REPORT

3rd Commercial Spaceport Summit

George R. Brown Convention Center
Houston, Texas
Monday, December 4, 2017

Contents

MISSION STATEMENT

Hosted by the Global Spaceport Alliance, the Commercial Spaceport Summit is a conversation among peers of spaceport facility executive managers from around the world. The Summit is a facilitated dialogue on the future commercial potential that a global network of spaceports will help to stimulate. Participants of the Commercial Spaceport Summit will identify common challenges and brainstorm what initiatives, activities, and actions can be taken in the next few years to lay the foundation for enabling commerce to flourish across the international network of spaceports.

GLOBAL SPACEPORT ALLIANCE

3rd COMMERCIAL SPACEPORT SUMMIT

December 4, 2017

ROSTER OF PARTICIPANTS as of COB 11/29/2017

Commercial Spaceport Participant

California Spaceport (Vandenberg AFB)
Dan Gillen, Program Manager, Harris Corporation, Spaceport Systems
Cape Canaveral Spaceport
Jim Kuzma, Chief Operations Officer, Space Florida
Cecil Spaceport
Todd Lindner, Director Cecil Spaceport, Cecil Spaceport
Houston Spaceport
Arturo Machuca, General Manager, Ellington Airport & Houston Spaceport
Bill Begley, Public Information Officer, Houston Airport System
JAXA
Shinichi Takata, Deputy Director, JAXA
Junichi Sakai, Manager, JAXA
Kodiak Launch Complex
Mark Greby, COO and VP, Alaska Aerospace Development Corporation
Manassas Regional Airport
HR Zucker, President, HR-ZTECH, Inc.
Midland International Air & Space Port
Justine Ruff, Director of Airports, Midland International Air & Space Port
J. Ross Lacy, Chairman,the Spaceport Development Board, Midland International Air & Space Port
Oklahoma Air & Spaceport
Bill Khourie, Executive Director, Oklahoma Space Industry Development Authority
Spaceport Colorado
David Ruppel, Airport Director, Front Range Airport/Spaceport Colorado
Spaceport America
Karen Barker, Strategic Solutions Director, Spaceport America
STARGATE - Boca Chica
Alma Miller, Assistant Director of Special Projects, University of Texas RGV
Fredrick Jenet, Professor, UTRGV/STARGATE
Shawn Schroeder, Assit Director of Aviation, Brownsville South Padre Island Int'l Airport
Bryant Walker, Brownsville South Padre Island International Airport

Special Guests to the Executive Session

Patricia Hynes, Director, NM Space Grant Consortium
Jane Kinney, Assistant Director, Commercial Spaceflight Federation

Yolanda Marshall, Director, Strategic Opportunity and Partnership Development Office, NASA Johnson Space Center

Federal Aviation Administration

George Nield, Associate Administrator, FAA
Ken Gidlow, Technical Advisor, FAA-Commercial Space Transportation
Mike Machula, Technical Advisor, FAA

Launch Service Providers

Christopher Allison, Systems Engineer, Sierra Nevada Corporation Space Systems
Warren Frick, Project Manager, Flight Systems Group, Orbital ATK
Sirisha Bandla, Business Development and Government Affairs Manager, Virgin Orbit

Other Participants

Carlo Bocchi, Trade Commissioner, Italian Trade Agency
Brian Gulliver, Aerospace and Spaceport Practice Leader, Kimley-Horn
Kevin Walsh, Business Development Manager, BRPH
Larry Strader, Executive, Jacobs

Organizers

David Alexander, Director, Rice Space Institute
James Causey, Executive Director, SpaceCom
Steven Gonzalez, Technology Transfer Strategist, NASA/JSC
Steve Wolfe, Deputy Executive Director, SpaceCom
Rich Hodge, Sales Manager, SpaceCom

GLOBAL SPACEPORT ALLIANCE
3rd COMMERCIAL SPACEPORT SUMMIT
December 4, 2017
RM 320A, George R. Brown Convention Center
AGENDA

