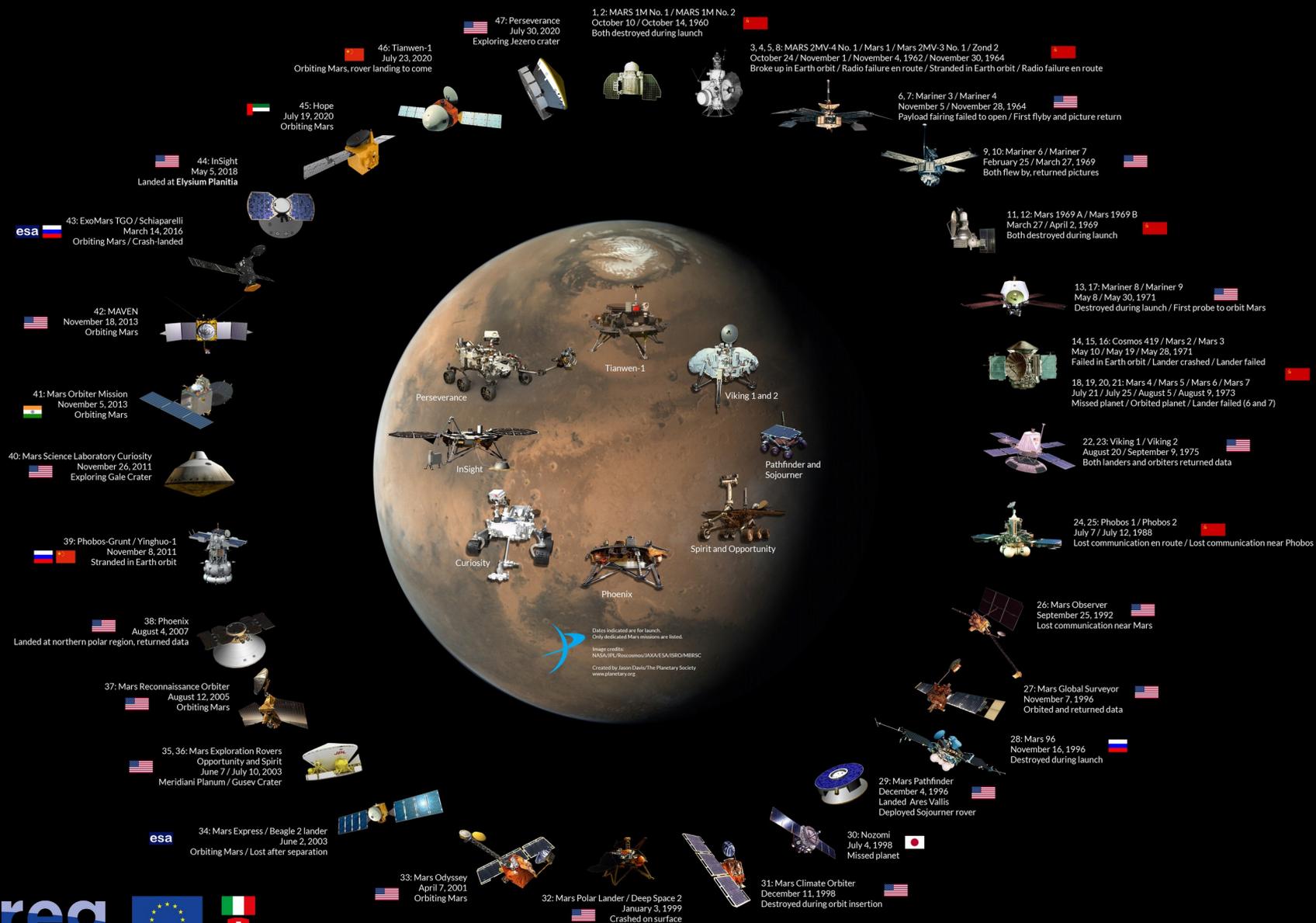


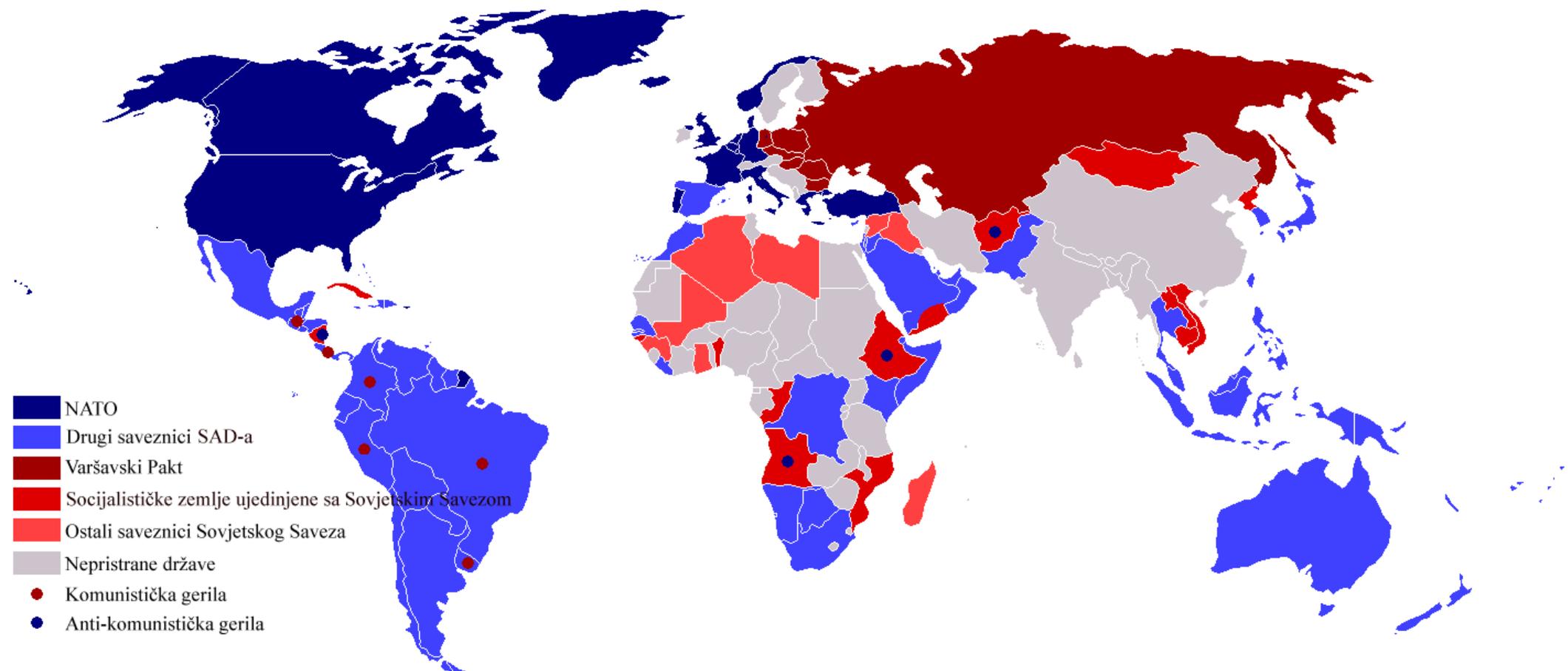
L'esplorazione di Marte

Mars Exploration Family Portrait



DAGLI INIZI AGLI ANNI '70

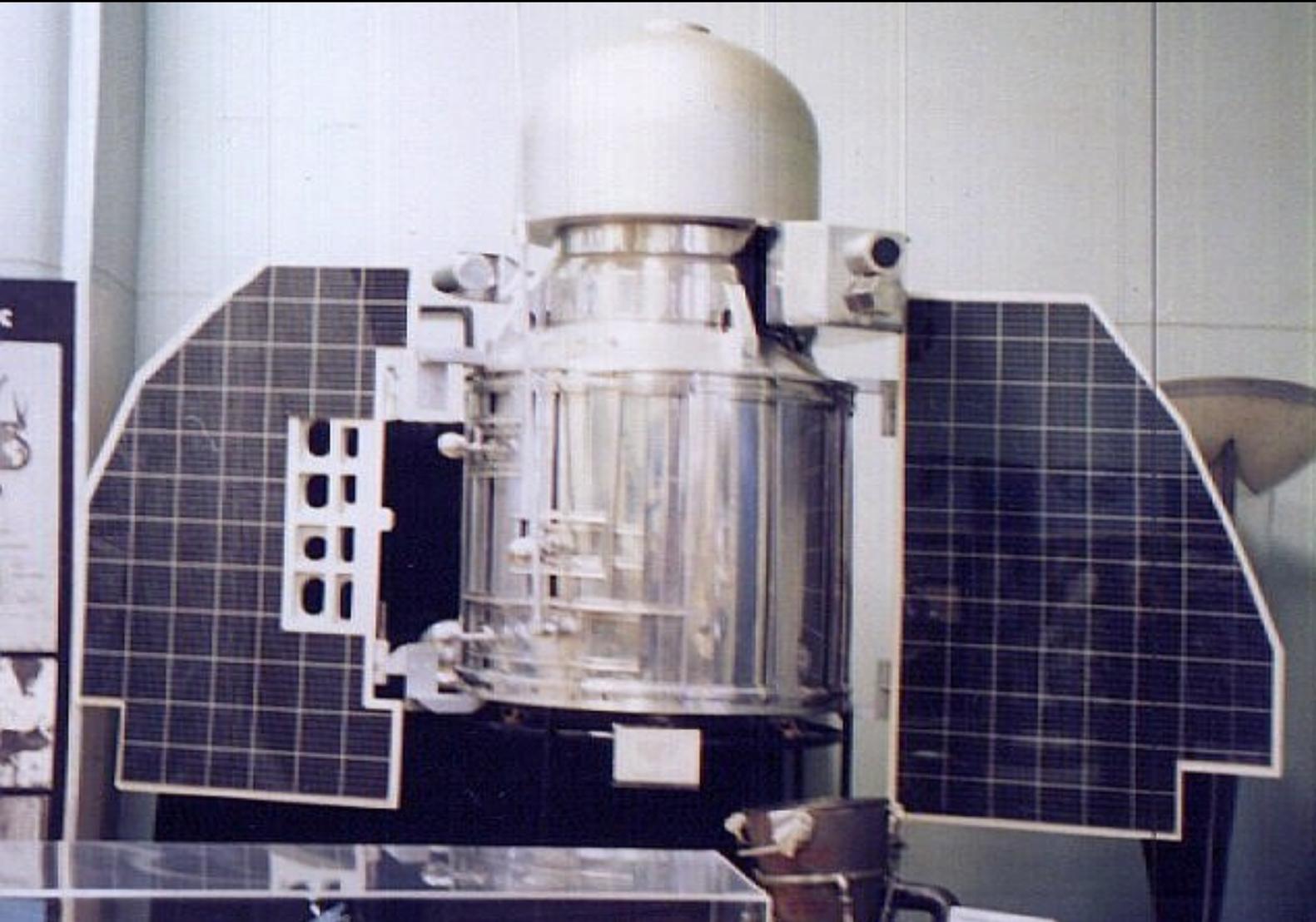
Guerra fredda



DAGLI INIZI AGLI ANNI '70

Mars 1M 1 novembre 1962

ma prima (1960) altre sonde...
Mars 2MV-4 numero 1 (Sputnik 22)



www.shutterstock.com · 83236951

Serghey Korolev
OKB-1

DAGLI INIZI AGLI ANNI '70

Mars 1M

m = 900 kg
Propulsore

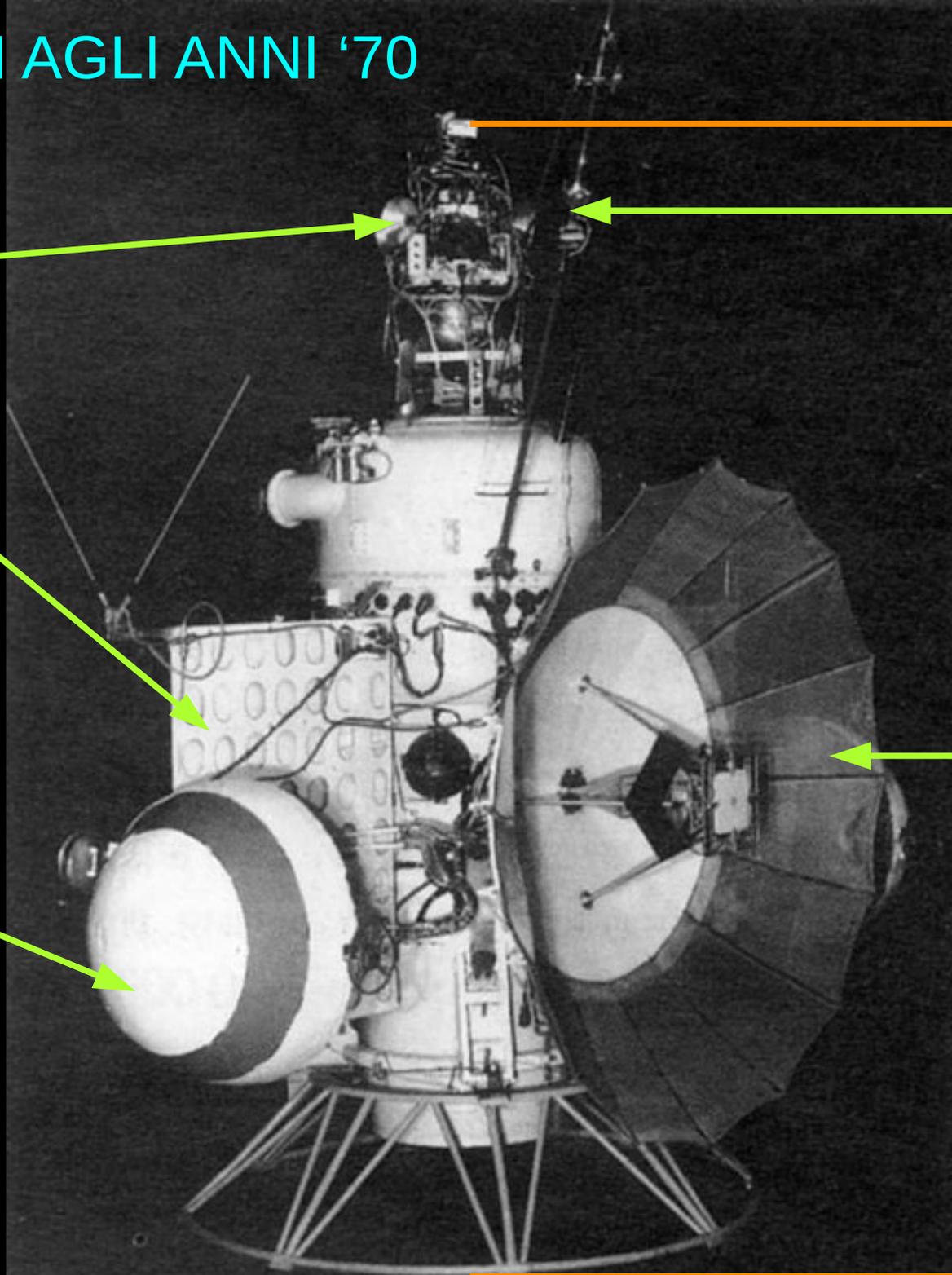
Pannelli solari
Ricaricano
batteria Pb/Ni

Radiatore per la
termoregolazione

Magnetometro,
Apparecchiature
Telefotografiche,
Spettrofotometro,
Sensori di
radiazione,
Rilevatore
di micrometeoriti

