EDA Technology Taxonomy

Overview

(Some Technology Taxonomy Numbers are not in use.)

(Some Technology Taxonomy Numbers are not in use.)

Details

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A01 Structural & Smart Materials & Structural Mechanics

A01.01 - Metals & Metal Matrix Composite Technology

Research to determine the properties and characteristics of Metallic alloys (all types including Intermetallics), Metal matrix composites (all types of MMCs), and materials used as Fibre and Particulate reinforcements in MMCs. Microstructural analysis of all types of samples, as-prepared, heat treated or fractured. Research leading to improved processes for making novel Metallic alloys or MMCs and new processes for shaping metallic materials, such as casting, powder, vapour deposition, forging, superplastic forming, etc., for applications in all service environments. Includes research to develop material modelling to improve alloy design and understand alloy behaviour.

A01.02 - Ceramics, Ceramic Matrix Composite and Glass Technologies

Research to determine the properties and characteristics of structural ceramic materials, including ceramic matrix composites (CMCs), and glass ceramics, fibre and particulate reinforcements, microstructural analysis, etc. Research leading to improved processes for making and shaping new structural ceramic materials, etc., for applications in armour and aeroengine systems. Also includes application of ceramic technologies for high performance device packaging. . Includes research to develop material modelling to improve ceramic material design and understand the behaviour of ceramic materials.

A01.03 - Polymers and Polymer Matrix Composite Technologies

Research to determine the properties and characteristics of organic materials for structural purposes, including, polymers and polymer matrix composites (PMCs), thermosetts, thermoplastics, elastomers, and materials used as reinforcing elements in PMCs such as fibres, particulates and laminates. Also includes work to understand the structural properties of biomimetic composite materials. Research leading to improved processes for making novel fibres or matrices, or for total composite manufacture, and new processes for shaping conventional composite materials, etc. Also includes identifying polymers for binders in LO paints and coatings. Also includes research to improve all sealants based on polymeric materials. Includes research to develop material modelling to improve design of materials based on polymers, including polymer composites, and understanding of the behaviour of such materials, particularly mechanical properties.

A01.04 - Structural Materials Processing - Joining Technology

Research to determine the properties and characteristics of joints between metallic, or ceramic or polymer-based materials, or between dissimilar combinations of these material types, etc. Research to improve joining/bonding processes used for any of the above cases, such as adhesive, diffusion, welded, interlayer, pre- and post-joining treatments, etc. Also includes the application of cost-effective joints in all service environments.

A01.05 - Structural Materials Processing - Surface Protection Technologies

Research to determine the properties and characteristics of surfaces on structural materials, and which increases understanding of corrosion barriers, thermal barriers, and other protective techniques to increase the lives of structures and components. Research to improve processes to control surface behaviour and increase lives of components and structures in service environments using advanced coating processes such as metal arc and flame spray, plasma spray, vapour deposition, diffusion processes, specialised paint formulations, and other protective coatings.

A01.06 - Non-Destructive Evaluation & Life Extension of Structural Materials

Research to determine the properties and characteristics of defects in structural materials using non-destructive tests and techniques of all types to detect flaws and cracks. Also work to develop inspection procedures through to service applications. Understand the limitations of techniques like ultrasonic, radiography, acoustic emission, optical and eddy current procedures. Research studies to develop techniques to predict service life of structures and individual components under the influence of mechanical, thermal and chemical environments, singly and conjointly, etc. and from theoretical and materials behaviour data including studies to understand internal microstructures and the effects of flaws.

A01.07 - Corrosion and Wear Control Technology

Research to understand and develop new modeling techniques which advance a wide range of defence applications. For example, new approaches to hydrocode and analytical modeling to underpin CE warhead research and attack of future targets. Includes new modeling approaches in/for synthetic environments, human factors, communications networks and related issues. Also includes work to improve the modeling of risk assessment techniques.

A01.08 - Structural Mechanics

Research studies to determine the effects of vibration and fatigue on structures and components, using practical dynamic and static structural analysis methods/techniques or employing finite element analysis and other computerised simulation techniques to understand the response of structures to a variety of conjoint mechanical environment influences. Analysis and evaluations of fracture mechanics, and fracture resistance as applied to airworthiness and other safety issues. Also includes work to exploit life extension technology. Also includes research supporting determinations of static, dynamic and hydrodynamic performance of marine structures, and the structural design of land vehicles, and marine platforms, especially those, which may undergo explosive loadings. Also includes research to aid the assessments of design options for and safety margins of future military satellites. Also includes research in the fields of aeroelasticity, hydroelasticity and structural dynamics and structural acoustics. Also includes supporting work to aid structural integrity studies.

A01.09 - Structural Materials - Forming

Research to understand new forming processes and improve scaled-up industrial processes required to shape all forms of structural materials to near-net shape and size with appropriate microstructures, cost effectively.

A01.10 - Structural Materials - Materials Removal

Research to understand and improve all mechanical and other types of physical techniques employed to remove material accurately and without microstructural damage during the manufacture of close tolerance components used in defence equipment.

A01.11 - Smart/Functional Materials for Structural Uses

Research to understand optical fibres, conducting wires, electro-active polymer films, electro-active ceramics and shape memory alloys as either sensing elements or actuators in "smart/functional" structural materials. Also includes materials aspects of application of embedded silicon micro-sensors for in-service in-situ monitoring of composite structures. Also includes studies on Biomimetic materials which may have structural applications in defence equipment.

A02 Signature Related Materials

A02.01 - Acoustic & Vibration Absorbing Materials

Research to determine the properties and characteristics of materials which can be used to attenuate/dampen the transmission and reflection of sound energy in military equipment, for example, ships, submarines, torpedoes, and other UUVs. Also includes support for applications requiring reduced signature materials. Also includes medical acoustic materials, flesh simulants, and materials for machinery isolation and blast protection, including active (smart) materials for control of vibration and noise. Research into processes which shape such materials and which lead to improved bonding to underlying structures. Includes relevant frequency selective or responsive materials.

A02.02 - IR Signature Control Materials

Research to determine the properties and characteristics of materials which absorb infra-red radiation and which can be used to reduce the IR. signature of military equipment. Also includes tailoring properties like reflectivity and emissivity(all types). Includes supporting the environmental and multispectral requirements for Land vehicle applications for improved IR. absorbing materials. Also includes materials which change properties (e.g. IR reflectivity) for application in stealth coatings. Includes relevant frequency selective or responsive materials.

A02.03 - Radar Absorbing Materials and Coatings

Research to understand materials which serve as electromagnetically active constituents in coatings for use on low radar cross section structures. Also includes such materials for signature reduction applications, including frequency selective or responsive RAM, switchable conductors and tailored dielectrics. Evaluations of RAM, and multispectral materials for use in missile systems, missile detection and platform stealth applications.

A02.04 - Structural Radar Absorbing Materials

Research to understand the radar absorbing characteristics of modified fibre reinforced polymer composites, and associated conducting and absorbing sealants. Also includes non-invasive loss layers and frequency selective or responsive surfaces in material terms. Also includes materials issues when integrating structural RAM into warship designs, and the environmental and mechanical applications of structural RAM in Land vehicle applications.

A02.05 – *Not in use*

A02.06 - *Not in use*

A03 Electronic Materials Technology

A03.01 - Silicon-based Materials

Research to characterise new silicon materials which offer advances in low cost thermal detectors and low power high performance electronic devices. Also work to improve growth and control of epitaxy for Si and SiGe alloys, and improve understanding and growth of porous silicon for quantum and bio-compatible devices. Also research on silicon carbide for use in microwave and high temperature electronic devices.

A03.02 - III-V Compounds

Research to improve the growth and control of III-V compounds such as GaAs, InAs, InSb, GaSb, AlSb, AlN, InP and GaN for use in passive sensing, ECM sub-systems, radar and active imaging.

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A03.03 - Other Semiconducting Materials

Research to improve CMT technology applied to high performance and elevated temperature detectors. Also includes research to characterise II-VI compounds.

A03.04 - Insulating & Dielectric Materials

Research to evaluate applications of I (both electrical & thermal) & Ds to integrated circuits, thermal detectors, to pigments in LO coatings and as IR absorbing materials. Research to improve the growth of ferroelectric materials at low temperatures for applications in room temperature detectors. Also includes understanding application of I&D devices in high power RF systems.

A03.05 - Carbon-based Materials

Research to understand the electronic characteristics of carbon60, carbon suspensions, diamonds and diamond coatings which may benefit defence systems. Research to identify and understand organic semiconductors and optical polymer matrices for electronic and opto-electronic effects.

A03.06 - Superconducting Materials

Research to evaluate thin films for microwave sensing and signal processing. Research to understand wire fabrication technologies for electric power applications. Also includes developing superconducting materials for mine-CM magnetic sweeping and for high power RF systems. Also includes research to develop HTS materials for ESM-Comms, and ESM-non Comms.systems.

A03.07 - Magnetic Materials

Research to understand magnetic behaviour of thin film magnetic materials for use in sensors and in signature reducing applications. Also includes "smart" magnetic materials which may find application in HF acoustic transducers used for MCM sonars.

A04 Photonic/Optical Materials & Device Technology

A04.01 - Optical Materials & Devices

Research to evaluate and analyse optical components, splitters and couplers. Also includes work on optical materials for wideband RF fibre optic links and fibre optics for communications, in particular with UUVs, underwater weapons, anti-tank missiles, hydrophone arrays and in data transmission systems. Also includes research to understand design and fabrication of optics for use in demanding defence applications, and materials for both lenses and their coatings.