10:45 a.m.	**Check-in**
11:00 a.m.	**Open Session:** **Introductions** • James Causey, Executive Director, Global Spaceport Alliance • Steve Wolfe, Deputy Executive Director, Global Spaceport Alliance • Arturo Machuca, General Manager, Ellington Airport & Houston Spaceport • Yolanda Marshall, NASA JSC
11:10 - 11:40 a.m.	**Regulatory Updates** Dr. George Nield, Associate Administrator, FAA-OCST
11:40 – 12:00 p.m.	**Legislative Update** Jane Kinney, Commercial Spaceflight Federation
12:00 - 12:30 p.m.	**Lunch**
12:30 - 1:30 p.m.	**Launch Service Provider Presentations and Discussion** • **Sirisha Bandla**, Business Development & Govt Affairs Manager, Virgin Orbit • **Warren Frick**, Project Manager, Launch Vehicles Division, Flight Systems Group, Orbital ATK • **Christopher Allison**, Systems Engineer, Sierra Nevada Corporation
1:30 – 2:30 p.m.	**Updates from each Spaceport with current key challenge** (2-3 minutes max, 1 slide max)
2:30 – 3:00 p.m.	**Federal Infrastructure Development Funds** Discussion Leader: Pat Hynes, Director, NM Space Grant Consortium
3:00 – 4:30 p.m.	**Spaceport revenue opportunities** The output of this discussion to be shared and further discussed during SpaceCom 2017 session on this topic Discussion Leader: Larry Strader, Business Development, Jacobs
4:30 – 5:00 p.m.	**Administration** • GSA Website Discussion • GSA Governance • Next GSA Commercial Spaceport Summit – **November 27, 2018** • First Conference Call of 2018
5:00 p.m.	**Wrap-Up & Meeting Adjourns** **Group Photograph – Attendance required or not invited to reception**
5:00–6:30 p.m.	**Commercial Spaceport Summit Networking Reception**

GLOBAL SPACEPORT ALLIANCE
3rd COMMERCIAL SPACEPORT SUMMIT
December 4, 2015
MINUTES

At 10:45 am James Causey opened the meeting welcoming attendees. Arturo Machuca, Yolanda Marshall, and Steve Wolfe also made opening statements.

A regulatory update was provided by Dr. George Nield, Associate Administrator, FAA Office of Commercial Space Transportation. **[ADDENDUM 1]** He discussed the Administration's decision to re-institute the National Space Council as positive step in national space policy.

Dr. Nield discussed emerging launch capabilities including SpaceX Falcon Heavy and Dragon 2 capsule, Google Lunar XPrize, Virgin Galactic SpaceShipOne, Blue Origin New Shepard, Boeing's CST-100 Starliner, and Stratolaunch. He reported that Saudi investors are investing in Virgin Galactic to development Point to Point suborbital transportation. The SpaceX BFR is also being promoted as a point-to-point vehicle. These developments give greater rationale for initiating a point-to-point prize.

Dr. Nield discussed the nomination of Rep. Jim Bridenstine (R-OK) to be the next NASA Administrator, and felt that he is a good choice because of his positions on commercial space.

Dr. Nield asked, "What would success look like for Spaceports?" He offered some ideas.

Idea #1: Commercial Spaceflight Training
Idea #2: Spaceflight Training & Education Program (STEP)
Idea #3: Point-to-Point Transportation Prize
Idea #4: Commercial Spaceflight Center

Dr. Nield offered potential enabling legislation, including:

- Designate a Lead Federal Agency for encouraging and facilitating commercial activities in space
- Select a national goal, with a significant prize attached, related to point-to-point transportation through space
- Allow operation of Space Support Vehicles under Title 51, using an "informed consent" regime
- Update and fund the Space Transportation Infrastructure
- Matching Grants program (Spaceport Grants)
- Select a Single Federal Authority to ensure public safety during commercial space launches

Dr. Nield also endorsed and discussed the *American Space Renaissance Act* legislation introduced by Rep. Jim Bridenstine.

Dr. Nield's closing Thoughts:

- This is an exciting time for commercial space.
- If we are willing to think outside the box, embrace innovation and creativity from the private sector, and take advantage of the benefits resulting from partnerships, we can accomplish some amazing things together!
- The FAA's Office of Commercial Space Transportation is committed to working with the Congress and other government agencies to enable industry's success, and ensure continued U.S. leadership in space.

Jane Kinney, Assistant Director of the Commercial Spaceflight Federation provided a legislative (**ADDENDUM 2**), on behalf of James Muncy of PoliSpace who was not able to attend.

Issues that Kinney addressed included:

- The re-establishment of the National Space Council, its first meeting and the anticipation of the 45-day report with recommendations to modernize FAA Office of Space Transportation.
- The nomination of Rep. Jim Bridenstine (R-OK) to head NASA and some of the controversy surrounding that nomination.
- The growing interest to in the industry about integration of space transportation with the national airspace.
- General Accounting Office (GAO) has asked Congress to identify anticipated commercial spaceport capital needs.
- Efforts with ASTM International to develop commercial spaceflight industry consensus on standards.
- The NASA authorization bill
- Efforts in the Senate to craft an all-encompassing commercial space bill.

There was limited discussion.

After lunch, select launch providers gave presentations on their system capabilities and spaceport requirements. The related Addendum slides provide details.

- Sirisha Bandla, Business Development & Government Affairs Manager, Virgin Orbit **[ADDENDUM 3]**

Virgin Orbit plans to launch payloads for NASA and OneWeb. They require a 10,000 foot runway for their air launch system. LauncherOne stresses agility in launch—truck and trailer based; not ground based. Fueling takes place just one hour before take-off.

