



## **Advancing the *High-Speed Aerospace Transportation* Industry**

# **HSAT<sup>TM</sup><sub>1</sub>**

10/30/2024

## **Flight Demonstrations and Entry into Service Humans in the Loop- Factors, Technologies and High Altitude and Speed Aerospace Medicine**

### **Foreword**

After more than four decades of tireless efforts, I believe that the high speed flight industry advocates have (finally) achieved the elusive goal for the people of the United States, and the free World, to decidedly ask their policy makers and air transportation leaders to be able to fly faster, to go anywhere on earth and back and to get tangible goods delivered from anywhere on earth, no matter how far, on the same day.

Not only that, but to fly fast safely, reliably, sustainably, and economically as well. And safely, also means securely, and healthily. Indeed, aerospace medicine is now being prioritized as supersonic, hypersonic, and suborbital flight demonstrations are beginning to take place. Human factors research and analysis, including care for crew and passengers, fitness for flight and even effects to the involved and uninvolved public (noise, propellant handling, etc) are now part of our Go-Fast Forward strategic thinking and planning.



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<sup>1</sup> IFG coined the term HSAT and expanded it through a series of industry workshops, trade marking the term HSAT<sup>TM</sup> [www.highspeedflight.com](http://www.highspeedflight.com)



Welcome to HSAT AIAA 7<sup>th</sup> Edition Workshop. [https://www.aiaa.org/events-learning/event/2024/11/14/default-calendar/high-speed-aerospace-transportation-\(hsat\)-workshop](https://www.aiaa.org/events-learning/event/2024/11/14/default-calendar/high-speed-aerospace-transportation-(hsat)-workshop)

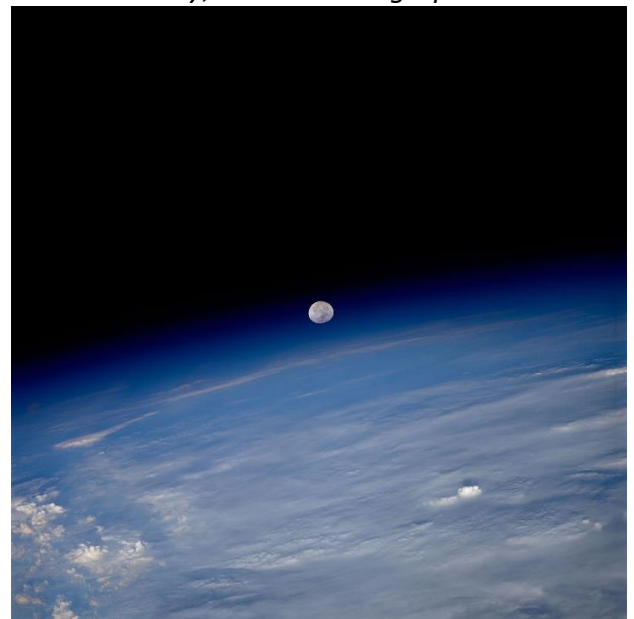
After sixty years of ever safer, cleaner, and more efficient subsonic air transportation, we are all moving into a renewed era of High-Speed Aerospace Transportation or HSAT™. The public demand to “shrink the planet” anywhere to anywhere in one-business-day, is to be the future new normal in air and space transportation, it is an unstoppable movement and a must-have human flourishing enhancing capability, which will align both the digital and physical worlds and greatly improve the quality and way-of-life and condition of all on earth.

The first vehicles will be supersonics Mach 2-3 evolutions of existing high-speed transonic (Mach .935-1.2 business jets). Then hypersonic Mach 5-10, vehicles will prelude the most ambitious of HSAT programs: rocket-based and/or boost-glide profiles, Mach 10+ which will blur the lines between atmospheric and orbital point-to-point flight profiles. Depending on flight distance, these vehicles optimal flight paths may be endo or exo atmospheric. Thus, aircraft and spacecraft policies and regulations will apply, and in some cases, a possible new hybrid realm of regulations and standards might emerge.

HSAT success will need a multi-dimensional sustained push in various areas, including decisive and sustained multi billion capital investments, synergies of academic-practical and “genius” knowledge sharing from not only the aerospace industries, but peripheral and adjacent industries such as travel-hospitality, multi-modal transportation, energy, A.I./M.L., quantum computing and others.

