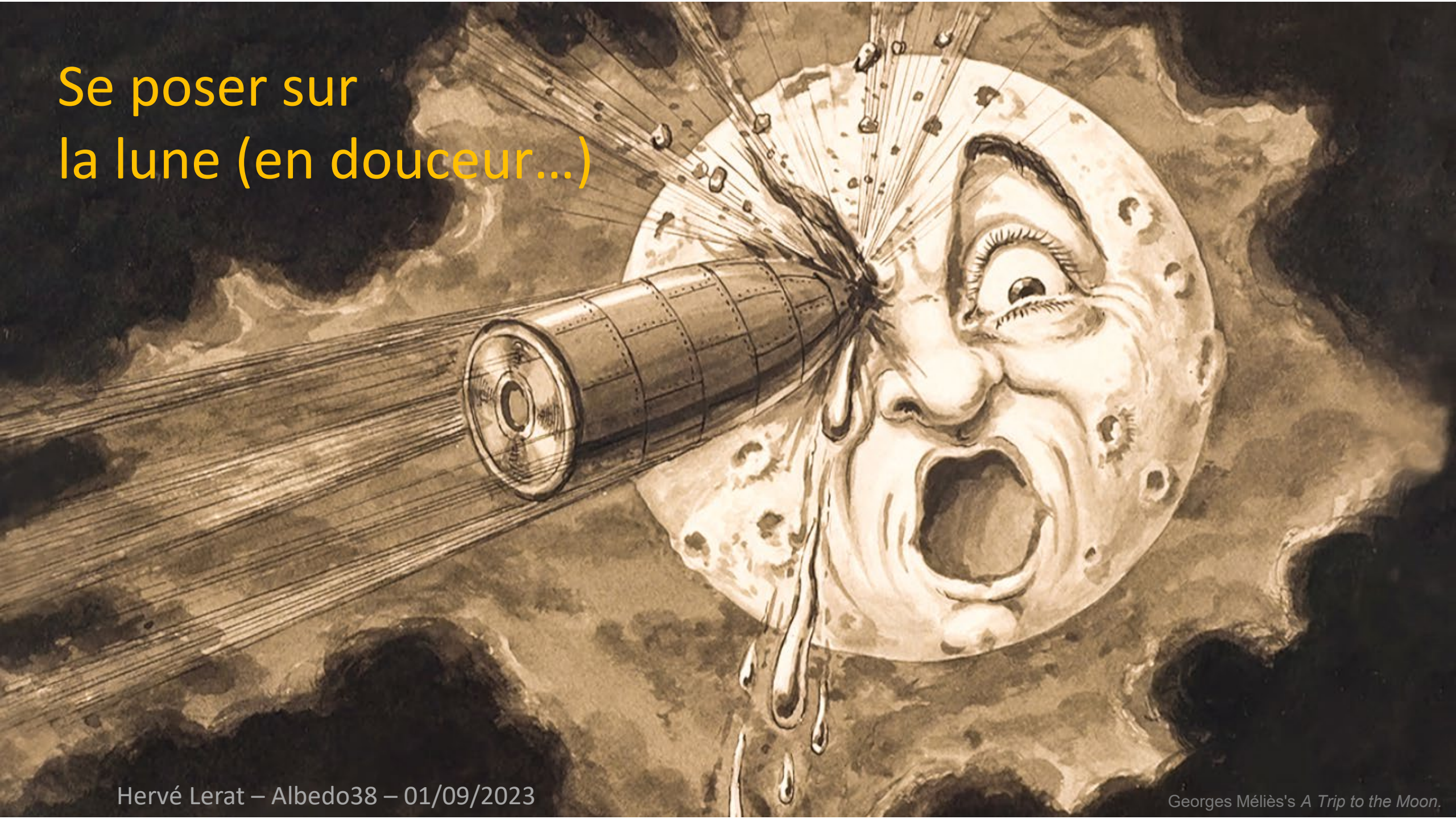


Se poser sur
la lune (en douceur...)



Le célèbre alunissage de la X-FLR 6
en 1953 dans le cirque
d'Hipparque...

En fait, la réalité commence 10 ans
plus tard...



- HERGÉ -



LES AVENTURES DE
TINTIN

ON A MARCHÉ SUR LA LUNE

casterman

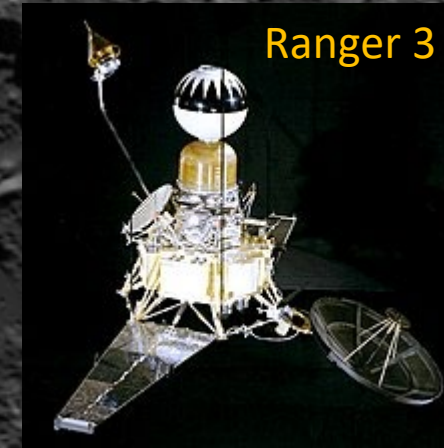
Première mission à objectif d'alunir : Ranger 3 en janvier 1962 (échec).

1962-2023 : 54 missions avec alunissage prévu (non impacteur)

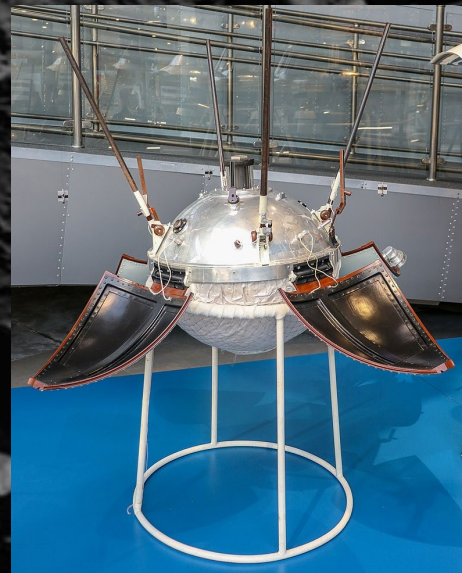
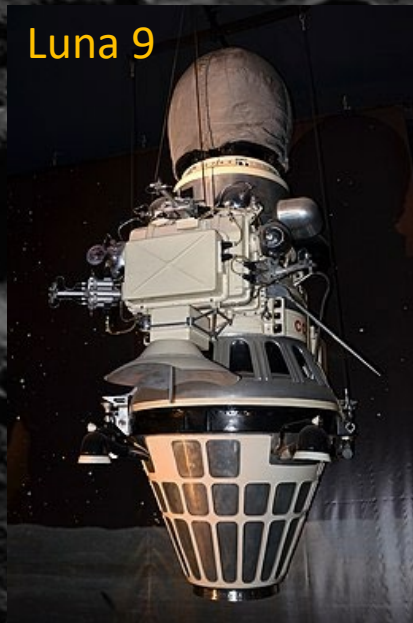
- 44 entre 1962 et 1976

- 10 depuis 2013

23 succès dont 4 depuis 2013 (43% succès)



1^{er} objet humain à alunir (en douceur!) : Luna 9 des soviétiques. Site : Oceanus Procellarum, 3 February 1966, 18:45:30 GMT



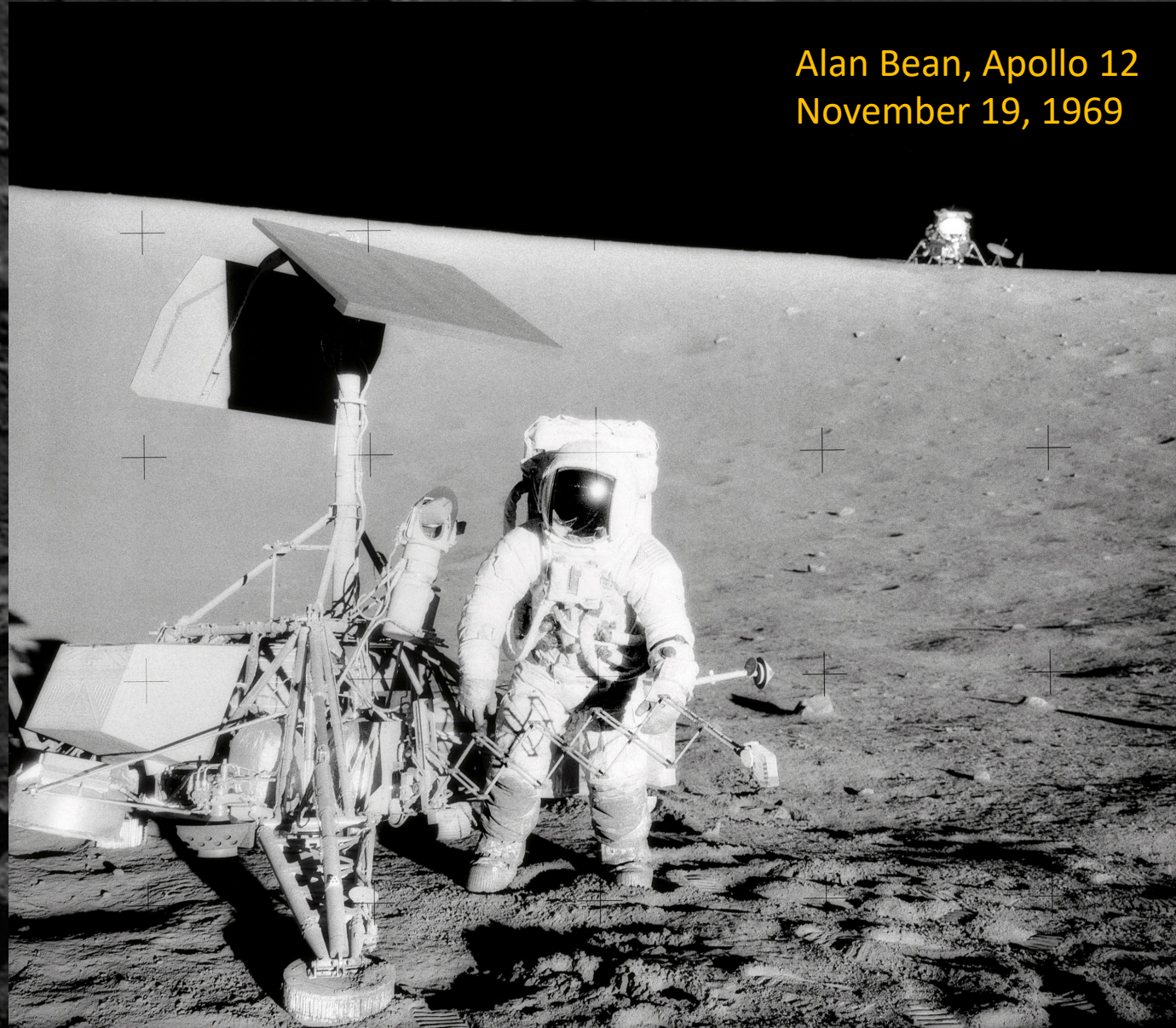
Première photo prise à la surface de la lune

