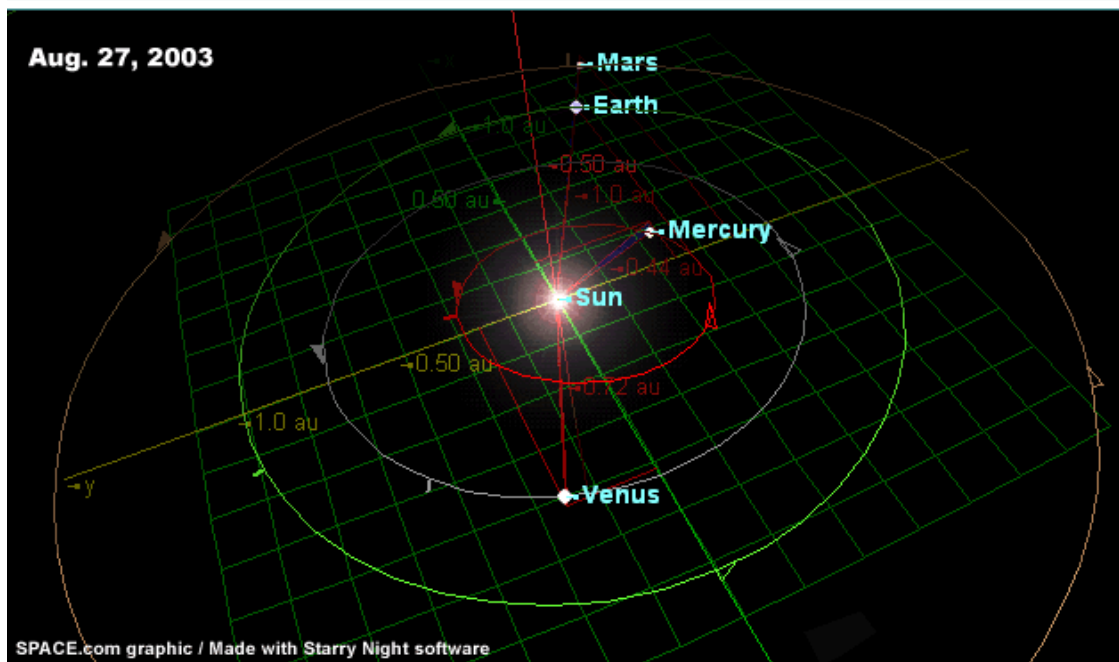
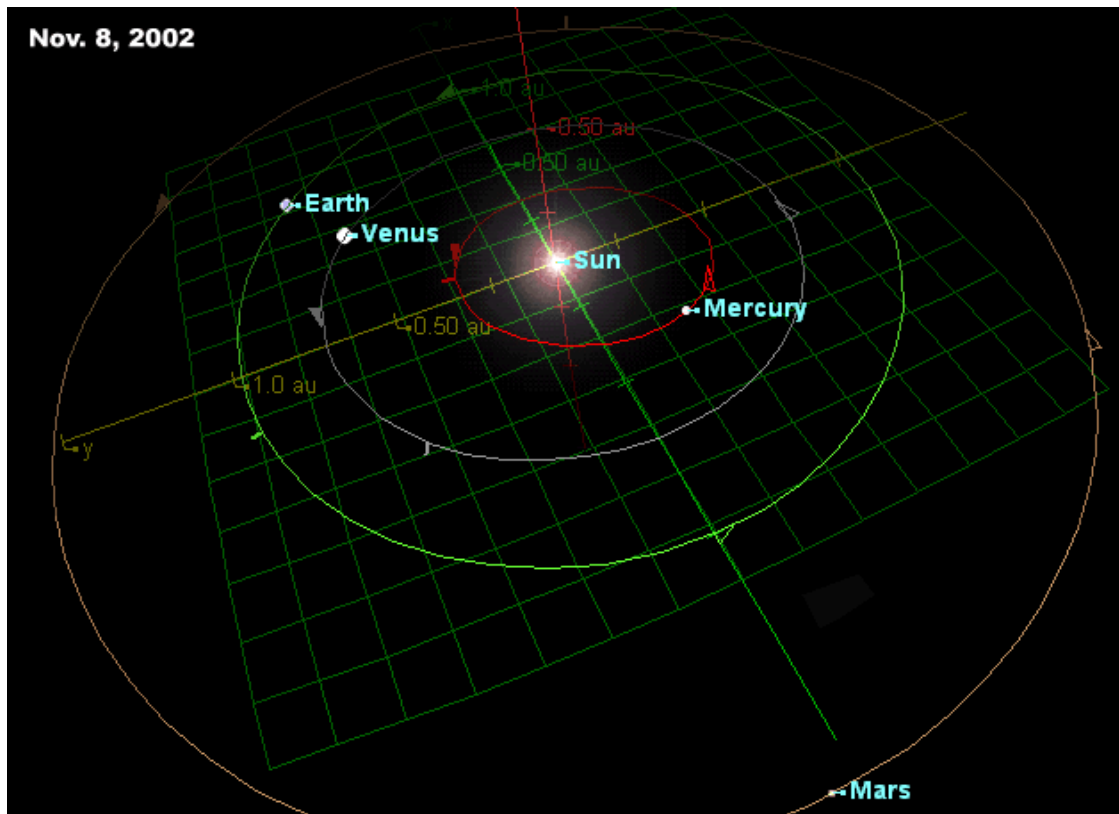
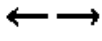
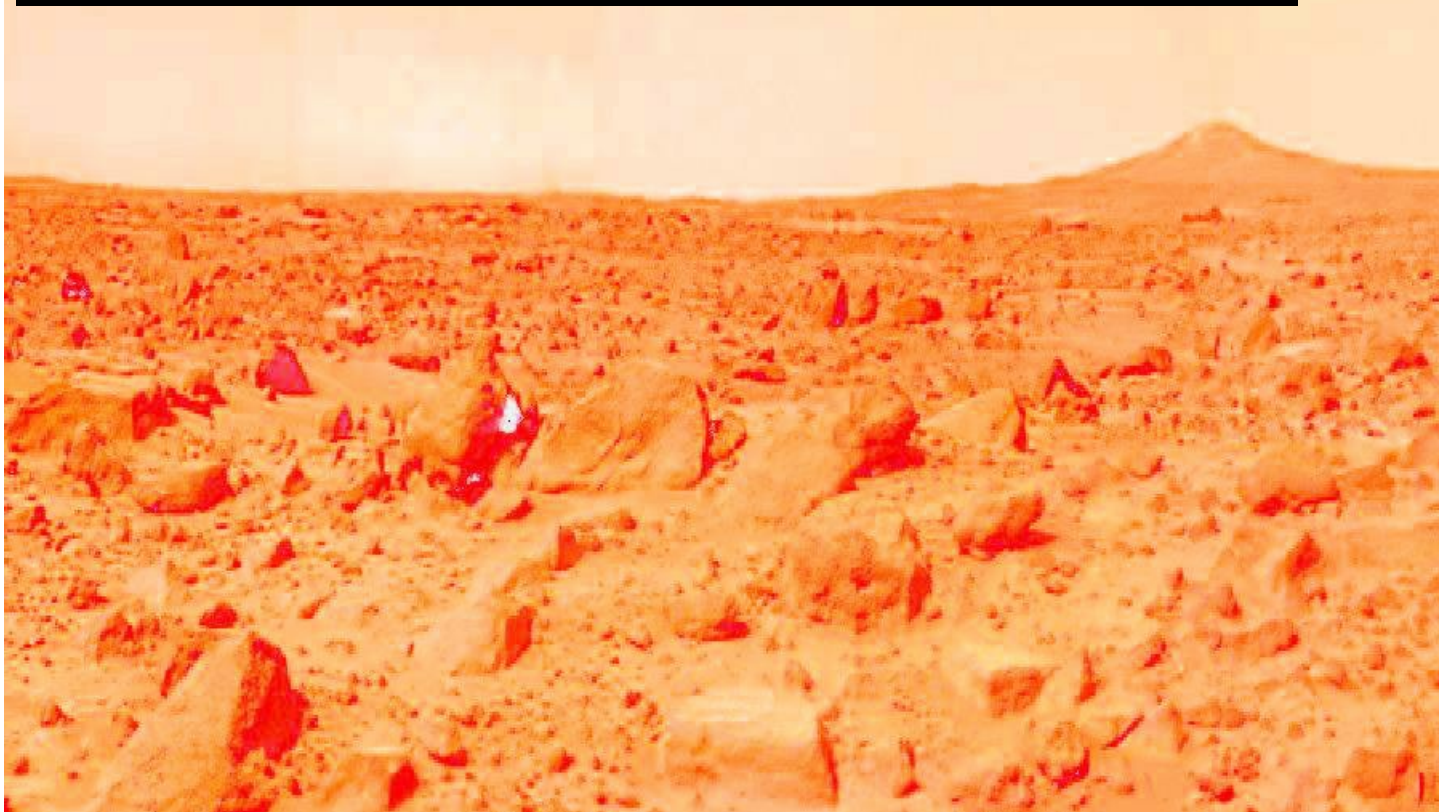
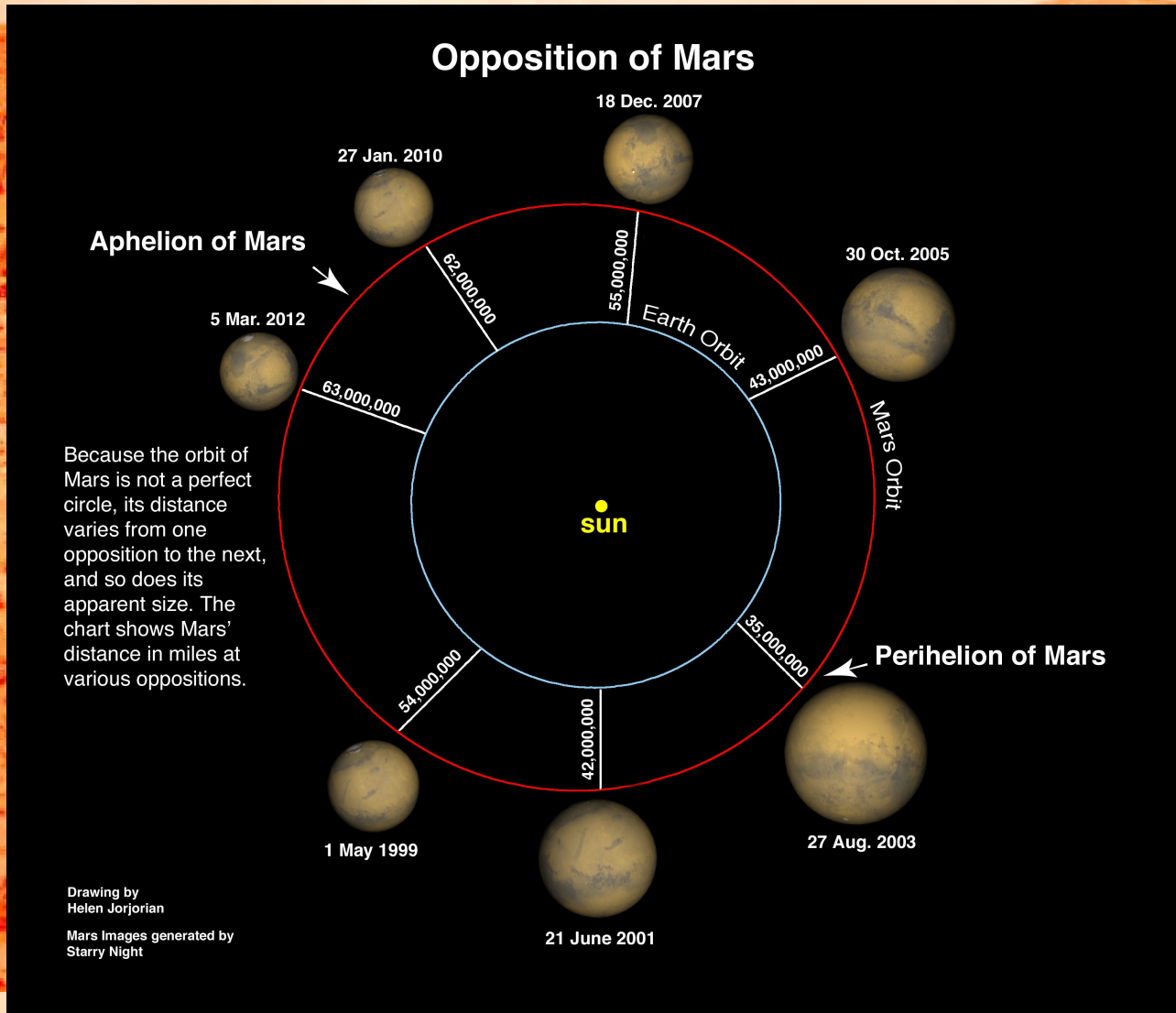


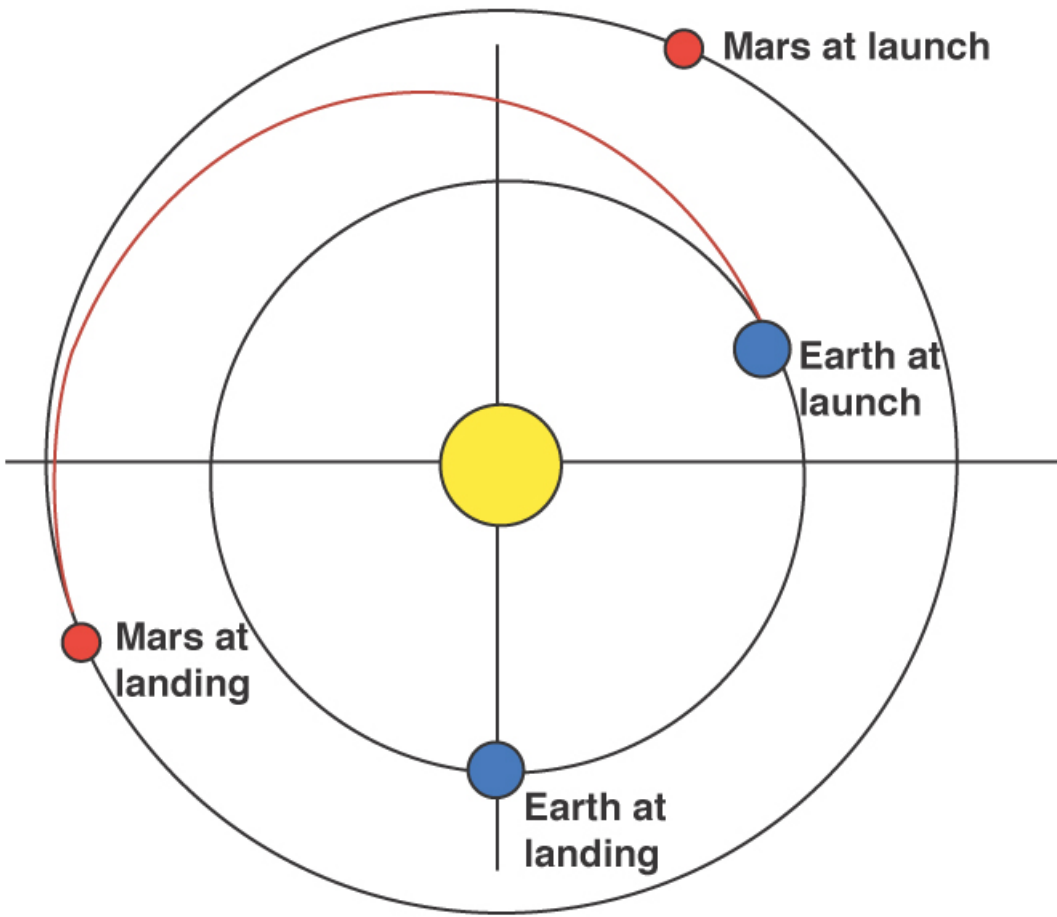
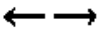
Getting to Mars





How close is Mars?



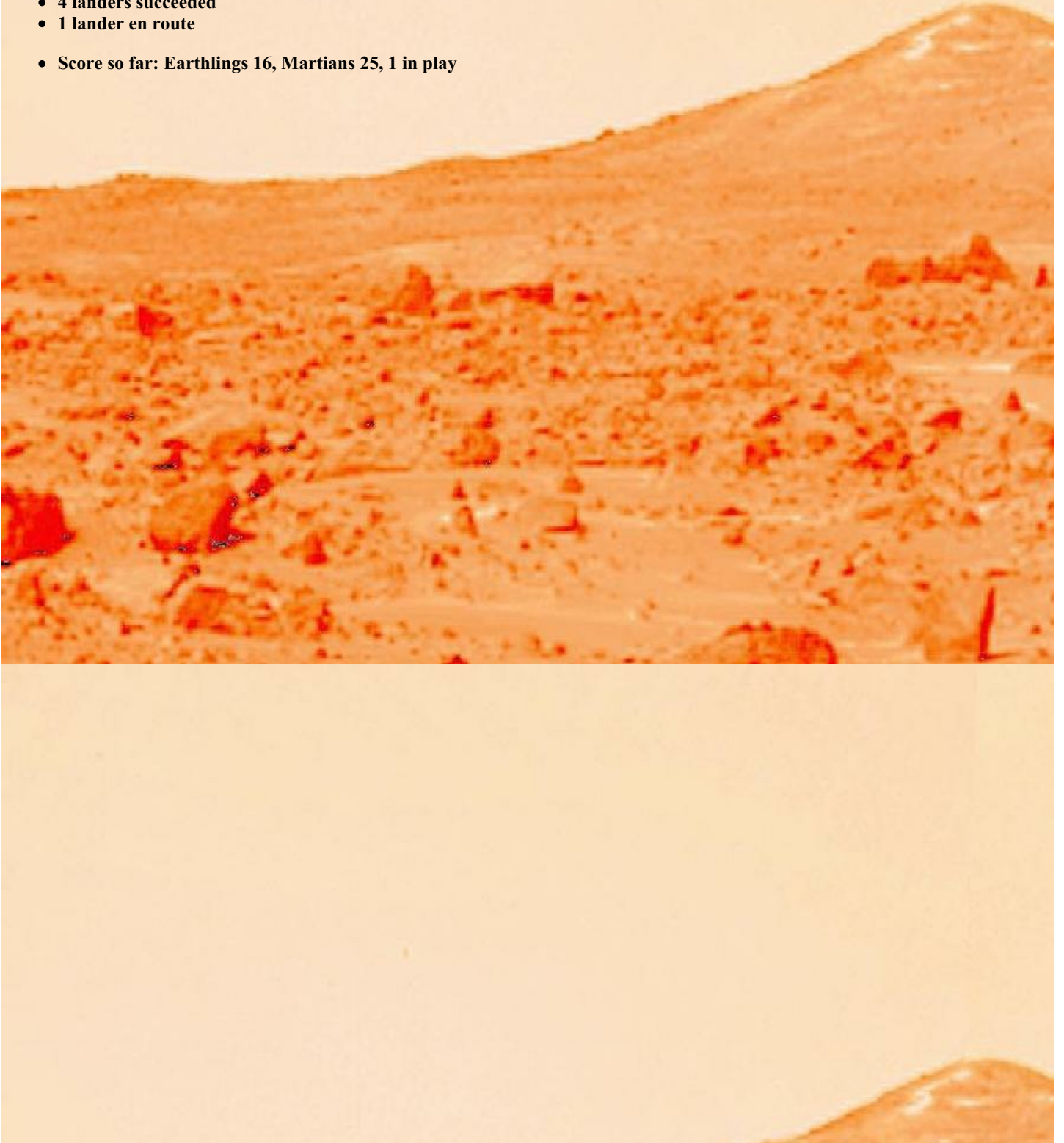


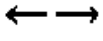


Exploring Mars 1960-2004

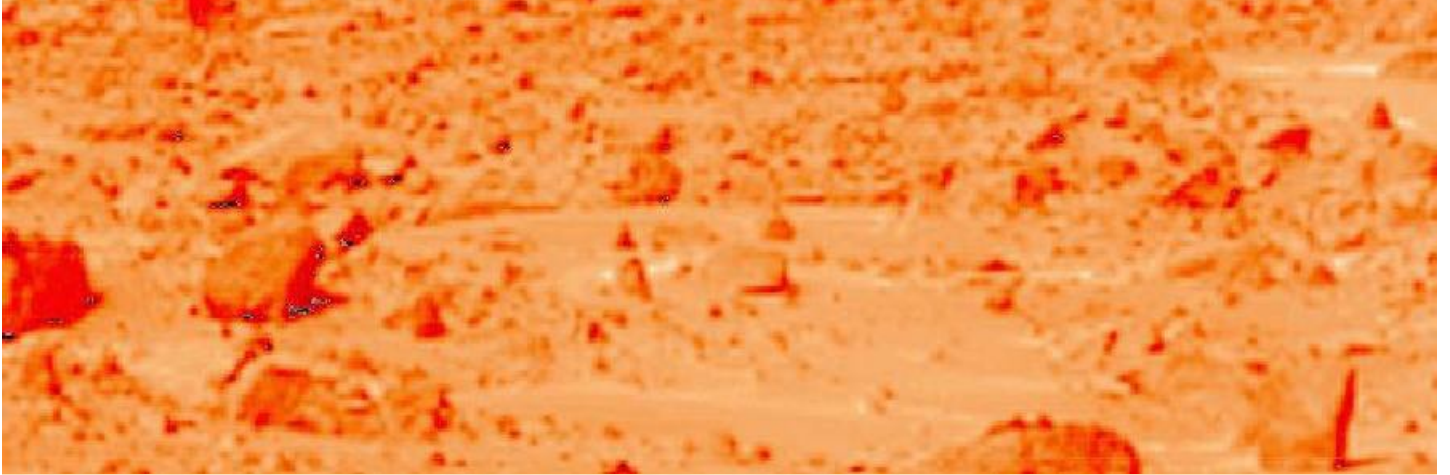
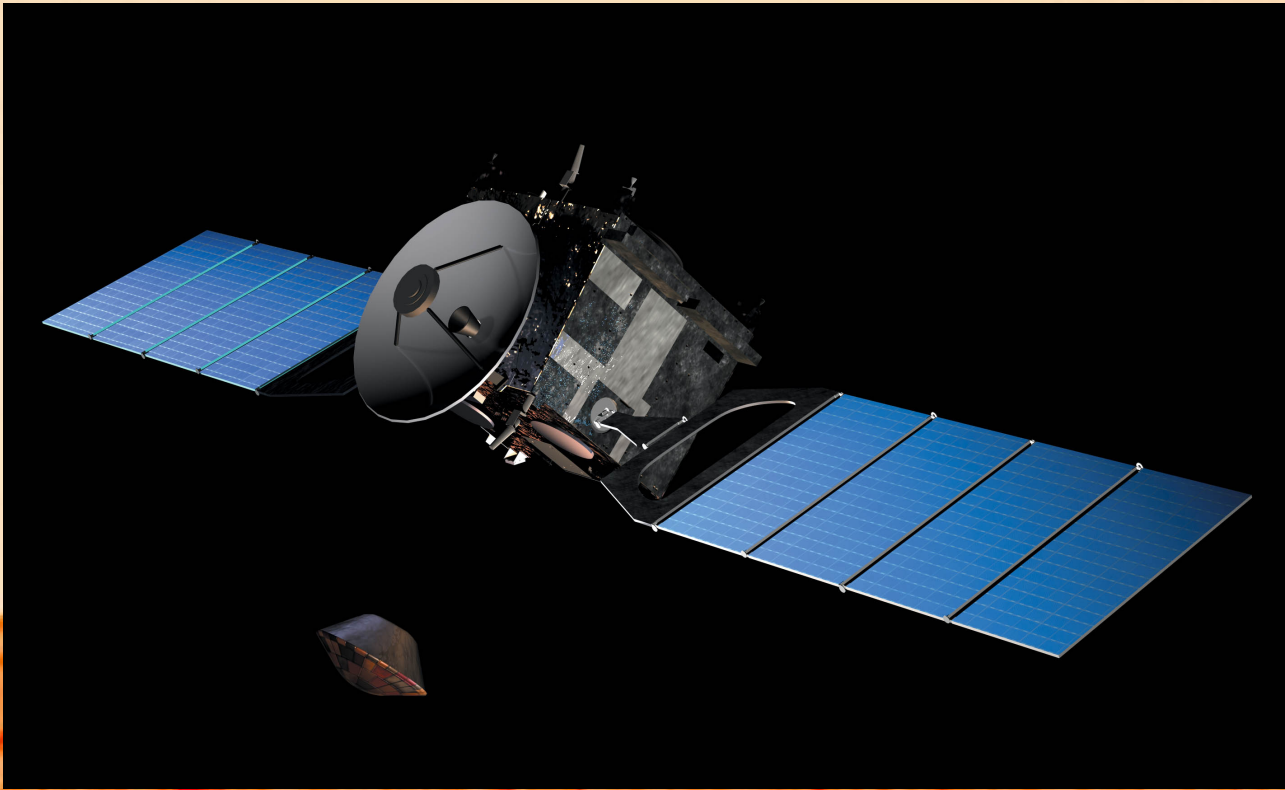
Of 42 probes launched:

