EVALUATION OF CRITICAL AND EMERGING SECURITY TECHNOLOGIES FOR THE ELABORATION OF A STRATEGIC RESEARCH AGENDA

DELIVERABLE D1.2

Validated List of Critical Technologies

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1 Introduction

The STACCATO taxonomy[1] has been used as the basis to obtain a list of critical technologies, i.e. technologies considered to be essential for European security. This list will be used to determine if there are critical dependencies, i.e. technologies (or materials or competences) which may become unavailable to European security organisations for any reason.

1.1 Definition (of a critical technology)

There is no commonly accepted definition of a critical technology. The ETCETERA project has therefore created a definition using the project cowiki as a discussion forum to achieve this.

In the ETCETERA Description of Work it was stated:

A Critical Technology is broadly defined as a technology that is currently available or expected to be available in the near future and that is indispensible [sic] for European security

However, this is not a workable definition, so following discussion a new and improved definition has been developed, viz:

Any technology (including equipment, skill, system, service, infrastructure, software or component) that is required by any organisation with a legal or contractual responsibility for security of citizens in Europe to properly perform its duties

While this definition is still not perfect and is still open to interpretation it does include less tangible aspects such as skills, services and software. Hence any "technology" fulfilling the above definition is to be considered as a critical technology. In the attached list all such technologies have been included; even such ubiquitous technologies as for example cement production. In WP2 each critical technology will be analysed to decide if a critical *dependence* exists. For a further definition of *dependence* we refer to WP2.

1.2 Relation to ESRAB mission areas

In the DoW it was mentioned that the critical technologies identified would be related to the ESRAB mission areas[2]. Briefly, the four mission areas identified by ESRAB (European Security Research Advisory Board) are:

- Border security
- Protection against terrorism and organised crime

[1] The STACCATO taxonomy was produced by a previous EC funded PASR project and can be downloaded from here: http://www.asd-europe.org/site/fileadmin/user_upload/STACCATO_final_taxonomy.pdf
[2] The ESRAB research agenda (full report) can be downloaded here: http://ec.europa.eu/enterprise/policies/security/files/esrab_report_en.pdf and the mission areas viewed graphically here: http://www.iai.it/pdf/ESRAB/ESRAB-GaspariniLeone.pdf

- Critical infrastructure protection
- Restoring security in case of crisis

Directly relating each and every technology/item in the STACCATO taxonomy to one or more oft he ESRAB mission areas is neither practical nor useful. There are many instances where a sensor technology for example can be used for more than one mission area. We have therefore illustrated the relationship(s) between technology and mission in the illustration below.

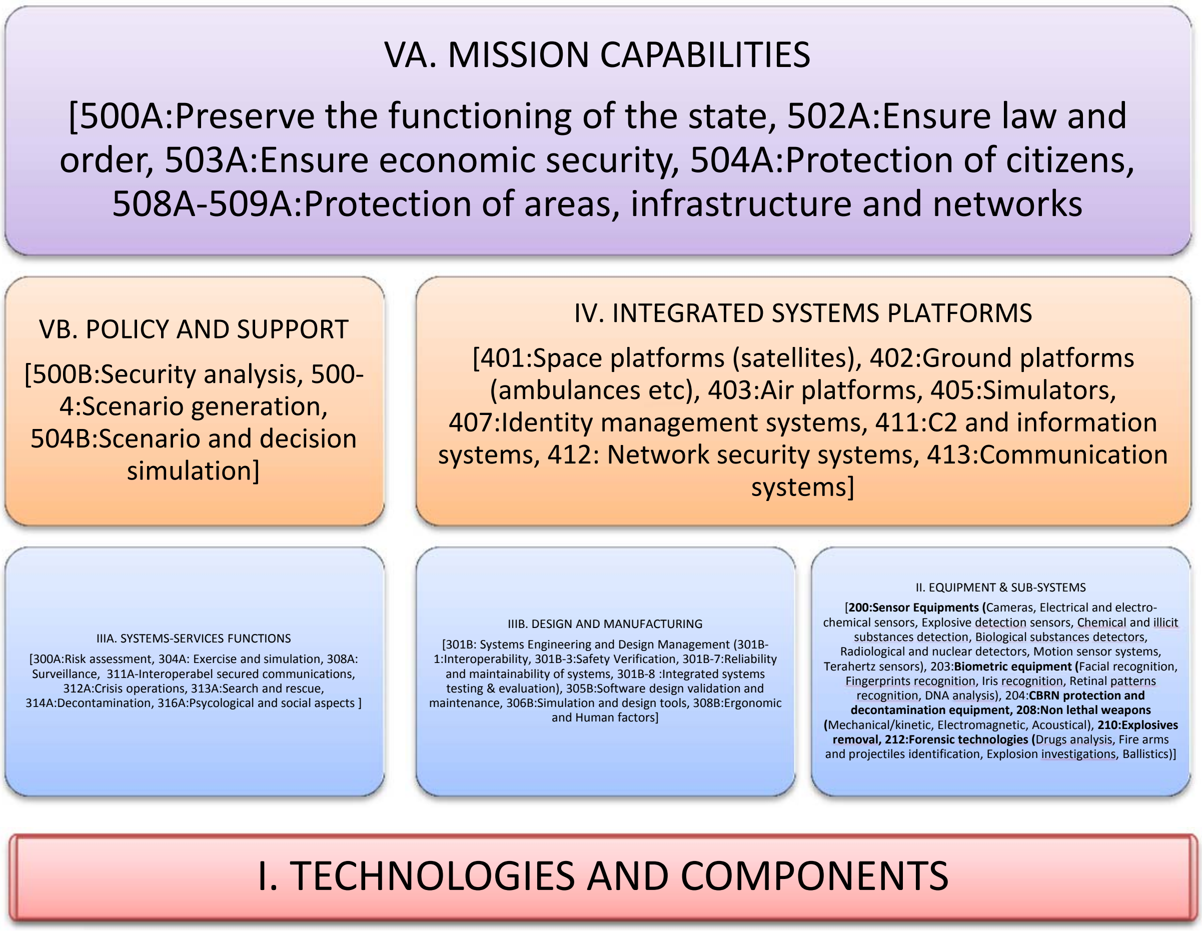

Figure 1 above illustrates the relationship between technology and mission areas in the STACCATO taxonomy (the Roman numerals in the box headings).

To further expand on the different levels:

- **VA** - Ultimately these are the functions the (critical) technologies there are to maintain
- **VB** and **IV** - These are functions and systems that are perceived necessary for **VA** It is important to create and maintain the integration skills needed to put these together from lower level systems
- **IIIA, IIIB** and **II - IIIA** and **IIIB** are skills and processes needed while II contains actual equipment (as e.g. cameras)
- **I** - The components that are the foundation for the levels above

2 Method

The STACCATO taxonomy[3] was generated by a previous EC funded PASR project carried out by the Aerospace & Defence Industries Association of Europe. The taxonomy is therefore based on terminology used in products and product-near areas, as opposed to pre-product technologies with lower TRL (technology readiness level) values. In this context we can expect the taxonomy to be:

- Reasonably well established in Europe
- Reasonably stable
- Reasonably widely accepted in Europe

and is therefore a useful basis to work on.
A snapshot of the STACCATO taxonomy is shown in the figure below, showing also the supplier-user division (approximately).