4 mois plus tard: Surveyor 1 des USA – 30 mai 1966









[Ocean of Storms](#)



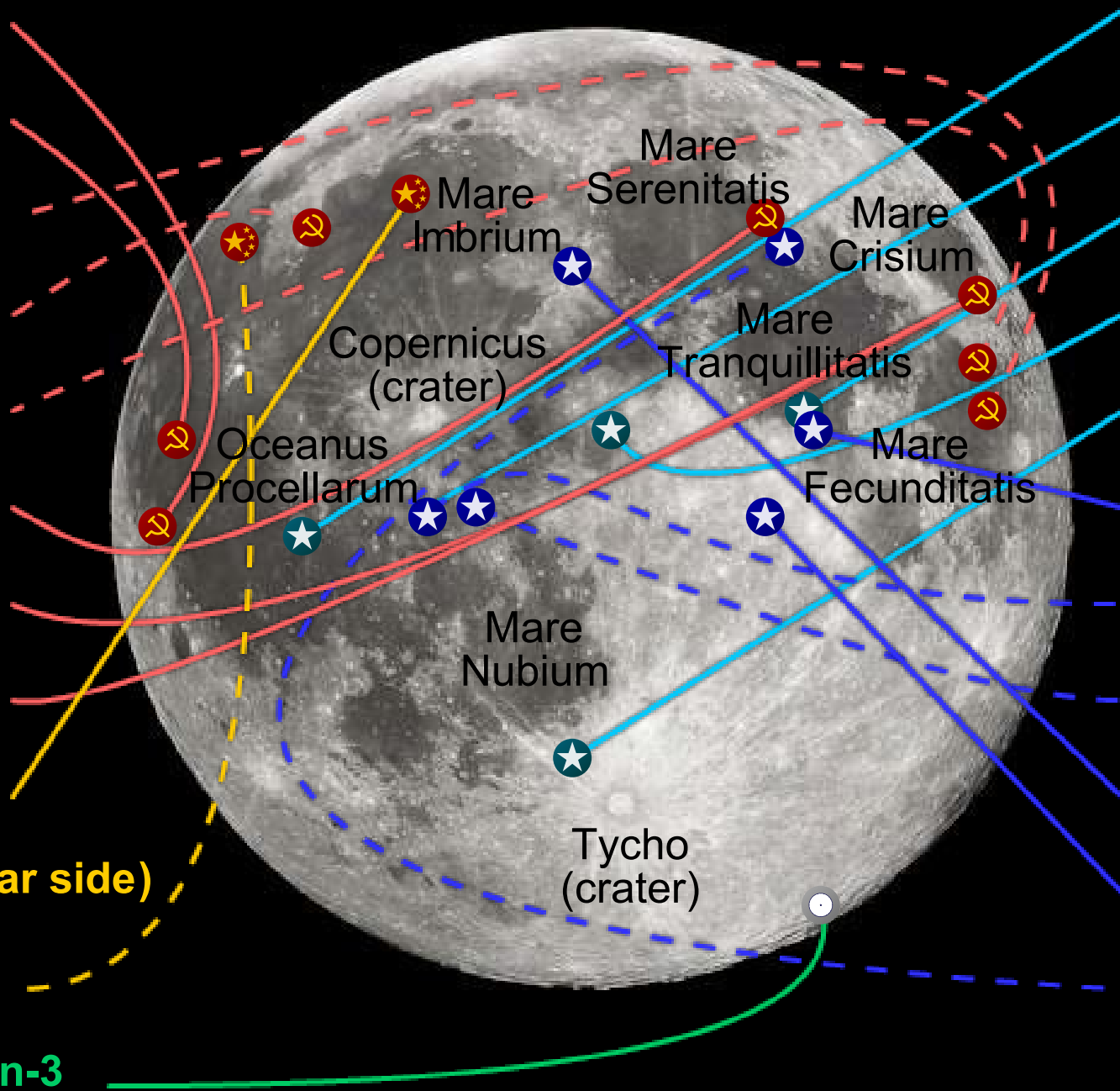
Alan Bean, Apollo 12
November 19, 1969



Mission	Spacecraft	Launch date	Carrier rocket	Operator	Mission type	Outcome
Ranger 3 (P-34)	Ranger 3 Ranger 3 lander	26 January 1962	Atlas LV-3 Agena-B	 NASA	Impactor Lander	Spacecraft failure Spacecraft failure
Ranger 4 (P-35)	Ranger 4 Ranger 4 lander	23 April 1962	Atlas LV-3 Agena-B	 NASA	Impactor Lander	Spacecraft failure Spacecraft failure
Ranger 5 (P-36)	Ranger 5 Ranger 5 lander	18 October 1962	Atlas LV-3 Agena-B	 NASA	Impactor Lander	Spacecraft failure Spacecraft failure
Luna E-6 No.2	Luna E-6 No.2	4 January 1963	Molniya-L	 OKB-1	Lander	Launch failure
Luna E-6 No.3	Luna E-6 No.3	3 February 1963	Molniya-L	 OKB-1	Lander	Launch failure
Luna 4	Luna 4	2 April 1963	Molniya-L	 OKB-1	Lander	Spacecraft failure
Luna E-6 No.6	Luna E-6 No.6	21 March 1964	Molniya-M	 OKB-1	Lander	Launch failure
Luna E-6 No.5	Luna E-6 No.5	20 April 1964	Molniya-M	 OKB-1	Lander	Launch failure
Kosmos 60	Kosmos 60	12 March 1965	Molniya-L	 Lavochkin	Lander	Launch failure
Luna E-6 No.8	Luna E-6 No.8	10 April 1965	Molniya-L	 Lavochkin	Lander	Spacecraft failure
Luna 5	Luna 5	9 May 1965	Molniya-M	 Lavochkin	Lander	Spacecraft failure
Luna 6	Luna 6	8 June 1965	Molniya-M	 Lavochkin	Lander	Spacecraft failure
Luna 7	Luna 7	4 October 1965	Molniya	 Lavochkin	Lander	Spacecraft failure
Luna 8	Luna 8	3 December 1965	Molniya	 Lavochkin	Lander	Spacecraft failure
Luna 9	Luna 9	31 January 1966	Molniya-M	 Lavochkin	Lander	Successful
Surveyor 1	Surveyor 1	30 May 1966	Atlas LV-3C Centaur-D	 NASA	Lander	Successful
Surveyor 2	Surveyor 2	20 September 1966	Atlas LV-3C Centaur-D	 NASA	Lander	Spacecraft failure
Luna 13	Luna 13	21 December 1966	Molniya-M	 Lavochkin	Lander	Successful
Surveyor 3	Surveyor 3	17 April 1967	Atlas LV-3C Centaur-D	 NASA	Lander	Successful
Surveyor 4	Surveyor 4	14 July 1967	Atlas LV-3C Centaur-D	 NASA	Lander	Spacecraft failure
Surveyor 5	Surveyor 5	8 September 1967	Atlas SLV-3C Centaur-D	 NASA	Lander	Successful
Surveyor 6	Surveyor 6	7 November 1967	Atlas SLV-3C Centaur-D	 NASA	Lander	Successful
Surveyor 7	Surveyor 7	7 January 1968	Atlas SLV-3C Centaur-D	 NASA	Lander	Successful
Luna E-8 No.201	Luna E-8 No.201 Lunokhod	19 February 1969	Proton-K/D	 Lavochkin	Lander Rover	Launch failure Launch failure
Luna E-8-5 No.402	Luna E-8-5 No.402 Luna E-8-5 No.402 Return Craft	14 June 1969	Proton-K/D	 Lavochkin	Lander Sample Return	Launch failure Launch failure
Luna 15 (E-8-5 No.401)	Luna 15 Luna 15 Return Craft	13 July 1969	Proton-K/D	 Lavochkin	Lander Sample Return	Spacecraft failure Launch failure

Apollo 11	Apollo 11	16 July 1969	Saturn V		NASA	Orbiter	Successful
	Apollo 11 Lunar Module					Lander/Launch Vehicle	Successful
Kosmos 300 (E-8-5 No.403)	Kosmos 300	23 September 1969	Proton-K/D		Lavochkin	Lander	Launch failure
	Kosmos 300 Return Craft					Sample return	Launch failure
Kosmos 305 (E-8-5 No.404)	Kosmos 305	22 October 1969	Proton-K/D		Lavochkin	Lander	Launch failure
	Kosmos 305 Return Craft					Sample Return	Launch failure
Apollo 12	Apollo 12	14 November 1969	Saturn V		NASA	Orbiter	Successful
	Apollo 12 Lunar Module					Lander/Launch Vehicle	Successful
Luna E-8-5 No.405	Luna E-8-5 No.405	6 February 1970	Proton-K/D		Lavochkin	Lander	Launch failure
	Luna E-8-5 No.405 Return Craft					Sample return	Launch failure
Apollo 13	Apollo 13	11 April 1970	Saturn V		NASA	Orbiter	Spacecraft failure
	Apollo 13 Lunar Module					Lander/Launch Vehicle	Successful
Luna 16 (E-8-5 No.406)	Luna 16	12 September 1970	Proton-K/D		Lavochkin	Lander	Successful
	Luna 16 Return Craft					Sample return	Successful
Luna 17 (E-8 No.203)	Luna 17	10 November 1970	Proton-K/D		Lavochkin	Lander	Successful
	Lunokhod 1					Rover	Successful
Apollo 14	Apollo 14	31 January 1971	Saturn V		NASA	Orbiter	Successful
	Apollo 14 Lunar Module					Lander/Launch Vehicle	Successful
Apollo 15	Apollo 15	26 July 1971	Saturn V		NASA	Orbiter	Successful
	Apollo 15 Lunar Module					Lander/Launch Vehicle	Successful
	Lunar Roving Vehicle					Rover	Successful
Luna 18 (E-8-5 No.407)	Luna 18	2 September 1971	Proton-K/D		Lavochkin	Lander	Spacecraft failure
	Luna 18 Return Craft					Sample return	Spacecraft failure
Luna 20 (E-8-5 No.408)	Luna 20	14 February 1972	Proton-K/D		Lavochkin	Lander	Successful
	Luna 20 Return Craft					Sample return	Successful
Apollo 16	Apollo 16	16 April 1972	Saturn V		NASA	Orbiter	Successful
	Apollo 16 Lunar Module					Lander/Launch Vehicle	Successful
	Lunar Roving Vehicle					Rover	Successful
Apollo 17	Apollo 17	7 December 1972	Saturn V		NASA	Orbiter	Successful
	Apollo 17 Lunar Module					Lander/Launch Vehicle	Successful
	Lunar Roving Vehicle					Rover	Successful
Luna 21 (E-8 No.204)	Luna 21	8 January 1973	Proton-K/D		Lavochkin	Lander	Successful
	Lunokhod 2					Rover	Successful
Luna 23 (E-8-5M No.410)	Luna 23	16 October 1975	Proton-K/D		Lavochkin	Lander	Partial failure
	Luna 23 Return Craft					Sample Return	Precluded
Luna E-8-5M No.412	Luna E-8-5M No.412	16 October 1975	Proton-K/D		Lavochkin	Lander	Launch failure
	Luna E-8-5M No.412 Return Craft					Sample Return	Launch failure
Luna 24 (E-8-5M No.413)	Luna 24	9 August 1976	Proton-K/D		Lavochkin	Lander	Successful
	Luna 24 Return Craft					Sample Return	Successful

