

→ ARTES

CORE COMPETITIVENESS

A View on Recent Success



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INTRODUCTION

A recent study by London Economics estimates that typical returns on public investments for ESA Member States in telecom projects were up to €21 for each €1 invested, including both direct returns and spillovers. This is higher than overall ESA membership.

“There is evidence that the returns to membership of ESA increases with the duration of continued membership, highlighting the importance of consistent funding to maintain momentum.”

Return from Public Space Investments, Final Report, London Economics, October 2015

ARTES CORE COMPETITIVENESS : FROM IDEA TO MARKET

In recent years the satcom market landscape has rapidly changed due to increased competition from terrestrial services, evolution of end-user demand towards universal availability of broadband, and the emergence of new system paradigms like high throughput satellites and megaconstellations. This is driving the satcom industry to deliver higher performance products at lower costs, to offer highly integrated solutions and to increase quality of service.

While traditional satellite services such as TV broadcasting still dominate business revenues, recent studies by Cisco show that by 2019 data traffic will experience an 800% increase. The satellite industry is evolving in order to compete in this new environment and to turn it into a strategic opportunity. Innovative solutions, emerging from an enhanced relationship between technology providers, academia and industry, are the key to securing a strong market share.

ARTES Core Competitiveness (CC) is defined to provide a single framework that reduces administrative overhead and time to market. This allows industry to start with an idea and develop it right up to the introduction of new products & services to the market. The three components included are Future Preparations (FP), Advanced Technologies (AT) and Competitiveness & Growth (C&G).

Through ARTES Core Competitiveness, ESA helps the European and Canadian space industry enhance their short and long term competitiveness in the global satcoms market. As noted by the London Economics report, a sustained subscription to the ARTES programme is key to securing and increasing the remarkable economic return that it provides.

This dossier contains a small but representative selection of commercial success stories that have been achieved by the European and Canadian industry since 2012, with the support of ARTES Core Competitiveness.

→ EUTELSAT 8 WEST B: ACHIEVING THE OBJECTIVE



Arianespace

The launch and start of operations of Eutelsat 8 West B in 2015 symbolised the successful clearing of the last hurdle in the development and bringing to market of a number of new products under an Atlas activity, part of the ARTES CC Demonstration Phase. This satellite launch is the culmination of the full product life-cycle path from idea to market, which lies at the heart of ARTES Core Competitiveness.

The 5.8 tonne Eutelsat 8WB was built by Thales Alenia Space and is currently in operation over the Middle East and North Africa, providing TV channels to over 52 million homes. Eutelsat 8WB carries no less than three products supported by Atlas, all of which started life in earlier phases of ARTES CC. The embarked products add significant performance, flexibility and security to this new satellite.

As part of Atlas, in-orbit performance data will be provided by Eutelsat to the manufacturers and ESA. This is a significant aspect of the activity

“ The Atlas (now Demonstration) activities on Eutelsat 8WB have been a successful partnership between Eutelsat and ESA to bring these new and exciting technologies into service and Eutelsat looks forward to working again with ESA on future Atlas cases. ”

Hector Fenech, Director of Future Satellite Systems, Eutelsat

as it allows in-orbit functional and performance validation. This in turn allows enhancements and spawns new ideas for future products, which gives customers confidence that these products will enable them to meet business objectives both now and in the future.

These new products are the Ku-Band Flexible Frequency Converters, the Dual Flex High Power Amplification systems, and Frequency Flexible Command Receivers. In a competitive but conservative market, the acceptance for launch of an innovative product by an established operator often triggers further sales to other operators, as was the case for all these products. Thus there has been an immediate commercial payback for these units, with further orders placed.

“ Working with ESA and Eutelsat to achieve the first flight of Dual Flex LCTWTAs on E8WB has been a great success for TAS-B and helped us to book further sales of these units even before the spacecraft was launched. ”

Patrick Bury, Deputy General Manager, Thales Alenia Space Belgium

→ NEW FEED SUB-REFLECTOR ASSEMBLY CUTTING COSTS AND TIME



Airbus Defence and Space

The development of standardised and generic components is a key enabler for reducing overall telecom satellite system complexity and cost and is therefore in high demand from the market. In response, Madrid-based Airbus Defence and Space (CASA) has developed, designed, and tested a new space antenna Feed Sub-reflector Assembly (FSA) for the commercial satellite market. The new unit supports twin power feeds, the reflectors, and relevant feed chain assemblies along with a wide range of

sub-reflectors. It also offers advantages such as a large operational temperature range and improved thermo-elasticity, which is important for pointing accuracy.

This product is the result of an ARTES Technology Phase with a follow-on Product Phase. The new FSA has been validated for commercial flight and its first mission will be the SES-10 telecommunications satellite, scheduled for launch in 2016. This first flight opportunity confirms its acceptance by operators.

→ NEW ORDERS FOR NEXT GENERATION TT&C

The telemetry, tracking and command (TT&C) subsystem is at the heart of a satellite, allowing communication between ground control and the spacecraft. With the previous support of ESA ARTES, the Norwegian company Kongsberg Norspace established itself as a highly successful supplier of these key components to the global satellite industry.

In a recent follow-up ARTES Product Phase activity, Kongsberg Norspace is developing new-generation versions of

the original TT&C receiver, beacon and telemetry transmitters. The company has just received its first commercial orders for these versions. Airbus Defence and Space will incorporate the newest frequency flexible command receivers into the SES-10 satellite, scheduled for launch in 2016. The first frequency flexible telemetry transmitter of the second generation will be deployed on the Quantum satellite, a public-private partnership between ESA, Eutelsat, and Airbus Defence and Space - UK.



