Excerpt from

Critical Space Technologies

for

European Strategic Non-Dependence

List of Urgent Actions 2010/2011

for use with FP7 call for proposals
FP7-SPACE-2011-1

Please note that for the FP7-SPACE-2011-1 call, of the 25 items listed in section 4 of the final List of Urgent Actions 2010/2011, items with ID No.1, 3, 5, 9 and 20 are not open in this call and have been removed from the table presented in this document

This page is intentionally left blank.

Table of content

This page is intentionally left blank.

1 BACKGROUND

A technology Non-Dependence action was initiated in ESA in 2002 with a very broad analysis based on the content of European Space Technology Requirements Document (ESTER, formerly Dossier0), and resulted in the document Critical Space Technologies for European Non-Dependence issued in 2003, and presented to the IPC in 2004 (212th IPC, Paris, March 2004).

Subsequently the items identified were further consolidated with the support from ESA experts, by focussing on criticality level 3 items only (see par. 3 for a definition of criticality), by taking into account the considerations expressed by Eurospace, and the findings of a separate survey aimed at identifying products needed by ESA missions that have been purchased outside the EU. A further review and consolidation of the findings was carried out in 2005 as part of the ESA end-to-end (E2E) process for the management of technology development, with the support of Eurospace (based on Eurospace Space R&T priorities and recommendations), and on the basis of the prioritised 2005 update of ESTER.

A further analysis of the non dependence situation was carried out in 2008 showing that although some progress was indeed being made, substantial further work and resources were needed. The document was made available at the 9th September 2008 Joint EC-ESA-EDA workshop on Critical Space Technologies for European Strategic Non-Dependence.

Following the September 2008 workshop, an EC-ESA-EDA Joint Task Force (JTF) was established to address Critical Space Technologies for European Strategic Non-Dependence, and amongst its activities was tasked (with a 6-month mandate) to:

a) define an agreed, common methodology for a coherent Europe-wide approach, building on the existing and recognised processes, such as the ESA led European Space Technology Harmonisation process,
b) define a common list of priorities for critical space technologies to be used in 2009, and identify clear instruments for implementation.

In May 2009, the JTF finalised its work, identifying a subset of items (from the list presented 9th September 2008) for immediate urgent actions for 2009, which were acceptable to all JTF members.

It also defined a European process to update the list based on the existing ESA Harmonisation process and made the following recommendations:

- launch the European Non-Dependence Process based on the common methodology in the 2nd semester 2009, with the aim to reach a European Non-Dependence list by January 2010 and establish the process as a structured way for identifying a common European position on the priorities and scope of individual activities to be proposed for funding
- to review and update the European Non-dependence list every 2 years
- to monitor the status of the list on a regular basis and for EC, EDA and EC to meet once a year to review the status of implementation and identify possible improvements in the process.

More information on the JTF defined European Non-Dependence process can be found in the EC-ESA-EDA JTF Final Report.

As proposed by the JTF, the European Non-Dependence process was launched for the first time in 2nd semester 2009.

The EC-ESA-EDA 2009 Non-Dependence Mapping Meeting took place on 10 September 2009, with participation of member state delegates of the 3 institutions and industry. Inputs were provided by delegates and industry at the meeting and through written contribution by delegations till end September.

A Draft List of Urgent Actions 2010/2011 was then prepared on the basis of the Background Document delivered before the Mapping Meeting, the inputs provided by delegations and industry and review by ESA together with EC and EDA.

A dedicated meeting of the three institutions (EC/ESA/EDA) with industry representatives took place on the 19 November 2009 to discuss industry comments to the Draft List. The updated document including Industry comments and agreed changes, was sent to delegations.

The EC-ESA-EDA 2009 Non-Dependence Roadmap Meeting took place on 9 December 2009, with participation restricted to representatives and member state delegations of the 3 institutions. The list was discussed and agreement was reached.

The updated List of Urgent Actions 2010/2011 was circulated to delegations for final checking before being issued end January 2010.

This extract was prepared for use with FP7 call for proposals FP7-SPACE-2011-1.

