Smart Lander for Investigating Moon (SLIM) Project review press briefing

2024/12/26

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Institute of Space and Astronautical Science

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Briefing contents

Today, we would like provide an overview of the Smart Lander for Investigating Moon (SLIM), which began development in 2016 and achieved the world's first pinpoint Moon landing on January 20, 2024.

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4. Towards realisation of future results and outcomes

1.1. SLIM Project objectives and overview (1/2)

SLIM (Smart Lander for Investigating Moon) is a JAXA project (2016～) aiming to contribute to future lunar and planetary exploration through the following two objectives:

【A】 **Demonstration of high-precision landing technology on the Moon**

- Target accuracy of order 100m, compared to the conventional Moon landing precision of several to tens of kilometres.
- Key technologies are "image matching navigation", "autonomous navigation and guidance control", and "propulsion system capable of precisely controlling large thrust".

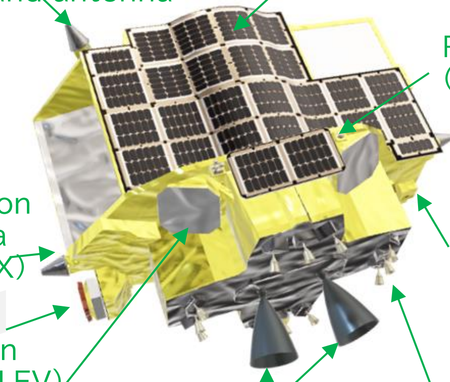
【B】 **Implementation of a lightweight spacecraft to contribute to increased frequency of lunar and planetary exploration**

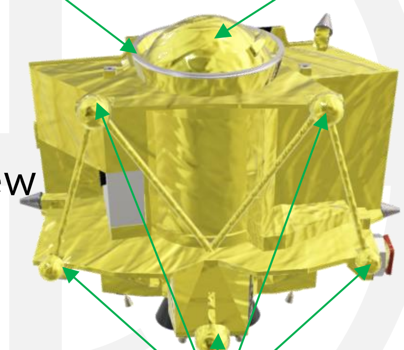
- Small, lightweight, and high-performance chemical propulsion system
- Weight reduction of core elements in most spacecrafts, such as computers and power supply systems

1.1. SLIM Project objectives and overview (2/2)

Item	SLIM
Mass	Approx. 200kg(dry) Approx. 715kg(at launch)
Dimensions	Height. : ~2.4m Length : ~1.7m Width : ~2.7m
Launch method	H-IIA Launch Vehicle No. 47 (Riding with X-Ray Imaging and Spectroscopy Mission, XRISM)
Launch date	2023/9/7
Arrival at lunar orbit	2023/12/25
Moon landing	2024/1/20
Total project development cost	14.9 billion yen (*1)

*1 … The budget was 18.05 billion yen at the time of transition to Project. However, this was adjusted during a plan modification associated with the ASTRO-H operation anomaly (including a change in the launch vehicle from the Epsilon to H-IIA piggyback launch.)





SLIM external view

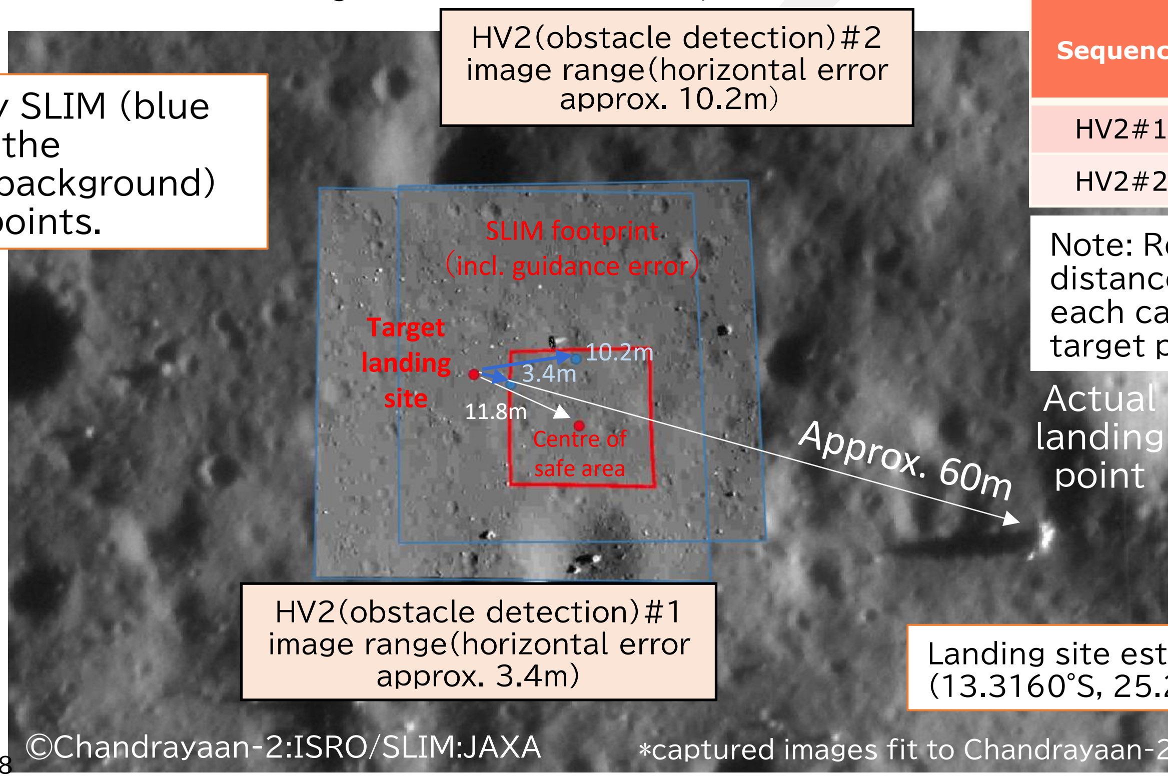
1.2. Pinpoint landing outcome

- Comparison of high-resolution images from Chandrayaan-2 and SLIM evaluates the landing accuracy at around 10m or better.
  - Evaluation uses images captured at an altitude of approximately 50m (beyond this point, obstacle avoidance takes precedence). High accuracy level was achieved through image matching navigation, autonomous navigation and guidance control, and the fine thrust adjustment capability of the propulsion system, and is overall consistent with the pre-launch evaluation. Obstacle detection was also judged to have functioned correctly.
  - During image acquisition, a problem occurred in the propulsion system, and the spacecraft gradually drifted eastwards during descent, making a soft landing about 60m east of the target landing site. (The spacecraft continued to function after landing, and communication with the ground was maintained.)