Kongsberg Norspace

→ SPACEGATE: THE COMPLETE SOLUTION

SpaceGate is a satellite network solution based on Digital Video Broadcasting (DVB) standards. It was previously developed and successfully marketed by Thales Alenia Space France and industrial partners for deployment in professional networks. As innovation and market preparation are key to many ARTES successes, TAS-F has taken the lead in an ARTES Product Phase activity to develop the third release of SpaceGate (R3). This release targets the High Throughput Satellite (HTS) market that is currently the chief focus of many operators and primes. The new product is compatible with diverse systems thanks to compliance with industry standards. It provides a full network solution based on the very high data rates offered via HTS (several hundred Gbytes/second) to hundreds of thousands of end-users.

Partnering within the ARTES programme has enabled TAS-F to achieve very good progress, and the company has now been awarded a major contract to deliver a complete solution for the first Bangladeshi telecom system, using SpaceGate as a primary component.



Thales Alenia Space

→ SATCOMS ANYWHERE

A SKYWAN 5G network does not require a standard hub to permit high-speed communication between remote sites. Rather, connectivity can be established between any two stations in the network with a single satellite hop. This capability allows deployment of remote-to-remote applications, such as video conferencing/collaboration and voice communications, with minimal satellite bandwidth utilisation and link delay. SKYWAN 5G is the smallest hub

device on the market that can also support outdoor equipment using its own power supply. Additionally, it can act either as a hub or master station, thereby adding significant network flexibility.

Developed by ND Satcom under an ARTES Product Phase activity, this flexible, high performance yet portable product has already entered series production.

“ With SpaceGate, Thales Alenia Space is able to provide optimised end-to-end satcom systems. This strategy is already validated thanks to its first commercial success in Bangladesh. ”

Cyrille Blossie, Head of SpaceGate Product Line, Thales Alenia Space



ND Satcom



ND Satcom

→ THRUSTER POINTING AIMS FOR MULTIPLE DELIVERIES

Electric propulsion thrusters are gradually being adopted for both orbit raising and station keeping. However, their use in both roles necessitates a completely different approach in order to make maximum use of their very high fuel efficiency.

In the course of three successive ARTES activities, Euro Heat Pipes has developed and qualified an articulated arm on which the thrusters are mounted. Its three-axis articulation enables the thrust to be oriented with the flight direction during electric orbit raising,

and pointed through the satellite centre of mass during station-keeping. Due to its critical role, this mechanism must be very reliable and capable to support all flight modes, yet remain compatible with a variety of thruster products. As such, the development has been thorough, with exhaustive design and testing activities. It is scheduled for first flight in 2017, selected by two fleet operators, and more sales are expected shortly. The ARTES path from idea to market has been crucial in supporting this important development.

“ The P-DPS programme has allowed EHP to move from a commodity manufacturer to a successful pointing mechanism integrator. Support from ARTES and Atlas programmes were key to this success! ”

Michel GANSEMAN, CEO, Euro Heat Pipes SA

→ MORE EFFICIENT CONTROL OF THE GROUND SEGMENT

Satellite operators are usually responsible for their satellite fleet as well as a large, complex and distributed ground segment. To increase their overall efficiency, it is desirable to enable the operations staff to use the same tools and resources to monitor and control both. In a recent ARTES Product Phase activity GMV developed and qualified such a product. Known

as Monitoring And Control (MAC), this tool enables the operator to control the ground segment facility in a similar manner as if it was another satellite in the overall controlled fleet, thus easing the operator burden and improving efficiency

The functionalities developed in the MAC project have been seamlessly

integrated into the GMV Hifly product line, leading to the Magnet product. Ground Segment satellite systems already in operation are now candidates to incorporate the new product, and one ground system has already started to use the generic driver and the graphical configuration wizard that resulted from the project.

“ MAC completed the GMV portfolio as GS provider, filling the gap in the area of configurable Ground Segment M&C, helping to consolidate GMV's world leading position in this market. ”

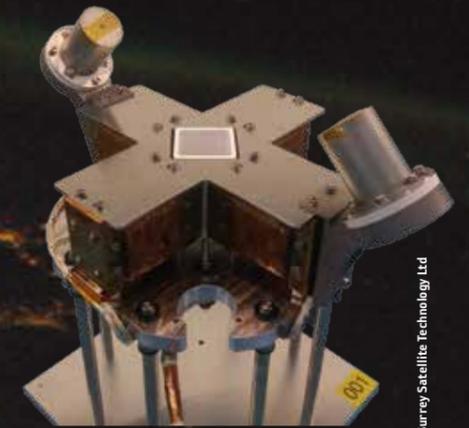
Rui Barradas Pereira, Project Manager, GMV

→ ELECTRIC PROPULSION FOR SMALL SATELLITES

The introduction of Electric Propulsion (EP) for telecom satellites allows larger, more capable and higher performing payloads. However, this benefit has primarily been available only to medium and larger class telecom satellites. This is due to the generally high fixed costs associated with the use of EP hardware. In an effort to bridge the gap for low-cost, low-power satellites, Surrey Satellite Technology Ltd (SSTL) has embarked on the development of a new 200W Quad Confinement Thruster (QCT-200) product which features unique thrust vector

control, eliminating the need for costly mechanical gimbaling systems.

An on-going ARTES C&G Demonstration (ATLAS) activity will support the qualification of the QCT-200 product with an in-orbit demonstration on NovaSAR. Flight hardware has been manufactured and is currently undergoing integration activities on the NovaSAR spacecraft. Success of this activity will verify the QCT-200 as a game-changer for EP on smaller satellites.



