

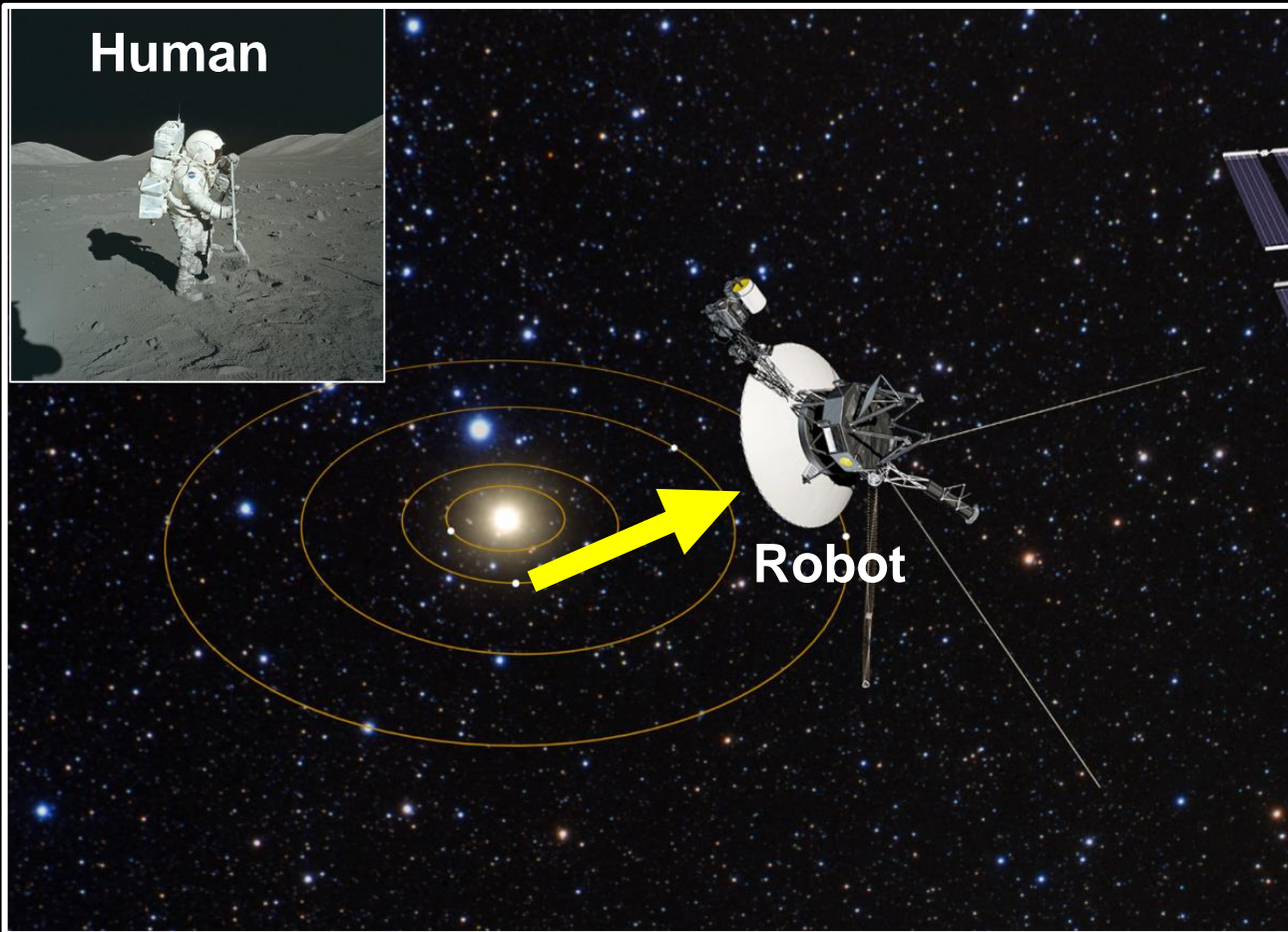
# Wat vliegt er zoal boven ons hoofd?

- 1. Ruimtevaart overzicht**
- 2. Zoeken naar buitenaards leven**
- 3. Bemande reizen: Nabije toekomst**

