

RETALT

RETro propulsion Assisted Landing Technologies



MT AEROSPACE

An OHB Company

DESIGN AND MANUFACTURING STATUS OF ADVANCED STRUCTURES FOR REUSABLE LAUNCH SYSTEMS DEMONSTRATORS

WITH RETRO PROPULSION ASSISTED LANDING TECHNOLOGIES (RETALT)

Dr. Patrick Starke, Dr. Carina Dorbath

EUCASS, Madrid, July 4th 2019

Content

- Short company overview
- Motivation
- The RETALT Project
- Workshare of MT Aerospace
- Summary







Who we are

MT Aerospace is

- employer of over 700 people in five locations in Europe and South America
- leader in high-tech aerospace products using metal and composite materials
- market leader for turn-key antennas and large telescopes
- first tier supplier to the global aerospace and aviation industry providing leading-edge solutions



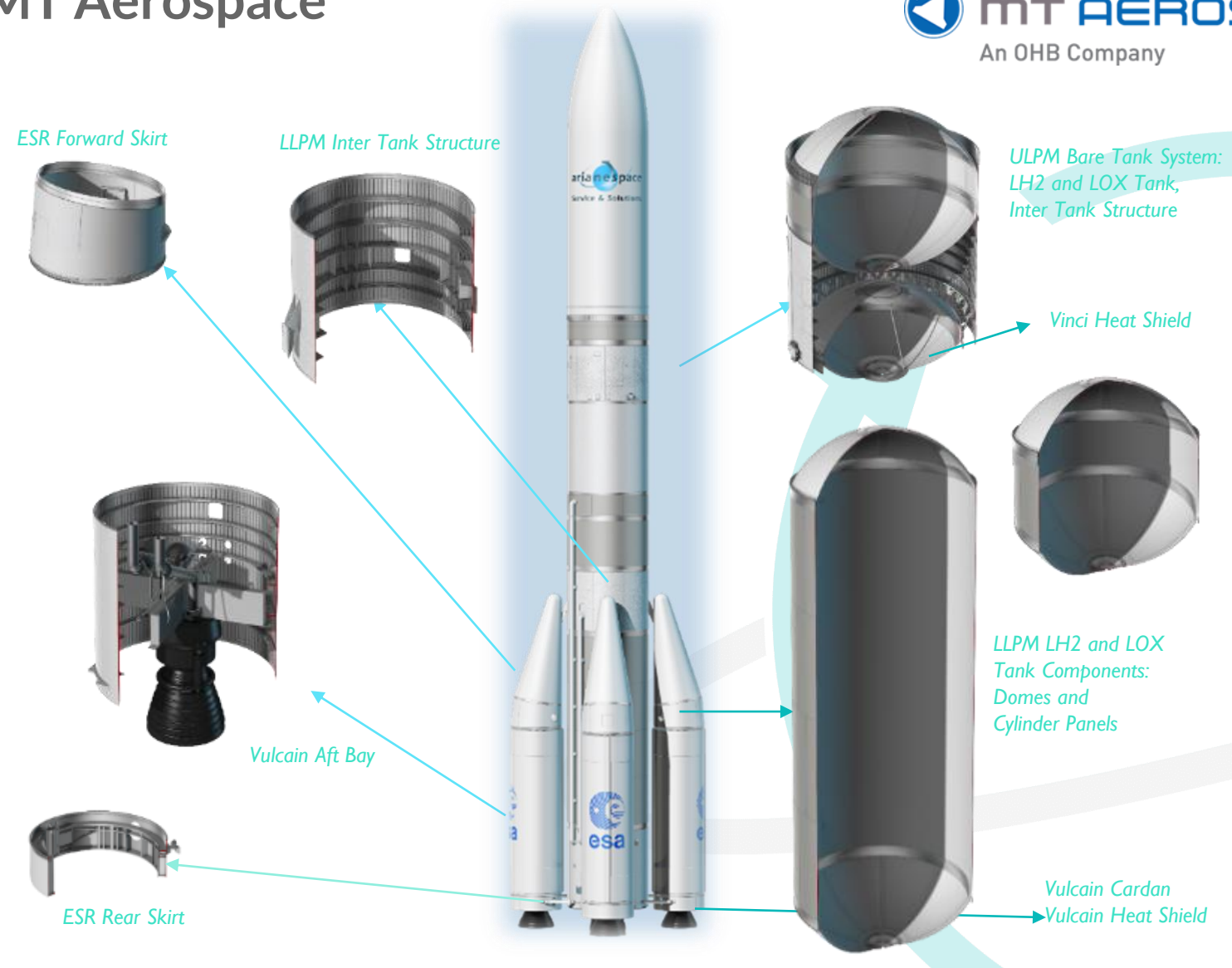
MT Overview: Portfolio

SPACE		
	Launcher Spacecrafts Satellites	<ul style="list-style-type: none">• Structures• Tanks• Booster• Satellite Panels• Pressure Vessels• Bulkheads• Tank Components
AERONAUTICS & DEFENCE		
	Commercial & Military Product Applications	<ul style="list-style-type: none">• Watertanks• Structures• Missile Component• Tanks Systems• Shafts• Struts
ANTENNAS & MECHATRONICS		
	Telescopes & Special Antennas Satcom systems Industrial mechatronics	<ul style="list-style-type: none">• Radio Telescopes• Optical Telescopes• Launching Facilities• Mechatronical Systems• Medical Systems• Servo & Control Systems• Ground Stations for Satellite Communications
SERVICES		
	Comprehensive Ground Services – remote, field and stationary – for Integration & Launch Facilities and Astronomical Observatories	<ul style="list-style-type: none">• European Space Center (Kourou, French Guiana)• ARIANE 5 Launch Facilities• ALMA/ Paranal Observatories

DESIGN AND MANUFACTURING STATUS OF ADVANCED STRUCTURES FOR REUSABLE LAUNCH SYSTEMS DEMONSTRATORS

