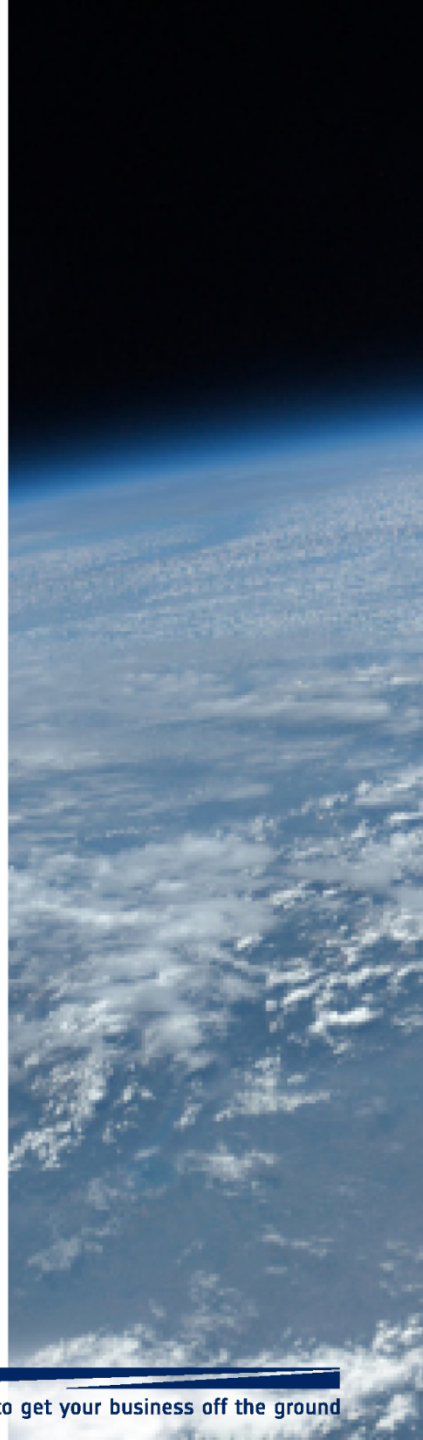
ESA'S IPR PORTFOLIO: MATCHING THE EU – JAPAN SPACE TECHNOLOGICAL NEEDS

15 MARCH 2016

VERONICA LA REGINA



AGENDA

- Introduction
- IPRs Portfolio
- IPRs Licensing Policy
- IPRs Opportunities for the Japanese market
- Q&A Session

INTRODUCTION: ESA

- Over 50 years of experience
- 22 Member States
- Eight sites/facilities in Europe, about 2200 staff
- 5.2 billion Euro budget (2016)
- Over 80 satellites designed, tested and operated in flight

INTRODUCTION: ESA

"To provide for and promote, for exclusively peaceful purposes, cooperation among European states in **space research** and **technology** and their **space applications.**"

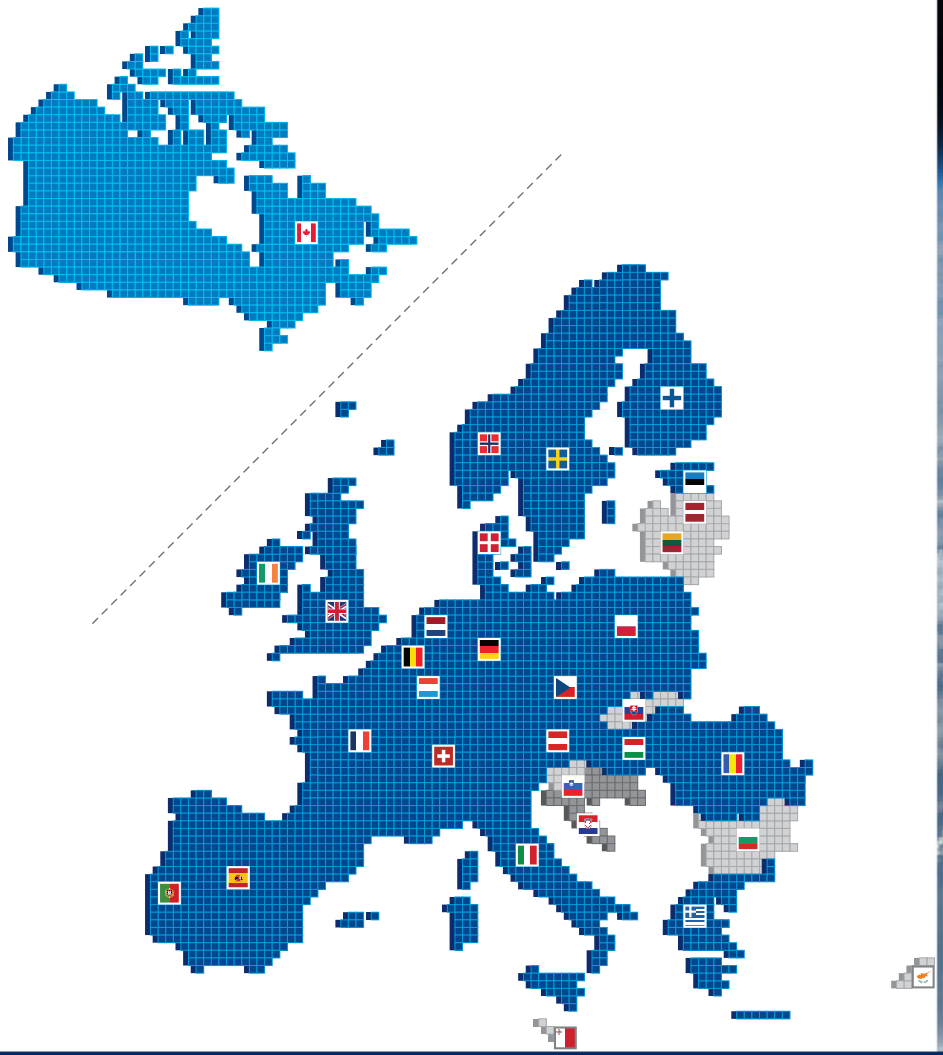
Article 2 of ESA Convention

INTRODUCTION: ESA

ESA has 22 Member States: 20 states of the EU (AT, BE, CZ, DE, DK, EE, ES, FI, FR, IT, GR, HU, IE, LU, NL, PT, PL, RO, SE, UK) plus Norway and Switzerland.

