DEPARTMENT OF THE AIR FORCE
Air Force Office of Scientific Research (AFRL)
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APPLIED RESEARCH INTERESTS OF THE EUROPEAN OFFICE OF AEROSPACE RESEARCH AND DEVELOPMENT, ASIAN OFFICE OF AEROSPACE RESEARCH AND DEVELOPMENT And BROAD AGENCY ANNOUNCEMENT 2000-4

FOREWORD

On behalf of the United States Air Force Research Laboratory (AFRL), the European Office of Aerospace Research and Development (EOARD) and the Asian Office of Aerospace Research and Development (AOARD) manage applied research investments in Europe, Africa, Asia, the Middle East, the Far East and the Pacific Rim. The technical experts within EOARD and AOARD foster support, manage research, and seed international technologies and expertise within university and industry laboratories to create new technology, advance current knowledge and lay the groundwork for militarily significant international cooperation and collaboration.

This document introduces potential *international* (non-US) proposers to the applied research interests of AFRL and provides information on preparing and submitting research proposals. This Broad Agency Announcement (BAA) is divided into five sections:

The *Introduction* briefly describes the types and scope of research activities sponsored by EOARD and AOARD. It also provides an overview of proposal submission.

The *Applied Research Interests* section briefly describes the applied research interests of each of the AFRL technology directorates. EOARD and AOARD act as agents for the directorates in managing international research activities in these interest areas.

The *Conferences and Workshops* section describes the financial support of technical conferences and workshops sponsored by EOARD and AOARD. This section also lists the conditions associated with EOARD and AOARD sponsorship.

The *Proposal Guidance* section provides information on submitting a proposal in response to this announcement.

The *Directory* lists contact information for EOARD and AOARD.

Interested, qualified international (non-US) researchers are encouraged to contact EOARD or AOARD. Proposers within Europe, the Former Soviet Union, Africa and the Middle East are urged to contact EOARD. Proposers within Asia, the Far East and the Pacific Rim countries are urged to contact AOARD. Proposers from US institutes/organizations should contact the appropriate AFRL technology directorate. All proposals received by EOARD or AOARD from US researchers will be forwarded to the appropriate AFRL technology directorate or AFOSR.

JOSEPH F. JANNI
AFOSR Director

I. INTRODUCTION

EOARD and AOARD solicit proposals from non-US researchers for applied research through this Broad Agency Announcement. Sections II and III describe the areas of applied research that EOARD and AOARD are interested in. Novel scientific approaches, especially multi-disciplinary efforts, are highly encouraged.

Research activities sponsored by EOARD and AOARD are in the form of short-term contracts/assistance agreements or technical conference support. The purpose of these activities is to seed non-US science and technology activities and lay the groundwork for future cooperation and collaboration in areas that show promise in meeting USAF needs. Funding for each approved activity is typically on the order of $25,000 US.

Guidance on submitting proposals is found in Section IV. For additional information on proposal format, content, and submission, see the EOARD website (http://www.ehis.navy.mil/), the AOARD website (http://www.nmjc.org/aoard/), or contact EOARD or AOARD by telephone.

Before submitting a research proposal, you may wish to further explore proposal opportunities. You can do this by contacting EOARD or AOARD program managers, who can provide greater detail about research opportunities. However, in your conversations with any US Government official, be aware that only contracting and assistance agreements officers are authorized to commit the US Government.

If you would prefer (or if the program manager requests), you may submit a preliminary proposal online or via letter. The preliminary proposal should briefly describe the proposed project's objective, general approach and impact on US Department of Defense (DoD) technology. Your preliminary proposal should also include example figures, if applicable, a curriculum vita(e) for the principal investigator(s) and any unique capabilities or experience you have such as collaborative research activities involving USAF, US Department of Defense or other US laboratories.

You are encouraged to obtain a copy of this BAA via the EOARD or AOARD homepage.

II. APPLIED RESEARCH INTERESTS

The US Air Force Research Laboratory (AFRL) is divided into nine technology directorates and the Air Force Office of Scientific Research (AFOSR). Since the focus of AFOSR is basic research, its interests are presented in a separate Broad Agency Announcement (see the AFOSR website at http://www.afosr.af.mil/). The applied research interests that the technology directorates wish to pursue with non-US researchers are briefly discussed in this section. The research interests are divided into technology thrust areas and sub-thrusts. Potential proposers should see the appropriate technology directorate website and contact EOARD or AOARD for detailed information.