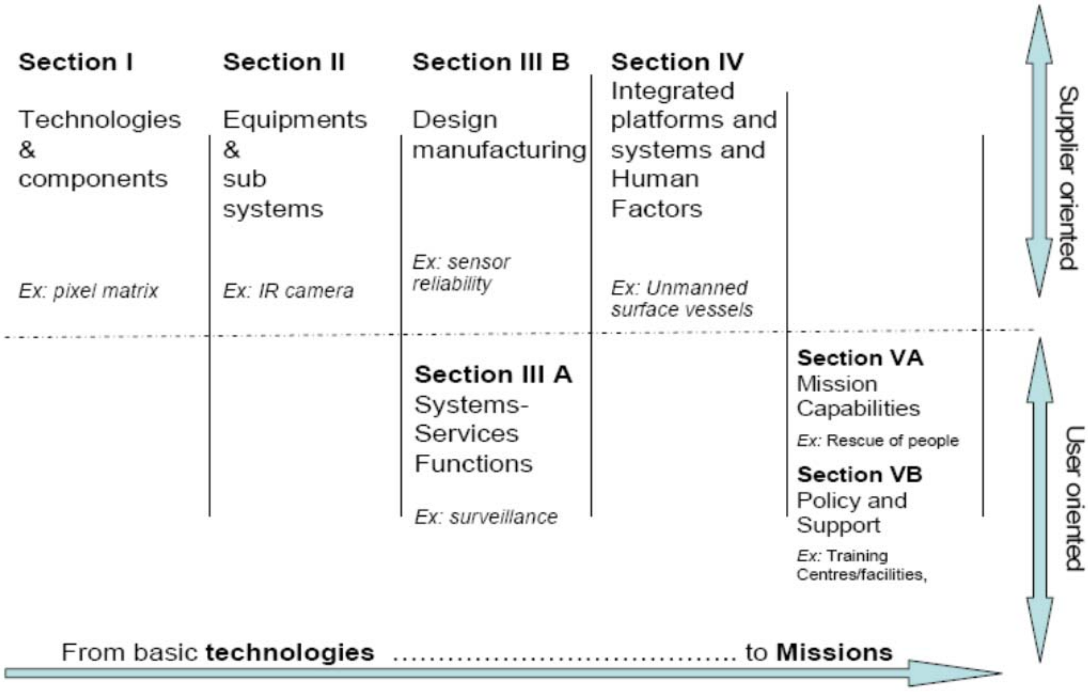

Figure 2. The figure above is copied from the STACCATO final report and shows how the taxonomy is constructed.

The seven different sections (also called levels) are listed below and are self-explanatory, and can be seen as in order of increasing complexity.

- Technologies and Components
- Equipments and sub systems
- (IIIA) Systems-Services Functions
- (IIIB) Design-Manufacturing
- Integrated platforms and systems and Human Factors
- (VA) Missions Capabilities
- (VB) Policy and Support

[3] The STACCATO taxonomy is itself derived from earlier work in the SeNTRE (Security network for technological research in Europe) project from 2004. More information on SeNTRE can be downloaded here: http://www.frstrategie.org/specifique/activitesEuropeennes/SeNTRE.pdf

This structure has been maintained in the CTL (critical technology list).

The STACCATO taxonomy has been extended from a simple list of technologies to include a description of the security relevance of the technology, i.e. what it might be used for, who (which organisation) might use the technology and potential suppliers of the technology. The supplier is not chosen on the basis of any particular merit, but simply as an example of the type(s) of products which can be found on the market. No recommendation is given or implied.

The general idea is that if a technology, listed in STACCATO, has at least one security application for which it is found to be essential then it is included in the Critical Technology List. Note that this makes sense for the lower level technologies while for the more high-level systems as e.g. [500A] Policy and [500B] Missions the STACCATO item is most often the “application” in itself. When preparing the CTL, areas that are close to each other were not both included, e.g. [208-1] Mechanical/kinetic anti-personnel and [208-2] Mechanical/kinetic anti-materiel.

The method used to extend the STACCATO taxonomy was primarily though expert consultation and use of the open scientific and commercial literature, supported by several parallel workshops.
Further details of the workshops and literature sources (reference list) are given in D1.3.

3 Critical technology list

The critical technology list is given below in text format. For convenience of further study it will also be made available as a spreadsheet. It should be noted that frequently there is overlap between topics. Further comments on the STACCATO taxonomy are given in D1.3.

	STACCATO Taxonomy	Security aspects	Users (examples only)	Suppliers (examples only)
I .	**TECHNOLOGIES AND COMPONENTS**			
100	**Structural materials and technologies and structural effects analysis**			
100-2	Ceramic composites	Ceramic composites might be e.g. silicon carbide/silicon nitride composites for high temperature applications, or aluminium oxide/silicon carbide for armour. Also porous ceramics are used as thermal insulation in extreme applications such as the heat shields on high velocity vehicles like the space shuttle or satellite launch vehicles. Ceramics are also used in seals for extreme environments, e.g. in chemical processing at high temperature.	Many & varied including manufacturers of armoured vehicles and space vehicles, manufacturers of chemical plant, etc	Generally ceramic composites are not likely to be critical, unless used in a critical application, device or system such as those mentioned. It might also be that machining to special shapes or tolerances is a critical step in manufacture of a system or component.

100-3	Composites materials technology	Composites, including carbon fibre reinforced plastics, glass-fibre reinforced plastics are used in construction of aeroplanes, bridges, pipelines and other structures which might be security critical. A special type of polymer composite is ARALL, (a laminar composite) which is used in the new Boeing Dreamliner. Polymer cmposites are also used in armour. Polymer composites with self diagnosing functions (e.g. integrated optical fibre sensors to detect stress/temperature/fire/fracture) to detect and/or predict catastrophic failure in aerospace, building walls and similar could be security applications	Saab, BAE Systems, EADS. See Sogo Security Services Co, Japan	Generally it is not only the material that is critical, although special composites such as ARALL and carbon fibre prepreg used in aerospace and other high performance structures that are critical, but also the manufacturing technology needed to make (especially) large, security critical structures. E.g. large autoclaves for manufacturing large composite structures should also be considered. Techniques for non-destructive inspection, for joining and for repair of composites are also important
100-4	Powder metallurgy	Metal (or other powders) are used as tags for unique identification of documents or other items. Metal powders are possible tracers for identifying commercial explosives. There are many other applications for PM where security applications might be one use, e.g. in bearings for motors. However, much of PM is ubiquitous.	See ETH, Switzerland	Not likely to be critical unless standards are developed which exclude European manufacturers' products
100-5	Dense alloys	By dense alloys we normally mean molybdenum, tungsten (wolfram) and rhenium alloys. These are used in special machine tools (for stiffness, low vibration, precision engineering), also for weapons (military) and potentially useful in future thermonuclear fusion reactors (containment walls and similar)		There may be a critical dependency, I don't think these ores are widespread in Europé, and I know there are efforts to re-open a tungsten-ore mine in Cornwall, UK. See e.g. http://www.hogenindustries.com/