- Warren Frick, Project Manager, Launch Vehicles Division, Flight Systems Group, Orbital ATK **[ADDENDUM 4]**

Orbital ATK has long history of spaceflight. It has experience launching out of eight spaceports. Their spaceport selection is determined on a mission-by-mission basis. Key determining factors include 1) safe path to space, 2) ability to handle vehicle, 3) ability to handle/store and supply fuels/logistics, 4) safety and 5) telemetry coverage.

- Christopher Allison, Systems Engineer, Sierra Nevada Corporation Space Systems **[ADDENDUM 5]**

The Dream Chaser winged vehicle is currently the only man-rated horizontal landing vehicle in development. He detailed the desired services at a spaceport include runway (length, width and material content), approach path (sonic boom and risk assessment), equipment (standard items like Tugs, baggage conveyer belts, lighting, etc.), and facilities (hangars and protection from elements).

At about 1:30 pm, each Spaceport gave a brief update on their respective facilities. **ADDENDUM 6** contains the slides provided. Most did not use slides for their updates.

At 2:30 Pat Hynes led a discussion on Federal Infrastructure Development Funds **[ADDENDUM 7]**. She opened the discussion by explaining that spaceports could be greatly improved is infrastructure development funds were made available by the federal government, administered by the FAA. There was general agreement that the federal government should be supporting spaceport, particularly through the use of public private partnership models. To the extent appropriate, the GSA should support such federal funding.

At about 3:00, Larry Strader led a discussion spaceport revenue opportunities. Justine Ruff of Midland that they had received $200,000 in funding and was actively supporting a technology incubator program. Arturo Machuca of the Houston Spaceport said that spaceports have to have a long term view for revenue generation. Karen Barker of Spaceport America made the point that spaceports need to stop looking for anchor tenants as the path to economic sustainability. This all-eggs-in-one-basket approach makes the spaceports vulnerable. Mark Greby of the

Kodiac Launch Complex gave testimony that the loss of the DOD anchor tenant has made their situation economically difficult. He stressed spaceport should stick to their core business.

Steve Wolfe provided an overview of the GSA website, and walked through the features. The website is a platform for interaction between spaceports. It features detailed information on all spaceports in the GSA membership. It also has profile information on individuals linked to the spaceports to facilitate communication. The site provides multiple opportunities for resources sharing as well as a curated discussion board. Members were encouraged to visit the sight, fill out the spaceport and individual profiles, and generally take advantage of its features.

James Causey led a discussion on the how GSA could be of greater value to the spaceport community. The group discussed an array of different projects/work products that would be of significant value to the members. But, as Causey said, in order for GSA to provide new and ongoing services, it will be necessary to set up a mechanism to provide funding to GSA. The initial thinking is that the GSA set a fee structure for spaceport operators and non-operators that would allow for top priority projects to be carried out.

It was agreed that staff would conduct a survey of the members to review the ideas generated from the discussion. The ideas, as well as some added by staff, are summarized as follows:

- Policy update on US activities
- Summary pf policy initiatives around the world.
- Linkage to FAA/DOT
- Linkage to the National Space Council
- Linkage to other spaceports around the world
- Linkage to the CSF and similar groups
- US State & Local Incentives Database
- International Incentives database
- Updatable Complimentary Services Database for each spaceport
- Assessment of linkages to each other transportation modes
- Updatable Spaceport vulnerabilities review:
    - Fire
    - Storm
    - Terror
    - Accident
- Use of the Commercial Space Launch Act to promote public private partnerships
- Access to and potential creation of specialty data
- Maintenance of a resource library
- Prepare communiques form GSA members to help inform and influence policy
- Expansion of the value of Spaceports in creating Academic Development Centers
- Linkages to the investments community
- Build the business case for Spaceports as a cluster of business activities not just centered on launch and thereby a true business development area
- Lessons learned to help new and foreign Spaceports succeed.
- Continue to explore all revenue ideas including:
    - Tourism
    - Training
    - Zero Gravity Spaceflight
    - Point to point
    - Education
- Specialized consulting services
- Hosting quarterly conference calls
- Planning and executing on site meetings at spaceport locations
- Hosting the Annual Spaceport Summit in Houston

- Conduct Surveys of interest to members
- Promote Spaceports at SpaceCom events
- Provide private chat rooms for members to collaborate on specific projects/initiatives.

In short we need to make a business case to sell spaceports to members.

Action Items

- Staff to prepare a survey for GSA members on issues and activities that GSA could apply itself on behalf of member. This survey would be made available to members by end of January, 2018.
- Consider holding a GSA meeting during The FAA meeting in Washington, DC on February 7-8

ADDENDUM 1: Commercial Space Update: George Nield, FAA/AST

Commercial Space Transportation Update

Federal Aviation Administration

3rd Commercial Spaceport Summit
George R. Brown Convention Center
Houston, Texas

December 4, 2017

National Space Council Executive Order

1st Meeting of National Space Council

Falcon Heavy

Google Lunar XPrize

SpaceShipTwo Powered Flights

New Shepard Flight with Crew Capsule

Dragon 2

CST-100 Starliner

Stratolaunch

Satellite Servicing

SpaceX Mission Around the Moon

Sunday's Washington Post

"Space tourism will surely be a blast, but can it also improve life on Earth?"