- 1. **Luna 9**
3 Feb 1966
- 3. **Luna 13**
24 Dec 1966
- 10. **Luna 16**
20 Sep 1970
- 11. **Luna 17**
17 Nov 1970
- 14. **Luna 20**
21 Feb 1972
- 17. **Luna 21**
15 Jan 1973
- 18. **Luna 23**
6 Nov 1974
- 19. **Luna 24**
19 Aug 1976
- 20. **Chang'e 3**
14 Dec 2013
- 21. **Chang'e 4 (far side)**
3 Jan 2019
- 22. **Chang'e 5**
1 Dec 2020
- 23. **Chandrayaan-3**
23 Aug 2023

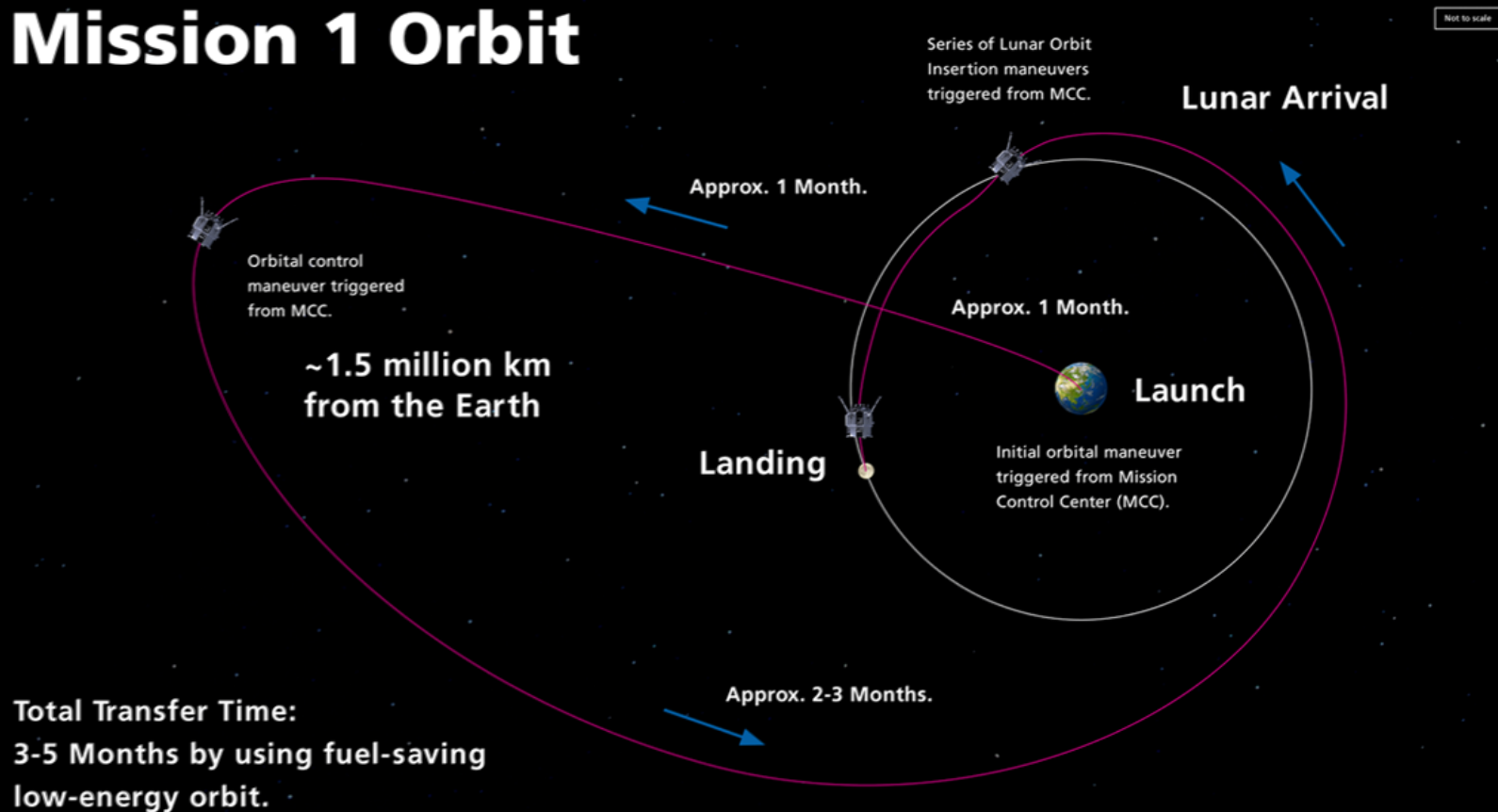


- 2. **Surveyor 1**
2 Jun 1966
- 4. **Surveyor 3**
20 Apr 1967
- 5. **Surveyor 5**
11 Sep 1967
- 6. **Surveyor 6**
7 Nov 1967
- 7. **Surveyor 7**
10 Jan 1968
- 8. **Apollo 11**
20 Jul 1969
- 9. **Apollo 12**
24 Nov 1969
- 12. **Apollo 14**
5 Feb 1971
- 13. **Apollo 15**
7 Aug 1971
- 15. **Apollo 16**
27 Apr 1972
- 16. **Apollo 17**
11 Dec 1972

Chang'e 3	Chang'e 3	1 December 2013	Long March 3B		CNSA	Lander	Operational
	Yutu					Rover	Successful
Chang'e 4	Chang'e 4	7 December 2018	Long March 3B		CNSA	Lander	Operational
	Yutu-2					Rover	Operational
Beresheet	Beresheet	22 February 2019	Falcon 9		SpaceIL	Lander	Spacecraft failure
Chandrayaan-2	Chandrayaan-2 Orbiter	22 July 2019	LVM3 M1		ISRO	Orbiter	Operational
	Vikram					Lander	Spacecraft Failure
	Pragyan					Rover	Spacecraft Failure
Chang'e 5	Chang'e 5 Orbiter	23 November 2020	Long March 5		CNSA	Orbiter	Operational
	Chang'e 5 Lander					Lander	Successful
	Chang'e 5 Ascender					Launch Vehicle	Successful
	Chang'e 5 Returner					Sample Return	Successful
Hakuto-R Mission 1	Hakuto-R	11 December 2022	Falcon 9 Block 5		ispace Tomy/JAXA/Dodai	Lander	Spacecraft failure
	SORA-Q					Rover	Spacecraft failure
Emirates Lunar Mission	Rashid	11 December 2022	Falcon 9 Block 5		UAESA/MBRSC	Rover	Spacecraft failure
Chandrayaan-3	Chandrayaan-3	14 July 2023	LVM3 M4		ISRO	Orbiter	Operational
	Vikram lander					Lander	Operational
	Pragyan rover					Rover	Operational
Luna 25	Luna 25	10 August 2023	Soyuz-2.1b/Fregat		Roscosmos	Lander	Spacecraft failure

Hakuto-R Mission 1 – ISPACE (Japon)

Mission 1 Orbit



Construire et de mettre en œuvre des atterrisseurs et des astromobiles lunaires de petite taille (Google Lunar X prize).

Emirates Lunar Mission Rashid



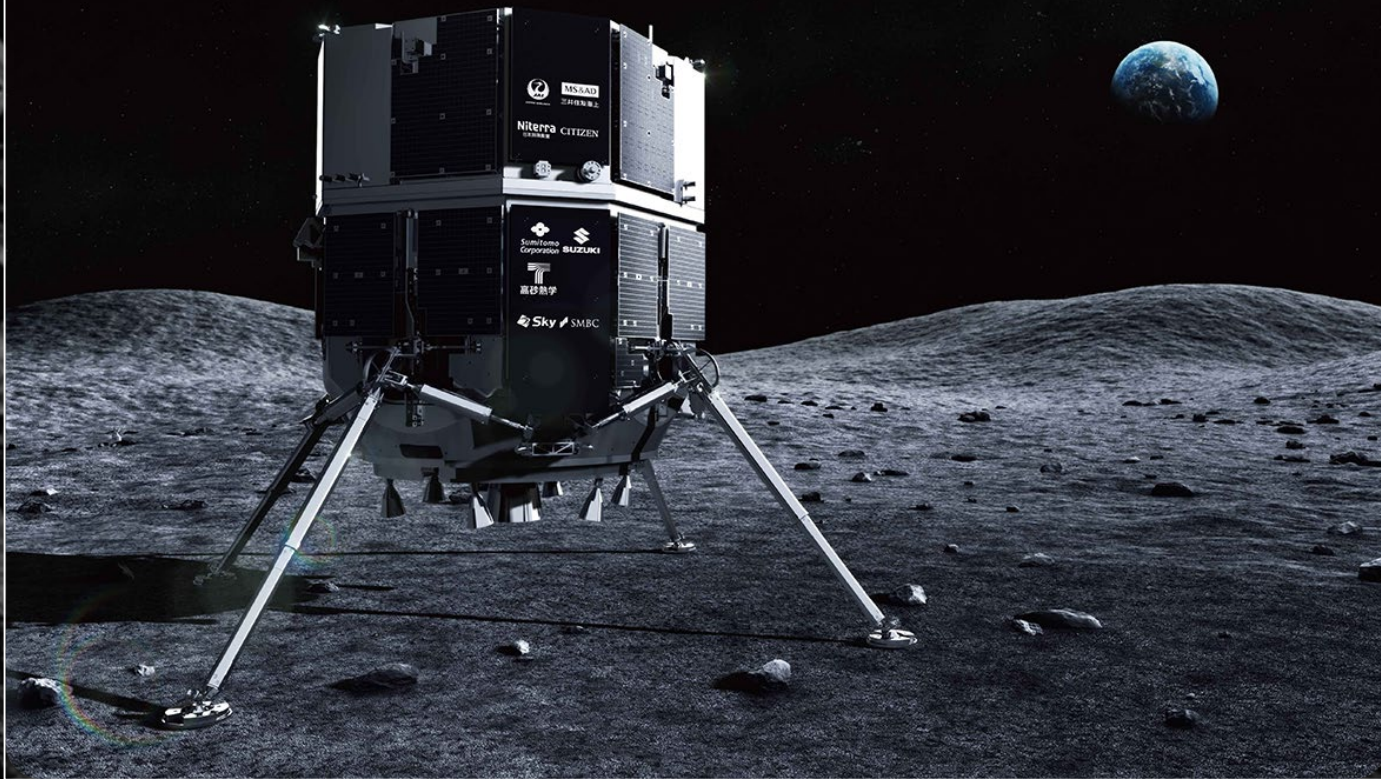
Astromobile de 10 kilogrammes appelé Rashid développé par les Émirats arabes unis.

