# HIGH SPEED FLIGHT BULLETIN

## January - March 2023

**From the Chairman's Desk and Cockpit:**

Dear HSAT Friends and Colleagues:

Welcome onboard. Time flies, FAST! This years first quarter has come and gone at hypersonic speed. I wish we could accelerate flight as time seems to be accelerating these days. Perhaps we should check if the earth is spinning faster, “earth rotation”-change anyone? We are glad to have waited to the end of the quarter to produce the HSAT Bulletin. I am pleased to say that the State of the HSAT industry is strong and promises to be structural to the aerospace industry for the next decade, as the air and space transportation industry stabilizes from the 2020-2022 ebbs and flows. We remain bullish on a commercial-supersonic world by the end of this decade, and certainly a hypersonic world by the mid 2030’s. The suborbital and orbital-world is projected to exist by the end of the 2030’s, but there might be surprises, and the arrival of space-commercial point to point operations might be, surprisingly, quicker than Hypersonics operations. For those who heard my presentation, you know what I mean (hint: orbital, rocket cargo). For those of you who would like to listen to the presentation or read it, click **here**. Enjoy, and contact us for further insights

As we entered the year, we committed to a 5-year campaign at the end of which, the people of the world will be galvanized and “demanding” high-speed flight to make the world a 1–2-hour journey, no matter how far the destination. Indeed, the year started with an incisive yet easy to complete survey, the **Space Works Enterprises Survey,** about high speed flight I encourage that all of you spread this survey wide and far across the mainstream public, in our quest to “onboard” as many people as possible to start questioning the Mach 1 Tyranny they live under, and ask to break free into the supersonic (Mach 1-3) and Hypersonic (Mach

4-20) realms in both air and space mediums. Keep an eye on the survey possible re-openings and results.

As the quarter progressed, we learned about high-speed flight as a National Strategic Priority, the **Presidential Determination Pursuant to Section 303** of the Defense Production Act of 1950, as amended, on Airbreathing Engines, Advanced Avionics Position Navigation and Guidance Systems, and Constituent Materials for Hypersonic Systems. The determination is a clear continuation of the drive for high-speed flight that seems to be permeating administrations and political pendulum swings, this is good news.

In addition, the hypersonic industrial production effort adds even more R&D muscle and financial resources to the development of the industrial complex supporting the development of ground (Multi Sonic Wind Tunnels, HAPCAT facilities, et al), and importantly airspace (corridors and R&D airspace volumes) testing, development, evaluation, and entry into service demonstrations for hypersonic flights.

All in all, our goal for 2023 is to engage the “Subsonic” passenger and cargo ecosystems and to invite them to attend and provide inputs to our July 7th and September 8th conference calls and HSAT 6th Edition in November (save the date November 16-17 and stay tuned for early-bird registrations **here**. I am referring to passenger, dispatchers, travel agents and other user groups. As well as operators of subsonic aircraft, airlines, charter operators, charter brokers as well as, cargo-logistics and freight forwarding.


We cannot have an update without addressing sustainability, and as we declared at the HSAT 5th Edition in 2022, the High-Speed Flight Re-evolution will be technologically matching “or exceeding “environmental standards prescribed for subsonic aviation well into the 2050’s, Period, no excuses, so to any environmental observers-readers out there. Be prepared to receive our data, intel and research and analysis proving that flying fast and flying “super” clean are synonyms. We are ready to show the proof. And glad to discuss it. This is much better than waiting for others to publish data coming from desktops that have never produced, flown or commercialized an aircraft or spacecraft.

Finally, our Point to Point Working Group in collaboration with our strategic partner, the Global Spaceport Alliance (GSA) will laser focus on a suborbital Spaceport to Spaceport demonstration between two US licensed spaceports. Stay tuned for more exciting updates on this front. We might make history very soon.

As always, Fly Fast, fly Safe!

Oscar S. Garcia, Chairman
High Speed Flight
www.highspeedflight.com

**Register for FastForward Group Call**

***(Image credit: InterFlight Global)***

**TRANSONIC**

MACH .9-1.2
All quiet in the Mach .9-1.2 programs front, quiet is good, in many ways. Gulfstream, Dassault, Bombardier progressing (fast) on their G-400-700-800, Global 8000 and 10X respectively.

The General Aviation Manufacturers Association's (GAMA) **2023 report** is out, and the deliveries of Mach .90+ aircraft remain strong at circa 200 aircraft . Our intel shows book to bill ratios of 2:1, and thus, we can forecast well over 300 aircraft in backlogs on excess of $18 billion. Indeed, there is a market there for fast aircraft, and these figures should be used when forecasting “faster” aircraft possible fleets globally.

We have the precedent from the Aerion program (more on this on the Supersonic section, and there is some good news) that below Mach 1.2, the sonic boom might be low enough to operate at such high transonic speed over land. More importantly, high-speed transonic aircraft are well accepted in terms of environmental sustainability, as their engines can use up to 100% SAF blends, which seems to be a consensus clean propellant for the next couple of decades, and even beyond.

The appetite for high-speed transonic is strong, and forecast to grow even stronger, as the business-jet fast-long range fleet forecasts from Honeywell, JetNet IQ and others were

published at **NBAA BACE October 2022** “sold out” event in Orlando. See our end of the year **HSAT Bulletin** for the forecast’s tables and detailed analysis.

You have heard me say, maybe too often, that transonic commercial aircraft environmental standards will set the bar for all future high-speed programs. Indeed, I would be remised about not mentioning NASA- Boeings’ environmental-centric -Enter E airplane trussed – program. Funded with -enter data $500 MM, this program will set the standards on specific fuel consumption, lift-drag state-of-the-art and other metrics that environmental observers, think tanks and other “clean flight” hawks are monitoring and reporting on with interest, intent and mediatic power.

