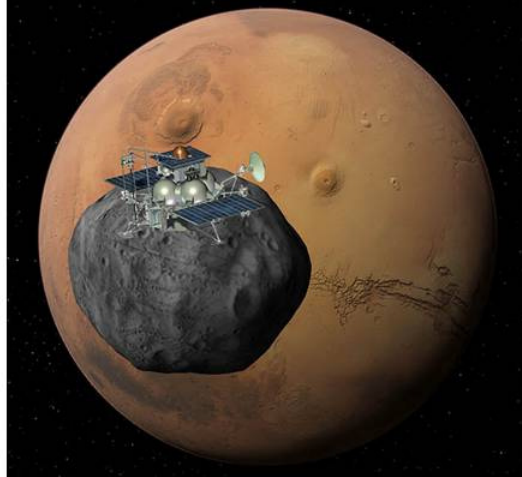


Fobos-Grunt sample return: Perspectives and Prospects



The opinions expressed represent those of the author and do not now (and probably never will) reflect the views of any hosting organization,

James Oberg
February 5, 2009
www.jamesoberg.com

Rumors of schedule impossibilities

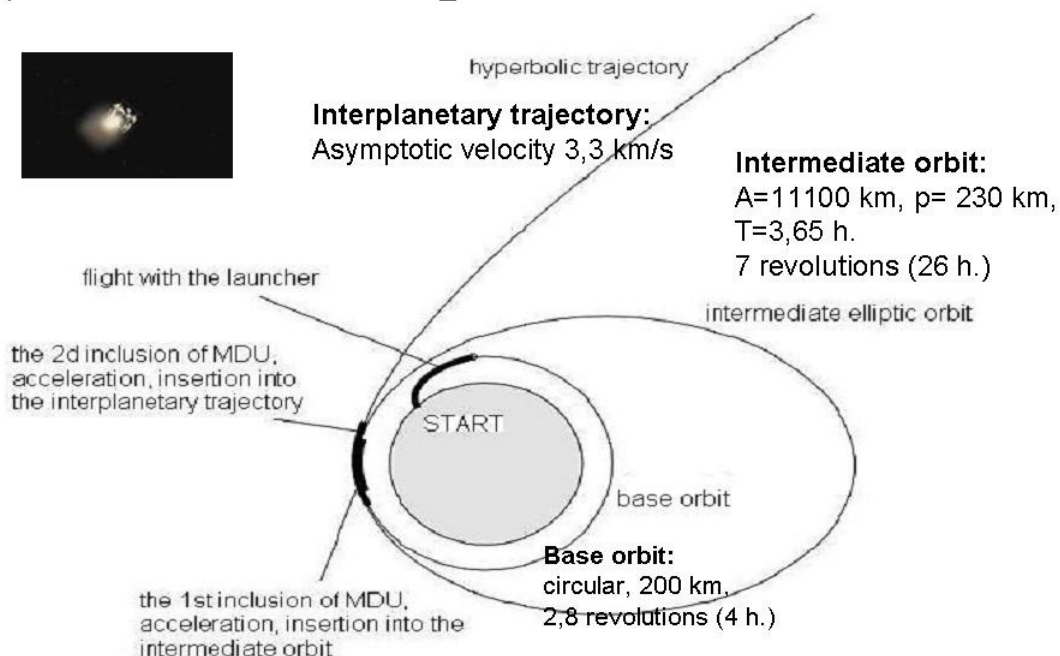
- Anatoliy Zak: "Everybody else involved in the Phobos-Grunt program now say that it has absolutely no chance to fly in 2009 and would be really lucky to fly in 2011."
www.russianspaceweb.com
- Anonymous DC space policy wonk (Jan 24): "I heard from someone who heard a Russian give a briefing just last week. Two things stood out. They still have not decided on the booster. They have no plans for an integrated spacecraft test. He said that the development team has been asking for a delay, but the government won't give it to them."
- www.nasaspacesflight.com blog (Jan 26): "They (Lavochkin) are mainly focused on Spektr and Elektro-L and not many resources are currently allocated to Phobos-Grunt."
- Private email from California (Jan 26): "No one I talk to who knows anything about the mission thinks they'll launch, but the official line doesn't seem to be changing."
- Air et Cosmos (Dec 12), Paris: "La mission Phobos-Grunt est prévue en 2009, mais il semble que cette date ne soit plus envisageable et qu'elle soit décalée en 2011."