Surrey Satellite Technology Ltd

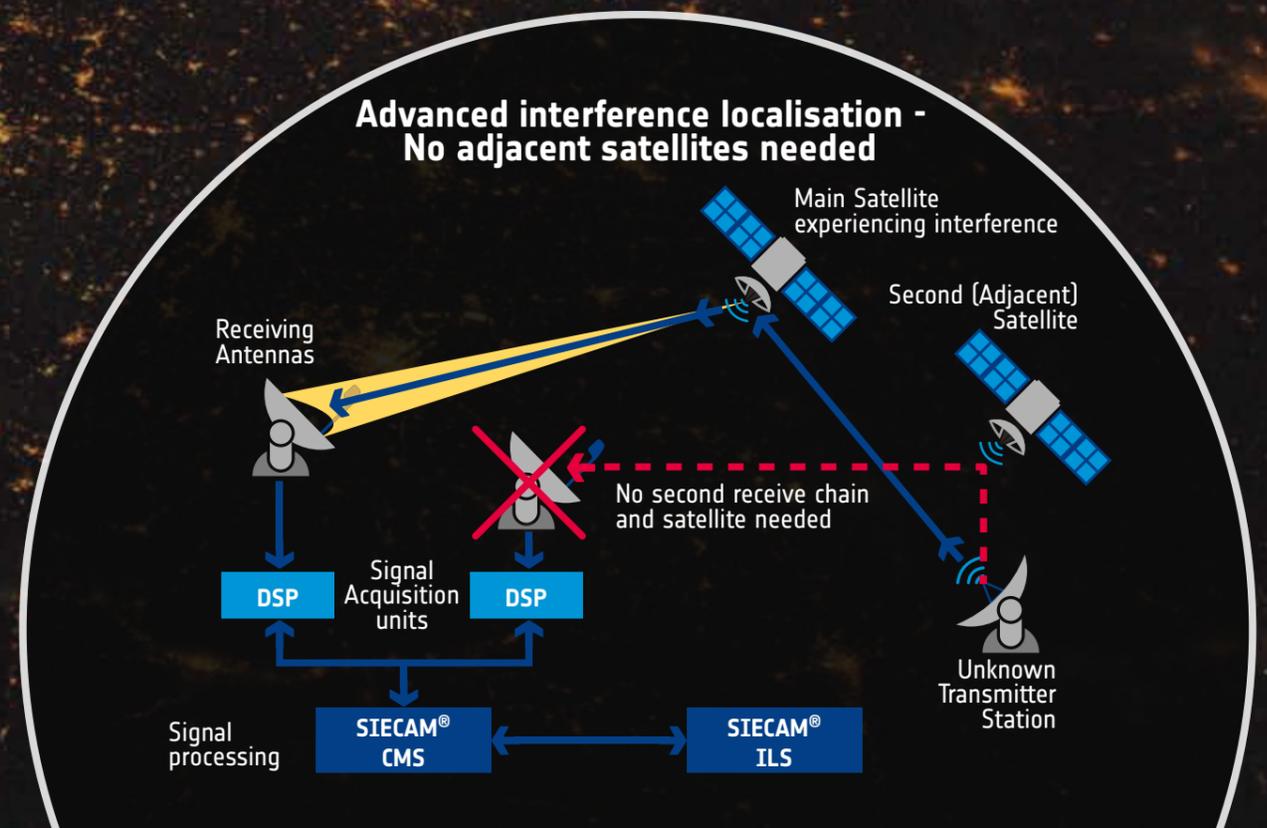
→ SINGLE SATELLITE GEO-LOCATION SYSTEM

Markets, governments and individuals continue to develop and rely on satellite communications as an instrumental and indispensable part of their regular activities. In order to ensure that such communications are not affected by interference or anomalies, intentional or not, the ability to identify and mitigate interference has become highly important. Existing means to do this rely

on multiple satellites in close proximity. Yet as the number, type and orbit of telecom satellite becomes more varied, these existing means no longer provide an adequate solution.

Seeing an opportunity, Siemens, with ARTES support, has developed a new geo-location system based on a single-satellite solution. This new product

utilises signal distortions caused by satellite movement and atmospheric phenomena to identify the sources of interference and is able to do so with higher rates and resolution than previous systems. The new system has been adopted for use by Eutelsat and is currently being offered to other operators.



→ NEW ADCS CRITICAL FACTOR IN SUCCESS

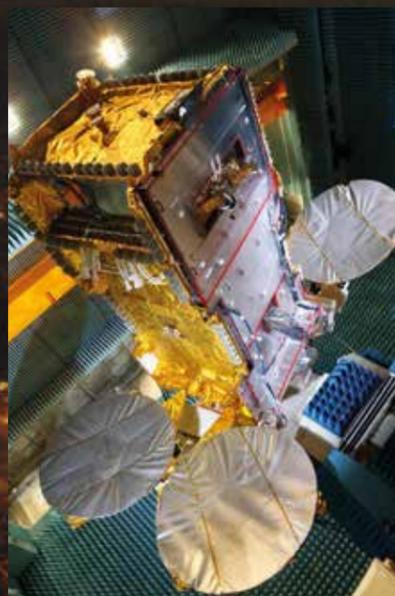
The ability to accurately position the payload antenna beams of a telecom satellite is critical to achieving maximum performance and commercial benefit. In past Attitude Determination and Control Systems (ADCS), an Infra-Red Earth Sensor (IRES) was used as the primary sensor to properly maintain spacecraft attitude while on-station in geostationary orbit. It only provided accurate 2-axis information. However, during electric orbit raising the satellite does not point at the Earth for several months, and antenna beam pointing requirements have become more stringent.

