 UH McCammon/University of Wisconsin  
- X-ray Quantum Calorimeter (XQC) - launched  
June 26, 2022

XQC was launched from Arnhem Space Center (ASC),  
Australia on June 26, 2022 at 23:59:49 LT.

The purpose of the XQC mission is to collect high resolution  
spectroscopy of the diffuse X-ray background in the 0.1  
to 3 keV range.

The night sky glows with X-ray light coming from all  
directions. Much of this X-ray light is produced by the  
interstellar medium, which includes hot gases filling the  
space between the stars. The unique X-ray detectors on  
this mission, cooled to a frigid one-twentieth of a degree  
above absolute zero, will measure the arriving X-rays  
with unprecedented precision to better understand the  
interstellar medium and its influence on the structure and  
evolution of galaxies and stars.

XQC was the first of three missions scheduled to launch  
from this new launch site in Australia.



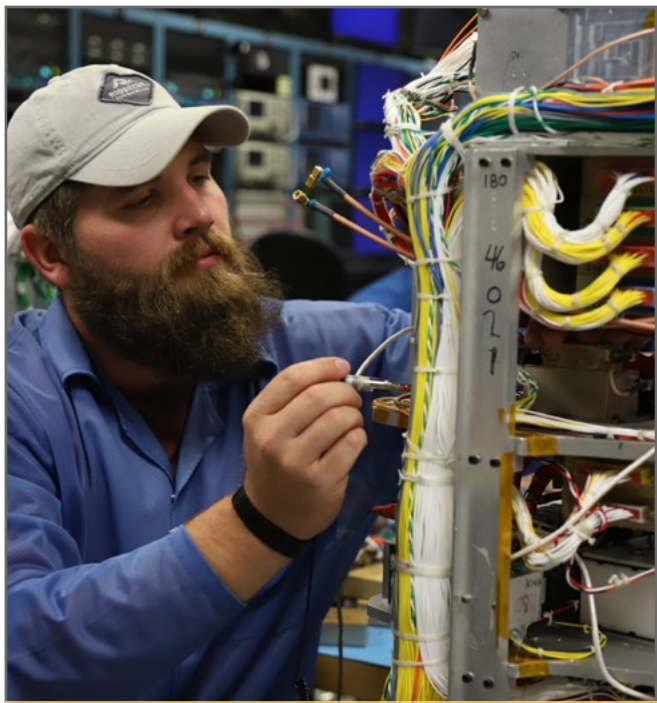
XQC ready to fly on a Terrier-Black Brant Sounding Rocket Credit: Wallops  
Imaging Lab.



XQC payload team and ASC staff before launch.







## PICTURE PLACE

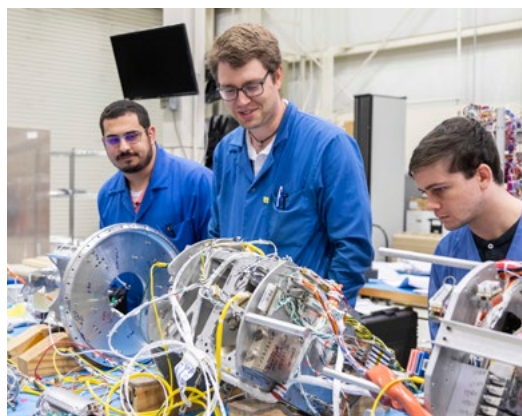




# Integration and Testing



Mike working on SpEED Demon. Photo by Berit Bland/NSROC



Koby, Adam and Anthony working on SpEED Demon. Photo by Berit Bland/NSROC

## 46.025 UE Barjatya/Embry Riddle - SpEED Demon

This mission will be a technology demonstration flight for the Sporadic E Electro Dynamics (SEED) campaign which is slated to launch from Kwajalein in June of 2024, the payload will be nearly identical to those flying from Kwajalein, but will not include vapor trail releases. The goal of the mission is to reduce risk surrounding new experiment instrumentation.

SpEED Demon will be launched from Wallops Island, VA, and while it is primarily a technology demonstration, scientific measurements of the magnitude of field aligned currents associated with Sporadic E layers at mid-latitude, and the in-situ spatial patchiness of the Sporadic E layers at mid-latitude will be taken.

Primary technologies to be tested include: GPS based position acquisition on the subpayload ejectables, deployment of telescopic booms, particulate contamination environment during launch and nosecone separation, deployment and alignment of the quad stacer booms using a quad gear box and the operation of all science instruments.

SpEED Demon is currently scheduled for launch on August 22, 2022.

## 46.036 UO Koehler/Colorado Space Grant Consortium - RockSat-X

The RockSat-X payload, the most advanced of the student flight opportunities, was integrated and tested with the students present at Wallops Flight Facility. In 2022 seven Universities are participating to fly their experiments on RockSat-X, scheduled for launch from Wallops Island, VA on August 9, 2022.



