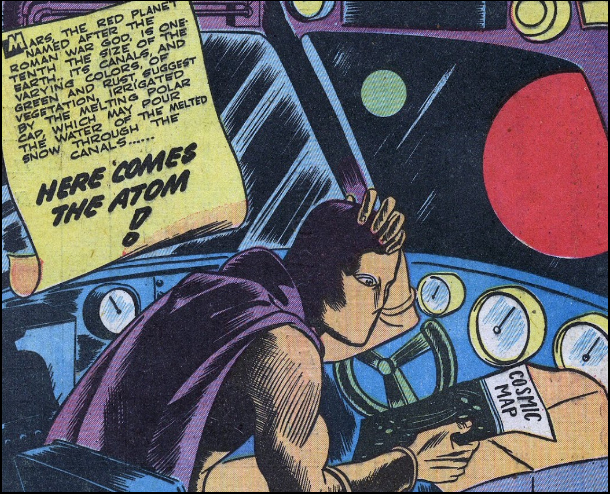
Da Marte a Kerbin passando per Brera

Gianluigi Filippelli, Stefano Sandrelli

Osservatorio Astronomico di Brera, Milano, 01/04/2019

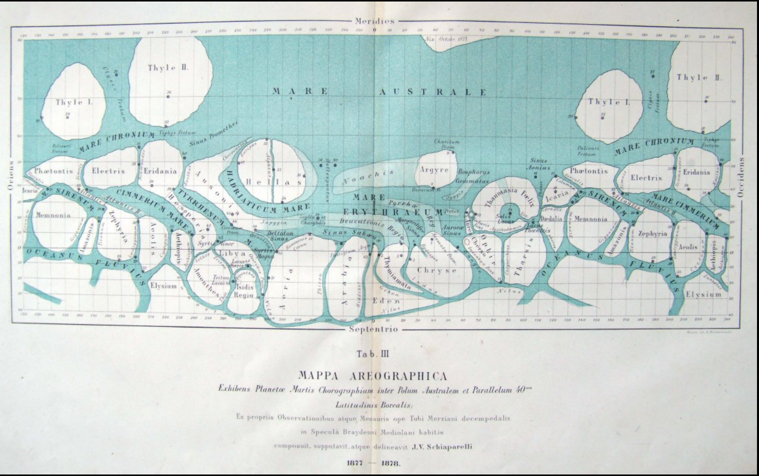
All Star Comics n.13 (1941)

All Star Comics n.13 (1941)

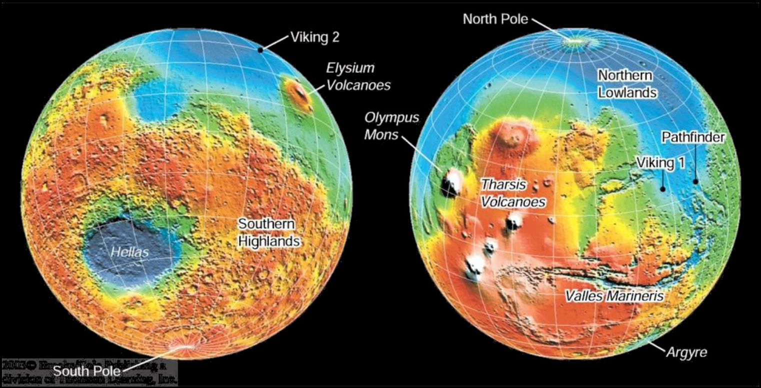


Benvenuti a Brera

La prima mappa di Marte



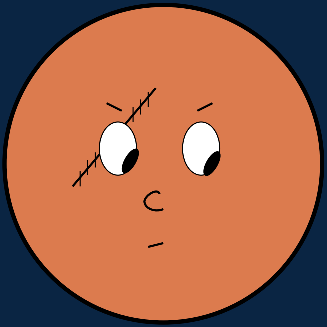
Topografia marziana



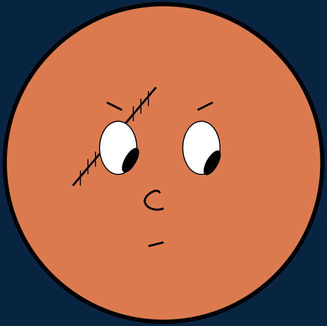
Fatterelli marziani: distanza dal sole

Distanza media tra il Sole
e le orbite di Terra e Marte

Fatterelli marziani: caratteristiche fisiche



Fatterelli marziani: caratteristiche fisiche



Marte è il 4.o pianeta dal Sole

Possiede due lune:

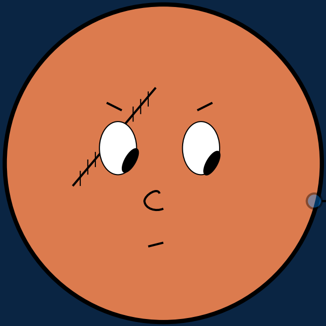
Phobos, con un diametro di

22.2 chilometri

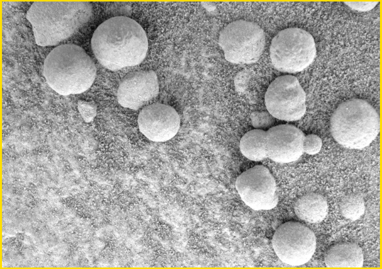
e Deimos, con un diametro di

12.6 chilometri

Fatterelli marziani: caratteristiche fisiche



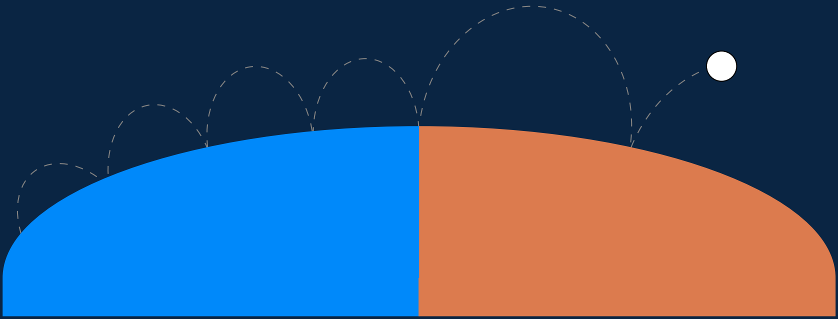
Sferule di ematite



Fatterelli marziani: gravità e atmosfera

Gravità

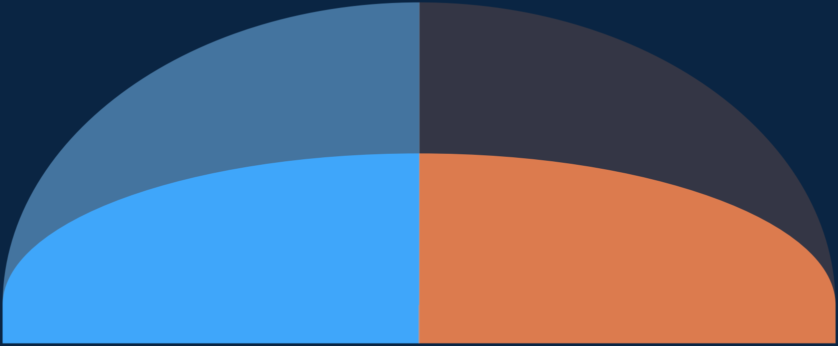
Un astronauta su Marte sperimenterebbe una gravità del 62.5% inferiore rispetto alla Terra



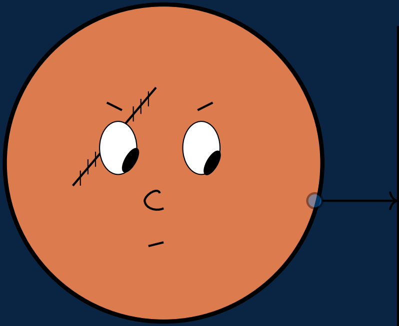
Fatterelli marziani: gravità e atmosfera

Atmosfera

L'atmosfera su Marte, ricca di CO_2 (96%) è circa 100 volte meno densa di quella sulla Terra

