



**Vizyon 2023 Projesi  
Savunma, Havacılık ve Uzay Paneli**

**PANEL RAPORU**

**EK-2**

**(Kritik Teknoloji Listesi Oluşturma Yönünde Yapılan Çalışmalar)**

TÜBİTAK  
Temmuz 2003  
ANKARA

## 1 İngiliz Savunma Bakanlığı Teknoloji Sınıflaması

Aşağıda, İngiliz Savunma Bakanlığı'na bağlı DDA<sup>1</sup> (Defence Diversification Agency) tarafından hazırlanan ve bir çok NATO ülkesi tarafından da adapte edilen "Teknoloji Sınıflaması" verilmiştir.

Teknolojik Faaliyet Konusu	Alt Konu Başlıkları
Defence Analysis	<ul style="list-style-type: none"> <li>• Policy, Force Development and Balance of Investment Studies</li> <li>• Combined Operational Effectiveness and Investment Appraisals</li> <li>• Platform and System Concept Studies</li> <li>• Requirement Definition Studies</li> <li>• Scenario Generation</li> <li>• Tactical Development and Support to Operations and Training</li> <li>• Other Effectiveness and Performance Studies</li> <li>• Military Doctrine Analysis</li> <li>• Wargaming &amp; Combat Simulation</li> </ul>
Integrated Platforms	<ul style="list-style-type: none"> <li>• Undersea Platforms</li> <li>• Fighting Land Vehicles</li> <li>• Logistic, Command and Surveillance Land Vehicles</li> <li>• Combat Aircraft</li> <li>• Logistic, Support and Surveillance Aircraft</li> <li>• Helicopters</li> <li>• Unmanned Land/Sea/Air Vehicles</li> <li>• Lighter-than-Air Platforms</li> <li>• Communications Satellites</li> <li>• Surveillance and Navigation Satellites</li> <li>• Other Satellites</li> <li>• Space Launchers</li> <li>• Fighting Sea Surface Platforms</li> <li>• Logistic and Support Sea Surface Platforms</li> </ul>
Weapons	<ul style="list-style-type: none"> <li>• Mines - Land</li> <li>• Missiles - Anti Air</li> <li>• Missiles - Anti Surface (Sea)</li> <li>• Gun Systems - Platform Mounted</li> <li>• Gun Systems - Hand Held</li> <li>• Directed Energy Weapons</li> <li>• Non-Lethal Weapons</li> <li>• Sea</li> <li>• Anti Ground (Land)</li> <li>• Anti Surface</li> <li>• Anti Submarine</li> </ul>

Installations and Facilities	<ul style="list-style-type: none"> <li>• Ground Stations</li> <li>• Fortifications/Defences</li> <li>• Battlefield Engineering</li> <li>• T&amp;E Facilities</li> <li>• Site Decontamination</li> </ul>
Equipped Personnel	<ul style="list-style-type: none"> <li>• Equipped Men</li> <li>• Recruitment, Selection and Allocation</li> <li>• Training &amp; Education</li> <li>• Health &amp; Well-Being</li> </ul>
Miscellaneous Defence Functions and Policy Support	<ul style="list-style-type: none"> <li>• IS &amp; COIN</li> <li>• Equipment Disposal &amp; Environmental Protection</li> <li>• Non Proliferation</li> <li>• Hazard Assessment</li> <li>• Logistics</li> <li>• Counter Stealth</li> </ul>
Battlespace Information	<ul style="list-style-type: none"> <li>• Information Infrastructure</li> <li>• Information Warfare</li> <li>• Command &amp; Control</li> <li>• Digitization of the Battlespace</li> <li>• ISTAR</li> <li>• Military Intelligence</li> </ul>
Business Processes	<ul style="list-style-type: none"> <li>• Requirements Capture</li> <li>• Concepts &amp; Product Definition</li> <li>• Product Supportability</li> <li>• Whole Life Cycle Improvement</li> <li>• Business Process Simulation</li> <li>• Benchmarking &amp; Best Practice</li> <li>• Lean Enterprise Models</li> <li>• R&amp;T Management</li> <li>• Design in the Extended Enterprise</li> <li>• Procurement &amp; Contracting Processes</li> </ul>

#### Sistem Teknoloji Alanları

Teknoloji Alanı	Alt Teknoloji Alanları
Munitions	<ul style="list-style-type: none"> <li>• Warheads</li> <li>• Penetrators</li> <li>• Battle Damage Reduction Techniques</li> <li>• Explosive Ordnance Disposal</li> <li>• Mine Detection and Clearance</li> <li>• Armour Systems</li> </ul>

	<ul style="list-style-type: none"> <li>• Defensive Aids Suite</li> <li>• Other Platform Protection Measures</li> </ul>
Propulsion and Powerplants	<ul style="list-style-type: none"> <li>• Gas Turbines</li> <li>• Reciprocating &amp; Rotary IC. Engines</li> <li>• Rocket Engines &amp; Ramjets</li> <li>• Gun &amp; Launch Tube Propulsion</li> <li>• Electric Propulsion - Rotary &amp; Linear</li> <li>• Transmissions/ Powertrains</li> <li>• Ion Thrusters</li> <li>• Nuclear Propulsion</li> <li>• Final Drive - Air Propellers &amp; Rotors</li> <li>• Final Drive - Water Propulsors</li> <li>• Final Drive - Wheels &amp; Tracks</li> </ul>
Design Technologies for Platforms and Weapons	<ul style="list-style-type: none"> <li>• Aerodynamic Designs</li> <li>• Hydrodynamic Designs</li> <li>• Structural Designs</li> <li>• Mechanical Designs</li> <li>• Stealth Designs</li> <li>• Ballistic Designs</li> <li>• Thermal / Cryogenic Designs</li> <li>• Electrical &amp; Electronic Designs</li> <li>• Optical Designs</li> <li>• Acoustic Designs</li> <li>• Environmental Protection Designs</li> </ul>
Electronic Warfare and Directed Energy Technologies	<ul style="list-style-type: none"> <li>• DET - RF</li> <li>• DET - Lasers</li> <li>• DET - Other</li> <li>• ECM - RF</li> <li>• EOCM - IR/ Visible/ UV</li> <li>• ECM - Acoustic</li> <li>• ECM - Magnetic &amp; Electrical</li> <li>• ESM - Communications</li> <li>• ESM - Non-communications</li> <li>• EPM - RF</li> <li>• EOPM - IR/ Visible/ UV</li> <li>• EPM - Acoustic</li> <li>• EPM - Magnetic &amp; Electrical</li> </ul>
Signature Control and Signature Reduction	<ul style="list-style-type: none"> <li>• Radar Signatures</li> <li>• Laser Signatures</li> <li>• IR Signatures</li> <li>• Visible/UV Signatures</li> <li>• Acoustic Signatures</li> </ul>

	<ul style="list-style-type: none"> <li>• Electrical and Electrochemical Signatures</li> <li>• Magnetic Signatures</li> </ul>
Sensor Systems	<ul style="list-style-type: none"> <li>• RF Sensors/Antennas - Active</li> <li>• RF Sensors/Antennas - Passive</li> <li>• IR Sensors - Active</li> <li>• IR Sensors - Passive</li> <li>• Visible/UV wave Sensors</li> <li>• Acoustic Sensors - Active</li> <li>• Acoustic Sensors - Passive</li> <li>• Non-Acoustic Sensors -UW</li> <li>• Electrical &amp; Electro-Chemical Sensors</li> <li>• Magnetic Sensors</li> <li>• CB Sensor Systems</li> <li>• Explosive Detection Sensors</li> <li>• Microsensor Systems for Active Control of Structures</li> <li>• Motion Sensor Systems</li> <li>• Environmental Monitoring Systems</li> </ul>
Guidance and Control Systems for Weapons and Platforms	<ul style="list-style-type: none"> <li>• Navigation Systems</li> <li>• Weapon Guidance and Control Systems</li> <li>• Platform Guidance and Control Systems</li> <li>• Display Systems</li> <li>• Stores and Weapon Release/ Discharge</li> </ul>
Simulators, Trainers and Synthetic Environments	<ul style="list-style-type: none"> <li>• Skills Training Systems</li> <li>• Tactical/Crew Training Systems</li> <li>• Command &amp; Staff Training Systems</li> <li>• Virtual Reality</li> <li>• Synthetic Environments - Synthetic Force Generation</li> <li>• Synthetic Environments - Natural Environment Generation</li> <li>• Synthetic Environments - Management Systems</li> </ul>
Integrated Systems Technology	<ul style="list-style-type: none"> <li>• Systems Engineering and Integrated Systems Design</li> <li>• Interoperability Standards</li> <li>• Radiation Hardening</li> <li>• Robotics/ Automation in Operational Systems</li> <li>• Reliability and Maintainability of Systems</li> <li>• Health Monitoring Systems</li> <li>• Safety Systems</li> <li>• System Repair Technology</li> <li>• Electro-Magnetic Compatibility</li> <li>• In-Service Data Capture Systems</li> <li>• Integrated Systems Testing &amp; Evaluation</li> <li>• Middleware Systems</li> </ul>
Communications and CIS-	<ul style="list-style-type: none"> <li>• Communications Systems - below microwave frequencies</li> </ul>

Related Technologies	<ul style="list-style-type: none"> <li>• Communications Systems - micro &amp; mm wave</li> <li>• Communications Technology - IR/ Visible/ UV</li> <li>• Communications Technology - Acoustic</li> <li>• Communications and CIS Security Systems</li> <li>• Command and Information Systems Integration</li> <li>• Non-Co-operative Target Recognition</li> <li>• Geographic Information Systems</li> <li>• Optimisation, Planning &amp; Decision Support Systems</li> <li>• Infrastructure to Support Information Management and Dissemination</li> <li>• Network Management Systems</li> <li>• Air Traffic Control Systems</li> </ul>
Personnel Protection Systems	<ul style="list-style-type: none"> <li>• Physical Protection Systems - Threat</li> <li>• Physical Protection Systems - Environment</li> <li>• CB &amp; N Protection - Physical</li> <li>• CB &amp; N Countermeasures – Medical</li> </ul>
Manufacturing Processes/Design Tools/Techniques	<ul style="list-style-type: none"> <li>• Design for Improved Reliability &amp; Maintainability</li> <li>• Cost Engineering</li> <li>• Concurrent Engineering and Reduced Design Cycle</li> <li>• Advanced Prototyping</li> <li>• Techniques &amp; Systems for Production Manufacturing</li> <li>• Project Management &amp; Control</li> <li>• Manufacturing Process Simulation</li> <li>• Lean Manufacturing</li> <li>• Process Control Technology</li> <li>• Environmentally Friendly Factory Processes</li> <li>• Knowledge Based Engineering</li> </ul>

**Temel Teknoloji Alanları**

<b>Teknoloji Alanı</b>	<b>Alt Teknoloji Alanları</b>
Structural & Smart Materials & Structural Mechanics	<ul style="list-style-type: none"> <li>• Metals &amp; Metal Matrix Composite Technology</li> <li>• Ceramic, CMCs and Glass Technology</li> <li>• Polymers &amp; Polymer Matrix Composite Technology</li> <li>• Structural Materials processing - Joining Technology</li> <li>• Structural Materials Processing - Surface Protection Technology</li> <li>• Non-Destructive Evaluation &amp; Life Extension of Structural Materials</li> <li>• Corrosion and Wear Control Technology</li> <li>• Structural Mechanics</li> <li>• Structural Materials Processing - Forming</li> <li>• Structural Materials Processing - Material Removal</li> </ul>

	<ul style="list-style-type: none"> <li>• Smart/Functional Materials for Structural Uses</li> </ul>
Signature Related Materials	<ul style="list-style-type: none"> <li>• Acoustic &amp; Vibration Absorbing Materials</li> <li>• IR Signature Control Materials</li> <li>• Radar Absorbing Materials and Coatings</li> <li>• Structural Radar Absorbing Materials</li> </ul>
Electronic Materials Technology	<ul style="list-style-type: none"> <li>• Silicon - based materials</li> <li>• III-V Compounds</li> <li>• Other Semiconducting Materials</li> <li>• Insulating &amp; Dielectric Materials</li> <li>• Carbon-based Materials</li> <li>• Superconducting Materials</li> <li>• Magnetic Materials</li> </ul>
Photonic/Optical Materials & Device Technology	<ul style="list-style-type: none"> <li>• Optical Materials &amp; Devices</li> <li>• IR/Visible/UV Detector Materials &amp; Devices</li> <li>• Non-Linear Optical Materials &amp; Devices</li> <li>• Display Materials &amp; Devices</li> <li>• Lasers -all types</li> <li>• Non-Laser Devices</li> <li>• Transparent Materials</li> <li>•</li> </ul>
Electronic, Electrical & Electromechanical Device Technology	<ul style="list-style-type: none"> <li>• Device Concepts and Fabrication</li> <li>• Device Packaging</li> <li>• Device Integration/Reliability</li> <li>• Electrical Batteries</li> <li>• Electrical Fuel Cells</li> <li>• Solar Cells</li> <li>• RF Power Sources &amp; Devices</li> <li>• Acoustic Power Sources &amp; Devices</li> <li>• Other Electrical Power Sources &amp; Devices</li> <li>• Electric Motors</li> <li>• Inertial/Gravitational Devices</li> </ul>
Energetic Materials and Plasma Technology	<ul style="list-style-type: none"> <li>• Propellants</li> <li>• Conventional Fuels</li> <li>• Explosives</li> <li>• Pyrotechnics</li> <li>• Plasma Techniques</li> <li>• Explosives Detection Techniques</li> </ul>
Chemical, Biological & Medical Materials	<ul style="list-style-type: none"> <li>• Chemical Agent Defence, Precursors &amp; Related Materials</li> <li>• Biological Agent Defence, Precursors &amp; Related Materials</li> <li>• Mid-Spectrum Agent Defence</li> <li>• Chemical &amp; Biological Detection Techniques</li> </ul>

	<ul style="list-style-type: none"> <li>• Chemical Research for non-CBD Applications</li> <li>• Medical Products and Materials</li> </ul>
Computing Technologies & Mathematical Techniques	<ul style="list-style-type: none"> <li>• Software Engineering</li> <li>• Protocol Technology</li> <li>• COTS Software Assessment</li> <li>• Architectures</li> <li>• High Integrity and Safety Critical Computing</li> <li>• Secure Computing Techniques</li> <li>• Encryption / Crypto Technologies</li> <li>• Mathematical Modelling Development</li> <li>• OA/OR Tools and Techniques</li> <li>• Software Verification and Accreditation Techniques</li> </ul>
Information and Signal Processing Technology	<ul style="list-style-type: none"> <li>• Data &amp; Information Management Technology</li> <li>• Digital Signal Processing Technology</li> <li>• Optical Signal Processing Technology</li> <li>• Image/Pattern Processing Technology</li> <li>• Speech &amp; Natural Language Processing Technology</li> <li>• Optimisation &amp; Decision Support Technology</li> <li>• Information &amp; Data Fusion Technology</li> <li>• Other Information Processing Technology</li> </ul>
Human Sciences	<ul style="list-style-type: none"> <li>• Human Information Processing</li> <li>• Military Human Resources</li> <li>• Teams, Organisations &amp; Cultures</li> <li>• Human Survivability, Protection &amp; Stress Effects</li> <li>• Individual &amp; Team Training</li> <li>• Human Factors Integration</li> <li>• Collective Training</li> <li>• Human Performance Enhancement</li> <li>• Surgical Techniques and Medical Procedures</li> <li>• Human Health Physics</li> <li>• Human Performance Monitoring Techniques</li> <li>• Human Factors in Manufacturing</li> </ul>
Operating Environment Technology	<ul style="list-style-type: none"> <li>• Oceanography</li> <li>• Terrain Science</li> <li>• Meteorology</li> <li>• Upper Atmosphere &amp; Space Environment</li> <li>• Acoustic Propagation in Air &amp; Water</li> <li>• Electromagnetic Propagation in Air &amp; Water</li> </ul>
Mechanical, Thermal & Fluid-Related Technologies & Devices	<ul style="list-style-type: none"> <li>• Mechanical /Hydraulic Technologies &amp; Devices</li> <li>• Lubrication Technology</li> <li>• Thermal &amp; Thermodynamic Technologies &amp; Devices</li> <li>• Fluid Mechanics - Phenomenological &amp; Experimental</li> </ul>



- Fluid Dynamics Techniques

## 2 ABD Savunma Bakanlığı Askeri Kritik Teknoloji Alanları<sup>2</sup>

### 2.1. Silah Sistemleri Teknolojileri

Teknoloji Alanı	Alt Teknoloji Alanları
1. AERONAUTICS SYSTEMS TECHNOLOGY	1.1 Aircraft, Fixed Wing 1.2 Gas Turbine Engines 1.3 Human (Crew) Systems Interfaces
2. ARMAMENTS AND ENERGETIC MATERIALS TECHNOLOGY	2.1 Ammunition, Small and Medium Caliber 2.2 Bombs, Warheads, and Large Caliber Projectiles 2.3 Energetic Materials 2.4 Fuzing, Safing, and Arming 2.5 Gun and Artillery Systems 2.6 Mines, Countermines, and Demolition Systems
3. CHEMICAL AND BIOLOGICAL SYSTEMS TECHNOLOGY	3.1 Chemical and Biological Defense Systems 3.2 Detection, Warning, and Identification
4. DIRECTED AND KINETIC ENERGY SYSTEMS TECHNOLOGY	4.1 Lasers, High Energy Chemical 4.2 Supporting Technologies for Directed Energy Weapons
5. ELECTRONICS TECHNOLOGY	5.1 Electronic Components 5.2 Electronic Materials 5.3 Fabrication Equipment 5.4 General Purpose Electronic Equipment 5.5 Microelectronics 5.6 Opto-Electronics
6. GROUND SYSTEMS TECHNOLOGY	6.1 Advanced Diesel Engines 6.2 Vetronics
7. GUIDANCE, NAVIGATION, AND VEHICLE CONTROL TECHNOLOGY	7.1 Aircraft and Vehicle Control Systems 7.2 Inertial Navigation Systems and Related Components 7.3 Radio Data-Based Referenced Navigation Systems
8. INFORMATION SYSTEMS TECHNOLOGY	8.1 Command, Control, Communications, Computing, Intelligence, and Information Systems (C4I2) 8.2 Computer-Aided Design and Computer-Aided Manufacturing (CAD/CAM) 8.3 High-Performance Computing 8.4 Human Systems Interface

	<p>8.5 Information Security</p> <p>8.6 Intelligent Systems</p> <p>8.7 Modeling and Simulation</p> <p>8.8 Networks and Switching</p> <p>8.9 Signal Processing</p> <p>8.10 Software</p> <p>8.11 Transmission Systems</p>
9. INFORMATION WARFARE TECHNOLOGY	<p>9.1 Electronic Attack</p> <p>9.2 Electronic Protection</p> <p>9.3 Optical Countermeasures</p> <p>9.4 Optical Counter-Countermeasures</p>
10. MANUFACTURING AND FABRICATION TECHNOLOGY	<p>10.1 Advanced Fabrication and Processing</p> <p>10.2 Bearings</p> <p>10.3 Metrology</p> <p>10.4 Non-Destructive Inspection Equipment</p> <p>10.5 Production Equipment</p> <p>10.6 Robotics</p>
11. MATERIALS TECHNOLOGY	<p>11.1 Armor and Anti-Armor Materials</p> <p>11.2 Electrical Materials</p> <p>11.3 Magnetic Materials</p> <p>11.4 Optical Materials</p> <p>11.5 Structural Materials (High-Strength and High-Temperature)</p> <p>11.6 Special Function Materials</p>
12. MARINE SYSTEMS TECHNOLOGY	<p>12.1 Propulsors and Propulsion Systems</p> <p>12.2 Marine Signature Control and Survivability</p> <p>12.3 Subsurface and Deep Submergence Vehicles</p>
13. NUCLEAR SYSTEMS TECHNOLOGY	<p>13.1 Fissions Reactors</p> <p>13.2 Nuclear Materials Processing</p> <p>13.3 Nuclear Weapons</p>
14. POWER SYSTEMS TECHNOLOGY	<p>14.1 High Density Conventional Systems</p> <p>14.2 Mobile Electric Platform Power</p> <p>14.3 Pulsed and High Power Systems</p>
15. SENSORS AND LASERS TECHNOLOGY	<p>15.1 Acoustic Sensors, Air and Terrestrial Platforms</p> <p>15.2 Acoustic Sensors, Marine, Active Sonar</p> <p>15.3 Acoustic Sensors, Marine, Passive Sonar</p> <p>15.4 Acoustic Sensors, Marine Platform</p> <p>15.5 Electro-Optical Sensors</p>

	<p>15.6 Gravity Meters and Gravity Gradiometers</p> <p>15.7 Lasers</p> <p>15.8 Magnetometers and Magnetic Gradiometers</p> <p>15.9 Obscurants</p> <p>15.10 Radar</p>
16. SIGNATURE CONTROL TECHNOLOGY	
17. SPACE SYSTEMS TECHNOLOGY	<p>17.1 Electronics and Computers</p> <p>17.2 Optronics</p> <p>17.3 Power and Thermal Management</p> <p>17.4 Propulsion for Space Systems</p> <p>17.5 Sensors for Space Systems</p>
18. WEAPONS EFFECTS AND COUNTERMEASURES TECHNOLOGY	18.1 Induced Shock Waves From Penetrating Weapons

## 2.2. Gelişmekte Olan Kritik Teknolojiler

<b>Teknoloji Alanı</b>	<b>Alt Teknoloji Alanları</b>
1. AERONAUTICS TECHNOLOGY	<p>1.1 Aerodynamics</p> <p>1.2 Aeronautical Propulsion</p> <p>1.3 Aeronautical Structures</p> <p>1.4 Aeronautical Vehicle Control</p> <p>1.5 Aeronautical Subsystems and Components</p> <p>1.6 Aeronautical Design and Systems Integration</p>
2. ARMAMENTS AND ENERGETIC MATERIALS TECHNOLOGY	<p>2.1 Small- and Medium-Caliber Weapon Systems</p> <p>2.2 Tactical Propulsion</p> <p>2.3 Safing, Arming, Fuzing, and Firing (SAFF)</p> <p>2.4 Guns, Artillery, and Other Launch Systems</p> <p>2.5 Guidance and Control</p> <p>2.6 Battlespace Environment</p> <p>2.7 Warhead Technologies</p> <p>2.8 Lethality and Vulnerability</p> <p>2.9 Energetic Materials</p> <p>2.10 Mines</p> <p>2.11 Missile Systems</p> <p>2.12 Survivability, Armor, and Warhead Defeat Systems</p> <p>2.13 Nonlethal Weapons (NLWs)</p>

3. BIOLOGICAL TECHNOLOGY	<p>3.1 Human Performance Enhancement</p> <p>3.2 Biological Sensors</p> <p>3.3 Biomaterials and Nanofabrication</p> <p>3.4 Individual and Group Protection</p>
4. BIOMEDICAL TECHNOLOGY	<p>4.1 Etiological Factors</p> <p>4.2 Defeat or Management of Biological and Chemical Attack</p> <p>4.3 Management of Trauma, Stress, and Treatment</p> <p>4.4 Tactical Medical Command and Control</p>
5. CHEMICAL TECHNOLOGY	<p>5.1 Chemical Defense Systems</p> <p>5.2 Chemical Dissemination and Dispersion</p> <p>5.3 Chemical Material Production</p> <p>5.4 Chemical Detection, Warning, and Identification</p> <p>5.5 Obscurants</p>
6. DIRECTED ENERGY (DE) AND KINETIC ENERGY (KE) SYSTEMS TECHNOLOGY	<p>6.1 Charged Particle Beams (CPBs)</p> <p>6.2 Neutral Particle Beams (NPBs)</p> <p>6.3 Antimatter Particle Beams (APBs)</p> <p>6.4 Gamma-Ray Lasers</p> <p>6.5 Kinetic Energy Weapon (KEW) Systems</p> <p>6.6 High Power Microwave/Radio Frequency (HPM/RF)</p>
7. ENERGY SYSTEMS	<p>7.1 Energy Conversion and Power Generation</p> <p>7.2 Energy Storage</p> <p>7.3 Power Conditioning</p> <p>7.4 Biological Energy Systems</p>
8. ELECTRONICS TECHNOLOGY	<p>8.1 Electronic Components/Microwave Tubes</p> <p>8.2 Electronic Materials</p> <p>8.3 Electronic Fabrication</p> <p>8.4 Microelectronics</p> <p>8.5 Nanoelectronics</p>
9. GROUND SYSTEMS TECHNOLOGY	
10. INFORMATION TECHNOLOGY	<p>10.1 Information Communications</p> <p>10.2 Information Exchange</p> <p>10.3 Information Processing</p> <p>10.4 Information Security</p> <p>10.5 Information Management and Control</p> <p>10.6 Information Systems Facilities</p> <p>10.7 Information Sensing</p> <p>10.8 Information Visualization and Representation</p>