Reasons for optimism

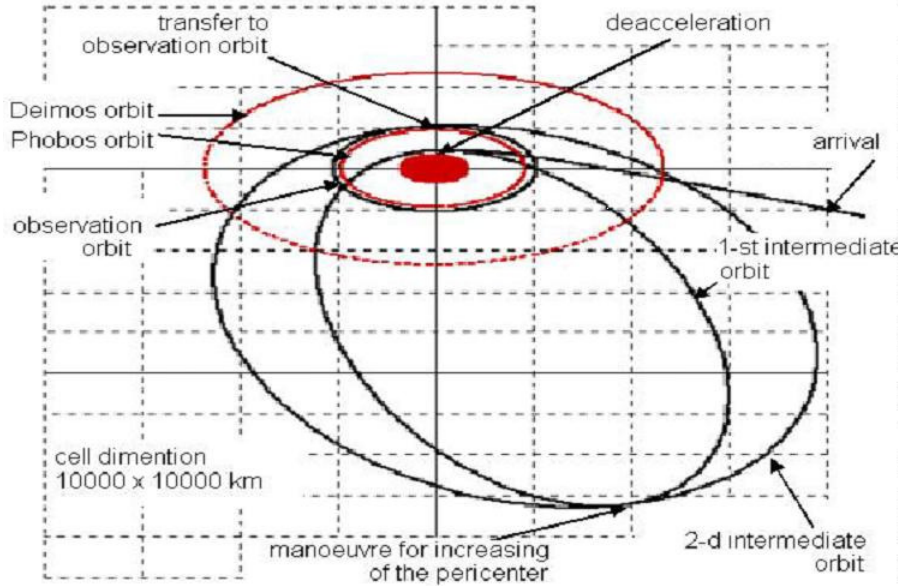
- THE DIFFICULT ROAD TO MARS (V. G. Perminov, Lavochkin Design Bureau)
- ***“As soon as the Russian economy is stabilized, young creative minds who have already developed [an] original approach to Mars and Phobos exploration will overcome and succeed”.***
- Budget environment is entirely unlike situation in 1980s and early 1990's.
- Context and causes of past failures may be under control, either absent or largely overcome already (to be discussed)
- In other words – main failure modes are not random, but are clear consequences of conditions subject to assessment and improvement
- Vastly improved knowledge of expected operating environment
- Larger booster may relieve over-complex ascent sequence and out-of-design demands on spacecraft propulsion systems
- Recent evolution of longer-lifetime spacecraft across the board
- Spacecraft and mission design is modular enough to allow handling of late-in-preparation simplification and offloading

Fobos-Grunt ascent profile

http://www.iki.rssi.ru/oct4/2007/index_e.htm



Fobos-Grunt orbits around Mars



intermediate orbit #1

P=800 km,
a=79000 km,
T=3 d.

Intermediate orbit #2

P=9910 km,
a=79000 km,
T=3,3 d.

Observation orbit

Circular, 9910 km (~ 500 km higher then the Phobos orbit),
T=8,3 h.

