

AVIATION WEEK

Program Excellence Awards 2022

November 2, 2022

The Watergate Hotel • Washington, DC

Nomination Form

INTELLECTUAL PROPERTY

(This section must be signed)

Individuals **outside your company**, including the companies listed above and other third parties, potentially including your competitors and others in your industry, may receive and/or review award submissions. All information submitted should address the program's management, leadership, and processes in a manner that you are comfortable sharing with third parties freely and without restriction, and may not include any classified or proprietary information or materials. Do not include any materials marked Confidential or Proprietary or bearing any similar legend. All responses and other submissions, whether in whole or in part ("Submissions"), shall be deemed not to be confidential, proprietary, and/or nonpublic information of any sort for any purpose.

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Thank you for participating,



Gregory Hamilton
President
Aviation Week Network

Acknowledged, agreed, and submitted by



Nominee's Signature

May 20, 2022

Date

Nominee's Name (please print): **Dan Hart**

Title (please print): **President and CEO**

Company (please print): **Virgin Orbit** _____

NOMINATION FORM

Name of Program: **LauncherOne** _____

Name of Program Leader: **Dan Hart** _____

Phone Number: **(949) 616-2504** _____

Email: **Dan.Hart@virginorbit.com** _____

Postal Address: **4022 E Conant St., Long Beach, CA 90808** _____

Customer Approved

○ Date: **5/19/2022** _____

○ Customer Contact (name/title/organization/phone):

- Bradley Smith
- Director
- NASA Launch Services Program
- 321.431.2166

Supplier Approved (if named in this nomination form)

○ Date: _____

○ Supplier Contact (name/title/organization/phone): _____

**PLEASE REFER TO PROGRAM EXCELLENCE DIRECTIONS
AS YOU COMPLETE THIS FORM.**

EXECUTIVE SUMMARY: Make the Case for Excellence (Value: 10 pts)

What is the vision for this program/project? What unique characteristics and properties qualify this program for consideration?

(12 pt. Times New Roman) LIMIT YOUR NARRATIVE TO THIS PAGE.

Virgin Orbit's LauncherOne program was built with the purpose of enabling flexible, responsive, and affordable launch capabilities globally. A two-engine, liquid-fueled, small-launch vehicle, LauncherOne combines proven technology with state-of-the-art manufacturing techniques, focused on simplicity and reliability of design. Having now proven out the system, LauncherOne is on track to accelerate growth and innovation throughout the small launch and satellite industries, opening space for good, for all.

Since its inception in 2017, the LauncherOne program has gone from concept to full-scale commercial production. LauncherOne performed its first series of test flights of the rocket and its carrier aircraft "Cosmic Girl" in August 2018, followed by a drop test in 2019 and a launch demonstration in 2020. Overcoming the challenges of the COVID-19 pandemic, starting in January 2021, Virgin Orbit went on to execute three back-to-back commercial missions within 12 months, bringing its unblemished count of successfully deployed satellites to 26. Prior to deploying its first 10 payloads for NASA's Launch Services Program in January of 2021, no other air-launched, liquid-fueled rocket had successfully reached orbit.

In its most recent mission "Above the Clouds", which took place in January 2022, the system further proved out the flexibility and responsiveness of its design by first allowing the rapid call up and late-load addition of a customer satellite within 24 hours of acceptance as well as by reaching a 500 km circular orbit at 45 degrees inclination from the West Coast - a first for the launch industry. During the same mission, LauncherOne was able to launch through inclement weather, taking off above thick cloud cover known to typically stall ground launchers.

With rockets air-launched from a modified 747-400 carrier aircraft, the system is opening space access internationally for allied states which previously were limited, including the United Kingdom, which is to launch their first domestically launched satellites through the LauncherOne program later in 2022. Similar efforts to open horizontal launch access have now begun in Japan, where the company has signed an agreement with ANA Holdings Inc. and the Space Port Japan Association. Virgin Orbit has also been selected by the Brazilian Air Force and Brazilian Space Agency and has an official memorandum of understanding to deploy full spaceport capabilities to Poland as soon as 2023.

