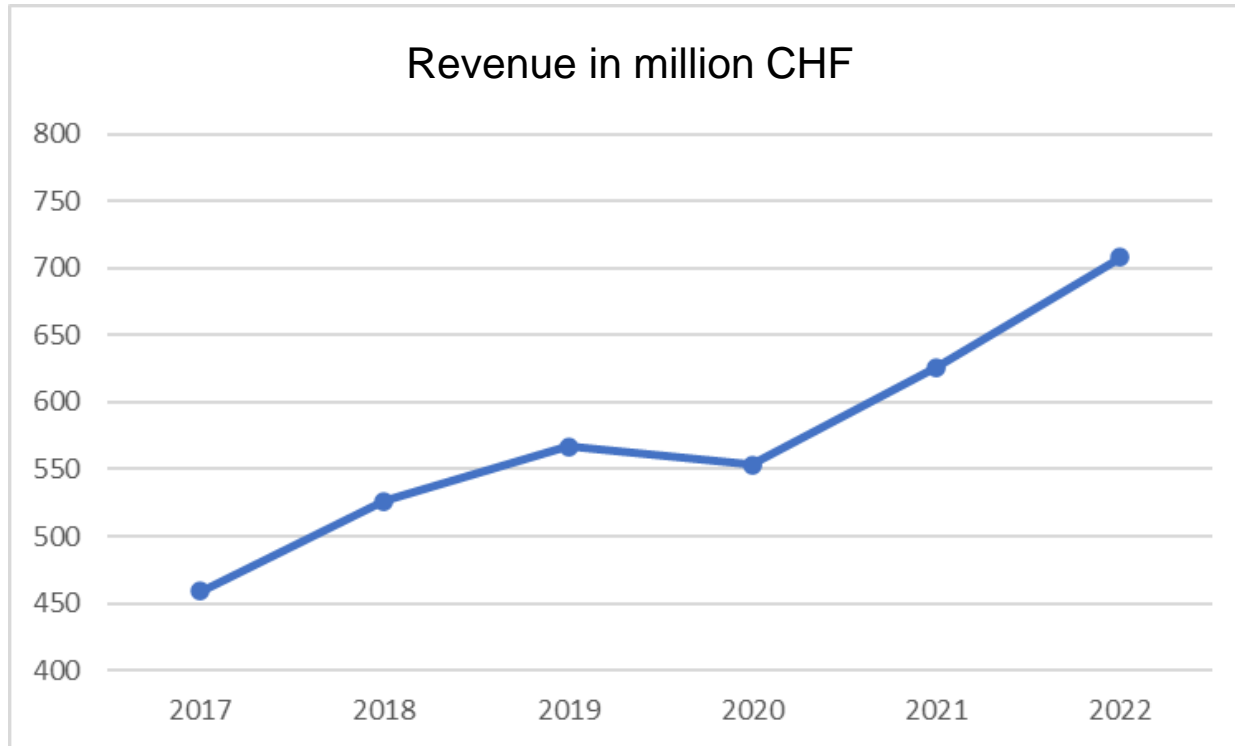




maxon

Over 60 years experience in drive technology

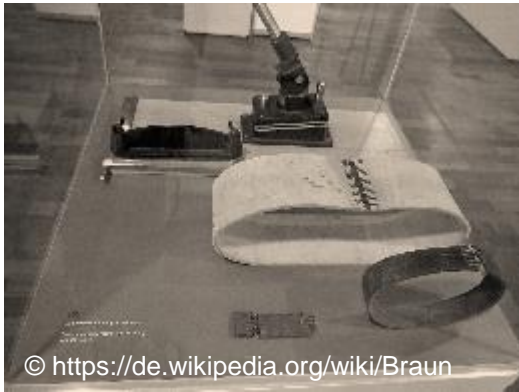
maxon – since 1961



Founded:	1961
Legal form:	Family-owned
Principal shareholder:	Dr. Karl-Walter Braun
Revenue in 2022:	CHF 708 Mio.
Employees:	3,350
Production:	>5 m drives per year
R&D investments:	7% of revenue annually

Innovative Founders

Transmission belt connector
«TRUMPF»



Radios «COSMOPHON»



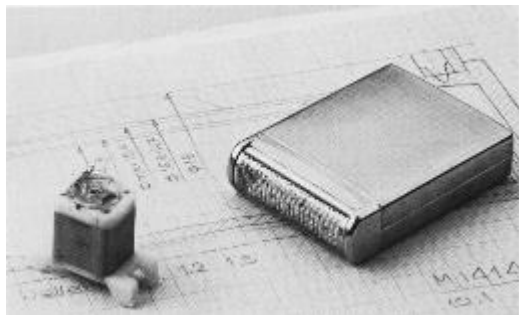
Flashlight «MANULUX»



Shaver
«S50»



