FLIGHT OPPORTUNITIES

Lessons Learned Library

Over many years and through numerous flights, participants in the Flight Opportunities program have identified dozens of suggestions to help researchers be more successful in their flight testing and as they advance their technologies through flight tests. The Lessons Learned Library curates suggestions from the Community of Practice webinars; post-flight reports; and other interactions with researchers, NASA personnel, and flight providers.

The lessons are organized as follows:

Check back often, as Flight Opportunities is always adding to the Lessons Learned Library.

Get Involved with the Flight Opportunities Program

Researchers interested in testing their payload in a relevant environment are encouraged to follow these best practices to engage with the program and make the most of their experience. In some cases, a link is provided where you can hear more about the suggestion from the relevant Community of Practice webinar. Follow the links below to jump to a set of suggestions.

Learn about the Program

- **Stay in the know:** Subscribe to the Flight Opportunities newsletter and monitor the NASA Solicitation and Proposal Integrated Review and Evaluation System (NPSIRES) to stay on top of the latest news about calls and solicitations. (Hear more about news subscriptions. Starts at timecode: 17:46)

- **Understand the avenues for funding:** Visit the Access Flight Tests page to see the funding mechanisms available to researchers. (Hear more about funding. Starts at timecode: 8:06)
- **Leverage resources from Flight Opportunities:** Review previous flight summaries, the technology portfolio, and the flight provider information to understand the types of technologies the program supports and the types of vehicles and flight profiles that program-supported teams have leveraged for flight testing.

››› Return to the beginning of Get Involved with the Flight Opportunities Program

Engage with Us

- **Reach out to Flight Opportunities personnel:** Talk to Flight Opportunities personnel early on for valuable insights, such as how to better scope your testing before flight. Subscribe to the Flight Opportunities newsletter to know which conferences program personnel will be attending. (Hear more about reaching out. Starts at timecode: 9:05)
- **Ask questions:** Reach out to the Flight Opportunities program to discuss your technology and any questions you have prior to the opening of a solicitation. (Hear more about asking questions. Starts at timecode: 42:56)

››› Return to the beginning of Get Involved with the Flight Opportunities Program

Align with Our Goals

- **Research the state of the art and current gaps:** Research what technologies already exist and the relevant technology gaps. As needed, find appropriate subject matter experts to help you understand the state of the art and how your technology might address any gaps. The Flight Opportunities technology team can assist you with finding appropriate partners to work with.
- **Understand NASA's needs:** Consult NASA's Strategic Framework, which has documents as well as videos from principal technologists within NASA's Space Technology Mission Directorate. (Hear more about NASA's needs. Starts at timecode: 43:50)

››› Return to the beginning of Get Involved with the Flight Opportunities Program

›› Return to Lessons Learned Table of Contents

Preparing Proposals

Here are some quick tips to keep in mind when writing proposals to apply for access to Flight Opportunities testing. In some cases, a link is provided where you can hear more about the suggestion from the relevant Community of Practice webinar. Follow the links below to jump to a set of suggestions.

Best Practices for Proposals

- **Do your research on the solicitation:** Explore our website to review fact sheets, reports on what has been funded, and details on previous solicitations. Attend the Q&A session to understand the specific requirements and focus points of the solicitation. (Hear more about researching the solicitation. Starts at timecode: 16:01)
- **Check if your project is within scope:** Ensure your technology fits within NASA's/the commercial space industry's needs and that it fits within the scope of the Flight Opportunities program. Keep in mind that you will receive feedback on your proposal, providing an opportunity to learn from the process. (Hear more about scope. Starts at timecode: 38:53)
- **Be clear, cogent, and to the point:** Don't repeat information and make appropriate use of the space (e.g., add graphics, data). (Hear more about making the best use of your space. Starts at timecode: 15:08)
- **Don't skip the basics:** Make sure your suborbital flight testing proposal is self-contained and meets all formatting requirements (e.g., page count, margins). (Hear more about the basics. Starts at timecode: 13:56)
- **Put your proposal through peer review:** Enlist the help of colleagues to ensure that your ideas flow and that your proposal is easy to read and follow. (Hear more about putting your proposal through peer review. Starts at timecode: 18:39)

