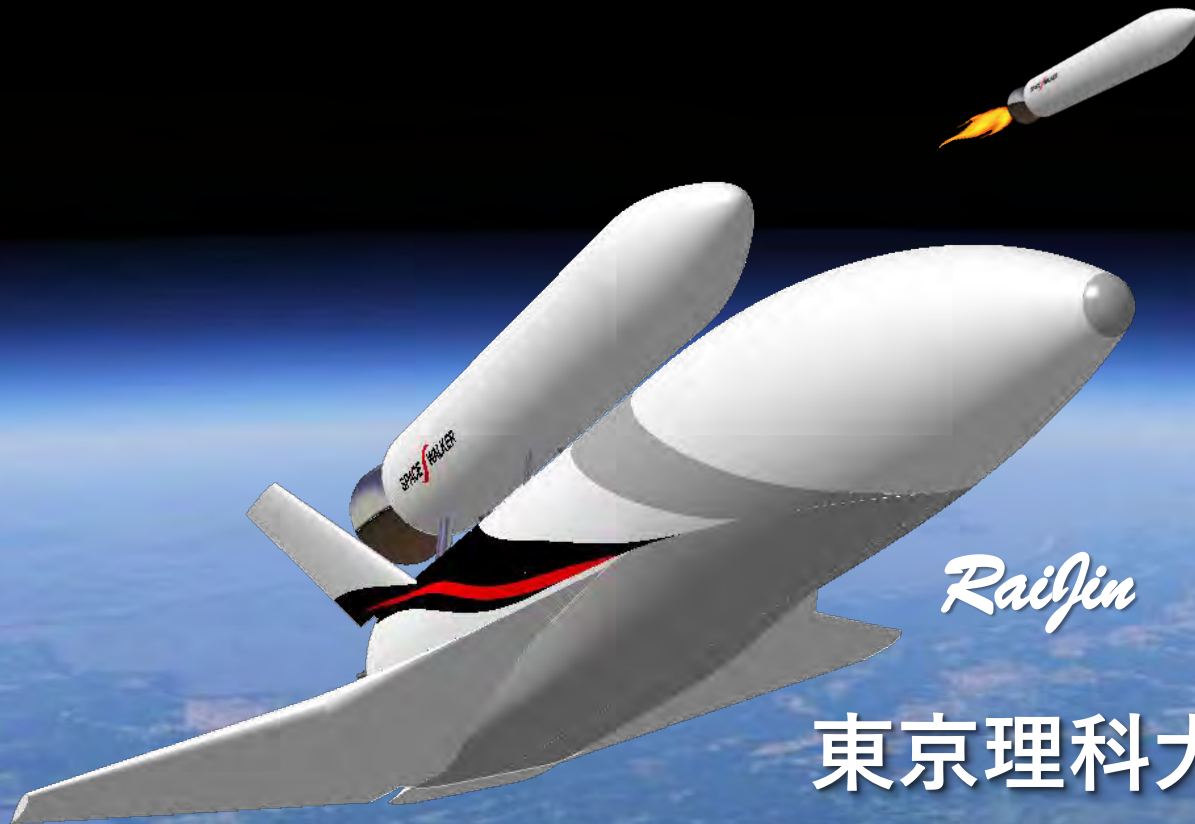


第6回サブオービタル飛行に関する官民協議会

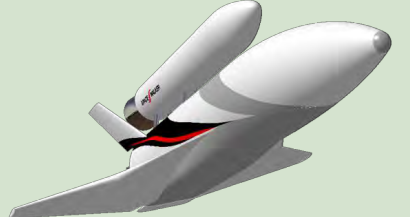
～ 2025年4月16日 ～



Railjin

東京理科大学発スタートアップ
SPACE WALKER
サブオービタルスペースプレーン
の開発状況

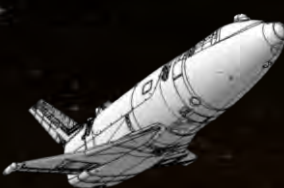
©Google

Company Name	SPACE WALKER Inc. (https://space-walker.co.jp/corporate-profile)	
Establishment	December, 25th, 2017	
Business Locations	HEAD QUARTER: Shimbashi 3-16-12 3Flr, Minato, 105-0004 Tokyo, Japan	
	SPACE TRANSPORTATION Division.: - Office in TOKYO UNIVERSITY OF SCIENCE Noda Campus, Building No.3, 2nd Flr (Yamazaki 2641, Noda, 278-8510 Chiba, Japan)	
	Composite Materials Technology Division.: - Office in KURE INDUSTRIAL PROMOTION CENTER KURE SUPPORT CORE (Agaminami 2-10-1, Kure, 737-0004 Hiroshima, Japan) - Manufacturing Plant in NIHON TAISHOKU Co., Ltd (Tashiromen 198, Tabira, Hirado, 859-4812 Nagasaki, Japan)	
Capital	439 mil. ¥ (Including Capital Reserve as of October 31, 2023)	
Activities	- Design, Manufacturing and Operation of Reusable Suborbital Spaceplanes - Manufacturing and Sales of Space Development Related Components	

1. Suborbital Spaceplane

- ✓ Unmanned Dual Mission for Science and Small Satellite Launch
- ✓ Common Shape for Space Tourism Service

