ARTES Future Preparations
ARTES Competitiveness & Growth
ARTES Advanced Technology:
An Overview

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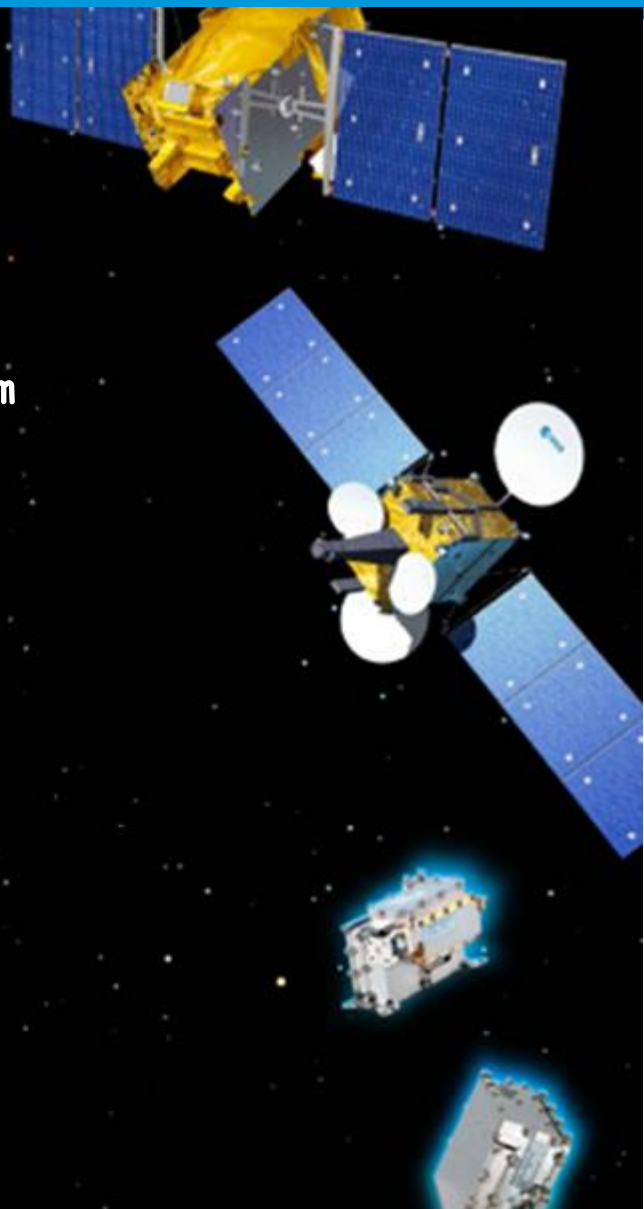
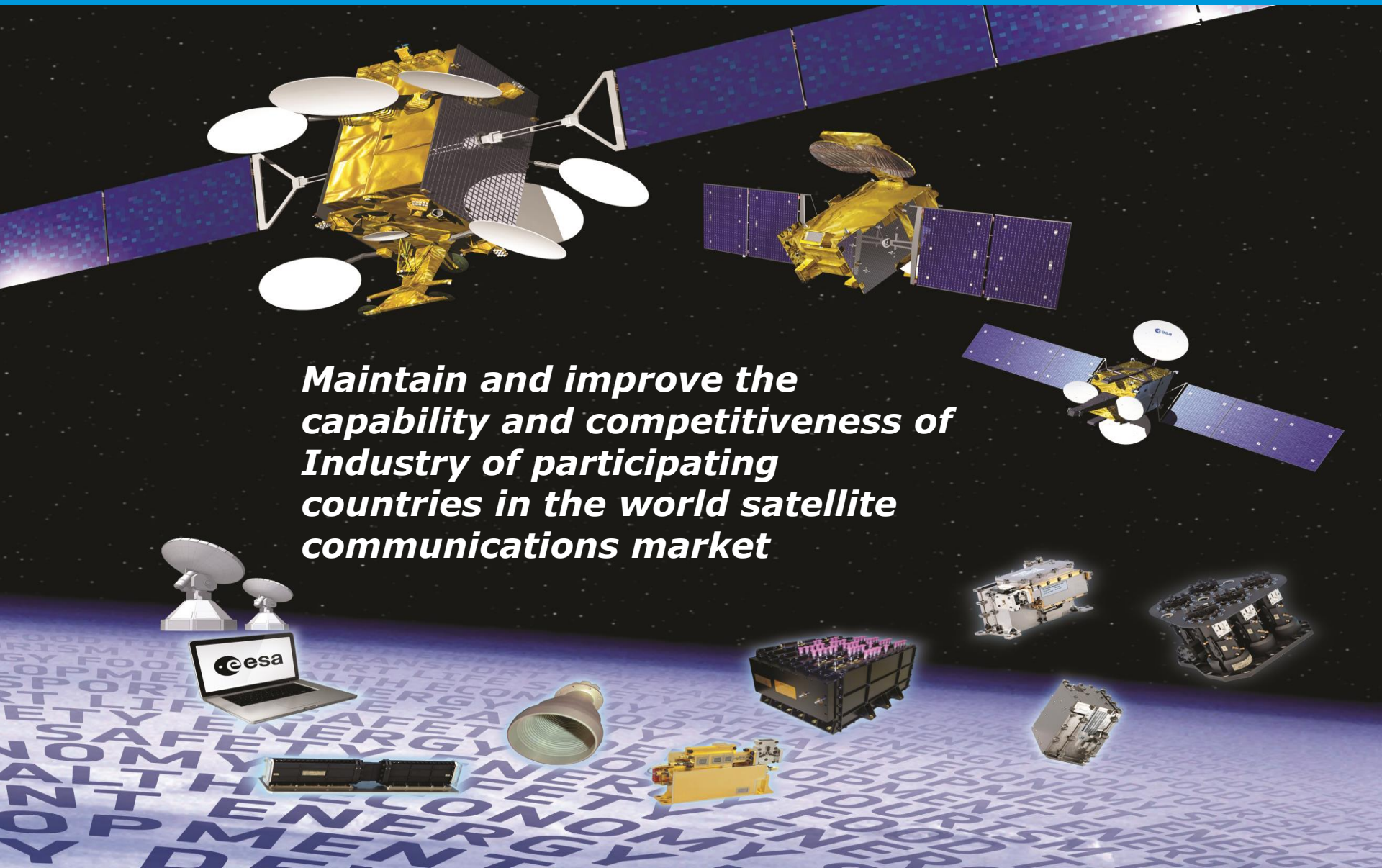
The ESA ARTES Programme elements

- Future Preparations
- Advanced Technology
- Competitiveness & Growth
- EDRS European Data Relay Satellite System
- Alphabus/Alphasat
- Iris Air Traffic Management
- SmallGeo Platform
- Neosat - Next Generation Platform
- IAP - Integrated Applications Promotion
- SAT-AIS Automatic Identification System
- Partner Programme (e.g. Electra, Indigo, Quantum, ICE)

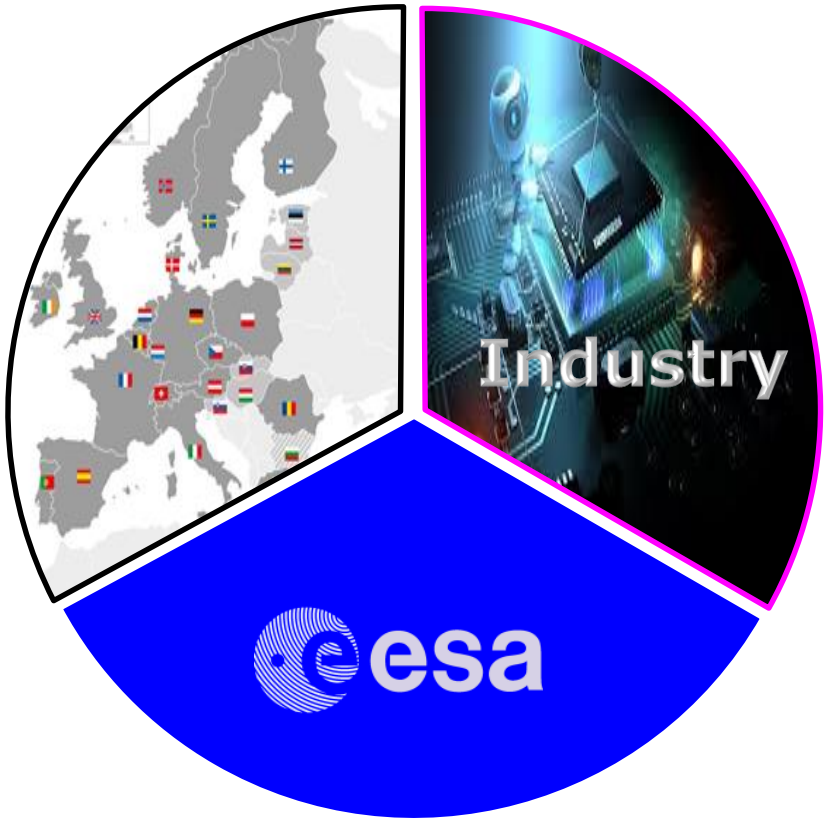


ARTES Advanced Technology (AT), Competitiveness & Growth (C&G)- Mission



Maintain and improve the capability and competitiveness of Industry of participating countries in the world satellite communications market