Small shaver



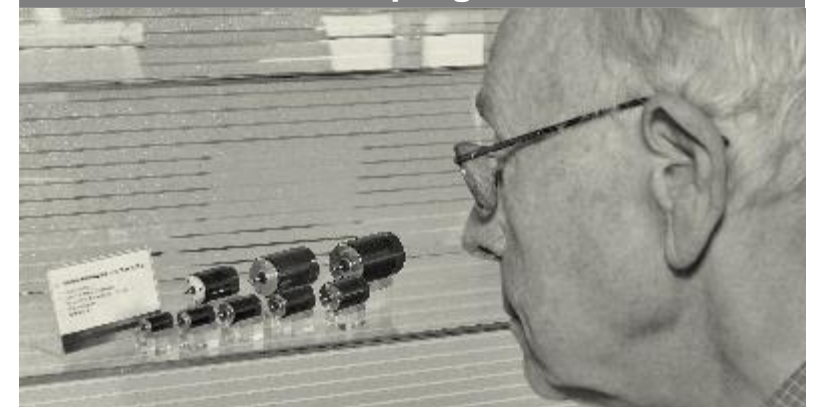
«autarc» device



ST program



Motor program



First applications



Calculator from TI



Video Tape Drive
Video 2000



High End Tape Drive



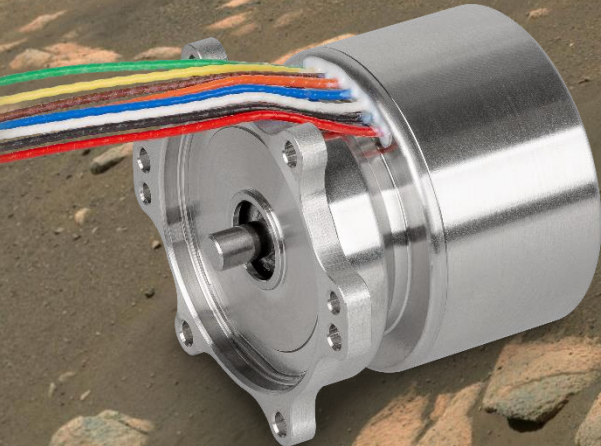
30 years later

**Since 1997, more than 100
of maxon's electric motors
have been used on Mars.**

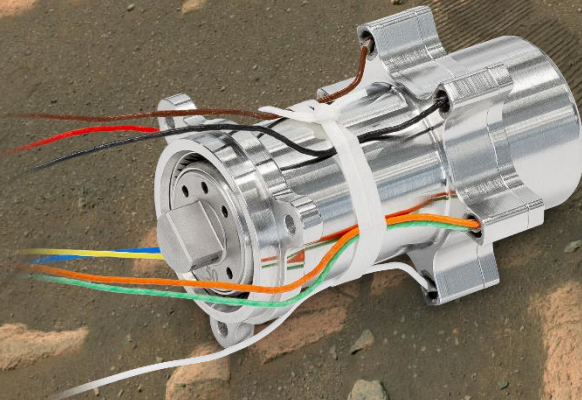
Mars 2020

Perseverance & Ingenuity

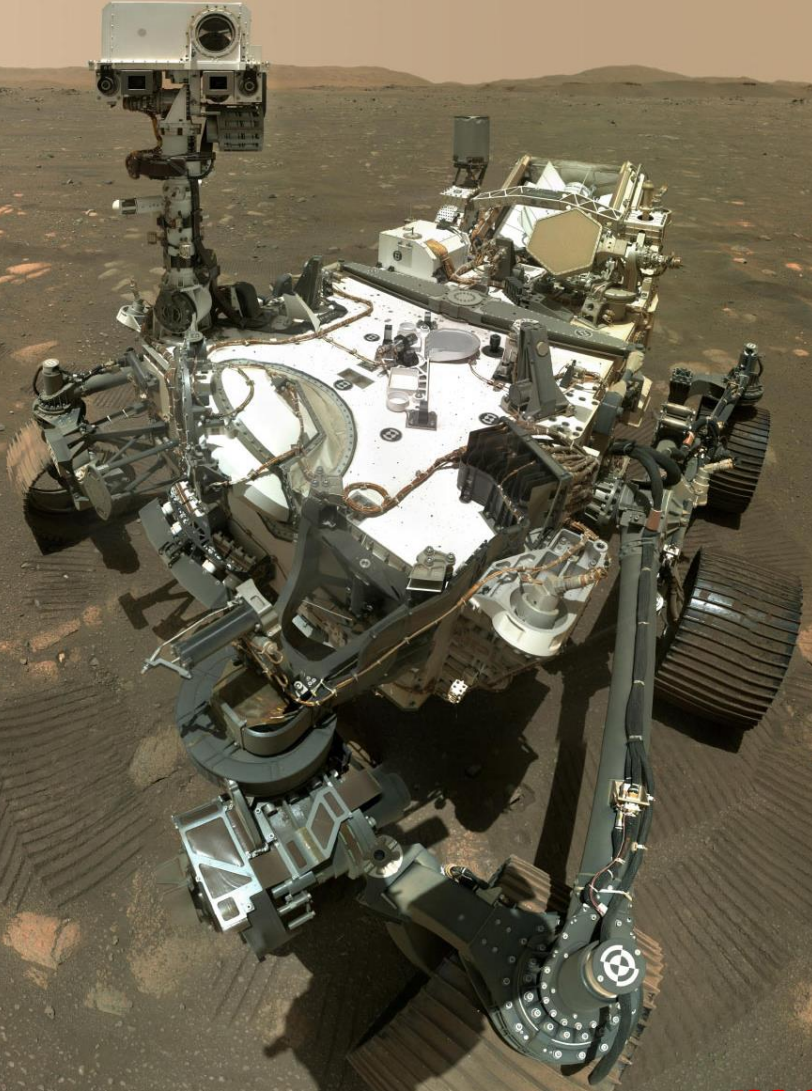
6x DCX10 motors for the helicopter swashplates