When all these elements are seamlessly aligned, capital formation and investments will increase exponentially, reducing the time to market, years, rather than decades. Investment areas include the necessary and full integration into the existing subsonic system, infrastructure development, aerospace flight research, test and evaluation activities, air, and space.

*Photo Courtesy; National Geographic*





SHAPING THE FUTURE OF AEROSPACE

navigation-position-surveillance capabilities development, powerplant and propellants sustainable development, flight guidance systems-autonomy and automation for high speed.

and altitude flights, and importantly, phased safe demonstrations-test-evaluations, scalable from entry into service to subsequent maturity and industrialization of programs for mass air and space flight frequent, scheduled a reliable commercial operations.

The return on such investment, and the direct indirect and induced economic impact to the world, will be an order of magnitude higher than the investment, well into the high single digit or even double-digit trillions by 2050<sup>2</sup>.

→ Airspace

HSAT™ air and space vehicles will be evolutionary and revolutionary at once (what I call (R/E)-volutionary). They will be flown through both air and space, will utilize FAA-licensed airports, spaceports which sometimes will be collocated, and will manage HSAT™ traffic seamlessly for departure and arrival procedures.

**The ability to conduct high-speed, long-distance transportation, specifically point-to-point transportation through space, will be a major game-changer, both for national security, and for economic competitiveness. This is an area that the United States needs to lead.**

Global Spaceport Alliance



**National Spaceport Network Development Plan, June 1<sup>st</sup>, 2020-Present**

Operations, like take off-climb-cruise acceleration and deceleration, descent, and landing from/ to hypersonic speeds, whether in atmospheric flight or with orbital launch and re-entry phases, will also be seamlessly integrated.

HSAT has published airspace corridors set of guiding principles for suborbital and orbital flight and is collaborating with Standards development Organizations (SDO's)' High Speed Task Forces (AIAA), and Technical Committees to develop supersonic and hypersonic guiding principles as well.

→ **United States National Airspace (NAS)**

In the United States, HSAT seamless integration into the National Airspace System (NAS) is necessary to ensure minimal impact on other, non-involved commercial flight operations, and equitable sharing of airspace volumes with the existing VFR and IFR abiding traffic. A new High-Speed OR "HSAT-IFR "rule could be developed and set, evolving into a Space Flight Rules (SpFR)

<sup>2</sup> <https://www.hermeus.com/halcyon>



rule set. Both rules' sets will evolve and come to be accepted to be enabled operationally a standardized "box to tick" on commercial flight plans.

→ **United States National Airspace, US DOC, DOT, FAA AVS, FAA AST**

Several aspects of NAS integration and spaceports have been highlighted in several steering groups, task forces and SDO's, including the High-Speed Flight and AIAA R&D surveys at the end of this HSAT Workshop primer. These and other HSAT considerations present themselves as topics worthy of the HSF and AIAA exploration and recommendations to the FAA, DOC and DOT and other agencies, for instance the DOE, as new propellant, and energy sources such as nuclear compact fusion appear in the HSF horizon.

→ **FAA and Regulations**

Through the FAA's NexGen, and FAA AST's Space Data Integrator (SDI) and Joint Space Operations Group (JSpOG) the FAA is currently developing several new capabilities to safely integrate supersonic, hypersonic, and suborbital space commercial vehicles into the NAS. Looking beyond today, the FAA is investigating concepts around dynamic hazard areas to further increase safety and efficiency to keep pace with the increasing frequency and complexity of commercial supersonic, hypersonic, and suborbital/orbital launch and reentry operations.

Air traffic management specialists monitor SDI at FAA Air Traffic Control System Command Center in Warrenton, Virginia. Credit: Bill Carey



HSAT operations, whether endo or exo atmospheric, the dynamics involved, and integration into the NAS should be considered in the NexGen, SDI/JSpOG and other tools follow-on planning to seamlessly integrate HSAT™ new entrants into the NAS.



