

**EUCASS
Krakow**

**PLENARY SESSION: LAUNCHERS
PRESENT AND FUTURE**

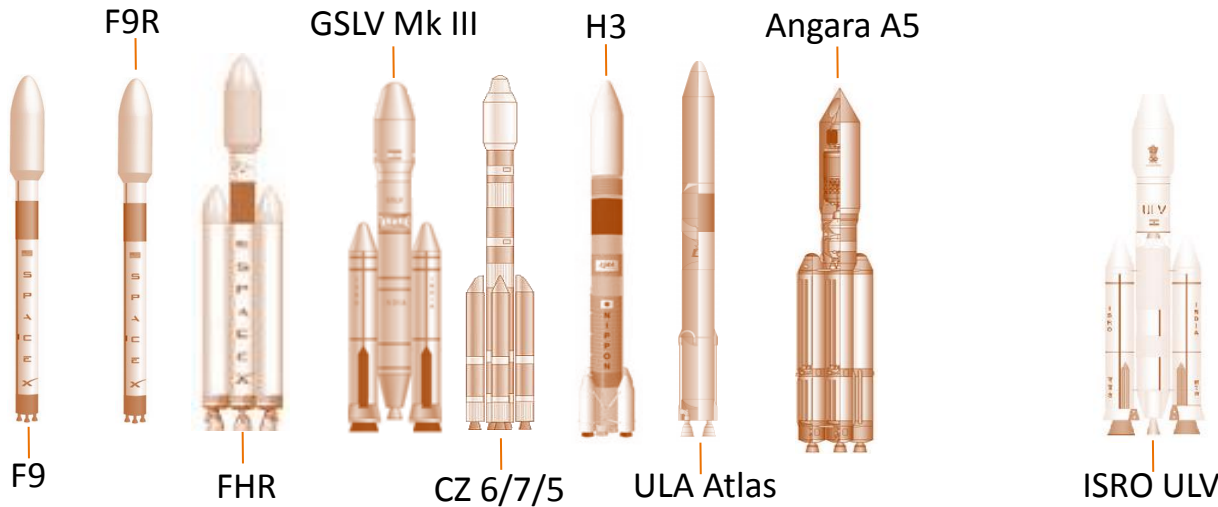
Jean-Marc ASTORG
Director of Launchers

CONTEXT

- Ariane 5ECA is the first commercial launcher with 50% of the world market in 2014 and 65 success in a row.
- Competition is increasing with many initiatives with a never experienced dynamic.
- Ariane 6 is in development for a first flight in 2020 and a full operational capacity in 2023.
- Space in general attracts money and develops in all fields: telecom, navigation, earth observation , science with spectacular initiatives such as Mega Constellations,
- What after Ariane 6 ?

Situation awareness 2025

WHICH COMMERCIAL SPACE IN THE FUTURE ?



Steady future

- ✓ Steady GEO satcom economy
- ✓ Space Launch economy still dominated by GEO market
- ✓ New launchers fielded by all usual suspects in an hyper-overcrowded sector
- ✓ Moderate launch cost decrease (< 20% at gen N+1)



Smallsat boom with non GEO economical models, new industry

Further **vertical integration** of the space economy

HTS satcom economy
New GEO economical models, datacom rules, flexible payloads...