Therefore, an alternative primary sensor is required to provide 3-axis information in all mission phases. This is achieved by using a startracker. Airbus Defence & Space foresaw the need to introduce

a new design to both improve pointing accuracy and enable orbit raising.

Due to the criticality of the ADCS on any satellite, a systematic validation approach was taken in two consecutive ARTES Product Phase activities. These projects transitioned from an Earth sensor based approach only (ADCS Mk1), via a combined Earth sensor and startracker design as an intermediate step (ADCS Mk1.5), to the eventual fully startracker-based design (ADCS Mk2), which also includes a new fibre-optic gyro.

The new product is higher performing, more cost-effective and enables full electric orbit raising. As a result, multiple orders have been received and are already in various stages of production and delivery.



Airbus Defence and Space

“ The combined ARTES projects "E3000 ADCS Mk 1.5" and "E3000 ADCS Mk2" have enabled upgrades and competitive improvements of the Eurostar E3000 product line, allowing it to consolidate its share of the geostationary telecommunications satellite market. These developments were a critical success factor in the capture by Airbus DS of 13 satellite contracts, including 6 with the Electrical Orbit Raising capability. Three ADCS Mk1.5-based satellites are already in orbit. These contracts represent a value of €2.5Bn with the associated jobs in the European industry. ”

Pascal Windels, Head of Satellite Product Line, Airbus Defence and Space - France

→ SUPPORTING NEW DIGITAL BROADCAST STANDARDS

DVB-S is a set of standards for satellite digital broadcast. It was defined in Europe with ESA support and is now a global standard used for direct-to-home digital satellite television distribution, with hundreds of millions receivers deployed worldwide. More recently, an extension was developed (DVB-S2X) that offers greatly improved spectral efficiency, up to 50% versus DVB-S2.

ARTES CC Future Preparations (FP) supported the industry in developing this new standard. The independent ESA perspective combined with design/

simulation capabilities and effort helped in facilitating convergence for rapid standardisation and exploitation of DVB-S2X. The ESA technical contributions have been acknowledged and appreciated by industry and operators alike.

ARTES FP support for such standardisation processes not only helps in the convergence and definition but also results in numerous ARTES follow-on developments for component and equipment manufacturers as well as service providers, proving benefits to a wide range of industrial actors.



DVB.org

→ HELIUM TANKS MEET EVOLVING MARKET DEMANDS

Despite the introduction of electric propulsion for orbit raising, there will always be a substantial market need for chemical propulsion systems. Here too, the same driving economics are forcing advances in low cost, low mass developments. One such advance was achieved in an ARTES Product

Phase project undertaken by OHB MT Aerospace to develop and qualify new, lightweight yet highly reliable high-pressure helium tanks. These tanks represent a cost-competitive, European-sourced solution (free of US export restrictions) based on well-known industry standards. As such, they

are attractive not only for telecom satellites, as was proven by their series production for the Spacebus 4000 platform, but also Earth observation, where twelve units are procured for the Meteosat Third Generation satellites. In the coming year a further 16-20 tanks are planned.

“ The unprecedented goal-oriented collaboration between the industrial team and the ESA ARTES technical experts led to a straightforward and proficient development of a flexible, high-performance helium tank family with a volume of 50-75 litre. These tanks have already led to a competitive, lucrative recurring product for the European space market. ”

Marc Giegerich, Project Manager, Satellite Tanks, OHB MT Aerospace AG



OHB MT Aerospace

→ HYDRA: THE MULTIHEADED STARTRACKER

With support of ESA through the ARTES programme and of CNES, SODERN developed a version of its HYDRA startracker tailored for the geostationary telecommunication satellite market (HYDRA-TC). This development has simplified and optimised the electronics to only drive two optical heads as needed for telecom missions, yet offers improved performance, robustness and reliability. It supports satellites in various orbits, which is crucially important when using electric propulsion for Electric Orbit Raising. As a result it was baselined for the Eurostar 3000 platform from Airbus Defence and Space and its first launch was on DirectTV-15. It was also deployed on the recently launched EDRS-A and several other flight orders are currently being completed.



Philippe Godfrey

“ Our Hydra for Telecom star tracker has been selected by Airbus Defense and Space to equip its Eurostar-3000 telecommunication platform, and has already proved its efficiency in orbit on several missions ”

Yves Kocher, Head of Space Business Development, SODERN



Global Inva.com

→ SOLVING INTERFERENCE RESULTS IN SALES

Telecom satellites are often co-located in order to increase services and still allow customers to point their home satellite dish at one location. Co-located satellites may, however, interfere with each other. Various techniques are available to prevent interference, one of which is the use of different polarisations transmitted by the satellite. There are many current and future orbital locations where linear and circularly polarised satellites may be co-located.

In order to receive the signal, a Low Noise Block down-converter (LNB) is attached to the satellite dish. The LNB must be

“ The ESA AT and C&G programme was a significant ingredient to the success of the project. While the funding de-risked the development of the product, ultimately making it possible. The discussions with the colleagues at ESA contributed greatly in shaping the project and making it a success. ”

Malcolm Burrell, Executive Director, Global Inva.com

able to receive the signals in the correct polarisation. In two successive ARTES activities, Global Inva.com developed and produced a new LNB that can receive from both types of satellites and is also capable of receiving four polarisations simultaneously. The Integrated Dual Linear and Circular Polarisation LNB is