100-6	Organic composites	A very broad category of materials, in many cases synonymous with polymer composites (100-3), but one possible security application is detection of toxic materials		This may be an emerging technology, there is a paper published by The Aerospace Corporation, Los Angeles. The material mentioned in this paper (polyaniline fibres) is not likely to be critical.
100-7	Metal-matrix composites	Used as heat sinks for electronics in demanding applications, e.g. space where low/controlled thermal expansion is needed. Used in optical systems where low/controlled thermal expansion is needed. Most common are aluminium-based MMCs containing SiC, but for some applications copper/diamond have been tested. Used as structural elements, e.g. tubular frames where thermal expansion must be limited, e.g. in optical systems (telescopes), satellites and similar applications. Boron-aluminium composite is used in the space shuttle, graphite-aluminium used in Hubble space telescope. Some studies on titanium-titanium carbide fibre composites are relevant for e.g. aerospace turbines.		Special metal matrix composites might be a critical technology, but not the common composites often used in automotive and transport.E.g. Lockeed-Martin Marietta, but they likely only build the structure and another manufacturer produces the material. See e.g. http://hos.cms.schunk-group.com/

100-8	Carbon-carbon composites	Used for aircraft brakes, potentially useful for high temperature components in thermonuclear reactors for future power generation, may already be used for high speed missiles (military application) but also for re-entry vehicles and similar structures. Is used on the space shuttle, wing leading edges. A highly specialised material demanding high level of expertise to produce and machine. Likely used in brakes on high performance automobiles, may be used on e.g. train braking systems. Likely used in chemical plants where severe conditions (corrosion, high temperature) exist, also maybe orthopeadic implants, in bearings, etc.		Se e.g Mersen http://www.mersen.com/
100-10	Synthetics fluids and lubricants	A very broad category, dry lubricants in space might be relevant, otherwise most synthetic fluids are used for machining operations. Special hydraulic fluids for security critical applications may be relevant.	ESA	
100-11	EM radiation absorbers	Absorbers for EM (electromagnetic) radiation include e.g. stealth coatings for military applications, but these are also used in electronic equipment (e.g. microwave communications) and in anechoic chambers for testing and certification of electronic equipment		EM absorbers for militray applications are very secret and definitely a critical technology, but if we exclude military applications then purely civilian uses do not demand such high performance. The materials used (carbon, metals, etc) are not likely to be critical.

100-12	Magnetic metals	This ia a very broad category, including iron, nickel, cobalt, metallic glasses, and some of the rare earth metals. They are used in transformers, many types of sensors and actuators, both at room temp. and high temp. Note that this topic would also include the rare earth metals and their widely used magnetic alloys of neodymium-iron-boron and cobalt-samarium. These are widely regarded as critical materials.		Nickel and cobalt may be critical, iron occurs widely in Europé. The rare earth metals are supplied to very large degree from China, where there are several manufacturers.
100-13	Superconductors	Superconductors are used in very special applications in medical diagnosis. There is potential to use superconductors in power transmission and in superconducting motors, although the technology is relatively immature.		
100-14	New metallic alloys	Too broad to be a useful category, although the rare earth magnets might be considered, also amorphous metallic alloys. See 100-12		
100-15	Metallic composites	Synonymous with metal matrix composites, see 100-7		
100-17	Concretes resistant	Concretes used in structures such as bridges, power stations, and for shielding radiation sources may be relevant.		It seems unlikely that concrete is a critical material
100-18	Anti-blast glasses	See 101-2. Existing blast-resistant glass is very thick and heavy, University of Missouri scientists are developing a thinner material strengthened with a thin layer of plastic which is reinforced with glass fibres.	Securitas, Falck	Pilkington (http://www.pilkington.com/) and Oran Safety Glass (http://www.osg-armor.com/). There are surely others

100-19	Materials for thermal control	Thermal control is important in electronic systems, in satellites and aerospace, etc to avoid over/under heating/cooling. Materials and devices for thermal control normally include heat pipes, phase change materials, thermal interface materials, thermal switches and radiation shields. Heat pipes are used for thermal control in space systems. Heat pipes might be useful for automatic cooling of nuclear generators if cooling pumps fail. Thermal interface materials are used to thermally conduct heat from an electronic chip/device to a heat sink for cooling, thermal switches are used to control the thermal contact, to either connect or isolate one component to another as in an switch		Heat pipes might be critical technologies, especially in space systems. Thermal switches as used in critical structures might be critical technologies. ALCATEL (France) has published a roadmap for developments concerning heat pipes.
100-20	Nano components and structures (tubes, ceramics, …)	Too vague to be useful, but most "nano" technology is immature, with low TRL (<3). Likely to contain a number of emerging technologies		
101	**Light and strong materials, surface treatments.**			
101-1	Light materials for human protection	Very broad, category which could include materials for ballistic protection, materials for protection against toxic chemicals and bacteria or viruses, protection for emergency responders	Emergency services	See the materials discussed above in category 100
101-2	Light materials for site protection	Shatterproof windows for high risk buildings. Other materials include blast curtains developed for protecting inner spaces against blast and fragments, e.g if windows are shattered in a blast. This topic	State & local government…	See the materials discussed above in category 100

		includes solid materials and textiles		
101-3	Armor and anti-armor materials	This category is largely military, but some armour materials used in personal protection (body armour) could be critical. Kevlar, Spectra, Dyneema, etc. Also ceramic armour		
101-4	Self-protective and explosive resistant material technology	We assume this refers to ballistic protection. See 100-17, 100-18, 101-1, 101-2, 101-3		
101-6	Structural & Smart Materials	Too broad to analyse, this could include almost anything but smart materials might include e.g. self-indicating materials which would show damage in the event of an impact, such as on a composite stucture forming part of an aeroplane.		
101-7	Surfaces treatments for improvement of mechanical properties	There are many possible surface treatments, improving mechanical properties likely includes shot peening, but could also include the rapid quenching applied to glass to produce "toughened" glass. Ion exchange treatments to improve the toughness of glass may also be considered.		
101-8	Surfaces treatments for improvement of life duration, corrosion reduction	See 101-10		
101-9	Paints (without CoVs…)	Paints (environmentally friendly, without volatile organic solvent such as polyurea-based paints give great resistant to blast	Retrofit and maintenance companies,	http://www.specialty-products.com/ http://www.youtube.com/watch?v=DGlMK0KWOJ4

		applied on construction elements and systems such as walls.	construction industry.	
101-10	Replacement of Cd, Hg, Cr	Cr, Cd are used on some safety critical aerospace components such as landing gear and fasteners. Substitutes include zinc alloy coatings, and more frequently organic coatings		
101-11	Simulation for surfaces treatment	How does radioactive contamination stick to concrete, glass and other materials in the event of a dirty bomb? It is difficult to see a direct security relation, but it is possible there is one.		
101-12	Nano surfaces	Self-decontaminating or easy to decontaminate surfaces? Such surface coatings are emerging, but are currently only available in the large scale on window glass. Some attempts are being made to use similar coatings on construction materials including concrete	Building construction and demolition companies, road building, mining	See eg Pilkington (http://www.buildingdesign.co.uk/arch/pilkglass/pilkglass.htm)
101-13	Smart textiles	Meaning textiles with sensors integrated for monitoring the wearer's health, e.g. 1st responders. This is an emerging technology area, but currently has low TRL but will definitely mature within the near-midterm future (5-10 yrs)		See FOV Fabrics, Öztec Textiles (Turkey)
102	**Materials for deterrence**			
102-2	Nuclear materials processing	Protection against theft and leakage of nuclear materials. Perimeter security, but the materials are not security related, only the facility (as it should be secure from terrorist attack and theft)		