NASA issued **an award** to The Boeing Company for the agency’s **Sustainable Flight Demonstrator Project**, which seeks to inform a potential new generation of green single-aisle airliners. Under a Funded Space Act Agreement, Boeing will work with NASA to build, test, and fly a full-scale demonstrator aircraft and validate technologies aimed at lowering emissions. Over seven years, NASA will invest $425 million, while the company and its partners will contribute the remainder of the agreement funding, estimated at about $725 million. As part of the agreement, the agency also will contribute technical expertise and facilities.

In terms of speed, the sad news is that the aircraft will be sub Mach .8, Back to the future? You draw your own conclusions.

***(Image Credit: The Boeing Company)***

As always, you have also heard me say, often, that wherever the environmental and sustainability bar is set, we will meet it and exceed it. We will fly fast, safe, clean and profitably. Period. We can and will do it; failure is not an option. We will make the world smaller, better and cleaner and lead the reporting on it. How “dare anyone” doubt it.

February 22, 2023

# General Aviation Aircraft Shipment Report

General Aviation Manufacturers Association
1400 K Street NW, Suite 801 | Washington, DC 20005 | USA
Rue de la Loi 67 | Brussels 1040 | Belgium

## 2022 Year-End Report

**Aircraft Shipments**[1, 2, 6] by Type Manufactured Worldwide

| | QI | QII | QIII | QIV | Year-To-Date |
|---|---|---|---|---|---|
| Single-Engine Piston and Electric | 238 | 331 | 344 | 453 | 1,366 |
| Multi-Engine Piston | 29 | 42 | 30 | 57 | 158 |
| **Total Piston Airplanes** | **267** | **373** | **374** | **510** | **1,524** |
| Single-Engine Turboprops | 95 | 120 | 116 | 174 | 505 |
| Multi-Engine Turboprops | 15 | 17 | 20 | 25 | 77 |
| **Total Turboprop Airplanes** | **110** | **137** | **136** | **199** | **582** |
| Business Jets | 118 | 171 | 157 | 266 | 712 |
| **Total Turbine Airplanes** | **228** | **308** | **293** | **465** | **1,294** |
| **Grand Total Airplane Shipments** | **495** | **681** | **667** | **975** | **2,818** |
| **Grand Total Airplane Billings** | **$3,825,379,493** | **$5,277,963,616** | **$5,013,638,765** | **$8,748,817,819** | **$22,865,799,694** |
| Piston Helicopters | 40 | 47 | 50 | 57 | 194 |
| Turbine Helicopters | 100 | 160 | 181 | 241 | 682 |
| **Grand Total Helicopter Shipments** | **140** | **207** | **231** | **298** | **876** |
| **Grand Total Helicopter Billings** | **$511,098,532** | **$925,566,333** | **$1,120,735,781** | **$1,399,886,653** | **$3,957,287,299** |

***(Image credit: GAMA)***


***(Photo Credit: Gulfstream: Tops the 2022 Mach .90+ Deliveries with 96 units)***

**SUPERSONIC**
MACH 1.3-3.0

Let me start with an upbeat note, a little bit of “I told you so” and a pat on the back of our HSAT community regarding our crystal-ball forecasting and a tad of educated optimism. The Aerion Supersonic program assets have been acquired by an entity named: Boeing ACE. This is **public information** from the successful assets auction that took place on September 7th, 2022. The next step is forthcoming and once approved by the judge, I am cautiously optimistic, and excited, that once more the Aerion AS-2/3/4 (either one) will reemerge in 2023.  As I hoped for, through the last couple of years, we were able to celebrate  the news with you on our March 10th yearly State of the HSAT Industry briefing.

*(Image credit: Aerion)*

Back to structural developments and ongoing programs. The program to watch in 2023 is still NASA's QueSST X-59. Progress on the aircraft final assembly at Lockheed-Martin "Skunk Works" factory and R&D center in Palmdale, California, is moving forward on time, and we think on-budget. We have briefed all of you on previous bulletins about the importance and "game-changing" noise standards and potential opening of "supersonic" over land flight authorization in the USA and potentially the rest of the world, by 2026-2028. The results of such legal change, is simply said, closing of the supersonic business case across the private and airline business models.

This should be great news for one of our closely tracked supersonic leaders: Boom! More on this **here** and on the **Boom website**.

This quarter, the QueSST program leadership is engaging industry, standards developers organizations and the FAA regulators in earnest. I would like to mention, commend and point our high-speed flight stakeholders to the Society of Automotive Engineers (SAE) supersonic flight standards steering group formed in the summer of 2022 and socialized to the HSAT community through NASA, and other workshops in the first quarter of 2023. Keep up the good work! **Lockheed Martin**