h = 3,3 m

Antenna direzionale
d = 1,7 m



DAGLI INIZI AGLI ANNI '70

Mars 1M

Lancio con
Molniya 8K78
da Bajkonur



DAGLI INIZI
AGLI ANNI '70

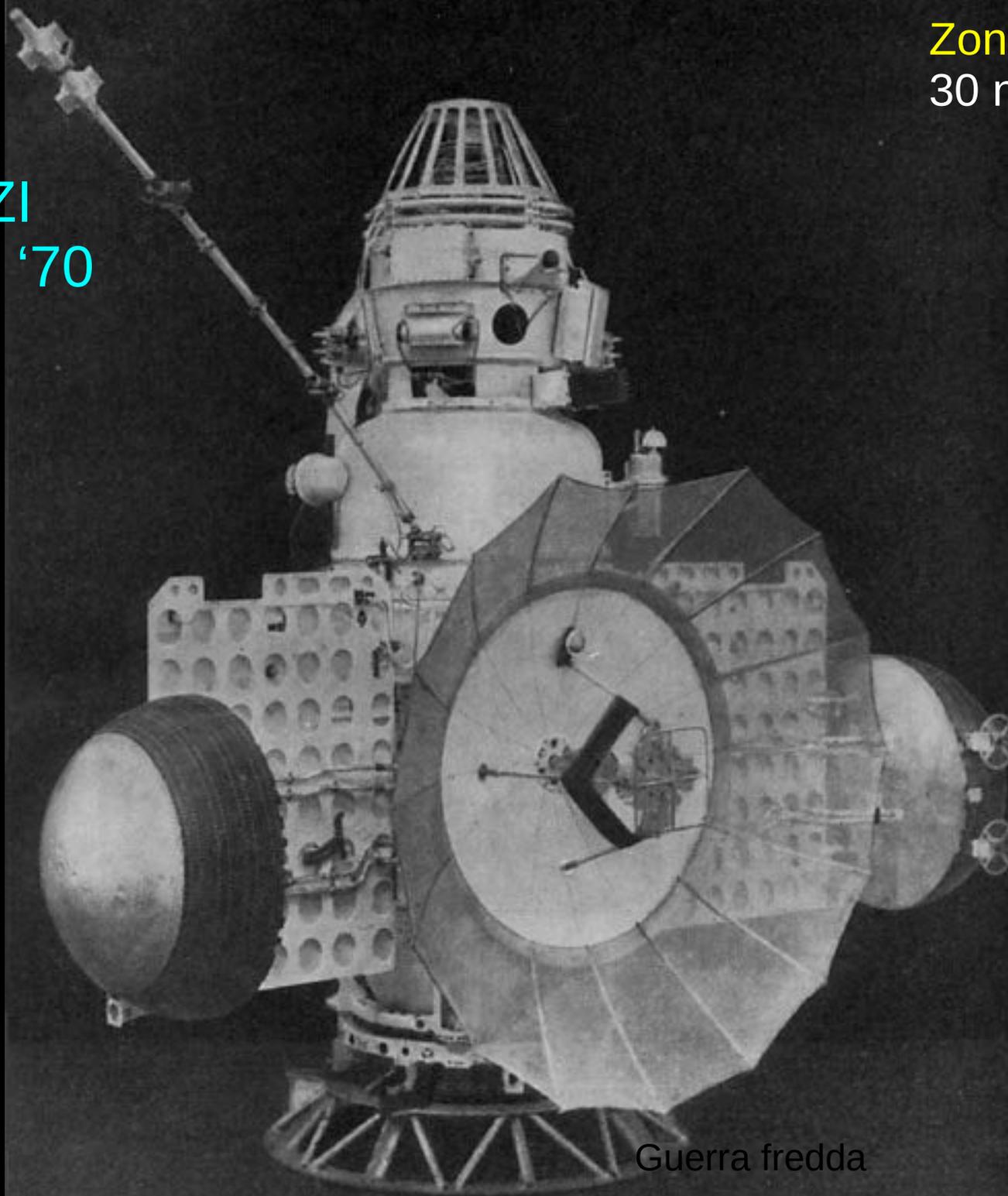


Mars 2MV-3 numero 1



Zond 2
30 novembre 1964

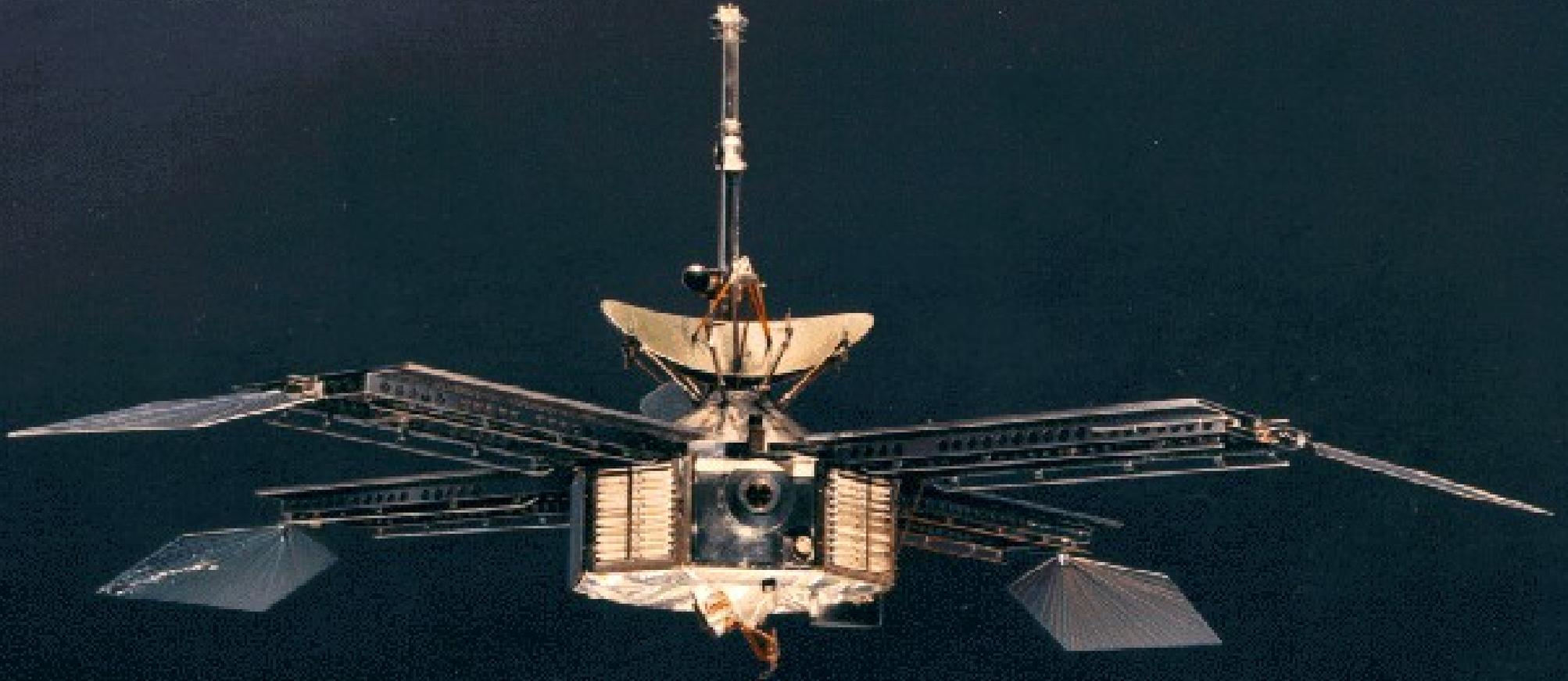
DAGLI INIZI
AGLI ANNI '70



Guerra fredda

DAGLI INIZI
AGLI ANNI '70

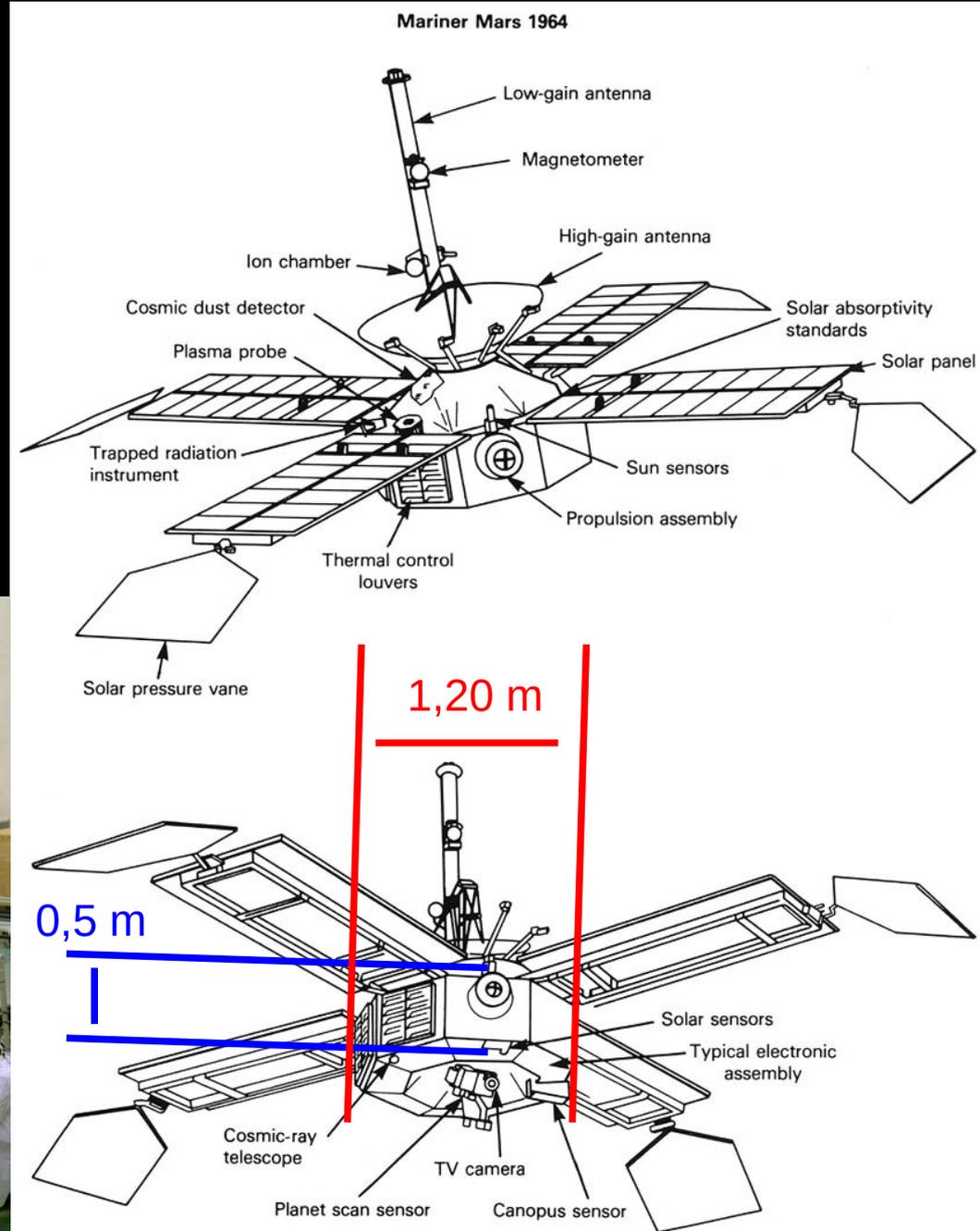
Mariner 3
5 novembre 1964
razzo Atlas-Ageena
da Cape Canaveral



DAGLI INIZI AGLI ANNI '70

Mariner 4

28 novembre 1964
razzo Atlas-Agena
da Cape Canaveral



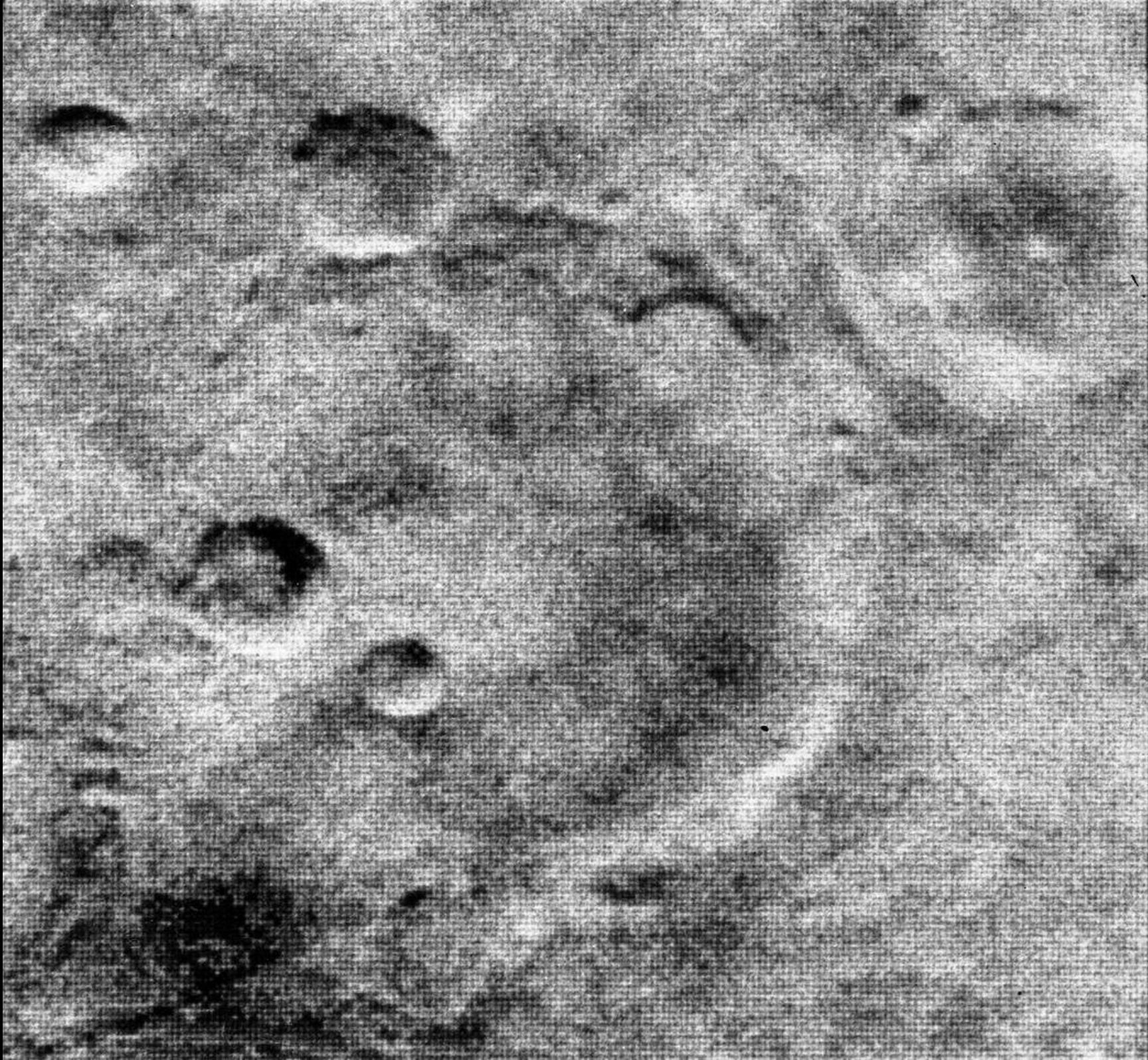
DAGLI
INIZI
AGLI
ANNI '70

Mariner 4

15 luglio 1965
Flyby marziano

22 foto

Campo
magnetico
marziano
debolissimo
rispetto rispetto
a quello
terrestre



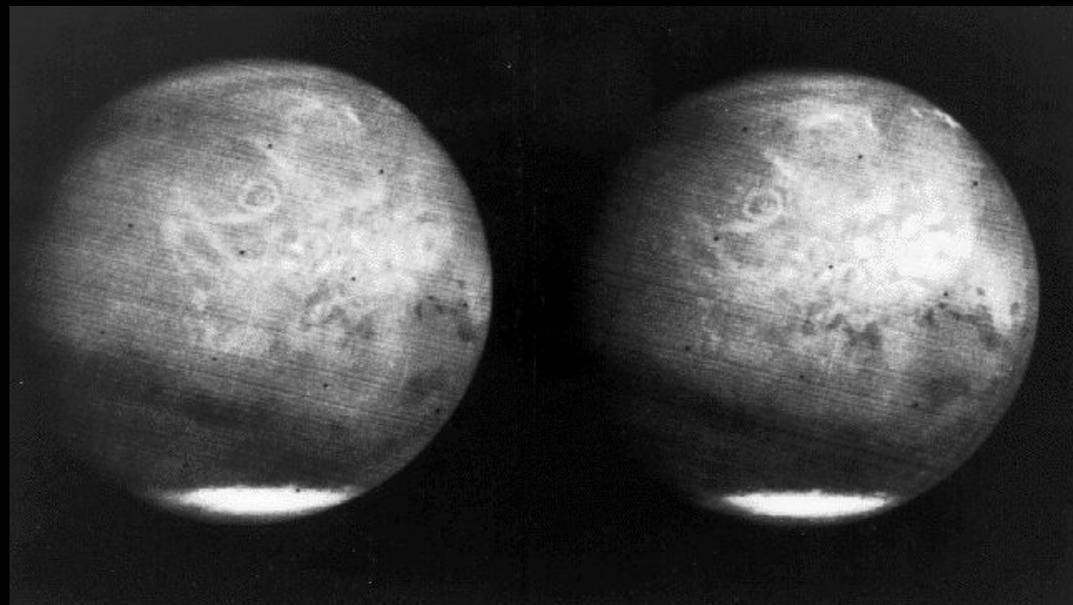
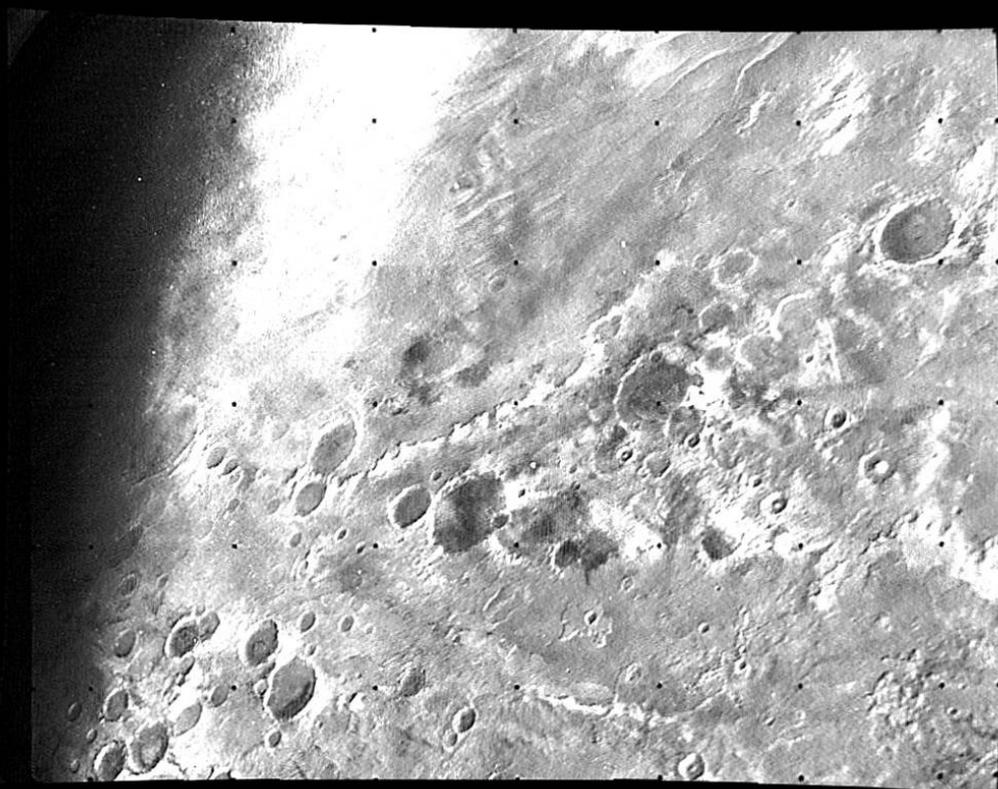
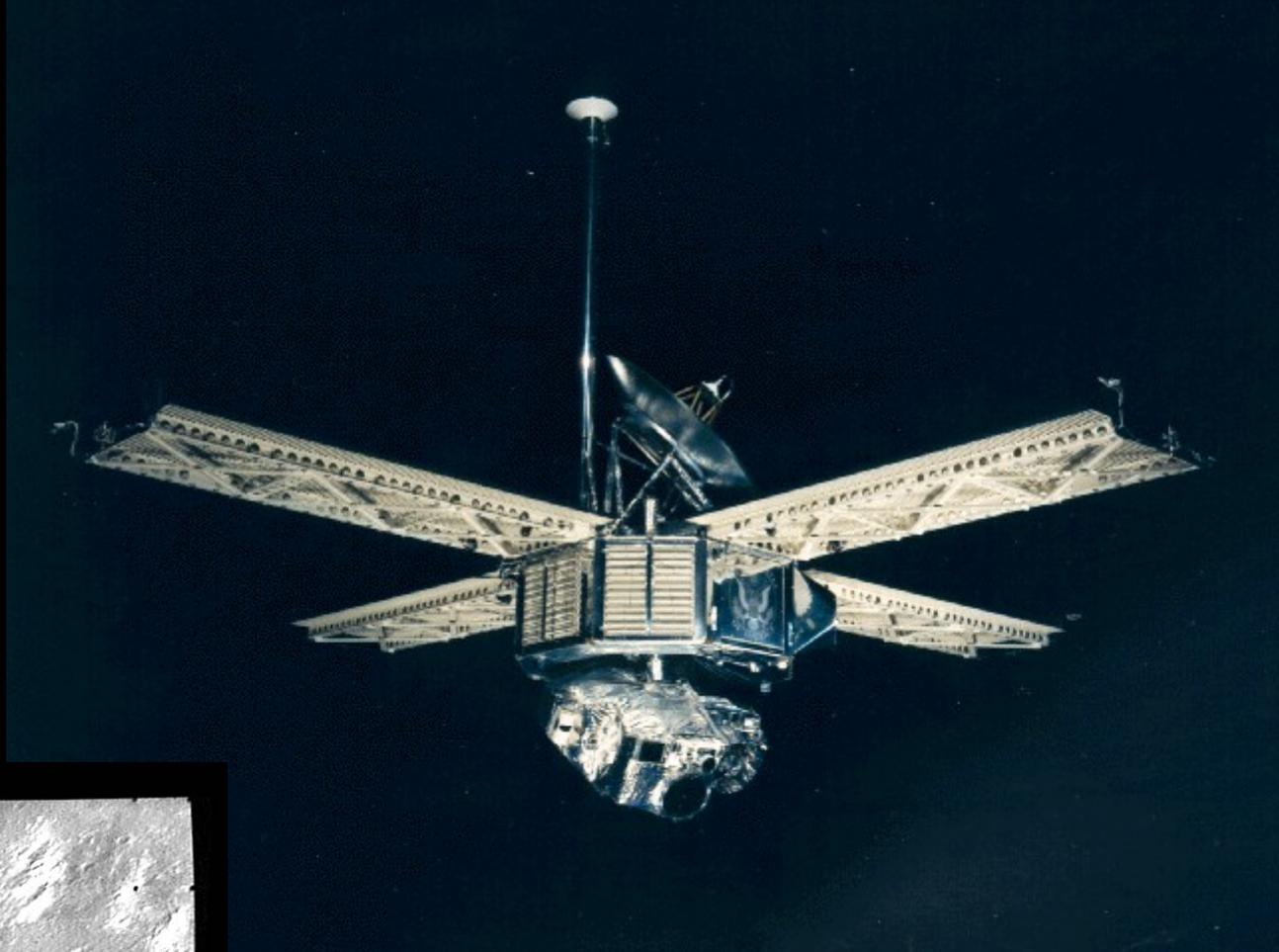
DAGLI INIZI AGLI ANNI '70

Mariner 6 e 7

25 febbraio 1969

27 marzo 1969

Flyby di Marte avvenuti con
successo per entrambe



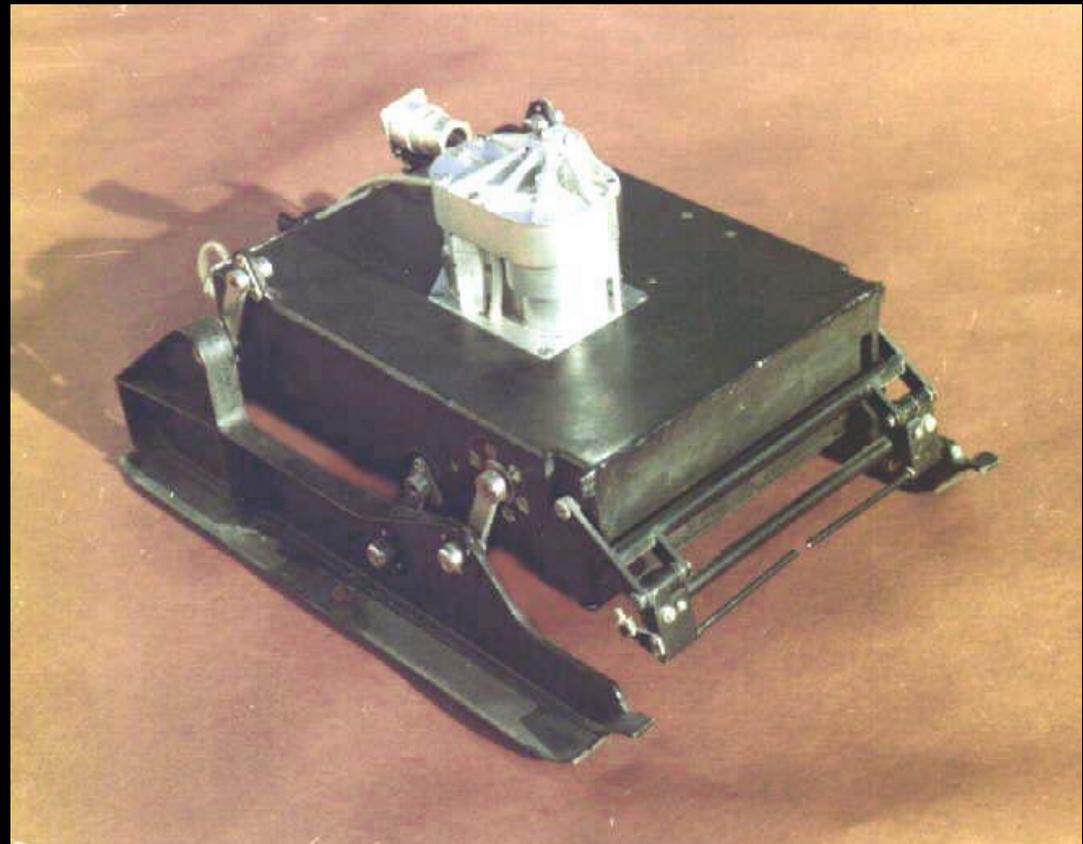
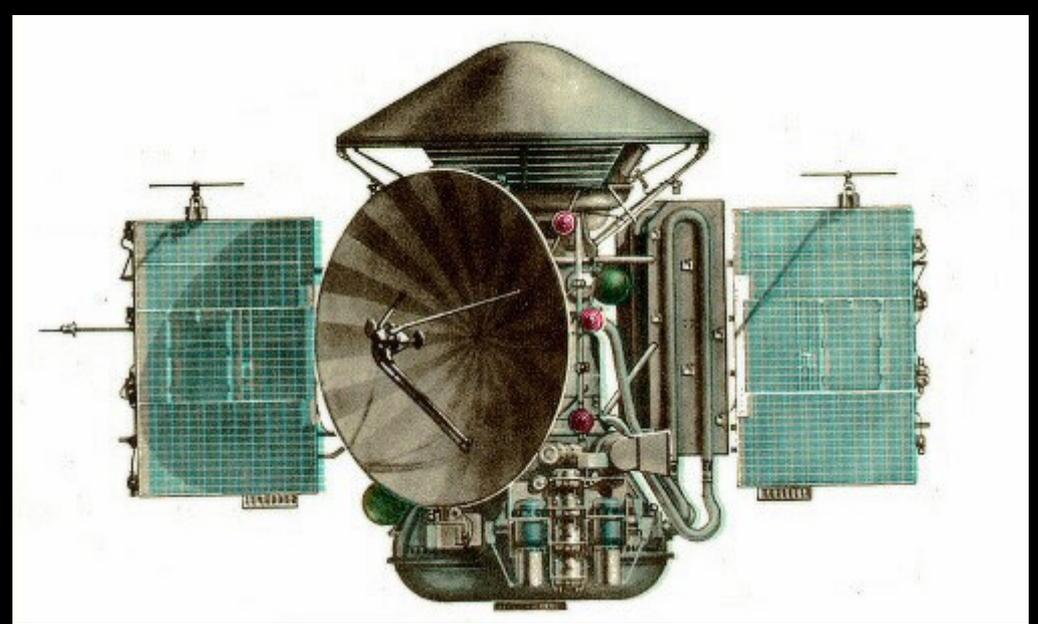
DAGLI INIZI AGLI ANNI '70