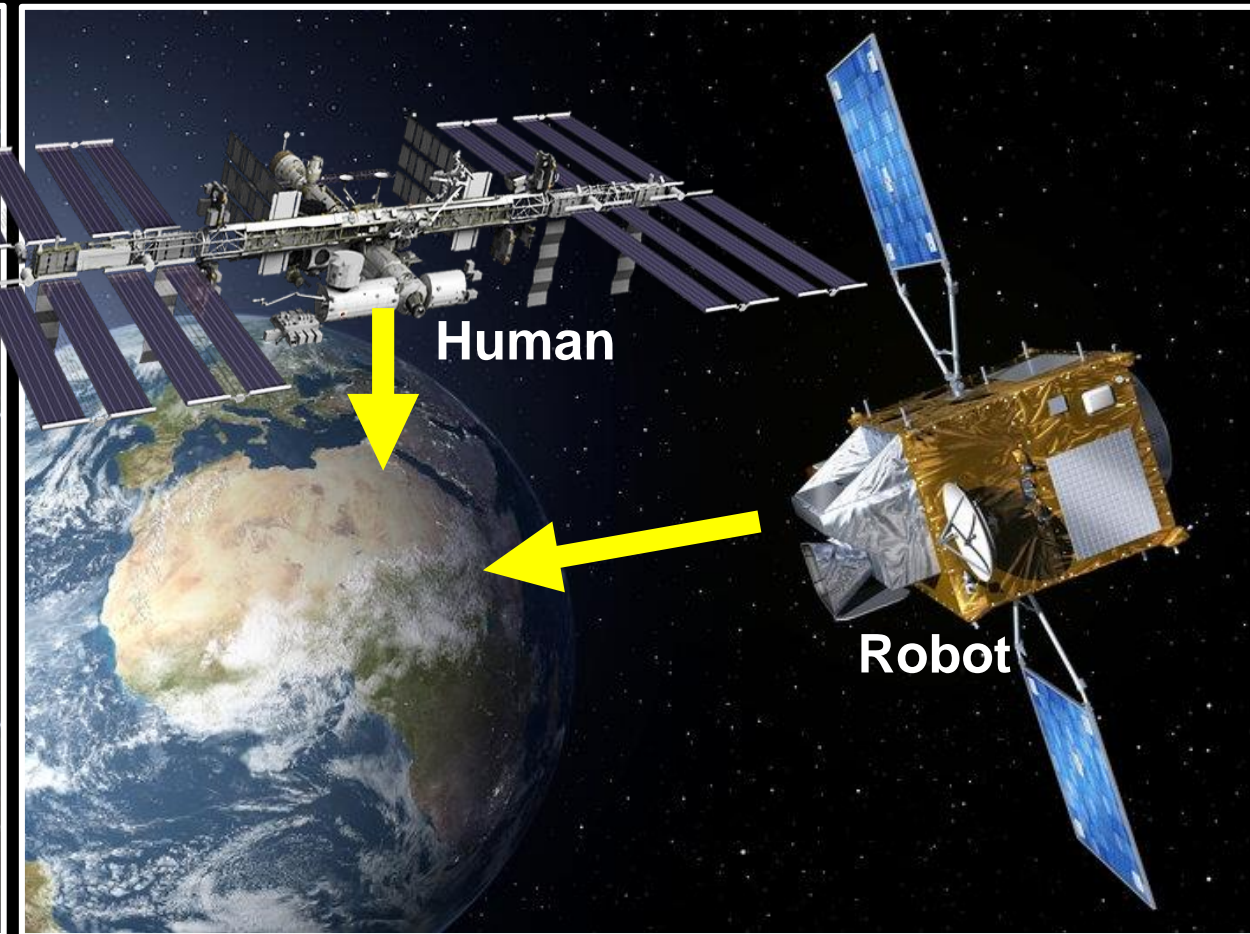


# Ruimtevaart overzicht

Looking up ↑



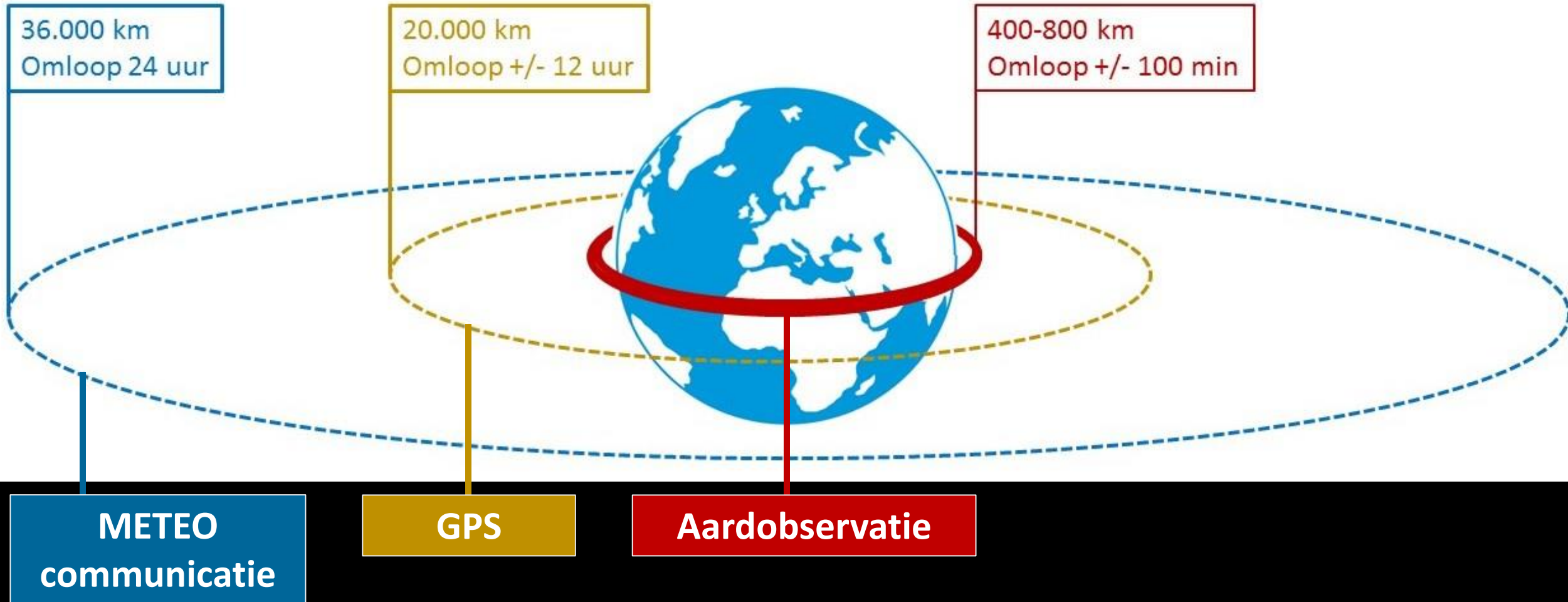
Looking down ↓





# Ruimtevaart overzicht

Looking down ↓





# Ruimtevaart overzicht

Starlink



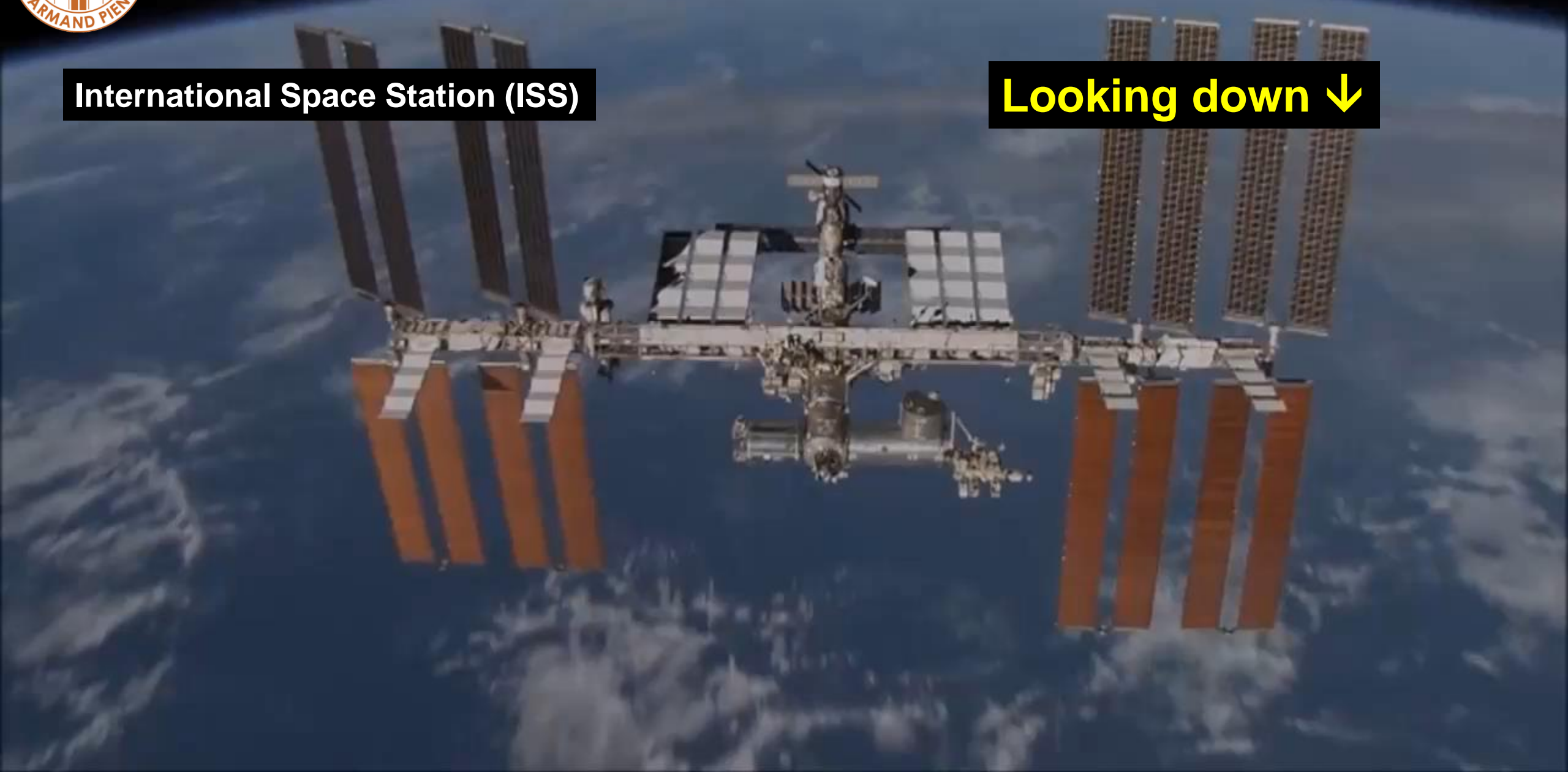
32 orbital planes  
53 degrees inclination  
**Looking down** ↓ plane  
1150km altitude