7 other EU states have Cooperation Agreements with ESA: Bulgaria, Cyprus, Latvia, Lithuania, Malta, Slovakia and Slovenia. Discussions are ongoing with Croatia.

Canada takes part in some programmes under a long-standing Cooperation Agreement.



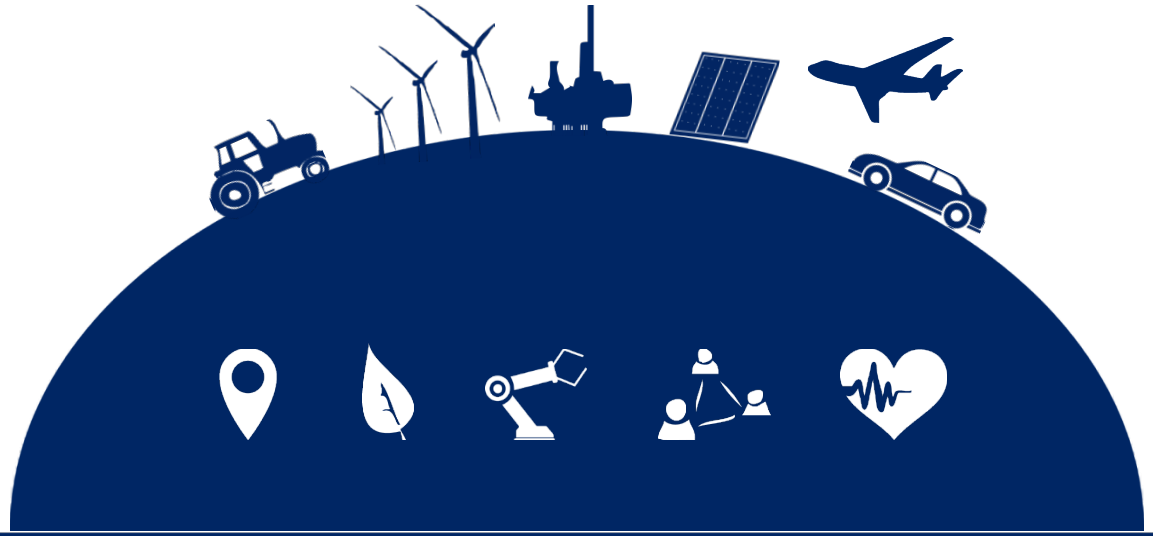
INTRODUCTION: ESA

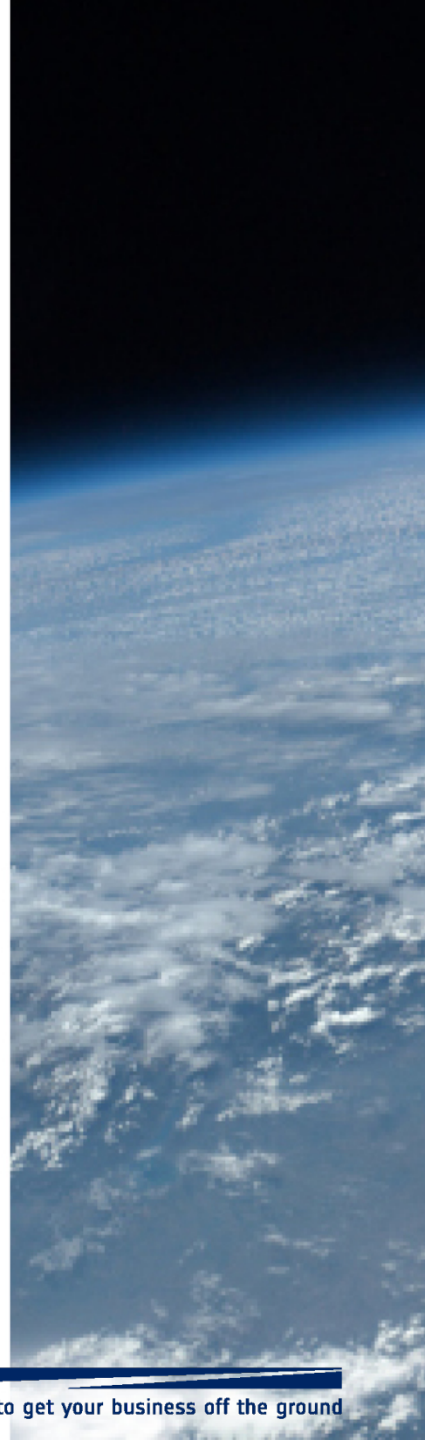
About 85% of ESA's budget is spent on contracts with European industry.

ESA's industrial policy:

- ensures that Member States get a fair return on their investment;
- improves competitiveness of European industry;
- maintains and develops space technology;
- exploits the advantages of free competitive bidding, except where incompatible with objectives of the industrial policy.

