PD AeroSpace, LTD.

Company Profile

Feb. 2025

https://pdas.co.jp/en/

Basic Company Information

	Description
Name	PD AeroSpace, LTD.
Address	HQ : 3519 Arimatsu Midori-ku, Nagoya, Aichi R&D center : 1-27 Minatohonmachi, Hekinan, Aichi Test site : Shimojishima Airport, Okinawa
Established	May 2007
Capital stock	7.6M USD (Including capital reserve)
Employees	15 (C. 2025)
Business content	1. Spaceplane development, Rocket engine development 2. Space transportation business (satellite orbit launch, space travel, etc.) 3. Spaceport business (R&D base, operation base) 4. Engineering Services and R&D support

- Our biggest technical ability is “**Combustion mode switching engines**" that have two functions: Jet and Rocket. (Basic patent acquired, international patent pending)
- Our aim is to develop “**Spaceplanes**" led by the private sector, and to expand space transportation and space utilization for civilian demand, including space tourism, orbital launching of artificial satellites, and high-speed passenger transport.
- **ANA Holdings, HIS, Mizuho Group** and others have invested in the company, forming a business alliance.
- We also provide **Engineering services and R&D support** to private and public sector clients.

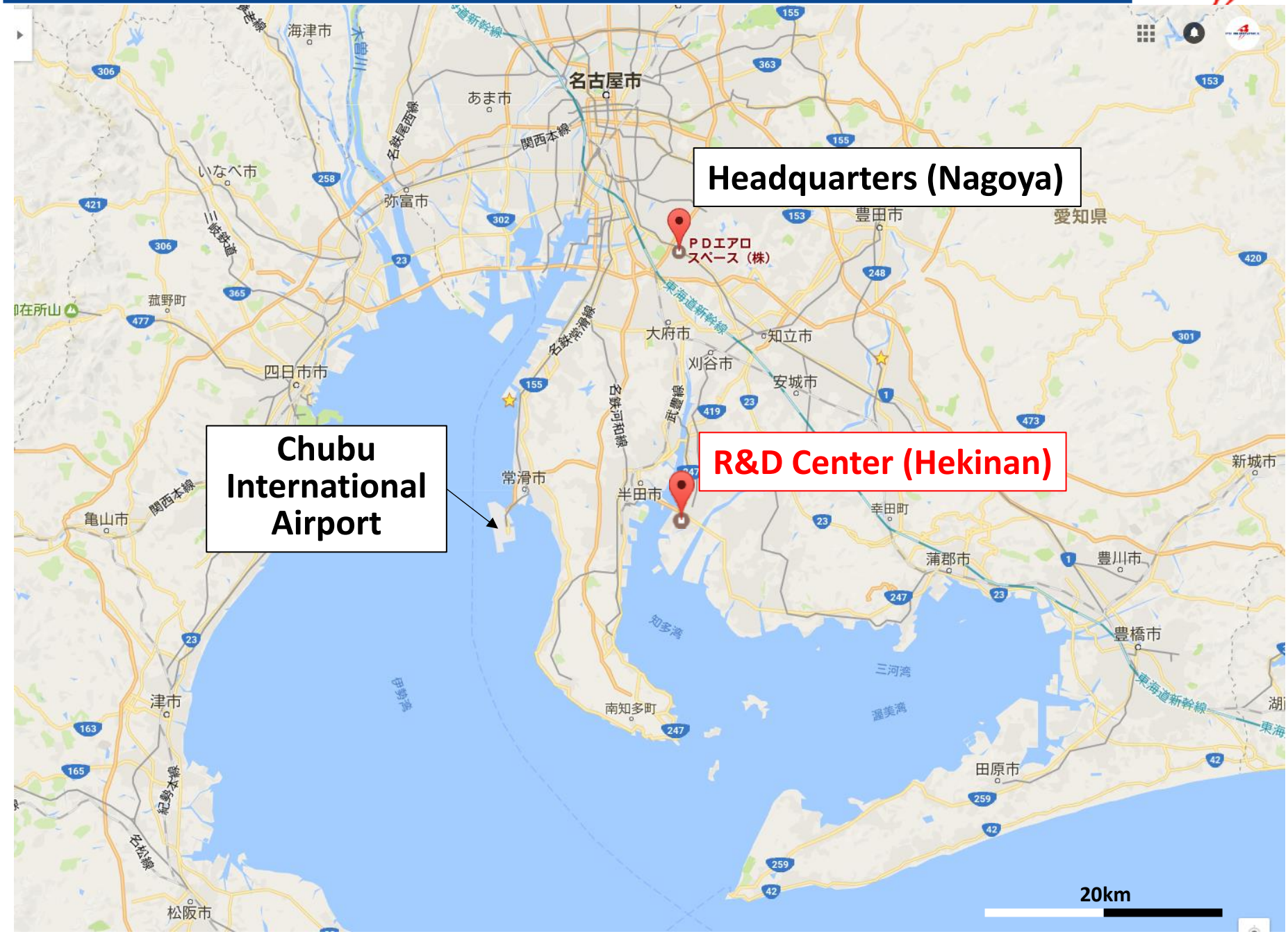
Location

① Headquarters
Nagoya City,
Aichi Prefecture

② R&D Center
Hekinan City,
Aichi Prefecture

③ Flight test site
Shimoji-shima Airport
Miyakojima City, Okinawa

Location (Headquarters, R&D Center detail)



"Be a Wing for Space"

- Space is vast and mostly unknown. Soaring into outer space will give us opportunities to discover a myriad of possibilities. We may even find totally new energy resources out there.
- Seeing our Planet Earth from space will also reawaken our love for nature and life.
- Travel to space will also present difficulties and risks. However, taking on those challenges will benefit humanity immensely.
- At PD AeroSpace, we are determined to make space more accessible and are committed to **"Be a Wing for Space".**

Our Corporate Philosophy

1. We contribute to society with technology.
2. We maintain harmony with space, the Earth, nature, and humanity.
3. We strive to be a company that society wants to exist, and to show the significance of its own existence in its activities.

Our Mottos

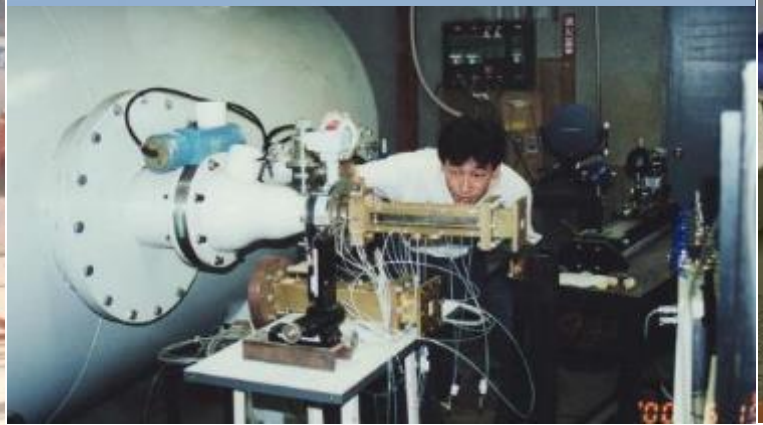
1. Embrace the challenge and never give up.
2. When there is no path, make one yourself.
3. Not improve, but innovate.
4. Understand that time and space are limited and take action accordingly.

Our Chief Executive Officer

CEO & CTO

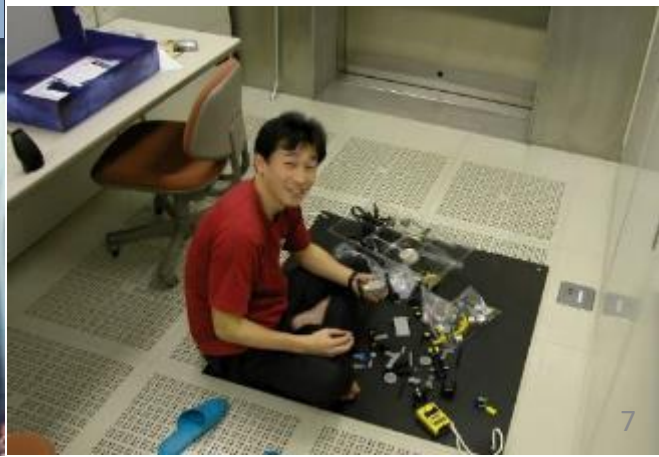
Shuji Ogawa

- Born in Nagoya, Japan.
- Helped his father with experiments and inventions since childhood and aspired to become a pilot and astronaut.
- Graduated from Division of Aerospace Engineering, Graduate School, Tohoku University. Developed aircraft and automobile parts.
- Member, Space Transportation Systems Subcommittee, Office of National Space Policy, Cabinet Office.
- Shuji is the Founder and CTO of the company.