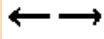
- 9 crashed on launch or failed to leave Earth orbit
 - 4 failed en route to Mars
 -
 - 4 failed to stop at Mars
 - 1 failed on entering Mars orbit
 - 1 orbiter crashed on Mars
 - 6 landers crashed on Mars
 -
 - 3 flyby missions succeeded
 - 9 orbiters succeeded
 - 4 landers succeeded
 - 1 lander en route
- Score so far: Earthlings 16, Martians 25, 1 in play



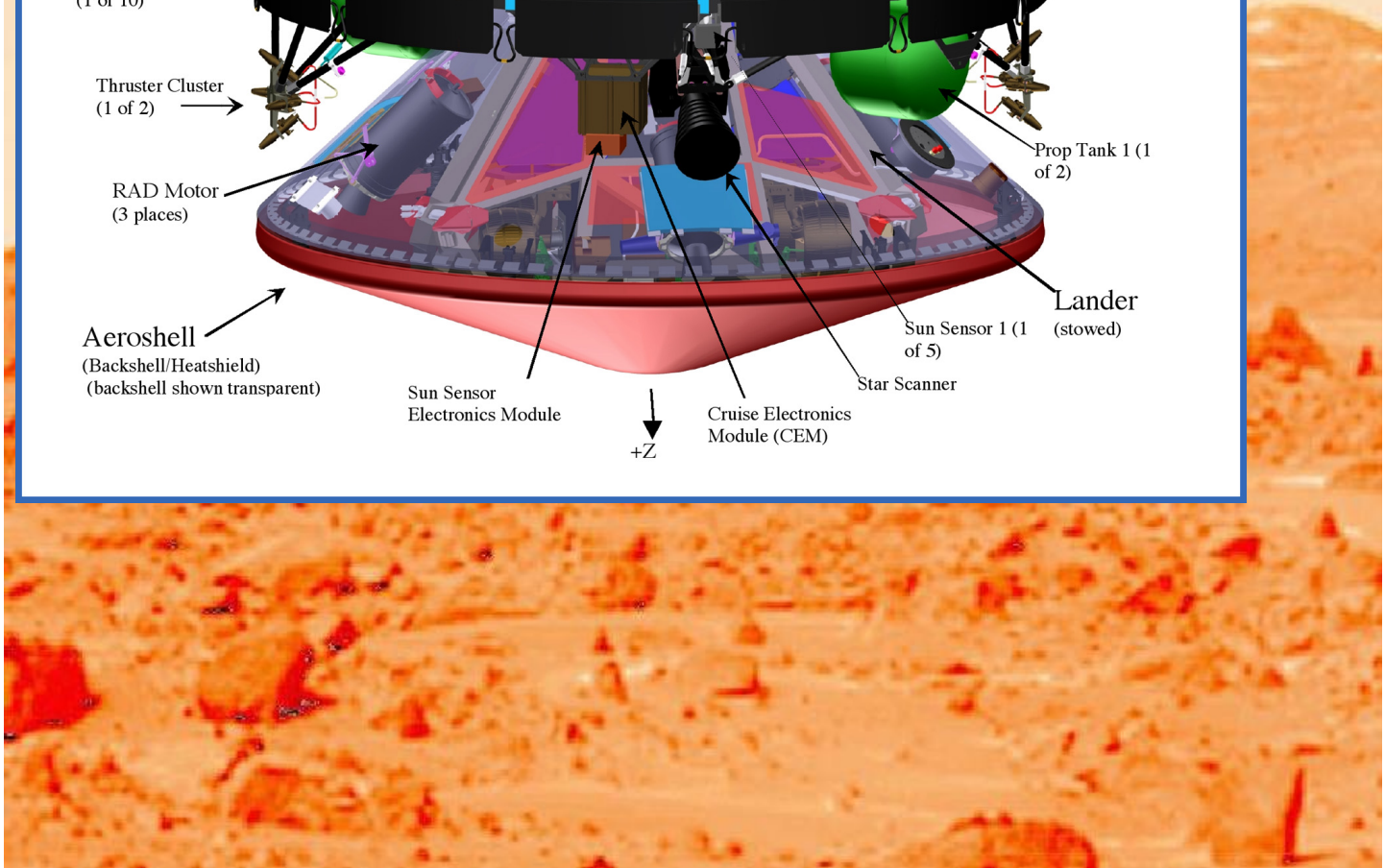
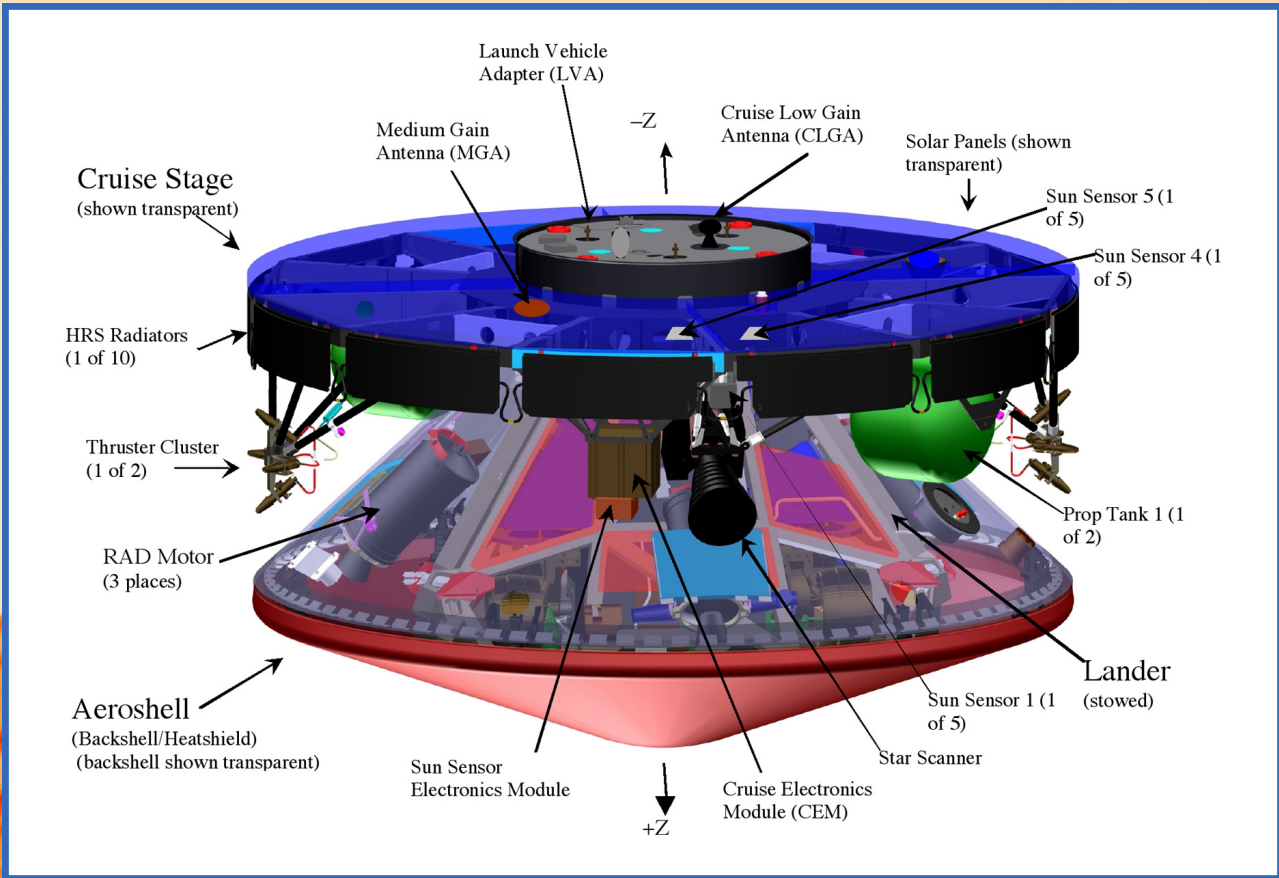


Mars Express



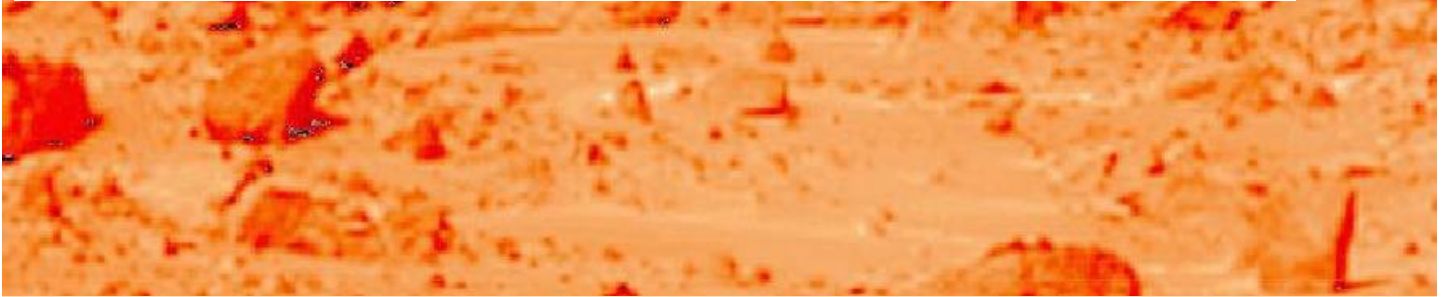
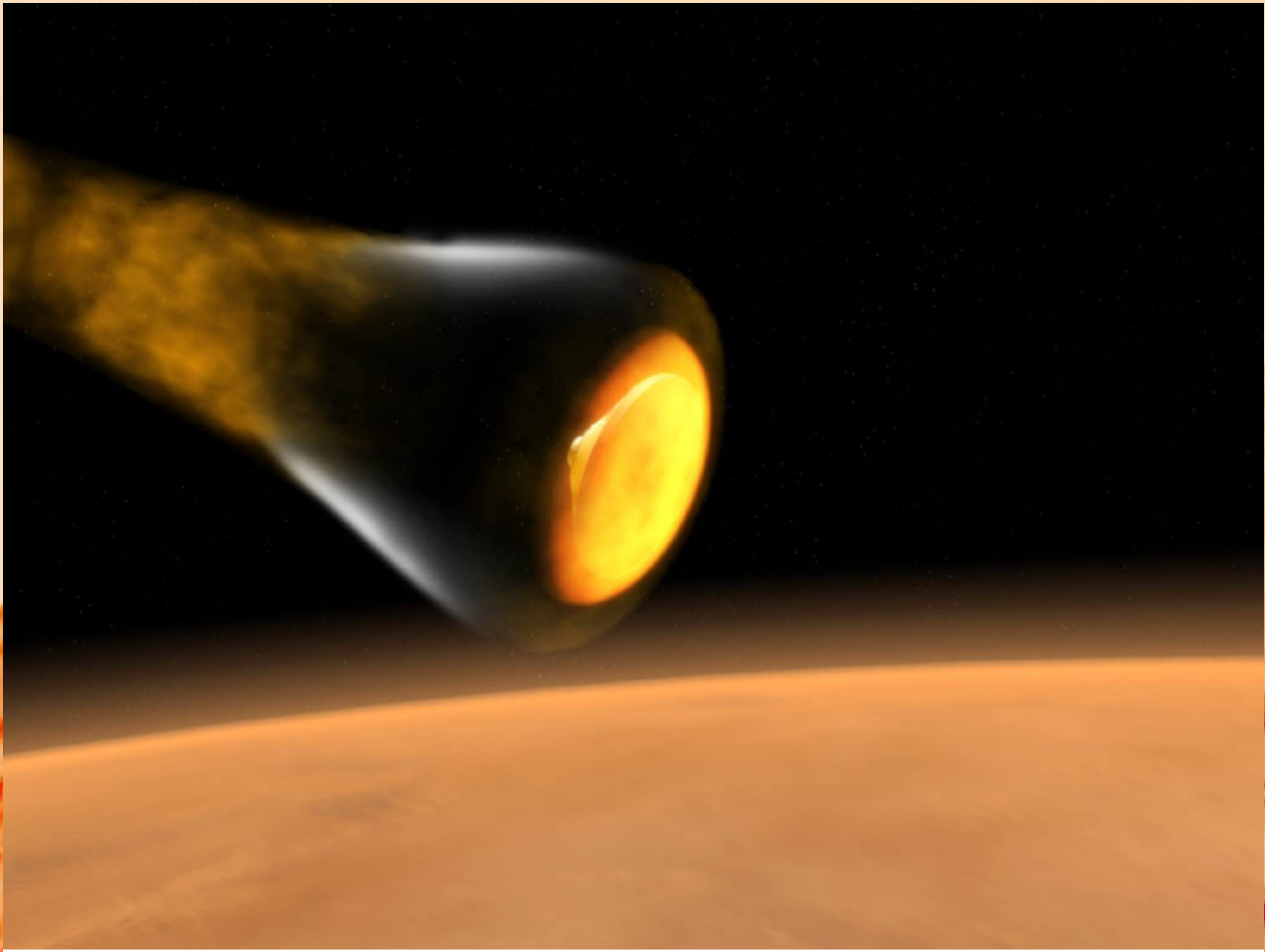


Mars Exploration Rover



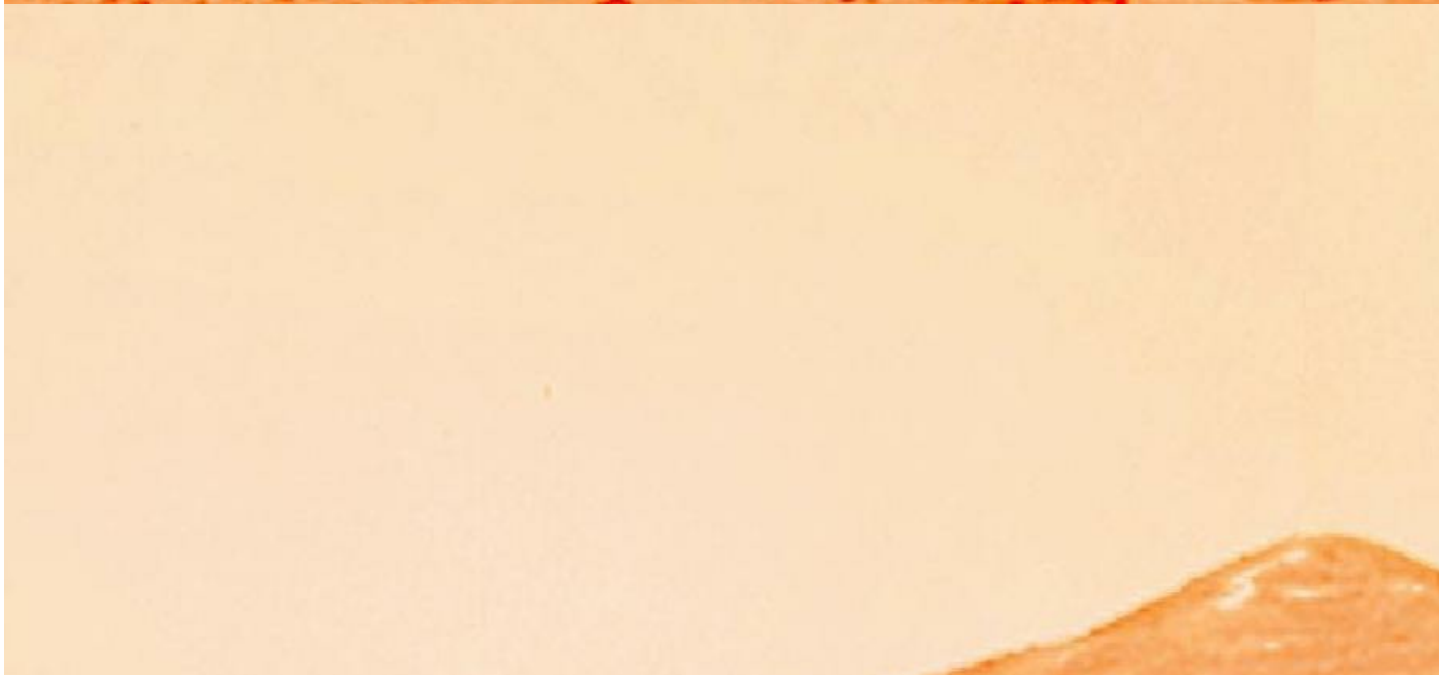
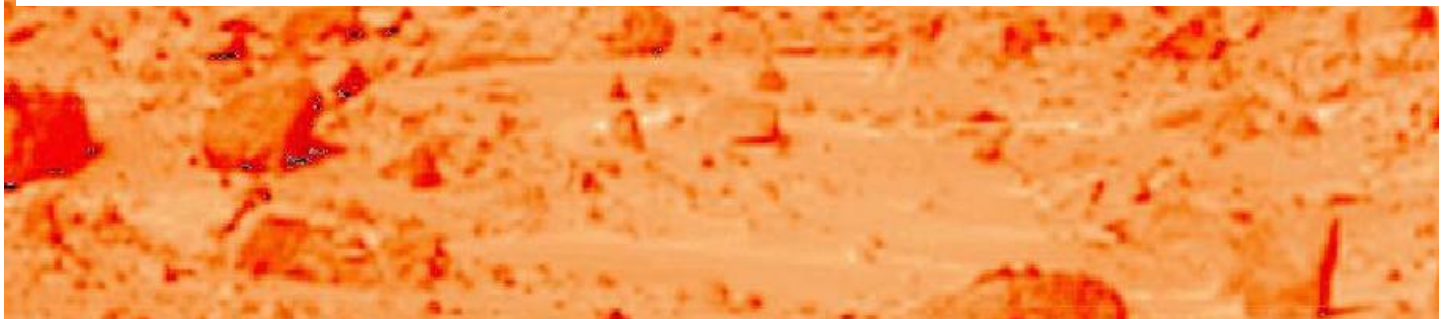
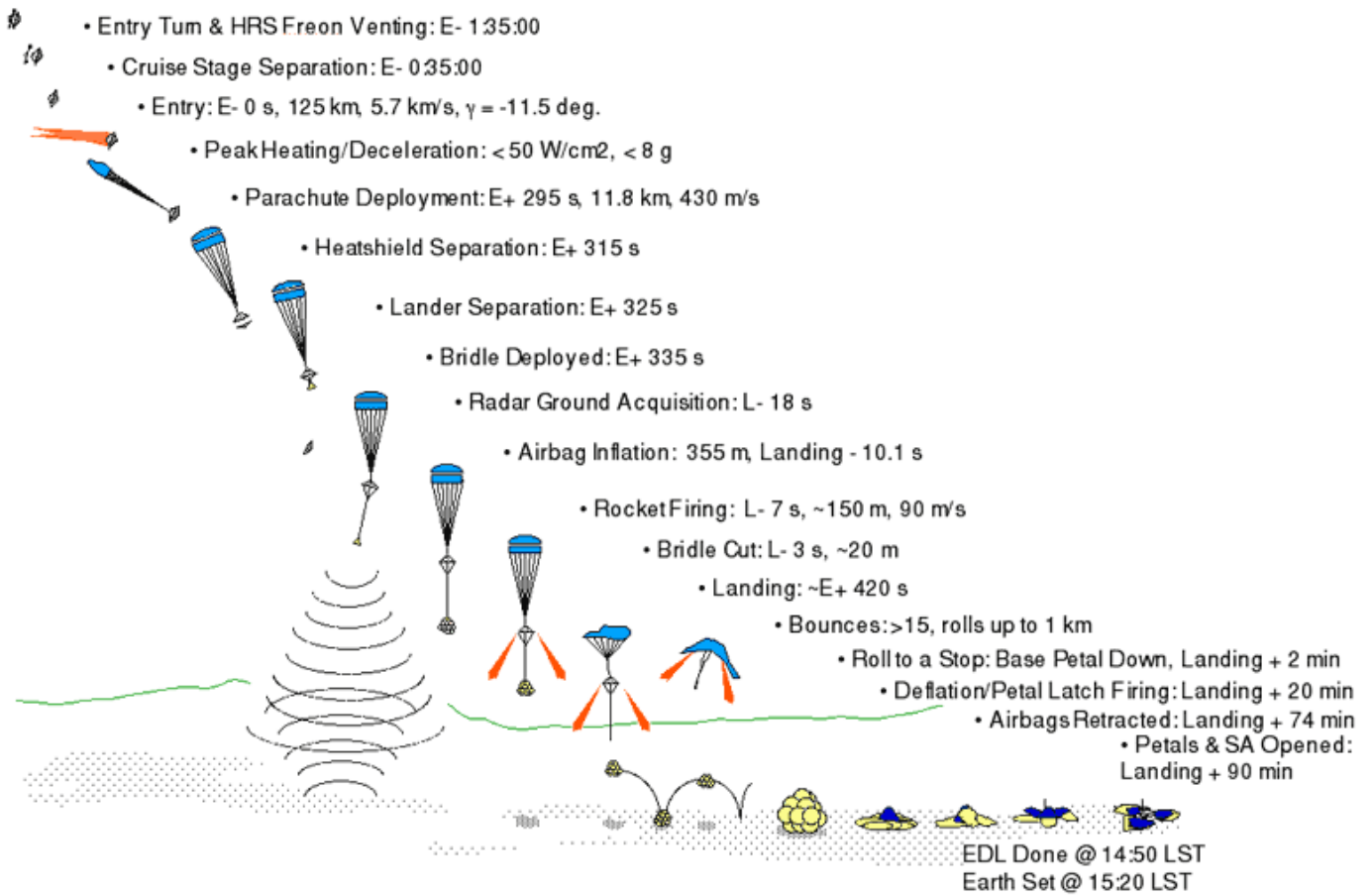


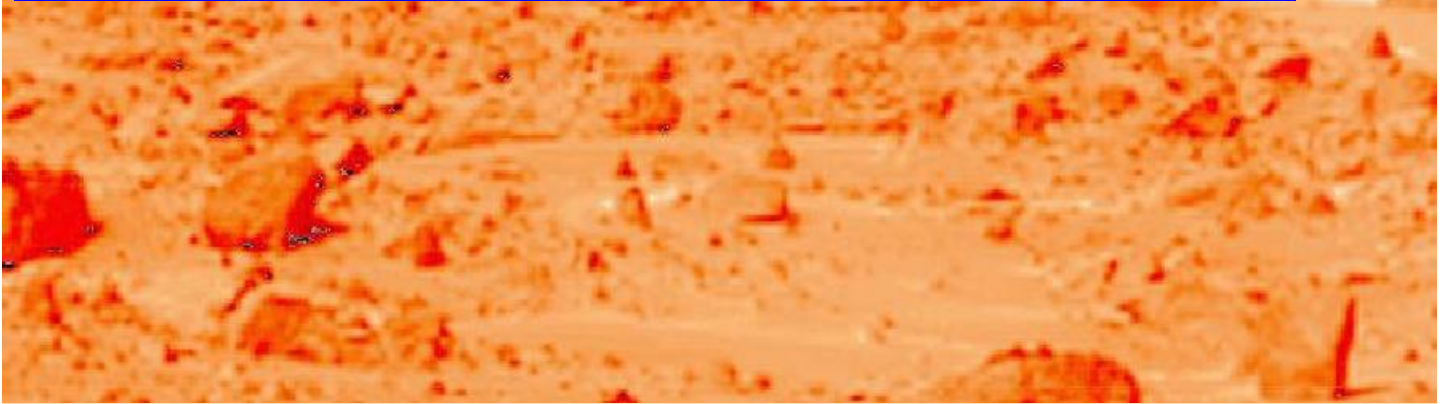
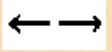
Mars Exploration Rover