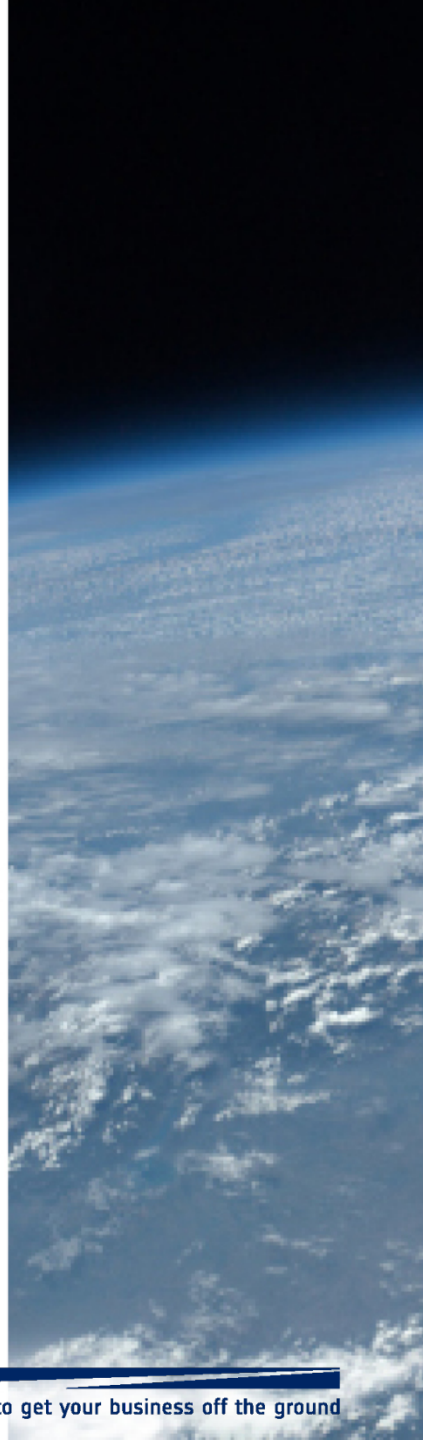
ESA SPACE SOLUTIONS





ESA SPACE SOLUTIONS

ESA PATENT PORTFOLIO	BROKER NETWORK	BUSINESS INCUBATION	INVESTMENT SUPPORT
132 inventions covered by **411** patents	**15** BROKERS **320** TRANSFERS	**16** CENTRES **130** new start-ups p/y **400+** SUCCESSES	Venture Capital Fund Investment Forums and training



WHY ESA PATENTS?

PROTECTION

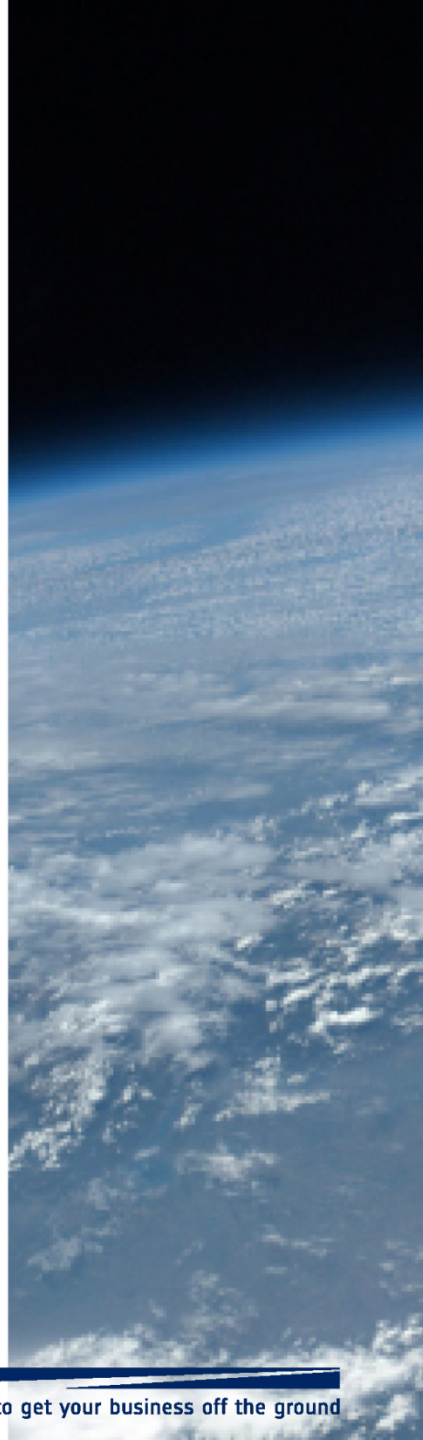
Protect ESA's inventions and prevent others from blocking us

EXPLOITATION

Monopoly for use and offer licences to third parties

TRADING

Cross licence or use it as a trading mechanism



ESA IPR PORTFOLIO

- Under ESA's staff regulations inventions by ESA **staff members** in the course of their duties are the property of ESA and should be declared to the **Director General**
- The **ESA Patent Group** studies applications from staff members to file a patent and estimates the patentability of the invention. It then assesses ESA's interest in filing for a patent. It also takes decisions on the maintenance or abandonment of the patent.

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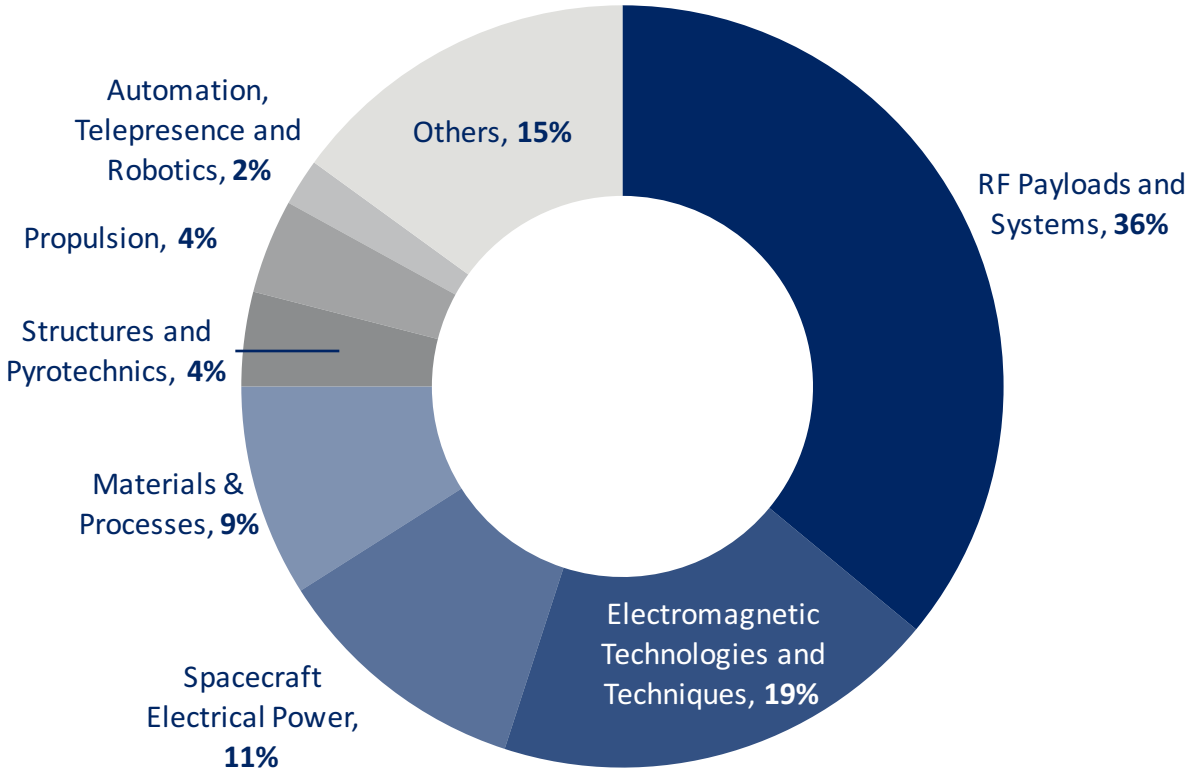
ESA IPR PORTFOLIO