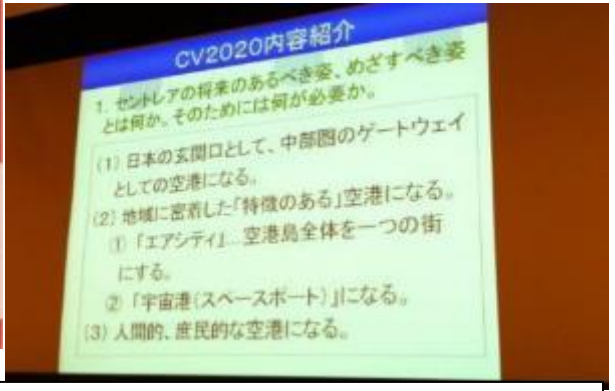


AISIN

アイシン精機株式会社



Ten years of progress since our inception



TV interviews

Shuji Ogawa, our CEO, was appointed to "Space Policy Committee" by Prime Minister Shinzo Abe ↓

緒　川　　修　治

(発動内容)

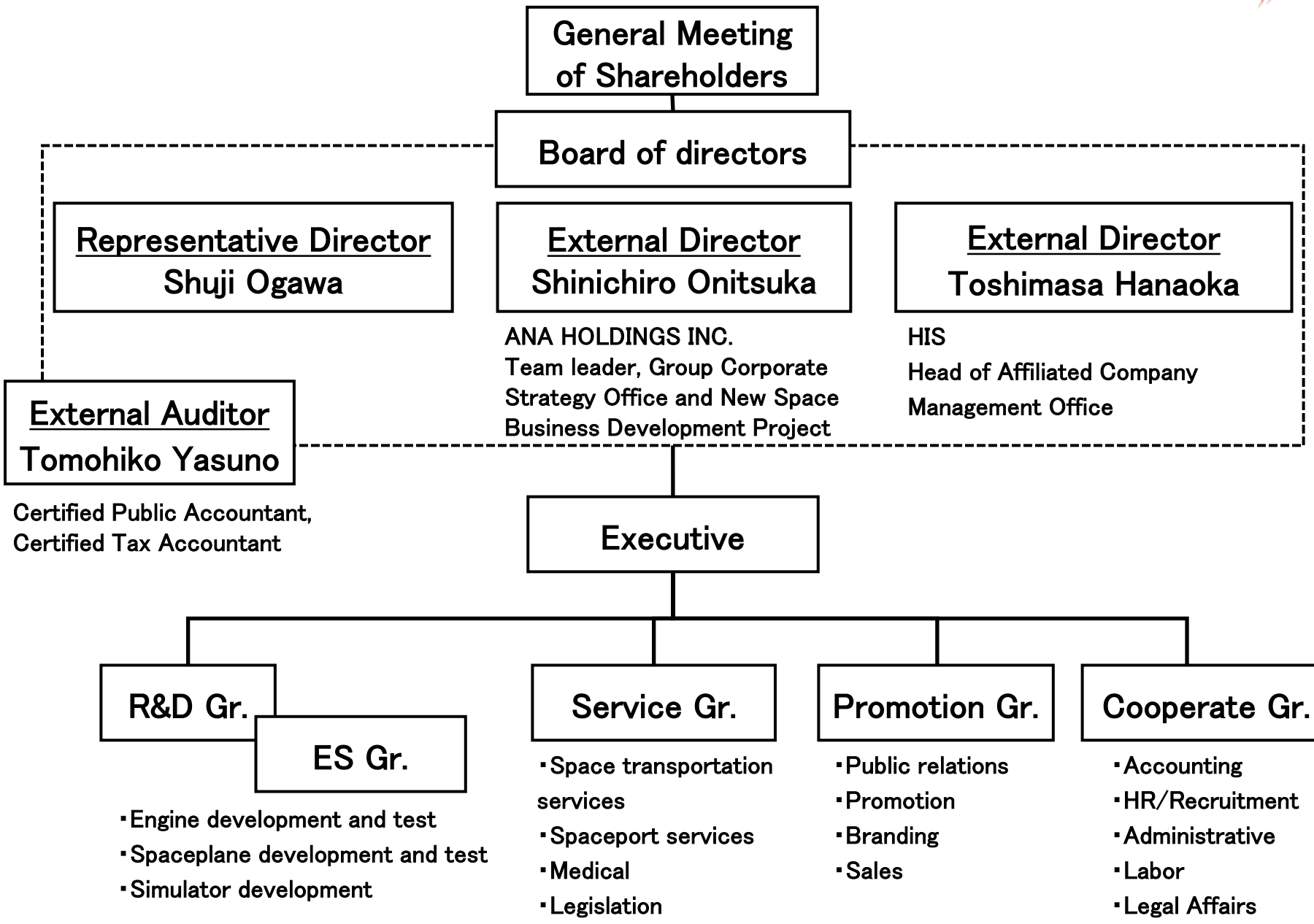
宇宙政策委員会臨時委員に任命する

平成　25　年　3　月　15　日

任命権者

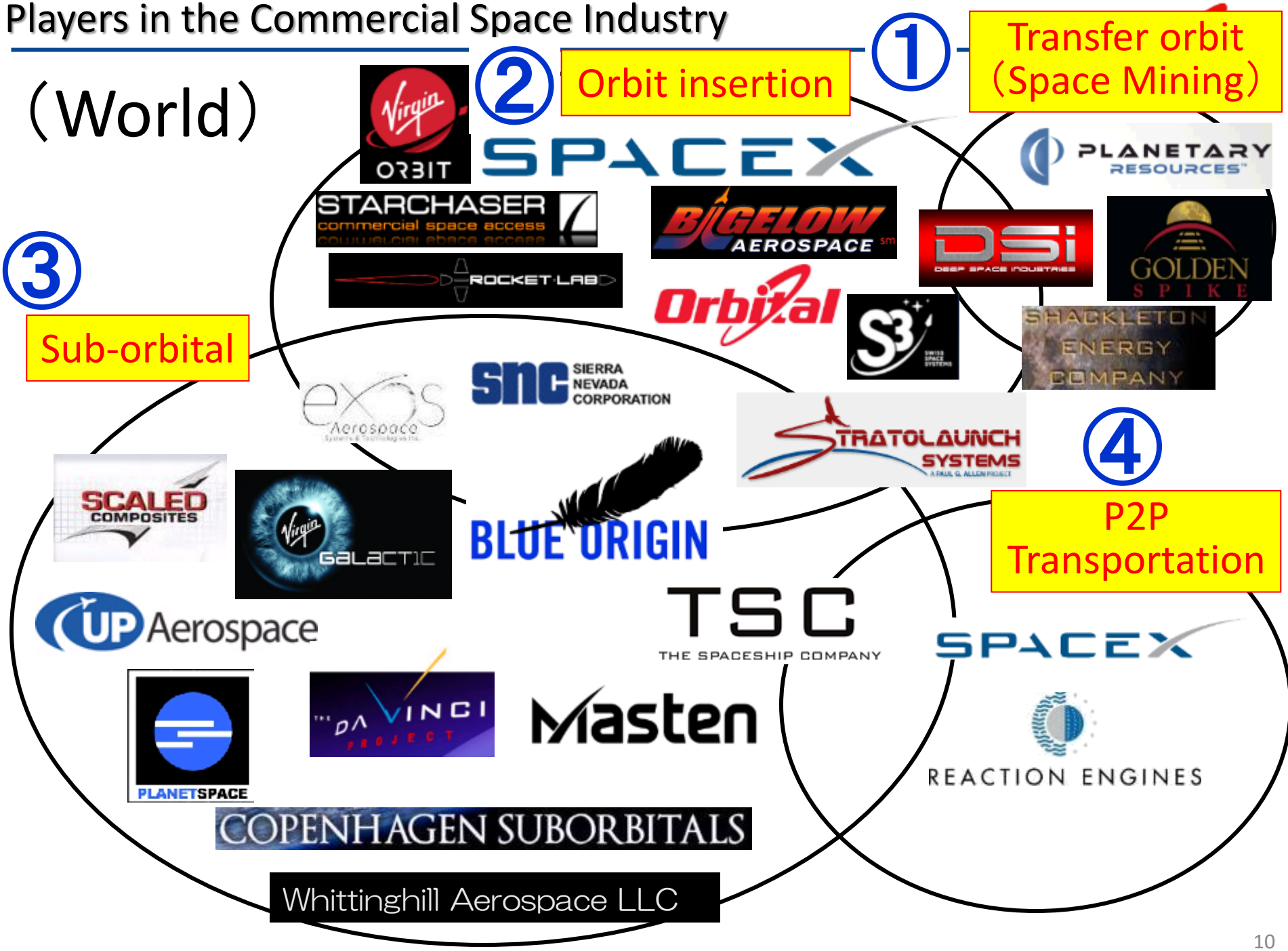
内閣総理大臣　安倍晋三

Management team

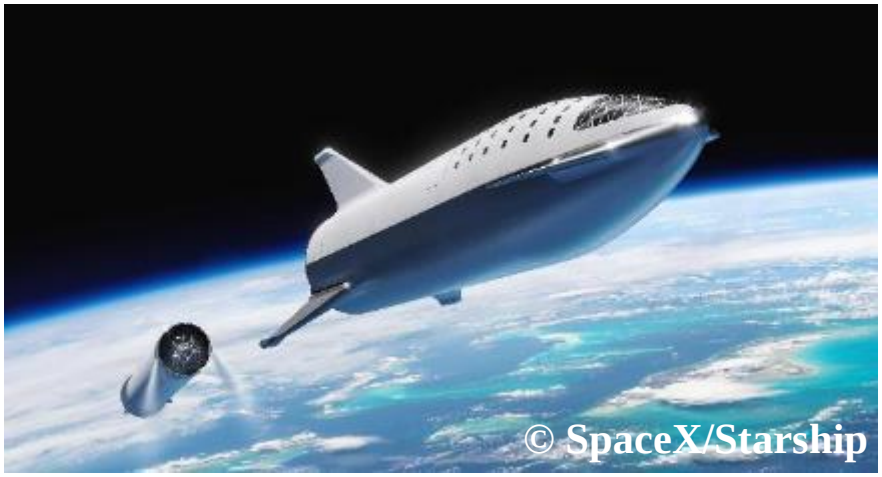


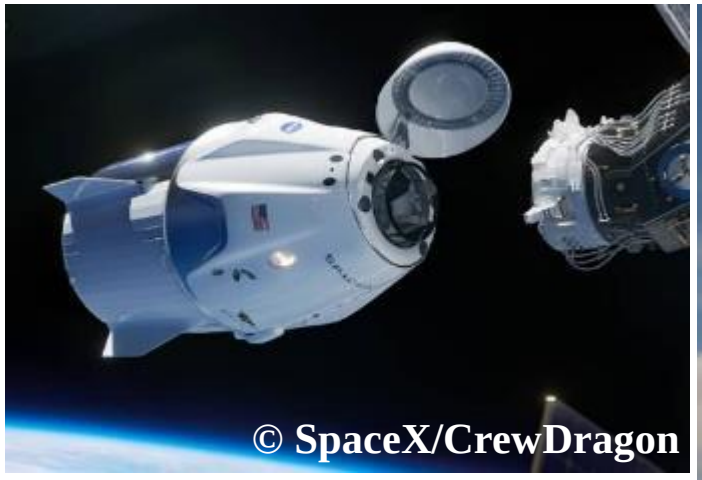
Players in the Commercial Space Industry

（World）



Images of various Spacecrafts (Overseas companies)





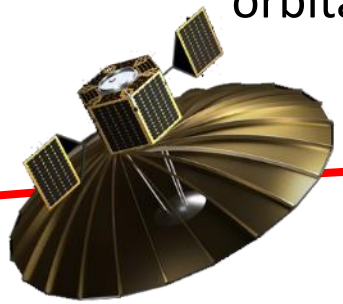
Our Target Businesses

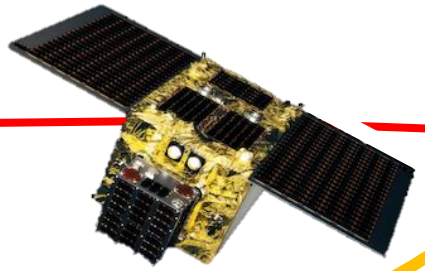
PD AEROSPACE

2nd Target

Small satellite orbital insertion

Orbital flight





400～600km

1st Target

Sub-orbital flight

Unmanned

Sounding rockets

Manned

Space Tourism

3rd Target

Hypersonic transport

Intercontinental flight (P2P flight)

Earth

Business Development Path

Business target	Unmanned spaceflight	Manned spaceflight
1st Target Sub-Orbital	• Microgravity experiments • Atmospheric measurement • Flying testbed ① X07	• Sub-orbital space tourism ③ X08