Mars 2 e 3

1971

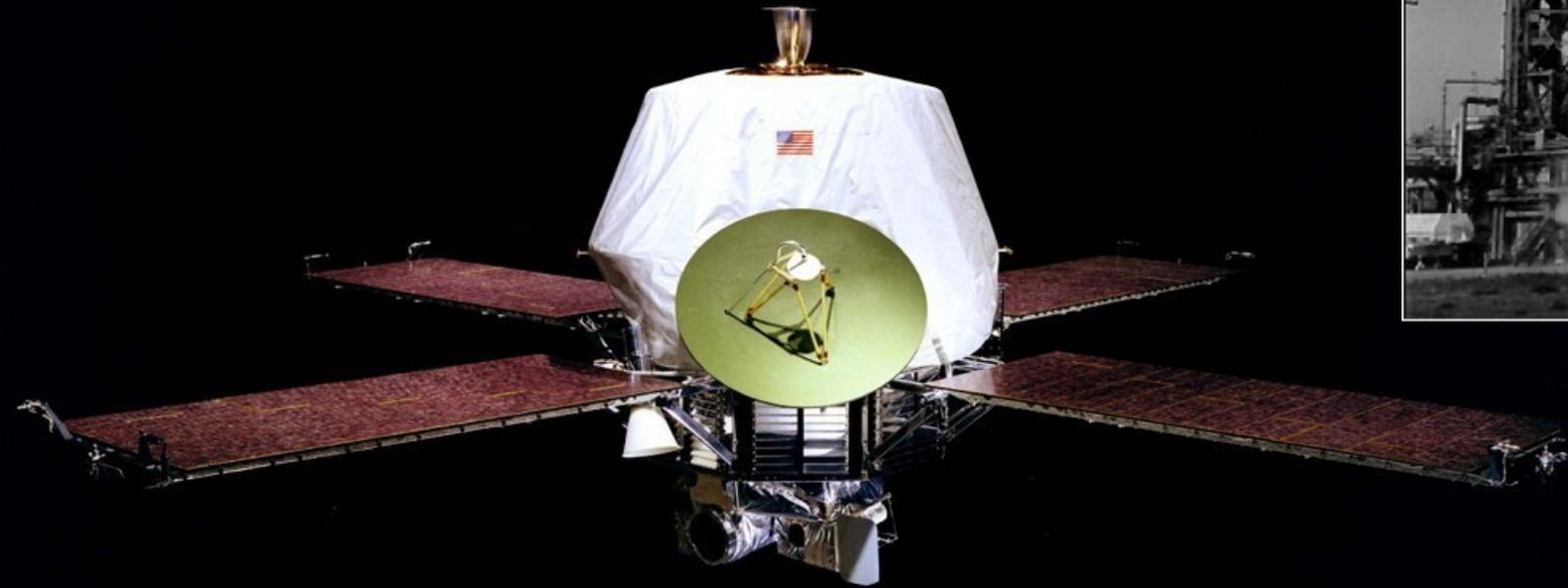
Orbiter + lander + rover

Obiettivi scientifici ambiziosi,
ma le cose andarono ben
diversamente...



DAGLI INIZI AGLI ANNI '70

Mariner 8 e 9
1971



DAGLI INIZI AGLI ANNI '70

Mariner 9

I successi:

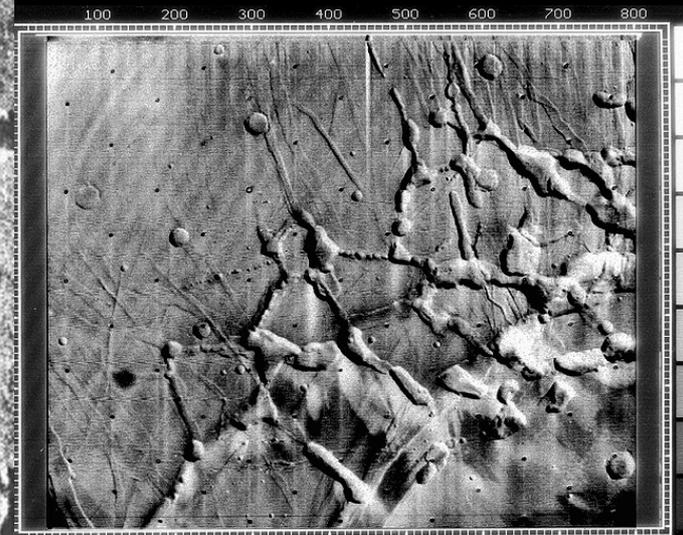
Prima sonda a inserirsi
in orbita stabile attorno
a Marte

Immagini di alta qualità

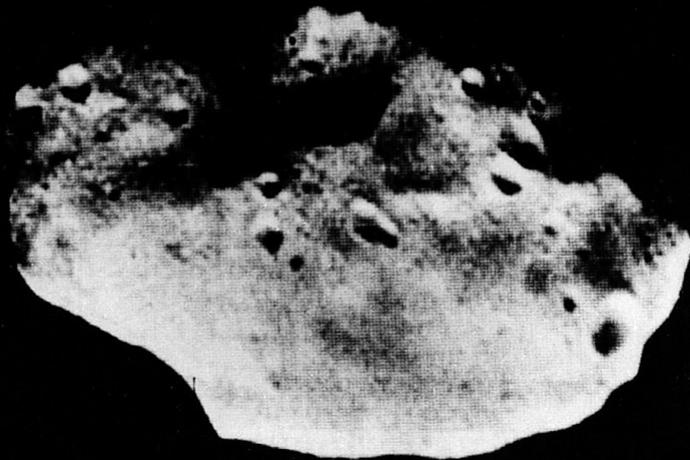
Prima sonda a misurare
l'altezza del Mons Olympus e
la lunghezza della Valles
Marineris → prima mappa
globale di Marte



Nirgal Valles



Valles Marineris



Phobos

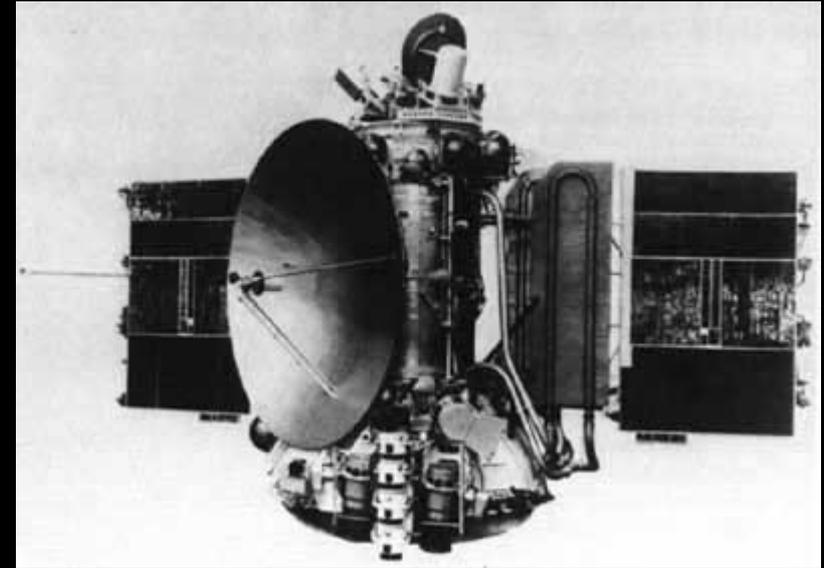


Mons Olympus

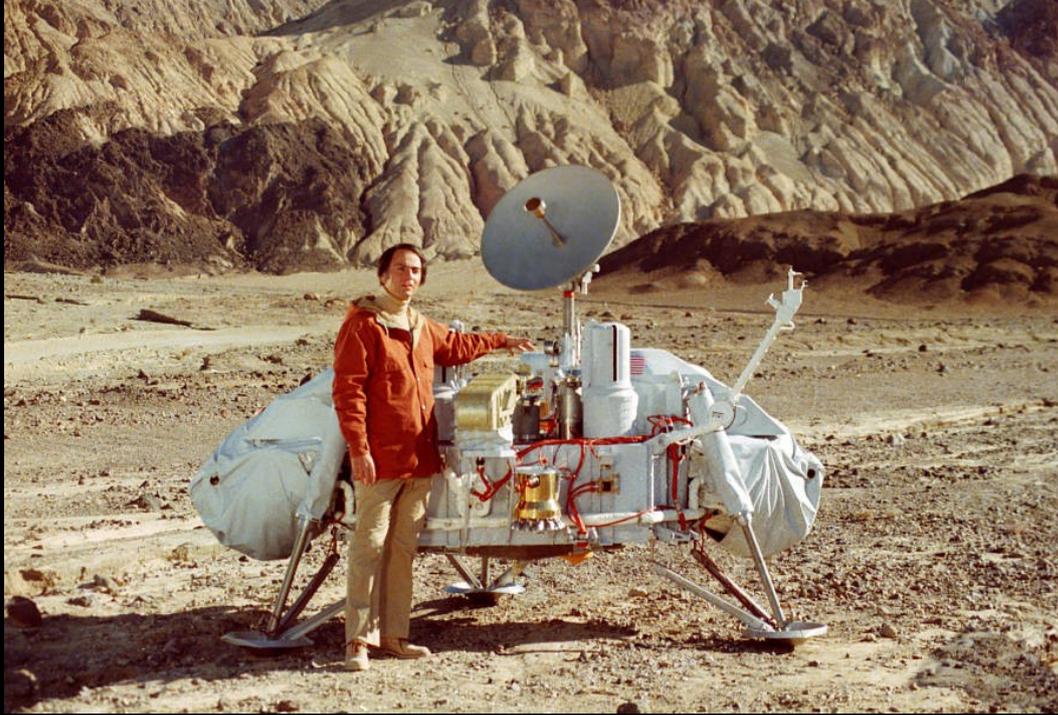
DAGLI INIZI AGLI ANNI '70

Mars 4 – 5 e Mars 6 – 7
1973

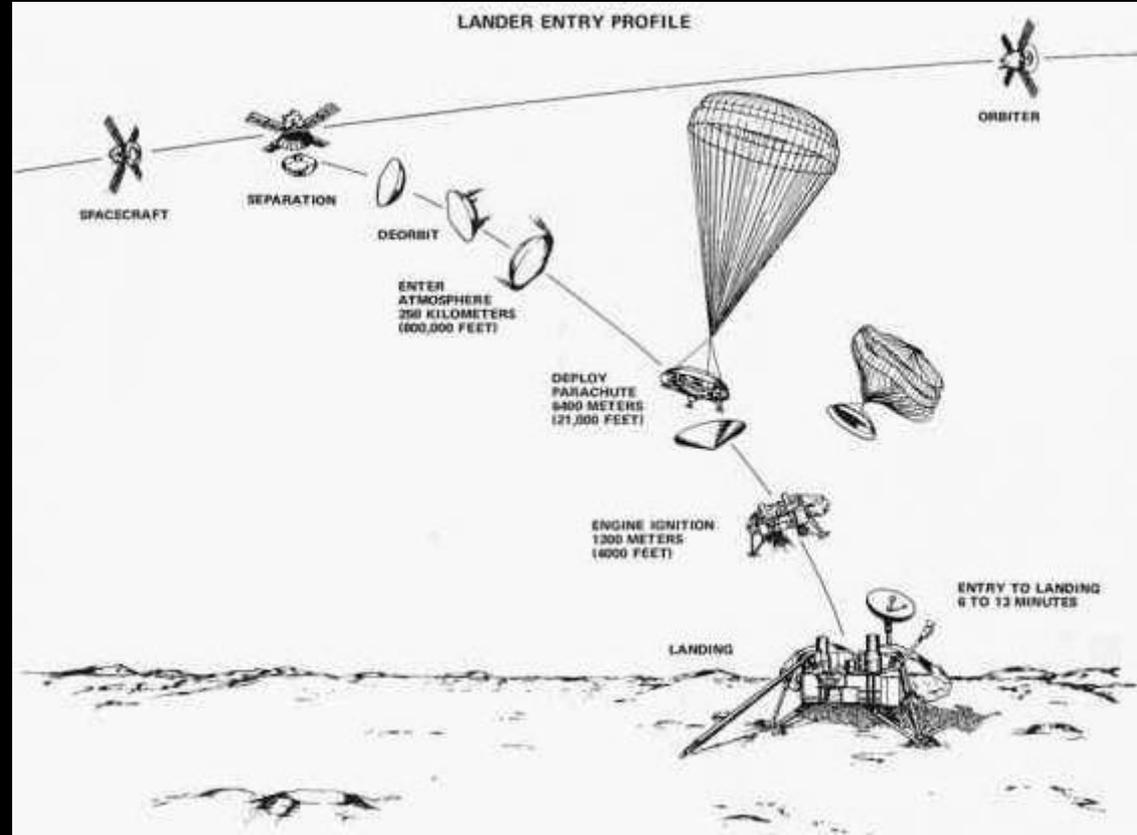
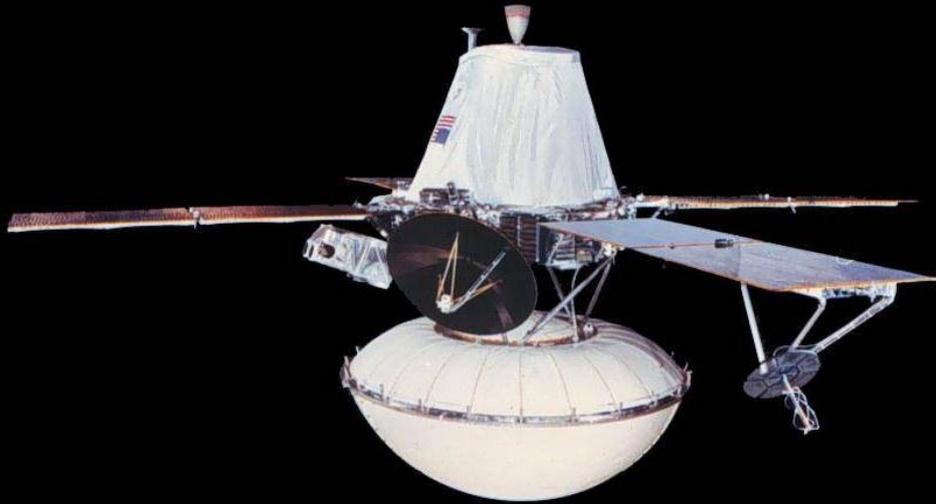
Esiti deludenti a causa di
problemi ai propulsori e
transistor difettosi



Viking 1 e 2
1975
Orbiter + lander



DAGLI INIZI
AGLI ANNI '70



DAGLI INIZI AGLI ANNI '70

Viking 1 e 2

Funzionarono per più di 6 anni!

4500 immagini ravvicinate della superficie marziana +
50000 immagini degli orbiter → mappatura del 97% della superficie
del pianeta



GLI ANNI '80 E '90: DALLE PHOBOS AL MARS POLAR LANDER



Space Shuttle



Salyut 7



Mir

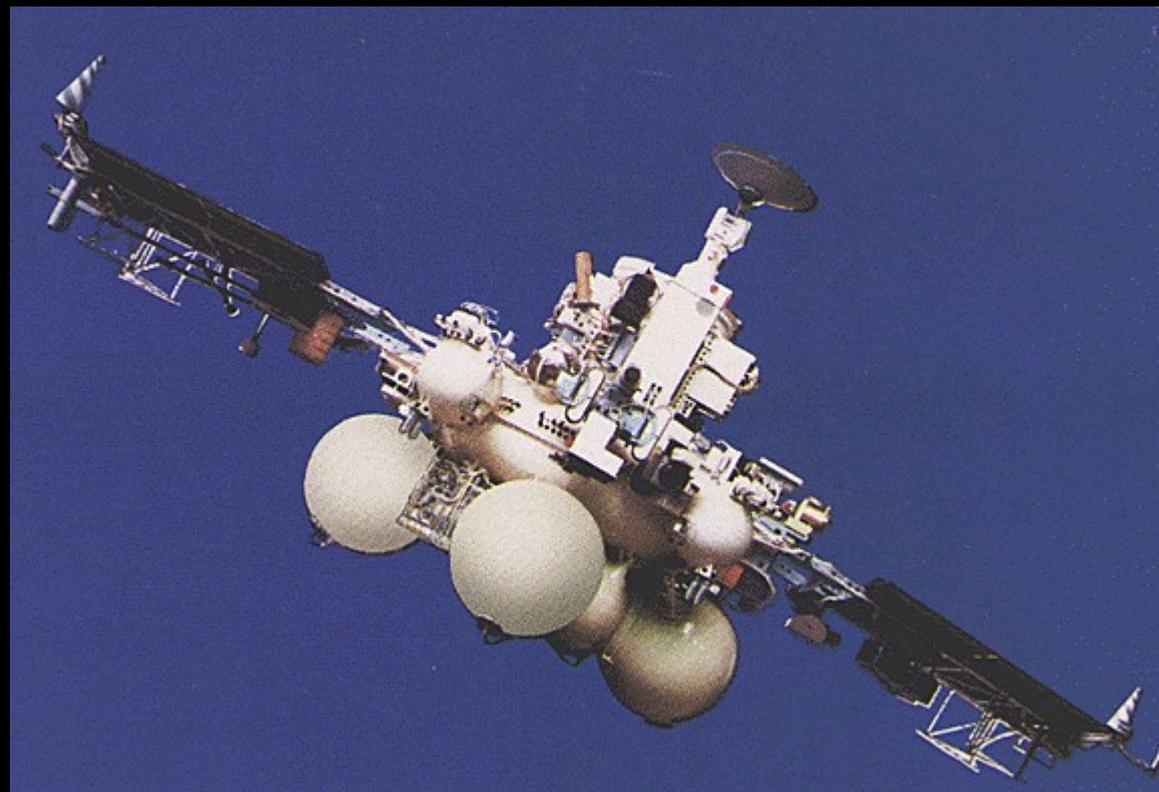
GLI ANNI '80 E '90: DALLE PHOBOS AL MARS POLAR LANDER

Phobos 1 e Phobos 2

7 e 12 luglio 1988

Lanciatore Proton

Baikonur



GLI ANNI '80 E '90: DALLE PHOBOS AL MARS POLAR LANDER

Mars Observer

25 settembre 1992

Cape Canaveral

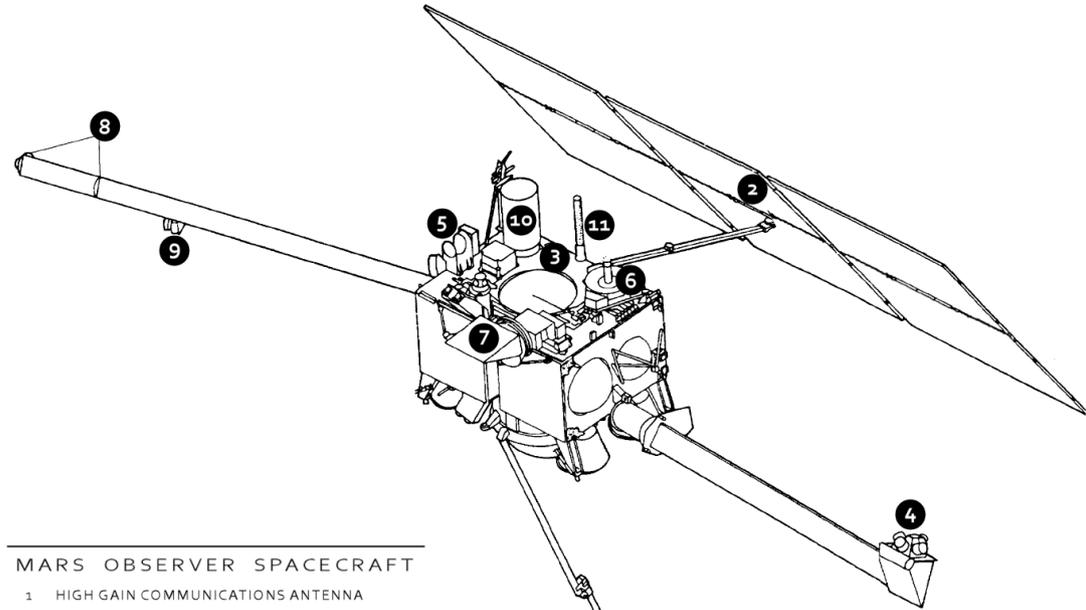
Titan III

Geologia, clima, geofisica marziani

“Off the shelf”

Termine missione:

1993 (perdita dei contatti con la sonda appena prima dell'inserimento in orbita)



MARS OBSERVER SPACECRAFT

- 1 HIGH GAIN COMMUNICATIONS ANTENNA
- 2 SOLAR ARRAY
- 3 NADIR PANEL
- 4 GAMMA-RAY SPECTROMETER
- 5 THERMAL EMISSION SPECTROMETER
- 6 MARS OBSERVER LASER ALTIMETER
- 7 PRESSURE MODULATOR INFRARED RADIOMETER
- 8 MAGNETOMETERS
- 9 ELECTRON REFLECTOMETER
- 10 MARS OBSERVER CAMERA
- 11 MARS '94 DATA-RELAY ANTENNA



GLI ANNI '80 E '90: DALLE PHOBOS AL MARS POLAR LANDER

Mars Global
Surveyor

7 novembre

1996

Delta II



La sonda più longeva
dell'epoca!