9x EC32fl motors + detent brake for the sampling & caching and helicopter deployment mechanisms

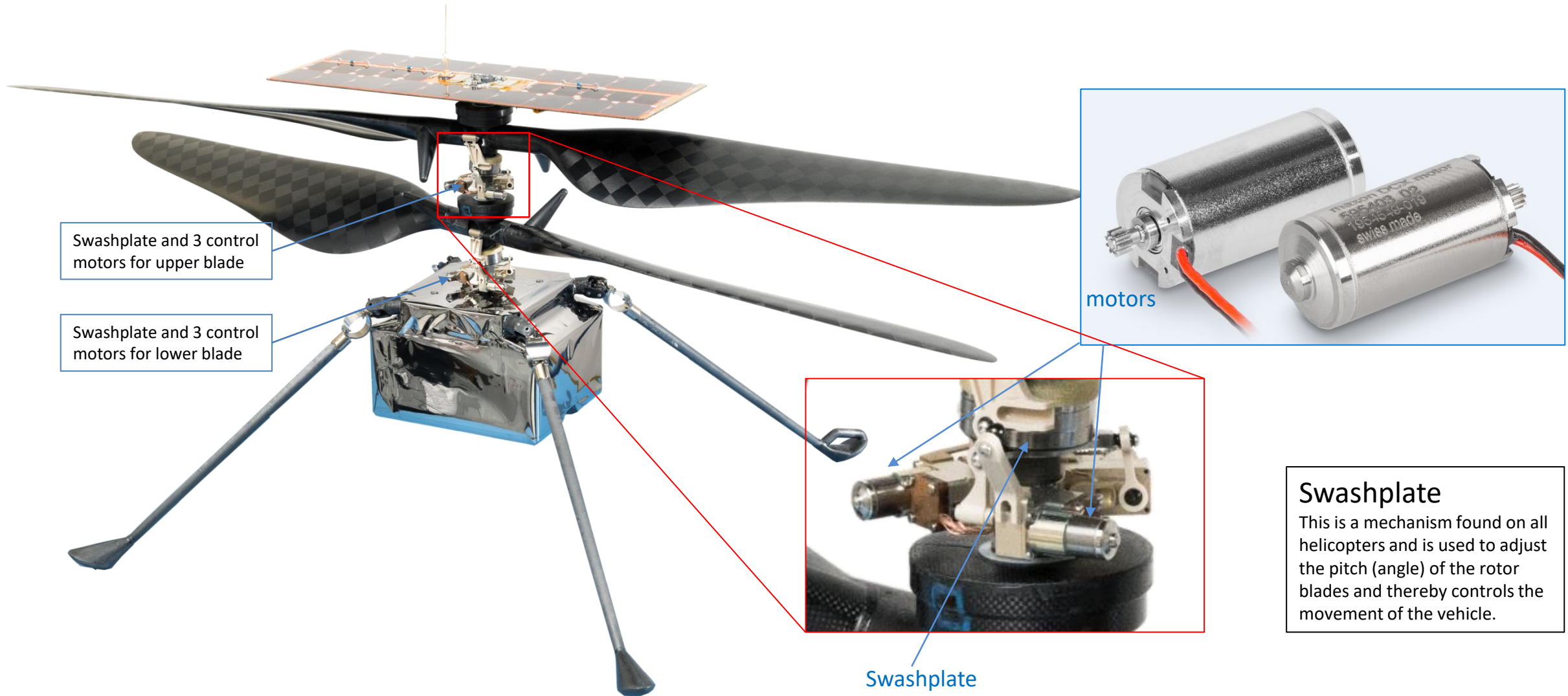


1x EC20fl motor + GP22UP gearbox for sample handling arm end effector



Mars helicopter "Ingenuity"

Six Brushed DC motors (DCX10 S) as swashplate actuators



Swashplate

This is a mechanism found on all helicopters and is used to adjust the pitch (angle) of the rotor blades and thereby controls the movement of the vehicle.