Space Vehicles Directorate (http://www.vs.afrl.af.mil)
The mission of the Space Vehicles Directorate is to innovate and develop science and technology for space vehicles, launch vehicles, and space concepts to support US aerospace forces. The directorate seeks to develop technologies to control and exploit space in two major technology thrust areas: Space-Based Surveillance and Space Capability Protection.

a. Space-Based Surveillance. This thrust area develops active and passive surveillance technologies for detecting and determining threats. This thrust area has three subthrusts. The All Weather, Day/Night Surveillance subthrust develops space-based radar technologies (antennas, data exploitation, ionospheric effects, collaborating constellations), spacecraft energy generation (solar cells, advanced concepts) and storage (batteries, flywheels) and improved space computing capability. The Detection and Characterization of Difficult Targets subthrust develops hyperspectral and multi-color sensors, data fusion, exploitation and dissemination, as well as characterization of the Earth, atmospheric and celestial backgrounds against which a space based surveillance must operate and development of techniques to mitigate them. The Long Dwell/Continuous Global Coverage subthrust develops lightweight optics, precision structural controls, multi-functional structures and autonomous systems, as well as technologies applicable to the microsat class of satellites.

b. Space Capability Protection. This thrust area develops technologies to assure the survival of space systems, whether the threat is natural or man-made. A major objective of this thrust is to advance the understanding of the effects of interactions between the environment and military systems and provide guidance to designers to ensure increased survivability and reduced weight. This thrust area has three subthrusts. The Hazard Alerts/Prediction subthrust develops technologies to monitor, specify and predict the natural spacecraft environment and to develop miniaturized on-board hazard detection systems. The Passive Protection subthrust develops technologies and techniques for hardening spacecraft structures, electronics, and electro-optical subsystems. The Active Protection subthrust develops technologies for active control and negation of natural and man-made threats as well as advanced technologies for on-orbit maneuverability.

Directed Energy Directorate (http://www.de.afrl.af.mil)

The mission of the Directed Energy Directorate is to develop directed energy science and technology to assure the preeminence of US aerospace forces. The directorate seeks to expand the science and technology knowledge of laser and microwave sources, beam control, target acquisition and tracking, and target and atmospheric interactions. These technical disciplines are addressed in three thrust areas: Advanced Optics and Imaging Technology, Laser Technology, and High-Power Microwave (HPM) Technology.

a. Advanced Optics and Imaging Technology. The objective of this thrust is to develop the world's best optics and imaging. This thrust area has four subthrusts. The Large Optics subthrust develops specialized systems, subsystems, components, and coatings for High Energy Laser (HEL) systems. The Remote Sensing subthrust focuses primarily on light detection and ranging (LIDAR) technologies for standoff determination of nuclear, chemical, or biological agents under battlefield conditions. The Space Situational Awareness subthrust develops advanced electro-optical detection techniques for situational awareness. The Beam Control subthrust develops critical optical acquisition, tracking, and pointing technologies for HEL system stabilization, pointing and for image place stabilization for optical imaging applications.

b. Laser Technology. This thrust is developing laser and nonlinear optical systems. The Laser Technology thrust has five subthrusts. The Near-Infrared (IR) Semiconductor Laser Technology subthrust is developing semiconductor diode laser and diode laser arrays for aircraft self-protection, laser communications and laser radar for precision guidance munitions. The Mid-IR Semiconductor Laser Technology subthrust is developing high power mid-IR (2-5 micron) semiconductor laser/array technologies for aircraft self-protection, illumination, chemical agent detection, IR missile warning sensor jamming and laser array pumping modules. The High Power Gas and Chemical Laser Technology subthrust is developing high power gas and chemical laser technology for airborne laser (ABL) technology insertion and ground-based laser (GBL) anti-satellite (ASAT) and space-based laser (SBL) weapon applications. The Laser Integration Technology (LITE) subthrust is developing dual-clad fibers, high-power connectors, fiber lasers and fiber laser arrays, micro-bench methods of implementation, integrated optics, scaleable pump modules and beam combining technologies. The Disrupt and Degrade (D2) Infrared Countermeasures (IRCM) subthrust is developing laser technology for IRCM sources, focal plane arrays susceptibility testing, countermeasure effectiveness evaluation, imaging missile surrogate fabrication, missile seeker damage testing and an advanced pointer/tracker.