2nd Target Orbital	• Satellite orbital insertion ② X09	• Space station transportation ④ X10
3rd Target Point-to-Point (P2P)	• Freight transportation	• General tourism
Spaceport	• Test activities • Collaborative services	• Commercial takeoff and landing

Blue path - Starting with "unmanned" sub-orbital ①, then expanding to orbital ②

Orange path - At the same time, we will acquire manned space technologies (③ ④)

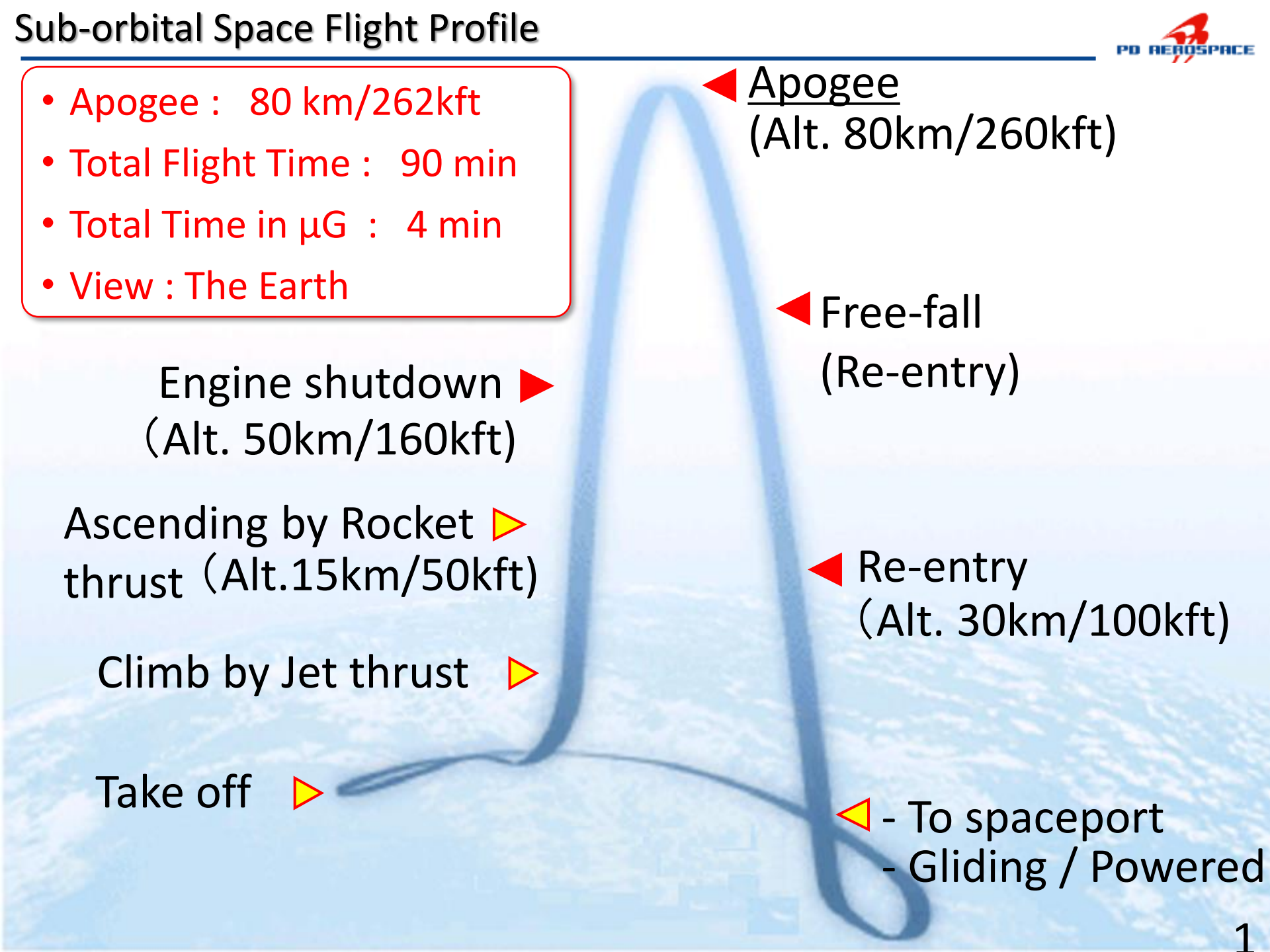
- **Zero G , Lunar G Environment**

G : Gravity

- **Solar Space Power Plant (Construction)**
- **Spaceport island (Shimoji-shima Spaceport)**
- **Japan to New York in 2 hours (P2P)**
- **Space tourism for the whole family**

Sub-orbital Space Flight Profile

- Apogee : 80 km/262kft
- Total Flight Time : 90 min
- Total Time in μG : 4 min
- View : The Earth



Technical and Business Alliance for Space Transport

HIS ANA ハウステンボス MIZUHO Mizuho Capital Future Venture Capital optima ventures CBC AWA 豊田通商株式会社 OKB グループ 株式会社OKBキャピタル

Multiple individual investors

- Bringing space closer to us, moving forward to realize **peaceful and prosperous society**.

- **Be a wing** that bridges Space and Earth.

