European Non-Dependence Process for Critical Space Technologies

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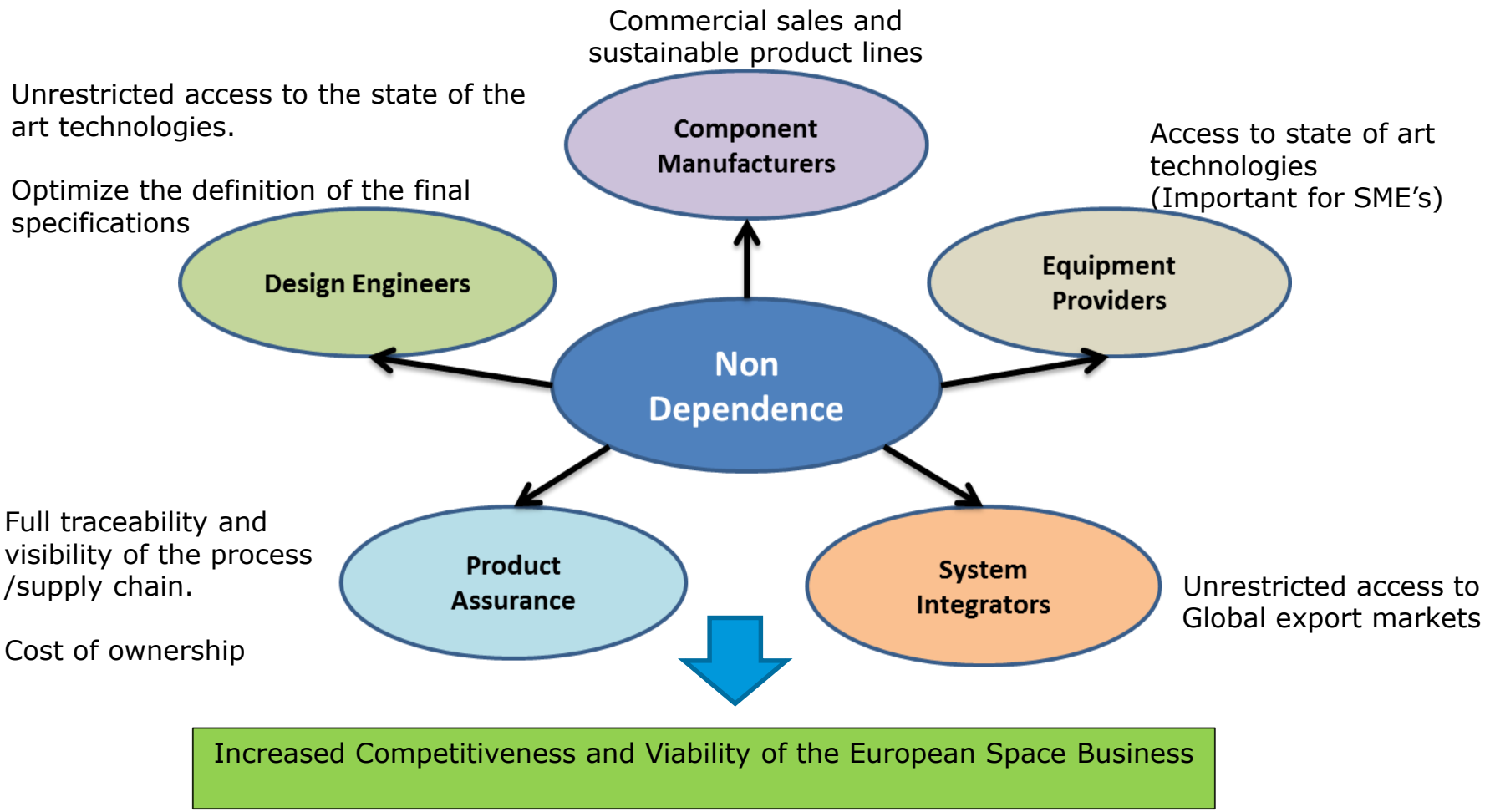
What is “non-dependence” ?