Quasi synchronous orbit

Similar to the Phobos orbit



Для российских ученых большой интерес представляет спутник Марса – "Фобос"

Landing on the martian moonlet



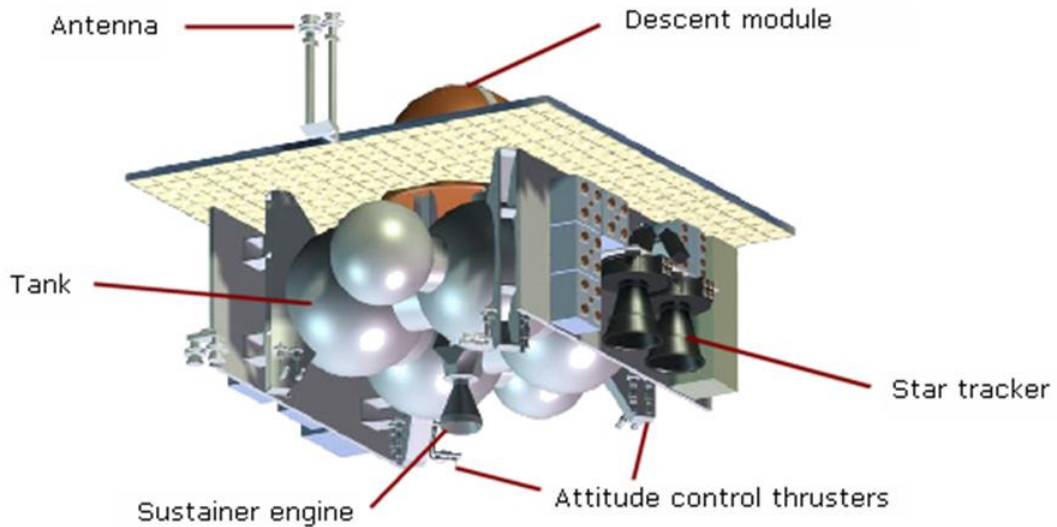


Manipulator and sampling device

Cooperation – IKI, “RAROS”,
Lavochkin Association

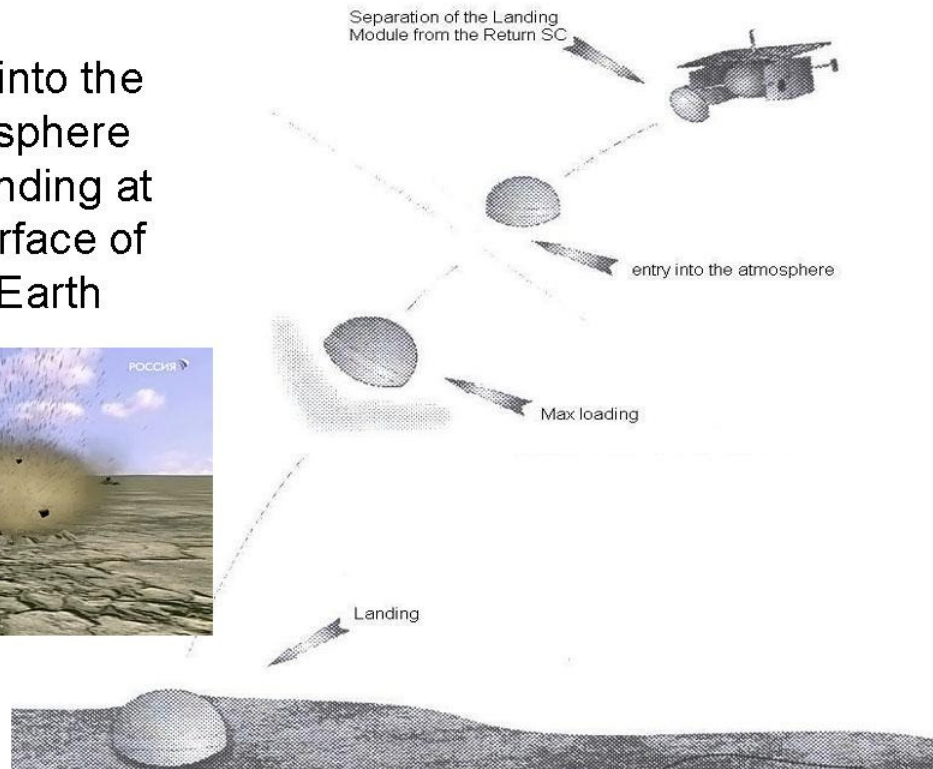
- pointing ± 5 mm
- length – to 1000 mm
- pressure – to 5 N
- sample volume - 0,5–1,5 cm³
- mass - 3,5 kg