››› Return to the beginning of Preparing Proposals

About Your Technology

- **Make the case for flight:** Show that you have done any necessary ground-testing to mitigate as much risk as possible, demonstrating that you have a real need to see your technology perform in the flight environment at this time. (Hear more about making your case. Starts at timecode: 13:08)

- **Communicate the connection to NASA's goals:** Express how your technology and flight experiment benefit NASA's mission and the agency's strategic goals. (Hear more about connecting to NASA goals. Starts at timecode: 10:15)
- **Demonstrate others' interest in your technology:** Discuss the potential customers/applications to build a compelling story for your technology (e.g., you could include the detail that NASA is interested). Although cost-sharing is not required, if any additional or matching funds are available, include that information in your proposal. (Hear more about demonstrating others' interest in your technology. Starts at timecode: 53:45)
- **Explain why your technology is outstanding:** Compare it to the state of the art so NASA is aware of how your technology is an advancement over what has been done before or addresses a technology gap. (Hear more about describing your technology. Starts at timecode: 12:27)
- **Provide sufficient technical detail:** Providing the technology background, key elements enabling your technology, and relevant performance metrics. (Hear more about providing the right level of detail. Starts at timecode: 59:00)
- **Communicate your technology development plan:** Be clear and specific about where you are today with your technology and what applications/benefits you see it having in the future. Refer to NASA's technology readiness level (TRL) definitions for more information on properly identifying the current TRL of your technology as well as the expected TRL after the proposed flight test. Think about how the flight testing opportunity fits into a progression or iterative plan for widespread commercial application or a future mission (e.g., to the International Space Station, the Moon, or Mars). (Hear more about communicating TRL. Starts at timecode: 51:56)
- **Understand the risks and requirements.** Be realistic about your minimum, nominal, and extended mission requirements. Take mission operations into account. Consider whether your payload is expendable, keeping in mind that it potentially could be lost. Build in redundancies or safety mechanisms for critical elements. Also, ensure your proposal reflects the time required to obtain any additional paperwork to meet regulatory requirements.

››› Return to the beginning of Preparing Proposals

About Flights and Flight Providers

- **Reach out to flight providers early:** Contact flight providers – either those that have flown with Flight Opportunities in the past or other vendors that meet the solicitation eligibility requirements – early in the process to strengthen your proposal:

  - Discuss which would be the best vehicle for your needs, determine whether customization is needed/available, and obtain a quote that reflects your test needs. (Hear more about vehicle choice. Starts at timecode: 33:05)
  - For more information about orbital platforms hosting payloads, refer to the *State-of-the-Art: Small Spacecraft Technology* report published by the Small Spacecraft Systems Virtual Institute (S3VI) to review a selection of companies that host payloads on their orbital platforms. Refer to the specific Flight Opportunities solicitation (e.g., TechFlights) to understand flight provider eligibility requirements.
  - Understand vehicle flight profiles and environments (e.g., length/duration of flight, temperature ranges, humidity ranges, vibration/shock). (Hear more about flight profiles and environments. Starts at timecode: 55:55)
  - Ask for a payload user's guide (PUG) with information about weight allowed, maximum dimensions, etc., to use as a starting point for building your payload. The payload integration package (PIP) is another resource for parabolic aircraft for researchers to reference and complete with the details of their payload. (Hear more about PUG. Starts at timecode: 14:14)

- **Build a trip to the flight provider into your budget:** Obtain a quote from your flight provider to factor into your proposal and gain valuable insight and first-hand experience with payload hardware. (Hear more about factoring a trip to the flight provider into your budget. Starts at timecode: 29:19)
- **Consider the number of flights you will need:** Consider proposing more than one flight test for an iterative development and test approach (i.e., fly-fix-fly). Consider creative funding mechanisms (e.g., cost sharing) to accommodate the cost of additional flights as needed.