INVENTIONS BY SPACE TECHNICAL DOMAINS



ESA IPR PORTFOLIO

INVENTIONS BY APPLICATION SECTOR

31%
Information & Communication Technologies

17%
Aeronautics, Automotive, Maritime and Transport

16%
Energy and Environment

10%
Security and Safety

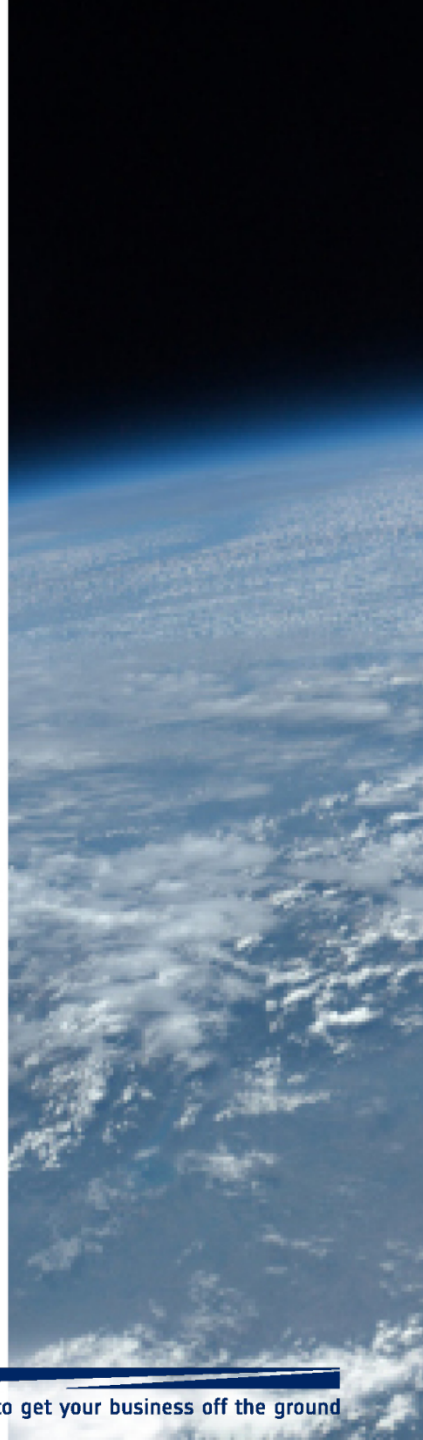
7%
Electronics

7%
Materials & New Production Technologies

4%
Healthcare & Biotechnology

4%
Industrial Production & Robotics

4%
Civil Engineering

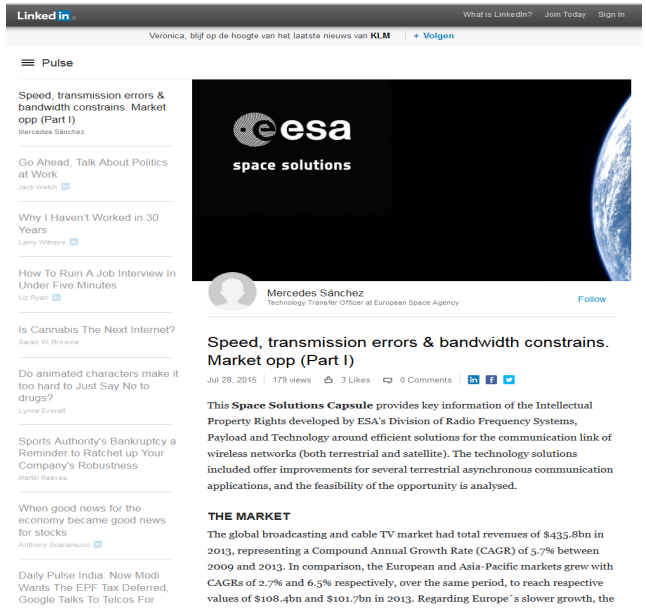


ESA IPR PORTFOLIO

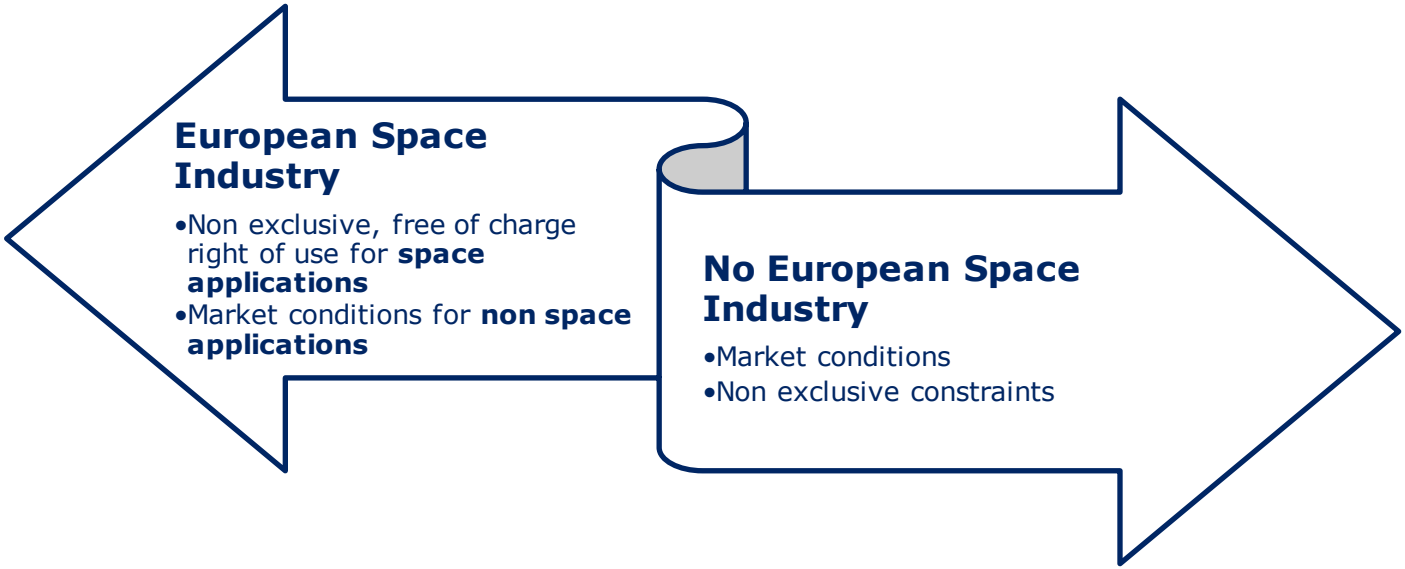
- ESA IPR portfolio is available at:
  http://www.esa.int/Our_Activities/Space_Engineering_Technology/IP_for_commercialisation