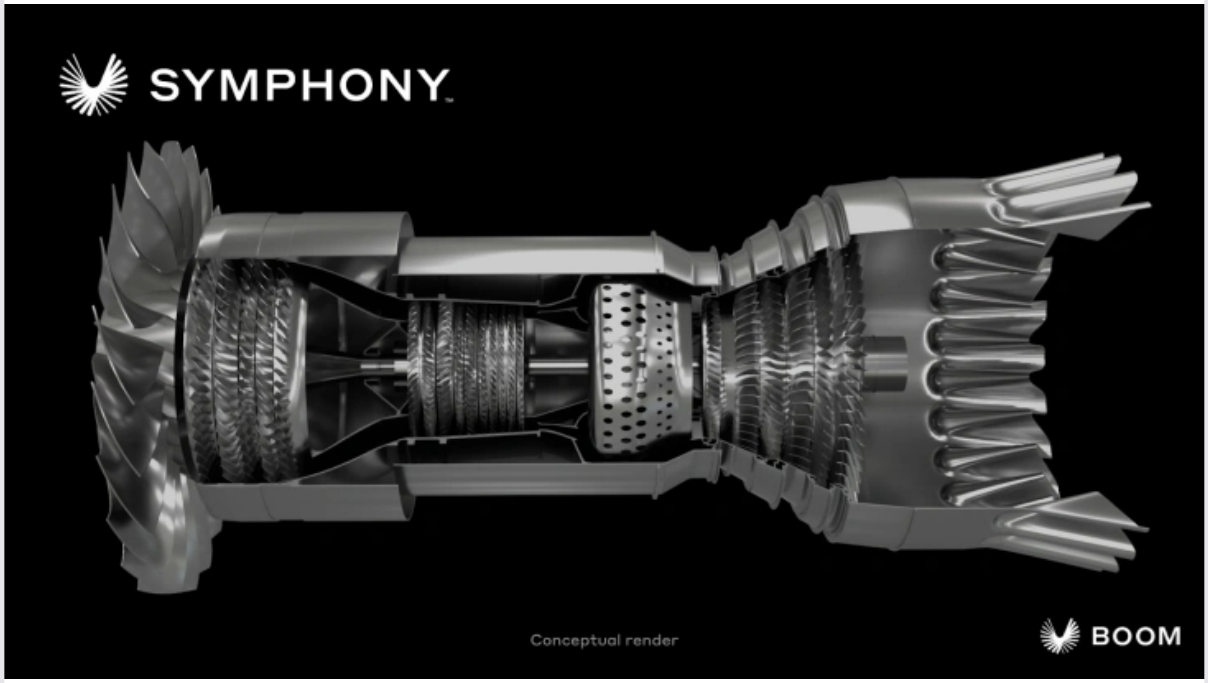

Thus, I encourage all of you to take a look at their web announcements and to contact **SAE** for possible participation. The key to the standardization of sonic boom noise levels, will be industry consensus standards. Driven by a balanced set of stakeholders, and a logical progression of performance standards of various types; guides, classifications, specifications and others.

As you all know, I am a fan of industry voluntary consensus standards as means of compliance, regulation and best practices. Thus, SAE's aforementioned initiative will lead to great results, particularly when combined with testing and evaluation of critical performance characteristics, such as the NASA QueSST program. I envision other Standards Development Organizations (SDO's) will join the efforts and benefit from normative referencing to avoid duplication of efforts. Industry bandwidth for standards development is to be used as efficiently as possible.

Propulsion again remains the challenge to enable the first demonstrations and entry into service of a certified commercial supersonic aircraft. Boom Supersonic ended the year on a high note with the announcement of the new Symphony supersonic engine for the Overture FAR 25 Air Transport category. We maintain our watch on the program development and no news is good news, as progress in the first stages of such a program, will be "quiet", no pun intended, and paraphrasing the indefatigable Max Kachoria, founder and developer of the Spike supersonic quiet business jet.

As Amelia Earhart said, "The most effective way to do it, is to do it". American Airlines, United, Japan Airlines, are counting on it, so is the market, comprising the billions of

passengers and millions of tons that move through the air every year!




***(Image credit: Boom)***

HYPERSONICS
MACH 3-10+

The convergence of private-public efforts to enable hypersonic platforms seems to be growing with every HSAT Bulletin. We relay to you, that at the highest levels of industry and government, there is a tacit agreement that Hypersonics “will” happen sooner rather than later.  We give credit to the vision and capabilities of NASA’s Leadership at many levels of insights, decision making and enabling hypersonic conversations with us and many of the HSAT community key players.

Could there be a hypersonic X-Aircraft by the end of the decade? Will the X-Plane concept inherit some of the X-43A characteristics? Is/are a/several large OEM’s involved in the conceptual design of a “practical” hypersonic vehicle? stay tuned. There are some key developments in the R&D hypersonic realm, very close to us at HSAT. You will be excited, encouraged and assured that hypersonic transportation is coming, within a decade, maybe sooner, read on.


*(Image credit: NASA)*

Let me start with the important and unequivocal push for hypersonic research and development push from the US Government as an “all hands on deck” investment strategy to achieve practical hypersonic flight “now”. We have been reporting on the crescendo of DO R&D and cross pollination into the commercial segment for a few years. However, the focus, strength and industrial war-like intent on funding hypersonic flight, must be mentioned.

Our own HSAT and IFG teams vouch for a most intriguing hypersonic-space boundary new entrant: **Venus Aerospace.** We will cover them in both hyper and orbital sections. Comparing notes with Venus’ founders, we agree that the business case for a hypersonic-spaceplane hybrid-either-way of the spectrum closes. The number of market driven vehicles is in the “couple” of thousand units, and the revenues possible are in the tens of billions with a “couple” of hundred million possible user of a Venue-Like hypersonic-orbital fast vehicle. Stay tuned, more on Venus through 2023, and ideally, sharing with our HSAT community.

*(Image Credit: Venus Aerospace)*

On the hypersonic commercial side **Hermeus** keeps impressing us with its exciting public releases. Now with the super exciting messaging announcement and progress of the Chimera II FJ-100 based engine in collaboration with Raytheon's Pratt & Whitney as OEM's. Chimera II will power Hermeus' aircraft, Darkhorse, a hypersonic uncrewed aerial system designed for defense and intelligence customers. The aircraft has multi-mission flexibility and is fully reusable.This engine contract keeps the Darkhorse program on track for engine testing in 2024, just around the corner. Time flies fast, go Hermeus!

With Chimera I and II in place, the fast coming of the Quarter horse, and Darkhorse programs, just got stronger as a prelude to the promising Halcyon passenger carrying aircraft.