# Ruimtevaart overzicht

**International Space Station (ISS)**

**Looking down ↓**





# Ruimtevaart overzicht

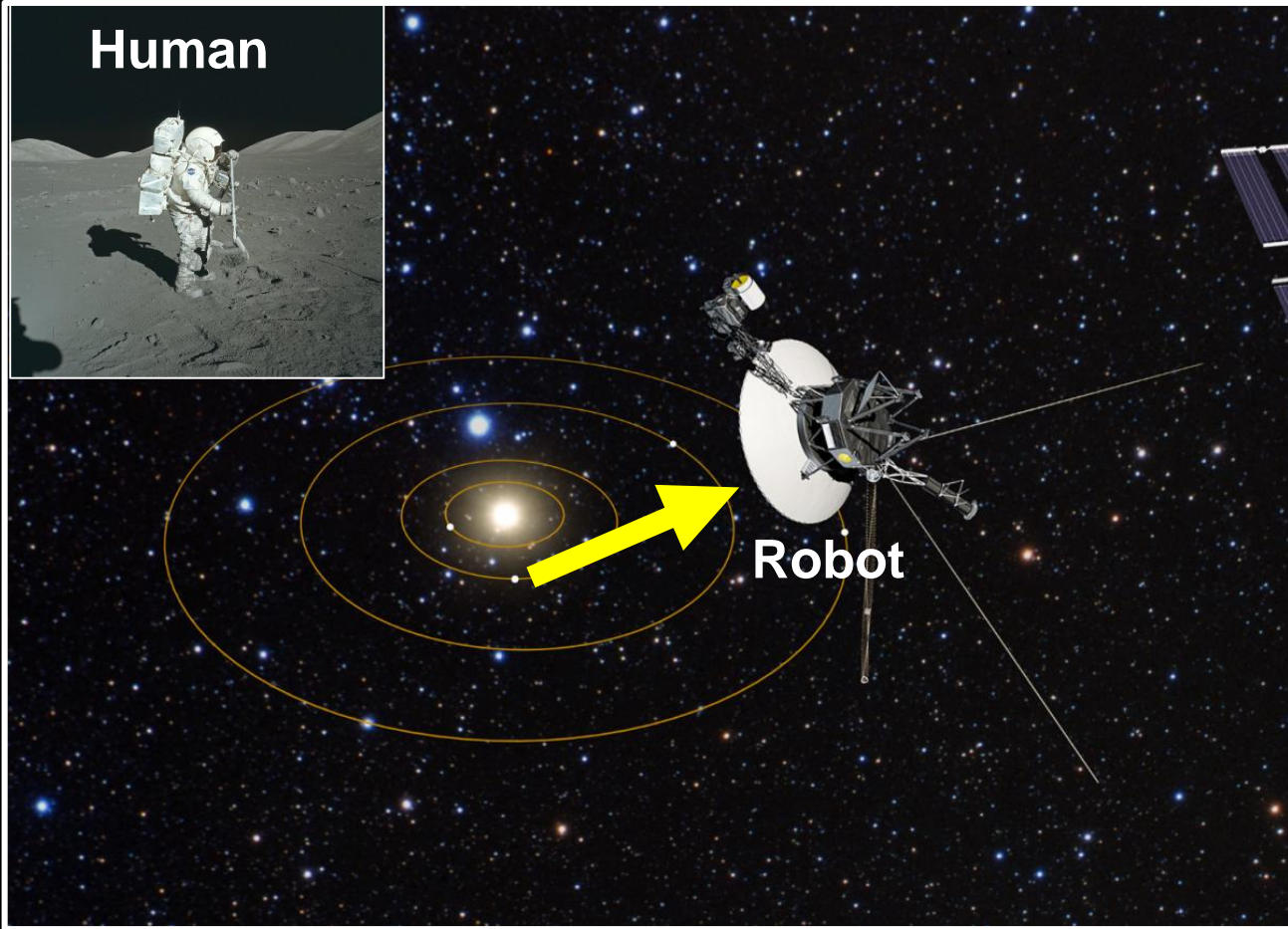
Looking up ↑

Looking down ↓

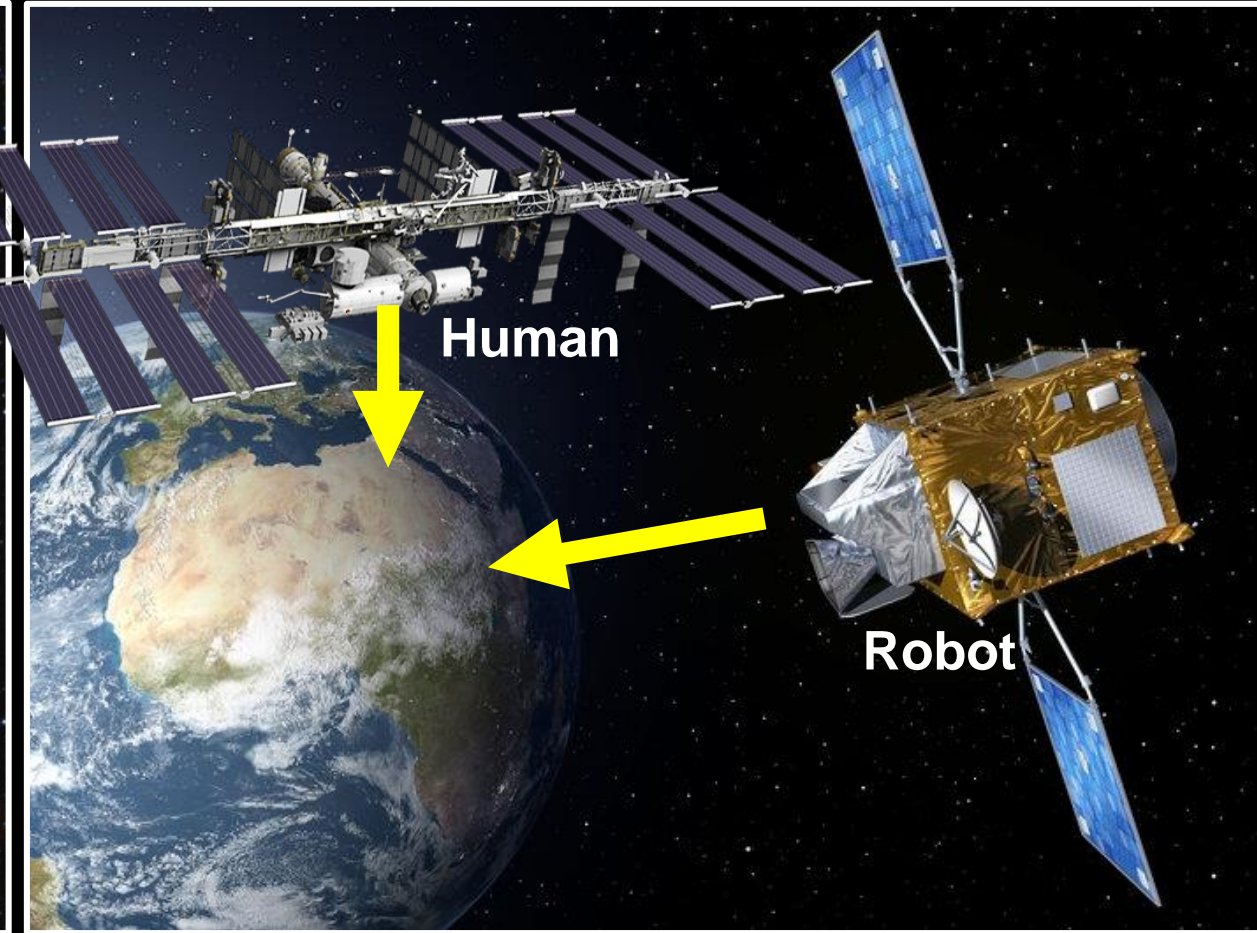
Human



Robot



Human

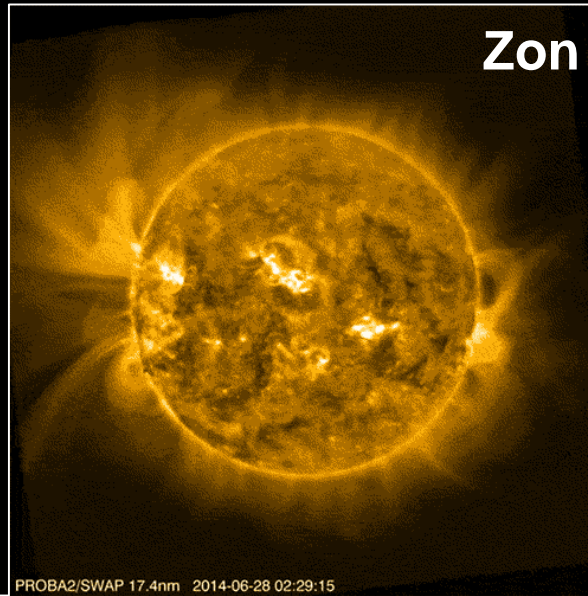


Robot

# Ruimtevaart overzicht

Looking up ↑  
ROBOTIC

Zon



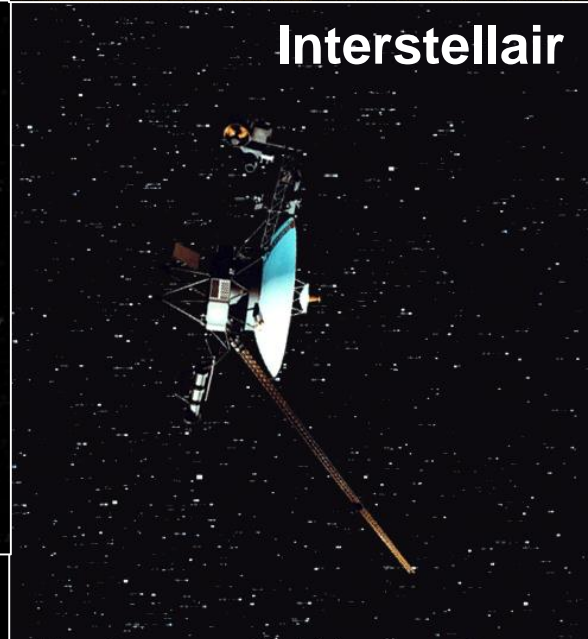
Planeten & Manen



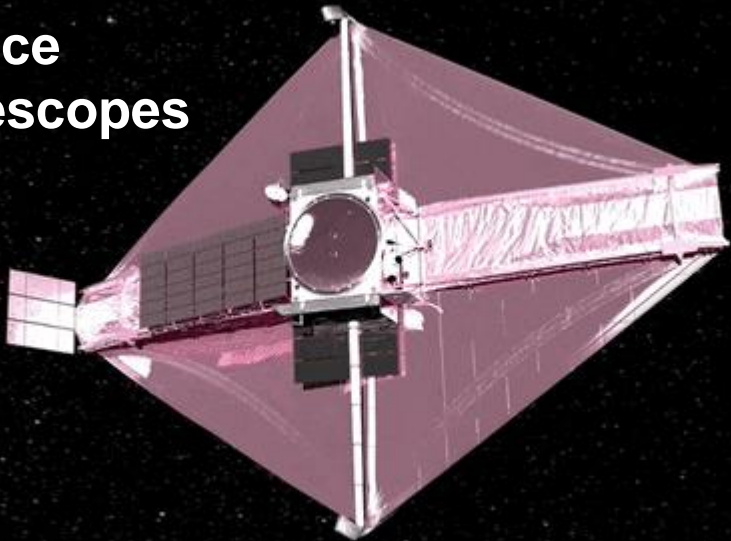
Asteroiden & Kometen



Interstellair



Space  
Telescopes





# Ruimtevaart overzicht

Looking up ↑  
HUMAN

MARS



MAAN







# Wat vliegt er zoal boven ons hoofd?

1. Ruimtevaart overzicht
2. Zoeken naar buitenaards leven
3. Bemande reizen: Nabije toekomst

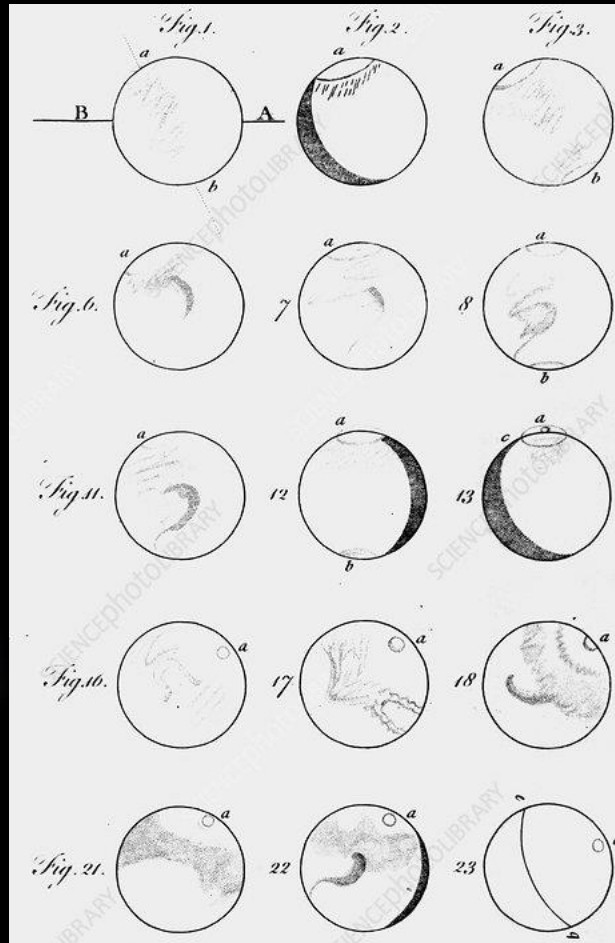
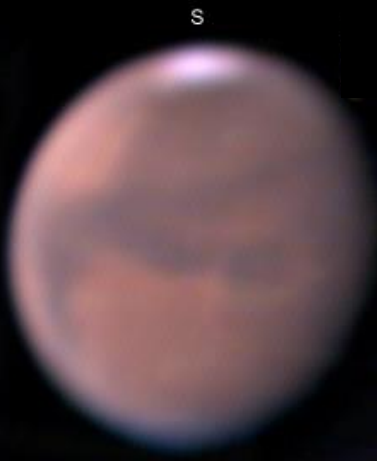


Pieter Mestdagh  
*UGENT Volkssterrenwacht Armand Pien*  
10 maart 2020

## 1784 : HOOP

### William Herschel

- 24 uur rotatie
- Poolkappen
- Wolken



## 1880–1930 : nog meer HOOP

### Giovanni Schiaparelli

### Perceval Lowell

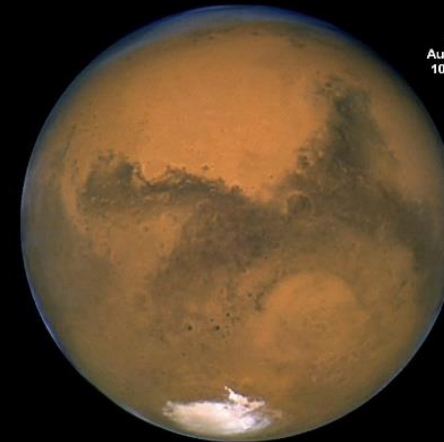
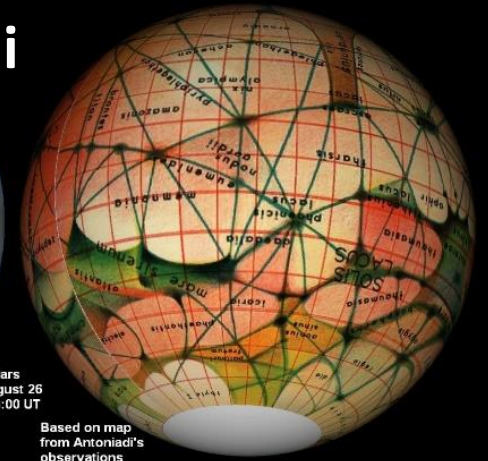
- Vegetaties
- kanalen