A04.02 - IR/Visible/UV Detector Materials & Devices

Research to evaluate and analyse high performance photon thermal detectors. Also includes optical devices for high speed detection, optical switching, and infrared detection on SiGe, ferroelectrics and InSb arrays. Also includes optical techniques applied to torpedo detection and fuzing.

A04.03 - Non-Linear Optical Materials & Devices

Research to understand optical materials capable of fast switching, or for tuneable filters, optical limiters and those showing non-linearities in liquid crystals, polymers and polar organic materials. Also includes evaluations of NLOs for personnel protection systems. Also includes studies of non-linear optical characteristics and susceptibility, harmonic generations, and devices for applications in waveguides and tuneable lasers.

A04.04 - Display Materials & Devices

Research to understand nanophase polydisperse tuneable filters and other novel liquid crystal materials offering benefits for future military display applications.

A04.05 - Lasers -all types

Research to understand FIR, VNIR, mid-IR, dye and frequency diverse sources. Also includes processes to produce solid state mid-IR material structures in a range of III-V compounds, and understanding of the fabrication of laser structures.

A04.06 - Non-Laser Devices

Research to understand certain specific structures in III-V materials and in porous silicon for light emitting diodes, and structures in other types of LEDs.

A04.07 - Transparent Materials

Research to understand diamond windows and coatings, and other materials which are transparent to electromagnetic radiation. Also includes studies of the characteristics of materials which serve the above purpose and which are also capable of sustaining mechanical and/or thermal loads, in applications like aircraft canopies, missile radomes, and sonar domes. Also includes relevant frequency selective or responsive surfaces.

A05 Electronic, Electrical & Electromechanical Device Technology

A05.01 - Device Concepts and Fabrication

Research to evaluate and analyse technologies for application in novel IR and EO devices like displays. Also includes process technologies required to fabricate advanced devices, and characterisation of device structures, including nanotechnology developments. Also includes studies of micro-structured and deformable surfaces to control the scattering direction of incident radiation for stealth purposes. Also includes devices for applications in high power RF systems. Also includes MEMS fabrication technology and device developments which give rise to novel luminescence effects.

A05.02 - Device Packaging

Research to understand application to ASICs and MMICs at the prototype stage, and also when applied to multichip modules. Also includes novel packaging requirements for bio-compatible Si and micro-sensors, and the requirements for device packaging in high power RF systems. Work to improve ruggedization of devices is also included.

A05.03 - Device Integration/Reliability

Research to evaluate and analyse defects in electronic components, device obsolescence tracking processes, specifications, and tests for reliability, quality and fitness for purpose. Also includes integration of discrete devices in silicon based materials and in other types of semi-conductors. Also includes work to understand the requirements for devices in applications like high power RF systems and ASIC devices handling large amounts of sonar data.

A05.04 - Electrical Batteries

Research to understand ship battery systems technologies, high energy density batteries, advanced power sources, thermal batteries, rechargeable batteries for portable equipment and aqueous rechargeable batteries. Also includes evaluation and analysis of power source integration using microsensors for autonomous operation to monitor all issues relating to battery performance.

A05.05 - Electrical Fuel Cells

Research to understand fuel reforming, fuel storage (hydrogen) and system integration issues, particularly in relation to marine propulsion, integrated full electric propulsion applications and for high power pulsed systems. Also includes fuel cell technology for man-portable systems.

A05.06 - Solar Cells

Research to understand organic solar cells for affordable, lightweight, flexible integrated power supplies, and to underpin capability to evaluate and analyse solar cells for satellite applications. Also includes research into photovoltaic cells for defence applications.

A05.07 - RF Power Sources & Devices

Research to give ability to evaluate and analyse solid state power devices e.g. amplifiers and circuits (RF, microwave and millimetre wave) for application in radar, communication and ECM systems.

A05.08 - Acoustic Power Sources & Devices

Research to understand miniaturization of acoustic power sources and high power, wide bandwidth, compact acoustic sources for application in active sonar systems operating in either air or water.

A05.09 - Other Electrical Power Sources & Devices

Research to understand developments of innovative electrical generating and power converting devices, for example, flywheel sustained systems, for incorporation into a variety of mobile defence equipment requiring standalone energy sources.

A05.10 - Electric Motors

Research to understand and evaluate technology for electric motors required in a wide range of demanding military applications.

A05.11 - Inertial/Gravitational Devices

Research to understand and develop inertial and gravitational devices, particularly detectors, for use in a variety of military applications such as guidance systems.

A06 Energetic Materials and Plasma Technology

A06.01 - Propellants

Research to understand, evaluate and analyse propellant materials for weapons systems applications and for compliance with OB and CINO policy on handling and use of propellant materials. Also includes use of predictive modelling in the characterisation of new propellants. Also includes research leading to improved fuels for ramjets. Also includes technologies applicable to environmentally-friendly disposal procedures at end of service life.

A06.02 - Conventional Fuels

Research to aid the evaluation and analysis of fuels used in all defence equipment, for compliance with OB and CINO policy. Also includes work to understand problems relating to fuel faults and failures, and hazard management processes. Research to improve capability to specify, conduct approval and quality assessments, and evaluate products and equipment during working life.

A06.03 - Explosives

Research to aid the evaluation and analysis of explosive materials used in weapons systems and armour applications, and for compliance with OB and CINO policy on the handling and use of energetic materials for defence purposes. Also includes research to improve understanding of detonics and use of predictive modelling. Also includes modelling of blast

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A06.04 - Pyrotechnics

Research to understand application of pyrotechnics in weapons systems, countermeasures, underwater mine disposal, and for compliance with OB and CINO policy for handling and use of pyrotechnic materials. Also includes behavioural studies of materials used for initiators and as obscurants, and the use of predictive modelling of pyrotechnics. Also includes research to address disposal issues relevant to pyrotechnics at end of their service life.

A06.05 - Plasma Techniques

Research to understand plasmas which have potential defence uses, such as in ETC gun systems. Also includes research to understand intense light propagation, absorption and scattering effects in plasmas, and interactions of plasmas with all forms of matter.

A06.06 - Explosives Detection Techniques

Includes research using active optical sensing and surface enhanced Raman effects for chemical detection purposes. Also includes research to maintain a capability applied to both bulk and trace detection techniques for explosives. Also includes work on bio-engineered organisms for use in explosive detection systems and related degradation determination activities.

A07 Chemical, Biological & Medical Materials

A07.01 - Chemical Agent Defence, Precursors & Related Materials

Research to aid the ability to identify, analyse and evaluate chemical materials which might be used as a threat against the EU. Also includes research to understand toxicity, producibility and properties of chemicals, and analyses of how such agents might be used, and to maintain the ability to predict the consequences of their use. Research to maintain expertise to specify detection, protection and medical countermeasures. Also includes work to understand pathology and handling of supertoxic chemicals.

A07.02 - Biological Agent Defence, Precursors & Related Materials

Research to aid the ability to identify, analyse and evaluate biological materials which might be used as a threat against the EU. Also includes research to understand toxicity, producibility and properties of biological materials, and analyses of how such agents might be used, and to maintain the ability to predict the consequences of their use. Research to maintain expertise to specify detection, protection and medical countermeasures. Also includes work to understand in vitro, pathology and handling of highly infectious pathogens.

A07.03 - Mid-Spectrum Agent Defence

Research to aid the ability to identify, analyse and evaluate those materials that are produced from biological sources which have severe toxic effects on personnel, and may be used as threat against the EU Also research to maintain the capability to predict the probable consequence of their use in the military environment. Also research to maintain expertise to specify detection of MSA, protection from MSA and appropriate medical countermeasures.

A07.04 - Chemical & Biological Detection Techniques

Research to maintain expertise in CB agent materials and toxic chemicals detection techniques, particularly monitoring levels of hazard, identifying the agent and establishing the exposure period retrospectively. Also includes research into the physics of aerosol collection and characterisation, and application of MS and IMS techniques to the analysis process. Also research to support capabilities in genetic engineering and amplification, antibody/antigen interactions, gene probes and biosensor transduction. Also includes work using novel silicon sensor devices, such as bio-compatible porous silicon sensors, and the use of optical sensing and surface enhanced Raman effects.

A07.05 - Chemical Research for non-CBD Applications

Research to understand toxicology and safety issues relating to non-CB chemicals used in a wide range of defence equipment. Also includes work on the behaviour of fire protection coatings and maintaining abilities to specify fire resistant materials employed in ships, aircraft and AFVs. Also includes research to aid the analysis and evaluation of new materials to be used as alternatives to halons and other materials prohibited by the Montreal Protocol. Includes research into monitoring techniques for submarine atmospheres, and research into advanced chemical analysis techniques applicable to defence-related materials.

A07.06 - Medical Products and Materials

Research to evaluate and analyse blood products and other important medical materials, including biomimetics for medical purposes. Also includes work on vaccines and other disease controlling substances.

A08 Computing Technologies & Mathematical Techniques

A08.01 - Software Engineering

Research to understand software systems engineering, coupled with diverse domain understanding in order to advise on software integration processes, QA, COTS product integration, development of algorithms, techniques and models. Research to understand simulation language developments and their benefits to military systems. Also includes work to understand the behaviour of relevant types of embedded software and time-critical aspects of middleware.

A08.02 - Protocol Technology

Research to understand protocols for satellite and terrestrial communications systems management and control, relevance of civil protocols and their interaction with military networks, including LANs and WANs. Research to aid evaluation and analysis of protocols relevant to communications and communications design for battlefield use. Also includes research into Distributed Interactive Simulation protocols. Also includes research to understand the role of middleware (transaction managers) in defence networked information systems.