Sequence	Assumed altitude	Horizontal distance from landing site
HV2#1	50m	3.4m
HV2#2	50m	10.2m

Note: Results evaluated based on distance between the centre of each captured image and landing target point.

Two images captured by SLIM (blue frames) are overlaid on the Chandrayaan-2 image (background) with matching feature points.



SLIM on the lunar surface, imaged from orbit by Chandrayaan-2

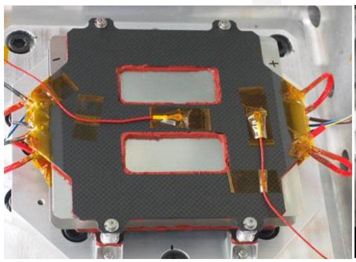
Landing site estimated by NASA LRO team: (13.3160°S, 25.2510°E) (ME coordinates)*1

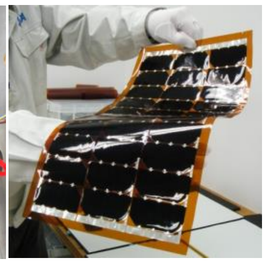
*1 … NASA LROC, M. Robinson, https://www.lroc.asu.edu/images/1358

1.3. Weight reduction outcome

- Core technologies were developed to reduce the weight of lunar and planetary spacecraft.
- SLIM is considered to be the lightest successful lunar lander.

Power:Lightweight “SUS laminated battery” and “thin-film solar cell” (first adoption in Japan for curved surfaces). The power controller is also fully digitized.

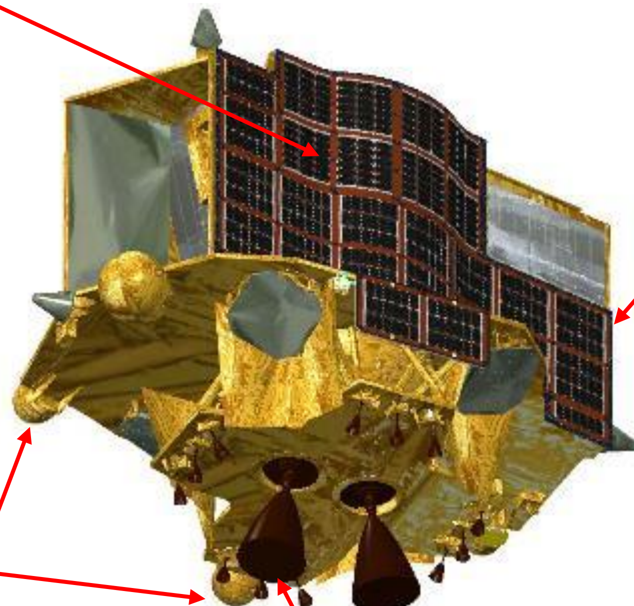




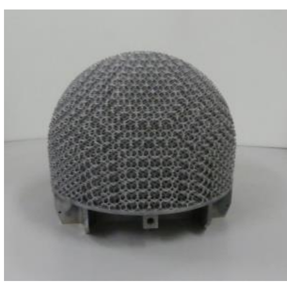
Sharp Corporation

Communications:Fully digitized S-band transceiver (first in the world to be installed on satellites or spacecraft)

Mitsubishi Electric Corporation

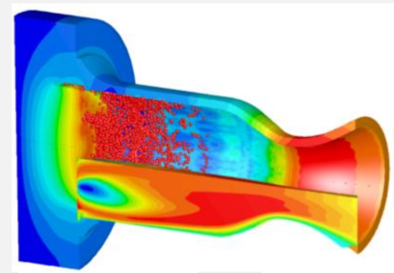


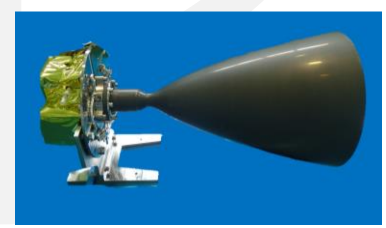
Landing gear: Instead of joints, “porous metal” created using 3D printing that collapse to absorb energy during landing.



KOIWAI Co., Ltd.
JAMPT Corporation
Technosolver Corporation
Aerospace Orbital Engineering Inc.

Main engine:Adopted a “ceramic thruster” with high efficiency and variable thrust.





Mitsubishi Heavy Industries, Ltd.
KYOCERA Corporation

In addition, the use of the integrated oxidizer/fuel tank as the main structure greatly contributed to weight reduction

▶【Reference】Comparison with recent lunar landers

Comparison between SLIM and the last six lunar landers (including estimated values)

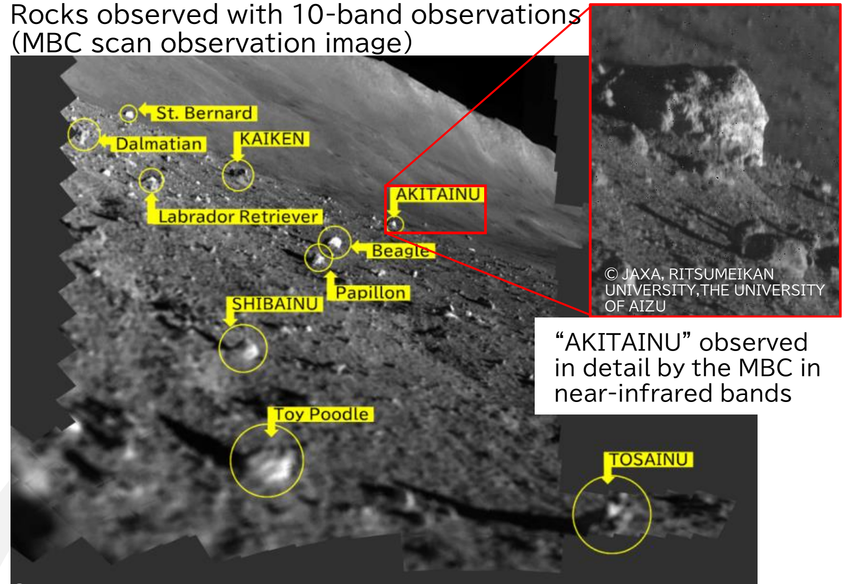
	SLIM	HAKUTO-R (M-1)	Chandrayaan -3	Luna-25	Peregrine Lander (M1)	Nova-C (IM-1)	Chang 'e 6
Organisation	**JAXA (JPN)**	ispace (JPN)	ISRO (India)	Roscosmos (Russia)	Astrobotic (USA)	Intuitive Machines (USA)	CNSA (China)
Launch date	**2023/9**	2022/12	2023/7	2023/8	2024/1	2024/2	2024/5
Launch mass ※ wet	**~715kg**	~1,000kg	~1,750kg	~1,750kg	~1,300kg	~1,900kg	~8,350kg
Landing mass ※ excluding fuel	**~200kg**	~340kg	(unknown)	~800kg	~480kg	~620kg	(unknown)
High-precision navigation using image matching	**Yes**	No	No	No	Test equipped (not used during landing)	Yes	No
Landing precision (km)	**0.1km (specified value)**	Several km ※company press report	4km×2.4km	30km ×15km	24km×6km	(Results unknown, but several km)	6km (value for Chang' e 3) (Chang' e 6 16.7km?)
Main mission	**High precision landing technology demonstration**	Commercial lunar lander	Lunar lander, science mission	Lunar lander, science mission	Commercial lunar lander	Commercial lunar lander	Sample return from lunar far side
Landing outcome	**Success**	Fail	Success	Fail	Fail	Success	Success