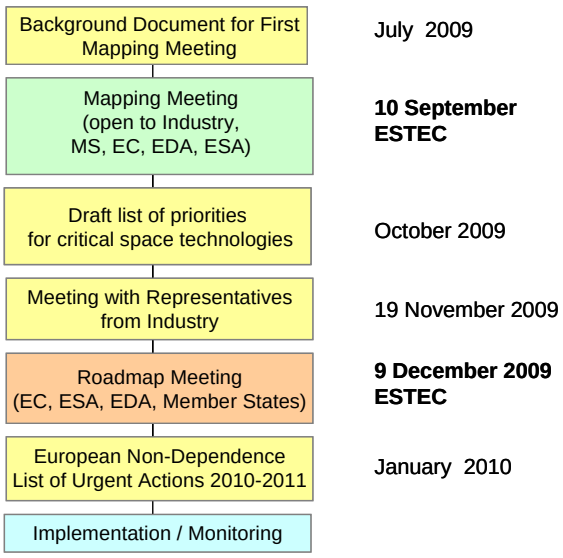

Figure 1 European Non-Dependence Process in 2009

2 OBJECTIVES

This excerpt of the European Non-Dependence List of Urgent Actions (2010/2011) was prepared for use with FP7 call for proposals FP7-SPACE-2011-1.

3 DEFINITIONS OF TERMS

3.1 Definition of dependence

In the context of this document, it is important to recall the definitions of "Independence" and of "Non-Dependence", namely:

- "Independence" would imply that all needed space technologies are developed in Europe.

- "Non-dependence" refers to the possibility for Europe to have free, unrestricted access to any required space technology.

The aim of this action is to contribute to ensuring European Non-dependence.

In particular, the criteria used to evaluate if a technology should be included in this action are:

1. Items shall be of low integration level, i.e. building blocks and components (System/sub-system assembly, methods and tools are not included)
2. Items shall have a clearly identified function and performance target
3. Items shall be multi use and/or applications (i.e. not an enabling technology for a one shot use)
4. Items shall be not available from a European source and for which the unrestricted availability from non-European suppliers can not be assured
5. Critical items for which no adequate or sufficient action is on going

The document reports only Critical items for which an immediate action is urgently required and for which no significant action is on-going.

3.2 Industry assessment of dependence

Industry suffer the consequences of dependence for critical technology when implementing European programmes and when competing in the world. Technology dependence affects all layers of industry, the primes and the manufacturers, large companies and SME. It is therefore essential to consult industry when analyzing the issues of technology dependence and to identify measures to strengthen non-dependence.

3.3 Harmonisation

Where relevant, references to the European Space Technology Harmonisation Roadmaps have been included in the tables. It has to be noted that non-dependence is addressed systematically as part of the harmonisation process.

3.4 Needed Capabilities

The information provided in this column is intended to highlight the capabilities needed in order to satisfy the requirement. This information is provided with the objective of highlighting that allocating funds to carry out a particular development activity by itself is not enough. What is, in fact, needed is to have a long term commitment to establishing in Europe the required technical capabilities.

The situation is especially critical for EEE components, where the capabilities cover the following areas:

Materials, Processes and Technologies
Even if the design related Intellectual Property Rights (IPR) reside in Europe, it is important to consider the effective availability of constituent materials and process capabilities, because a limited availability may result in a lower level dependence. This is critical e.g. in case of the European GaN technology where the initial R&D activities toward industrialisation of this technology (e.g. GREAT) are now based on substrate materials supplied from a US source, as substrates produced in Europe are considerably less advanced.

Furthermore, most of the EEE-component designs (e.g. ASICs) require priority access to space qualified foundry processes. Priority access and adequate visibility of technology details and status required for the space qualified products is not possible without close foundry co-operation. Establishing and maintaining an effective foundry co-operation requires a systematic effort and continuous investment. In the current economic climate, restructuring and globalisation of the commercial semiconductor industry is a fact. In this context it is one of the main priorities of the space community to secure the future availability of the existing technologies and strive to widen the supply chain in close co-operation with the end-users. Losing these dependable resources would dramatically and immediately affect European space projects in terms of schedule, cost and perhaps even mission objectives. The space qualification of a new foundry process takes typically a minimum of 2 years.