- Technology “non-dependence” means assured (non-dependent) access to any technology required to implement Europe’s space missions
- Non-dependence does not mean producing everything in house
- It is not just an ITAR/EAR problem
- It is not only an issue for EEE parts, but affects other technologies and products
- It is not an issue of end products only but affects all capabilities in the complete supply chain

Non Dependence – Supply Chain



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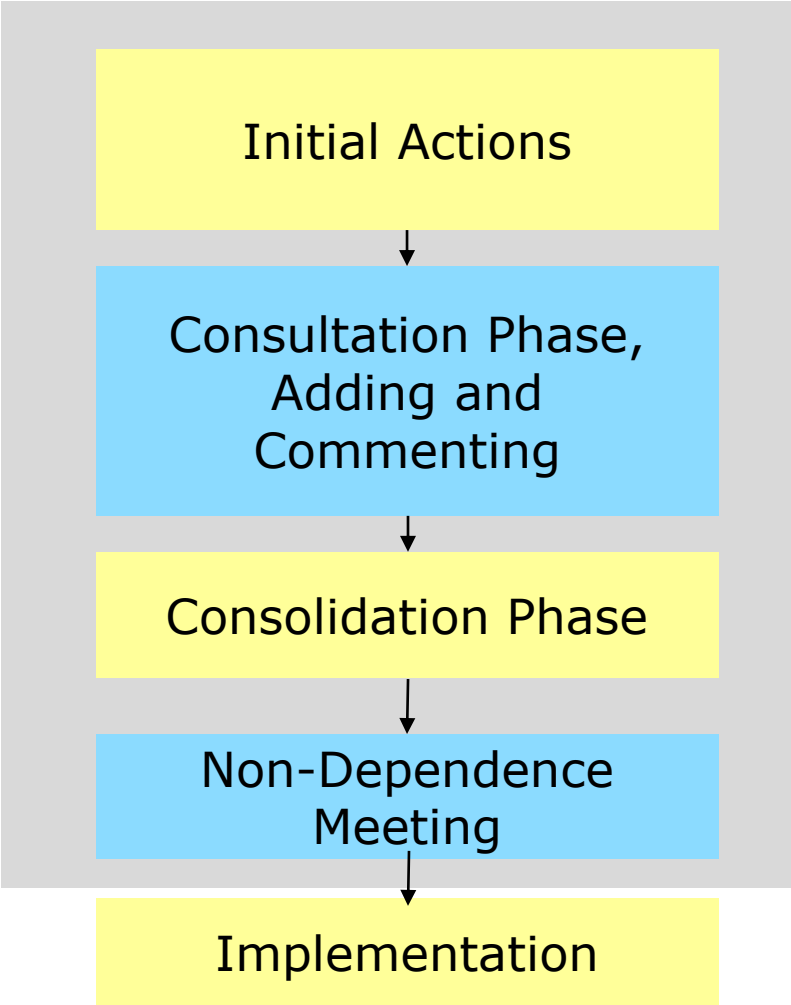
Critical Space Technologies for European non-dependence
EC-ESA-EDA Joint Task Force (JTF)

- ESA, EC and EDA are jointly running the European Non-Dependence process since 2009, which was founded upon the harmonisation process and has the objective to map the situation and identify urgent actions, to be implemented by the institutions and industry
- The EC–ESA-EDA (JTF) European Non-Dependence process has been run in 2009, 2011 and 2014 involving all stakeholders through dedicated meetings, and resulted in three Lists of Urgent Actions, the latest in March 2015
- The last cycle started in mid-October 2014 with the aim of identifying urgent actions on critical space technologies for European non-dependence to be implemented in the time frame of 2015-2017
- Implementation of actions is through programmes of each institution involved (EC, ESA, EDA, national programmes).

2014-2015 Non-Dependence Process Overview



Mid October 2014
(European Commission, ESA, EDA)

Mid October – end November 2014
(Eurospace,SME4Space,Delegations)

December 2014 – January 2015
(European Commission, ESA, EDA)

13 February 2015
(Open / JTF and Delegations)

2015 - 2017
(European Commission, ESA, EDA and national programmes)

European Space Agency

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List of actions for 2015-2017

- A large consultation of European stakeholders allowed to gather feed-back from Member States, Industry through Eurospace and SMEs through SME4Space
- A consensus on a list of 27 High Priority Actions for 2015-2017 was reached with the delegates of the Commission, ESA and EDA during the European Non-Dependence meeting held on February 13th 2015 in Brussels. 12 other actions of lower priority have also been identified
- A range of technology domains are covered, including materials, electronic and photonic components, propulsion, mechanisms, thermal and complex structures

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List of High Priority actions for 2015-2017 (1/2)

- ✓ U1 - Space qualification of low shock Non-Explosive Actuators (NEA)
- ✓ U2 - Advanced thermal control systems
- ✓ U3 - Propellant flow and distribution components for chemical propulsion
- ✓ U4 - Advanced materials and material technology for combustion chambers
- ✓ U6 -Fiber optic or photonics integrated technology Gyro based inertial measurement unit (IMU)
- ✓ U7 - Power amplification: Travelling Wave Tube (TWT) materials
- ✓ U9 - Cost-effective high quality Ge-substrates and high performance, cost effective multi - junction solar cells for space applications
- ✓ U10 - Digital Signal Processor (DSP) computers
- ✓ U11 - ASICS for Mixed Signal Processing
- ✓ U12 - High Capacity FPGAs
- ✓ U13 - Passive components
- ✓ U14 - Active discrete power components