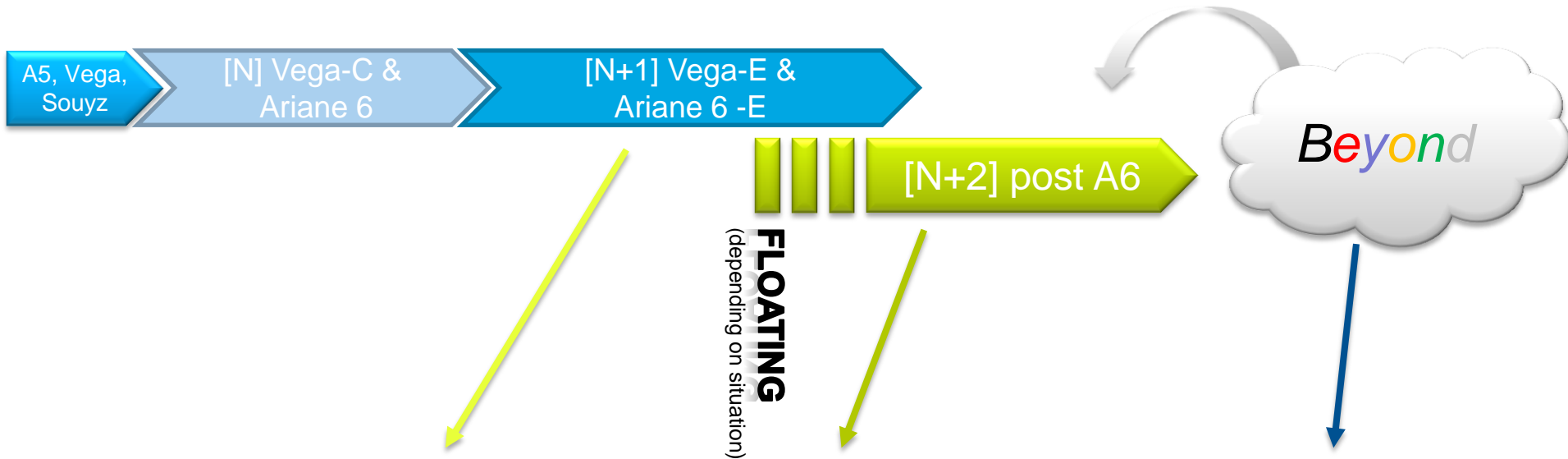
Wild future

- ✓ GEO satcom economy shake up
- ✓ New space markets emergence
- ✓ Disruptive new entrants with innovatives strategies
- ✓ Sharp launch cost cut



Blue Origin
F9M / F9MR
Any other economically viable reusable system

Choosing a path to the future



Incrementing Ariane...

Staying within competition

- ✓ Launch cost ↘ by 20%
- ✓ A6 incremental approach
- ✓ Improved modular design to medium mission
- ✓ Increased synergy Vega/Ariane

Reinventing Ariane

Get prepared for wild future

- ✓ Further decrease on in-orbit delivery ↘ by 50%
- ✓ New transport strategy, including in space TUG
- ✓ Reusability
- ✓ Automation and 3D print
- ✓ ↘ design and prod cycles

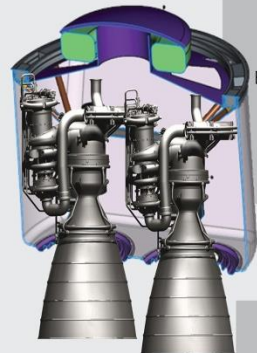
Advanced concepts

Explore potential breakthroughs

- ✓ New propulsion (e.g. nuclear, magnetic sail...)
- ✓ New space missions, including exploration
- ✓ Disruptive launch concepts (e.g. stratoballoon...)