Return vehicle



Return vehicle mass: 215 kg
Descent module mass: 9,45 kg

Entry into the atmosphere and landing at the surface of the Earth



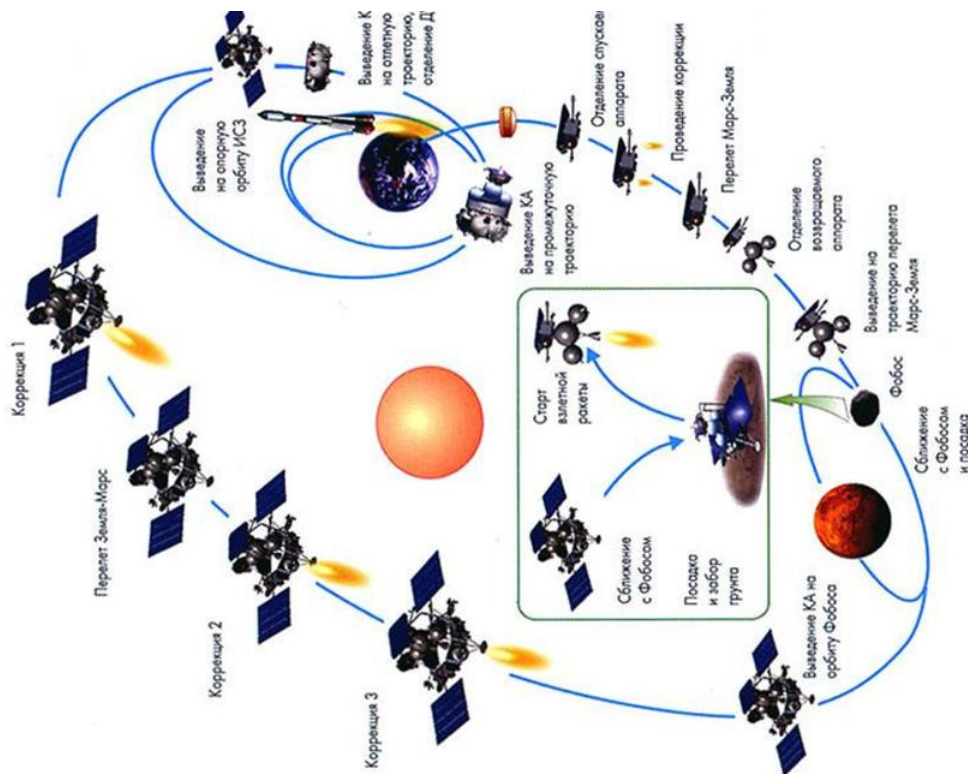
Part 2: CONTEXT

- Past problems are indications of specific technical shortcomings subject to cure
- Failures are usually not due to 'mission difficulty' or flag-of-registration or superstition – they generally have traceable causes
- Lamentable outcomes of Fobos-1 & 2 and Mars-96 missions provide guidance to major programmatic weaknesses needing attention
- Level of such remediation provides insight into likelihood of repetition of similar failures

