



# Flight Opportunities



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## Dear Flight Opportunities Community,

Hello, Flight Opportunities community! Fall is here, and with the new season we have many exciting developments in the program to share with you. Take a look at what we're covering in this month's newsletter:

- **Northwestern University has advanced its titanium foams manufacturing process** through Flight Opportunities, and it's the focus of this month's technology spotlight.
- Our flight provider profile this month highlights the capabilities of **Blue Origin**.
- Flight Opportunities Technology Manager **Stephan Ord** gives readers expert advice about how to write strong proposals and increase their chances for selection.
- **Technologies have been selected** from the NASA Internal Call for Payloads, and the most recent call closes at the end of this month. Selections from the latest SpaceTech-REDDI call are also in progress.
- **Flight Opportunities will be at ASGSR**, starting in just a few days. Please stop by and say hi!



*Ronald Young, Program Manager*

We hope you enjoy reading, and we thank you for being a valued part of our growing community.

**Ronald Young**, *Program Manager*  
*NASA's Flight Opportunities Program*

## Freeze Casting Metallic and Ceramic Foams in Microgravity

Freeze casting in microgravity is a novel materials-processing technique with the potential to provide scalable, affordable in-space manufacturing of materials and structures. Its numerous advantages for space exploration include reducing launch costs and enabling transport of raw materials to build structures that would otherwise be too large to launch.

To better understand the properties of titanium (metal) foams and titanium-oxide (ceramic) foams resulting from freeze casting, scientists at Northwestern University have taken advantage of parabolic flight testing through Flight Opportunities, maturing their process and putting it in the queue for a 6-month CubeSat mission.



*(Left to right) Northwestern University student researchers Felicia Teller and Amelia Plunk work with Bryce Tappan of Los Alamos National Laboratory on the freeze casting process during a test flight. Photo credit: NASA*

### About the Research

Researchers have surmised that terrestrial-based gravitational forces result in inferior titanium and titanium-oxide foams and that those created in microgravity-based freeze casting would have better pore alignment and order. Northwestern University's flight tests aimed to verify this assumption.

### Flight Results

The 2014 flight tests revealed that gravity had a substantial impact on the freeze casting results. Structures created in near space indeed exhibited far more desirable properties than those created on Earth. Subsequent testing in 2015 allowed the researchers to isolate other factors, such as convective fluid motion and sedimentation of particles in the titanium and titanium-oxide foams.

Combining these observations helped them better understand the material's properties in order to improve their process for longer-duration testing.

### Looking Ahead

Northwestern University's work with Flight Opportunities has increased the process's TRL to 6, contributing to its selection for a 6-month NASA CubeSat mission. It has also been selected under the NASA MaterialsLab Open Science Campaign for an International Space Station demonstration expected to launch in 2019 or 2020.

*“What we’ve learned through the Flight Opportunities program testing has put us in a position to better design our experiment for the CubeSat. In the two years we spent with the program, we were able to continue to improve our process and understanding--and that puts us in a much better position to actually succeed with the CubeSat testing.”*

*— David Dunand, James N. and Margie Krebs Professor of Materials Science and Engineering, Northwestern University*

# Flight Highlights

## Recent Balloon Flight Helps Advance SwRI's Solar Instrument Pointing Platform

A high-altitude balloon carrying Southwest Research Institute's Solar Instrument Pointing Platform (SSIPP) was launched from Benson Municipal Airport in Arizona on September 3. SSIPP enables low-cost research with optical precision equivalent to pointing at a dime from 2.5 miles away.

World View in Tucson, Arizona, lifted the payload aboard its Stratollite high-altitude balloon into the stratosphere. Staying aloft for over five hours, the solar observatory platform was carried to an altitude of 103,000 feet. The flight was designed to help SwRI further advance the technology in preparation for space-based missions. To learn more about the flight and the payload, [read the full NASA news feature](#).

## ProfileFlight Provider Profile

### Blue Origin

One of Flight Opportunities' newest commercial flight providers, Blue Origin has been flying its New Shepard--a fully reusable vertical takeoff, vertical landing (VTVL) space vehicle--since April 2015 in a test flight capacity. The company has flown five flights in the last 12 months on the same booster and capsule.