1.4. Results obtained from the lunar surface after landing (1/2)

- The landing attitude differed from planned, and the spacecraft temporarily powered down. But operations resumed as the direction of the sun changed*1.
- After resuming operations, the onboard Multi-Band Camera (MBC) made scientific observations of 10 rocks and 2 regolith sites, each in ten wavelength bands. SLIM then experienced its first night on the Moon*2.

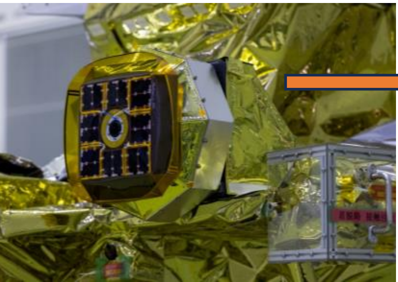
- Just prior to landing, SLIM separated two ultra-small rovers. Each rover succeeded in completely autonomous operation on the lunar surface, achieving the world's first lunar exploration through the coordinated operation of multiple robots.
  - LEV-1 conducted experiments in hopping and wheeled locomotion on the lunar surface. It was capable of direct communication with Earth via an independent communication system. Mass approx. 2.1kg.
  - LEV-2 (nickname: SORA-Q, developed with private sector collaboration led by the JAXA Space Exploration Innovation Hub Center) succeeded in imaging SLIM and transmitting images to Earth via LEV-1. LEV-2 also became the world's smallest and lightest lunar exploration robot. Communication functionality with LEV-1 (Bluetooth). Mass: 238g. Diameter: ~8cm.

Rocks observed with 10-band observations (MBC scan observation image)



"AKITAINU" observed in detail by the MBC in near-infrared bands

© JAXA, RITSUMEIKAN UNIVERSITY, THE UNIVERSITY OF AIZU



©JAXA/TOMY/Sony Group Corporation/ Doshisha University

Image of SLIM on the lunar surface, captured by LEV-2 (SORA-Q) and transmitted to LEV-1 via short-range communication, then sent directly to Earth by LEV-1

*1 … 2024/1/28 *2 … 2024/1/31

1.4. Results obtained from the lunar surface after landing (2/2)

- The lunar surface alternates between 14 days of daylight and 14 days of night, during which the lunar surface experiences a large temperature change. SLIM was therefore not designed to stay active through the night. However, the spacecraft continued to function after three overnight *1 stays.
- While it is difficult to determine how SLIM was able to survive the lunar night, that data could be obtained from the after overnight periods was a significant achievement.

- SLIM is also equipped with a reflector (LRA) provided as part of the international collaboration with NASA. The purpose was to perform precise distance measurements by reflecting laser light off the LRA from lunar orbit.
- After landing, SLIM's attitude data was provided to NASA and SLIM successfully performed laser range finding with the NASA Lunar Reconnaissance Orbiter (LRO) *2 .
- NASA will continue to measure the distance in the future, and SLIM will continue to serve as a target and reference point for distance measurements on the lunar surface.

LRA(Laser Retroreflector Array) provided by NASA. The LRA consists of an array of multiple mirrors that are retroreflective and reflect light back in the direction of origin. Mass is approximately 21g.

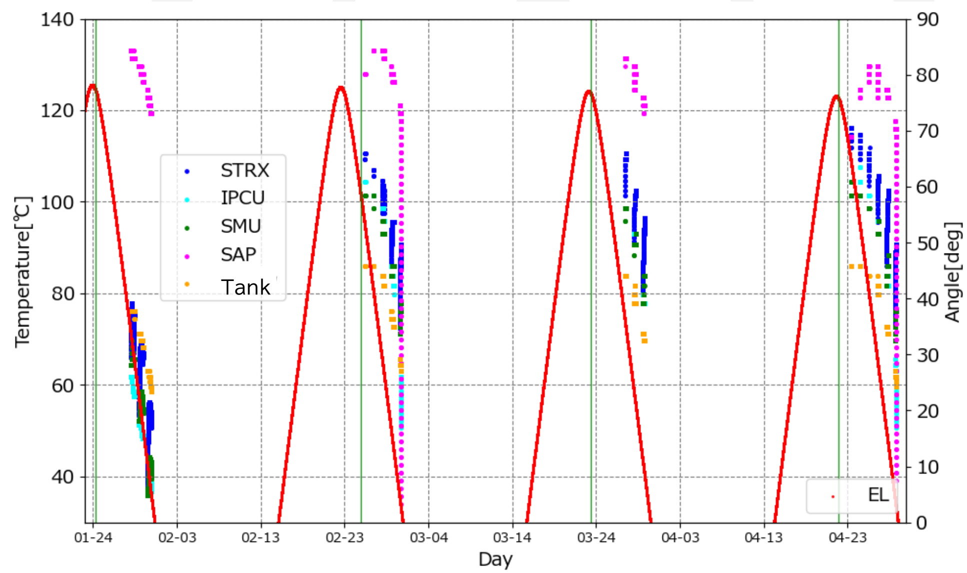
*1 … 2024/2/25～3/1、2024/3/27～3/30、2024/4/23～4/29
*2 … 2024/5/24.　https://science.nasa.gov/missions/nasa-jaxa-bounce-laser-beam-between-moons-surface-and-lunar-orbit/

1.5. End of operations

- After operations ended on April 28 – 29, 2024, and even after the fourth lunar night, continued attempts were made to re-establish communication with SLIM during afternoon periods on the Moon, but these were unsuccessful.
- Attempts were therefore ceased on August 23, 2024, and SLIM operations were terminated.
- Data obtained from the spacecraft after surviving the lunar nights may also provide useful insight for the future development of lunar landers. Therefore, even after the Project has been disbanded, research activities including investigations into the cause of the spacecraft becoming inoperable after the final overnight stay will continue at JAXA.