››› Return to the beginning of Preparing Proposals

›› Return to Lessons Learned Table of Contents

Getting Ready to Fly: Step-by-Step Suggestions

In addition to general advice for getting involved with the Flight Opportunities program, the following are key best practices at specific stages of the Flight Opportunities process. In some cases, a link is provided where you can hear more about the suggestion from the relevant Community of Practice webinar. Click the links below to jump to that stage in the process:

General Best Practices

- **Cultivate a successful team:** Choose team members you trust and work well with and who can contribute in specific ways that add value to the flight testing effort. (Hear more about choosing team members. Starts at timecode: 48:18)
- **Reach out early:** Communicate with your flight provider, NASA flight campaign manager, and other team members early and often to resolve questions and best prepare for your flight. (Hear more about reaching out early. Starts at timecode: 47:28)
- **Stay organized:** Make organization a priority for you and your team every step of the way as you prepare for your flight. For example, create and follow procedures/checklists and ensure that you have the user's guides and documentation you need. (Hear more about staying organized. Starts at timecode: 36:36)
- **Have contingencies for your experiment:** Consider everything that could go wrong with your technology as well as the demonstration itself and plan for how to solve it. For example, if software is automated, make sure you have the option to override it. If a team member gets sick, ensure you have a back-up person in place. (Hear more about having contingencies. Starts at timecode: 19:11)

››› Return to the beginning of Getting Ready to Fly: Step-by-Step Suggestions

Upon Award

- **Understand what your flight provider can offer:** Review vehicle specs in the flight provider documentation and talk to your flight provider to see what other options are available (e.g., flight modeling and safety support), as discussed in this example from Aerostar, one of the program's flight providers. (Hear more about understanding what your flight provider can offer. Starts at timecode: 36:36)
- **Contact your flight provider if your team includes a foreign national:** Ask if the flight provider has export control support or processes in place. Even if what you need is not a standard service for the flight provider, it could be possible to have it included in the contract. (Hear more about making sure export control support or processes are in place. Starts at timecode: 46:12)
    - **NASA researchers:** Familiarize yourself with U.S. export control protocols well in advance of your flight to determine if you will need Office of International Relations involvement. (Hear more about export control. Starts at timecode: 44:56)
- **Start preparing forms required by the flight provider:** Some flight providers require a payload integration package (PIP) to be completed, which includes a description of your payload. Consult the payload user's guide (PUG) and discuss what paperwork is needed with your flight provider and your NASA campaign manager, as it could vary depending on your payload.
- **Start the process of applying for any required licenses or other permissions:** Work with your flight provider to learn which regulatory requirements they cover and which ones you will need to acquire or complete yourself. Depending on your payload and the type of flight platform, you may need to have a license to transmit radio frequency (RF) systems, which can take various forms. Also investigate safety requirements, special arrangements for shipping hazardous materials, and any local government or Federal Aviation Administration (FAA) requirements. (Hear more about licenses and permissions. Starts at timecode: 30:44)
    - Start the process of securing licenses/permissions early, as they can take more than two months to be approved and may need to be in place well before the flight.
    - Ensure that the licenses will still be valid in the event of a delayed flight.
    - Add a one-month margin to account for potential weather delays.