Business Scope

PD AEROSPACE

【R&D】⇨【Manufacturing, Maintenance】

- Design
- Manufacture
- Periodical maintenance

(Collaborative research)

Universities, Research institutes

(Development partners)

OEMs
Parts suppliers, Manufacturers
Software developers

* To purchase existing products for electronic devices and parts

ANA (Planned)

【Operation】

- Flight operation
- Daily maintenance
- Ground service

HIS (Planned)

【Service】

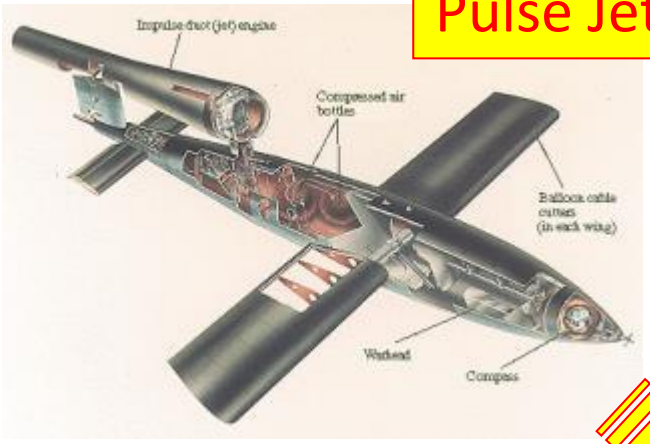
Customers

- Japan Meteorological Agency
- Universities, research institutions
- Aerospace manufacturer
- Planning companies, travel agencies

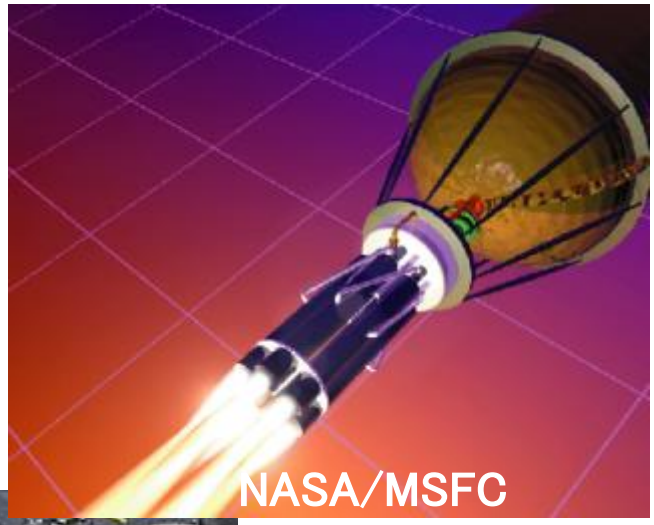
Detonation Engine Technology

PD AEROSPACE

Pulse Jet Engine



V-1（ドイツ）



Detonation Engine

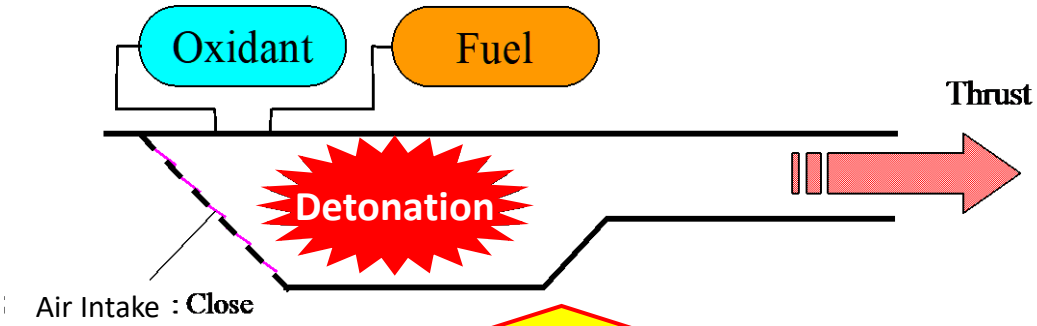
Original concept
“Jet/Rocket combustion mode Switchable Engine”

Jet/Rocket combustion mode switchable engine

Detonation engine features: Uses detonation combustion and can switch from jet to rocket combustion and vice versa, depending on atmospheric conditions.

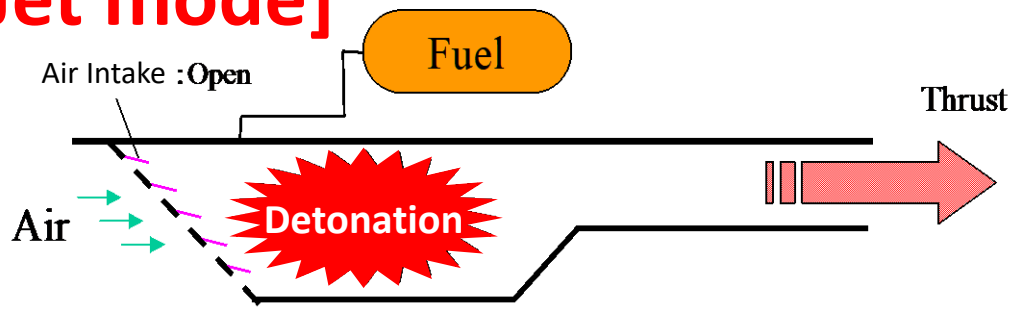
(Pulse Detonation Engine : Patented in 2012)
(Rotating Detonation Engine : Patent application in 2022)

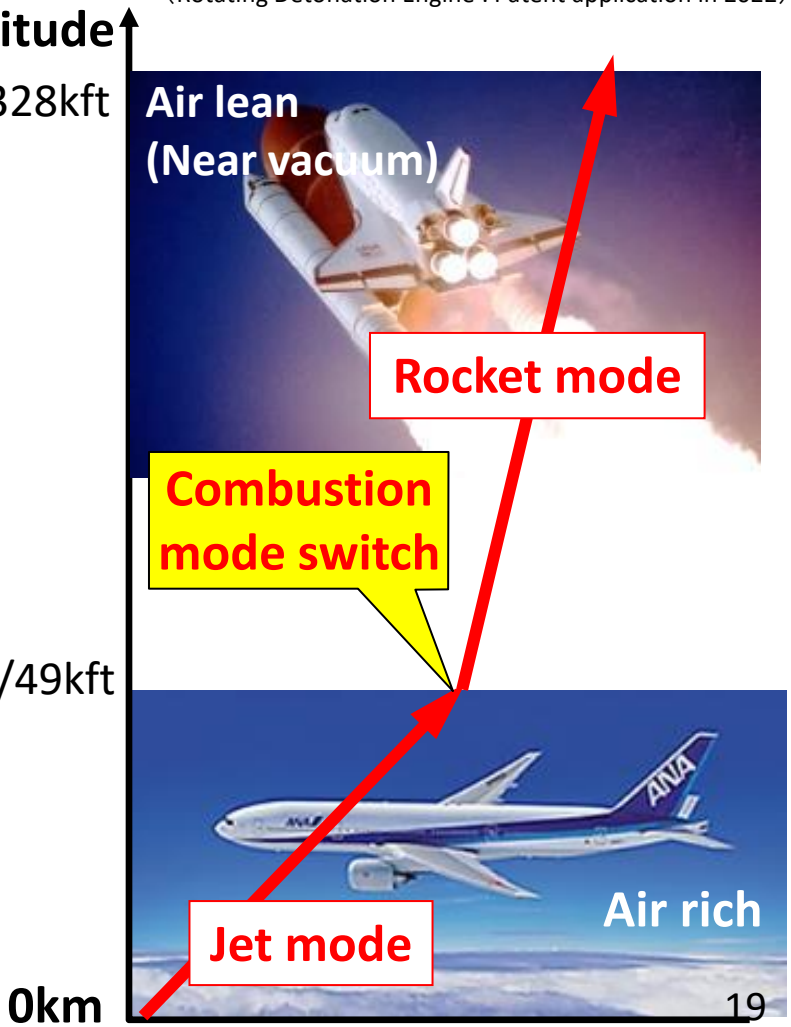
[Rocket mode]



Combustion mode switch

[Jet mode]





Jet/rocket combustion mode switching engine

Switch from jet to rocket to jet for takeoff, space flight, and landing

(Unique system based on the rotating detonation engine)

燃焼実験動画

Competitive power

VTVL: Vertical launch, vertical landing HTHL: Horizontal takeoff, horizontal landing

	Rocket Type	Winged Type	Winged Type
Appearance			
Plane name	New Shepard	SpaceShipTwo	PEGASUS
Country	USA	USA	Japan
Manufaturer	Blue Origin	The Spaceship Company	PD AeroSapce
Type	Rocket type (VTVL)	Winged type (HTHL)	Winged type (HTHL)
Cost	△ Acceptable unknown	--- $500K/person	○ Competitive $350K/person
Safety **(Re-entry)**	○ Good by Reverse thrust, Parachute	--- by ONLY Gliding	◎ Very good by Powered flight (Retryable landing, waiting)
Versatility	--- Even Needed launch site, Landing place	--- Dedicated spaceport	◎ Very good Avalable regular airport
Develop. difficulty	○ Good Possible by current tech.	--- Experiment success	△ Weak Needed new technology

PD AEROSPACE

1) Safety improvement

- Able to abort at any phase of flight
- Able to hold and perform go-around
- Able to keep flight permitted area, divert to another airport

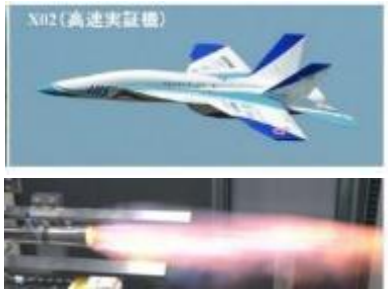
2) Lower production and operational costs

- Simple system = Lower production and maintenance costs
- Able to reduce numbers of pilots, maintenance staff, tools and spare parts = Reduced maintenance costs
- Specialized airport not required = Lower operation costs
- High efficiency engine = Reduced fuel costs

3) Expandable

- For multiple purposes

Design study of suborbital spacecraft applying hypersonic engine technology



JAXA
Operates at Mach 5 from takeoff
Hypersonic engine technology

PD AeroSpace LTD.
Jet/Rocket Hybrid Engine Technology, Unmanned Aerial Vehicle Experimental Technology

Joint research results
Presented the feasibility of a suborbital spacecraft reaching an altitude of 100 km with a jet/rocket hybrid engine.