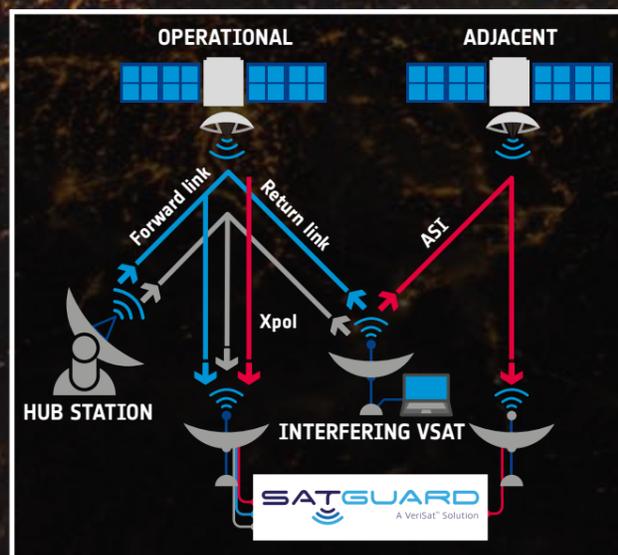
designed as a Quad LNB. The development and production of this LNB adds value to existing satellite service business by stimulating demand for new services like HDTV. This product has seen phenomenal success on the consumer market, with many hundreds of thousands of units being sold.

→ SATGUARD: CUTTING THROUGH THE NOISE

With the growing number of satellite user terminals (VSAT) and new types of satellite architectures, radio frequency interference caused by misaligned equipment has become a serious issue for satcom operators and service providers, impacting the quality of service offered, revenues and operational costs. Combatting the problem is complicated, time-consuming, and resource-intensive due to the use of shared inbound frequencies.

To address this problem, ESA supported the creation of SatGuard, a novel solution for mitigating and resolving interference from VSAT terminals. In an ARTES Technology Phase project, VeriSat developed a range of techniques for effectively detecting interfering

VSAT terminals. The company now has a system that identifies the level of interference and corresponding terminal through its terminal ID, while supporting multiple satellite system access protocols. Although further development is required for a final product, its attractiveness is such that it has already been used by operators such as SES and Eutelsat with excellent results. The operator community at large is keenly interested and awaiting its commercial release.



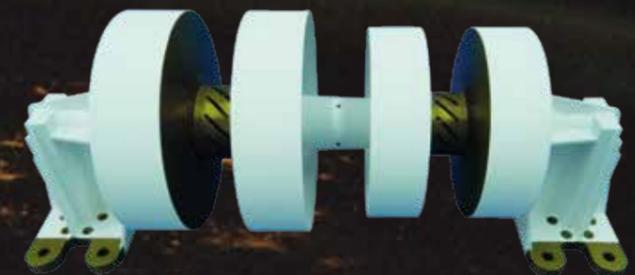
“ SatGuard has already been recognised as a game changer for combatting VSAT interference. VeriSat was awarded as the Technology Company of the Year 2015 at the Satellite 2016 conference in Washington DC earlier this year. ”

Petter Amundsen, Managing Director, VeriSat AS

→ NEW ANTENNA SUCCEEDS IN EXPORT MARKET

Telecom satellites represent a substantial commercial investment on the part of operators, thus the reliability of commanding and receiving telemetry is critical. One of the more important components in this regard is the Telemetry, Tracking and Command (TT&C) antenna, which must be able to send and receive signals in various orientations and thermal environments and yet not interfere with payload operations. It must also of course be light and low-cost. Of particular note in this development was the specific design enabling the elliptical coverage of the antenna.

TRYO Aerospace (formerly RYMSA) understood the potential benefit and competitiveness of their intended design and thanks to support from ESA through the ARTES programme were able to successfully develop and market their recently qualified product to an American satellite manufacturer. This opened a lucrative export door. Four units have been delivered and a long-term agreement with another US customer is currently in progress.



TRYO Aerospace

“ TRYO Aerospace (formerly RYMSA) developed in 1994 the first model of a TT&C horn in the frame of an ARTES programme. Thanks to the continuous support of ESA and our internal R&D strategy, TRYO Aerospace is today the world leader in TT&C antennas and has a relevant prestige in the satellite market as platform and payload antennae, equipment and subsystem supplier. ”

Andres Nubla Martinez, CEO, TRYO Aerospace

→ KA-BAND INNOVATION SUPPORTS HD TV

The introduction of High Definition TV (HDTV), along with ever-increasing demand for faster data rates, substantially increased the need for satellite output power and bandwidth, particularly in Ka-band. A critical component for Ka-band satellites is the Output (De-)Multiplexer (OMUX), which combines or separates various frequency bands for efficient transmission to the ground.

In response to this demand, TESAT (DE) introduced a high-power 20 GHz OMUX, which solved the technical challenges

by exploiting a novel temperature-compensated aluminium technology. The underlying filter technology, which was developed by TESAT with the support of ARTES, paves the way for the next-generation HDTV and broadband services that satellite operators have been planning. The project was such a success that it immediately went into production and has been gathering in-orbit heritage since 2013, with more than 300 flight model channels currently operating and more in production.

“ The TC OMUX at Ka-band has been one of the best examples of pioneering a new product at TESAT. We hired and trained young engineers, have given them a challenge and they mastered a new technology to become world market leader, all at once in one project. ”

Dr. Siegbert Martin, Head of Passive Microwave Products, TESAT

→ DUAL BAND USER TERMINAL FOR SATCOM

Mobile satellite ground reception and transmission is an essential part of any modern communication system. The market for such systems continues to expand and develop as new technologies are introduced at all levels.

With support from an ARTES Product Phase activity, Space Engineering is now well-positioned, having developed and brought to market an aeronautical version of its lightweight, compact, high throughput mobile satellite

transmission and reception system: Janus Aero.