2026



**Experimental
Winged
Rocket
WIRES#015**

2028



Fujin 風神
Raijin 雷神

Dual Mission

μ Gravity Science / Small Satellite Launch

2030



NagaTomo 長友

Space Tourism

Suborbital Spaceplane

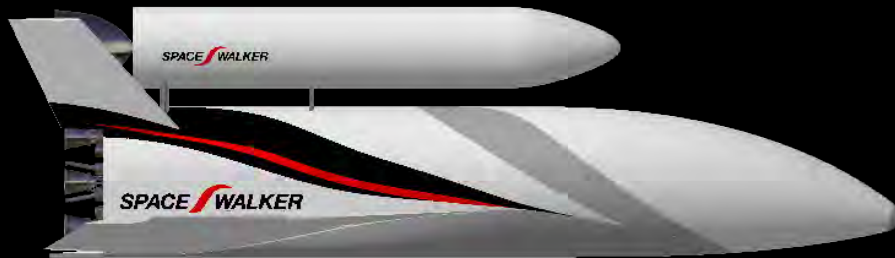
2040s ~



**TSTO
(Two-Stage-To-Orbit)
Spaceplane**

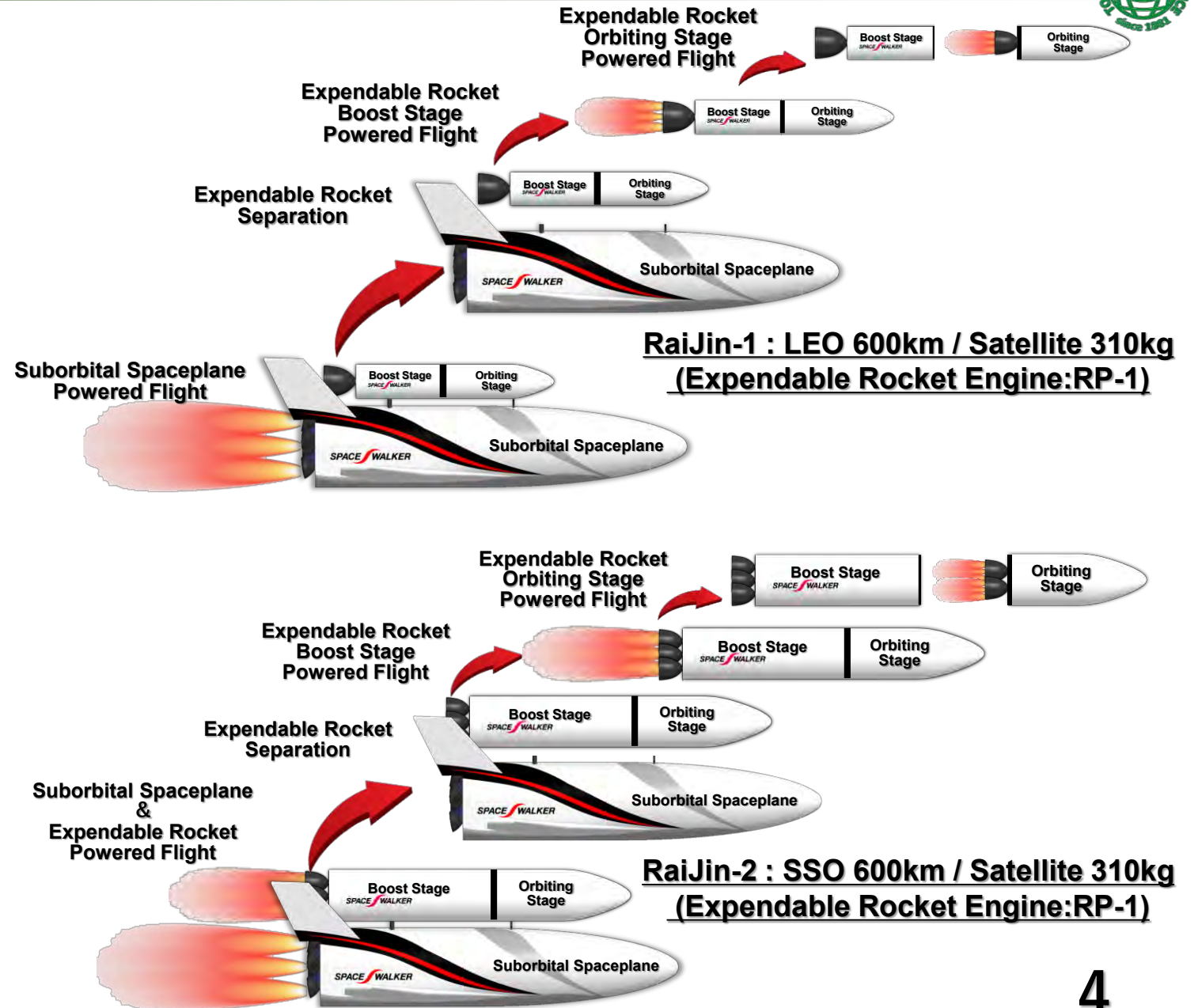
**Space Tourism
Cargo Transportation**

- **RaiJin (雷神) Mission**
- ✓ **Small Satellite of 310 [kg]**
- ✓ **Low-earth Orbit and Sun-synchronous Orbit of 600 [km]**



Elon Musk's Starlink
Satellite-Internet Service

<https://www.wsj.com/articles/elon-musks-starlink-satellite-internet-service-battles-dish-over-airwaves-11657359181>



- Multi-disciplinary Optimization Design

< Major Vehicle Dimensions >

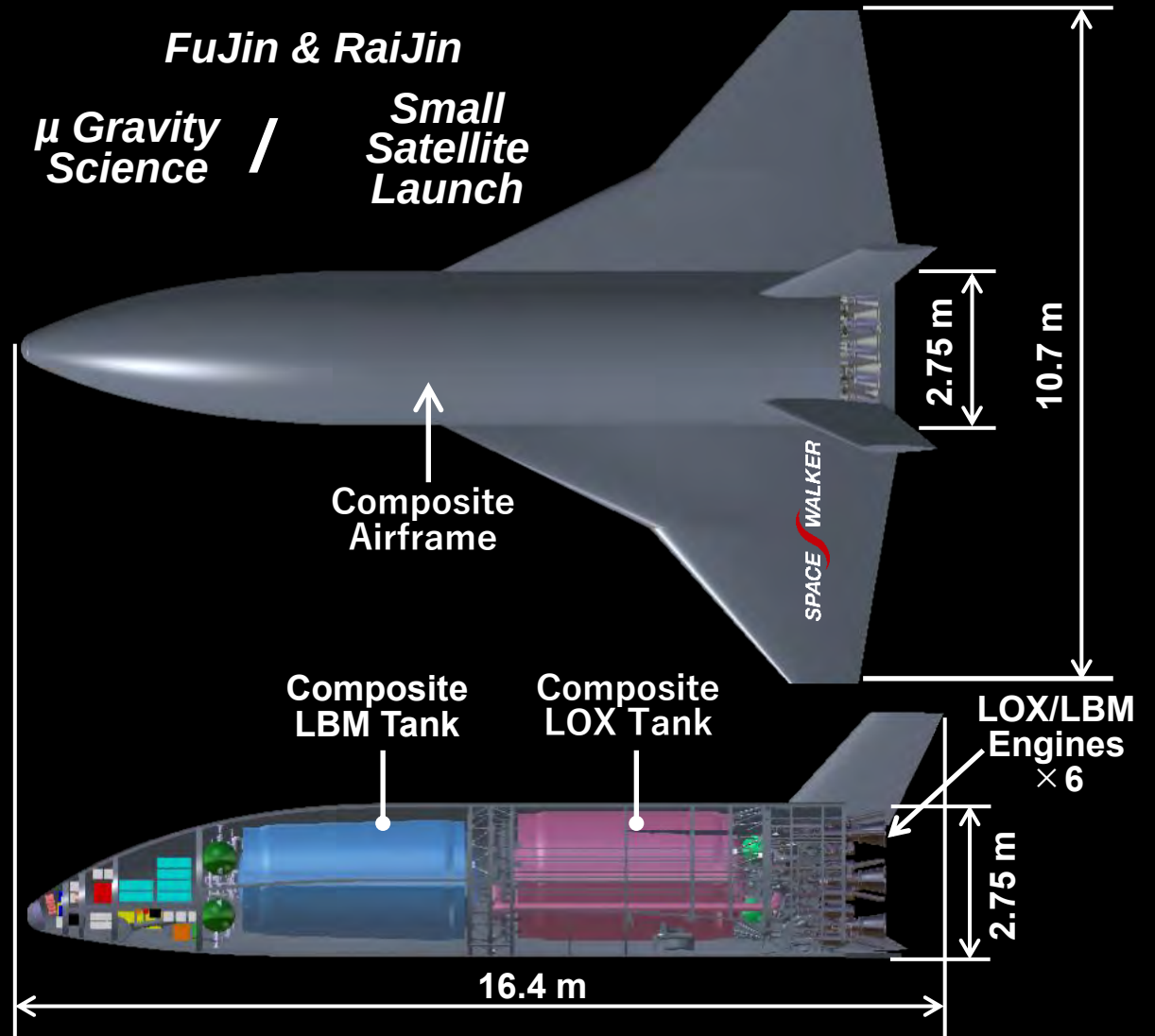
Length : 16.4 [m]