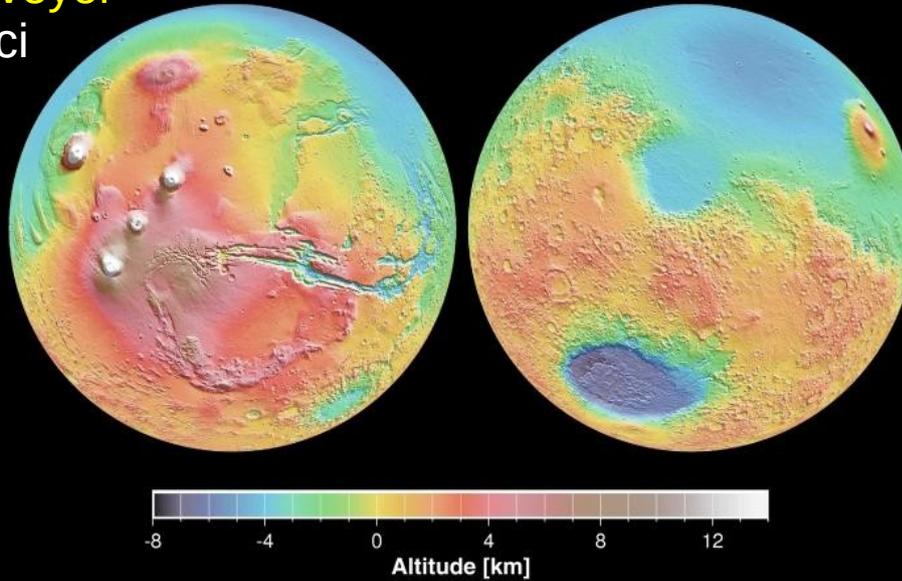


Glenn Cunningham

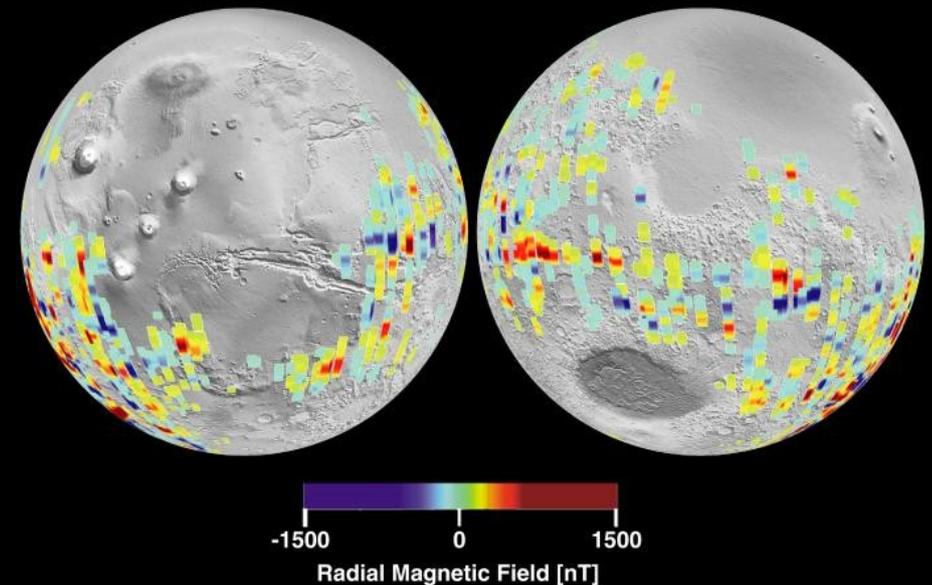
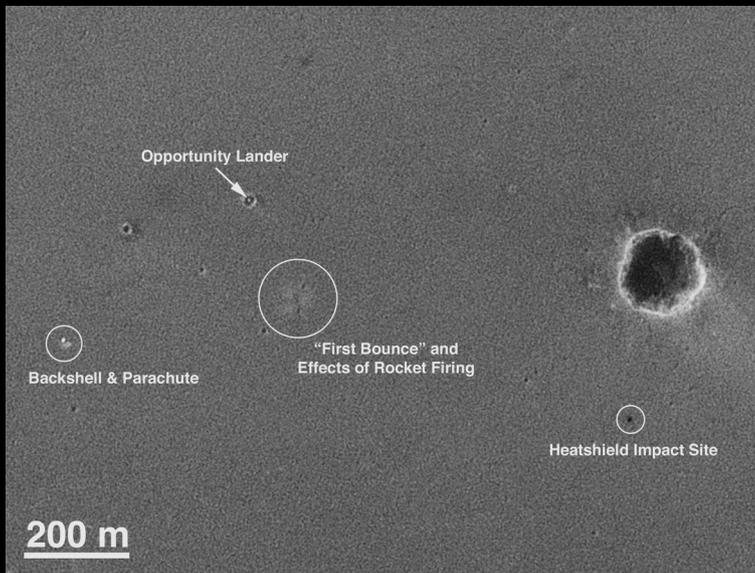
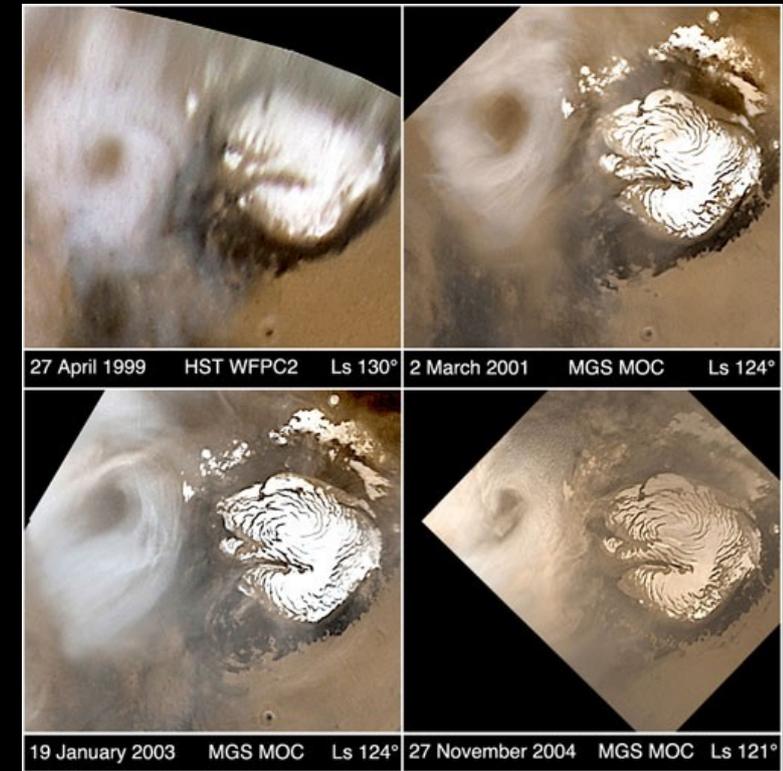


GLI ANNI '80 E '90: DALLE PHOBOS AL MARS POLAR LANDER

Mars Global Surveyor Risultati scientifici



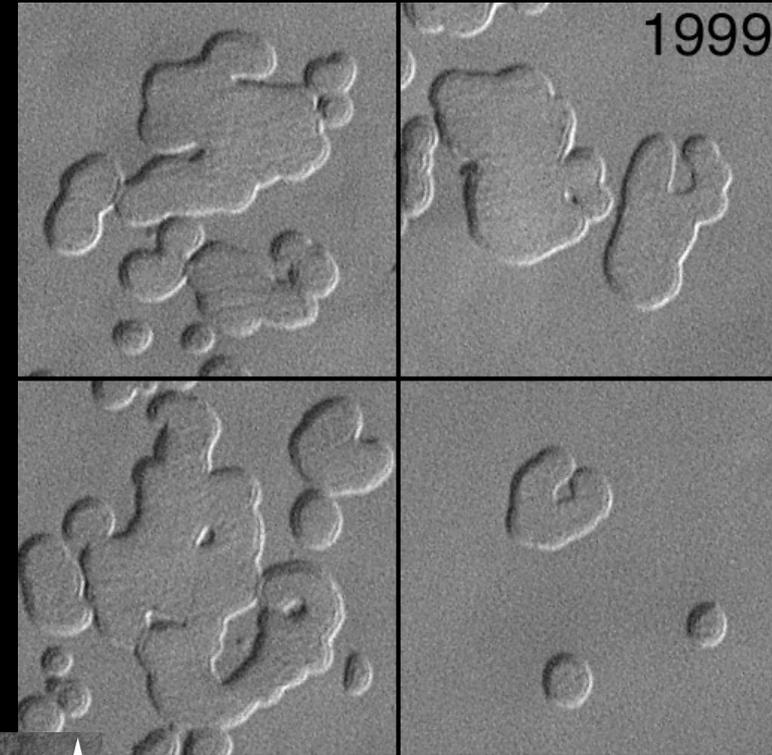
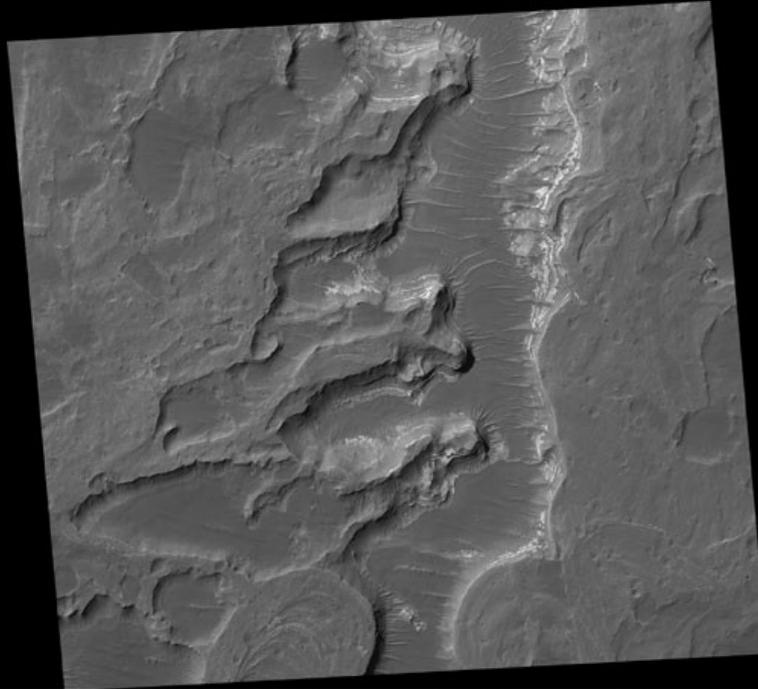
Mappa topografica globale estremamente accurata
Misurazioni delle spaccature polari marziane
Rilevazione di ematite → sito di atterraggio Opportunity
Residui campo magnetico



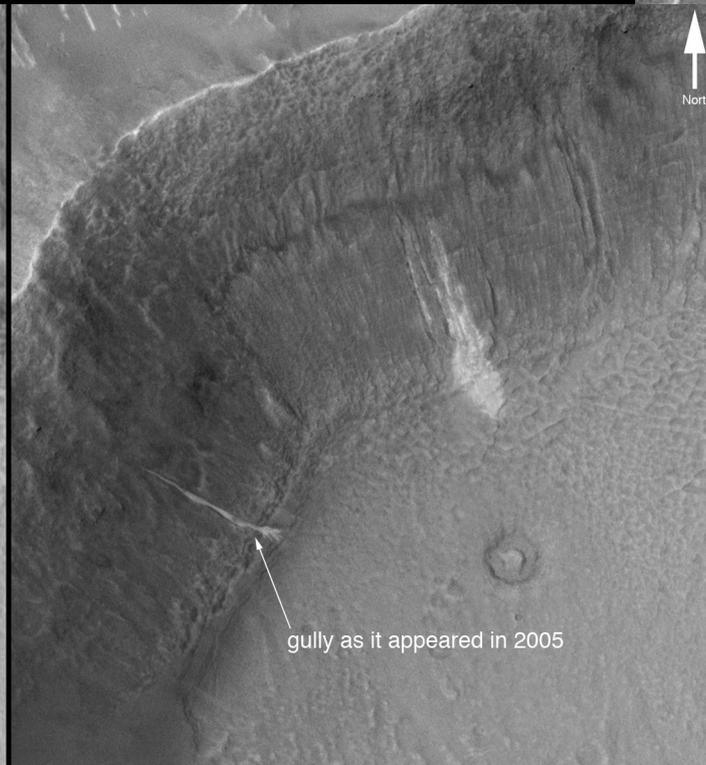
GLI ANNI '80 E '90: DALLE PHOBOS AL MARS POLAR LANDER

Mars Global Surveyor Risultati scientifici

Fotografie Eberswalde Delta
Scioglimento depositi
ghiaccio secco polo sud
Canaloni su pendici crateri
pieni di sedimenti