102-3	Nuclear-related materials	Techniques to combat theft, movement or smuggling of fissile or other nuclear materials including industrial sources such as cobalt 60, medical isotopes.	See sensors for radioactive materials 110-16	
102-4	Fission reactor	A critical infrastructure which must be protected		
103	**Stealth materials and Technologies**			
103-1	Radar passive absorbing materials	Likely to be mainly military, but there are civilian applications in absorbers on wind power towers/wings and where microwave technology is used to e.g. monitor traffic flows. Relevant technologies are magnetic absorbers and Salisbury screens, but most likely carbon-based absorbers (graphite particles dispersed in e.g. foam rubber). Similar materials are used in a range of microwave equipment to absorb microwave leaks, for safety and to improve performance	Saab Aerospace interested both in military and civilian applications	Eccosorb (http://www.eccosorb.com/), Cumming Microwave (http://cumingmicrowave.com/), ETS-Lindgren (http://www.ets-lindgren.com/pdf/absorber.pdf)
103-2	IR passive materials	The description is unclear, but we assume this refers to materials with low IR emission for stealth (military applications). Civilian applications include materials with controlled reflection/emission for energy efficient buildings, to either allow IR (solar) radiation in or to keep it out. Solar cells and smart windows are also potential applications. Materials include (electrically) conducting polymers such as PEDOT (polyethylenedioxythiophene) and ITO (indium-tin-oxide) and other semiconductors. Low IR emission is a property of several partially conducting	Solar cell manufacturers, smart window manufacturers	Solar cell manufacturers, smart window manufacturers

		materials (polymers, composites)		
103-3	Multifunctional stealth materials	Only military users would be interested in multifunctional stealth materials, they are not relevant for ETCETERA		
103-4	Coatings and absorbing materials for laser signature reduction	Likely to be mainly military users, but both coatings and absorbers are important for safety when using lasers in industrial and medical situations. Laser absorbing coatings are used to measure laser power (important for calibration, medical uses, industrial applications), and coatings for safety. Illegal use of lasers is increasing and a growing problem for society. Hooligans and criminals use lasers to disrupt and in criminal activities and there are large numbers of malicious incidents against aeroplanes	Manufacturers of laser power meters. The technology is not sufficiently well developed for there to be users of laser protection yet.	ThorLabs (http://www.thorlabs.de/), Ophiroptic (http://www.ophiropt.com/laser-landing/)
103-5	Passive materials for acoustic reduction	We can assume acoustic absorbing coatings for submarines are relevant (and therefore only of military interest), but acoustic absorbers are used in many safety and security related applications, to avoid accidental or deliberate "listening".	Governments, authorities and companies, security facilities	Eckalusa (http://www.eckelusa.com/products/applied-solutions/high-security-facilities.html) + many others

103-6	Obscurants materials/equipments	We assume this topic relates to smoke for military purposes and is outside the scope of this study, but tear gas and similar non-lethal/less lethal gases, smokes and materials might also be included.		
104	**Survivability and hardening**			
104-1	Underground nuclear weapons effects testing	This relates to weapons testing and is outside the scope of this study, but techniques for measuring effects on buildings might also be useful for earthquake damage prevention.		
104-2	Blast and shock effects	Protection of humans against blast and shock involves many materials. How they are used in structures is also important, i.e. design of the structure and use of the optimum material in the best way. Materials such as Kevlar, Nomex, Dyneema and other ballistic fibres are important for protection against blast, splinters, knives and bullets. Ceramics for body armour are used by both military and civil organisations, including police and civilian security forces. Blast curtains in security installations and government buildings, also simple constructive designs as defence perimeters, blast wave deflection elements can mitigate human injury and contruction damage in extreme events.	Police, security guards, prison officers, bodyguards, makers of armoured vehicles for VIP transport or transport of valuable items includng currency	Kevlar (http://www2.dupont.com/), Dyneema (dyneema), Scanfiber (http://www.scanfiber.dk/), Twaron (http://www.teijinaramid.com/), etc

104-3	Structures vulnerability prediction after explosures and structural solutions	Safety of high risk infrastructure (bridges, etc). It is unclear what technology is meant, but could be software to (re)calculate strength and load-bearing capacity. For "re-using" existing buildings for new use (such as government administrative use, military site, embassy) retrofit strategies are needed but only if the real security level without protecction is not sufficient. New evaluation methodologies are needed to adapt existing constructive designs to modern requirements.	Civil authorities, building engineers, road and rail transport authorities	LS-DYNA (http://www.lstc.com/products/ls-dyna), SolidWorks (http://www.solidengineer.se/) are common programmes
104-4	Thermal radiation effects	Unclear what is meant, but this could be related to thermal loading of structures in the event of fire, which would affect the load bearing capacity of the structure	Civil authorities, building engineers, designers of factories using inflammable or other potentially dangerous materials	Same as E55 + eg COMSOL multiphysics (http://www.comsol.com/)
104-5	Transient radiation effects in electronics (TREE) and Systems-generated electromagnetic pulse (SGEMP) effects	This relates to deliberate ("jamming") or accidental ("interference") of electronic equipment & systems and is related to electromagnetic compatibility. See 104-11		This is not a technology, it is a competence, the ability to know what to do, how to choose alternative transmission methods
104-6	Nuclear effects on electromagnetic signal propagation	Here we assume this means the effects of detonation of a nuclear weapon in the atmosphere which would be likely to greatly disturb radio and TV transmission. General protection against such effects is likely	Defence agencies and military forces in the first instance, but	This is not a technology, it is a competence, the ability to know what to do, how to choose alternative transmission methods

		impossible, but there are techniques to protect special equipment. Some signals will be more affected than others.	GPS signals would be affected	
104-7	High altitude electromagnetic pulse (HEMP) effects including dispersed EMP (DEMP)	This seems to be exactly the same as 104-6.		
104-8	Source region electromagnetic pulse (SREMP) effects	This is related to the explosion of nuclear weapons at low altitude, and the effects on the target, i.e. this is related to the use of nuclear weapons and therefore outside the scope of ETCETERA, but techniques to protect civilian equipment (eg radio & TV transmission) from such effects is important.		
104-9	Pulsed-power driven nuclear weapons effects simulation sources	This relates to devices driven mechanically, electrically or chemically (explosives) in order to simulate the effect of a nuclear weapon. The technology is extremly complex and only of interest for organisations interested in developing nuclear weapons. It is outside the scope of ETCETERA, but techniques to protect against the effects of such devices is important for civilian security.		
104-10	Hardening against natural environment lighting	We assume this means lightning (high voltage natural electrical discharges in the atmosphere), not lighting. If so see 104-11		

104-11	EMC evaluation and hardening	Safety against malicious ("jamming") and accidental (e.g. natural) interference by electromagnetic signals including EMP attack and how to protect against such damage. This involves both the technology to prevent the damage but much more the competence to know how to design electronic systems to avoid damage or temporary interference. Relevant technologies include: EMC analysers Test Cells & Chambers RF generators Antennas Emissions Reference Source (ERS) Power amplifiers LISNs CDN's Sniffer probes EMI detectors Specialised transducers and antennas	All manufactures of electronic equipment are obliged to make measurements of the electromagnetic signals their products emit. Computers are a typical example, but all electronic equipment is covered by the regulations. Those who should be especially concerned are public authorities responsible for information transmission (TV, radio, internet), private companies with major	See e.g. Laplace (http://www.laplace.co.uk/) for an initial introduction. Suppliers of surge protection equipment (spark gaps, fuses and similar devices

			computer installations and the growing number of companies provideing secure data storage and cloud computing services.	
104-12	Strong fields and MFP hardening	It is unclear what is meant. Strong fields we assume are related to EMP, detonation of nuclear weapons and how to protect against these effects. This is covered in 104-11, see C63. It is not known what MFP refers to - the only reasonable interpretations are "major force program" and "materiel fielding plan" both of which relate to warfare and are outside the scope of ETCETERA		