Ariane 6 – Workshare MT Aerospace

- MT Aerospace with about 11% workshare of Ariane 6
- Design definition authority for metallic aero structures & 50% of IMC
- Risk sharing partner with significant own investment



Motivation

- Europe's non-dependence, access to space is of strategic importance
 - Autonomous
 - Reliable
 - cost-effective
- One game changer in the global market is reusability
- New developments e.g. by SpaceX or Blue Origin show that a significant reduction of launch costs are possible
- Key success of SpaceX is the concept of recovery of the first stage
 - Falcon 9 is Vertical Takeoff Vertical Landing (VTVL) Two Stage To Orbit (TSTO) Reusable Launch Vehicle (RLV)
 - Retropropulsion keeps number of additional needed parts small and rocket simple

The RETALT Project

The two main scientific and technological objectives of the RETALT project are:

- To investigate Launch system re-usability **technology** of VTVL TSTO RLV applying retro propulsion combined with the use of aerodynamic control surfaces which is currently dominating the global market.
- To investigate Launch system re-usability **technology** of VTVL SSTO RLV applying retro propulsion for future space transportation systems.

Lead



almatech



Launcher Configuration Concepts

TSTO



RETALT 1

SSTO

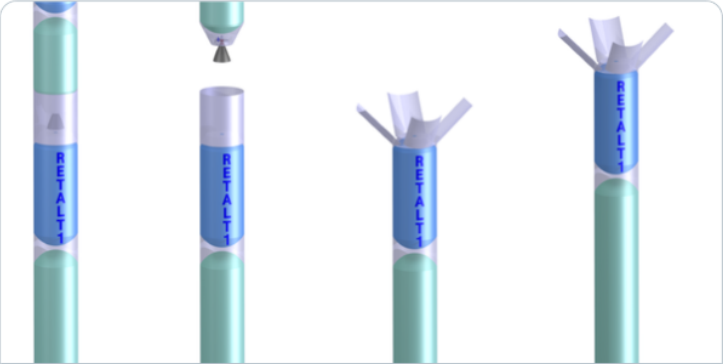


RETALT 2

Launcher Configuration Concepts



Eric Berger @SciGuySpace · 26. Juni
This announcement from Europe is remarkable for its frankness. It explicitly says what SpaceX's competitors must really think about a reusable Falcon 9, but rarely say in public.



Europe says SpaceX "dominating" launch, vows to develop Falcon 9...
"What is state-of-the-art in the USA is only in its beginnings in Europe."
arstechnica.com

62 386 3,5 Tsd.