gully as it appeared in 2001



gully as it appeared in 2005

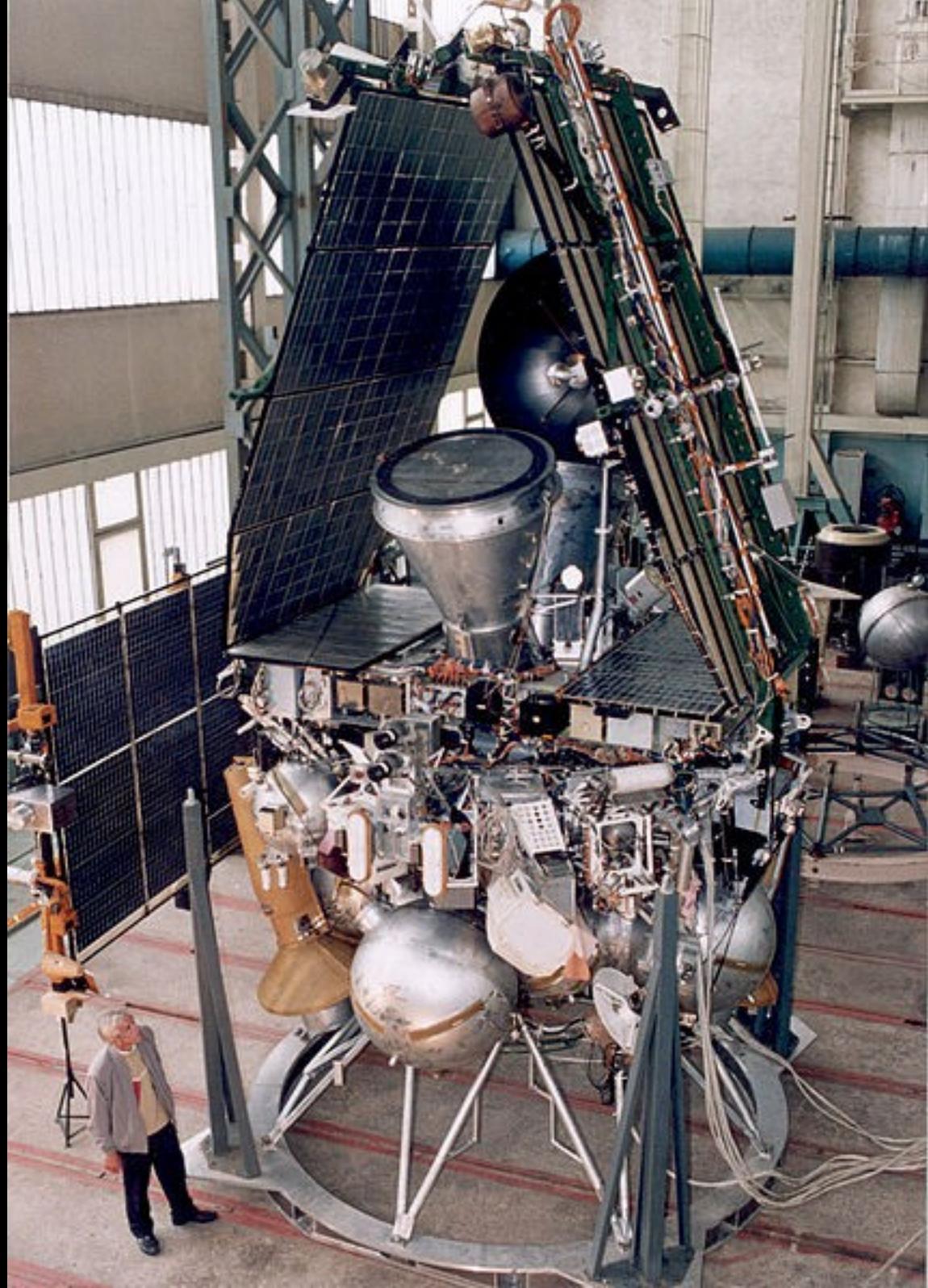
Oltre 240000 immagini

GLI ANNI '80 E '90: DALLE PHOBOS AL MARS POLAR LANDER

Mars 96

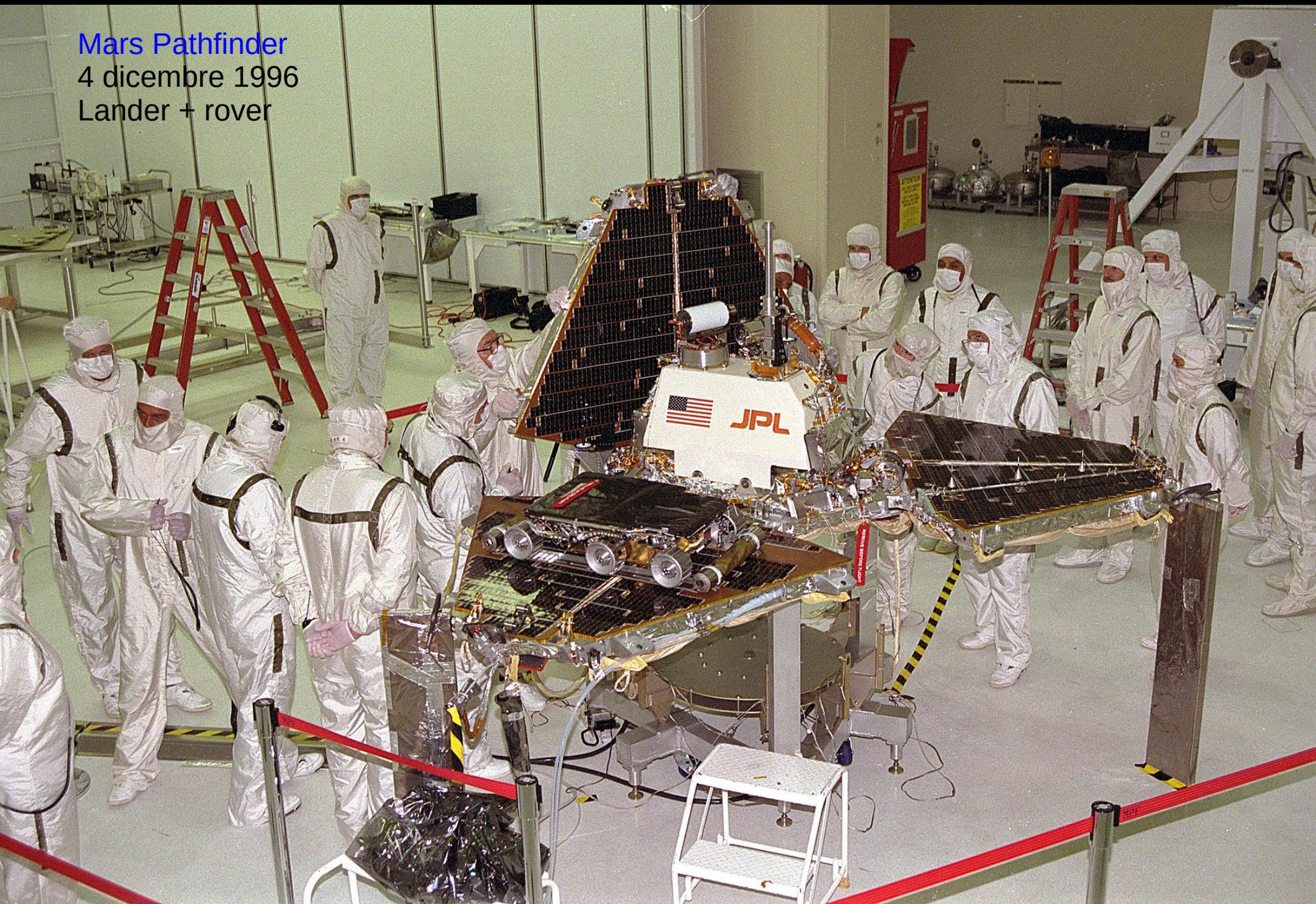
16 novembre 1996

ESA/Roscosmos



GLI ANNI '80 E '90: DALLE PHOBOS AL MARS POLAR LANDER

Mars Pathfinder
4 dicembre 1996
Lander + rover



GLI ANNI '80 E '90: DALLE PHOBOS AL MARS POLAR LANDER

Banco di prova nuove tecnologie: sistema di atterraggio

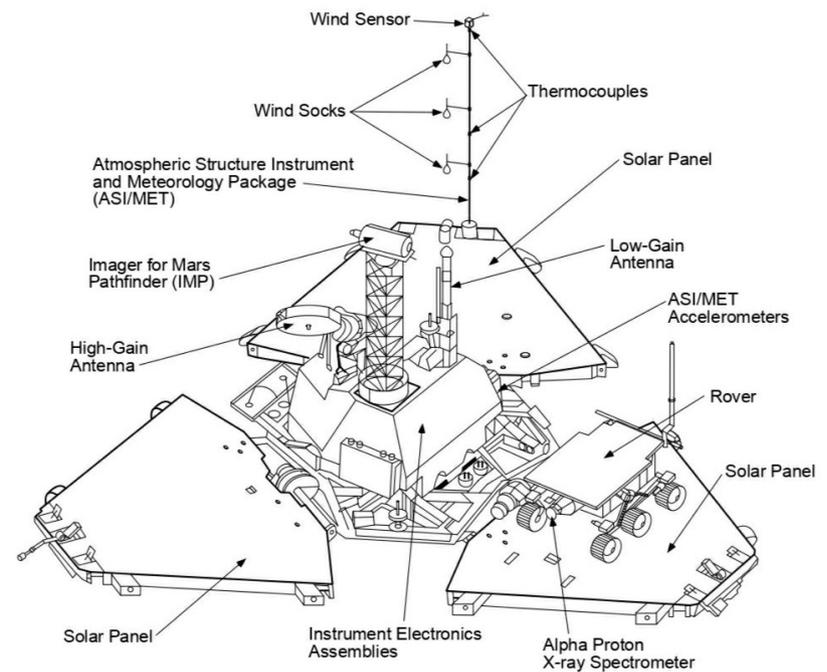
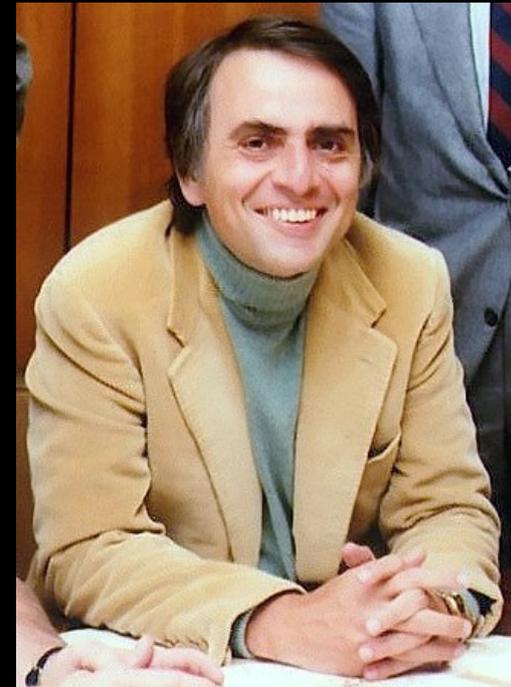


GLI ANNI '80 E '90: DALLE PHOBOS AL MARS POLAR LANDER

Banco di prova nuove tecnologie: rover Sojourner



Lander
Carl Sagan



Mars Pathfinder lander

GLI ANNI '80 E '90: DALLE PHOBOS AL MARS POLAR LANDER

Conglomerati

Rocce che si formano dall'accumulo di sedimenti trasportati dall'acqua

Maghemite



Nubi di cristalli di ghiaccio d'acqua

PEBBLES, COBBLES, AND SOCKETS



SHARK - SOL 71

Henry Moore

Pathfinder dust devils

Color image

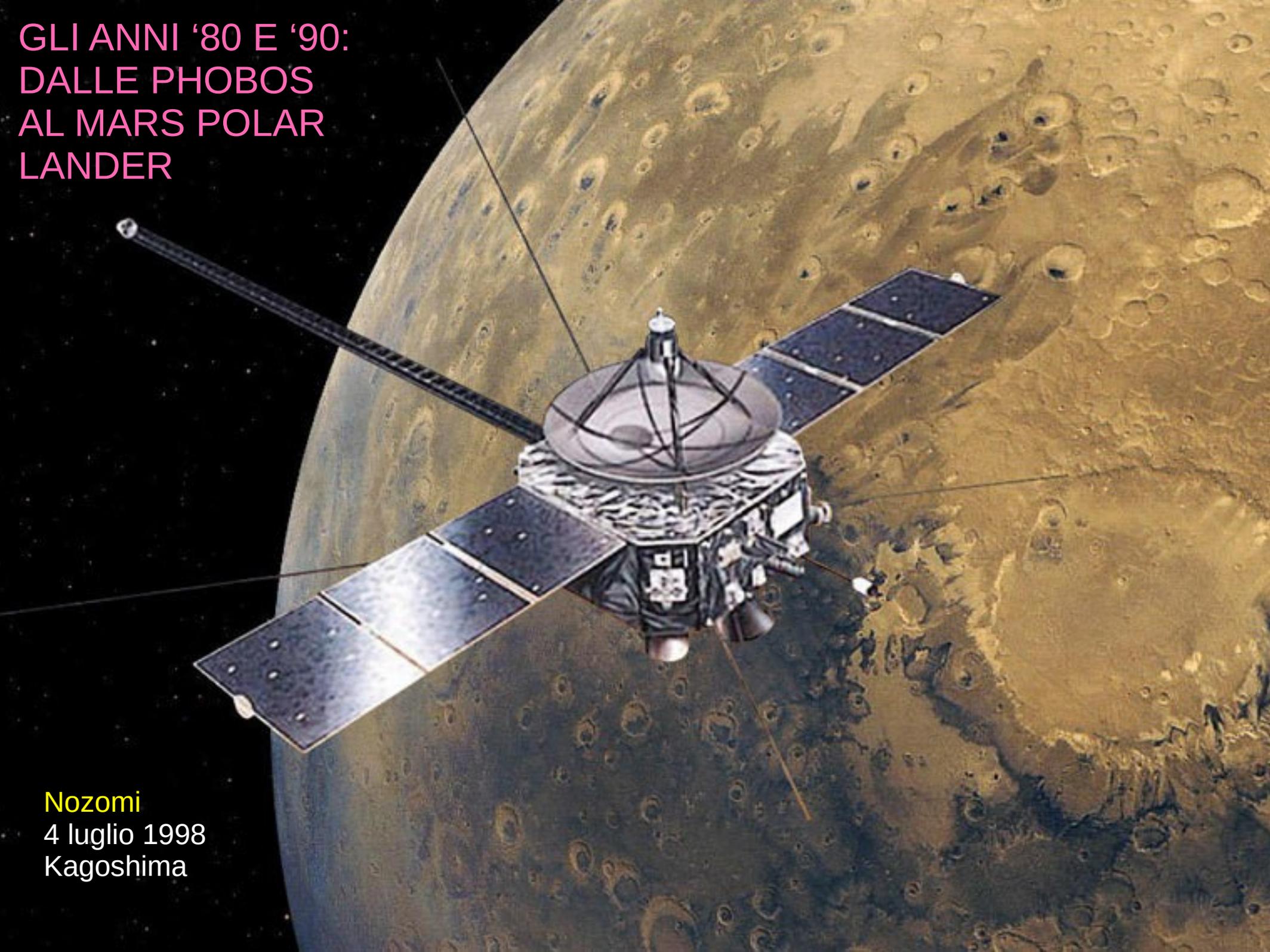


Enhanced image



↑ ↑
Dust devils

GLI ANNI '80 E '90:
DALLE PHOBOS
AL MARS POLAR
LANDER



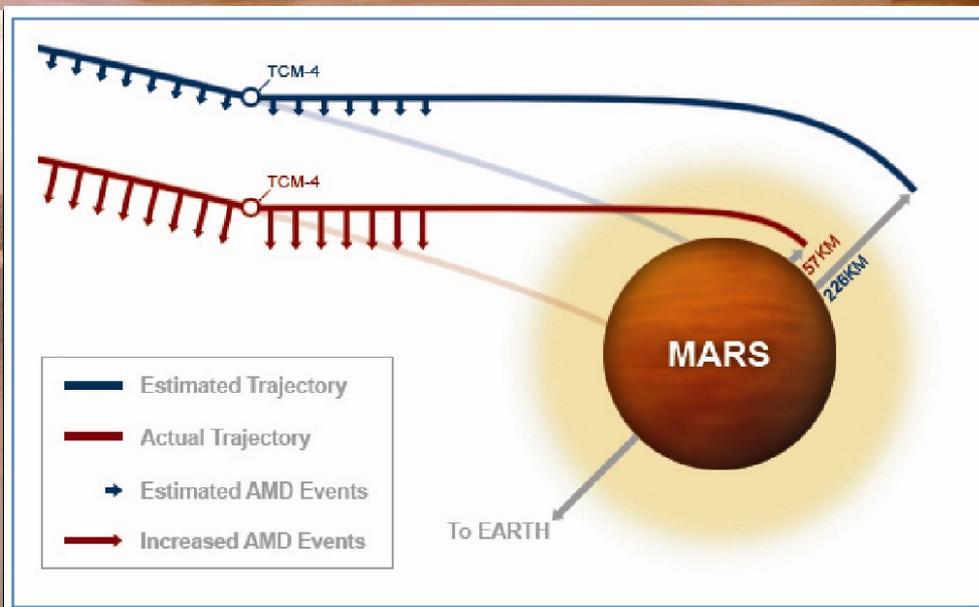
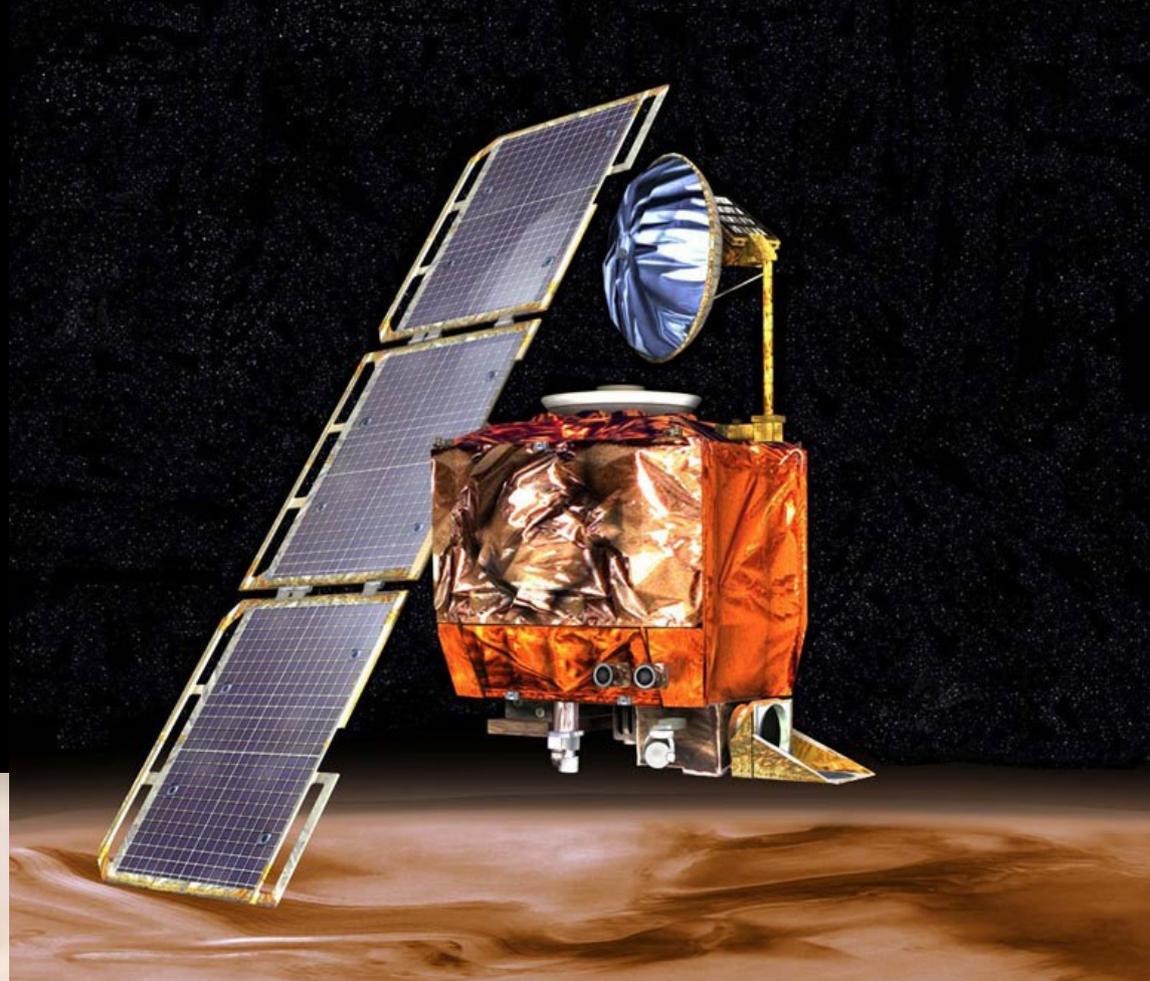
Nozomi

4 luglio 1998

Kagoshima

GLI ANNI '80 E '90: DALLE PHOBOS AL MARS POLAR LANDER

Mars Climate Orbiter 11 dicembre 1998
Mars Polar Lander 3 gennaio 1999

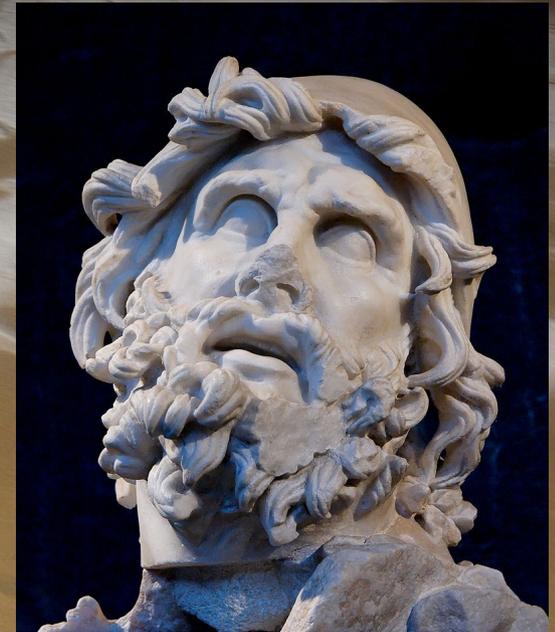
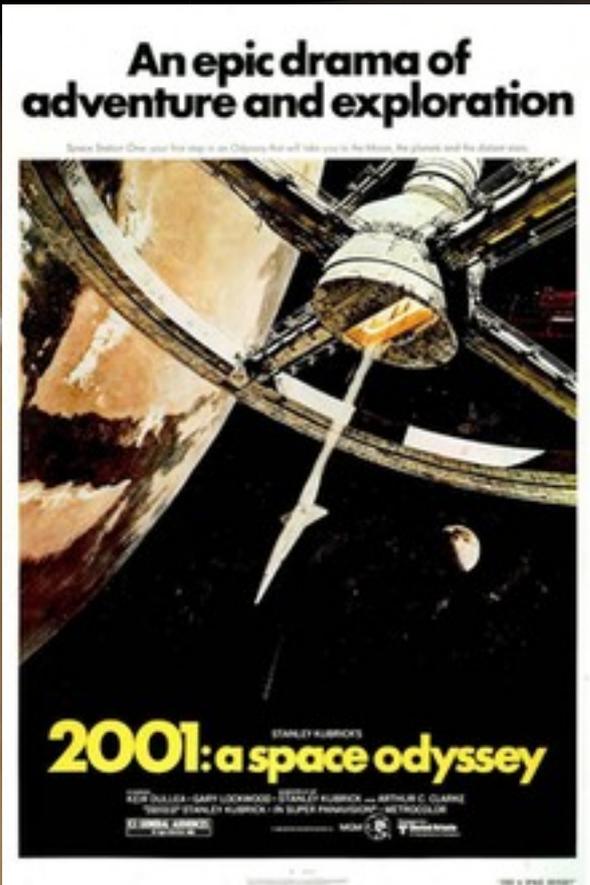


GLI ANNI 2000: DA MARS ODYSSEY A OGGI

2001 Mars Odyssey

7 aprile 2001

Orbiter marziano più longevo della storia

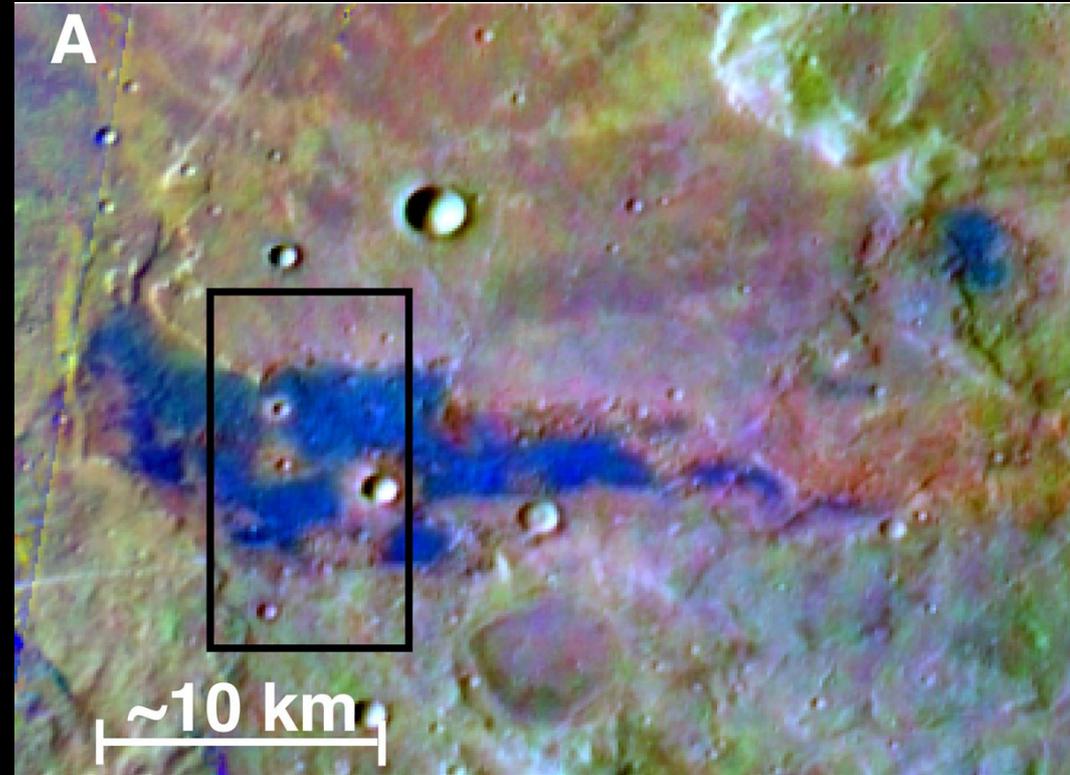


GLI ANNI 2000: DA MARS ODYSSEY A OGGI

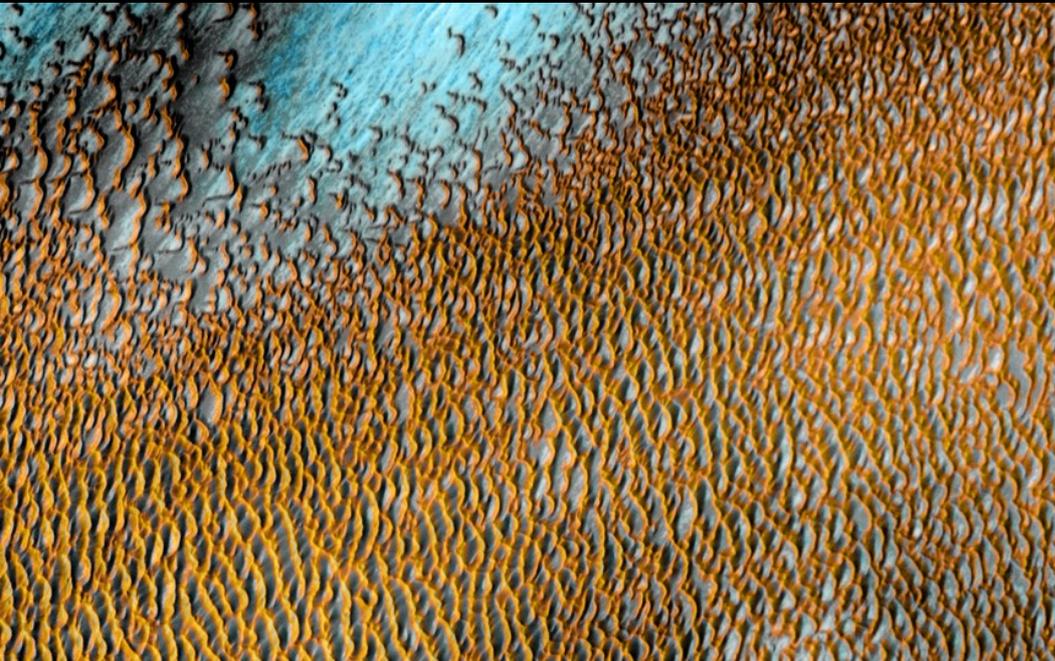
2001 Mars Odyssey

Risultati scientifici

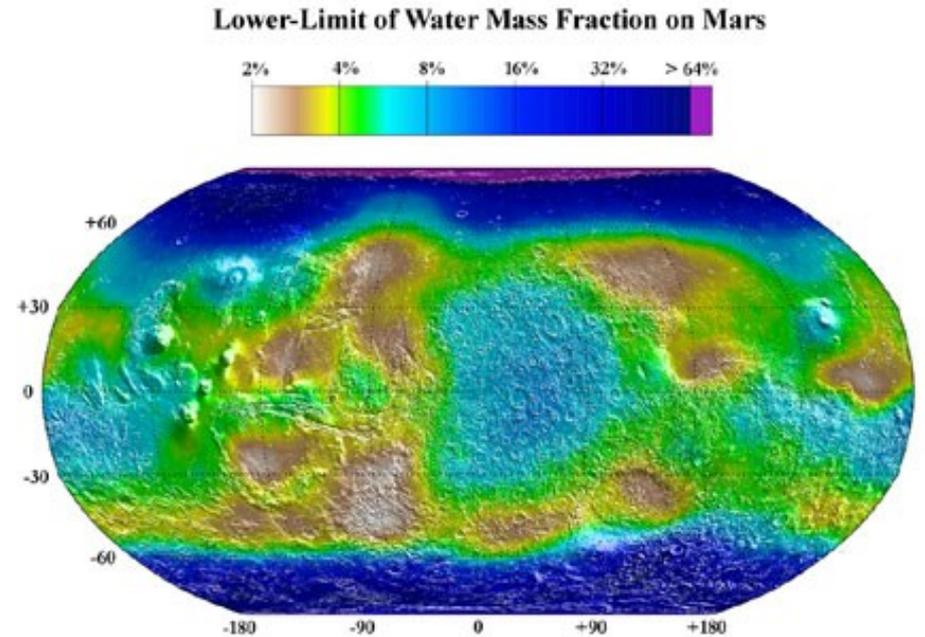
Minerali a base di cloruri
nell'emisfero meridionale di Marte
2008



