



MT AEROSPACE

An OHB Company



Demisable Metallic Tank

ESA CleanSpace Industrial Days 23.-27.05.2016

MT Aerospace AG



- ▶ Programmatic background
- ▶ Technological background
- ▶ Requirements
- ▶ MT approach
- ▶ Baseline design
- ▶ Design options
- ▶ Assessment results
- ▶ Conclusion



▶ Building Block study: demisable metallic tank

- In the frame of CleanSat's technology assessment and concurrent engineering phase

- The general objective:

- To **mature the specifications** for the **selected building block** for **future LEO spacecraft**



- ▶ Tank Family → Titanium as shell material and a diaphragm for the propellant management

- ▶ EPS Tank → AA2219 with compatibility for MMH/NTO

Reference tank for this study

96I PTD

177I PTD

222I PTD

1908I and 2335I
PTG



- ▶ Input from the three LSIs: OHB System, TAS-I, Airbus DS

- ▶ Harmonization of requirements during first Concurrent engineering session, amongst others:
 - Demisability: initial conditions were delivered

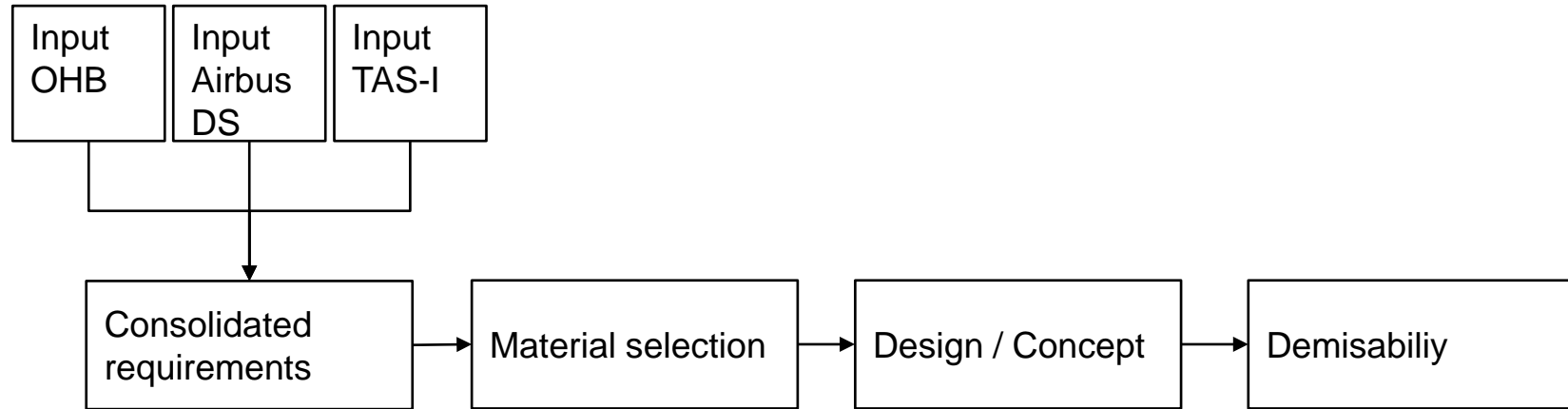
 - Propellants:
 - Conventional propellants and possible future propellants (green propellants)

 - Lifetime
 - 10 years (nice to have 15 years) operational life

 - MEOP
 - 24 bar

 - Volume
 - 177l





- ▶ Using existing technologies
- ▶ Using existing expertise

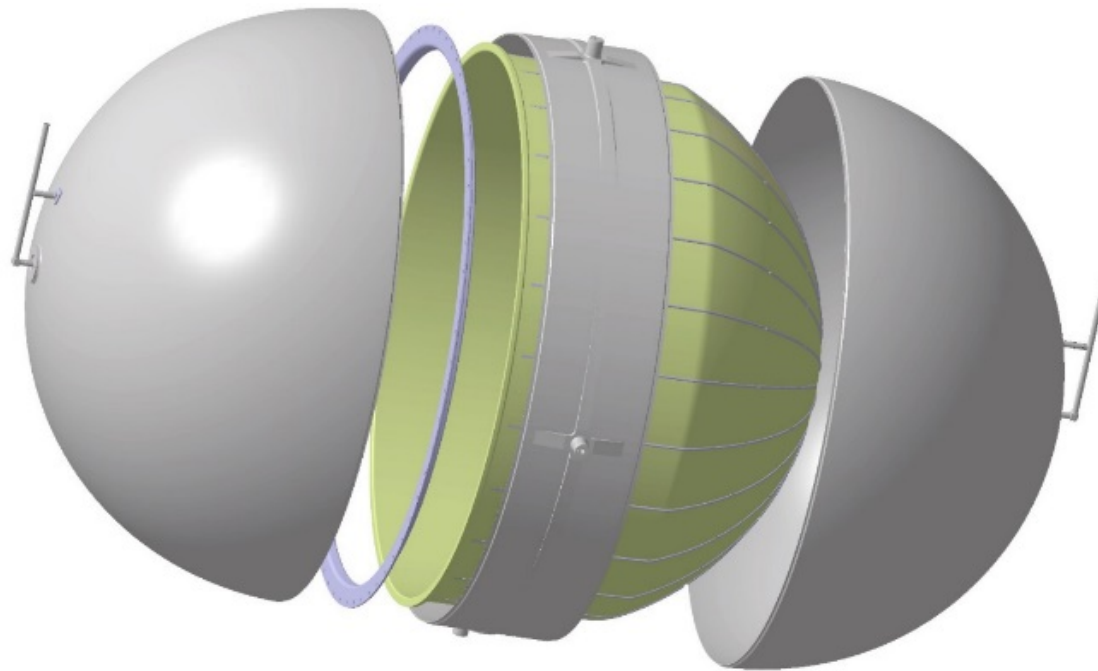
- ▶ High possibility of demisability

Competitive tank concept



- Substitute the commonly used shell material with aluminum
 - Two hemispheres
 - Cylindrical section
 - Diaphragm