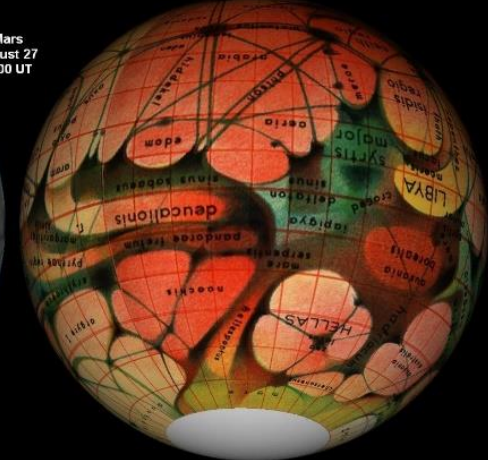
Hubble

Mars  
August 26  
23:00 UT

Based on map  
from Antoniadi's  
observations



Mars  
August 27  
10:00 UT





### 1947 : DOMPER

#### Gerard Kuiper (spectroscopie)

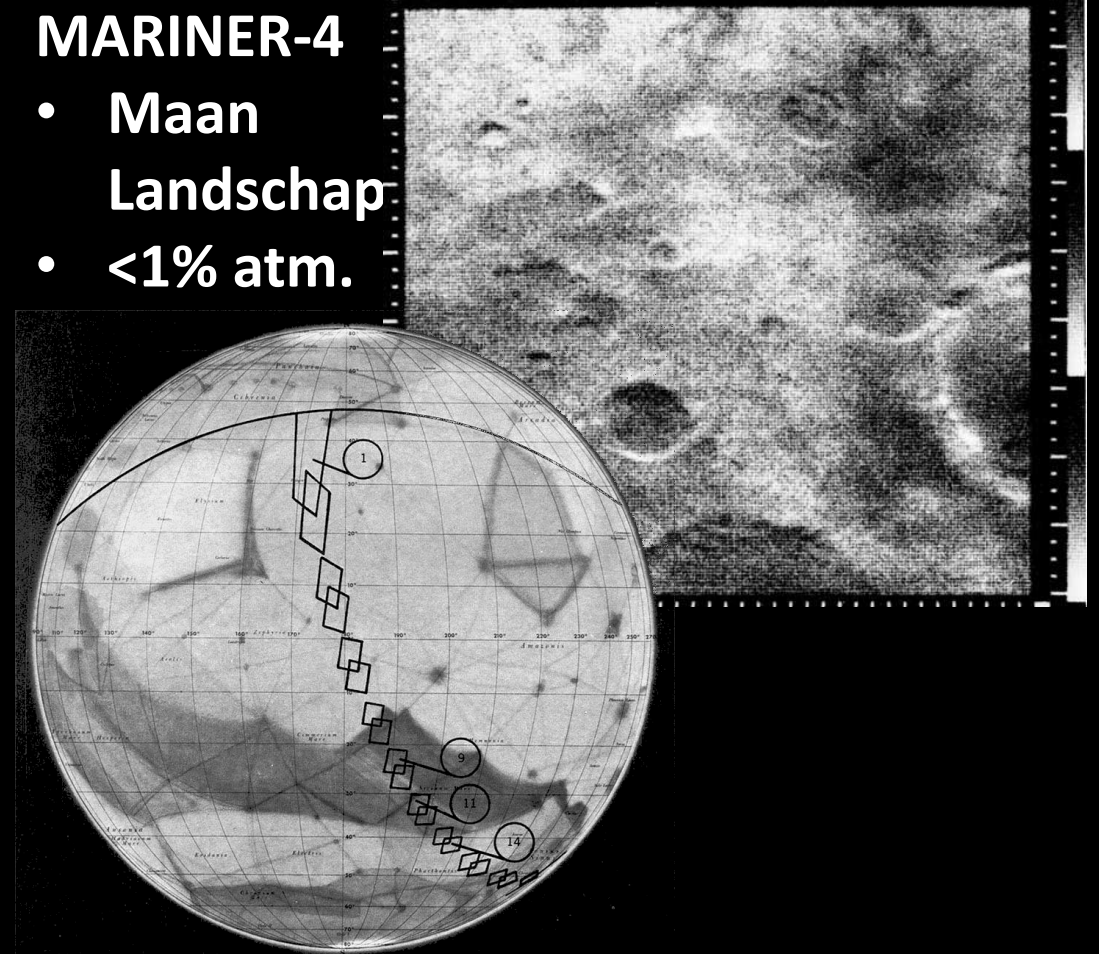
- Lucht =  $\text{CO}_2$
- Geen  $\text{H}_2\text{O}$
- Geen  $\text{O}_2$
- Pool-ijs:  $\text{CO}_2$



### 1964 : nog grotere DOMPER

#### MARINER-4

- Maan
- Landschap
- $<1\%$  atm.





### 1971 : HOOP

#### MARINER-9

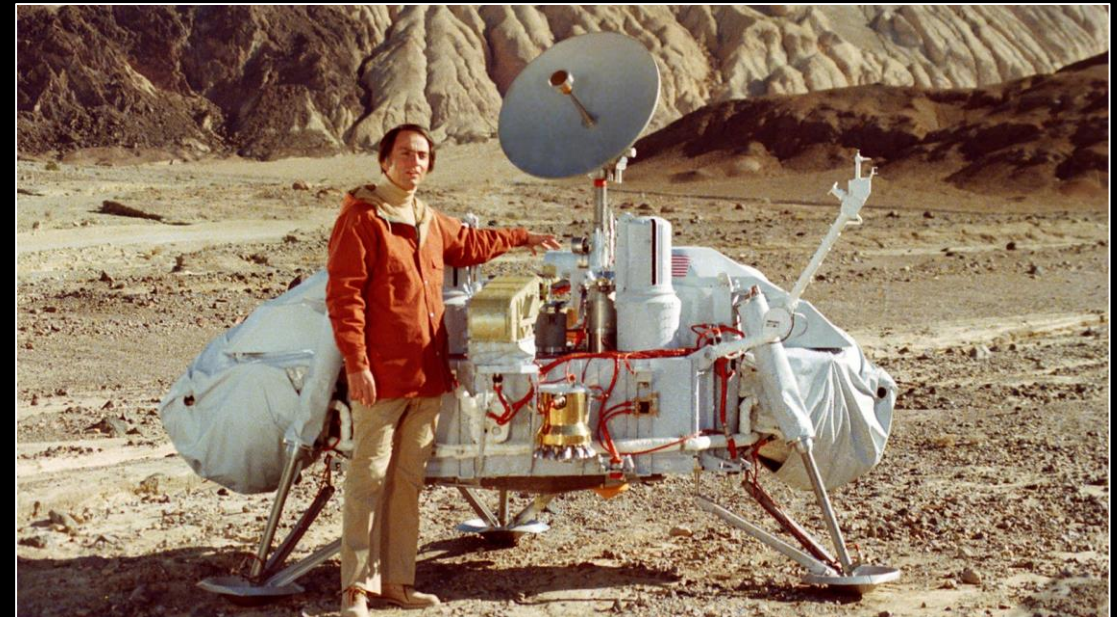
- Rivieren
- Geologische activiteit



### 1976 : grote DOMPER

#### VIKING LANDERS

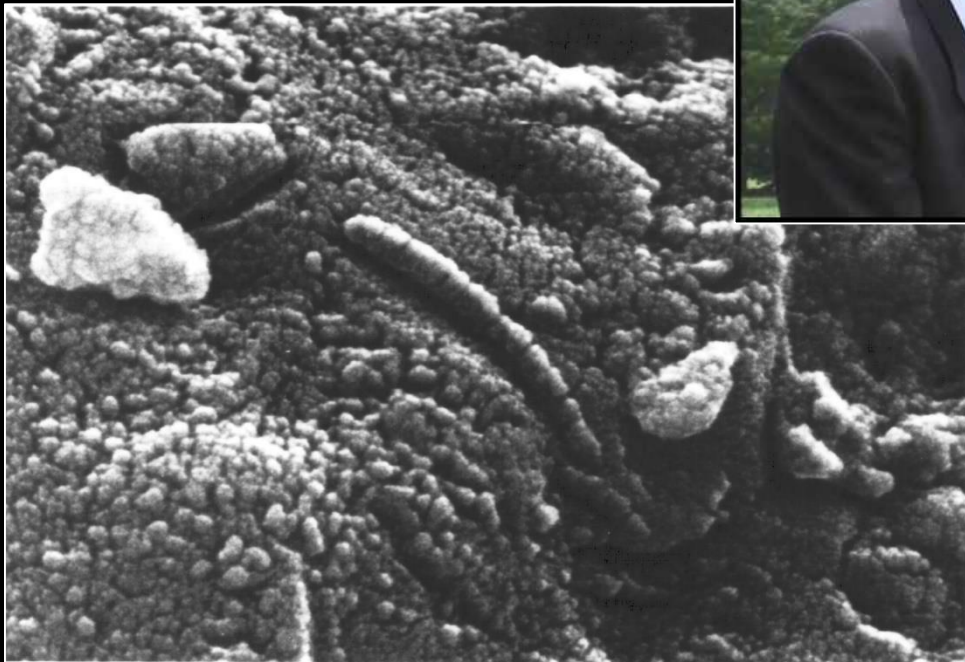
- 3 exp. Negatief, 1 positief
- Later: alle 4 negatief
- Uitgebreide geologie !





### 1996 : HOOP

#### AH 84001



### 2021 : ???

#### Rosalind Franklin (ExoMars rover)

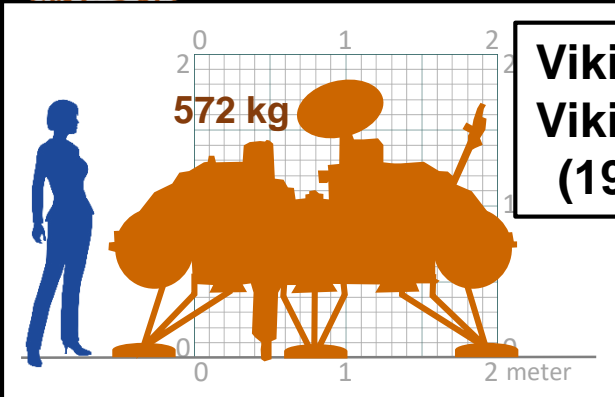
- Fossiel leven?