Span Width : 10.7 [m]

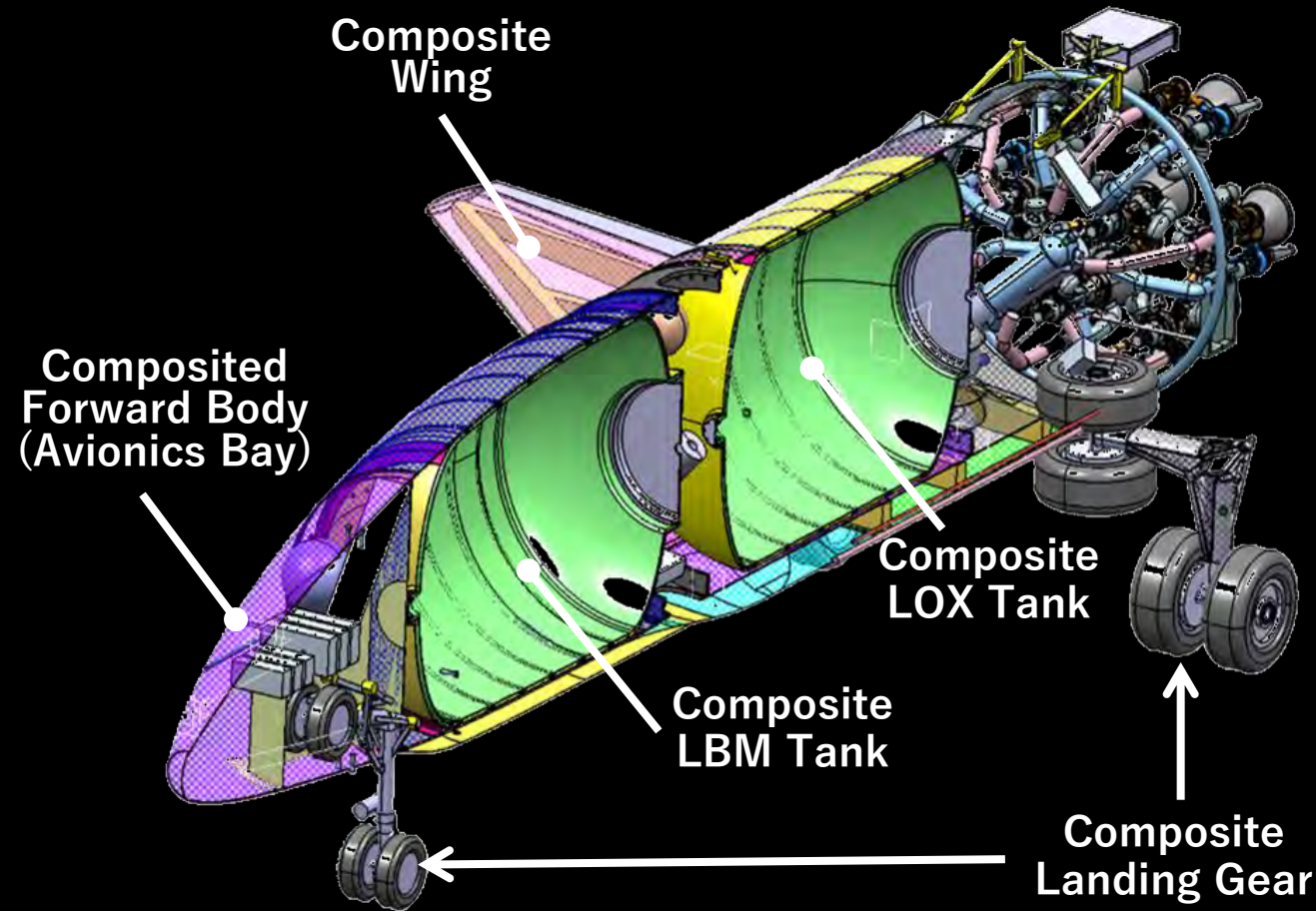
Body Width : 2.75 [m]

Initial Launch

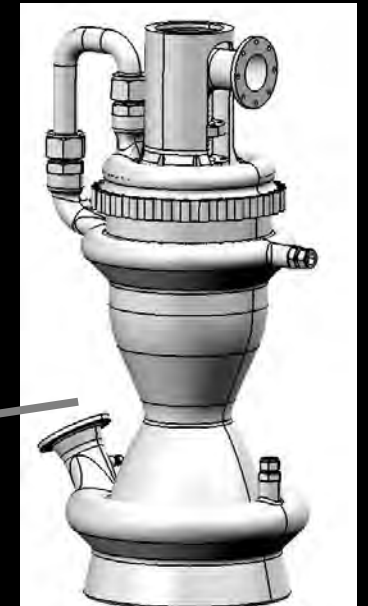
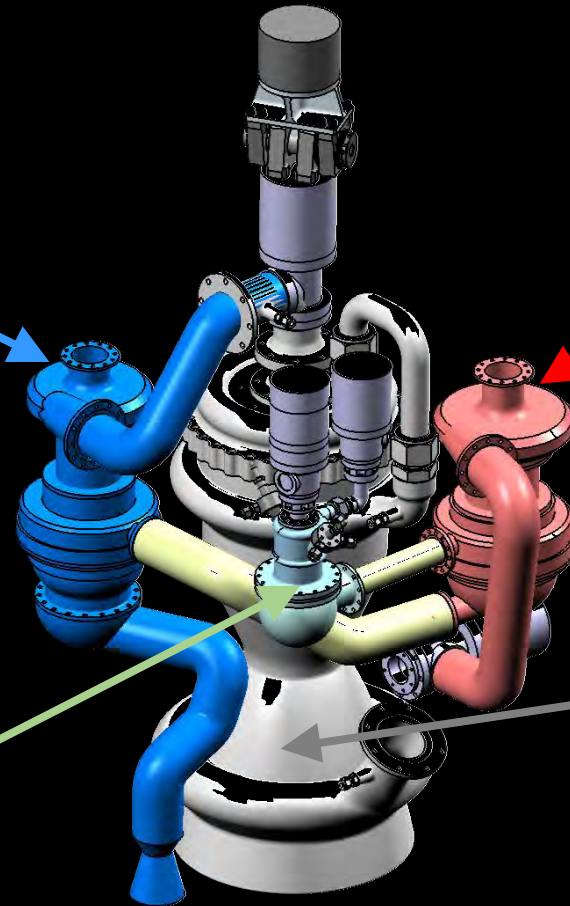
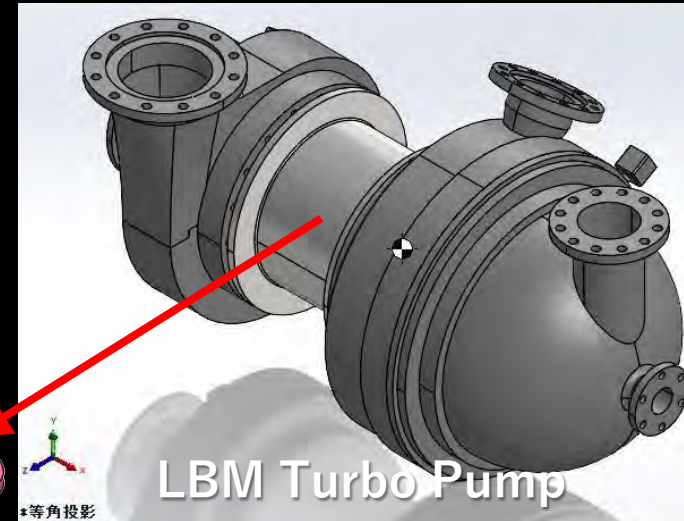
Mass : 42.3 [tonf]