ESA IPR PORTFOLIO

- ESA IPR portfolio is available at:
  - LinkedIn: ESA Space Solutions
  - Innoget: http://esa.innoget.com/



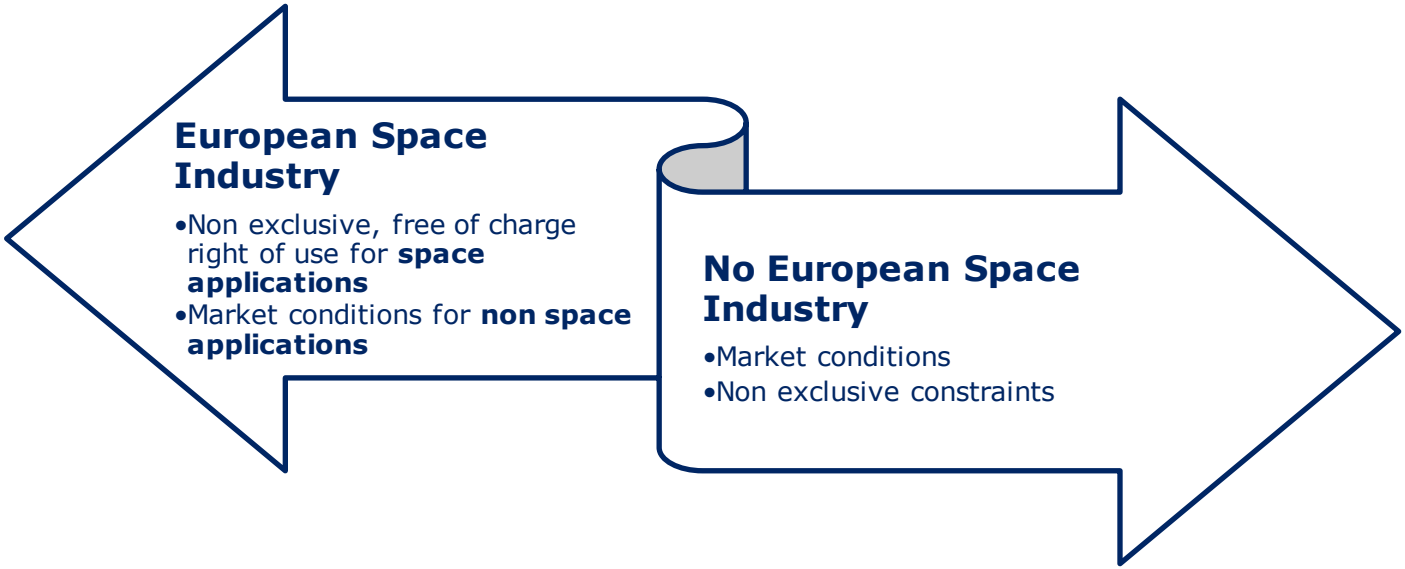
ESA IPR LICENSING



Extra- ESA Exploitation of IPRs:

- A board (*Industrial Policy Committee*), composed of representatives of ESA Member States, monitors the transfer of technology to non-Member States
- An uniform procedure enables ESA and Member States to control the circulation of information and data to third countries to guarantee consistency with ESA's own objectives.