Elon Musk @elonmusk
Antwort an @SciGuySpace
Good to see this. Splitting interstage into 4 sections will have some challenges, but could work.
14:26 - 26. Juni 2019

RETALT Objectives concerning Structures

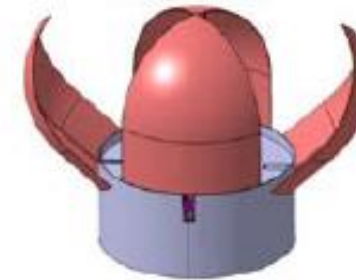
- **To improve the understanding of the aerothermal performance of necessary structures, materials and mechanisms.**
- **To develop new structural concepts and mechanisms for landing legs and control surfaces and manufacture ground demonstrators and test them.**
- **To reach TRL 5 for the aerodynamics and aerothermodynamics and landing mechanisms and structures investigated within the project in view of a possible IOD/IOV in-flight demonstration as a next step.**

Role of MT Aerospace

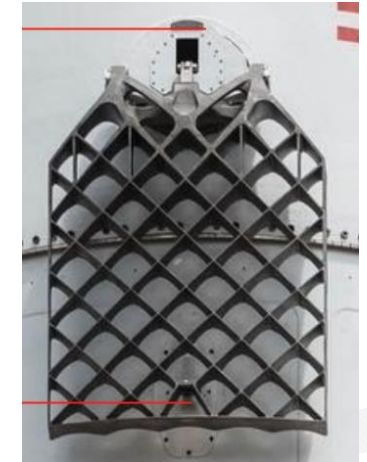
- **Design:**
- Structural components
 - **Mechanisms will be developed by ALMATECH**
 - High-level architectural concepts for RETALT 1&2 (Pictures: Falcon 9 SpaceX)
- Consideration of:
 - Structural requirements
 - Aerodynamic constraints
 - Thermo-mechanical constraints
 - Maintainability
 - Serviceability
 - Commercial viability
- **Manufacturing:**
- Test Models
- Ground demonstrators