››› Return to the beginning of Getting Ready to Fly: Step-by-Step Suggestions

During Payload Development

- **Communicate with your NASA campaign manager frequently:** Your campaign manager can help you have the most successful flight possible. They have

experience working with many researchers and flight providers. By staying in frequent communication with them, you will gain valuable insights that will help you make the most of your flight opportunity. (Hear more about communicating with your NASA campaign manager. Starts at timecode: 47:31)

- **Keep in touch with your flight provider:** Discuss the specific requirements for your experiment (e.g., considerations for pressure systems, heat sources, fluids that might be used, or large amounts of power draw). Leverage their expertise by asking detailed questions to confirm you are meeting all requirements laid out in the flight provider documentation (e.g., the payload integration package (PIP) provided by flight providers for parabolic flights). (Hear more about staying in touch with your flight provider. Starts at timecode: 14:49)
- **Take advantage of the flight vehicle's capabilities:** Consider the environment the flight vehicle will experience and plan to gather as much relevant data as possible to maximize the flight test opportunity. (Hear more about vehicle capabilities. Starts at timecode: 28:32)
- **Set a payload readiness date with your flight provider:** Develop a realistic timeline to implement the design, review it with colleagues, and pre-test it. Reach out to your flight provider and Flight Opportunities campaign manager if you encounter any issues or delays.
- **Request feedback on your technical documentation:** Ask the flight provider if they would be willing to review a draft of your technical documentation and, if so, how far in advance of the flight it should be submitted. (Hear more about technical documentation. Starts at timecode: 51:37)
- **Prepare as much as possible:** It is better to over-prepare than under-prepare for the flight and learn from your experience. (Hear more about preparation. Starts at timecode: 21:07)
- **Follow best practices for payload design:** Review this advice for designing your payload.
- **Test as you plan to fly:** Conduct tests in the lab that are as close to the flight configuration as possible to identify issues early.

››› Return to the beginning of Getting Ready to Fly: Step-by-Step Suggestions

Months Before the Flight

- **Submit your technical documentation on time:** Complete and return technical documentation according to the deadline given by your flight provider, typically 6–8 weeks prior to the flight. This includes securing any licenses, completing payload integrations, and other required paperwork. Talk to your flight provider for more specifics.

- **Use the flight provider and Flight Opportunities campaign manager as a key resource:** Reach out to your flight provider, as they often have expertise and experience that could be instrumental for your flight test. (Hear more about tapping into expertise. Starts at timecode: 32:57)
- **Establish procedures:** Ensure you have procedures in place for every part of the process (e.g., testing, launch, post-flight operations) and update them as you test to best prepare for your flight. Use checklists and labels to simplify the tasks. Consider making a stand-alone card with key information for each part of the experiment. Brainstorm other tools that might be helpful to your team during flight. (Hear more about procedures. Starts at timecode: 38:08)
- **Have a back-up plan:** Build redundancies into your setup – not only in equipment but also in team members – and practice executing the experience so that the process is simplified. (Hear more about back-up plans. Starts at timecode: 21:53)
- **Cross-training is important:** For parabolic flights, crew members may get sick, so cross-training the crew such that they can perform all roles is a best practice.
- **Consider the in-flight environment:** For researcher-tended experiments, account for the time needed for team members to get used to the in-flight environment and be realistic with your expectations. (Hear more about the in-flight environment. Starts at timecode: 46:27)
- **Prepare, prepare, prepare:** Practice running your experiment outside the lab to be fully prepared for the flight. (Hear more about the importance of preparing. Starts at timecode: 54:39)
- **Account for shipping and travel time:** If you need to ship your experiment to the site, ensure that it gets there early and safely. Check with your campaign manager to determine the best way for your experiment to arrive at the site intact (e.g., consider adding electronic shock and humidity trackers to the packages). Consult with your flight provider about arriving a few days early to set up the payload. (Hear more about shipping and travel. Starts at timecode: 58:42)
- **Test your payload prior to delivery:** Take care to perform all necessary testing, particularly for the duration of the flight test, to ensure you are fully prepared. To the extent possible, test your payload against parameters outlined in the payload user's guide (PUG), including the temperature, pressure, acceleration, shock, vibration, and other environmental variables your payload may be exposed to. (Hear more about testing your payload. Starts at timecode: 37:12)