Example data from the spacecraft after the lunar overnight stay. Since the first night at the end of January, temperatures inside the spacecraft were observed to be higher than prior to the overnight stay.

(STRX: S-band Transponder, IPCU: Integrated Power Control Unit, SMU:, System Management Unit, SAP: Solar Array Panel)



1.6. Status of Project goals

Progress against the success criteria is shown below. The main goals are considered to be achieved.

Standard	Contents	Achievement status
Minimum success	Perform the Moon landing using a small, lightweight spacecraft achieved through the following two goals: • Verify optical reference navigation, which is essential for high–precision landing, by conducting actual lunar descent and landing operations. • Develop a lightweight spacecraft system and verify its operation in orbit.	Success
	(A–1) Develop image-matching navigation, which is essential for high-precision landing, and combine this with other navigation systems to result in a navigation error of about 100m.	○ : Demonstration of image navigation technology, achieving an accuracy of about 3 – 4m at HV2.
	(A–2) Provide a simple shock–absorbing mechanism for a soft landing.	○ :New shock absorbing mechanism was developed and installed.
	(B–1) Realise a compact, lightweight, high-performance chemical propulsion system.	○ : Achieved lunar orbit insertion and landing with the installed small, lightweight propulsion system
	(B–2) Weight reduction of the core elements of the spacecraft, including the computer and power supply system.	○ : Developed and operated the SMU integrated computer and IPCU integrated power controller.
Full success	Achieve high–precision landing with accuracy within 100m. Specifically, nominal operation of the high–precision landing navigation system, feedback is correctly fed back to the guidance system, and analysis of the post–landing data will confirm that the spacecraft is functioning normally and has achieved landing accuracy.	Success
	(A–3) Realise autonomous landing guidance rules that can take into account navigation guidance errors while detecting obstacles.	○ : Successful operation of obstacle detection system and landing guidance rules.
	(A–4) A high-precision landing (accuracy of 100m) on the Moon's surface performed by a spacecraft equipped with these technologies, and results verified.	○ : Achieved precision of about 3 –4m at HV2 stage, and around 55m in landing site evaluation.
	(B–3) Spacecraft remained functional after landing.	○ : Maintained function of the lander after landing, and obtained landing operation data.
Extra success	In addition to the full success criteria and transmission of technical data regarding the high–precision landing, activities on the lunar surface will continue for the period of time until sunset, with an eye towards carrying out future missions that will operate on the lunar surface during full–scale lunar and planetary exploration.	Success
	(B–4) After reaching the Moon's surface, the mission continued for a period until sunset.	○ : After recovering SAP power, operated MBC until sunset. ※ : Confirmed operation and obtained data after 3 nights.

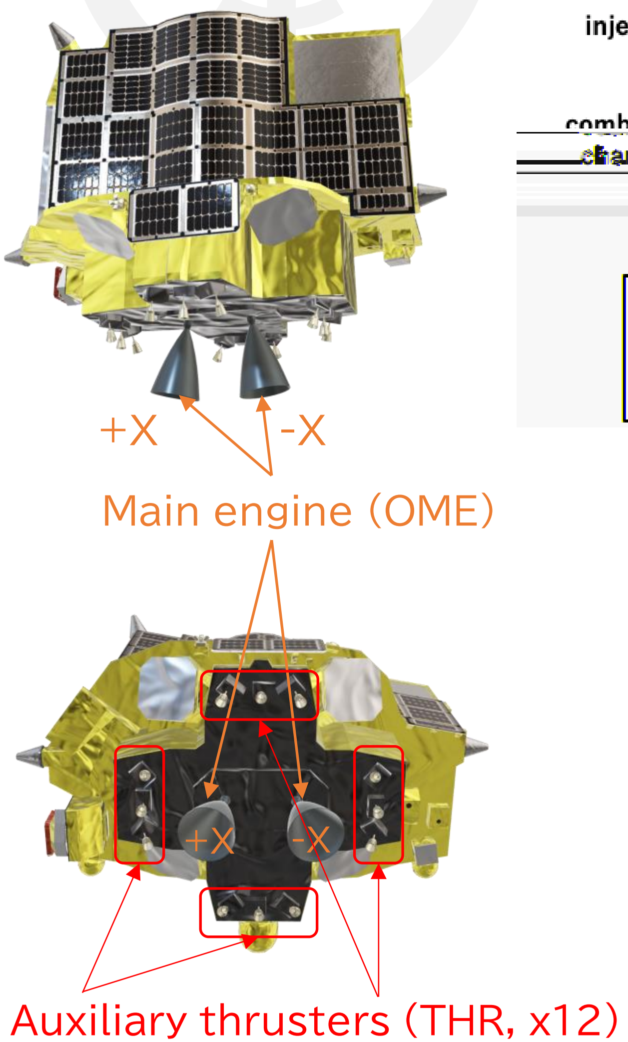
2. Investigation into the origin of the propulsion system trouble that occurred just prior to landing (1/4)