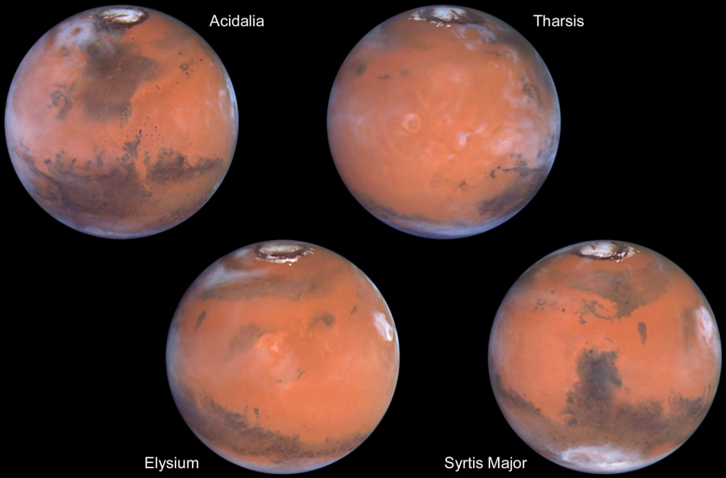


Un buco su Marte

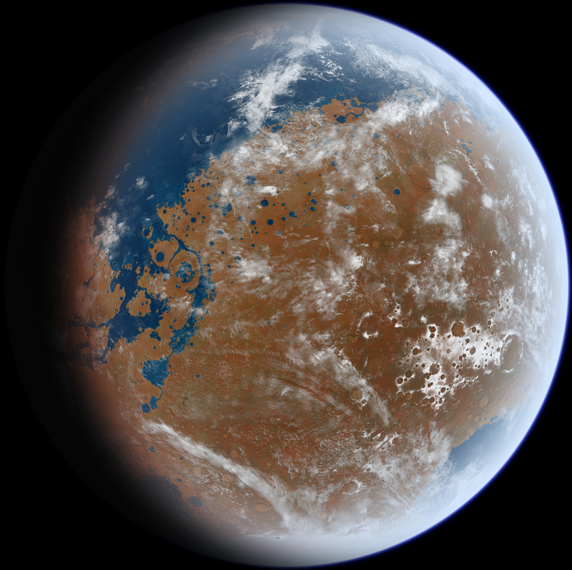


Curiosity

Marte oggi



Marte ieri

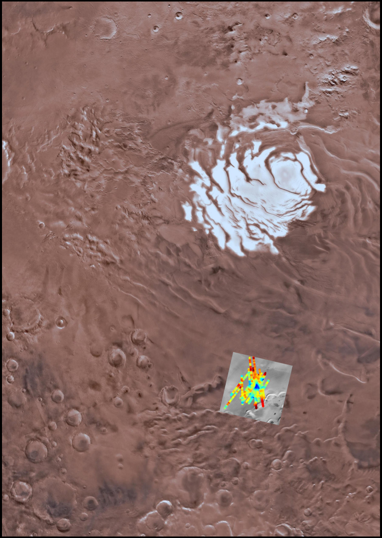


Brindisi

25 luglio 2018

Roberto Orosei
INAF

Un lago salato



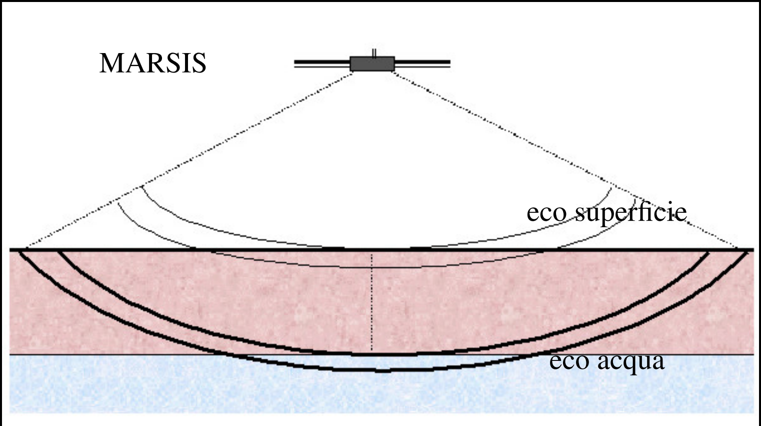
Profondità: 1500 m

Estensione: 20 km

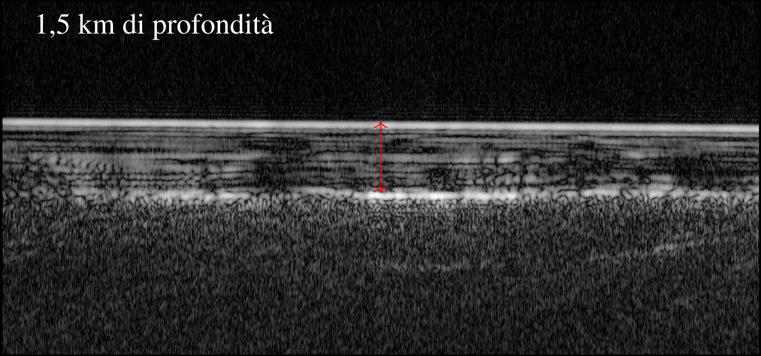
Spessore: almeno 1m

Temperatura: tra $-10°C$ e $-20°C$