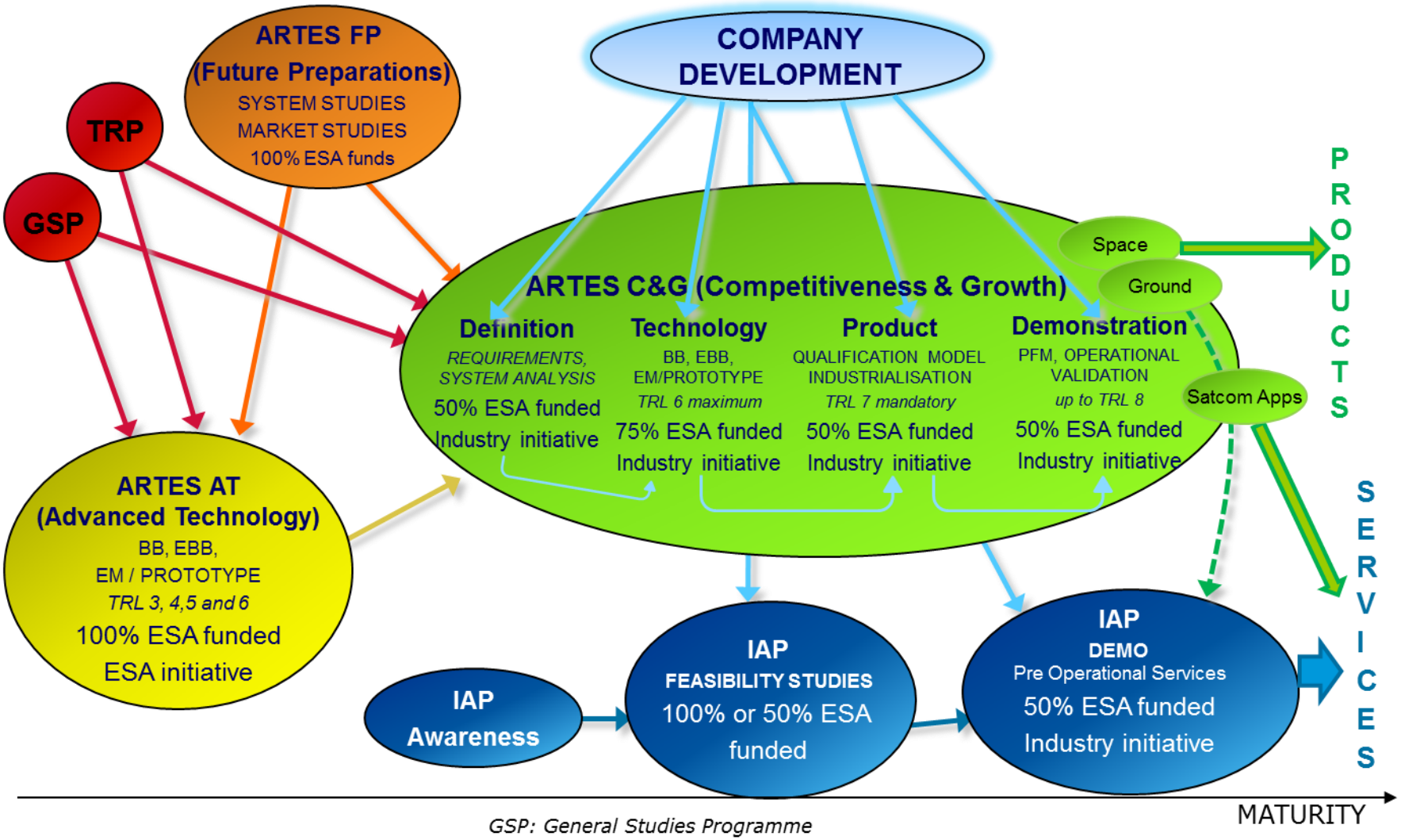
ARTES Programme
Main stakeholders and their roles



- National Delegates authorise funding
- ESA Members States industry and institutions develop technology and products for the world Satcom market
- ESA implements the activities and manages the contracts

→ **Teamwork**

ARTES FP, AT and C&G ecosystem



GSP: General Studies Programme
TRP: Technology Research Programme
ARTES: Advances Research in TElecommunications Systems
IAP: Integrated Applications Promotion
TRL: Technology Readiness Level

ARTES Future Preparations (FP)

ARTES Future Preparations
"Preliminary Studies and Investigations"

- Perform mission, system, general configuration studies and other activities to prepare and continuously update the medium and long-term programme of ESA in the field of Telecommunication.

- Define the technology developments necessary for the execution of the telecommunication programme and provide their requirements as inputs to other elements of ARTES.

Technology Development

Scope of ARTES Future Preparations

- Strategic analysis, market analysis, technology and system feasibility studies, support of satellite communication standards.
- Activities performed under ARTES Future Preparations:
  - Monitoring economic conditions and overall market trends to assess potential in the European and Canadian satcom markets
  - Understanding future market needs while considering all actors participating in the satcom industry
  - Understanding competition and synergy with terrestrial systems
  - Building telecom product strategy through Research & Development activities (i.e. defining technology development roadmaps)
  - Validating performance/feasibility of new concepts with an end-to-end system perspective
  - Supporting standardisation and regulatory activities

ARTES Future Preparatins Industrial Work
The Rolling Work Plan By Numbers

The Rolling Work Plan is the most visible element of ARTES Future Preparations:

- Proportion of budget spent on the Rolling Work Plan: 50%
- Annual budget for industry study contracts: €5 M per year
- Funding level: 100%
- Completed and Published activities: 120
- Running activities: 27
- ITTs issued in the last five years: >60
- Proposals received in the last five years: >200
- Countries with ARTES Future Preparations prime contractors: 18
- Final report requests in the last 12 months: >120
- Typical study duration: 15 months
- Typical study budget: €300k

How Can I Participate in ARTES Future Preparations?

- Manage or participate in an ARTES Future Preparations study
  - ARTES Future Preparations industrial activities are initiated by an open ITT
  - Open to any organisation based within the ARTES participating states
  - No specific support required from National Delegations
  - Prime contractors based in 18 out of 22 ARTES participating states

- Contribute to the Work Plan formation
  - *Open "Call for Ideas" for future ARTES Future Preparations activities*
  - *Guidelines and submission forms available on the ESA Telecom web-site (https://artes.esa.int/artes-call-for-ideas)*
  - *Continuously open throughout the year*
  - *Ideas considered for addition to the ARTES Future Preparations work plan on a quarterly basis*
  - Ideas adopted issued in open competition as they are 100% funded

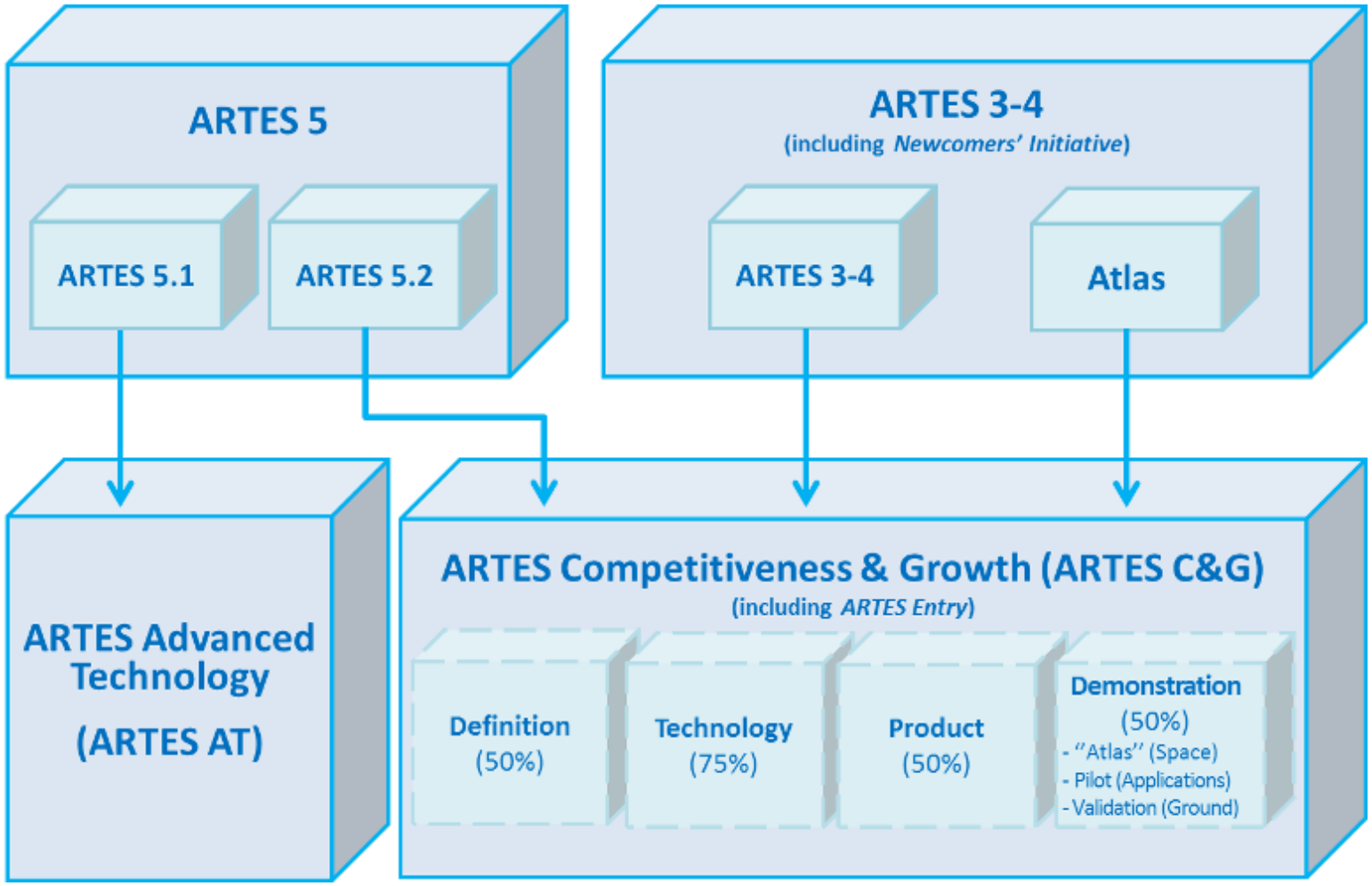
↳ ***Your inputs and suggestions are requested and gratefully received***

How can I Access the Results of ARTES Future Preparations?