Status
21 Sep 2023

Perseverance
1000 Sol
22.2km

Ingenuity

66 flights

>15km total distance, ~2hr flight time

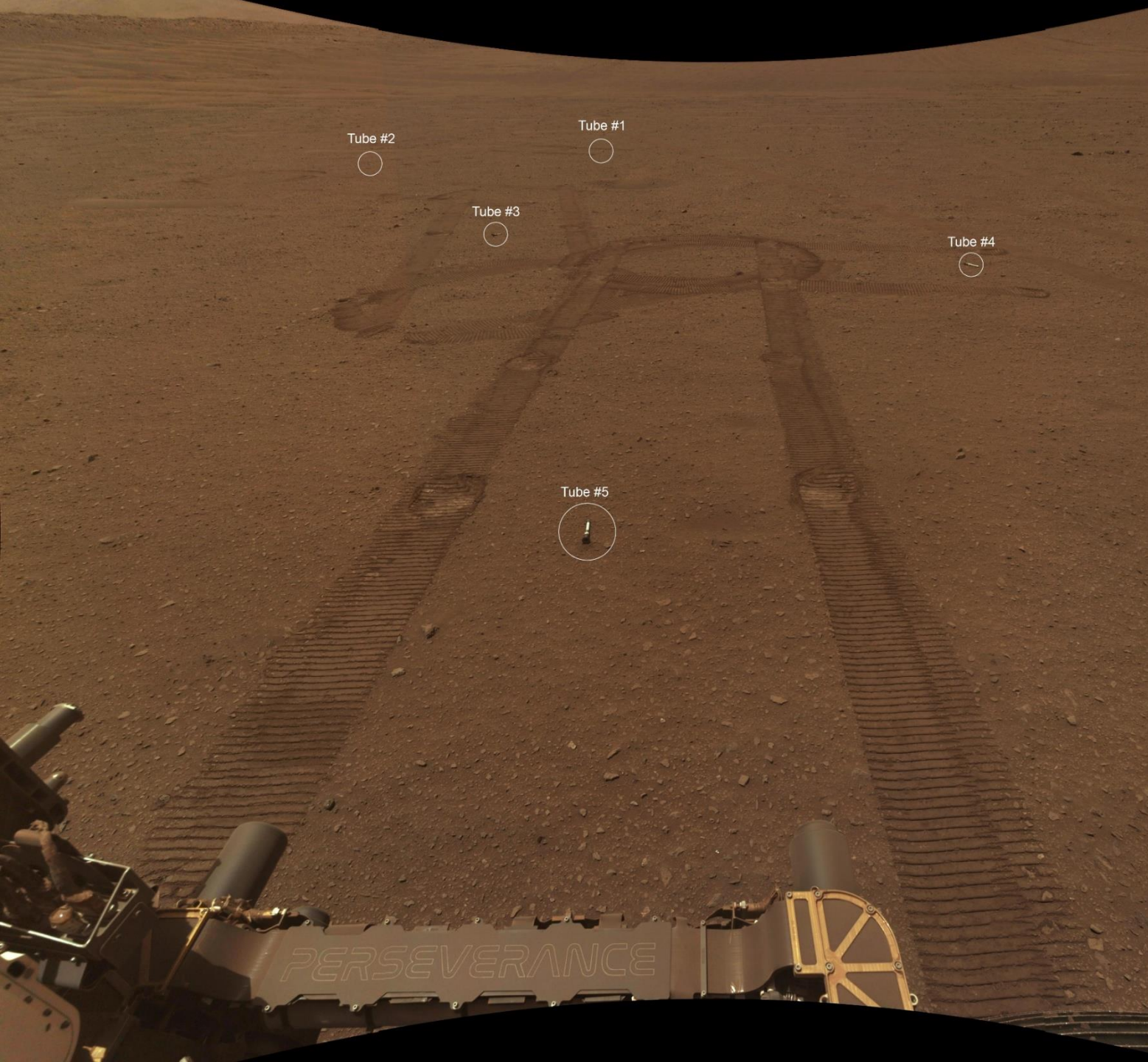




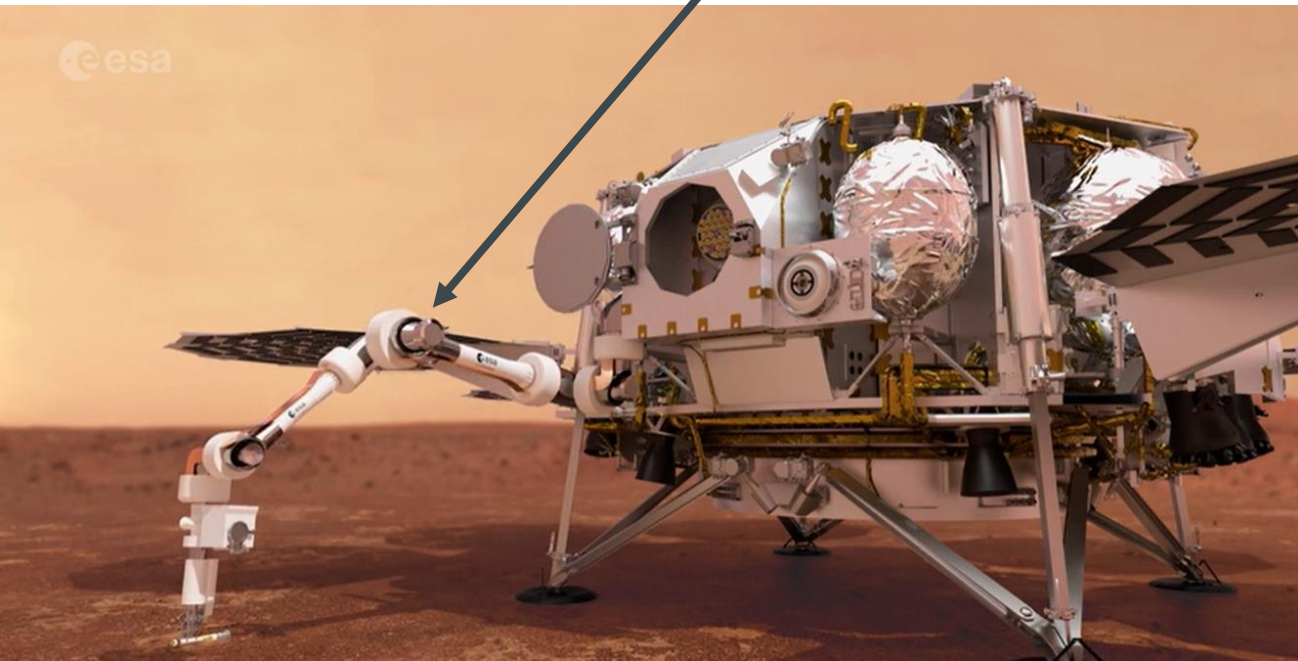
Spectacular aerial views

Helicopter is now sent on "scouting" flights to assess route for rover or decide on science targets