- Composite Propellant Tanks (LBM & LOX) with Vacuum Insulation Layer Manufactured by ATP (Auto-Tape Placement)



● LBM (Liquefied Bio-Methane) Engine (Vacuum Thrust 10tonf)



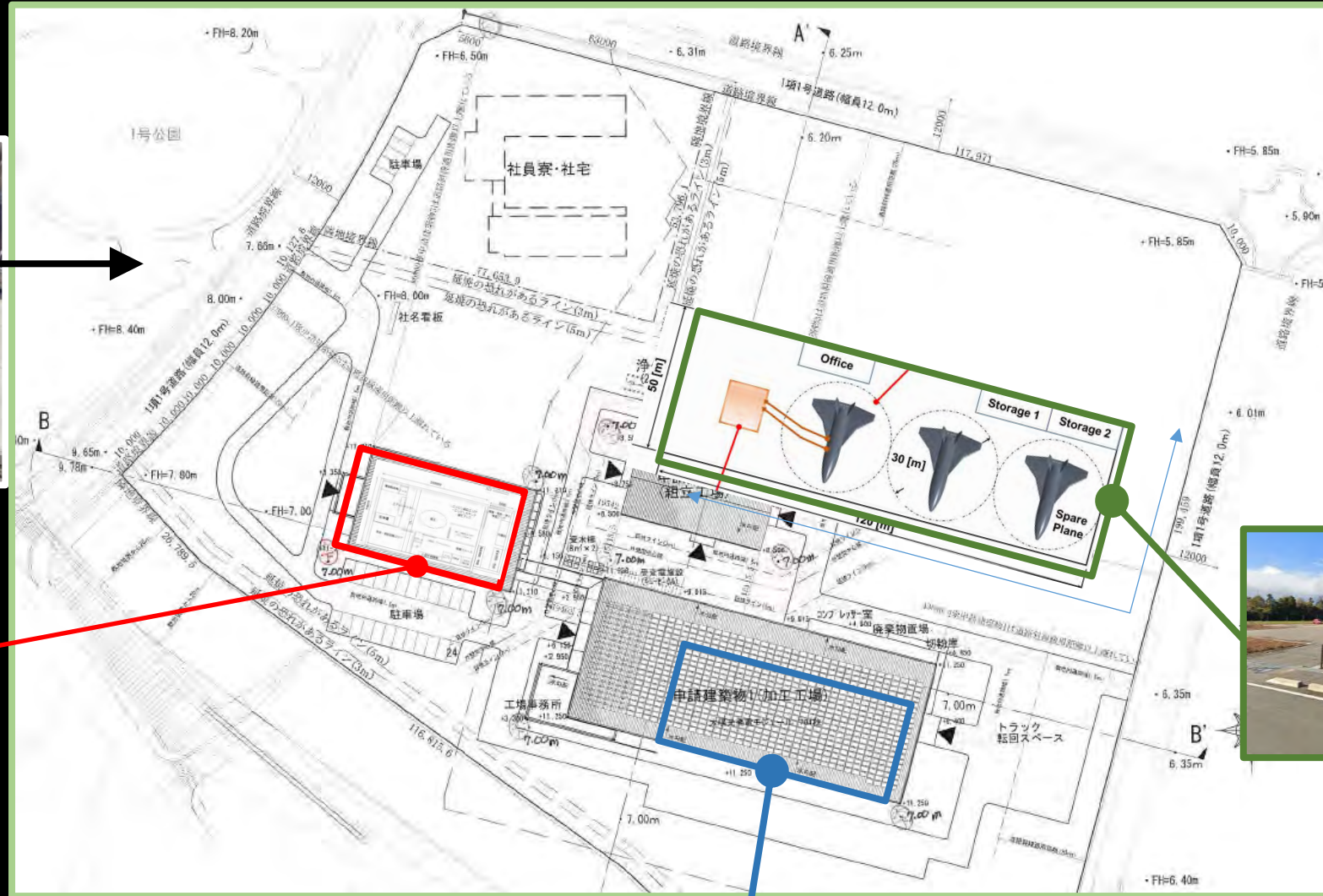
Combustion Chamber

● Engines, Propellant Tanks and Airframe Manufacturing Plants

Minamisoma,
Fukushima Pref.