A08.03 - COTS Software Assessment

Research to understand the behaviour of COTS software in defence systems and develop COTS product integration and maintenance procedures. Also to include research into consequences of operation outside the standard performance envelope.

A08.04 - Architectures

Research to understand architecture systems and parallel computing developments. Also includes the design of Distributed Systems.

A08.05 - High Integrity and Safety Critical Computing

Research to understand high integrity hardware and software and their applications in defence equipment. Includes new developments in safety critical software (SCS), particularly new tools and methodologies used to investigate fault tolerance/detection, atomicity and liveness. Also includes work on software quality and reliability issues in SCS and also work to improve knowledge of fault tolerant computing and fault tolerant software.

A08.06 - Secure Computing Techniques

Research to understand secure operational procedures and secure segregation of information, including infosec and vulnerabilities at all levels of communications and information systems, and understanding the nature of IW, high integrity software, open systems integration, architectures and standards. Research to ensure compliance with international standards.

A08.07 - Encryption / Crypto Technologies

Research to understand quantum optical processing for secure comms. systems, system vulnerabilities, and encryption work in the context of information warfare processes and infosec. Also work to understand interaction of communications systems design and encryption techniques.

A08.08 - Mathematical Modeling Development

Research to understand and develop new modeling techniques which advance a wide range of defence applications. For example, new approaches to hydrocode and analytical modeling to underpin CE warhead research and attack of future targets. Includes new modeling approaches in/for synthetic environments, human factors, communications networks and related issues. Also includes work to improve the modeling of risk assessment techniques.

A08.09 - OA Tools and Techniques

Research to aid the evaluation and analysis of OA/OR techniques for application to security or defence issues, particularly those which allow more effective provision of advice to MoD. Also includes the exploitation of object oriented techniques within a modelling framework applied to all levels of communications, information systems networks and management, and to provide rapid prototyping and cost effective re-use of validated model elements.

A08.10 - *Not in use*

A08.11 - Software Verification and Accreditation Techniques

Research on the verification and accreditation of software, but not the validation of models which should be carried out within the appropriate technology area.

A09 Information and Signal Processing Technology

A09.01 - Data & Information Management Technology

Research to understand data mining and automatic image retrieval based on content addressed coding. Also includes work to understand ILS and CALS techniques and to maintain archival and current information databases concerning trials, equipment and manufacturing . Also includes work to understand international standards and codification bodies requirements. Also includes research to address the requirements of military mission simulators in the air environment, and real-time database structures. Includes new data and information storage techniques, including datawarehousing technologies. Includes research into new data and information compression techniques. Also includes work on information management and information compression techniques, and application of IM techniques to knowledge-based engineering designs. Also includes research to support the exploitation of middleware in defence database management systems.

A09.02 - Digital Signal Processing Technology

Research to understand DSP for high-throughput MCM sonars and UUVs., underwater weapon homing and countermeasure algorithms and systems. Also includes DSP techniques in relation to radar systems, weapon dynamics, guidance and weapon/target interactions. Also includes work to understand application of DSP to Satcom EPM and multifunction RF modems, to future software radio concepts, EPM and adaptive systems concepts for tactical communications. Research to understand novel mathematical techniques and to aid the evaluation and analysis of DSP in systems involving PAR, sonar, and comms. hardware. Also includes fast DSP techniques, signal correlation, single flux quantum logic in high temperature superconducting devices, and Focal Plane Processing techniques. Also includes data compression/decompression techniques for video and other applications.

A09.03 - Optical Signal Processing Technology

Research to understand pattern and target recognition for repeaters, and jammers, mm and microwave generation. Research to aid evaluation and analysis of adaptive optics and distributed apertures. Also includes work to understand use of novel components for implementation in optical processing algorithms. Also includes OSP in the context of prototyping ground stations. Also includes data compression and decompression techniques for video and other applications.

A09.04 - Image/Pattern Processing Technology

Research to understand IR focal plane arrays and passive mm wave imaging, making use of advanced super resolution algorithms. Also includes relevant mathematical techniques, and hardware and software implementation. Also includes work to understand HF sonar imaging, and real time image processing to support unmanned vehicles, machine vision and AFV crew aids. Also includes research to improve understanding of algorithms used for target detection, recognition and identification purposes in weapon and countermeasure system applications, and also used for weapon dynamics, guidance and weapon/target interactions.

A09.05 - Speech & Natural Language Processing Technology

Research to understand novel mathematical techniques, requirement assessment, fast prototyping, language modelling, hardware and applications evaluation. Research to aid the development of speech/voice recognition systems for the air environment and for AFV crew station applications.

A09.06 - Optimisation & Decision Support Technology

Research to understand AI and expert techniques for support of data fusion, decision support techniques and their application to satcom system management. Also includes AI/ET in the context of information management, MCM sonar classification systems, combat management systems and planning aids, torpedo homing and simulations, and in wargames supporting analysis of security or other defence issues. Also includes machine intelligence developments, and decision planning aids. Also includes research to develop techniques to aid better situational awareness. Research to understand optical processing components and algorithms for neural network implementation. Also includes work to understand the uses of Neural Nets in HUMS, for example, fatigue and load excedance monitoring. Also includes work to understand application of novel mathematical techniques specific to NNs used in a range of weapons systems, simulations and wargames. Also includes work on neuro-fuzzy systems and recurrent NNs.

A09.07 - *Not in use*

A09.08 - Information & Data Fusion Technology

Research to understand applications of I&DF techniques in multispectral sensor systems, sensor integration and picture compilation, anti-stealth and target identification, and various weapons systems issues such as guidance, dynamics, and weapon/target interactions. Research to aid evaluation and analysis of data fusion applied to combat aircraft and sensor systems, including software, simulation and flight trial techniques. Also includes work to understand human factors requirements for data fusion. Also includes work to support CALS and CIRPLS activities. Also includes work on decentralised architectures and emergent behaviour.

A09.09 - *Not in use*

A09.10 -*Not in use*

A09.11 - Other Information Processing Technology

Research to understand applications of OIPT to all aspects of weapon systems, simulations and wargames, and to aid the evaluation and analysis of non-spatial recognition algorithms as applied to long range targeting systems, and to model the optical properties of complex pigments and binders. Also includes fuze algorithms.

A10 Human Sciences

A10.01 - Human Information Processing

Studies of human sensory, perceptual and cognitive processes. Includes work on modelling of the human visual system; human error and reliability; studies of workload reduction for crew systems in military platforms and installations; human decision making and situational awareness; and principles of human interaction with systems.

A10.02 - Military Human Resources

Development of techniques for the recruitment, selection and retention of personnel. Includes work on the management of equal opportunities; aptitude, personal qualities, and physical characteristics; manpower modelling; and systems complementing.

A10.03 - Teams, Organisations & Cultures

Studies of groups ranging from small teams to complete societies. Includes work on team process and effectiveness; impact of command and leadership style on organisational behaviour; human determinants of collective performance - e.g. morale; studies of the impact of cultural norms on social behaviour; and studies of influences on social perception, such as work underpinning Psychological Operations.

A10.04 - Human Survivability, Protection & Stress Effects

Studies relating to the impact of stressors on human performance, behaviour and well being. Includes work on the impact of irregular duty schedules; sleep loss; physical and mental fatigue; impact of thermal strain; clothing assemblies; decompression and diving studies; post-traumatic stress effects; fear; head impact modelling; prevention of musculo-skelatal injuries; and studies of the human performance implications of protection against environmental and weapon threats.

A10.05 - Individual & Team Training

Studies of skills and physical training techniques. Includes management of skill acquisition and skill fade; Crew Resource Management techniques; training needs analysis; and physical fitness training. (Excludes Skills Training systems - B08.01).

A10.06 - Human Factors Integration

Development of methods, tools, and processes to support the integration of people with complex systems. Includes modelling of human performance; development of design standards; kinetic body modelling and anthropometry; and techniques for the allocation of functions to systems. Includes research into applications to integration of speech, performance of MCM sonar, and visual displays. Also includes work on human-interface design and evaluation, such as vision modelling studies.

A10.07 - Collective Training

Studies of techniques for training collective performance. Includes collective non-real-time training; after action review; and metrics of collective performance.

A10.08 - Human Performance Enhancement

Studies of interventions excluding training (A10.05 / A10.07) and protection (A10.04), that enhance individual physical and mental performance. Includes work on nutrition; pharmacological agents; ergogenic aids; and other treatments for to enhance human performance.

A10.09 – *Not in use*

A10.10 – *Not in use*

A10.11 – *Not in use*

A10.12 - Surgical Techniques and Medical Procedures

Research to evaluate and analyse non-CB medical defence issues such as treatment of battlefield casualties affected by either conventional or novel weapons, using surgical and medical skills, operating theatres, and mathematical modelling. Also includes work to understand ballistic and explosive effects on human tissues, and the effects of hyperbaric oxygen treatment of soft tissue injuries.

A10.13 - Human Health Physics

Research into the application of dosimetry techniques to assess the nature and scale of radiation effects on military personnel. Also includes work to understand the use of epidemic modelling including use of man as a detector.

A10.14 - Human Performance Monitoring Techniques

Research into techniques to sense and monitor the performance of personnel. Includes physiological sensing and monitoring.

A10.15 - Human Factors in Manufacturing

Research into techniques that enhance human capabilities within the industrial workplace, both in the design shop and on the factory floor. Also includes "time-and-motion" studies in the context of human control over manufacturing processes.