Landing legs



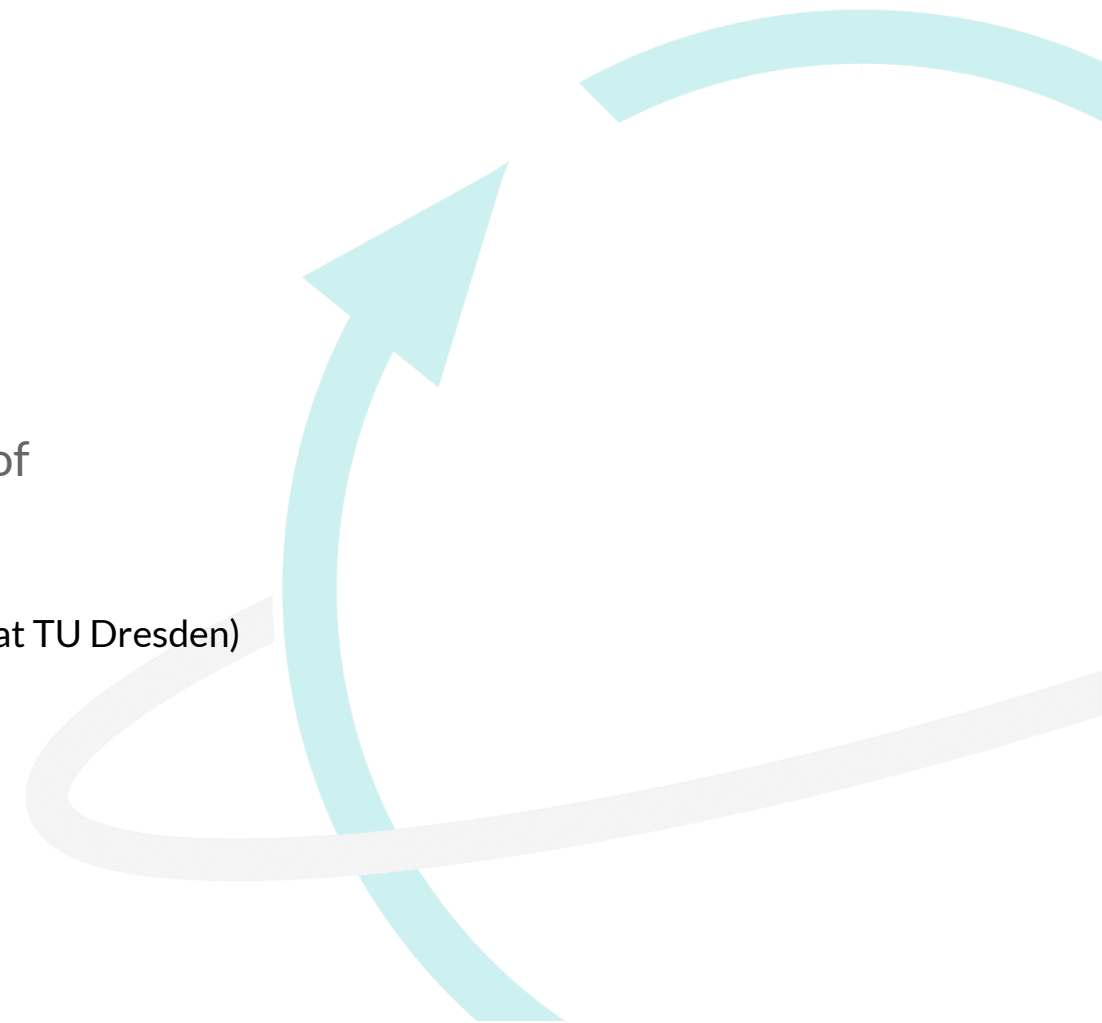
Control Surfaces



Grid fins

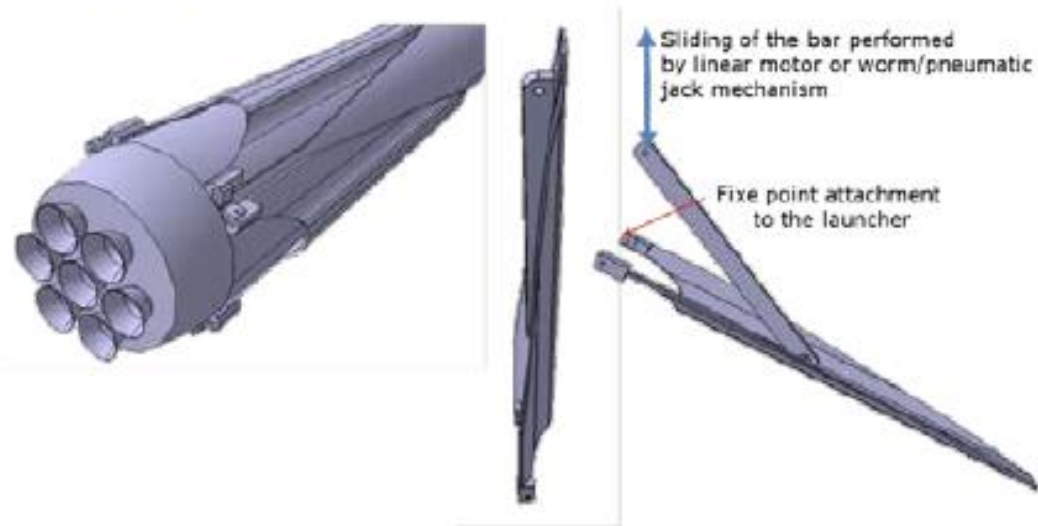
Testing

- **Aerodynamic and Aerothermal:**
 - Performed in Wind Tunnels of DLR
 - Wind tunnel models built by MT Aerospace
- **Ground demonstrators**
 - Proof tests with the representatively scaled demonstrators of
 - Functionalities
 - Mechanisms
 - Structural behavior (e.g. Drop tower test for the Landing leg demonstrator at TU Dresden)