c. High-Power Microwave (HPM) Technology. The objective of this thrust area is to develop HPM technology in an effort to protect US systems against potential radio frequency (RF) threats. The HPM Technology thrust has three subthrusts: Suppression of Enemy Air Defenses (SEAD), Command and Control Warfare and

Advanced Tactical Applications. The SEAD subthrust will develop pulse power and microwave sources and capabilities associated with SEAD technologies. The Command and Control Warfare subthrust is addressing application development, effects experiments, source parameter definition, analysis of effects data, selective engagement concept development, source design and development, high illumination effectiveness and pulsed power device effects.

Information Directorate (http://www.if.afrl.af.mil)

The mission of the Information Directorate is to develop information systems science and technology for aerospace command and control to meet USAF needs in three major thrust areas: Global Awareness, Dynamic Planning and Execution, and Global Information Exchange.

a. Global Awareness. The goals of this thrust area include increasing the amount of data exploited, information fusion, with scaleable resolution and accuracy, and storage/processing of information on platforms. This thrust area has three subthrusts. The Information Exploitation subthrust will conduct research and development to implement Global Awareness and support Precision Engagement and Full Dimensional Aerospace Protection by advancing the state of the art in intelligence and surveillance and reconnaissance exploitation capabilities. Technologies developed support collection, processing, storage, fusion, and dissemination of both real-time and stored information in support of all battlespace participants. The Information Fusion subthrust will develop systems to correlate and analyze events, activities and movements, as they occur in time and space, for determining location, identity and status of individual objects (equipment and units). The Access, Information & Knowledge Bases subthrust will develop capabilities to generate, access, and manage a distributed, heterogeneous information/knowledge repository which provides intelligent information services to Dynamic Planning, Execution and Intelligence operations.

b. Dynamic Planning and Execution. The goal of this thrust area is faster, proactive, and timely planning and scheduling which can be coordinated across multiple components. The Dynamic Planning/Execution thrust area has three subthrusts. The Next Generation Collaboration Planning and Scheduling subthrust focuses on enabling a two orders of magnitude improvement in the agility, accuracy, timeliness, and efficiency over current planning and scheduling processes and structures. The Collaboration/Simulation/Visualization subthrust will develop the collaboration, simulation and visualization technology, processes and tools necessary to enable dominant battlespace awareness and information superiority. This will provide planners and decision makers with the ability to view, analyze, and understand the vast amounts of information available from command, control, communications, computer, intelligence, surveillance and reconnaissance (C4ISR) system. The goals of the Dynamic Execution subthrust center on wireless information exchange systems and technologies that interconnect remotely separated command and

control systems and users, providing high quality, timely, secure and low-probability-of-exploitation communications to air, land, and space assets.

c. Global Information Exchange. The goal of the Global Information Exchange thrust area is to provide information anywhere, anytime, for any mission through adaptable and scalable communications and networking, as well as the technologies that protect those capabilities. The Global Information Exchange thrust has three subthrusts. The Aerospace Connectivity subthrust extends the current C4ISR information architecture to include sensor to decision-maker to shooter concepts, the integration of space assets, and the incorporation of airborne-C2 in order to create a robust, seamless near real time aerospace information environment in theater with global reachback. The Information Assurance subthrust is concerned with the defense of friendly information systems and computer networks including wireless information networks. This subthrust seeks to protect against corruption, exploitation and destruction of friendly information systems; ensure confidentiality, integrity and availability of systems; and integrate actions (offense, defense and mitigation) to ensure an uninterrupted flow of information for weapons employment and sustainment. The Information Systems and Networking subthrust will develop and integrate information-related technologies to improve operational command, control, communications, computer, and intelligence (C4I) capability in a worldwide military/commercial infrastructure environment.