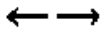




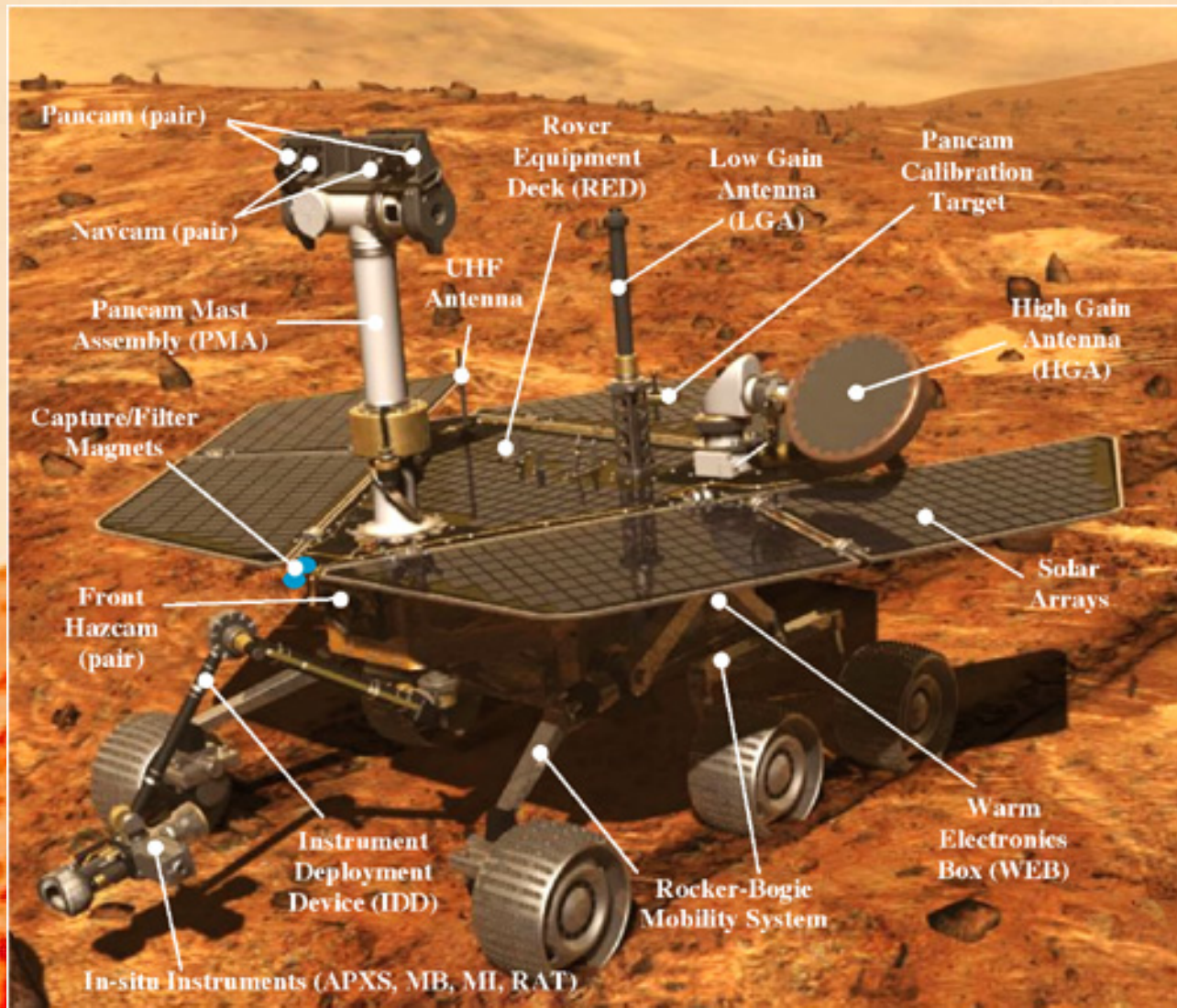
EDL Process

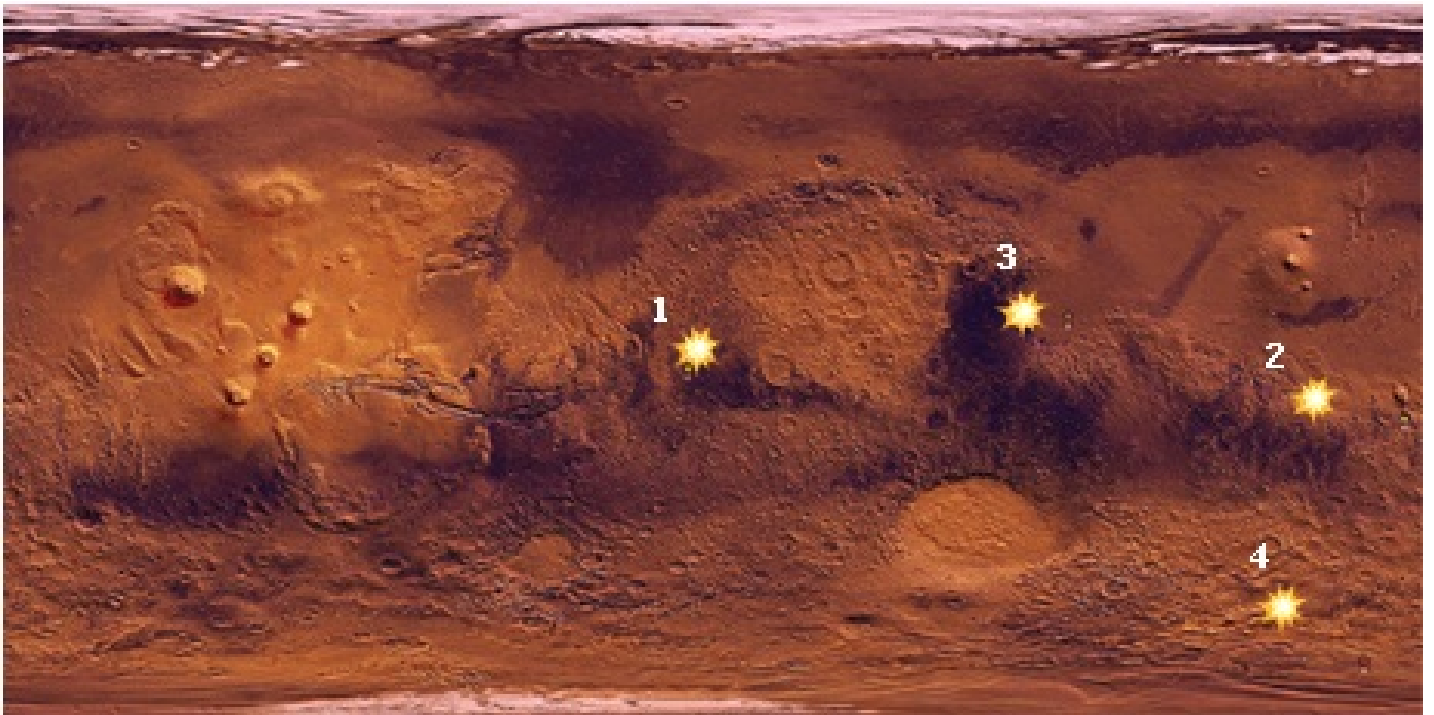
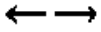




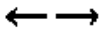


Mars Exploration Rover



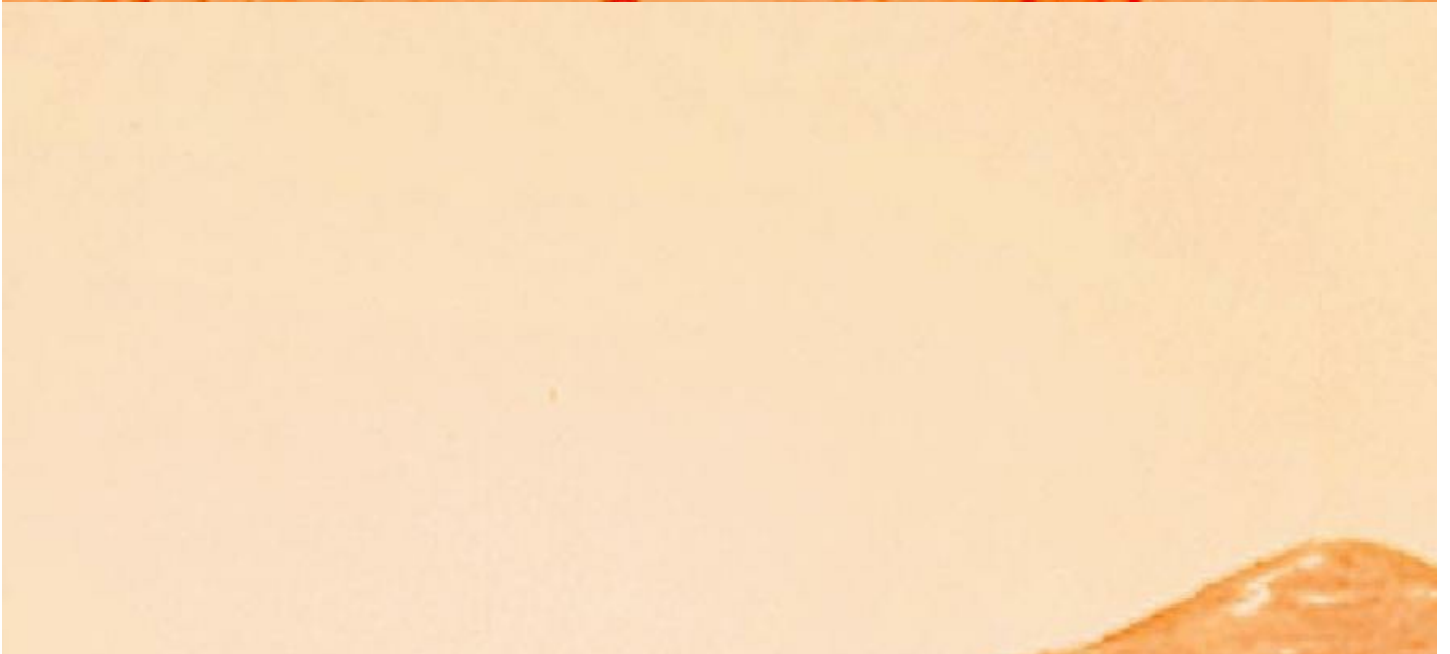
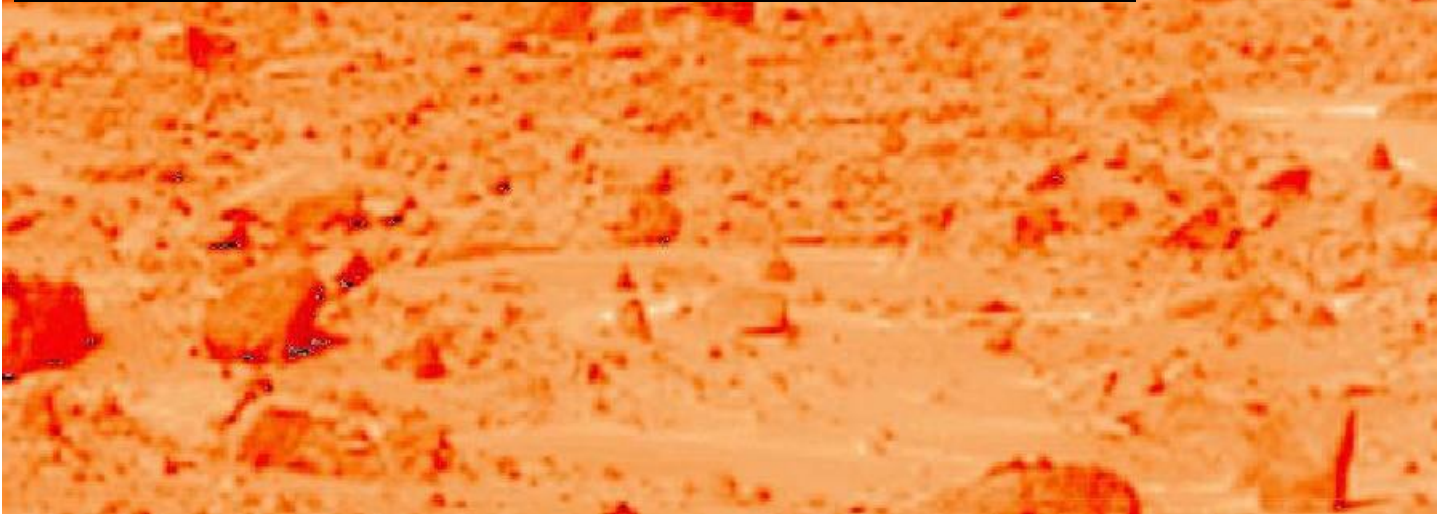


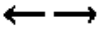
- 1: Meridiani (Opportunity)
- 2: Gusev (Spirit)
- 3: Isidis (Beagle-2)
- 4: Mars Polar Lander



Launch Window 21: Jun-Jul 2003

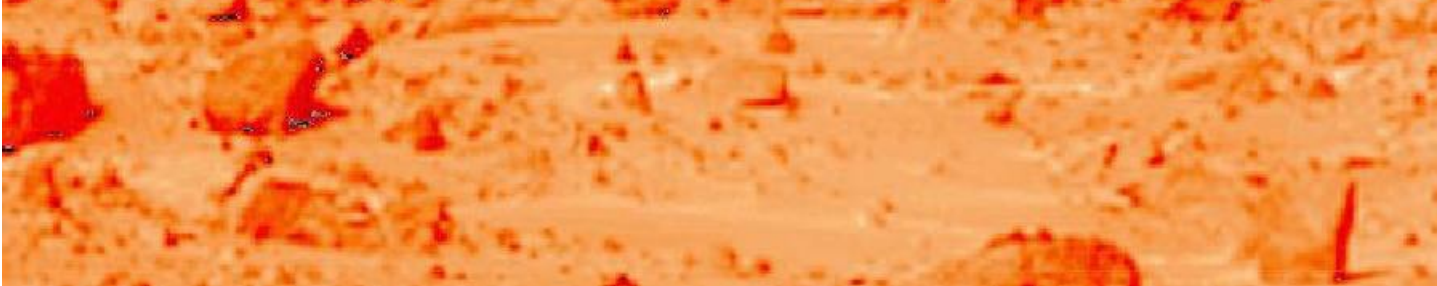
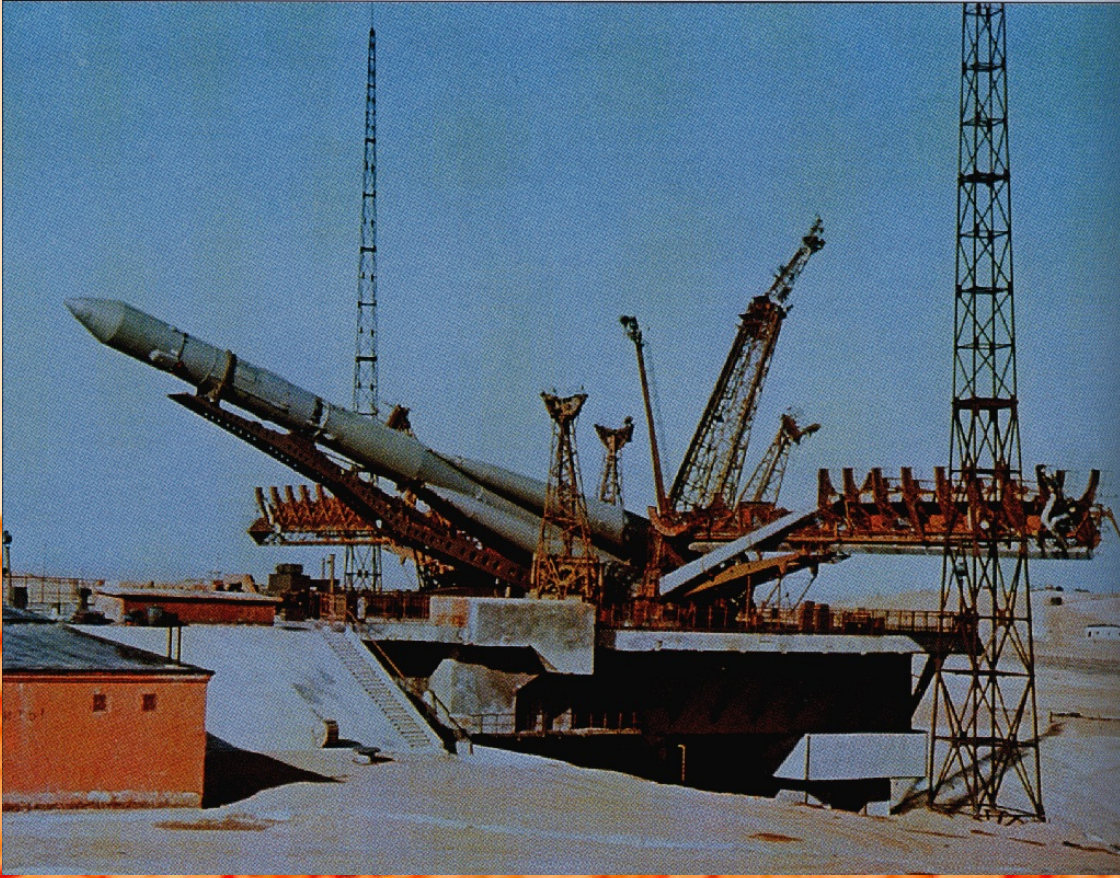
Mars Express	2003 Jun 2	In Mars orbit Dec 25
Beagle 2 Lander	2003 Jun 2	Crashed at Isidis Dec 25
Spirit/ Rover A	2003 Jun 10	Landed at Gusev Jan 4
Opportunity/ Rover B	2003 Jul 8	Heading to Meridiani on Sunday

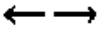




Launch Window 1: Oct 1960

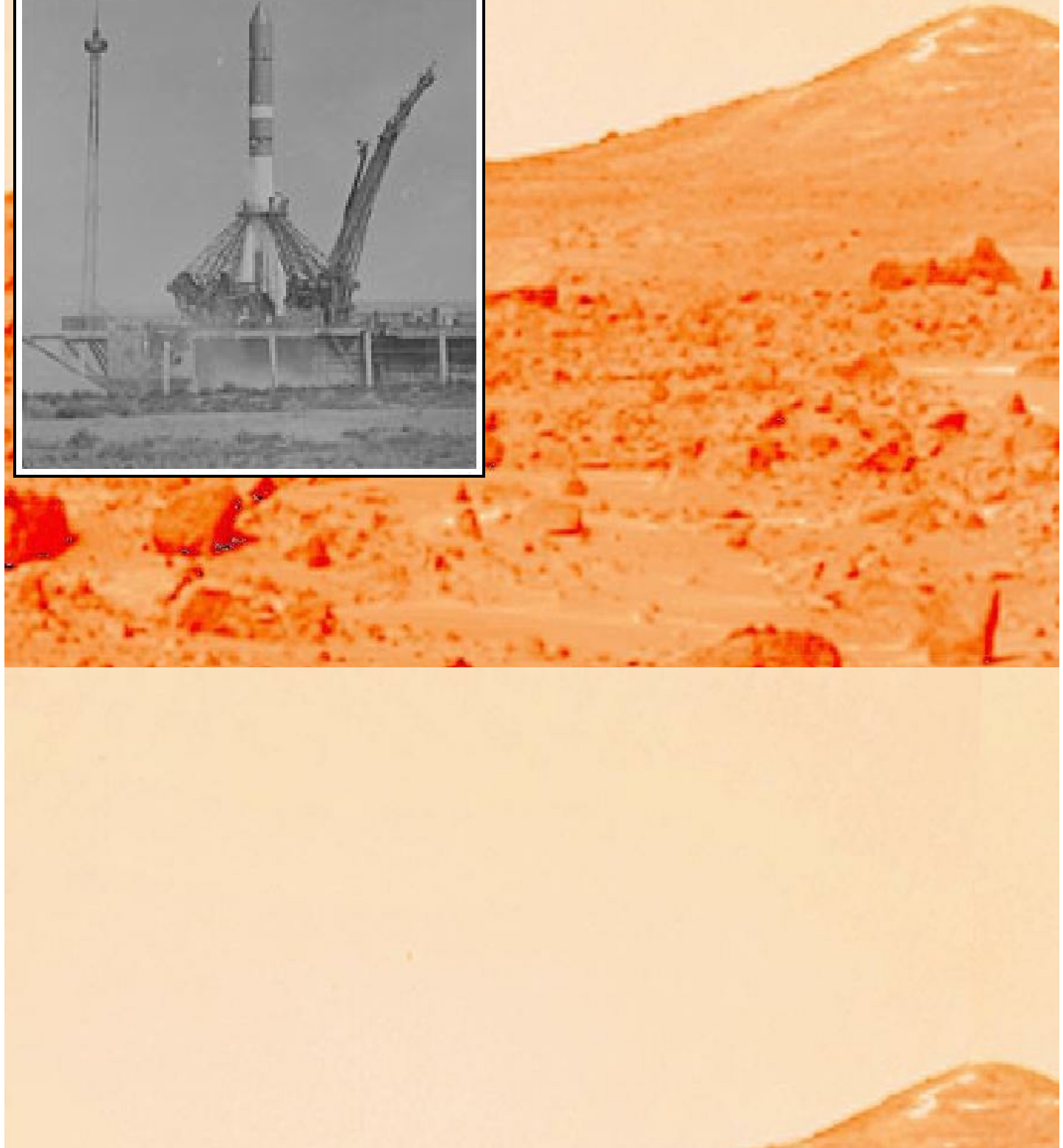
1M No. 1	1960 Oct 10	Rocket crashed in Siberia
1M No. 2	1960 Oct 14	Rocket crashed in Kazakhstan





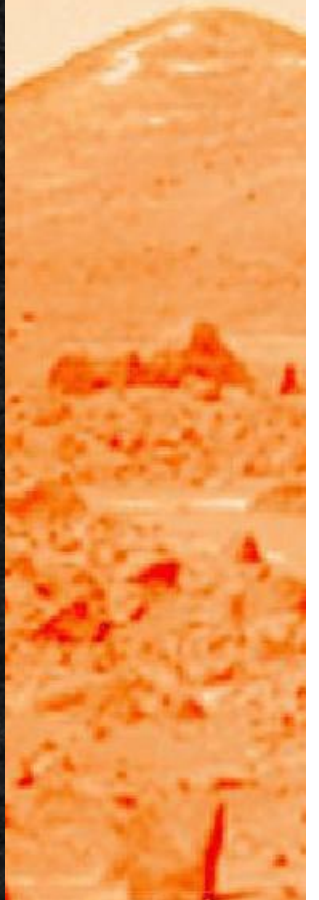
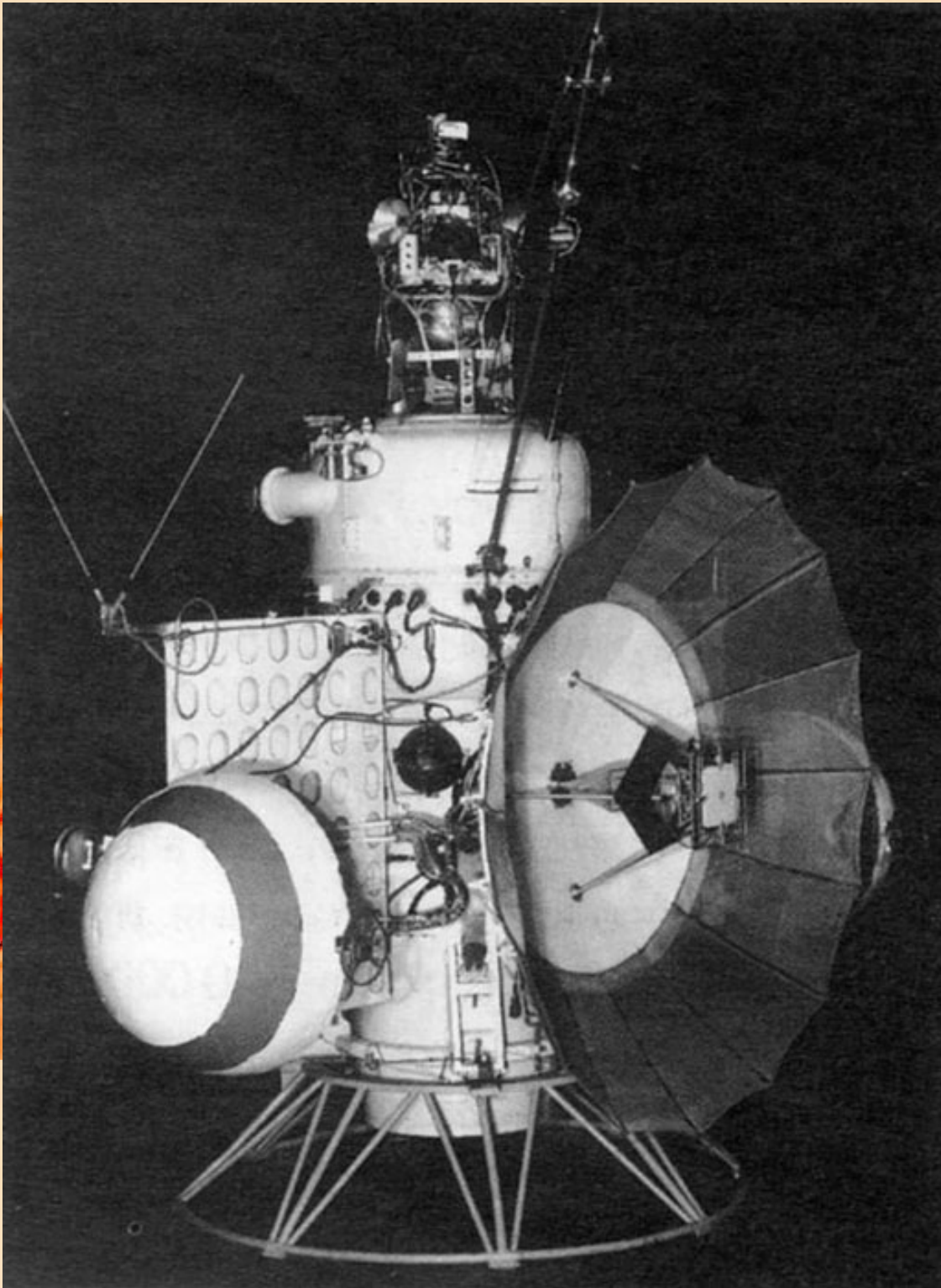
Launch Window 2: October-November 1962