A11 Operating Environment Technology

A11.01 - Oceanography

Research to understand military oceanography and develop expertise in ocean and ocean bed imaging. Also includes work to understand the underwater environment in terms of its effect on underwater weapon homing algorithms. Also includes research to understand HF acoustics propagation for applications like MCM sonars.

A11.02 - Terrain Science

Research to understand terrain for representation in models and synthetic environments. Work to develop expertise in digital map processing facilities. Also includes work to understand land mapping from space imagery.

A11.03 - Meteorology

Research to understand representation of weather systems in models and synthetic environments. Also includes work to understand ocean-atmosphere coupling for underwater propagation modelling, and effect of meteorological conditions on long range radar propagation at sea. Also includes work to sense remote air movements using optical techniques.

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A11.04 - Upper Atmosphere & Space Environment

Research to understand ionospheric and exo-atmospherics space environment and its effects on military spacecraft. Includes work to measure and model space radiation and debris effects. Also includes research to understand effect of ionospheric environment on EHF satcomms, sensors for BMD, HF and space based radar and precision time systems like GPS.

A11.05 - Acoustic Propagation in Air & Water

Research to understand and model propagation of sound in water at all frequencies, including effects of bottom and surface interactions, velocity structure, both vertical and horizontal, reverberations and transmission loss. Also includes similar work on sound propagation in air.

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A11.06 - Electromagnetic Propagation in Air & Water

Research to understand and model propagation of electromagnetic radiation in air at all frequencies, including the effect of meteorological conditions on long range radar propagation at sea. Also includes similar research into electromagnetic radiation propagation in water.

A12 Mechanical, Thermal & Fluid-Related Technologies & Devices

A12.01 - Mechanical/Hydraulic Technologies & Devices

Research in mechanical and hydraulic technologies and their application in a wide range of devices used in land, sea or air systems. Also includes understanding, modelling and evaluation of devices such as bearings, seals, clutches, actuators, pumps, etc

A12.02 - Lubrication Technology

Research to aid the evaluation and analysis of lubricants and lubricating systems used in defence equipments under demanding conditions. Also includes work to understand problems relating to lubrication faults and failures and associated hazards. Research to improve capability to specify, conduct approval and quality assessments, and monitor performance of lubrication products and systems throughout service life.

A12.03 - Thermal & Thermodynamic Technologies & Devices

Research in thermal and thermodynamic technologies and their application in a wide range of devices used in land, sea and air systems. Also includes understanding, modelling and evaluation of thermodynamic cycles, heat exchangers, thermal de-icing devices, etc. Also includes work on heat transfer by conduction, convection and radiation. Also includes work into combustion processes typical of gas turbines and conventional internal combustion engines.

A12.04 - Fluid Mechanics - Phenomenological & Experimental

Research to identify and understand phenomena in aerodynamics, gas dynamics and hydrodynamics, e.g. vortex behaviour, flow separations, unsteady flows, all other types of flows. Also covers work in experimental facilities - wind tunnels; shock tubes; water tanks; etc. Also includes work to understand the nature of facility testing, including wall interference corrections, support interference corrections, non-intrusive measurements, balance design and calibration, pressure measurements. Also includes work to support the testing of all types of fixed wing and rotorcraft components such as intakes, afterbodies, propellors, helicopter rotors, isolated weapons, weapon carriage and release, wing/body configurations, dynamic derivative, scale effect, and transition fixing. Compliments CFD research in A12.05.

A12.05 - Fluid Dynamics Techniques

Research to understand computational fluid dynamics, and to aid the evaluation and analysis of hydrodynamic performance of all types of marine platforms. Also the evaluation and analysis of supercomputer outputs, fluid dynamic and numerical mathematics in turbulence modelling, transition prediction, viscous flow, solution algorithms, grid generation, CFD/CAD interfaces, GUI and data interpretation/presentation. Also includes rotorcraft fluid dynamics and the use of models to predict rotor loads, signature, novel rotor technology and advanced configurations, and the aerodynamic effects of icing on rotors.

B01 Lethality & Platform Protection

B01.01 - Warheads

Research to understand, model, evaluate and analyse all types of warhead designs employing chemical energy (CE) in the context of armour/anti-armour interactions, weapon/target interactions, attack of hard/buried targets and underwater weapon applications, including the behaviour of the debris cloud. Also includes work on insensitive munition designs. Also includes work to support quality assurance of all types of warhead components. Also includes research relating to fuzing, such as microwave warhead fuzes and other types of intelligent fuze systems and arming systems. Also includes research on solid state devices for safety and arming purposes, "smart" functionality, and application of electrical, optical and other novel methods of initiation of propellants and charges.

B01.02 - Penetrators

Research to understand, model, evaluate and analyse all types of penetrator designs employing kinetic energy (KE) in the context of armour/anti-armour and hard/buried target interactions.

B01.03 – *Not in use*

B01.04 - Battle Damage Reduction Techniques

Research to understand and reduce the vulnerability of military platform structures and installations to all types of penetrative and blast or shock wave effects.

B01.05 - Explosive Ordnance Disposal

Research to support the evaluation and analysis of land-based countermine technology. Also includes work to understand all forms of EO and related devices requiring disposal, including underwater EOD. Also includes research on disposal systems for energetic materials and other munition materials in accordance with environmental legislation requirements.

B01.06 - Mine Detection and Clearance

Research to evaluate and analyse counter-mine technology covering MCM systems, platform and diver signatures, diver communication, mine hunting and avoidance sonars, sweeping, UUV systems and MCM reconnaissance and disposal systems. Also includes work on landmine detection, neutralisation and route marking systems. Also includes work on advanced hand-held landmine detection systems.

B01.07 - Armour systems

Research to model, evaluate and analyse all types of armour systems in the context of armour/anti-armour and hard/buried target interactions and behaviour of the debris cloud. Also includes work on heavy armours and electric armours, including materials behaviour studies under extreme stress/strain rate conditions. Also includes mine effects simulation work and protective measures modelling. Also includes understanding anti-torpedo hardkill devices for ships and submarines.

B01.08 - Defensive Aids Suite systems

Research to understand and improve the performance of all elements in DAS systems, including the potential use of UAVs and advanced pyrotechnic countermeasures. Also includes work to ensure that any conflicts between the DAS system and the platform's signature control techniques are minimised. Also includes DAS/CDAS aspects of weapon/target interactions.

B01.09 - Other Platform Protection Measures

Research to understand and improve techniques and procedures to protect sea systems platforms from threat weapons such as torpedoes such as work on netting techniques. Also includes research on platform protection measures not mentioned specifically elsewhere in these notes.

B02 Propulsion and Powerplants

B02.01 - Gas Turbines

Research to evaluate and analyse compressor and turbine aerodynamics, external heat transfer, combustion aerothermodynamics, aero-engine emissions, noise prediction and reduction, aero-engine controls and dynamic simulation. Also includes system integration aspects including intakes and propulsion/lift nozzles relating to platforms and weapons and related structural design aspects. Also includes work on torpedo thermal engine designs. Also includes improved testing techniques to determine engine performance parameters. Also includes work to improve the resistance of gas turbines to effects of sand/salt ingestion.

B02.02 - Reciprocating and Rotary IC Engines

Research to understand integration aspects, as well as improving efficiency, of IC engines for platform and weapons systems. Also includes research on engines to give a high performance irrespective of fuel type. Also includes research on reducing vibration and/or noise generation in these engines.

B02.03 - Rocket Engines and Ramjets

Research to understand solid and liquid fuel ramjets, ramrockets and rockets. For example, combustion systems, ramburner aerodynamics and reaction kinetics, throttle control systems, air intakes, nozzles including nozzleless boost systems, design of rocket and ramjet missile cases and associated internal insulation systems. Also includes relevant predictive modelling studies.

B02.04 - Gun and Launch Tube Propulsion

Research to understand all aspects of gun tube designs using chemical propellants (all calibres). Also includes work on relevant weapon system integration applications and associated structural design issues. Also includes work on electrothermal gun system designs. Also includes research into non-chemically-driven launcher tube systems. (but not electrically driven tube systems)

B02.05 - Electrical Propulsion - Rotary & Linear

Research to understand electric propulsion systems for submarines, surface ships, underwater weapons, UUVs, and also land vehicles Also includes work on relevant platform or weapons system integration aspects and associated structural design issues. Also includes work on electromagnetic launch systems/gun designs and their integration into land and sea platforms, such as power supplies and power management systems. Also includes associated predictive modelling on all of the above aspects.

B02.06 - Transmissions and Powertrains

Research to understand rotorcraft transmissions and their role in the overall power train. Also includes research to understand ship/submarine gearboxes and powertrains in the context of their acoustic impact. Also covers work on the improvement of wheeled and tracked vehicle transmissions and powertrains, including life and reliability aspects.

B02.07 – *Not in use*

B02.08 - Ion Thrusters

Research to understand ion thruster designs to improve performance and operating life.

B02.09 - Nuclear Propulsion

Research to provide advice on the engineering aspects of non-nuclear elements in nuclear propulsion systems.

B02.10 - Air Propellors and Rotors

Research to understand propellor and lifting rotor design in the context of performance, integrity and life aspects, and interactions with the local operating environment included radiated noise effects. Also includes work to understand rotor interactions with the local operating environment. Also includes work to minimise rotor icing effects.

B02.11 - Final Drive - Water Propulsors

Research to understand propulsor design in the context of performance, interaction with the local operating environment and radiated noise effects.

B02.12 - Final Drive - Wheels and Tracks

Research to understand wheel and track interactions with the local operating environment, to improve traction and safety, and to maximise integrity and life.