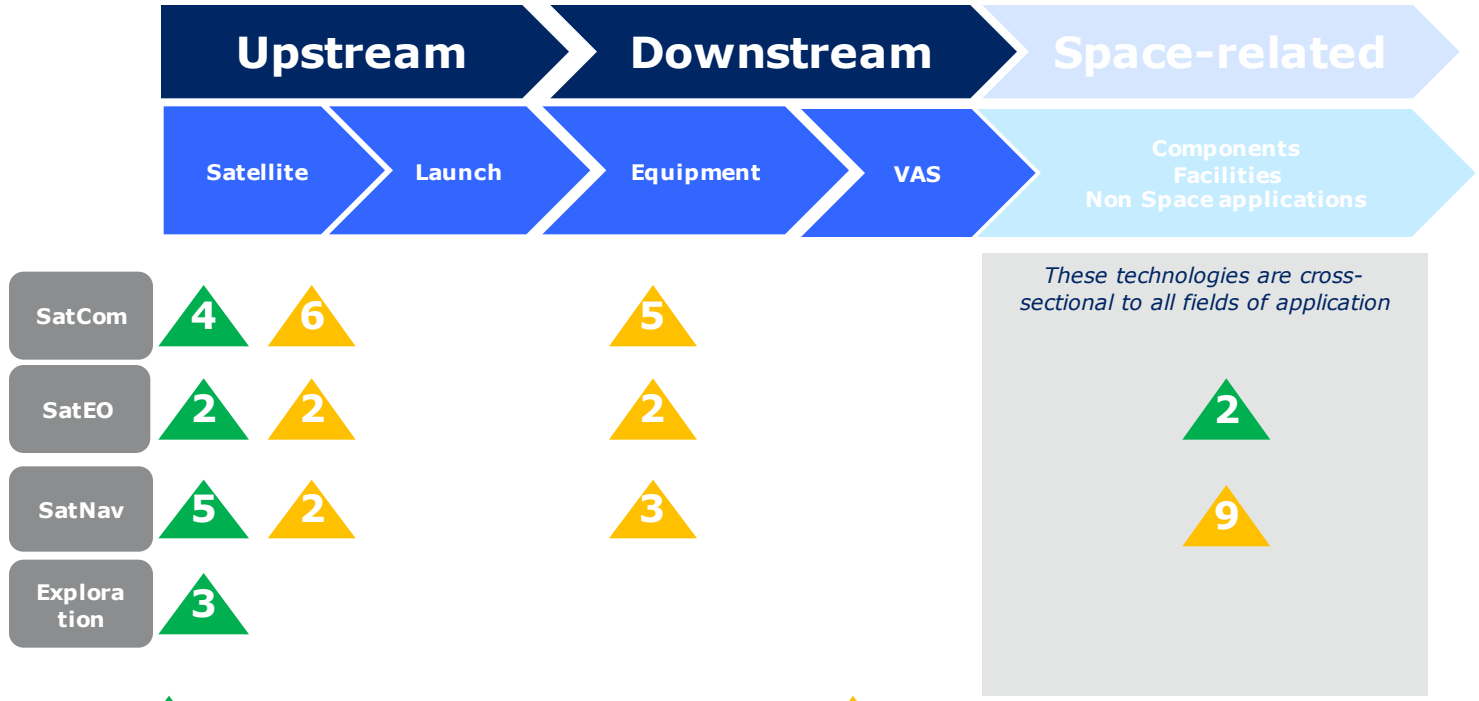
ESA IPR LICENSING



A License agreement with ESA enables you:

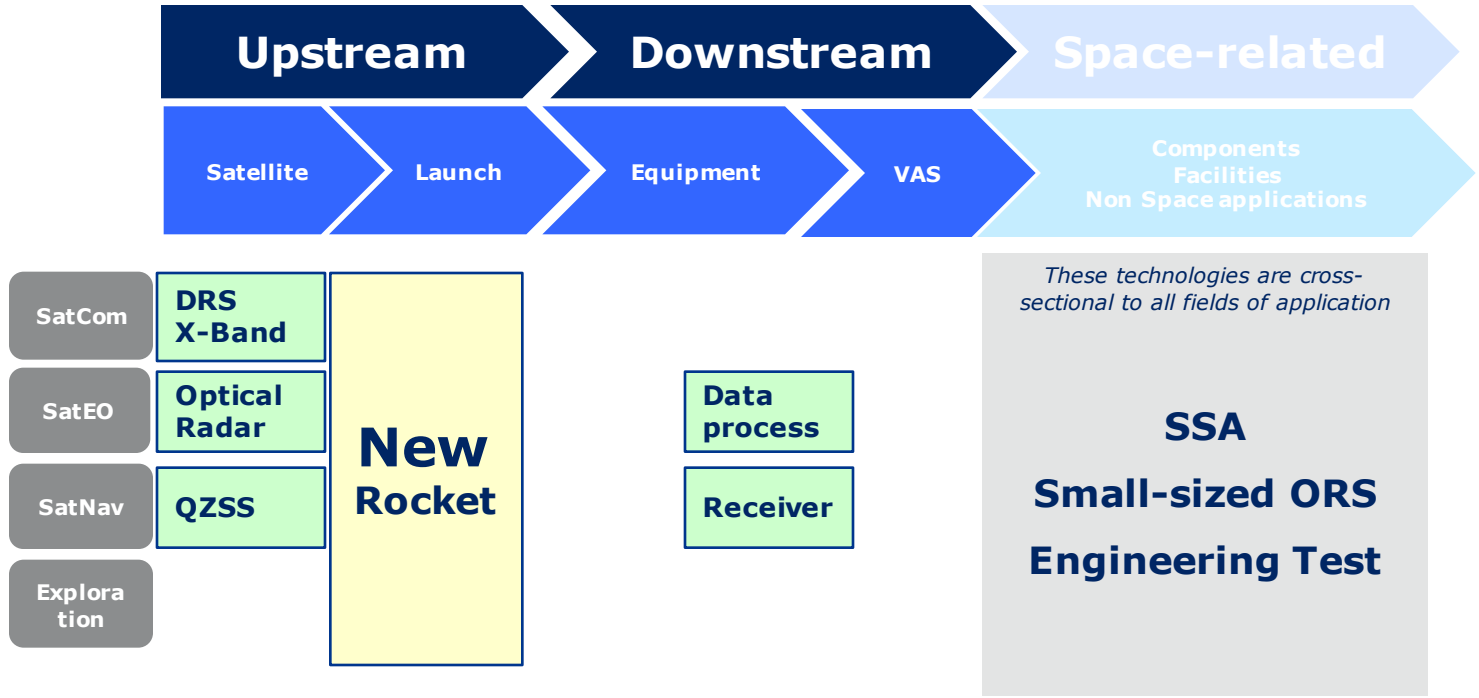
- To exploit the right of using the IPRs
- To fit the technology from the IPR to your purposes through the technical support of the ESA inventors
- To brand your business with esa space solutions

ESA IPR FOR JAPAN



- The current ESA IPR Portfolio presents almost 35 inventions with single and multiple applications

ESA IPR FOR JAPAN



- The current 10-year Japanese Space Policy Plan presents programs a long the all space value chain

ASSEMBLING OF X-RAY REFLECTING GLASS FOR OPTICAL UNITS

Technology description

Method of assembling X-ray reflecting plates into an optical unit. The mirrors are shaped and **aligned nearly parallel to incoming X-Ray**. The reflection is based on the **grazing angle impact** of the photons or the high-energy particles with the reflecting surface. This technology provides a solution to the problems associated to the design and alignment required for the X-Ray reflecting surfaces.

Applications

This solution can provide advantages in those technical applications based on X-ray proton captions, such as **X-ray Medical Imaging**, **material quality controls**, **security inspection systems** and **particle telescopes**, among others. New areas of application could also include **electron microscopy** and **X-ray based crystallography**.

Added-value and benefits

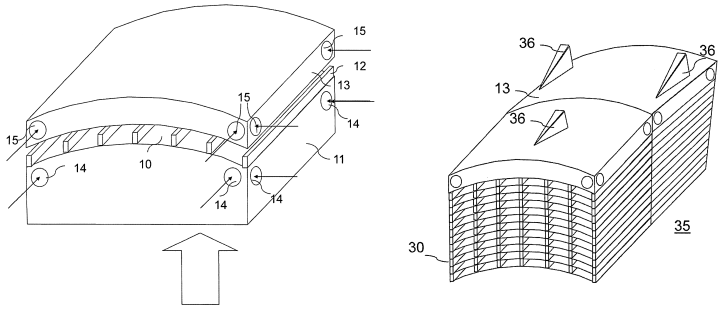
- **Reduced manufacturing cost** compared to similar **patents**
- **Increased performance** of equipment dealing with X-ray imaging
- **Power of required** X-ray sources will be **reduced**, lowering costs
- Increased focus will **reduce over-radiation**.