- Via the ESA ARTES web-site (https://artes.esa.int/future-preparations/projects)
  - Summaries of over 150 running and completed ARTES Future Preparations activities
  - Copies of Final reports and Executive Summaries can be requested (normally provided within a week)
  - Available to anyone working within the ARTES participating states (web site registration required)
  - >120 document requests last year

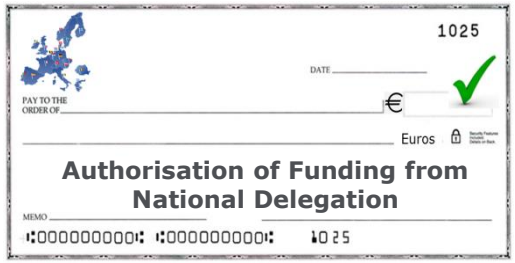
- Attending the ARTES Future Preparations Final Presentation Days:
  - Objectives are to disseminate the results of recently completed ARTES Future Preparations study activities to industry and institutions from within the ARTES participating states
  - Share the results and conclusions from internal (ESA) studies and investigations
  - Held annually each January

ARTES 3-4 & 5 Evolution



ARTES Advanced Technology (AT)

ARTES Advanced Technology (AT) : ESA-initiated activities – open competition



Always open ESA Call for Ideas

Annual Workplan

Invitation To Tender (ITT)

ESA awards 1 contract

ARTES AT - 100% funded

ARTES AT
- ***Breadboard***
- ***Engineering Model***

New: ESA focuses Statement Of Work in the Invitation To Tender on the **"What"**

ARTES AT Implementation: System
Status 08/04/2016

Activity Ref.	Title	Cost	Priority	Cost (K€) (priority 1)	Cost (K€) (priority 2)	Proc. Policy	Intended ITT issue quarter / closing date ITT	ITT (re-) issued	originally approved in Workplan
	SYSTEM/ NETWORK / PROTOCOLS								
	System, Networking and Management								
3A.062	Prototype for a command and control data link for UAV's in the 5 GHz band (re-issue) (**)	500	P1	500	0	C	4Q 2016		2015
3A.066	Test-bed for Cost-efficient M2M Systems (**)	400	P2	0	400	C	n/a		2015
3A.069	Network Coding Protocols for Satellite Terminals with Multiple Logical Paths (**)	500	P1	500	0	C1	12/04/2016	Y	2015
3A.070	Verification campaign of the DVB Carrier-ID detection and demodulation (re-issue) (**)	600	P1	600	0	C1	17/03/2016	Y	2015
3A.071	Demonstrator of light-weight application and transport protocols for future M2M applications (*) (**) *(initiation requested by AT and LU)*	400	P1	400	0	C1	22/04/2016	Y	2015
3A.073	High Throughput Digital Broadcasting Satellite Systems (**)	500	P1	500	0	C	12/04/2016	Y	2015
3A.074	Security and content rights management in satellite-assisted in-network caching systems (**)	600	P1	600	0	C	02/05/2016	Y	2015
3A.075	Demonstrator for Satellite Terrestrial integration in the 5G context	1,500	P1	1,500	0	C1	4Q 2016		2016
3A.076	Carrier Aggregation in Satellite Communication Networks	450	P1	450	0	C1	4Q 2016		2016
3A.077	Demonstrator of License Assisted Spectrum Access Satellite Networks	600	P1	600	0	C	4Q 2016		2016
3A.078	Live Satellite Demonstration of Advanced Interference Management Techniques	1,300	P2	0	1,300	C	n/a		2016
3A.079	Demonstrator for Extremely High Frequency (EHF) Broadband Links	400	P2	0	400	C	n/a		2016
3A.080	Satellite M2M Technologies Demonstration	500	P2	0	500	C	n/a		2016
	subtotal	***8,250***		**5,650**	**2,600**				
	Propagation								
3B.030	Reference procedure for adoption of software tools and digital products as ITU-R recommendation (*) (**) *(initiation requested by AT)*	300	P1	300	0	C3	13/05/2015	Y	2013
3B.033	Cubesat-based W-band channel measurements (re-issue) (**)	3,000	P1	3,000	0	C	14/04/2016	Y	2015
	subtotal	***3,300***		**3,300**	**0**				
	Coding, Modulation and Access								
3C.011	Live Demonstration of Orthogonal Frequency Division Multiple Access Technologies (re-issue)	700	P1	700	0	C1	01/03/2016	Y	2015
3C.012	DTH Transmit and Receive Demonstrator using Variable/Scalable Coding and Modulation	520	P2	0	520	C	n/a		2016
	subtotal	***1,220***		**700**	**520**				

ARTES AT Implementation: Platform
Status 08/04/2016

Activity Ref.	Title	Cost	Priority	Cost (K€) (priority 1)	Cost (K€) (priority 2)	Proc. Policy	Intended ITT issue quarter / closing date ITT	ITT (re-) issued	originally approved in Workplan
	SPACE SEGMENT - PLATFORM								
	Platform - System and Architecture								
4A.055	Energy Storage Packaging Optimisation (re-issue)	700	P1	700	0	C	15/03/2016	Y	2015
4A.056	3D Molded Interconnect Device (3D MID) characterisation for space telecom applications (re-issue)	600	P1	600	0	C2	14/01/2016	Y	2015
4A.057	Low cost GNSS Receiver for Geostationary Telecom Satellites (re-issue) (**)	500	P1	500	0	C	2Q 2016		2015
4A.058	Augmented reality for telecom spacecraft AIT	500	P1	500	0	C	22/02/2016	Y	2015
4A.060	Fault-Tolerant and Commercial Off The Shelf-based On Board Computer	500	P1	500	0	C	4Q 2016		2016
4A.061	Multifunctional Structure Elements	500	P2	0	500	C	n/a		2016
4A.063	Industrial Radiation Shielding Analysis Methods for Telecom Satellites	450	P2	0	450	C	n/a		2016
4A.064	Pointing Error Engineering for Telecommunication Missions	400	P2	0	400	C	n/a		2016
	subtotal	***4,150***		**2,800**	**1,350**				
	Propulsion System								
4B.084	Flexible pipes for propulsion systems (re-issue)	450	P1	450	0	C2	13/10/2015	Y	2014
4B.107	High Power High Voltage Transformer for Electric Propulsion	500	P1	500	0	C	04/02/2016	Y	2015
4B.108	High flow rate pressure regulator for all electric telecom satellite applications (**)	600	P2	0	600	C	n/a		2015
4B.120	Alternative Titanium Tank Hemisphere Manufacturing Techniques	500	P2	0	500	C	n/a		2016
4B.121	Long-Life and High Performance Thruster	700	P1	700	0	C	4Q 2016		2016
	subtotal	***2,750***		**1,650**	**1,100**				
	AOCS								
4C.035	Star Tracker based on Faint Star predevelopment for Telecoms (**)	500	P1	500	0	C1	2Q 2016		2014
4C.041	Improved Torque Stability of Reaction Wheels via Embedded Digital Wheel Speed Control	500	P1	500	0	C	4Q 2016		2016
4C.042	On-board Guidance Optimisation for Electric Propulsion Orbit Raising	450	P1	450	0	C	4Q 2016		2016
	subtotal	***1,450***		**1,450**	**0**				
	Thermal System								
4D.044	3D Thermal Interface for High Power Unit using Additive Layer Manufacturing	400	P1	400	0	C	4Q 2016		2016
4D.045	Development of Wireless Passive Sensors for Temperature Measurement	300	P2	0	300	C1	n/a		2016
4D.046	Heat Pump System Compressor	600	P2	0	600	C1	n/a		2016
	subtotal	***1,300***		**400**	**900**				

ARTES AT Implementation: Platform
Status 08/04/2016

Activity Ref.	Title	Cost	Priority	Cost (K€) (priority 1)	Cost (K€) (priority 2)	Proc. Policy	Intended ITT issue quarter / closing date ITT	ITT (re-) issued	originally approved in Workplan
	SPACE SEGMENT - PLATFORM								
	Mechanical System								
4E.059	Design margin optimisation for mechanisms on board telecommunication spacecrafts	500	P1	500	0	C	2Q 2016		2015
4E.061	Characterisation of integrated damping features for elastic collapsible CFRP hinges (re-	300	P1	300	0	C	13/10/2015	Y	2014
4E.066	CFRP grid tubular structures (*)	800	P1	800	0	C	21/01/2016	Y	2015
	subtotal	***1,600***		**1,600**	**0**				
	Power System								
4F.084	Aluminium wire application in telecommunication platforms (**) *(former priority 1 activity)*	400	P2	0	400	C	n/a		2014
4F.099	Power Processing Unit Switch-On strategy after Spacecraft Separation	400	P1	400	0	C	4Q 2016		2016
4F.100	Alternative European Micro-Point of Load Design	500	P2	0	500	C1	n/a		2016
4F.101	Development and Optimisation of a new Slip-Ring for High Power Density Applications	500	P2	0	500	C1	n/a		2016
4F.102	Enhanced Coating Technologies for Next Generation Solar Cells	500	P2	0	500	C	n/a		2016
4F.103	Solar Array Drive Mechanism Slip-Ring Sensitivity Against Standard Pollution Types and Levels	600	P2	0	600	C	n/a		2016
4F.104	Alternative Components for Medium to High Power Solar Array Drive Mechanisms	700	P2	0	700	C	n/a		2016
	subtotal	***3,600***		**400**	**3,200**				
	Command and Data Handling								
4G.013	Low-cost multi-channel transceiver for hosted payloads (**)	700	P1	700	0	C	2Q 2016		2015
4G.015	Development of a Hosted Payload Interface Unit	400	P1	400	0	C	4Q 2016		2016
4G.016	Corona-Free S-band Diplexers for Tracking Telemetry & Command	400	P2	0	400	C	n/a		2016
	subtotal	***1,500***		**1,100**	**400**				