Embarqué sur l'atterrisseur lunaire japonais Hakuto-R M1, s'écrase sur la Lune le 25 avril 2023.



- l'analyse des propriétés thermiques du régolithe
- l'analyse de la structure et de la taille de la poussière
- l'étude du plasma des électrons proches de la surface
- mesurer la manière dont la poussière lunaire colle à la surface de différents types de matériaux.
- il emporte plusieurs caméras à haute résolution, fournies par le CNES.

Hakuto-R

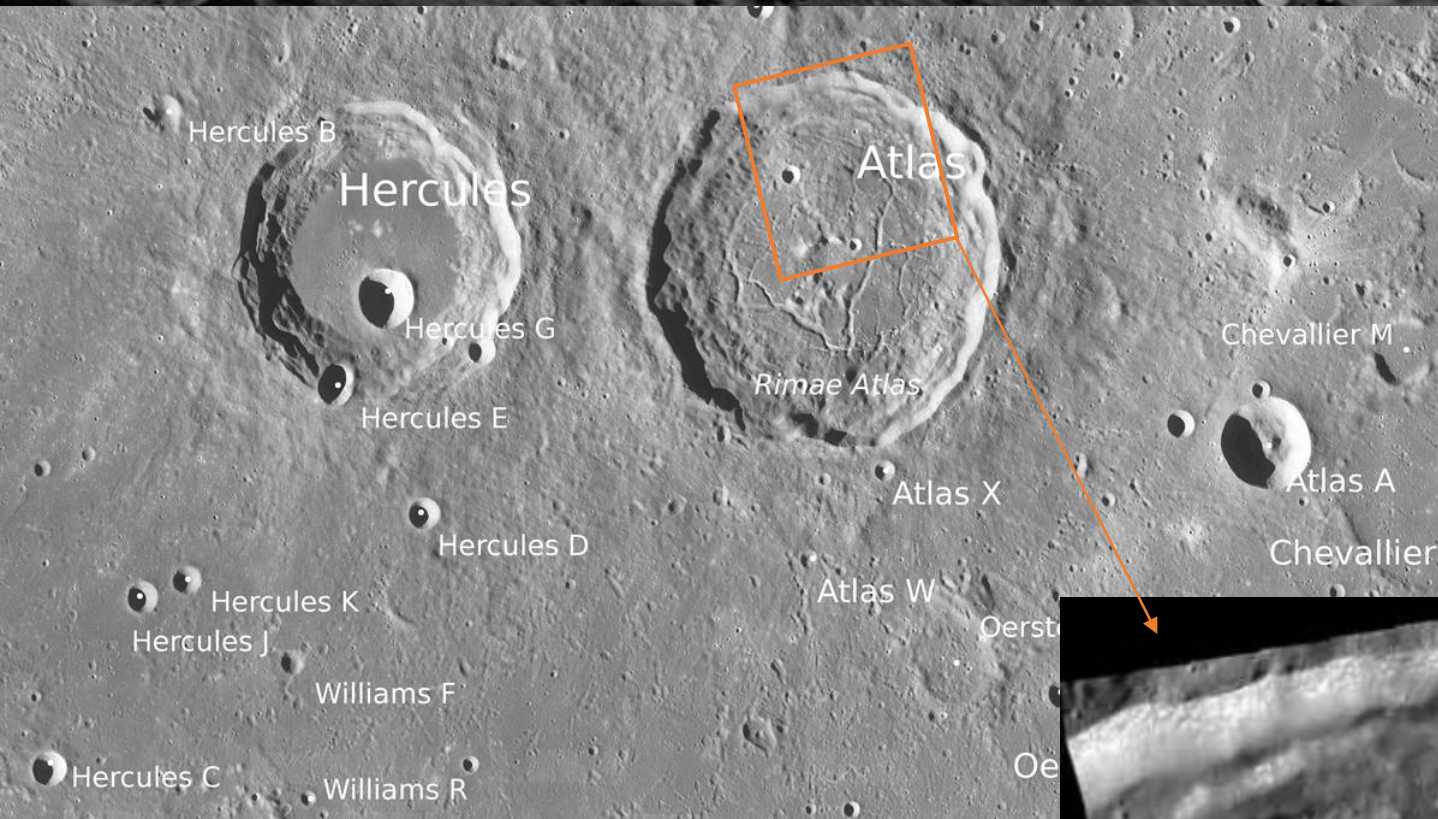


L'atterrisseur permet de déposer des charges utiles d'une masse totale de 30 kilogrammes à la surface de la Lune. Avec son train d'atterrissage déployé, il est haut de 2,3 mètres pour un diamètre de 2,6 mètres. Sa masse à vide (sans ergols) est de 340 kilogrammes

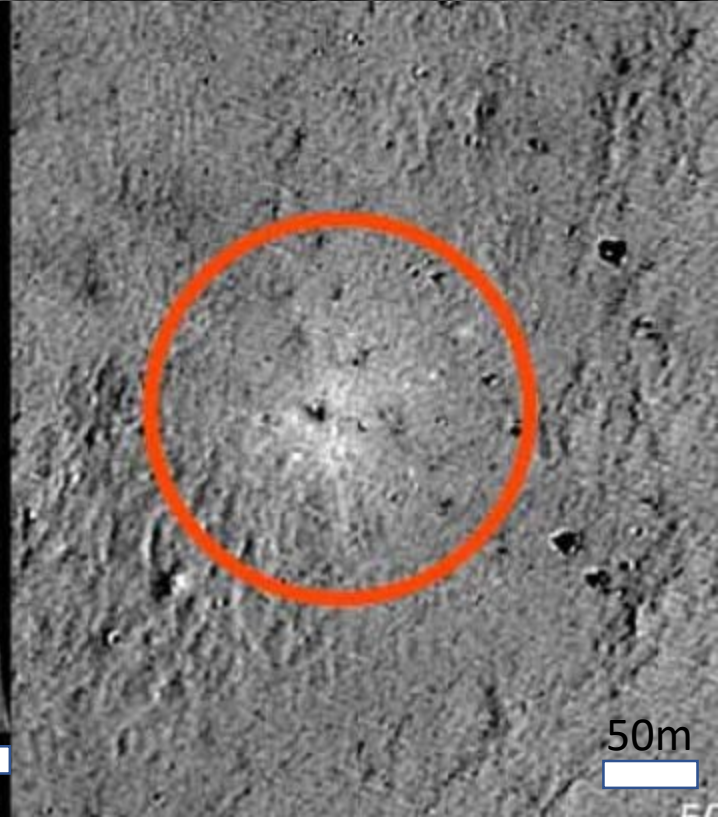
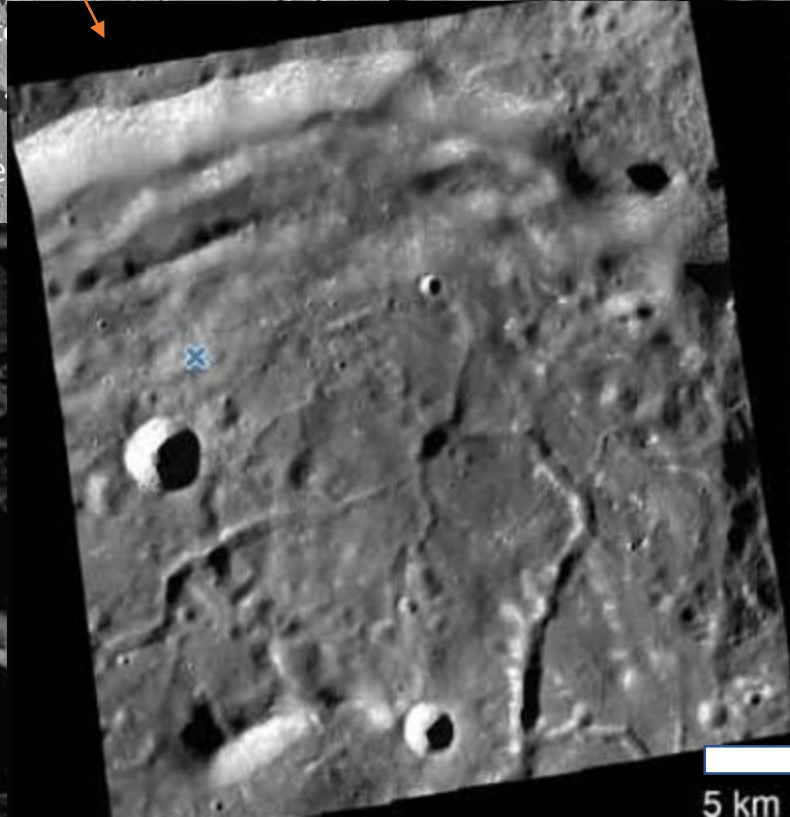
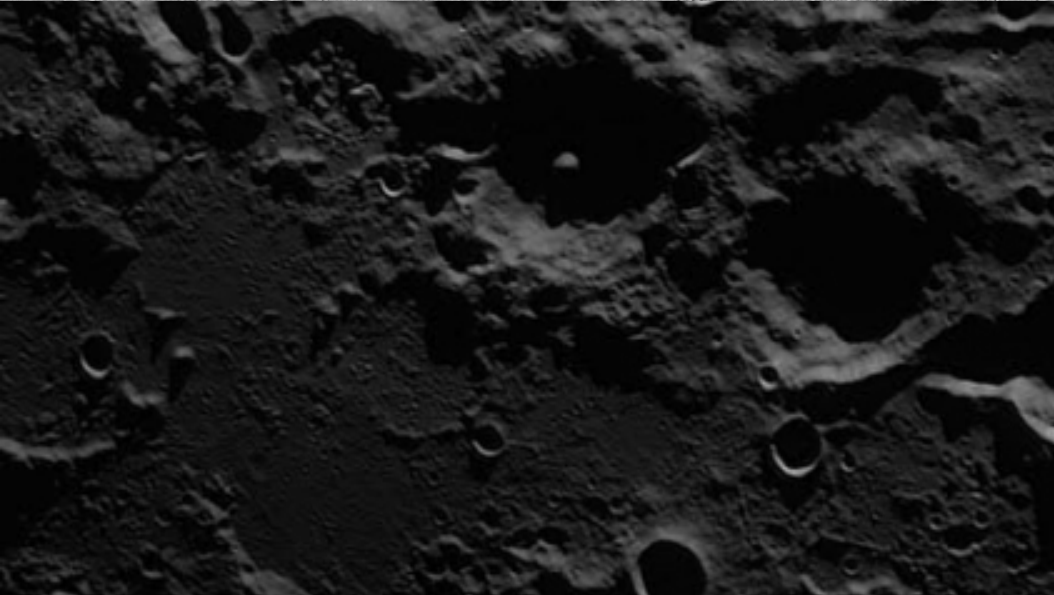
SORA-Q