	10.9 Modeling and Simulation
11. LASERS AND OPTICS	11.1 Lasers 11.2 Optics 11.3 Optical Materials and Processes 11.4 Supporting Technologies and Applications 11.5 Optoelectronics and Photonics Technology
12. MANUFACTURING AND FABRICATION TECHNOLOGY	12.1 Advanced Fabrication and Processing 12.2 Bearings 12.3 Metrology 12.4 Non-Destructive Inspection and Evaluation 12.5 Production Equipment 12.6 Robotics
13. MARINE SYSTEMS TECHNOLOGY	13.1 Ocean Salvage 13.2 Propulsion 13.3 Signature Control and Survivability 13.4 Undersea Vehicles 13.5 Advanced Hull Forms 13.6 Human Systems Integration
14. MATERIALS AND PROCESSING TECHNOLOGY	14.1 Armor and Anti-armor Materials 14.2 Electrical Materials 14.3 Structural Materials (High Strength and High Temperature) 14.4 Special Function Materials 14.5 Smart Materials and Structures 14.6 Micromachined Materials and Structures [including Microelectromechanical Systems (MEMS)] 14.7 Magnetic Materials
15. NUCLEAR TECHNOLOGY	
16. POSITIONING, NAVIGATION, AND TIME TECHNOLOGY	16.1 Inertial Navigation Systems and Related Components 16.2 Gravity Meters and Gravity Gradiometers 16.3 Radio and Data-Based Referenced Navigation Systems 16.4 Magnetometers and Magnetic Gradiometers 16.5 Precise Time and Frequency (PT&F) 16.6 Situational Awareness/Combat Identification
17. SENSORS TECHNOLOGY	17.1 Acoustic Sensors, Terrestrial Platform 17.2 Acoustic Sensors, Marine, Active Sonar 17.3 Acoustic Sensors, Marine, Passive Sonar 17.4 Acoustic Sensors, Marine Platform

	17.5 Electro-optical Sensors 17.6 Radar 17.7 Land Mine Countermeasures 17.8 Sea and Littoral Region Mine Countermeasures
18. SIGNATURE CONTROL TECHNOLOGY .	
19. SPACE SYSTEMS TECHNOLOGY .	
20. WEAPONS EFFECTS TECHNOLOGY	

### 2.3. ABD Savunma Bakanlığı Savunma Teknoloji Alanları Planı<sup>3</sup>

Teknoloji Konusu	Teknoloji Alanları
AIR PLATFORMS	Advanced Aerodynamic Concepts for Increased Flight Efficiency Fixed-Wing Vehicle Structures Technology Aircraft Support/Sustainment Reduction Flight Control Technology for Affordable Global Reach/Power Maturity Demonstration of Advanced Air Platform Technologies Helicopter Active Control Technology Demonstration of Advanced Rotor Concepts Fighter/Attack/Strike Propulsion Transport/Patrol/Helicopter Propulsion Cruise Missile/Expendable Propulsion Aircraft Power (MEA) Rotorcraft Drive Affordable/Supportable Fixed-Wing Vehicle Subsystems Technology Rotary-Wing Structures Technology Rotary-Wing Affordable/Supportable Subsystems Technologies Rotary-Wing Signature Reduction Technologies Hydrocarbon Scramjet Missile Propulsion Improved JP-8 Fuel High Heat Sink Fuels (JP-900/Endothermic)
CHEMICAL/BIOLOGICAL DEFENSE AND NUCLEAR	Joint Warning and Reporting Network Advanced Lightweight Chemical Protection Laser Standoff Chemical Detection Technology Advanced Adsorbents for Protection Applications Enzymatic Decontamination Nuclear Hardness and Survivability Testing Technologies

	<p>Electronic System Radiation Hardening  Hard-Target Defeat  Prediction and Mitigation of Collateral Hazards  Balanced Electromagnetic Hardening Technology  Enhanced Respirator Filtration Technology</p>
<p>INFORMATION SYSTEMS  TECHNOLOGY</p>	<p>Consistent Battlespace Understanding  Forecasting, Planning, and Resource Allocation  Integrated Force and Execution Management  Simulation Interconnection  Simulation Information Technologies  Simulation Representation  Simulation Interfaces  Assured Distributed Environment Support  Defensive Information Warfare  Universal Transaction Communications  Assured Communications  Network Management  Digital Warfighting Communications  Multimode, Multiband Information System  Intelligent Information Technology  Software Technology for High-Performance Computing  Advanced Embedded Software/System Engineering Technology  Intelligent Control  Information Presentation and Interaction  Embedded High-Performance Computing  Joint Force Air Component Command Battle Management Program  Antenna Technologies  Individual Combatant and Small-Unit Operations Simulation  Advanced Logistics Program</p>
<p>GROUND AND SEA  VEHICLES</p>	<p>Future Scout and Cavalry System  Future Combat System  Ground Vehicle Electronic Systems  Advanced Ground Vehicle Mobility Systems  Ground Vehicle Chassis and Turret Technologies  Surface Ship Integrated Topside Concepts  Surface Ship Advanced Electrical Power System  Surface Ship Automation  Submarine Advanced Machinery Truss Support System</p>

	<p>Submarine Signature Control</p> <p>Submarine Electric Drive System</p> <p>Mission-Reconfigurable Unmanned Undersea Vehicle</p>
MATERIALS/PROCESSES	<p>Laser Eye Protection</p> <p>Plasma Arc Shipboard Waste Destruction System ATD</p> <p>Materials and Processes for Integrated High-Performance Turbine Engine Technology</p> <p>Nondestructive Evaluation for System Life</p> <p>Materials and Processes for Reentry Vehicle Technology</p> <p>Protective Materials for Combatant and Combat Systems Against Conventional Weapons</p> <p>Computing and Signal Processing Materials for Use in High-Temperature Shock and Radiation Environments</p> <p>Materials and Processes for Metal Cleaning, Corrosion Control and Coatings</p> <p>Affordable Sustainment of Aging Aircraft Systems</p> <p>Affordable Multimissile Manufacturing ATD</p> <p>Producibile Designs for Affordable Force Modernization</p> <p>Interferometric Fiber Optic Gyro Flexible Manufacturing ATD</p> <p>Higher Sea State Logistics Support for Expeditionary Forces</p> <p>D-Day Fuel Support for Expeditionary Forces</p> <p>Wartime Contingencies and Bare Airbase Operations</p> <p>Firefighting Capabilities for the Protection of Weapon Systems</p> <p>Hazardous and Toxic Waste Treatment/Destruction for DoD Operations</p> <p>Airfields and Pavements To Support Force Projection</p> <p>Cleanup of Contaminants</p> <p>Life-Extension Capabilities for the Navy's Aging Waterfront Infrastructure</p> <p>Capable Electronics Manufacturing Processes</p> <p>Capable Metals Manufacturing Processes</p> <p>Capable Composites Manufacturing Processes</p> <p>Affordable, Short-Lead-Time Parts Production and Repair</p> <p>Missile Defense</p>
BIOMEDICAL	<p>Sustained Operations Enhancement Ensemble</p> <p>Vaccines for Prevention of Malaria</p> <p>Far-Forward Assessment and Treatment for Blood Loss;</p> <p>Development of Blood Products and Resuscitation Fluids</p>



	<p>Medical Countermeasures for Botulinum Toxin          Chemical Agent Prophylaxes          Prevention of Diarrheal Diseases          Medical Countermeasures for Vesicant Agents          Laser Bioeffects Countermeasures          Advanced Medical Technology-Advanced Field Medical Support in Forward Combat Areas          Toxic Hazards Evaluation Tools          Far-Forward Assessment, Treatment, and Management of Combat Trauma and Severe Hemorrhage and Sequelae          Antiparasitic Drug Program          Medical Countermeasures for Staphylococcal Enterotoxin B          Medical Countermeasures for Yersinia pestis          Medical Countermeasures for Encephalomyelitis Viruses</p>
<p>SENSORS, ELECTRONICS          AND BATTLESPACE          ENVIRONMENT</p>	<p>Low-Cost Electronically Scanned Antennas          Foliage Penetration Detection Algorithm Demonstration          Enhanced Moving Target Detection Development          High-Frequency Surface Wave Radar Shipboard Demonstration          Automatic Radar Periscope Detection and Discrimination          Multifunction Electro-Optical Sensors and Signal Processing          Advanced Pilotage          Advanced Infrared Search and Track Systems          Multifunction Laser          Lightweight, Broadband, Variable-Depth Sonar          Multistatic Active ASW          Affordable High-Performance Towed Arrays          Affordable ATR via Rapid Design, Evaluation, and Simulation          ATR for Reconnaissance and Surveillance          Integrated Platform Avionics Demonstration          Advanced Common Electronic Modules          Millimeter-Wave Power Modules          Microwave SiC High-Power Amplifiers          Low-Power Radio Frequency Electronics          Design Technology for Radio Frequency Front Ends          Advanced Focal Plane Array Technology          Optical Processing and Memory          Photonics for Control and Processing of Radio Frequency Signals          High-Density Radiation-Resistant Microelectronics</p>

	<p>Microelectromechanical Systems  Wide-Bandgap Electronic Materials Technology  Energy Conversion/Power Generation  Power Control and Distribution  Forecast of Littoral Currents and Waves  Autonomous Ocean Sampling Network: Mapping of Ocean Fields  Weather/Atmospheric Impacts on Sensor Systems  On-Scene Weather Sensing and Prediction Capability  Space Radiation Mitigation for Satellite Operations  Satellite Infrared Surveillance Systems Backgrounds  Analog-to-Digital Converter</p>
SPACE PLATFORMS	<p>Cryogenic Technologies  Thermal Management Technology  Space Structures and Control  Large Precise Structures  Space Power System Technologies  Satellite Control  Boost Propulsion (ET)  Orbit Transfer Propulsion AT  Tactical Rocket Propulsion AT  Protection Technologies  Threat Warning and Attack Reporting  Technology for the Sustainment of Strategic Systems</p>
HUMAN SYSTEMS	<p>Advanced Aircrew Escape  Advanced Hybrid Oxygen System  Aircrew Distributed Mission Training Technology  Authoring Tools for Adaptive Training Systems  Ballistic Protection for Individual Survivability  Cognitive Engineering for Battlespace Dominance  Crew Station Integration Demonstrations  Crew System Engineering Design Tools  Development of Advanced Embedded Training Concepts for Shipboard Systems  Force XXI Land Warrior  Force XXI Training Strategies  Helmet-Mounted Sensory Ensemble  Human-Centered Automation Testbed  Human Performance Metrics for Theater Missile Defense</p>

	<p>Integrated Personnel Management Technologies  Interactive Multisensor Analysis Training Technology  Night Vision Goggle Technology  Precision Offset, High-Glide Aerial Delivery of Munitions, Equipment, and Personnel  Rotorcraft Pilot's Associate  Warfighter System Modeling  Weapon System Decision Support</p>
WEAPONS	<p>Land Mines  Airborne Lasers for Theater Missile Defense  Future Missile Technology Integration Program  Ground-Based Laser Antisatellite System  Antijam GPS Flight Test  Counteractive Protection System  Hammerhead  Direct Fire Lethality  Aircraft Self-Protect Missile Countermeasures  Fiber Optic Gyro-Based Navigation Systems  High-Power Microwave C2W/IW Technology  Modern Network Command and Control Warfare Technology  Multimode Airframe Technology Demonstration  Concurrently Engineered Ball-Joint Gimbal Imagery Seeker  Antitorpedo Torpedo ATD  Broadband Torpedo Sonar Demonstration  ETC and EM Armaments for Direct Fire  Objective Crew-Served Weapon Technology Demonstration  Air Superiority Missile Technology  Highly Responsive Missile Control  Tactical Missile Propulsion  Infrared Decoy Technology  Multimission Space-Based Laser  Laser Aircraft Self-Protect Missile Countermeasures  Advanced Multiband Infrared Countermeasures Laser Source Solution Technology  Sea Mines  Coherent RF Countermeasures Technology  Imaging Infrared Seeker Countermeasures Technology  Missile Warning Sensor Technology</p>

	Compact Kinetic Energy Missile Small Diameter Antiair Infrared Seeker
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<b>DoD's Key Technology Areas</b>	
<b><i>The following is an outline of the Defense Technology Area Plan, February 2002.</i></b>	
<p><b>1. Air Platforms</b> -- Fixed-Wing Vehicles; Rotary-Wing Vehicles; Integrated High Performance Turbine Engine Technology (IHPTET); Aircraft Power; High-Speed Propulsion.</p> <p><b>2. Chemical / Biological Defense</b> -- CB Detection; CB Protection; CB Decontamination; CB Modeling and Simulation; Medical Chemical Defense; Medical Biological Defense.</p> <p><b>3. Information Systems Technology</b> -- Decision making; Modeling &amp; Simulation Technology; Information Assurance; Seamless Communication; Computing and Software Technology.</p> <p><b>4. Ground and Sea Vehicles</b> -- Ground Vehicles; Surface Ship Combatants; Submarines.</p> <p><b>5. Materials / Processes</b> -- Materials and Processes for Survivability, Life Extension, and Affordability; Manufacturing Technology; Civil Engineering; Environmental Quality.</p> <p><b>6. Biomedical</b> -- Infectious Diseases of Military Importance; Combat Casualty Care; Military Operational Medicine; Medical Radiological Defense.</p> <p><b>7. Sensors, Electronics and Battlespace Environment</b> -- Radar Sensors; Electro-Optical Sensors; Acoustic Sensors; Automatic Target Recognition; Integrated Platform Electronics; Radio-Frequency Components; Electro-Optical Technology; Microelectronics; Electronic Materials; Electronics Integration Technology; Terrestrial Environments; Ocean Battlespace Environments; Lower Atmosphere Environments; Space/Upper Atmosphere Environments; EW Threat Warning; EW Self-protection; EW Control.</p> <p><b>8. Space Platforms</b> -- Launch/Transfer Vehicles; Space Vehicles; Propulsion [Integrated High-Payoff Rocket Propulsion Technology (IHRPT)].</p> <p><b>9. Human Systems</b> -- Information Display and Performance Enhancement; Design Integration and Supportability; Warrior Protection and Sustainment; Personnel Performance and Training.</p> <p><b>10. Weapons</b> -- The Weapons area has two broad categories. 1) Conventional Weapons: Countermine/Mines; Guidance and Control; Guns; Missiles; Ordnance; Undersea Weapons; and Weapon Lethality / Vulnerability. 2) Directed-Energy Weapons: Lasers; and High-Power Microwave.</p> <p><b>11. Nuclear Technology</b> -- Warfighter Support; Systems Effects and Survivability; Test and Simulation Technology; Scientific and Operational Computing.</p> <p><b>12. Battleship Environments</b> -- Terrestrial Environments; Ocean Battleship Environments; Lower Atmosphere Environments; Space/Upper Atmosphere Environments.</p>	
<p>Note: The above information is a summary of the information contained in documents "DefenseTechnology Plan" (DTIC # A285415) and "Defense Science and Technology Strategy" (DTIC #A285414).</p>	

#### 2.4. ABD Savunma Bakanlığı Uzay Teknoloji Rehberi Kapsamındaki Teknolojiler<sup>4</sup>

Teknoloji Konusu	Teknoloji Alanı
Propulsion / Propellants	<ul style="list-style-type: none"> <li>– Advanced cryogenic</li> <li>– Full flow cycle</li> <li>– Advanced solid rocket motors (SRMs)</li> <li>– Combined-cycle (air-breathing engines +rocket)</li> <li>– Electric (Hall effect, ion, plasma thrusters)</li> <li>– Solar thermal/chemical</li> <li>– High-energetic, low-hazard, non-toxic, storable propellants</li> </ul>
Electric Power (Solar /	– Higher energy density and efficiency

Chemical / Mechanical; i.e., cells/ batteries/ flywheels)	<ul style="list-style-type: none"> <li>- Longer life, higher duty cycle</li> <li>- Lightweight, thermally stable</li> </ul>
Structures and Materials	<ul style="list-style-type: none"> <li>- Lightweight, high-strength composites and ceramics</li> <li>- Multi-functional, adaptive structures</li> <li>- Processing techniques</li> <li>- Vibration and thermal control</li> <li>- Thin films and environmentally protective coatings and insulation</li> </ul>
"Thinking" Satellites	<ul style="list-style-type: none"> <li>- Autonomous control</li> <li>- Self-assessment/correction</li> <li>- Threat detection</li> <li>- On-board supercomputing</li> <li>- On-orbit robotics</li> </ul>
More Precise Clocks / Time Sources	<ul style="list-style-type: none"> <li>- Laser/optical, atomic</li> </ul>
Communications	<ul style="list-style-type: none"> <li>- Lasercom</li> <li>- Wideband microwave/millimeter wave</li> </ul>
Antennas	<ul style="list-style-type: none"> <li>- Large, light, controllable, adaptive space-time</li> <li>- Higher frequency</li> <li>- Steerable beam phased arrays</li> <li>- Higher-efficiency amplifiers</li> </ul>
Synthetic Aperture Radar (SAR)	<ul style="list-style-type: none"> <li>- Large, light, high-power</li> <li>- Interferometric</li> </ul>
Electro-optic (EO) Sensors	<ul style="list-style-type: none"> <li>- Large, light, deployable, stable, adaptive optics</li> <li>- Multi-, hyper- and ultraspectral</li> <li>- Large-scale, high-quality focal plane arrays (FPAs)</li> <li>- Light, long-life, high-efficiency cryocoolers</li> <li>- Uncooled sensing materials</li> </ul>
Signal Processors (Transmitters / Receivers)	<ul style="list-style-type: none"> <li>- Higher signal-to-noise ratio</li> <li>- Higher density devices and circuitry</li> <li>- Higher efficiency analog-to-digital (A/D) conversion</li> <li>- Advanced encryption technologies</li> </ul>
Microelectromechanical Systems (MEMS) / Microelectronics / Photonics	<ul style="list-style-type: none"> <li>- Switches and actuators</li> <li>- Gyroscopes (e.g. fiber-optic gyros)</li> <li>- Inertial measurement units (IMUs)</li> <li>- Accelerometers</li> <li>- Non-volatile logic and memory</li> <li>- Opto-electronics</li> </ul>
Radiation Hardening	<ul style="list-style-type: none"> <li>- Techniques and components</li> <li>- Memory, processors, semiconductor materials</li> </ul>
Ground Processing	<ul style="list-style-type: none"> <li>- Data fusion</li> <li>- Advanced algorithms for processing and exploitation</li> </ul>

## 2.5. ABD Savunma Bakanlığı Birleşik Muharebe Bilim ve Teknoloji Planı<sup>5</sup>

Konu	Program
INFORMATION SUPERIORITY	<ul style="list-style-type: none"> <li>Robust Tactical/Mobile Networking</li> <li>Joint Power Projection/Real-Time Support (Navy)/Rapid Force Projection</li> <li>Initiative Command and Control TD (Army)</li> <li>Information Operations C2</li> <li>Integrated Collection Management</li> <li>Rapid Battlefield Visualization</li> </ul>

	<p>Battlefield Awareness and Data Dissemination          Semiautomated Imagery Processing          High-Altitude Endurance Unmanned Aerial Vehicle          Counter-Camouflage Concealment and Deception ATD          Information Security          Satellite C3I/Navigation Signals Propagation Technology          Tactical Unmanned Aerial Vehicle ACTD          Navigation Warfare ACTD          Joint Task Force ATD          Advanced Cooperative Collection Management          Extending the Littoral Battlespace (Sea Dragon) ACTD</p>
PRECISION FORCE	<p>Precision Rapid Counter Multiple Rocket Launcher ACTD          Rapid Force Projection Initiative ACTD          Precision Signals Intelligence Targeting Systems ACTD          Target Acquisition ATD          Air/Land Enhanced Reconnaissance and Targeting ATD          Joint Continuous Strike Environment (Proposed ACTD)          Arsenal Ship          Hunter Sensor Suite ATD          Precision-Guided Mortar Munitions ATD          Guided MLRS ATD          Enhanced Fiber Optic Guided Missile ATD          High-Mobility Artillery Rocket System          Intelligent Minefield ATD          Antimateriel Warhead Flight Test          Concentric Canister Launcher ATD          Low-Cost Missile ATD          Low-Cost Precision Kill          Cruise Missile Real-Time Retargeting ATD          Miniaturized Munition Technology Guided Flight Tests</p>
COMBAT IDENTIFICATION	<p>Battlefield Combat Identification ATD          Combat Identification ACTD          Advanced Identification ATD          Enhanced Recognition and Sensing Laser Radar ATD          Specific Emitter Identification ATD</p>
JOINT THEATER MISSILE DEFENSE	<p>Integrated Sensor/Data Fusion Demonstration          Discriminating Interceptor Technology Program</p>

	<p>Advanced X-Band Radar Demonstration</p> <p>Advanced Space Surveillance</p> <p>Atmospheric Interceptor Technology</p>
MILITARY OPERATIONS IN URBAN TERRAIN	<p>Small Unit Operations TD</p> <p>Military Operations in Urban Terrain ACTD</p> <p>Objective Individual Combat Weapon ATD</p> <p>Non-Lethal Weapons Technical Demonstration</p>
JOINT READINESS AND LOGISTICS	<p>Synthetic Theater of War ACTD</p> <p>Advanced Joint Planning ACTD</p> <p>Joint Training Readiness</p> <p>Joint Decision Support Tools (Joint Logistics ACTD, Phase II)</p> <p>Real-Time Focused Logistics (Joint Logistics ACTD, Phase III)</p> <p>Logistics Technologies for Flexible Contingency Deployments and Operations</p> <p>Advanced Amphibious Logistics and Seabasing for Expeditionary Force Operations ATD</p> <p>Joint Advanced Health and Usage Monitoring ACTD</p>
JOINT COUNTERMINE	<p>Mine Hunter/Killer ATD</p> <p>Vehicular Mounted Mine Detector ATD</p> <p>Joint Countermine ACTD</p> <p>Rapid Battlefield Mine Reconnaissance</p> <p>GRapid Sea Mine Neutralization</p> <p>Autonomous Shallow-Water Influence Sweeping</p> <p>In-Stride Amphibious Breaching</p> <p>Advanced Mine Reconnaissance/Minehunting Sensors</p> <p>Advanced Mine Detection Sensors</p> <p>Lightweight Airborne Multispectral Countermine Detection System</p>
ELECTRONIC COMBAT	<p>Multispectral Countermeasures ATD</p> <p>Miniature Air-Launched Decoy ACTD</p> <p>Large-Aircraft Infrared Countermeasures ATD</p> <p>HAdvanced Electronic Countermeasures Transmitter ATD</p> <p>Enhanced Situation Awareness Insertion ATD</p> <p>Onboard Electronic Countermeasures Upgrade ATD</p> <p>Sensor Fusion/Integrated Situation Assessment TD</p>
CHEMICAL/BIOLOGICAL WARFARE DEFENSE AND PROTECTION	<p>Biological Early Warning ACTD</p> <p>Airbase/Port Biological Detection ACTD</p> <p>Integrated Biodetection ATD</p>

	Chemical Add-On for the Airbase/Port Biological Detection ACTD
COUNTER WEAPONS OF MASS DESTRUCTION	Counterproliferation ACTD Wide-Area Tracking System ACTD

## 2.6. ABD Savunma Bakanlığı DARPA Programları<sup>6</sup>

Ofis	Program
Advanced Technology Office	Active Networks Airborne Communications Node (ACN) Buoyant Cable Array Antenna (BCAA) Center of Excellence for Research in Oceanographic Sciences (CEROS) Composable High Assurance Trusted Systems (CHATS) Cyber Panel Dynamic Coalitions Fault Tolerant Networks FCS Communications Friction Drag Reduction Program Information Assurance Operational Experimentation (IA OPX) Loki System Development Micro-Electronics and Bio Processes (MEB) Networking in Extreme Environments (NETEX) NeXt Generation Communications (XG) Optical Tags Robust Passive Sonar (RPS) Self Healing Minefield Small Unit Operations:Situational Awareness System (SUO SAS) Tactical Mobile Robotics Tera Hertz Operational Reachback (THOR) Totally Agile Sensor Systems (TASS) Vocorder Vortex Combustor Development Wolfpack
Defense Sciences Office	Accelerated Insertion of Materials Advanced Biomedical Technologies Advanced Ceramics Advanced Consequence Management



	<p>Advanced Diagnostics</p> <p>Advanced Energy Technologies</p> <p>Advanced Flexible Manufacturing</p> <p>Advanced Magnets for Power Systems (AMPS)</p> <p>Advanced Mathematical Algorithms for Signal and Image Processing</p> <p>Advanced Thermoelectric Materials and Devices</p> <p>Agile Manufacturing</p> <p>Air and Water Purification</p> <p>BIO: INFO: MICRO Program</p> <p>Bio-Magnetics Interfacing Concepts (BioMagnetICs)</p> <p>BioFlips</p> <p>Biological Input/Output Systems (BIOS)</p> <p>Biomolecular Motors</p> <p>Bio-Optic Synthetic Systems (BOSS)</p> <p>Biosensor Technologies</p> <p>Brain Machine Interfaces</p> <p>Compact Hybrid Actuators</p> <p>Continuous Assisted Performance (CAP)</p> <p>Controlled Biological and Biomimetic Systems</p> <p>Crystal Growth</p> <p>DARPA Initiative in Titanium</p> <p>Electroactive Polymers and Devices</p> <p>Energy Harvesting</p> <p>Engineered Bio-Molecular Nano-Devices/Systems (MOLDICE)</p> <p>Engineered Tissue Constructs</p> <p>Exoskeletons for Human Performance Augmentation</p> <p>Fast and Scalable Scientific Computation</p> <p>Frequency Agile Materials for Electronics (FAME)</p> <p>Integrated Sensing and Processing (ISP)</p> <p>Lithium Ion Batteries</p> <p>Magnetic Materials and Devices (Spintronics)</p> <p>Mesoscale Machines</p> <p>Mesoscopic Integrated Conformal Electronics (MICE)</p> <p>Metabolic Engineering</p> <p>Meta-Materials</p> <p>Mobile Electric Power</p> <p>Molecular Electronics</p> <p>Molecular Observation, Spectroscopy and Imaging using Cantilevers</p>
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	<p>(MOSAIC)</p> <p>Morphing Aircraft Structures (MAS)</p> <p>Optimal Portable Applications Libraries</p> <p>Palm Power</p> <p>Pathogen Genomic Sequencing</p> <p>Persistence in Combat (PIC)</p> <p>Personnel Protection</p> <p>Photovoltaics</p> <p>PiezoCrystals</p> <p>Portable Diagnostic Ultrasound</p> <p>Portable Power</p> <p>Quantum Information Science and Technology (QuIST)</p> <p>Rapid Design Exploration and Optimization (RaDEO)</p> <p>Simulation of Bio-Molecular Microsystems (SIMBIOSYS)</p> <p>Smart Materials and Structures Demonstrations</p> <p>Solid Freeform Fabrication</p> <p>SPINS (SPins IN Semiconductors)</p> <p>Structural Amorphous Metals (SAM)</p> <p>Synthetic Multifunctional Materials</p> <p>Thermal Barrier Coatings</p> <p>Thermal Management Diamond</p> <p>Thin Film Coatings</p> <p>Tissue-Based Biosensors</p> <p>Ultra-Lightweight Materials</p> <p>Ultra-Short Pulse, High-Irradiance Laser Diodes</p> <p>Unconventional Pathogen Countermeasures</p> <p>Virtual Electromagnetic Testrange</p> <p>Virtual Integrated Prototyping of Materials</p> <p>Water Harvesting</p>
<p>Information Awareness Office</p>	<p>Total Information Awareness (TIA) System</p> <p>Babylon</p> <p>Bio-Surveillance</p> <p>Communicator</p> <p>Effective, Affordable, Reusable Speech-to-Text (EARS)</p> <p>Evidence Extraction and Link Discovery (EELD)</p> <p>FutureMap</p> <p>Genisys</p> <p>Genoa</p>