ARTES AT Implementation: Payload
Status 08/04/2016

Activity Ref.	Title	Cost	Priority	Cost (K€) (priority 1)	Cost (K€) (priority 2)	Proc. Policy	Intended ITT issue quarter / closing date ITT	ITT (re-) issued	originally approved in Workplan
	SPACE SEGMENT - PAYLOAD								
	Payload - system and architecture								
5A.037	On-board Interference Geo-Location System (**) (*) *(initiation requested by BE)*	600	P1	600	0	C	02/03/2016	Y	2014
5A.047	Digital to RF direct converters (re-issue)	400	P1	400	0	C	4Q 2016		2015
5A.051	Performance Enhancement of Transparent Digital Processors	400	P1	400	0	C	4Q 2016		2016
5A.052	Risley Prism Beam Steering Device	800	P1	800	0	C1	4Q 2016		2016
5A.053	Wavelength Division Multiplexing (WDM) on Optical Communication Terminals	800	P2	0	800	C1	n/a		2016
5A.054	C-band Inter-Satellite Link	650	P2	0	650	C	n/a		2016
5A.055	Accurate Pressure Predictions in Critical High Power RF Hardware	400	P2	0	400	C	n/a		2016
	subtotal	***4,050***		**2,200**	**1,850**				
	Antenna								
5B.120	Array fed reflector antenna for non-regular beam-size coverage (re-issue)	700	P1	700	0	C	29/01/2016	Y	2013
5B.137	Radio Frequency and deployment test methods for large antennas (re-issue)	550	P1	550	0	C	18/04/2016	Y	2014
5B.138	Mesh and associated carrying net for Deployable Reflector	500	P1	500	0	C1	12/10/2015	Y	2014
5B.162	Measurement Methodology for Fast Antenna Testing	600	P1	600	0	C	4Q 2016		2016
5B.163	Antenna Deployment Arm with Integrated Elastic Hinges	400	P1	400	0	C	4Q 2016		2016
5B.164	Design for Manufacture Approach for Large Frequency Selective Surfaces for Telecom Applications	500	P1	500	0	C1	4Q 2016		2016
5B.165	Cost-Effective High-Gain CubeSat Antennas	350	P2	0	350	C2	n/a		2016
	subtotal	***3,600***		**3,250**	**350**				
	Repeater Equipment								
5C.200	Ka/Q-band Upconverter (*) (**) *(initiation requested by SE)*	500	P1	500	0	C	06/01/2016	Y	2013
5C.227	Technology development for Q-/V-band lineariser (re-issue)	500	P1	500	0	C	01/02/2016	Y	2014
5C.237	High Power Photoreceivers for High Dynamic Range - High Frequency Photonic RF Links (*) (**) *(initiation requested by CH)*	300	P1	300	0	C1	22/10/2015	Y	2014
5C.263	PIM free tuning technologies for microwave filters and OMUX manifold (re-issue)	400	P1	400	0	C	4Q 2016		2015
5C.264	High performance Surface Acoustic Wave filters (**) *(Initiation requested by NO)*	400	P1	400	0	C1	02/11/2015	Y	2015
5C.266	Gallium Nitride output stage for converter (re-issue) (**)	750	P1	750	0	C	2Q 2016		2015
5C.268	Compact C-/Ku-band Broadband Waveguide Filters	400	P1	400	0	C	02/11/2015	Y	2015
5C.269	Miniaturised Ka-Band Beamforming Network Using Additive Manufacturing Techniques (**)	500	P2	0	500	C	n/a		2015

ARTES AT Implementation: Payload
Status 08/04/2016

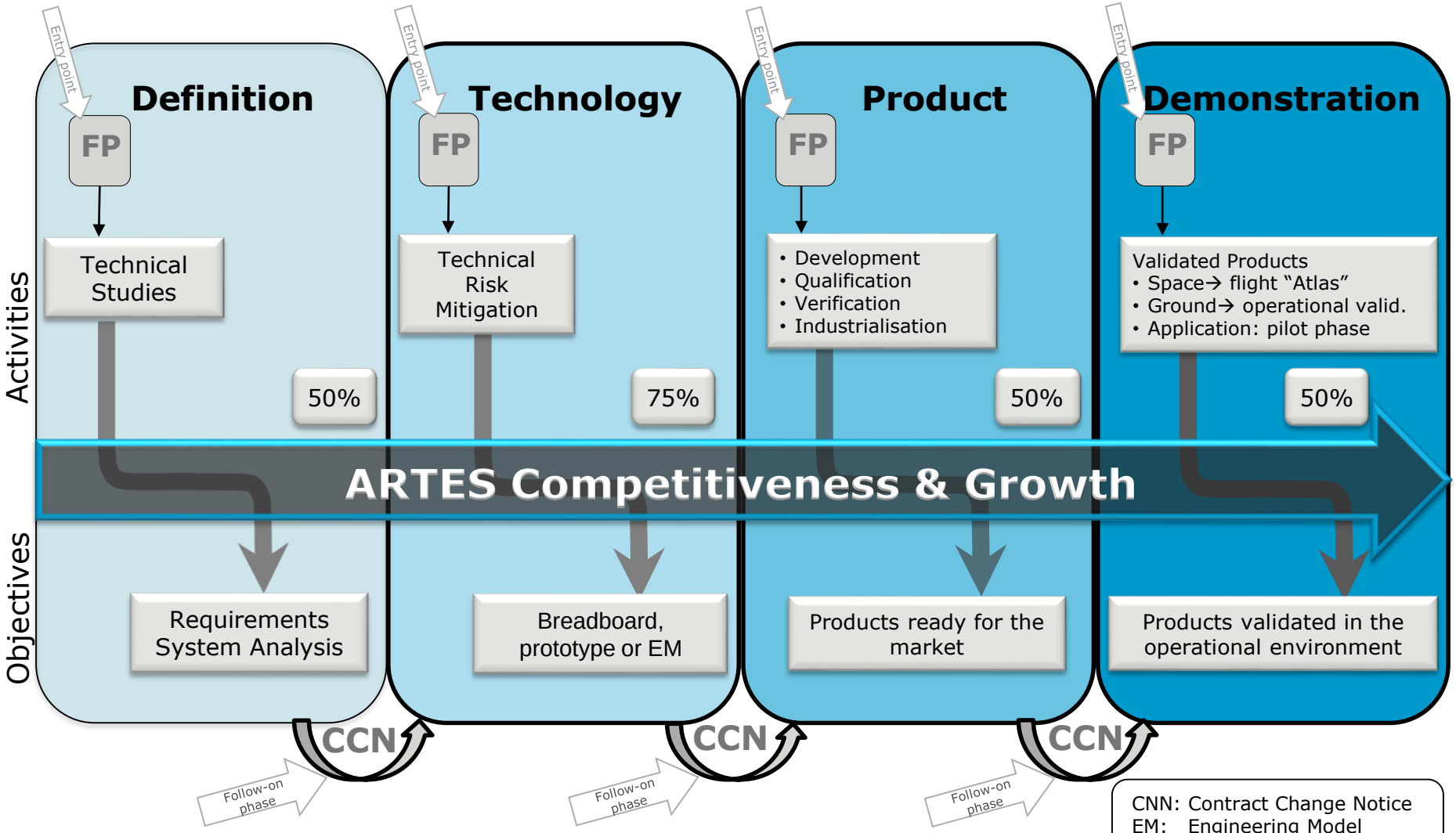
Activity Ref.	Title	Cost	Priority	Cost (K€) (priority 1)	Cost (K€) (priority 2)	Proc. Policy	Intended ITT issue quarter / closing date ITT	ITT (re-) issued	originally approved in Workplan
	SPACE SEGMENT - PAYLOAD								
5C.270	Miniaturised Diplexers for L-Band Mobile Missions (re-issue) (**)	600	P1	600	0	C1	4Q 2016		2015
5C.275	High Voltage Cable for Q-Band Traveling Wave Tube Amplifiers (re-issue) (**)	600	P1	600	0	C1	4Q 2016		2015
5C.276	Waveguide Flanges with enhanced passive intermodulation performance (**)	300	P1	300	0	C	21/04/2016	Y	2015
5C.279	Filters and Diplexer with Improved In-band Performance (re-issue)	450	P1	450	0	C	2Q 2016		2015
5C.300	Cost Competitive and Reliable Converters	1,000	P1	1,000	0	C	4Q 2016		2016
5C.301	Miniature Bulk Acoustic Wave Filters	500	P1	500	0	C1	4Q 2016		2016
5C.302	High Linearity Gallium Nitride (GaN) Mixer	500	P1	500	0	C1	4Q 2016		2016
5C.303	Fully Adaptive RF Linearisers for High Power Amplifiers	850	P1	850	0	C	4Q 2016		2016
5C.304	Next Generation Temperature Compensated OMUX Channel Filters	650	P1	650	0	C	4Q 2016		2016
5C.305	Adaptable MODEMs for Inter-Satellite Links	900	P2	0	900	C1	n/a		2016
5C.306	Transparent Optical Transponder Demonstrator	750	P2	0	750	C	n/a		2016
5C.307	Q-Band Output Multiplexer	500	P2	0	500	C	n/a		2016
5C.308	Development of Nonlinear Broadband Models of TWTs for Highly Optimised Linearisers	700	P2	0	700	C	n/a		2016
5C.309	Low Loss Flexible Waveguide Interconnections	350	P2	0	350	C1	n/a		2016
5C.310	Novel Class of Isolators	600	P2	0	600	C1	n/a		2016
5C.311	Demonstration of GaN HPA with Improved Radiation Robustness for Future Telecom Missions	600	P2	0	600	C	n/a		2016
5C.312	Channel Amplifier Integrating SiGe Technology	500	P2	0	500	C	n/a		2016
5C.313	W-Band Waveguide Switch	400	P2	0	400	C1	n/a		2016
	subtotal	***#####***		**8,700**	**5,800**				
	Small Sat Payload Equipment								
5E.001	Miniaturised Ka-band FSS transponder for small satellites	500	P1	500	0	C	05/02/2016	Y	2015
5E.002	C-band transceiver for small satellites (**)	500	P1	500	0	C	01/06/2016	Y	2015
5E.003	Ka-band LEO-LEO ISL for small satellites	900	P1	500	0	C	18/01/2016	Y	2015
5E.004	Ka-band Medium-gain antenna and pointing mechanism for smallsats	500	P1	500	0	C	27/11/2015	Y	2015
5E.005	Deployable antenna structures for small satellites (re-issue) (**)	500	P1	500	0	C	20/04/2016	Y	2015
5E.006	Network and link layer solutions for inter-satellite links between small satellites (**)	350	P1	350	0	C	01/07/2016	Y	2015
5E.008	Small receive-only Ka-band 23 GHz antenna and demodulator for use on smaller satellites (re-issue)	450	P1	450	0	C	4Q 2016		2015
5E.009	Space Based VDE Transceiver (*) *(initiation requested by NO)*	900	P1	900	0	C2	2Q 2016		2016
5E.010	Development of a Light-weight Optical Terminal for Small Satellites	1,000	P2	0	1,000	C2	n/a		2016
	subtotal	***5,200***		**4,200**	**1,000**				

