

Are We on the Verge of Suborbital Flights ?

3rd ICAO / UNOOSA Aerospace Symposium
*Emerging space activities and civil aviation –
challenges and opportunities*
29 Aug 2017

Dr. Stefano FERRETTI
ESPI Resident Fellow
stefano.ferretti@espi.or.at

Outline

- **1. Introduction**
- **2. What are the challenges for suborbital flights?**
 - and the opportunities ?
 - A strategic alliance between the aeronautical and space sectors ?
- **3. Way forward**
 - An example of policy framework
- **4. What could be the societal impacts of suborbital flights?**
- **Conclusions**

“ESPI BRIEFS” No. 13



Are We on the Verge of Suborbital Flights?

1. Introduction

Recently, Richard Branson announced that Virgin Galactic will operate its first suborbital flight, which he will board, starting next year¹. This latest development comes after a series of promising steps and announcements. However, in the last decade(s), technical drawbacks have been keeping this dream from becoming a reality for the about six hundred and fifty people who have already paid up to two hundred and fifty thousand dollars.

This year in May, the European Space Agency announced the kick-off of the construction in the UK of a rocket engine test facility, in partnership with institutional and industrial actors. Within three years it will be possible to fire airbreathing engines with the potential to revolutionise space launches, powering vehicles that can take off and land like aircraft, and allowing for flights up to five times the speed of sound, opening up the frontier of hypersonic air travel².

2. What are the challenges and opportunities for suborbital flights?

The risks associated with suborbital flights are certainly high, since they operate in the domain of experimental flight vehicles, employing new technologies and with a very limited number of flight hours. In addition, some critical failures occurred in the past years, causing the loss of the pilot's life as well as a substantial slowing of the development process. These elements clearly question the robustness of the initially foreseen business case, and require a thorough and critical analysis of future strategies.

A game changer, which emerged in recent years, is given by industrial alliances and strategic partnerships with institutional actors. In this latter case, providing services in the microgravity sciences domain represents a new opportunity for both the suborbital flights industry and the scientific communities. These flight opportunities could become an integral part of space agencies' programmes and microgravity platforms portfolios, which nowadays encompass automatic capsules, sounding rockets, parabolic flights and drop towers, all currently used worldwide³. Many new actors entering the suborbital flights business are indeed considering strategic partnerships with space agencies, seeking technical support in the earlier development stages, and pooling expertise in specific domains such as aerospace medicine and passengers' well-being.

¹Foust, Jeff. "All booked: Virgin Galactic says suborbital spaceflights are full until 2021." 19 May 2017. SpaceNews. Accessed 6 Jun 2017. Web: <http://spacenews.com/all-booked-virgin-galactic-says-suborbital-spaceflights-are-full-until-2021/>

²ESA. "Test site for ESA-backed airbreathing engine." 4 May 2017. Accessed 6 June 2017.

Web: http://www.esa.int/Our_Activities/Space_Engineering_Technology/Test_site_for_ESA-backed_airbreathing_engine

³Foust, Jeff. "Blue Origin joins NASA's suborbital research flight program." 3 Jun 2016. SpaceNews. Accessed 6 June 2017.

Web: <http://spacenews.com/blue-origin-joins-nasas-suborbital-research-flight-program/>

1. Introduction

- Virgin Galactic recently announced that will operate its first suborbital flight, which Richard Branson will board, starting next year 1)
 - 650 people who have already paid up to two hundred and fifty thousand dollars
 - in the last decade(s) technical drawbacks have been keeping this dream from becoming a reality
- In May 2017, the European Space Agency announced the kick-off of the construction in the UK of a rocket engine test facility, in partnership with institutional and industrial actors
 - fire airbreathing engines with the potential to revolutionise space launches, powering vehicles that can take off and land like aircraft
 - allowing for flights up to five times the speed of sound, opening up the frontier of hypersonic air travel 2)

All booked: Virgin Galactic says suborbital spaceflights are full until 2021

By Jeff Foust — May 19, 2017



TEST SITE FOR ESA-BACKED AIRBREATHING ENGINE




4 May 2017 Wo
UK's latest ro
firing the engi
propulsion sys
The Synergistic
uniquely design
during the earl
realises the nee
onboard oxygen
switching to res