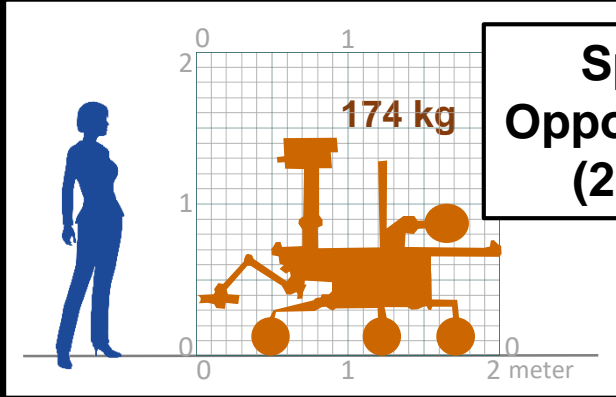


# Buitenaards leven zoeken

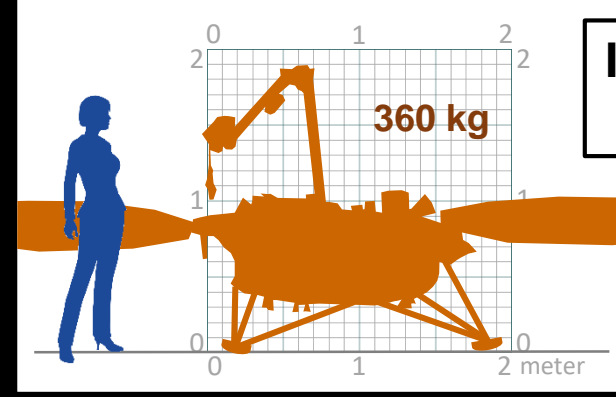
## MARSLANDERS



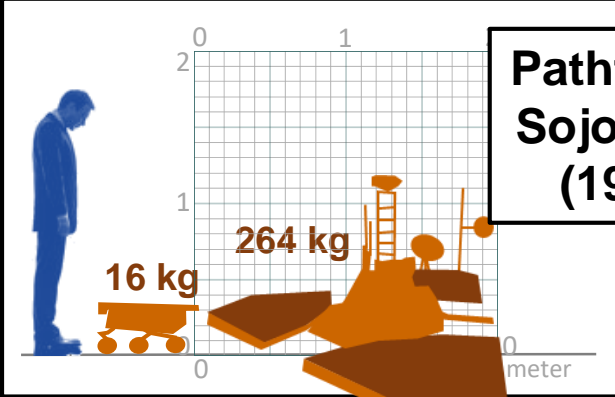
**Viking 1  
Viking 2  
(1976)**



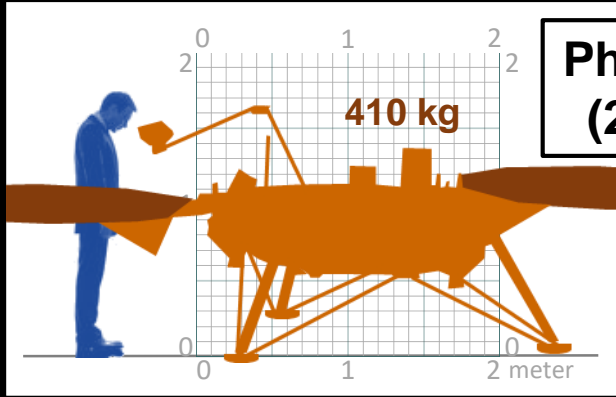
**Spirit  
Opportunity  
(2003)**



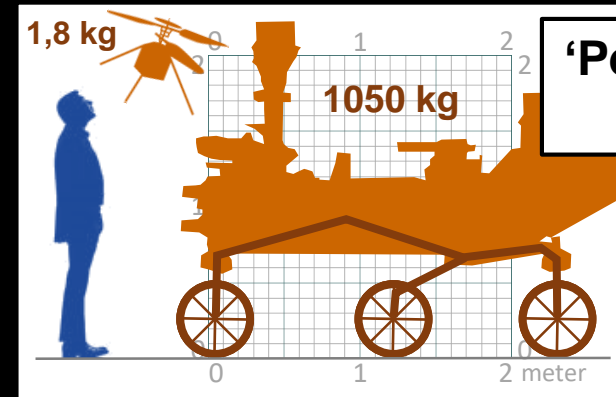
**INSIGHT  
(2018)**



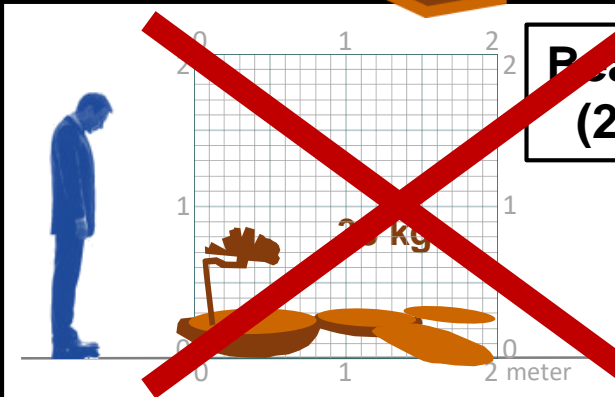
**Pathfinder  
Sojourner  
(1996)**



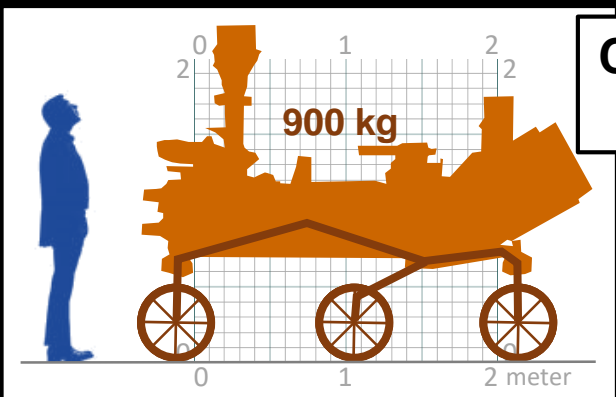
**Phoenix  
(2008)**



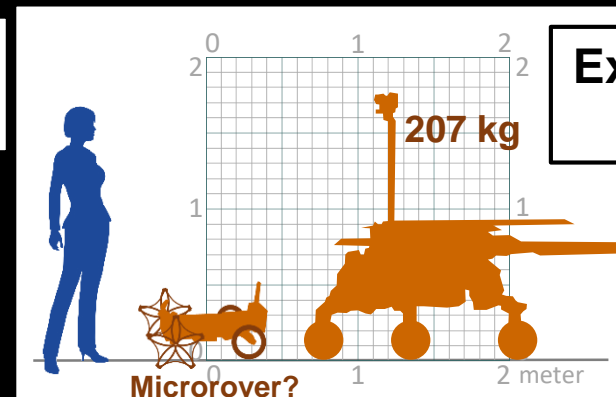
**'Perseverance'  
(2021)**



~~**Beagle 2  
(2003)**~~



**Curiosity  
(2012)**



**ExoMars rover  
(2021)**

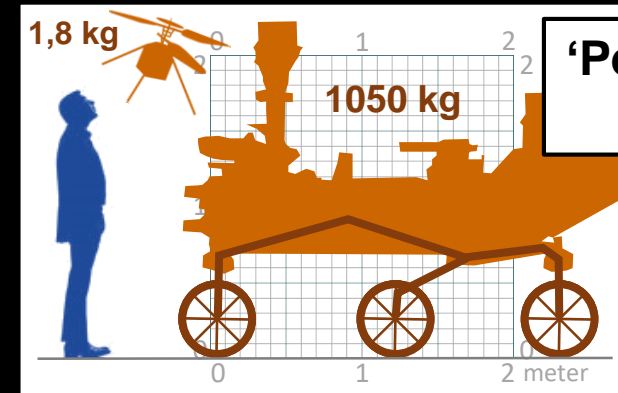
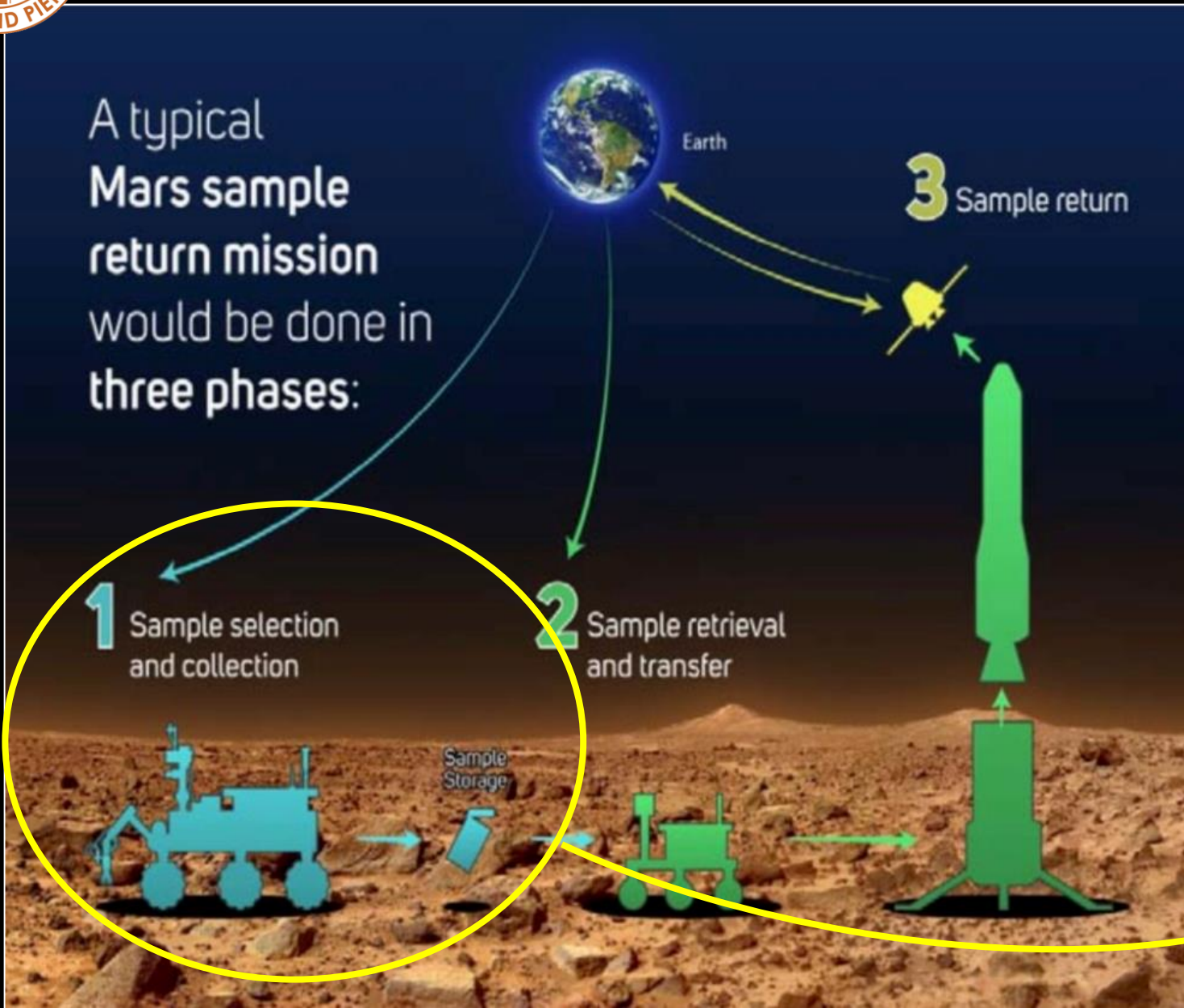


A typical Mars sample return mission would be done in three phases:

**1** Sample selection and collection

**2** Sample retrieval and transfer

**3** Sample return

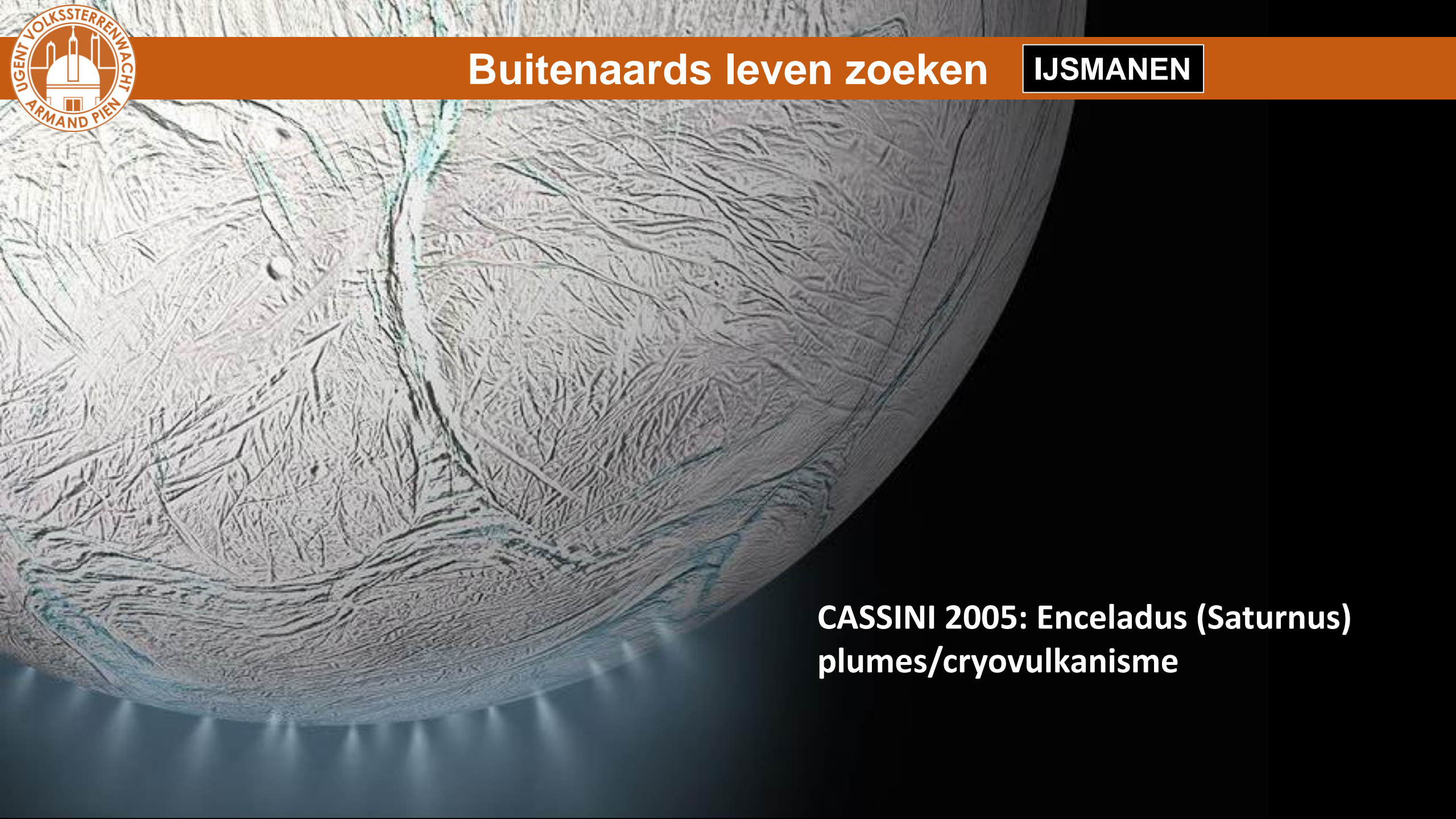


**'Perseverance'**  
(2021)



# Buitenaards leven zoeken

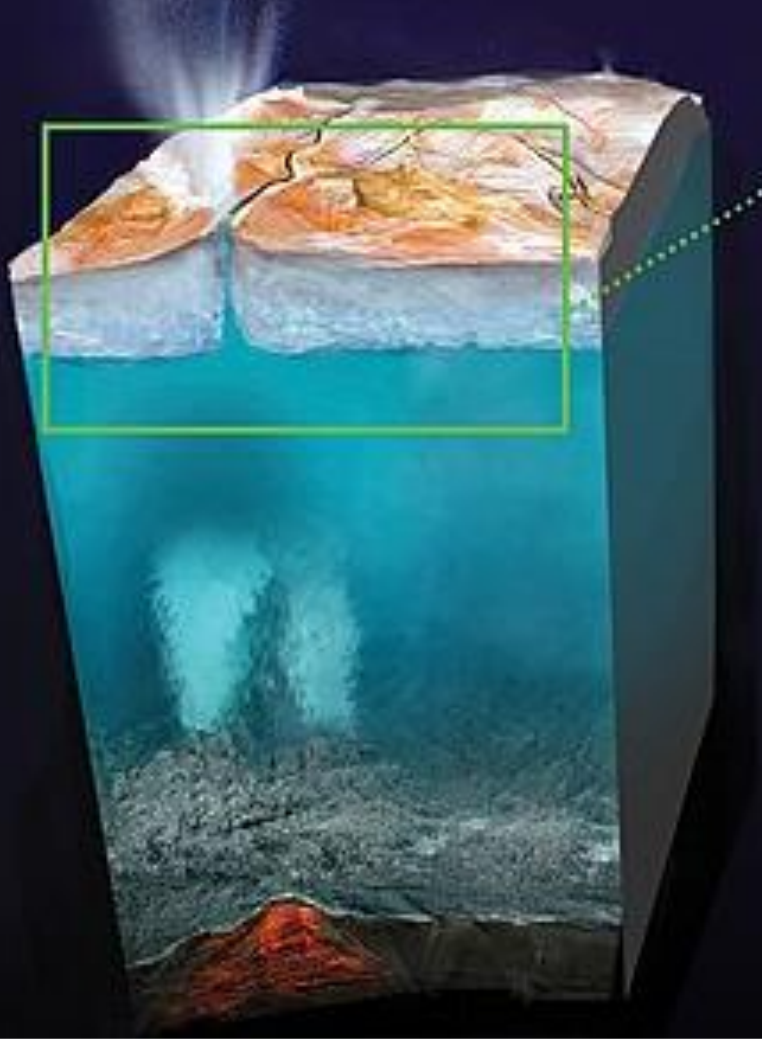
IJSMANEN



**CASSINI 2005: Enceladus (Saturnus)  
plumes/cryovulkanisme**



### Europa Maan

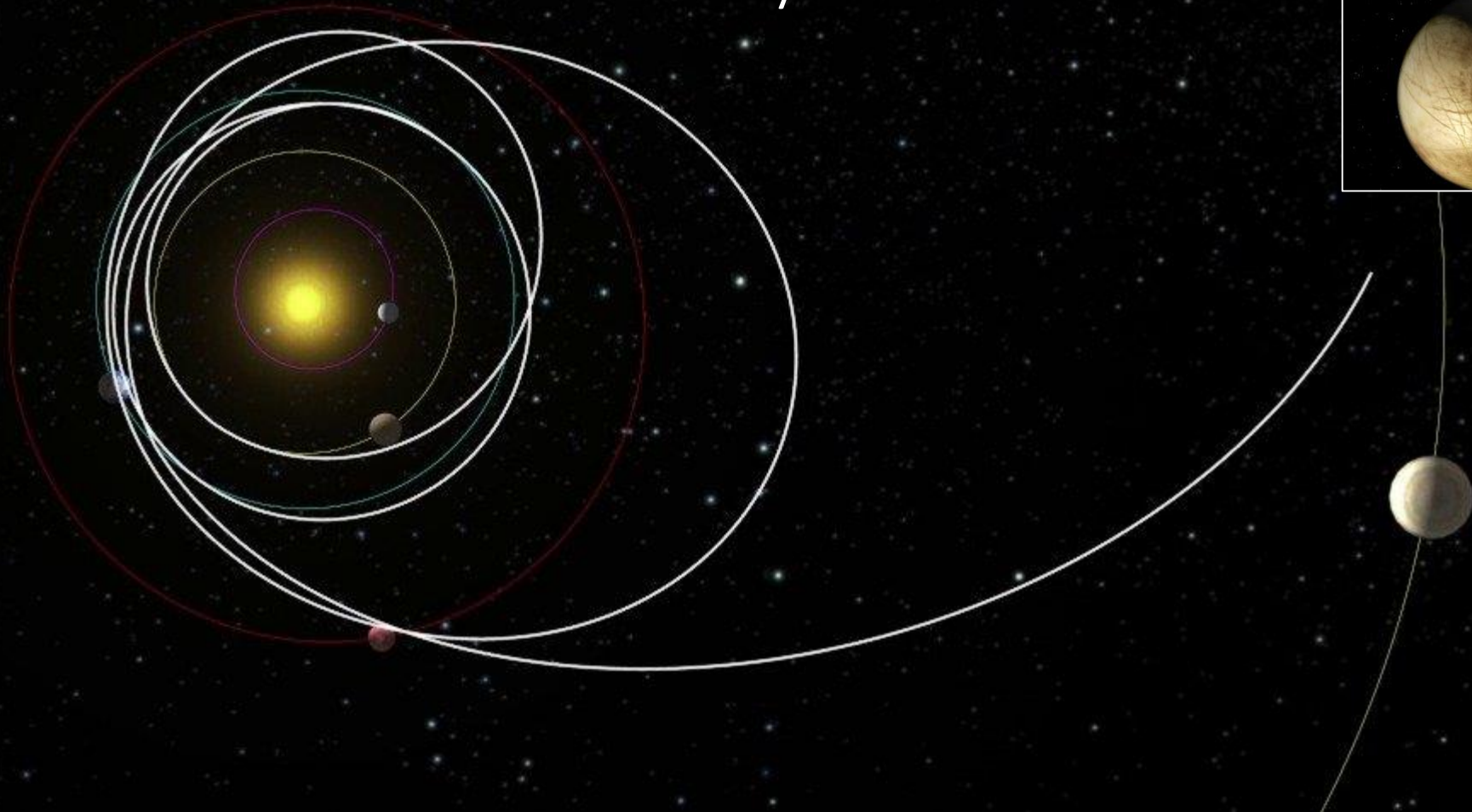


### White smokers Lost City (Aarde) Pacific -3/-4 km



### JUICE (ESA)

- Vertrek 2022