Engine
Assembly Plant



Airframe
Assembly Plant

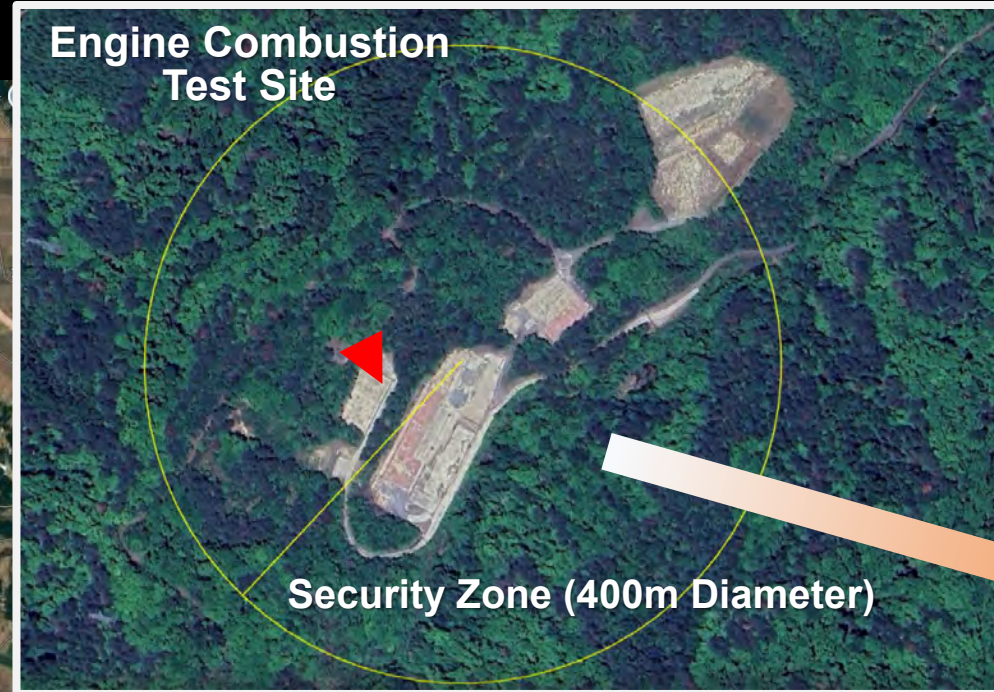
Propellant Tank Manufacturing Plant

● Engine Combustion Test Site

Engine Combustion Test Site



Minamisoma, Fukushima Pref.



Concrete Foundations and Walls
(Former Factory Site)



● Flight Operation at Spaceport of Hokkaido in Taiki Town



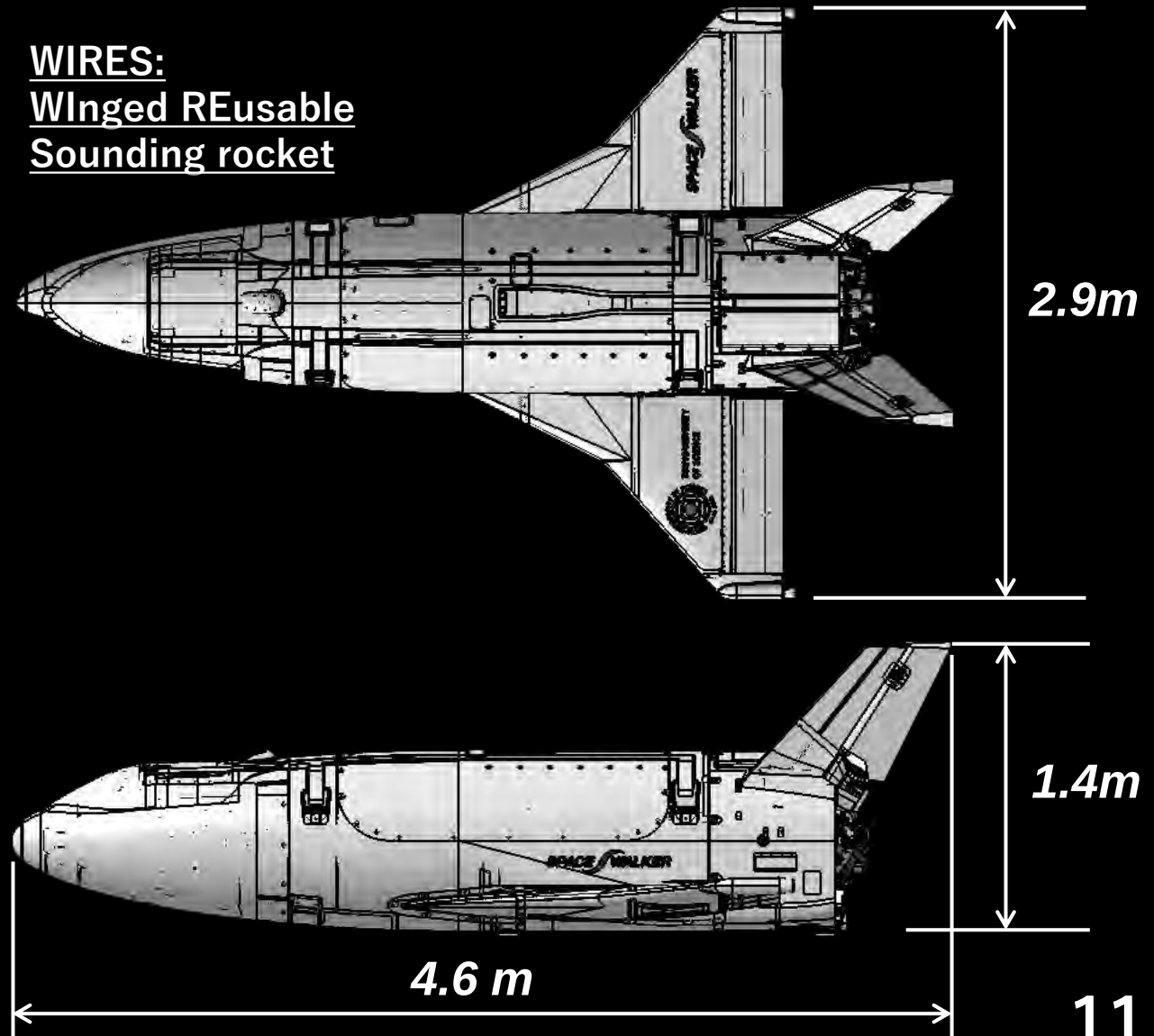
2. Experimental Winged Rocket WIRES#015

Major Dimensions		
Initial Mass	1,000	[kg]
Max. Thrust	17.8	[kN]
Combustion Time	30	[s]
Max. Altitude	5.5	[km]