*(photo credit: Hermeus)*

The quarter surprised us in a very positive way with the announcement of the Defense Innovation Unit (DIU) DOD to California based Fenix Aerospace and to Australian Hypersonix Launch Systems. We will invite and hope to see Fenix at HSAT calls, workshops and across our community activities from now on. Welcome onboard Fenix. The second awardee, **Hypersonix** (Delta Velos Mach 5+ vehicles and proprietary power plant, is an HSAT friend, speaker and collaborator with the JHTO-UCAH Program. Both companies, funding and progress are fully aligned with our educated optimism that we will see a viable reusable-commercially-certifiable Mach 4-5 vehicle in the sub 100 seat category.

The companies will prototype a suite of hypersonic weapon test systems. Under the Hypersonic and High-Cadence Airborne Testing Capabilities (HyCAT) program, Hypersonix Launch Systems will develop an airborne testing vehicle capable of flying non-ballistic flight patterns at speeds greater than Mach 5 while operating within a “representative environment”. Fenix

*(photo credit: Fenix Aerospace - HyCat Program)*

Space will offer its reusable tow-launch platform designed to enable DOD to conduct low-cost high-cadence test flights.

DOD aims to use the resulting technologies to perform high-cadence long-endurance testing of future hypersonic platforms and components.


***(Photo credit: Hypersonix - HyCat Awardee)***

What is very encouraging, to me, and I hope to you too, is the great strides that the US DOD Joint Hypersonic Technology (JHTO) office keeps making through the University Consortium of Applied Hypersonics (UCAH) towards the development of effective, reliable and precises hypersonic platforms, both expendable, and reusable. The latter, of outmost interest to this group. My assessment of the TRL's. MRL's and advances in materials, guidance, propulsion and maintainability that I saw at the UCAH Fall meeting in Huntsville Alabama is that we are well above TRL/MRL's of 6-8 in most of the elements needed for Hypersonic practical and safe flight.

Moreover, I look forward to the Spring meeting, to confirm momentum is building and that we can have a reusable hypersonic transportation platform at TRL's 9-10 by the end of the decade, and we can do it "not because it is easy, but because it is hard". And because it shows how the ingenuity, creativity, innovation and technological magic that our "way of life" in the free world allow. Stay tuned for some great feedback on the **UCAH 2023 Spring Meeting**.

I am also very proud that my firm **InterFlight Global** has been a participant in a bid with the Research and Technology leaders for **NASA's Hypersonic Technology Project** (HT) Conceptual Design project. Indeed, led by Mary-Jo Long Davis and Chuck Leonard and **Supersonic Technologies** (ST). NASA's efforts are converging very well with NASA's High-Speed Capabilities Assessment Team (HiSCAT), where experts and leaders with commercial-industry and government R&D acumen, like Erik Axdahl, are a key to public-private success within the decade. Soon, the awardees will be made public and we will report the winners and teams in our Q2 HSAT Bulletin. Stay tuned!

Send us a note, let us know how you could add, enable and enhance a hypersonic demonstration, proof of concept or similar "actual flight" development around 2025. We are all ears, **contact us**, maybe we should start a high-speed Prize Mach 5 demo contest?

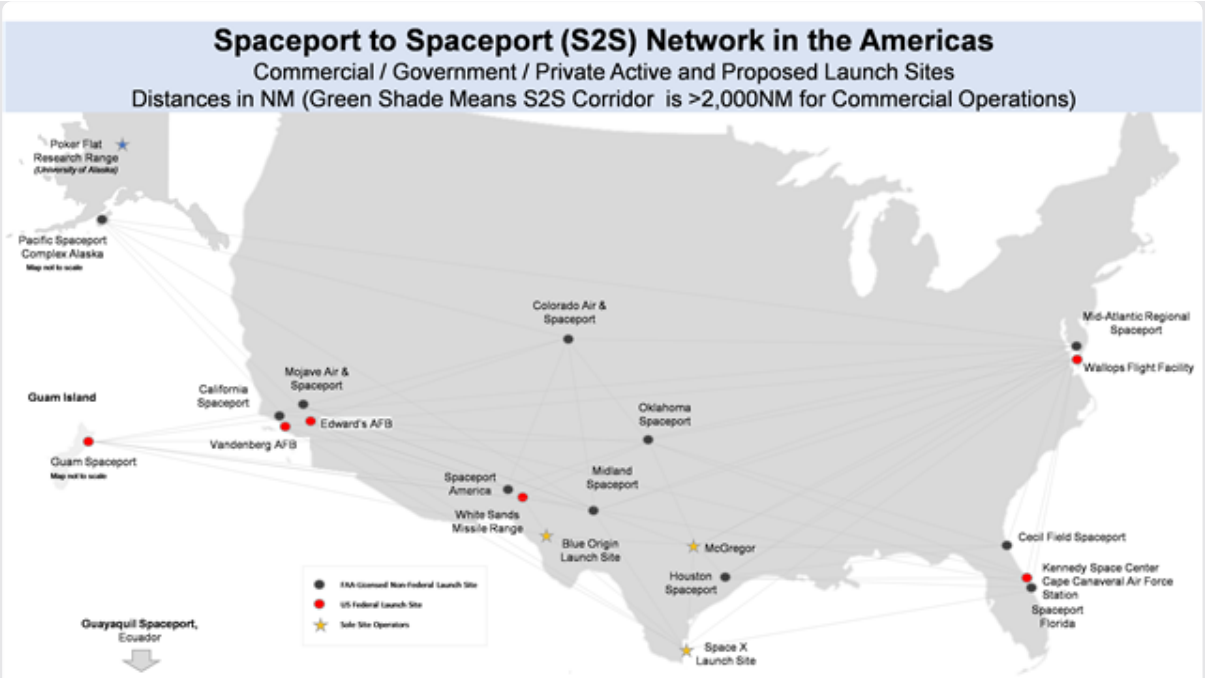
Now, the complex part. Trust me in my assessment that the technologies for all the elements of a Mach 4-5 commercially viable hypersonic aircraft are in place, right here and right now. What I strongly believe is holding us, is the buy-in from the world at large regarding the environmental-sustainability elements of such an aircraft. We need to lead the world in analyzing the climate and ozone impacts of commercial hypersonic aircraft using state-of-the-art science modeling capabilities from detailed plume analysis to global impact scales. Ideally, with a rigorous scenario-based approach that captures variability-uncertainty and correlates impacts to market adoption, vehicle design, and regulatory-standards oversight and compliance.  We need to do this NOW! More on this on the Q2 HSAT Bulletin! Stay tuned!