2002 H nel sottosuolo



Nuova mappa topografica 2010

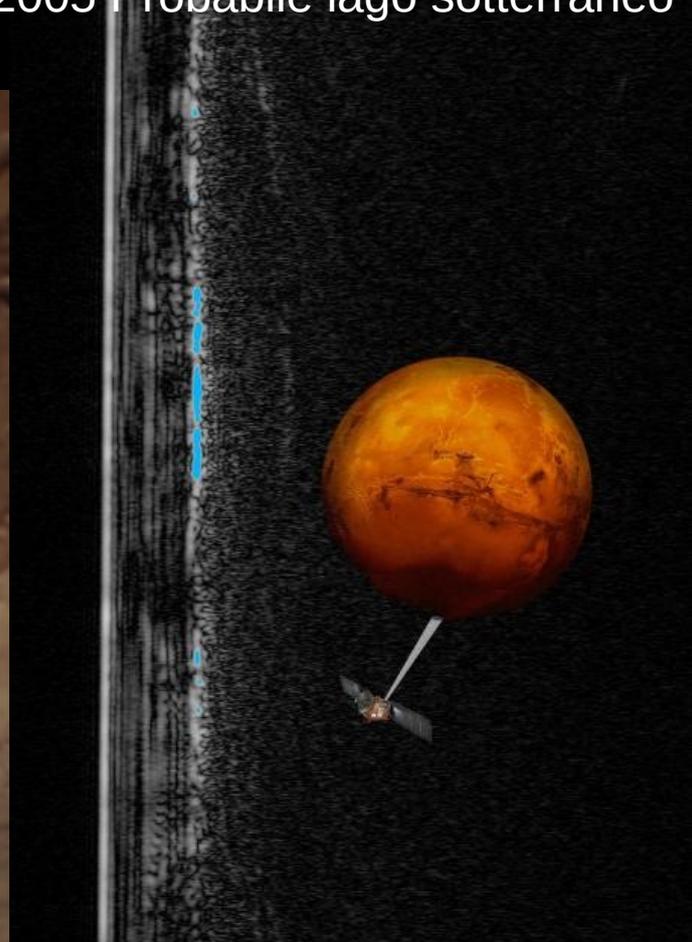


GLI ANNI 2000: DA MARS ODYSSEY A OGGI

Mars Express
2 giugno 2003



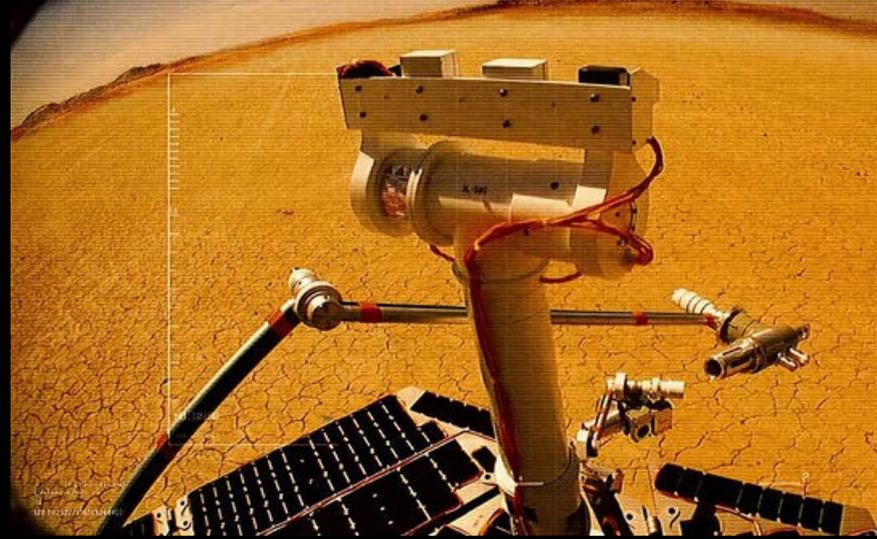
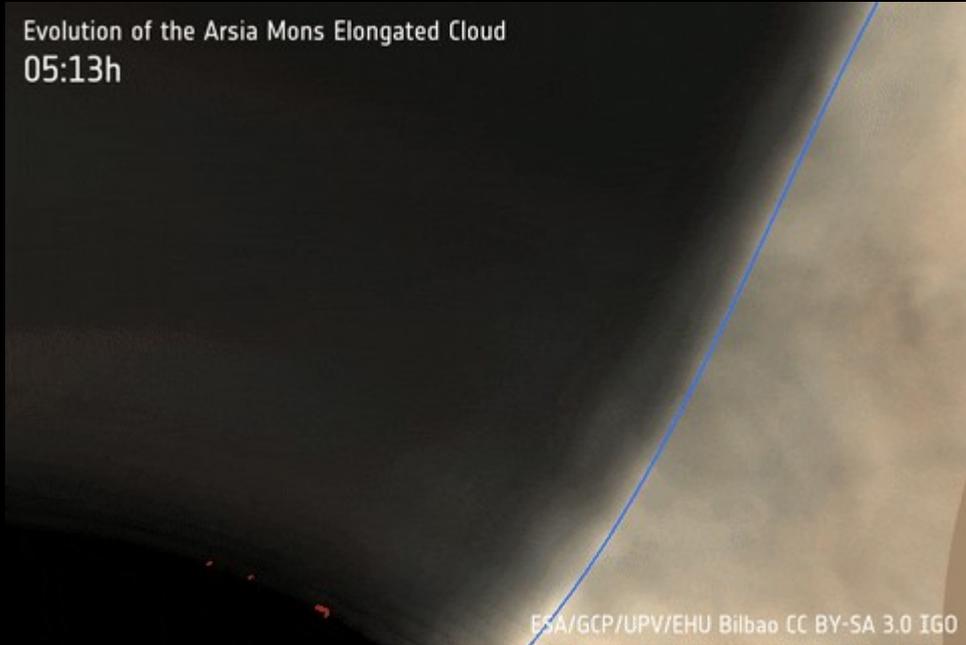
2005 Probabile lago sotterraneo



GLI ANNI 2000: DA MARS ODYSSEY A OGGI

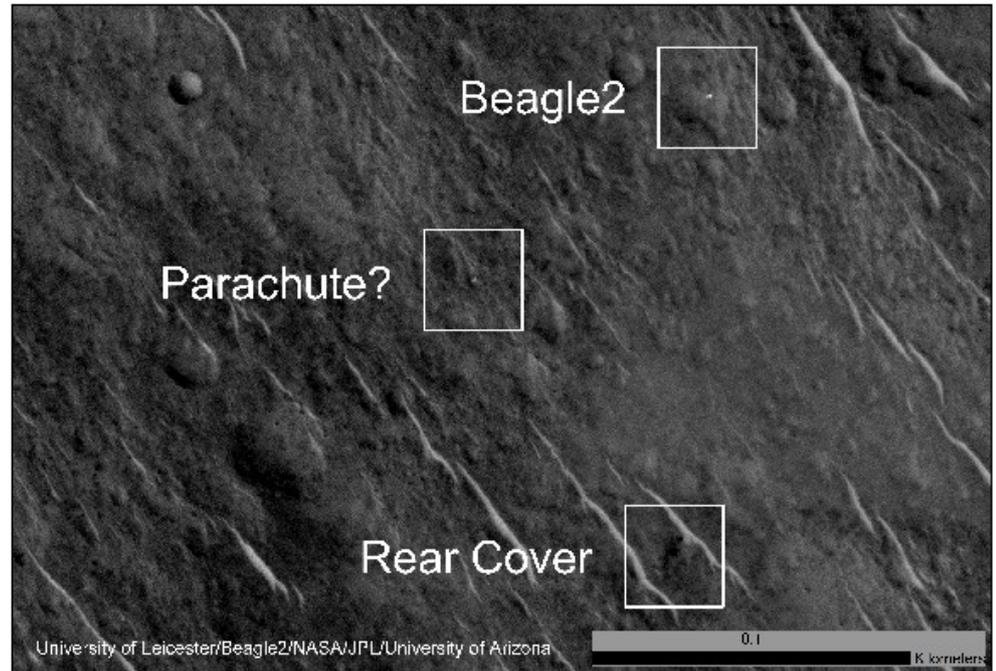
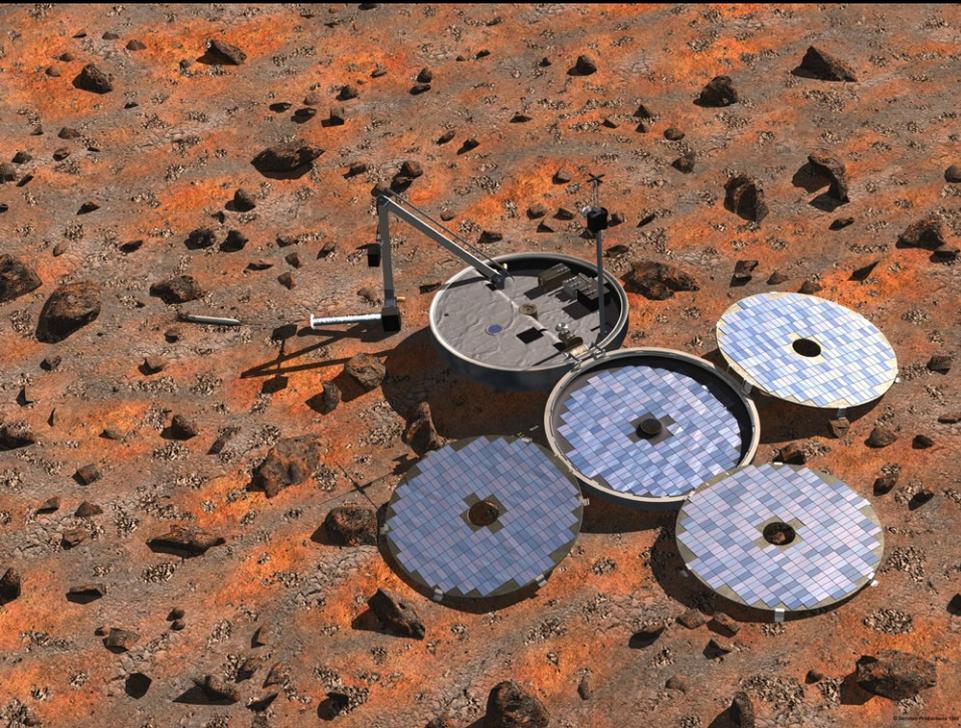
Mars Express

Evolution of the Arsia Mons Elongated Cloud
05:13h



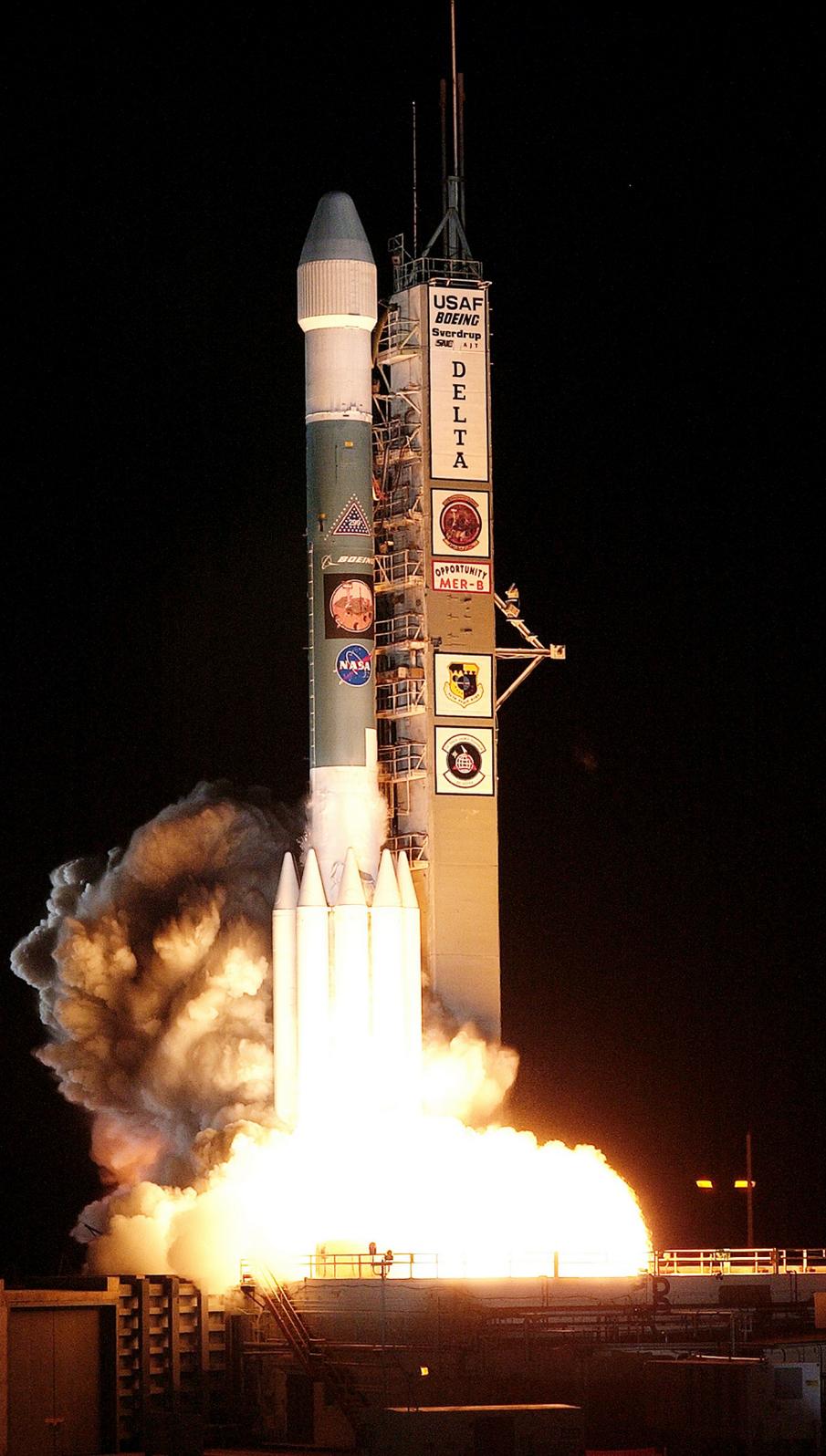
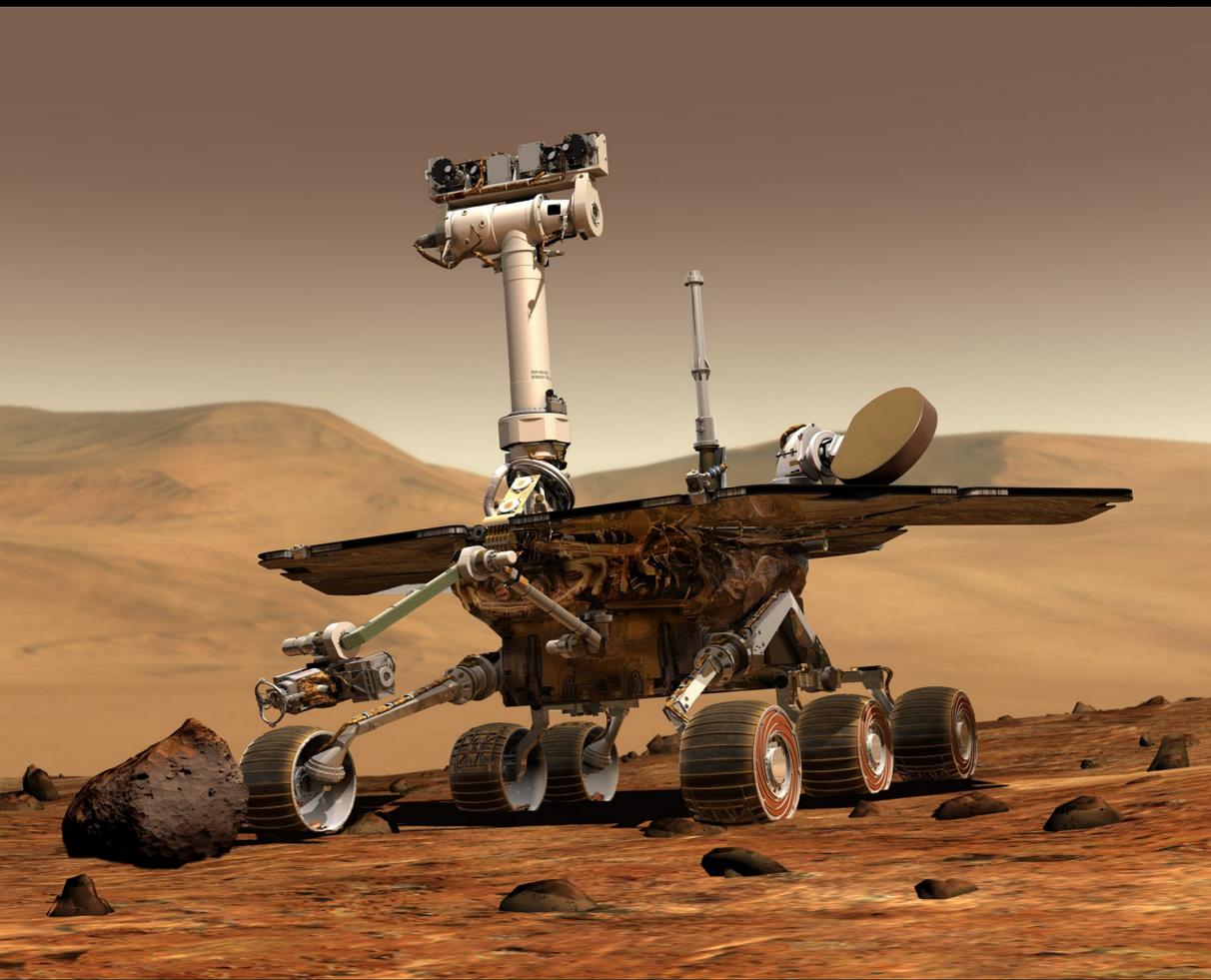
2018 nube orografica
sull'Arsia Mons

Lander Beagle 2 anche nel film Transformers!