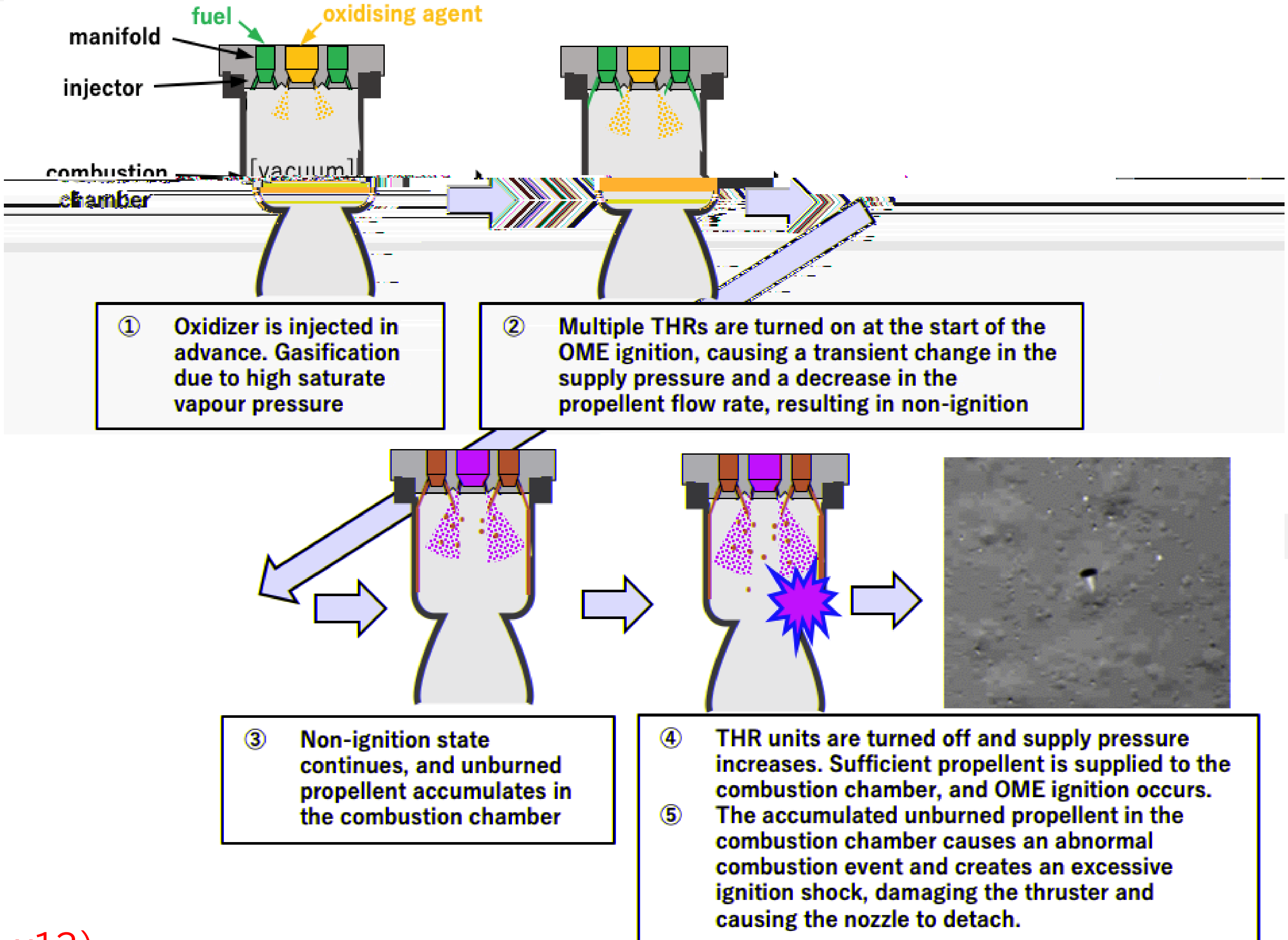
- Trouble with the propulsion system occurred at an altitude of approximately 50m, specifically when the nozzle separated and thrust was reduced in one of the two main engines (OME) (-X side). The cause has been investigated together with the relevant manufacturers and cooperation of experts from various departments, including the JAXA Research and Development Directorate.
- It was concluded that the problem was not caused by the main engine itself, but it is highly likely that the nozzle separation and reduction in thrust of the main engine were the result of the following operations in the population system:
  - In order to reduce weight, SLIM adopted a "blowdown method" in which the supply pressure gradually decreases as propellent is consumed (generally, a "pressure regulating method" is used in which an air accumulator and pressure regulating device are installed to keep the supply pressure constant).
  - The trouble occurred towards the end of the spacecraft's operational life, so propellent supply pressure was significantly reduced.
  - Generally, thrusters tends to be difficult to ignite under conditions of low propellant supply pressure.

1. For control purposes, the start of firing of the numerous auxiliary thrusters (THR, 12 in total) coincided with the start of firing the main engine.
2. This caused a temporary further reduction in propellant supply pressure to the main engines. As a result, the –X side main engine was unable to ignite at this time, and the propellant supply remained unburned inside the –X main engine.
3. Approximately 1 second later, the auxiliary thrusters completed their required firing and all stopped at once, and propellant supply pressure to the main engine was restored.
4. With the restoration of the propellant supply pressure, the main –X side engine ignited. The propellant that had been supplied for approximately one second up until that point had remained in the –X main engine unburned, and this also ignited, resulting in an excessive ignition shock.
5. The excessive ignition shock damaged the nozzle of the –X side main engine, resulting in a major reduction in thrust.

2. Investigation into the origin of the propulsion system trouble that occurred just prior to landing (2/4)

The estimated process described on the previous page that that led to nozzle separation is illustrated below.





2. Investigation into the origin of the propulsion system trouble that occurred just prior to landing (3/4)

- The validity of this scenario was confirmed using a numerical analysis model that reproduces the SLIM propulsion system to evaluate the ignition conditions in typical pulse patterns during the SLIM descent and landing, while referencing the telemetry data .
- The evaluation also takes into account knowledge of JAXA specialists based on SLIM design information and development data, as well as the results of combustion tests and experiments.