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List of High Priority actions for 2015-2017 (2/2)

- ✓ U15 - Photonics components
- ✓ U16 - Space qualified GaN components and demonstrators
- ✓ U17 - High density (up to 1000 pins and beyond) assemblies on PCB and PCB
- ✓ U18 - Enhanced performance and space qualified detectors
- ✓ U19 - High speed DAC-ADC based on European Technology
- ✓ U20 - Very high performance microprocessors
- ✓ U21 - Very high speed serial interfaces
- ✓ U22 - ASICS: Deep Sub-Micron (DSM)
- ✓ U23 - Development of Large Deployable structures for Antennas
- ✓ U25 - ASIC: Availability of IP Cores
- ✓ U26 - Space qualified carbon fibre and pre-impregnated material sources for launcher and satellite subsystems
- ✓ N27 – RF components
- ✓ N28- Non Dependence of materials and processes
- ✓ N35- High pressure very light tank for space applications
- ✓ N45- High conductive adhesives

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Critical space technologies / Non-Dependence

Implementation in ESA programmes

- ESA has been addressing Non-Dependence issues for over a decade
- Implementation in ESA is done mainly via the Technology R&D programmes TRP, GSTP, the European Components Initiative (ECI) and ARTES (Telecommunications)
- As special highlights one could for instance name the **GREAT** and **GREAT2** initiative for **GaN** (>10 Meuro), or activities in conjunction with ARTES 8 on a large deployable radiator and **TRP /ARTES activities on large deployable reflector antenna**
- Via its Technology R&D programmes, ESA has spent around 10 Meuro per year on identified non-dependence items

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Critical space technologies
ESA coordination activities

- In addition to the EC-ESA-EDA Joint Task Force, an effective and complementary ESA coordination is ensured by means of the following tools:
  - European Space Technology Harmonisation
  - European Space Components Coordination (ESCC)
  - ESA participation in Horizon 2020 CST Steering Group
  - ESA Technology End-to-End Process (TECNET)

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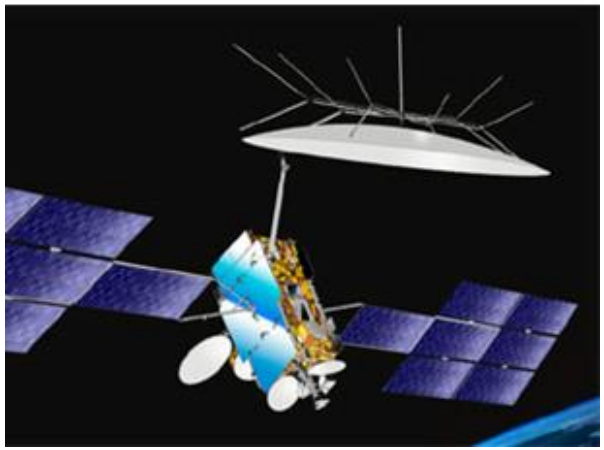
Large Deployable Structures for Antenna
A typical example of critical space technology

- Few countries have successfully flight proven the large unfurlable reflector technology up to now (US, Russia, Japan)
- Situation of duopoly by 2 US Companies (Northrop Grumman, Harris Corporation) on this product with export license restrictions
- Emergence of new players (China, India) in the near future

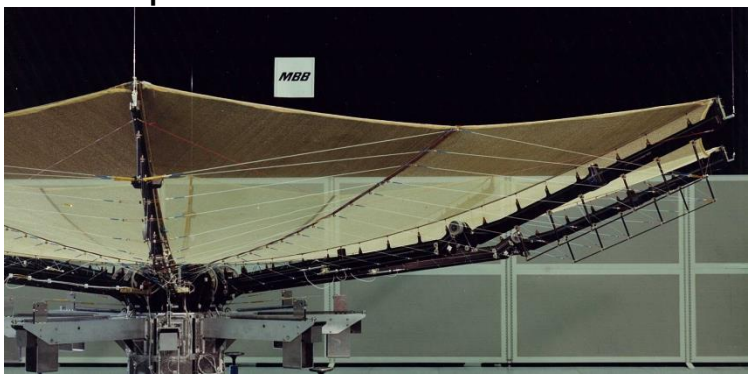


Eutelsat W2A (Harris reflector)