SMART Reuse

FIRST STAGE ENGINES INHERENTLY REUSABLE

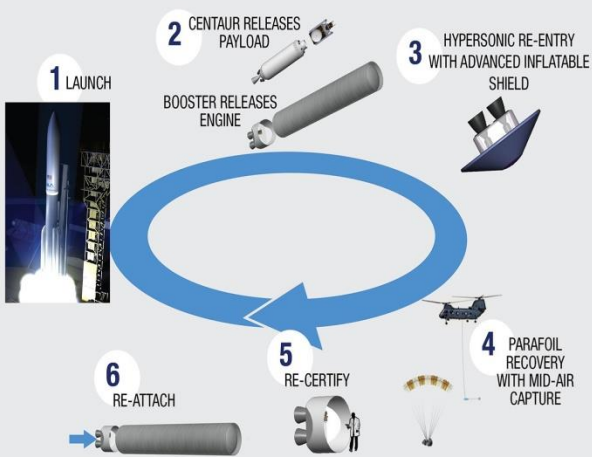


25%
OF THE
BOOSTER WEIGHT

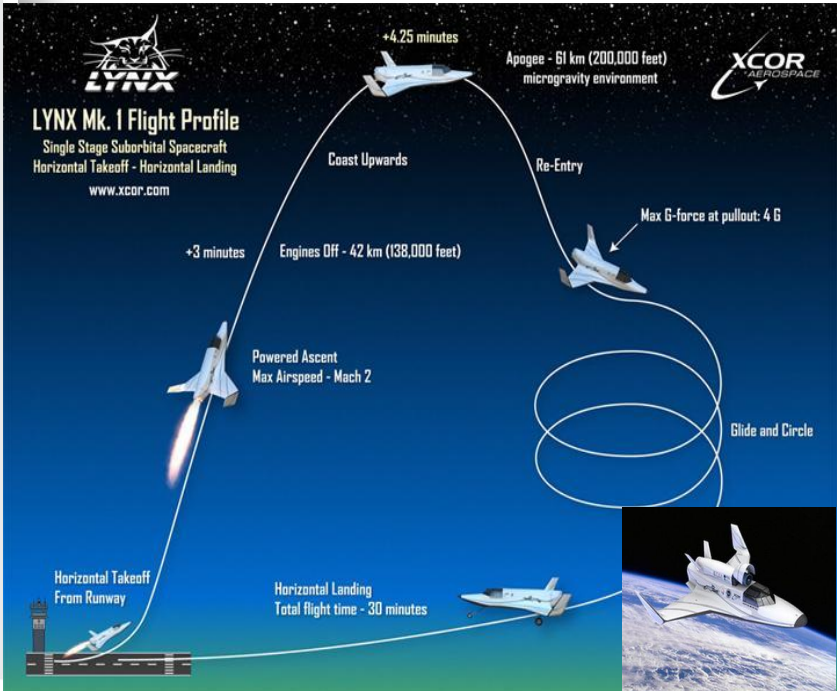
65%
OF THE
BOOSTER COST

90%
REDUCTION IN
BOOSTER
PROPULSION COST

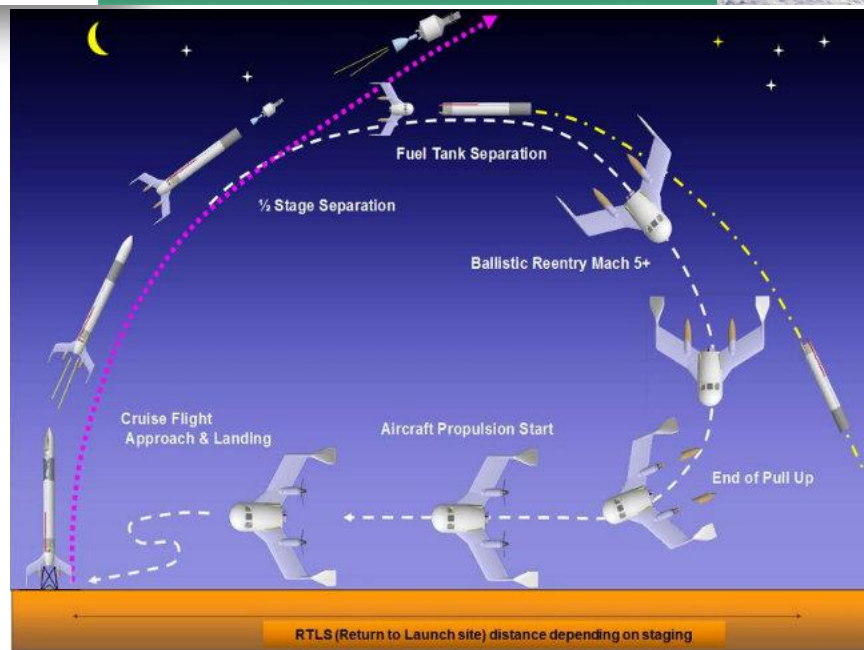
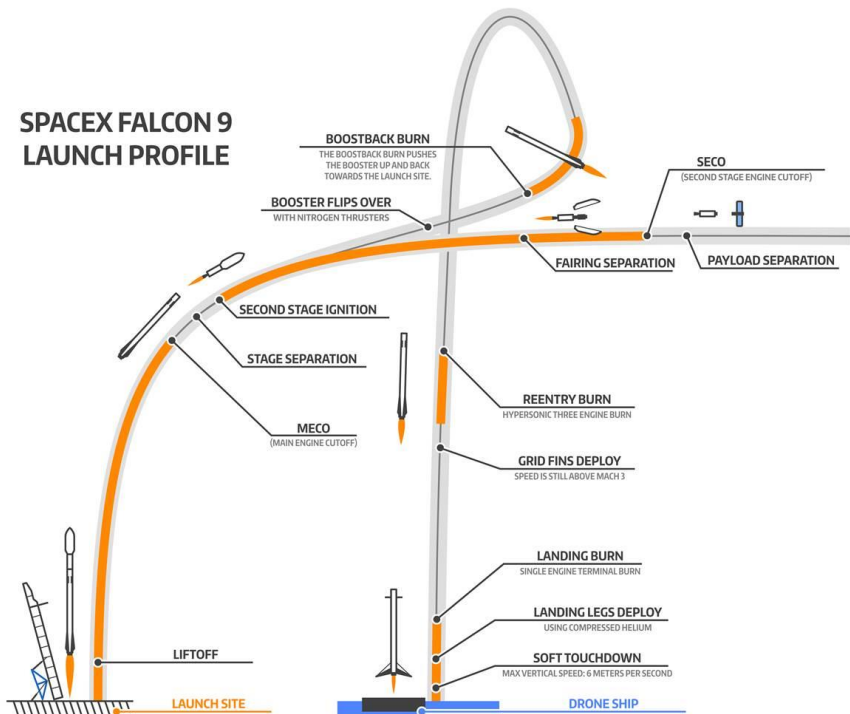
Sustainably Collapsing the Cost of Lift