Design teams and tools
Space related designs require typically special expertise to ensure reliable operation over the long mission duration and under the dire effects of the space environment. Furthermore, in many cases the technology used is stretched to the limit of its potential and requires a deep and specific understanding of the technology behaviour when optimised for space use. For example this is particularly important for space qualified Application Specific Integrated Circuits (ASIC). Keeping the design competence in Europe on a solid commercial basis

requires a continuous flow of ASIC designs coming from the space industry combined with a focussed R&D effort for future technologies and tools.

Assembly and testing

Assembly and testing requirements of Space products differ from the commercial ones due to the space environment (e.g. vacuum, radiation etc.) and mission requirements (e.g. duration, reliability, thermal cycling). The presence of space application specific properties can not be readily expected from technologies developed and tested for terrestrial applications. This is of particular importance for Radiation Hardness Assurance which is ultimately dependent on validation by means of radiation testing. Radiation testing requires special facilities (e.g. particle accelerators). The provision of technically adequate facilities and a sufficient amount of beam time to satisfy the strongly increasing demand remains a challenge. Integration density and performance requirements mandate the development and introduction of new high pin-count micropackages along with sophisticated assembly processes. The very high frequency of operation associated with advanced microcircuits is posing a major challenge in the implementation of at speed testing and maintaining sufficient fault coverage.

Obsolescence issues of basic materials are also affecting printed circuit board manufacturers and the search for adequate replacement solutions continues. Over a long time the relevant space specific requirements and know-how has been developed, demonstrated, documented and harmonised in European space industry standards (ECSS and ESCC). These form a backbone for the reliable construction, assembly and test of space hardware. To secure this competence in Europe requires continuous proliferation and training (e.g. soldering schools).

A similar situation is applicable also to the other technology areas identified in this document.

4 EXCERPT FROM LIST OF URGENT ACTIONS RELEVANT TO FP7-SPACE-2011-1 CALL

The information collected has been processed with the objective of identifying the technology requirements (TRQs) for which urgent R&D actions need to be supported.

The following items are indicated in the table:

- ID: Identifier (**Please note that for the FP7-SPACE-2011-1 call, of the 25 items listed in section 4 of the final List of Urgent Actions 2010/2011, items with ID No.1, 3, 5, 9 and 20 are not open in this call and have been removed from the table presented in this document**)
- TD: Technology Domain number (ESA Technology Tree, Version 2.1 (ESA–STM 277)).
- Detailed Requirement
- Needed Capability
- Harmonisation Reference: semester, year and title of applicable European Space Technology Harmonisation Roadmap
- ESTER Ref.: reference number of relevant requirement(s) in the ESTER database
- Additional description
- Indication of Technology Readiness Level (TRL) / Technology Readiness Target (TRT) / Potential Funding Programme / Comments

CRITICAL ITEM, IMMEDIATE ACTION IS REQUIRED (LEVEL 3.3)

ID[1]	TD	Title	Detailed requirement	Needed capability	Harmoni-sation Reference	ESTER Ref.	Additional description	TRL / TRT / Comments
2	1	ASICS	- Deep submicron (DSM) CMOS technologies 65 nm - Support to existing 0.18 µm technologies Mixed-signal technologies	• Access to Deep Submicron silicon process with Radiation hardened library • VLSI design techniques and tools for complex devices Assembly and testing of high speed and high I/O pin number devices (e.g. flip chip packaging for devices with very high number I/Os)	S1 2007 - Micro-electronics	T-7795	Advanced CMOS technology and mixed signal technologies Deep submicron (DSM ASIC) TRL6 end 2012 Low power very high performance sub micron technologies for Data path and signal processing applications. Development of rad hard, long life-time libraries for commercial DSM. Definition of "platform ASIC architecture". ASIC technology including High Speed Serial Links (as hard macro and standalone chip). Validation and space qualification.	TRL6 / 2011

[1] Please note that for the FP7-SPACE-2011-1 call, items with ID No. 1, 3, 5, 9 and 20 are not open in this call and have been removed from the table.