This version is already a commercial success, with contracted production for several patrol aircraft.

“ ARTES programmes have been key to help Space Engineering grow unique innovations for space communication over the last decade, but nothing was more instrumental to unique competitiveness than the Janus ARTES programme on dual band mobile broadband antenna. ”

Sabino Titomanlio, Head of Business Development and Commercial Operations, Space Engineering S.p.A

→ FLEXIBILITY IN FREQUENCY YIELDS SOLID RESULTS

Today's satellite operators are seeking enhanced operational capacity and flexibility. In multiple ARTES projects, Thales Alenia Space France has developed and flown two different products with key operational features: flexible frequency selection in the command receiver and flexibility in payload frequency selection.

The Frequency Flexible Command Receiver provides the ability to avoid jamming or interference issues with other satellites, also particularly important for spacecraft during electric propulsion orbit raising. This new product re-uses some previous modules yet provides a sufficient range of Ku-band frequencies for the operator and can easily be configured for use in the C- or Ka- frequency bands.

The second project developed Flexible Ku-band Converters, providing customers with a great degree of flexibility in payload frequency selection while maintaining the high levels of performance. Operators can now select various uplink frequencies with no impact on the downlinked signal to home viewers, a major breakthrough in avoiding jamming that is caused by rogue uplink signals.

These two units were developed separately under the ARTES C&G Product Phase and with support from ARTES C&G Demonstration launched on Eutelsat 8WestB. The continuing success of these products, based on their flexibility and competitiveness, has resulted in more than forty combined orders by various primes and operators.

“ When it became known that the TAS flexible frequency converter was to be given its first flight opportunity on the Eutelsat mission, this gave several other customers the confidence to order it for forthcoming commercial missions. We have since been very successful with the commercialisation of this equipment, with about 35 sold and additional under consideration. ”

Florence Valent, project manager, TAS



Thales Alenia Space

→ FREQUENCY SPECTRUM ACCESS: PREPARATION FOR WRC-15

The World Radio-communication Conferences (WRCs) are the body of the International Telecommunications Union (ITU) responsible for maintaining and amending the Radio Regulations and are of great importance to the entire communications industry. ARTES CC Future Preparations (FP) helped ESA Members State industry promote and safeguard European interests on issues addressed at last year's WRC-15.

Many participants, including the European Satellite Industry Consortium

(ESIC) stated that ESA initiative and support was key to facilitating cooperation in the run-up to WRC-15 where there was a major challenge to the continued availability of satellite C-Band frequencies. This challenge came from the more terrestrial based Information and Mobile Technology (IMT) industry which proposed to re-allocate a significant portion of the bandwidth.

One main WRC-15 decision to preserve most C-Band frequencies for satellite use showed that early preparation and timely

availability of consolidated industry viewpoints had a very positive impact.



WRC/ITU

“ The support provided by ESA at the very challenging WRC-15 helped achieve a positive outcome. The ESA provided study on C-Band globally, but particularly in Africa and Asia, has served to inform the dialogue of all governments concerned and thus preserve satellite C-Band frequencies at international level. Further, this support and the WRC decision will be most useful to continue advocating for ESA industry stakeholders at various national and regional levels. ”

David Hartshorn, Secretary General, Global VSAT Forum (GVF)

→ TURNKEY VSAT PLATFORM WINS MAJOR CONTRACT

Newtec commercialises Dialog, a multi-service platform which is scalable, flexible and efficient. Dialog is offered to all kinds of service providers, enabling them to adapt their satellite communication network infrastructure smoothly as their business evolves..

ARTES support in reducing development risk has been instrumental to help Newtec (BE) secure a major contract with the UAE-based satellite operator Yahsat. As a turnkey solution, Newtec Dialog covers the delivery of service platforms and operating systems to support Yahsat's entry into the Brazilian satellite broadband services market. The success was achieved as a result of a combination of ARTES investments from the Technology Phase

“Beamsat” project, the follow-on Product Phase “Beamsat B2X” project and the use of novel technology coming from the Product Phase “Pleiades” project.

Dialog is the perfect fit in humanitarian crises, where the immediate need for communications across a wide variety of demanding conditions is met by a flexible, scalable system, thus greatly aiding rescue efforts. This is a classic example of how highly innovative technology supported by the ARTES programme has a significant impact, not only on the competitiveness of ESA Member States industry in the worldwide commercial satcom market but also in its strong humanitarian contribution.

“ The way ESA supported Newtec's R&D effort has been translated into a boost of innovation and competitiveness in a very dynamic and difficult market, enabling us to grow into the leader we have become in the global satcom industry. ”

Dirk Breyngaert, CSO & co-founder, Newtec

→ EFFICIENT AUTOMATION OF SATELLITE OPERATIONS

Space-based communications is an integral and ever-expanding part of modern daily life and essential to support development in economically challenged areas of the world. Accordingly the number and types of telecom satellites has expanded dramatically, which necessitates an increase in satellite controller efficiency, overall standardisation, and safety of satellite operations. SES foresaw this need and with the support of ESA through the ARTES programme embarked on the Efficient Automation of Satellite Operations (EASO) project, to meet the challenge of establishing automatic and error-free procedure translator software.

The EASO-developed software handles the complex job of taking unique satellite manufacturer procedures and turning them into standard operating procedures, capable of operation on different ground control systems by a common suite of applications. This greatly reduces the operator workload, improves performance and increases the safety of operations. Such is its usefulness that SES has already deployed it to control no less than 37 in-orbit satellites and is continuing to expand its role.