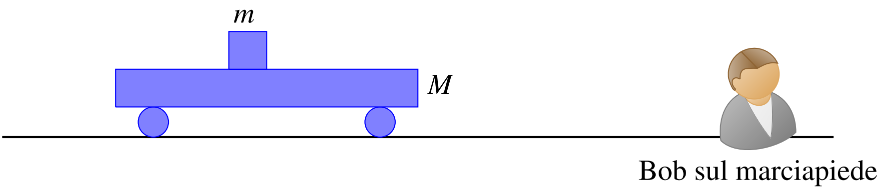
Marsis: Mars Advanced Radar for Subsurface and Ionosphere Sounding



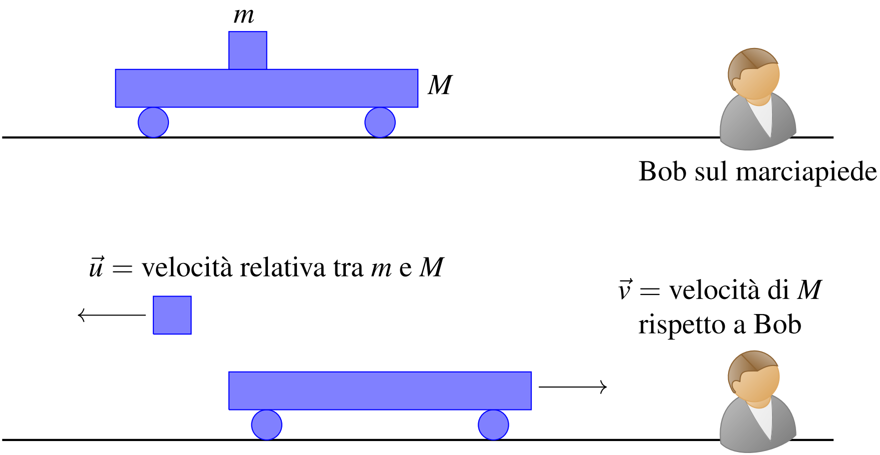
Una foto col radar



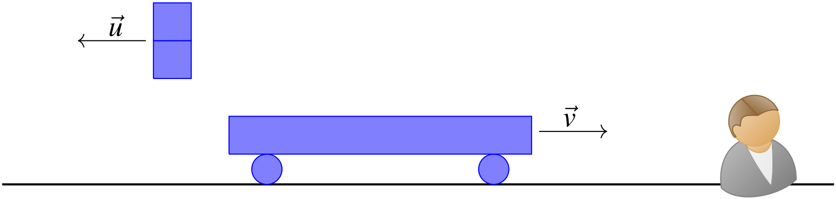
Muovere un carrellino



Muovere un carrellino



Aumentiamo i blocchetti



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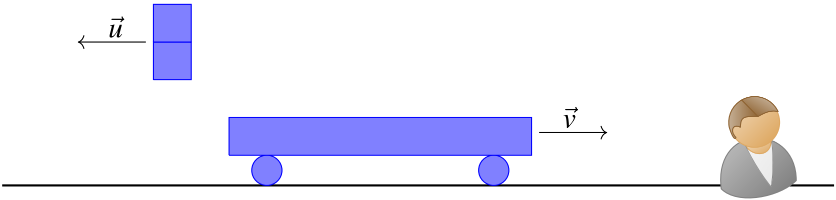
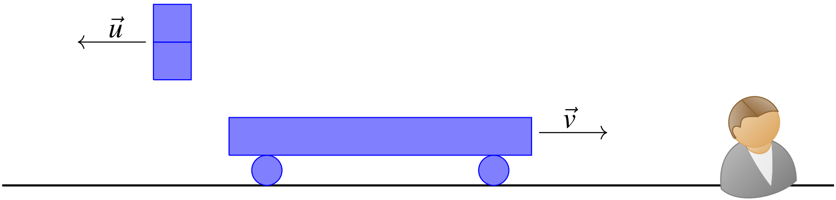