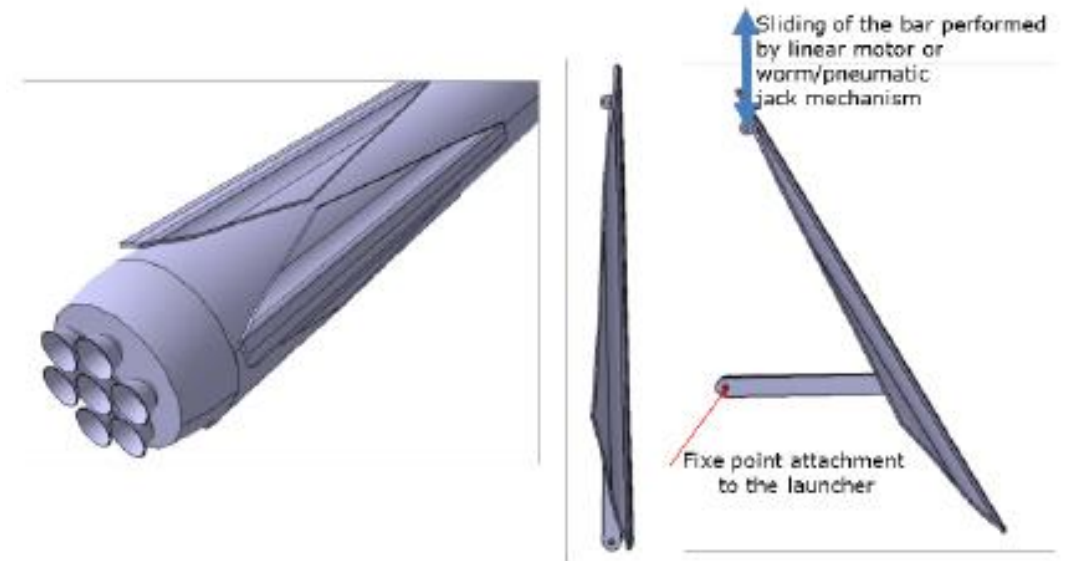


Landing Structures and Mechanisms

- Further development of downselected landing leg system (Mechanism by ALMATECH)
- Including all necessary information for manufacturing
- Mechanical and thermal analyses where appropriate



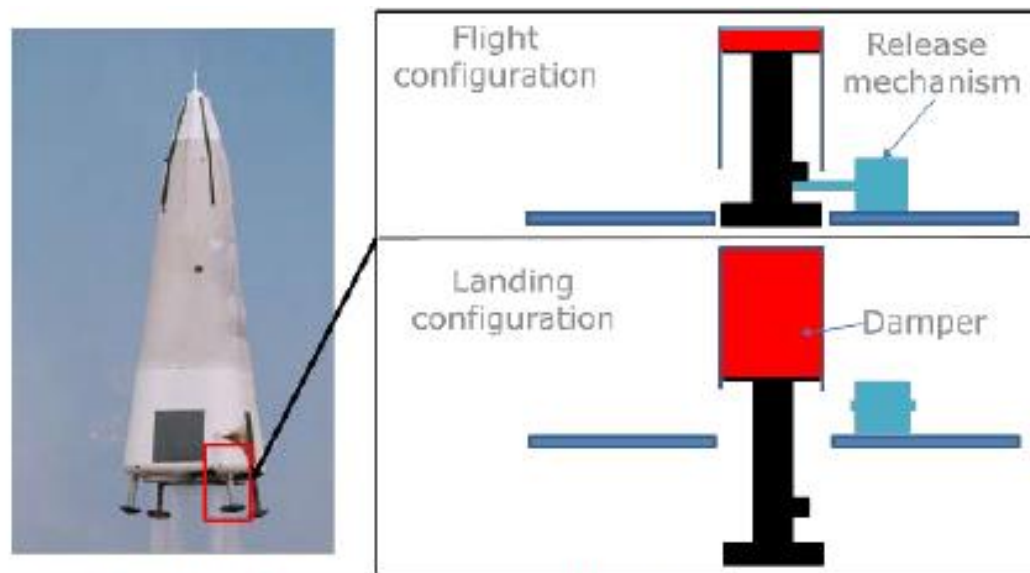
a) RETALT1: linear actuator attached to sliding bar