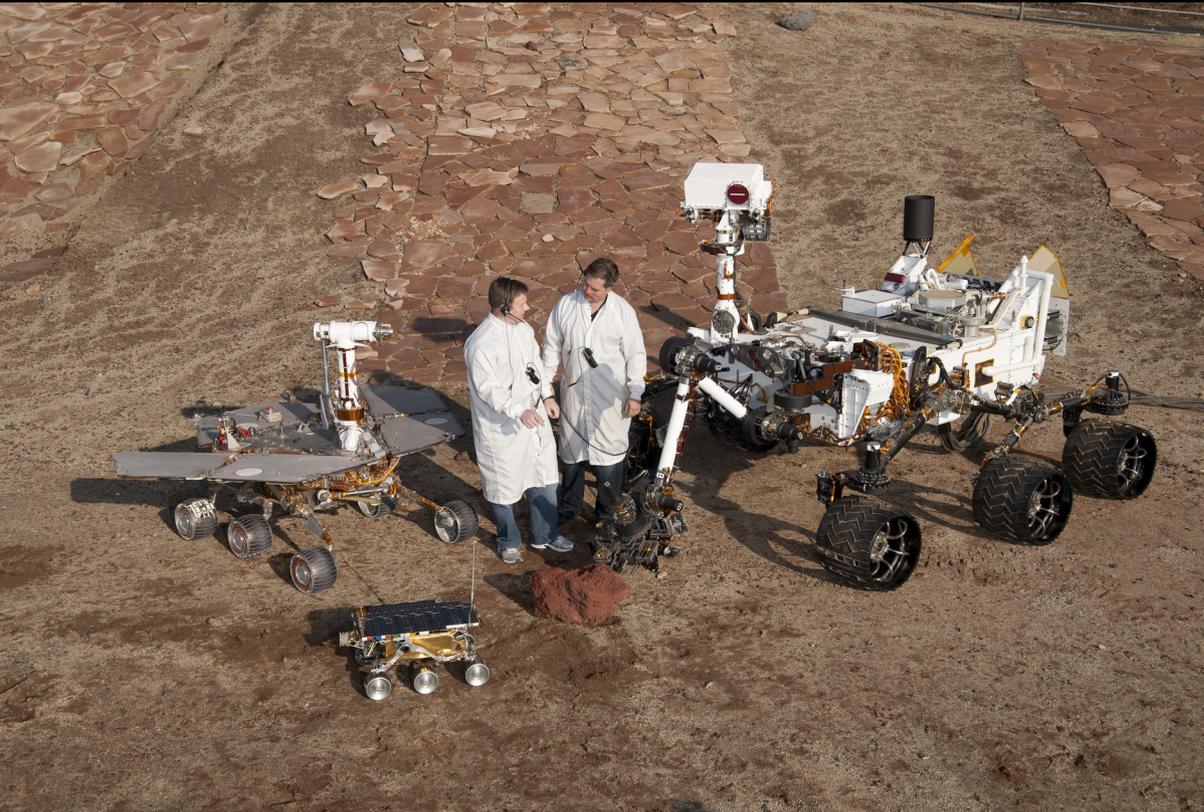
GLI ANNI 2000: DA MARS ODYSSEY A OGGI

Spirit e Opportunity
10 giugno e 7 luglio 2003



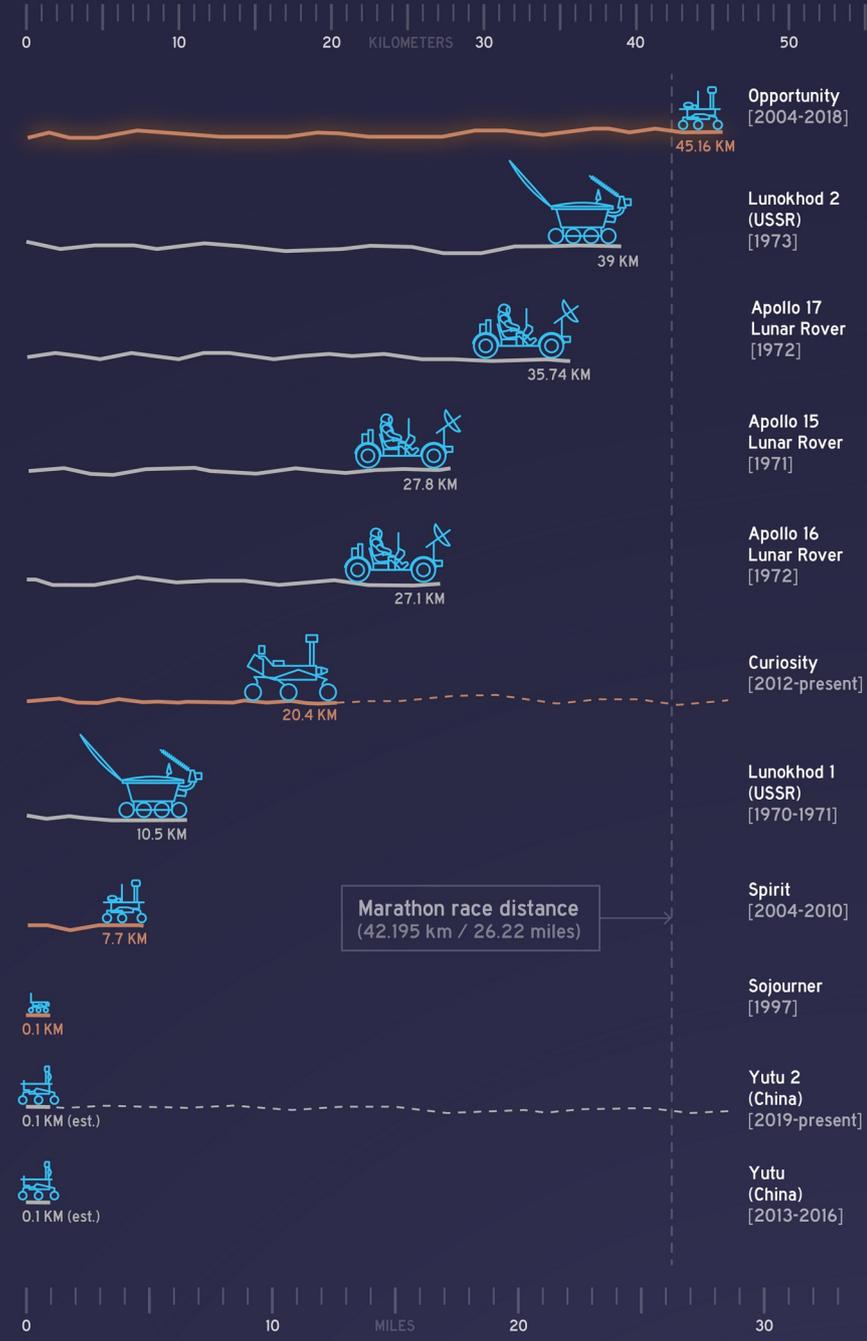
GLI ANNI 2000: DA MARS ODYSSEY A OGGI

Spirit e Opportunity



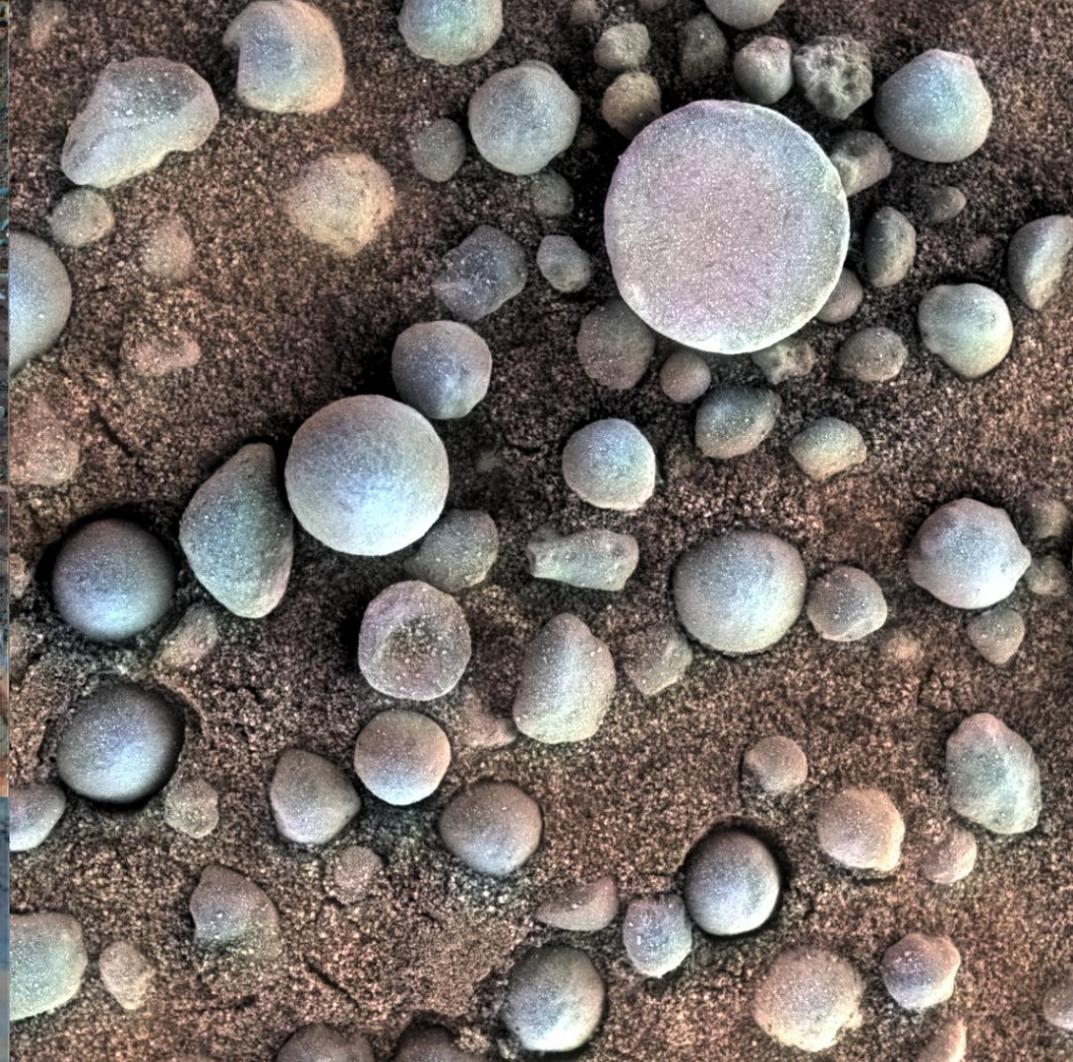
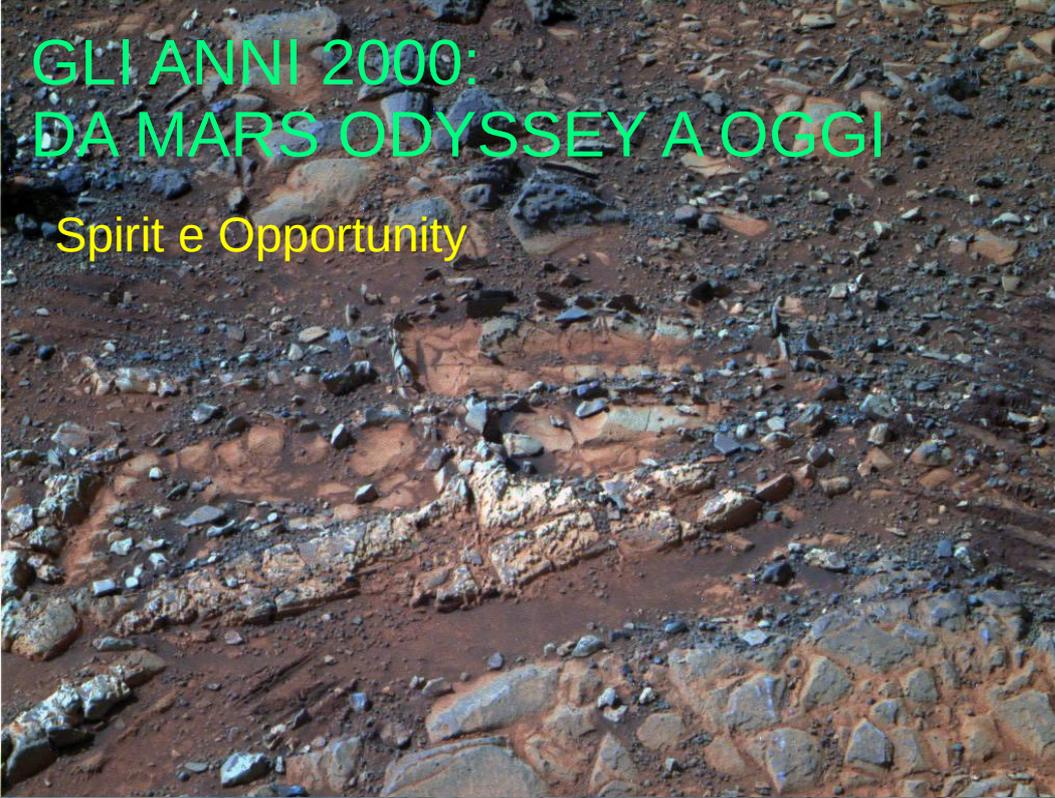
OUT-OF-THIS-WORLD RECORDS! DRIVING DISTANCES ON MARS AND THE MOON

(AS OF FEBRUARY 13, 2019)
MARS — MOON —



GLI ANNI 2000: DA MARS ODYSSEY A OGGI

Spirit e Opportunity



Spirit: carbonati di calcio e rocce ricche in magnesio
Comanche Outcrops

5 m

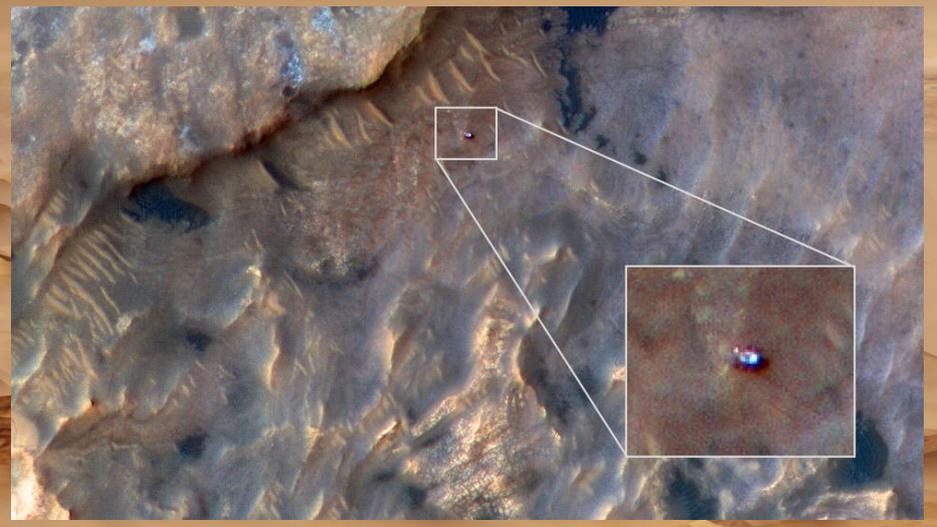
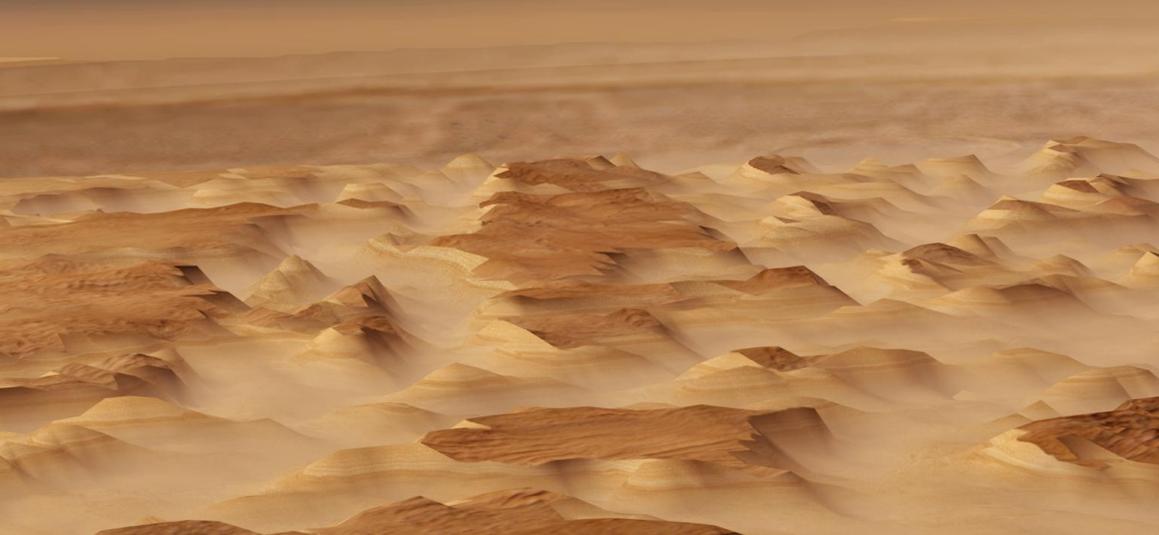
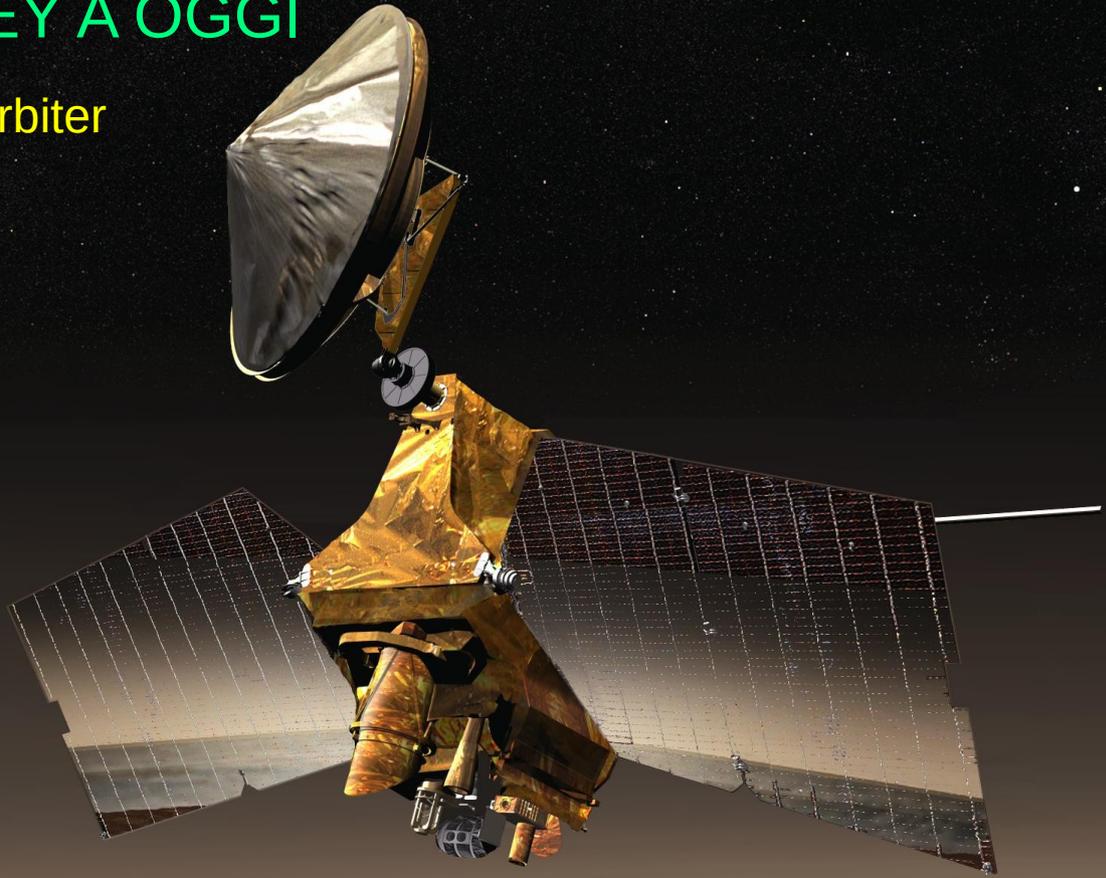
Algonquin Outcrop