B03 Design Technologies for Platforms and Weapons

B03.01 - Aerodynamic Designs

Research to understand, evaluate, analyse and exploit aerodynamic designs, both basic and unsteady, using CFD code application in conjunction with experimental data as appropriate, on fluid dynamic problems, relating to rotorcraft, stealthy weapon designs, part aircraft configurations such as intakes, afterbodies, weapons, weapon carriage and release systems, and high lift systems. Also includes associated predictive modelling and assessments based on wind tunnel testing. Includes work on applied aerodynamics; prediction and measurement techniques, development/validation/application of semi-emprical codes. Modelling stores carriage loads and release trajectories, drag prediction. Also includes work to exploit experimental and theoretical aerodynamics data generated in research activities in A12.04 and A12.05. Also includes research on relevant parts of aerolastics and aerothermodynamics disciplines.

B03.02 - Hydrodynamic Designs

Research to understand impact of hull form and integration of stealth technology on the hydrodynamic, sea-keeping and handling of all types of marine platforms and marine structures. Also includes the hydrodynamic aspects of all naval weapons systems, such as the effects of flow noise on torpedo homing systems. Also includes work to understand and exploit wake effects.

B03.03 - Structural Designs

Research to understand, evaluate and analyse structural design for all platforms and weapons systems, and for battlefield bridging. Includes the structural aspects of integration with aerodynamic and stealth design. Also includes predictive modelling, and dynamics and acoustic measurement, and associated test activities. Also includes work to understand and prevent transmission of noise through structures in military equipment. Also includes research on relevant parts of the aerolastics discipline.

B03.04 - Mechanical Designs

Research to understand, evaluate and analyse mechanical engineering design for all platforms and weapons and their sub-systems. Also includes associated test activities, and predictive modelling. Also includes work to improve aircraft launch and recovery systems in conditions of low visibility and at restricted austere sites or on ships. Also includes research on relevant parts of the thermomechanics discipline.

B03.05 - Stealth Designs

Research to understand hull vibration in ships and submarines arising from machinery and fluid flow effects, and work to relate the results to signature characteristics. Also includes analysis of threat stealth design and threat sensor technology leading to improvements in own reduced signature stealth designs for all platform and weapon applications. Also includes associated predictive modelling and work on specialised testing facilities to improve stealth design aspects. Also includes research into problems of co-ordinating the management of all signatures.

B03.06 - Ballistic Designs

Research to understand the integration of ballistic design and related design drivers into platform and weapon systems. Includes work on internal and external ballistics of projectile behaviour and gun and launcher system designs.

B03.07 - Thermal/Cryogenic Designs

Research to understand, evaluate and analyse thermal/cryogenic design factors, and improve their integration in all platforms and weapon systems. Also includes research on relevant parts of the thermomechanics and aerothermodynamic disciplines. Also includes associated test activities and predictive modelling.

B03.08 - Electrical/Electronic Designs

Research to understand, evaluate and analyse electrical/electronic design factors, and improve their integration in all platforms and weapons systems. Also includes associated test activities and predictive modelling.

B03.09 - Optical Designs

Research to understand, evaluate and analyse optical design factors, and improve their integration in all platforms and weapons systems. Also includes associated test activities and predictive modelling.

B03.10 - Acoustic Designs

Research to understand, evaluate and analyse acoustic design factors, and improve their integration in all platforms and weapons systems. Also includes associated test activities and predictive modelling.

B03.11 - Environmental Protection Designs

Research and development of designs aimed at reducing the effects of icing on the performance of military equipment. Also includes work on designs to combat the effects of thermal extremes on military equipment. Also includes work to develop improved designs for the protection for all types of engine from the effects of sand ingestion.

B04 Electronic Warfare and Directed Energy Technologies

B04.01 - DET - RF

Research to understand RF DE systems and their effects on silicon microelectronic components, circuits and sub-assemblies. Also includes integration aspects of DE into weapon systems. Also includes work on non-destructive RF DE systems and their integration in the context of anti-ship missile defence systems.

B04.02 - DET - Lasers

Research to understand integration of laser DE systems into weapon systems and platforms. Also includes work to exploit high power laser technology.

B04.03 - DET - Other

Research to understand other types of DE, for example, particle beam technology, and their integration into weapon systems and platforms.

B04.04 - ECM - RF

Research to evaluate and analyse techniques such as generic and specific countermeasure waveforms to be integrated into ECM systems employed to protect platforms. Includes work on comms.ECM and non-comms ECM. Also includes work to understand tactical comms.ECM, long range surveillance and tactical battlefield ECM systems. Also includes novel microwave filter and MMIC design aspects of ECM systems, and power amplifiers for jammers. Also includes work to understand effects of RF on microelectronic component survivability. Includes research into micro- and milli-metre wave ECM techniques.

B04.05 - IR/Visible/UV

Research to evaluate and analyse techniques including generic and specific waveforms to be integrated into EOCM systems. Also includes work on comms.EOCM, and non-comms.EOCM. Also includes work exploiting laser technology, stealth materials, novel negative luminescent device technologies and E-O sensors in the context of ECM systems. Also includes work to understand sensor design and signature measurement related to EOCM.

B04.06 - ECM - Acoustic

Research to evaluate and analyse design of countermeasures to acoustic homing torpedoes and their launch platforms. Also includes work to understand acoustic ECM systems integration and the associated man-machine interface requirements.

B04.07 - ECM - Magnetic and Electrical

Research to evaluate and analyse the design and performance of magnetic and electrical CMs to incoming torpedoes and their fuzes. Also includes work to understand the M&E threat to spacecraft systems. Also includes research to understand the integration of ECM systems into combat systems.

B04.08 - ESM - Communications

Research to evaluate and analyse communications ESM techniques and technology. Also includes work to specify ESM systems capabilities/performance and to integrate ESM with weapon systems and for tactical employment. Also includes work to understand Information warfare technology, long range and tactical battlefield communications and counter-comms.technology. Also includes evaluations and analyses of geolocation of interferors and unauthorised users. Also includes research to apply HTS technology to ESM-Comms.systems.

B04.09 - ESM - Non-Communications

Research to understand techniques for the high probability of intercept of RF signals, their rapid identification, and for integration of ESM systems into weapon and combat systems. Also includes radiographic mapping of electromagnetic sources from satellite observations. Also includes research to apply HTS technology to ESM-non-Comms.systems.

B04.10 - EPM - RF

Research to evaluate and analyse RF EPM and integration of EPM systems with weapon systems. Also includes work to analyse spread spectrum techniques applied to comms.signals at SHF and EHF. Also includes work to understand hardening of comms. assets and to set standards for advanced adaptive EPM for HF comms. Includes research at micro- and millimetre wave frequencies for EPM purposes.

B04.11 - EOPM - IR/Visible/UV

Research to evaluate and analyse image processing algorithms for navigation and targeting sensors employed by threat systems. Also includes understanding EOPM across visible, IR and FIR, for eyes, imagers and magnifying optics. Also includes work on the integration aspects related to weapon systems, and on sensor design issues.

B04.12 - EPM - Acoustic

Research to evaluate and analyse mine avoidance sonars employed in submarines and surface ships. Also includes work related to acoustic EPM systems integration at the man-machine interface.

B04.13 - EPM - Magnetic and Electrical

Research to understand and reduce the effects of magnetic and electrical stray fields and hazards on all types of military equipment.

B05 Signature Control and Signature Reduction

B05.01 - Radar Signatures

This technology covers all used radar frequencies. Research to evaluate, model, analyse and manipulate platform radar signatures and integration of radar signature control into weapon systems. Also includes work relating threat radar sensor technology and the environment to own platform signatures. Also includes work on active stealth measures (in the context of radar signatures).

B05.02 - Laser Signatures

Research to evaluate model, analyse and manipulate platform laser signatures and integration of laser signature control into weapon systems. Also includes work to understand threat laser sensor technology, low observable materials technology and operating environment signatures.

B05.04 - IR Signatures

Research to evaluate, model, analyse and manipulate platform IR signatures and integration of signature control into weapon systems. Also includes work to understand the effects of pigments and other materials on signature control. Also includes issues relating to stealthy missile launch detection (plumes), threat IR sensor technology, and operating environment signatures. Also includes work to understand thermal signature control in the context of gas turbines, reciprocating/rotary engines, and rockets and ramjets.

B05.05 - Visible/UV Signatures

Research to understand, model and manipulate platform UV/Visible signatures and integration of signature control with weapon systems. Also includes work to understand threat UV/Vis sensor technology, missile detection filters and operating environment signatures. Also includes research to understand the behaviour of coatings and micro-structured surfaces that minimise laser retro-reflections.

B05.06 - Acoustic Signatures

Research to evaluate, model, analyse and manipulate underwater acoustic signatures of all types of marine craft, and torpedo decoys. Also includes work to detect and classify targets, mine threat analysis, and to optimise processing techniques. Also includes work to understand acoustic echo characteristics of target ships and submarines to be employed in own sonar, torpedo and fuzing systems. Also includes work to develop and improve measurement techniques for underwater signatures, both active and passive. Also includes work to understand acoustic signature detection of helicopters including modelling to predict rotor noise and its propagation through the environment. Also includes work on land-based systems acoustic signatures, particularly on the application of passive and active acoustic signature control to land equipment. Also includes work to understand laser generated acoustic waves. Also includes work to understand acoustic signature control in the context of gas turbines, and reciprocating/rotary engines.