Education & Training

Idea #1 – Commercial Spaceflight Training

- Goal: Make your spaceport the "go-to" place for commercial spaceflight participant training.
- Needed capabilities:
  - Classroom training
  - Simulators
  - Altitude Chamber
  - Centrifuge
  - Aircraft operations
- Enabling Legislation: Passage of H.R. 3038 (SOARS Act) or the equivalent provision from the CSLCA
- Benefits: Safety, regulatory efficiency (1-stop shop), jobs and economic activity, plus near-term operations at the Spaceport!

Space Support Vehicles

- In 2013, Congressman Posey and Congressman McCarthy introduced H.R. 3038 (the SOARS Act), that would provide for the use of certain experimental or former military aircraft to support commercial space transportation activities, in the same way that NASA uses the T-38 for astronaut training.
- In response to a Congressional request, the FAA provided technical assistance concerning this bill in June 2014.
- In November 2015, the CSLCA called for reports on how to enable non-launch, space-related operations, and on the potential benefits of Space Support Vehicles.

Non-Launch, Space-Related Activities

The common theme is "aircraft that may be used in activities related to Title 51 launches."

Hybrid Launch Systems **High Performance Aircraft**

Hybrid Launch Systems

Astronaut Training at NASA

Potential Systems for Commercial Spaceflight Training

Christa McAuliffe

Idea #2 – Spaceflight Training & Education Program (STEP)

- Goal: With the start of Suborbital Space Tourism operations close at hand, now is the time to create a new, improved Teacher in Space Program to inspire and motivate both students and teachers
- Needed capabilities:
  - One or more spaceports could partner with launch operators to offer regular and frequent suborbital spaceflights for teachers
- Enabling Legislation: Congressional support (especially funding) would be helpful, but is not required
- Benefits: For roughly $12.5M per year, 50 competitively selected teachers (1 from every state) would have a chance to fly to the edge of space, and then return to their classrooms following a once-in-a-lifetime adventure

Point-to-Point Transportation

SpaceShipThree?

SpaceX BFR

Idea #3 – Point-to-Point Transportation

- Goal: Your spaceport announces its intent to become the "thought leader," home base, and facilitator for the development of high-speed, long distance transportation, specifically, Point-to-Point Transportation through Space
- Needed capabilities:
  - Academic research
  - Ground tests and flight tests
  - Collaboration between government, industry, and academia
- One way to "Jump Start" the activity: Creation of a multi-million-dollar Commercial Space Transportation Prize to guide and encourage the industry
- Benefits: Opportunity to "create" the future of high-speed transportation, positive attention from the public, potential industry investment

Center of Excellence for Commercial Space Transportation

FAA Center of Excellence for Commercial Space Transportation (COE CST)

Idea #4 – Commercial Spaceflight Center

- Goal: Combine some or all of the preceding ideas into a newly created Commercial Spaceflight Center that would demonstrate leadership in, and commitment to, Commercial Space Transportation.
- Potential capabilities:
  - Accident investigation and prevention
  - Commercial Human Spaceflight training
  - Spaceflight Training & Education flights for teachers
  - Human Spaceflight Standards development (with industry)
  - Encouragement of Point-to-Point space transportation development efforts
  - Administration of space-related prize programs

Idea #4 – Commercial Spaceflight Center (cont.)

- Potential capabilities (cont.)
  - Space Traffic services
  - Commercial Space Transportation research
- Prerequisite: Support from key Stakeholders (including the Congress)
- Benefits: Your spaceport could clearly demonstrate its leadership in commercial space transportation, and all of the stakeholders and partners (including federal, state, and local government; industry; and academia) would benefit as a result of our collaborative efforts.

Congressional Action

Potential Enabling Legislation

- Designate a Lead Federal Agency for encouraging and facilitating commercial activities in space
- Select a national goal, with a significant prize attached, related to point-to-point transportation through space
- Allow operation of Space Support Vehicles under Title 51, using an "informed consent" regime
- Update and fund the Space Transportation Infrastructure Matching Grants program (Spaceport Grants)
- Select a Single Federal Authority to ensure public safety during commercial space launches

American Space Renaissance Act (1)

- Establishes the position of Assistant Secretary of Transportation for Commercial Space Transportation
- Authorizes AST appropriations for FY17-FY21
  - FY17 - $43.2M
  - FY18 - $55.5M
  - FY19 - $66.0M
  - FY20 - $80.5M
  - FY21 - $99.0M

American Space Renaissance Act (2)