250 grammes et de 8 centimètres de diamètre



S'écrase à la surface le 26 avril 2023
(erreur de calcul d'altitude, chute de plusieurs km)





ispace

Mission 1 Milestones

ispace has already completed 8 out of 10 milestones, verifying a large part of our lander technology and business model concept.

▶ Success 1

Completion of Launch Preparations

Completed 2022 Nov 28

▶ Success 2

Completion of Launch and Deployment

Completed 2022 Dec 11

▶ Success 3

Establishment of a Steady Operation State

(*Initial Critical Operation Status)

Completed 2022 Dec 16

▶ Success 4

Completion of first orbital control maneuver

Completed 2022 Dec 15

▶ Success 5

Completion of stable deep-space flight operations for one month

Completed 2023 Jan 11

▶ Success 6

Completion of all deep space orbital control maneuvers before LOI

Completed 2023 Mar 17

▶ Success 7

Reaching the lunar gravitational field / lunar orbit

Completed 2023 Mar 21

▶ Success 8

Completion of all orbit control maneuvers in lunar orbit

Completed 2023 Apr 13

▶ Success 9

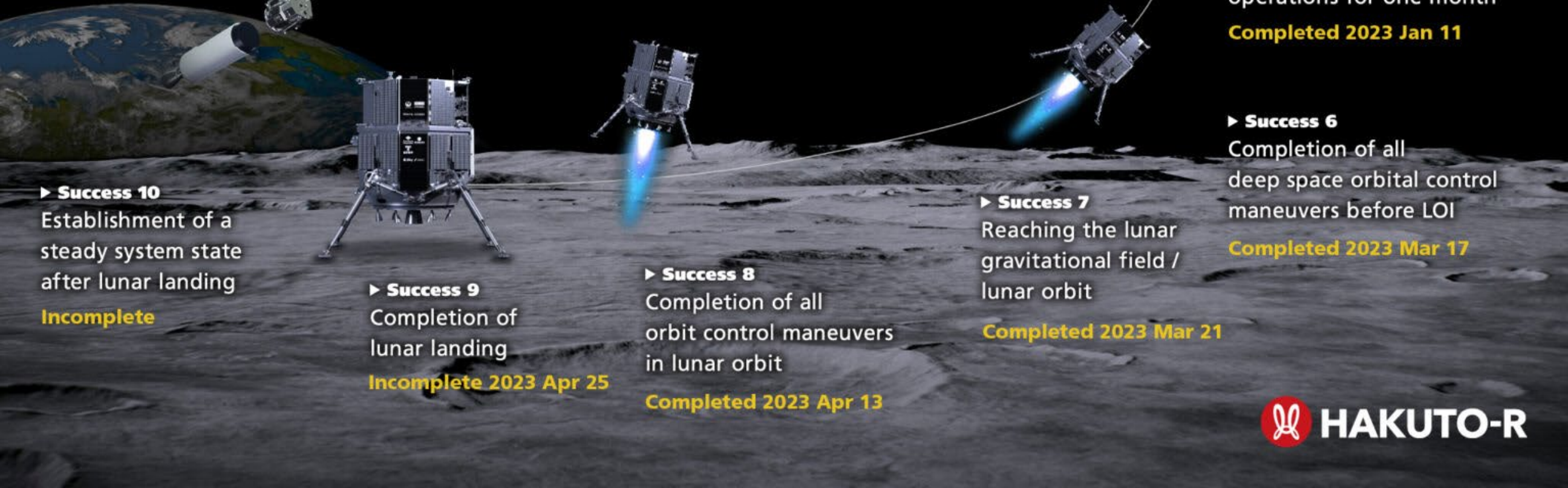
Completion of lunar landing

Incomplete 2023 Apr 25

▶ Success 10

Establishment of a steady system state after lunar landing

Incomplete





Lunar Earthrise Captured by ispace HAKUTO-R Mission 1 at an altitude of 100 km from lunar surface.

CHANDRAYAAN-3 vs LUNA 25

While Luna 25 was launched after Chandrayaan-3, it is likely to touch down on the moon before the Indian mission



	Chandrayaan-3	Luna-25
Lift-off mass	~3,900 kg	1,750 kg
Landing site	69.36°S, 32.34°E	69.54°S, 43.54°E
Mission life	14 days	1 year

Graphic: IE Design

How the two attempts stack up

CHANDRAYAAN-3		LUNA-25	
Jul 14 Chandrayaan-3 Launch	Aug 23 Probable landing	Aug 10 Luna-25 Launch	Aug 21-22 Probable landing
Lift-off mass	3,900 kg	Lift-off mass	1,750 kg
Landing site	69.36°S, 32.34°E	Landing site	69.54°S, 43.54°E
Mission life	14 days	Mission life	1 year

LIGHTER
Luna-25 does not carry a rover. Chandrayaan-3 has a rover capable of moving around 500 metres

PAYLOADS

CHANDRAYAAN-3

LANDER:

- RAMBHA to study properties of electrons and ions such as temperature and density
- ChaSTE to study the thermal properties of the lunar surface near the polar region

ROVER:

- APXS to determine the composition of elements such as Magnesium, Aluminium, Silicon, etc.
- LIBS to determine the chemical and mineral composition of the lunar surface

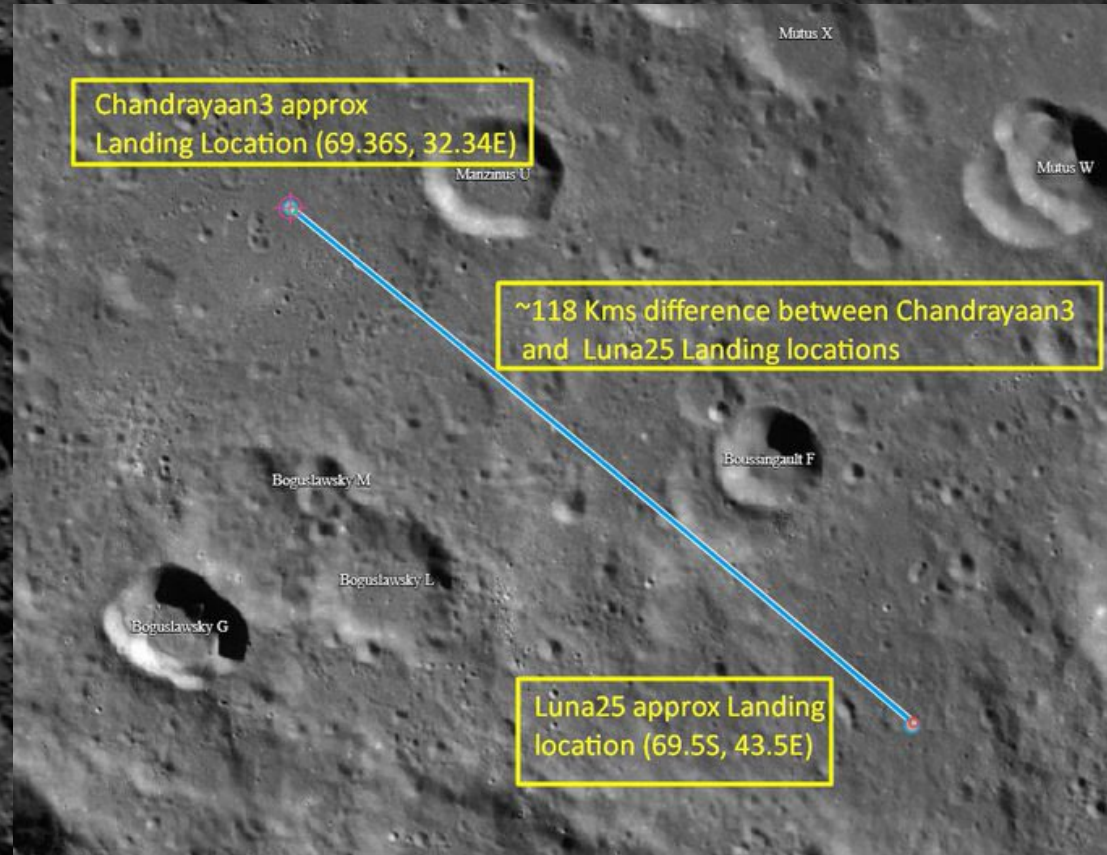
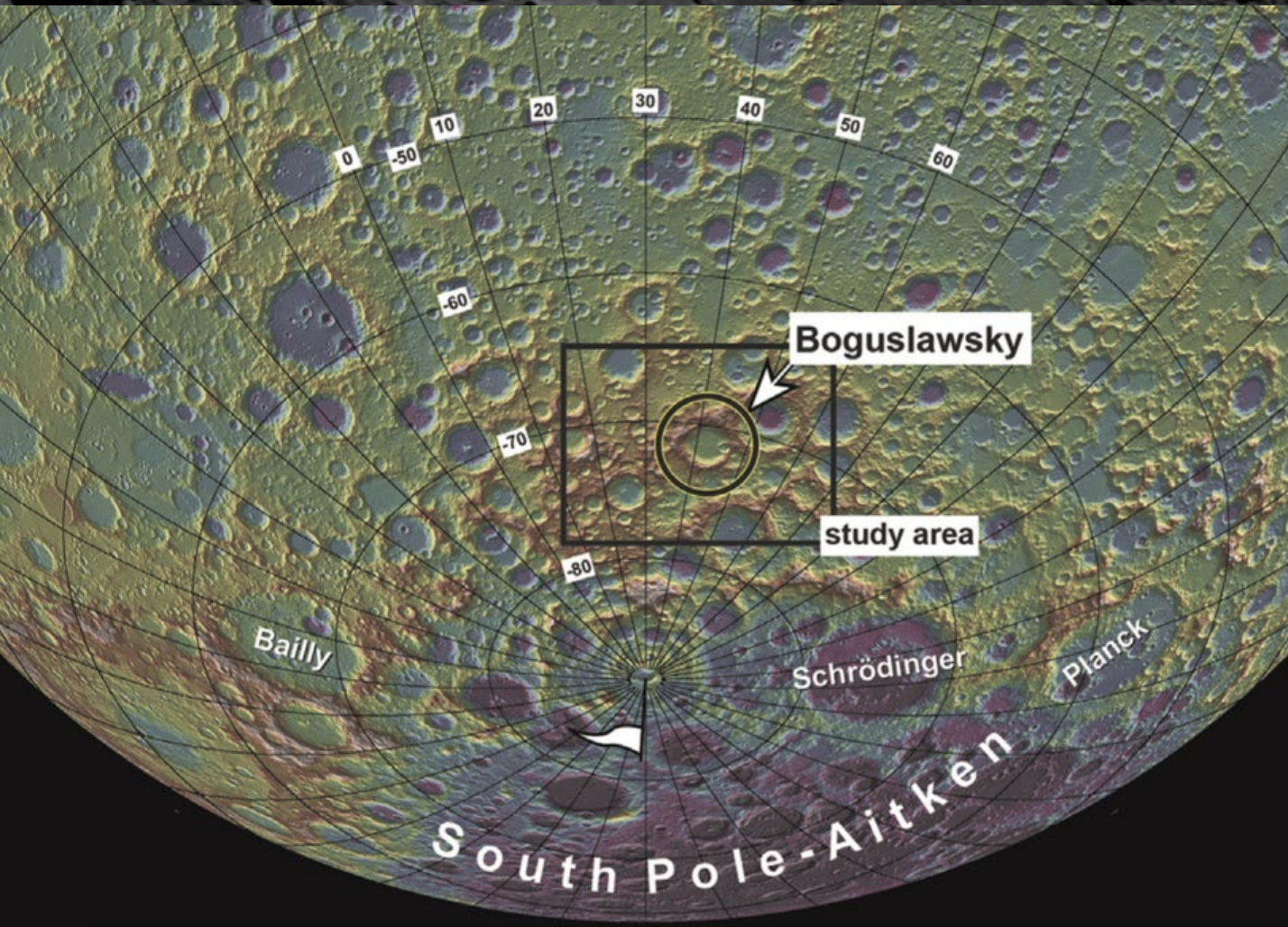