B05.07 - Electrical and Electrochemical Signatures

Research to understand mine threat to maritime vessels and also to understand and model mechanisms by which electrical signatures of naval platforms may be reduced or manipulated. Also includes work to understand electrical signatures for TEMPEST testing, evaluation and certification.

B05.08 - Magnetic Signatures

Research to evaluate, model and analyse mine threat for maritime vessels and to understand mechanisms for reducing or manipulating magnetic signatures of naval platforms. Also includes work to understand the interaction between torpedo fuzes, targets and countermeasures in the undersea environment. Also includes work to understand measurement of the magnetic signature content of equipment and components fitted in minehunting/mine countermeasure vessels. Also includes work on magnetic signature ranging and reduction. Also includes work to evaluate and analyse display technology for operation in environments with magnetic fields.

B06 Sensor Systems

B06.01 - RF Sensors/Antennas - Active

This technology covers all used radar frequencies. Research to evaluate and analyse detectability of air targets, surface targets using active radar. Also includes work to evaluate and analyse DSP, system modelling, detectors, antennas, system design, active array technology and advanced processing for multifunction radar. Also includes work to understand space based comms. antennas and radar for surveillance. Research to evaluate and analyse returns from air targets, surface targets and sensor performance. Also includes work to evaluate and analyse system design, system modelling, integrated sensor suites, SARA, MIT, maritime rec., advanced phased arrays, and obstruction avoidance sensors. Also includes work to understand calibration and metrology advice. Also includes work to enable effective integration of radomes.

B06.02 - RF Sensors / Antennas - Passive

This technology covers all used radiometric frequencies. Research to evaluate and analyse detectability of air targets, surface targets using passive radiometric sensors. Also includes work to understand antenna calibration. Research to evaluate and analyse returns from air targets, surface targets and sensor performance. Also includes work on systems aspects, temperature sensitivity and resolution, and passive radar sensors. Also includes work to exploit MMIC design and device packaging technology for a low cost passive radar imager.

B06.03 – *Not in use*

B06.04 – *Not in use*

B06.05 - IR Sensors - Active

Research to evaluate and analyse integrated sensor suites incorporating targeting, navigation, and terrain and obstruction avoidance sensors. Also includes work to understand optics, system modelling, detectors, lasers and system design. Also includes work to understand vision systems for AFVs and WASAD, and to understand intelligent surveillance. Also includes work to understand laser detection of mines in very shallow water/surf zone, underwater target detection and laser weapon fuzing. Also includes work to understand laser rangefinders, vibration sensors, laser sources, and CLARA.

B06.06 - IR Sensors - Passive

Research to evaluate and analyse integrated sensor suites incorporating targeting, navigation, terrain and obstruction avoidance IR sensors. Also includes work to understand optics, system modelling, IR detectors, lasers and system design. Also includes work to understand vision systems for AFVs and WASAD, and intelligent surveillance systems. Also includes work to understand IR detection of buoyant mines on the sea surface, and IR detection of land mines. Also includes work to understand space based IR surveillance. Also includes work to understand smart IR sensors. Also includes work to understand "obsolescence management" of IR sensor systems, including interpretation of national standards. Also includes work to evaluate and analyse advanced IR detector designs for improved identification and Counterstealth. Also includes work to understand COTS sensor technology in the context of defence equipment. . Also includes work to enable effective integration of IR domes.

B06.07 - Visible / UV Wave Sensors

Research to understand integrated sensor suites incorporating UV/Visible sensors for targeting, and other applications. Also includes work to analyse optics, system modelling, UV/Vis detectors, UV/Vis lasers and system design. Also includes research to exploit organic semiconductors for application in photon detection and image intensifiers, and also to analyse the performance of UV-sensitive missile launch detectors. Also includes work to maintain awareness of visual sensors for space-based surveillance.

B06.08 - Acoustic Sensors - Active

Research to understand airborne ASW systems and maintain technical specifications for active UK sonobuoys and sonic processors. Also includes work to understand HF acoustics and propagation and support analysis of MCM, mine avoidance and MCM reconnaissance systems. Also includes work to evaluate and analyse design and integration of towed bodies for LF active sonar and the application to underwater homing and acoustic countermeasures. Also includes work to understand active sonar transducers, arrays, and associated signal/data processing and display systems. Also includes work to enable effective integration of sonar domes.

B06.09 - Acoustic Sensors - Passive

Research to understand airborne ASW systems and specifications for passive sonobuoys and service sonic processors. Also includes work to understand acoustics and propagation for land and airborne vehicle detection and location of artillery and rockets. Also includes work to understand HF acoustics for passive mine detection. Also includes evaluations and analyses of underwater weapon passive sensors in the presence of high levels of flow noise. Also includes the design of towed arrays in terms of handling and reliability, sonar performance, and other passive sonar systems and passive sonar array types. Also includes work to exploit ferroelectric liquid crystal polymers for application in compact, sensitive, directional sonar elements. Also includes work to exploit novel silicon acoustic sensors and integrated sensors for passive sonar systems. . Also includes work to enable effective integration of sonar domes.

B06.10 - Non-Acoustic Sensors - Underwater

Research to evaluate and analyse non-acoustic sensors for mine detection in very shallow water/surf zone and for MCM reconnaissance. Also includes work to understand non-acoustic sensor technology for application to underwater weapon homing and fuzing, and as a non-acoustic UW sensor to complement acoustic sensors. Also includes work to understand behaviour of non-acoustic sensors in the military oceanographic environment. Also includes wake detection systems and biodetection (biologics) techniques for underwater non-acoustic detection systems.

B06.11 - Electrical & Electrochemical Sensors

Research to understand and develop underwater electric potential (UEP) sensor technology.

B06.12 - Magnetic Sensors

Research to understand integration of novel magnetic material with silicon circuitry to provide smart micro-magnetic sensors. Also includes work to understand magnetic sensor application to weapon systems and to fuzing systems in all weapons (except underwater) and in land mine detection systems.

B06.13 - CB Sensor Systems

Research to support and maintain expertise in CB sensor systems which monitor the level of the hazard, identify the agent and identify exposure retrospectively. Also includes work to apply genetic engineering and amplification, antibody/antigen interactions, gene probes and biosensor transduction to CB detection systems.

B06.14 - Explosive Detection Sensors

Research to understand application of EDS to very shallow water/surf zone mine detection and to land mine detection. Also includes work to enhance detection system performance for explosives.

B06.15 - Microsensor Systems for Active Control of Structures

Research to understand silicon microsystems technology for sensors and transducers, and use of fibre probes using frequency selective RAM. Also includes work to exploit smart/functional material technology to control the shape of intelligent structures, including sound damping applications. Includes structural applications of micro-electronic and mechanical systems (MEMS) technology to active structures.

B06.16 - Motion Sensor systems

Research into new approaches to gyroscopic control systems and other inertial sensors for platforms and weapons, particularly those based on solid-state devices. Also includes associated work on the relevant signal processing element of motion sensor systems. Also includes work on techniques to measure structural vibration.

B06.17 - Environmental Monitoring Systems

Research to support the design of systems to monitor atmosphere quality in submarines and crew spaces in other military platforms and installations. Also includes work to determine and analyse noise levels in crew spaces.

B07 Guidance and Control systems for Weapons and Platforms

B07.01 - Navigation systems

Research to understand integration and application of navigation systems to missile seekers, AFV fire control systems, and MCM and reconnaissance systems. Also includes work to apply silicon microsystems technology for micro-accelerometers and micro-gyros, including embedded control and signal processing electronics. Also includes work to understand "obsolescence management" and technology insertion in the context of navigation systems.

B07.02 - Weapon Guidance and Control systems

Research to evaluate and analyse use of guidance and control technology to remote guidance techniques for underwater weapons, and to integrated precision attack techniques, MLRS and other ballistic systems. Also includes work to understand the application of silicon microsystems technology to precision G&C systems employed in missiles. Also includes work to understand "obsolescence management" and technology insertion in the context of G&C systems. Seekers/Homers (both above and underwater) - Research to evaluate and analyse seeker/homer systems used in both air-launched and underwater weapon systems and attack platforms. Also includes work to exploit advanced focal plane arrays and related image processing and data fusion techniques. Also includes work to evaluate and analyse seeker guidance system tests using dynamic infra-red scene projectors. Also includes work to understand small RF phased arrays and multispectral(radar & IR) sensors in the seeker context. Also includes research to exploit acoustic sensor technology for precision homing systems.

B07.03 - Platform Guidance and Control systems

Research to evaluate and analyse G&C systems, including avionics and vetronics, in the context of platforms, AFV fire control systems, autonomous underwater vehicles, and in relation to integrated precision attack techniques. Also includes work to exploit HFI technology for control systems in crew spaces/cockpits. Also includes work on multivariable, discrete, non-linear control design methods and relevant image processing and data fusion technology. Also includes work to understand attitude and orbit control systems employed in satellites.

B07.04 – *Not in use*

B07.05 - Display systems

Research to understand characteristics of displays used in or for helmet systems, missile seekers, AFV fire control systems, torpedo track information displays, and related display information on target/environmental conditions. Also includes work to apply novel display science to military display systems. Also includes work on displays in the context of "obsolescence management" and technology insertion.

B07.06 - Stores and Weapons Release / Discharge systems

Research to understand, evaluate and analyse the factors involved in release/discharge of stores and weapons from land, sea and air platforms. Includes model and full scale experiments and predictive modelling.

B08 Simulators, Trainers and Synthetic Environments

B08.01 - Skills Training systems

Research to understand skills training, and application of synthetic environments to skills training systems for all service environments. Also includes application of hardware-in-the-loop and PC-based systems to skills trainers.