- Establishes an Office of Spaceports within AST
- Updates and funds the Space Transportation Infrastructure Matching Grants program
- Establishes a prize account for commercial space activities
- Establishes a loan guarantee program within the Department of Commerce to support the space industrial base
- Permits the Secretary of Transportation to allow experimental aircraft to be used for spaceflight training at FAA licensed spaceports

American Space Renaissance Act (3)

- Authorizes the Secretary of Transportation to obtain Space Situational Awareness information and provide it to civil, commercial, and international entities
- Directs that a lead Government agency be designated for Space Traffic Management activities and services

Closing Thoughts

- This is an exciting time for commercial space.
- If we are willing to think outside the box, embrace innovation and creativity from the private sector, and take advantage of the benefits resulting from partnerships, we can accomplish some amazing things together!
- The FAA's Office of Commercial Space Transportation is committed to working with the Congress and other government agencies to enable industry's success, and ensure continued U.S. leadership in space.

ADDENDUM 2: Legislative Update with Jane Kinney, Commercial Spaceflight Federation

As you all know, the first meeting of the National Space Council occurred on October 5th in Washington D.C. Following that meeting, many in our industry were enthusiastic about the participation and attitude of the vice president and the other members of the council. Since this initial meeting, the enthusiasm has not died down. The council staff is diligently working with industry and congress on issues ranging from regulatory reform, export control, and more. They want to make sure American companies in commercial space are competitive, innovative, and influential. The National Space Council 45-day report is anticipated to include serious efforts to modernize FAA AST launch and spaceport licensing regulations which will be a tremendous win for spaceports and the industry as a whole.

Fortunately, CSF members -- including Space Florida, Spaceport Camden, and Spaceport America -- had been working with FAA/AST staff as part of a joint regulatory reform task force since this spring. Collectively we have identified many recommended changes in the regulations for launch and reentry site operators, and some of them are being put on the Department of Transportation's regulatory agenda for 2018.

One obvious question many have is when we will see the next NASA administrator? So far, Congressman Jim Bridenstine has passed the committee vote and his nomination is moving on to the full Senate. Although he has not had the easiest of paths to confirmation, we believe that he will be confirmed and be sworn in as the next NASA administrator later this month. We expect the vote to be down the party line, although Senator Marco Rubio has expressed concern and might side with the democrats. Three Republicans would need to vote against Bridenstine for his nomination to be turned down, so even if Senator Rubio does not side with his party, Bridenstine should still be confirmed.

As far as legislation Spaceports specifically goes, there is a lot going on. One focus at CSF is infrastructure funding. While AST provides opportunities for revenue through this means, the Department of Transportation does not. We are working to make sure that spaceflight is included as a defined method of transportation so that spaceports and launch facilities may gain access to infrastructure funding and grants.

Integration of space transportation with the national airspace is a topic of growing interest to those here, and the industry in general, and CSF is working to tackle this in conjunction with the FAA and other industry stakeholders. The FAA Administrator has appointed an Aviation Rulemaking Committee (ARC), and both CSF and many of our members have been selected for this important Committee. The FAA is also planning to create another ARC to help come up with a system for classifying spaceports. That system will feed into the airspace ARC I just mentioned.

The GAO was tasked by the House Transportation and Infrastructure Committee and its Aviation Subcommittee to review a wide range of issues facing the space transportation industry, including one topic directly related to the spaceports community:

"Identify anticipated commercial spaceport capital needs, as well as current sources of funding and financing available to commercial spaceports."

They have already started to reach out to many key players in the industry as they commence work on their report. If you are interested in talking to the GAO about this, please give me your contact information and I will pass it on to them.

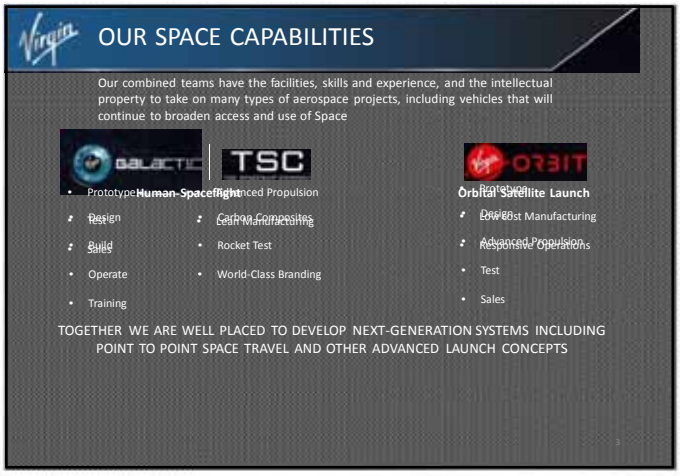
Development of industry consensus standards are well underway through the F47 committee at ASTM. There is a specific committee dedicated to Spaceports with two active standards in progress, and more to follow shortly. The ASTM biannual meetings are actually happening this afternoon and tomorrow morning, and I encourage anyone interested to contact me regarding further questions.