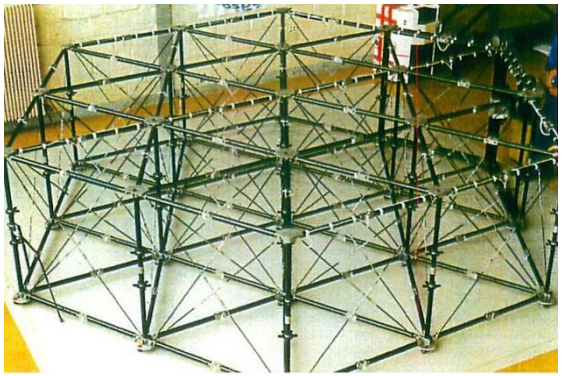
NASA JPL SMAP (Northrop Grumman Astromesh reflector)

Large Deployable Structures for Antenna
A typical example of critical space technology

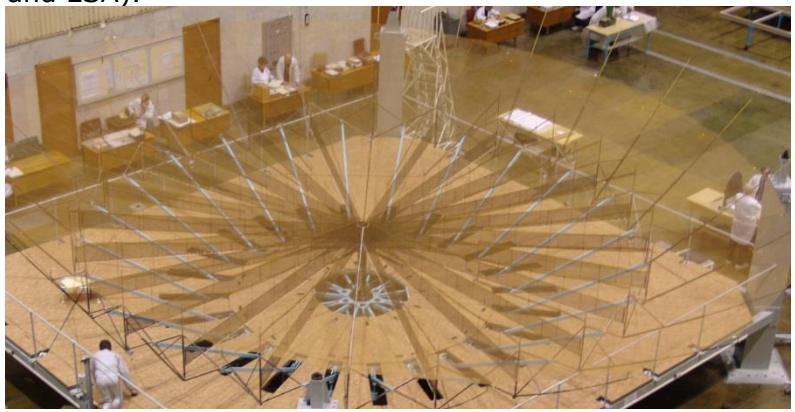
- Europe does not start from scratch.



MBB Unfurlable Mesh Reflector during deployment testing
(Courtesy of Airbus DS and ESA).



Structure deployment test of ERA 9 m antenna
(Courtesy of Airbus DS).



Large Deployable Antenna EQM in deployed configuration
(Courtesy of TAS-I, NPO-EGS, RSC-Energia and ESA).

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Large Deployable Structures for Antenna
A typical example of critical space technology

- In order to increase the TRL of some key building blocks of the large reflector (e.g. mesh reflector, reflector support structure, reflector arm,…), ESA has implemented several technology developments as listed here below:

RESTEO	GSP/TAS	Specifications and commonality of EO and TLC. Finalised.
TALDES	TAS/TRP	Breadboards and demonstrators 6 m aperture. Finalised.
LDR Structure	ITI	Breadboard of 4 m aperture
LABUM	TRP	Alternative reflective surface demonstration. Running.
MESH	TRP	Metal mesh technology development. Running.
SCALABLE	TRP	Reflector structure technology consolidation. Running. Two parallel activities in Germany and Italy.
LARREQ	ARTES 1	Specifications and integration in telecom platform. Activity recently initiated.
RF & Deployment Test Methods	ARTES 5.1	Development of Deployment and RF testing methods.
MODULAR Deployable Structures	TRP	Activity in TRP Workplan. ITT in preparation, planned in 2015.
Mesh and associated carrying net for Deployable Reflector	ARTES 5.1	Activity in P1 in WP 2014 but postponed to mid 2015 (waiting for the TRP results)
Advanced techniques for mesh reflector with improved radiation pattern performance	TRP	Activity in TRP Workplan. ITT in preparation, planned in 2015.
Deployable antenna structures for small satellites	ARTES 5.1	Activity in P1 in ARTES Workplan for 2015.
Flexible PIM-free Antenna Reflector	ARTES 5.1	Activity in P2 in ARTES Workplan for 2015.

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Large Deployable Structures for Antenna

A typical example of critical space technology

Based on key recent achievements on critical breadboarding, and the momentum created, it is time to move from ground testing to in-orbit demonstration (IOD)

- This is key to ensure the non-dependence on large reflector antenna as requested by several applications and procurement at affordable cost

- IOD shall demonstrate :
  - The space qualification of a European product: a 6 meter Deployable Antenna Reflector for Earth Observation, Telecommunication and Science.
  - In particular, the functionality of a large deployable 6 meter model in the space environment by verification of the deployment sequence as well as the realised reflector shape accuracy.

  This IOD is mandatory in the development plan to get acceptance by customers to fly European Technology for large mesh reflector.

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Conclusions

- A coordinated and coherent joint European institutional approach is now well established, targeting the development of critical space technologies and products for European Strategic Non-Dependence
- The implementation of the high priority actions identified by the European Non-Dependent Process will be approached individually by the three organisations and national agencies
- The new JTF list of Actions for 2015-2017 has been used as an input to the Horizon 2020 Space 2016-2017 Work Programme
- Items identified in the JTF process will also be considered in several ESA programmes e.g. ARTES, ECI, TRP and GSTP

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