Aerospace Development Applications

Reusable Space Transportation

Private Business

Suborbital spaceplane

Collaborative Research Implementation System

Research Representative：PD AeroSpace LTD
（CEO Shuji Ogawa）

Researcher in JAXA：Aviation Technology Division
（Propulsion Technology Research Unit ／ Hideyuki Taguchi *et al.*）

Background and Outline of Joint Research

Suborbital spacecrafts, which are being developed by various companies for applications such as space travel and nano-satellite launches, are typically equipped with separate jet engines and rocket engines, or with the same vehicle. However, the use of two different engines or two different airframes results in a complex and expensive system.

PD AeroSpace has the technology and knowledge to develop a new concept engine that switches between jet and rocket combustion.

This joint research will utilize the hypersonic engine technology developed by JAXA, which can operate at Mach 5 from takeoff, to complement the design of the jet/rocket switchable hybrid engine and present the feasibility of a suborbital spacecraft with improved reliability and safety while reducing operational costs.

The jet/rocket switchable hybrid engine and suborbital spacecraft technologies are expected to be applied to future reusable space transportation vehicles.

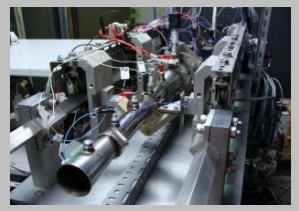
Business development after completion of joint research

By utilizing the spaceplane system to be created, we aim to develop services such as suborbital space travel, provision of observation and experiment environments, manned/unmanned microgravity experiments, and nano-satellite launches.

Development roadmap

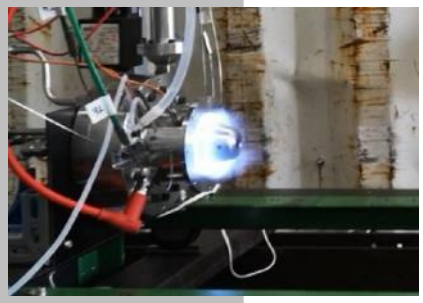
~2020 | '21 | '22 | '23 | '24 | '25 | '26 | '27 | '34

【Engine】



Pulse Detonation Engine (Rocket)

Pulse Detonation Jet/Rocket switching engine



Rotating Detonation Engine
FTE2n (X06), FTE3n (X07)

【Suborbital Manned】
X08, PEGASUS
2032
Achieve manned suborbital flight

【Airframe】

FPV、
Tracking system

200km range

Spaceport Facility

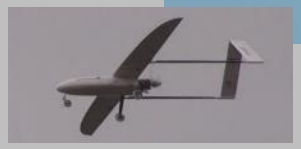
Scale up unmanned technology

X02A

X06

【Suborbital Unmanned】
X07
July 2027 Achieve unmanned suborbital flight

Autopilot
X03A



X04
Unmanned technology demonstrator

【Orbital】
X09
Oct 2030

X-Planes and New-type Rocket Engine

PD AEROSPACE

X01（for Demonstration）

X02A（for High-speed flight）

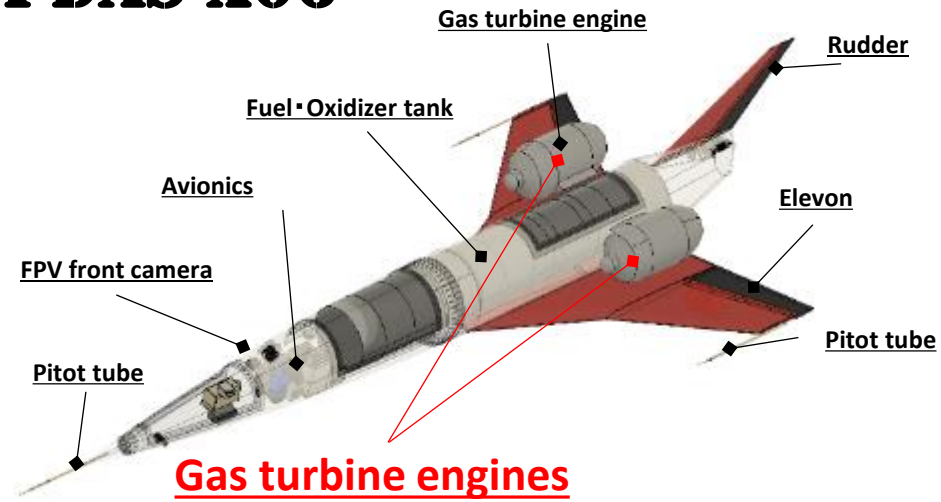
X03A（for Autopilot）

X06 (Integrated Technology Demonstrator)

X04 (Remote Control Demonstrator)

Technology Demonstrators

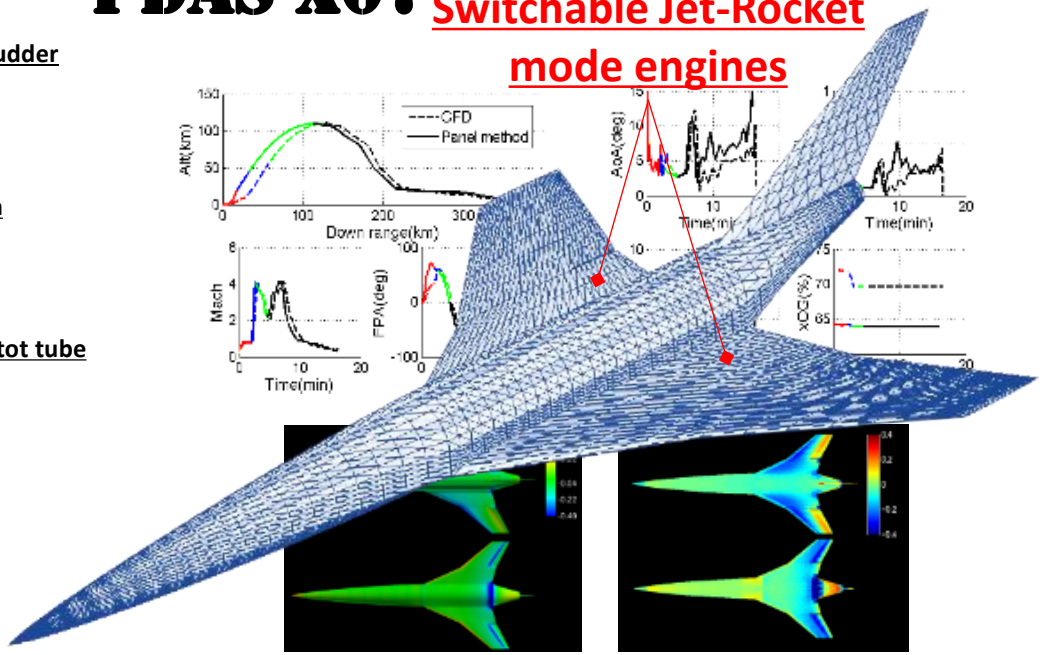
PDAS-X06



Gas turbine engines

PDAS-X07

Switchable Jet-Rocket mode engines



Specifications	PDAS-X06	PDAS-X07
Length	4.9 m	10.4 m
Wingspan	2.4 m	5.0 m
MTOW	400 kg	3.5 t
Service Ceiling	10 km	> 80 km
Max Mach	M0.35	M3.2
Max Total Thrust	3 kN	40 kN x2
Engine	Gas Turbine x2	RDE-C/S

Flight Testing

Maintenance in Hangar


Entry to Commercial airport

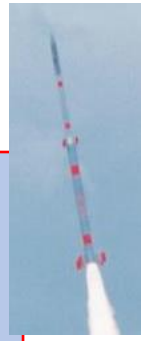
Ground Control Station
（Radio Communication System）