Focusing on simplicity, the two-engine (one-per-stage) design aims to deliver access to space affordably while eliminating the potential failure points common to multi-engine rockets or those that rely on complex, limited designs. Virgin Orbit also makes use of advanced manufacturing techniques borrowed from the aviation and automation industries to increase the speed and reliability of production in order to help reach their near-term objective of 24 launches each year. By taking advantage of the fully reusable 747-400 airliner "upcycled" from their sister company, Virgin Atlantic, Virgin Orbit's LauncherOne program also removes more than 40% of the ground acoustic pollution in protected habitats that is common to ground launchers. In so doing, LauncherOne is also pushing the launch industry towards a more sustainable future.

Virgin Orbit is now scaling up its flight rate to accommodate the high demand seen from commercial customers, the national security community, the international community, and the US civil space community. The company is on track to double its commercial launches in 2022.

Do not exceed 10 pages in responding to the following four descriptions; allocate these 10 pages as you deem appropriate, but it is important that you respond to all four sections. DO NOT REMOVE THE GUIDANCE PROVIDED FOR EACH SECTION.

VALUE CREATION (Value: 15 pts)

Please respond to the following prompt:

- Clearly define the value of this program/project for the corporation
- Clearly define the value of this program/project to your customer
- Clearly define the value of this program/project to members of your team
- Clearly define the contribution of this program/project to the greater good (society, security, etc.)

(12 pt. Times Roman)

The LauncherOne program provides affordable, dedicated, reliable access to orbit for cube and small satellites. We designed and developed this system, manufacture it in our state-of-the-art rocket factory, and have been launching it on operational missions since 2021. Now, the LauncherOne system is the world’s most flexible and responsive launch service — flying on short notice and from a wide variety of locations to access any orbit and revolutionizing the way the satellite launch industry operates.

As an air-launch platform, our system can utilize multiple air and spaceports worldwide, providing access to a large selection of orbital inclinations. This readily available capability to offer direct-inject launch services allows us to meet a wide array of government and commercial customer needs.

LauncherOne can loft payloads up to 500kg to altitudes of 200km and higher to achieve maximum mission flexibility. Our design, production, and test approaches leverage commercial best practices that lead to cost-effective mission success for our customers. Furthermore, Virgin Orbit’s commercial launch service model ensures efficient and timely task order execution

We also have the proven ability to mitigate weather-related delays by flying our carrier aircraft through conditions that would scrub ground-based rockets. As a small launch vehicle, we can provide dedicated solutions for cube and small satellites that would otherwise require our customers to over-buy capability on larger vehicles.

The LauncherOne program offers full-service access to space, with the personnel and processes in place to achieve a low-risk launch solution. Our team brings expertise in program management, mission management, mission integration services, payload-rocket integration, real-time flight tracking and telemetry, range support, and flight safety to benefit our customers’ highest value missions.

Furthermore, the LauncherOne program has provided immense value to the greater good of the public by bringing orbital launch capability to nations around the globe.

The LauncherOne Program successfully deployed 10 payloads for NASA’s Launch Services Program in January of 2021. No other air-launched, liquid-fueled rocket had successfully reached orbit before.

Virgin Orbit’s agreements with international organizations including Added Value Solutions UK, ANA Holdings Inc., the Space Port Japan Association, Brazilian Air Force and Brazilian Space Agency represent major steps forward in the journey to bring space launch to Britain, the Islands of the North Atlantic, and to bring orbital launch capability to Brazil.

METRICS (Value: 15 pts)

Please respond to the following prompt:

- What are your predictive metrics?

- How did you perform against these metrics?
 - How do your predictive metrics drive action toward program excellence? Please provide examples.
- (12 pt. Times Roman)

We utilize multiple metrics to carry out successful launches for our customers. The LauncherOne program relies on detailed safety and health, reliability, and quality assurance plans that enable a safe, confident and reliable launch service. Our robust risk management process documents responsibilities and provides customers with insight into their programs. In addition, Virgin Orbit's company leadership applies our proven program management processes and polices to execute production, test, and operations.