ID[1]	TD	Title	Detailed requirement	Needed capability	Harmoni-sation Reference	ESTER Ref.	Additional description	TRL / TRT / Comments
4	1	Very high speed serial interfaces	Development of very high speed (1-10 Gbit/sec) links and networks for components/units interconnections. I/O devices for DSP computer applications: SpaceFiber (CODEC IP, Network terminal, Network bridge and Router ASICs)	• SERDES validated design • Access to Deep Submicron silicon process with Radiation hardened library • VLSI design techniques and tools for complex devices • Assembly and testing of high speed and high I/O pin number devices • PCB design techniques and interconnect technologies implied by very high speed transmission	S2 2006 - On-Board Payload Data Processing	T-84(04)	Higher speed obtained by parallelisation. Full chip set (router, terminal unit, …) to be developed For Quatuor chip (4 links at 6.25 Gsps) : TRL 6 in 2012	For Quatuor chip (4 links at 6.25 Gsps) TRL 6 / 2012
6	23	Solid state gyroscope components	Although the technology is available in Europe the actions is needed to replace obsolete components (Pinfet and optical source) for the FOG Inertial Measurement Unit (IMU) high precision class (bias stability < 0.01 deg/h).		S1 2009 - AOCS Sensors & Actuators	T-7818		TRL6 / 2011

[1] Please note that for the FP7-SPACE-2011-1 call, items with ID No. 1, 3, 5, 9 and 20 are not open in this call and have been removed from the table.

ID[1]	TD	Title	Detailed requirement	Needed capability	Harmoni-sation Reference	ESTER Ref.	Additional description	TRL / TRT / Comments
7	24	Power amplifi-cation: TWT materials	To identify European suppliers for a set of critical TWT materials (ceramics, metals and alloys), to realise an evaluation and qualification programme for the most sensitive ones and to validate the material suitability for TWT applications.	Secure procurement of Raw/Processed material	NA	T-7825		TRL7 / 2012
8	24	European State of the Art Dielectric Materials	To develop state of the art dielectric materials for high and low power microwave equipments in particular microwave filters.	Dielectric material supplier	NA	T-283	Two kind of activities required: 1) Eps-r about 13,Hi quality coefficient, raw material identification and characterisation, 2) Eps-r about 36, characterisation of existing European raw material impact on filters performances	1) TRL4 / 2012 2) TRL6 / 2013

[1] Please note that for the FP7-SPACE-2011-1 call, items with ID No. 1, 3, 5, 9 and 20 are not open in this call and have been removed from the table.

ID[1]	TD	Title	Detailed requirement	Needed capability	Harmoni-sation Reference	ESTER Ref.	Additional description	TRL / TRT / Comments
10	17	Space-worthy solid-state laser sources	This address a set of requirements at component and subsystem level in terms of reliability, lifetime, radiation, efficiency and space operation both under vacuum and pressurized. The key elements addressed are pump diodes and pumping modules, laser crystals and frequency converters, transmissive and reflective optics and coatings, thermal control and control electronics.		S2 2005 - Lidar Critical Solid-State Compo-nents	T-7884	High-power single mode laser sources (0,8 µm) High efficient laser pump source: plug-in efficiency * 2, life time *2 Quasi high power laser diodes at 800 nm and thermal/ageing robustness (10 W per bar, life time *10). Space qualification of solid-state lasers (lifetime *2, efficiency * 2) The main dependency issue is related to the amplification, and to wavelength conversion crystals.	TRL8 / 2013
11	17	Enhanced performance and space-worthy 1-D and 2-D Sensor focal planes operating from X ray to the Infrared	This requirement addresses all technological requirements related to the development of rad-hard, low-noise, high Q-E, large-format detector arrays for operation from X ray to Infrared. It includes monolithic and hybrid technology for detector and read-out, foundry optimization/spatialization Production capabilities on High Perf CCD/TDI.		S1 2006 + S2 2008 – Techno-logies for Optical Remote Passive Instruments	T-7886	Large Array IR technologies (> 12µm), Large APS technologies (resolution > 2000*2000 and ~ 12 000 linear) Additional potential issue on CCD-TDI availability	
12	19	Bladder tanks for bipropellants	Development of family of bipropellants bladder tanks for on-board chemical propulsion systems with the aim of producing competitive European components.	Extension of current Hydrazine TRP activities to bi-propellant tanks	S1 2008 - Propellant Tanks & High Pressure Vessels	T-867	Expulsion efficiency >99%	TRL6 / 2012