$$\vec{v}_{2b} = \frac{2m\vec{u}}{M+2m}$$

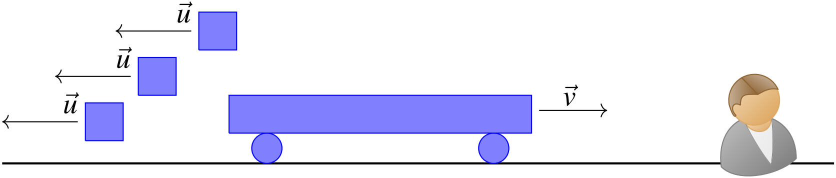
Aumentiamo i blocchetti



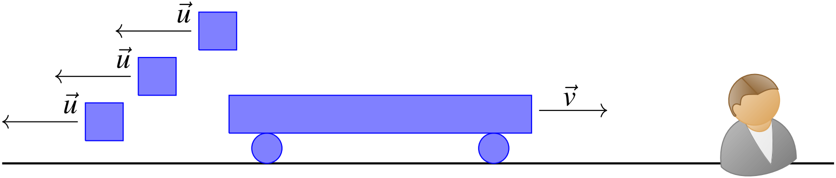
$$\vec{v}_{2b} = \frac{2m\vec{u}}{M+2m}$$

$$\vec{v}_{Nb} = \frac{Nm\vec{u}}{M+Nm}$$

Aumentiamo i blocchetti

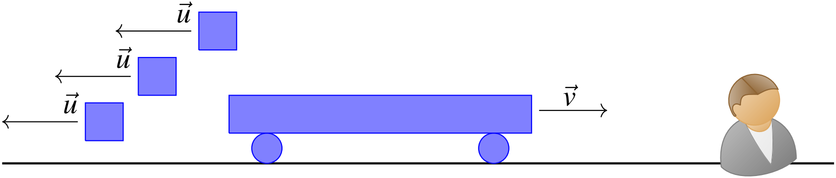


Aumentiamo i blocchetti



$$\vec{v}_3 = \frac{m\vec{u}}{M+3m} + \frac{m\vec{u}}{M+2m} + \frac{m\vec{u}}{M+m}$$

Aumentiamo i blocchetti

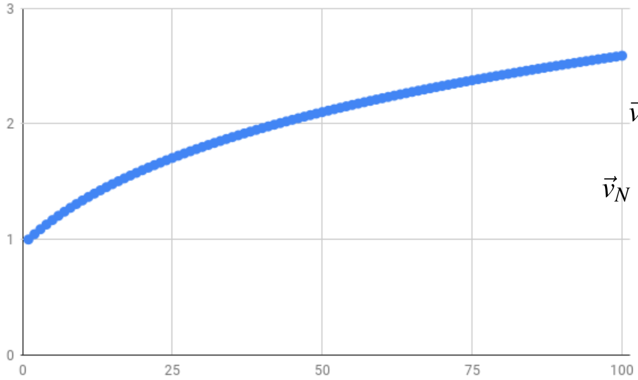


$$\vec{v}_3 = \frac{m\vec{u}}{M+3m} + \frac{m\vec{u}}{M+2m} + \frac{m\vec{u}}{M+m}$$

$$\vec{v}_N = \sum_{i=1}^{N} \frac{m\vec{u}}{M+im}$$

Confrontiamo i due metodi

$$\frac{\vec{v}_N}{\vec{v}_{bN}}$$

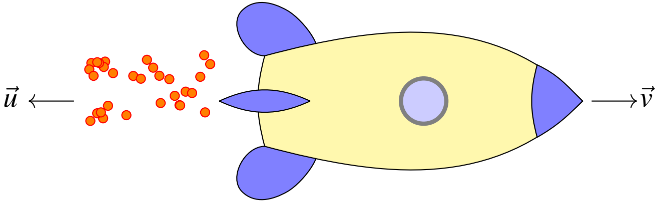


$$N$$

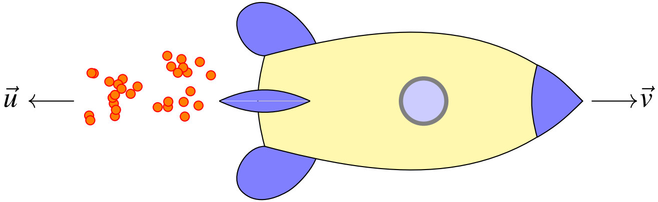
$$\vec{v}_{Nb} = \frac{Nm\vec{u}}{M+Nm}$$