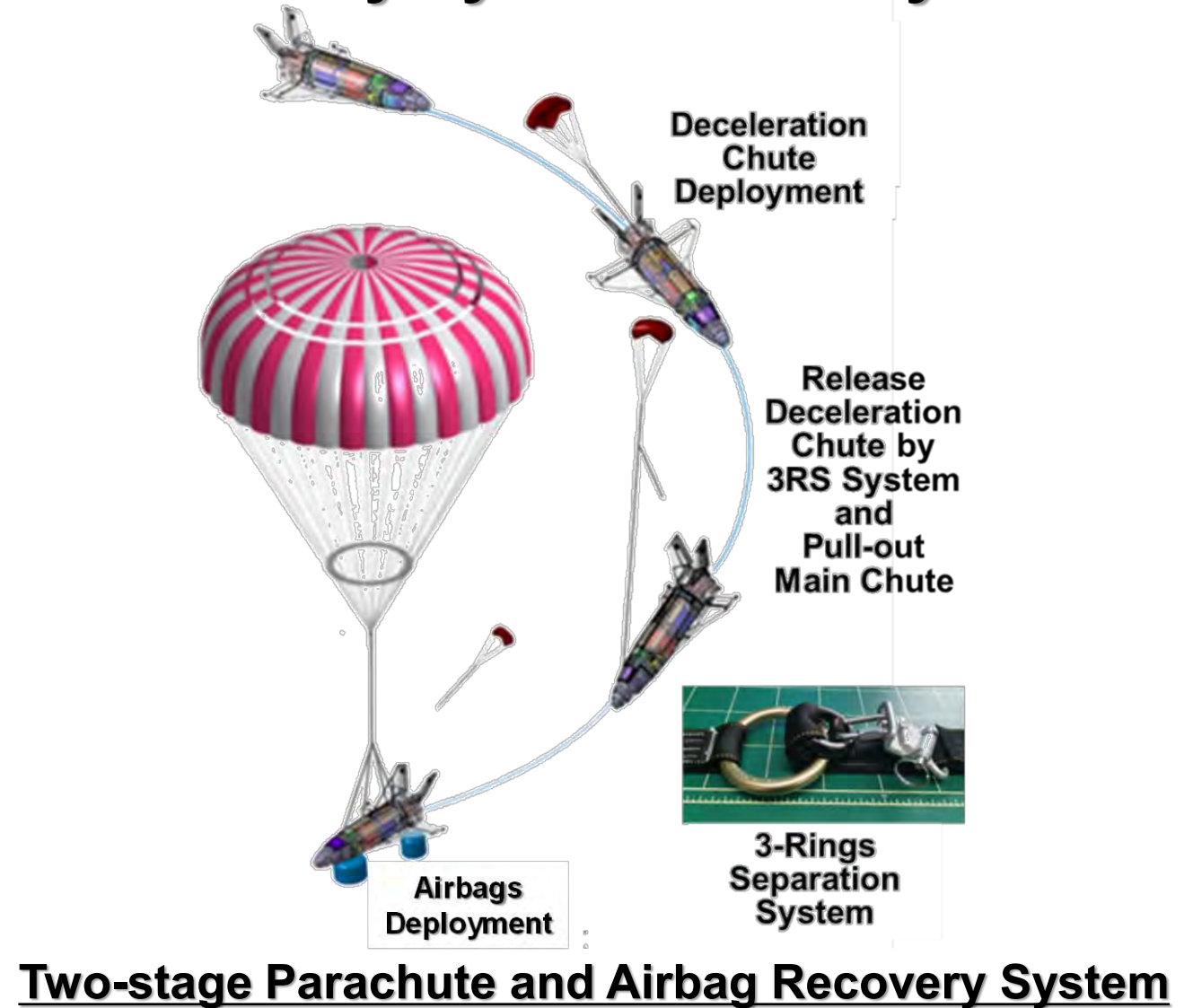
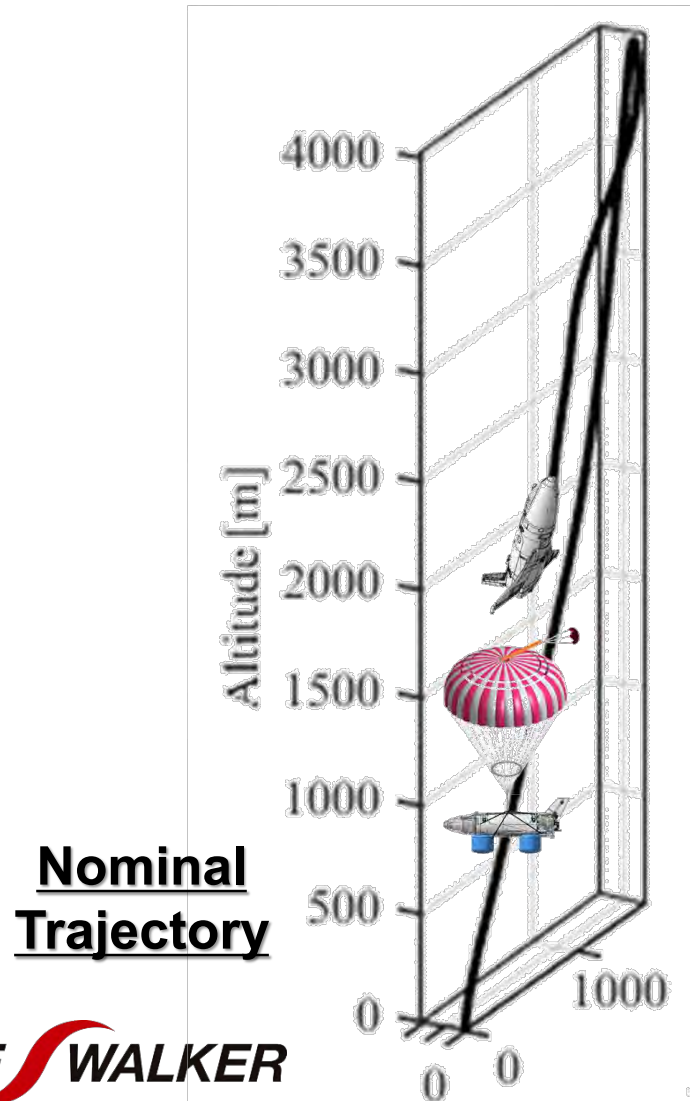
Demonstration Issues

- LOX/LBM Engine (JAXA/IHI)
- Cryogenic Composite LOX and LNG Tanks
- Non-linear Attitude Control System Using DI Theory
- Real Time Guidance System Using Genetic Algorithm