	<p>Genoa II</p> <p>Human ID at a Distance (HumanID)</p> <p>Translingual Information Detection, Extraction and Summarization (TIDES)</p> <p>Wargaming the Asymmetric Environment (WAE)</p>
<p>Information Technology Processing Office</p>	<p>Augmented Cognition (AugCog)</p> <p>Bio-Computation (BIO-COMP)</p> <p>Control of Agent-Based Systems (CoABS)</p> <p>Cognitive Systems Exploratory Effort (CSEE)</p> <p>Data Intensive Systems (DIS)</p> <p>Dynamic Assembly for System Adaptability, Dependability, and Assurance (DASADA)</p> <p>High Productivity Computing Systems (HPCS)</p> <p>Mobile Autonomous Robot Software (MARS)</p> <p>Network Modeling and Simulation (NMS)</p> <p>Next Generation Internet (NGI)</p> <p>Organically Assured and Survivable Information Systems (OASIS)</p> <p>OASIS Integration, Demonstration and Validation (OASIS DEM/VAL)</p> <p>Polymorphous Computing Architectures (PCA)</p> <p>Power Aware Computing/Communication (PAC/C)</p> <p>Quantum Information Science and Technology (QuIST)</p> <p>Software for Distributed Robotics (SDR)</p> <p>Taskable Agent Software Kit (TASK)</p>
<p>Information Exploitation Office</p>	<p>Active Templates</p> <p>Advanced ISR Management</p> <p>Advanced Logistics Project</p> <p>Advanced Tactical Targeting Technology</p> <p>Affordable Moving Surface Target Engagement</p> <p>Autonomous Negotiating Teams</p> <p>Command Post of the Future</p> <p>Counter Camouflage Concealment and Deception</p> <p>DARPA Agent Mark Up Language</p> <p>Digital Radio Frequency Tags</p> <p>Dynamic Tactical Targeting</p> <p>Exploitation of 3-D Data</p> <p>Eye Ball</p> <p>FCS Command and Control</p> <p>High Resolution Rotocraft Radar</p>

	<p>Jigsaw</p> <p>Mixed Initiative Control of Automateams</p> <p>Model-Based Integration of Embedded Software</p> <p>Networked Embedded Software Technology</p> <p>Organic Ground Moving Target Indicator Radar</p> <p>Program Composition for Embedded Systems</p> <p>Rapid Knowledge Formation</p> <p>Real-Time Battle Damage Assessment</p> <p>Sensor Information Technology</p> <p>Software Enabled Control</p> <p>Standoff Precision ID in 3-D</p> <p>Tactical Sensors</p> <p>Tactical Targeting Network Technology</p> <p>UltraLog</p>
Microsystems Technology Office	<p>Advanced Lithography</p> <p>Distributed Robotics</p> <p>MEMS</p> <p>Semiconductor Based UV Light Sources</p> <p>Steered Agile Beams</p> <p>Photonic Device Technologies</p>
Special Projects Office	<p>Biosensor Systems</p> <p>TIGER Pathogen Detection Sensor</p> <p>Fieldable MALDI TOF BW Agent Sensor System</p> <p>Biosensor Technology</p> <p>Counter Underground Facilities (CUGF)</p> <p>Global Eye</p> <p>Global Positioning Experiments (GPX)</p> <p>Immune Building Program</p> <p>Innovative Space-Based Radar Antenna Technology (ISAT)</p> <p>Knowledge Aided Sensor Signal Processing and Expert Reasoning (KASSPER)</p> <p>Low Cost Cruise Missile Defense (LCCMD)</p> <p>Low Cost Tactical Imager (LCTI)</p> <p>Micro-Electromechanical Sensor (MEMS) Inertial Navigation System (INS) (MEMS INS)</p> <p>Micro-Electromechanical Sensor (MEMS) Antenna (MEM-tenna)</p> <p>Multifunction Electro-Optics for Defense of US Aircraft (MEDUSA)</p> <p>Reconfigurable Aperture Program (RECAP)</p>

	RF MEMS Improvement Program
Tactical Technology Office	<p>Unmanned Systems</p> <ul style="list-style-type: none"> <li>• Canard Rotor/Wing (CRW)</li> <li>• FCS A160</li> <li>• FCS OAV: Organic Air Vehicles</li> <li>• FCS PerceptOR</li> <li>• FCS UGCV: Unmanned Ground Combat Vehicle</li> <li>• Hummingbird Warrior</li> <li>• Unmanned Combat Armed Rotorcraft (UCAR)</li> <li>• Unmanned Combat Air Vehicle (UCAV)</li> <li>• UCAV - N</li> </ul> <p>Tactical Multipliers</p> <ul style="list-style-type: none"> <li>• Coherent Communications, Imaging and Targeting (CCIT)</li> <li>• Future Combat Systems (FCS)</li> <li>• FCS Net Fires</li> <li>• High Power Fiber Lasers (HPFL)</li> <li>• Hypersonic Flight (HyFly)</li> <li>• Joint Theater Logistics (JTL) Advanced Concept Technology Demonstration (ACTD)</li> <li>• Micro Adaptive Flow Control (MAFC)</li> <li>• Mission Specific Processing (MSP)</li> <li>• Quiet Supersonic Platform (QSP)</li> <li>• Reconnaissance, Surveillance and Targeting Vehicle (RST-V)</li> <li>• Small Scale Propulsion Systems (SSPS)</li> <li>• Supersonic MAL Interceptor (MALI)</li> </ul> <p>Space</p> <ul style="list-style-type: none"> <li>• Orbital Express Space Operations Architecture / ASTRO</li> <li>• Responsive Access, Small Cargo, Affordable Launch (RASCAL)</li> <li>• Space Surveillance Telescope (SST)</li> <li>• Water Rocket</li> </ul>

## 2.7. ABD Savunma Bakanlığı “Savunma Teknik Bilgi Merkezi” Teknoloji Sınıflaması<sup>7</sup>

- 01--Aviation Technology
- 02--Agriculture
- 03--Astronomy and Astrophysics
- 04--Atmospheric Sciences

- 05--Behavioral and Social Sciences
- 06--Biological and Medical Sciences
- 07--Chemistry
- 08--Earth Sciences and Oceanography
- 09--Electrotechnology and Fluidics
- 10--Power Production and Energy Conversion (Nonpropulsive)
- 11--Materials
- 12--Mathematical and Computer Sciences
- 13--Mechanical, Industrial, Civil and Marine Engineering
- 14--Test Equipment, Research Facilities and Reprography
- 15--Military Sciences
- 16--Guided Missile Technology
- 17--Navigation, Detection and Countermeasures
- 18--Nuclear Science and Technology
- 19--Ordnance
- 20--Physics
- 21--Propulsion, Engines and Fuels
- 22--Space Technology
- 23--Biotechnology
- 24--Environmental Pollution and Control
- 25--Communications

#### 01--Aviation Technology

01	Aerodynamics	Flight characteristics and problems of full-scale or model aircraft and their components as they are affected by the dynamics of air; Flight testing and wind tunnel testing. Includes theoretical and experimental aerodynamics as applied to missiles, See <a href="#">16/02/01</a> , Guided Missile Dynamics, Configurations and Control Surfaces. For the behavior of spacecraft in air, see <a href="#">22/03</a> , Spacecraft Trajectories and Reentry. For the aerodynamics of ground structures, see <a href="#">13/13</a> , Structural Engineering and Building Technology
02	Military Aircraft Operations	Military aircraft operations such as takeoff Operations and landing, air traffic, all weather and night flight, taxiing, approach, and inflight refueling; Flight safety; Ground safety; Aviation accident studies; Aircraft simulators and training devices. For missile operations, see <a href="#">Field 16</a> , Guided Missile Technology. For spacecraft operations, See <a href="#">Field 22</a> , Space Technology. For navigation and air traffic control, see <a href="#">17/07/03</a> , Air Navigation and Guidance.
03	Aircraft	Design, production, and maintenance of aircraft, aircraft components, and aircraft equipment; Structural studies of complete aircraft components such as airframes, bodies, and wings. Airworthiness; Crashworthiness; Aircraft damage assessment and vulnerability studies; effects of gunfire and blast on aircraft and flight equipment. For civilian aircraft, See <a href="#">01/03/09</a> , Civilian Aircraft. For specific types of aircraft, See subgroups <a href="#">01/03/01</a> - <a href="#">01/03/12</a> . See also <a href="#">Field 16</a> , Guided Missile Technology and <a href="#">Field 22</a> , Space Technology.
03/01	Helicopters	Includes attack helicopters. For civilian helicopters, See <a href="#">01/03/09</a> , Civilian Aircraft.
03/02	Bombers	
03/03	Attack and	

	Fighter Aircraft	
03/04	Patrol and Reconnaissance Aircraft	Includes observation aircraft.
03/05	Transport Aircraft	Includes tanker aircraft.
03/06	Training Aircraft	
03/07	V/STOL	
03/08	Gliders and Parachutes	Includes paragliders and kites, for both military and civilian applications.
03/09	Civilian Aircraft	Does not include aircraft modified for military use.
03/10	Pilotless Aircraft R.P.V.; Drones.	Includes full size aircraft when configured as drones.
03/11	Lighter-than-air Aircraft	Airships, blimps, dirigibles, balloons, for both civilian and military applications.
03/12	Research and Experimental Aircraft	Includes aerospace aircraft.
04	Flight Control and Instrumentation	Instruments, sensors, displays and recorders necessary for control and monitoring the flight of an aircraft; Cockpit and cabin display devices and onboard checkout systems; Onboard navigation display devices; Automatic pilots; Stability and control systems; Boundary layer control systems; Dynamic and static control devices. If the application of a flight control system is apparent, see the field where the application is treated. For devices used to compute flight times and headings, See <a href="#">17/07/03</a> , Air Navigation and Guidance.
05	Terminal Flight Facilities	Airports; Military air bases; Runways; Hangars; Ground refueling systems; Heliports; Aircraft handling and maintenance equipment; Taxiways; Parking aprons; Crash and fire facilities. For air traffic control systems, See <a href="#">17/07/03</a> , Air Navigation and Guidance.
06	Commercial and General Aviation	Civil aircraft operations, as described in <a href="#">01/02</a> . Also includes civil airport passenger and vehicle traffic studies.

## 02--Agriculture

01	Agricultural Chemistry	The application of chemistry to the production and use of crops and livestock; Chemurgy; Fertilizers; Feeds; Pesticide chemistry. For harmful effects of pesticides, See <a href="#">24/05</a> , Pesticides Pollution and Control. For uses of pesticides, See <a href="#">02/04</a> , Agronomy, Horticulture and Aquiculture. For food additives and preservatives, See <a href="#">06/08</a> , Food, Food Service and Nutrition.
02	Agricultural Economics	Economic conditions such as markets, production control and subsidies affecting agriculture; Farm management, finance, labor; Land economics; Surpluses, policies and programs; Food imports, exports, consumption and utilization; Prices and price control; Agribusiness;

		Crop surveys.
03	Agricultural Engineering	Design of agricultural machinery, tools and structures; Soil conservation; Agricultural soil erosion and its prevention; Irrigation systems; Water conservation; Agriculture facilities, equipment and supplies. For food processing, See <a href="#">06/08</a> , Food, Food Service and Nutrition. For processing of natural and synthetic fibers, See <a href="#">11/05</a> , Textiles. For other types of soil erosion, See <a href="#">08/03</a> , Physical and Dynamic Oceanography, <a href="#">08/07</a> , Geology, Geochemistry and Mineralogy and <a href="#">08/08</a> , Hydrology, Limnology and Potamology.
04	Agronomy, Horticulture and Aquiculture	Field crop production; Cultivation of vineyards, orchards and gardens; Nurseries; Greenhouses; Plant breeding and propagation; Hydroponics; Marine farming; Cultivation of fishes, shellfish and algae in natural and artificial water bodies; Use of pesticides for plants. For plant anatomy, genetics and physiology, See <a href="#">06/03</a> , Biology. For pesticide chemistry, See <a href="#">02/01</a> , Agricultural Chemistry. For harmful effects of herbicides, fungicides and pesticides, See <a href="#">24/05</a> , Pesticides Pollution and Control. For food processing, See <a href="#">06/08</a> , Food, Food Service and Nutrition.
05	Animal Husbandry and Veterinary Medicine	Production, care, testing and training of animals including birds; Animal pathology; Animal quarantine; Disease resistance, control and treatment; Use of pesticides for animals; Care and breeding of laboratory animals. For animal anatomy and physiology, See <a href="#">06/04</a> , Anatomy and Physiology. For harmful effects of herbicides, fungicides, pesticides and other toxic materials on animals, See <a href="#">24/05</a> , Pesticides Pollution and Control.
06	Forestry	Development, management, and cultivation of forests; Silviculture; Diseases of trees; Forest fires and forest fire prevention. For products derived from forests, see <a href="#">11/12</a> , Wood, Paper and Related Forestry Products.

### 03--Astronomy and Astrophysics

01	Astronomy	Observations of celestial bodies, their distances and positions. Includes all observation equipment and techniques. For spectroscopic and radio observations and their related data analysis of celestial bodies and interstellar space, See <a href="#">03/02</a> , Astrophysics. For chemical aspects of celestial bodies, See <a href="#">03/02</a> , Astrophysics
02	Astrophysics	Physical and chemical aspects of celestial bodies, their origin and evolution. Includes astronomical spectroscopy, radio astronomy, planetary atmospheres and luminosity. For earth atmosphere, See <a href="#">Field 04</a> , Atmospheric Sciences.
03	Celestial	The motions of celestial bodies under the Mechanics influence of gravity; Ephemerides; Eclip

### 04--Atmospheric Sciences

01	Atmospheric Physics	Physical and chemical properties of the atmosphere, exclusive of considerations of weather and climate; Aeronomy, aurorae and airglow; Atmospheric structure, energetic particles and solar-terrestrial relationships. For atmospheric propagation of radio waves, See <a href="#">20/14</a>
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		Radiofrequency Wave Propagation. For solar terrestrial magnetic interactions, See <a href="#">08/04</a> , Geomagnetism.
02	Meteorology	Weather observations, prediction, and modification of the atmosphere; Climatology; Meteorological modelling.

#### 05--Behavioral and Social Sciences

01	Administration and Management	Management techniques; Planning; Budgeting; Public relations; Production planning; Organization coordination; Accounting; Cost control. Includes management information systems. For the administration and management of a specific subject area, see the group where the subject is treated. For example, use <a href="#">15/05</a> , Logistics, Military Facilities and Supplies for logistics management. See also, <a href="#">12/04</a> , Operations Research, <a href="#">05/03</a> , Economics and Cost Analysis and <a href="#">12/05</a> , Computer Programming and Software.
02	Information Science	Information processing such as acquisitions, cataloging, classifying, indexing and abstracting; Storing, retrieving, and distributing recorded information in hardcopy, microform or electronic form; Information storage and retrieval systems; Documentation centers; Library and information networks. For bibliographies, symposia, conferences, handbooks, patents, specific subject matter involved, for example, use <a href="#">13/10/01</a> , Submarine Engineering for a bibliography on submarines. For printing techniques and equipment, See <a href="#">14/05</a> , Printing and Graphic Arts. See also, <a href="#">Field 12</a> , Mathematical and Computer Science.
03	Economics and Cost Analysis	Econometrics; Economic history; Economic theory; Banking and finance; International economic relations; Trade and Commerce. Includes cost effectiveness studies, cost- benefit analysis, tradeoff factors, market research and production forecasts. See also <a href="#">02/02</a> , Agricultural Economics. For budgeting and cost control, See <a href="#">05/01</a> , Administration and Management.
04	Government and Political Science	Theory and practice of government; International relations; Political conditions. Includes treaties, arms control, and negotiations.
05	Sociology and Law	Social relations; Sociometrics; Social concerns; Family life; Ethnology; Criminology; Demography; Military, civil and criminal law including codes, statutes and legal interpretations; Police methods; Riot control; Penology; Court administration.
06	Humanities and History	Philosophy; Religion; Literature; Art; Music; Drama; Archaeology; Educational philosophy and methods; Educational organizations. For the training aspects of a subject, see the group where the subject is treated.
07	Linguistics	Study of languages, including phonology, morphology, syntax and semantics; Mathematical linguistics; Machine translation.
08	Psychology	Perception; Learning; Motivation; Behavior; Intelligence; Attitudes; Group dynamics: Experimental psychology, including animal studies:

		Physiological psychology; Developmental psychology; Social psychology; Clinical psychology; Educational psychology; Military psychology; Industrial psychology; Parapsychology. For psychiatry, See <a href="#">06/05</a> , Medicine and Medical Research. For psychological warfare, See <a href="#">15/06</a> , Military Operations, Strategy and Tactics.
09	Personnel Management and Labor Relations	Recruitment, selection, utilization and evaluation of civilian and military personnel; Manpower studies; Industrial relations; Wages; Benefits; Housing; Work measurement; Labor unions; Arbitration and bargaining; Job analysis; Job benefits; Job satisfaction; Career guidance. Includes physical fitness standards and examinations. For Military force levels, See <a href="#">15/01</a> , Military Forces and Organizations.

#### 06--Biological and Medical Sciences

01	Biochemistry	Chemical reactions and properties of biochemical compounds; Analytical methods and identification of biochemical substances; Biochemical assay and analysis. For physiological effects of drugs, See <a href="#">06/15</a> , Pharmacology. See also <a href="#">06/11</a> , Toxicology. For the biological warfare applications of biochemistry, See <a href="#">15/06/03</a> , Chemical, Biological and Radiological Warfare.
02	Genetic Engineering and Molecular Biology	Intentional production of new genes and alteration of genomes by the modification of new genetic material; Use of chemistry and physics to study biological phenomena on the molecular level; Structure and function of biological macromolecules such as proteins and nucleic acids. For genetic and heredity studies, See <a href="#">06/03</a> , Biology.
03	Biology	Biological topics not included in other groups such as botany, zoology, animal behavior, heredity, genetics, and evolution; Reproduction and development; Morphology; Taxonomy, classification and nomenclature. For anatomy and physiology, See <a href="#">06/04</a> , Anatomy and Physiology. For aquatic plants and animals in ocean or sea water, See <a href="#">08/01</a> , Biological Oceanography. For the care and breeding of laboratory animals, See <a href="#">02/05</a> , Animal Husbandry and Veterinary Medicine. For genetic engineering, See <a href="#">06/02</a> , Genetic Engineering and Molecular Biology. For studies of animal behavior under experimental conditions, See <a href="#">05/08</a> , Psychology.
04	Anatomy and Physiology	The study of the functions of cells, tissues, organs and systems in humans and animals by physical and chemical methods; Growth; Aging; Metabolism; Biological rhythm; Healing and repair; Sensation; Respiration; Electrophysiology; Neuroanatomy. For physiological psychology, See <a href="#">06/10</a> , Stress Physiology.
05	Medicine and Medical Research	Prevention, diagnosis and therapy of diseases; Internal medicine; Pediatrics; Geriatrics; Dermatology; Ophthalmology; Psychiatry; Dentistry; Nuclear medicine; Experimental medicine; Public health; Medical and paramedical training; Paramedical services. Includes nursing, first aid, medical technology, physical therapy and prosthesis. For pharmaceuticals, See <a href="#">06/15</a> , Pharmacology. For veterinary medicine, See <a href="#">02/05</a> , Animal Husbandry and Veterinary Medicine. For industrial medicine, See <a href="#">24/07</a> , Environmental Health and Safety.

06	Ecology	Interrelations of organisms and their environment; Ecosystems; Food chains; Adaptation; Ecological succession; Biogeography. For the effects of pollution on the environment, See <a href="#">Field 24</a> , Environmental Pollution and Control.
07	Radiobiology	Radiation biology; Interaction of biological systems with ionizing electromagnetic and particle radiation; Dosimetry; Health physics; Radiation injury; Infrared burns; Nuclear radiation sickness and injury. For radiology and radiotherapy, See <a href="#">06/05</a> , Medicine and Medical Research.
08	Food, Food Service and Nutrition	Processing, packaging, storage, preparation and dispensing of food; Kitchen and cooking equipment; Dietetics; Food bacterial count; Calorie count; Food chemistry.
09	Hygiene and Sanitation	Personal hygiene. For sewage treatment, See <a href="#">24/04</a> , Water Pollution and Control.
10	Stress Physiology	Effects of extreme environments or unusual stimulation on biological processes; Acclimatization; Physiological effects of motion, gravity, sound, light, heat, magnetism, sensory deprivation, fatigue, weightlessness, cold and altitude. Includes air, space and underwater environments. For effects of ionizing electromagnetic and particle radiation, see <a href="#">06/07</a> , Radiobiology.
11	Toxicology	Study of the adverse effects of substances on biological systems and the diagnosis and treatment of toxic diseases; Toxicity studies; Antidotes. See also <a href="#">15/06/03</a> , Chemical, Biological and Radiological Warfare.
12	Medical Facilities, Equipment and Supplies	Medical facilities such as civilian and military hospitals and clinics; Equipment and supplies for hospital, laboratory and field use. For equipment and techniques for sustaining life in adverse environments, See <a href="#">23/05</a> , Life Support Systems. For bioinstrumentation, See <a href="#">23/01</a> , Biomedical Instrumentation and Bioengineering. For veterinary facilities, See <a href="#">02/05</a> , Animal Husbandry and Veterinary Medicine.
13	Microbiology	Studies of microscopic plants and animals, bacteria, viruses and rickettsia. See also <a href="#">08/01</a> , Biological Oceanography, and <a href="#">15/06/03</a> , Chemical, Biological and Radiological Warfare.
14	Weapons Effects (Biological)	Wound ballistic studies; Wounds, injuries or other conditions directly resulting from weapons. For effects of CBR weapons, See <a href="#">15/06/03</a> , Chemical, Biological and Radiological Warfare. For the physiological effects of nuclear weapons, See <a href="#">06/07</a> , Radiobiology. For the nondiological effects of nuclear weapons, See <a href="#">19/11</a> , Nuclear Weapons. For the nondiological effects of conventional weapons, See <a href="#">19/09</a> , Explosions, and <a href="#">19/10</a> , Ballistics. For the medical treatment of wounds and injuries, See <a href="#">06/05</a> , Medicine and Medical Research.
15	Pharmacology	The synthesis, composition, properties and physiological effects of drugs. Includes psychopharmacology. See also <a href="#">15/06/03</a> , Chemical.

		Biological and Radiological Warfare.
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### 07--Chemistry

01	Industrial Chemistry and Chemical Processing	Techniques, processes, unit operations, apparatus and plant equipment that apply to chemical manufacturing, processing, transportation and storage; Specifications and standards for shipping of chemicals; Desalination technology. For disposal of industrial wastes, See <a href="#">Field 24</a> , Environmental Pollution and Control.
02	Inorganic Chemistry	Synthesis, properties and reactions of inorganic compounds; Studies of the chemical elements; Inorganic quantitative and qualitative analysis; Complex compounds including metal carbonyls. Includes spectra studies of inorganic compounds. For fuels chemistry, See <a href="#">21/04</a> , Fuels. For the chemistry of rocket propellants, See <a href="#">21/09</a> , Rocket Propellants. See also <a href="#">Field 11</a> , Materials. For inorganic polymers, See <a href="#">07/06</a> , Polymer Chemistry.
03	Organic Chemistry	Synthesis, properties and reactions of organic compounds; Organic quantitative and qualitative analysis. Includes spectra studies of organic compounds. For fuels chemistry, See <a href="#">21/04</a> , Fuels. For the chemistry of rocket propellants, See <a href="#">21/09</a> ; Rocket Propellants. See also <a href="#">06/01</a> , Biochemistry; <a href="#">06/15</a> , Pharmacology; and <a href="#">Field 11</a> , Materials. For organic polymers, See <a href="#">07/06</a> , Polymer Chemistry.
04	Physical Chemistry	Physical aspects and theoretical interpretations of chemical systems; Colloid chemistry; Catalysis; Chemical solutions; Reaction kinetics; Chemical equilibria; Chemical thermodynamics; Thermochemistry; Electrochemistry; Phase studies of non-metallic systems; Liquid crystals; Quantum chemistry; Physical methods of analysis not applied exclusively to either organic or inorganic chemical substances; Membranes; Surface chemistry. For the qualitative and quantitative analysis of chemical substances by means of their spectra, See <a href="#">07/02</a> , Inorganic Chemistry, and <a href="#">07/03</a> , Organic Chemistry. For photochemistry, See <a href="#">07/05</a> , Radiation and Nuclear Chemistry. For spectroscopic studies, See <a href="#">20/05</a> , Atomic and Molecular Physics and Spectroscopy.
05	Radiation and Nuclear Chemistry	Studies involving the interrelationships of electromagnetic or particle radiation and chemical reactions; Study of radioactive substances and their chemical reactions; Radiochemistry; Photochemistry. See also <a href="#">18/02</a> , Isotopes, and <a href="#">18/07</a> , Radioactivity, Radioactive Wastes and Fission Products.
06	Polymer Chemistry	Synthesis, properties and reactions of polymers; Polymerization; Curing; Crosslinking. For the applications of polymers, see group where the application is treated, for example, <a href="#">11/01</a> , Adhesives, Seals and Binders; <a href="#">11/05</a> , Textiles, etc.