Inside of GCS（Cockpit System）

As a service provider

CONFIDENTIAL

PD AEROSPACE



Sounding Rocket

High Altitude Service

Altitude

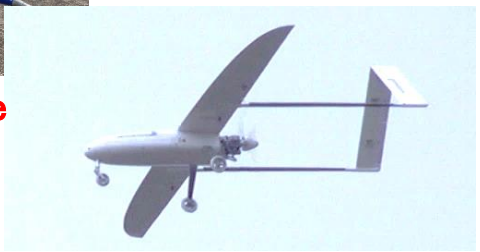
80km

Sub-Orbital Flight Area

High Speed Service

Ground Control Station

Flight Simulator



Long endurance service

Weather Balloon

15km

Aviation Flight Area

Commercial Drone

Helicopter, Airplane

Payload / Distance / Speed

Spacecraft orbital insertion overview

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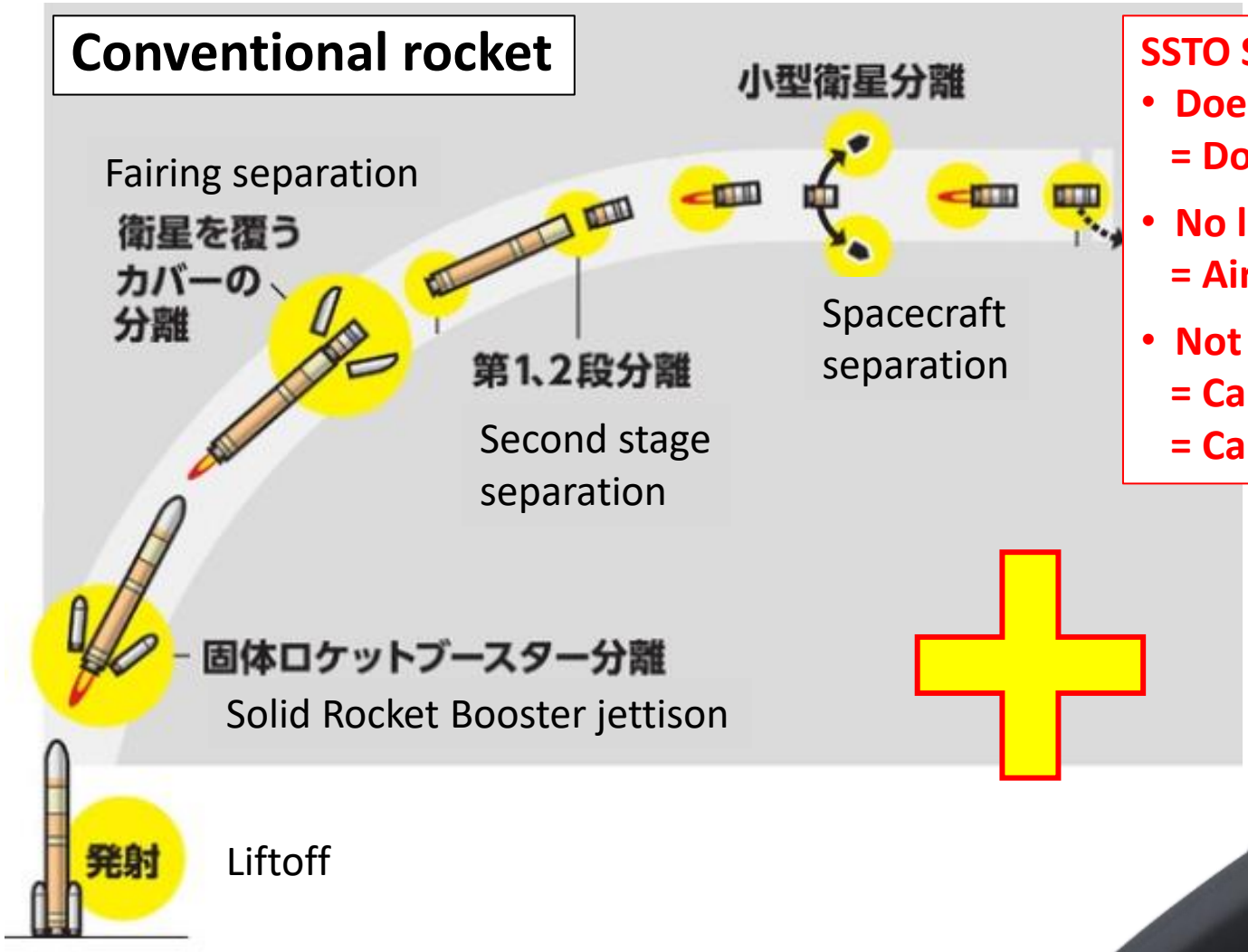
Conventional rocket



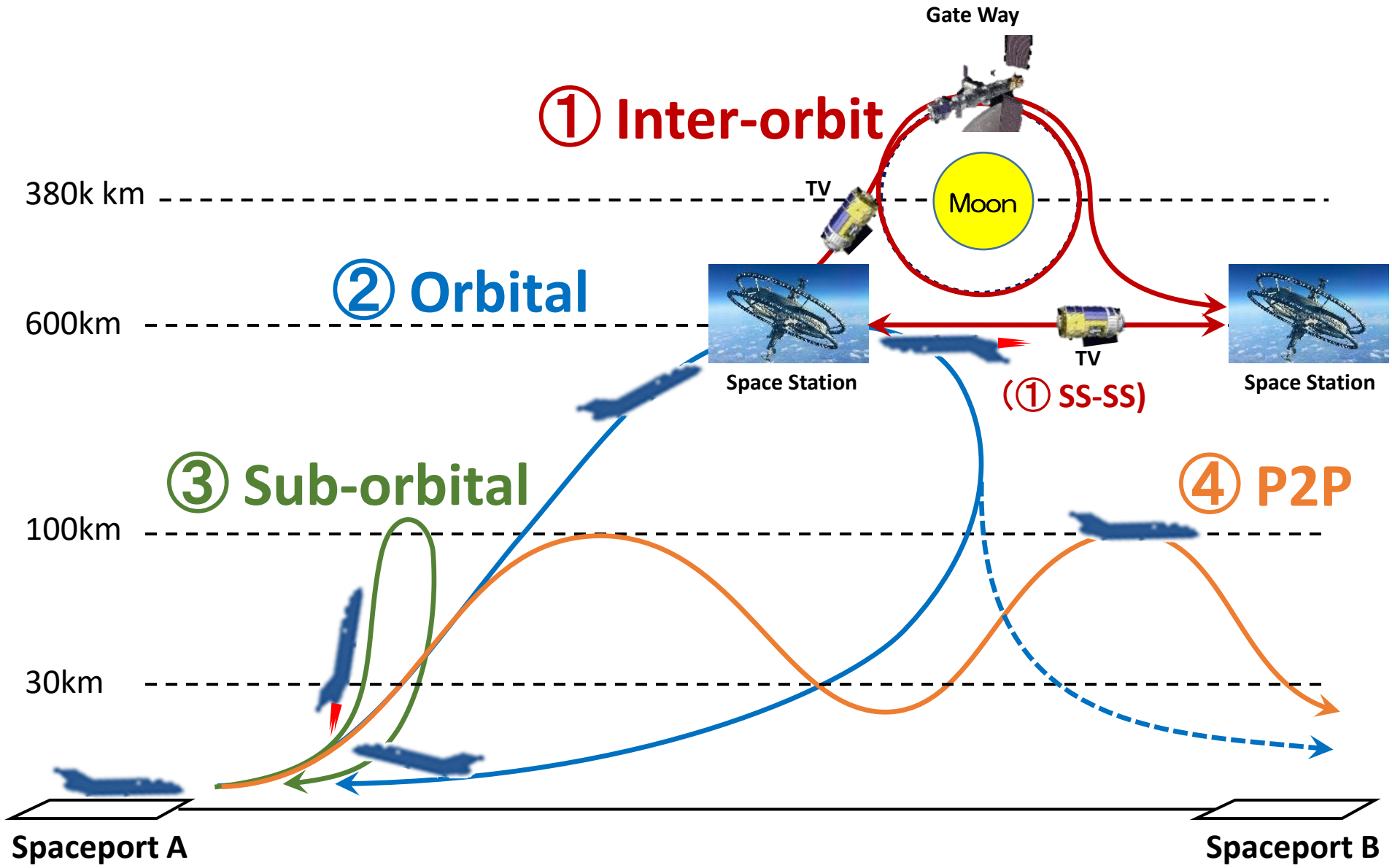
SSTO Spaceplane

- **Does not separate**
  = Does not produce waste
- **No launch site required**
  = Airports can be used
- **Not disposable**
  = Can be used multiple times
  = Can be used frequently

