



SUSTAINABLE SPACE ACCESS  
FOR SATELLITE CONSTELLATIONS

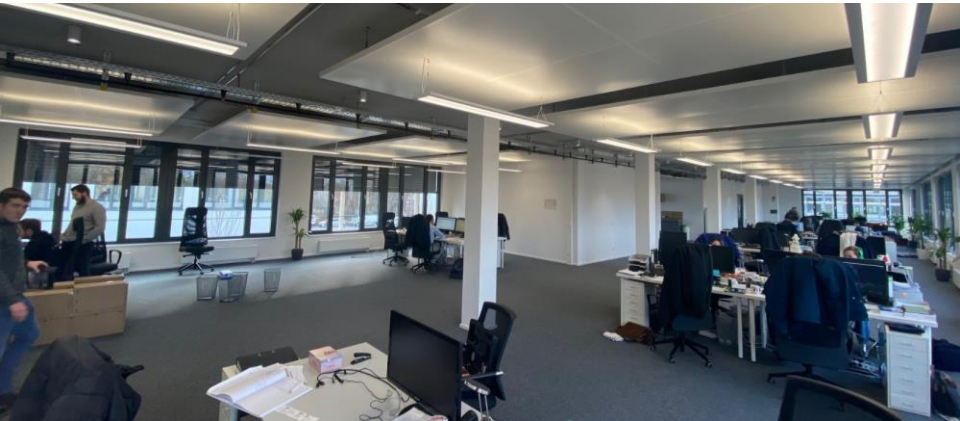
# COMPANY OVERVIEW

45 ↗

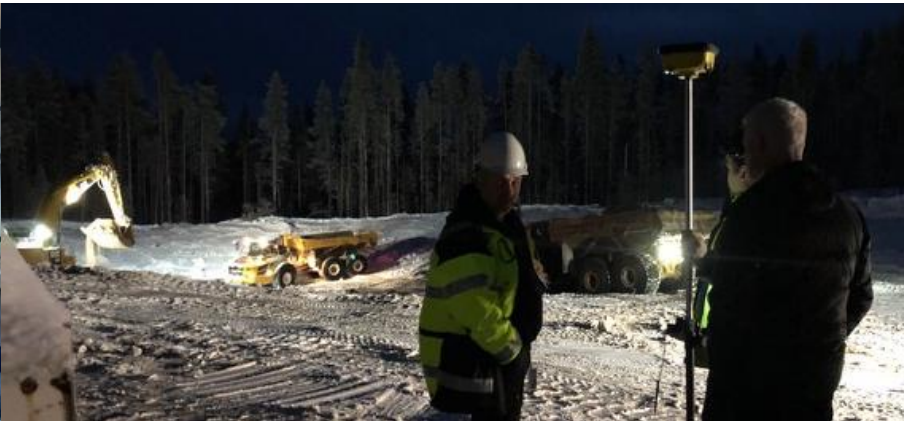
highly motivated  
employees

€15M+

private funding from  
world-class investors



Ottobrunn, DE  
Engineering & management HQ



Kiruna, SE  
Engine and stage testing



Bavaria, DE  
Component and assembly testing



# ENTOURAGE



**Bulent Altan**

Mynaric Co-CEO  
VP Avionics&GNC, SpaceX  
VP Innovation, Airbus



**Clemens Kaiser**

Director of Development,  
EUMETSAT  
COO, Kayser-Threde



**Lin Kayser**

CEO, Hyperganic  
Director of  
Engineering, Adobe



**Robert Schmucker**

Prof. for rocketry & spaceflight  
Director of Development,  
BayernChemie

Investors



BULENT ALTAN





# POWERFUL LEGACY

Prof. Harry Ruppe

Core team member to build Saturn V

|

Prof. Robert Schmucker

Founded WARR in 1962 to advance  
rocket engineering in Germany

|

Isar Aerospace

Spin-off from TUM & WARR to enable  
sustainable access to space



**Humanity's greatest achievement**  
Landing men on the moon and returning  
them safely back to earth.







