

CONQUERING SPACE

Sources: Planetary Resources, PwC

USES OF RARE METALS FROM SPACE

- Reduce cost of **electronics**
- Electrify **transportation**
- Preserve the **ecosystem**



ASTEROIDS RICH IN RESOURCES

The asteroid named Ryugu on which Jaxa – the Japanese Space Agency – placed two rovers in September 2018 contains an estimated mineral wealth of **USD 82.7 billion**. These resources could be used for long-term space missions, but also on Earth in the **automotive and medical sectors**

NEAR-EARTH ASTEROIDS

More asteroids discovered near Earth everyday:

- 9,000 asteroids (NEOs)** (near-earth asteroids sharing an orbit similar to Earth)
- 1,500 asteroids** more accessible than the moon

THE MOON – SPACE GATEWAY TO THE FUTURE

The **moon** is the entry point for the exploration of space. The existence of water allows the production of energy and hence, the moon could become a base **for constructing and launching spaceships**



THE SPACE MARKET IN LUXEMBOURG

- 50 companies** of which **6** are public
- 800** skilled jobs
- 1.8% of GDP**, a record within the EU



LUXEMBOURG AND CONNECTIVITY

- 70** active SES satellites orbiting Earth
- 350 million** connected homes
- 1 billion** connected people



THE SPACE SECTOR IN LUXEMBOURG

The exploitation of celestial minerals could generate between **EUR 73 and 170 billion** in turnover worldwide by **2045** and create between **845,000 and 1.8 million jobs**, according to a study by the PwC firm, commissioned by the European Space Agency (ESA) and the Luxembourg Space Agency (LSA)



USES OF WATER IN SPACE

- Rocket fuel
- Oxygen
- Drinkable water



WATER-RICH ASTEROIDS

- One asteroid of **75 meters in diameter** could contain the total fuel – **hydrogen and oxygen** – used for **135** space shuttle launches!
- The average cost of sending **1 litre of water** from earth to space is **EUR 15,000**



- OCTOBER 1957**
The 1st artificial satellite is sent into orbit by the USSR, *Sputnik 1*
- NOVEMBER 1957**
The dog *Laika* is the 1st living being sent into space
- APRIL 1961**
The Soviet Yuri Gagarin becomes the 1st human being to travel into space
- DECEMBER 1962**
A probe, *Mariner 2*, flies over another planet for the 1st time: Venus
- MARCH 1965**
The Soviet Aleksei Leonov is the 1st man to walk in space
- JULY 1969**
Landing of *Apollo 11*. The Americans Neil Armstrong and Edwin Aldrin are the 1st men to walk on the moon
- JULY 1976**
The American probe *Viking 1* successfully lands on Mars for the 1st time
- DECEMBER 1979**
1st launch of Ariane 1
- APRIL 1981**
1st takeoff of the American space shuttle *Columbia*
- FEBRUARY 1986**
1st element of the Soviet space station *Mir* is placed in orbit around Earth
- APRIL 1990**
The *Hubble* space telescope, developed by NASA and ESA, enters into orbit
- NOVEMBER 1998**
Start of the assembly in orbit of the ISS, the international space station
- OCTOBER 2003**
1st manned flight in space by the Chinese Yang Liwei with the *Shenzhou 5* space capsule
- APRIL 2001**
Dennis Tito, 1st space tourist
- MARCH 2004**
The American probe *Opportunity* confirms the existence of traces of water on Mars
- JANUARY 2005**
The European probe *Huygens* lands on Titan
- JULY 2015**
1st flyby of Pluto by the probe *New Horizons*
- JANUARY 2019**
1st landing on the dark side of the moon, by the Chinese module *Chang'e 4*

- 1985**
Creation of SES
- 1988**
Launch of the 1st Luxembourg satellite
- 2005**
Luxembourg becomes the 17th member of the ESA
- 2016**
Launch of the government initiative *SpaceResources.lu*
- 2018**
Launch of the Luxembourg Space Agency (LSA)
- 2019**
Launch of the LSA data centre

Facts & Figures Merkur 04/2019