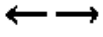
2MV-4 No. 1	1962 Oct 24	Rocket blew up in parking orbit
		during Cuban Missile Crisis
2MV-4 No. 2 "Mars-1"	1962 Nov 1	Lost attitude control -
		Missed Mars by 200000 km
2MV-3 No. 1	1962 Nov 4	Rocket failed to restart in parking orbit





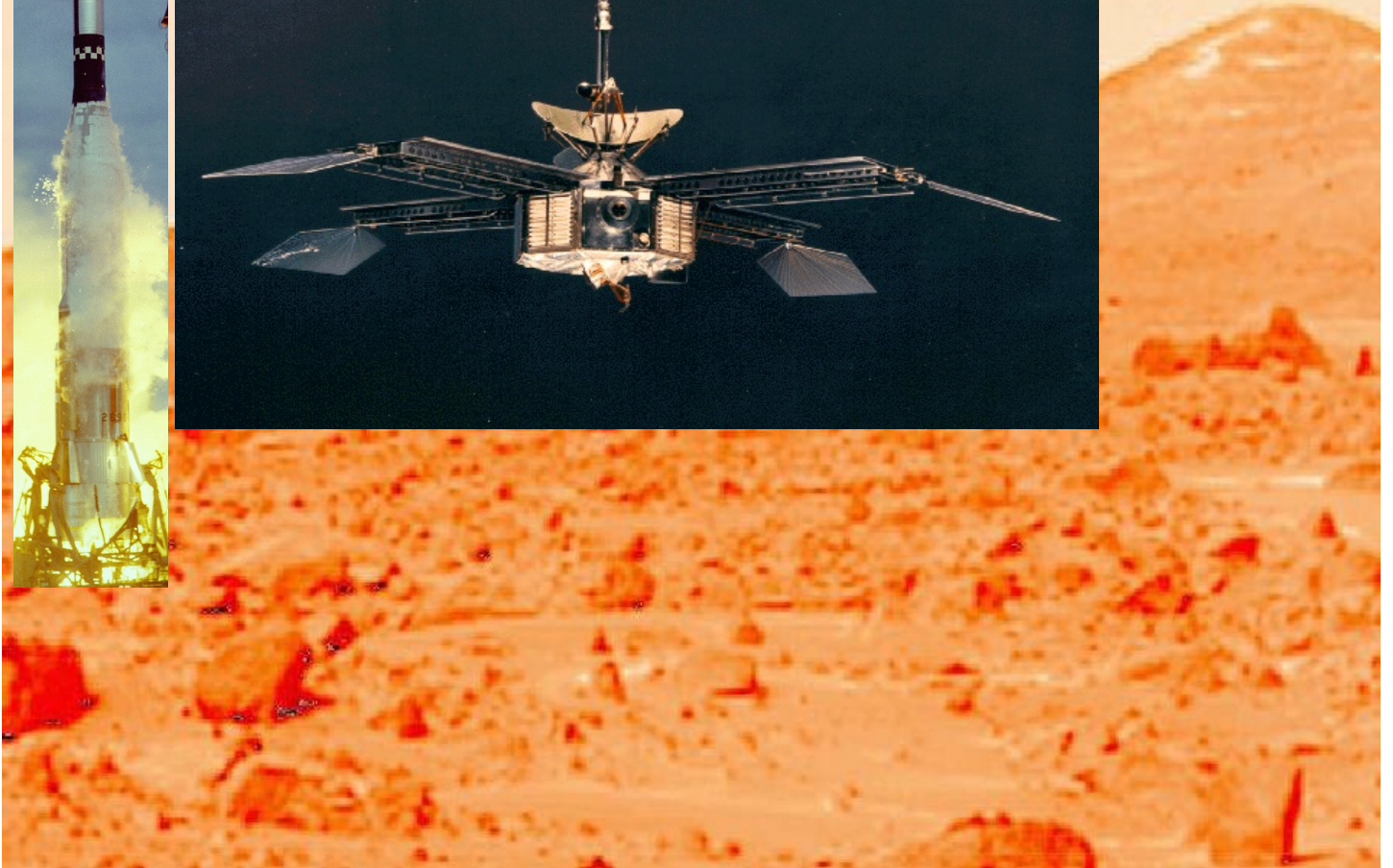
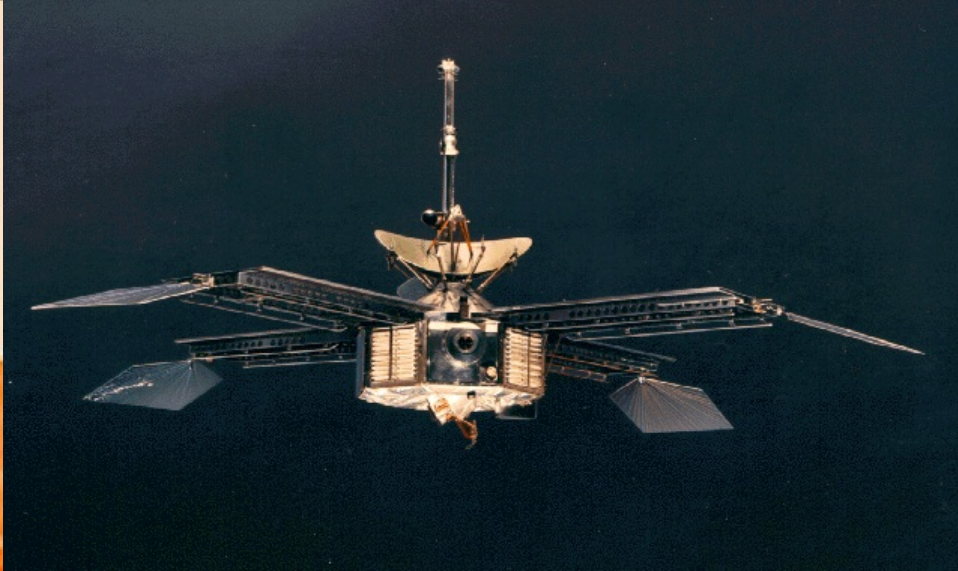
The Mars-1 probe





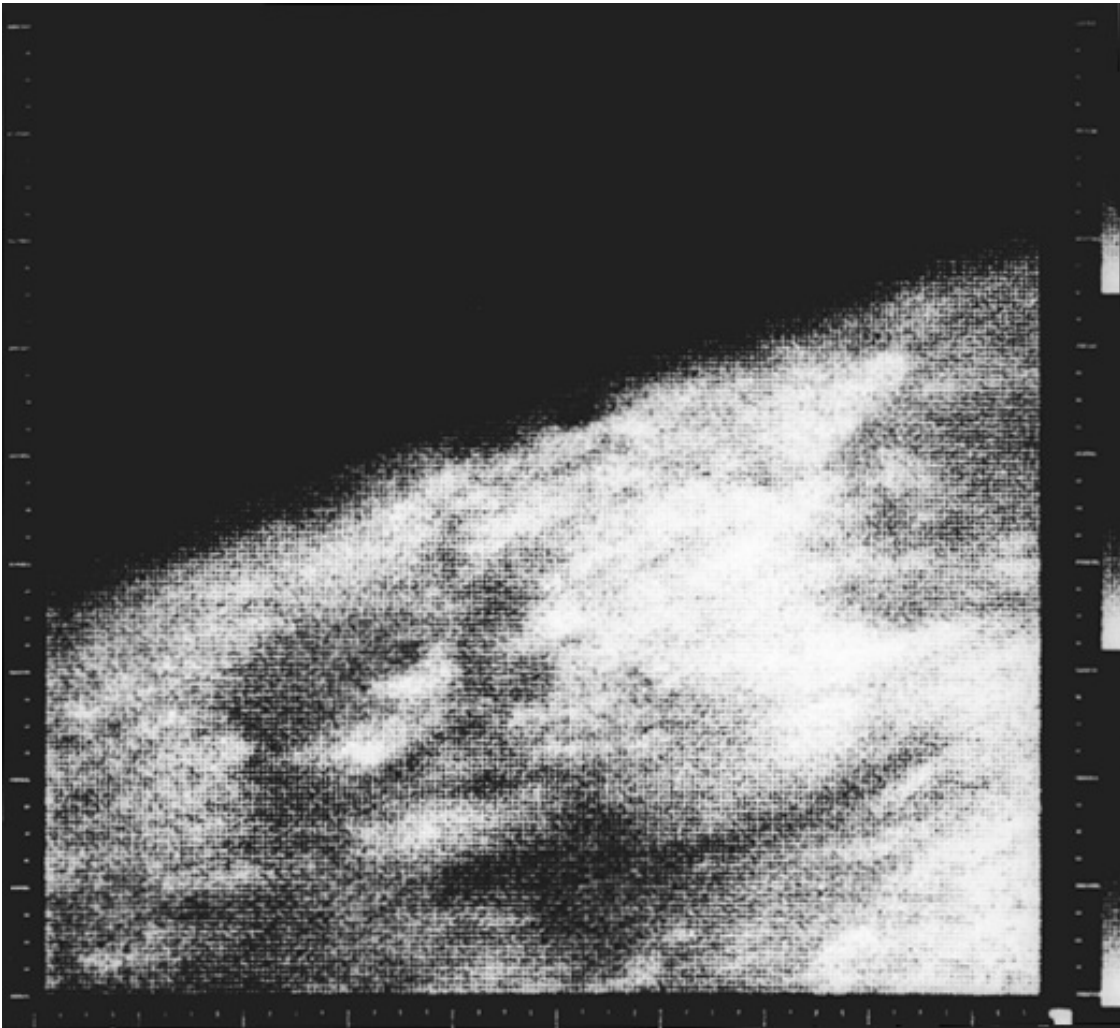
Launch Window 3: November 1964

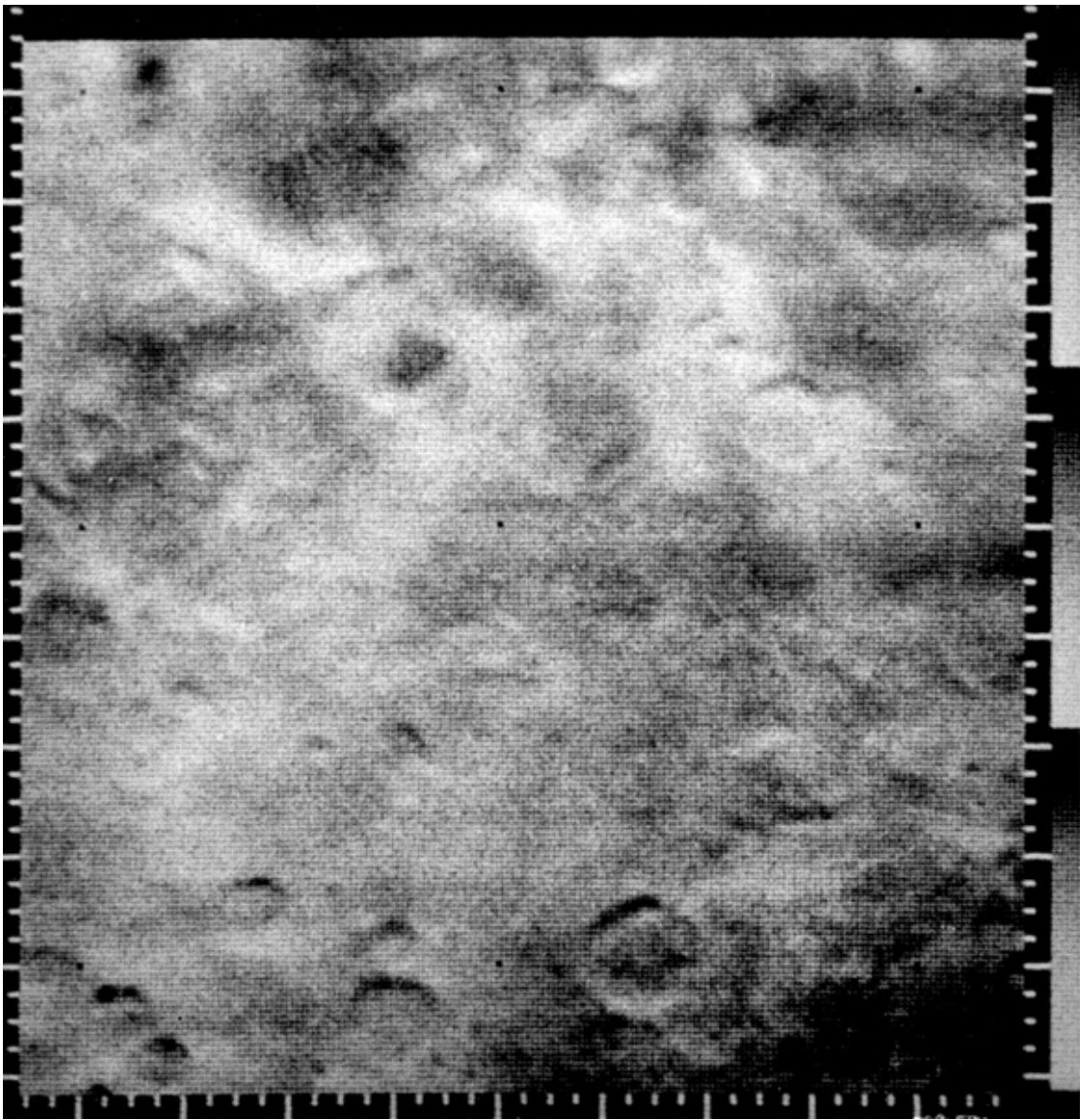
Mariner 3	1964 Nov 5	Failed after launch,
		nose cone failed to separate
Mariner 4	1964 Nov 28	SUCCESS, flyby in Jul 1965
3MV-4 No. 2 "Zond-2"	1964 Nov 30	Solar panel failed to deploy
		Fell silent May 1965 3 months before flyby





First spacecraft images of Mars - Mariner 4, July 1965







Launch Window 4: January 1967

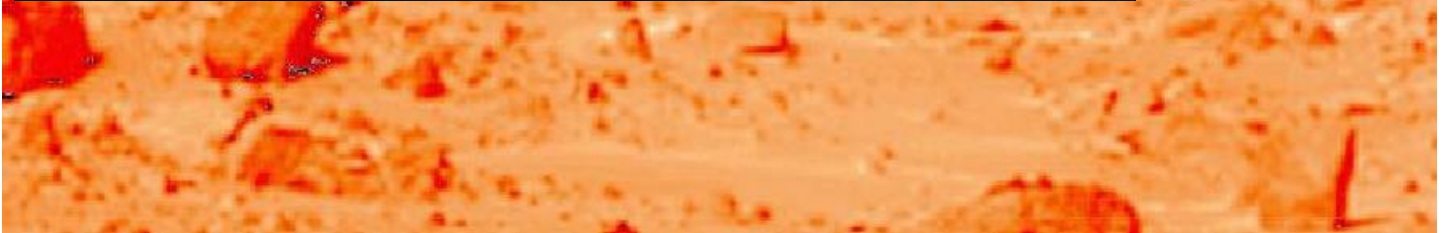
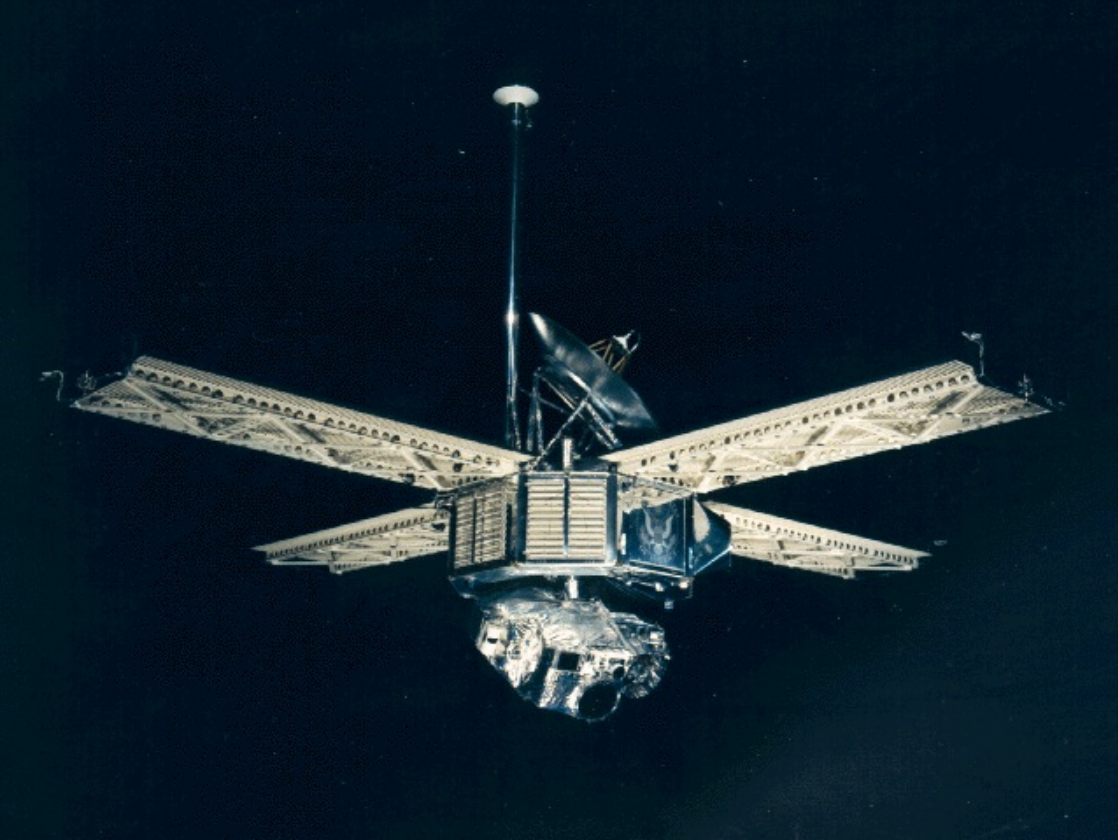
- No launches: too busy shooting for the Moon

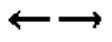




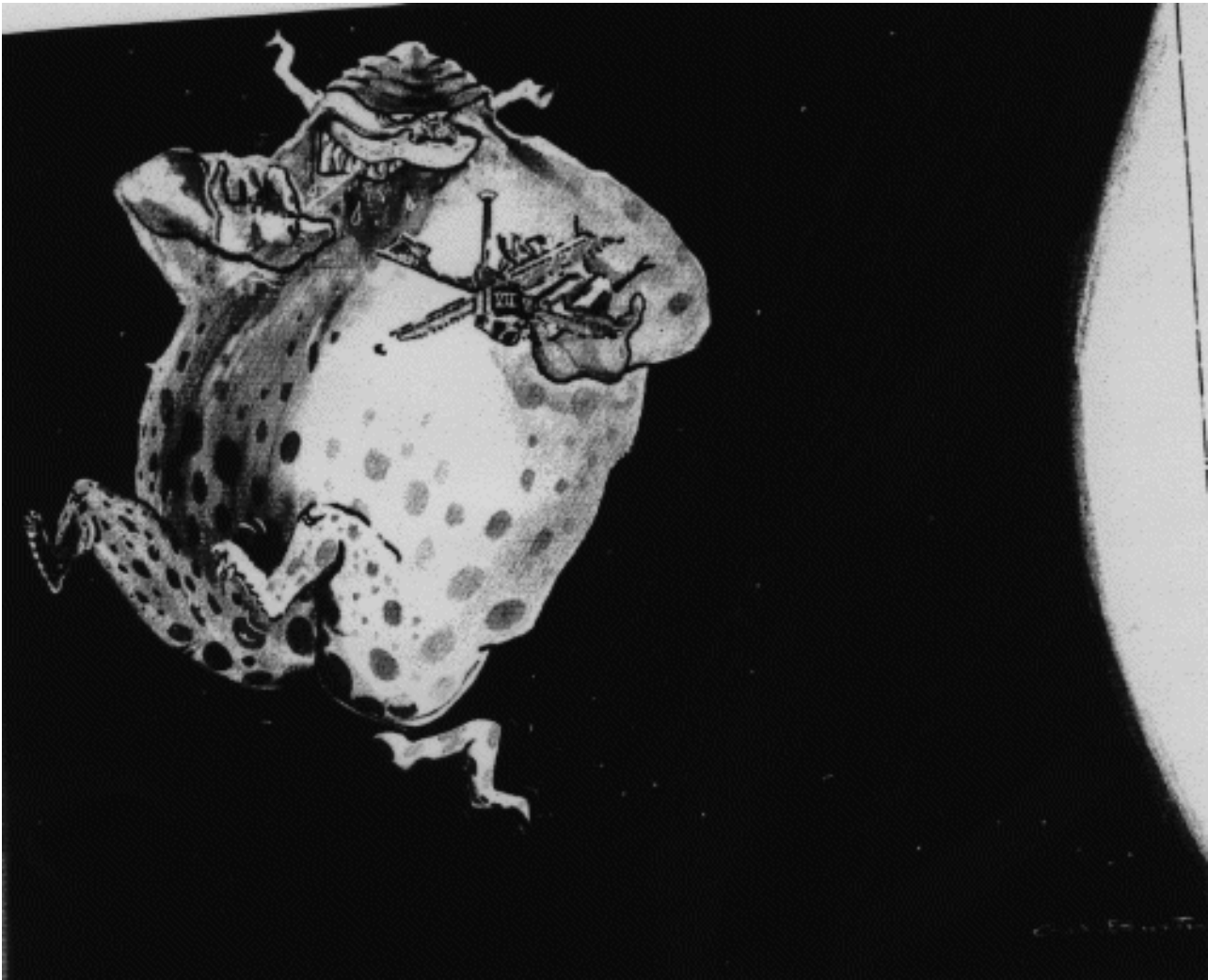
Launch Window 5: Feb-Mar 1969

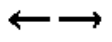
Mariner 6	1969 Feb 25	SUCCESS, flyby
Mariner 7	1969 Mar 27	SUCCESS, flyby
2M No. 521	1969 Mar 27	Rocket crashed in Altai Mts.
2M No. 522		Rocket crashed near launch site