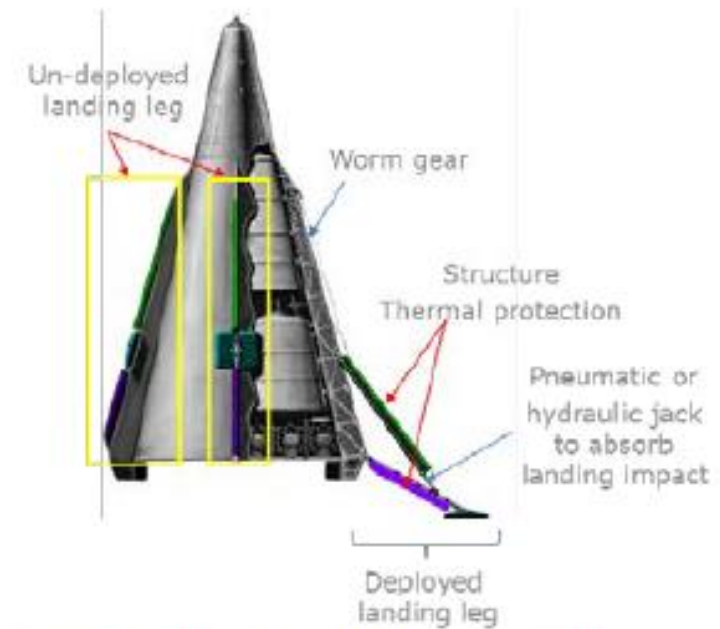
b) RETALT1: leg structure attached to actuator

Landing Structures and Mechanisms

- Further development of downselected landing leg system (Mechanism by ALMATECH)
- Including all necessary information for manufacturing
- Mechanical and thermal analyses where appropriate