Technology readiness

The technology has been validated under laboratory conditions.

IP Status

Patents have been granted in France, Germany, Italy, United Kingdom and USA and a patent application has been filed in Japan.
EP2348348; JP2013503324; US2012182634.



METHOD FOR DESIGNING A MODULABLE METASURFACE ANTENNA STRUCTURE

Technology description

This manufacturing method creates an **artificial electromagnetic surface (metasurface) that can be applied to the field of reflector antennas.** The metasurface has a modulated impedance tensor with sub-wavelength variations, allowing the **metasurface to adapt to the electromagnetic properties of an antenna so the antenna can work at different bandwidths**. Thanks to the properties of these meta-surfaces, the invention **allows much larger apertures at reduced size of antennas' reflectors** because the feeding elements don't need to be placed at or around the optical focus of the reflector. Moreover the invention can be implemented in a simple way and using low-cost technologies.

Applications

This technology can be of interest **to antenna reflector manufacturers** that can adopt this method in order to shape new reflectors based on metasurfaces. This solution can benefit different sectors such as **telecom services providers** (e. g. cell phone communication, electromagnetic shielding)**, defense** (radars) **and medical imaging.**

Added-value and benefits

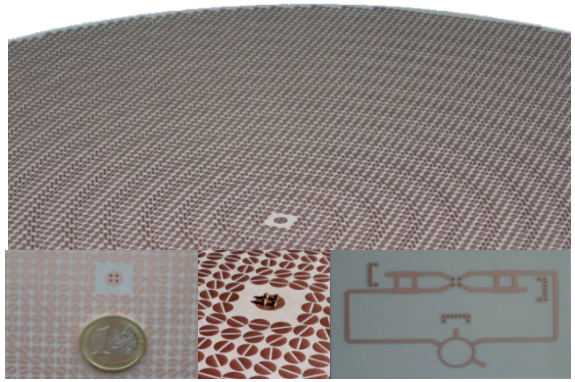
- More degrees of **freedom in the design** of antennas
- Much **larger apertures at reduced size**.
- Useful in all fields of telecommunication (terrestrial and satellite) .
- Overall **cost reduction** (% depending on the application).
- Very **simple implementation** using **low-cost** technologies (eg. standard printed circuit manufacturing).
- **Improved performances.**

Technology readiness

The proof of concept has been validated.

IP Status

An International patent application has been filed



MANUFACTURING OF A CERAMIC ARTICLE FROM A METAL PREFORM PROVIDED BY 3D-PRINTING

Technology description

New method of **producing 3D ceramic lattices** for use in catalytic applications. The desired **structure is printed in metallic form** and then carry out a special 2-stage heat and oxidation treatment afterwards, that turns the metal to oxide in a controlled manner. The metal, the gas and the time-temperature profile is applied so as to **induce a metal-gas reaction resulting in at least a part of the preform transforming into a ceramic**. This provides an **affordable method to produce ceramic lattices** (or other complex articles) in comparison with other currently used methods.

Applications

Apart from the original propose for which this invention has been designed (**ionic thrusters**), the catalytic ceramic lattices obtained with this invention might also provide **benefit for different processes** such as:

- **Gas purification** by dehydration or desulfurization.
- **Crude hydro-processing**.
- Vehicle or industry **emission purification**.
- **Bad smell removal**.
- **Heat exchange applications** in order to save energy mainly in steel works and metallurgy industry.
- **Biomedical applications** (artificial ceramic-based tissues that allow oxygen supply).

Added-value and benefits

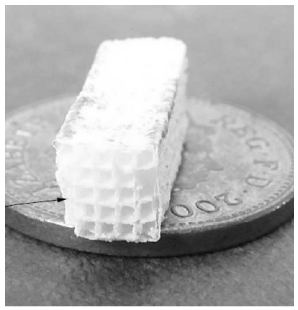
- **High cost reduction** in comparison with the current methods.
- **Full control over the spatial configuration** of the material.
- **Higher control of the inner structure** of a porous or lattice-type ceramic article (It is possible to obtain articles in which the grain size is nano-size)
- Falling of **loose powder is avoided**.

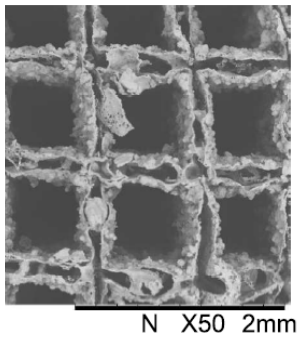
Technology readiness

A prototype has been tested under industrial resembling conditions.

IP Status

An international patent application has been filed





ADVANCED FLUIDIC FILTER

Technology description

Multi-layer mesh filter for fluids with an improved structure that maximizes the surface and **prevents particle build up**. The filter is **obtained by an additive manufacturing** process and, thanks to this, some unique features can be achieved. The main feature is that **the filter is a single piece**, which provides advantages such as avoiding weld joints, reducing the manufacturing time and avoiding spread of filter passages found in wire mesh filter elements. Furthermore, the filter is **manufactured with a Titanium alloy**, which makes it **corrosion resistant**.

Applications

This technology can benefit those applications in which a **fluid shall be filtered from pollutants or impurities** such as: **Aeronautics and automotive** (fuel impurities), **chemical industry** (High pressure liquid chromatography systems, capillary based systems), **Industrial biotechnology** (enzyme production), **thermo-nuclear plants** (cooling systems)

Added-value and benefits

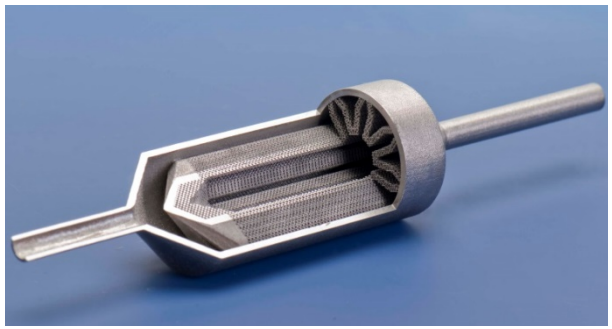
- **Single piece**
- **Reduced building time and cost**
- **High corrosion resistance**
- **Light weight**
- The structure **maximizes the filtering surface and minimizes the clogging and pressure drop**
- **Multi-layer mesh structure** (prevent the passage of long slender contaminants).