104-13	Damage reduction techniques	We assume this means damage caused by nuclear weapons. Protection against the explosive and thermal effects of a nuclear explosion are expteme cases of ballistic protection, see therefore ??. Protection against the electromagnetic pulse and induced voltages is obtained by design, by incorporating the (electronic) equipment inside a shielded container (a "Faraday cage") and is covered by 104-11. This may also mean design and production of "hardened" electronic chips, where the chip is designed to resist surges and overvoltages. Here the competence in design is the essential factor, manufacturing the chips is done on the normal way.	See D63. Users are military organisations and satellite manufaturers	See E63. Not all chip manufacturers have the competence to design hardened chips, and the market is small so there is little driving force. Intel is one manufacture of hardened chipsn as is Sandia Labs (http://www.sandia.gov/media/rhp.htm). See also (http://www.satellite-links.co.uk/links/satman.html) for a listing of satellite manufacturers
105	**Energetic materials**			
105-1	Propellants	Here we disregard the use of propellants for military purposes and limit the study to propellants for space launch vehicles. We exclude fuels such as liquid hydrogen and liquid oxygen as these are very common in many other applications and are widely available.	ESA is the main user, smaller private users are becoming more important but are not yet really relevant for European security. We should probably also include propellant containers	EADS (http://cs.astrium.eads.net/) supplies fuel tanks. Hydrazine is a very commonly used fuel with several suppliers (see http://www.jazdchemicals.com/chemyellowpages/leaf/Organic-Compounds/Hydrazine.htm). Thiokol Corp is a supplier of solid rocket propellants to NASA. LMP-103S (a blend of ammonium dinitramide (ADN) with water, methanol and ammonia) is a new environmentally friendly fuel supplied by ECAPS (http://www.sscspace.com/ecaps).

			(tanks) where liquid fuels are stored.	
105-2	Conventional fuels and lubricants	This category is to broad to analyse, although it should be emphasised that Europe is a major importer of oil petroleum products. The question of security of supply for such materials is outside the scope of ETCETERA.		
105-3	Explosives	We exclude the military uses of explosives from this study. Protection against theft, tracking in case of theft and substitution of e.g. ammonium nitrate fertiliser by less dangerous substances are relevant. We include here associated technologies including detonators and fuses. Methods to convert the power/effects of any explosive (even home made explosives) to TNT equivalence to be able to use established methods to calculate effect on structures	Building construction and demolition companies, road building, mining	Detonators (http://www.cdetexplosives.com/); fuses (http://www.safetyfuse.in/). Explosives (http://www.oricaminingservices.com/)

		and humans. Military explosives are well characterised to this conversion, but home-made explosives are uncertain. It would be valuable to create a list of frequently used home-made explosives and their TNT equivalents.		
105-4	Pyrotechnics	We assume this relates to ignitors and exploding bolts for space applications (launch and satellite release)	ESA, Arianespace	TNO (http://www.tno.nl/)
105-5	(Micro-) pyrotechnology	It is unclear what is meant by the topic but we assume this is related to satellite and launch vehicle technology and specifically ignitors. See 105-4	ESA, Arianespace	Arianespace (http://www.arianespace.com/index/index.asp)
106	**Plasma technology**			
		Here we assume the technology is relevant in the context of electromagnetic (radio, TV) signal transmission in the upper atmosphere and is there fore covered in 104-6		
107	**Energy generation storage & distribution**			

107-1	Electrical generators	Reserve power for essential functions	Many users where power interruption would cause disruption, e.g. hospitals, water supplies, food processing, transport networks (railways), information processing and storage (server halls)	A selection is given at (http://www.directindustry.com/industrial-manufacturer/emergency-generator-set-76804.html)
107-2	Electrical batteries	Reserve power for essential functions		A selection is given at (http://www.critical-power.com/)
107-3	Electrical fuel cells	Fuel cells are still in their infancy and not used to any large extent, so it is likely they have little or no security implications today. However in the future they may be used for emergency generation, as generators for base stations, etc.		A selection is given at (http://energy.sourceguides.com/businesses/byP/fcsys/byB/mfg/mfg.shtml)
107-4	Solar cells	Solar cells are still in their infancy and not used to any large extent, so it is likely they have little or no security implivations today. However in the future they may be used for emergency generation, as generators for base stations, or as power supplies for sensors or other applications in remote areas (away from the electrical grid)	Any users needing power in remote locations, eg for monitoring weather, water, etc	A selection is given at (http://www.globalsources.com/gsol/I/Solar-cell-manufacturers/b/2000000003844/3000000192889/12517.htm?gclid=CLS6iY3_8LACFc0vmAodkRrBvw) Note that a majority of solar cell manufacturers are found in China.

107-5	RF power sources and devices	Used for communications (military and civilian), used for jamming devices eg to defeat IEDs	Security services, polics	See eg LF Enterprises (http://www.lcfamps.com/applications/defense-national-security/)
107-6	Acoustic power sources and devices	High intensity noise as non-lethal weapon, crowd control. Here we include other techniques for non-lethal/less lethan weapons intended for crown control	Security services, polics	See (https://www.ncjrs.gov/pdffiles1/nij/205293.pdf) for a useful review, also tasers (http://www.globalsources.com/manufacturers/Taser.html)
107-8	Inertial / gravitational devices (flywheels, …)	Difficult to see any security application, these devices are still very low TRL but there may be important emerging technologies		
107-9	Other Energy storage & conditioning	This topic is related to emergency power supplies and is covered in 107-1, 017-2. 107-3		
107-10	Energy distribution	Electricity distribution, large transformer stations, high voltage switches	National electricity supply companies	Eg Siemens, ABB
108	**Photonic/Optical Materials and Device Technology**			
108-1	Optical surfaces	Direct security applications are in eg holograms used to defect copying/counterfeiting.	Holograms are used in a wide variety of ways to defeat counterfeinting, on banknotes, credit cards, passoprts, etc	See eg (http://www.scanseals.dk/produkter/forsegling.html?gclid=CJe8u-CE8bACFQowmAodl1Gpuw) but there are many others
108-2	Passive materials	Difficult to understand what is meant by passive materials		