A NASA authorization bill is currently being drafted although it is meant to be limited in scope and mostly focused on microgravity strategy and will probably not touch on infrastructure. With that being said, the NASA Auth of 2017 that was signed into law earlier this year had several spaceport-related studies that are coming due soon and will create an opportunity to tee-up some legislative action for things like Enhanced Use Lease, and other issues.

Regarding the budget, another short-term CR will be passed into January, giving Congress additional time to pass a budget agreement and increase funding levels for everyone.

Last but not least, The Senate is working on an all-encompassing commercial space bill, which will look at the possibility of modernizing the legal requirements for FAA AST launch and spaceport licensing procedures.

ADDENDUM 3: Launch Services, Sirisha Bandia, Virgin Orbit



FIRST FEATHER TESTING - May 1, 2017

SPACESHIP ENGINE TESTING

SPACEPORT AMERICA IN NEW MEXICO

OUR PHILOSOPHY TO LAUNCH

Our goal is to enable the small satellite revolution by providing affordable launch services underpinned by three key pillars:

- Simple, low cost rocket architecture
- Well understood, established, supported aircraft
- Advanced manufacturing technologies that enable efficient build processes

LAUNCHERONE HARDWARE

STRUCTURES

PROPULSION

AVIONICS

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REDEFINING LAUNCH PARADIGM

Agile Launch Operations Overview

Airplane and GSE enable a true mobile launch site

Truck and trailer based; not ground based. Multiple VO trailers for launch campaign including: Gas, LOX, RP-1, Transport & Mating, Shop, and Mobile Command Van

747-400 aircraft is fueled prior to launch vehicle integration operations

Warm gases and fuel are loaded prior to flight; LOX and cold helium are loaded starting one hour before take-off with all crew cleared from the area

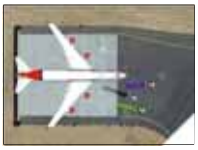
Fly Out and Launch

Most missions will stage out of MHV. The 747 carrier aircraft will fly a flight path going southwest to a drop point just south of the Western Test Range.

VO is currently coordinating with local FAA for guidance on fly-out path with least interference with airline routes

VO is also coordinating with U.S. Government for Special Use Airspace

Currently defined operations for L1 use standard launch corridors from the Western and Eastern Test ranges



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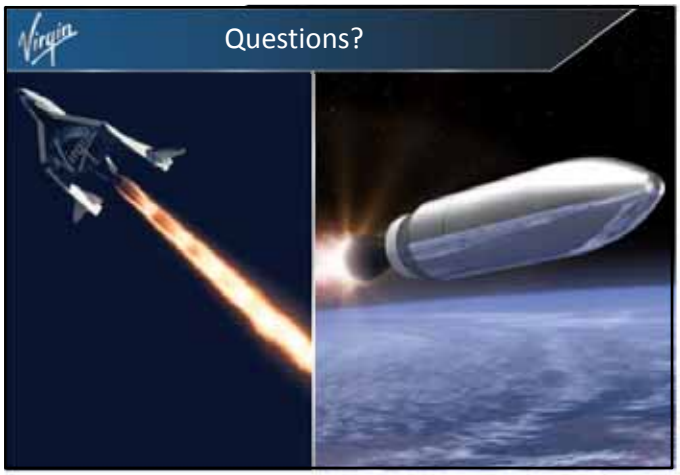
Questions?



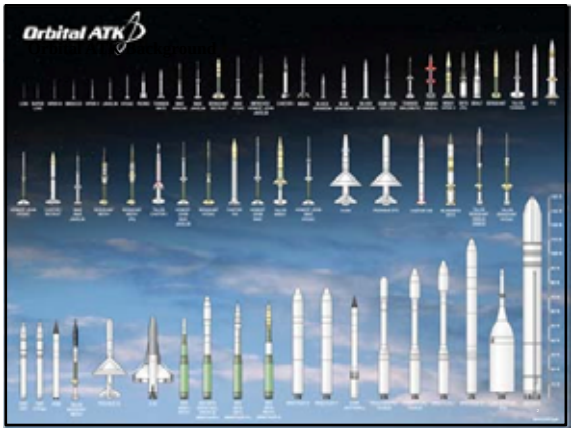
ADDENDUM 4: Launch Services, Warren Frick, Orbital ATK

Orbital ATK

Orbital ATK and Spaceports

Warren Frick

4 December 2017



Launch Site Experience

Orbital ATK

Orbital ATK has ***Extensive*** General Launch Site Experience

Space Launch Site Experience

Orbital ATK

- Edwards Air Force Base
- Vandenberg Air Force Base
- Kennedy Space Center
- Wallops Flight Facility
- Cape Canaveral Air Force Base (now Cape Canaveral Air Force Station)
- Kodiak Launch Complex (Now Pacific Spaceport Complex – Alaska)
- Kwajalein Atoll (Now Reagan Test Site)
- Canary Islands