Our Safety and Health Plan prioritizes the safety of our personnel and assets. We have a rigorous system in place to identify hazards and put adequate controls in place to mitigate or eliminate those hazards, and is consistent with federal, state, and local regulations. Our Reliability Plan maintains a reliability program to have confidence that the design of LauncherOne achieves our customers' necessary operational reliability requirements. The Reliability Plan aligns with NASA standards for maintaining reliability. Finally, our Quality Management Plan helps us maintain a Quality Management System that conforms with industry standards.

We proactively manage programmatic, technical performance, and safety risks in partnership with executing organizations, our Safety, Mission Assurance, and Quality (SMAQ) organization, senior advisors, and customers. We accomplish this by considering the potential for adverse consequences over the entire development and operational life of a program. Our risk management team draws on personnel who bring experience from such programs as Delta, Atlas, Falcon 9, Pegasus, and more. This rich, diverse understanding of risk management has yielded three consecutive successful liquid propulsion air launches to date that delivered to orbit.

We assess risks for technical interface complexity; design and test margins; mission criticality; mission performance; availability and allocation of resources; program security and data handling; available industrial capacity; urgency; and level of management engagement required. Regulatory requirements are also factored in to ensure business continuity for all customers.

Lastly, our program management applies industry and commercial best practices to achieve mission success. Mission Management team acts as the conduit to the customer as we apply our program management practices. Our approach includes executing internal reviews and maintaining open communication. This increases program insight and provides a disciplined path to ensure launch vehicle and payload readiness.

DEALING WITH PROGRAM COMPLEXITY (VOLATILITY, UNCERTAINTY, COMPLEXITY, AMBIGUITY, OR VUCA) (Value: 25 pts)

Please respond to the following prompts:

- 10 pts: Describe areas of VUCA faced by your program and why.
- 15 pts: Explain how your team responded to these challenges.

(12 pt. Times Roman)

Virgin Orbit developed a new liquid-fueled air launch system. This means LauncherOne is the first rocket of its kind, as liquid-fueled air launch had never been done. The unique and unprecedented nature of LauncherOne meant the development process was complex.

The design of the LauncherOne rocket allows our team and customers to avoid uncertainty during liftoff and serve as a ullage solution. There are two Propellant Settling Thrusters (PSTs) near the fin of the engine that ignite just seconds before the NewtonThree engine to force the propellants to the bottom

of the tank where the valves are. The valves lead to the propellant transfer lines so that the engine doesn't take in air.

Furthermore, Virgin Orbit uses innovative solutions to increasing production line efficiency. In order to develop the best manufacturing facility in aerospace, we have partnered with the best manufacturing company in any industry, such as our unique relationship with DMG Mori, the world's premier supplier of manufacturing machine tools. DMG Mori's top-of-the-line hardware — their 5-axis CNC machines, mills, lathes, and more — form the backbone of our machine shop, pumping out our first iterations of development and (soon thereafter) flight-ready hardware.

DMG Mori's hybrid machines — which combine all the advantages of subtractive and additive (or 3D printing) manufacturing — unlock many possibilities in terms of how we approach the design and build of any one rocket part. Leveraging this flexibility, we focused our energies on simplifying the hardest, most expensive, and most labor-intensive parts to build.

Beyond having proven tools for traditional manufacturing, what makes our relationship with DMG Mori truly special is that we work closely with them to drive the future of advanced manufacturing. Combining their unmatched expertise and experience base with our engineering creativity and with the rigorous demands that come from making a commercial rocket, we've got a powerful partnership that allow us to overcome complexities and uncertainties through driving capabilities that don't exist anywhere else.

ORGANIZATIONAL BEST PRACTICES AND TEAM LEADERSHIP (Value: 35 pts)

Please respond to the following prompts

- 15 pts: Describe the innovative tools and systems used by your team
- 10 pts: Define how you developed, led and managed people
- 10 pts: How did you leverage skills and technologies of your suppliers?