WIRES:
Winged REusable
Sounding rocket

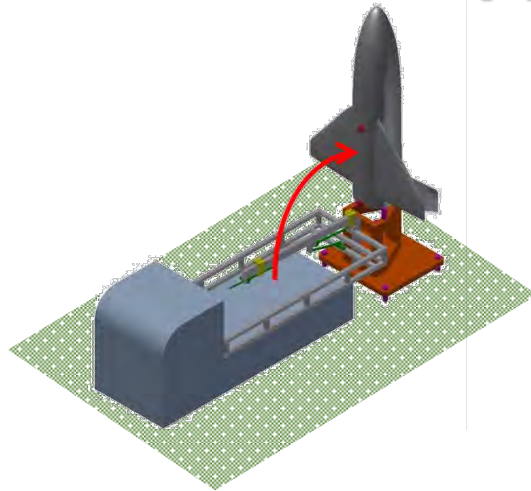


● Nominal Flight Trajectory and Recovery by Parachute System



Two-stage Parachute and Airbag Recovery System

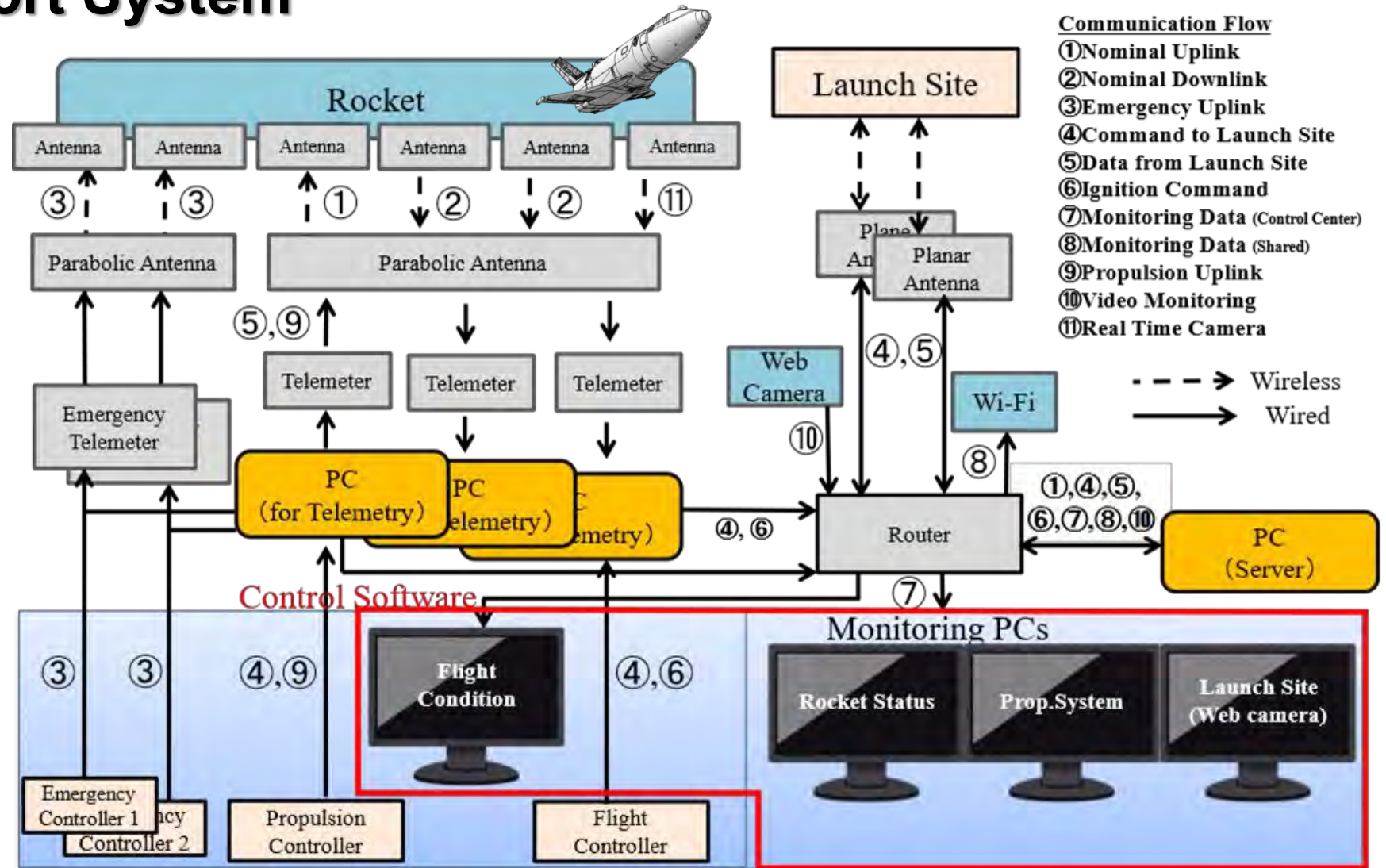
● Ground Support System



Mobile Launcher



Mobile Flight Control Center

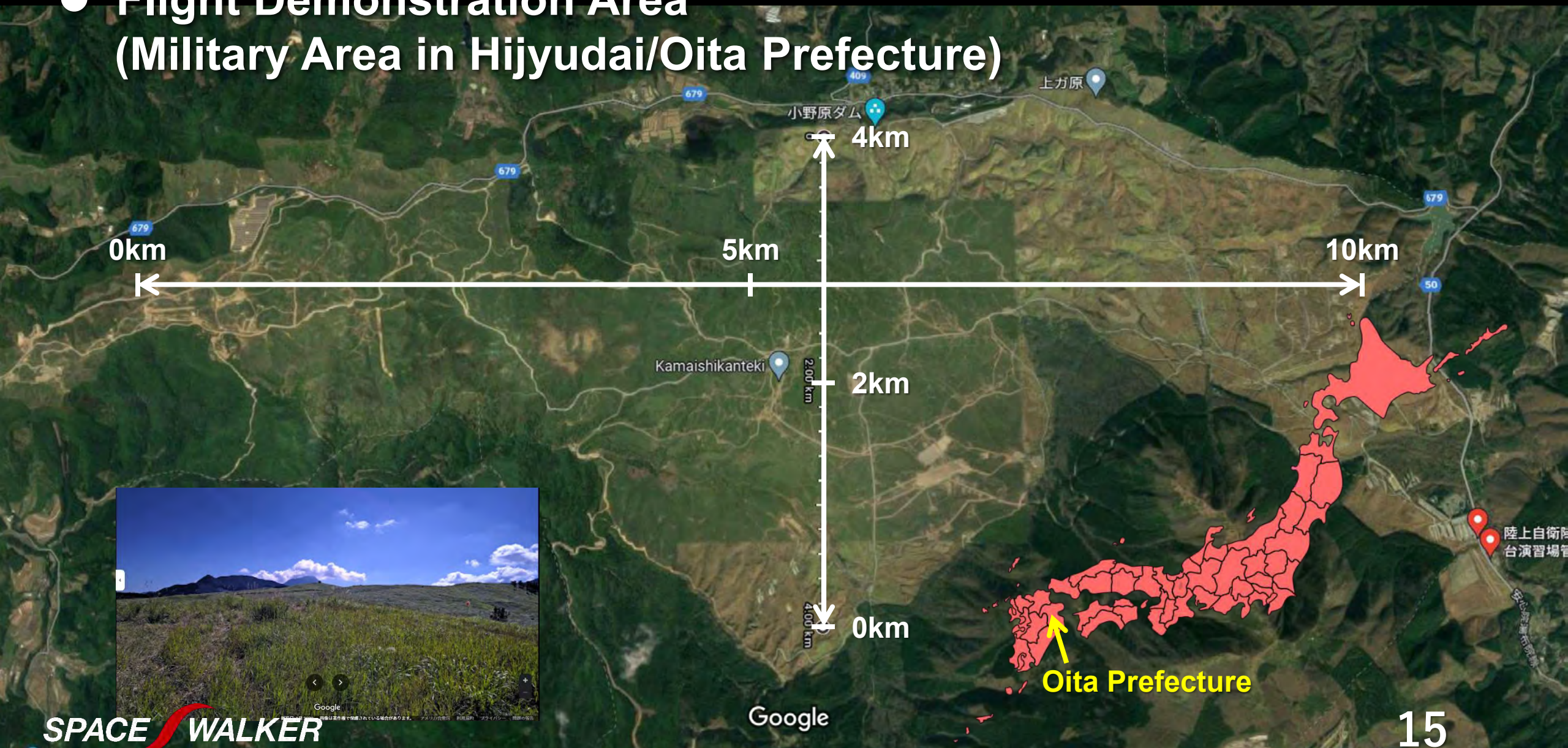


● Telemetry Command and Down Link

- Final Combustion Test of LOX/LBM Engine at Aioi Works (IHI Corporation/Hyogo Prefecture on March 7th , 2023)