***(Image credit: FAA Circa 2020)***

The use of space orbital trajectories to enable HSAT is our most ambitious vision for a future way for people and goods to be transported  “anywhere to anywhere” on earth within one-hour. We shared our vision with the Commercial SpaceFlight Federation (CSF) last September at the Fall Members meeting, the Transportation Research Board (TRB) and the Global Spaceport Alliance (GSA), and we would like to say thank you to all of them for the proactive, empowering and collaborative stance towards the space Point to Point (P2P) and Spaceport to Spaceport (S2S) brave new world in the making. In our presentations to these influential groups, we discuss how commercial space technologies can be harvested to enable the transportation of goods and people through space to make anywhere on earth connectivity, a day affair.

This year, we are taking our “home grown” S2S White Paper guiding principles for the design and implementation of airspace (i.e.  “space ways”) to flight demonstrations accommodating  experimental spacecraft linking points (P2P, a la SpaceX Starship)  or ideally, spaceports (stay tuned for more on this…trust me, this is going to be exciting).

The P2P or S2S journey starts with a single-demo and then will proliferate to over 195 possible S2S corridors linking US licensed Spaceports, and  suitable to R&D  missions, and over 70 S2S corridors, routes or space ways suitable for commercial S2S spaceflight.




*( All Possible S2S Routes from/to US Licensed Spaceports )*

The potential for S2S commercial flight is finally here, and it is gaining support from NASA, the FAA (Special thanks to Pam Underwood, Director of the Office of Spaceports and leader of the **National Spaceport Intergovernmental Working Group** (NSIWG)). **CHARTER for NATIONAL SPACEPORT INTERAGENCY WORKING GROUP** , the TRB, several think-Tanks and Federal Funded Research Centers, the DOD and most, if not all, industry stakeholders involved in HSAT. We will keep working on the S2S guiding principles and documents in parallel with actual flight demonstration.

As we mentioned on previous Bulletins, January 2023 marked two years since the historic **NASA-FAA MOU** of January 4th, 2021, reaffirming the agencies' longstanding relationship to foster robust American commercial space transportation capabilities, including commercial crew and cargo activities.

The Suborbital Spaceflight Scope section of this historical MOU addresses the joint NASA-FAA intent to "advance the interests of a commercial suborbital point-to-point pilot program with designated spaceports, airspace design, sequencing, launch and landing windows, etc". Our White Paper, on S2S Corridors support well the implementation of the MOU. We will bring forth the vision and intent of the MOU to NASA and the FAA this year as soon as there is a new FAA Administrator in place (there is so much that one for two Administrator Billy Nolen can do by himself.

We intend, along 2023, to request further input from both NASA and the FAA on the status of this MOU, and will enable IFG strategic partners, collaborators, and relevant stakeholders to build upon the foundations of what I consider a "seed" to grow on a very important collaboration to enable high speed point to point and, or spaceport to spaceport flight. Join us in the effort!

We are even more confident today than in 2022 about the favorable and already existing

regulatory context and tools available for S2S mission planning and execution are mostly in place.

Make no mistake, the developmental efforts are challenging, yet manageable. But be assured, these efforts will be effective as long as there are vehicles that can start to demonstrate “pathfinding” S2S missions linking spaceports and, or airports (i.e., Midland to and from Spaceport America) even when involving short distances (i.e., KSC to/from Jacksonville Spaceport).

Don’t forget that the first powered controlled flight was 23 seconds -enter wrights’ flight distance, leading to today’s longest commercia flight -enter flight distance.

In conclusion, our HSAT efforts for S2S Suborbital and Orbital trajectories are predicated on; first, ever improving safety, second seamless integration with the NAS other users and third , enabling the competition and cooperation of Spaceports (“coopetition”) or as I heard recently to demonstrate the safety, reliability and general feasibility of the vehicles.

The S2S airspace development projects in place are meant to evolve with your input, so please, complete the airspace corridors **questionnaire** on this link, we will keep improving guiding principles and demonstration missions.

As always, contact us to provide feedback on the S2S Corridors White Paper and related work, as well as to join the HSF-GSA Point to Point Working Group.
The WG seeks input in several areas including:

- NAS integration with emphasis and focus on Upper Class E Airspace and Terminal Areas-Airport-Spaceports
- Environmental contexts, research and data for modeling and forecasting environmental impact from emissions derived from future frequent S2S flight operations
- New technologies and CONOPS, i.e., Hybrid-Electric propulsion, Beamed energy, nuclear power.