ARTES AT Implementation: Ground Segment
Status 08/04/2016

Activity Ref.	Title	Cost	Priority	Cost (K€) (priority 1)	Cost (K€) (priority 2)	Proc. Policy	Intended ITT issue quarter / closing date ITT	ITT (re-) issued	originally approved in Workplan
	GROUND SEGMENT								
	TT&C/Ground Support Equipment								
6A.054	Implementation of Virtualised Network Function (VNF) for Broadband Satellite Networks	750	P1	750	0	C	4Q 2016		2016
6A.055	Integrated Bi-Directional Amplifier for Remotely Piloted Vehicle Applications	500	P1	500	0	C1	4Q 2016		2016
	subtotal	***1,250***		**1,250**	**0**				
	Ground Network Operation Control and Gateway								
6B.025	High Power Q/V-Band Diplexers for Ground Stations (re-issue)	350	P1	350	0	C1	4Q 2016		2015
6B.030	Satellite Gateway Development for Massive Uncoordinated Access Networks	700	P1	700	0	C	4Q 2016		2016
6B.031	Critical Building Blocks for Next-Generation Q-/V- and W-Band ground HPAs	1,500	P2	0	1,500	C2	n/a		2016
6B.032	Innovative Feeder Link Antenna Array for Future Wide Band Communications in Ka-	300	P2	0	300	C	n/a		2016
	subtotal	***2,850***		**1,050**	**1,800**				
	USER TERMINALS								
7-.038	Embedded Antenna Arrays in small UAV Wing Structures (re-issue) (*) (**) *(initiation requested by NL)*	500	P1	500	0	C1	3Q 2016		2012
	subtotal	***500***		**500**	**0**				
	Professional User Terminals								
7A.031	Modem prototype for MEO broadband access (*) *(initiation requested by LU)*	400	P1	400	0	C1	25/01/2016	Y	2014
7A.036	Ka-band Transceiver Power devices	1,000	P2	0	1,000	C2	n/a		2016
7A.038	10 Gbps Modem for Telecom Point-to-Point Applications	1,400	P2	0	1,400	C1	n/a		2016
7A.039	Terrestrial Interference Resilient Terminal Prototype	600	P2	0	600	C1	n/a		2016
	subtotal	***3,400***		**400**	**3,000**				
	Consumer User Terminals								
7B.026	Low Cost Satellite M2M Front-End (re-issue)	800	P1	800	0	C1	15/02/2016	Y	2015
7B.031	M2M 'Makerspace' for Satellite Communications (*) *(initiation requested by FI and IE)*	500	P1	500	0	C3	2Q 2016		2016
7B.032	Broadband SiGe IQ-modulator	350	P1	350	0	C1	4Q 2016		2016
	subtotal	***1,650***		**1,650**	**0**				
	User Terminal Mobile								
7C.028	Aeronautical antenna for dual band including L-band AMS(R)S and other existing aircraft applications (re-issue)	500	P1	500	0	C1	02/05/2016	Y	2013
7C.037	Cost Effective VDE-SAT User Terminal and Ground Component Validation Platform	650	P1	650	0	C1	18/090/2015	Y	2015
7C.039	Ka-band Receive Only Active Antenna for the Consumer Market (**)	1,500	P2	0	1,500	C1	n/a		2015
7C.040	Low Profile Active Scanning Antenna Array Demonstrator (re-issue)	1,000	P1	1,000	0	C1	2Q 2016		2015
7C.042	SatCom Module for Smartphones (re-issue) (**)	550	P1	550	0	C1	18/05/2016	Y	2015
	subtotal	***4,200***		**2,700**	**1,500**				

ARTES Competitiveness & Growth (C&G)

ARTES C&G Development Phases toward the Market

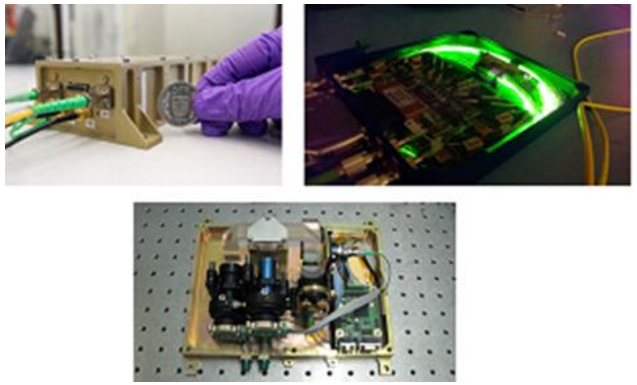


ARTES C&G
Definition Phase

- Used when there is lack of clarity on:
  - Market requirements
  - Interface requirements
  - Product specification
- Can be used to collect customer requirements but business development activities are not eligible for funding
- May be used as a first step to entry in a product/application development Activity
- Up to 50% funded up to a maximum of 250k€ ESA price.
- Expected output: Assessment/requirements of the future product
- Typically the Definition Phase is followed by an ARTES development activity

ARTES C&G
Technology Phase

- New technologies or techniques for products/ applications for satellite telecommunications
- Up to and including TRL 6 (Engineering Model).
- Technical risks shall be identified in the full proposal and mitigated during the activity.
- Qualification activities are excluded.
- **Proposals required:**
    1. Outline Proposal (including business case)
    2. Full Proposal
- Prior Work is not accepted.

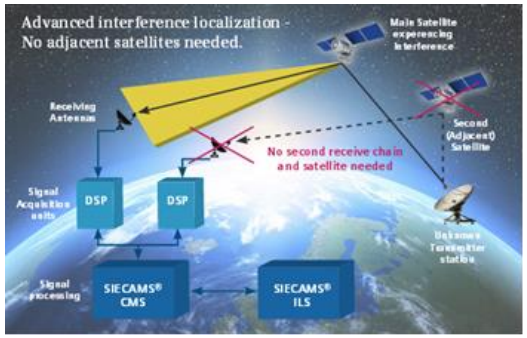


Terminal for Small Satellite Applications (RUAG) *Optel-μ pulsed laser transmitter, optical fibre amplifier and micro pointing assembly*

ARTES C&G
Product Phase

The products shall be for satellite telecommunications including:

- Improvement or development of space and ground HW, SW, or (sub)system;
- Development of satellite communications applications and services.



SIECAMS system courtesy of SIEMENS AT

Proposals:

1. Outline Proposal (incl. business case)
2. Full Proposal (Ground Segment, Space, Application)

An Outline Proposal **is mandatory** prior to submitting a Full Proposal.

Marketing and commercialisation activities are not supported.

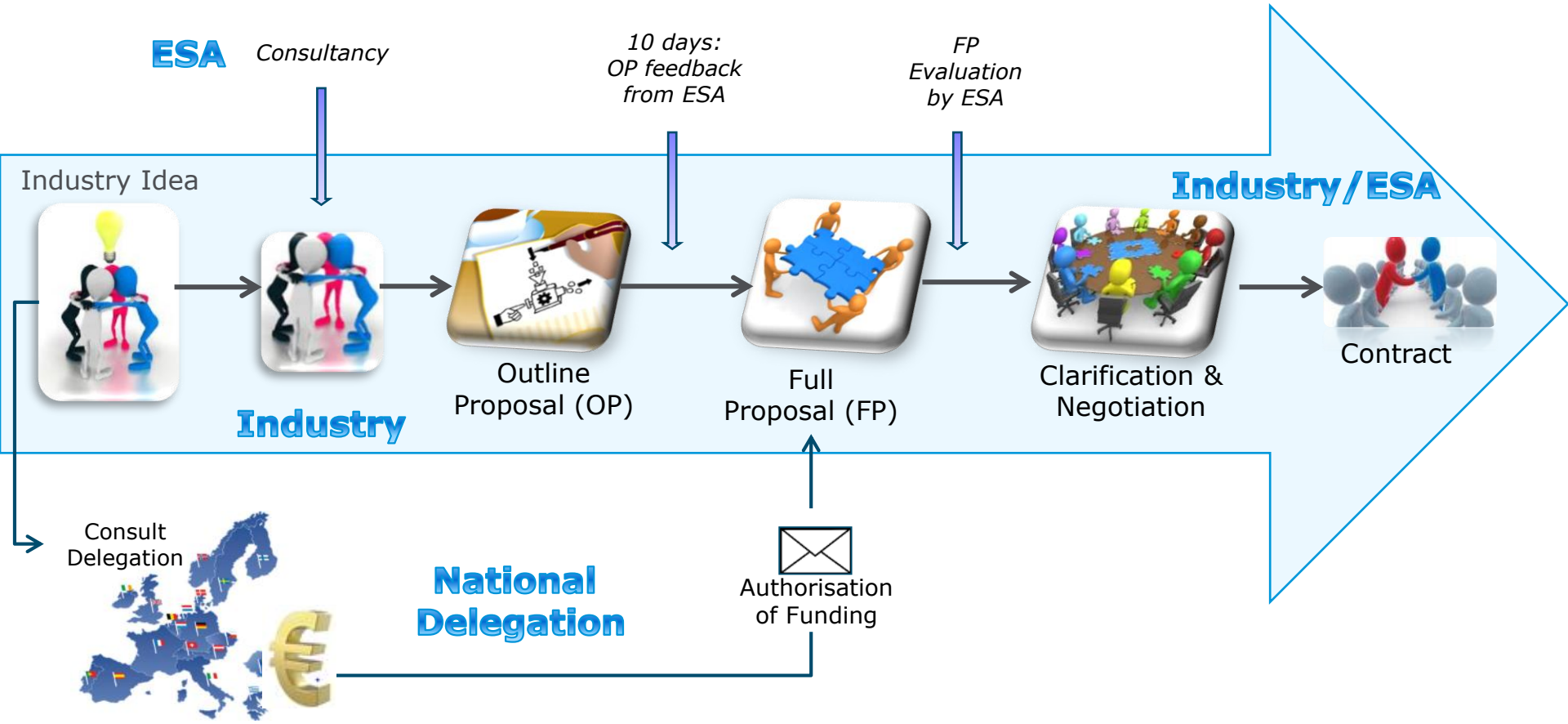
Mandatory outcome=> Product ready for commercial exploitation

ARTES C&G
Demonstration Phase

The **Demonstration Phase** aims to support demonstration activities in the space, ground segment and satcom application areas:

1. **Flight activities** ("Atlas") to gain flight heritage
2. **Ground:** a validation in an operational environment to demonstrate the commercial attractiveness of the product shall be included
3. **Applications and Service:** a pilot operation to demonstrate the sustainability of the commercial service shall be included. In this pilot phase, the service shall be validated with relevant users and customers.