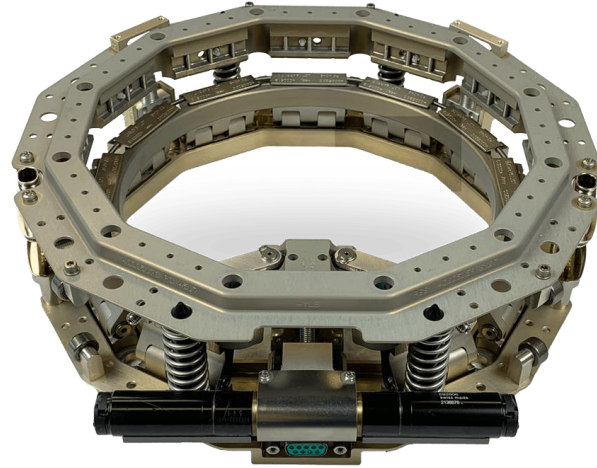


Space Science & Technology Development: Mars Sample Return



maxon

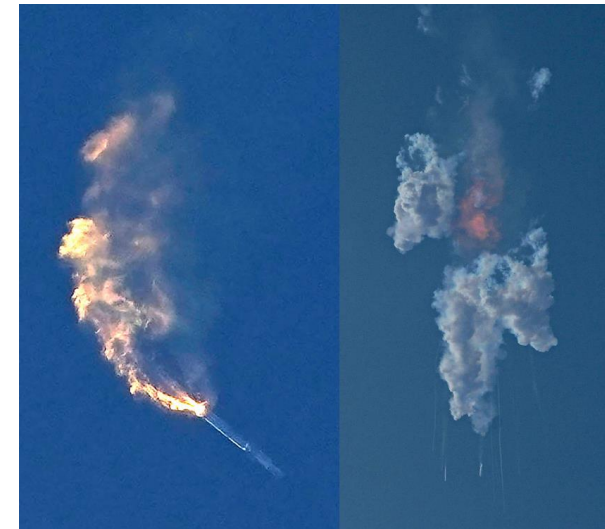
Commercial Space



Solar Array Deployment



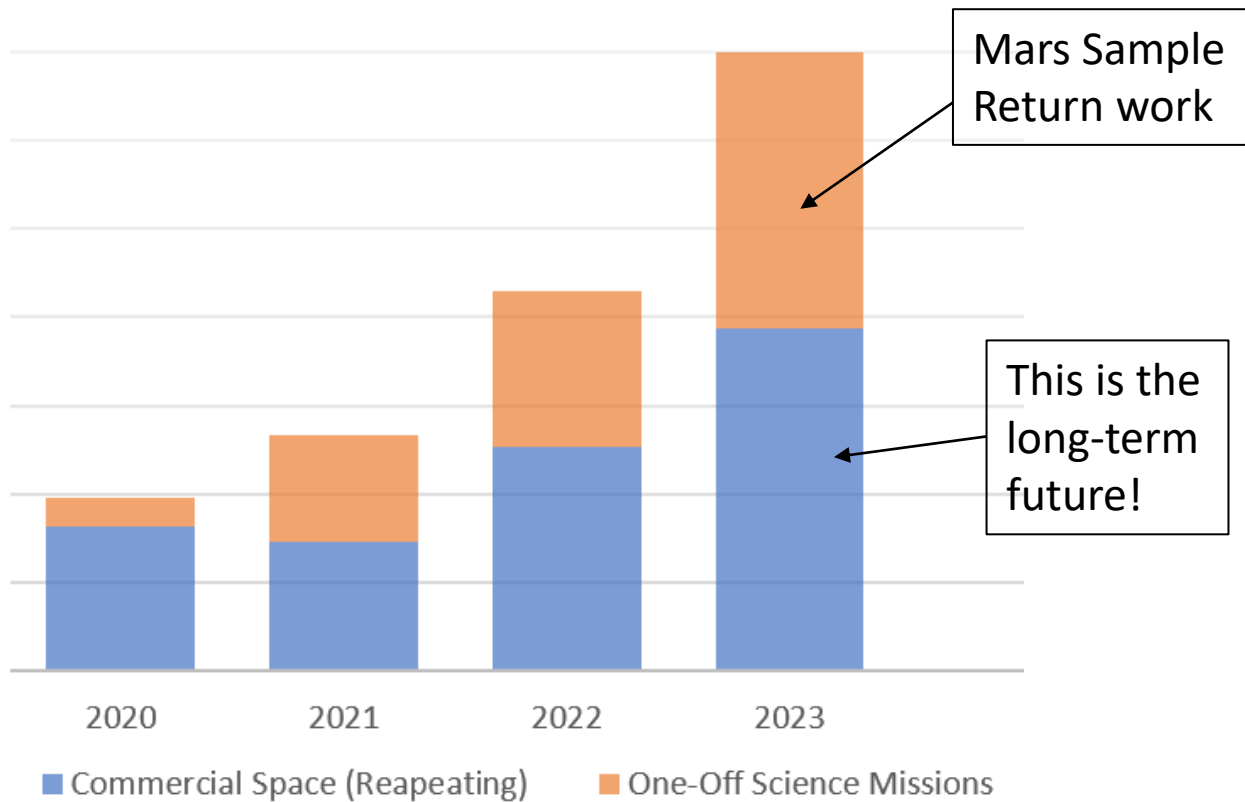
Separation Systems



Flight Termination Systems

Commercial Space

Total Turnover SpaceLab



DCX22+GPX32UP/HD



EC40+GPX42UP



EC20fi+GPX22UP



EC32fi+GPX32UP



ECX8+GPX8



EC32fi+GP22HD

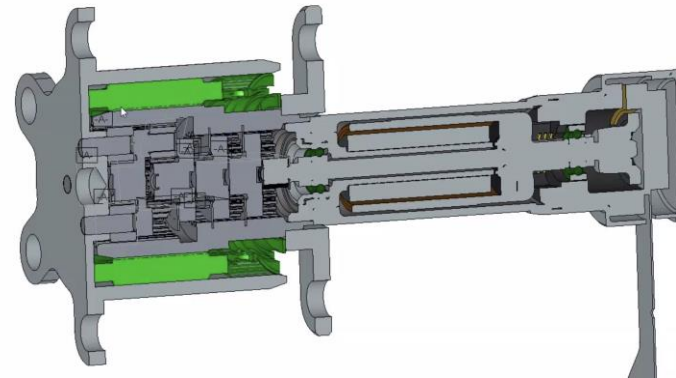
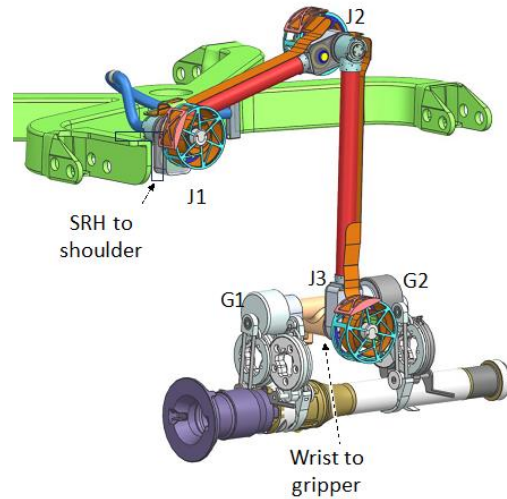
maxon