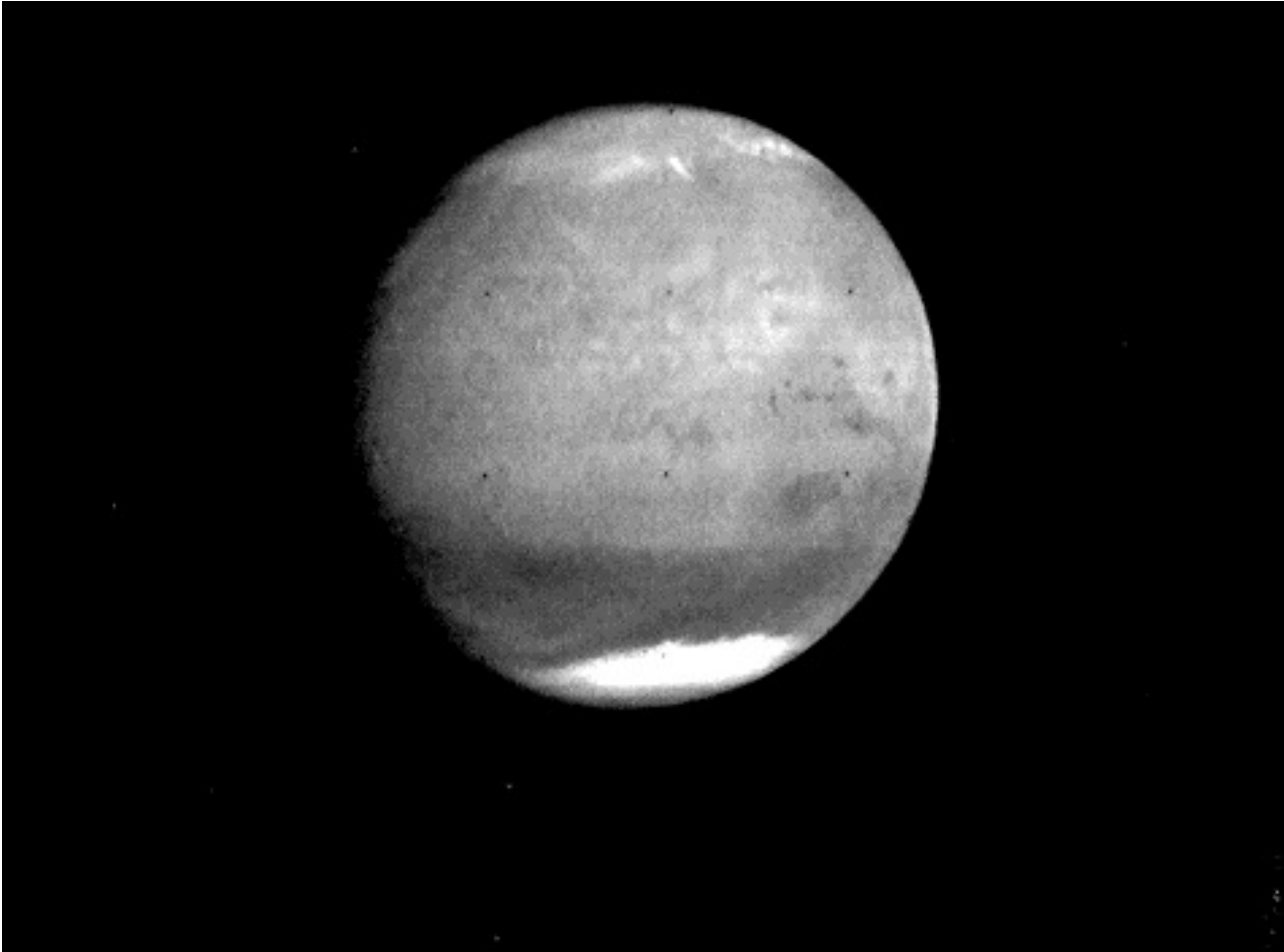


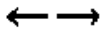
The Great Galactic Ghoul



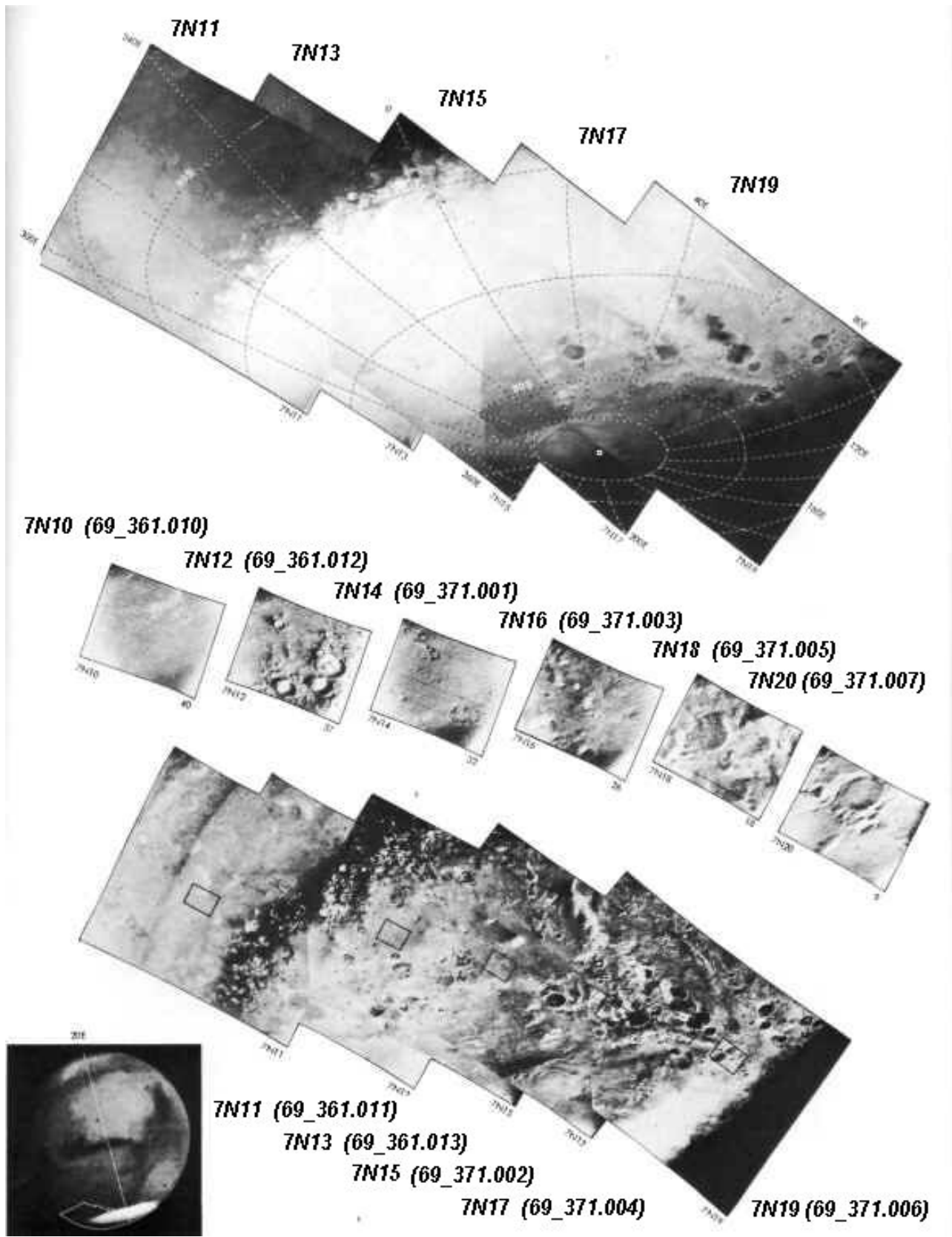


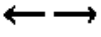
Mariner 6 approach





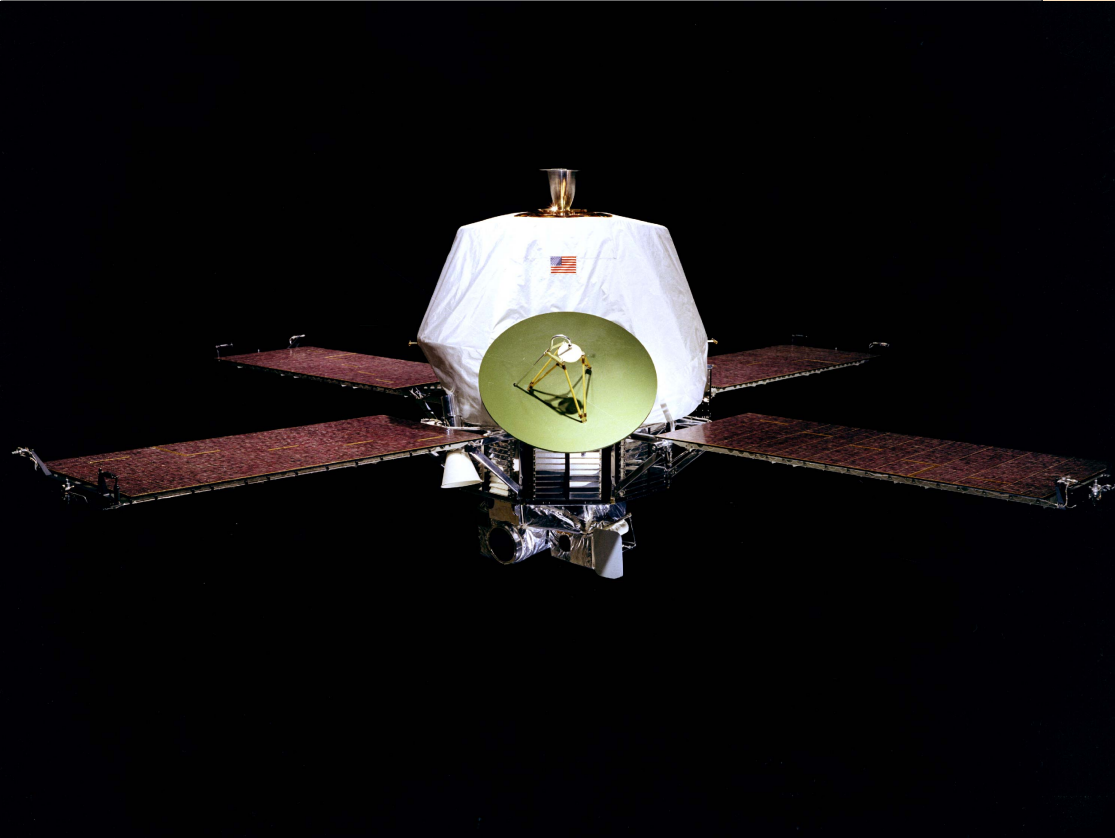
Mariner 7 flyby

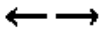




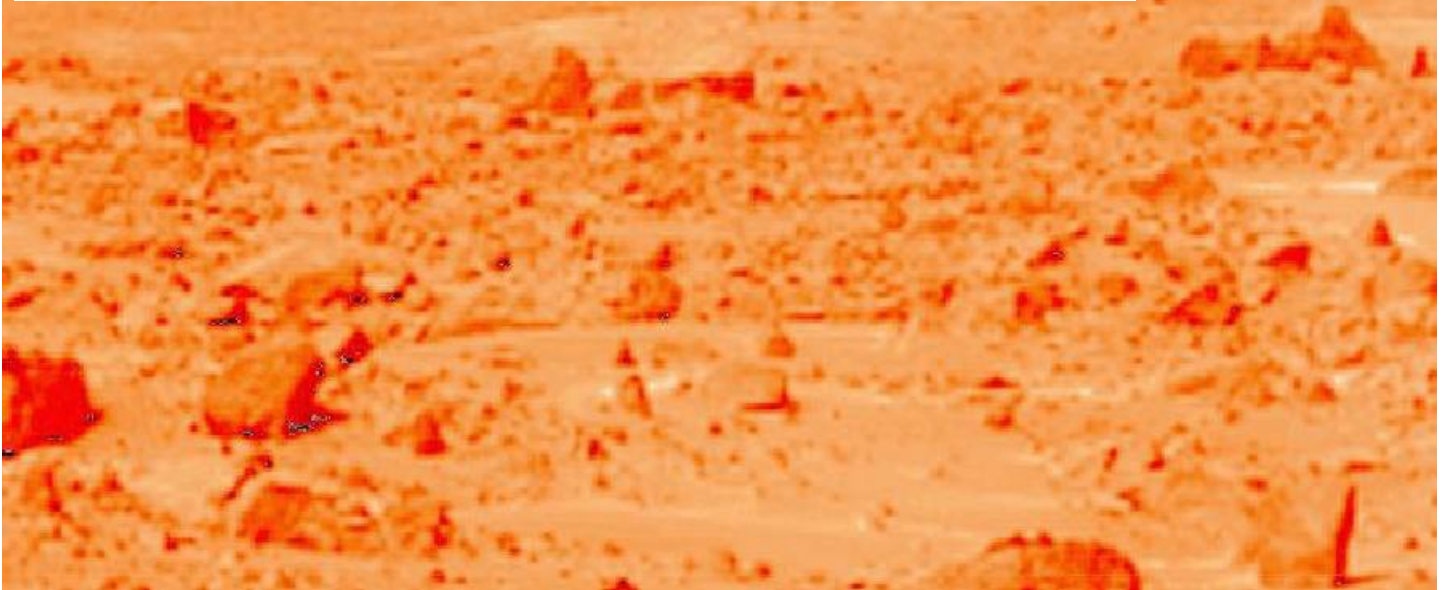
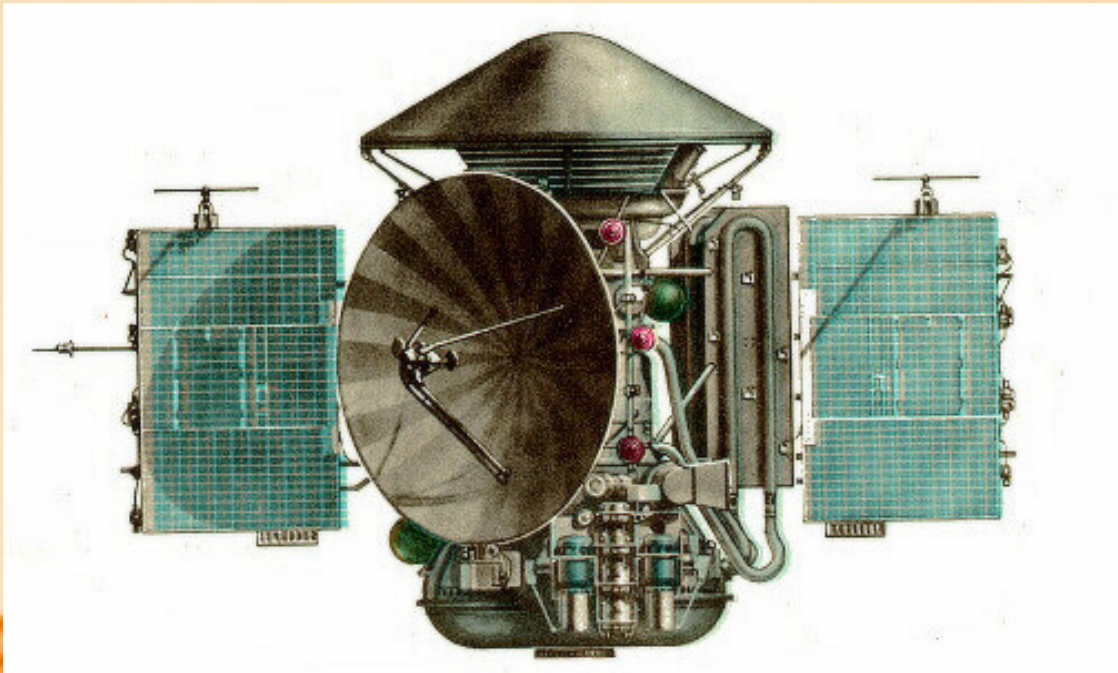
Launch Window 6: Mar 1971

Mariner 8	1971 May 9	Rocket crashed in Atlantic
3MS No. 170 (Kosmos-419)	1971 May 10	Rocket failed to restart in parking orbit
3MS No. 171 (Mars-2)	1971 May 19	SUCCESS, Mars orbiter
SA No. 171 (Mars-2 Lander)	1971 May 19	Lander crashed on Mars
3MS No. 172 (Mars-3)	1971 May 28	SUCCESS, Mars orbiter
SA No. 172 (Mars-3 Lander)	1971 May 28	Lander on Mars, no good data
Mariner 9	1971 May 30	SUCCESS, Mars orbiter



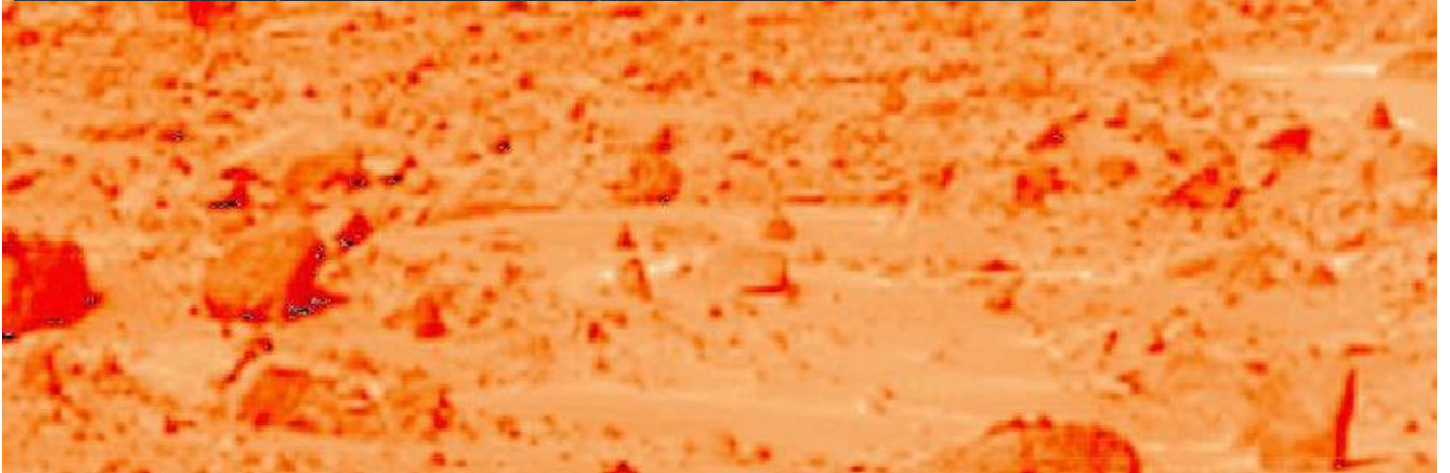
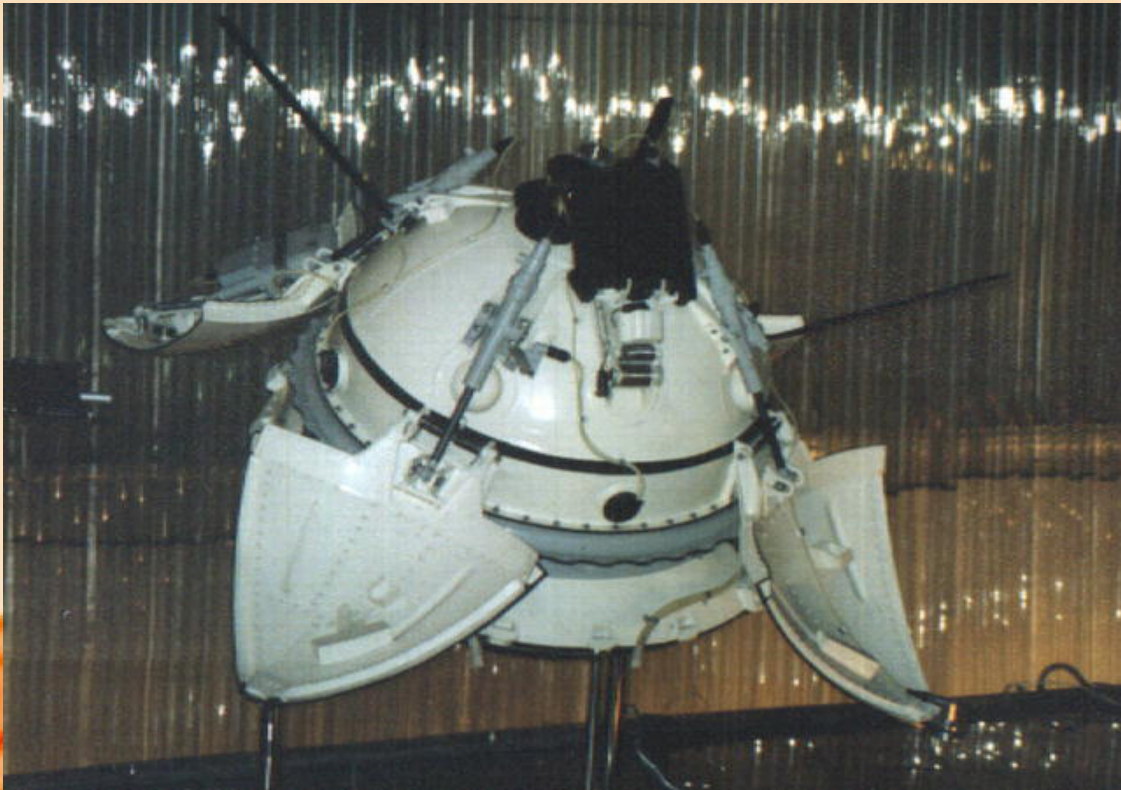


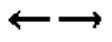
The Soviet Mars-3 probe



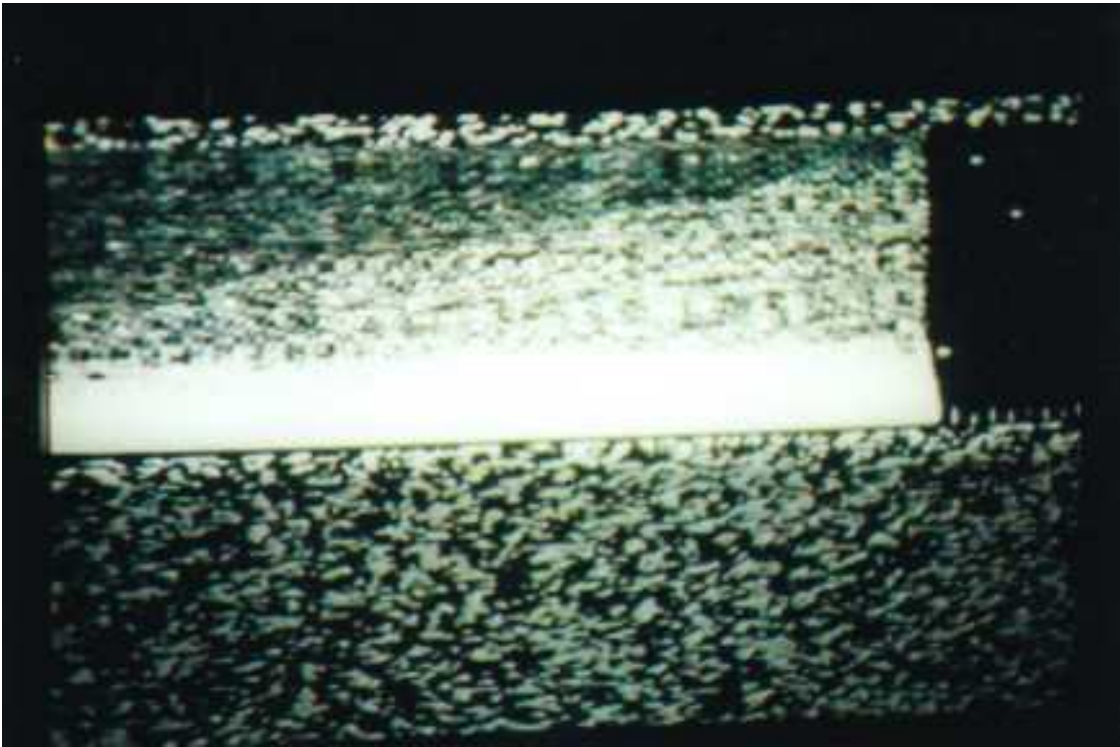


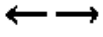
Landing on Mars





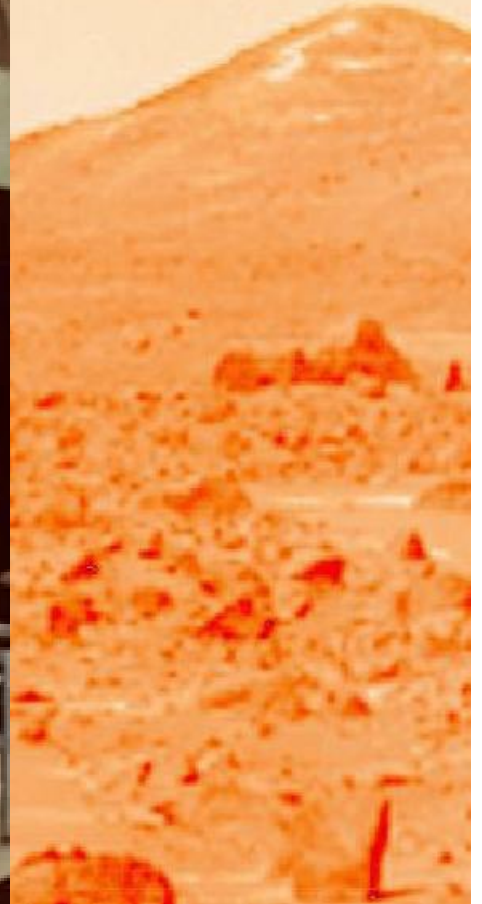
First Picture From Mars

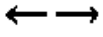




Launch Window 7: May 1973

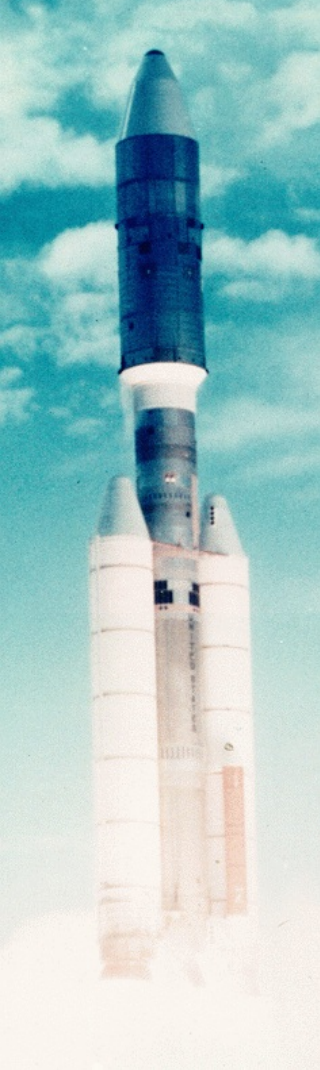
3MS No. 52S "Mars-4"	1973 Jul 21	Failed to enter orbit, flew past Mars
3MS No. 53S "Mars-5"	1973 Jul 25	SUCCESS, operated 3 weeks in Mars orbit
3MP No. 50P "Mars-6"	1973 Aug 5	Lander crashed on Mars
3MP No. 51P "Mars-7"	1973 Aug 9	Lander missed Mars by 1500 km