B08.02 - Tactical / Crew Training systems

Research to understand synthetic theatre of war (STOW) and the application of synthetic environments, including virtual reality techniques in simulators to reflect the critical cues provided by the real platform. Also includes application of hardware-in-the-loop and PC-based systems to tactical/crew trainers.

B08.03 - Command & Staff Training systems

Research to understand command level training systems, STOW and the use of speech for interactive training. Also includes work to understand the application of synthetic environments to command level training systems and computer assisted staff training systems. Also includes application of hardware-in-the-loop and PC-based systems to command and staff trainers.

B08.04 – *Not in use*

B08.05 - Virtual Reality

Research to evaluate and analyse virtual crew stations as a tool for procurement and training. Also includes work to understand integration of 3-D imaging and display technology in the fields of remote telepresence, and cognitive aspects of operator performance. Also includes work to assess the physiological impact imposed by man, the task, and the environment. Also includes work to understand techniques for measuring performance in VR environments. Also includes work to understand the nature of physiological and psychological interactions between humans and VR, and the value of VR in design and training systems.

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B08.06 - Synthetic Environments - Synthetic Force Generation

Research to understand synthetic environments for such purposes as; training, OA, procurement, requirements capture process, platform and weapons systems, sensor systems and relevant countermeasure systems. Also includes work to understand the use of stimulators and simulators, system performance, design, testing, validation, acceptance and use, and environments. Also includes work to understand the nature of physiological and psychological interactions between humans and SEs. Also includes work to assess the value of SEs in design, selection and training activities.

B08.07 - Synthetic Environments - Natural Environment Generation

Research to understand SEs for natural environment generation. Includes work to facilitate the rapid generation of geotypical terrain and feature/cultural data. Includes work to understand Variable Representation in support to simulation systems. Also includes research on the application of models to generate internal wave wake for the prediction of surface wave modulations.

B08.08 - Synthetic Environments - Management systems

Research to include the management of databases covering terrain, environment, dynamic models, and other relevant databases. Work on developments arising from the SEDRIS programme. Also work on the configuration management and maintenance of models and software for SEs. Also includes work to exploit HLA, languages and AI for SEs.

B09 Integrated Systems Technology

B09.01 - Systems Engineering and Integrated Systems Design

Research to understand system engineering, integrated system and platform (and propulsion systems) design, architecture of weapons systems and weapon systems integration processes. Includes EW systems integration and Sensor integration. Also includes work to evaluate and analyse combat systems, software system design, display technology, system architectures, and flight trials techniques. Also includes work to understand multiple vehicle installations. Also includes work to understand thermal management of platform and weapon systems. Also includes work to understand definition and integration of user requirements into specifications for manned systems including Human Factors Integration, MANPRINT procedures and design standards for the procurement of future manned systems. Also includes work to integrate disparate information systems, computer systems and communications systems. Also includes research to improve systems performance analysis at the systems level. Also includes work to achieve multi-disciplinary optimisation.

B09.02 - Interoperability Standards

Research to evaluate and analyse UKAD airborne early warning systems, including combat identification and operating environment. Also includes work to interpret national and international standards for all technologies in a defence context. Also includes work to understand weapon system interoperability issues, including interoperability of small arms ammunition. Also includes work to understand standards for cable and connectors, including specification writing. For CIS: Research to understand communications methods and networks, including network management techniques, to support end-to-end connectivity via the integration of terrestrial bearers with HF and Satcom systems. Also includes work to evaluate civil networks and relevant testing methods. Also includes work to understand system interoperability across the digitized battle space, particularly for comms. systems, protocols, software and COTS issues.

B09.03 - Radiation Hardening

Research to understand integrated system design, particularly weapon system vulnerabilities against EMP. Also includes work to evaluate and analyse integrated hardening, reconfiguration and electronic monitoring techniques. Also includes work to understand protection against space radiation, and radiation hardening of ICs.

B09.04 - Robotics and Automated systems in Operational Systems

Research to understand automated systems for remote underwater EOD and engineering systems. Also includes work to understand applications of various technologies to remotely controlled sea, land and air equipment. Also include research on autonomous systems for uninhabited air vehicles, particularly the integration of technologies like embedded computing, comms. and sensor fusion.

B09.05 - Reliability and Maintainability of Systems

Research to understand probabilistic structural analysis on reliability of aircraft, helicopters, mechanical systems and other engineering systems. Also includes work to monitor and predict all types of platform reliability and durability issues. Also includes work to understand configuration control, and identifying alternative components. Also includes work to understand reliability of PC boards within systems under systems conditions. Also includes work to understand cost-effectiveness, fitness for purpose and environmental impact of military packaging.

B09.06 - Health Monitoring systems

Research to understand integrated systems for health monitoring of all engineering systems. Also includes work to evaluate and analyse electronic monitoring techniques.

B09.07 - Safety systems

Research to understand all engineering systems characteristics and unsafe system testing procedures, particularly of weapon systems. Also includes work to evaluate and analyse reliable fire detection (early stages particularly), and chemical products released during overheating/early stages using robust sensors providing unambiguous indications.

B09.08 - System Repair Technologies

Research to understand the consequences of repair schemes and procedures on system performance and system durability.

B09.09 - Electromagnetic Compatibility

Research to understand EMC issues in integrated system design, particularly in weapon system. Includes research into experimental methods to quantify electromagnetic phenomena in military systems including material property measurement, and antenna measurement. Includes work to identify and overcome electromagnetic hazards, and improved designs to allow equipment to function in the presence of lightning strikes. Also includes research to understand the consequences of lightning strikes on all defence equipment. Also includes associated predictive modelling. Also includes work to evaluate and analyse EMC interference and failure.

B09.10 - In-Service Data Capture systems

Research to improve techniques for the capture and analysis of in-service operational data.

B09.11 - Integrated System Testing and Evaluation

Research to develop improved cost-effective whole-system tests and evaluation methods.

B09.12 - Middleware systems

Research to ensure that the most appropriate forms of middleware are fully exploited in datawarehousing activities and message-oriented applications relevant to defence applications.

B10 Communications and CIS-related Technologies

B10.01 - Communications Systems - Below Microwave Frequencies

Research to understand the requirements for, and design of architectures for tactical communications systems below microwave frequencies. Also includes work to evaluate and analyse design of systems working at frequencies from ELF through HF to SHF and EHF. Also includes work to understand operations, environment and the transmission media. Also includes work to understand the vulnerability of systems at the RF modulation, coding and protocol level. Also understand systems management issues in the context of threat and countermeasures. Also includes work to understand the requirements for tactical and trunk management systems and the interaction at network and systems level. Also includes work to evaluate and analyse EHF for satellite payloads and ground stations. Also includes research to understand and optimise long haul communications systems in the context of SATCOM and STRATCOM.

B10.02 - Communications Systems - Micro and Millimetre Wave

Research to understand low cost phased array technology for communications links. Also includes work to design architectures for tactical and strategic communications systems including antenna subsystems. Also includes work to understand supporting generic technology like MMICs and solid state microwave sources in the context of communication system design. Also includes work to evaluate and analyse designs for high power microwave tubes for transmitter systems. Also includes work relevant to SATCOM.

B10.03 - Communications Systems - IR/Visible/UV

Research to evaluate and analyse miniature laser device technology in the context of understanding novel optical communications systems.

B10.04 - Communications Systems - Acoustic

Research to understand acoustic communications system design for UUV to submarine communications, and for off-platform sensors, also for multi-static operations design, underwater navigation design, and for speech and signal intelligibility system design. Also includes work on communications systems for interacting with man in airborne systems.

B10.05 – *Not in use*

B10.06 - Communications & CIS Security Systems

Research to understand system vulnerabilities, infosec and information warfare techniques. Also includes work to model degraded systems and to gain an understanding of security policy and architectures. Also includes work to evaluate and analyse COMSEC.

B10.07 - Command & Information Systems Integration

Research to evaluate and analyse combat management systems C2, surveillance and satcoms systems, and intelligence systems and their integration at all levels. Also includes work to study CIS concepts development, prototyping and CIS systems definition. Also includes work to exploit data fusion, speech and special systems CIS. Also includes work to understand efficiency, vulnerability and survivability of communications networks. Also includes work to understand open systems, JCSI architecture and test bed processes, information management and infosec. Also includes work to evaluate and analyse distributed systems. Also includes research to improve modelling capabilities in the context of communications systems.

B10.08 – *Not in use*

B10.09 - Non-Co-operative Target Recognition

Research to exploit novel technologies for thermal imaging systems and secure communication systems. Also includes work to understand combat ID systems (IFF), and radar systems for Non-Co-operative Target Recognition (NCTR) systems, and for NATO identification systems.

B10.10 – *Not in use*

B10.11 - Geographic Information Systems

Research to develop expertise in geographic information systems, particularly using digital map processing facilities. Also work to optimise the use of space data in GIS.

B10.12 - Optimisation, Planning & Decision Support Systems

Research to support a Battlespace Spectrum Management System. Includes work to aid the tactical decision making process to contribute to improved survivability and operational effectiveness using approaches which derive "measures of effectiveness". Also work to demonstrate that decision support systems can be used to formulate Staff Targets/Requirements. Also work to investigate the provision of a global optimisation for service to all users across the JBD environment. Also includes work to develop and improve mission support systems.