››› Return to the beginning of Getting Ready to Fly: Step-by-Step Suggestions

Weeks Before the Flight

- **Plan for flight provider facility logistics:** Ensure you know the process for what happens when you arrive on site and have a plan in place. For example, determine

whether an escort is required to and from the integration facility. Consider visiting the flight provider ahead of the flight week. (Hear more about facility logistics. Starts at timecode: 40:28)

- **Communicate needs to the flight provider:** Talk to your flight provider if you have special requirements like cold storage, power, clean environments, electrostatic discharge (ESD) benches, or special test equipment to make sure they can be accommodated. Common in-lab items may not be standard at the flight provider's site. Make alternative plans if needed.
- **Develop your packing list:** Stage your lab before you go so you can take stock of the tools and space you will need at the launch site.
- **Plan ahead for personnel attendance:** Ensure the principal investigator (PI) can attend payload integration and flight. Identify knowledgeable alternate personnel to be on site in case the PI cannot be present.
- **Prepare all team members:** Make sure ***all*** team members are familiar with the payload, including hardware, software, and other systems as well as pre-flight testing and in-flight operation so that a team member is prepared to step in for the PI if needed. Ensure all team members are aware of safety protocols.
- **Start preparing your team to fly:** Follow best practices for flight testing on aircraft flying parabolic profiles if that is the vehicle platform you will be using.

››› Return to the beginning of Getting Ready to Fly: Step-by-Step Suggestions

Packing for and Traveling to the Flight Site

- **Use labels:** Identify items by team name to stay organized at the flight site.
- **Create a checklist:** Make note of every part, procedure, and step-by-step process. Group the information on the checklist, ensuring it is in logical order. (Hear more about checklists. Starts at timecode: 51:12)
- **Address special payload needs for multi-flight campaigns:** Plan for consumables or materials that may require servicing or replacement between flights (e.g., additional batteries to hot-swap).
- **Do a final check for easily overlooked items:** Keep in mind the remote location of many launch sites – they often lack conveniences like local hardware stores. Don't assume you will be able to do any last-minute shopping for tools or equipment:
    - Pack an extension cord.
    - Bring spares of all critical payload modules, including hardware, biological samples, etc.

- Include extra electrical peripherals, such as batteries, power connectors, and data cards.

››› Return to the beginning of Getting Ready to Fly: Step-by-Step Suggestions

Week of the Flight

- **Be prepared:** Have a thorough understanding of what to expect and contingency plans to account for things you might not have expected.
- **Know the schedule:** Be sure you are familiar with the schedule and key activities. Each flight campaign is unique, so don't assume this flight schedule will be the same as the last one.
- **Be familiar with the facility and equipment:** Get a description of the payload integration facility and any available payload support equipment from your flight provider before you arrive on site.
- **Be aware of the security protocol:** Ask for a security briefing from the flight provider when you arrive.
- **Perform integrated compatibility testing:** Conduct comprehensive and flight-like representative integrated tests, including system electromagnetic and interference (EMI) testing to identify potential radio frequency (RF) impacts on the payload systems.
- **Perform functional and/or performance checks on your hardware:** Check on hardware at the beginning and end of each day to ensure the payload is at a nominal state at each stage of the integration process.

››› Return to the beginning of Getting Ready to Fly: Step-by-Step Suggestions

Immediately After Flight

- **Perform daily hardware reviews:** For multi-day flight campaigns, check the status of your hardware at the end of each day (if possible) to detect any issues before the next day's flight. (Hear more about performing daily reviews. Starts at timecode: 29:47)
- **Assess how the flight went:** Document lessons learned right away to identify what went well and what could be improved. (Hear more about assessing the flight. Starts at timecode: 39:07)
- **Prepare for the next flight:** Develop new techniques, checklists, approaches, and activities to practice in advance based on your experience. (Hear more about preparing for what's next. Starts at timecode: 21:13)