(12 pt. Times Roman)

LauncherOne is a first-of-its-kind, two-stage, liquid propulsion (LOX/RP-1) rocket launched from a Boeing 747-400 carrier aircraft designed to loft payloads up to 500 kg to orbit altitudes 200 km and higher. L1.0 has successfully flown three times to date and deployed 26 payloads into 500 km orbits ranging in inclination from 45 degrees to 60 degrees.

The LauncherOne program is a vertically integrated approach. Virgin Orbit's well-capitalized factory and the close proximity of engineering, manufacturing, and operations functions enable high-rate production of the LauncherOne vehicle.

Our corporate structure is organized with all primary business functions reporting directly to Chief Executive Officer (CEO) Dan Hart. Dan brings more than 30 years of innovative space leadership to Virgin Orbit, making him intimately familiar with all phases of the aerospace product cycle. Since his arrival at the company, Dan has instilled a culture of launch operations flexibility and responsiveness among the company's 600+ professionals. He is supported by a team of senior space and launch leaders who bring a wealth of industry experience to our company. Our team applies a proven subcontractor and supply chain management (SCM) approach combining the benefits of commercial efficiencies and best practices by engaging trusted suppliers who bring proven past performance. Due to our vertical integration approach, we have no subcontractors—all vendors are classified as suppliers.

Our Supply Chain team provides experienced personnel and disciplined processes to select and manage LauncherOne suppliers effectively. We assign an experienced supplier manager to each supplier to ensure contractual and technical issues are proactively resolved. Overall supplier status is reported at quarterly program management reviews.

Approach to screening and selecting subcontractors and suppliers

Subcontractors and suppliers selected to receive an award or a Request for Proposal/Request for Quote (RFP/RFQ) are assessed on their capability to serve our needs in the most economical and efficient manner possible, with past performance and cooperation being important factors.

The Purchasing team strives to select a supplier on the Approved Supplier List (ASL) maintained by the Strategic Sourcing team per our Strategic Sourcing Procedure. If additional sources of suppliers are needed, then the buyer will select suppliers from onboarded suppliers in our supply chain Oracle database. If there are no onboarded suppliers in Oracle to purchase from, then the buyer initiates the supplier onboarding process, or sends out an RFI to gauge supplier capability and quality.

Although the Purchasing department makes the final choice of supplier, requisitioners within the company may suggest the supplier from which to purchase goods and services. All prospective suppliers must comply with the Federal and State regulations noted in the RFP/RFQ or award. We strive to source from small businesses, minority-owned businesses, and women's business enterprises.

Once selected, the supplier is added to our ASL, and we apply a 4-tier supplier strategy to classify and manage each supplier within the ASL.

Benefits of our established supplier relationships

The LauncherOne product line includes an existing supply chain for our launch vehicle parts that we draw on. Respective roles, responsibilities, and work scope have already been clearly defined by the Supply Chain team, and detailed design concepts and program baseline plans have been developed and are in place. The existing long term purchase agreements with our supply chain will reduce costs and increase schedule certainty.

All our LauncherOne suppliers are in-place, are actively managed through our ASL strategy process, and are producing components and subassemblies.

Subcontractor and supplier conformance with quality requirements

Drawings and referenced documents provided to suppliers contain specific part requirements that relate to quality requirements. Our internal buyer may impose additional requirements via quality clauses listed on the purchase order. Quality clauses are assigned by Supplier Quality Engineering team and contain at least one clause per rocket flight inventory part. This method provides a standardized approach to ensuring that all suppliers are provided with clear, consistent guidance regarding quality requirements for a given part or component. Virgin Orbit aspires to be a leader in corporate sustainability. We are committed to this important journey — as a business partner, an employer, a community leader, and as an environmental steward. Therefore, we choose to work with innovative organizations to help us open space to change the world for good. To fulfill our mission of offering dedicated launch services that are both highly affordable and extremely reliable, we require excellence from our entire supply chain.