$$\vec{v}_N = \sum_{i=1}^{N} \frac{m\vec{u}}{M+im}$$

L'equazione del razzo

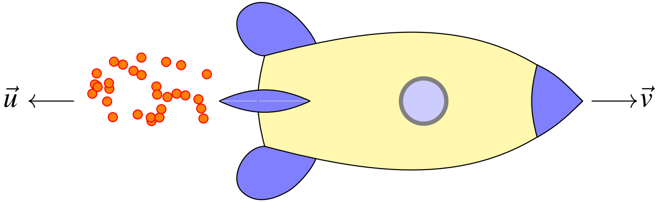


L'equazione del razzo



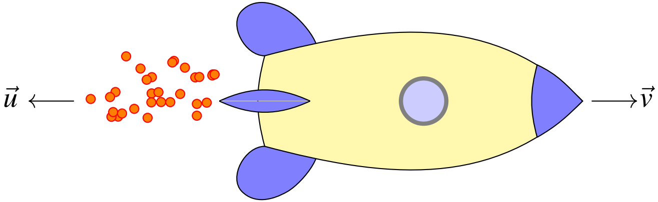
$$F = \frac{\Delta(mv)}{\Delta t}$$

L'equazione del razzo



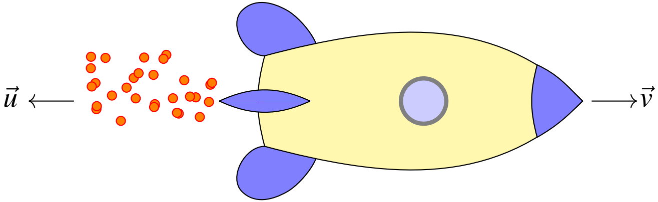
$$m\,\frac{\Delta\vec{v}}{\Delta t}$$

L'equazione del razzo



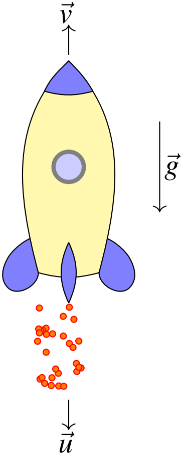
$$m\,\frac{\Delta\vec{v}}{\Delta t} = \vec{F}_{\text{ext}}$$

L'equazione del razzo



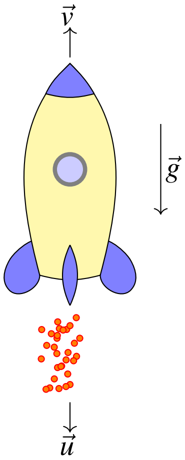
$$m\,\frac{\Delta\vec{v}}{\Delta t} = \vec{F}_{\text{ext}} + \vec{u}\frac{\Delta m}{\Delta t}$$

L'equazione del razzo



$$m\frac{\Delta v}{\Delta t} = -mg - u\frac{\Delta m}{\Delta t}$$

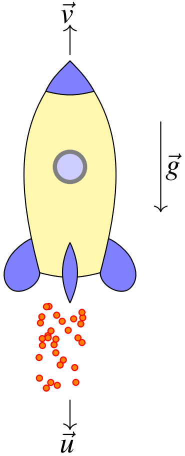
L'equazione del razzo



$$m\frac{\Delta v}{\Delta t} = -mg - u\frac{\Delta m}{\Delta t}$$

$$v = -u \ln \frac{m_i}{m_f} - gt$$

L'equazione del razzo



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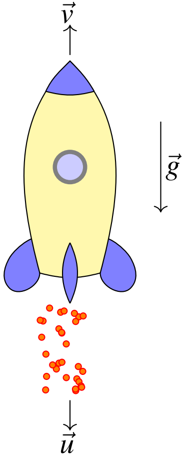
Konstantin Ciolkovskij