[1] Please note that for the FP7-SPACE-2011-1 call, items with ID No. 1, 3, 5, 9 and 20 are not open in this call and have been removed from the table.

ID[1]	TD	Title	Detailed requirement	Needed capability	Harmoni-sation Reference	ESTER Ref.	Additional description	TRL / TRT / Comments
13	19	Propellant flow and distribution components for electric and chemical propulsion	Development of propellant flow and distribution components for on-board electric and chemical propulsion systems with the aim of producing competitive European components.	Materials selection for sealing devices capable to sustain long lifetimes without leaking Welding capabilities (laser welding, etc.)	S1 2005 - Electric Propulsion - Flow control systems (S2 2009)	T-8117, T-8119	European Mechanical Pressure regulators -electric propulsion: no European solution available. Full dependence situation -chemical propulsion: further development required on European product	TRL7 / 2012
14	20	Development of Large Deploy-able structures	Large deployable structures are needed as backbone and integral part of large reflectors, Earth observation antennas, radiators, sun shields and solar arrays. In addition to providing a deployment function, the structure shall provide shape, stability and integrity for the subsystem in question throughout its mission. This requirement includes: 1. Large thin walled deployable boom and membrane structures 2. Large thin walled inflatable structures 3. Large deployable structures for reflector antennas	Facilities and associated competences for manufacturing of large deployable reflector structures, thin walled inflatable structures and large deployable boom and membrane structures. Large testing facilities for deployment simulation, incl. gravity compensation. (adaptation of existing facilities) Flight demonstration opportunities are essential in order to raise the TRL level to facilitate application in European commercial and institutional spacecraft projects (can not be demonstrated on ground).	S2 2003 - Deployable Booms S2 2009 – Reflector Antennas for Telecom S2 2003 - Inflatable Structures	T-617	Large reflector LF incl L&S > 16 m consolidation and integration for mobile application	TRL6 / 2012

[1] Please note that for the FP7-SPACE-2011-1 call, items with ID No. 1, 3, 5, 9 and 20 are not open in this call and have been removed from the table.

ID[1]	TD	Title	Detailed requirement	Needed capability	Harmoni-sation Reference	ESTER Ref.	Additional description	TRL / TRT / Comments
15	20	Development of low shock (NEA-like) initiators	Pyrotechnics are needed for the many non repeating functions which are crucial to mission success (solar arrays, antennas, boom, valves, etc.). Increasingly demanding missions require enhancements in temperature survivability, lifetime before firing, reduction of undesirable side effects and continued increasing efficiency. This includes the development of new pyrotechnic materials and ignition methods as well as miniaturization. Self energized separation interfaces of all types and their supporting systems are covered by this effort (life extension, thermal environment extension. Thermite devices development. Miniaturisation.)	Sustainable product development opportunity for design and manufacturing of European pyrotechnic devices.	S1 2006 - Pyro-technics	T-626		
16	21	Advanced Ablative Systems for high speed re-entry	Development of advanced ablative materials and heat shield concepts (e.g. in combination with ceramic or metallic materials or using inflatable systems), with the aim of mass and volume reduction, covering also the very high heat flux ranges.	Sustainability for design, manufacturing and testing. Flight demonstration	NA	T-7878		

[1] Please note that for the FP7-SPACE-2011-1 call, items with ID No. 1, 3, 5, 9 and 20 are not open in this call and have been removed from the table.