### 08--Earth Sciences and Oceanography

01	Biological	Marine plant and animal life as it relates to its environment For
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	Oceanography	pollution of the ocean, See <a href="#">24/04</a> , Water Pollution and Control.
02	Cartography and Aerial Photography	Mapping including radar mapping; Photogrammetry; Terrain modelling; Map projections; Topographic representation; Aerial and satellite photography; Photointerpretation.
03	Physical and Dynamic Oceanography	Physical, chemical and dynamic properties of the oceans and seas; Topography, geochemistry and geophysics of the ocean bottom; Ocean waves; Currents; Tides; Ocean- air interactions; Beach and shore erosion and sediment transport. For sea ice phenomena and ice breaking operations, See <a href="#">08/12</a> , Snow, Ice and Permafrost. For fresh water phenomena, See <a href="#">08/08</a> , Hydrology, Limnology and Potamology. For water pollution, See <a href="#">24/04</a> , Water Pollution and Control.
04	Geomagnetism	The study of the earth's magnetism, geomagnetic field theory and measurement. Includes solar terrestrial magnetic interactions. For magnetic detection of manmade events, See <a href="#">17/06</a> , Magnetic and Electric Field Detection and Detectors. For geomagnetic location of mineral deposits, See <a href="#">08/09</a> , Mining Engineering.
05	Geodesy	Geodetic surveying; Determination of position of points on the earth's surface; Shape and size of the earth; Variations of terrestrial gravity; Astronomical geodesy and geodesics.
06	Geography	The study of the non-physical aspects of the natural and political divisions of the earth. Includes country and area studies. For physical geography, See <a href="#">08/07</a> , Geology, Geochemistry and Mineralogy. For biogeography, See <a href="#">06/06</a> , Ecology. For economic geography, See <a href="#">05/03</a> , Economics and Cost Analysis. For political geography, See <a href="#">05/04</a> , Government and Political Science.
07	Geology, Geochemistry and Mineralogy	The sciences that deal with the physical history of the earth, the materials of which it is composed, and the physical changes which the earth has undergone such as erosion; Mineralogy; Geochemistry of rock and soils; Paleontology; Stratigraphy; Vulcanology; Tectonics; Engineering Geology; Structural Geology; Petrology; Petrography; Physical geography including geomorphology and physiography. See also <a href="#">08/11</a> , Seismology, and <a href="#">08/10</a> , Soil Mechanics.
08	Hydrology, Limnology and Potamology	Distribution and circulation of inland bodies of water such as estuaries, streams and lakes. Includes their surface and underground occurrence and their physical, chemical and biological properties; Eutrophication; Runoff and ground water; Shore and channel erosion and sedimentation. For water pollution and waste treatment facilities, See <a href="#">24/04</a> , Water Pollution and Control.
09	Mining Engineering	Exploration, location and evaluation of mineral deposits including oil and gas; Layout and equipment of mines and recovery techniques; Geophysical prospecting including use of seismic waves. For geophysical exploration techniques used for other purposes, see field of application. For disposal of mining wastes, See <a href="#">24/03</a> , Solid Wastes Pollution and Control.

10	Soil Mechanics	Physical properties and engineering aspects of soils; Landslides; Freezing of non- permanently frozen soils. For studies of permanently frozen soils, See <a href="#">08/12</a> , Snow, Ice and Permafrost. For soil erosion, See <a href="#">08/03</a> , Physical and Dynamic Oceanography, <a href="#">08/07</a> , Geology, Geochemistry and Mineralogy, <a href="#">08/08</a> , Hydrology, Limnology and Potamology, and <a href="#">02/03</a> , Agricultural Engineering.
11	Seismology	Detection, measurement and analysis of natural seismic phenomena. Includes tsunamis and seismic generated landslides and earthquakes. For seismic detection of nuclear explosions, See <a href="#">18/03</a> , Nuclear Explosions and Devices(Non-Military), and <a href="#">19/11</a> , Nuclear Weapons. For seismic detection of other man made events, See <a href="#">17/10</a> , Seismic Detection and Detectors. For location of mineral deposits by seismic waves, See <a href="#">08/09</a> , Mining Engineering. For other seismic profiling, see group where application is treated.
12	Snow, Ice and Permafrost	Physical characteristics of snow, ice and permanently frozen soil, such as trafficability, stability, mechanical properties; Avalanches; Glaciers and sea ice. For studies of non-permanently frozen soil, See <a href="#">08/10</a> , Soil Mechanics. For equipment icing studies also use the group where the equipment is treated.

#### 09--Electrotechnology and Fluidics

01	Electrical and Electronic Equipment	Electrical and electronic components, systems and subsystems, such as electric motors, electron tubes, semiconductor devices, integrated circuits, electric switches, electric connectors, electric amplifiers and antennas where the application is not apparent or where there is more than one application. If the application is apparent, see the group where the application is treated.
02	Fluidics and Fluorics	Technology that uses the interaction of flowing gases or liquids to perform fluidic sensing, logic, amplification and control functions, employing devices which have no moving parts. For non-fluidic hydraulic and pneumatic equipment, See <a href="#">13/07</a> , Hydraulic and Pneumatic Equipment.
03	Lasers and Masers	Devices which amplify electromagnetic waves by stimulated emission of radiation. Includes lasers and masers. If the application of the laser or maser is apparent, see the group where the application is treated. See also <a href="#">14/01</a> , Holography. For laser countermeasures, See <a href="#">17/04/04</a> , Optical Countermeasures
04	Line, Surface and Bulk Acoustic Wave Devices	Devices such as filters, resonators and oscillators, which employ acoustic waves which propagate along a line or a surface or through the bulk of piezoelectric material to process signals.
. 05	Electrooptical and Optoelectronic Devices	Includes display equipment, photosensitive diodes, phototubes, image tubes, cathode ray tubes, electroluminescent panels, light emitting diodes, light sensitive mosaics, and phototransistors where the application is not apparent or where there is more than one application. If the application of the device is apparent, see the group where the application is treated. For lasers. See <a href="#">09/03</a> , Lasers and

		Masers. For optical detection, See <a href="#">17/05</a> , Optical Detection and Detectors.
06	Acoustooptic and Optoacoustic Devices	Devices that deal with the interactions between acoustic waves and light where the application is not apparent or where there is more than one application. If the application is apparent, see the group where the application is treated.
07	Electromagnetic Shielding	Design, development and application of techniques which will allow operation of electronic equipment in the electromagnetic environment, including shielding from electromagnetic pulses, and which will also allow the prevention of the detection of spurious signals which might radiate from electronic equipment. For shielding to prevent interception of generated signals, See <a href="#">17/04</a> , Countermeasures, <a href="#">17/04/01</a> , Radio Countermeasures and <a href="#">17/04/03</a> , Radar Countermeasures.

#### 10--Power Production and Energy Conversion (Nonpropulsive)

01	Non-electrical Energy Conversion	Techniques and devices for the conversion of one form of energy to a form of non- electrical energy, but which do not primarily involve energy storage; General studies of energy conversion. If the application of a technique or a device is known, see the group where the application is treated.
02	Electric Power Production and Distribution	Techniques and devices used in the generation and distribution of electric power which do not primarily use energy storage. Includes electric power generators, transformers, converters, circuit breakers and electrical power transmission lines. For electrochemical power sources, See <a href="#">10/03</a> , Electrochemical Energy Storage. For electric power production devices which primarily use non-electrochemical energy storage, See <a href="#">10/04</a> , Energy Storage. For nuclear power plants, See <a href="#">18/05</a> , Nuclear Power Plants and Fission Reactor Engineering. For onboard electrical power systems, see group where application is treated.
03	Electrochemical Energy Storage	Devices which use chemical processes to produce electricity, such as electric batteries and electrical fuel cells.
04	Energy Storage	Techniques and devices for the storage and subsequent use of energy. Includes inductive, compressed gas, pumped hydro, capacitor banks, flywheels and thermal energy storage. For electrical batteries and battery components, See <a href="#">10/03</a> , Electrochemical Energy Storage. For devices which produce electric power without energy storage, See <a href="#">10/02</a> , Electric Power Production and Distribution. For solar cells, See <a href="#">10/02</a> , Electric Power Production and Distribution.

#### 11--Materials

01	Adhesives, Seals and Binders	Adhesives; Binders; Sealants; Seals; Gaskets; O Rings; Fabrication and manufacturing methods. Includes equipment directly related to processing these materials. For propellant binders, See <a href="#">21/09/02</a> , Solid Rocket Propellants. For concrete cements, See <a href="#">13/03</a>
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		Construction Equipment, Materials and Supplies. For the chemistry of adhesives and seals, See <a href="#">Field 07</a> , Chemistry.
02	Ceramics, Refractories and Glass	Ceramic materials including glass, brick, porcelain and tiles; Non-metallic refractory materials; Cermets; Property studies of concrete; Fabrication and manufacturing methods; Equipment directly related to processing these materials. For concrete, brick and other ceramic material used as building materials, See <a href="#">13/03</a> , Construction Equipment, Materials and Supplies. For ceramic coatings, See <a href="#">11/03</a> , Coatings, Colorants and Finishes. For reinforced concrete and glass reinforced plastics, See <a href="#">11/04</a> , Laminates and Composite Materials.
02/01	Refractory Fibers	Ceramic, glass and carbon fibers, filaments and yarns; Fabrication and manufacturing methods; Equipment directly related to processing these materials.
03	Coatings, Colorants and Finishes	Paints; Paint primers; Varnishes; Plastic, rubber, ceramic and metal coatings; Wood preservatives; Uses of dyes and pigments; Electroplating; Electrodeposition; Flame and plasma spraying; Vapor deposition; Fabrication and application methods. For the chemistry of coatings, colorants and finishes, See <a href="#">Field 07</a> , Chemistry.
04	Laminates and Composite Materials	Composite materials including reinforced plastics, graphite, carbon and metal matrix composites; Laminates; Reinforced concrete; Fabrication and manufacturing methods; Equipment directly related to processing these materials. For concrete used as a building material, See <a href="#">13/03</a> , Construction Equipment, Materials and Supplies. For plywood and wood composites, See <a href="#">11/12</a> , Wood, Paper and Related Forestry Products.
05	Textiles	Natural and synthetic fibers, threads and yarns when used in textile products; Fabrication and finishing methods; Equipment directly related to processing these materials. For ceramic, glass and carbon fibers, See <a href="#">11/02/01</a> , Refractory Fibers. For metallic fibers, See <a href="#">11/06</a> , Metallurgy and Metallography. For the dyeing of textiles, See <a href="#">11/03</a> , Coatings, Colorants and Finishes.
06	Metallurgy and Metallography	General studies; Metal fibers and crystals; Powder metallurgy; Refining; Extractive metallurgy. For metal coatings, See <a href="#">11/03</a> , Coatings, Colorants and Finishes.
06/01	Properties of Metals and Alloys	Microstructure of metals and alloys; Mechanical and chemical properties; Phase studies; Corrosion studies.
06/02	Fabrication Metallurgy	Casting; Forging; Drawing; Electroforming; Extrusion; Machining; Rolling; Stamping; Spinning; Welding.
07	Miscellaneous Materials	Materials not included in another group, for example, leather, fur, straw, refrigerants and waxes. Includes equipment directly related to processing these materials.
08	Lubricants and	Physical and mechanical properties. performance and production of



	Hydraulic Fluids	solid and liquid lubricants; Lubricating oils; Hydraulic fluids; Greases; Drilling fluids; Additives for lubricants; Equipment directly related to processing these materials. For the chemistry of lubricants and hydraulic fluids, See <a href="#">Field 07</a> , Chemistry.
09	Plastics	Physical and mechanical properties, performance and production of plastics, polymeric resins and their additives; Curing agents for plastics; Plasticizers. Includes equipment directly related to processing these materials. For reinforced plastics and laminates, See <a href="#">11/04</a> , Laminates and Composite Materials. For plastic coatings, See <a href="#">11/03</a> , Coatings, Colorants and Finishes. For plastic fibers used in textiles, See <a href="#">11/05</a> , Textiles. For the chemistry of plastics, See <a href="#">07/06</a> , Polymer Chemistry.
10	Elastomers and Rubber	Production, performance and physical and mechanical properties of natural and synthetic rubber, rubber products and their additives; Curing agents for elastomers or rubber. Includes equipment directly related to processing these materials. For rubber coatings, See <a href="#">11/03</a> , Coatings, Colorants and Finishes. For the chemistry of elastomers and rubber, See <a href="#">07/06</a> , Polymer Chemistry.
11	Solvents, Cleaners and Abrasives	Cleaning compounds; Industrial solvents; Detergents; Soaps; Abrasives; Cleaning action of these materials. Includes equipment directly related to processing these materials. For the chemistry of solvents, cleaners and abrasives, See <a href="#">Field 07</a> , Chemistry.
12	Wood, Paper and Related Forestry Products	Wood products such as paper, cardboard, plywood, lumber, composition board and sawdust; Lumbering. Includes equipment directly related to processing these materials. For wood preservatives, See <a href="#">11/03</a> , Coatings, Colorants and Finishes.

## 12--Mathematical and Computer Sciences

01	Numerical Mathematics	Numerical methods and procedures; Error analysis; Interval analysis; Matrix computations. For numerical applications as applied to Statistics, See <a href="#">12/03</a> , Statistics and Probability.
02	Theoretical Mathematics	Includes topology, number theory, group theory, set theory and Boolean algebra.
03	Statistics and Probability	Statistical, techniques and applications, probability and reliability theory, and probability equations; Monte Carlo method; Regression analysis; Stochastic process; Error estimation.
04	Operations Research	Queueing theory; Mathematical programming; Game theory; Decision theory. Includes systems analysis. For applied techniques, see the Group where the application is treated. For computer systems analysis, See <a href="#">12/05</a> , Computer Programming and Software.
05	Computer Programming and Software	Programming techniques; Software engineering; Firmware; Database management systems; Programming languages; Operating systems. For computer programs applied to a specific application. see also the

		field of application.
06	Computer Hardware	Design and development of computers and peripheral equipment, including analog computers, digital computers, hybrid computers, minicomputers, microcomputers and supercomputers; Computer storage and memory devices; Computer architecture; Computer logic. For special purpose computers, such as fire control computers, see the field where the application is treated. For electronic components used in computer hardware, such as very large scale integrated (VLSI) circuits, See <a href="#">09/01</a> , Electrical and Electronic Equipment. For programmed computer chips, such as firmware, See <a href="#">12/05</a> , Computer Programming and Software.
07	Computer Systems	Computer networks; Local area networks; Distributed data processing; Teleprocessing systems; Data communication systems; Time sharing; Real-time systems; Information systems; Process control systems. For computer systems applied to a specific application, see also the field of application.
08	Computer Systems Management and Standards	Computer operations; Benchmarks; Computer system modeling; Computer security; Performance measurement and improvement.
09	Cybernetics	Artificial intelligence; Robotics; Information theory and coding; Pattern recognition; Image processing. Includes control theory and feedback. See also <a href="#">23/03</a> , Bionics. For speech recognition and analysis, See <a href="#">25/04</a> , Voice Communications.

### 13--Mechanical, Industrial, Civil and Marine Engineering

01	Air Conditioning, Lighting, Heating, and Ventilating	Heating, air conditioning and Lighting ventilating systems; Heat pumps; Boilers; Furnaces; Radiators; Condensers; Refrigeration and cold storage systems for non-food use. For equipment used for food preservation and preparation, See <a href="#">06/08</a> , Food, Food Service and Nutrition.
02	Civil Engineering	Construction and design of bridges, tunnels and dams; Reservoir engineering; dredging; Flood control; Waterway and coastal engineering; water supply systems; Highway and traffic engineering; Urban planning and renewal; Land surveying techniques. For the design and construction of sewers and water treatment facilities, See <a href="#">24/04</a> , Water Pollution and Control. For the design and construction of buildings, See <a href="#">13/13</a> , Structural Engineering and Building Technology. For the natural distribution and circulation of water, See <a href="#">08/08</a> , Hydrology, Limnology and Potamology.
03	Construction Equipment, Materials and Supplies	Excavation and earth moving equipment; Hoisting and conveying equipment used in construction; Construction equipment; Building materials and supplies. For property studies of brick, concrete and other ceramic materials used as building materials, See <a href="#">11/02</a> , Ceramics, Refractories and Glass.
04	Containers and	Design, production, performance and testing of containers: Packaging

	Packaging	methods; Storage tanks and accessories. For the transportation and storage of chemicals, See <a href="#">07/01</a> , Industrial Chemistry and Chemical Processing. For the storage of fuels, See <a href="#">21/04</a> , Fuels. For radioactive material containers, See <a href="#">18/06</a> , Nuclear Radiation Shielding, Protection and Safety.
05	Couplers, Fasteners and Joints	Design, performance and testing of bolts, screws, studs, rivets, hooks, couplers, and fittings; Bonded, soldered and welded joints. For electric connectors, See <a href="#">09/01</a> , Electrical and Electronic Equipment. For pipe fittings, See <a href="#">13/11</a> , Pumps, Filters, Pipes, Tubing, Fittings and Valves
06	Surface Transportation and Equipment	Design, operation, performance and maintenance of systems to transport passengers and cargo; Civilian passenger and cargo movement and handling; Passenger vehicles; Railroads; Rolling stock; Surface and rapid transit systems; Mass transportation systems; Moving sidewalks; Marine transportation; Merchant and marine shipping. Includes vehicle components. For armored vehicles designed specifically for combat, See <a href="#">19/03</a> , Combat Vehicles. For military logistics, See <a href="#">15/05</a> , Logistics, Military Facilities and Supplies. For civil aviation operations, See <a href="#">01/06</a> , Commercial and General Aviation. For surface effect vehicles and amphibious vehicles, See <a href="#">13/06/01</a> , Surface Effect Vehicles and Amphibious Vehicles.
06/01	Surface Effect Vehicles and Amphibious Vehicles	Vehicles supported by low pressure, low and velocity air capable of traveling over one or more of the following: water, ice, marsh or relatively level land. Also includes amphibious vehicles and ground effect machines. For hydrofoils, See <a href="#">13/10</a> , Marine Engineering.
07	Hydraulic and Pneumatic Equipment	Design, production, performance, and testing of hydraulic and pneumatic systems; Accumulators, distribution equipment, actuators, controls, and components. For fluidic and fluoric equipment, See <a href="#">09/02</a> , Fluidics and Fluorics.
08	Manufacturing and Industrial Engineering and Control of Production Systems	Industrial production engineering; Quality control; Reliability; Maintainability; Standardization; Plant design; Inspection; Fabrication, cleaning and finishing of industrial materials. For fabrication metallurgy, See <a href="#">11/06/02</a> , Fabrication Metallurgy. For the fabrication and manufacturing of laminates, composite materials, textiles, plastics, rubber, elastomers, adhesives, seals, binders, ceramics, refractories, glass, refractory fibers, coatings, colorants or finishes, see the appropriate group in <a href="#">Field 11</a> . For food processing, See <a href="#">06/08</a> , Food, Food Service and Nutrition. For chemical engineering processes, See <a href="#">07/01</a> , Industrial Chemistry and Chemical Processing. For the quality assurance and reliability management of a specific product, see the group where the product is treated.
09	Machinery and Tools	Design, production, performance and testing of machinery and tools; Machines and machine elements; Gears; Bearings; Clutches; Drives; Cams; Springs; Metal working tools; Wood working tools.
10	Marine Engineering	Design, construction, maintenance, salvage, operation and performance of all types of ships, boats, and related equipment; Naval architecture: Ships and shipbuilding. Includes hydrofoil craft. SWATH

		ships and planing hull craft. For submarines, See <a href="#">13/10/01</a> , Submarine Engineering. For coastal and bottom structures, See <a href="#">13/02</a> , Civil Engineering, and <a href="#">13/13</a> , Structural Engineering and Building Technology. For air cushioned ships such as hovercraft, See <a href="#">13/06/01</a> , Surface Effect Vehicles and Amphibious Vehicles. For marine nuclear propulsion, See <a href="#">21/06</a> , Nuclear Propulsion.
10/01	Submarine Engineering	Design, construction, maintenance, salvage, operation and performance of submarines and submersibles and their equipment. See also <a href="#">19/08</a> , Underwater Ordnance.
11	Pumps, Filters, Pipes, Tubing, Fittings and Valves	Design, production, operation, performance and testing of pumps, filters, pipes, tubing, pipe fittings and valves. If the application of a device is apparant, see the group where the application is treated.
12	Safety Engineering	Accident prevention; Safety measures and devices; Fire prevention; Firefighting equipment and techniques; Fire detection equipment; Safety warning systems. For forest fires and forest fire prevention, See <a href="#">02/06</a> , Forestry. For aviation accident studies, ground safety and flight safety, See <a href="#">01/02</a> , Military Aircraft Operations, and <a href="#">01/06</a> , Commercial and General Aviation. For airport crash and fire facilities, See <a href="#">01/05</a> , Terminal Flight Facilities. For environmental health and safety, See <a href="#">24/07</a> , Environmental Health and Safety. For protective equipment, See <a href="#">23/04</a> , Protective Equipment. For nuclear safety engineering procedures, See <a href="#">18/06</a> , Nuclear Radiation Shielding, Protection and Safety.
13	Structural Engineering and Building Technology	Construction of buildings and building systems, including modular and stacking construction; Architectural design; Structural analyses; Building standards; Building technology; Earthquake engineering; Roofs and roofing systems. For the Construction of bridges, tunnels and dams, See <a href="#">13/02</a> , Civil Engineering. See also <a href="#">13/03</a> , Construction Equipment, Materials and Supplies.

#### 14--Test Equipment, Research Facilities and Reprography

01	Holography	Techniques and devices for producing holograms. Acoustic holography.
02	Test Facilities, Equipment and Methods	Laboratory and test facility design and operation; Measuring, testing and simulation devices with more than one application. For devices and facilities used for a single application, see the group where the application is treated.
03	Recording and Playback Devices	Techniques and devices for recording variable quantities. Includes magnetic, thermoplastic, electrostatic and electrooptical recording systems. For photographic recording, See <a href="#">14/04</a> , Photography. For holographic recording, See <a href="#">14/01</a> , Holography. For devices used for a single application, see the group where the application is treated.
04	Photography	Photographic techniques, equipment, processes and materials. For aerial and satellite photography and photogrammetry, See <a href="#">08/02</a> , Cartography and Aerial Photography. For holography. See <a href="#">14/01</a> .

		Holography.
05	Printing and Graphic Arts	Lithography and Photolithography; Drawing; Engraving; Visual design; Xerography. For computer graphics, See <a href="#">12/05</a> , Computer Programming and Software, or <a href="#">12/06</a> , Computer Hardware.