L'equazione del razzo



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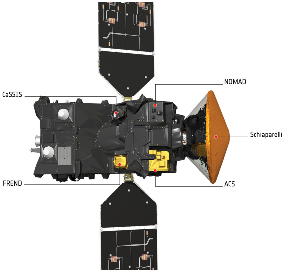
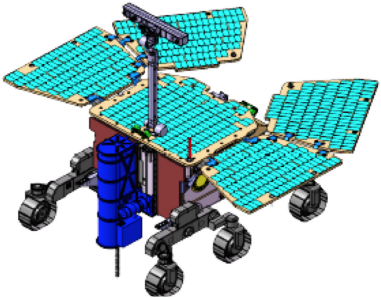
Konstantin Ciolkovskij

Per il principio di conservazione
della quantità di moto,
è possibile accelerare un corpo in una data direzione,
espellendo massa nella direzione opposta.

ExoMars 2016

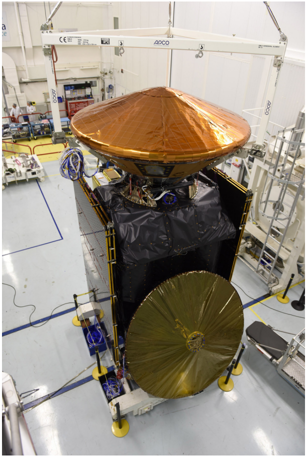




Journey to Mars

Schiaparelli's descent to Mars

ExoMars 2016



Schiaparelli
Dimostratore tecnologico per atterraggio
Trace Gas Orbiter - **TGO**

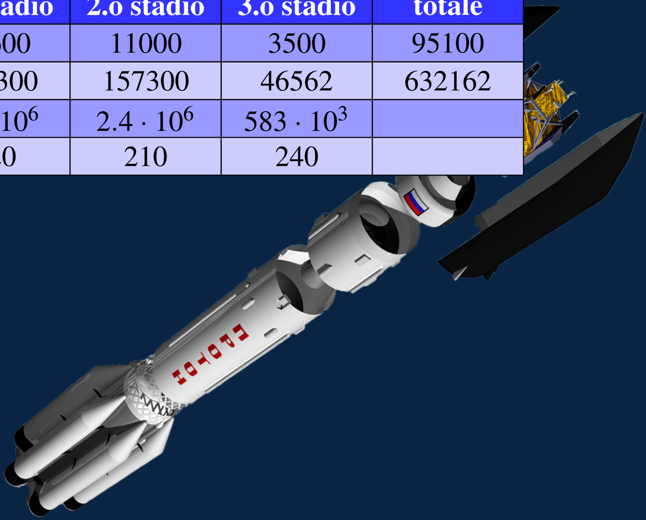
Atmosfera, ricerca di gas rari - metano
Ghiaccio di acqua superficiale e subsuperficiale
Identificazione del luogo di atterraggio
di *Pasteur*