High Speed Flight-Global Spaceport Alliance Spaceport to Spaceport (S2S) White Paper and Guiding Principles

# S2S WHITE PAPER

**Spaceport to Spaceport**
**Suborbital Flight**
**Airspace Guiding Principles**

Access the White Paper with this QR code:

1. **SPACEPORTS**

- Licensed Launch Sites and Spaceports in the USA supporting S2S flight operations should compete and collaborate at the same time. Such activity is known as "coopetition" and enables a network of S2S airspace routes or corridors supporting the safe, efficient, and scalable transportation of goods and people on suborbital spaceflight vehicles.
  - Suborbital S2S missions will require both origin and destination spaceport co-preparation of the required flight corridor to accommodate the flight profile as per FAR 450.
- Spaceports and launch site operators supporting suborbital flights should ensure CFR 14 FAR 420 License to Operate a Launch Site regulations are relevant and support S2S commercial flights for the transportation of payloads and people. Particularly as related to Appendix A and Appendix B Methods for Defining a Flight Corridor.
- S2S Flight corridors will include portions of Upper-Class E airspace. Upper Class E airspace is becoming more congested with time. Spaceports must preempt and manage the portions of S2S airspace crossing Upper Class E Airspace in close collaboration with the relevant air traffic managers and operators.
- Spaceports and related launch and reentry sites should plan for adequate S2S corridors dimensions.
  - S2S Corridors with lengths up to and exceeding 2,000NM separation between spaceports-launch and reentry sites are suitable for R&D and T&E suborbital missions.
  - S2S Corridors with lengths of more than 2,000NM of separation between spaceports' launch and reentry points are suitable for commercial flights carrying cargo and people onboard.

2. **AIRSPACE**

- S2S airspace needs to integrate seamlessly and with minimal changes into the National Airspace System rules and regulations (i.e., Visual flight Rules (VFR) and Instrument Flight Rules (IFR)).
- S2S airspace volumes to emerge as "one-off" segregated airspace for R&D, T&E, and demonstrations and evolve into on-demand standardized corridors and eventually into charted or "published" airspace.
- The S2S Suborbital Transit or "cruise" phase of flight must be defined by CFR 14 FAR 450.1 and included in Subpart C-Safety Requirements and CFR 14Suborbital Mission Analysis
- S2S Airspace Corridors development technical approach includes Air Traffic-National Airspace System (NAS) Simulation Models (i.e., Terminal Area Route Generation Evaluation and Traffic Simulation (TARGETS)) and Dynamic ATMC Research Technology (DARTS) and with current air traffic routes, including airspace and weather considerations for the launch, "cruise" and reentry phases of an S2S suborbital mission. Key performance indicators include delays, rerouting, and other traffic flow considerations for Enroute and Terminal Departure/Arrival ATC centers.
- Corridors Dimensions (GSA-HSF-FF Surveys[1] as of 12/2022~75 responses)

| S2S CORRIDOR PURPOSE | LENGTH | WIDTH | HEIGHT |
|---|---|---|---|
| R&D, T&E | 0-ANTIPODAL MAXIMUM ~12,500 NM | 40-130 NM | GROUND-UNLIMITED |
| COMMERCIAL OPS | 2,000-MAXIMUM ANTIPODAL 12,500 NM | 20-130 NM | FL 600-UNLIMITED |

- S2S suborbital airspace corridors design is most effective based on real flight experience and data
  - Data collection, analysis and databasing of all "flown" Suborbital flight trajectories regardless of their flown cross range is key to enabling future S2S flight operations with expanding cruise segments.
  - Dimensions and characteristics of S2S corridors informed by stakeholders involved in suborbital spaceflight activities (ground and air ops) via surveys and data analytics.

[1] https://surveys.benchmarkemail.com/Survey/Start?id=1395206&s=696900

AIRSPACE Cont.

- S2S suborbital airspace corridors seamlessly integrated with existing endo-atmospheric (i.e., aviation) CFR 14 FAR 91, 135, 121, etc. airspace rules, standards, practices and regulations.
  - S2S corridors users to seek equitable access with other users of airspace, the atmosphere, and space.
- S2S suborbital airspace corridors to seamlessly integrate with existing CFR 14 FAR 450 Launch and Reentry Rules, FAR 420 Launch and Reentry Site Operators, and related standards, practices and regulations
  - The development of S2S corridors is ideally always aligned with FAA AVS-AST, SDOs and other government agencies DOD, DOC (for Suborbital transit or cruise stage), NASA, etc.
- S2S suborbital airspace corridors safety focus on "cruise" phase collision avoidance to meet or exceed orbital separation and probability of collision standards
  - If the maximum altitude of a S2S flight is 150 km or higher, a collision avoidance analysis must be performed according to FAR 450.169.
  - If below 150Km, novel definitions and dimensioning of S2S corridors is necessary
    - Most US S2S missions linking licenses Spaceports are forecast to be flown at altitudes below 150 km.
  - S2S Corridors are to meet and exceed separation and probabilities of collision requirements for suborbital flights above 150 km.
- Launch and launch window, reentry a reentry window should be time and position "gates" in the planned trajectory of a suborbital S2S flight mission.
  - Definitions should be included in both the FAA 450 and US DOC Office of Space Commerce (OSC) definitions.
- Suborbital S2S vehicles exceeding an apogee of 150 km are subject to collision analysis and separation criteria as per FAR 450.169.
  - For S2S flights with apogees less than 150 km, separation criteria need to be defined, for instance, as industry voluntary consensus standards.
- Suborbital S2S Operations should coordinate the "cruise" orbital transit phase with:
  - The US DOC (new regulation, standards or practices required) and the Launch and Reentry Spaceports as required by FAR 450.181.
  - The FAA as the Suborbital S2S "cruise" phase is defined as the orbital parameters for Collision Analysis (FAR 450 Appendix A).