Why is this market working for maxon?

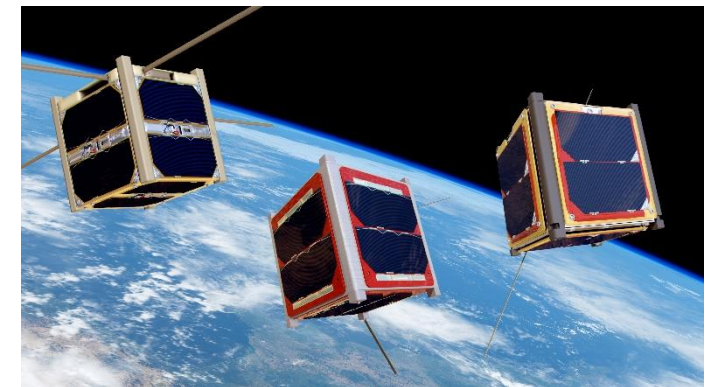
- Increase in market volume requirements
 - More price sensitivity
 - Capacity
 - More variety in motor/gear types
- Our reputation
- Brushed motors for space (!)
- Customer support
- Adjusting our offering to fit the market (standard motors don't work!)
- We're not trying to guess where the market is going

General Strategy

- Get space science (=government) to pay basic product development
- Then transfer qualified product to space catalog and offer to industry