“ The EASO project is an SES-ESA success story for the benefit of not just SES but also the wider satellite community. Thanks to the valuable support from the ESA ARTES programme and funding support from the Luxembourg government, the EASO project has promoted the use of SPELL as an industry de-facto standard for the automation of satellite operations across the worldwide user community. ”

Gianluigi Morelli, General Manager, Operations Architecture, SES Technology

→ SMALL MODULAR PROCESSOR: WINNING BIG CONTRACTS

The Small Modular Processor (SMP) represents Airbus Defence & Space's fourth generation digital processor. This new product sits at the heart of modern advanced telecoms payloads, processing the radio frequency input signals by chopping them into small sub-channels, routing and then re-combining them for onward transmission. Airbus initiated the development of SMP with ESA's support in 2012, under an ARTES Technology Phase activity building on the lessons learned from previous ARTES activities. The processor is now well advanced in the Product Phase and is currently undergoing qualification testing.

SMP is aimed at developing the next generation of equipment for telecommunications satellites in a cost effective manner. The functions required for a wide range of processing missions, in Earth observation and science as well as telecoms, can be implemented



Inmarsat - 6

Airbus Defence and Space

using a generic set of modules, allowing the cost of development to be spread over multiple programmes.

While the qualification activities are still on-going, the advanced state of development of the SMP was instrumental in helping Airbus to win the recent order for two large Inmarsat-6 satellites, where it will form the heart of these next generation L-Band spacecraft. It will allow them to flexibly route up to 8000 channels and to dynamically allocate RF power to over 200 spot beams, thereby supporting a wide range of services, from emergency distress beacons to in-flight WiFi on aircraft.

ESA will continue to support Airbus to the end of the qualification activities, ensuring that any specific Inmarsat-6 needs are taken into account.

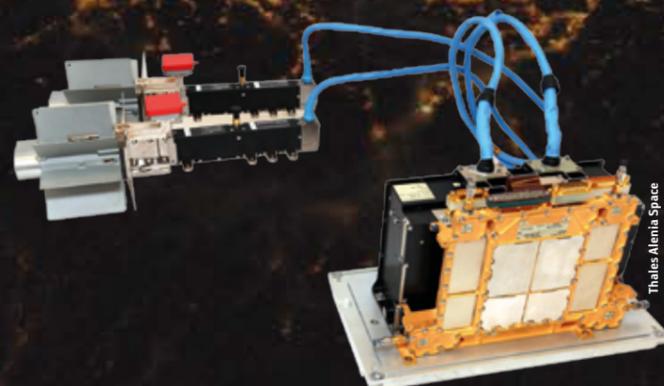
“ Inmarsat considers that the ARTES support and expertise provided by ESA to Airbus significantly reduced the risks for the first flight of the SMP. This in turn gave us sufficient confidence, in the product and its delivery timescale, to select it as the heart of Inmarsat's next generation L-Band payload. Inmarsat looks forward to future opportunities to work with ESA and all the European satellite manufacturers. ”

Massimiliano Ladovaz, VP Space Segment, Inmarsat

→ PRECISION RF POWER CONTROL ENHANCES PERFORMANCE

Travelling Wave Tube Amplifiers (TWTA) provide the radio-frequency amplification necessary for a large proportion of telecom payloads in-orbit and in development. In turn the electrical power driving the TWTA is provided at very high voltage and in specific operating conditions by the Electronic Power Conditioner (EPC). Traditionally the TWTA's have been specified to operate over a wide frequency band, even though once in orbit they will only operate over a small fraction of that bandwidth at any one time. This leads to inefficiencies, requiring the spacecraft to provide more power and to be larger to dissipate the extra heat. Similarly, in some operational scenarios the TWTA is required to generate less power, which again reduces its efficiency.

its introduction and first flight with Eutelsat on Eutelsat 8WB, supported by ESA through an ARTES Demonstration Phase activity, it has become an extremely attractive product for the operators. To date more than 160 flight units have been sold for this highly competitive product, many even before the launch of the first flight.



Thales Alenia Space

Thales Alenia Space Belgium undertook an ARTES Product Phase activity to meet these demands and qualify its third generation EPC product. The new product offers power and frequency flexibility and precisely optimises power distribution for each channel, while also being compatible with a large range of interfaces, power levels and frequency bands. Since

→ MOVING TOWARDS MEGA-CONSTELLATIONS

Low-cost series production is not a term normally used within the telecom satellite world, as high performance and reliability usually come at a high price with a long production schedule. However, in an ARTES Product Phase activity, RUAG responded to the demands of the customer. For the Iridium Next constellation, the company developed and qualified just such a product: the Payload Interface Unit (PLIU). The PLIU is essential to communicate not just with the primary payload units but also with the various temperature

control components, such as heaters, thermistors and stepper motors.

The design approach was based on incorporating commercial components and adopting a production-friendly design. Nevertheless, producing a large number of low-cost units necessitated an extensive development environment consisting of several breadboards and design iterations before the electrical qualification model could be manufactured. The investment provided via ARTES was instrumental in supporting this activity and the

resulting product performance and cost has resulted in sales of 81 flight units for Iridium alone. Moreover, it has laid the production groundwork for RUAG to successfully compete in the growing mega-constellation market.