LUNA-25

- ADRON-LR, a spectrometer to study the surface

- ARIES-L detects charged particles in the polar exosphere
- LIS-TV-RPM, an infra-red spectrometer, measures surface water and OH
- The LASMA-LR mass spectrometer will measure composition of soil samples
- The PML detector will study dust in the polar exosphere
- STS-L is a panoramic and local imaging system







Mission LUNA25 - Roscosmos

<https://youtu.be/h9h10mQvKUc>

Atterrisseur Luna-25

Mission : prélèvement et analyse d'échantillons, étude des composants de l'exosphère du pôle lunaire

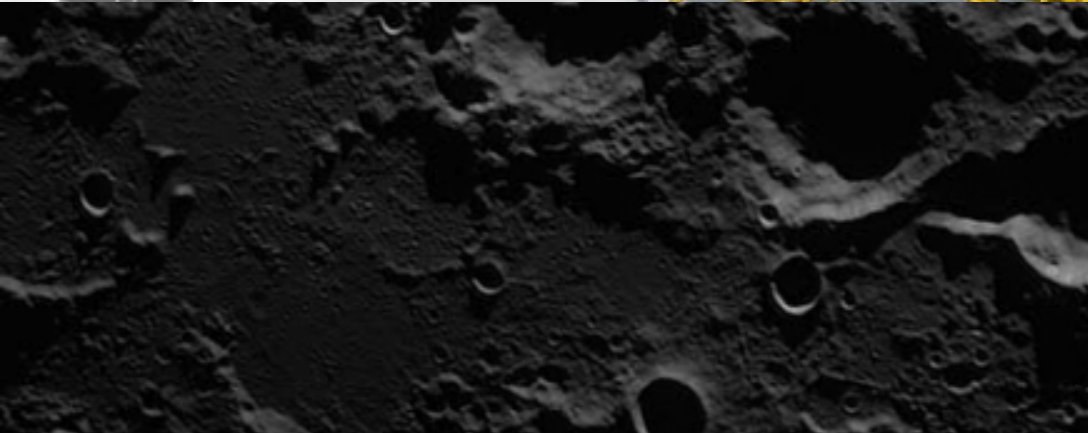
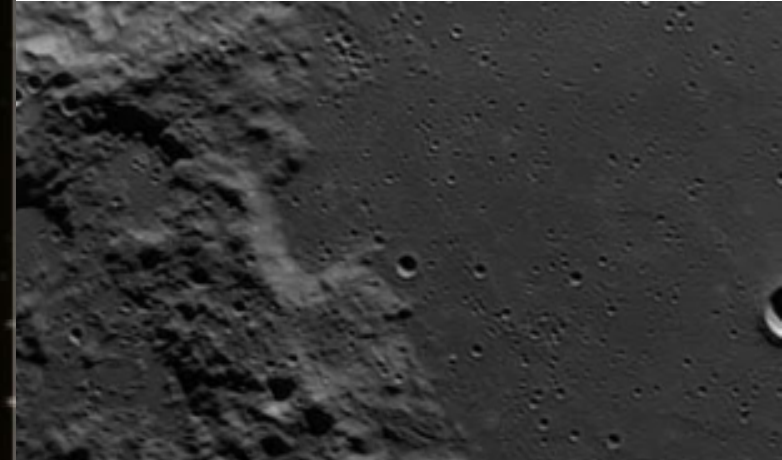
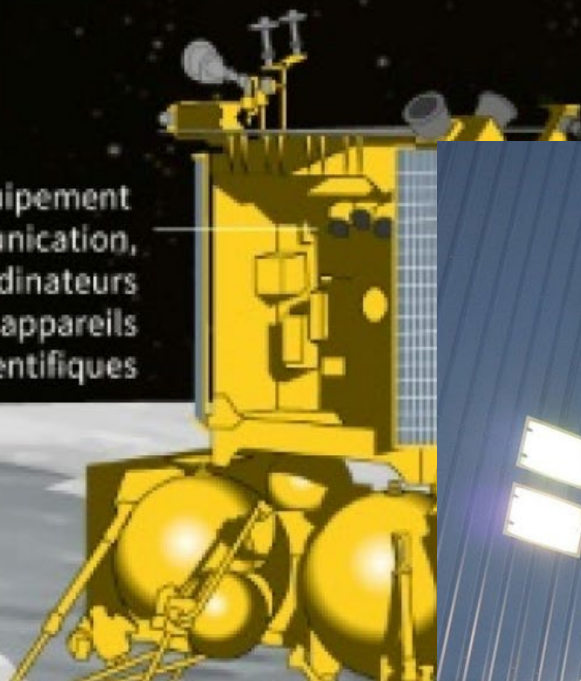
Durée : 1 an

Lanceur :
Soyouz 2.1b
Frégate

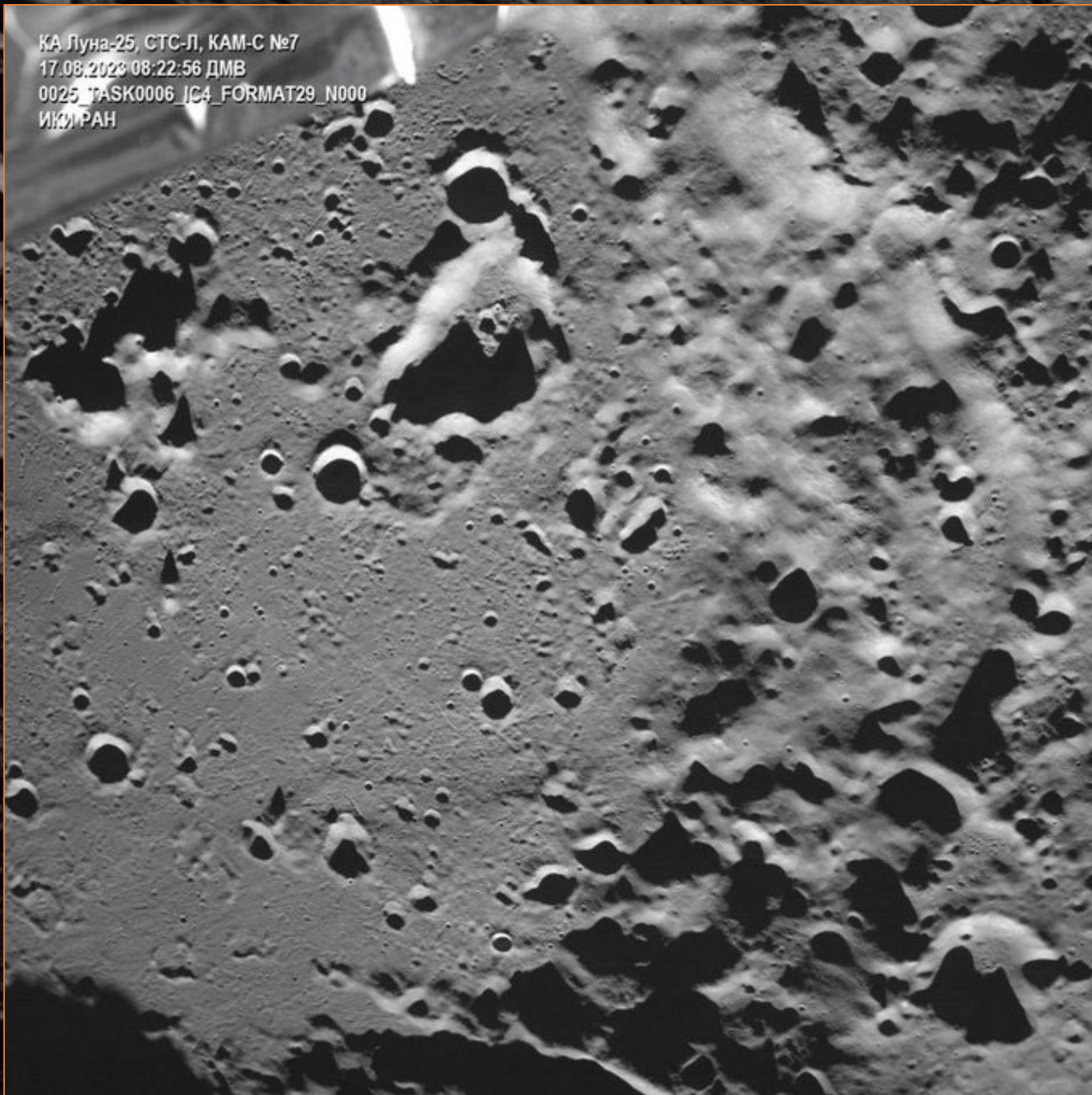
Lancement dans la nuit du 10-11 août depuis le cosmodrome de Vostotchny en Russie