**3. VEHICLES**

- For the purposes of S2S suborbital spaceflight missions, a Suborbital Vehicle is defined[1] as a licensed launch vehicle or Space Support Vehicle[2] (SSV) that is designed to achieve trajectories not completing a full orbit of the Earth.
- Spaceflight vehicles' operational performance should comply with CFR 14 FAR's aviation and space flight regulations for the following flight phases:
  - Departure and arrival to/from spaceports
  - Launch and reentry to/from launch and reentry sites
  - Suborbital transit or cruise phase between the launch and reentry points
- Suborbital spaceflight vehicles on S2S missions should complete sonic boom, environmental reviews, and flight safety analysis as per applicable CFR 14s.
- Suborbital spaceflight vehicles' performance should be compatible with other airspace users in Upper Class E airspace (FL 600 and above) and with CFR14 FAR 91 Instrument and Visual Flight Rules (IFR/VFR) below Flight Level 600, and particularly in the terminal Spaceport area. This consideration would enable the reduction and eventual elimination of "segregated" airspace for S2S suborbital flight missions.

[1] ASTM F47 Commercial Spaceflight Committee F3377-20 Standard Terminology Relating to Commercial Spaceflight
[2] CFR 51 USC 50902(22) space support vehicle (22) "space support vehicle" means a vehicle that is — (A) a launch vehicle; (B) a reentry vehicle; or (C) a component of a launch or reentry vehicle.

## SUBORBITAL
## MACH 3-10

In this section we track the suborbital point to point HSAT industry programs and vehicles operating in near space or below 150Km (~500,000) and completing less than a full orbit of earth to complete a point-to-point mission. Our S2S White Paper Guiding Principles research shows that the airspace corridors design, regulations and standards for sub and orbital flights only differs on the necessary Collision Analysis (COLA) required by FAA-FAR's and assessed by NASA as **Best Practices**. This is very encouraging, as we envision future flight vehicles to be able to fly at higher orbits for longer missions.

## Dawn Aerospace

The First 2023 quarter ended with a newsworthy suborbital-spaceplane demonstration worth mentioning. Dawn Aerospace, a New Zealand-Dutch and American based company demonstrated rocket powered flight of the Aurora MK-II vehicle. Kudos to the Dawn Aerospace team on this first demo of a rocket powered spaceplane. The journey of a thousand flights starts with a single demo. We look forward to an update from Dawn Aerospace, and their US spaceplane business developers. We are ready to host you again in our quarterly calls, or better, ready to host you for demo flights in a US suborbital P2P or S2S corridors.

We welcome Dawn to use America's newest "Tirplex" Super-Hypersonic and Sub/Orbital R&D, T&E corridors in West Texas, see feasibility study **here.** These inland corridors allow the reuse and R&D/T&E efficiencies from recovering the tests articles over land, in nominal and off nominal conditions. Well done, Jeroen, Stefan, and Khaki Rodway. We look forward to having you fly to the USA soon.

## Virgin Galactic

We are staunch fans of a possible SpaceShip S2S vehicle, as a future iteration of

Spaceship 2/3. We are keen on VG's decision to serialize production of Mothership eve (Aurora Flight Technologies) and the Spaceship 3 final assembly line at Mesa-Arizona, Way to go! Economies of scale and standardization are the precursors to S2S suborbital transportation of people and payloads.

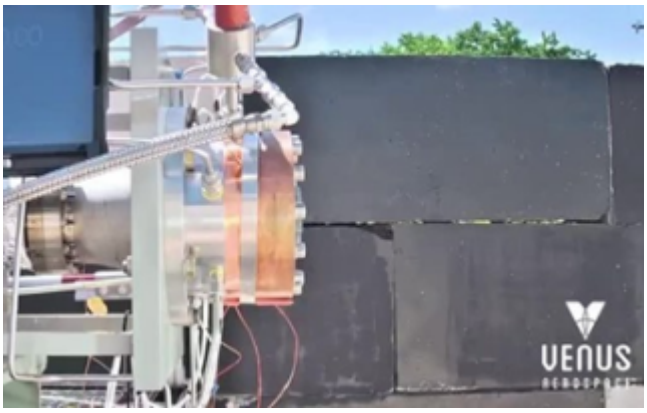
Sir Richards Branson's enthusiasm for Suborbital P2P in 2019/2020 with the TSC-VG and NASA Space Act Agreement has always been praised and well noted by our group. We would like to see VG's products come into service, from the Mach 3+ Super-Hypersonic aircraft to future Spaceship 3 and beyond, demonstrations as viable P2P practical profitable vehicles, filing Space-Flight rules future flight plans and using "airway" like Airspace Corridors and "space ways". We are intent to develop guiding principles and research to support these demonstrations.

VG's Mothership Eve returned to service to Spaceport America this quarter, and we were impressed with the reliability and capabilities that the vehicles promises. We are also fans of Aurora Flight Sciences (a Boeing

Company) and its collaboration to build more **Motherships** in the future.

**Venus Aerospace**

We are proud to have exchanged notes about the business case, markets and viability of spaceplanes with Venus Aerospace this first quarter. Venus' hypersonic-spaceplane concept, fundamentals and technologies, are in our opinion viable and potentially "game-changing", we will be glad to share some more insights with you, please contact us. We are particularly keen and supportive of their rotation detonation powerplant and "airplane" like design dubbed Stargazer and concept of operations.




**ORBITAL**
**MACH 10+**

Our orbital report for Q1 is almost fully focused on the US DOD 'Rocket Cargo" program from the USAF TRANSCOM and the US Space Force's perspectives. We believe that the first "practical" demonstration of Orbital Point to Point (P2P) and Spaceport to Spaceport (S2S) future technologies will aim to military cargo missions; whether aimed at humanitarian, Other than War (OTW) or defensive military missions.