# STARTING SMALL





# SPACE TECHNOLOGY IN BAVARIA





# BIG AMBITIONS





# COMMERCIAL TRACTION



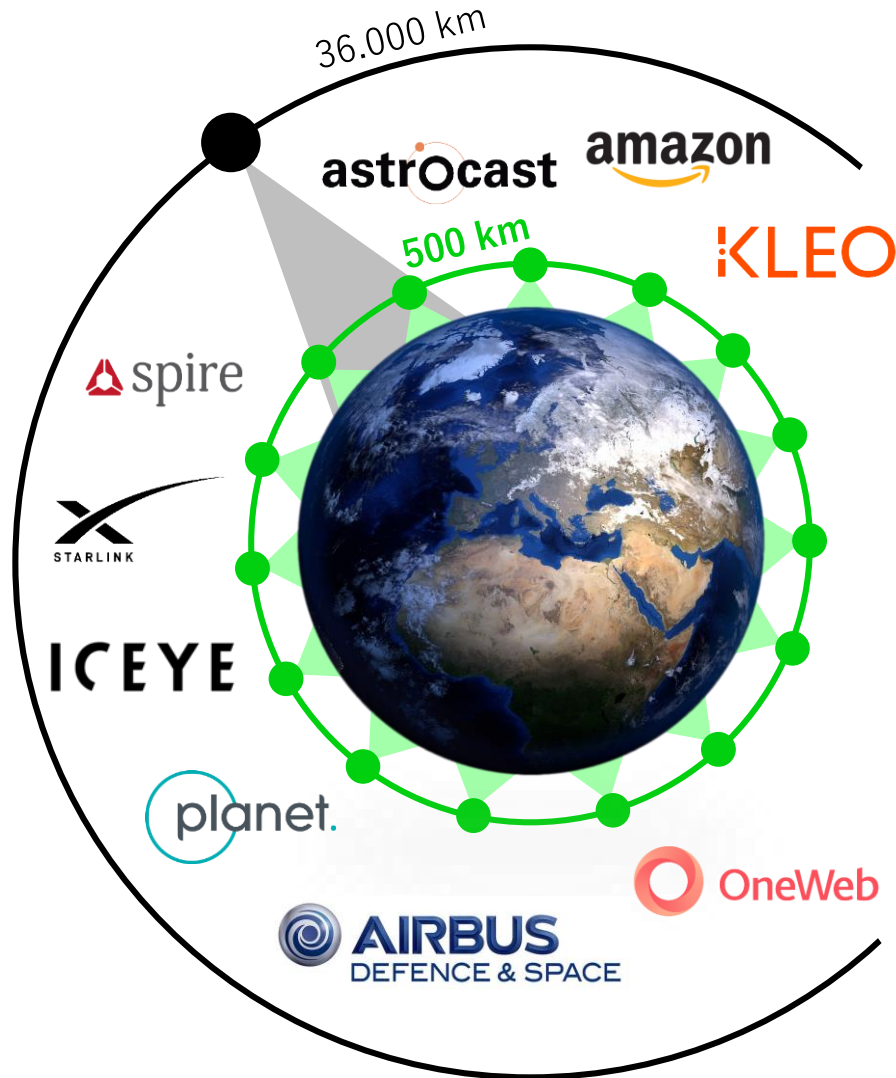
## Airbus and Isar Aerospace sign MoU on low Earth orbit satellite constellation launch solutions

12 Aug 2019

In the fast-moving space industry, launch service provider Isar Aerospace and Airbus Defence and Space have entered a Memorandum of Understanding (MoU) on launch solutions for satellite constellations to low Earth orbit (LEO). The flexible launch solutions offered by Munich-based Isar Aerospace allow Airbus greater launch flexibility and cadence at industry-defining low cost.



# SPACE SYSTEMS ARE ESSENTIAL



## Satellites drive technology advancements

**Telecommunications** Internet & phone services

**IoT devices** Supply chain & logistics, industrial remote sensors

**Agriculture** Precision farming, water monitoring, fertilizer usage reduction

**Earth observation** Weather forecasting, mapping, leakage detection

**Business analytics** Predict revenues, oil prices & plant output

**Security** Pirate search, emergency services, civil protection

...