››› Return to the beginning of Getting Ready to Fly: Step-by-Step Suggestions

Later After Flight Testing

- **Take stock of lessons learned:** When you get your payload back, review what worked and what did not to advance your technology. Even if the technology did not advance, reviewing the lessons learned is key part of the process. What would you change? What improvements could you make for the next iteration? (Hear more about capturing lessons learned. Starts at timecode: 27:07)
- **Prepare follow-on proposals:** Use your Flight Opportunities experiences for a path toward technology maturation, advancing your technology readiness level (TRL) and preparing you to write follow-on proposals for larger missions or applications, following these best practices for proposal preparation. (Hear more about preparing follow-on proposals. Starts at timecode: 28:57)

››› Return to the beginning of Getting Ready to Fly: Step-by-Step Suggestions

›› Return to Lessons Learned Table of Contents

Best Practices for Payload Design

In addition to the tips provided for the payload-development stage of the process, keep the following guidance in mind when designing your payload. In some cases, a link is provided where you can hear more about the suggestion from the relevant Community of Practice webinar. Follow the links below to jump to a set of suggestions.

Integrating with the Flight Vehicle

- **Use the guidelines from your flight provider:** Each flight provider has their own information about how to integrate your technology with their vehicle. For example, your flight provider may provide an interface control document (ICD) that includes

information about mechanical, electrical, and data interfaces. When extensive software is involved, there may be a separate software interface document. Be sure to follow your flight provider's guidance and reach out to them with any questions.

- **Discuss payload design:** Bring your colleagues (and engineering review team if you have one) into the design conversation early to allow plenty of time to accommodate their input.
- **Employ smart payload design:** Incorporate independent or backup subsystems to avoid multi-point or chain-reaction failures.
- **Remember modularity is key:** Employ a modular design approach with your payload hardware to enable replacement of critical parts or removal of non-critical parts if needed.
- **Focus on ease of access:** Ensure hardware is easily accessible during and after installation on the flight vehicle while also meeting the flight provider's mechanical design requirements.
- **Fit-check everything beforehand:** If possible, send a 3D printed model of your payload or critical payload mechanical interfaces to the flight provider to confirm fit.
- **Avoid payload changes after flight system integration and testing (I&T):** All payload configurations are considered "locked" after combined system/electromagnetic interference (EMI) testing with the other payloads manifested on your flight. Engage with your flight provider to discuss any post-I&T changes, but only ***after*** you have considered ways to avoid reconfiguration, as it is best to fly as you have tested. Any last-minute changes to hardware, software, or experiment procedures will require a thorough and rigorous calibration and operational checkout prior to flight.

››› Return to the beginning of Best Practices for Payload Design

Designing for Flight

- **Consider the flight environment:** Consider adding structures to stabilize the payload (e.g., to avoid vibrations) and to address the risk of floating during microgravity flights (e.g., provide handholds, secure parts). (Hear more about the flight environment. Starts at timecode: 16:05)
- **Consider power needs:** If you will be providing your own payload power, evaluate the payload's power consumption and select a suitable-sized battery with enough capacity to withstand significant launch delays. Consider the operational time, battery shut off, and any battery charge time as well as whether a hot swap will be needed.

- **Keep EMI and EMC in mind:** Implement radio frequency (RF) shielding techniques, proper ground planes, and build-up stages to aid electromagnetic interference (EMI) prevention and ensure electromagnetic compatibility (EMC).
- **Ensure your payload is ruggedized:** Inspect all electrical connections and solder joints. Replace any faulty components.

››› Return to the beginning of Best Practices for Payload Design

›› Return to Lessons Learned Table of Contents

Top Tips for Each Type of Flight Platform

Click the links below to jump to the advice for that platform. Then check with your flight provider for considerations for their specific vehicle. In some cases, a link is provided where you can hear more about the suggestion from the relevant Community of Practice webinar.