Équipement de communication, ordinateurs et appareils scientifiques

Alunissage prévu sur le pôle sud



КА Луна-25, СТС-Л, КАМ-С №7
17.08.2023 08:22:56 ДМВ
0025 TASK0006 IC4_FORMAT29_N000
ИКИРАН



Cratère Zeeman (face cachée)

« 19/08/2023- Un moteur de manœuvre n'a pas pu être arrêté et a fonctionné pendant 127 secondes au lieu de 84. Le module d'alunissage s'est écrasé à la surface lunaire à la suite de la manœuvre ratée, ce qui a créé une trajectoire qui a croisé la Lune au lieu d'une orbite elliptique prévue avec une distance minimale de 18 km.



इसरो isro

CHANDRAYAAN 3



SPACE

India's Chandrayaan-3 moon mission

The mission carries a lander and a rover with scientific payloads to analyse the chemical and geological composition of the lunar surface.



Landing site
Near lunar south pole



Vikram lunar lander
carries rover plus 4 scientific payloads

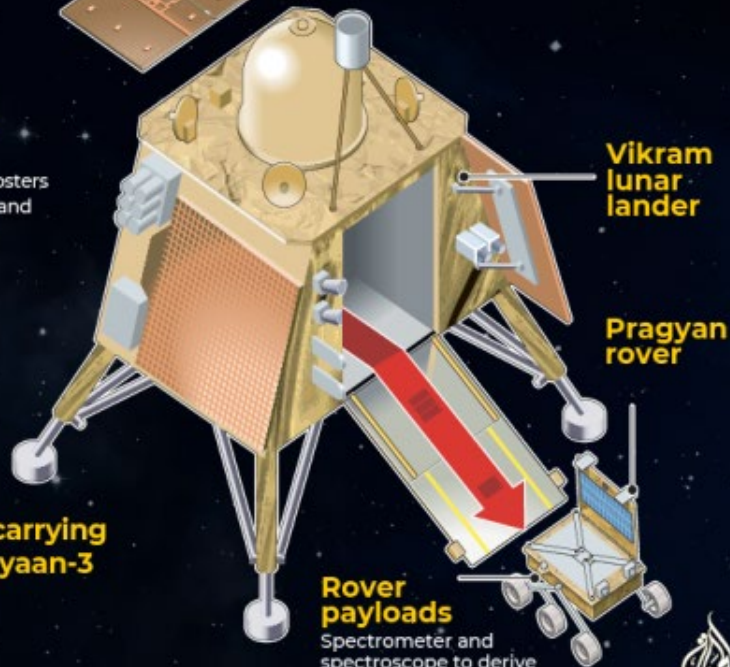


Mass: **1,752kg**
including 26kg rover

Launch Vehicle Mark-III (LVM3)
Two solid-fuel strap-on boosters
One liquid-fuel core stage and cryogenic upper stage

Overall length:
43.5 metres

LVM3 will lift off carrying 3,900kg Chandrayaan-3



Vikram lunar lander

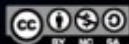
Pragyan rover

Rover payloads

Spectrometer and spectroscope to derive elements present in lunar soil and rocks



@AJLabs ALJAZEERA



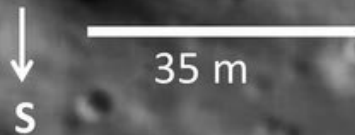
Source: Graphic News | July 13, 2023



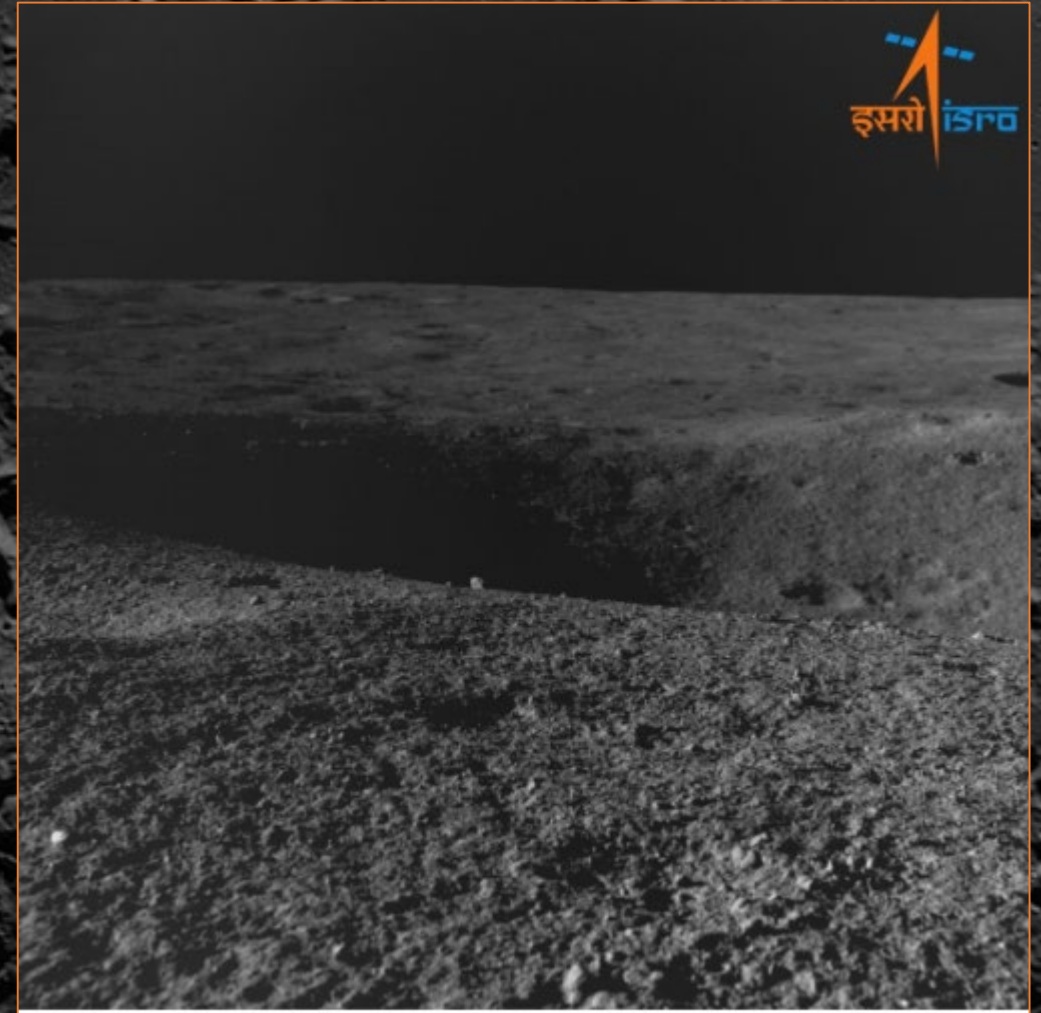
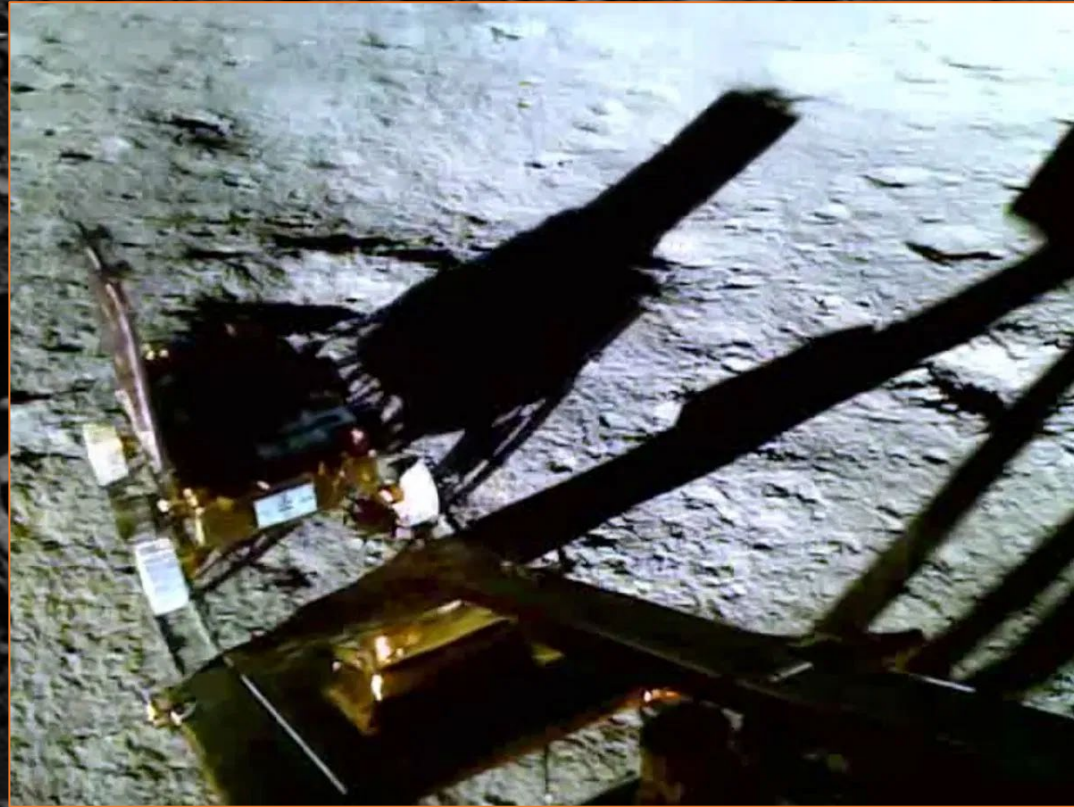
Landing 23 August 2023 - 12:32 UTC