### 15--Military Sciences

01	Military Forces and Organizations	The organization and structure of United States or foreign military forces and organizations. Includes force mixes, force structures, force levels and tables of organization; NATO; Rapid deployment forces; Military reserves; Paramilitary forces such as the National Guard and Civil Air Patrol.
02	Civil Defense	Activities and measures designed to minimize the effects upon the civilian population caused by an enemy attack or a natural disaster, to deal with the immediate emergency conditions which would be created by such an attack or disaster, and to effect emergency repairs to, or the temporary restoration of, vital utilities and facilities destroyed or damaged by such an attack or disaster. Includes the protection of military bases and population from natural disasters.
03	Defense Systems	Active and passive systems of military defense; Systems, structures and devices to provide area monitoring, security and terrain denial; Area and point defense; Antipersonnel and area defense through the use of remote sensors. Includes barbed wire, warning systems, barriers and other antiintrusion devices. For antimissile defense systems, See <a href="#">15/03/01</a> , Antimissile Defense Systems. For anti-aircraft defense systems, See <a href="#">15/03/02</a> , Anti-aircraft Defense Systems. For Civil defense, See <a href="#">15/02</a> , Civil Defense. For the use of land mines, See <a href="#">15/06/06</a> , Land Mine Warfare. For defense planning, policy and doctrine, See <a href="#">15/06</a> , Military Operations, Strategy and Tactics. For electronic and acoustic countermeasures, See the appropriate group in <a href="#">Field 17</a> , Navigation, Detection and Countermeasures.
03/01	Antimissile Defense Systems	Techniques and equipment for the interception and destruction of guided and ballistic missiles. Includes appropriate tracking and computing systems.
03/02	Anti-aircraft Defense Systems	Techniques and equipment for the interception and destruction of aircraft. Includes appropriate tracking and computing systems.
03/03	Antisatellite Defense Systems	Techniques and equipment for the ground or air based interception and destruction of satellites. Includes appropriate tracking and computing systems. For space based operations, See <a href="#">15/06/05</a> , Space Warfare.
04	Military Intelligence	Techniques for collecting, evaluating and disseminating information concerning foreign or enemy activities needed for the purpose of national security.
05	Logistics.	Logistics planning; Procurement, storage distribution, stock level

	Military Facilities and Supplies	controls and inventory techniques, issue, repair, reclamation, preventive and corrective maintenance, and replacement of military equipment and supplies; Design and testing of equipment such as clothing, field gear, and tents; Transportation of troops and military cargo; Industrial mobilization; Weapons and explosives storage facilities. For protective clothing, See <a href="#">23/04</a> , Protective Equipment. For related civilian studies, See <a href="#">13/06</a> , Surface Transportation and Equipment, <a href="#">05/01</a> , Administration and Management, and <a href="#">01/06</a> , Commercial and General Aviation. For Petroleum, oils and lubricants (POL) storage, See <a href="#">21/04</a> , Fuels. For nuclear weapons storage, See <a href="#">15/06/04</a> , Nuclear Warfare.
06	Military Operations, Strategy and Tactics	Joint and combined operations; Campaigns; Battles; Invasions; Theater operations; Psychological warfare; Conventional warfare; Methods of attack and combat support; Tactical and strategic defense planning, policy and doctrine; War gaming; Military exercises; Threat evaluation; Types of warfare; Rapid deployment operations; Amphibious and riverine operations. For naval surface warfare, See <a href="#">15/06/01</a> , Naval Surface Warfare. For submarine warfare, See <a href="#">15/06/02</a> , Undersea and Antisubmarine Warfare. For chemical, biological and radiological warfare, See <a href="#">15/06/03</a> , Chemical, Biological and Radiological Warfare. For nuclear warfare, See <a href="#">15/06/04</a> , Nuclear Warfare. For space warfare, See <a href="#">15/06/05</a> , Space Warfare. For land mine warfare, See <a href="#">15/06/06</a> , Land Mine Warfare. For unconventional warfare, See <a href="#">15/06/07</a> , Unconventional Warfare.
06/01	Naval Surface Warfare	Strategy and tactics of naval military operations conducted on the ocean surface; Fleet exercises; Naval convoys; Techniques and equipment for the interception and destruction of surface vessels, including tracking and computing. Includes ship and antiship defense systems.
06/02	Undersea and Antisubmarine Warfare	Submarine warfare; Naval mine warfare; Torpedo attack; Techniques and equipment for the interception and destruction of submarines, including tracking and computing systems; Fleet exercises. For submarine detection techniques, See <a href="#">Field 17</a> , Navigation, Detection and Countermeasures. For underwater ordnance, See <a href="#">19/08</a> , Underwater Ordnance, and <a href="#">19/08/01</a> , Torpedoes.
06/03	Chemical, Biological and Radiological Warfare	Design, development, production and use of lethal and non-lethal chemical and biological agents, and radiological weapons. Includes nerve gases and irritating agents such as incapacitating agents, psychochemical agents and choking gases; Riot control agents; Tear gases; Defoliating agents for military purposes; Detection; Decontamination; Protective equipment; CBR ordnance items, such as bombs, projectiles, rockets and guided missile warheads. For nuclear weapons, See <a href="#">19/11</a> , Nuclear Weapons. For nuclear warfare, See <a href="#">15/06/04</a> , Nuclear Warfare. For pyrotechnic ammunition and incendiary bombs, See <a href="#">19/01/01</a> , Pyrotechnics.
06/04	Nuclear Warfare	Storage, transport and use of strategic and tactical nuclear weapons. Includes nuclear warfare strategy and planning. For treaties, arms control and negotiations, See <a href="#">05/04</a> , Government and Political Science. For the design and development of nuclear weapons. See

		<a href="#">19/11</a> , Nuclear Weapons.
06/05	Space Warfare	Military operations conducted in space. For ground or air based antisatellite systems, See <a href="#">15/03/03</a> , Antisatellite Defense Systems.
06/06	Land Mine Warfare	Land minefield design; Minelaying and mine clearing methods and equipment; Antitank, antimateriel and antipersonnel mines. Includes the design and development of land mine hardware and components. For naval mine warfare, See <a href="#">15/06/02</a> , Undersea and Antisubmarine Warfare.
06/07	Unconventional Warfare	Guerrilla warfare; Terrorist activities; Insurgency and counterinsurgency.

### 16--Guided Missile Technology

01	Guided Missile Launching and Basing Support	Missile handling and launching; Transportation of missiles; Preparations for launching; Surface, air, space or underwater launching; Launching equipment; Checkout equipment and procedures; Missile service support equipment; Missile sites and storage; Missile ranges.
02	Guided Missile Trajectories, Accuracy and Ballistics	Determination, analysis and processing of missile trajectory data including launch, boost, midcourse, unpowered, and reentry trajectories; Flight path analysis; Impact prediction; Impact data; Interior, exterior, terminal and reentry ballistics including hydroballistics and aeroballistics. For spacecraft reentry, See <a href="#">22/03</a> , Spacecraft Trajectories and Reentry.
02/01	Guided Missile Dynamics, Configurations and Control Surfaces	Operational characteristics and problems of full-scale missiles or models as they are affected by the dynamics of the environment. Includes theoretical and experimental aerodynamics, thermodynamics and hydrodynamics, as applied to missiles, missile control surfaces and configurations. For missile guidance systems, See <a href="#">17/07/03</a> , Air Navigation and Guidance.
03	Guided Missile Warheads and Fuzes	Design and performance of all types of missile warheads including high explosive, chemical, biological and nuclear; Missile fuzes of all types. For rocket warheads and fuzes, See <a href="#">19/07</a> , Rockets. For reentry missile warheads, See <a href="#">16/05</a> , Guided Missile Reentry Vehicles.
04	Guided Missiles	Guided missile theory, design, construction, performance and components. Includes damage assessment, vulnerability, survivability and threat analysis. For specific missile types, See <a href="#">16/04/01</a> , Air- and Space-Launched Guided Missiles, <a href="#">16/04/02</a> , Surface-Launched Guided Missiles, and <a href="#">16/04/03</a> , Underwater-Launched Guided Missiles. For endoatmospheric and exospheric ballistic missile defense systems, See <a href="#">15/03/01</a> , Antimissile Defense Systems.
04/01	Air- and Space-Launched Guided Missiles	Theory, design, construction, performance and components. Includes damage assessment, vulnerability, survivability and threat analysis.

04/02	Surface-Launched Guided Missiles	Theory, design, construction, performance and components. Includes damage assessment, vulnerability, survivability and threat analysis.
04/03	Underwater-Launched Guided Missiles	Theory, design, construction, performance and components. Includes damage assessment, vulnerability, survivability and threat analysis.
05	Guided Missile Reentry Vehicles	Theory, design, construction, performance and components. Includes damage assessment, vulnerability, survivability and threat analysis. For spacecraft reentry vehicles, See <a href="#">22/02</a> , Unmanned Spacecraft, or <a href="#">22/02/01</a> , Manned Spacecraft.

### 17--Navigation, Detection and Countermeasures

01	Acoustic Detection and Detectors	Detection by means of acoustic waves, including infrasonic, sonic and ultrasonic waves; Sonar detection. For underwater sound transmission studies, See <a href="#">20/01</a> , Acoustics. For acoustic countermeasures, See <a href="#">17/04/02</a> , Acoustic Countermeasures. For acoustic holography, See <a href="#">14/01</a> , Holography. See also <a href="#">17/10</a> , Seismic Detection and Detectors.
02	Non-acoustic and Non-magnetic Submarine Detection	The detection of submarines by means other than acoustic or magnetic.
03	Direction Finding	Determination of the direction of arrival of signals. For target direction finding, see the appropriate group in <a href="#">Field 17</a> , Navigation, Detection and Countermeasures. For determining one's own position or direction, See <a href="#">17/07</a> , Navigation and Guidance.
04	Countermeasures	Interception, jamming and antijamming, and deception of signals other than radio, radar, optical and acoustic; Applicable counter countermeasures. For countermeasures against directed energy weapons, See <a href="#">19/12</a> , Directed Energy Weapons. For underwater countermeasures, See <a href="#">19/08</a> , Underwater Ordnance, and <a href="#">19/08/01</a> , Torpedoes.
04/01	Radio Countermeasures	Interception, jamming and antijamming, and deception of radio signals; Applicable counter countermeasures. For radio communications, See <a href="#">25/02</a> , Radio Communications.
04/02	Acoustic Countermeasures	Interception jamming and antijamming, and deception of acoustic signals; Applicable counter countermeasures. For acoustic detection, See <a href="#">17/01</a> , Acoustic Detection and Detectors.
04/03	Radar Countermeasures	Interception, jamming and antijamming, and deception of radar signals, chaff; Applicable counter countermeasures. For radar homing and navigation, See <a href="#">17/07</a> , Navigation and Guidance. For radar detection, See <a href="#">17/09</a> , Active and Passive Radar Detection and Equipment.
04/04	Optical Countermeasures	Interception, jamming and antijamming, and deception of optical signals; Electrooptics to nullify use of optical systems; Applicable counter countermeasures. Includes infrared, ultraviolet and laser



		countermeasures. For optical detection, See <a href="#">17/05</a> , Optical Detection and Detectors.
05	Optical Detection and Detectors	Detection by means of visible light or light of unspecified frequency; Electronic detectors of light waves. Includes such optical instruments as binoculars and periscopes. For infrared detection, See <a href="#">17/05/01</a> , Infrared Detection and Detectors. For ultraviolet detection, See <a href="#">17/05/02</a> , Ultraviolet Detection and Detectors.
05/01	Infrared Detection and Detectors	Detection by measurement of infrared radiation. Includes optical instruments Which detect infrared radiation. For infrared photography, See <a href="#">14/04</a> , Photography.
05/02	Ultraviolet Detection and Detectors	Detection by measurement of ultraviolet radiation. Includes optical instruments which detect ultraviolet radiation.
06	Magnetic and Electric Field Detection and Detectors	Detection by measurement of magnetic or electric fields. For natural geomagnetic phenomena, See <a href="#">08/04</a> , Geomagnetism.
07	Navigation and Guidance	Navigation and guidance theory, analysis, design methodology, techniques, procedures and systems. For navigation on land, bodies of water, underwater, in air or space, See <a href="#">17/07/01</a> , Land and Riverine Navigation and Guidance; <a href="#">17/07/02</a> , Underwater and Marine Navigation and Guidance; <a href="#">17/07/03</a> , Air Navigation and Guidance; and <a href="#">17/07/04</a> , Space Navigation and Guidance, respectively.
07/01	Land and Riverine Navigation and Guidance	Navigation and guidance of surface craft and water. Includes navigating and guiding vehicles on land, rivers and small bodies of planetary surface exploratory vehicles. For surveying to determine one's own position underground, See <a href="#">13/02</a> , Civil Engineering.
07/02	Underwater and Marine Navigation and Guidance	Navigation and guidance of ships, submarines, submersibles, and underwater vehicles in the oceans and other large bodies of water. For torpedo guidance, See <a href="#">19/08/01</a> , Torpedoes.
07/03	Air Navigation and Guidance	Navigation and guidance of aircraft, missiles, remotely piloted vehicles and drones. Includes air traffic control systems, controlled approach systems, and instrument landing systems. For navigation by animals, See <a href="#">06/03</a> , Biology. For aircraft onboard navigation display systems, See <a href="#">01/04</a> , Flight Control and Instrumentation.
07/04	Space Navigation and Guidance	Navigation and guidance of manned and unmanned spacecraft and vehicles. For the navigation and guidance of planetary surface exploratory vehicles, See <a href="#">17/07/01</a> , Land and Riverine Navigation and Guidance.
08	Miscellaneous Detection and Detectors	Includes detection by biological and chemical means. For nuclear radiation detection, See <a href="#">18/04</a> , Nuclear Instrumentation. For detection of CBR agents, See <a href="#">15/06/03</a> , Chemical, Biological and Radiological Warfare.

09	Active and Passive Radar Detection Equipment	Detection by means of reflected Radar Detection and radiofrequency waves. Includes passive radar and microwave radiometry. For optical radar, See <a href="#">17/05</a> , Optical Detection and Detectors, or <a href="#">17/05/01</a> , Infrared Detection and Detectors. For radar signal interception, See <a href="#">17/04/03</a> , Radar Countermeasures. For radar mapping, See <a href="#">08/02</a> , Cartography and Aerial Photography.
10	Seismic Detection and Detectors	Detection by measurement of seismic waves; Seismic intrusion alarms. For studies of natural seismic events, See <a href="#">08/11</a> , Seismology. For detection of nuclear explosions, See <a href="#">18/03</a> , Nuclear Explosions and Devices (Non-Military), and <a href="#">19/11</a> , Nuclear Weapons. For location of mineral deposits by means of seismic waves, See <a href="#">08/09</a> , Mining Engineering.
11	Target Direction, Range and Position Finding	Determination of the direction, range or position of a target. If the means of detection is known, use the appropriate group in <a href="#">Field 17</a> , Navigation, Detection and Countermeasures. For signal direction finding, See <a href="#">17/03</a> , Direction Finding.

#### 18--Nuclear Science and Technology

01	Fusion Devices (Thermonuclear)	Theory, design, construction, and operation of devices for producing controlled thermonuclear fusion reactions; Development, design, testing, and operation of thermonuclear power plants. See also <a href="#">20/09</a> , Plasma Physics and Magnetohydrodynamics. For thermonuclear weapons, See <a href="#">19/11</a> , Nuclear Weapons.
02	Isotopes	Identification, separation, and concentration of isotopes. For isotopic SNAP(Systems for Nuclear Auxiliary Power) applications, See <a href="#">18/08</a> , SNAP(Systems for Nuclear Auxiliary Power) Technology. For pollution of the environment by radioactive isotopes, See <a href="#">24/06</a> , Radiation Pollution and Control. For the use of isotopes in a particular application, such as radioactive isotope tracer studies, see the group where the application is treated. See also <a href="#">07/05</a> , Radiation and Nuclear Chemistry.
03	Nuclear Explosions and Devices (Non-Military)	Design and development of nuclear devices for peaceful purposes, such as Plowshare; Explosion effects such as shock waves and earth movement; Simulation and testing of non-military nuclear devices. Includes the use of nuclear explosions to inject charged particles into the endoatmosphere and exosphere. For the design and applications of military nuclear devices, See <a href="#">19/11</a> , Nuclear Weapons, and <a href="#">15/06/04</a> , Nuclear Warfare.
04	Nuclear Instrumentation	Nuclear radiation detection and measurement devices and systems. For nuclear health physics instrumentation, such as dosimeters, See <a href="#">06/07</a> , Radiobiology.
05	Nuclear Power Plants and Fission Reactor Engineering	Engineering related directly to the design and operation of a fission reactor; Integrated assemblage, including reactor and turbogenerator equipment; Control and regulatory devices. Includes mobile as well as stationary power plants. For critical assemblies. See <a href="#">18/09</a> . Fission

		Reactor Physics. See also <a href="#">18/05/01</a> , Nuclear Fission Reactors (Power), and <a href="#">18/08</a> , SNAP (Systems for Nuclear Auxiliary Power) Technology. For thermonuclear power plants, See <a href="#">18/01</a> , Fusion Devices (Thermonuclear). For nuclear propulsion power plants, See <a href="#">21/06</a> , Nuclear Propulsion.
05/01	Nuclear Fission Reactors (Power)	Design, construction and operation of nuclear fission reactors used for electric power generation. Includes site selection and feasibility studies. See also <a href="#">18/05</a> , Nuclear Power Plants and Fission Reactor Engineering, and <a href="#">18/08</a> , SNAP (Systems for Nuclear Auxiliary Power) Technology. For disposal of radioactive wastes from nuclear reactors, See <a href="#">24/06</a> , Radiation Pollution and Control.
05/02	Nuclear Fission Reactors (Non-Power)	Nuclear fission reactors designed and built for purposes other than for electric power or propulsion. Includes production, research and training, test, and process heat reactors.
06	Nuclear Radiation Shielding, Protection and Safety	Shielding design; Nuclear radiation transport properties of materials; Decontamination; Nuclear safety engineering procedures; Container design and transportation requirements for radioactive materials. See also <a href="#">23/04</a> , Protective Equipment. For civil defense, See <a href="#">15/02</a> , Civil Defense. For the storage and transport of nuclear weapons, See <a href="#">15/06/04</a> , Nuclear Warfare. For electromagnetic shielding used to protect electronic equipment, See <a href="#">09/07</a> , Electromagnetic Shielding.
07	Radioactivity, Radioactive Wastes and Fission Products	Radioactive decay; Natural and induced radioactivity; Interaction of charged particles and radiation with matter; Separation, processing, handling, and storage of radioactive wastes; Fission product utilization; Natural radioactivity. For fission reaction studies, See <a href="#">18/09</a> , Fission Reactor Physics. For disposal of radioactive wastes and radioactive fallout, See <a href="#">24/06</a> , Radiation Pollution and Control. See also, <a href="#">07/05</a> , Radiation and Nuclear Chemistry.
08	SNAP (Systems for Nuclear Auxiliary Power)	Systems for nuclear power, both isotopic and reactor.
09	Fission Reactor Physics	Fission reactor kinetics and theory; Neutron transport theory; Criticality; Scattering; Slowing down economy. Includes critical assemblies and reactor simulators.
10	Fission Reactor Materials	Production, testing, and reclamation of fuel materials, coolants, moderators, control materials, structural materials, and shielding materials. Includes fabricated elements or assemblies and specific configurations. For disposal of reactor materials, See <a href="#">24/06</a> , Radiation Pollution and Control.

#### 19--Ordnance

01	Ammunition and Explosives	Projectiles, fuzes, demolition explosives, detonators, grenades, high explosives, primers, ammunition propellants, ammunition shaped charges, and ammunition handling equipment. For CBR ordnance items, See <a href="#">15/06/03</a> , Chemical, Biological and Radiological Warfare. For nuclear weapons See <a href="#">19/11</a> Nuclear Weapons For guided
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		missile ordnance items, See <a href="#">16/03</a> , Guided Missile Warheads and Fuzes. For ammunition and explosives storage, See <a href="#">15/05</a> , Logistics, Military Facilities and Supplies. For land mines, See <a href="#">15/06/06</a> , Land Mine Warfare. For naval mines, See <a href="#">19/08</a> , Underwater Ordnance.
01/01	Pyrotechnics	Production, performance, stability in storage of incendiaries, pyrotechnics, screening agents and smokes; Flame throwers; Flares; Pyrotechnic ammunition; Illuminating ordnance; Obscuration devices. Includes incendiary bombs, smoke bombs and photoflash bombs. For the storage of pyrotechnics, See <a href="#">15/05</a> , Logistics, Military Facilities and Supplies.
02	Aerial Bombs	High explosive, fragmentation, antipersonnel, armor piercing, and general purpose bombs; Bomb handling equipment such as bomb handling vehicles. Includes bomblets and air-dropped submunitions. For CBR bombs, See <a href="#">15/06/03</a> , Chemical, Biological and Radiological Warfare. For nuclear bombs, See <a href="#">19/11</a> , Nuclear Weapons. For bomb directors and bomb release mechanisms, See <a href="#">19/05</a> , Fire Control and Bombing Systems. For hydrobombs, See <a href="#">19/08</a> , Underwater Ordnance. For guided bombs, See <a href="#">19/13</a> , Guided Munitions.
03	Combat Vehicles	Armored wheeled and track laying military vehicles for both cargo and personnel; Heavy, light and medium tanks; Tank chassis used as gun carriers, their components and accessories.
04	Armor	Design, testing and performance of armor, armor plate, and body armor, including bullet proof, flak proof, explosion proof, and fragment proof devices and related equipment. For other types of protective equipment, See <a href="#">23/04</a> , Protective Equipment. See also <a href="#">18/06</a> , Nuclear Radiation Shielding, Protection and Safety.
05	Fire Control and Bombing Systems	Fire control computers, sights, directors, range finders, gunlaying and bombing radar systems, bomb releases and other devices used to direct the firing of weapons or the dropping of bombs. Includes gunnery and target practice. For torpedo fire control systems, See <a href="#">19/08/01</a> , Torpedoes.
06	Guns	Small arms, automatic weapons, recoilless weapons, mortars, artillery and naval guns, their components, and accessories; Gun carriages; Gun mounts; Projectile launchers. For interior ballistics, See <a href="#">19/10</a> , Ballistics.
07	Rockets	Unguided, self-propelled projectiles whose trajectory or course cannot be altered after launch; Ground, air and ship launched rockets, launchers and launch support equipment. For CBR rockets, See <a href="#">15/06/03</a> , Chemical, Biological and Radiological Warfare. For sounding rockets, see the field of application. For rocket engines, See <a href="#">21/08</a> , Rocket Engines. For rocket propellants, See <a href="#">21/09</a> , Rocket Propellants.
08	Underwater Ordnance	Naval mines; Depth charges; Hydrobombs; Antisubmarine ammunition including weapon projectors, launching devices, support equipment and countermeasures: Naval mine field clearance

		equipment.
08/01	Torpedoes	Torpedo guidance and control systems; Launching devices and support equipment; Countermeasures and counter countermeasures.
09	Explosions	Explosion effects such as blast, shock waves, detonation waves, cratering, ground motion or movement. Includes target vulnerability and damage assessment studies. For the effects of nuclear explosions, and nuclear explosion simulations, See <a href="#">18/03</a> , Nuclear Explosions and Devices(Non-military) and <a href="#">19/11</a> , Nuclear Weapons. For damage done to biological systems by explosives and weapons, See <a href="#">06/14</a> , Weapons Effects (Biological).
10	Ballistics	The study of motion, behavior and aerodynamics of projectiles thrown or launched by ordnance projectors; Interior, exterior and terminal ballistics.
11	Nuclear Weapons	Design and development of nuclear devices for military purposes; Testing of nuclear weapons; Studies of the nonbiological effects of nuclear weapons, such as explosion effects. Includes the generation of electromagnetic pulses by nuclear weapons. For the biological effects of nuclear weapons, See <a href="#">06/07</a> , Radiobiology. For radiation pollution, See <a href="#">24/06</a> , Radiation Pollution and Control. For storage, transport, security and use of nuclear weapons, See <a href="#">15/06/04</a> , Nuclear Warfare. For guided missile nuclear warheads, See <a href="#">16/03</a> , Guided Missile Warheads and Fuzes.
12	Directed Energy Weapons	High energy lasers, such as continuous wave, repetitively pulsed, and single pulse, for tactical and strategic applications; Charged and neutral particle beam weapons. Includes energy generators, beam handling and control, target effects and countermeasures.
13	Guided Munitions	Terminally guided, wire guided and laser guided munitions. Includes guided bombs, and cannon launched guided projectiles. For guided missiles, see <a href="#">Field 16</a> , Guided Missile Technology.

## 20--Physics

01	Acoustics	Generation and propagation of acoustic waves, including ultrasonic and infrasonic radiation; Underwater acoustics. For noise pollution, See <a href="#">24/02</a> , Noise Pollution and Control. For acoustooptic and optoacoustic devices, See <a href="#">09/06</a> , Acoustooptic and Optoacoustic Devices. See also <a href="#">17/01</a> , Acoustic Detection and Detectors.
02	Crystallography	Study of crystal structure; Theory, techniques and mechanics of crystal growth. Includes grain structures and crystal lattice defects. For the crystal structure of metals, See <a href="#">11/06/01</a> , Properties of Metals and Alloys. For liquid crystals, See <a href="#">07/04</a> , Physical Chemistry.
03	Electricity and Magnetism	Theoretical and experimental studies of electrical and magnetic phenomena; Circuit theory. For geomagnetic fields, See <a href="#">08/04</a> , Geomagnetism. For radiofrequency wave propagation. See <a href="#">20/14</a> .