Technology readiness

A prototype has been tested under industrial resembling conditions.

IP Status

An international patent application has been filed



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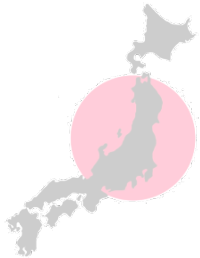

Patent	Title	Application	JP Program Need	Status	Age
JP 2003509660A	Multipath discriminator module for a navigation system	SATNAV	QZSS	Granted in JP	15 years
JP 2004561578A	Method and system for real time navigation using satellite transmitted three-carrier radio signals and ionospheric corrections	SATNAV	QZSS	Granted in JP	14 years
JP 2004546033A	Sub-millimetre wavelength camera	SATEO, Science	IGS, Exploration	Granted in JP	14 years
JP 200539799A	Optical reflector element, its method of fabrication, and an optical instrument implementing such elements	SATEO, Science	IGS, Science	Granted in JP	12 years
JP2007529383A	Electronic timepiece of the type that is a multifunctional, navigational aid watch, which is particularly suitable for space missions	SATNAV	QZSS	Granted in JP	12 years
JP 2010541700A	Active pixel sensor apparatus for use in a star tracker device	SATCOM, SATNAV, SATEO, Explorations	Upstream segment	Granted in JP	8 years
JP 2011526824A	Installation for the treatment of urea containing water, toilet, stable and method	Exploration, non Space	Exploration	Granted in JP	8 years
JP 2012525936A	Method for assembling a mirror plate stack	Exploration	Exploration	Granted in JP	7 years
US 20140354473 A1	Navigation system using spreading codes based on pseudo-random noise sequences	SATNAV	QZSS	Granted in JP	5 years

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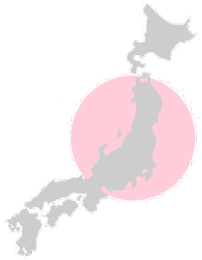
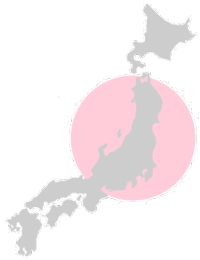


Patent	Title	Application	JP Program Need	Status	Age
JP H08116214A	A method and apparatus for generating an input signal for a parameter sensitive circuit	Cross-sectional	Cross-sectional	Granted in JP	16 years
WO 2014170710 A1	Radio-frequency high power amplifier with broadband envelope tracking by means of reversed buck converter	SATCOM	DRS	Granted in JP	3 years
WIPO					
WO 2015131930 A1	Methods for production of superconducting components	Cross-sectional	Cross-sectional	WIPO	< 2 years
WO 2015028065 A1	Manufacturing of a metal component or a metal matrix composite component involving contactless induction of high-frequency vibrations	Cross-sectional	Cross-sectional	WIPO	< 3 years
WO 2015058784 A1	Very compact tm01 mode extractor	SATCOM	DRS, Dual-use SATCOM	WIPO	< 3 years
WO 2015117680 A1	Lumped element rectangular waveguide filter	SATCOM, SATEO, Science	DRS, Dual-use SATCOM, IGS	WIPO	< 2 years
WO 2015058809 A1	Hybrid folded rectangular waveguide filter	SATCOM, SATEO, Science	DRS, IGS, Dual-use SATCOM	WIPO	< 2 years
WO 2015110155 A1	Receiving method and receiver for timing and frequency offset correction of continuous phase demodulation in satellite-based automatic identification systems	SATCOM	Maritime Awareness	WIPO	< 2 years

ESA IPR FOR JAPAN



Patent	Title	Application	JP Program Need	Status	Age
WIPO *(Cont'd)*					
PCT/EP2015/055807	Reconfigurable RF front end circuit for a multi-beam array fed reflector antenna	SATCOM	DRS, Dual-use SATCOM	WIPO	< 1 year
WO 2015092478 A1	Digital beam-forming network having a reduced complexity and array antenna comprising the same	SATCOM	DRS, Dual-use SATCOM	WIPO	< 2 years
WO 2015090351 A1	Method for designing a modulated meta-surface antenna structure	SATCOM and terrestrial use	Telecommunication	WIPO	< 2 years
WO 2015192872 A1	Methods for production of alloy wires and shaped alloy components from mixed metal halides	Cross-sectional	Cross-sectional	WIPO	< 2 years
WO 2015132618 A1	Imaging antenna systems with compensated optical aberrations based on unshaped surface reflectors	SATCOM, SATNAV, SATEO	DRS, Dual-use SATCOM, IGS, QZSS	WIPO	< 2 years
WO 2015081996 A1	Manufacturing of a ceramic article from a metal preform or metal matrix composite preform provided by 3d-printing or 3d-weaving	Cross-sectional	Cross-sectional	WIPO	< 3 years
WO 2015192995 A1	Joint transmitter signal processing in multi-beam satellite systems	SATCOM	DRS, Dual-use SATCOM	WIPO	< 2 years

ESA IPR FOR JAPAN

Patent	Title	Application	JP Program Need	Status	Age
WIPO *(Cont'd)*					
PCT/EP2014/073611	Fluidic filter	Cross-sectional	Cross-sectional	WIPO	< 2 years
WO 2015166296 A1	Wideband Reflect array Antenna for Dual Polarization Applications	SATCOM, SATEO	DRS, Dual-use SATCOM, IGS	WIPO	< 2 years
PCT/EP2014/072214	Method of manufacturing bulk metallic glass components	Manufacturing satellite and rocket components	SATCOM, SATNAV, SATEO, New Rocket	WIPO	< 2 years

- An IPR license agreement with ESA will empower your business to Japan
- ESA can be your technological partner

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Q&A SESSION

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