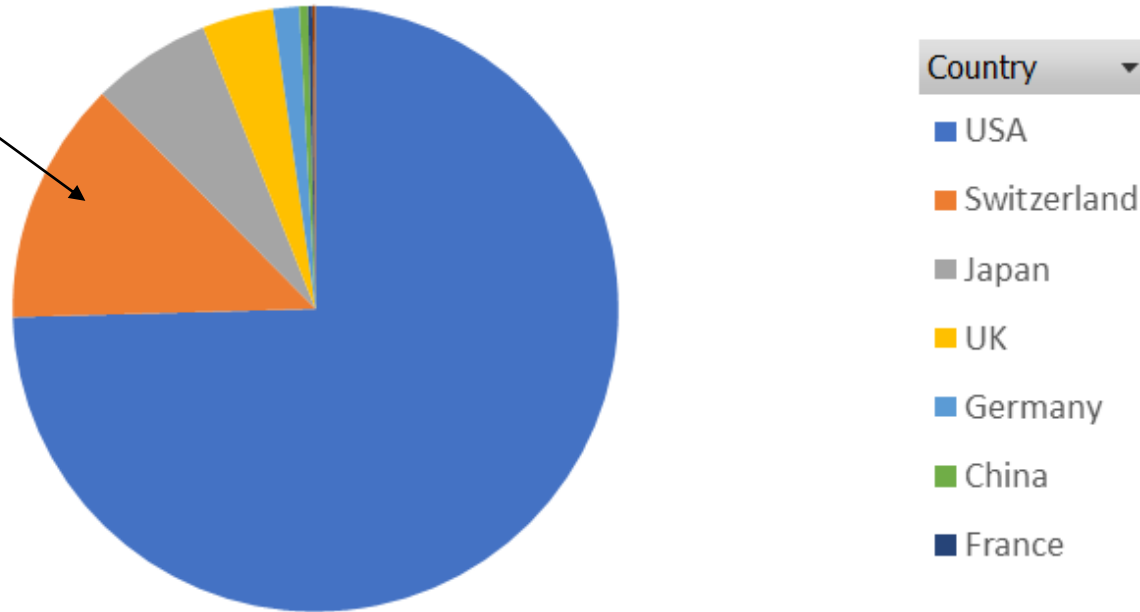
Commercial actuators
for Cube Sats



Where are Europe's Commercial Space Companies?

SpaceLab Turnover in 2022 by region

About 50% of maxon Switzerland turnover is actually from the USA



- The SSO & ESA have historically been very supportive of maxon's attempts to enter the space market
- A rigid adherence in Europe to outdated processes are holding back progress
- More use of industrial standard processes is needed

Why are >80% of maxon's space orders coming from the USA?

Some Suggestions

- Reduce complexity of ESA contracts -> this is not a useful use of resources!
- Don't analyze everything to death
 - Take advantage of "COTS" -> it means industrial heritage exists
 - Get on with building and testing hardware as fast as possible
- Take more risks on new technologies (mitigate the risk by holding traditional solutions in reserve)
- Proof that things work comes from testing (don't ever skip this!)
- Let companies use their own quality control processes (with suitable oversight)
 - "Trust but Verify"
- ECSS* isn't the only acceptable standards system!
 - Eg. IPC, EN9100, etc.