RUAG Space AB

“ The commercial outcome of the PLIU development has been very large sales, amounting to a total of 80 flight models. It has also enabled us to take an important step in the use of COTS electronic components for high-reliability operational satellite missions. ”

Mr Folke Brundin, Director Marketing and Sales, RUAG Space AB

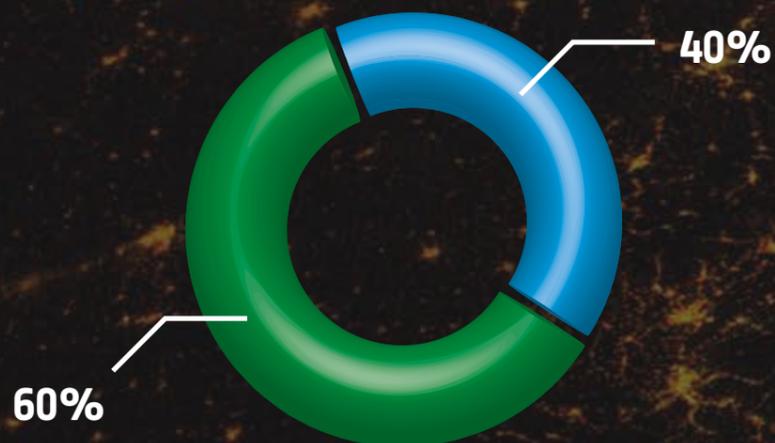
→ THE SOCIO-ECONOMIC IMPACT OF ARTES CORE COMPETITIVENESS

Benefits at a glance:

- large number of new high-skilled jobs
- excellent return on public investment
- high success rate on developments
- proven preparation for the future.
- strengthened competitiveness of ESA Member States Industry

WHY INVEST IN ARTES CORE COMPETITIVENESS

- New Products
- Product Improvement or Industrialisation



Based on industry feedback, the vast majority of projects directly result in new sales opportunities. Of these, around 60% come from the introduction of new products to the market while the remaining 40% is a result of improved products or improved production techniques.

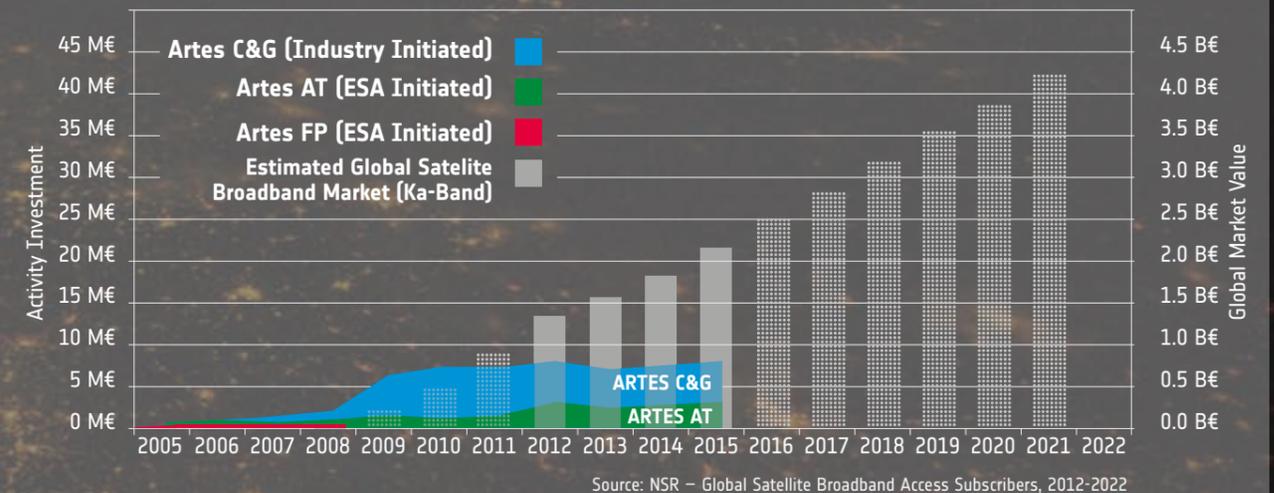
ARTES Core Competitiveness (CC) delivers a remarkable success rate and has proven to be the most successful satcoms technology initiative in Europe. In past years, 60% of the Technology Phase activities were followed up with a Product Phase, which eventually results in the introduction of new products and services. The benefits for the ESA Member States have been impressive, with high returns in terms of revenues, permanent high-skilled jobs, and innovative services for society.

Furthermore, a recent study from Technopolis estimated that the overall ARTES programme has maintained more than 2,000 jobs over the past decade and created an additional 2,000 jobs. The total return on investment for ESA Member States for each Euro ranges from €12 to €21.

As part of the overall ARTES programme, ARTES CC has substantially contributed to the European and global satcoms industry's on-going growth and evolution. In addition to funding, the participating industries gain access to ESA's enormous expertise, helping them increase their knowledge, skills and capacity to develop new technologies. ARTES CC also encourages newcomers to the satcoms markets by providing opportunities to develop partnerships with other stakeholders, facilitated by the reputation of ESA and its extensive support network.

ANTICIPATING FUTURE MARKET OPPORTUNITIES

Positioning Industry for the growing Ka-Band Market



Targeted investments at the right time require expert knowledge and vision in order to capture future markets. Accordingly, ARTES CC provides high rates of return on public investment by encouraging and enabling industry to prepare for new opportunities. The recent and substantial growth in the Ka-band market is a good example of this. Thanks to the support of ARTES CC, European and Canadian industry were able to develop the Ka-band technologies and know-how which

have been instrumental to win market share. In this case, an investment of few millions of euros supported ESA Member States Industry to compete effectively in a multi-billion euro market. In the continuous effort of anticipating future opportunities, ARTES CC is now preparing the technology and products for potential growth areas such as high frequency markets opening up in Q/V, W and optical frequency bands as well as self-scanning flat antennas.

ARTES CORE COMPETITIVENESS PREPARES INDUSTRY FOR THE FUTURE : SUPPORTING THE DEVELOPMENT OF INNOVATIVE SOLUTIONS, READY TO CAPTURE NEW MARKETS



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