At the **SpaceCom** highly acclaimed and attended event in February of this year in Orlando, the US Space Force and Space Systems Command led a first "Space Mobility" Conference, and the Rocket-Cargo program perspectives was one of the key conversation tracks.

The event also included the Global Spaceport Summit, chaired by Dr. George Nield, and the week was a unique space industry "three-day" extravaganza that clearly showed a voracious appetite for an orbital P2P/S2S demonstration by the commercial-defense synergistic industry complexes.

Both the DOD's US Strategic Command and the US Space Force converged, in my opinion, about the important imperative to study, conceptualize and demonstrate P2P/S2S orbital Rocket Cargo studies and demos to provide assured, frequent and reliable orbital flight to deploy defense, security and humanitarian payloads anywhere on

earth within 2 hours. We could not agree more, we are of support and are very excited about it.

We emphasized the need for plenty and frequent Collaborative Research and Development (CRADA) studies and we emphatically proposed funding multiple CRADA's with industry leaders in the very near future.  Here are some relevant updates for this quarter.

**Space X Starship**

We are fans of Space X Starship. We have met the teams leading the first mission and are fans! We like how Space X succinctly and decisively address "earth to earth" Starship transportation on their websites and public marketing collaterals, not to mention the videos, graphics and other messaging channels. As per Space X's website: **link**

We are proud of our  interactions with SpaceX Starship Team, including  Ryan Parino and George Sondecker last year at the **HSAT Workshop 5th Edition**, and this year at the FAA CSF 25th **Commercial Space Conference**.

We are literally monitoring day-by-day the first Starship flight, any time now! In fact, we waited until the end of the Q1 for this Bulletin with the hope to be able to report on this historical flight, pathfinder and game-changing for the future of orbital P2P.

With the environmental, and FCC preparations to fly  completed, the first mission from Brownsville to Hawaii, the long way around in 90 minutes or so. We all know there will be a before-and-an-after when this flight takes place… Godspeed Starship! We are all tuned in and ready to support this important development, anytime

**Sierra Space**

We are friends and fans of Sierra Space, and commend CEO's Tom Vice multi-decadal vision for the space economy, humanity's access to it and importantly, the understanding of both vehicles to take us to space (Dreamchaser crewed and uncrewed family of vehicles, and infrastructure to live and work in space (LEO, **Orbital Reef Stations and beyond**)

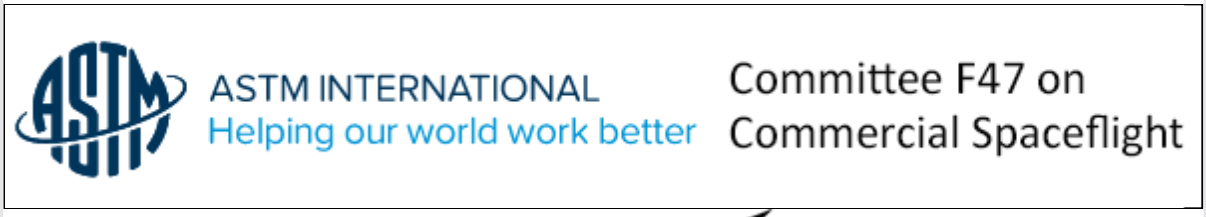
The evolution of Dream Chaser spaceplanes looks very promising to us, as the crewed versions have an 85% commonality with the cargo-freighters first version. We are very bullish on Spaceplanes for the P2P future orbital missions that are "airplane" like in safety, reliability and economics.


Time will tell and we are all tuned to the first flights of Dream chaser later in 2023. Aviation Week's article "Bigger Picture" by Guy Norris is possibly one of the best written pieces, in my opinion about the Dreamchaser program, the DC-100/200 programs and "families" or spacecraft. Some highlights from the article, relevant to our HSAT conversations and this bulletin, are as follows. Sierra is working with the Air Force Research Lab (AFRL) on a DC-300 variant through a Collaborative Research & Development Agreement (CRADA) with the US Transportation Command. This is music to our Point-to-Point "ears", and welcome initial cross-ranges of circa 700 Nautical Miles (NM). These elements ring a bell towards high reliability, safety, scale, frequencies and ensuing lower costs and higher profitability. Way to go Sierra, Tom Vice and Team!

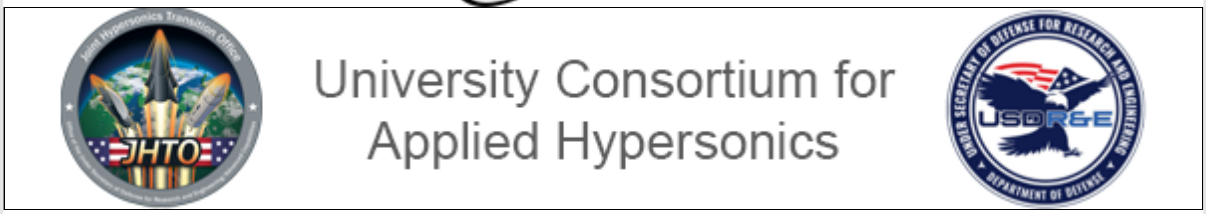
In conclusion, and as always, we look forward to supporting any efforts for the first demonstration this year, for both suborbital and orbital missions within the defined airspace, air and space traffic management, mission requirements and flight planning elements to enable S2S for Ultra-long distances across the earth. As we mentioned before, the good news is that most regulatory and compliance frameworks are in place, and ready to be streamlined to accommodate frequent-commercial operations across the world. As they say, the journey of a thousand P2P Spaceflights starts with one demonstration at a time!

Fly Fast, fly Safe, for a Smaller, Better, More Harmonious World!









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