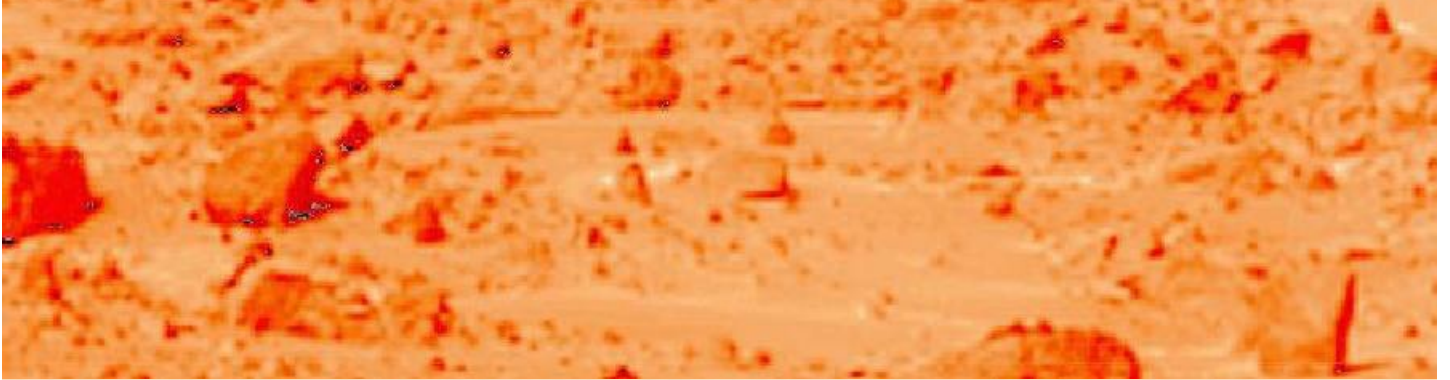
Launch Window 8: Aug-Sep 1975 - Triumph of the Vikings

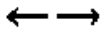
Viking 1 Orbiter	1975 Aug 20	SUCCESS, orbited Mars June 1976
Viking 1 Lander	1975 Aug 20	SUCCESS, landed on Mars July 1976
Viking 2 Orbiter	1975 Sep 9	SUCCESS, orbited Mars Aug 1976
Viking 2 Lander	1975 Sep 9	SUCCESS, landed on Mars Sep 1976



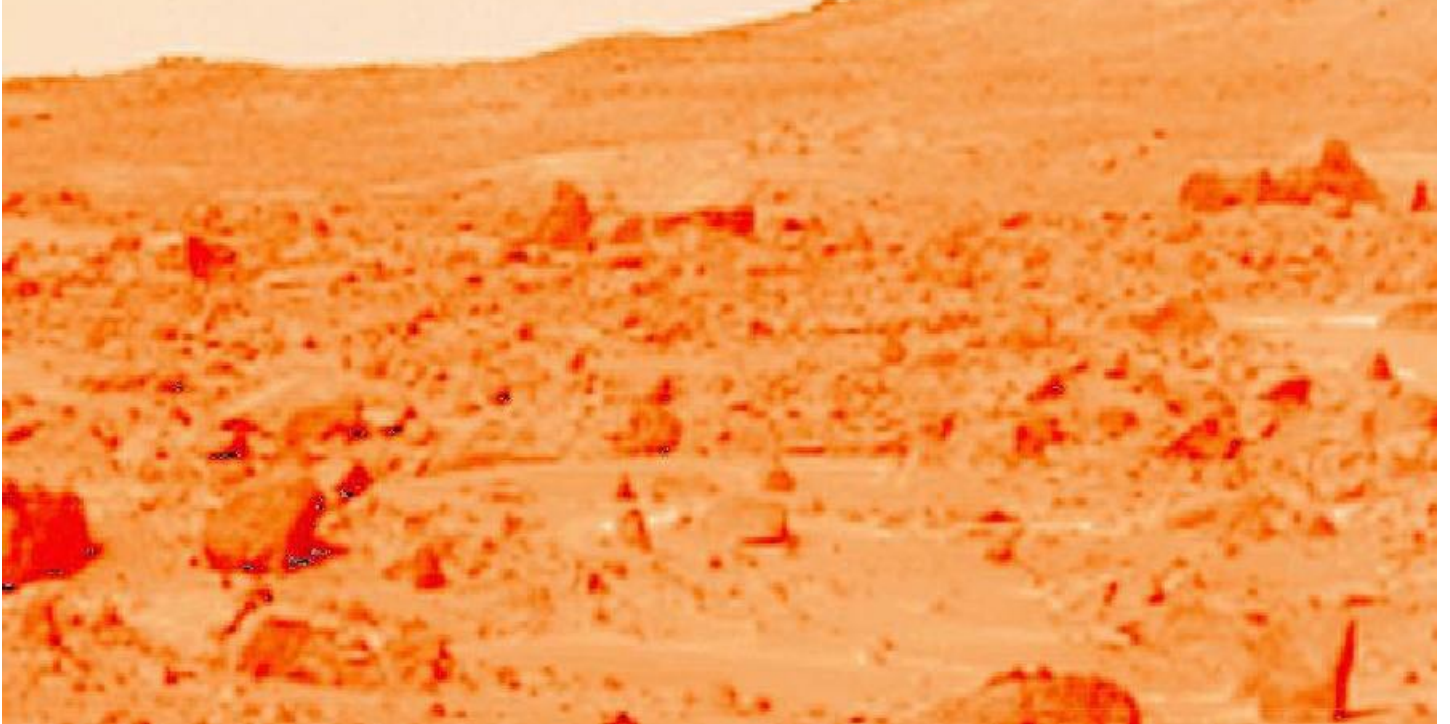
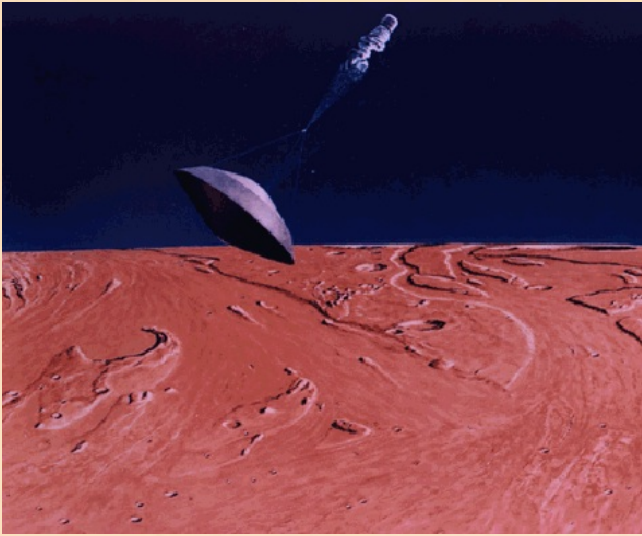


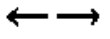
Viking Spacecraft - Orbiter and Lander



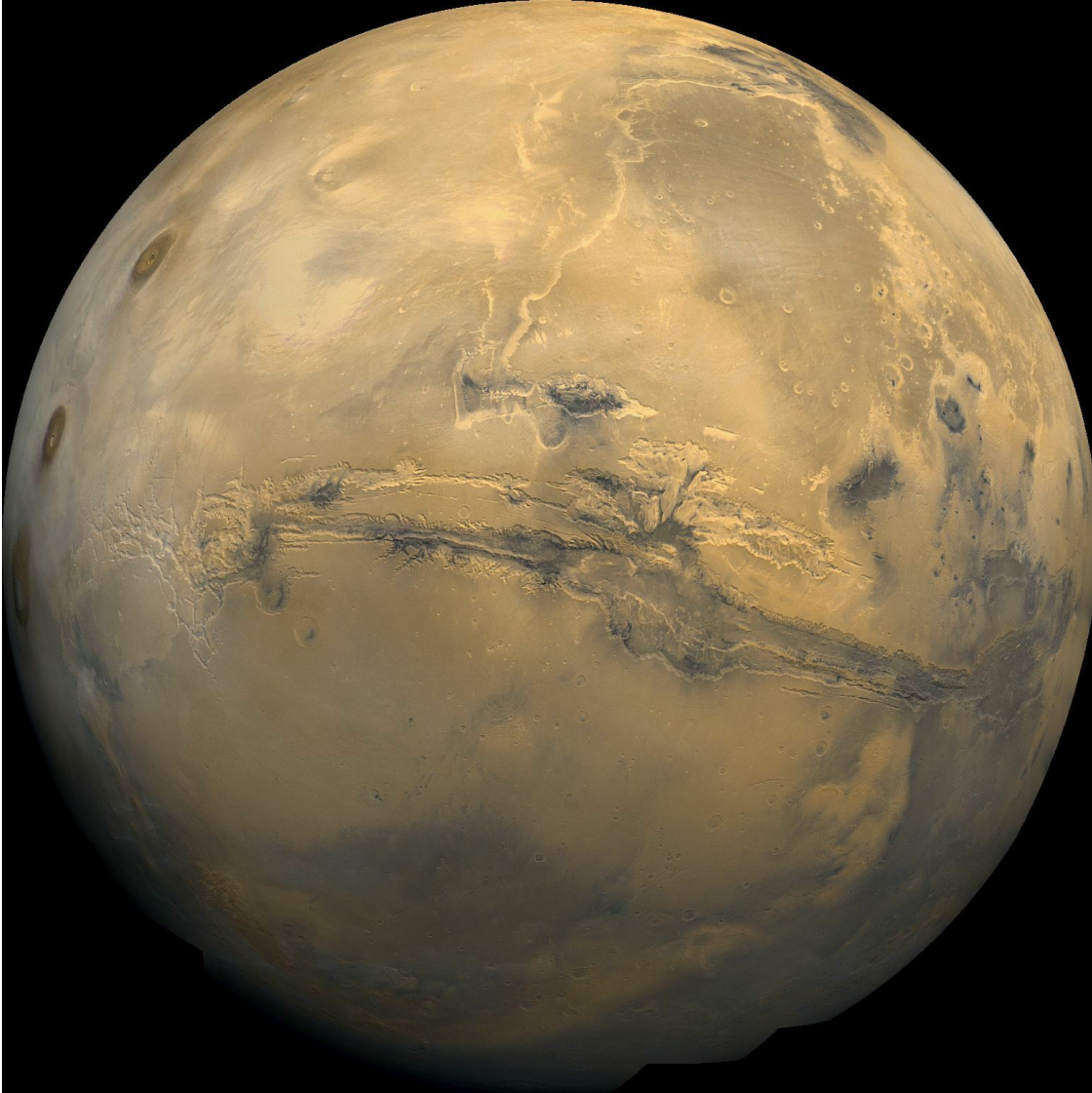


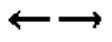
Viking Spacecraft - Lander



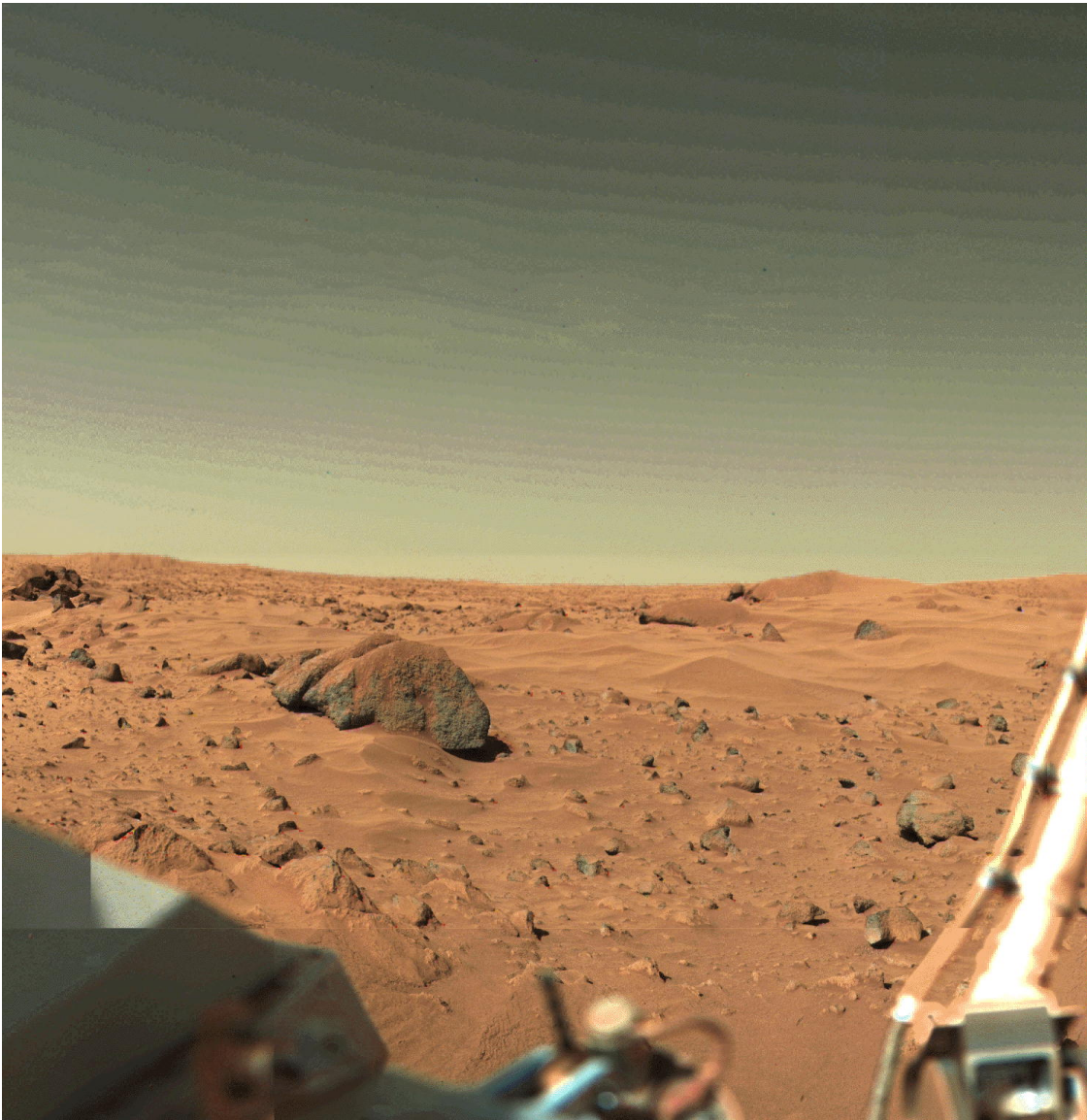


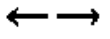
Mars from Viking images



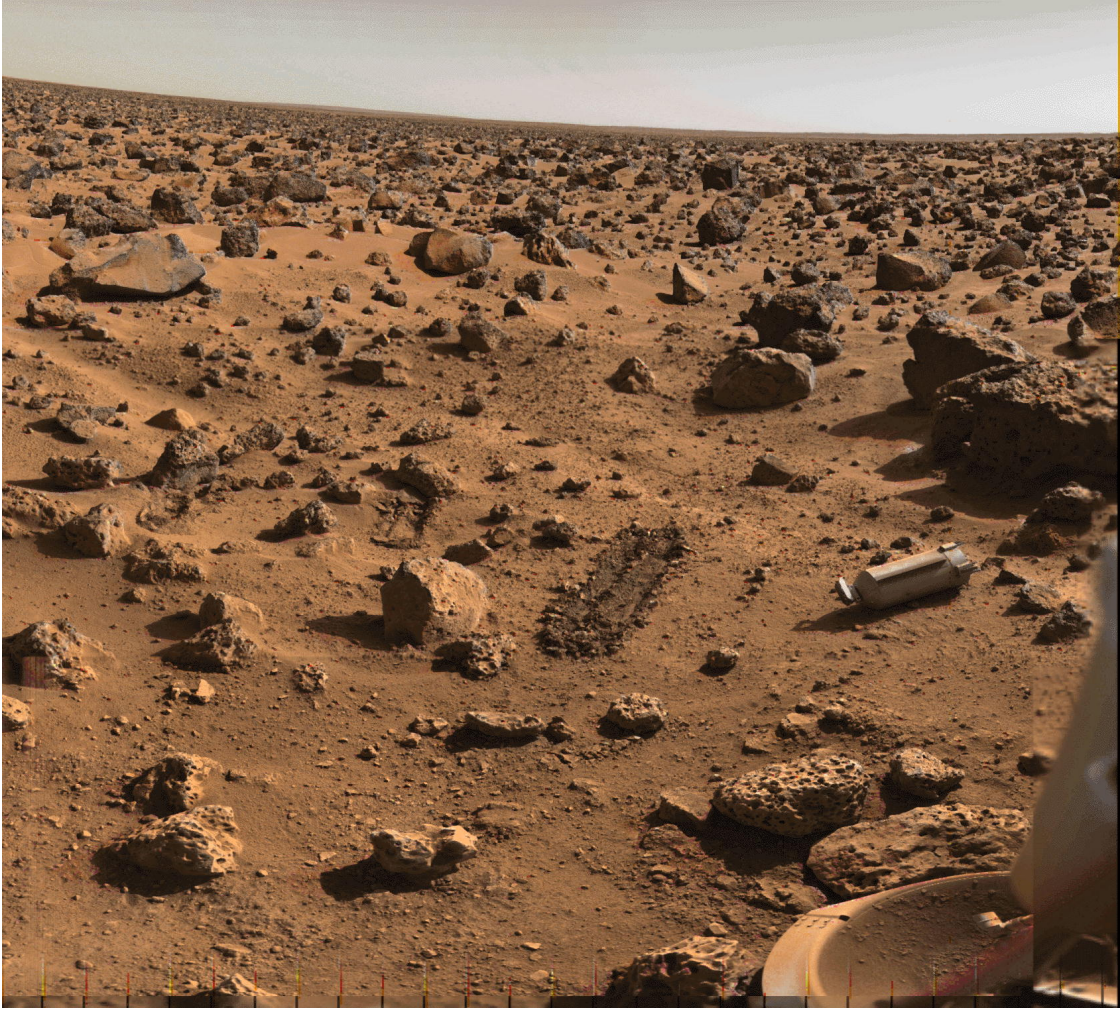


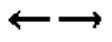
Viking 1's view of Chryse



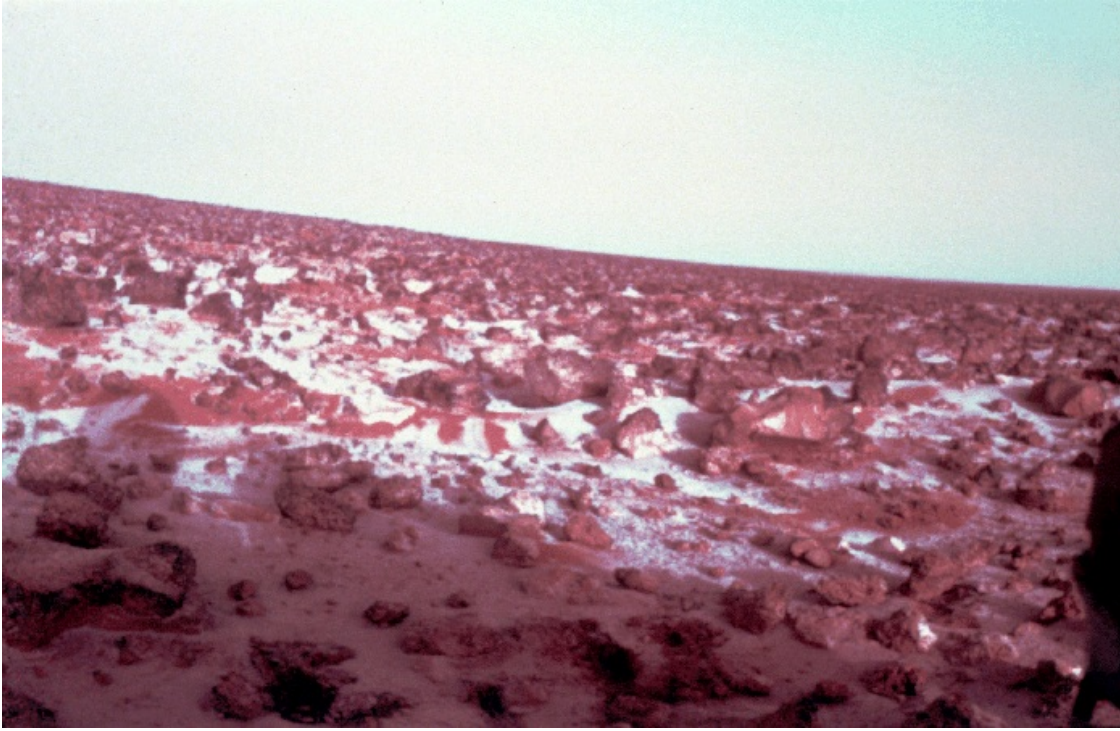


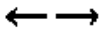
Viking 2 views Utopia Planitia





Frost at Utopia, 1979

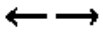




The Big Hiatus

- Launch Window 9, Sep 1977
- Launch Window 10, Dec 1979
- Launch Window 11, Feb 1982
- Launch Window 12, Apr 1984
- Launch Window 13, May 1986

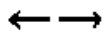




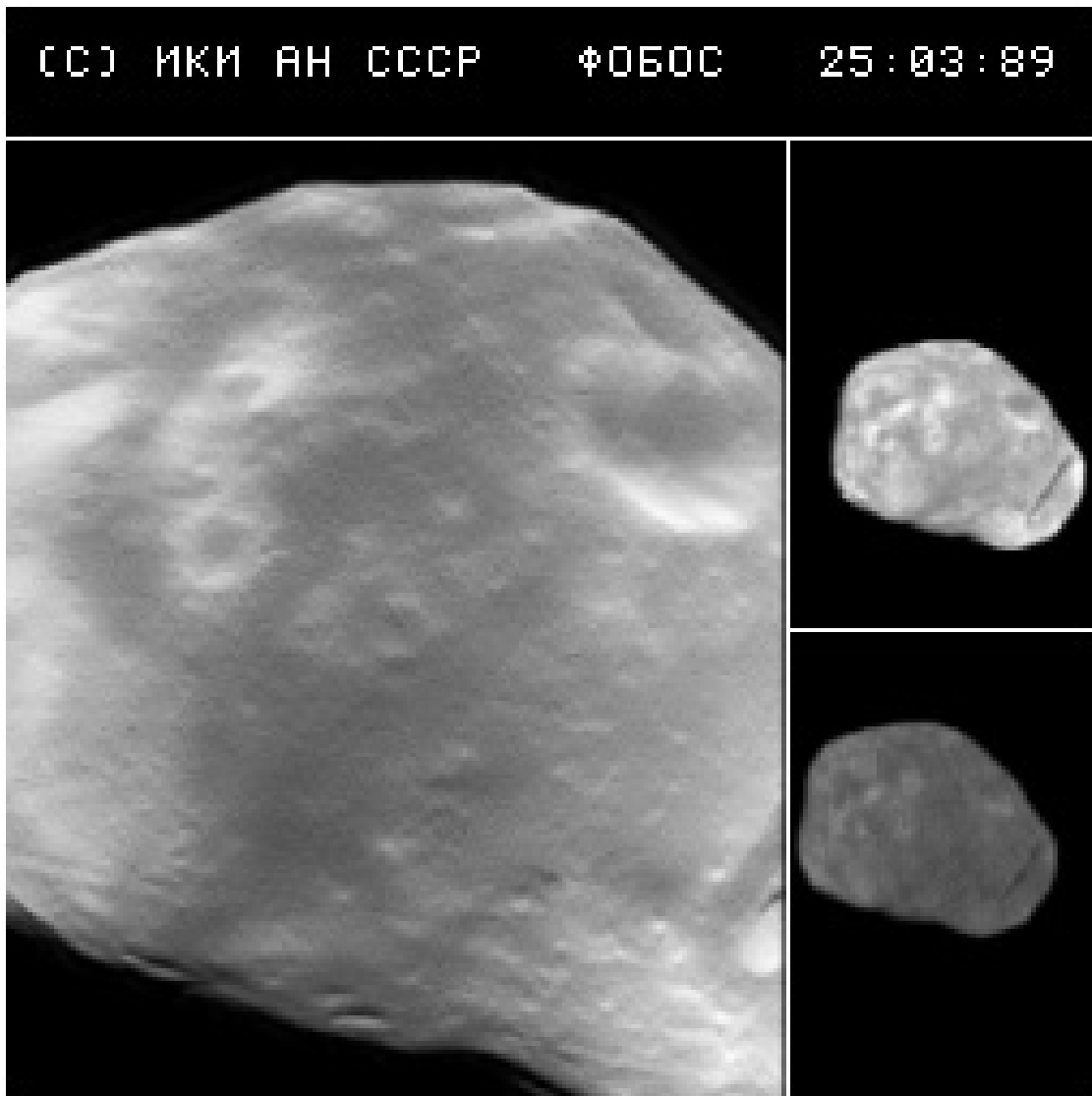
Launch Window 14: Jul 1988

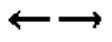
Fobos-1	1988 Jul 7	Failed en route to Mars
Fobos-2	1988 Jul 12	Failed approaching Phobos