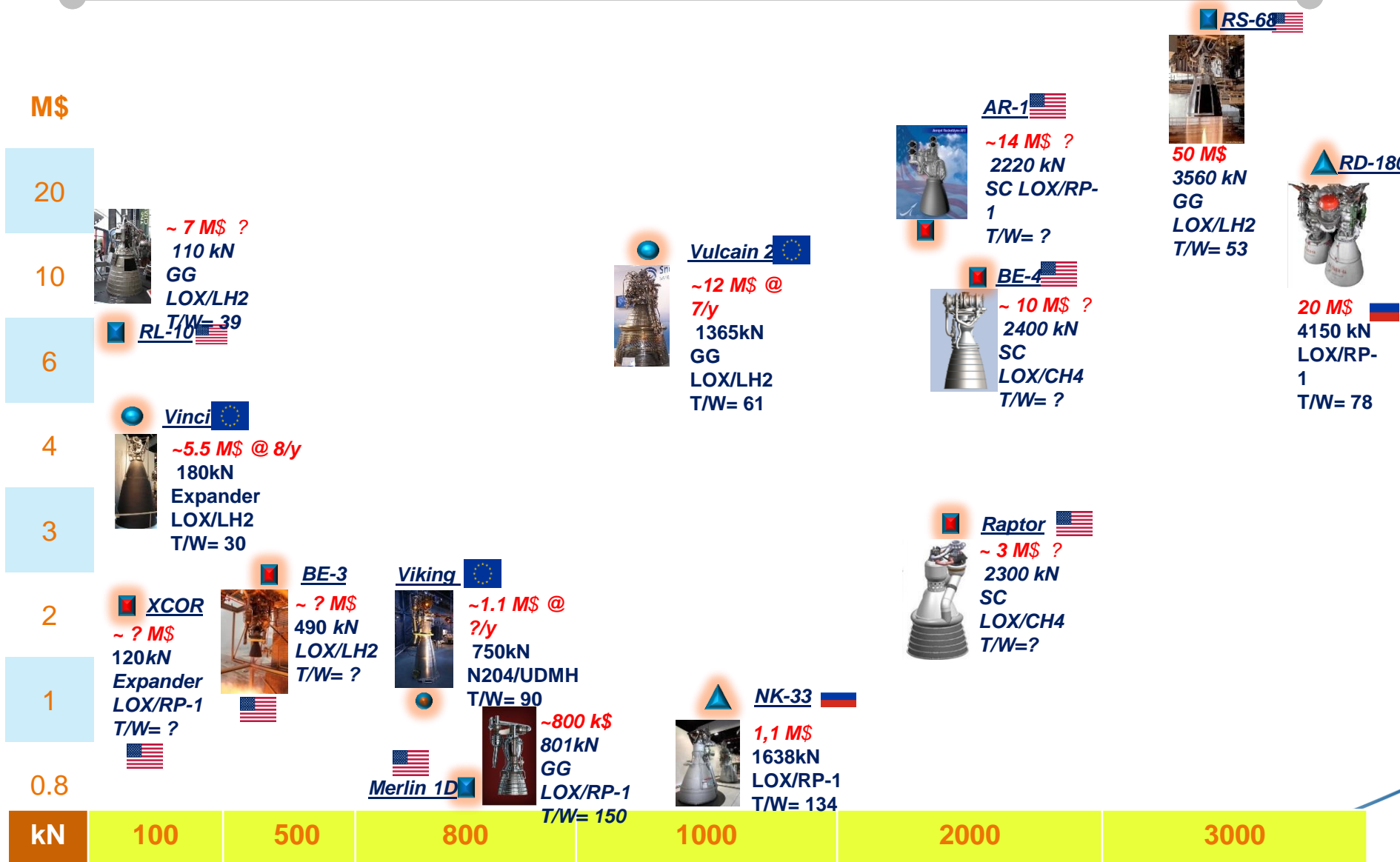
...S NEXT...