108-3	Active and adaptive optical systems (material, sensors, actuators,…).	Adaptive optics are used eg in astronomy, to correct for atmospheric disturbance and for correcting defects in other optical systems. Optical devices are increasingly being used in security devices, eg retina scanners	Border control could be a future use	See eg Silas (http://www.cilas.com/adaptative-mirrors.htm)
108-4	Optical busses	For optical communications		
108-5	Sights	Sighting devices are normally used with weapons systems (outside the scope of ETCETERA) but could also be used for aligning optical comunication links	Communications companies, communications infrastructure	
108-6	Optical fibre material technology	Communications	Many, eg telecommunications companies	Many, see eg Gould(http://www.gouldfo.com/gfo/main.aspx), For plastic optical fibres see (http://www.powersourcing.com/Europe/plastic-optical-fiber.htm) for glass see (http://www.powersourcing.com/Europe/optical-fiber.htm)
109	**Opto-electronics: Laser, optics and related devices**			
109-1	Lasers based power systems (lasers, optics, fibres, amplifiers, collimating, ...)	We exclude lasers as weapons and see the main uses for lasers in communications and as sensors. See 108-3		
109-2	High density conventional systems	We assume this means high power lasers which are used for indusrtrial applications (cutting, welding) and as weapons. No direct security applications		
109-3	Pulsed and high power systems	We assume this means high power lasers which are used for industrial applications (cutting, welding) and as weapons. No direct security applications. However, QC (quantum cascade) lasers are suggested as		See eg Pranalytica (power supplies for QC lasers) (http://www.pranalytica.com/1101-46-HP.html)

		sources for Thz radiation, which is likely to be useful for scanning persons for weapons and dangerous substances		
109-5	Short pulses laser propagation	Used for self-collimating laser beams, only useful for weapons and outside ETCETERA scope		
109-6	Flame spectometry technologies	Used for chemical analysis, perhaps of dangerous substances		
109-7	Laser induced fluorescence	Remote detection of biological agents (currently low TRL), more likely for general environmental monitoring but could become more important in say 10 years	Security agencies, environmental agencies	These are not really commercial systems yet, but see eg Arctic photonics (http://www.arcticphotonics.com/)
109-8	Quantum Cascade Lasers	THz generation for hidden weapons and explosives detection	Security agencies, environmental agencies	Not yet available for weaons detection, but see (http://www.globalspec.com/industrial-directory/quantum_cascade_laser) for a listing oc QC laser suppliers for medical and chemical uses
109-9	Blooming simulation for components and optronic subsystems	Blooming is usually a surface coating applied to optical components (lenses, mirors) to reduce reflection and improve transmission, also know as anti-reflection coatings. The coating itself has no security implications, but the optical components may have. See therefore 108-1 and 108-3		See (http://www.thomasnet.com/products/optical-coatings-15821200-1.html) for a listing of coating suppliers
110	**Sensor Technology and Components**			
110-1	Neutronic detection technologies (neutron tubes, ...)	Unclear what is meant, but detection of nuclear materials is relevant for security		

110-2	X-ray technologies	Detection of weaons and dangerous devices (bombs) in bags, suitcases, packages	Border security, airport security	See eg (http://www.airport-suppliers.com/supplier/Detection_Technology_Inc/) for components of X-ray scanners and Smiths (http://www.smithsdetection.com/?no_cache=1&L=4&e=1) for a complete range of detection technologies including x-ray scanners
110-3	Gamma technologies	Gamma radiation is emitted by radioactive materials (eg cobalt 60, an industrial source which might be abused for terrorist purposes). Gamma radiation might also be used for inspecting integrity of high density structures	Border security, airport security	See eg Dynasil (http://dynasilproducts.com/category/radiation-detection/radcam/)
110-4	Ion Mobility Spectrometry technologies	Explosives and drugs detection	Border security, airport security	See (http://www.zhdanov.ru/classified-catalogue/manufacturers-and-suppliers/ion-mobility-spectrometers-vapor-detection-systems-ie.htm) for a listing of several suppliers
110-5	IR Spectroscopy	Used for explosives detection	Border security, airport security	Smiths Detection and Bruker Daltonics are the two leading vendors in this market, although General Dynamics, Edo, and Thermo Electron are also significant competitors.
110-6	UV/Visible wave sensor technologies	Emerging technology potentially useful for explosives detection	Border security, airport security, police	
110-7	UV VIS Spectroscopy	See 110-6, potentially useful for detection of missile exhaust plumes		

110-8	Terahertz technologies	Emerging technology potentially useful for detection of hidden weapons, explosives, biological agents	See TeraView, UK	See Teraview (http://www.teraview.com/)
110-9	Terahertz Spectroscopy	Emerging technology potentially useful for detection of hidden weapons, explosives, biological agents	See TeraView, UK	See Teraview (http://www.teraview.com/)
110-10	RF sensor technologies	The most common security application is in RFID tags used in a larrge number of products including eg passports	Secure documents, eg passports and their issuers which varies from country to country. Normally a government authority	See (https://www.securitytagstore.com/cats.aspx?catid=1001) for a range of suppliers
110-11	Micro- and Millimeter Wave sensor technologies	Used frequently for perimeter security, a type of radar	Security installations, authorities	See eg (http://www.southwestmicrowave.com/products/)
110-12	Hyperspectral technologies	Today emerging in the military field for detection and identification, useful for detection of fats, contaminants in food	Security agencies	There seem to be 2-3 European suppliers, see eg (http://www.kayser-threde.de/)
110-13	Multispectral technologies	Similar to hyperspectral (110-13), used for imaging, eg of fingerprints	Security agencies, police, border control	See eg FluxData (http://www.fluxdata.com/)
110-14	Acoustic sensor technologies	Acoustic sensors (microphones) are widespread. For security applications devices specifically designed for eg perimeter security and directional microphones may be considreed useful	Perimeter security, border control	See eg Vanguard (http://www.vandgard.co.uk/)

110-15	Nanotechnologies for sensors	Likely to be many applications including sensitive and selective chemical sensors, biosensors, acoustic sensors, electromagnetic sensors and mechanical sensors. However the field is extremely broad. An important point is that the TRL of these sensors is still low, about 2-3 in most cases and there are few manufaturers or users		
110-16	NaI detectors	Detection of radiation sources (eg illegal nuclear materials) using sodium iodide (NaI) scintillation detector	Police and border control, security agencies	See eg EOD Partner (http://eodpartner.de/)
110-17	BGO detectors	Detection of radiation sources (eg transport of illegal nuclear materials) using BGO (bismuth germanate) scintillation detector. BGO may be used instead of NaI	Police and border control, security agencies	See Ortec (http://www.ortec-online.com/Solutions/RadiationDetectors/semiconductor-photon-detectors.aspx)
110-18	CdZnTe detectors	Detection of radiation sources (illegal nuclear materials)	Police and border control, security agencies	See eg Redlen (http://www.redlen.com/)
110-19	Techniques for discrete surveillance	Use against organised crime, this topic includes all of the above (acoustic sensors, optical inc. IR senors, microwave sensors, etc.). It is the method of use which defines if the technology is suitable for discrete surveillance, not the technology itself. That is simply a design question.	Police and border control, security agencies	Too many to list

110-20	Sensor related imaging and mapping techniques	We assume this means imaging sensors such as optical, IR sensors, where the information from the sensor is converted into a picture. This is normally done within the sensor system. One might consider multisensor data fusion to be relavant here, but this is still very much a research field and there are no commercial products. This might be an emerging technology in a few years.		
110-21	Microelectromechanical Systems (MEMS)	There are many actual and potential applications including various sensors, perimeter security, imaging/displays, platforms (eg micro-UAVs), etc. These are already contained (mainly) in section 110 of the taxonomy. For a useful overview of the applications see (http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA430286)		
111	**Electronic components**			
111-1	Silicon-based materials	All forms of microelectronic circuits used in security devices, also MEMS, but the topic is too broad to analyse as a whole. The individual topics are covered partially in section 110 (many sensors are build using silicon chips) and partially under section 112		
111-2	III-V Compounds	This is a commonly used term to include a family of semiconductors created from aluminum, gallium, and indium (group III elements) with phosphorus, arsenic, and antimony (group V elements). Common componds are GaP, GaN, AlGaAs, etc.	For LEDs, displays,	Here the element itself may be a critical material, eg Indium is not widely available. The other elements should be checked for critical dependence. There are amany suppliers of these elements, typivally from chemical companys such as Sigma-Aldrich or Goodfellows.