		Radiofrequency Wave Propagation. For electromagnetic pulses, See <a href="#">20/15</a> , Electromagnetic Pulses.
04	Fluid Mechanics	Theoretical and experimental studies of the dynamics and statics of fluids, including aerodynamics and hydrodynamics. For all aircraft applications, See <a href="#">01/01</a> , Aerodynamics. For missile applications, See <a href="#">16/02/01</a> , Guided Missile Dynamics, Configurations and Control Surfaces. For spacecraft applications, See <a href="#">22/03</a> , Spacecraft Trajectories and Reentry. See also <a href="#">09/02</a> , Fluidics and Fluorics, <a href="#">20/09</a> , Plasma Physics and Magnetohydrodynamics, and <a href="#">13/07</a> , Hydraulic and Pneumatic Equipment
05	Atomic and Molecular Physics and Spectroscopy	Study of the structure of atoms and molecules and of the interactions between atoms and molecules; Processes which involve the interaction of radiant energy with matter; Infrared, optical and ultraviolet spectroscopy; Atomic and molecular spectroscopy; Electron paramagnetic resonance; Nuclear magnetic resonance; Quantum mechanics used to determine the orbitals, energy levels or properties of atoms and molecules. For interactions involving elementary particles and Nuclear energy levels, See <a href="#">20/08</a> , Nuclear Physics and Elementary Particle Physics. For the identification of inorganic and organic chemicals by means of their spectra, See <a href="#">07/02</a> , Inorganic Chemistry, and <a href="#">07/03</a> , Organic Chemistry. For astronomical spectroscopy, See <a href="#">03/02</a> , Astrophysics.
06	Optics	Generation, propagation and interaction with matter of electromagnetic waves in the infrared, visible and ultraviolet regions of the spectrum; Theory and design of optical equipment. For optical equipment used for specific applications, see group where application is treated. For identification of inorganic and organic chemicals by means of their spectra, See <a href="#">07/02</a> , Inorganic Chemistry, and <a href="#">07/03</a> , Organic Chemistry. For spectroscopy applied to atomic and molecular structures, See <a href="#">20/05</a> , Atomic and Molecular Physics and Spectroscopy. For Astronomical spectroscopy, See <a href="#">03/02</a> , Astrophysics. For electron optics, See <a href="#">20/08</a> , Nuclear Physics and Elementary Particle Physics. For microwave optics, See <a href="#">20/14</a> , Radiofrequency Wave Propagation. For fiber optics, See <a href="#">20/06/01</a> , Fiber Optics and Integrated Optics. See also <a href="#">17/05</a> , Optical Detection Detectors; <a href="#">17/05/01</a> , Infrared Detection and Detectors; and <a href="#">17/05/02</a> , Ultraviolet Detection and Detectors.
06/01	Fiber Optics and Integrated Optics	Theoretical and technological studies of the transmission of light through fibers of glass, plastic and other transparent materials; Studies of integrated optical circuits. For the application of fiber optics or integrated optics, see the group where the application is treated.
07	Particle Accelerators	Design and operation of particle accelerators; Betatrons; Cyclotrons; Synchrotrons. Includes accelerator target design and accelerator particle beam control. For directed energy weapons, See <a href="#">19/12</a> , Directed Energy Weapons.
08	Nuclear Physics and Elementary Particle Physics	Properties and reactions of elementary particles, gamma rays and x rays; Nuclear reactions, nuclear properties and nuclear structure; Electron optics. For atomic and molecular structure and spectra. See

		<a href="#">20/05</a> , Atomic and Molecular Physics and Spectroscopy. For nuclear magnetic resonance, See <a href="#">20/05</a> , Atomic and Molecular Physics and Spectroscopy. For solar and stellar nuclear physics, See <a href="#">03/02</a> , Astrophysics.
09	Plasma Physics and Magneto-hydrodynamics	Properties and actions of plasmas, including pinch effect, plasma oscillations, plasma jets. For magnetohydrodynamic(NHD) generators, See <a href="#">10/02</a> , Electric Power Production and Distribution. For plasma propulsion systems, See <a href="#">21/03</a> , Electric and Ion Propulsion. For astrophysics, See <a href="#">03/02</a> , Astrophysics. For aeronomy, See <a href="#">04/01</a> , Atmospheric Physics.
10	Quantum Theory and Relativity	Relativistic and nonrelativistic quantum theory; Relativity theory; Quantum mechanics and quantum statistics. For quantum chemistry, See <a href="#">07/04</a> , Physical Chemistry.
11	Mechanics	Dynamics and statics of solid bodies; Structural mechanics; Kinetics; Kinematics; Equilibria; Stress Analysis; Buckling; Plasticity; Mechanical shock and vibration; Theory of structural shells.
12	Solid State Physics	Properties exhibited by atoms and molecules because of their association and regular periodic arrangement in crystals; Properties of solids at cryogenic temperatures; Fundamental research and theoretical studies of semiconductors; Band structure of solids. For solid state electronic devices, See <a href="#">09/01</a> , Electrical and Electronic Equipment. For the structure of crystals, See <a href="#">20/02</a> , Crystallography. For the structure and property of metals, See <a href="#">11/06/01</a> , Properties of Metals and Alloys.
13	Thermodynamics	Thermodynamic theory; equations of state; Free energy; Enthalpy; Entropy; Thermodynamic cycles; Theoretical studies of heat transfer; Cryogenic phenomena and methods; Kinetic theory of gases. For properties of solids at cryogenic temperatures, See <a href="#">20/12</a> , Solid State Physics. For thermal radiation properties such as absorptance, emittance, reflectance, and transmittance, See <a href="#">20/06</a> , Optics.
14	Radiofrequency Wave Propagation	Generation and propagation of radiofrequency waves and radar signals. Includes microwave optics.
15	Electromagnetic Pulses	Studies of the properties and effects of electromagnetic pulses from all sources; Studies of the generation of electromagnetic pulses by non-nuclear sources. For the generation of electromagnetic pulses by nuclear explosions, See <a href="#">19/11</a> , Nuclear Weapons.

## 21--Propulsion, Engines and Fuels

01	Air Breathing Engines	Unconventional engines which use ingested air to oxidize their fuel, for example, the (Unconventional) liquid air cycle engine (LACE). For conventional air breathing engines, See <a href="#">21/05</a> , Jet and Gas Turbine Engines, and <a href="#">21/07</a> , Reciprocating and Rotating Engines.
02	Combustion and Ignition	Combustion and flame studies of fuels; Ignition and ignition systems. For combustion studies of nonfuels. See <a href="#">07/04</a> , Physical Chemistry.

		For combustion devices, see the group where the application is treated.
03	Electric and Ion Propulsion	All types of engines deriving power from free ions or electrons; Ion, plasma and arc-jet engines; Photopropulsion. For vehicles propelled by electric motors, see the group where the vehicle is treated.
04	Fuels	Production, performance and storage of all types of fuels except those used in rocket engines; Fuel thickeners and their additives. Includes fuel tanks and fuel storage tanks. For rocket fuels, See <a href="#">21/09</a> , Rocket Propellants; <a href="#">21/09/01</a> , Liquid Rocket Propellants; and <a href="#">21/09/02</a> , Solid Rocket Propellants.
05	Jet and Gas Turbine Engines	Design, performance and testing of all types of jet and gas turbine engines and their components, such as engine nozzles. Includes hydroduct, ramjet and turboprop engines.
06	Nuclear Propulsion	Nuclear systems for marine, ground, air and space propulsion.
07	Reciprocating and Rotating Engines	Design, performance and testing of reciprocating and rotating engines of various configurations for all types of propulsion. Includes internal and external combustion engines. For turbine engines, See <a href="#">21/05</a> , Jet and Gas Turbine Engines.
08	Rocket Engines	Design, performance and testing of rocket engines and propulsion hardware; Gaseous, thixotropic and hybrid rocket motors. See also <a href="#">21/08/01</a> , Liquid Propellant Rocket Engines, and <a href="#">21/08/02</a> , Solid Propellant Rocket Engines.
08/01	Liquid Propellant Rocket Engines	Studies of liquid propellant rocket engines and propulsion hardware.
08/02	Solid Propellant Rocket Engines	Studies of solid propellant rocket engines and propulsion hardware.
09	Rocket Propellants	Production, handling, stability and performance of chemical rocket propellants and propellant combinations other than all liquid or all solid propellants, including fuels, oxidizers, additives and binders. Includes propellant tanks.
09/01	Liquid Rocket Propellants	Production, handling, stability and performance of all liquid rocket propellants, including fuels, oxidizers and additives. Includes propellant tanks.
09/02	Solid Rocket Propellants	Production, handling, stability and performance of all solid rocket propellants, including fuels, oxidizers, additives and binders. Includes propellant cases.

## **22--Space Technology**

01	Astronautics	Space missions, projects, logistics and exploration; Orbital rendezvous; Launching in space; Spacecraft operating problems; Space crews; Extravehicular activity
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02	Unmanned Spacecraft	Design and construction of unmanned spacecraft including space probes, and space vehicles capable of atmospheric reentry; Satellites such as military, communication, scientific and reconnaissance satellites; Spacecraft instruments, gauges indicators and instrument systems of all spacecraft not designated as manned; Spacecraft damage assessment and vulnerability studies.
03	Spacecraft Trajectories and Reentry	Determination, analysis and processing of spacecraft trajectory data; Orbital calculations; Flight path analysis; Controlled space flight; Controlled and uncontrolled reentry; Space mechanics. For guided missile reentry trajectories, See <a href="#">16/02</a> , Guided Missile Trajectories, Accuracy and Ballistics. For the guidance and navigation of spacecraft, See <a href="#">17/07/04</a> , Space Navigation and Guidance.
04	Ground Support Systems and Facilities for Space Vehicles	Handling and launching including transportation, storage, preparation for launching and countdown; Launching equipment; Checkout equipment; Ground support equipment; Recovery support; Launch complexes; Research facilities; Test facilities; Spacecraft simulators and simulation. For launching of space vehicles in space, See <a href="#">22/01</a> , Astronautics.
05	Manned Spacecraft	Design and construction of manned spacecraft and space stations; Spacecraft damage assessment and vulnerability studies Includes spacecraft instruments, gauges indicators and instrument systems. For aerospace craft, See <a href="#">01/03/12</a> , Research and Experimental Aircraft.

### 23--Biotechnology

01	Biomedical Instrumentation and Bioengineering	Bioinstrumentation and equipment to monitor man in the operation of man machine systems; Biotelemetry including biotelemetry transducer and transmitter equipment; Use of body potentials as intrinsic power supplies. Includes equipment for monitoring and processing biomedical information from closed cycle ecological systems. For nonbiomedical telemetry, See <a href="#">25/01</a> , Telemetry. See also, <a href="#">23/05</a> , Life Support Systems, <a href="#">06/12</a> , Medical Facilities, Equipment and Supplies, and <a href="#">23/02</a> , Human Factors Engineering and Man Machine Systems.
02	Human Factors Engineering and Man Machine Systems	Application of human factors to the design of equipment; Habitability of work and living space; Ergonomics; Interaction of man and equipment in terms of subsystem and system performance requirements and evaluation.
03	Bionics	Study of biological processes in order to develop engineering systems. See also, <a href="#">12/09</a> , Cybernetics.
04	Protective Equipment	Clothing or equipment providing protection against such environmental elements as heat, cold, noise and machinery. For equipment providing protection against CBR agents, See <a href="#">15/06/03</a> , Chemical, Biological and Radiological Warfare. For armor. See <a href="#">19/04</a> .

		Armor. For equipment and techniques for sustaining life in adverse environments such as space and underwater, See <a href="#">23/05</a> , Life Support Systems. See also <a href="#">13/12</a> , Safety Engineering. For electromagnetic shielding to protect electronic equipment, See <a href="#">09/07</a> , Electromagnetic Shielding.
05	Life Support Systems	Equipment and techniques for sustaining life in adverse environments, such as space and underwater; Systems which provide, as a minimum, respiratory support; Closed ecological systems including space suits, diving gear, oxygen masks, breathing apparatus. For equipment providing protection against CBR agents, See <a href="#">15/06/03</a> , Chemical, Biological and Radiological Warfare. For equipment providing protection against such environmental elements as heat, cold, noise and machinery, See <a href="#">23/04</a> , Protective Equipment.
06	Escape, Rescue and Survival	Equipment and techniques for escape and rescue from disabled aircraft, ships, submarines, spacecraft and ground vehicles. Includes rescue signals, flotation devices and survival kits. For fire extinguishing techniques, See <a href="#">13/12</a> , Safety Engineering. For forest fire fighting techniques, See <a href="#">02/06</a> , Forestry. For natural disaster planning and operations, See <a href="#">15/02</a> , Civil Defense.

#### 24--Environmental Pollution and Control

01	Air Pollution and Control	Air pollution from sources such as flue gases, exhaust gases, odors, dust, smog and microorganisms; Control techniques and equipment; Sampling and analytical techniques and equipment; Waste gas recovery; Biological, ecological and socio-economic effects; Air pollution chemistry. For effect on public health, See <a href="#">24/07</a> , Environmental Health and Safety. For pesticides and radioactive contaminants, See <a href="#">24/05</a> , Pesticides Pollution and Control, and <a href="#">24/06</a> , Radiation Pollution and Control.
02	Noise Pollution and Control	Pollution in the environment by noise from any acoustic source including engine noise, traffic and transportation noise, machinery noise, industrial noise, urban noise, sonic boom; Theory and devices for control; Noise detection and measurement; Biological, ecological and socio-economic effects. For the effects on public health, See <a href="#">24/07</a> , Environmental Health and Safety.
03	Solid Wastes Pollution and Control	Pollution by solid wastes including garbage, scrap, junked automobiles, spoil, sludge, containers; Disposal methods such as composting, injection wells, incineration, and sanitary landfills; Mining wastes; Materials separation, processing and recovery; Recycling; Biological, ecological and socio-economic effects. For the effects on public health, See <a href="#">24/07</a> , Environmental Health and Safety. For the disposal of pesticides and radioactive contaminants and wastes, See <a href="#">24/05</a> , Pesticides Pollution and Control, and <a href="#">24/06</a> , Radiation Pollution and Control, respectively.
04	Water Pollution	Water pollution by municipal, agricultural and industrial wastes, mine

	and Control	waters, radioactive contaminants; Chemistry and analysis of pollutants; Thermal pollution; Oil pollution; Control techniques and equipment; Sewage treatment including the design and construction of sewers and drinking water treatment facilities; Biological, ecological and socio-economic effects; Waste water reuse. For the effects on public health, See <a href="#">24/07</a> , Environmental Health and Safety. For pollution by pesticides and radioactive contaminants, See <a href="#">24/05</a> , Pesticides Pollution and Control, and <a href="#">24/06</a> , Radiation Pollution and Control, respectively.
05	Pesticides Pollution and Control	Pollution by insecticides, herbicides, fungicides; Decomposition studies; Analysis and detection; Biological, ecological and socio-economic effects. For the effects on public health, See <a href="#">24/07</a> , Environmental Health and Safety.
06	Radiation Pollution and Control	Pollution of the environment by particle and electromagnetic radiation from electric fields, magnetic fields or natural and man made sources including neutrons, x-rays, ultraviolet radiation, microwaves, alpha particles; Sampling and analytical techniques; Radioactive fallout; Biological ecological and socio-economic effects. Includes controlled disposal of radioactive wastes from nuclear reactors. For the effects on public health, See <a href="#">24/07</a> , Environmental Health and Safety.
07	Environmental Health and Safety	Effects of pollution on public health and safety; Industrial medicine and health. For pollution effects on plants and animals, see narrower categories in <a href="#">Field 24</a> , Environmental Pollution and Control. See also <a href="#">13/12</a> , Safety Engineering.

## 25--Communications

01	Telemetry	Data transmission techniques and equipment including transmitters, receivers, and antennas. Includes acoustic, optical, wired and radio telemetry. For biotelemetry, See <a href="#">23/01</a> , Biomedical Instrumentation and Bioengineering.
02	Radio Communications	Communication by radio waves; Microwave communications; Television communications. Includes radio transmitting and receiving equipment, radio broadcasting, radio relay stations, radio scanning. For radiotelemetry, See <a href="#">25/01</a> , Telemetry. For radiofrequency propagation, See <a href="#">20/14</a> , Radiofrequency Wave Propagation. For radio countermeasures, See <a href="#">17/04/01</a> , Radio Countermeasures.
03	Non-Radio Communications	Communications by means other than radio waves. For communication by radio waves, See <a href="#">25/02</a> , Radio Communications. For wired telemetry, See <a href="#">25/01</a> , Telemetry.
04	Voice Communications	Research and development in vocal communication; Speech intelligibility; Speech recognition; Speech analysis and synthesis. See also <a href="#">12/09</a> , Cybernetics.
05	Command, Control and Communications Systems	Includes command and control systems.

### **3. WEAG Ürün ve Teknoloji Sınıflamaları<sup>8</sup>**

#### A) Military Functions

- 01 Command and control
- 02 Surveillance
- 03 Reconnaissance
- 04 Intelligence support
- 05 Training and exercise
- 06 Logistics
- 07 NBC defence
- 08 Electronic warfare
- 09 Interdiction
- 10 Land combat operations
- 11 Land combat support
- 12 Air defence operations
- 13 Offensive air operations
- 14 Supporting air operations
- 15 Maritime support operations
- 16 Maritime mine warfare
- 17 Anti-submarine warfare
- 18 Amphibious operations
- 19 Special operations
- 20 Peace support operations

#### B) Defence Products

1. Combat and support armoured vehicles
2. Engineers equipment (building and construction equipment, bridgelaying equipment, etc.) and ground robots
3. Weapons and ammunitions
4. Combat aircraft
5. Transport aircraft & patrol
6. Helicopters
7. Unmanned aerial vehicles
8. Tactical missiles
9. Surface ship
10. Non-nuclear submarine
11. Torpedo systems and submarine unmanned vehicles
12. Mine hunting and sweeping

13. Electronics, communication, data processing
14. Military satellite systems
15. Forces systems

C) Technology Areas

A = Generic (or basic multisectorial) technologies

- A01 Structural materials
- A02 Signature related materials & materials for smart structures
- A03 Electronic materials
- A04 Photonic/optical materials & devices
- A05 Electronic & electric devices
- A06 Energetic materials
- A07 Chemical, biological & medical materials & medical processes
- A08 Computing, information processing & communication technologies
- A09 Human sciences
- A10 Manufacturing processes/ design tools/ techniques
- A11 Operating environmental issues

B = Systems-related technologies

- B01 Lethality & platform protection
- B02 Propulsion & power plants
- B03 Design aspects (platforms & weapons)
- B04 Electronic warfare and DEW systems
- B05 Signature control & signature reduction
- B06 Sensor systems
- B07 Guidance & control systems (weapons & platforms)
- B08 Simulators, trainers & human-computer interfaces
- B09 Integration & other system issues
- B10 C2I systems
- B11 Communication systems
- B12 Personnel protection measures

#### 4. NATO Referansları

##### 4.1. DRAFT BI-STRATEGIC COMMAND LIST OF LONG TERM CAPABILITY REQUIREMENTS FOR EACH MILITARY FUNCTION (MF)

Military Function	Capability Requirement
Command & Control	<ul style="list-style-type: none"> <li>• Interoperable Joint Combat Identification</li> <li>• Common Operational Picture</li> <li>• Worldwide, reliable, precise, protected positioning &amp; navigation capability</li> <li>• Improved use &amp; access to bandwidth &amp; frequency spectrum</li> </ul>
Reconnaissance, Surveillance & Target Acquisition	<ul style="list-style-type: none"> <li>• Interoperable Joint Identification &amp; Target Acquisition</li> <li>• Timely sensor-shooter connectivity in order to locate, identify and attack concealed, high value, timecritical targets</li> <li>• Short range (10-100m) reconnaissance, surveillance &amp; target acquisition</li> <li>• Aerospace ground surveillance</li> <li>• Network-centric RSTA among all component commanders</li> <li>• Intelligence collection &amp; analysis for cyber warfare</li> </ul>
Intelligence Support	<ul style="list-style-type: none"> <li>• Interfaces between NATO and national intelligence systems</li> <li>• Automated intelligence indicators &amp; warning</li> <li>• Advanced analytical tools for threat assessment</li> </ul>
Education, Training, Exercise & Evaluation	<ul style="list-style-type: none"> <li>• Computer network architecture for education &amp; training</li> <li>• Models of Peace Support and terrorist-related operations</li> <li>• Modelling &amp; simulation capability for experimentation</li> <li>• Reconstruction tools for exercise analysis</li> </ul>
Nuclear, Chemical & Biological Defence	<ul style="list-style-type: none"> <li>• Stand-off detection and identification of biological agents, integrated into a NBC warning and reporting system</li> <li>• Protection of individual combatants against NBC agents</li> <li>• Decontamination of equipment &amp; personnel using non-toxic means</li> <li>• Portable monitoring capability to register presence of biological threat agents</li> <li>• Stand-off weapon capability to destroy NBC agents of adversary forces before they can be used</li> </ul>
Special Operations	<ul style="list-style-type: none"> <li>• Tactical insertion &amp; extraction of special forces at long range</li> <li>• Light-weight, self-contained power supplies</li> <li>• Light, compact, portable devices to provide a common operational picture</li> <li>• Precise delivery of equipment &amp; supplies by air drop</li> <li>• Fully integrated, day/night, all-weather long range image collection &amp; dissemination</li> </ul>

Electronic Warfare	<ul style="list-style-type: none"> <li>• Directed Energy Weapons</li> <li>• Stealthy EW systems/platforms</li> <li>• Common EW picture</li> <li>• Detect &amp; identify advanced systems</li> <li>• Infrared/Electro-optical countermeasures</li> </ul>
Logistics	<ul style="list-style-type: none"> <li>• Force Deployability</li> <li>• Sustainment of expeditionary forces</li> <li>• Transportation infrastructure</li> </ul>
Plans & Policy	<ul style="list-style-type: none"> <li>• Analysis tools in support of operational planning</li> <li>• Management system for defence planning</li> <li>• Requirements generation process</li> </ul>
Joint & Combined Operations	<ul style="list-style-type: none"> <li>• Tactical data exchange between national land, air and maritime forces</li> <li>• Command, control &amp; information multi-level security access system</li> <li>• Time-critical targeting, battle damage assessment &amp; tasking/retasking of strike assets</li> </ul>
Land Operations	<ul style="list-style-type: none"> <li>• Non-lethal weapons &amp; low-collateral damage precision-guided munitions</li> <li>• Area access denial system</li> <li>• Infantry personnel protection &amp; network centric battle-dress</li> <li>• Deep strike precision-guided munitions</li> <li>• Light, mobile long-range, decisively-lethal armour systems</li> </ul>
Air Operations	<ul style="list-style-type: none"> <li>• Lower/upper boost phase tactical ballistic missile (TBM) defence</li> <li>• Rapid, effective &amp; low-risk suppression of enemy air defences</li> <li>• Recognised &amp; common air picture</li> <li>• Long-range combat search &amp; rescue (CSAR)</li> <li>• Rapid detection &amp; identification of high-value time-critical targets</li> </ul>
Maritime Operations	<ul style="list-style-type: none"> <li>• All-weather detection &amp; localisation of threat submarines, and secure identification and recognition of own submarines in littoral/shallow water</li> <li>• Rapid mine countermeasures in all water depths, including shallow to very shallow waters, against modern mines (e.g. self-burying, pressure sensitive mines) with the capability to remove and dispose of mines from ports &amp; harbours without collateral damage.</li> <li>• Precision land-attack capability to support land operations with effective, on-time naval fires with guns and missiles</li> <li>• Integration of maritime surveillance, reconnaissance &amp; target acquisition systems in joint &amp; combined operations</li> </ul>

#### 4.2. NATO RTO Panelleri<sup>9</sup>

Panel	Kapsam
AVT - Applied Vehicle Technology	<p>The scope of activity of AVT is to address technology issues related to vehicle, platform, propulsion and power systems operating in all environments (land, sea, air, and space), for both new and aging systems. The activities of AVT may be grouped into two broad areas:</p> <p>(a) Vehicle and platform technologies, including: - Vehicle and platform design - Configurational fluid dynamics and fluid mechanics - Stability and control - Noise and vibration control - Structural loads and dynamics - Smart structures - Structural materials and manufacturing processes - Non-structural materials - Environmental effects - Affordability, availability, survivability and supportability - Reliability, maintenance and repair - Test facilities, techniques, and instrumentation</p> <p>(b) Propulsion and power technologies, including: - Air breathing engine design (piston, gas turbine, ramjet/scramjet) - Rocket motors and rocket based combined cycles - Electric propulsion including hybrid systems - Engine control and thrust vectoring - Power generation and storage - Fuels and combustion - Power plant materials and structures - Propellants and explosives - Operation, condition monitoring, reliability, maintenance and affordability - Environmental impact - Test facilities, techniques, and instrumentation</p>
HFM - Human Factors and Medicine	<p>The Mission of the Human Factors and Medicine (HFM) Panel covers the fields of Human Factors that affect the warfighter's ability to acquire, process and make effective decisions using task critical information. Operational Medicine which encompasses aerospace, hyperbaric, and military medicine necessary to ensure sustenance, health, safety and survival of warfighters. Human Protection in Adverse Environments which encompasses human-centered research for optimizing human physiological tolerance, protection and survivability in adverse mission nuclear, environments.</p> <p>The mission of the Human Factors and Medicine Panel (HFM) is to optimise performance, health, well-being, and safety of the human in operational environments with consideration of affordability. This involves understanding and ensuring the physical, physiological, psychological and cognitive compatibility among military personnel, technological systems, missions, and environments. This is accomplished by: exchange of information, collaborative experiments, and shared field trials.</p> <p>The panel is to maintain expert networks and foster information exchange as well as coordinate with other panels common activities (eg : IST linkage in the field of human information processing, visualization, human computer interface, virtual reality,...).</p> <p>The scope is multi-disciplinary and encompasses a wide range of theory, data, models, knowledge and practice pertaining to:</p> <p>Human Factors that affect the military personnel's ability to acquire, process and make effective decisions using task critical information. Areas of interest include, selection, training, gender and minority issues, anthropometry, design of information displays and controls, communications and team work, human error, fatigue management, cognitive engineering, performance enhancement and aiding, and function allocation including in automated systems.</p>