Blue Origin's Business Development Manager, Dr. Erika Wagner, says the company is extremely proud of its achievements to date, and is looking forward to beginning flying payloads for Flight Opportunities in early 2017. "A lasting legacy of what we do in space is the benefit to the research community and how it can impact technology development and education," says Wagner. "So we're really excited to work with NASA's Flight Opportunities program, which has been at the forefront of the growth in suborbital research."

Wagner says Blue Origin's work with Flight Opportunities will aim to get to the heart of science and technology maturation. "We can work with a researcher on a payload and then fly it again and answer new questions and really start to do science the way science is meant to be done," she says. "You have a hypothesis, you collect some data, and then you go back and refine and take another bite at the apple. I think that's something that's been hard to do in previous eras of spaceflight, but in working with programs like Flight Opportunities we'll begin to open more doors



*Blue Origin's New Shepard space vehicle lifts off from the landing pad.*

in this area. We look forward to flights that are capable of delivering relevant scientific results and increasing technology readiness levels as hardware makes the transition from the ground up to orbit.”

In addition to preparing to fly researcher payloads, Wagner says Blue Origin is very excited about its outreach program for students. The program--NanoLabs--offers students the opportunity to put a small payload in space for as little as \$5,300. “So we’re now working with students at the elementary school level up through PhD programs, as well as our more traditional researchers,” says Wagner. “This kind of hands-on access to space is really unheard of, and we’re super excited about the potential impact it will have.”

- For Flight Opportunities researchers, Blue Origin will be flying payloads on New Shepard, which offers:
- An apogee of over 100 km
- Payload lockers in two sizes, supporting experiments up to 50 lbs
- Custom solutions for larger payloads
- Fast turnaround times from launch to recovery, and potentially re-flight

Blue Origin’s engineering, manufacturing, and business teams work in a 260,000 square foot facility on 26 acres in Kent, WA and the company conducts engine and flight testing at its privately owned and operated launch site two hours east of El Paso, TX.

[Click here to learn more about New Shepard and its flight testing capabilities.](#)

*“The Flight Opportunities program has been and continues to be a great steward of the growing marketplace in suborbital research and technology development, and we’re honored to be part of that partnership.”*

*— Dr. Erika Wagner, business development manager, Blue Origin*

## Steve Ord Talks Shop on Writing a Successful Proposal for Flight Opportunities

As Technology Manager for NASA's Flight Opportunities program, Steve Ord is responsible for helping to bring more technology researchers into the flight testing pipeline. Passionate about his work and diligent in his approach to providing the most comprehensive guidance possible to help innovators from all organizations be successful, Steve is a valuable resource for researchers interested in preparing proposals for submission to both Internal NASA calls and SpaceTech-REDDI solicitations.



Steve Ord, technology manager for NASA's Flight Opportunities program

In this interview, Steve gives us the scoop on straightforward steps all researchers can take to improve their proposals--and their prospects for having their experiment selected for a test flight.

### **When should researchers contact you to discuss their proposals?**

Before they propose—in fact, the earlier the better. For some solicitations, like REDDI, once the solicitation has been issued, I can't talk with potential proposers during what's called the "blackout period." So sooner is definitely best.

### **How can they get in touch with you?**

Any researcher interested in submitting a proposal can just pick up the phone and give me a call or send me an email. *(Editor's note: You can find Steve's contact info at the bottom of this newsletter.)*

### **What do the meetings with researchers often look like?**

In these one-on-one sessions, I can help clarify proposal requirements that they might have questions about. If they've submitted a proposal in the past that was unsuccessful, we can have a debrief about how they can improve their proposals in the future. We can discuss the experiment they are interested in proposing. While I cannot offer strategic advice about their experiment, I can answer questions to help them make sure their proposal will be clear and understood by the review team.

### **What is your top advice for making proposals as strong as possible?**

Researchers should know why the technology they are proposing is better than the current state of the art, and they should make this very clear in their proposal. We often find that the state of the art is simply not stated clearly, and sometimes it is even apparent that the researchers do not have a clear grasp of it. By contrast, proposals that are successful have done their homework--they've gone to industry conferences, they've read research papers, they understand their competition. And then they clearly and explicitly demonstrate how their technology is better.

Another piece of advice I often give is to be clear about why a test flight is needed. What will the flight help you learn about your technology that you cannot learn in a ground-based experiment? This is key.

***Do you see any frequent “rookie mistakes” that researchers should look out for when submitting proposals?***

Definitely. Researchers should be aware of the basics of the proposal criteria--don't exceed the page limits, make sure graphics are clear, and make sure the writing is cogent and high quality. It's remarkable how often the basics are overlooked, and they really are important.