- **Flight Demonstration Area**
(Military Area in Hijyudai/Oita Prefecture)



3. 官民協議会への要望

(1) 背景

米国を中心に再使用型ロケットの実用化が進む中、近隣諸国でも技術開発が国内外で進みつつある。



中国民間ロケットベンチャー藍箭航天空間科技
「朱雀3号(Methane/LOX推進薬)」
垂直離着陸実験(2023年9月)

(<https://uchubiz.com/article/new56437/>)



インド宇宙研究機関 (ISRO) は2023年4月2日、
無人の有翼宇宙往還機 (スペースプレーン) を自律飛行で
着陸させる実験「RLV LEX」に成功

(<https://chizaizukan.com/news/6aT2NRv4ionpieo9wmEX0e/>)

(2) 認定制度等の加速

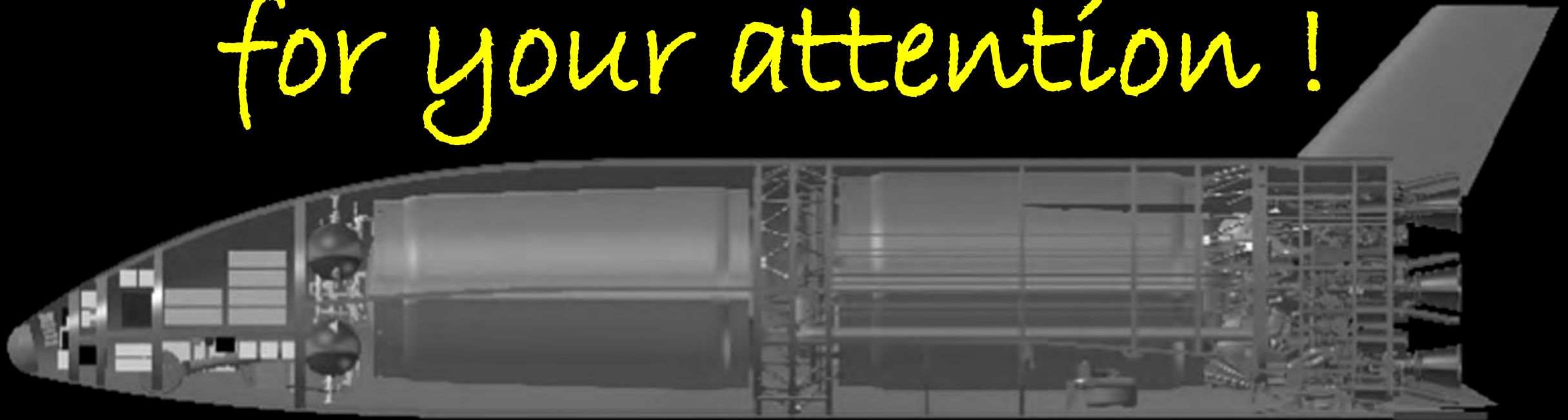
- a. 国土交通省航空局を中心とする審査及び認定組織の設置
- b. 機体の信頼性や安全性の審査要領の確立
- c. 民間機が利用する滑走路および付帯設備の共用
- d. 民間機との飛行管制システムの統合
- e. 機体再使用を前提とした新ビジネスや運用面での課題整理

（３）米国FAA商業宇宙輸送法を手本とする我が国の審査要領の確立

CFR (Code of Federal Regulation) 14 Aeronautics and Space
Vol. 4, Chapter III COMMERCIAL SPACE TRANSPORTATION, Part 400-1199

Index	Title	和訳	Words	Pages	Expendable [%]	Reusable [%]	Suborbital [%]	Orbital [%]
SubchapterA	General	一般						
400	<u>Basis and Scope</u>	基準及び範囲	7,020	3	100	0	0	0
401	<u>Organization and Definitions</u>	組織及び定義	35,261	24	25	25	25	25
SubchapterB	Procedure	手続き						
404	<u>Petition and Rulemaking Procedures</u>	申請及び法整備に関する手続き	12,994	7	0	27	0	0
405	<u>Compliance and Enforcement</u>	コンプライアンス及び施行	7,821	3	0	33	0	0
406	<u>Investigations, Enforcement, and</u>	調査, 施行, 及び機関による評価	77,625	72	0	0	0	0
SubchapterC	Licensing	ライセンス						
411	<u>[Reserved]</u>	[留保]						
413	<u>License Application Procedures</u>	ライセンス申請手続き	20,002	12	0	8	0	0
414	<u>SAFETY Element Approvals</u>	安全要素証明	24,652	15	0	0	0	0
415	<u>Launch License</u>	打上げライセンス	57,416	42	100	0	40	42
417	<u>Launch SAFETY</u>	打上げ安全	629,320	629	100	0	27	10
418-419	<u>[Reserved]</u>	[留保]						
420	<u>License to Operate a Launch Site</u>	発射場運営ライセンス	112,684	114	100	100	100	100
421-430	<u>[Reserved]</u>	[留保]						
431	<u>Launch and Reentry of a Reusable</u>	再使用型ロケットにおける打上げと再突入	45,755	32	0	41	5	5
432	<u>[Reserved]</u>	[留保]						
433	<u>License to Operate a Reentry Site</u>	再突入サイト運営ライセンス	7,593	2	0	0	0	0
434	<u>[Reserved]</u>	[留保]						
435	<u>Reentry of a Reentry Vehicle Other</u>	再使用型ロケット(RLV)以外の再突入機の再突入	14,574	7	53	42	0	0
436	<u>[Reserved]</u>	[留保]						
437	<u>Experimental Permits</u>	試験許可	28,968	19	0	100	100	0
438-439	<u>[Reserved]</u>	[留保]						
440	<u>Financial Responsibility</u>	財務責任	133,759	105	0	82	82	2
441-449	<u>[Reserved]</u>	[留保]						
450	<u>Launch and Reentry License</u>	打上げ及び再突入ライセンス要件	123,982	110	62	64	26	26
451-459	<u>[Reserved]</u>	[留保]						
460	<u>Human Space Flight Requirements</u>	有人宇宙飛行要件	16,333	8	13	31	19	6
461-1119	<u>[Reserved]</u>	[留保]						
Total			1,355,759	1204				

Thanks
for your attention!



Space Systems Lab. <https://space-systems.me.noda.tus.ac.jp/en/>
SPACE WALKER Inc. (<https://www.space-walker.co.jp>)