Orbital ATK has a Greater Variety of Space Launch Site Experience than ANY ONE

Launch Site Requirements

Orbital ATK

- A US Vehicle/Company Must Have USG Authority to Launch
  - FAA, NASA, DoD
- **Internationally, per UN Space Treaty, a Sponsoring State is Responsible for** Space Activities, whether National or Commercial – to Include Liability.
- Orbital ATK's Space Launch Site Needs:
  - Safe Path to Space
    - Acceptable Risk for Overflight
    - Avoid Habitable Space Object
  - Ability to Handle Vehicle
    - Launch Pad
    - Runway
    - Facilities
  - Ability to Handle/Store and Supply Fuels/Logistics
  - Safety
    - Ground/Operational
    - Flight
      - Telemetry Coverage (If Needed)

ADDENDUM 5: Launch Services, Christopher Allison, SNC Space Systems

Dream Chaser Overview

Presented by:

Christopher Allison – Federal Agencies Integration Lead and Landing Site Coordinator

Dream Chaser® Space Vehicle

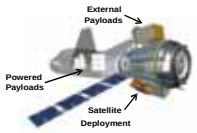
- Only runway-landing, crew-capable space vehicle actively in development
- Capable of runway landing in any country in the world
- Crewed or uncrewed transportation to and from Low-Earth Orbit (LEO)
- Non-toxic propulsion for launch abort, orbital translations, attitude control, deorbit
- < 1.5g re-entry profile and >1000 mile cross-range capability
- Designed to launch on a variety of launch vehicles

Crewed Dream Chaser

Uncrewed Dream Chaser

Missions in Development

- **NASA's CRS2 (minimum 6 flights)**
  - Resupply the ISS for the remaining mission life (currently 2024)
- **Dream Chaser for European Utilization (DC_4EU)**
  - The objective is to provide affordable, reliable, and flexible space services for autonomous European access to low Earth-orbit
  - ESA, OHB, Telespazio
- **Dream Chaser UN Mission**
  - Targeted at developing countries with the ambition of an in-country space program but not the means to implement
  - UN collected CFIs this past month
- **Dream Chaser Global**
  - Opening space to countries with no national space program



Your Logo Here

Flight Test Vehicle

Completed flight testing at NASA Armstrong

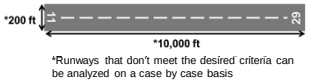
VIDEO

Dream Chaser Landing Capability

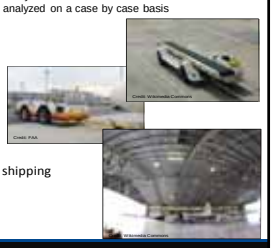
- **Low-toxicity fluid commodities to enable runway landings around the world**
  - Can land at any runway that supports a B737 or A320 aircraft
- **Basic runway landing**
  - Nominal 10,000ft
  - >1,000 nmi cross-range capability
- **No go-around capability**
  - Gliding reentry with active energy management
- **Tri-landing gear configuration**
  - Two main landing gear with wheels
  - One nose landing gear with a nose skid
    - Extensive testing on both concrete and asphalt runways
- **Licensing and approval will be in place before a landing**

Preferred Services at a Landing Site

- Runway
  - Length and Width *vs.* Guidance Navigation and Control (GN&C)
  - Breaking Distance
  - Runway Material
- Approach Path
  - Sonic Boom
  - Risk Assessment
  - Potential Environmental Impacts
- Equipment
  - Standard items found at an airport
    - Tugs, baggage conveyer belts, lighting, etc.
- Facilities
  - Hangar for any post flight preparations for shipping
    - Controlled facility protect from the elements



*Runways that don't meet the desired criteria can be analyzed on a case by case basis



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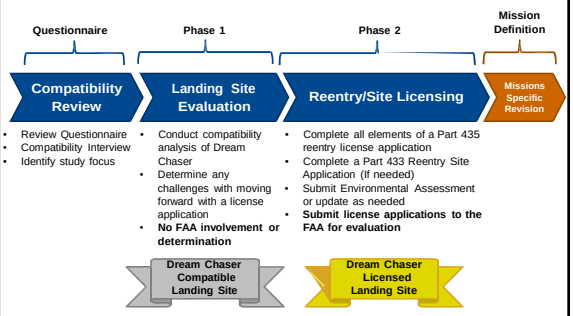
Dream Chaser Impact on Local Airspace

 8

Landing Site Designation Approach



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Active Work

- The CRS2 program is working the initial Part 435 License to land at the SLF
  - Pathfinding analysis and application process
  - This license will be used as a starting point for other licenses as part of the Landing Site Designation
- Currently on contract conducting a landing site designation with the Huntsville International airport
  - Working through both phases and will apply for both a Part 435 and 433 license
- Previously conducted a Phase 1 study with Midland International Air and Spaceport