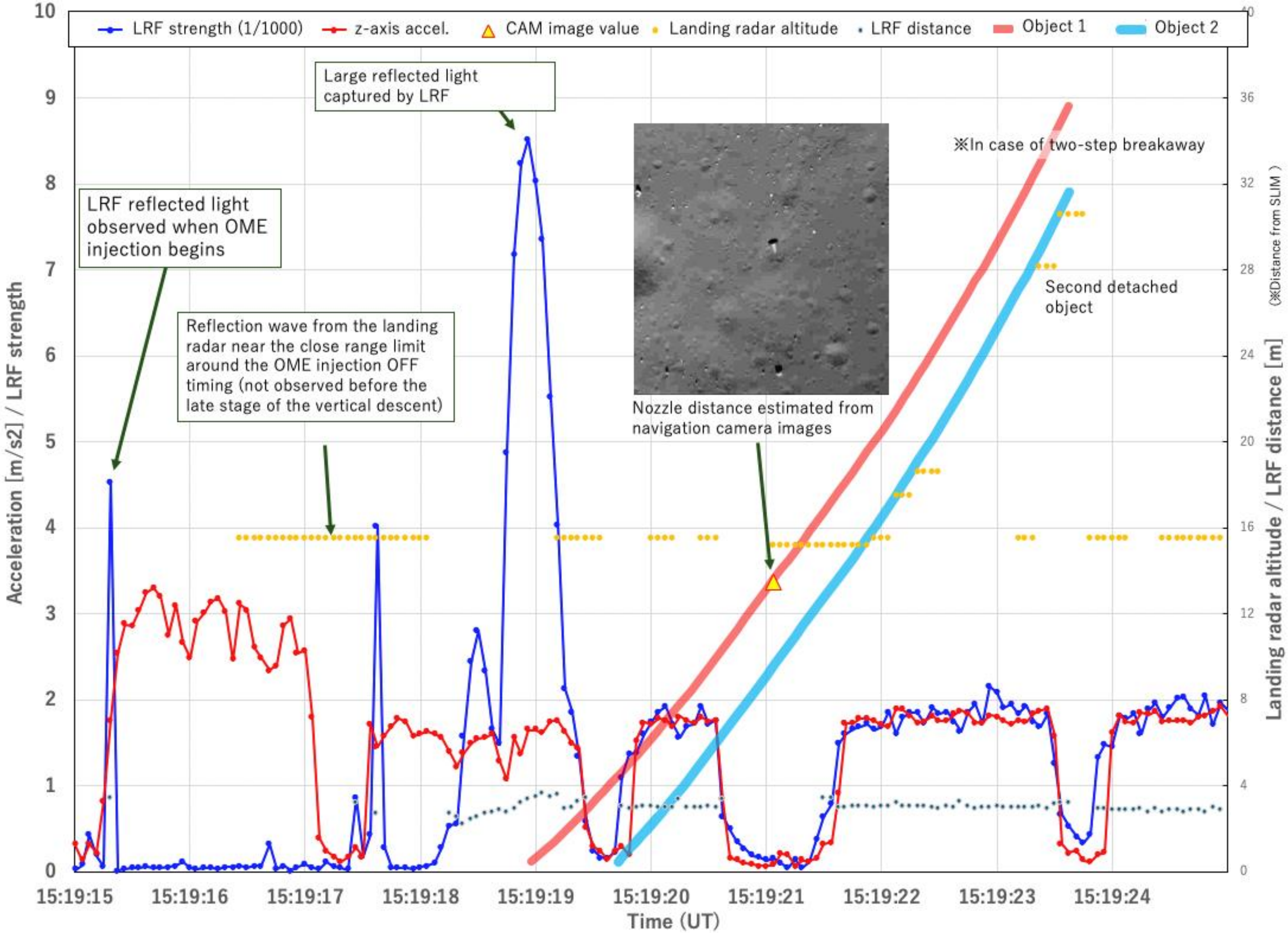
- The proposed scenario has been confirmed as consistent with the various telemetry data (accelerometer, landing radar, laser range finder, navigation camera images) obtained before and after the event (next page).

- It is also considered that damage to the thrusters due to excessive ignition shock is not unique to this main engine (ceramic thrusters), but is an operation outside the anticipated design, and it is highly likely that even typical metallic thrusters would have lost functionality.
- As the material is ceramic and there is essentially no need to consider the material lifespan, overload tests were conducted on the actual main engine before installation on the spacecraft, eliminating the possibility of manufacturing errors.

- The knowledge obtained from this investigation should be appropriately referenced in future projects, and we have therefore begun to disseminate information within JAXA and to related manufacturers through the JAXA Safety and Mission Assurance Department.
- The propulsion system is used continuously from immediately after rocket separation until landing on the Moon, for orbit change (ΔV), attitude control, and descent and landing. In both evaluations in terms of total ΔV or accumulated main engine fuel injection time, the propulsion system trouble occurred at approximately 98% through the total propulsion from separation to the Moon landing, and it had been confirmed that the expected performance was achieved up until that point.

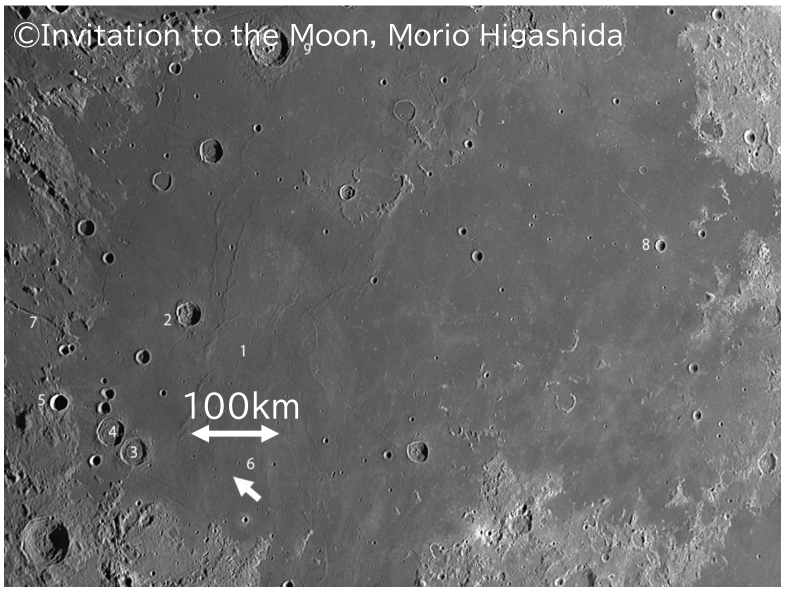
2. Investigation into the origin of the propulsion system trouble that occurred just prior to landing (4/4)

Summary of the estimated timing of the main engine −X side nozzle separation event



3. Outcomes and impacts to date (1/4)

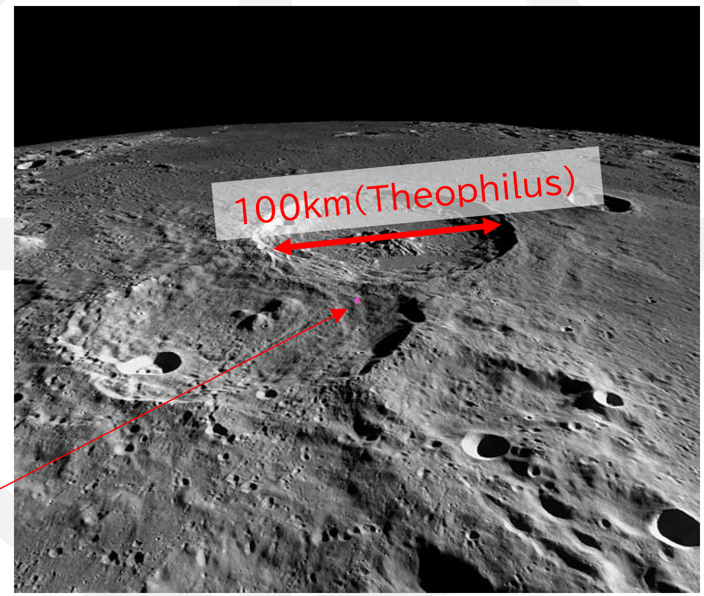
- SLIM has been a world pioneer in advocating high-precision landing technology since the proposal of the Project, and has successfully demonstrated this ability for the first time in the world, bringing in a paradigm shift from the conventional "landing where we can" to "landing where we want" exploration, and expanding the possibilities of future lunar and planetary exploration.
  - The importance of pinpoint landing is being recognised internationally, and although only SLIM has achieved this to date, the USA and other countries are working on the development of spacecraft equipped with pinpoint landing technology.
  - This technology is essential for sustainable lunar and planetary exploration in the future, and therefore is an achievement that will have an impact that going beyond only a technological success.