Opportunity:
ematite in Meridiani Planum
Gesso
minerali argillosi



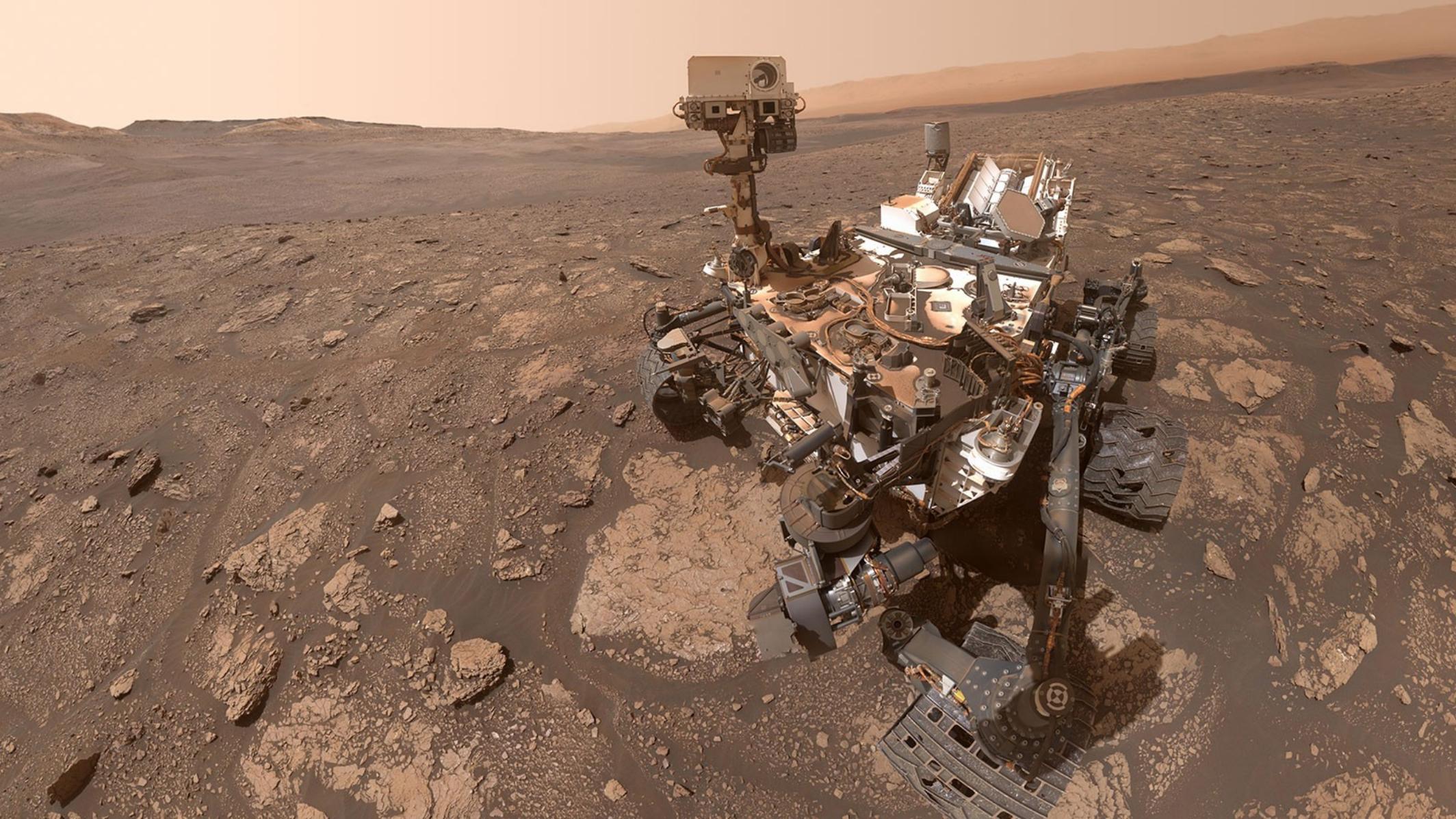
GLI ANNI 2000: DA MARS ODYSSEY A OGGI

Mars Reconnaissance Orbiter
2005



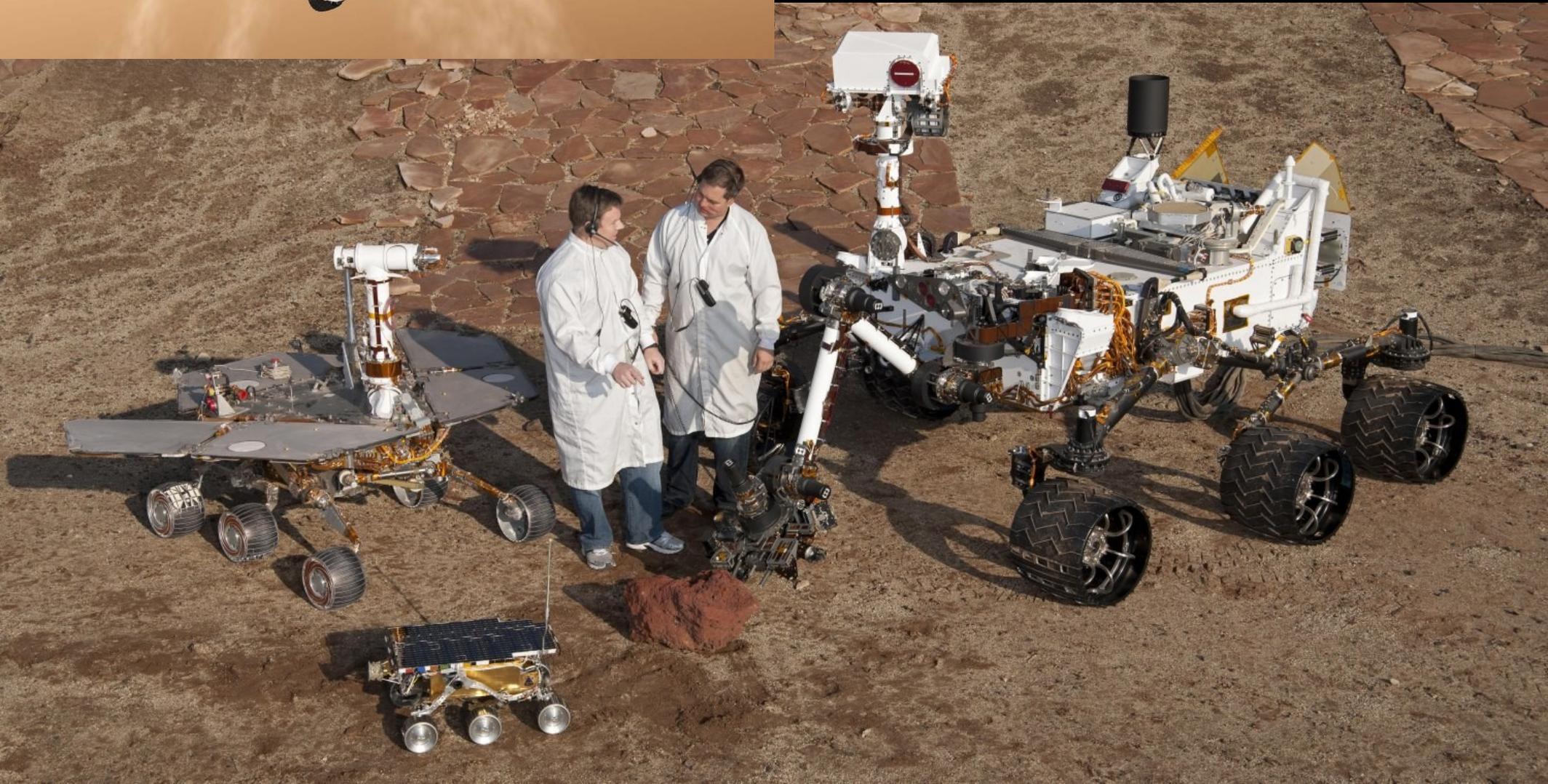
GLI ANNI 2000: DA MARS ODYSSEY A OGGI

Curiosity
2011



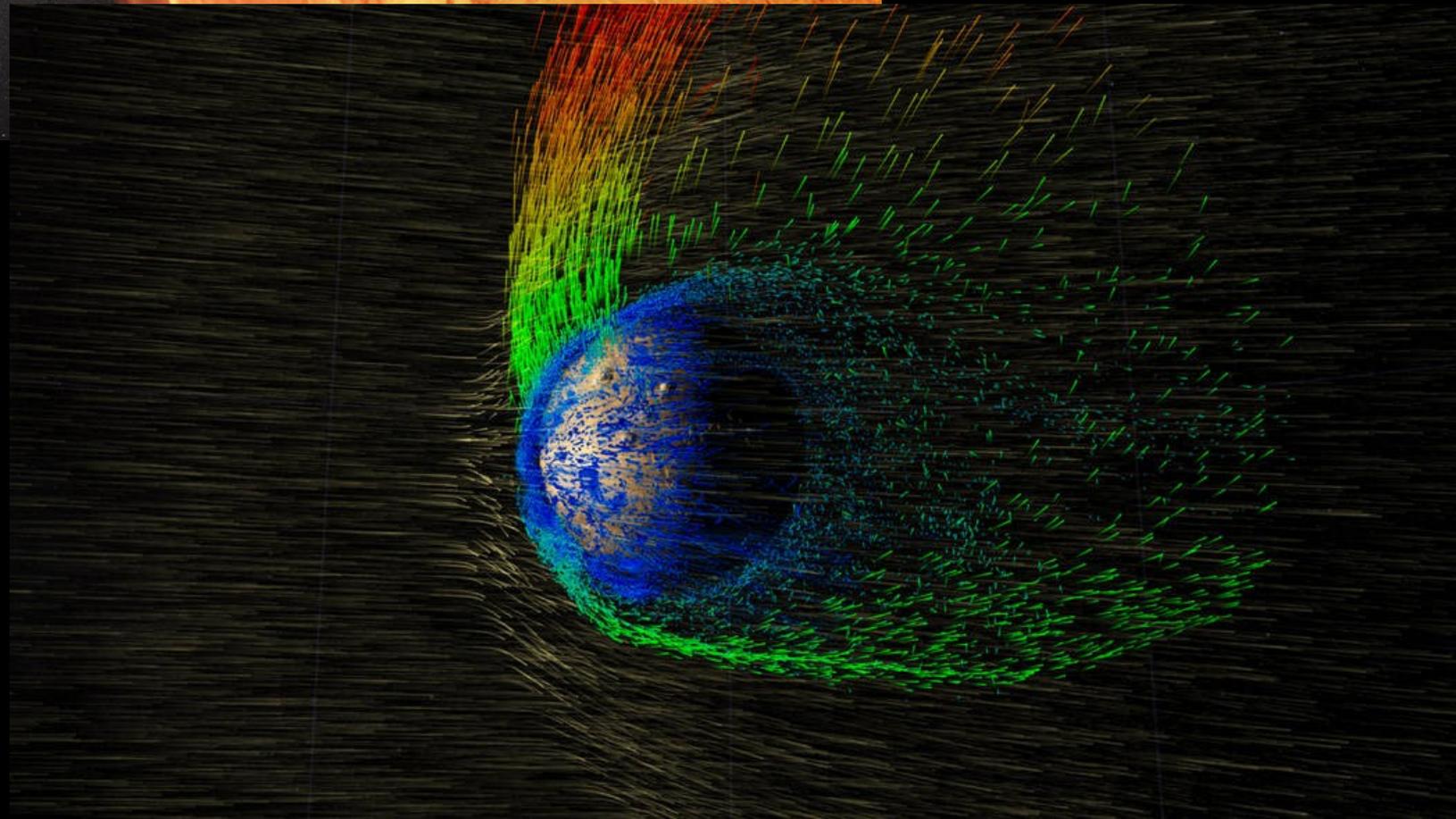
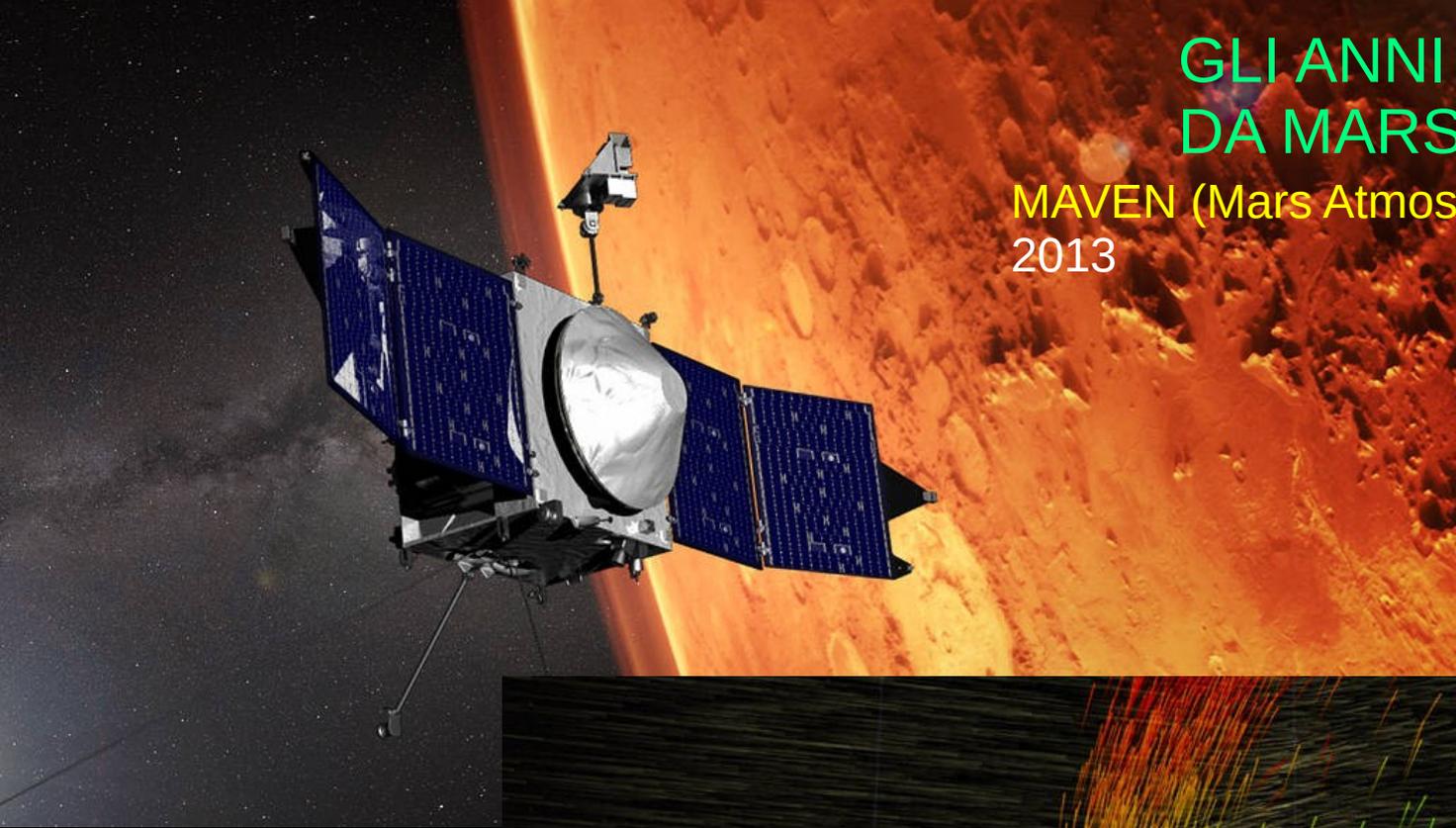
GLI ANNI 2000: DA MARS ODYSSEY A OGGI

Curiosity
2011
Skycrane



GLI ANNI 2000: DA MARS ODYSSEY A OGGI

MAVEN (Mars Atmosphere and Volatile Evolution)
2013



GLI ANNI 2000: DA MARS ODYSSEY A OGGI

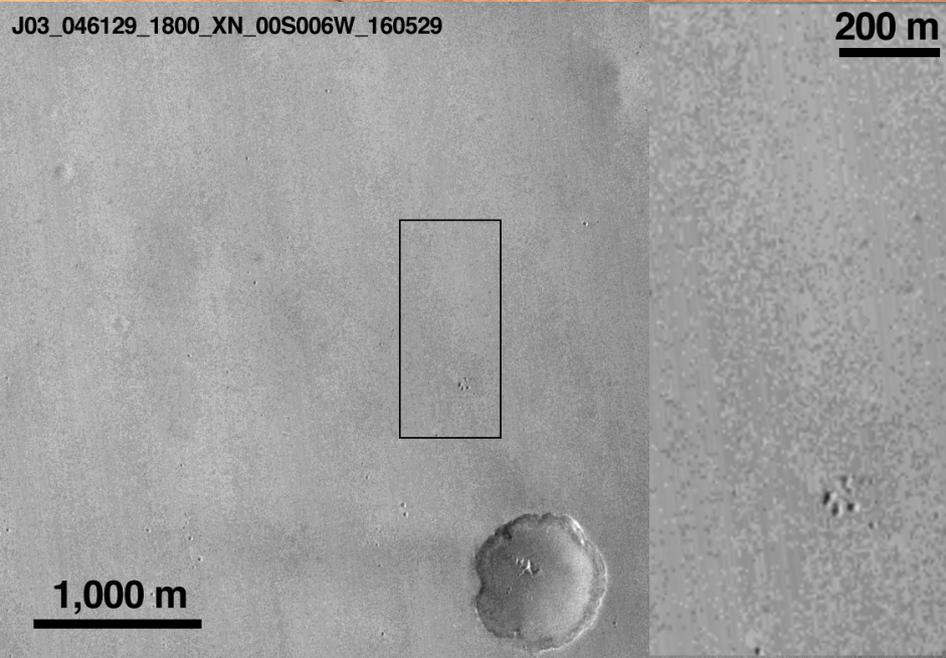
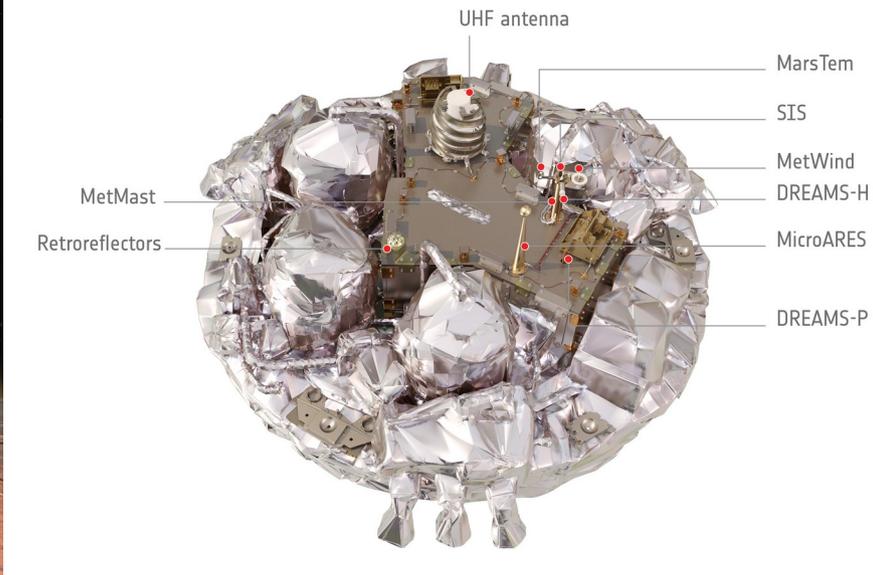
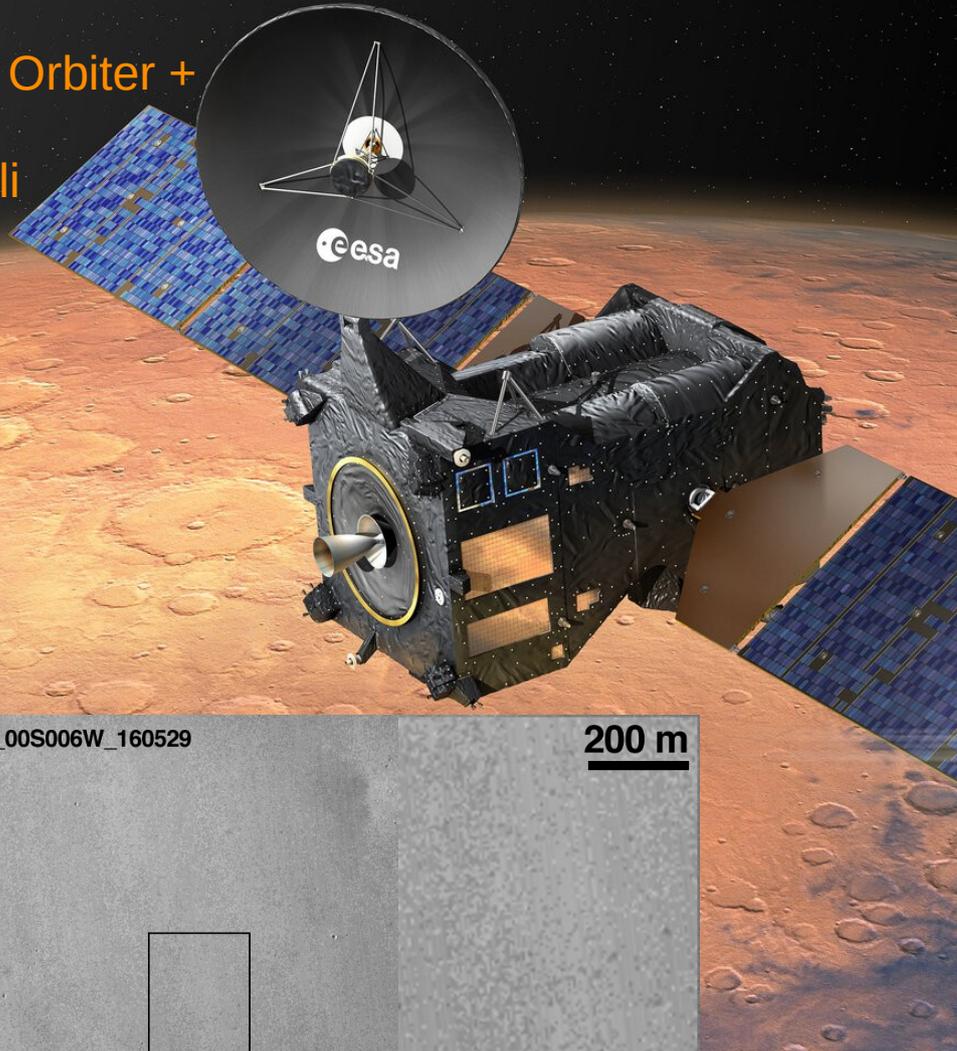
Insight
Lander 2018



GLI ANNI 2000: DA MARS ODYSSEY A OGGI

ExoMars ESA, ASI, Roscosmos

2 fasi:
Trace Gas Orbiter +
Lander
Schiaparelli
2016



GLI ANNI 2000: DA MARS ODYSSEY A OGGI

ExoMars ESA, ASI, Roscosmos

2 fasi:

Rover Rosalind Franklin

Data originaria lancio: 20 settembre 2022

Nuova data per il lancio?