Lander Location
69.373 S, 32.319 E



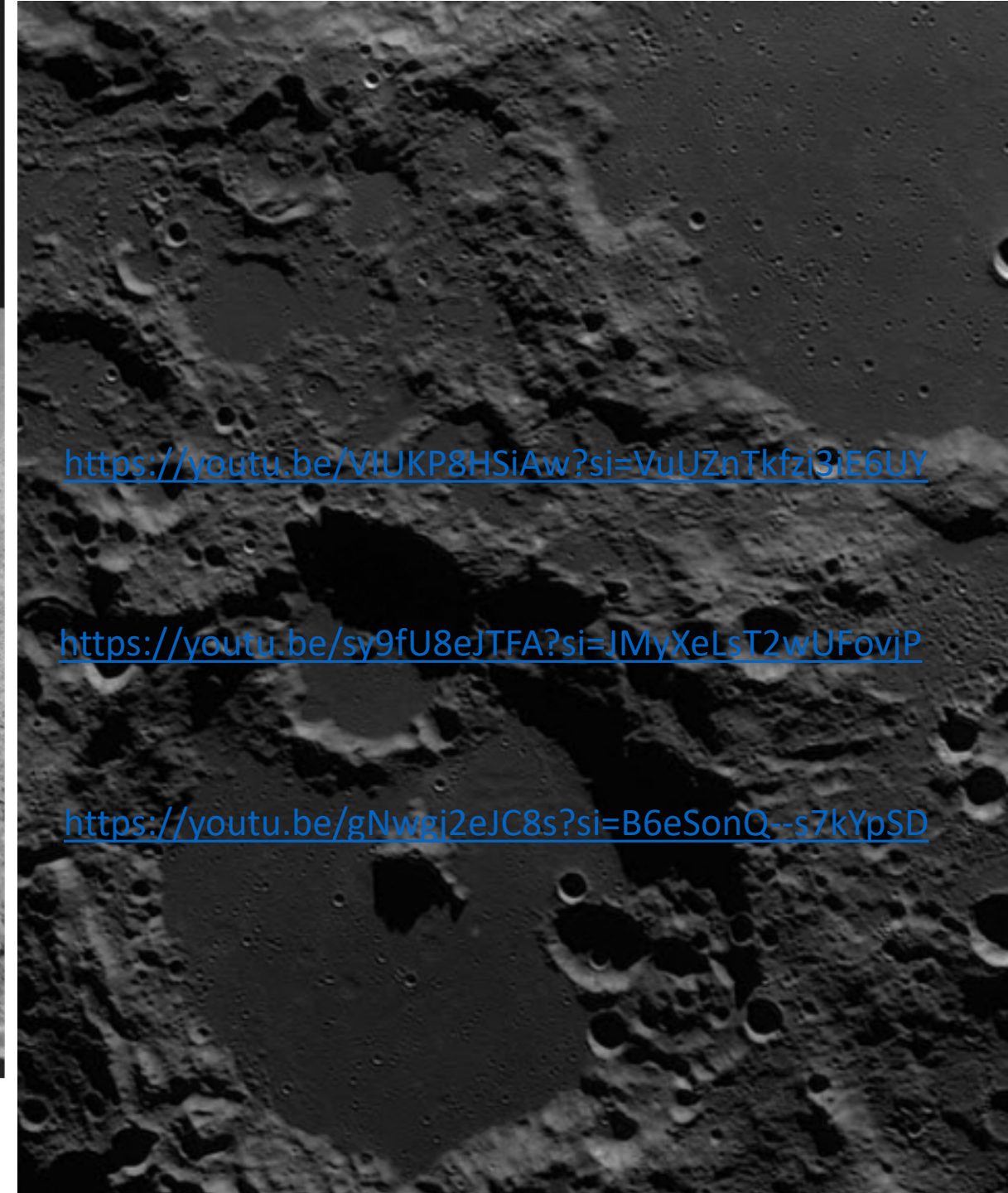
View of Chandrayaan-3 Lander
captured by Chandrayaan-2 orbiter



The crater that the Chandrayaan-3 Rover encountered on August 27, 2023, as seen by the Navigation Camera.



The path retraced by the Chandrayaan-3 Rover on August 27, 2023, as viewed by Navigation Camera onboard Rover.

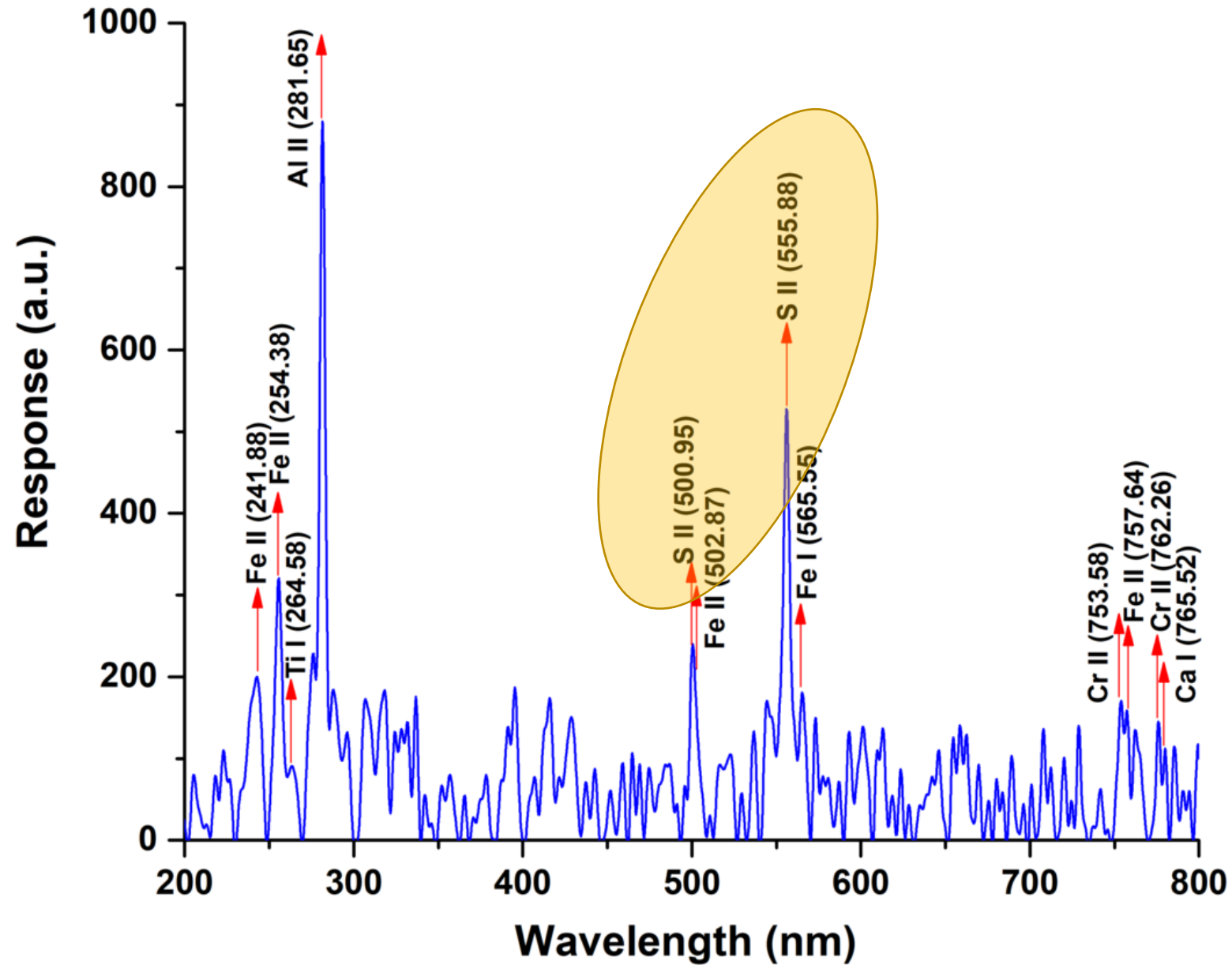


<https://youtu.be/VIUKP8HSiAw?si=VuUZnTkfzi3iE6UY>

<https://youtu.be/sy9fU8eJTFA?si=JMyXeLsT2wUFovjP>

















<https://youtu.be/gNwgj2eJC8s?si=B6eSonQ--s7kYpSD>

The first in-situ close-range LIBS emission spectrum of the lunar surface



FUTURES MISSIONS

Sept 2023-2024

Agency or company	Mission	Spacecraft	Launch date	Launch vehicle	Notes
 JAXA	SLIM ^[98]	SLIM lander	NET September 2023 ^[99]	H-IIA 202	Pinpoint landing and roving. ^{[100][101][102]}
		LEV-1			Hopper, carries multiple instruments.
		LEV-2			Rover in preparation for Lunar Cruiser. ^[103]
 Intuitive Machines	IM-1	Nova-C	15 November 2023 ^[104]	Falcon 9 B5	Lander, Payloads delivery for NASA's CLPS and for private customers. ^[105]
 GEC	Doge-1 ^[106]				12U privately funded cubesat.
 Astrobotc Technology	Mission One	Peregrine	Q4 2023 ^[107]	Vulcan Centaur VC2	Part of CLPS. Peregrine lander will deliver 25 payloads to Gruithuisen Gamma.
 UNAM		Colmena			5 Microrovers.
 CMU		Iris			CubeRover, technology demonstration.
 Intuitive Machines	IM-2	Nova-C	Q1 2024 ^[108]	Falcon 9 B5	Second Nova-C. Payloads delivery for NASA's CLPS.
		Khon1			Communication Satellite.
		Micro-nova			Hopper.
 Lunar Outpost  Nokia		MAPP			Rover, communication technology demonstration.
 MIT		AstroAnt ^[109]			Micro rover, will travel on MAPP rover.
 Dymon		Yaoki ^[110]			Small rover, mapping.
 Spaceflight Industries		SHEPRA-ES mission ^[111]			SHEPRA-ES
 NASA	Lunar Trailblazer		Orbiter, lunar ice scouting.		
 CNSA	Queqiao 2	Queqiao relay satellite 2	early 2024 ^[112]	Long March 8	Relay satellite to support future missions of the Chinese Lunar Exploration Program targeting south pole region. ^[113]
 Deep Space Exploration Laboratory		Tiandu-1 ^[114]			2 orbiters, technology demonstration of lunar constellation.
		Tiandu-2 ^[114]			
 CNSA	Chang'e 6	Lander	May 2024 ^[115]	Long March 5	Sample-return from the south pole Aitken basin on the far side of the Moon. ^[116]
		Orbiter			
		Ascent Vehicle			