Sensors Directorate (http://www.sn.afrl.af.mil)

The mission of the Sensors Directorate is to ensure unequaled reconnaissance, surveillance, precision engagement and electronic warfare capabilities for US aerospace forces by conceiving and developing advanced sensors and sensor technologies. The directorate has three major technology thrust areas: Radio Frequency (RF) Sensors and Countermeasures (CM), Electro-Optical (EO) Sensors and Countermeasures, and Automated Target Recognition (ATR) and Sensor Fusion.

a. Radio Frequency (RF) Sensors and Countermeasures (CM). The RF Sensors and Countermeasures thrust area develops technologies for airborne and space-based RF sensors to perform all-weather threat/target acquisition, tracking, and identification; platform self-defense; and counter enemy command, control, intelligence, surveillance and reconnaissance. The RF Sensors and Countermeasures thrust has six subthrusts. The Radar subthrust includes detection of difficult targets, space-based radar, and tool development. The Electronic Warfare (EW) subthrust includes electronic attack, electronic protection and command, control and communications (C3) countermeasures. The Assured Reference subthrust includes Global Positioning System (GPS) modernization, inertial technology and integration technology. The RF Apertures subthrust includes large, lightweight antennas, conformal arrays, multi-function, multi-mode antennas and digital beam forming antennas. The Algorithms and Phenomenology subthrust includes adaptive processing, detection and tracking, waveform diversity and

phenomenology. The Digital Receivers and Exciters subthrust includes EW, radar and GPS.

b. Electro-Optical Sensors (EO) and Countermeasures. The EO Sensor and Countermeasures thrust has two primary goals: 1) Provide affordable, long-range, all weather, day/night detection and identification of non-cooperative and deep-hide targets and 2) Provide affordable protection to USAF aerospace vehicles from a lethal and potent EO/IR threat. The EO Sensors and Countermeasures thrust has the two subthrusts. The Target Detection subthrust includes large area search/detection, precision/difficult targeting and nuclear, biological and chemical (NBC) detection and identification (ID). The Threat Warning and CM subthrust includes large aircraft IRCM, day/night EO/IR tracker CM, new flares and expendables, all aspect threat warning, threat warning/attack reporting, and laser warning. The Receivers subthrust includes hyperspectral sensor imaging (HSI) receivers for target search, detection and threat warning, multi-dimensional imaging sensors, and receivers for eye-safe laser detection and ranging (LADAR). The Transceivers subthrust includes frequency agile laser sources, non-mechanical beam steering, long-range, robust laser radar, multi-discriminant EO sensors, and laser communications. The Algorithms and Phenomenology subthrust includes n-dimensional LADAR techniques, HSI phenomenology and techniques, imaging threat investigation, and multi-discriminant EO sensors.

c. Automated Target Recognition (ART) and Sensor Fusion. The primary goal of the ART and Sensor Fusion thrust area is to provide warfighters with the ability to rapidly and continuously find, fix, identify, and track all military targets in the battlespace from space and air. The ATR and Sensor Fusion has six subthrusts. The Space and Air Sensors ATR subthrust includes synthetic aperture radar ATR, RF moving target ATR, multi-sensor ATR, and hyperspectral ATR. The Precision Identification and Location subthrust includes combat ID and fire control for air and space superiority, special operations forces, and combat identification for time critical targets and other air-to-surface missions. The ATR Spiral Development subthrust includes modeling, simulation, integration, ATR environment, and data generation. The Innovative Algorithms subthrust includes physics-based ATR, adaptive ATR and resource management for ATR. The Target and Phenomenology Modeling subthrust includes computational electromagnetics (CEM), computer-aided design (CAD) model development, electromagnetic (EM) phenomenology and validation, modeling and simulation physics, and application objective support. The Evaluation Science subthrust includes performance theory, and evaluation experiments.

Munitions Directorate (http://www.mn.afrl.af.mil)

The mission of the Munitions Directorate is to develop science and technology for air-launched munitions in order to defeat ground fixed, mobile/relocateable, air, and space targets and assure the pre-eminence of US aerospace forces. The directorate has three major technology thrust areas: Assessment and Demonstrations, Advanced Guidance, and Ordnance.