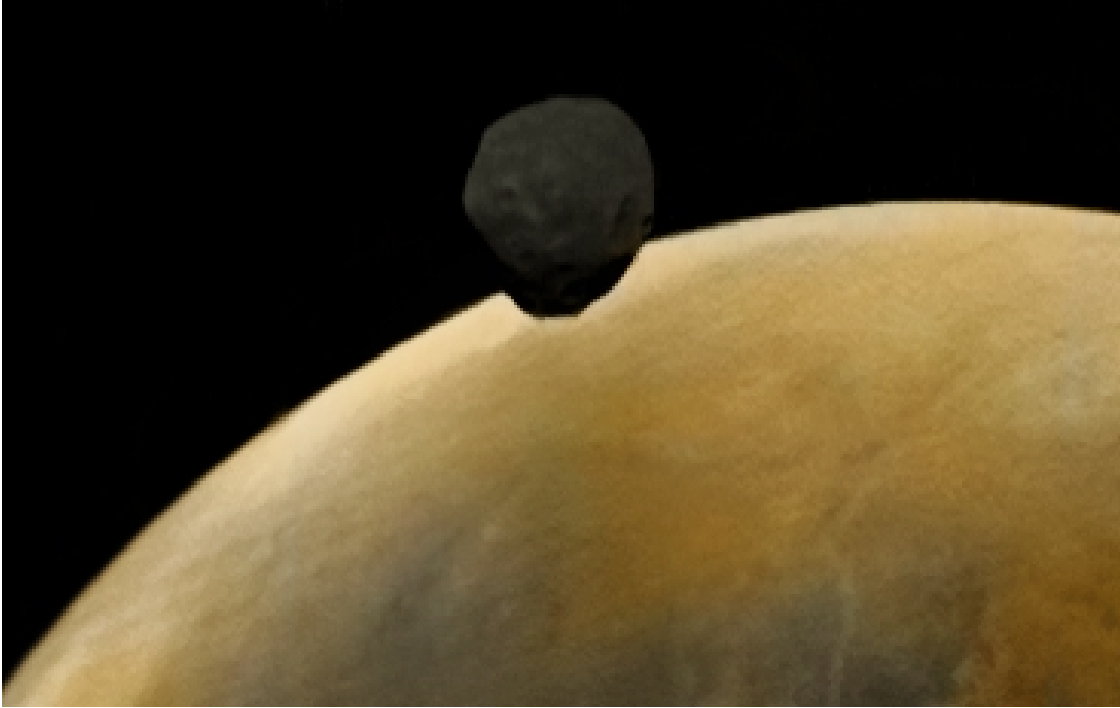


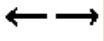
Fobos-2 images





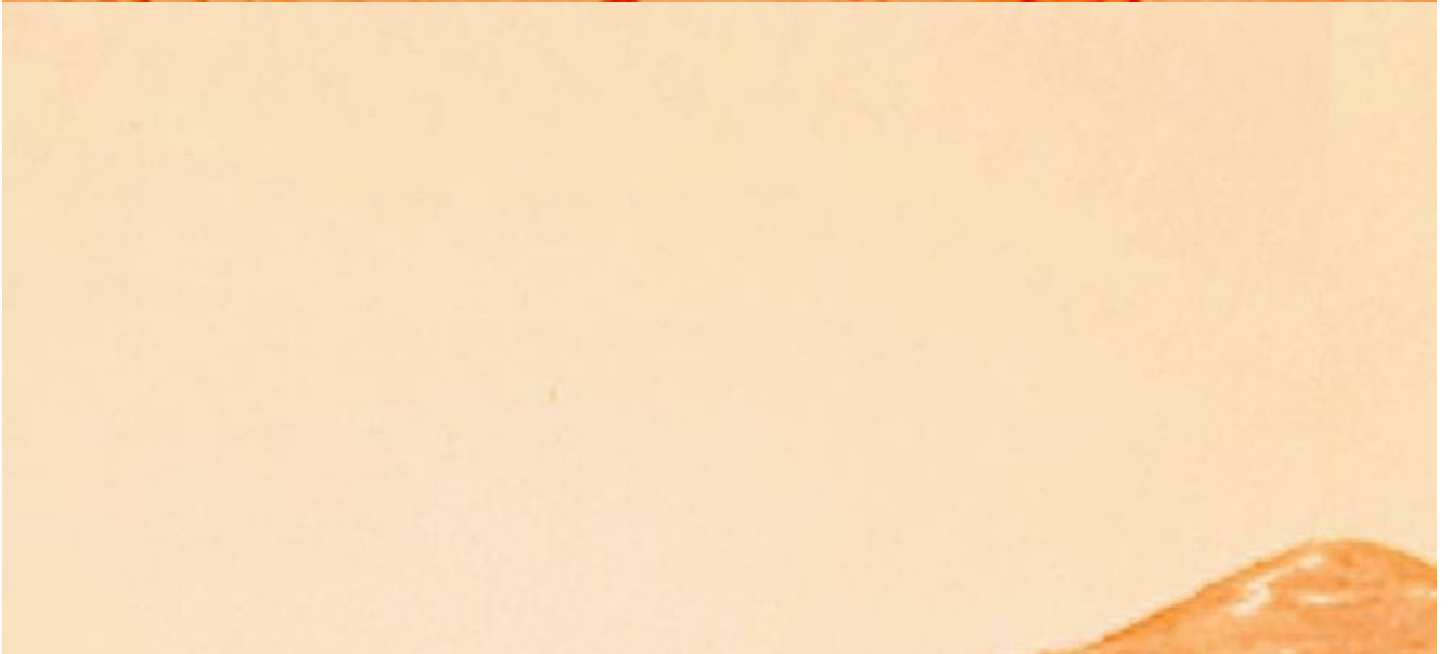
Fobos-2 images





Launch Window 15: Aug 1990

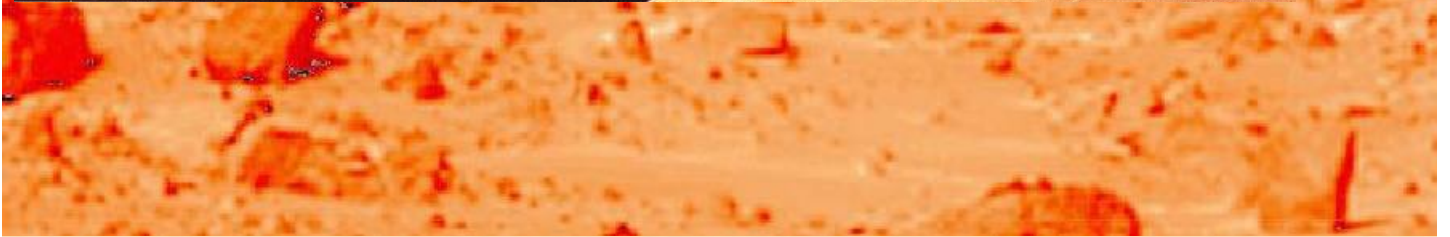
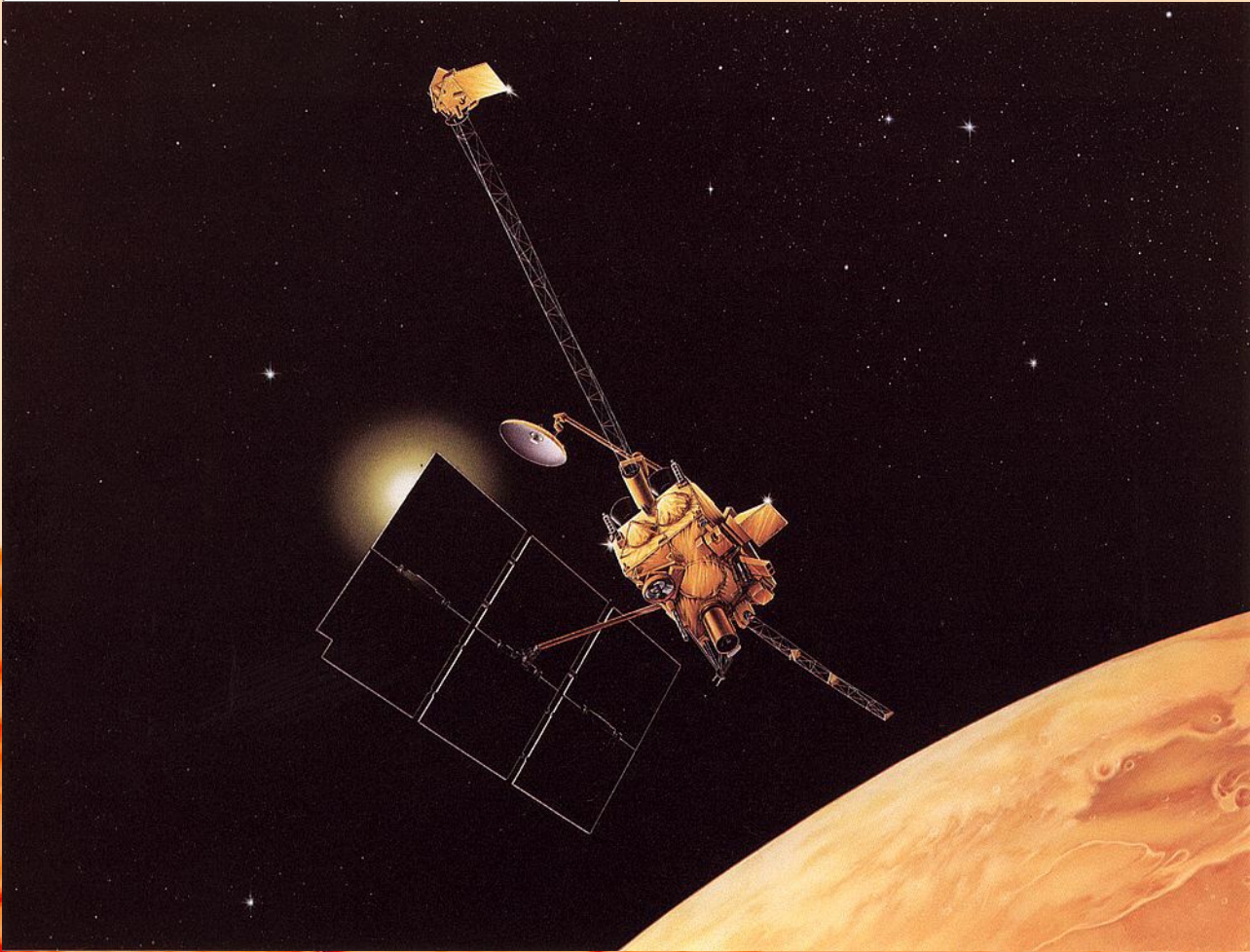
- Nothing in window 15

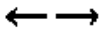




Launch Window 16: Sep 1992

Mars Observer	1992 Sep 25	Failed at Mars arrival
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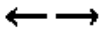




Launch Window 17: Oct 1994

- Nothing in window 17 - Mars-94 delayed to 1996
- Last launch window not used





Launch Window 18 Nov-Dec 1996

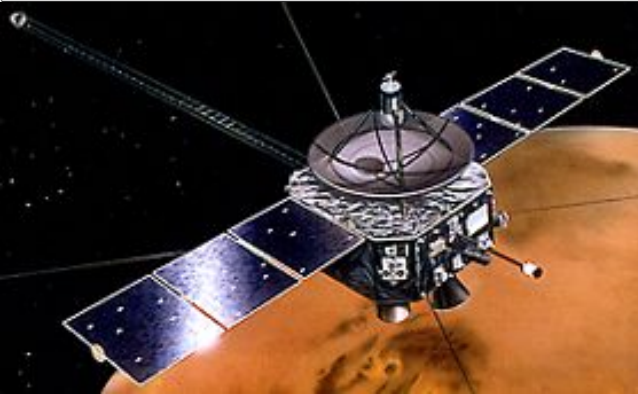
Mars Global Surveyor	1996 Nov 7	SUCCESS, orbiting Mars
Mars-96	1996 Nov 16	Rocket failed, probe crashed in Bolivia
Mars Pathfinder	1996 Dec 4	SUCCESS, landed mini-rover on Mars





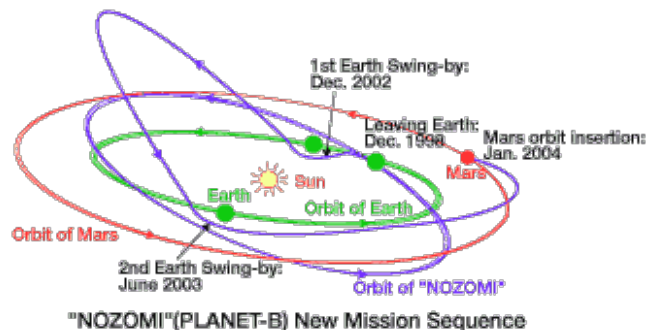
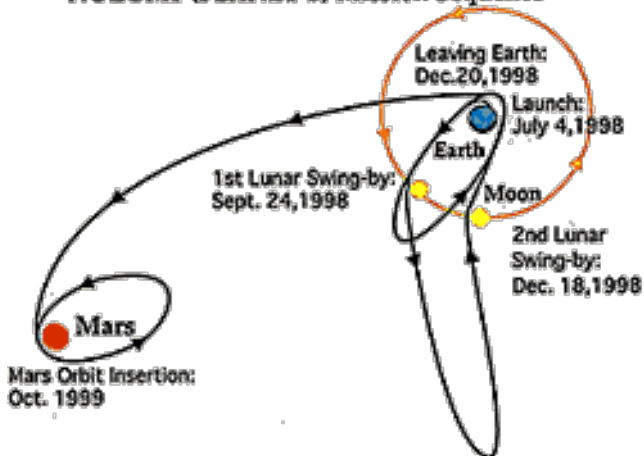
Launch Window 19: Dec 1998 - Jan 1999

Nozomi	1998 Jul 3	Past Mars in Dec 2003, failed
Mars Climate Orbiter	1998 Dec 11	Burnt up in Mars atmosphere
Mars Polar Lander	1999 Jan 3	Crashed near Martian South Pole
Deep Space 2 penetrators	1999 Jan 3	Crashed near Martian South Pole



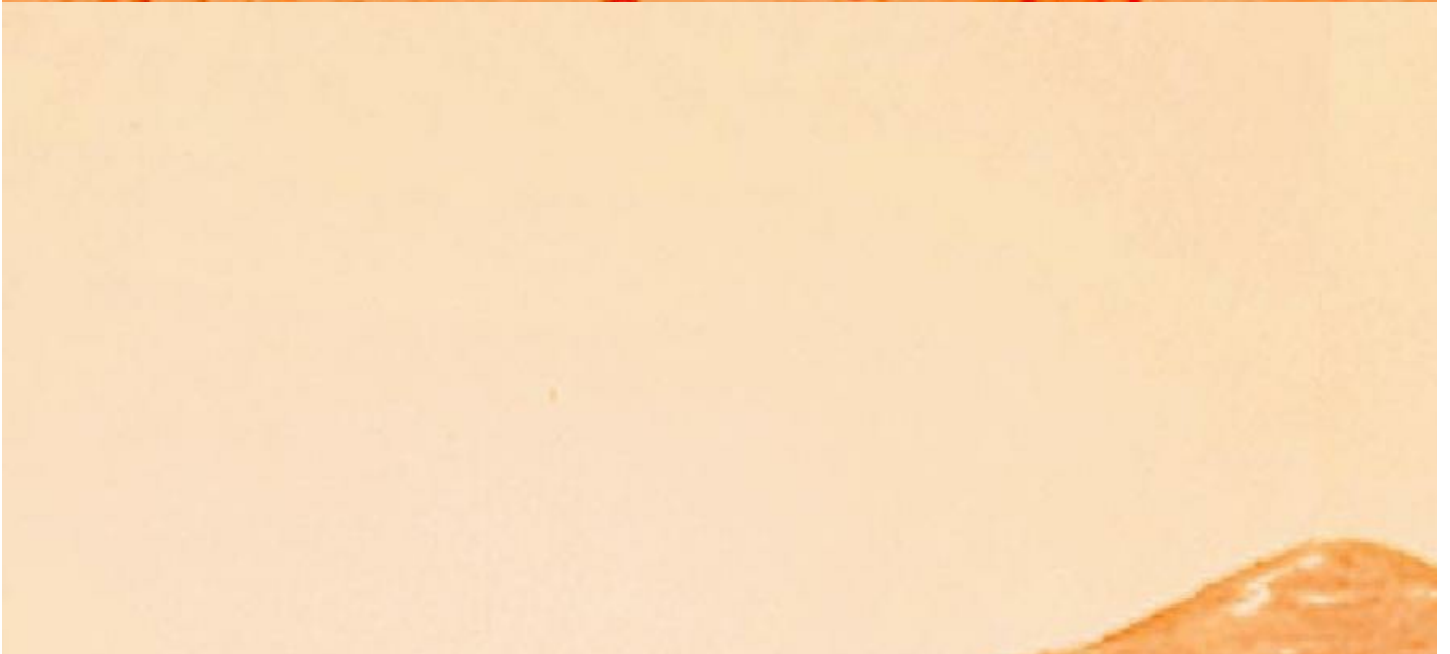
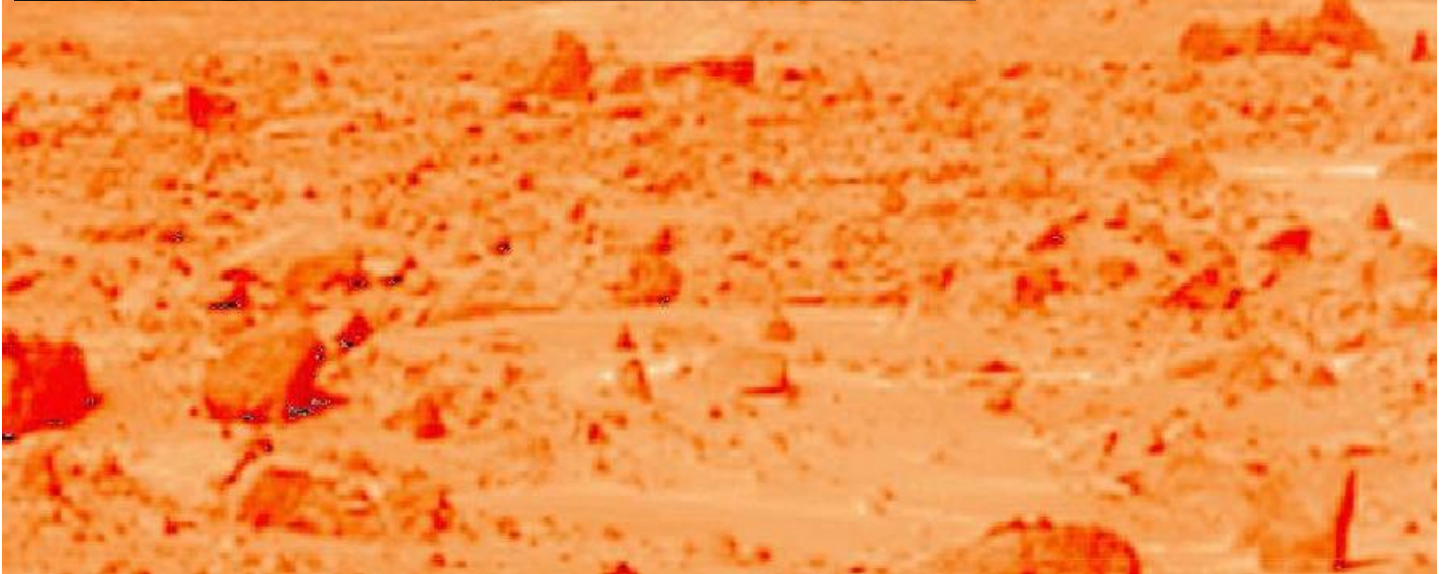
Nozomi stayed in the Earth-Moon system until 1998 Dec 20 when Earth and Moon swingbys threw it into solar orbit. They went wrong, and Nozomi took 4 years to Mars the long way round. The fuel froze, the comms failed, and it sailed on past without stopping.

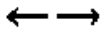
"NOZOMI"(PLANET-B) Mission Sequence



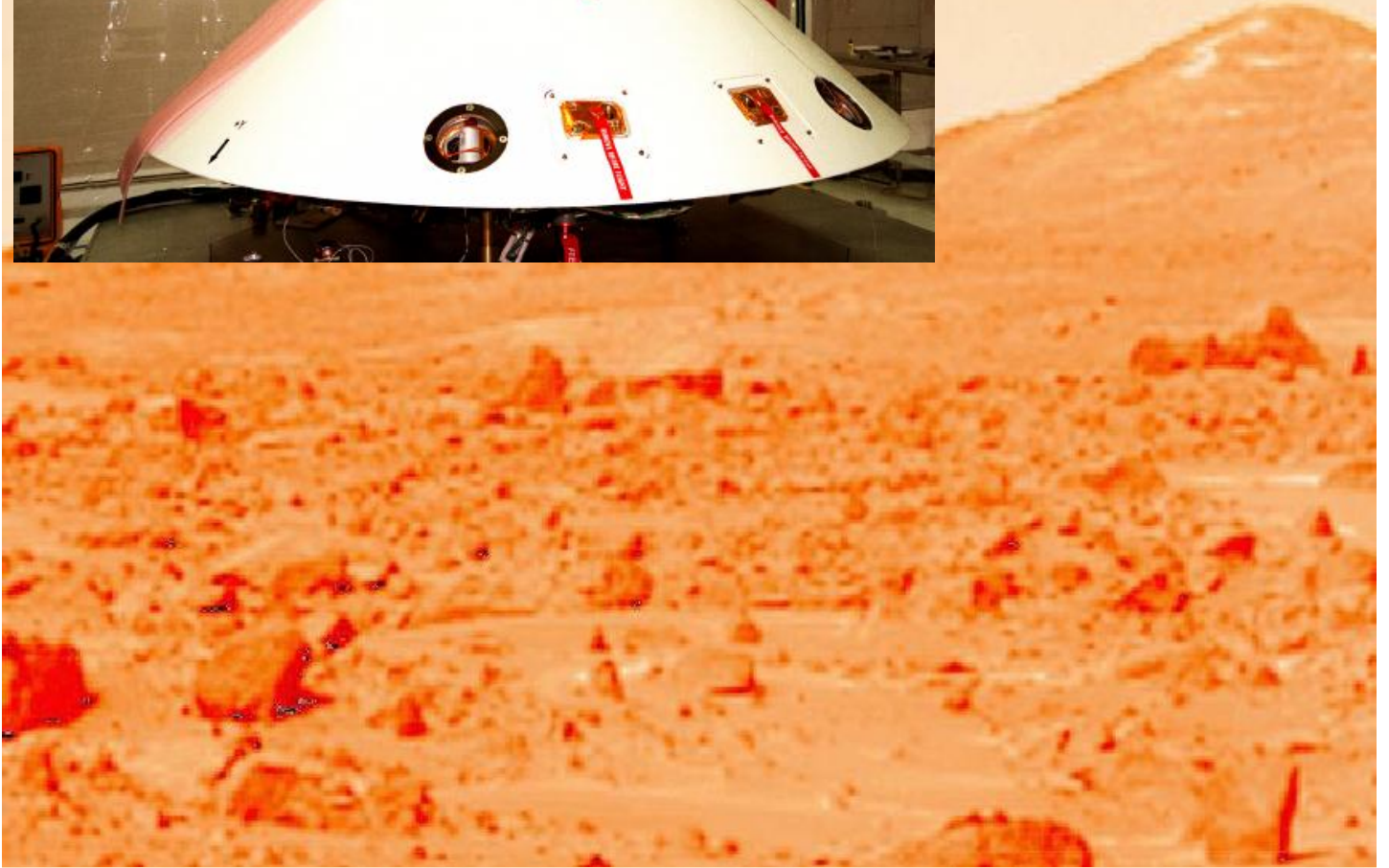
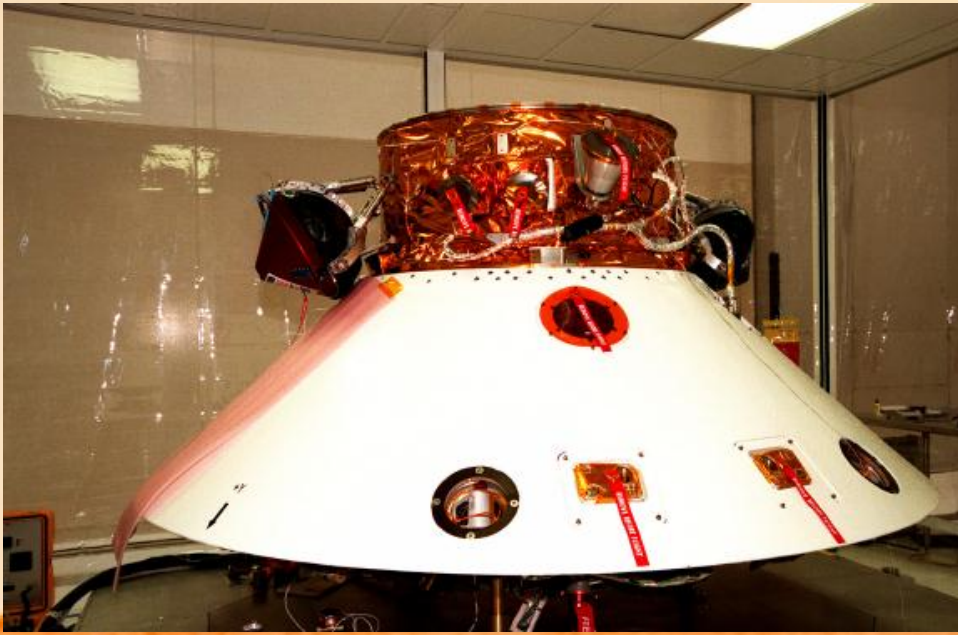