Near the Sea of Tranquillity. The arrow indicates the Apollo 11 landing site.
Source: Invitation to the Moon: Sea of Tranquillity
https://moonworld.jp/tranquillitatis/

Until now, lunar landers have essentially landed on flat, safe areas across large areas known as the lunar maria (seas).

SLIM landing site



Source : X, @dfuji1 ©Fujii Daichi, LRO
https://x.com/i/status/1748103951336227113

Pinpoint landing makes it possible to land on even complex terrain that was previously impossible, even if desired. In other words, "a new door has opened".

3. Outcomes and impacts to date (2/4)

- By successfully demonstrating pinpoint landing technology using one of the world's lightest landers, and exceeding expectations in the successful completion of multiple lunar overnight stays, Japan has demonstrated that these areas of space development are at a world-class level. This has enhanced Japan's international presence.
  - The success of the SLIM landing was reported at the United Nations Committee on the Peaceful Uses of Outer Space.
  - Prime Minister Kishida mentioned SLIM in a speech to Congress during his visit to the USA, and afterwards a courtesy call was made to the to the Prime Minister's Office (courtesy visits were also conducted to the Minister of Education, Culture, Sports, Science and Technology, and the Minister of State for Space Policy at this time).

Prime Minister's Address to the US Congress
(2024/4/11、SLIM results were mentioned in the second half)

©Ministry of Foreign Affairs of Japan

SLIM report to the UN Committee on the Peaceful Uses of Outer Space (2024/6/21 at Vienna)

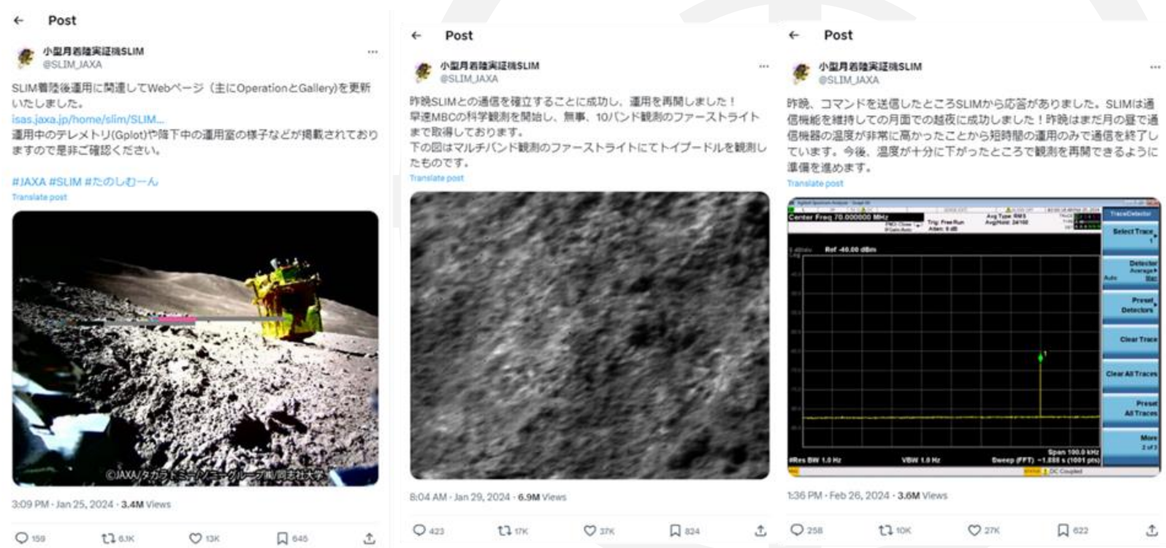
©Prime Minister's Office of Japan

Courtesy call to the Prime Minister's Office (2024/4/17)

3. Outcomes and impacts to date (3/4)

- Through public relation activities, the SLIM Project has contributed to the deepening of the general public's understanding of space activities.
  - By delivering a design by a private toy manufacturer to the lunar surface, it was demonstrated to the civilian industry that the barrier to entry into the space industry are becoming lower.
  - Several social media posts by SLIM received millions of views. In addition, the live broadcast of the landing operation had more than 300,000 simultaneous viewers, and the recorded YouTube video has been viewed more than 2 million times, making it possible to reach the public through the internet (for example, SLIM was ranked as a trending buzzword on social media).

In SNS buzzword ranking(2024/1～3), SLIM is ranked 9th (Web Analytics Consultants Association). ※ Evaluated as delivering specialized topics to general users in an easy-to-understand manner and attracting attention from a wide ranging audience.



SNS posts with over a million views (X/Twitter)
(left:release of lunar surface images, centre: communication was re-established, right: when overnight stay was successful.)

3. Outcomes and impacts to date (4/4)

- The development and operation of SLIM has also contributed to human resource development.
  - Veteran members on the SLIM team have been involved since the first consideration of the "SELENE-B" Project in 2002, and have played a central role in advancing technical studies and development.
  - Both before and after the transition to a JAXA Project in 2016, many mid-career and young engineers from different departments within JAXA have participated, collaborating with veteran members to gain experience from development to launch and landing.
  - In particular, working with the engineers from the manufacturers to solve technical issues onsite, while also managing their respective areas of responsibility, improved project management skills. We feel this has enabled us to train many key personnel for subsequent missions.

- A "One Team" system was established in which all members worked closely together, including those at the manufacturers, to take on this highly challenging mission. As a result, we believe that we were able to also contribute to the development of human resources at the manufacturer. Below is an illustrative example of this.
  - "We had no experience in spacecraft development, and we were not skilled at creating something new from scratch. [···] Before long, young members who wanted to take on new challenges became involved, and we started to move on the project in earnest. Through this experience, it became a habit to think about how to make something possible, rather than consider the reasons why it cannot be done. Additionally, through the process of creating something new, company members came to appreciate the importance of a merit-based approach, as opposed to the traditional demerit-based approach."