→ **Spaceport considerations**

In its National Spaceport Network Development Plan, published in June 2020 (available on the GSA website here <https://www.globalspaceportalliance.com/wp-content/uploads/2023/08/National-Spaceport-Network-Development-Plan.pdf>), the Global Spaceport Alliance makes the following observations and recommendations:

- The ability to conduct high-speed, long-distance transportation, specifically point-to-point transportation through space, will be a major game-changer, both for national security, and for economic competitiveness. This is an area that the United States needs to lead.
- The Office of Spaceports could be a focal point for these initiatives, in anticipation of the day when point-to-point transportation through space is routinely available.
- The U.S. Government should establish a goal of leading the world in Point-to-Point transportation through space. Accomplishing this challenging goal will require a partnership between government, industry, and academia, and will involve not only advances in engineering and technology, but also work in policy, law, regulations, customs and security, flight and ground operations, market analysis, and economics.

The same logic and reasoning above are true for airports and the U.S. Government leadership for endo atmospheric Point-to-Point HSAT™ transportation. The FAA Aviation and the FAA Office of Commercial Space (AST) converge and collaborate increasingly seamlessly as demonstration flights, such as SpaceX Starship Integrated Flight Test (IFT's) proceed safely.





#### → **Defense and National Security**

According to the S DOD TRANSCOM, DIU, Space Force and the Space Force Association (a growing leading link between the USSF and industry), and other groups like the High-Speed Flight-FF, GSA, further, language contained in the FY 2021 National Defense Authorization Act (NDAA) highlights the value of commercial spaceports, and specifically “encourages the Department of Defense to leverage existing inland spaceports with accompanying range and

airspace for land-based testing” of hypersonic platforms. This extension into hypersonic and supersonic vehicles and the airports that accommodate such vehicles, creates an opportunity to leverage the more than 5,000 commercial and general aviation National, regional, county and community airports in the Nation.

The NDAA goes on to note that “these facilities and complexes could improve the resiliency of U.S. launch infrastructure and help ensure consistent access to space.” This group believes that high-speed flight and launch and reentry capabilities must be interoperable for operators and users. Spaceports, and airports may find support of HSAT activities complementary to their endo atmospheric flight traffic and orbital launch, making returns on investments in these facilities, particularly for dedicated spaceports, more attractive.

As orbital operations ramp up to become weekly or even daily occurrences at many of these sites, experience conducting dynamic HSAT operations will provide a baseline for these ever-dynamic evolutions with positive effects in both national security and the economy.

#### → **Future regulatory framework**

The FAA AST, in its role to “facilitate the strengthening and expansion of the United States space transportation infrastructure,” and the FAA in its role to provide the safest, most efficient aerospace system in the world, offer a unique position to ensure safety, and help encourage, facilitate, and promote HSAT™ in the two segments of commercial atmospheric and spaceflight.

It is certain that human-rated endo atmospheric HSAT vehicles will be certified under rules evolving from subsonic aircraft. And it is also highly likely that human rated HSAT concepts will need to move beyond an informed consent regulatory construct to something more akin to traditional regulation to begin routine commercial operations.



At the same time, the regulation for certification, permitting and licensing of HSAT vehicles will need an innovative and greater degree of flexibility to keep up with an ever-increasing pace of innovation and iteration.

In the spirit of making this regulatory burden as light as possible, while providing the requisite certification, oversight, and safety of paying passengers and the public, discussion should begin now to determine the best paths forward for these unique HSAT architectures and operations. The roles of the FAA and of FAA AST in the process of making HSAT™ reality, should be explored and defined.

→ **Recommendations and Next Steps**

HSAT-Fast Forward, AIAA, CSF, GSA, HSF, ASTM, SAE, and other relevant groups should examine HSAT™ and associated airport and spaceport operations as well as their integration into the NAS as discussed above and make recommendations to FAA and FAA AST regarding regulatory considerations.

The FAA Reauthorizaiton Bill of 2024, H.R. 3935 contains several sections empowering the high speed aerospace transportaiton industry. A bipartisan effort, well led and executed, which is expected to yield important stuides in the areas of integrating supersonic, hypersonic and sub-orbital launch and re entry into the NAS, emisisions and noise standards, passenger and crew aerospace medicine consideraitons and much more. Special thanks go to Representative Mike Collins R-Georgia 10<sup>th</sup> District, for this support and vision on the Hypersonic Amendement to the Bill <https://collins.house.gov/media/press-releases/collins-hypersonic-amendment-signed-law> The full H.R. 3935 cxcan be reviewed here [file:///C:/Users/inter/Downloads/BILLS-118hr3935eh%20\(2\).html](file:///C:/Users/inter/Downloads/BILLS-118hr3935eh%20(2).html)

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