Mars Climate Orbiter





Mars Polar Lander

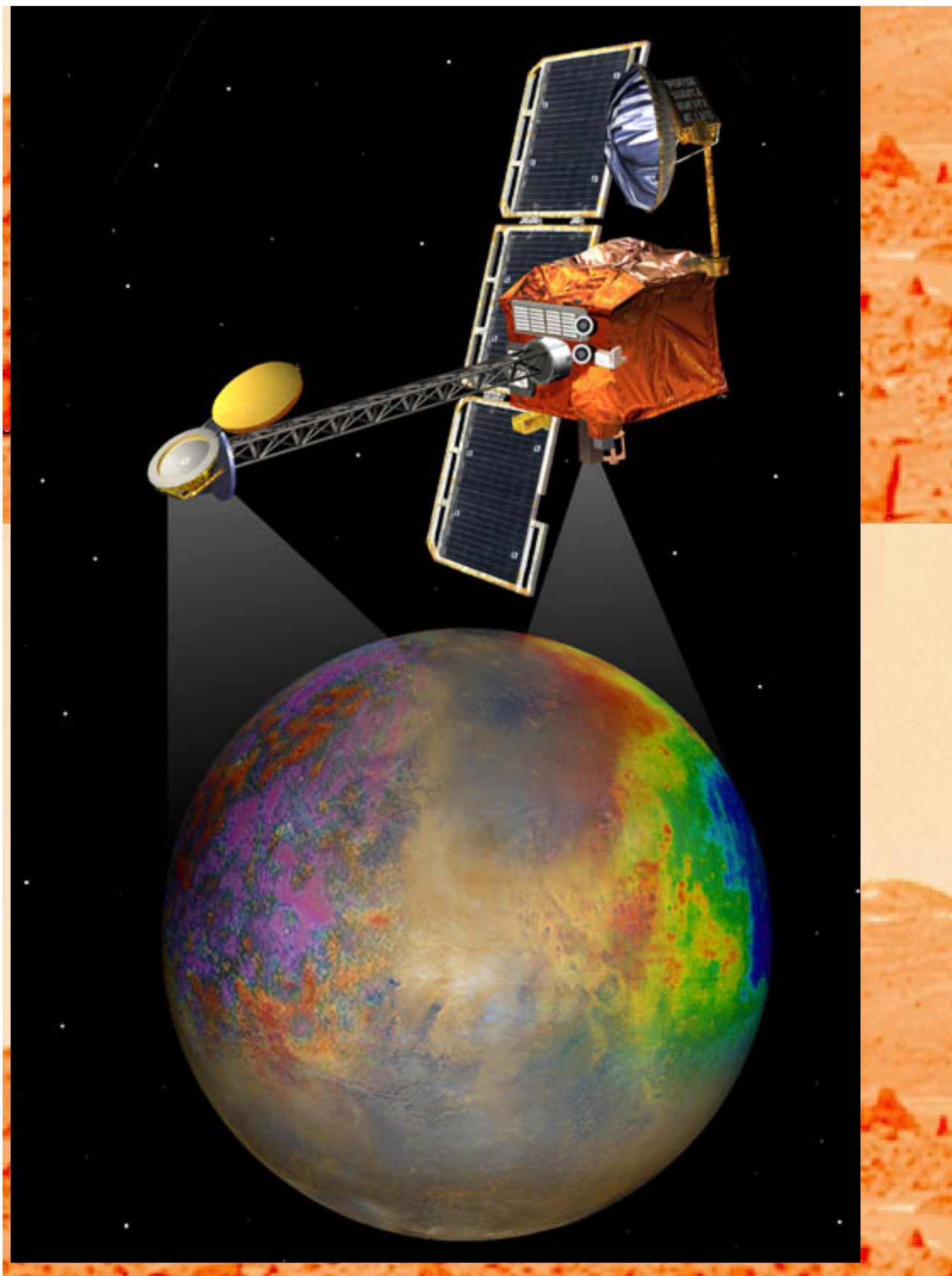


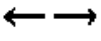


Launch Window 20: Mar-Apr 2001

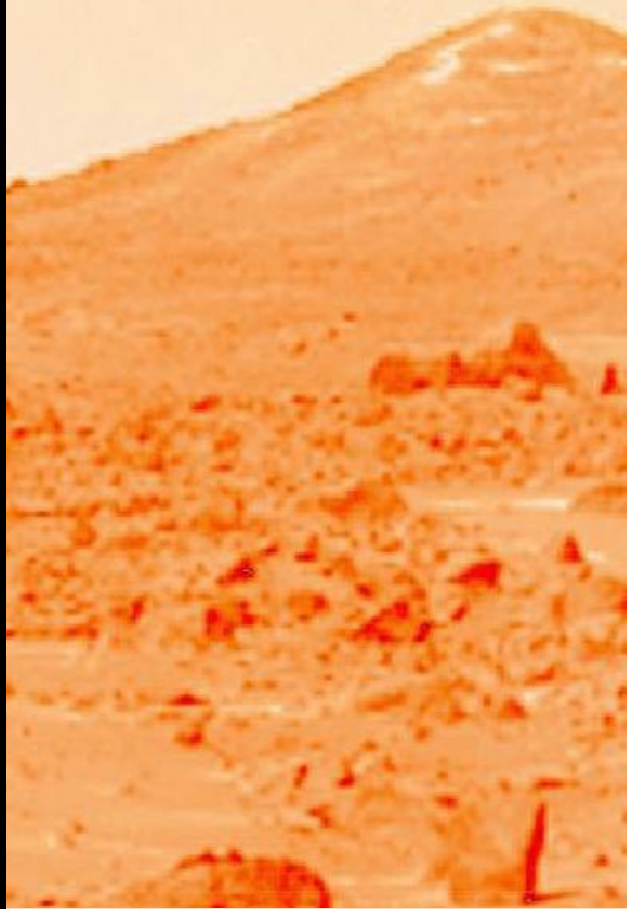
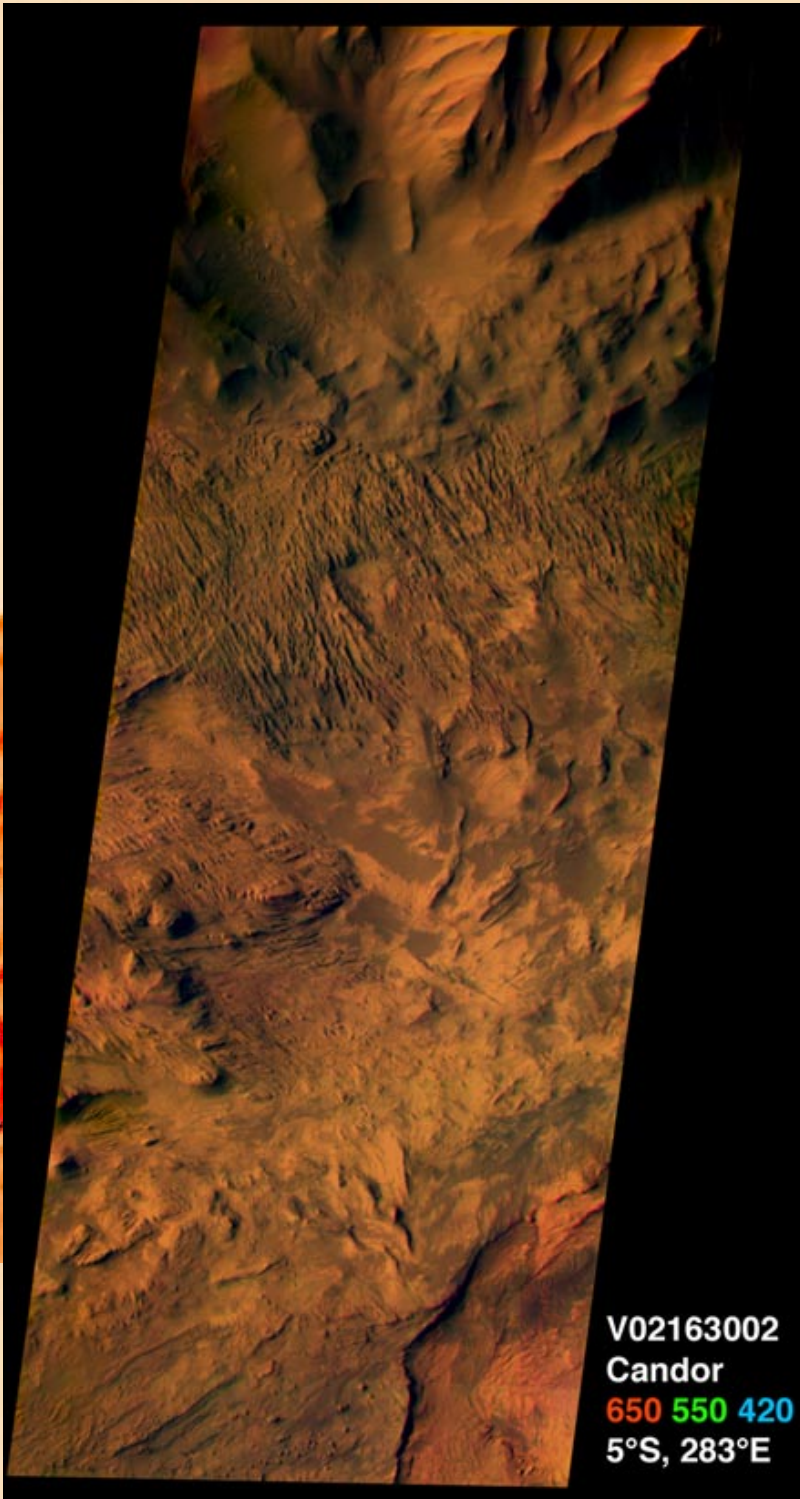
2001 Mars Odyssey	2001 Apr 7	SUCCESS, orbiting Mars
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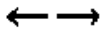






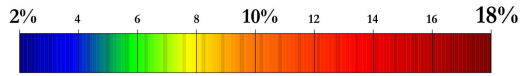
Images from 2001 Mars Odyssey



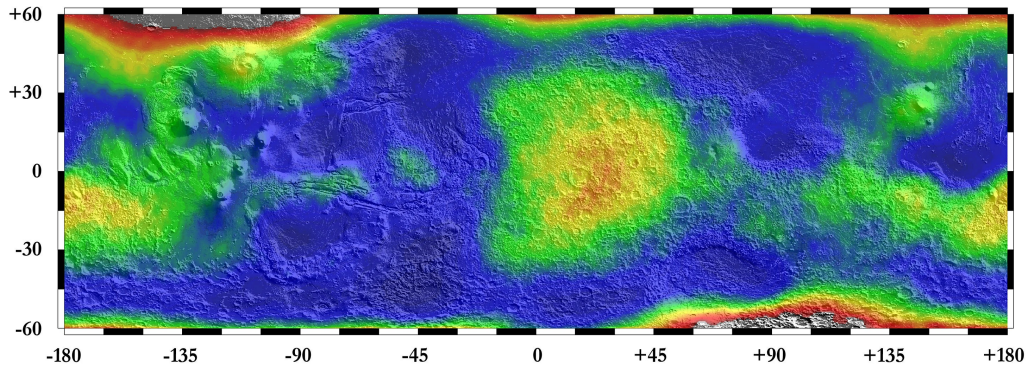


Images from 2001 Mars Odyssey

Water Equivalent
Hydrogen Abundance



Los Alamos
NATIONAL LABORATORY

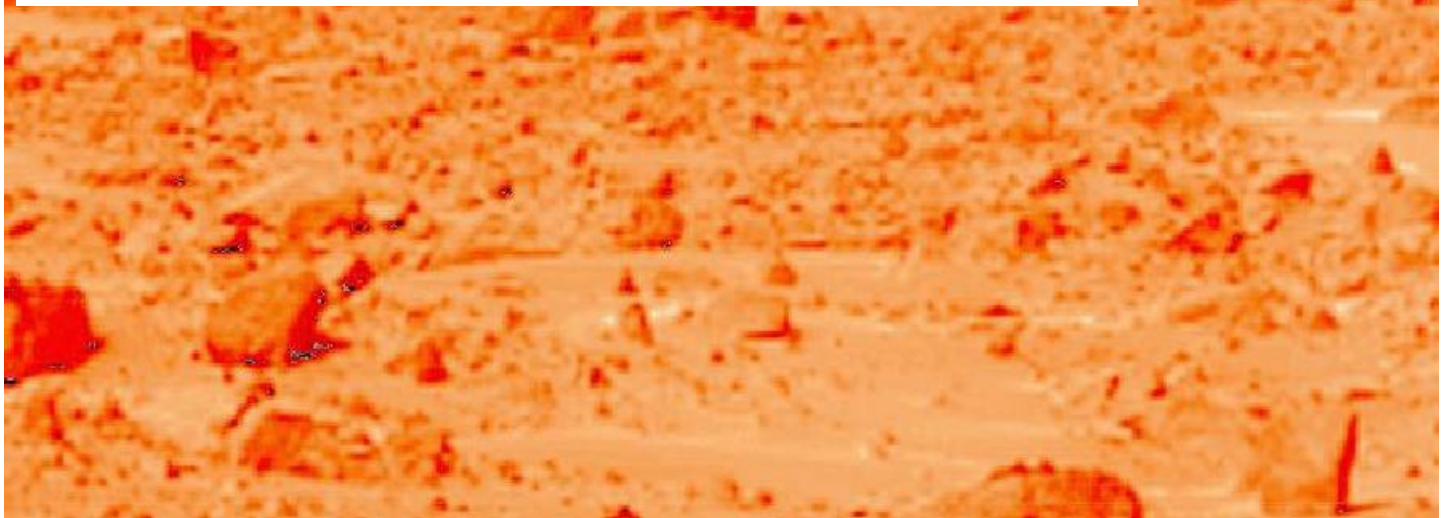


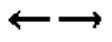
Distribution of Water on Mars: Overlay of water equivalent hydrogen abundances and a shaded relief map derived from MOLA topography. Mass percents of water were determined from epithermal neutron counting rates using the Neutron Spectrometer aboard Mars Odyssey between Feb. 2002 and Apr. 2003.

Reference: Feldman W.C., T.H. Prettyman, S. Maurice, J.J. Plant, D.L. Bish, D.T. Vaniman, M.T. Mellon, A.E. Metzger, S.W. Squyres, S. Karantza, W.V. Boynton, R.C. Elphic, H.O. Founos, D.J. Lawrence, and R.L. Tokar, The global distribution of near-surface hydrogen on Mars, *JGR Planets*, submitted July 2003.

These data were generated by the Planetary Science Team at Los Alamos: B. Barraclough, D. Bish, D. Delapp, R. Elphic, W. Feldman, H. Founos, O. Gasnault*, D. Lawrence, S. Maurice*, G. McKinney, K. Moore, T. Prettyman, R. Tokar, D. Vaniman, and R. Wiens. * Also at Observatoire Midi-Pyrénées, France.

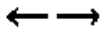
The neutron spectrometer aboard Mars Odyssey is a component of the Gamma-ray Spectrometer suite of instruments, was designed and built by the Los Alamos National Laboratory and is operated by the University of Arizona in Tucson. The Mars Odyssey mission is managed by the Jet Propulsion Laboratory.



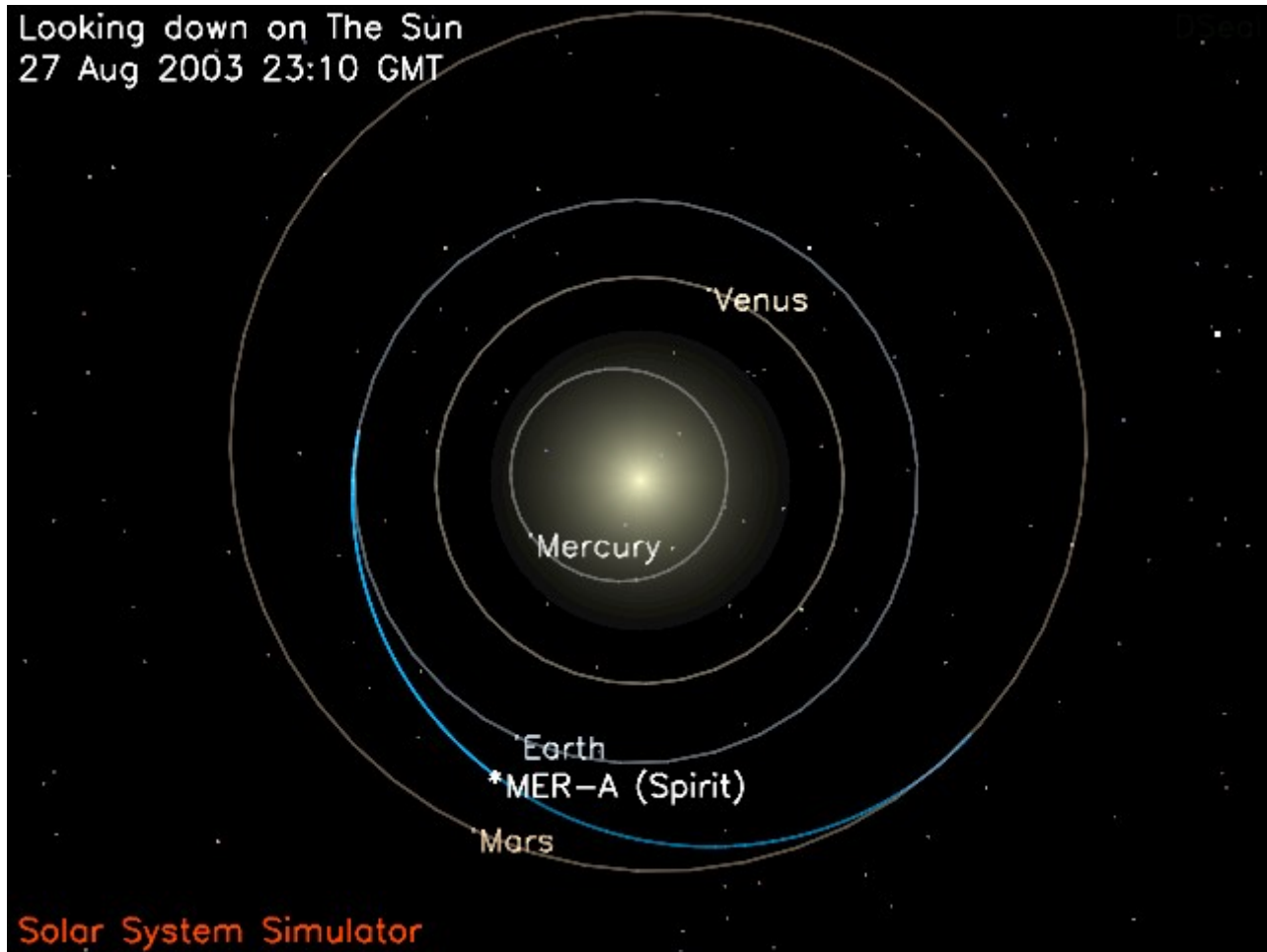


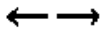
Someday...



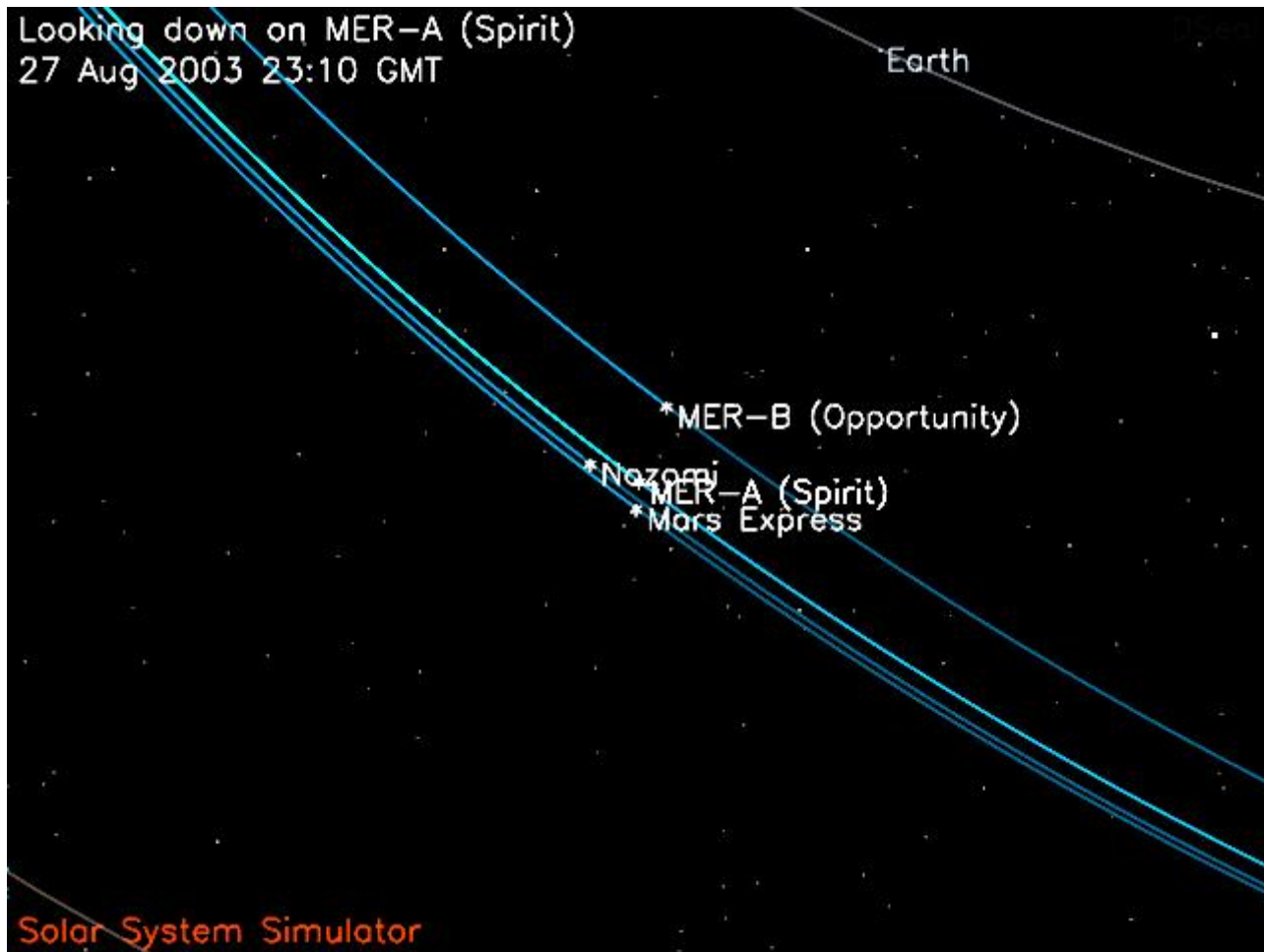


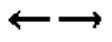
Last summer...





Parallel tracks





Right now...