Mitsubishi Electric Corporation's Science Site 「DSPACE」 published on 2023/11/27,
Excerpt from "How did the unusual idea of a two-stage landing take shape? The unknown challenges of the SLIM lander" (partially summarised)
https://www.mitsubishielectric.co.jp/me/dspace/column/c2311_2.html

4. Towards realisation of future results and outcomes (1/2)

- The technologies demonstrated with SLIM are expected to be utilised in multiple situations in the future, and plans are in place to continue activities necessary to achieve this.
  - By adopting a Payload Attach Fitting (PAF) equipped with a new low-shock separation mechanism for docking with the H-IIA Launch Vehicle, an opportunity was provided to demonstrate outstanding domestic technology. In the future, this technology is expected to be passed on to core and commercial launch vehicles.
  - The components of the image matching navigation technique demonstrated by SLIM will be used as part of the image navigation onboard the Martian Moons eXploration (MMX) Project. The design examples from SLIM were used as reference during this mission development.
  - In the Lunar Polar Exploration (LUPEX) Project, the SLIM landing simulator will be used to verify the landing simulation of the lander being developed by the Indian Space Research Organisation (ISRO), and technology from the Multi-Band Camera (MBC) will be transferred to the near-infrared Advanced Lunar Imaging Spectrometer (ALIS), a scientific observation instrument developed by JAXA that will be installed on the rover.

- Arrangements are also being made to provide the technology and knowledge on the high-precision landing obtained through SLIM to domestic private companies conducting the Moon landings.

4. Towards realisation of future results and outcomes (2/2)

- Further papers on the results of the Moon landing and activities are also planned.
  - On engineering technology, approximately 18-20 papers are in preparation for submission, or have already been submitted, focussing on the development and operational results of each technology.
  - For the scientific results, observations of olivine in rocks on the lunar surface that is thought to originated from the deep interior of the Moon have already been announced at academic conferences. Several papers have been submitted that discuss the origin and evolution of the Moon based on the olivine observational data.
  - Submission of further papers on obtained results are planned as the research progresses.

- The SLIM Project is scheduled to be disbanded once internal JAXA procedures are complete.

We would like to express our sincere gratitude to the researchers from many institutes, Mitsubishi Electric Corporation and all the related companies, the Ministry of Education, Culture, Sports, Science and Technology and our other government officials, who have supported and collaborated with us for approximately 20 years since the concept began and during the approximately 8.5 years since the Project launched, as well as the many people who watched and supported the descent and landing from so many different places and through many different ways.

Images and figures used in this document are credited to JAXA (unless otherwise stated).

【Appendix】Abbreviations and SLIM-related material

略称	名称(英語)	名称(日本語)
AANT	RAV Altimeter ANTenna	着陸レーダ高度測定用アンテナ
ADM	Apolune Descending Maneuver	遠月点降下マヌーバ
BAT	BATtery	バッテリ(二次電池セルモジュール)
CAM	navigation CAMera	航法カメラ
COM	COMmunication system	通信系
CSS	Coarse Sun Sensor	粗太陽センサ
DSN	Deep Space Network	深宇宙用追跡ネットワーク
EPS	Electrical Power System	電源系
FLT	FiLTer	フィルタ
GFD	Gas Fill and Drain valve	ガス系注排弁
GN	Ground Network	追跡ネットワーク
IMU	Inertial Messurement Unit	慣性基準装置
INT	INTegration hardware	計装系
IPCU	Integrated Power Control Unit	電力制御分配器
ISC	Integrated Spacecraft Control system	統合化制御系
LEV	Lunar Excursion Vehicle	小型プローブ
LOI	Lunar Orbit Insertion	月周回軌道投入
LRA	Laser Retro-reflector Array	リフレクタ(NASA JPL)
LRF	Laser Range Finder	レーザレンジファインダ
LRO	Lunar Reconnaissance Orbiter	ルナー・リコネサンス・オービター
MBC	Multi-Band Camera	分光カメラ
NPV	Non-Pyro valve	ノンパイロ弁
OME	Orbit Maneuvering Engine	メインエンジン
PAM	Period Adjustment Maneuver	周期調整マヌーバ
PD	Powered Descent	動力降下
PDM	Perilune Descending Maneuver	近月点降下マヌーバ
PFD	Propellant Fill and Drain valve	液系注排弁

略称	名称(英語)	名称(日本語)
PLD	PayLoaD mission system	月面活動系
PT	Pressure Transducer	圧力センサ
RAV	Radio Altimeter and Velocity meter	着陸レーダ
RCS	Reaction Control System	推進系
REU	Rav Electorical Unit	着陸レーダ電気ユニット
SABS	Shock ABSorber	衝撃吸収材
SANT	S-band ANTenna	Sバンドアンテナ
SAP	Solar Array Panel	太陽電池パネル(薄膜太陽電池シート)
SDIP	S-band DIPlexer	Sバンドダイプレクサ
SHYB	S-band HYBrid	Sバンドハイブリッド
SLIM	Smart Lander for Investigating Moon	小型月着陸実証機SLIM
SMU	System Management Unit	統合化計算機
SSW	S-band SWitch	Sバンドスイッチ
STR	STRucture system	構造系
STRX	S-band TRansponder	Sバンドトランスポンダ
STT	STar Tracker	スタートラッカ
SWB	lunar SWing-By	月スイングバイ
TCS	Thermal Control System	熱制御系
THR	THRuster	補助スラスタ
TLI	Trans-Lunar Injection	月遷移軌道投入
TNK	fuel TaNK	推進薬タンク
TOR	Trim ORifice	トリムオリフィス
UDSC	Usuda Deep Space Center	臼田局
USC	Uchinoura Space Center	内之浦局
VANT	RAV Velocity meter ANTenna	着陸レーダ速度測定用アンテナ
XRISM	X-Ray Imaging and Spectroscopy Mission	X線分光撮像衛星

SLIM Project Press Kit (2023/10)
https://global.jaxa.jp/countdown/slim/SLIM-mediakit-EN 2308.pdf

Results from the Smart Lander for Investigating Moon (2024/1/25)
https://www.isas.jaxa.jp/en/outreach/announcements/files/SLIM-pressconf-20240125.pdf

Smart Lander for Investigating Moon (SLIM) ISAS/JAXA Project Homepage (Japanese)
https://www.isas.jaxa.jp/home/slim/SLIM/index.html