a. Assessment and Demonstrations. Integrates new and innovative technologies for future weapon concepts, such as urban combat weapon, close air support weapon, low cost miniature cruise missile, counter-proliferation weapon, time-critical target defeat, functional defeat of hard targets, limited collateral damage weapons, and Bomb Damage Indication/Battle Damage Assessment (BDI/BDA) systems. Technologies under consideration include weapon design, innovative flight controls and range extension technologies, compressed carriage and dispense technologies, micro technologies, munition-borne and munition-deployed BDI/BDA sensor, processor, and transmitter technologies, and integrated subsystem techniques. Modeling and simulation tools of interest include high-fidelity physics-based codes for warhead design and penetration analysis, engineering-level tools for weapon/target interaction analysis, and system-level analysis for theater- level modeling. New concept and innovative tools are developed for: system-level evaluations, the prediction of functional relationship of fire and/or blast effects on fixed structures, and dispersion of chemical/biological neutralization agents in a high-temperature environment.

b. Advanced Guidance. Develops new technologies in areas associated with closed-loop guidance of autonomous munitions including inertial sensors, anti-jam GPS, and terminal seekers, including electro-optical (I2R and LADAR), millimeter-wave, and synthetic aperture radar seeker technology, and the components thereof, and the signal/image/data processing used in such areas. Algorithm/software concepts of interest include (1) guidance software, including guidance laws, estimators, autopilots, and AJGPS software, (2) innovative signal and image processing algorithms for use within autonomous target acquisition (ATA) applications, and (3) operations/functions associated with the ATA process involving noise elimination, detection, segmentation, feature extraction, classification, and identification. Algorithms capable of processing/fusing multi-sensor data are of interest. Fundamentally new approaches to closed-loop autonomous guidance based on biomimetic principles are of particular interest.

c. Ordnance. Develops new and innovative technologies to support the development of advanced warheads, fuzes, and explosives for use in air-delivered conventional munitions to defeat ground, mobile, air targets, as well as above-ground and buried structures. Technologies developed are pursued to meet the complex future munitions requirements for general-purpose bombs, penetrating warheads, submunitions, safe-arm-fire devices, explosive detonators, explosives and advanced energetic materials, and devices for collecting data to be used in warhead design and analysis.

Propulsion Directorate (http://www.pr.afrl.af.mil)

The Propulsion Directorate develops all forms of propulsion science and technology of interest to the USAF: turbine and rocket engines, advanced propulsion systems, and propellants. The directorate is also responsible for most forms of power technology.

The Propulsion Directorate technology portfolio is organized into three integrating technology thrusts: Air, Space, and Weapons.

a. Air Thrust. Propulsion and power technologies for platforms that operate solely within the earth's atmosphere. This thrust includes technologies for turbine engines, power subsystems and components (including propulsive power for some unmanned aerial vehicles (UAVs)), and propulsion sciences (such as combustion, fuels, lubricants, bearings and advanced concepts). Some of the air platform applications that are benefiting from these technologies include fighter aircraft, strike aircraft, transports and UAVs.

b. Space Thrust. Propulsion and power technologies for platforms that place payloads in orbit or that operate in space. This thrust includes technologies for liquid and solid propellant rockets, solar thermal and electric propulsion, power subsystems and components, and propulsion sciences (such as combustion, propellants, materials applications, bearings and advanced concepts). Some of the space platform applications that are benefiting from these technologies include reusable and expendable space launch vehicles, orbit transfer vehicles, and spacecraft (such as orbit maneuver vehicles, conventional satellites and microsatellites).

c. Weapons Thrust. Propulsion and power technologies for systems or devices intended to destroy, disrupt, or disable. This thrust includes technologies for large and small solid rocket motors, expendable turbine engines, scramjets, power subsystems and components, hybrid rockets and propulsion sciences (such as combustion, propellants, fuels, materials applications and advanced concepts). Some of the weapon platform applications that are benefiting from these technologies include strategic missiles, air-to-air missiles, air-to-surface missiles, tactical missile defense and directed energy weapons.