1) Foust, Jeff. "All booked: Virgin Galactic says suborbital spaceflights are full until 2021." 19 May 2017. SpaceNews. Accessed 6 Jun 2017. Web: <http://spacenews.com/all-booked-virgin-galactic-says-suborbital-spaceflights-are-full-until-2021/>

2) ESA. "Test site for ESA-backed airbreathing engine." 4 May 2017. Accessed 6 June 2017. Web: http://www.esa.int/Our_Activities/Space_Engineering_Technology/Test_site_for_ESA-backed_airbreathing_engine

2. What challenges for suborbital flights?

- **High risks** associated with suborbital flights
 - new technologies
 - very limited number of flight hours
 - domain of experimental flight vehicles
- Some **critical failures** occurred in the past years
 - the loss of the pilot's life
 - substantial slowing of the development process
- These elements clearly question the robustness of the initially foreseen **business case**
- Need for thorough/critical analysis of **future strategies**



*"Don't believe what your eyes tell you.
All they show is limitation.
Look with your understanding,
Find out what you already know
and you'll see the way to fly."*

Richard Bach
"Jonathan Livingston Seagull"

...and opportunities ?

- Provision of **services** in the **microgravity sciences** domain as an integral part of space agencies' microgravity platforms portfolios 3)
- **New industrial actors** are considering strategic **partnerships** to:
 - seek technical support in the earlier development stages
 - pool expertise in specific domains such as aerospace medicine and passengers' well-being



SPACENEWS

NASA Technology Program Seeks To Help Suborbital V Developers
By Jeff Foust — June 16, 2016



Three companies — Masten Space Systems, UP Aerospace and Virgin Galactic — provide suborbital flights to varying altitudes on rocket-powered vehicles. Credit: Virgin Galactic photo

Blue Origin joins NASA's suborbital research flight program
By Jeff Foust — June 3, 2016



Blue Origin's New Shepard suborbital vehicle lifting off on a Jan. 22 test flight. The vehicle is now research payloads through NASA's Flight Opportunities program. Credit: Blue Origin

3) Foust, Jeff. "Blue Origin joins NASA's suborbital research flight program." 3 Jun 2016. SpaceNews. Accessed 6 June 2017.
Web: <http://spacenews.com/blue-origin-joins-nasas-suborbital-research-flight-program/>

A strategic alliance between the aeronautical and space sectors ?

- Institutional side: alliance more easily supported in the United States and Japan, where the **space agencies** clearly encompass both space and aeronautics in their **mandates**.
- European industrial actors that are already engaging in R&D activities with JAXA on **hypersonic flight technology development**
- Could these new approaches boost the development and deployment of large fleets ?

The European institutional side

- Promising ESA initiative in the UK, but actors are somehow still limited by the mandate of the respective agencies and institutions
- When / how Europe could support a **fully-fledged programme that covers joint space and aeronautics developments**, enabling the realization of suborbital flights and hypersonic travel ?

3. Way forward

- A more substantial role for the European public sector ?
 - extension of the agencies' mandate
 - appropriation of the necessary funding
- Development left to private industry ?
 - prompt definition and implementation of policy mechanisms
 - regulatory frameworks (definition of the air-space interface) 4)
 - Benefits for the suborbital (flight and ground segments), tourism and transportation industries worldwide



4) United Nations Committee on Peaceful Uses of Outer Space (UNCOPUOS), Questions on suborbital flights for scientific missions and/or for human transportation. UN Doc A/AC.105/1039/Add.7 of 19 Dec 2016, Vienna, United Nations.