111-3	Other Semiconducting Matrials (AsGa, GaN, ...)	GaN is used in high power microwave devices (mainly for military radar) and LEDs, although technology is still emerging. ZnS lenses may be useful in the future for combined visible and IR cameras		See eg Janostech (for ZnS) (http://www.janostech.com/) and Sumitomo Electrical Industries for GaN
111-4	Insulating & Dielectric Materials	This is too broad to be analysed, there are thousands of different insulators and dielectrics. We assume the materials are to be used in some form of device/chip or system and it is is those topics the security uses may be identified. We assume insulators such as the special oils used in transformers might be considered relevant, and this will appear under another topic, likewise special dielectrics for chip insulation.		
111-5	Carbon-based Materials	The security connection to carbon seems limited. We can think of only two applications, using carbon (graphite) in microwave absorbers (for military applications) and activated charcoal as absorbent in chemical protection. suits and breathing filters. Here the security aspect is covered by the application, not the material		
111-6	Superconductiong Materials	In the context of security supersonducting materials might be used in very sensitive magnetic sensors (SQUIDS, superconducting quantum intereference device)		So far there seem to be no manufactures of SQUID devices for security, this is still very much in the basic research stage. See eg (http://sevenhorizons.pbworks.com/w/page /21517669/Heterostructural%20Uncooled% 20Magnetic%20Sensors%20(HUMS))

111-7	Magnetic Materials	See 100-12		
111-8	Device Concepts and Fabrication	Fabrication facilities (factories) for producing semiconductor chips are mainly located outside of Europé.		
111-11	COTs assessment and obsolesence management	Security systems will be in place for many years. Cf. military situation. How will the issue of maintaining systems and equipment over many years be resolved, when the original models and components are no longer manufactured and even the original manufacturer may no longer exist?		
112	**Signal processing technologies**			
112-1	Analog Signal Processing Technology	Image processing		
112-2	Digital signal processing technology	Image processing		
112-3	Analog/digital conversion technologies	Image processing		
112-4	High precision time measurement	Essential in many areas, finance, navigation, used in satellites for GPS (atomic clocks)	Galileo, IRNSS, Compass satellite systems	See Orolia (http://www.orolia.com/us_navigation_industry.php)
113	**Information technologies**			
113-1	Image / pattern processing technology	Biometrics	Any agency to establish identity	Eg SEENE-X (http://www.seenex.com/products/biometric.html)
113-2	Pattern recognition	Biometrics	Any agency to establish identity	See eg Accenture (http://www.accenture.com/us-en/pages/service-technology-biometrics-high-performance.aspx)
113-3	Data collection, data classification	Not really a technology, but data collation and classification is essential in many security systems for eg anomaly detection		

		and identification, passport and ID control.		
113-4	Data and Information fusion technologies	Many sensor systems but also emerging is data fusion combining eg physical data from a sensor system with contextual data from eg datamining on the www		
113-5	Speech processing technology	As a method of identification, perhaps where the person is not known or may be far from the listener	Police	Eg SEENE-X (http://www.seenex.com/products/biometric.html)
113-6	Natural language processing technology	As a method of identification, perhaps where the person is not known or may be far from the listener		
113-7	Data and information management technology (DB, …)	Protection of information e.g. cloud computing		
113-8	Data analysis	Data mining for security threats		
113-9	Contextual search techniques	Data mining for security threats		
113-10	Jamming and anti-jamming technologies	Protect against IEDs during VIP transport, protection of sensitive infrastructures	Security agencies	See eg SESP (http://www.sesp.com/)
113-11	Web intelligence	See 113-9		
113-12	Text-mining / data-mining	See 113-9		
113-13	Time synchronization	See 112-4		
114	**Artificial Intelligence & Decision support**			
114-2	Neural network techniques	Data mining for security threats		
114-3	Mathematical modelling development	Too broad to analyse, but eg cryptography applications may exist		
114-4	Optimisation and decision support technology	Crisis management		
114-5	Modelling and simulation	Crisis management		

114-6	Operational Analysis tools and techniques	Crisis management		
115	**Simulation tools and technologies**			
115-1	Virtual and augmented reality	Command training for crisis		
116	**Computing Technologies**			
		Comment, computing is a generic technology with many uses in security systems		
116-1	Software engineering	Advanced simulation techniques that take into account the existing interations between threat, critical infrastructure and human response, effective identification of vulnerabilities as well as optimization for a desired security level would be valuable, taking into account a range of risk situations. Advanced tools typically include: explicit dynamics, SDOF, PÎ-curve, Q-D chart, etc	Engineering consultants, safety engineers	
116-2	Protocol technology	Based on advance simulation techniques that take into account the existing interation among threat, critical infrastructure and human response, effective emergency protocols can be developed taking into account a range of risk situations.	Critical infrastructure owner/operator, engineering consultants	
116-3	COTS software assessment	The security aspect is unclear but could eg be detection of malicious software		
116-5	High integrity and safety critical computing	Safety critical systems, power and water distribution,		

116-6	Secure computing techniques	Financial transactions		
116-7	Software verification and accreditation techniques	Secure communication		
117	**Information Security Technologies**			
117-3	Cryptography algorithms (including quantum cryptography)	Secure communication		See eg (http://www.cryptographyworld.com/supply.htm) for a list of suppliers of algorithms
117-4	Cryptography implementation (including quantum cryptography)	Secure communication		See eg (http://www.cryptographyworld.com/supply.htm) for a list of suppliers of algorithms
117-5	Cyber attack technologies	Protection against cyber attack		
117-6	Key management	Secure communication		
117-7	Intention detection	Secure communication		
117-8	Intrusion detection technologies	Secure communication		
117-10	Integrity protection	Secure communication		
117-11	Intrusion prevention technologies	Secure communication		
117-12	IT Authentication technologies	Secure communication		
117-13	OS hardening	Secure communication		
117-14	Hardware protection technologies (tamper-evidence or tamper-protection)	Secure communication		
117-16	Retro engineering protection	To prevent reverse engineering of (normally) a chip design. This is more a case of protecting intellectual property than security, unless we consider the case of a secure computing device.		
117-18	Secured communication protocols	Secure communication		

117-19	Source code Static Analysis (Source code vulnerability analysis)	Secure communication		
117-20	Virtual Private Networks (VPN) technologies	Secure communication		
118	**Communication technologies**			
118-2	Micro- and millimeter wave	Secure communication		
118-3	Ultrawide band	Secure communication		
118-4	IR / Visible / UV laser	Secure communication		
118-7	Optical fibre	Protection of vital infrastructure (perimeter protection)		
118-8	Cable technoligies	Optical and electrical cables for information transfer		
119	**Physiology Science & Medical technologies**			
119-1	Medical products and materials	E.g access to vaccines in case of pandemi, or rare radioactive isotopes used for specialised medical treatment		There are a number of vaccine suppliers, see (http://www.themedica.com/drug/vaccine/) for a listing
119-3	Human survivability, protection and stress effects	In case of crisis		
119-6	Genome Engineering	In case of "designer" infections and diseases		
119-7	Biomedical technologies	A wide topic, but relevant for protection against disease		
119-8	Rapid diagnosis of infectious disease	Crisis management		
119-9	Telemedicine (diagnosis and surgery)	For distributed medical care if society is severly disrupted, but the technology is in its infancy and has only been demonstreated recently. An emerging technology		