	<p>Operational Medicine encompasses aerospace, hyperbaric, and military medicine necessary to ensure sustenance, health, safety and survival of military personnel. Areas of interest include nutrition, hygiene, fitness, medical problems, pharmacology (drugs, vaccines and countermeasures) and medical evacuation.</p> <p>Human Protection in Adverse Environments encompasses human-centered research for optimizing human physiological tolerance, protection and survivability in adverse mission environments (e.g. cold, heat, hypobaric, hyperbaric, undersea, noise, vibration, motion, nuclear, biological, chemical, acceleration, ionizing, nonionizing radiation, etc.).</p>
<p>IST – Information Systems Technology</p>	<p>The Mission of the Information Systems Technology (IST) Panel is tasked to identify and review areas of research of common interest, to recommend the establishment of activities in these areas and to initiate and approve exploratory teams. It is to maintain expert networks and foster information exchange as well as coordinate with other panels common activities (eg : modelling and simulation with SAS, electronic warfare with SCI and SET, avionics and smart vehicles with AVT, human computer interface with HFM).</p> <p>The Information Systems Technology Panel (IST) covers the fields of:</p> <ul style="list-style-type: none"> <li>• Information Warfare and Assurance,</li> <li>• Information and Knowledge Management,</li> <li>• Communications and Networks</li> <li>• Architecture and Enabling Technologies</li> </ul> <p>The IST Panel is concerned with domains and disciplines such as :</p> <ul style="list-style-type: none"> <li>• Information Warfare and Assurance - INFOSEC - COMPUSEC - COMSEC - TRANSEC - Information Assurance - System Assurance</li> <li>• Information and Knowledge Management - Decision Support Architectures - Data Mining - Data Warehousing - Information Fusion - Information filtering - Visualization - Knowledge-based Systems - Artificial Intelligence</li> <li>• Communications and Networks - Voice Data and Video over disadvantaged links - Network Management - Network Security - Mobile Communications - Satellite Communications</li> <li>• Architecture and Enabling Technologies - Software Engineering Technologies - Computing Technologies - Requirements Capture - Modelling and Simulation Technologies - Modelling and Simulation Architectures and Standards - Speech and Natural Language Processing - GroupWare and Collaboration Tools.</li> </ul>
<p>SET – Sensors and Electronic Technology</p>	<p>The Mission of the Sensors &amp; Electronics Technology (SET) Panel is: to advance technology in electronics and passive/active sensors as they pertain to reconnaissance, surveillance and target acquisition, electronic warfare, communications and navigation; and to enhance sensor capabilities through multi-sensor integration/fusion. This concerns the phenomenology related to target signature, propagation and battlespace environment, EO, RF, acoustic and magnetic sensors, antenna, signal and image processing, components, sensor hardening and electromagnetic compatibility.</p> <p>The scope of activity in SET includes the following disciplines:</p> <p>Phenomenology:</p> <ul style="list-style-type: none"> <li>• target/background signatures</li> </ul>

	<ul style="list-style-type: none"> <li>• propagation</li> <li>• battlespace environment characterization</li> </ul> <p>Sensors:</p> <ul style="list-style-type: none"> <li>• EO (Imaging IR, IR search and track, ultraviolet, laser radars, etc.)</li> <li>• RF (radar, radiometers, goniometers, etc.)</li> <li>• acoustic, seismic, magnetic, chemical, inertial etc...</li> </ul> <p>Electronics:</p> <p>Processing:</p> <ul style="list-style-type: none"> <li>• antenna processing and aperture control</li> <li>• signal processing</li> <li>• image processing</li> <li>• pattern recognition including automatic target recognition</li> <li>• multi-sensor fusion</li> </ul> <p>Components:</p> <ul style="list-style-type: none"> <li>• EO (optics, integrated optics, fibre optics, focal plane arrays, lasers, etc.)</li> <li>• RF (antenna, amplifier, filter, DRF (digital radio frequency)-memories, monolithic microwave integrated circuits, high power microwave sources, etc.)</li> <li>• microelectronics</li> <li>• micromechanics</li> <li>• displays</li> <li>• mechanical, chemical, etc.</li> </ul> <p>Sensor Hardening, Electronic Protection Measures, Electromagnetic Compatibility.</p>
<p>SCI – Systems Concepts and Integration</p>	<p>The Mission of the Systems Concepts and Integration (SCI) Panel is to advance knowledge concerning advanced systems, concepts, integration, engineering techniques and technologies across the spectrum of platforms and operating environments to assure cost-effective mission area capabilities.</p> <p>Integrated defence systems, including air, land, sea and space systems (manned and unmanned) and associated weapon and countermeasure integration are covered.</p> <p>Panel activities focus on NATO and national mid- to long-term system level operational needs.</p> <p>The scope of Panel activities covers a multidisciplinary range of theoretical concepts, design, development and evaluation methods applied to integrated defence systems. Areas of interest include:</p> <ul style="list-style-type: none"> <li>• Integrated mission systems including weapons and countermeasures</li> <li>• System architecture/mechanization</li> <li>• Vehicle integration</li> <li>• Mission management</li> <li>• System engineering technologies and testing</li> </ul>
<p>SAS – Studies, Analysis and Simulation</p>	<p>The mission of the Studies, Analysis and Simulation (SAS) Panel is:</p> <ul style="list-style-type: none"> <li>• To conduct studies and analyses of an operational and technology nature.</li> <li>• To exchange information on operational analysis (OA) technology and to advance the development of OA methods and tools.</li> <li>• To provide a forum for NATO modelling and simulation (M&amp;S) oriented towards operational issues.</li> </ul>

	<p>The scope of activity under SAS is:</p> <p>(a) Studies. Conduct studies concentrating on the linkage between technology and operations. SAS will be responsive to requests for studies from a variety of sources, including nations, the R&amp;T Board, the Military Committee, CNAD, the Main Armaments Groups, SHAPE, SACLANT, NC3A, NIAG, industry and academia. SAS can also perform studies of a more purely technological nature if such studies are not appropriate for another NATO group.</p> <p>(b) Analysis. Conduct analyses focused on the operational effectiveness of forces and systems. Promote exchange between the nations and appropriate NATO agencies on issues of methodologies for operational analyses and research. This exchange must be responsive to the demands on OA to cope with issues raised by the changing world, the role and expansion of NATO and the type of studies conducted by the Panel. It should include the exchange of OA modelling concepts, research into new methodological approaches and the exchange of models.</p> <p>(c) Simulation. SAS will be primarily concerned with simulation of an operational nature rather than that of a technical nature (such as flight simulators). The mandate of SAS will include:</p> <ul style="list-style-type: none"> <li>• monitoring the state-of-the-art of relevant simulation and modelling in the NATO nations;</li> <li>• identifying opportunities for cooperative development or enhancement of simulation tools, and facilitating such cooperative efforts;</li> <li>• identifying opportunities for improvement of NATO command structures through the application of simulation technologies; and,</li> <li>• harmonising the integration of simulation tools in NATO.</li> </ul>
<p>NMSG – NATO Modelling and Simulation Group</p>	<p>The Mission of the NATO Modelling and Simulation Group (NMSG) is to provide readily available, flexible and cost-effective means to dramatically enhance NATO operations in the application areas of defence planning, operational planning, training and exercises, support to operations and modernization. This goal will be accomplished by a NATO-wide co-operative effort that promotes interoperability, reuse and affordability.</p> <p>The mission of the NATO Modelling and Simulation (M&amp;S) Group (NMSG) is to promote co-operation among Alliance bodies, NATO Member Nations and PFP Nations to maximise the effective utilisation of M&amp;S according to the NATO M&amp;S Action Plan. Primary mission areas include M&amp;S standardisation, education, and associated science and technology. Additionally, the Group will provide M&amp;S expertise in support of the tasks and projects within the RTB and from other NATO organisations.</p> <p>The Group:</p> <ul style="list-style-type: none"> <li>• Is responsible for the development and execution of, and proposing revisions to the NATO M&amp;S Action &amp; Business Plans.</li> <li>• Is a level-2 body of which its most important actions are enabling M&amp;S and promoting best practices in the Alliance.</li> <li>• Develops, advocates and guides implementation of M&amp;S standards.</li> <li>• Fosters maximum levels of M&amp;S interoperability and reuse of models.</li> <li>• Develops, advocates and guides programs to facilitate education and information exchange in M&amp;S science and technology, application methods and standards.</li> </ul>

	<ul style="list-style-type: none"> <li>Identifies, advocates and executes science and technology projects to improve M&amp;S tools, standards, interoperability, network concepts and databases.</li> <li>As required, provides M&amp;S expertise to support pertinent projects of the RTO Panels.</li> <li>In co-ordination with the RTA Director, guides the efforts of the fulltime staff support of the Modelling and Simulation Co-ordination Office (MSCO).</li> </ul>
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## 5. Avrupa Birliđi :

### 5.1. Avrupa Birliđi Rekabetçi ve Sürdürülebilir Büyüme Programı Araştırma Temaları<sup>10</sup>

Tema	Kapsam
Innovative products, processes and organisation	<p>European industry - particularly traditional sectors with a high percentage of SMEs - must continually adapt to change by adopting new technologies and ways of working. Research projects are tackling a wide range of issues in innovative products, processes and organisations.</p> <p>These include miniaturised systems, the construction of safe and sustainable infrastructure, and developing new organisational tools and methodologies. Medium- to long-term goals include improving overall quality and reducing resource consumption by over 50%, towards zero waste in manufacturing and processing.</p> <p>Main fields of research</p> <ul style="list-style-type: none"> <li>Efficient production, including design, manufacturing and control - developing approaches, innovative technologies and methodologies for improved competitiveness.</li> <li>Intelligent production - improving the performance of industry by the application of innovative technologies.</li> <li>Eco-efficient processes and design - developing global approaches to minimise the impact of processes, products and services from extraction of resources through production to waste management.</li> <li>Organisation of production and work - moving towards innovative high performance industrial systems and customer-driven enterprises with multi-skilled personnel.</li> </ul> <p>To concentrate resources and efforts and pursue the problem-solving approach that characterises the Growth Programme calls for research proposals grouped into clearly identified targeted research actions (TRAs).</p> <p>Five TRAs address the selected research areas:</p> <ol style="list-style-type: none"> <li>The products of the future</li> <li>A new generation of machines</li> <li>The extended enterprise</li> <li>The modern factory</li> <li>Infrastructure</li> </ol>
Sustainable mobility and intermodality	<p>An important challenge for our society is to reconcile the increasing demand for transport while reducing its environmental impact. The transport sector represents around 10% of Europe's GDP and 10% of EU employment. Over the past 25 years, goods traffic has increased by 75% and passenger</p>

	<p>movements by 110%.</p> <p>The growth has led to increasing pollution and congestion. This action focuses on enhancing the integration between different transport modes. It complements the European Commission's Common Transport Policy by promoting sustainability, efficiency and quality, safety and security, and by optimising the human role.</p> <p>There are three main research areas:</p> <ol style="list-style-type: none"> <li>1. Mobility of people and goods;</li> <li>2. Infrastructure and integration; and</li> <li>3. Modal and intermodal transport management.</li> </ol>
<p>Land transport and marine technologies</p>	<p>Growing demand for transport in Europe requires development and deployment of sustainable new transport methods and concepts. This action targets development of the technological infrastructure required for innovation while maintaining and consolidating the competitive position of European land transport (road and rail) and marine industries as well as intermodal activities.</p> <p>Main objectives</p> <ul style="list-style-type: none"> <li>• Improved fuel efficiency and reduced emissions - cutting CO2 emissions and developing and validating zero-emission vehicles.</li> <li>• Improved performance - increasing safety, reliability, maintainability, availability, operability, energy efficiency and adaptability.</li> <li>• Improved system competitiveness -</li> <li>• reducing both time to market and development costs.</li> </ul> <p>Key research priorities</p> <ul style="list-style-type: none"> <li>• Development of critical technologies <ul style="list-style-type: none"> <li>○ For land transport, the emphasis is on developing more efficient, intelligent, clean and safe vehicles.</li> <li>○ For marine technologies, priority is placed on more efficient, safe and environmentally-friendly ships and innovative marine technologies particularly for unmanned operations.</li> </ul> </li> <li>• Technology integration and validation <p>Research will focus on integrating and validating six technology platforms:</p> <ul style="list-style-type: none"> <li>• New land transport vehicle concepts; enhanced systems efficiency,</li> <li>• Advanced concepts for ships and vessels; competitive shipbuilding,</li> <li>• Enhanced design and manufacturing for road vehicles,</li> <li>• Sustainable and modular trains,</li> <li>• Safe, efficient and environmentally friendly vessels and platforms,</li> <li>• Efficient interoperability and transshipment</li> </ul> </li> </ul>
<p>New perspectives in aeronautics</p>	<p>Global air traffic is forecast to triple between 2000 and 2015 and, if this demand is to be met, more than 5,000 new aircraft will have to be built each year. Europe's aeronautics industry therefore faces a massive challenge to satisfy demand for economic, safe and environmentally friendly air travel.</p> <p>This part of the Growth Programme aims to strengthen the competitiveness of the European aeronautic industry, including SMEs, while ensuring sustainable</p>

<p>growth of air transportation.</p> <p>Main objectives Four priorities have been set for European aeronautics research over the next eight to ten years:</p> <p>1. Cut procurement costs through reductions in aircraft production costs by 35% and development time by 15 to 20%. This is being achieved by:</p> <ul style="list-style-type: none"><li>- Advanced design systems and tools</li><li>- Development of intelligent and flexible manufacturing methodologies and exploitation of advanced materials</li><li>- Improvements in quality control at all stages of the supply chain.</li></ul> <p>2. Improve efficiency and performance, with reduction in fuel consumption by 20% and general improvement in reliability and direct operating costs. Work includes:</p> <ul style="list-style-type: none"><li>- Reducing aerodynamic drag at all stages of flight, from take off to landing</li><li>- Cutting weight by 20% without increasing manufacturing cost or shortening structural life</li><li>- Improving fuel use and reducing emissions of greenhouse gases</li><li>- Decreasing the power requirements and weight of on-board systems without affecting safety, cost or reliability.</li></ul> <p>3. Reduce noise and climate impacts as well as improve passenger environment, with reductions in emissions of NOx by 80% and CO2 by 20% and decrease of external and cabin noise by 10dB each.</p> <p>4. Improve operational capability and safety, through reductions in aircraft maintenance costs by 25% and decrease in accident rates by at least the same factor as the growth in traffic.</p> <p>Factors include:</p> <ul style="list-style-type: none"><li>- Improving air traffic management to increasing airspace and airport capacity</li><li>- Development of smart maintenance systems, improved non-destructive analysis and methodologies for surveying ageing aircraft</li><li>- Improving understanding of the human-machine interfaces and crew performance</li><li>- Ameliorating airframe behaviour to improve survivability.</li></ul> <p>Technology platforms Technology integration and validation activities are focusing on nine technology platforms:</p> <p>Low-cost, low-weight primary structures Involving cost-efficient combinations of materials and structural concepts, particularly for the wings and fuselages of commercial aircraft</p> <p>Efficient and environmentally friendly aero-engines Covering both selection of best available component technologies for existing designs and developing advanced designs to reduce NOx and CO2</p>
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	<p>emissions</p> <p>Novel rotary-wing aircraft configurations Developing high speed and cost-effective VTOL (vertical take off and landing) concepts to provide a hovering capability in aircraft similar to helicopters</p> <p>More autonomous aircraft in the air traffic management systems Transforming research results into operational air traffic management procedures, covering both air and ground segments</p> <p>Power-optimised aircraft Involves improved aircraft system integration and optimising overall energy use of non-propulsive equipment rather than individual elements</p> <p>Low external noise aircraft Overcoming a major barrier to air traffic growth by making aircraft more acceptable by reducing noise from all sources - including engines, nacelle, airframe and installation</p> <p>Low noise aircraft cabins Reducing noise and increasing passenger comfort as planes continue to grow and flights get longer</p> <p>Novel fixed-wing aircraft configurations Developing new configurations based on advances in aerodynamics, structures and flight controls to improve operational efficiency for larger capacity aircraft</p> <p>Integrated and modular aircraft electronic systems Obtaining cost-effective avionics architectures based on increased modularity and integration - this requires new standards, test environments and concept validation.</p>
<p>New materials and production technologies</p>	<p>The increasing complex needs of industry and society demand improved industrial processes and products with better quality, durability, cost effectiveness, functionality and structural properties. Furthermore, it is essential for environmental sustainability to examine all aspects of a product's life cycle to make substantial reductions in the use of resources while minimising environmental and health concerns. Therefore, materials research has an essential role in supporting development of competitive and sustainable growth in Europe.</p> <p>Materials properties and performance are closely linked to materials production and transformation. It is therefore important that materials research should also be closely integrated with work on materials processing. This generic activity proposes a pan-European systems approach, reflecting activity underway in advanced materials technologies and responding to important problems at the European level. It supports the long-term R&amp;D of generic materials technologies with potential for multi-sector applications and medium-term R&amp;D with a strong materials technology component relevant to FP5 key actions.</p> <p>Main technological objectives Sustainable use of materials requires an integrated approach for optimum use of materials and increased recycling. Priorities are:</p>

	<p>Crosscutting materials technologies This involves developing novel materials with wide-ranging application potential. Such research can be long term with high risk and high potential gain, and includes:</p> <ul style="list-style-type: none"> <li>- Nanotechnology: working at the nanoscale (1-100nm) with use of nano particles to improve properties in organic, biological and inorganic materials, and nano-structured materials for further miniaturisation of electronic systems</li> <li>- Surface engineering: building on European strengths to expand target materials and the range of coating properties</li> <li>- Materials processing technologies: for multi-sector applications to improve performance of ceramics, polymers and metal alloys, coated materials and composites</li> </ul> <p>Advanced functional materials This is looking at highly advanced materials with multi-sector use, including:</p> <ul style="list-style-type: none"> <li>- Electronics: focusing on novel electronic and opto-electronic devices</li> <li>- Magnetic/optical materials: for magneto-resistive sensors and magnetic data storage</li> <li>- Sensors and industrial systems: an important area for medium- and long-term development</li> <li>- Biomaterials: for medical applications, including drug-delivery systems and biosensors.</li> </ul> <p>Sustainable chemistry This covers development of sustainable industrial chemistry with efficient use of resources and recycled materials, such as:</p> <ul style="list-style-type: none"> <li>- Chemical engineering: particularly support for membranes and catalysts</li> <li>- Advanced chemical reactions: especially small batches of speciality chemicals and polymers</li> <li>- Chemistry for new materials: developing cost-effective, clean synthesis routes leading to high added-value materials with novel properties.</li> </ul> <p>Structural materials Structural materials cover all types of engineering needs - from civil engineering to aerospace. Priorities include:</p> <ul style="list-style-type: none"> <li>- Materials properties: to determine and extend the limits to open up novel and more efficient construction</li> <li>- Reliability: with study of degradation mechanisms that limited material lifetimes</li> <li>- Construction materials: to overcome the large amount of waste in an area of massive consumption.</li> </ul>
<p>New and improved materials and production technologies in the steel field</p>	<p>For over 40 years, the European Coal and Steel Community (ECSC ) was responsible for European steel R&amp;D. This treaty started in 1952 and the first research projects were funded in 1955. However, as the ECSC treaty runs out in 2002, steel research is being integrated into the European Commission Framework Programmes, starting with FP5. The Commission is managing the programme in close contact with steel producers, steel users and workers.</p>



	<p>ECSC steel research made an important contribution to the efficiency of the European steel industry by avoiding dispersion and duplication of research work. It also enabled the steel industry to work together on large projects that individual companies could not handle.</p> <p>In addition, a network of researchers, steel producers and users has been created throughout the EU member states, providing effective exchange of information and rapid transfer of technology from the research stage to industrial implementation. There are currently some 275 projects with 880 partners are running under the ECSC steel research programme.</p> <p>Until 2002, the ECSC steel research programme will run in parallel with FP5, with the ECSC programme continuing to support pilot projects and sectoral research for items not eligible under FP5. Generic steel research is already included in the FP5 Growth Programme. The objective of this generic activity is to reduce costs, improve user satisfaction and increase value added to the benefit of the iron and steel industry and its suppliers, end users, and other research partners.</p> <p><b>Main technological objectives</b> The principle fields of research in the iron and steel sector under the Growth Programme cover:</p> <p><b>Iron and steel production lines</b> developing cost-effective, flexible and environmentally friendly iron and steel production methods, including new ironmaking processes and improved scrap-based steelmaking</p> <p><b>Rolling and finishing</b> developing flexible and clean steel casting, rolling and downstream treatment with on-line analysis process control, integrated information management and closed-loop processing.</p> <p><b>Steel products</b> developing new grades with improved characteristics and in-service performance as well as improving forming, joining and so on.</p>
<p>Measurements and testing</p>	<p>The measurements and testing activity provides generic support for the Growth Programme as well to other FP5 actions to facilitate implementation of EU policies. The action addresses three socio-economic objectives:</p> <p><b>Standardisation</b> - developing and validating measurement and testing methods and producing scientific and technical data needed to define performance, reliability and safety requirements for products and services.</p> <p><b>Fighting fraud</b> - developing measurement and testing methods to detect and prevent fraud and to protect the economic interests of enterprises and society as well as the health and safety of citizens.</p> <p><b>Improving quality</b> - developing new and better measurement and testing methods to improve the quality of industrial products and services as well as establishing international traceability and equivalencies to help dismantle barriers to international trade.</p> <p><b>Main research objectives</b></p>

	<p>Instrumentation Development of new and improved instrumentation and measuring systems, including software, providing improved performance and reliability, intelligent operation and cost efficiency for use in the field or on production lines.</p> <p>Methodologies Development and improvement of measurement and testing methods, sampling strategies and databases and production of the scientific and technical data required for the definition of performance, reliability and safety requirements.</p> <p>Certified Reference Materials (CRMs) Development of the ability to produce and certify reference materials to be used for identification, calibration and quality control in physical, chemical and biological measurements and testing.</p>
<p>Support for Research Infrastructures</p>	<p>An important element of the Growth Programme is support for European research infrastructures, mainly working through thematic networks. This action is intended to:</p> <p>Create a synergistic use of geographically dispersed medium- and large-scale EU research facilities, Encourage the rapid transfer and implementation of research results into industrial applications Improve interoperability and common protocols. This activity is also designed to increase cohesion between EU member and candidate member states on strategic R&amp;D needs and exploitation of results.</p> <p>Main research objectives Supporting medium and large scale facilities Creating networks for optimum use of facilities having a strong and innovative scientific, technical or socio-economic relevance to the Growth Programme Establishing virtual research institutes Linking geographically dispersed complementary research and industrial capabilities using advanced information, communication and knowledge-management tools to create potentially independent and self-supporting entities beyond the period of EC funding. These would offer a high standard of services to industry - and particularly to SMEs - for research, technology transfer and exploitation of research results. Identifying reference databases Reference databases are critical to the development of the EU research fabric. The objective is to catalogue priority databases and set up networks in order to improve their accessibility, comparability and quality. Strengthening metrology infrastructure Developing and strengthening the European measurement and quality management infrastructures to reinforce traceability, improve cohesion of metrology systems and promote a harmonised approach to quality management in organisations and enterprises, particularly SMEs.</p>

## 5.2. Avrupa Birliği Araştırma ve Teknolojik Gelişme 6. Çerçeve Programı Tematik Öncelikler<sup>11</sup>

life sciences, genomics and biotechnology for health;	<p>Advanced genomics and its application for health</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Fundamental knowledge and basic tools for functional genomics in all organisms : gene expression and proteomics, structural genomics, bioinformatics, etc.</li> <li><input type="checkbox"/> Application of knowledge and technologies in genomics and biotechnology for health : technological platforms, prevention and therapeutic tools, etc.</li> <li><input type="checkbox"/> Combating major diseases</li> <li><input type="checkbox"/> Application- oriented genomic approaches to medical knowledge and technologies : diabetes, cardiovascular diseases, resistance to antibiotics, brain and ageing, etc.</li> <li><input type="checkbox"/> Cancer</li> <li><input type="checkbox"/> Major poverty- linked infectious diseases : aids, malaria and tuberculosis</li> </ul>
information society technologies	<p>Applied IST research addressing major societal and economic challenges : security, societal challenges, 'ambient intelligence', electronic commerce, etc</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Communication, computing and software technologies</li> <li><input type="checkbox"/> Components and microsystems</li> <li><input type="checkbox"/> Knowledge and interface technologies</li> </ul>
nanotechnologies and nanosciences, knowledge-based multifunctional materials, and new production processes and devices;	<p>Nanotechnologies and nanosciences : long- term research, supramolecular architectures and macromolecules, nano-biotechnologies, applications in health, chemistry etc</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Knowledge- based multifunctional materials : fundamental knowledge; production, transformation and processing technologies, etc</li> <li><input type="checkbox"/> New production processes and devices : flexible and intelligent manufacturing systems, systems research and hazard control, clean and safe production, optimisation of life cycles, etc</li> </ul>
aeronautics and space	<p>Aeronautics : competitiveness of the industry (new aircraft, engines etc); improving environmental impact (emissions and noise); safety; increasing the capacity of the air transport system (' Single European Sky')</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Space : research relevant to Galileo (satellite navigation) and GMES (monitoring for environment and security); satellite telecommunications (integrating terrestrial networks and space systems)</li> </ul>

<p>food quality and safety</p>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Epidemiology of food- related diseases and allergies</li> <li><input type="checkbox"/> Impact of food on health</li> <li><input type="checkbox"/> 'Traceability' processes all along the production chain</li> <li><input type="checkbox"/> Methods of analysis, detection and control</li> <li><input type="checkbox"/> Safer and environmentally friendly production methods and healthier foodstuffs</li> <li><input type="checkbox"/> Impact of animal feed on human health</li> <li><input type="checkbox"/> Environmental health risks</li> </ul>
<p>sustainable development, global change and ecosystems</p>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Sustainable energy systems : clean energy, energy savings, alternative motor fuels, fuel cells, energy carriers/ transport/ storage, etc</li> <li><input type="checkbox"/> Sustainable surface transport : environmentally friendly transport, interoperability, safety, etc</li> <li><input type="checkbox"/> Global change and ecosystems : greenhouse gas emissions, water cycle, biodiversity, natural disasters, land management, climate modelling, etc</li> </ul>
<p>citizens and governance in a knowledge-based society</p>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Knowledge- based society and social cohesion : generation/ distribution/ use of knowledge; development of a knowledge- based society; variety of paths towards a knowledge- based society; etc</li> <li><input type="checkbox"/> Citizenship, democracy and new forms of governance : consequences of EU integration, enlargement; new forms of governance; resolution of conflicts; citizenship and cultural identities</li> </ul>

## 6. ABD Hava Kuvvetleri İçin Yapılan “New World Vistas” Çalışmasında Öngörülen Teknolojiler<sup>12</sup>

(R): revolutionary capabilities

(\*): will be pursued in both commercial and military forms

Technologies to be developed:

- (R)UCAV structures and engines - including hypersonic operation
- Remote control technologies
- Composite, tailored materials for air and space
- (R)Large lightweight structures for optics and antennas
- Nonlinear optic compensation
- (R)High power, short wavelength lasers with emphasis on phased arrays
- (R)High power radio frequency sources
- (R)Active and IR stealth
- (R)Point of use delivery starting with low cost precision airdrop
- Next generation airlifter - higher wing and engine efficiencies
- (R)Automated, reusable space launch vehicles with "airplane-like" operations
- High Isp engines for low earth orbit flight
- High bandwidth laser communication for satellite and aircraft cross- and down-link\*
- (R)Distributed satellite vehicles and sensors
- Precision station keeping and signal processing for distributed satellite constellations
- Radiation resistant satellites
- Precise positioning overlaid on military and commercial information
- (R)High precision, jam resistant GPS
- Hyperspectral sensing and target identification at low spatial resolution
- (R)Human-Machine interactions\*
- (R)Information munitions
- Information protection
- Chemical enhancement of biological functions
- Continuous simulation
- Secure operations across large networks having secure RF components\*
- Language translation of stylized language
- Micro-electro-mechanical systems for sensing and manipulating\*
- Nuclear hardened electronics

Technologies to buy:

- Software tools and languages
- High bandwidth laser communication for satellite and aircraft cross- and down-link\*
- (R)Human-Machine interactions\*
- Information protection\*
- Operations with large databases\*
- Secure operations across large networks having secure RF components\*
- Micro-electro-mechanical systems for sensing and manipulating\*
- Services and equipment to buy without development:
- Mapping of the world to 1 m
- High speed processors
- Space launch
- Satellites
- Focal Plane Arrays
- Database software
- Data compression systems
- Computer displays
- Networking technologies
- Direct downlink broadcast equipment
- Satellite to aircraft communication equipment
- Fiber and satellite communication services
- Training systems

**7. Genel Sanayi Açısından Kritik Teknoloji Alanları – Uluslararası<sup>13</sup>**

- Yazılım
- Mikroelektronik ve Telekomünikasyon
- İleri Üretim
- Malzeme
- Sensör ve Görüntüleme

## 7. Askeri Teknolojik Faaliyet Konuları– Türkiye (MSB Teknoloji Panelleri)<sup>14</sup>

- Bilişim Sistemleri
- Sensörler ve Elektronik Sistemler
- Hava ve Uzay Sistemleri
- Kara ve Deniz Araçları
- Malzeme ve Süreçler
- Kimyasal, Biyolojik ve Nükleer Sistemler
- Silah Sistemleri
- Enerjitik Malzemeler

## 8. Savunma Teknoloji Değerlendirmesi

Ülkelerin bağımsızlığının ve diğer milletler arasındaki itibarının en önemli dayanağının sahip oldukları teknolojik güce bağlı olduğu artık herkes tarafından kabul edilmiş bir gerçektir. İster ekonomik güç açısından ister askeri güç açısından ele alınsın tek temel güç teknolojik güçtür.