→ Concept



▶ Mounting

- Polar, Equatorial/skirt, Equatorial/trunnions (as reference PTD 177s)
- In general feasible
- But design strongly dependent on detailed analysis results
- Wrt especially stiffness (eigenmodes), local stresses/constrained deformation

▶ Safety Factors

- $SF_{\text{Proof}} = 1.25$, $SF_{\text{Burst}} = 1.5$ is stated in the requirements
- $SF_{\text{Proof}} = 1.5$, $SF_{\text{Burst}} = 2.0$ as commonly applied for state-of-the-art PTA
- Expected feasible
- However with mass impact, but still demising

▶ Tank Volume

- Justification for 177l tank scalable to $V = 200l$
- No critical impacts wrt function and manufacture expected
- Smaller tanks also feasible with potential for savings wrt raw material/amount of connections

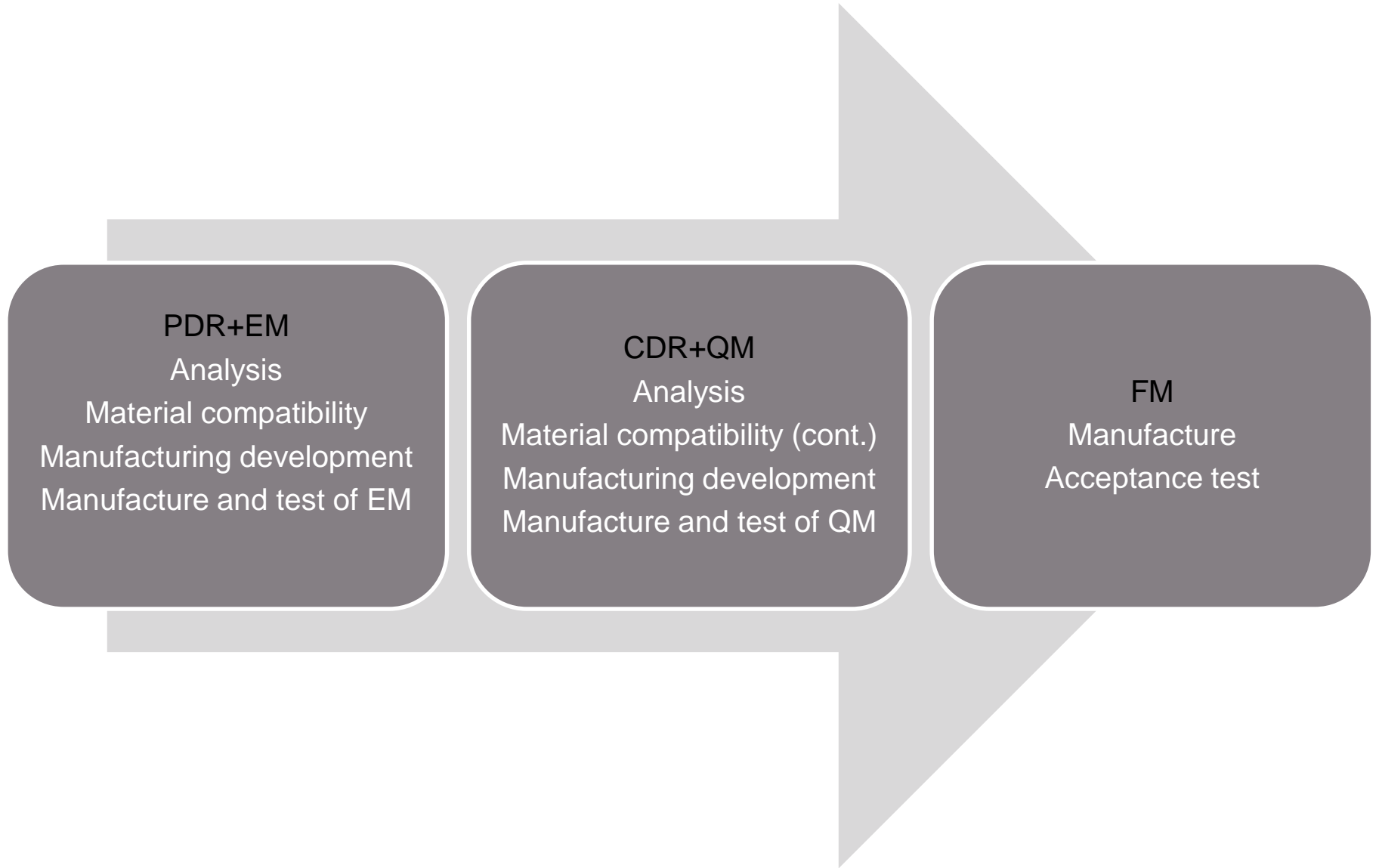


Demisability	Compliant	For the given initial conditions; using DRAMA
Propellant	Compliant	Long-term compatibility is open
Lifetime	?	Data missing for a specific statement
MEOP	Compliant	Commonly used value
Volume	Compliant	Other volumes possible



- ▶ Risks and development focus
 - Lifetime → missing data
 - Aluminium long-term compatibility
 - Diaphragm compatibility to new propellants





▶ Requirements given from three LSIs as an input

- Harmonization of the requirements in the first CE session

▶ Result:

- Design concept of a metallic demisable tank:
 - Shell material: aluminum
 - Analyzed and assessed with regard to the given input requirements
 - DRAMA assessment
- Development plan
- MAIT plan



▶ Thank you very much for your attention!