We also recommend peer reviews. Ask colleagues who are unfamiliar with your technology if they understand your proposal. If they don't, chances are good that the review committee won't either.

***Should researchers speak with the flight providers before submitting a proposal?***

Yes. In fact, the information that comes from conversations that researchers have with potential flight providers can help strengthen a proposal. For solicitations like REDDI, the proposal needs to include a quote from a flight provider, so those conversations definitely need to happen up front. Also, some solicitations require a cost-sharing component. Many times this is left out of the proposal, or the arrangements are simply unclear. If proposers have questions about this aspect, they should definitely get in touch with me. Procurement scrutinizes this section closely, so it's an important part of the proposal.

***Are there other resources available to researchers as they prepare proposals?***

There are many resources available, some formal and others more ad hoc. We have Q&A sessions for each solicitation, and I highly recommend attending those. We also have FAQs and presentations available on our website that provide a lot of great information. There are professional organizations for folks conducting microgravity-based research. Flight Opportunities will have a table at the ASGSR conference in Cleveland, Ohio, October 26-29 and will be available to answer questions. So any researchers who are at that annual meeting should feel free to stop by.

## Opportunities

### **NASA Announces Selections From Internal Call for Payloads**

Two payloads have been selected to participate in the Flight Opportunities program via the NASA Internal Call for Payloads (NTRNL-Jul-16). These teams will have the opportunity to fly their payloads in relevant environments to advance the TRL and prepare the technologies for use in NASA missions. The selected payloads are:

***High-Altitude Electromagnetic Sounding of Earth and Planetary Interiors***

- NASA sponsor - Dr. James Gaier, program officer, NASA's Planetary Science Division (PSD)
- Principal Investigator - Dr. Robert Grimm, program director, Southwest Research Institute (SwRI)

***Suborbital Flight Experiment Monitor-2 (SFEM-2)***

- Principal Investigator: Dr. Kathryn Miller Hurlbert, senior engineer, NASA's Johnson Space Center (JSC), Crew and Thermal Systems Division

## NASA Internal Call for Payloads Closes October 31

Proposal submissions for the current NASA Internal Call for Payloads (NTRNL-Oct-16) are due Oct. 31, 2016.

The NASA Internal Call for Payloads applies to internally funded NASA development activities seeking maturation advancement beyond TRL 4. The call is open to NASA and other U.S. government researchers and is made quarterly. Principal investigators (PIs) can be from a NASA center, or the PI can be from an external organization if the technology is for a NASA-funded activity (e.g., SBIR/STTR, NIAC, GCD, HEOMD, SMD programs). For more information, [visit the Flight Opportunities website](#) or [contact Steve Ord](#) to learn more about the program and discuss how to best prepare your submission.

## SpaceTech-REDDI Announcements Expected by Year End

Reviews from the recently closed SpaceTech-REDDI F1(B) solicitation are currently underway with selections expected to be announced near the end of the year. To learn more, [visit the SpaceTech-REDDI section](#) of the Flight Opportunities website.

## Tipping Point 2016 Call Now Closed

Proposal reviews are currently underway for the NASA 2016 “Utilizing Public-Private Partnerships to Advance Tipping Point Technologies” Appendix , part of the REDDI-2016 NASA Research Announcement (NRA). Flight Opportunities will invest in this appendix as part of its continuing efforts to foster new commercial capabilities to serve the orbital and suborbital launch communities.

## Upcoming Conferences & Events

### October 26-29: [Annual Meeting of the American Society for Gravitational and Space Research](#) (ASGSR)

*Flight Opportunities Technology Manager Steve Ord will be on hand to meet with researchers and answer questions. Stop by to say hello!*

- November 15-17: [Space Commerce Conference and Exposition](#) (SpaceCom)
- December 12-16: [American Geophysical Union \(AGU\) Fall Meeting](#)
- February 2-3: [Commercial Space Transportation Conference](#)
- February 6-8: [SmallSat Symposium](#)



Have ideas or feedback for the Flight Opportunities newsletter?

Drop us a line at: [NASA-FlightOpportunities@mail.nasa.gov](mailto:NASA-FlightOpportunities@mail.nasa.gov)

STAY CONNECTED:



NASA Flight Opportunities Program

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