SPACEX FALCON 9 LAUNCH PROFILE



ROCKET ENGINES IN USE OR IN DEVELOPMENT



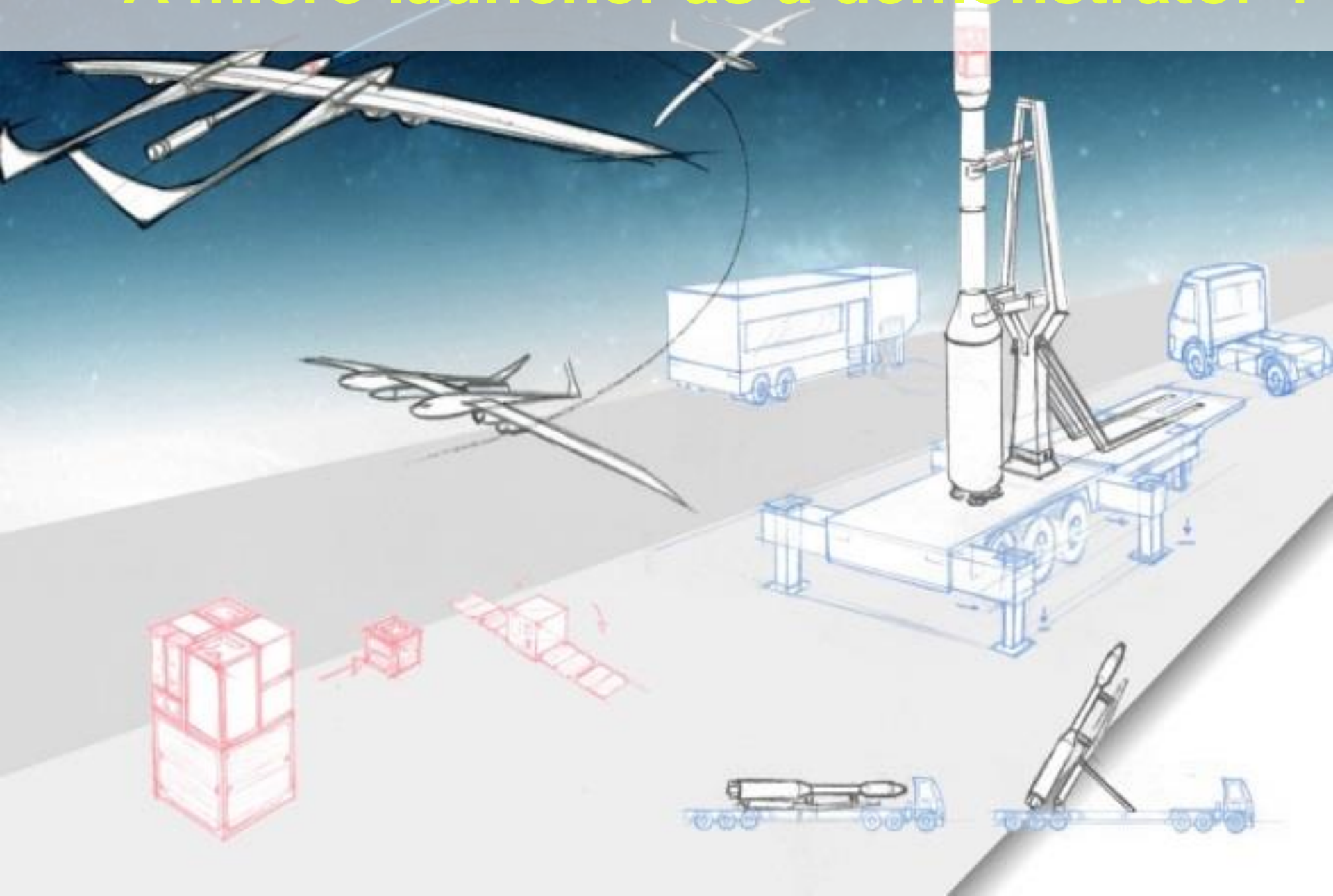
Under development

Retired

Active

T/W: thrust to weight ratio

A micro launcher as a demonstrator ?



CONCLUSIONS: LINE OF ACTIONS

- **To consolidate the current launchers fleet exploitation until Ariane 6 / Vega-C:**
 - Increase of A5 GTO performance
 - Competitiveness
- **To develop Ariane 6 and VEGA-C as quickly as possible**
- **To actively prepare post A6 launchers with the pre-development of a future low-cost and potentially reusable engine:**
 - LOX/HC
 - 80-100 t Thrust
 - Reusable
 - Universal