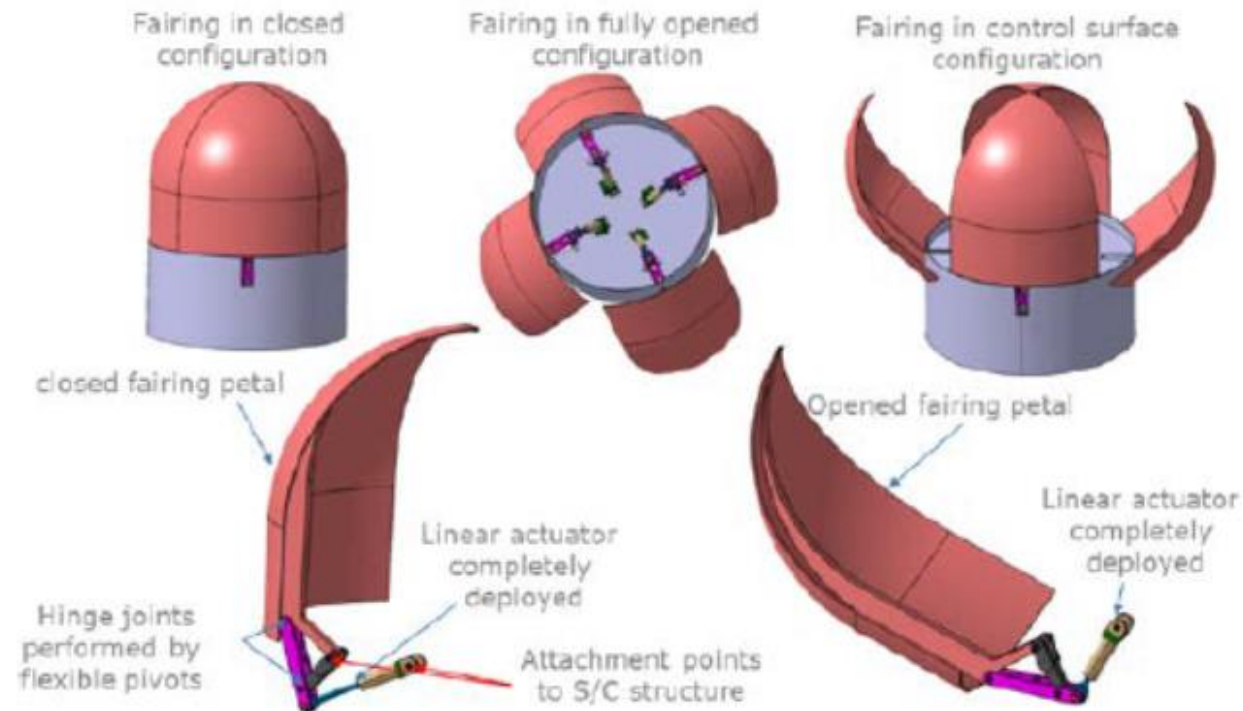
c) RETALT 2: pneumatic cylinder



d) RETALT 2: deployment kinematics

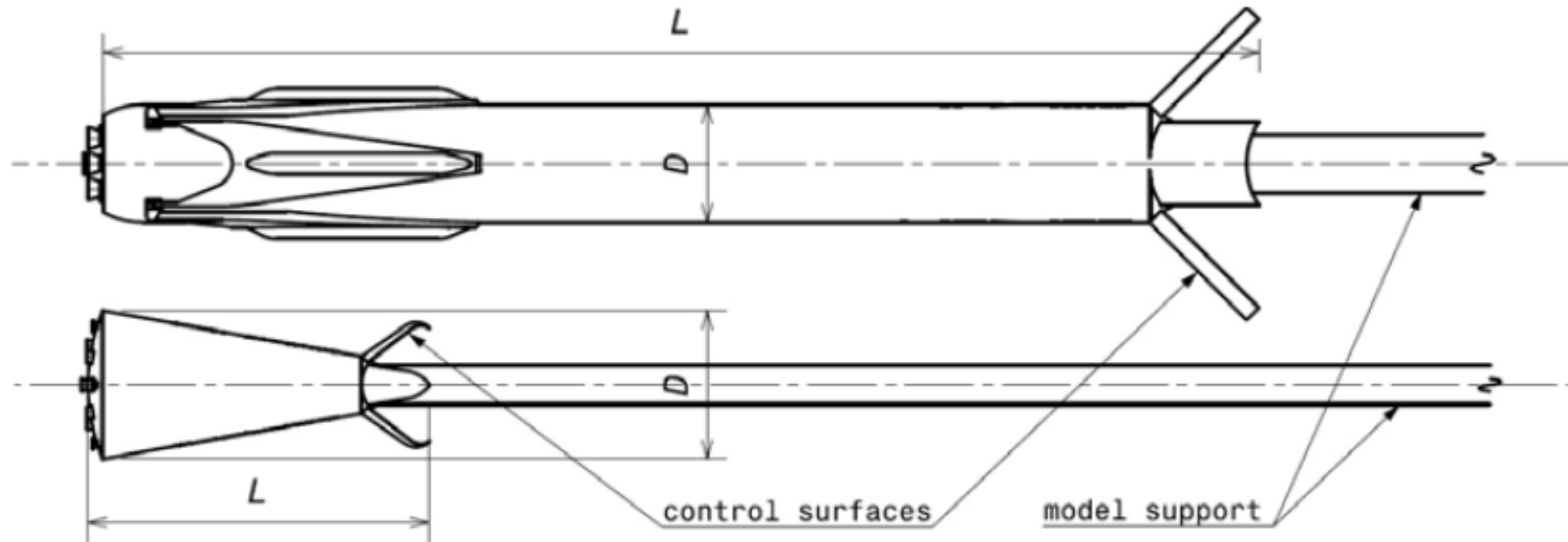
Control Surfaces and Grid Fins

- Further development of downselected Control Surface System (Mechanism by ALMATECH)
- Including all necessary information for manufacturing
- Mechanical and thermal analyses where appropriate