* European Cooperation for Space Standardization

Return to the moon in 2024

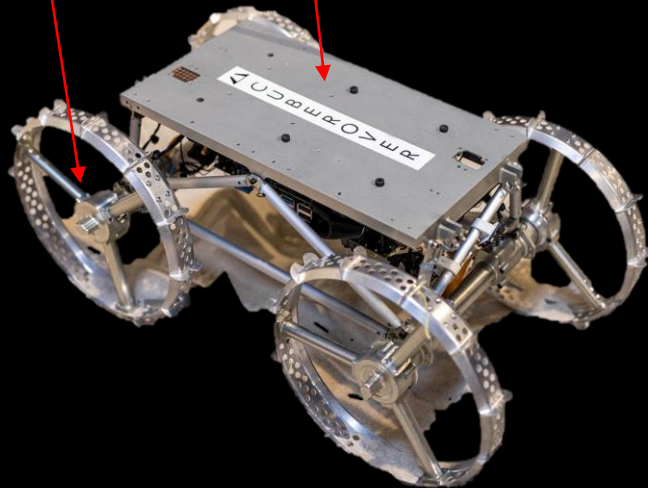
NASA CLPS program



Rocket throttle



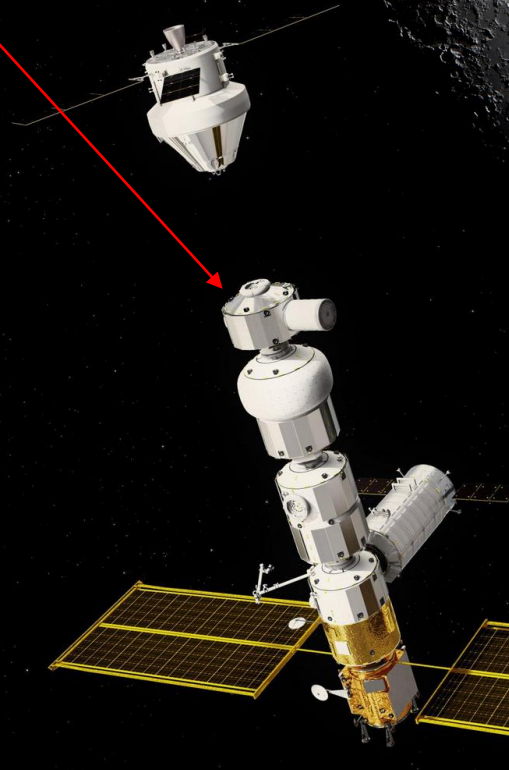
Wheel drive



Solar array drive



Docking mechanism



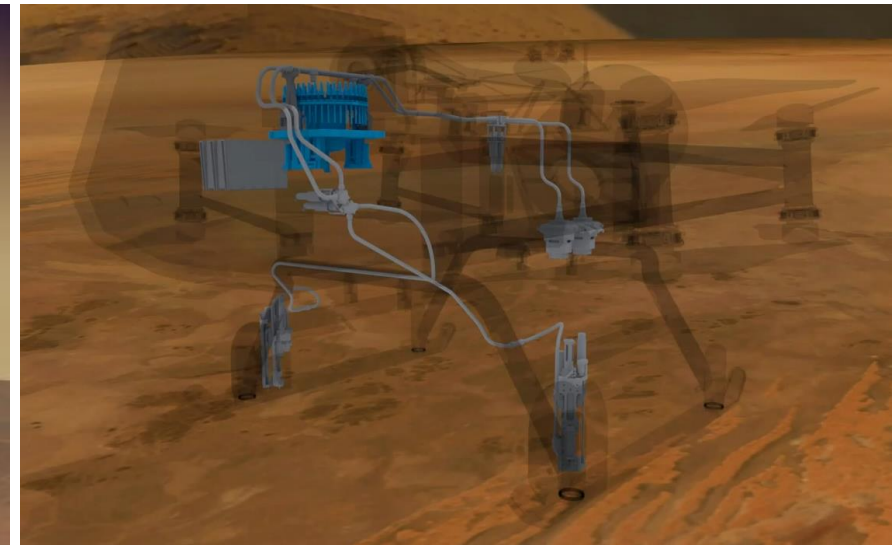
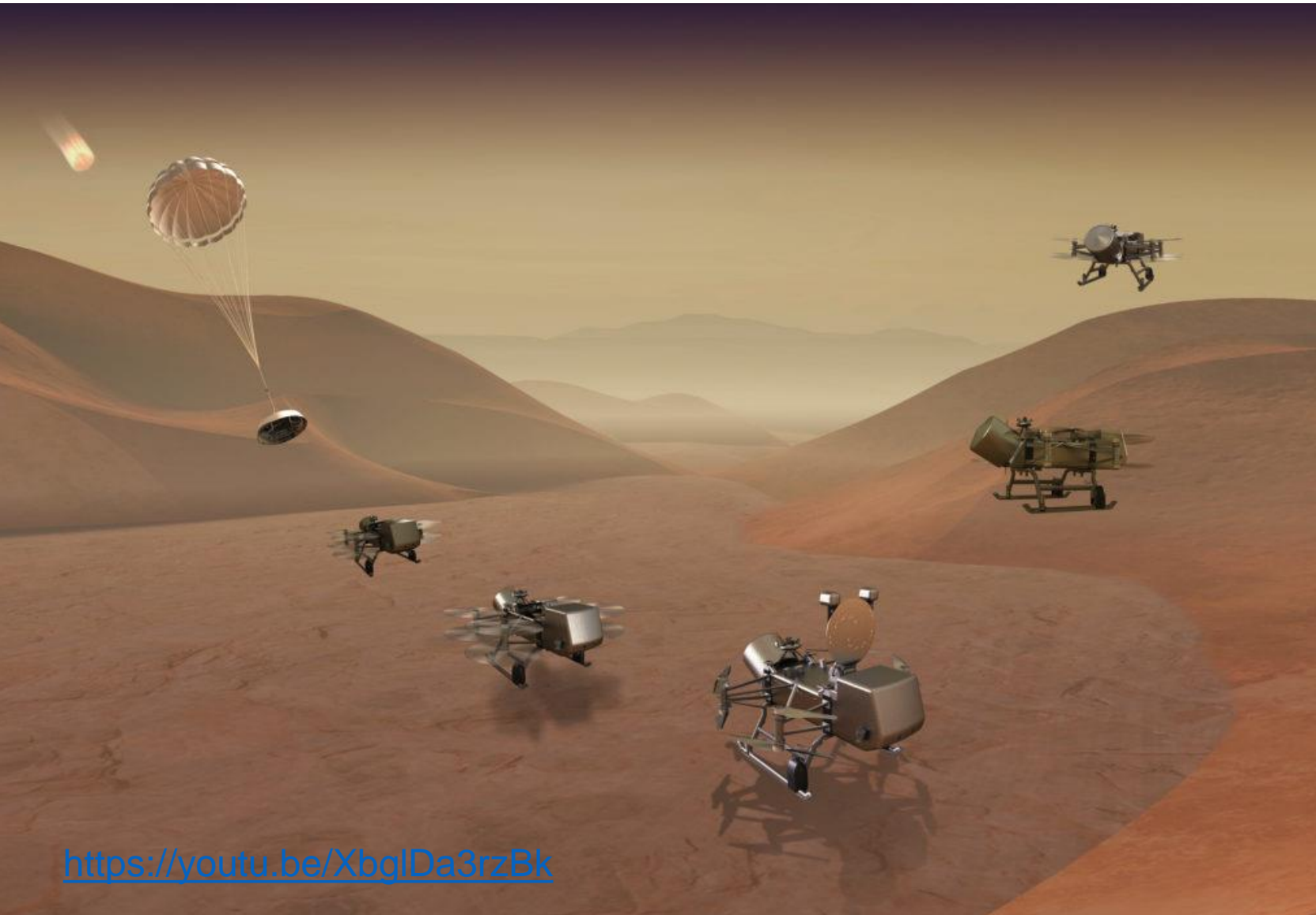
Dragonfly

A Quadcopter for Saturn's moon Titan

Launch: 2027

Landing: 2034

3½ yr primary mission on Titan



maxon

<https://youtu.be/XbqI Da3rzBk>

“Our mission doesn't end here; it launches us into a future where the skies are no longer the limit but a gateway to endless possibilities.”

Same high-tech
Same precision
Same quality