ID[1]	TD	Title	Detailed requirement	Needed capability	Harmoni-sation Reference	ESTER Ref.	Additional description	TRL / TRT / Comments
17	23	Passive Compo-nents	Development and qualification of European passive components	European manufacturing capabilities (foundries, assembly and test houses).	NA	T-7890	Resistors, capacitors Relays Connectors Development of a European thermistor for the temperature range of -200^0 C to +220^0 C	TRL8 / 2011
18	23	Active Compo-nents	Development and qualification of European active components like MOSFET and diodes, according to the CTB workplan	European manufacturing capabilities (foundries, assembly and test houses).			Transistors and diodes (MOS or SiC or GaN)	TRL8 / 2011

[1] Please note that for the FP7-SPACE-2011-1 call, items with ID No. 1, 3, 5, 9 and 20 are not open in this call and have been removed from the table.

ID[1]	TD	Title	Detailed requirement	Needed capability	Harmoni-sation Reference	ESTER Ref.	Additional description	TRL / TRT / Comments
19	23	Very High perfor-mance micro-processors	Development of very high performance (32-64 , multicore) general purpose µprocessor : 1GIPS processing speed to fulfil telecom, science and earth observation requirements	• IP VHDL model or design available and open for licensing or competency to design high end multi-core microprocessors • Access to Deep Submicron silicon process with Radiation hardened library • VLSI design techniques and tools for complex devices • Assembly packaging and testing of high I/O pin number devices • Availability or development of a SW development framework Compilers supporting multi-threading	S2 2006 - Data Systems and On-Board Computer	T-7796, T-7891	High speed General purpose processor (400 to 1000 MIPS with multi-core architecture).	TRL6 / 2012
21	23	Low-cost high-resolution L and X-band SAR components	Monolithic Integrated front end, low-cost antenna concepts and components, including LNA, Mixer, Oscillator		S2 2005 - Array Antennas	T-171T-388T-278T-132	Advanced (generic) TR Modules (20 W GaN), standardized architecture - Flexibility Generic power supply units (converter) Low loss arrays technologies Advanced core radar processing electronics High demanding Solid state mass memory (Flash and DDR) > few Tbits from 1 to few Gbit/s High Speed High Efficiency ACM Modems Advanced antennas Broadband, high power, passive RF components Broadband, high power TWTs	TRL6 / 2012

[1] Please note that for the FP7-SPACE-2011-1 call, items with ID No. 1, 3, 5, 9 and 20 are not open in this call and have been removed from the table.

ID[1]	TD	Title	Detailed requirement	Needed capability	Harmoni-sation Reference	ESTER Ref.	Additional description	TRL / TRT / Comments
22	21	Advanced thermal control systems	Further improve the performance and optimize current heat transfer technology to provide current and future missions with enhanced heat rejection capabilities. One solution to such requirement is the use of Deployable Radiators (DPR), another one is the increase of the rejection temperature by using heat pumps.	European capabilities. Sustainability for design, manufacturing and testing. Need for flight demonstration to improve maturity and facilitate applications on European missions (institutional and commercial)	S1 2009 Two-Phase Heat Transport Systems	-	High efficiency deployable radiators (DPR) Heat-pump systems to increase the radiator temperature	

[1] Please note that for the FP7-SPACE-2011-1 call, items with ID No. 1, 3, 5, 9 and 20 are not open in this call and have been removed from the table.

ID[1]	TD	Title	Detailed requirement	Needed capability	Harmoni-sation Reference	ESTER Ref.	Additional description	TRL / TRT / Comments
23	24, 21	Advanced thermal control materials	Materials used at the outside of a spacecraft are generally multifunctional in that they protect the underlying hardware from different environmental parameters. One of these functions is thermal control, for which Multi layer Insulations (MLI) are typically used. Currently most of the MLI materials are procured from non-European sources often under access restrictions In addition, one of the basic materials for MLI, namely Kapton, is also used in other thermal control applications, which can then also fall under access restrictions.	Materials suppliers Replacement for all type of ITAR restricted MLI's (incl. Conductive ones)	NA	T-8386, T-7880	ITAR-Free MLI (Multi layer insulation) material Germanium Coated Kapton Material Kapton or Kapton alternative for Heaters	

[1] Please note that for the FP7-SPACE-2011-1 call, items with ID No. 1, 3, 5, 9 and 20 are not open in this call and have been removed from the table.