Agenzie: ESA / Roscosmos

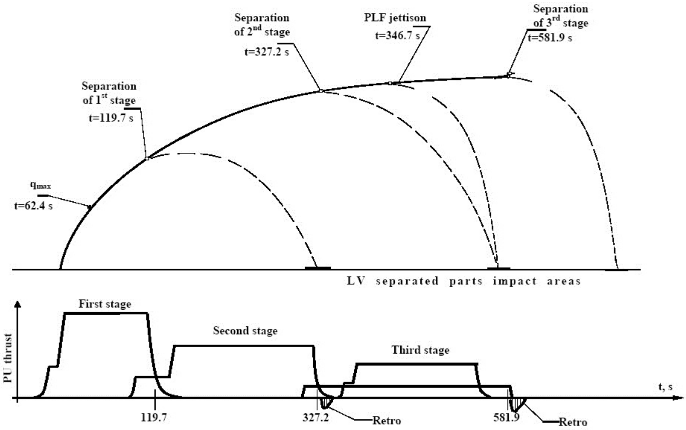
Forte contributo INAF e ASI

Gli stadi del razzo di ExoMARS

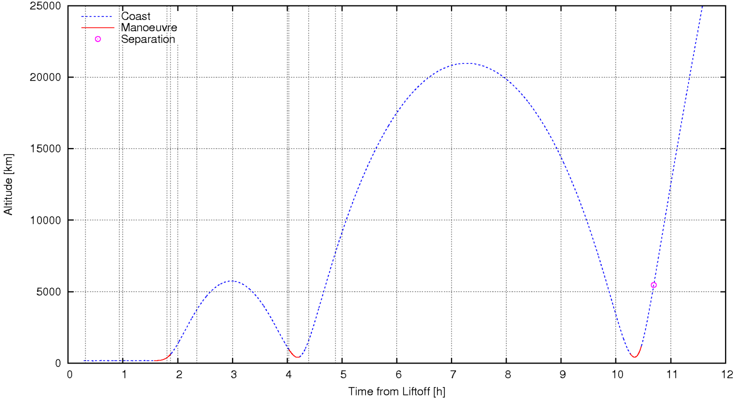
	1.o stadio	2.o stadio	3.o stadio	totale
massa (kg)	30600	11000	3500	95100
carburante (kg)	428300	157300	46562	632162
spinta (N)	$10 \cdot 10^6$	$2.4 \cdot 10^6$	$583 \cdot 10^3$	
tempo (s)	120	210	240	



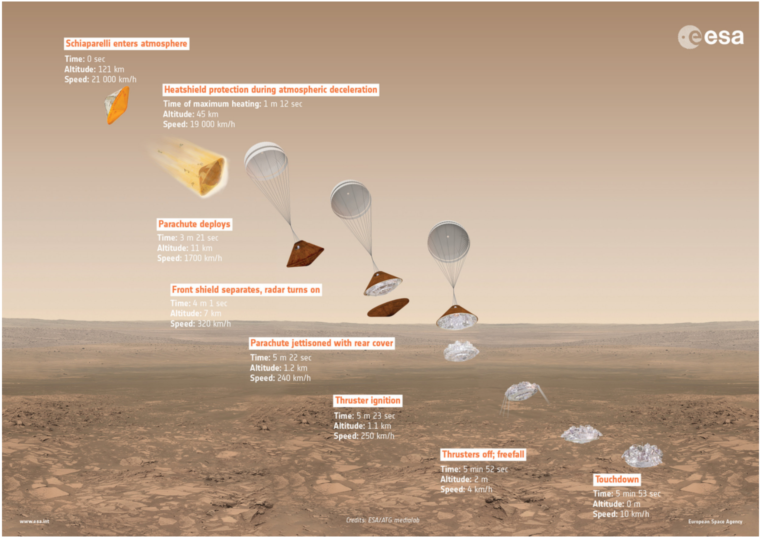
Lo stacco degli stadi



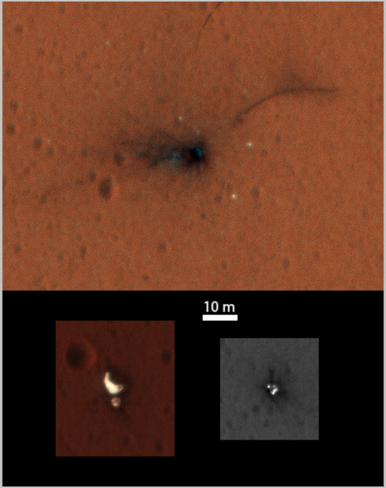
Accensione dei motori



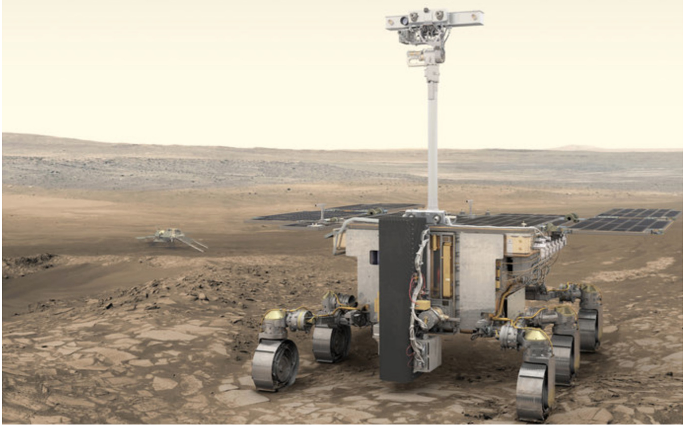
La discesa di Schiaparelli



La fine di Schiaparelli



ExoMars 2020



Verso Kerbin

Verso Kerbin

Verso Kerbin

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Verso Kerbin