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ADDENDUM 6: Spaceport Slides Submitted

JAA | Cecil

Cecil
Cecil Spaceport

Global Spaceport Alliance
Commercial Spaceport Summit

December 4, 2017

JAA | Cecil

Mayo Clinic

Operational Activity

- NE Florida Space Medicine Consortium
- C-AST

- **Launch Operator Activity**
  - **Feb/Mar 2018 - Rocket Motor Testing**
  - **Mar/May 2018 - Launch Test Article**
  - **Dec 2018/Feb 2019 - AFRL Launch**
  - **Part 433/435 Analysis**

JAA | Cecil

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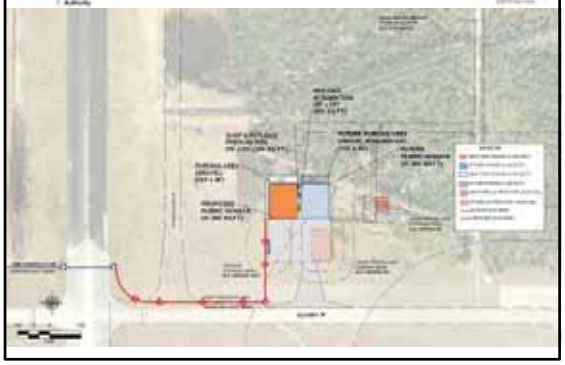

Midland International Air & Space Port

MIDLAND

California Spaceport – Vandenberg AFB

HARRIS

Co-located Payload & Launch Processing Facilities

Located near SLC-6; leased from the US Air Force for 25 years

Integrated Processing Facility (IPF)

- Designed and built for NRO Shuttle class payloads
- Three large processing cells, highbay, airlock & office space
- Validated 10,000 class cleanroom facility

Space Launch Complex-8 (SLC-8)

- 1st commercially owned/operated launch facility in the US; current FAA Commercial Space Transportation License
- Southernmost launch facility at Vandenberg AFB
- Environmental Assessment complete for liquid & solid rockets
- Remote launch capability & full connectivity to Western Range assets

ADDENDUM 7: Federal Infrastructure Development Funds, Pat Hynes, Director, NM Space Grant Consortium

Preparation Document for GSA 12.4 discussion: 2:30-3pm
Pat Hynes

Dear Colleagues: I was asked by Steve Wolfe on 11.30 to lead a discussion at the GSA meeting on "State and county incentives for spaceport development". Since this is a very broad topic, and would require preparation by each of the spaceports, I felt it better to decline to open a discussion on this topic.
I believe we can take advantage of the Mission of the GSA, to … identify common challenges and brainstorm what initiatives, activities, and actions can be taken in the next few years to lay the foundation for enabling commerce to flourish across the international network of spaceports.
Would you consider engaging on a discussion as described below?

Assumption:
Spaceports could benefit from federal infrastructure development funds that would enable consistent support of safe operations of spaceports.
The funds would be used but not limited to support development and maintenance of: common infrastructure such as launch pads, runways, lighting, navigation, communications, fire, crash rescue and mishap response equipment, flight safety and telemetry systems.

Spaceport organizations already approach state and local entities for bonding authority, investment support for development of spaceports as economic engines in our communities. Spaceports are part of our national transportation infrastructure system. The federal government does not offer any support currently … "ensuring the resiliency of the space transportation infrastructure in the United States for spaceport infrastructure development." (see full statement below)

Task:
If the spaceports we were able to indicate a national, broad network need for federal infrastructure support, and create a unified and defensible proposal, would this group be will to work on developing a proposal to request funding to support funding the authorized STIM or create another programmatic approach?
What are the common needs, rather than get into a competitive discussion, what should a launch operator expect from any site?

Further considerations.
The FAA AST is authorized but due to budget cuts, is no longer offering the Space Infrastructure Matching Grants (STIM) program.

***Background**
The Federal Aviation Administration (FAA) Office of Commercial Space Transportation (AST) has established a Space Transportation Infrastructure Matching (STIM) Grants Program for the purpose of ensuring the resiliency of the space transportation infrastructure in the United States. The U.S. Congress mandated the Grant Program under 51 U.S.C. Chapter 511 Space Infrastructure Matching Grants. This legislation authorizes the use of Federal monies in conjunction with matching state, local government, and private funds.

FY 2010 was the first year that Federal funds were appropriated under this discretionary grant program. Development projects eligible for funding include technical and environmental studies; construction, improvement, and design and engineering of space transportation infrastructure, including facilities and associated equipment; and real property to meet the needs of the United States commercial space transportation industry. A total of ten grants were awarded during FY2010, 2011, and 2012. Due to budget cuts, no STIM grants have been made since FY2012, but we hope to continue the program in the future.