ID[1]	TD	Title	Detailed requirement	Needed capability	Harmoni-sation Reference	ESTER Ref.	Additional description	TRL / TRT / Comments
24	24	High density (up to 1000 pins) assemblies on PCB	All missions need very reliable electronic assemblies and the amount of data to be handled by this electronic is largely limited by the possibility to populate PCBs. In this Technology Requirement are evaluated the means to increase component density on PCBs. This includes the assemblies possibilities for new components, e.g. Ball Grid Arrays (BGA s), high dissipation packaging technologies. There is an urgent need to replace the Thermount that is obsolete and soon not anymore available	European manufacturers for ECSS qualified PCBs. Active maintenance and development of these capabilities is necessary.	NA	T-8385	High Density Interconnect PCB High pin count package up to 1000 pins	TRL7 / 2011
25	24	Space qualified carbon fiber and pre impregnated material sources for satellite subsystems	In several cases only one source is existing with major issues related to increased delivery lead times and costs. Space market is only a niche sector and aeronautical takes priority. This requires a central coordinated qualification of European sources. Links with aeronautical needs may allow cost sharing.	Facilities for manufacturing of high modulus fibers in Europe (extension / enhancement of existing facilities)	S2 2005 - Composite Materials (2010)	T-7750	Carbon fibres production	TRL6 / 2011

[1] Please note that for the FP7-SPACE-2011-1 call, items with ID No. 1, 3, 5, 9 and 20 are not open in this call and have been removed from the table.

APPENDIX:

TABLE OF ACRONYMS

1 D	1 Dimensional
A/D	Analogue/Digital
ADC	Analogue Digital Converter
ARTES	ESA Advanced Research In Telecommunication Systems Programme
ASIC	Application Specific Integrated Circuit
CCSDS	Consultative Committee for Space Data Systems
CNES	Centre national d'études spatiales
CPL	Capillary Pumped Loop
CTB	ESCC Components Technology Board
CTE	coefficient of thermal expansion
DAC	Digital Analogue Converter
DLR	Deutsches Zentrum für Luft- und Raumfahrt
DSM	Deep Sub-Micron
DSP	Digital Signal Processor
EC	European Commission
ECSS	European Cooperation for Space Standardization
ECI	European Component Initiative
EDA	European Defence Agency
EEE	Electrical, Electronic and Electromechanical
ESA	European Space Agency
ESCC	European Space Components Coordination

ESP	European Space Policy
ESSS	European Space Surveillance System
ESTER	European Space Technology Requirements Document
FOG	Fiber Optic Gyro
FPGA	Field Programmable Gate Array
GaN	Gallium Nitride
GIPS	Giga Instructions per Second
Gsps	Giga samples per second
GSTP	ESA General Support Technology Programme
HSSL	High Speed Serial Link
I/O	Input/Output
IMU	Inertial Measurement Unit
IP	Internet Protocol
IPC	ESA Industry Policy Committee
IR	Infrared
JTF	Joint-Task-Force
LHP	Loop Heat Pipe
LNA	Low Noise Amplifier
LO	Local Oscillator
MEMS	Micro-Electro-Mechanical Systems
MMIC	Monolithic Microwave Integrated Circuit
MS	Member States
PCB	Printed Circuit Board
RAD hard	Radiation hard

RF	Radio-Frequency
SAR	Synthetic Aperture Radar
SiGe	Silicon Germanium
TD	Technology Domain
THAG	ESA Technology Harmonisation Advisory Group
TPS	Thermal Protection Systems
TRL	Technology Readiness Level
TRT	Technology Readiness Target
TRP	ESA Basic Technology Research Programme
TWT	Travelling Wave Tube
UHF	Ultra High Frequency
VHF	Very High Frequency