119-10	Novel antiviral, antibiotics, vaccines, and drug development	In case of new infection diseases		See E213 and the many pharmaceutical suppliers sich as Farmacia, Astra-Zeneca, etc
119-11	C & B knowledge and related data bases	In case of terror attack or release of toxic industrial chemicals		There are specialised laboratories working with this topic, eg FOI (www.foi.se) and the Belgium lab (http://www.mil.be/ops-trg/doc/viewdoc.asp)
120	**Human sciences, including research and studies**			
120-1	Security / Military human resources management technologies	Crisis management		
120-2	Human performance enhancement in crisis situations	Crisis management		
120-6	Behavioural analyses	Crisis management		
120-8	Psychology of workplaces and in emergency situations	Crisis management		
120-10	Social analyses of teams and groups	Crisis management		
120-13	Crisis Communication	Crisis management		
120-14	Human behaviour models	Crisis management and human behaviour models could be used for: · preventing or mitigating a crisis situation by means ofmodels to evaluate/optmize the safety and security level of any critical infrastructure according to potential or implemented protective measures.	Regulatory organizations, critical infrastructure owners/operat ors	
120-25	Human factors in computers	Design of secure data		

	security	systems		
408B-4	Special Studies about the automation of human tasks in security related environment	Anomaly detection		
121	**Biotechnology**			
121-1	Biological technologies	Various techniques (eg fermenting) can be misused to produce harmful agents		
121-5	Rapid analysis of biological agents and of human susceptibility to diseases and toxicants	Terror attack using bio-agents		
121-6	Agro/food-biotechnologies	For food supply/quality assurance		
121-7	Contamination and poisoning of agriculture (water sources, rivers, soil, air, …)	Environmental pollution		
121-8	Crop and animal viruses	For security of food supplies		
121-9	Food testing and control techniques	Security of food and water		
121-10	Water testing and purification techniques	Security of food and water	Water supply companies	See (http://www.thomasnet.com/products/water-purification-equipment-ultraviolet-uv-92862002-1.html) for a listing of water purification equipment manufacturers
121-11	Decontamination techniques	Security of food and water	Security agencies, public health agencies	See NIJ (https://www.ncjrs.gov/pdffiles1/nij/189725a.pdf) for a list of equipment suppliers
II. EQUIPMENT & SUB-SYSTEMS				
200	**Sensor Equipments**			
200-2	Cameras	Detection and surveillance		

200-3	Electrical and electro-chemical sensors	Detection of explosives etc.		
200-4	Explosive detection sensors	Detection of explosives		
200-10	Chemical and illicit substances detection	Detection of harmful material		
200-11	Biological substances detectors	Detection of harmful material		
200-12	Radiological and nuclear detectors	Detection of harmful material		
200-21	Motion sensor systems	Automated surveillance		
200-23	Terahertz sensors	Detection of weapons		
203	**Biometric equipment**			
203-1	Facial recognition	Use against organised crime		
203-2	Fingerprints recognition (digital fingerprints)	For border security and against identification theft		
203-4	Iris recognition	Border security		
203-6	Retinal patterns recognition	Border security		
203-7	DNA analysis	Use against organised crime		
204	**Chemical, Biological, Radiological and Nuclear (CBRN) protection and decontamination equipment**			
204-1	Chemical agent defence, precursors and related materials	Is it possible to protect civil society against chemical attacks?		
204-2	Biological agent defence, precursors and related materials	Is it possible to protect civil society against biological attacks?		
204-6	CB Countermeasures - Medical	Crisis management		
204-8	Infrastructure and goods decontamination	Crisis management		
208	**Non lethal weapons**			
208-1	Mechanical/kinetic anti-personnel	Crowd control		

208-3	Electromagnetic anti-personnel	Crowd control		
208-5	Acoustical anti-personnel	Crowd control		
210	**Explosives removal**			
210-2	Explosives detection equipment	Explosives detection		
212	**Forensic technologies, others**			
212-1	Drugs analysis	Forensics and crime prevention		
212-2	Fire arms and projectiles identification	Against organised crime		
212-3	Explosion investigations	Forensics and crime prevention		
212-4	Ballistics	Against organised crime		
IIIA.	**SYSTEMS-SERVICES FUNCTIONS**			
300A	**Risks assessment, modelling and impact reduction**	Crisis management		
301A	**Risks and vulnerabilities assessment**	Protection of vital infrastructure		
303A-3	Population protection	Crisis management		
303A-5	Training and exercises	Crisis management		
304A	**Exercise and simulation, training**	Crisis management		
306A-2	Positioning and localization	Crisis management		
308A	**Surveillance**			
308A-1	Environmental monitoring systems	Crisis management		
311A	**Interoperable secured communications (Security systems architecture)**			
311A1	Command and Control	Should be well established and protected		
312A	**Crisis Operations / Management - C3I**	**Should be well established and protected**		

312A-1	Population warning systems	Should be well established and protected		
313A	**Search and Rescue and evacuation**	Crisis management		
314A	**Decontamination and de-pollution**	Crisis management (e.g. xiodine tablets)		
316A	**Psychological and Social aspects**	Civil acceptance of security measures and protection of civil rights		
IV.	**INTEGRATED SYSTEMS PLATFORMS AND SYSTEMS AND HUMAN FACTORS**			
401	**Space platforms**			
401-1	Communication satellites	Vital for communication		
402	**Ground platforms**			
402-1	Ambulances	Crisis management		
402-2	Fire engines	Crisis management		
402-5	C2 and surveillance-vehicles	Crisis management		
403	**Air platforms**			
403-5	Transport helicopters	Crisis management		
407	**Identity management systems**			
407-1	biometrics solutions	Border security		
407-3	secure database management	Information security		
411	**C2, Information and intelligence systems**			
411-2	Communication Command Control Information systems	Crisis management		
411-4	Information exchanges and interoperable databases	Crisis management		
411-5	Optimisation, Planning & Decision Support systems	Crisis management		

411-6	Infrastructure to Support Information Management & Dissemination	Crisis management		
412	**Networks and information security systems**			
412-1	Cyber security policy management tools	Protect vital infrastructure		
412-3	Cyber protection systems and architectures	Protect vital infrastructure		
412-4	Network security and data integrity between distributed sensors	Protect vital infrastructure		
413	**Communication Systems**			
413-1	Rapidly Deployable Communication Infrastructure	Crisis management		
413-2	Mobile Communications Infrastructure	Crisis management		
413-3	Rescue Services Mobile Communication Systems	Crisis management		
415	**Equipped Personnel**			
415-2	Equipped fire fighter	Crisis management		
415-3	Equipped medics	Crisis management		
VB.	**POLICY & SUPPORT**			
500-4	Scenario generation	Crisis management		
504B	Scenario and decision simulation	Crisis management		
504B-2	Simulation for decision making (real time simulation)	Crisis management		