Spaceplane

SSTO：Single Stage To Orbit

Our proposal to the Japanese Government

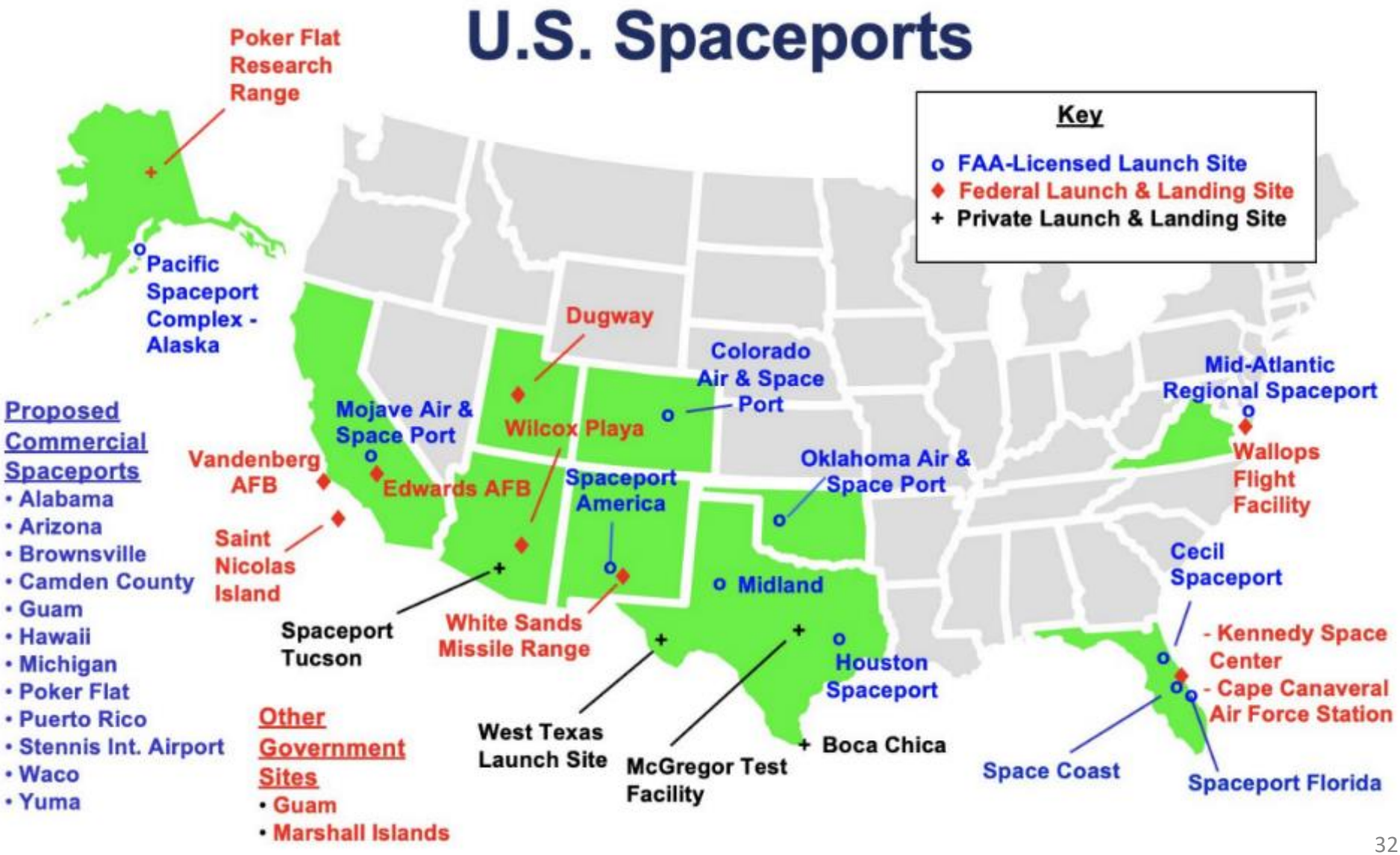


Spaceport Business

- Development site
- Operation site

※ Japan and Overseas

Currently 14 Authorized Spaceports



Currently 4 Active Spaceports

Taiki, Hokkaido

Oita

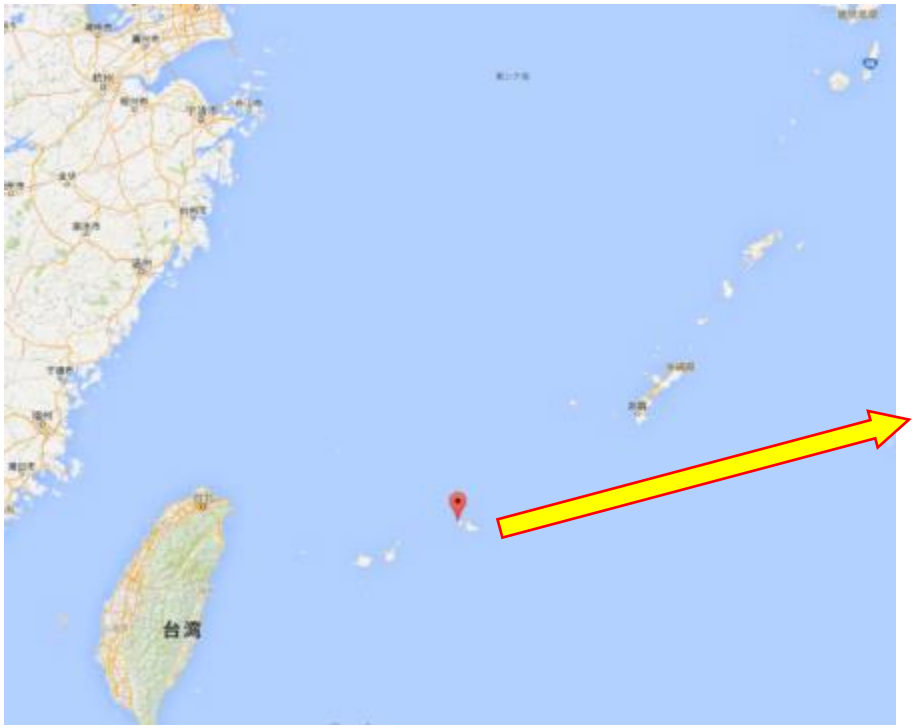
Shimoji-island, Okinawa

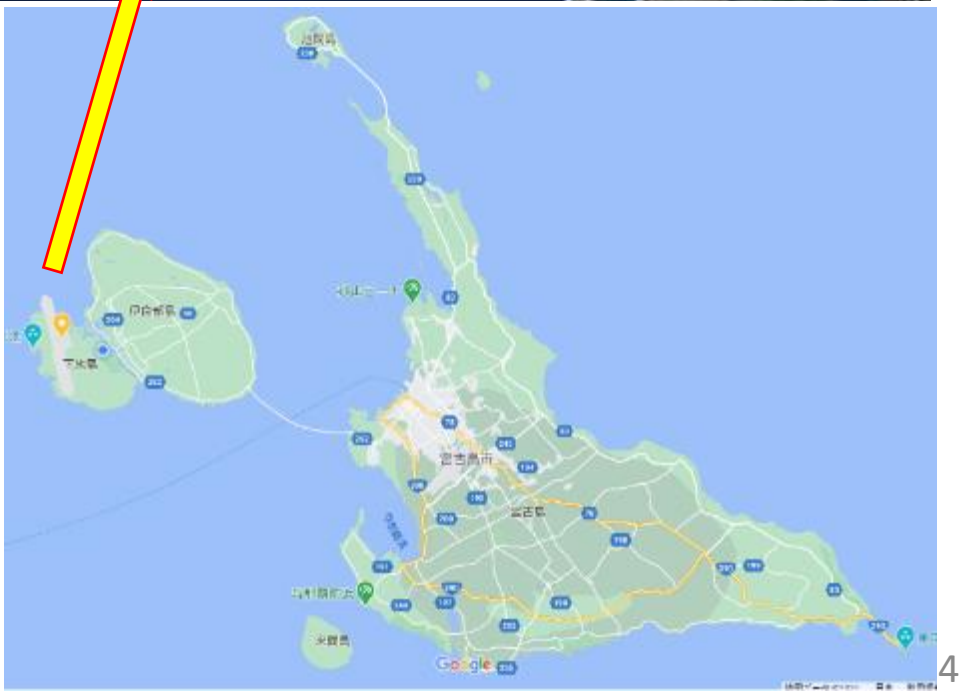
Kushimoto, Wakayama

PD AEROSPACE

[Shimoji-island (Shimojishima)]

- 320km from Okinawa island
- 3,000m x 60m runway
- Fully equipped air traffic management facility
- Wide civil airspaces on North and South corridors





Spaceport Development (Spaceport Asia in Okinawa)

[Shimoji-island: a Gateway to Space]

Aerial images courtesy of Mitsubishi Estate Co.

1. ”Spaceport”

To utilize Shimoji-island (Shimoji-shima) Airport as a takeoff and landing site for winged space craft (spaceplane): a Spaceport.

2. Two phases

The spaceport project will be developed in two major phases:

1) Initial phase: Flight testing of our experimental aircraft

2) Operation phase: Attracting companies from Japan and overseas

3. Four kinds of Services

1) Flight testing

2) Tenant

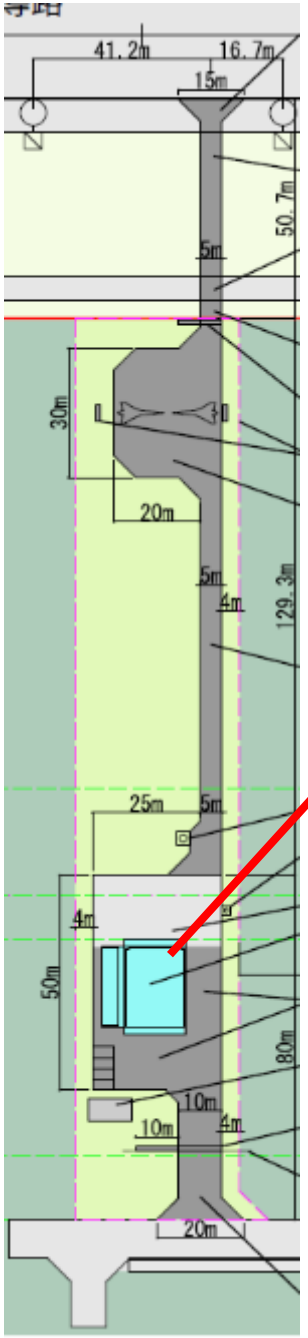
3) Training program

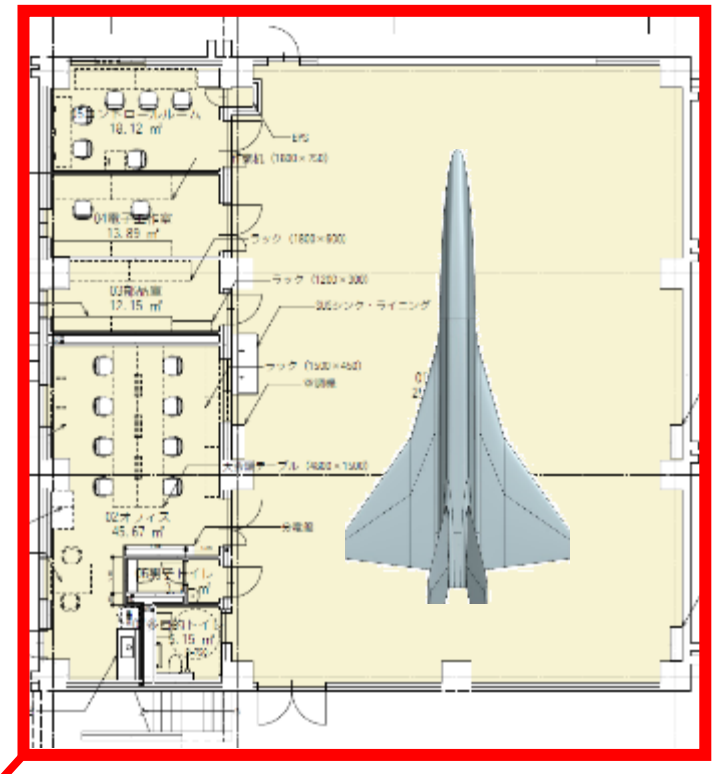
4) Tourism

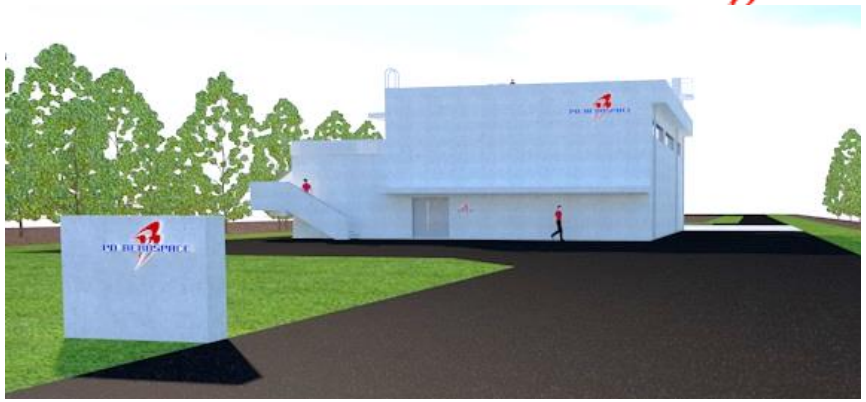
Spaceport Asia – Hangar 1 plan for X07

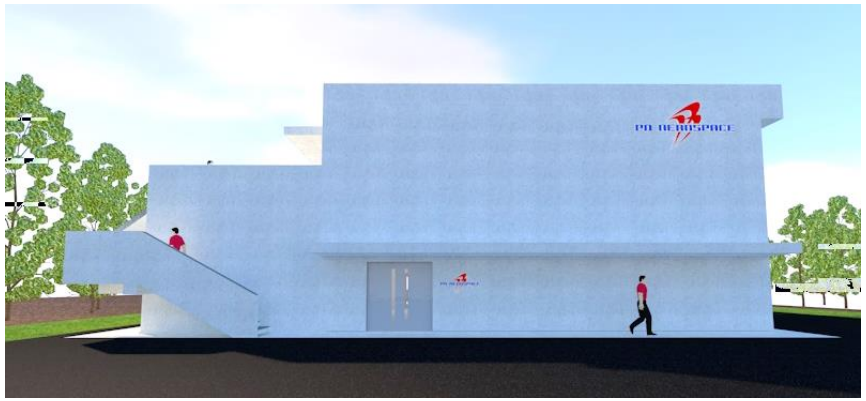
Construction of access road by Okinawa prefecture completed

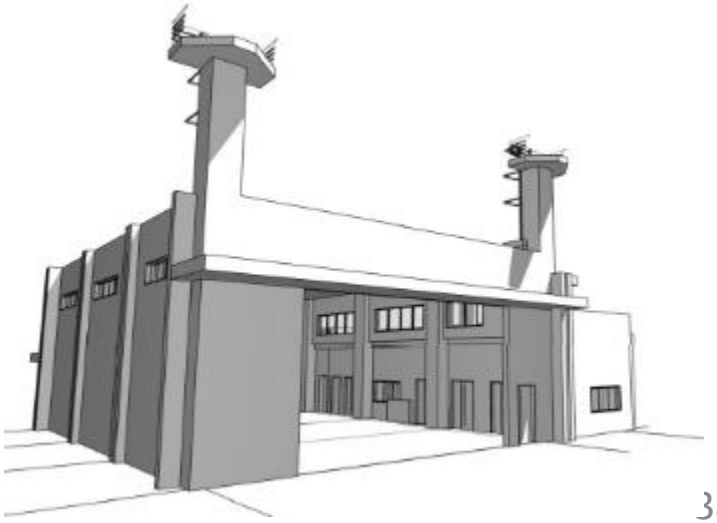
Spaceport Asia – Hangar 1 plan for X07











Spaceport Business Consortium

https://www.spc.pdas.co.jp/

Spaceport Asia Business Promotion Consortium

CONCEPT

設立の趣旨

「宇宙に行ける島、下地島」をキーコンセプトに下地島宇宙港事業並びに宇宙港事業を基点とした産業振興に資する活動を行うことを目的とします。
多種多様な事業者の皆様と連携し宇宙港事業を推進します。

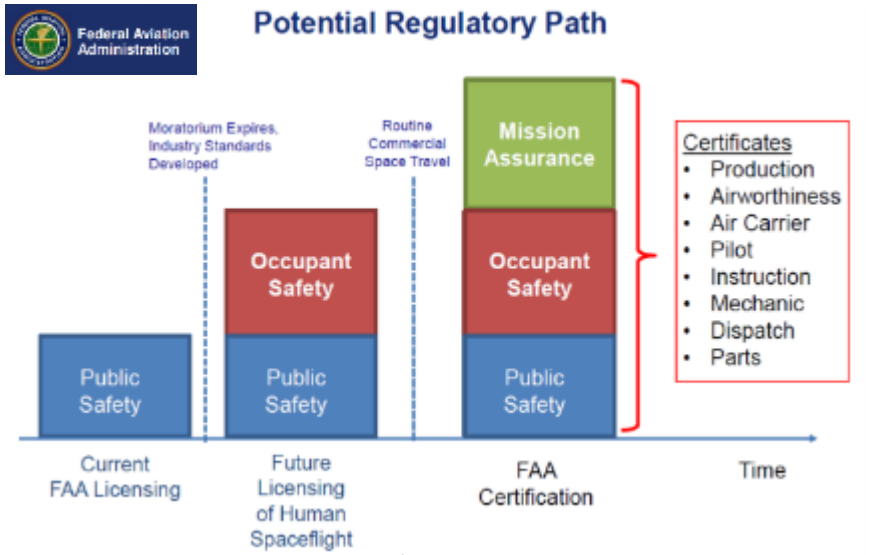
Spaceport Asia / Business Promotion Consortium: Members

PD AEROSPACE

※抜粋

Regulatory issues：Strategies for Human Space Flights

1. Roadmap



Commercial Space Transportation / FAA (COMSTAC-STANDARD WORKING GROUP (SWG) April 27-28, 2016 OBSERVATIONS, FINDINGS AND RECOMMENDATIONS (OFR'S)

2. Consideration of target group and IC

IC: Informed Consent

- 1) Operator
- 2) Participants in experiment
  - General IC
  - Special IC
- 3) Consumer

Participants in experiment：A person who accepts risk at their own risk (Neither a business nor a consumer).

Special IC：The participants in the experiment waive all claims for damages against the government and the operator

3. Organizing Correspondents

1) Public-private council
 / Two working groups

2) Local government
 / Special national strategy zone

3) Cabinet Secretariat
 / Regulatory sandbox

4. Consideration of response policy

Different policies from 1. through 3.

e.g.)
Introduce government compensation programs up to the level of certification

List of points to be considered for “Space Tourism”

10 themes	20 items
A) Plan	1. Business plan
B) Promotion	2. Promotion
C) Services	3. Service contents
	4. Customer Service
D) Ticket Sales	5. Sales method
	6. Sales
E) Flight Operation	7. Flight management
	8. Crew
	9. Cabin equipment
	10. Craft maintenance
F) Medical	11. Medical

10 themes	20 items
G) Insurance	12. Insurance
H) Law	13. Law issues
I) Spaceport	14. Construction
	15. Facilities
	16. Operation
	17. Other sites
J) Spaceplane	18. Development
	19. Docking
	20. Mass production

Development milestones

PD AEROSPACE

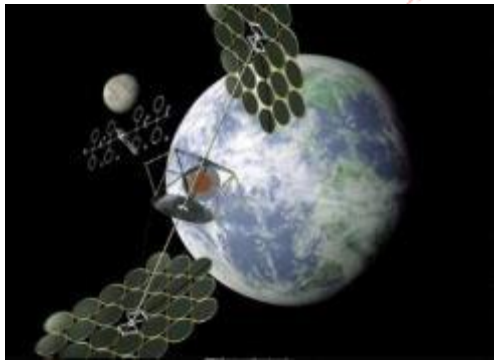
- Basic technology demonstration ～ Oct 2017
- Engine technology patent ～ Oct 2017
- Remote flight technolo ～ Jun 2023
- Mode switching engine demonstration ～ May 2024

Completed

Now

- Achieve Unmanned suborbital flight ～ July 2027
- Suborbital commercial operation ～ Nov 2027
- Achieve Orbital flight ～ Oct 2030
- Orbital commercial operation May 2031 ～

Long-term Objectives



Space mining

Space Transportation

Constructions

Space tourism

Air launch

Orbital launch

Altitude 100km

μG flight
(Flying test bed)

High alt. observation

Hypersonic transportation

Point to Point flight

Spaceport

Be a wing for Space

～ 宇宙への翼 ～