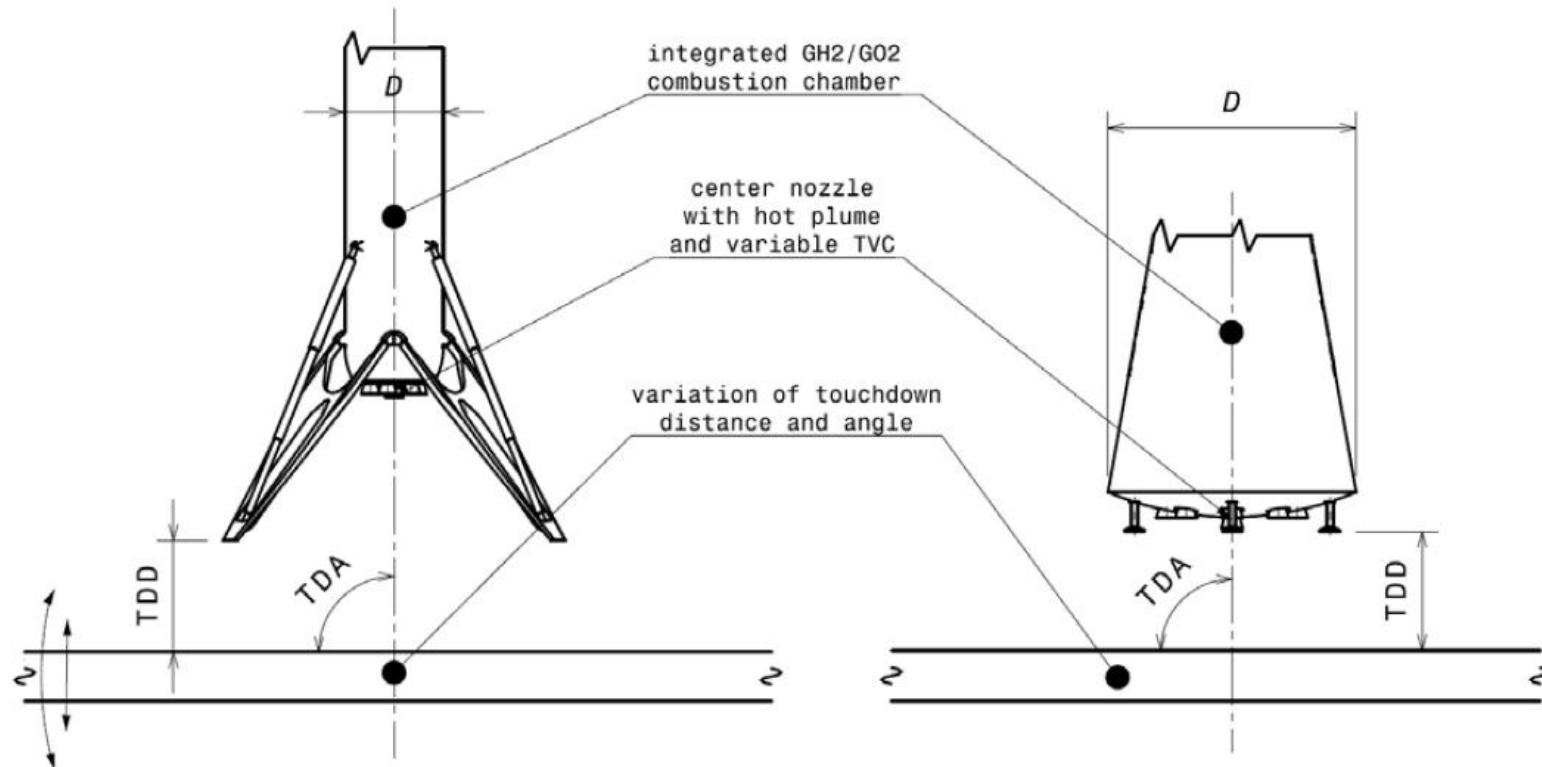


Manufacturing of Test Models

- Wind tunnel models



- Hot plume aerothermal impact tests



Summary

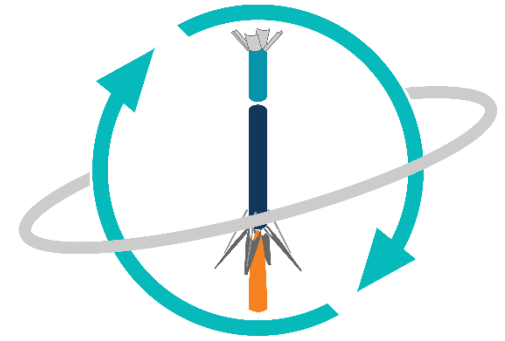
- The RETALT Project aims to increase the knowledge of technologies for RLV systems in Europe
- Two concepts will be examined: SSTO and TSTO
- Target TRL of the examined technologies is 3 – 5
- MT Aerospace is responsible for the design and manufacturing of test models and structural demonstrators
 - Landing legs
 - Aerodynamic control surfaces / grid fins



almatech



Thank
you!



RETAL
RETro propulsion Assisted Landing Technologies

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION FRAMEWORK PROGRAMME UNDER GRANT AGREEMENT NO 821890