Teknoloji ise en kısa ifadeyle “**Bilimin Uygulaması**” olarak tanımlanabilir. Daha açık bir anlatımla teknoloji; bilimsel bulgu veya sonuçların endüstriyel uygulamaya yönlendirilmesi süreci ve şeklidir.

***Bir ülkenin sağlam bir teknoloji temeline sahip olabilmesi için;***

- *Uzun vadeli (20-25 yılı görebilen) teknolojik vizyonlar oluşturulmalı,*
- *Bunlar zaman zaman gözden geçirilmeli ve sonuçlar değerlendirilmeli,*
- *Elde edilen sonuçlara göre vizyon yeniden güncellenmeli,*
- *Bu vizyon ışığında, orta/uzun vadeli yetenek öngörülerini hazırlanmalı ve görev fonksiyonları bazında ulaşılmak istenen hedefler belirlenmeli,*
- *Hedeflere ulaşmak için sahip olunması gereken teknolojiler belirlenmeli,*
- *Maliyet etkin çözümler oluşturulabilmesi için bu teknolojiler önceliklendirilmeli,*
- **ARGE ve kaynak projeksiyonları bu teknolojiler baz alınarak yapılmalıdır.**

Türkiye'nin 2020'li yıllarda sahip olması gereken savunma, havacılık ve uzay teknolojilerinin neler olduğu belirlenmeden önce, TSK'nin sahip olduğu konseptler ve vizyon ışığında, TSK orta ve uzun vadeli ihtiyaçlarının ortaya konulmasında yarar görülmektedir. Ortaya konulacak yetenek ihtiyaçlarına bağlı olarak, “Teknolojik Faaliyet Konuları”nın, “Teknoloji Alanları”nın ve “Revize Edilmiş Milli/Kritik Önceliklere Haiz Teknoloji Listesi”nin hazırlanması uygun bir hareket tarzı olacaktır.

Türkiye'nin benimsemiş olduğu “Millî Savunma Politikası” ve “Askeri Stratejisi” aşağıda sunulmaktadır.



**Türkiye'nin Millî Savunma Politikası :** Soğuk Savaş dönemi sonrasında, Türkiye'nin güvenliğine yönelik tehdit ve riskler geçmiştekilerden oldukça farklılık göstermektedir. Soğuk Savaşın ve bloklar arası mücadelenin sona ermesi sonucunda, küreselleşmeye yönelik yeni bir dünya düzeni arayışına gidilmesi, tehdit kavramını da değiştirmiştir. Tehdit kavramı daha önce belirgin ve kitlesel iken, 21 inci yüzyıl başlarında, çok yönlü, çok boyutlu ve değişken hale gelmiştir, ortama belirsizlikler hakim olmuştur. Geleneksel tehdit kavramı artık;

- *Bölgesel ve etnik çatışmalar,*
- *Ülkelerdeki siyasi ve ekonomik ve istikrarsızlıklar ve belirsizlikler,*
- *Kitle imha silâhları ve uzun menzilli füzelerin yayılması,*
- *Kökten dincilik,*
- *Uyuşturucu ve her türlü silâh kaçakçılığı,*
- *Uluslararası terörizm, şeklinde ortaya çıkan yeni tehdit ve riskleri de ihtiva etmeye başlamıştır.*

Mevcut konumuyla, yeni tehdit ve risklerin yoğunlaştığı Balkanlar, Kafkaslar ve Orta Doğu, üçgeninin merkezinde, global güç ve oluşumların menfaatlerinin kesişim bölgesinde yer alan Türkiye'nin jeostratejik konumundan kaynaklanan bu durum, bugüne kadar olduğu gibi, 21 inci yüzyılda da değişmeyeceği ve Türkiye'nin öneminin ve yeni dünya düzenindeki yerinin daha da artacağı kıymetlendirilmektedir.

Türkiye'nin savunma politikası, doğası itibariyle savunmaya yöneliktir ve ülkenin ulusal bağımsızlığını, egemenliğini, toprak bütünlüğünü ve hayati çıkarlarını korumak için düzenlenmiştir. Bu itibarla, Türkiye; 21 inci yüzyılda Millî Savunma Politikası olarak :

- Bölgede barış ve güvenliğe katkıda bulunmayı ve bunu geniş bölgelere yaymayı,
- Bulunduğu bölgede ve ötesine yönelik tüm stratejileri etkileyebilecek strateji ve güvenlik üreten bir ülke olmayı,
- Bölgesinde bir güç ve denge unsuru olmayı,
- İşbirliği, yakınlaşma ve olumlu ilişkiler geliştirmek için her türlü fırsattan istifade etmeyi ve girişimlerde bulunmayı, çağın gerektirdiği hedefler olarak görmektedir.

Atatürk'ün ön gördüğü "Yurtta Sulh, Cihanda Sulh" prensibi çerçevesinde tespit edilen savunma politikasının temel esasları;

- Her türlü uluslar arası gerginliğin azaltılmasına, adil ve kalıcı bir barışın sağlanmasına azami katkıda bulunmak,
- Bağımsızlığı, bütünlüğü ve Cumhuriyeti korumak ve kollamak,

- Krizleri ve çatışmayı önleyici tüm tedbirleri almak,
- Kolektif savunma sistemlerinde aktif olarak yer almak ve kendisine tevdi edilecek sorumlulukları yerine getirmektir.

**Türkiye'nin Askeri Stratejisi** : Belirtilen bu savunma politikasının uygulanabilmesi için Türkiye'nin izleyeceği Askeri Strateji dört önemli esası içermektedir. Bunlar,

- Caydırıcılık,
- Kriz Yönetimine Askeri Katkı ve Krizlere Müdahale,
- İlerden Savunma,
- Kolektif Güvenliktir.

Jeopolitik ve jeostratejik konumu itibariyle çok yönlü tehdit ve risklerle karşı karşıya bulunan Türkiye'nin, belirlenen bu askeri strateji doğrultusunda Millî Güvenlik Siyaseti'ni destekleme imkan ve kabiliyetine sahip bir askeri güce ulaşması; bu gücü, koşulların ve çağın ihtiyaçlarına göre idamesi ve geliştirilmesi büyük önem arz etmektedir.

Türkiye'nin benimsemiş olduğu "Millî Savunma Politikası" ve "Askeri Stratejisi" bağlamında, Silâhlı Kuvvetlerimizin üzerine düşen görevleri yerine getirilebilmesi maksadıyla sahip olması gereken ve gelecekteki operasyonların başarısı için hayati önem taşıyan askeri kabiliyetlerin aşağıdaki gibi tanımlanması yararlı olacaktır:

- Tehdit bölgesinde ve hareket ortamında meydana gelen gelişmeler ve hareketler eş zamanlı olarak, geniş bir çerçeve içerisinde izlenebilmeli ve değerlendirilebilmelidir. Yapılan bu değerlendirmeye bağlı olarak da en etkin hareket tarzının belirlenebilmesi için "Etkin Karar Verme" yeteneğine sahip olunmalıdır.
- Arzu edilen zaman, yer ve biçimde kuvvet aktarabilme yeteneğine sahip olunmalıdır.
- Sahip olunan kuvvet ve kritik hedefleri koruyabilme yeteneğine sahip olunmalıdır.
- Farklı ortam ve seviyelerde meydana gelebilecek krizlere zamanında ve esnek müdahale edebilme yeteneğine sahip olunmalıdır.
- Sahip olduğumuz güçleri en etkin şekilde kullanma ve bunu karşı tarafın da yapmasını engelleyebilme yeteneğine sahip olunmalıdır.

Yukarıda belirtilen yeteneklere sahip olunması için gerek duyulan yetenek hedefleri kısaca aşağıdaki maddelerde sunulmaktadır. Bu yetenek hedefleri; büyük ölçüde teknolojinin bulunduğu mertebeye ve sahip olunan teknoloji alt yapısına bağlı olarak tanımlanabilmektedir. Dolayısıyla, bu hedefler teknolojik gelişmeler ışığında zaman içinde revize edilebilmektedir.

### **8.1. Teknolojik Faaliyet Konuları**

TSK'nin orta ve uzun vadeli yetenek hedefleri çerçevesinde, üzerinde durulmasında yarar görülen teknolojik faaliyet konuları konu başlığı bazında aşağıda sunulmaktadır.

- **Hava, kara ve deniz platform teknolojileri;**
  - o Entegrasyon,
  - o Malzeme,
  - o İz,
  - o İtki ve güç,
  - o Dizayn,
  - o Güdüm ve kontrol,
  - o Ateş gücü,
  - o Beka,
- **Konvansiyonel silâh teknolojileri,**
  - o İz,
  - o İtki ve güç,
  - o Dizayn,
  - o Güdüm ve kontrol,
  - o Ateş gücü,
  - o Beka,
- **Malzeme ve proses teknolojileri,**
  - o Dizayn teknikleri,
  - o Üretim metotları,
  - o Yapısal, düşük izli, elektronik, fotonik ve optik malzemeler.
- **Uzay platform ve gözetleme teknolojileri,**
  - o Dizayn,
  - o İtki ve güç,
  - o Malzeme,
  - o Sensör,
  - o Muhabere,
- **Sensör ve elektronik teknolojileri,**
  - o Elektronik, fotonik ve optik malzemeler,
  - o RF, EO, akustik sensörler,
  - o Aktif kontrol sensörler,
  - o Mikro elektronik,
  - o Elektronik entegrasyon,

- Otomatik hedef tanıma.
- **Bilgi sistem teknolojileri,**
  - Sistem entegrasyonu,
  - Bilgi ve sinyal işleme,
  - Bilgi ve Veri birleştirme,
  - Bilgi hareketi,
  - Yapay zeka,
  - Simülasyonlar,
  - Yapay ortamlar,
  - Muhabere.
- **Coğrafi Bilgi Sistem teknolojileri,**
- **Elektronik harp ve yönlendirilmiş enerji silâhları teknolojileri,**
  - Lazer ve yüksek güçlü mikrodalga,
  - Elektronik karşı tedbirler,
  - Elektronik destek tedbirleri,
  - Elektronik korunma tedbirleri,
- **Kimyasal ve biyolojik savunma teknolojileri,**
  - Malzeme,
  - Teşhis,
  - Kişisel korunma,
  - Tehdit algılama.
- **Beşeri bilimler,**
  - Eğitim sistemleri,
  - İnsan-makine ara yüzü,
- **Biomedikal bilim ve teknoloji.**
  - Kişisel korunma,
  - Tıbbi kimyasal ve biyolojik korunma,

## 8.2 Teknoloji Alanları

TSK'nin orta ve uzun vadeli yetenek hedefleri çerçevesinde, yetenek bazında üzerinde durulmasında yarar görülen teknoloji alanları aşağıda sunulmaktadır.

**Komuta Kontrol Sistemleri'nin geleceğini etkileyecek önemli teknolojik eğilimler;**

- Minyatürizasyon,
- Modülürizasyon,
- Dijitalizasyon,
- Optoelektronik Ağ Muhaberesi,
- Yüksek erişim hızlı ağ teknolojileri,
- Yapay zeka ve multimedya teknolojileri.

**Kimyasal ve biyolojik birikintilerin emniyetli mesafeden tespiti ve tanımlanması maksadıyla;**

- Radar, Infrared (IR) ve Ultra-Viyole (UV) ışık,
- Biyoteknoloji uygulamaları,

**İstihbarat Destek maksadıyla gerek duyulan ana sistem / teknolojiler ;**

- Optik-Elektronik,
- Dijital Teknoloji,
- İnsansız Platformlar,
- Minyatürizasyon,
- Modülürizasyon,
- Yapay zeka uygulamaları,
- Yapay yaşam uygulamaları,
- Veri Birleştirme teknolojileri,
- Bilgi İşleme Teknolojileri
- Bilgisayar Ağ Sistemleri
- Telekomünikasyon teknolojileri.

**Keşif Gözetleme ve hedef değerlendirme maksadıyla;**

- Elektro-Optik,
- Algılayıcılar,
- Muharebe sistemleri,
- Havada konuşlu algılama sistemleri,
- Çevre şartlarının bilgisayarda modellenmesi,
- Veri işleme teknolojileri.

**Elektronik Harp alanında gerek duyulan ana sistem / teknolojiler;**

- Elektromanyetik Tayf kullanımının yaygınlaştırılması,

- Sistem bileşenlerinin minyatürizasyonu,
- Daha kullanışlı ve çeşitli tayfların kullanıma alınması,
- İz azaltma,
- Tayf yayma/dağıtma teknikleri,
- Yönlendirilmiş Enerji,
- Aldatma teknikleri,

**Platform Dizaynı alanında gerek duyulan ana sistem / teknolojiler :**

- Uzaktan kontrol teknikleri
- Kompozit malzeme,
- Süper hafif alaşımlar,
- Hassas ve karıştırma korumalı GPS,
- Yüksek güce ve kısa dalga boyuna sahip lazer,
- Aktif ve Infra red görünmezlik teknolojileri,
- Hipersonik itki sistemi,
- Daha kullanışlı (user friendly) araç personel ara yüzleri,
- Sistem dizayn ve entegrasyon yeteneği,
- Nano teknoloji,
- Mikro Elektronik- Mekanik Sistem (MEMS) teknolojileri,

**Koruma alanında gerek duyulan ana sistem / teknolojiler :**

- Tespit, takip, seyrişer ve E/H sistemleri ile bütünlüştürülmüş entegre aviyonik sistemler,
- İz küçültme,
- Gelişmiş sevk sistemleri,
- Hipersonik Hızlı Füzeler,
- Yönlendirilmiş Enerji Silâhları,
- Yüksek Delme Gücüne sahip mühimmatlar.

**Müşterek hareket alanında gerek duyulan ana sistem / teknolojiler :**

- Aviyonik, Muhabere, C2, Keşif, Gözetleme ve Hedef Tespit sistemleri için ihtiyaç duyulan veri işleme teknolojiler,
- Bilgi toplama ve birleştirme sistem teknolojileri,
- Harekat Alanı Yönetim sistemleri,

**Eğitim alanında gerek duyulan ana sistem / teknolojiler :**

Daha geniş eğitim ve tatbikat olanaklarına sahip olunması simülatörlerin ve MODSIM teknolojilerinin gelişmesi ile mümkün olabilecektir. Komuta ve Kontrol için “Bilgisayar Tabanlı Eğitim” simülasyonlarındaki gelişmeler, simülatörlerin; Taktik Angajman Simülasyonu, farklı ortamlarda silâh

kullanım eğitimi ve Bilgisayar Destekli Tatbikatların her komuta seviyesine yönelik olarak kullanılmasına yardımcı olmaktadır. Ayrıca teknolojiye yaşanan gelişmeler simülasyon modüllerinin operatif sistemlere entegre edilebilmesine de müsaade etmektedir.

**Kara Harekatı alanında gerek duyulan ana sistem / teknolojiler :**

- Vektronik, Aviyonik, E/H, Muhabere, C2, Keşif, Gözetleme ve Hedef Tespit sistemleri için ihtiyaç duyulan veri işleme teknolojileri,
- Zırhlı muhabere araçlarının güç üretim, iletim ve aktarma sistem teknolojileri,
- Zırhlı muhabere araçlarının zırh koruma ve görünmezlik teknolojileri,
- Yönlendirilmiş Enerjili Silâh sistem teknolojileri,
- Mühimmat atış sistem teknolojileri,
- Yüksek vuruş ve tahribat oranına sahip mühimmat ve silâh sistem teknolojileri,
- Sensörler ve ateşleme ünitelerinde yaşanacak gelişmeler,
- Aktif ve pasif koruyucu tedbirler kapsamında yaşanacak gelişmeler,
- Sistem güvenilirlikleri, dayanıklılıkları ve onarım kolaylıklarında yaşanacak gelişmeler,
- Süper hafif metal teknolojileri,
- Robotik ve modülürizasyon teknolojileri,
- Harekat alanının sayısallaştırılması,
- Öldürücü olmayan silâh teknolojileri.

**Deniz Harekatı alanında gerek duyulan ana sistem / teknolojiler:**

- Füze sistemlerinin görülebilirliğinin azaltılması teknikleri,
- İz küçültme teknikleri,
- Ufuk Ötesi Hedef Tespiti,
- Aktif ve pasif gemi kendini koruma sistemleri,
- Stand Off tespit ve teşhis yeteneği,
- Otonom İnsansız Hava ve Sualtı Araçları,
- Düşük frekanslı aktif sonar tespit teknikleri,
- Sığ su yetenekli sensörler,
- Robotik ve Yapay Zeka uygulamaları,
- Kompozit Malzeme teknolojileri,
- Oşinografik veri birleştirme model ve veri tabanları,
- Sinyal işleme teknikleri,
- Sinyal azaltma teknikleri,,
- Gelişmiş Radar ve E/O yeteneği,
- İHA sistemleri,
- Entegre aviyonik sistemler,
- Gelişmiş kendini koruma sistemleri,

- Yönlendirilmiş Enerji Silâhları,
- Gelişmiş Stand Off Teşhis sistemleri,

**Hava Harekatı alanında gerek duyulan ana sistem / teknolojiler :**

- E/H, seyrüsefer, takip ve hedef tanıma sistemleri ile bütünleştirilmiş entegre aviyonik sistem teknolojileri,
- Karıştırma korumalı önleme radar teknolojileri,
- Modüler dizayn edilmiş İHA sistem teknolojileri,
- İz küçültme teknolojileri,
- Yönlendirilmiş enerji silâh teknolojileri,
- Gelişmiş itki sistem teknolojileri,
- Silâh sistemlerinin menzil ve öldürücülüğünün geliştirilmesine yönelik teknolojiler,
- Füze son güdüm teknolojileri,
- Ufuk ötesi hedef tespit sistem teknolojileri,
- Silâh sistemlerinin güvenilirlik ve bakım/onarım teknolojileri,
- Öldürücü Olmayan Silâh teknolojileri,
- Görünmezlik teknolojileri,
- Stand Off yetenekli silâh sistem teknolojileri.
- Gelişmiş kendini koruma sistem teknolojileri,
- Muharebe Tanıma Sistem teknolojileri,



## **9. Türkiye'nin Katıldığı WEAG Çalışmaları<sup>15</sup>**

### Panel I :

- (1) Topçu Atış Destek Sistemleri (ADS) (KKK.İğİ-Gözlemci)
- (2) NBC Savunma (NBCD) (KKK.İğİ-Üye)
- (3) Geleceğin Zırhlı Araçları (FAV) (KKK.İğİ-Üye)
- (4) Yaklaşma ve İniş Sistemleri (APLS) (Hv.K.K.İğİ-Üye)
- (5) Direkt Atış Plâtfomu (DFP) (SSM.İğİ-Üye)
- (6) Geleceğin Muharebe Uçağı (FCA) (Hv.K.K.İğİ-Üye)
- (7) İnsansız Hava Aracı (UAV) (SSM.İğİ-Üye)
- (8) Yeni Lojistik Araçlar (NLV) (KKK.İğİ-Üye)
- (9) Her Türlü Arazi Aracı (ATV) (KKK.İğİ-Üye)
- (10) Geleceğin Köprücü Teçhizatı (FBE) (KKK.İğİ-Üye)
- (11) Mayın Karşı Tedbir Teçhizatı (CME)

### Panel II :

#### (1) EUCLID (European Cooperation For Longterm In Defence) :

- CEPA-1 : Modern Radar Teknolojisi
- CEPA-2 : Mikro Elektronikler (Türkiye katılmaktadır)
- CEPA-3 : Gelişmiş Malzeme ve Yapılar (Türkiye katılmaktadır)
- CEPA-4 : Modüler Aviyonik
- CEPA-6 : Gelişmiş Bilgi İşleme (Türkiye katılmaktadır)
- CEPA-8 : Opto Elektronik Cihazlar (Türkiye katılmaktadır)
- CEPA-9 : Uydu Gözetim Sistemleri
- CEPA-10 : Su altı Teknolojisi ve Denizhidrodinamiği (Türkiye katılmaktadır)
- CEPA-11 : Savunma Modelleme ve Simülasyon Teknolojileri (Türkiye katılmaktadır)
- CEPA-13 : Kimyasal ve Biyolojik Savunma Teknolojileri (Türkiye katılmaktadır)
- CEPA-14 : Enerjetik Malzemeler (Türkiye katılmaktadır)
- CEPA-15 : Füze Kumanda ve Kontrol Teknolojileri (Türkiye katılmaktadır)
- CEPA-16 : Elektrik Mühendisliği (Türkiye katılmaktadır)

- <sup>1</sup> DDA, Defence Diversification Agency, <http://www.dda.gov.uk>
- <sup>2</sup> Militarily Critical Technologies – <http://www.dtic.mil/mcti>
- <sup>3</sup> <http://www.milnet.com/milnet/pentagon/dto/dtap/aptoc.htm>
- <sup>4</sup> DoD Space Technology Guide, FY2000-01, Office of the Secretary of Defense (Kaynak: <http://www.spaceimaging.com>)
- <sup>5</sup> <http://www.milnet.com/milnet/pentagon/dto/dtotoc.htm>
- <sup>6</sup> <http://www.darpa.mil/body/darpaoff.html>
- <sup>7</sup> Defense Technical Information Center. (<http://www.dtic.mil/dtic/subcatguide/index.html>)
- <sup>8</sup> WEAG Science and Technology Strategy (Kaynak: New Technologies in Defense Policy and Conflict Management: A Challenge for the EU, European Parliament, Directory General for Research, May 2001, PE 297.567/Fin.St.)
- <sup>9</sup> <http://www.rta.nato.int/>
- <sup>10</sup> Avrupa Komisyonu, Rekabetçi ve Sürdürülebilir Gelişme Programı (Kaynak: <http://www.eu.int/research/growth/index.html>)
- <sup>11</sup> DECISION No 1513/2002/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 June 2002
- <sup>12</sup> New World Vistas, Air and Space Power For The 21st Century, USAf Scientific Advisory Board
- <sup>13</sup> New Forces At Work: Industry Views Critical Technologies – [http://www.rand.org/scitech\\_area](http://www.rand.org/scitech_area)
- <sup>14</sup> MSB Teknoloji Panelleri - <http://www.msb.gov.tr>
- <sup>15</sup> <http://www.msb.gov.tr/Birimler/SSDID/SSDIDSubelerCokTarDisllis.htm>