Air Vehicles Directorate (http://www.va.afrl.af.mil)

The mission of the Air Vehicles Directorate is to develop options to improve capabilities in current fixed wing air vehicles and deliver revolutionary fixed wing air vehicle technologies for new warfighting capabilities. The directorate has three major technology thrust areas: Aeronautical Sciences, Structures and Control Science.

a. Aeronautical Sciences. The Aeronautical Sciences thrust area develops critical technologies that sustain the current fleet and enable the USAF to build and field future Unmanned Aerial Vehicles (UAVs) and space vehicles. This thrust has three subthrusts: Computational Sciences, Aerodynamic Configuration, and Aerospace Vehicle Integration and Demonstration. Emphasis includes: multidisciplinary design optimization computer codes, computational fluid dynamic solutions for highly coupled aero-thermal-structural problems, design codes to optimize wing-body configurations, theories and techniques to understand highly nonlinear aerodynamics, and the separation of small class munitions from weapons bays.

b. Structures. The Structures thrust area plans, manages, and conducts research and development programs to solve critical structural problems on fixed-wing aerospace vehicles. This thrust has three subthrusts: Extreme Environment Structures, Structural Sustainment, and Structural Technology Integration. These subthrusts advance design, analysis, and integration technology and develop advanced structural concepts and fabrication techniques to improve structural integrity and reduce weight. Emphasis is on advanced repair techniques and repair design methods, effects of corrosion on the fatigue life of airframe structures, methods to alleviate the effects of buffeting on twin tail aircraft, and exploiting the latest in materials, processes, and manufacturing to produce more durable and survivable structures.

c. Control Science. The primary objectives of the Control Science thrust area are to improve combat mission effectiveness and increase flight safety and reliability. The Control Science thrust area has two subthrusts. Emphasis in the Control Technology subthrust includes: control theory and systems mechanization to enable control of both single air vehicles and multiple aerospace systems; all electric, photonics-based control systems; and flight management technology to enable safe, mixed manned aircraft and UAV combat operations in the future high-threat, highly dynamic battlespace. The Simulation-Based R&D subthrust covers the full spectrum from single aerospace vehicle evaluation through assessment of multiple technologies on a diverse set of aerospace assets in a complex and highly realistic battle environment.

Human Effectiveness Directorate (http://www.he.afrl.af.mil)

The mission of the Human Effectiveness Directorate is to develop science and technology products for selecting and training personnel, protecting and sustaining crew members, and improving human interfaces with weapon systems to assure the preeminence of US aerospace forces. This is accomplished through four major technology thrust areas: Crew System Interface, Warfighter Training, Deployment and Sustainment, and Bioeffects and Protection.

a. Crew Systems Interface. This thrust area develops the crew system interface technology to match the design of systems and equipment with the warfighter's capabilities and limitations in order to maximize performance. The Crew System Interface thrust area has five subthrusts. The Information Analysis and Exploitation Technology subthrust develops new cognitive information-based interface solutions and human speech processing and control solutions for time-critical command and control, to organize battlefield intelligence data, to eliminate decision-making bottlenecks, to gain a common battlespace understanding and to shorten the timeline for intelligence-to-shooter operations. The Aural Displays and Bioacoustics Technology subthrust provides the vibroacoustics building blocks of 3-D audio, active noise reduction, acoustic modeling, digital audio, voice warning and integrated audio/visual symbology in order to enhance crew performance under high noise and vibration environments. The Crew Station Development Technology subthrust

develops and employs human-centered analysis models with high fidelity, real-time mission simulations to demonstrate tailored crew station design solutions to answer pervasive questions about control/display placement and function, information requirements and flow, and to exploit new generation cockpit devices. Emphasis in the Human Interface Technology subthrust includes: development of physical measurement methods to assure the fit of crew stations and equipment to humans; performance assessment techniques to quantify the human performance contribution to system effectiveness; development and evaluation of interface technologies involving bio-centered controls; multi-sensory adaptive displays; and immersive design. The Visual Display Systems subthrust emphasizes state-of-the-art visual display technology including helmet-mounted tracker/displays (HMT/D); night vision goggle (NVG) and panel mounted display technologies; large screen, flat-panel, electronic displays; laser eye protection; synthetic vision and vision through visors; and windscreens and heads-up displays.