ARTES C&G Process for the Full Proposal covering one or more Development Phases



Outline Proposals: Business case is a key element

1. **Target Customer:** describe who would buy and use the product and their needs, and how you reach them – when possible engage them to gather requirements or involvement
2. **Market Analysis:** try to obtain 3rd party data to support claims and financial analysis
3. **Competition:** identify the competitors and their offering and provide the Product Positioning: Features, Performances, Price
4. **Value Chain:** identify suppliers, distributors, resellers and key dependencies. Describe also the main interaction among key players
5. **ROI**: expected ROI (e.g. NPV) for the investment and strategic impact (e.g. job creation)

ARTES C&G Development Phases, Funding and Objectives

	Maximum Funding Level			
Development Phase (Main activities)	**Industry**	**Entry (up to 250k Euro)**	**Universities or research institutes**	**Objectives**
Definition Phase (Technical Studies)	50%	N/A	50% (up to 30% contract cost)	Performance requirements defined, or system analysis completed
Technology Phase (technical risk mitigation excluding any qualification or industrialisation)	75%	75%	100% (up to 30% contract cost)	Breadboard, Prototype or Engineering Model
Product Phase (development, qualification, verification and industrialisation)	50%	75%	50% (up to 30% contract cost)	Space: (E)QM or similar
				Ground: verified product in a non-operational environment
				Applications: application validated in a satcom system
Demonstration Phase For space, ground product and application/services	50%	75%	N/A	Flight Phase "Atlas": Flight hardware (e.g. PFM)
				Operational Validation Phase: Ground Product validated in an operational environment
				Pilot Phase: Application/Service validated with relevant users and customers

Demonstration Phase for Space Products

« Atlas »

What is Atlas?

- **Atlas** is a **mechanism,** within ARTES C&G, to **support** the **Launch of "Flight Hardware"**
- **Atlas** supports any flight product related to **telecommunications satellites**
- **Atlas** helps the product gain the critical **Flight heritage**
    - helping de-risks introduction of new and **innovative** products and services
- **Atlas** Hardware can be:
    - On any **type of mission**
    - On a flight opportunity from anywhere in the **World**
    - within main mission (**Embedded**) or alongside the main mission as Hosted Technology (**Passenger**)
    - **Integrated** into an ARTES-supported Mission

Atlas is a flexible tool to gain flight heritage

Evolution in Atlas from ARTES 3-4 to ARTES C&G

- With the introduction of ARTES C&G some changes have been made to Atlas.
- In ARTES 3-4 Atlas was limited to supporting the **PFM** of innovative hardware.
- In ARTES C&G Atlas is part of the Demonstration Phase and can support "**Flight Hardware**":
  - Ability to support industry with **demonstrators** or where **lower qualification** levels are appropriate for **introducing** the product into the **target market**.
  - This includes launching **demonstrator payloads** to support system demonstrators.
- In ARTES C&G the Demonstration Phase can be used in conjunction with other Development Phases.

What are the benefits of Atlas?

- **Benefits for Equipment Supplier**
  - Gain crucial **flight heritage**
  - **Operator acceptance** of a product
  - **Prime acceptance** of a new product
  - **Support** from ESA
  - Help **introduce** new products to the market
  - **Expand range** of products
  - Others….

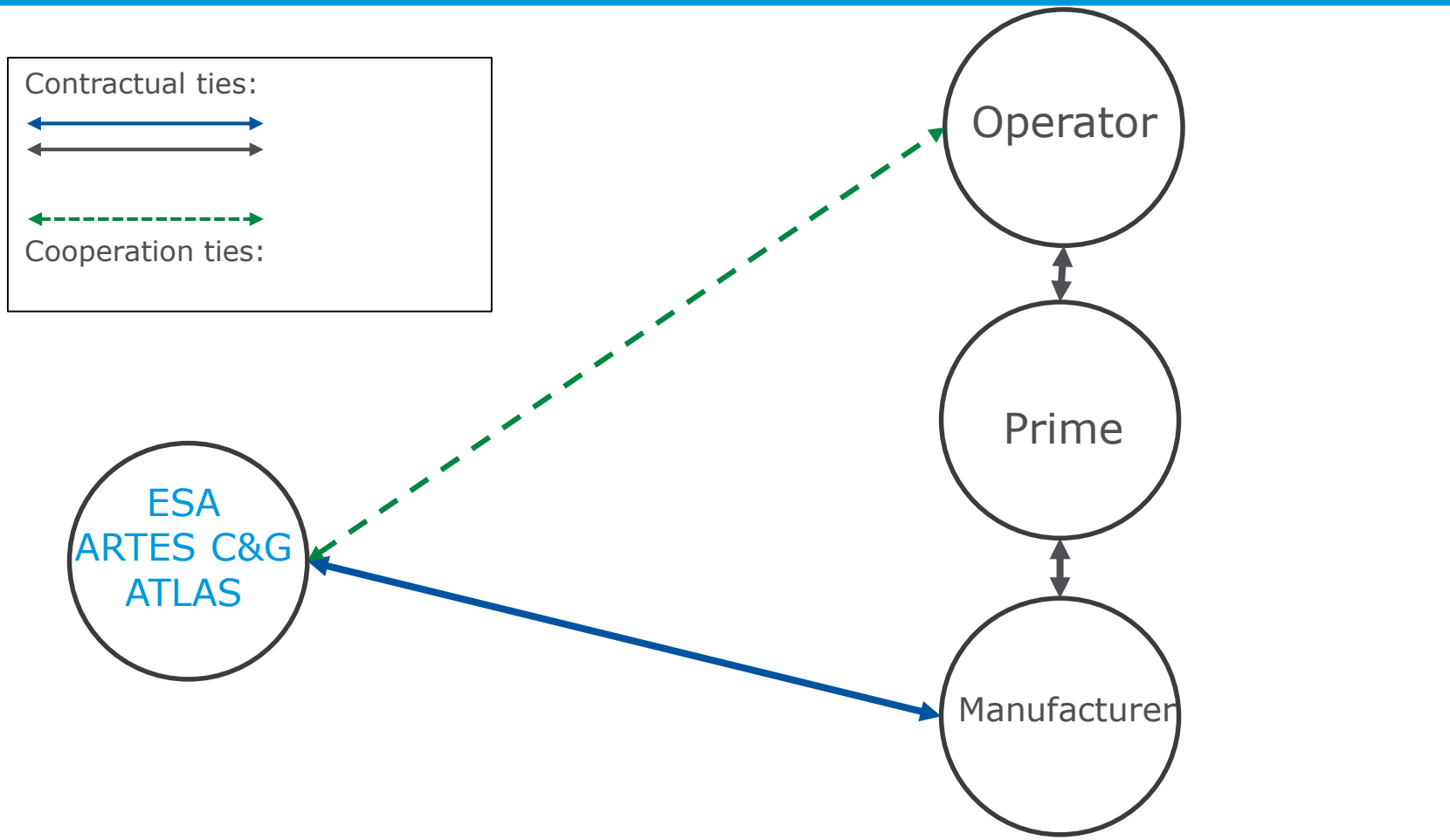
What are the benefits of Atlas?

- **Prime:**
  - Access to & influence on **new, innovative technologies**
  - Support for **integrating** the new product onto their platform.
  - Introduces a **Differentiator** giving a **competitive edge,** and makes the spacecraft **more attractive**

- **Operator:**
  - **enhanced capabilities** through the **new technology**
  - New **Differentiator** for their services
  - Test new services/**capabilities** in **realistic environment**

Atlas offers benefits to all the Players

ARTES C&G Demonstration Phase Atlas



Atlas aims to de-risk, not add risk to the mission

Atlas Support

- ESA supports the equipment manufacture in the development.
  - Access to ESA resources and support.
  - Provides co-funding for the Flight Model:

	Embedded (item part of commercial mission)	Passenger (Hosted Technology)
Accommodation study	Up to 50%	Up to 50%
Flight Hardware DVT (incl. hardware)		
Satellite level accommodation		
Portion of Sat Platform & Launch cost	Not eligible	
Launch campaign specific to item		
IOT and early Ops specific to item		

- Application process is basically the same as for ARTES C&G:
  - Proposal comes **from Manufacturer**.

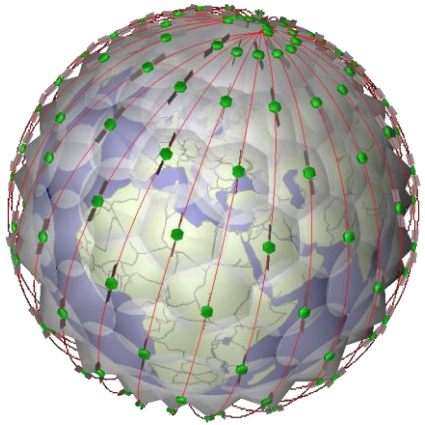
Atlas Opportunities

- One of ESA's goals is to support the introduction of new products:
  - **Atlas** is another tool to achieve this.

- ESA is building a catalogue of products looking for flight opportunities:
  - Work with industry to promote new products and services.
  - Help establish a dialogue with Primes and Operators.
  - Promote new technology.