Policy frameworks

- United States is already tackling the issue since some time
- In Europe it would be advisable to develop a framework that enables the full exploitation of this business opportunity
- Memorandum of Cooperation on 'Commercial Space Transportation' 5):
 - Italian Space Agency
 - Italian National Civil Aviation Agency (Ente Nazionale per l'Aviazione Civile - ENAC)
 - US Federal Aviation Administrationto support the nascent Space tourism sector by developing and regulating Space Ports 6)

5) FAA. "Memorandum of Cooperation in the development of Commercial Space Transportation". 30 June 2016. Web: https://www.faa.gov/about/office_org/headquarters_offices/ast/programs/international_affairs/media/Memorandum_of_Cooperation_FAA_Italy_ENAC.pdf

6) ASI. "A spaceport in Italy?" 30 Jun 2016. Accessed 6 June 2017. Web: <http://www.asi.it/en/news/a-spaceport-in-italy>

4. What could be the societal impacts of suborbital flights?

The overview effect as change in awareness:

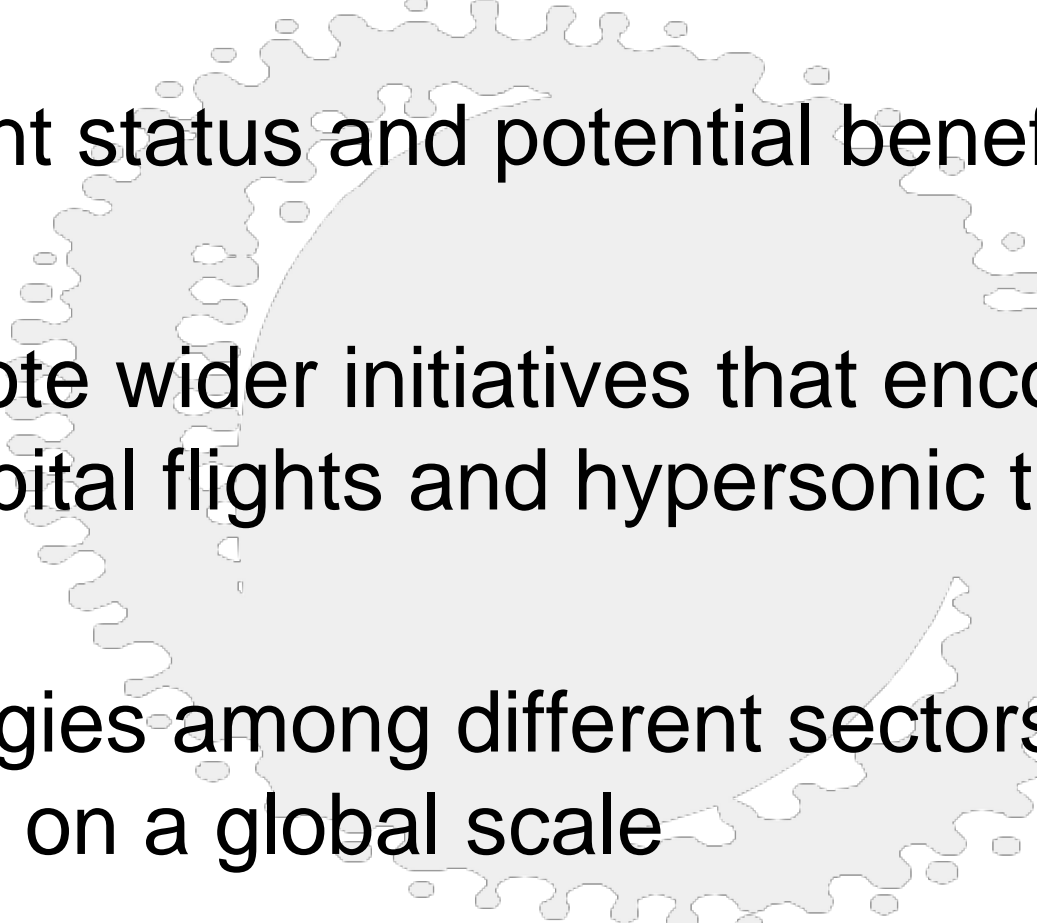
- experienced by the few individuals observing the Earth from Space
- key outreach element for space agencies around the world

The implications of this could clearly be largely extended if an increasing number of people were to see the Earth from Space, further developing in our societies feelings and behaviors associated with:

- environmental awareness
- democratization of space
- sense of oneness
- belonging to our “common home”



Conclusions

- 
- Current status and potential benefits
 - Promote wider initiatives that encompass suborbital flights and hypersonic travel
 - Synergies among different sectors and actors on a global scale