# TECHNOLOGICAL SHIFT

## Satellite constellations replace one-off satellites



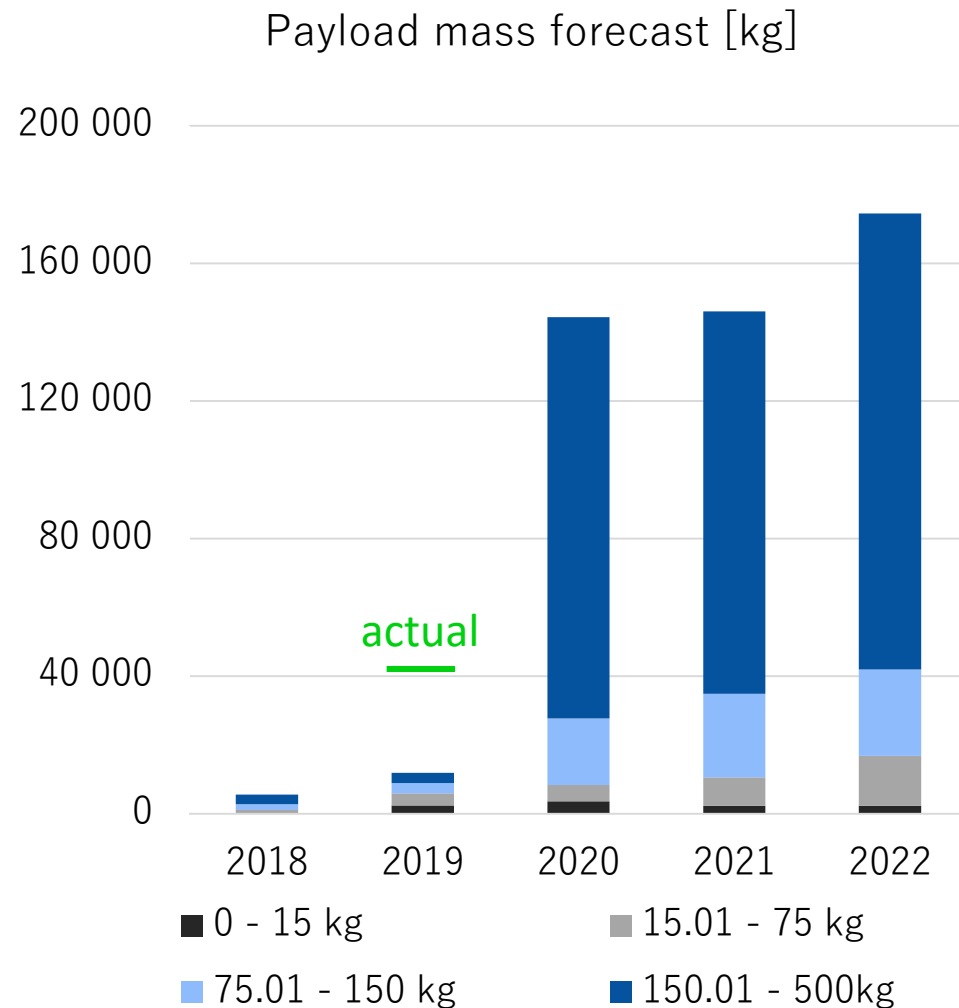
Single satellites  
Geostationary orbit  
Limited coverage  
High latency  
\$500 million per piece  
Operated by institutions

Hundreds of satellites  
Low earth orbit  
Global coverage  
Low latency  
\$50k-\$1m per piece  
Operated by companies

- Smaller
- More flexible
- Lower-cost launch vehicles for sustainable deployment of satellite constellations



# MARKET GROWTH



„The revenue generated by the global space industry may increase to \$1.1 trillion or more by 2040.“  
- Morgan Stanley



## Global space economy

\$385bn in 2018

\$515bn in 2022



## Satellite launch industry

\$ 7bn in 2018

\$11bn in 2022

**Isar Aerospace takes leadership position in non-US markets first.**



# SUSTAINABLE LAUNCH SERVICES

**1'000 KG**

payload to 400km LEO  
enabling large satellite constellations

**5X**

cost reduction for small satellites  
compared to current solutions

**40%**

less emissions per kg payload  
than current solutions through  
ultra-clean burning propellants





# TECH DISRUPTION

Ultra-high performing, clean-burning propulsion system for sustainable space access.

**LHC**

propellant

**LOX**

oxidizer

Fuel has minimal impact on environment:

- ✓ Barely any global warming potential
- ✓ 30% increased overall efficiency vs. European state-of-the-art medium-sized vehicles



## Challenge

High pressures and limited soot layer formation complicate chamber cooling: Completely new cooling architecture using both propellants, enabled by metal additive manufacturing.



## Reusability

First stage reusability on vehicle v2 through propulsive landing paves the way for flexible space access



# SUSTAINABILITY

Focus on high-performing green propulsion systems to enable sustainable access to space

- ✓ Lower emissions
- ✓ No space debris
- ✓ In-house development

World-class engineering based on extensive hands-on experience in rocketry and spaceflight, backed by leading international investors.





**isra**aerospace  
technologies



BUILDING A SPACE POWERHOUSE



# WHY EUROPEAN?

## IMPORT/EXPORT CONTROL

- ✓ US and Chinese markets rather closed
- ✓ ITAR prevents US companies to operate outside US
- ✓ Chinese companies driven by government
- ✓ Europe is free from constraints

## REGULATIONS

- ✓ Isar Aerospace mitigated regulatory burden
- ✓ Operational test site achieved
- ✓ Priority access to engine & stage test and launch site

## TALENT & HIRING

- ✓ Unique opportunities in Europe similar to SpaceX history in the US.
- ✓ Old and governmentally-driven industry is laying off workforce
- ✓ Avg. Aerospace hire: US \$100k vs. EU \$60k

## MARKET OPPORTUNITY

- ✓ Only launch vehicle competitors < 300kg in Europe
- ✓ No reusability programs in Europe
- ✓ Less bureaucratic operations inside European Union