Innovative Products in Orbit is a success for us ALL

ARTES Support to Megaconstellations



generated with SaViT™

The Megaconstellations Sector

- **OneWeb**:
  - > 800 LEO small satellites to deliver 3G/4G & WiFi.
  - Airbus Defence & Space partner to design & deliver satellites.
- **LEOSAT:**
  - > 100 LEO satellites to deliver high throughput services.
  - Thales Alenia Space selected as prime for system design, development, production & integration.
- **SSII:**
  - 300+ satellite constellation under definition with OHB.
- **Others**: O3bNetworks (operational) & NG, SpaceX, Samsung, Eightyleo etc.

Opportunities maturing, others emerging, a sector developing

Industrial Opportunity

- **European primes involved in the design & delivery of system and space segments;**
- **Selection process of suppliers for phase 1 started in Q4-2015 and is to finish as soon as Q3-2016:**
  - Worldwide supplier selection process
  - Disruptive production requirements: Cost, Volume, Rates
  - New technologies & production processes needed
  - Urgent opportunity for European & Canadian suppliers
- **Extension of the industrial capabilities to other applications is expected, beyond the initial wave of Megaconstellations**

A work plan for the immediate present AND the future

Workplan – Short term
Urgent support for immediate opportunities

- **Support the implementation of product development activities performed by European/Canadian suppliers that want to anticipate product developments addressing the requirements of LEO Megaconstellations**
- **Implementation: use of ARTES Competitiveness and Growth (Product Phase):**
  - A Procurement Plan approved by our Member States (MS).
  - **Immediate authority** to proceed with the **implementation of individual developments** for a **maximum total amount of 75 MEuro** (ESA price, 50% funding).
  - **Not requiring additional authorisation** for **initiation.**
  - Associated with an ARTES C&G Call for Proposals in support of Megaconstellations, **with a fast track procurement process**.
  - **Implementing** rules of ARTES C&G remain unchanged.
  - **A living procurement plan**: Should industrial proposals cover activities not initially identified, amendments would be further proposed to Member States.

ARTES C&G Fast Track for Megaconstellations

- **Scope of the ARTES C&G Fast Track for Megaconstellations:**
  - Currently for Space Products (platform and payload) and associated tools.
    Note: in case you wish to develop products for ground segment or applications please contact ESA
  - ARTES C&G Fast Track for Megaconstellations opened initially from Oct. until 31 July 2016.
  - Support equipment or sub-system development activities for which the supplier:
    - has been selected by an industrial prime or
    - can demonstrate a business opportunity linked with Megaconstellations
  - Support developments performed at system or subsystem level by an industrial prime involved in a Megaconstellations.

ARTES C&G Fast Track for Megaconstellations: Eligible Space Products

- **Antennas:**
  - On-board user, gateway and steerable multi-user antennas.
- **Repeater Units:**
  - Ka & Ku band RF high power amplifier, Ka & Ku band LNA's, frequency generation and distribution, frequency converters, passive RF filters, transparent and regenerative digital signal processors, ISL terminal, switches and switch networks, RF harness, integrated front end equipment, DC power subsystems, modulators/demodulators, RF test and calibration systems.
- **Satellite Platform:**
  - On board computer and satellite management system, solar arrays and cells, power conversion, batteries, Mechanisms (SADM, antenna deployment, pointing), structure, propulsion, TT&C equipment, sensors, actuators.
- **Mechanical & Electrical Ground Support Equipment:**
  - EGSE and MGSE adapted to the production of large number of units.

NOTE: Whilst not initially identified, other space segment or ground segment activities are not excluded. Interested companies are invited to contact ESA. The standard ARTES C&G Call for Proposals is applicable and always open for all products and applications.

ARTES C&G Fast Track for Megaconstellations: Routes to Contract

- **Two possible routes to contract:**
  - **Fast Track** Call for Proposals (AO 5891): for a supplier who can ***demonstrate a business opportunity linked with Megaconstellations*** (via a letter of support from the customer).
  - **Fast Track++** Call for Proposals (AO 8468): Prime (i.e. AIRBUS or TAS) involved in Megaconstellations, or a supplier ***selected by them with a letter of confirmation***.

Demonstration of a business plan for Fast Track

Outline Proposal	Full Proposal
Confirmation that the Tenderer has received the technical and commercial requirements from potential Customer(s) Detailed Description of the Business plan	Business plan is demonstrated (e.g. letter of interest from customer)

Demonstration of business plan for Fast Track++

Company/ Tenderer role	Draft Proposal (no PSS forms)	Full Proposal
Prime	Tenderer has received technical and commercial requirements from internal Customer	Evidence that the business case is confirmed (e.g. letter of confirmation that the supplier/product has been selected, copy of contract)
Supplier to prime	Tenderer has received technical and commercial requirements from Prime/Customer(s)	Evidence that the business case is confirmed (e.g. letter of confirmation that supplier/product has been selected, copy of contract)
Provider to a Supplier	Tenderer has received technical and commercial requirements from selected Supplier	Evidence that the business case is confirmed for both the Supplier (customer) and the Provider (e.g. letters of confirmation from customers, copy of contract)

ARTES Entry

ARTES Entry - Eligibility

ARTES Entry is a particular element **within ARTES Competitiveness & Growth** dedicated to promoting innovation in space telecommunications

Eligibility:

- **SMEs**(*) within the ARTES C&G Participating States:
  Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Romania, Spain, Sweden, Switzerland, United Kingdom.

- That **have not worked with ESA** either as Prime or Subcontractor **within the last ten** years.

(*) <250 employees, annual turnover <EUR 50 million
Full definition: criteria of the European Commission, recommendation 2003/361/EC of 6 May 2003 (OJ L 124, 20.5.2003, p. 36)

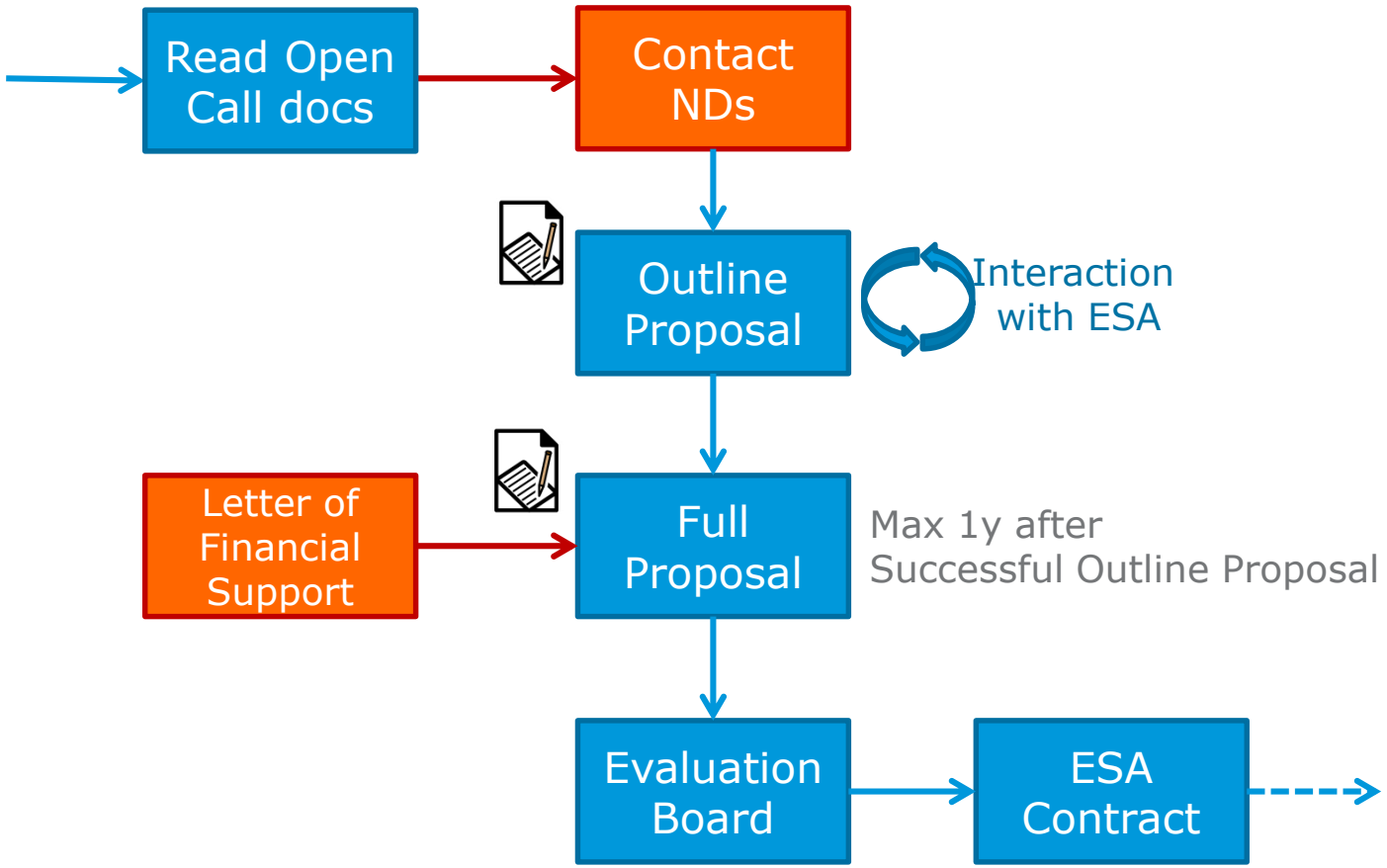
ARTES Entry – Scope

Segment → Development Phase ↓	Space	Ground	Application
Definition	NO	NO	NO
Technology	YES	YES	YES
Product	YES	YES	YES
Demonstration	NO	YES	YES