- Europa/Ganymedes/Callisto 2030
- Ganymedes satelliet 2032





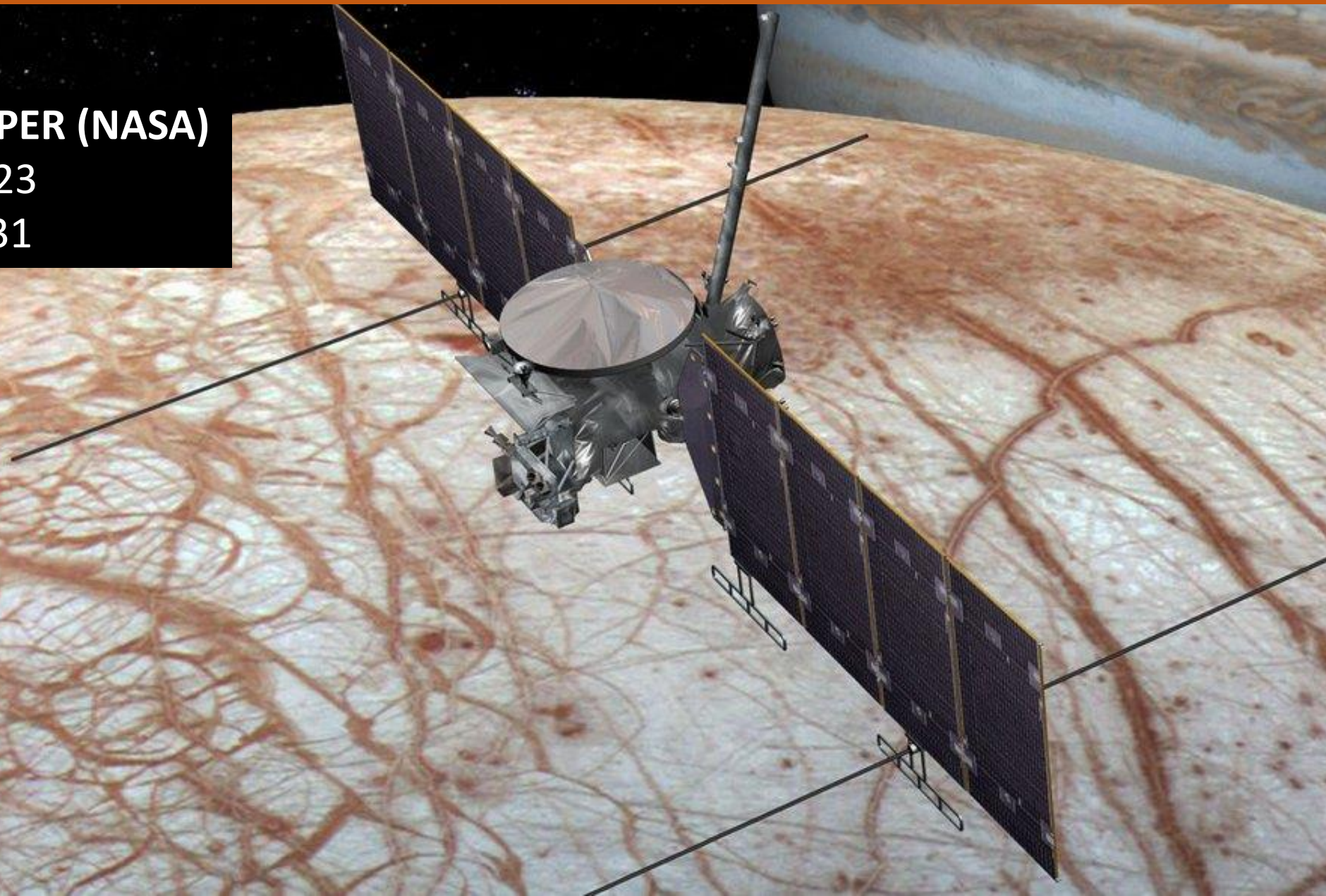


# Buitenaards leven zoeken

IJSMANEN

## EUROPA CLIPPER (NASA)

- Vertrek 2023
- Europa 2031

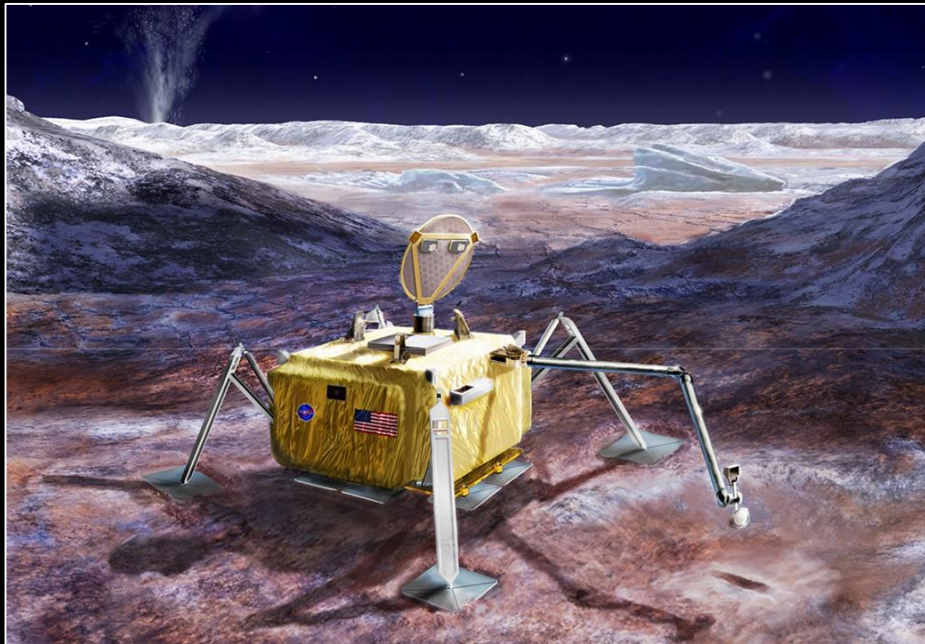




### EUROPA submarine?

#### EUROPA Lander (NASA)

- Vertrek 2025 ? Of 2030 ?

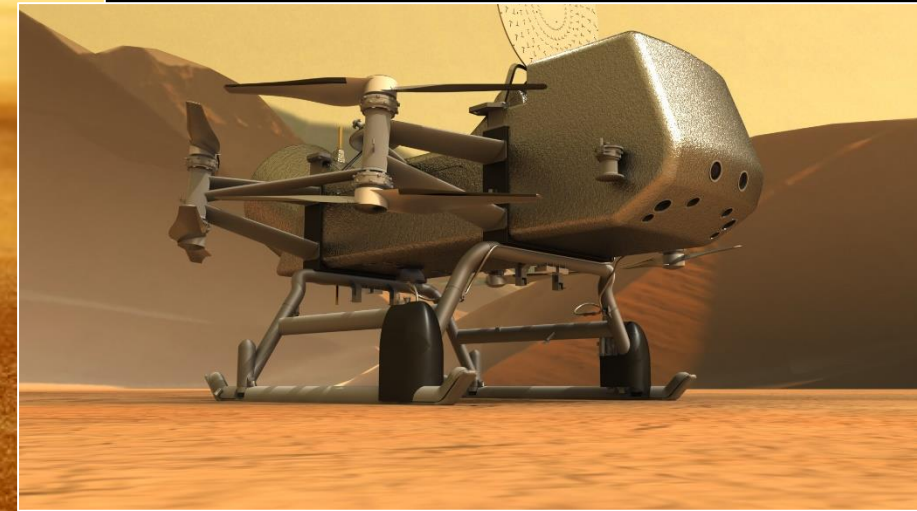
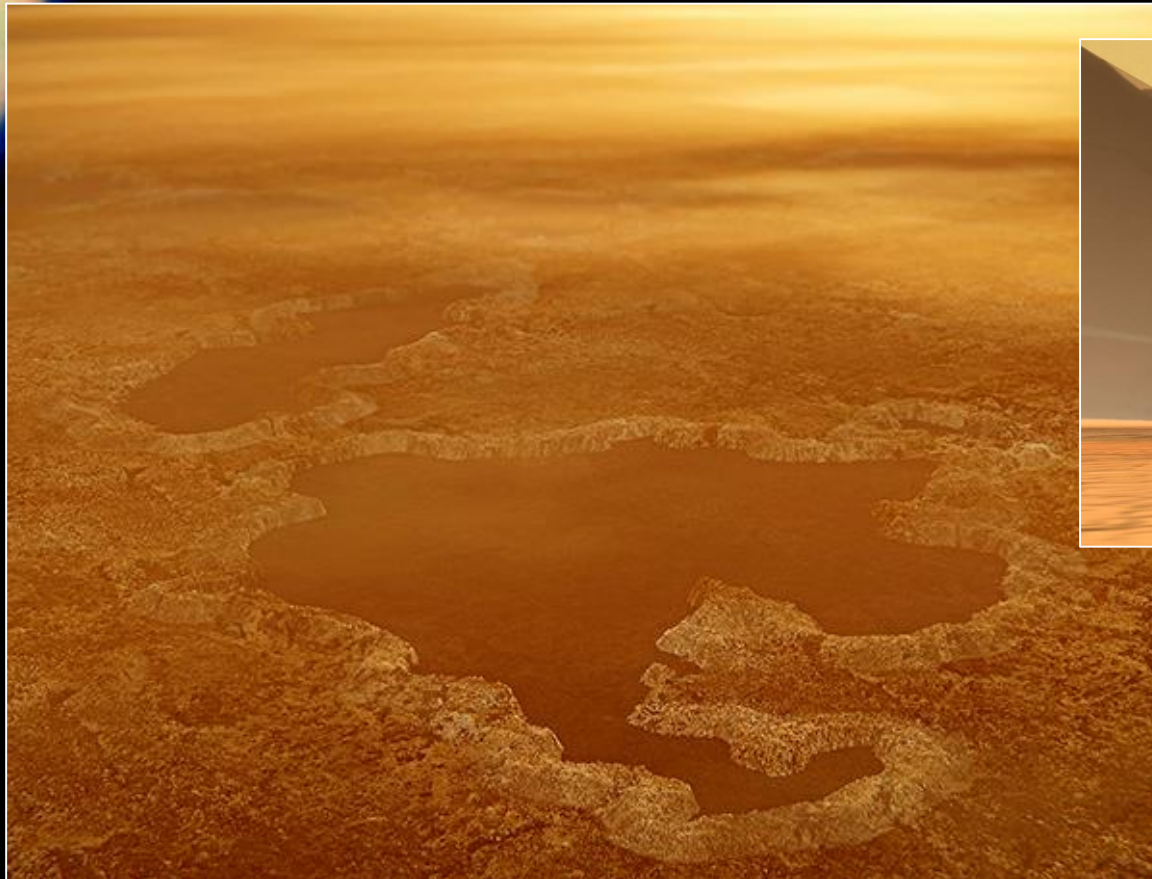