Students with the University of Kentucky deployable experiment. Photo by Berit Bland/NSROC



Darren (foreground) during sequence testing of RockSat-X. Photo by Berit Bland/NSROC



## Launching rockets from El Arenosillo on Spain's southwest coast.

Collaboration between NASA and the Spanish counterpart, Instituto Nacional de Técnica Aeroespacial (INTA) began in 1951 with sharing of aeronautical information. Later, in 1960, a Memorandum of Understanding led to the establishment of the first NASA satellite tracking station in Spain, near the Maspalomas lighthouse in the southern part of Grand Canaria. This location was chosen because Cape Canaveral and Maspalomas are at the same latitude, with an ocean between them. The Maspalomas station first tracked the Mercury flights.

In 1966, the El Arenosillo sounding rocket launch site was established on the south western coast of mainland Spain. The first two rockets were a Judi–Dart and a Skua, both suitable for meteorological observations. The Judi I rocket was manufactured by the US company Rocket Power Incorporated, and the Skua, a British rocket, was developed by Bristol Aerojet and RPE Wescott.

Prior to commencing launch operations a group of Spanish El Arenosillo staff attended a three month training session at NASA Wallops. The training included experience in handling, assembling and operating rockets and payloads, and in the operation of radar, telemetry and other range equipment. At the same time another group was building the range in Spain.



Nike-Apache on the rail at El Arenosillo.<sup>2)</sup>

On July 3, 1972 a Nike–Apache, 14,483, rocket was launched from El Arenosillo to study the Sporadic E ( $E_s$ ) layer of the ionosphere. The Principal Investigator was Dr. Aikin from NASA Goddard Space Flight Center.

Mid–latitude sporadic  $E_s$  is commonly observed on ionograms as a low lying horizontal trace. It is the result of an electron density enhancement in a narrow altitude range in the vicinity of the E region maximum. This enhancement is thought to be caused by horizontal wind shears acting in the presence of the vertical component of the terrestrial magnetic field. Long lifetime ions (e.g. metallics) must be a part of the ion composition of the  $E_s$  layer to support the wind shear theory. Metallic ions have in fact been observed within  $E_s$  layers by rocket–borne ion mass spectrometers.<sup>1)</sup>

The launch of 14,483 coincided with the Beta–Taurids<sup>4)</sup> meteor shower caused by



Main Gate at El Arenosillo.<sup>3)</sup>

comet Encke. Dr. Goldberg,<sup>5)</sup> also from Goddard Space Flight Center, reports that the abundances of the metallic ions detected during the flight agree with abundances found in chondrites (class of meteorites) suggesting that the metallic ions are from extraterrestrial debris.

Dr. Goldberg concludes: “The measurement of metallic ions in the upper atmosphere during the period of the Beta–Taurids meteor shower suggests that extraterrestrial debris can contain enriched abundances of trace constituents not predictable from the cosmic abundance of these constituents. In situ measurements of the ion composition of the atmosphere during and after the entry of significant amounts of extraterrestrial debris offer a unique opportunity to analyze and study such material.”

Ref.

<sup>1)</sup> [ION COMPOSITION: DURING THE FORMATION OF A MIDLATITUDE  \$E\_s\$  LAYER.](#)

<sup>2,3)</sup> [IAC–06–E4.4.01 THE BEGINNING OF CEDEA](#)

<sup>4)</sup> [Taurids Meteorshower](#)

<sup>5)</sup> [Comet Encke: Meteor Metallic Ion Identification by Mass Spectrometer](#)



## SCHEDULE

MISSION	DISCIPLINE	EXPERIMENTER	ORGANIZATION	PROJECT	RANGE	DATE
36.339 UG	UV/OPTICAL ASTROPHYSICS	FRANCE	UNIV OF COLORADO	SISTINE	AUS	07/06/22
36.350 UG	UV/OPTICAL ASTROPHYSICS	FLEMING	UNIV OF COLORADO	DEUCE	AUS	07/11/22
46.036 UO	STUDENT OUTREACH	KOEHLER	COLORADO SPACE GRANT	ROCKSAT-X	WI	08/09/22
36.355 UH	HIGH ENERGY ASTROPHYSICS	FIGUEROA	NORTHWESTERN	Micro-X	WS	08/22/22
46.025 UE	GEOSPACE SCIENCES	BARJATYA	EMBRY RIDDLE	SpEED Demon	WI	08/22/22
36.367 UH	HIGH ENERGY ASTROPHYSICS	MCENTAFFER	PENN STATE UNIV	tREXS	WS	09/25/22
46.032 WT	TEST & SUPPORT	HESH	NASA WFF	SUBTEC 9	WI	09/26/22

AUS – Arnhem Space Center, Australia

WI – Wallops Island, VA

WS – White Sands Missile Range, NM

## MISCELLANEA



## NASA Activities for Students

Build a straw rocket: [https://www.nasa.gov/stem-ed-resources/make-a-straw-rocket.html?utm\\_source=stemexpress&utm\\_medium=email&utm\\_campaign=stemjune232022](https://www.nasa.gov/stem-ed-resources/make-a-straw-rocket.html?utm_source=stemexpress&utm_medium=email&utm_campaign=stemjune232022)