ARTES Entry - Funding

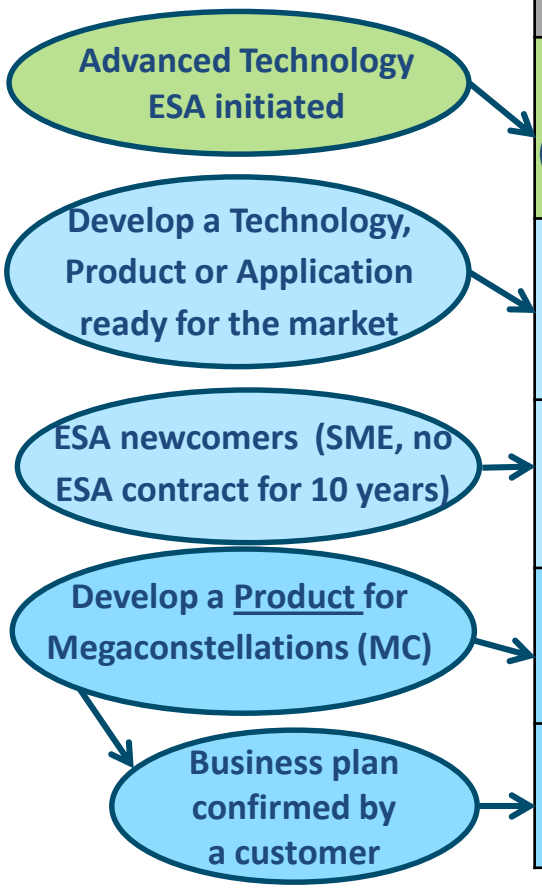
	Technology Phase	Product Phase	Demonstration Phase
SME	Up to 75%	Up to 75%	Up to 75%
University(ies) or Research Institute(s) as subcontractor(s) without commercial interest	Up to 100% (up to 30% contract cost)	Up to 50% (up to 30% contract cost)	n/a
University(ies) or Research Institute(s) as subcontractor(s) with commercial interest, or any other non-SME subcontractor	Up to 75%	Up to 50%	Up to 50%

ARTES Entry - Submission process



ARTES Entry is being implemented in the frame of the new ESA eTendering scheme (esa-star)

ARTES Advanced Technology, Competitiveness & Growth - Summary



Programme	Funding Level	Call for Proposals on EMITS	Announcem-ent of activity	Outline/Draft Proposal (OP/DP)	Full Proposal (FP)	Prior Work allowed
ARTES AT (ESA initiated)	100%	ITTs on EMITS (AO 8547)	No	No	Yes	No
ARTES C&G	50%/75%	AO 5891 AO 6000 (new one is in preparation)	No	OP	Yes	Depending on Phase up to 10% of costs
ARTES Entry	75% (up to 250K€)	AO8595	No	OP (simplified)	Yes	No
ARTES C&G Fast Track	50%	MC AO 5891	Yes	OP	Yes	Yes (20% of costs)
ARTES C&G Fast Track++	50%	MC AO 8468	Yes	DP (= FP without PSS forms)	Yes	Yes (20% of costs)

What is the Outline Proposal Toolkit? (OPTK)

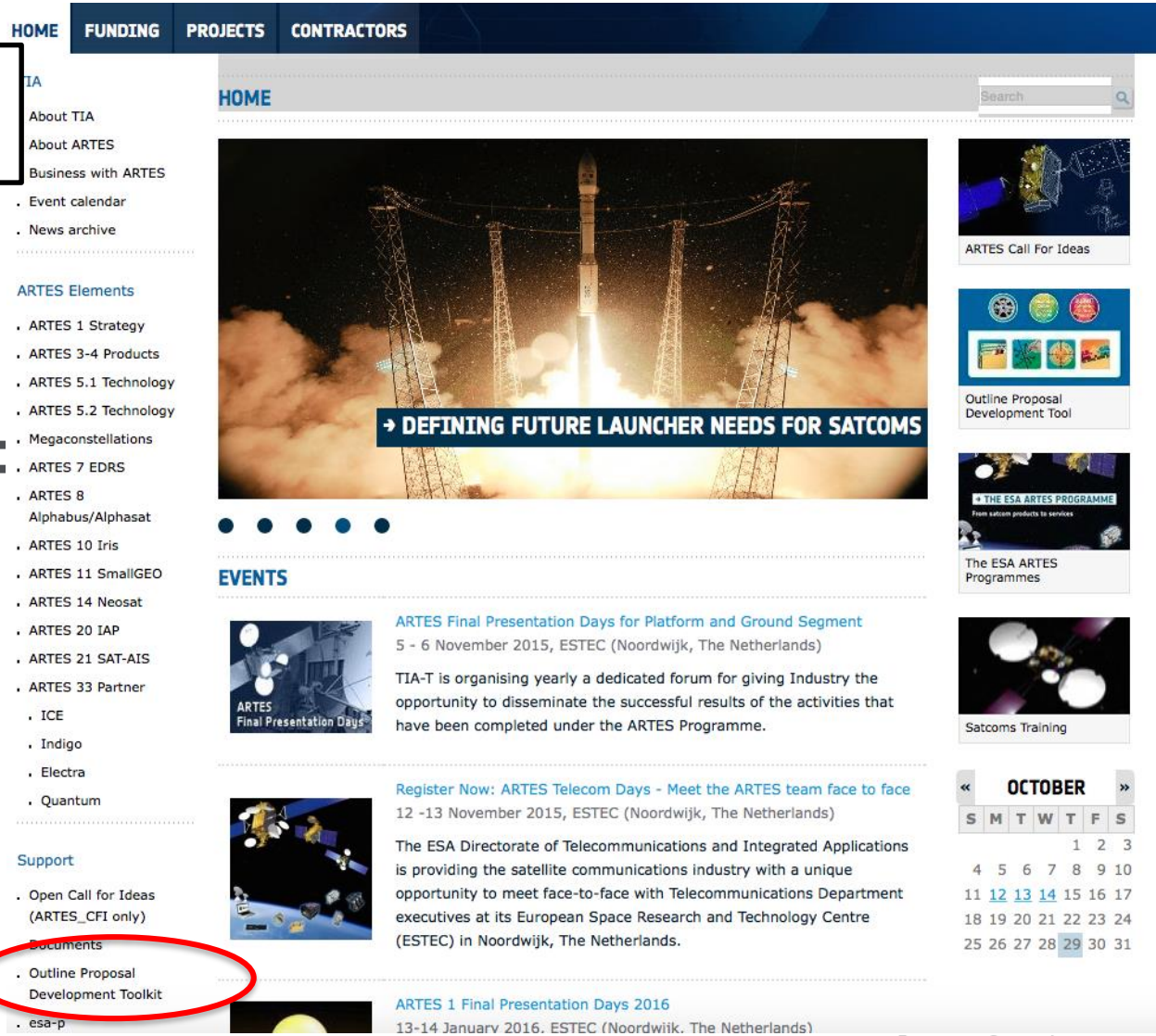
- Toolkit is an **optional** web-based training suite for preparing ARTES C&G as an Outline Proposal (OP)
- Tools are **web-based tutorials** comprised of video and animated presentations
- Tool is broken up into **modules** which can be used in a complete sequence or individually
- Tools help industry to understand:
  - what information is requested
  - how to present an idea
  - how to write it up in an OP

Link on artes.esa.int website

The web link for the tool is:

http://artes.esa.int/opdt/

Access tool from
ESA TIA home page:



Need to be registered user...

- Alphabus/Alphasat
- ARTES 10 Iris
- ARTES 11 SmallGEO
- ARTES 14 Neosat
- ARTES 20 IAP
- ARTES 21 SAT-AIS
- ARTES 33 Partner
  - ICE
  - Indigo
  - Electra
  - Quantum

Support

- Open Call for Ideas (ARTES_CFI only)
- Documents
- Outline Proposal Development Toolkit
- esa-p
- daptiv PPM
- ESA Technical Assets
- User Support Office
- FAQ

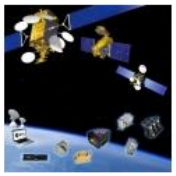
Contact

- National Delegations
- Newsletter
- Register

EVENTS

ARTES Final Presentation Days for Platform and Ground Segment
5 - 6 November 2015, ESTEC (Noordwijk, The Netherlands)

TIA-T is organising yearly a dedicated forum for giving Industry the opportunity to disseminate the successful results of the activities that have been completed under the ARTES Programme.



Register Now: ARTES Telecom Days - Meet the ARTES team face to face
12 -13 November 2015, ESTEC (Noordwijk, The Netherlands)

The ESA Directorate of Telecommunications and Integrated Applications is providing the satellite communications industry with a unique opportunity to meet face-to-face with Telecommunications Department executives at its European Space Research and Technology Centre (ESTEC) in Noordwijk, The Netherlands.

ARTES 1 Final Presentation Days 2016
13-14 January 2016, ESTEC (Noordwijk, The Netherlands)

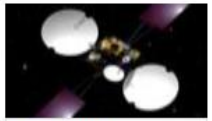
The Final Presentation Days represent a unique opportunity to gain a complete overview of recently completed ARTES 1 activities, and to discuss them with colleagues from ESA and other representatives of the satellite telecommunications sector.

3rd ESA Workshop on Advanced Flexible Telecom Payloads
22-25 March 2016, ESTEC (Noordwijk, The Netherlands)

The Workshop organisers are now accepting the submission of abstracts. The deadline is 1 December 2015. For more details, see the workshop website.

NEWS

The ESA ARTES Programmes



Satcoms Training

OCTOBER

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				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

You need to be registered and Logged in to TIA

Contact points

If you want to participate, go to: **http://artes.esa.int**
or contact us:

ARTES FP: **Andrew.Murrell@esa.int**
ARTES AT, ARTES C&G: **Dietmar.Schmitt@esa.int**
ARTES Entry:
Technical, Programmatic matters: **Francesco.Feliciani@esa.int**
Contractual matters: **Andrea.Dean@esa.int**

ARTES C&G Demonstration Phase Atlas: **John.Shirlaw@esa.int**

Megaconstellations (MC) Workplan: **Andrew.Murrell@esa.int**

Outline Proposal for ARTES C&G and MC Announcements of Activity are to be sent to:
Artes-CG@esa.int

ARTES Advanced Technology Expression of Interest are to be sent to:
Artes-AT@esa.int