TITAN

**DRAGONFLY**

- Vertrek 2026





# Wat vliegt er zoal boven ons hoofd?

1. Ruimtevaart overzicht
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3. **Bemande reizen:  
Nabije toekomst**

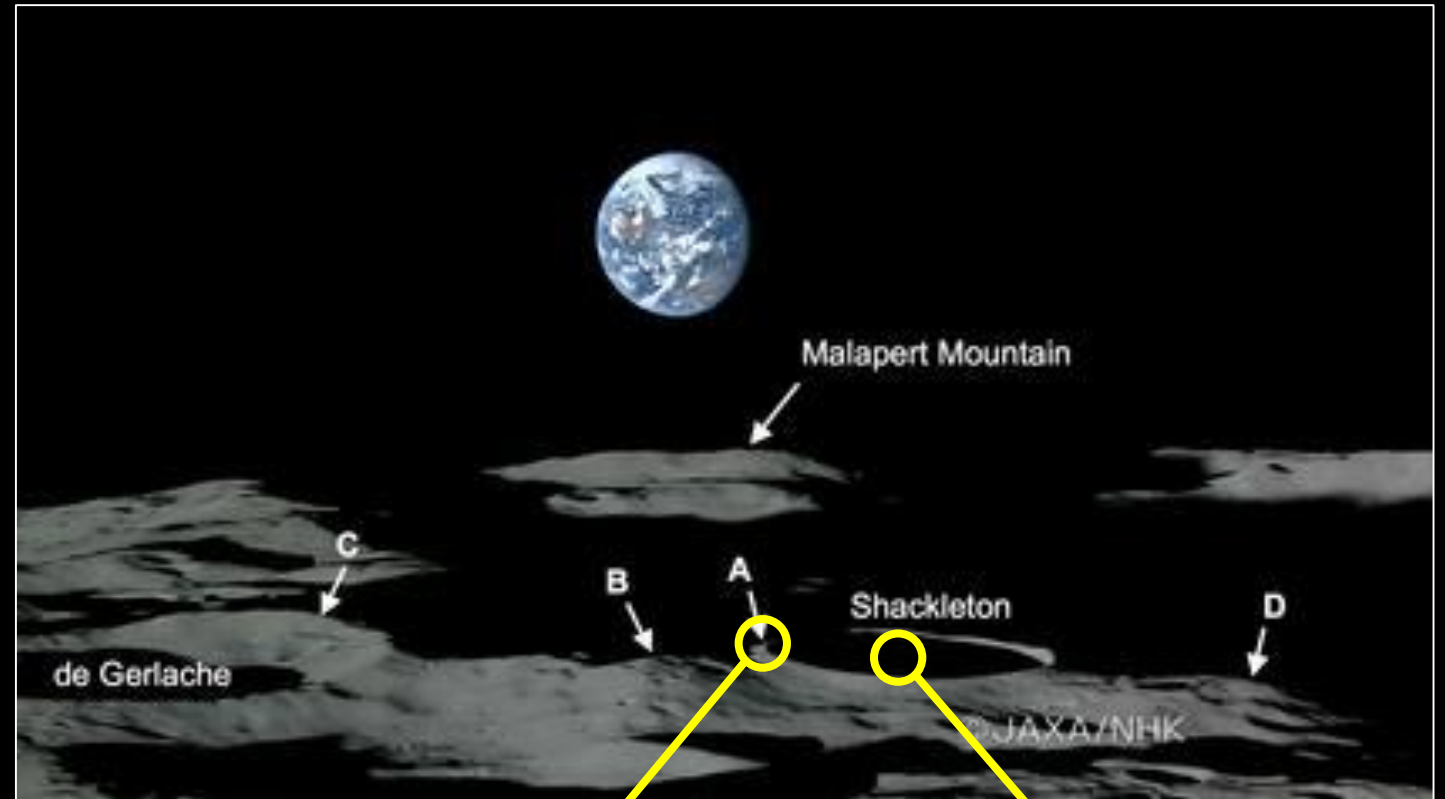


Pieter Mestdagh  
*UGENT Volkssterrenwacht Armand Pien*  
10 maart 2020



# Maanprogramma 2020-2030

## Maan Zuidpool



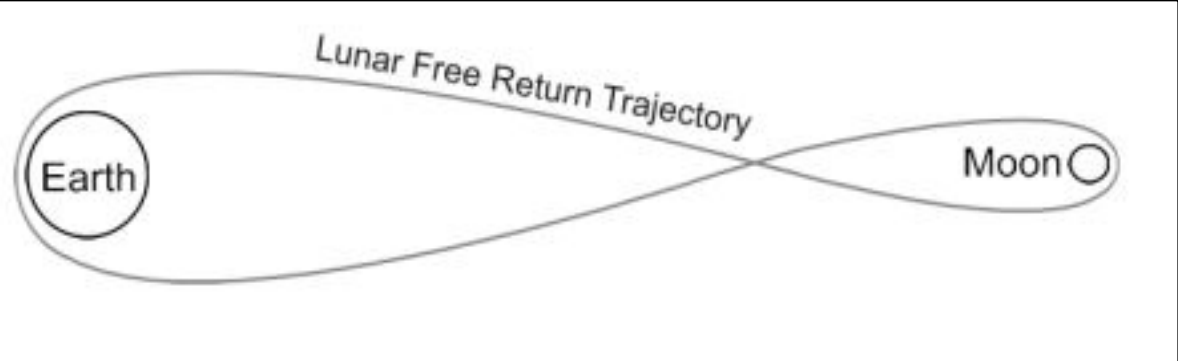
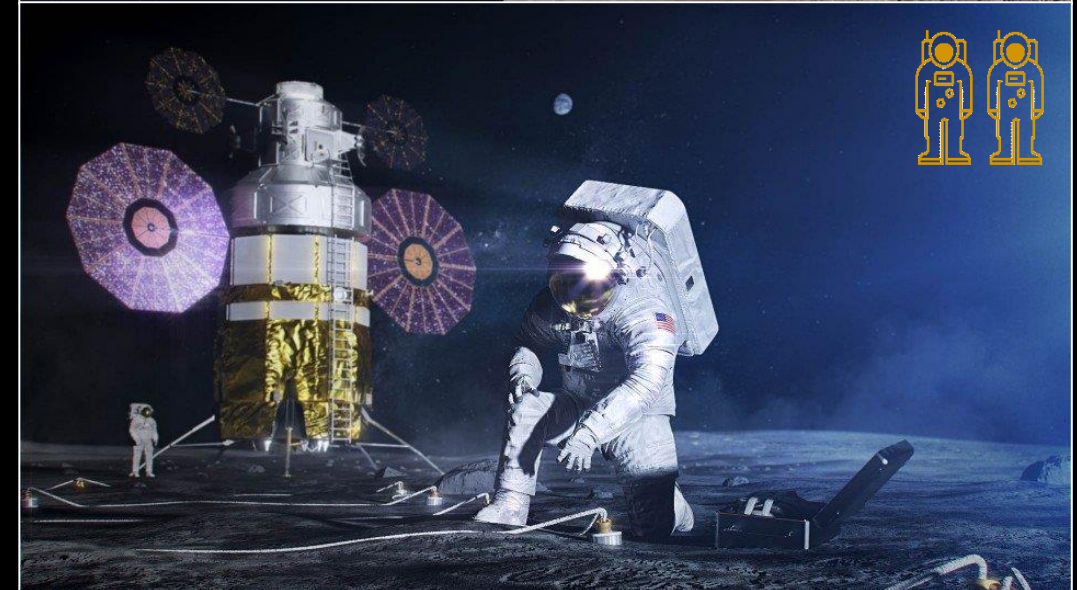
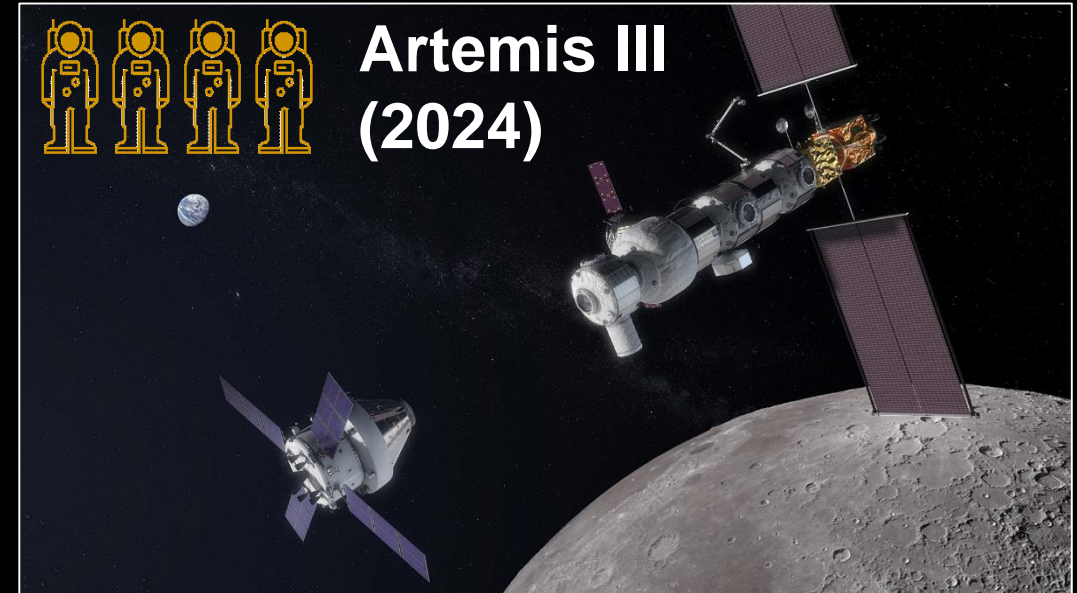
Peaks of eternal light

Craters of eternal darkness

# Maanprogramma 2020-2030

**Artemis I  
(2021)**

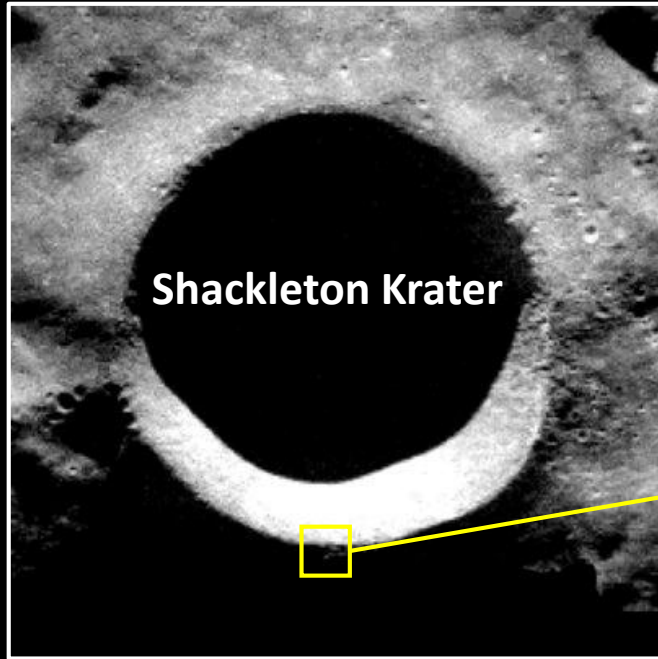
 **Artemis II  
(2022)**





# Maanprogramma 2020-2030

## Moon base (2030)



**Maan = oefening voor Mars**





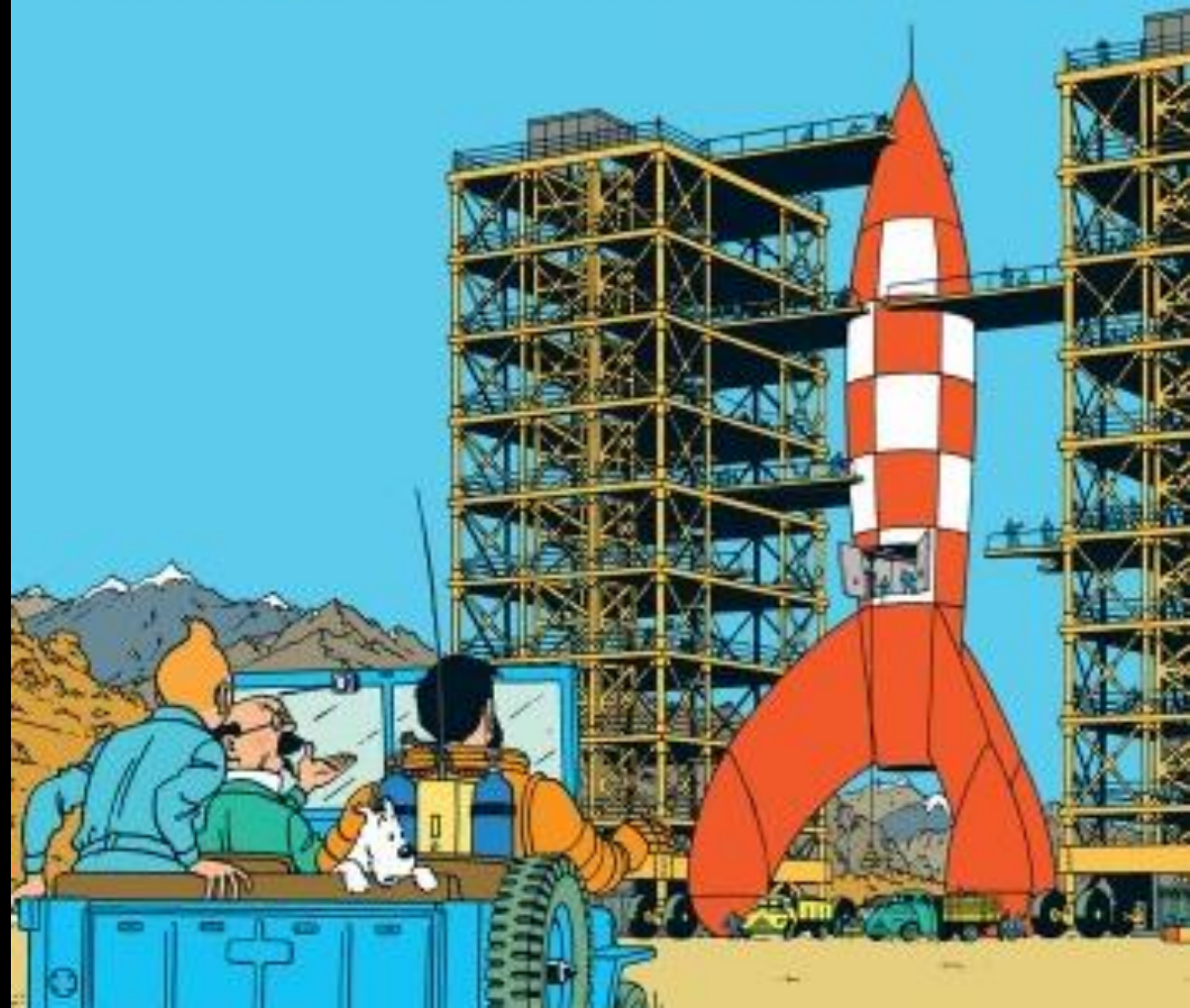
# MARS na 2030



STARSHIP



# OBJECTIF LUNE





# MARS na 2030