Parabolic Flights

- **Clarify research team roles:** Assign and document clear roles and responsibilities and make sure that each team member fully understands them prior to flying.
- **Rehearse flight procedures with your team:** Run an all-hands-on-deck rehearsal to reveal holes or errors to be addressed and ensure that all research team members understand how the experiment will run on the day of the flight. (Hear more about rehearsing. Starts at timecode: 14:24)
- **Get your timing down:** Consider the timing of each step and rehearse those timings carefully with the researchers involved to make sure that they are accurate.
- **Plan for the environment:** Practice your experiment with the in-flight environment in mind. Consider simulating the challenges you expect to encounter. (Hear more about planning. Starts at timecode: 48:22)
- **Practice in-flight communication with your team:** Consider using brief, clear call-outs during flight. Also, ask the flight provider how they will communicate with you and your team during flight. (Hear more about in-flight communications. Starts at timecode: 29:11)
- **Train all participants:** Go through scenario planning and/or debug training with all team members so they can resolve any issues that arise during the flight. (Hear more about training. Starts at timecode: 30:13)
- **Prepare for in-flight nausea:**
    - Account for the time needed for team members to get used to the in-flight environment and be realistic with your expectations. Use the first few parabolas to get used to the environment. Ask the flight provider in advance for advice on how to best get accustomed to the flight environment. (Hear more about acclimation to flight. Starts at timecode: 24:26)
    - Cross-train everyone so that all team members can do each other's jobs if someone gets sick.
    - Develop a clear procedure if a team member is not feeling well so the experiment can proceed without disruption. (Hear more about wellness procedures. Starts at timecode: 28:26)

››› Return to the beginning of Top Tips for Each Type of Flight Platform

High-Altitude Balloons

- **Meet the flight provider's requirements:** Follow all requirements outlined in the payload user's guide (PUG), including parameters for mass, center of mass, expected temperatures, secondary locking features for fasteners, secondary capture features for deployables, and range safety.

- **Consider the environmental conditions of high-altitude balloons:** The environment could be very cold, and there could be pressure issues. Design your payload accordingly.
- **Automate experiment processes:** Remember that your experiment will be out of your hands during the flight test; therefore, the entire experiment must run autonomously.
- **Plan for remote and dusty environments:** Bring appropriate clothing and support equipment for the test environment, including closed toe shoes, hat, sunglasses, pants (no shorts/skirts), clean tents if needed for payload staging, and rental cars suited for off-road terrain for payload recoveries.
- **Be prepared for darkness:** Bring a headlamp as most launches happen at dawn.
- **Factor in delays:** Plan for weather delays up to 7 days.
- **Plan for long campaign days:** Pre-flight and actual flight campaign days are long. Ensure you bring enough people and/or plan for adequate crew rest.

››› Return to the beginning of Top Tips for Each Type of Flight Platform

Rocket-Powered Vehicles

- **Meet the flight provider's requirements:** Check that you are following all requirements outlined in the payload user's guide (PUG), such as parameters for electrical, communications, range safety, and vibration tests (if required).
- **Consider the environmental conditions of rocket-powered vehicles:** Vibrations likely will be substantial during launch, flight, and/or descent. Deign your payload accordingly.
- **Automate experiment processes:** Remember that your experiment will be out of your hands during the flight test; therefore, the entire experiment must run autonomously.
- **Plan for remote and dusty environments:** Bring appropriate clothing and support equipment for the test environment, including closed toe shoes, hat, sunglasses, pants (no shorts/skirts), clean tents if needed for payload staging, and rental cars suited for off-road terrain for payload recoveries.
- **Be aware of the procedures:** Ensure that you understand range safety rules and mishap plans.
- **Factor in delays:** Plan for delays due to high winds.

››› Return to the beginning of Top Tips for Each Type of Flight Platform

Orbital Platforms Hosting Payloads

- **Confirm the environmental test requirements:** Get clarity on testing requirements (e.g., vibration tests, off-gas all volatiles) and how/when tests should be performed. Keep in mind that you may be required to test your payload once and then again after it is integrated with the platform.

››› Return to the beginning of Top Tips for Each Type of Flight Platform

›› Return to Lessons Learned Table of Contents