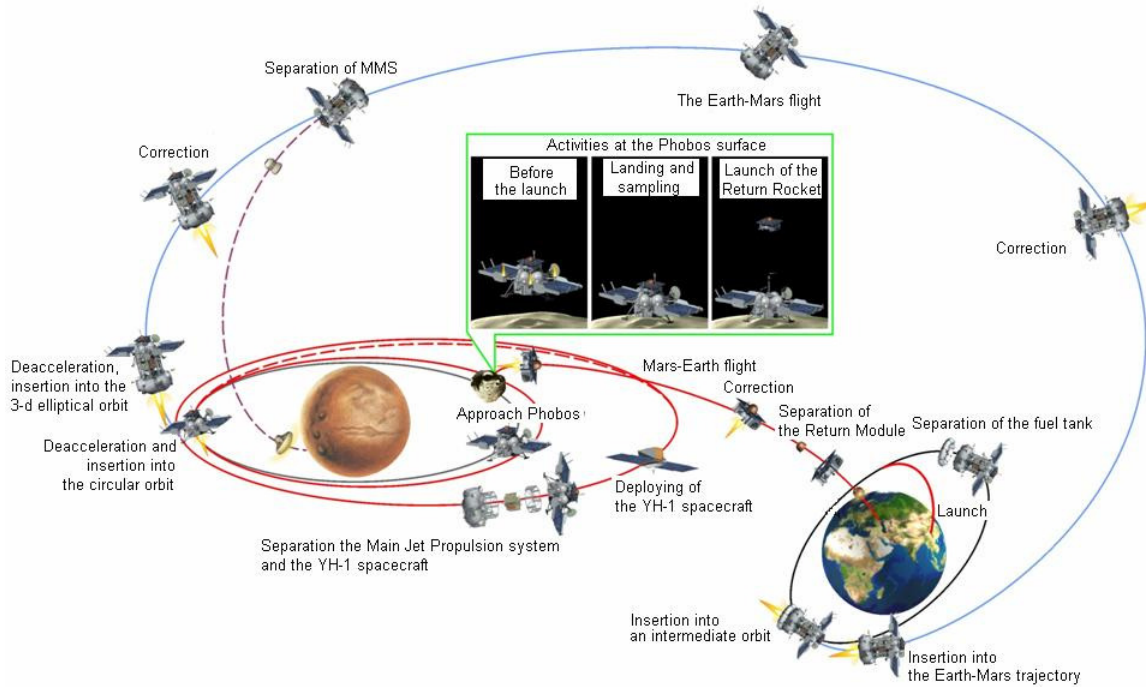
Fobos-Grunt

What are current options?

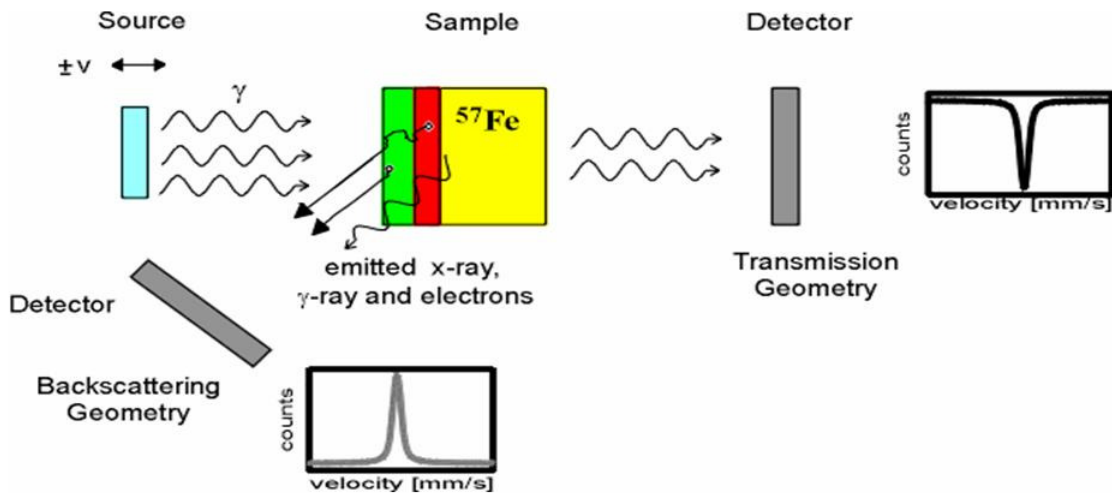
- Proceed with launch ready-or-not (Mars-96 mode)
- Go from two-shift ops to three-shift (recall retirees)
- Scale back mission – obvious choice, remove core drill, transfer mechanism, and return vehicle
- What about the China sub-satellite?



Flight profile



Manipulator Instrument



Cooperation –Mainz University, Germany, IKI,