B10.13 - Infrastructure to Support Information Management & Dissemination

Research to aid the validation of the UCS concept using the Integrated CIS Infrastructure Demonstrator. Also work to integrate BISA with CIBIS and UCS concept research. Also includes work to get existing information sources to appropriate users taking advantage of advanced dissemination management systems. Also includes work to model the behaviour of complex network-based systems.

B10.14 - Network Management systems

Research to improve the understanding of network management requirements and techniques, including data links to all potential users.

B10.15 - Air Traffic Control systems

Research to gain knowledge of airspace management issues applicable to all defence air platforms including UAVs. Also includes work to improve air traffic control systems and concepts.

B11 Personnel Protection Systems

B11.01 - Physical Protection systems - Threat

Research to understand the issues involved in the design, selection and evaluation of specialist clothing and equipment to protect individuals and groups operating in military threat situations. Also includes work to understand human protection and survival systems in environmental extremes including radiological, thermal, and sensory threat conditions. Also includes work to understand EOPM for bare eyes. Also includes work on body armour systems and related behind-armour protective clothing systems.

B11.02 - Physical Protection systems - Environment

Research to understand the short and long term effects of exposure to high altitude and other extreme environments on human physiology in applications like aircrew escape systems, diving systems, and submarine escape systems. Also includes work to understand maintenance of physical and visual performance with effective communication in high ambient noise environments. Also includes work to design, select and evaluate specialist clothing and individual equipment, and investigations of the degradation in individual and collective performance. Also includes work to understand protection for MCM diving, safety and support systems and decompression tables. Also includes work on on-board oxygen generating systems, breathing regulator technology, anti-G systems, air conditioning for humans and equipment, and internal noise control for habitability purposes.

B11.03 - CB & N Protection systems - Physical

Research to understand the construction, performance and utilisation of individual and collective protection equipment (IPE & COLPRO), decontamination systems and contamination management, and chemical hardening processes. Also includes work to exploit surface chemistry technology and airflow cleaning and management systems. Also includes work to optimise the handling of supertoxic chemicals. Also includes work to understand the HFI issues associated with the design, selection and evaluation of NBC protective systems. Also includes work to understand integration of COLPRO systems onto land vehicles. Also includes work to evaluate and analyse the statutory requirements regarding ionising radiation environments.

B11.04 - CB & N Countermeasures - Medical

Research to understand the identification, efficacy, licensing and military acceptability of NBC medical countermeasures. Also includes work to analyse effectiveness of pre-treatments (drugs and vaccines) and therapy (drugs and procedures) for all materials that comprise the CB threat spectrum. Also includes work on anti-emetic drugs used to combat deleterious effects of radiation. Also includes work which exploits biotechnology, pharmacology, toxicology and pathology for the protection of military personnel from CB threats.

B12 Manufacturing Processes/Design Tools/Techniques

B12.01 - Design for Improved Reliability & Maintainability

Research to understand interface requirements and applicability of data employed in system engineering to the industrial process. Also includes work to understand reliability modelling of land vehicles and equipment, satcom systems, and aircraft and helicopter structures and systems where dynamic characteristics under vibration conditions is important. Also includes work to understand open systems, high integrity systems and device reliability design concepts. Also includes work to evaluate, analyse and produce Asics, interconnects and packaging for cryptographic ICs.

B12.02 - Cost Engineering

Research to understand the integration of structural, aerodynamic, signature and control techniques for cost optimisation at the design stage. Also includes work on structural design and materials requirements in the context of cost reductions. Also includes work on cost modelling and analysis for land vehicles, equipment, and for space surveillance and satcom systems. Also includes work to understand minimisation of cost in instances where there are technology obsolescence implications. Also includes design for improved affordability.

B12.03 - Concurrent Engineering and Reduced Design Cycle

Research to understand the implications of configuration control at all levels from IC board to platform. Also includes work to understand concurrent engineering design tools

B12.04 - Advanced Prototyping

Research to understand device prototyping and of rapid prototyping tools for software developments. Also includes work to understand the implications of a virtual manufacturing approach. Also includes rapid prototyping in an air system context.

B12.05 - Techniques and Systems for Production Manufacturing

Research to understand, analyse and evaluate techniques and systems for production manufacturing of defence equipment. Examples include, flexible assembly, robotics/automation, IT systems, "just-in-time" provision of components and subsystems, reduced emissions manufacture, etc. Includes work to minimise systems installation problems during the later stages of assembly. Examples include; use of robotics, modular systems, multiplexing, improved interfaces/connectors, operator support tools for installation and remedial functions, and visualisation tools.

B12.06 - Project Management and Control

Research to understand, analyse and evaluate improved project management and control techniques and associated factors. Also includes human resource management, cultural issues, IT applications to communication and programme control, error budget management, etc.

B12.07 - Manufacturing Process Simulation

Research into all aspects of the manufacturing process that are amenable to advanced simulation techniques in order to identify potential problem areas and cost effective remedial solutions. Also includes relevant aspects of material behaviour modelling.

B12.08 - Lean Manufacturing

Research to evaluate techniques which minimise delays in component supply and insertion into the manufacturing and assembly processes.

B12.09 - Process Control Technology

Research on methods of real time process control applied to manufacture of all defence products. Examples are cure monitoring of composites, weld process monitoring, and on-line tolerance measurement and control. Also includes relevant aspects of material behaviour modelling.

B12.10 - Environmentally Friendly Factory Processes

Research to understand and aid implementation of environmentally friendly (EF) materials and processes wherever possible in the manufacturing cycle, so that adverse human effects caused by chemical effluent sources or noise transmission are minimised. Also includes work to meet the requirements of the Montreal Protocol and other international agreements in the context of EF factory processes and product behaviour.

B12.11 - Knowledge-based Engineering

Research to maximise the effective use of existing data and know-how contained in libraries of past experience.

C01 Defence Analysis

C01.01 Policy, force development and balance of investment studies

No further details.

C01.02 Combined operational effectiveness and investment appraisals
No further details.

C01.03 Platform and system concept studies
No further details.

C01.04 Requirement definition studies
No further details.

C01.05 Scenario generation
No further details.

C01.06 Tactical development and support to operations and training
No further details.

C01.07 Other effectiveness and performance studies
No further details.

C01.08 Military doctrine analysis
No further details.

C01.09 Wargaming and Combat Simulation
No further details.

C02 Integrated Platforms

C02.01 No longer in use
No further details.

C02.02 Undersea platforms
No further details.

C02.03 Fighting land vehicles
No further details.

C02.04 Logistic, command and surveillance land vehicles
No further details.

C02.05 Combat aircraft
No further details.

C02.06 Logistic, support and surveillance aircraft
No further details.

C02.07 Helicopters
No further details.

C02.08 Unmanned land / sea / air vehicles
No further details.

C02.09 Lighter-than-air platforms
No further details.

C02.10 Communications satellites
No further details.

C02.11 Surveillance and navigation satellites
No further details.

C02.12 Other satellites
No further details.

C02.13 Space launchers
No further details.

C02.14 Fighting sea surface platforms
No further details.

C02.15 Logistic and support sea surface platforms
No further details.

C03 Weapons

No further details.

C03.01 – *Not in use*

C03.02 - *Not in use*

C03.03 - Mines - Land
No further details.

C03.04 - *Not in use*

C03.05 - Missiles - Anti Air
No further details.

C03.06 - Missiles - Anti Surface (Sea)
No further details.

C03.07 - Gun Systems - Platform Mounted
No further details.

C03.08 - Gun Systems - Hand Held
No further details.

C03.09 - Directed Energy Weapons
No further details.

C03.11 - *Not in use*

C03.10 - Non-Lethal Weapons
No further details.

C03.12 - Mines - Sea
No further details.

C03.13 - Missiles - Anti Ground (Land)
No further details.

C03.14 - Torpedoes - Anti Surface
No further details.

C03.15 - Torpedoes - Anti Submarine
No further details.

C04 Installations and Facilities

No further details.

C04.01 Ground stations
No further details.

C04.02 Fortifications / defences
No further details.

C04.03 Battlefield engineering
No further details.

C04.04 T&E facilities
No further details.

C04.05 Site decontamination
No further details.

C05 Equipped Personnel

No further details.

C05.01 Equipped men
No further details.

C05.02 Recruitment, selection and allocation
No further details.

C05.03 Training and education
No further details.

C05.04 Health and well-being
No further details.

C06 Miscellaneous Defence Functions and Policy Support

No further details.

C06.01 *Not in use*

C06.02 International Security
No further details.

C06.03 No longer in use
No further details.

C06.04 Equipment disposal
No further details.

C06.05 Non-proliferation
No further details.

C06.06 Hazard assessment
No further details.

C06.07 *Not in use*

C06.08 Logistics
No further details.

C06.09 Counter stealth
No further details.

C07 Battlespace Information

No further details.

C07.01 Information infrastructure
No further details.

C07.02 Information Warfare
No further details.

C07.03 Command & Control
No further details.

C07.04 Digitization of the battlespace
No further details.

C07.05 ISTAR (= Intelligence, Surveillance, Target Acquisition & Reconnaissance)
No further details.

C07.06 Military intelligence
No further details.

C08 Business Process

No further details.

C08.01 Requirements capture
No further details.

C08.02 Concepts and product definition
No further details.

C08.03 Product supportability
No further details.

C08.04 Whole-life cycle improvement
No further details.

C08.05 Business process simulation
No further details.

C08.06 Benchmarking and Best Practice
No further details.

C08.07 Lean enterprise models
No further details.

C08.08 R&T management
No further details.

C08.09 Design in the extended enterprise
No further details.

C08.10 Procurement and contracting processes
No further details.

(Some Technology Taxonomy Numbers are not in use.)