b. Warfighter Training. The Warfighter Training thrust area conducts engineering and behavioral research to improve training technologies and methods. This thrust area has four subthrusts aimed at understanding learning concepts and new training technologies, and applying them to improve warfighter training: 1) Knowledge Representation application of knowledge acquisition and training technologies to distributed team training and performance improvement, 2) Distributed Mission Training (for aircrews) R&D of a shared, scaleable training environment comprised of live, virtual, and constructive entities that allows warfighters to affordably train in a realistic, fully integrated environment, capable of supporting the entire training spectrum from individual training through campaign-level mission rehearsal, 3) Night Vision Device Training, exploring all areas pertinent to providing sensor-aided night fighting capability, and 4) Command and Control Training research examining the best way to train personnel who man and operate command and control nodes such as Air Operations Centers, to include producing practical prototypes for Operations Center training. The Distributed Mission Training (DMT) concept is the overarching focus concerned with developing new technologies, taking better advantage of existing technologies, and developing methods to improve USAF's readiness capability by training mission skills for all warfighting domains (aircrew, space, information operations & C2, force protection), on a distributed basis using virtual, live, and constructive assets.
c. Deployment and Sustainment. The Deployment and Sustainment thrust develops technologies that improve the performance, supportability and readiness of current and future weapon systems and technologies that support the deployment and employment of global operations. The Deployment and Sustainment thrust area has three subthrusts. The Readiness Logistics subthrust includes wing and theater-level logistics support technologies and methods to improve logistics planning, readiness, deployment and information systems, along with aids and diagnostic processes for wing level aircraft maintenance. The Sustainment Logistics subthrust develops methods, processes, tools, and equipment technologies to enhance weapon system acquisition, affordability, and supportability from design inception through retirement. This subthrust also develops techniques to improve logistics sustainment of global

air power operations through better distribution systems and more effective weapon system support. The Operational Toxicology subthrust develops technologies to prevent mission degradation due to exposure to toxic and hazardous chemicals and materials across a broad spectrum of deployment contingencies. This subthrust also develops methods of detection, identification and assessment of the potential human health risk from operational chemicals and chemical/biological detection (CBD) agents. Operational Toxicology has a major emphasis in toxicological modeling.

d. Bioeffects and Protection. The Bioeffects and Protection thrust area predicts and mitigates mission degradation due to operational stresses. This thrust area has seven subthrusts. The Optical Radiation subthrust performs basic research, exploratory and advanced development, and biomedical consultation to understand, mitigate, and exploit the effects of optical radiation sources and their countermeasures. The RF Radiation subthrust conducts dosimetric modeling of RFR absorption in biological tissue, studies the biological effects of acute, chronic, and repeated exposure to RFR, and facilitates the science-based International Harmonization of RFR human exposure standards. The Biomechanisms and Modeling subthrust studies biological effect mechanisms of non-ionizing radiation, develops models for predicting interactions of radio frequency radiation and other forms of non-ionizing radiation with biological tissues, and applications of biotechnology to Air Force problems such as Counterproliferation of chemical and biological warfare weapons. The Safe Escape and Impact Protection subthrust includes research and development (R&D) of human response and tolerance criteria for dynamic environments as well as development of advanced crew escape system technologies. The Aircrew Protection subthrust includes R&D of technologies for aircrew protection from high altitude exposures; research and development of physiological and cognitive response countermeasures to G-induced performance degradation and incapacitation; and development of aircrew life support equipment and advanced oxygen system technologies. The Sustained Operations subthrust encompasses definition and development of countermeasures for effects of fatigue and circadian disruption due to sustained operations and global engagement. The Spatial Disorientation Countermeasures subthrust investigates the mechanisms of spatial orientation and develops display symbologies and aircrew training procedures to reduce impact of spatial disorientation during flight operations.

Materials and Manufacturing Directorate (http.www.ml.af.mil)

The Air Force Research Laboratory's Materials and Manufacturing Directorate (AFRL/ML) is the primary source for advanced materials, material processing and manufacturing technology used to reduce life cycle costs and to improve the performance, affordability, reliability and survivability of current and future Air Force aircraft, spacecraft and missile systems. AFRL/ML also provides systems support to USAF users to solve material-related problems and to enhance the sustainment of operational systems.

To provide these technologies for today's fleet and tomorrow's war-fighters, AFRL/ML has 10 Core Technology Areas: polymers, metallics, organic matrix, composites, nondestructive evaluation, ceramics, tribology and coatings, sensor materials, laser hardened materials, Air Force field and aging systems support and Air Expeditionary Force Technology.

a. Polymers. Polymers are being developed to advance the science, promote the development and transition the technologies of polymers into Air Force applications. Specifically this includes development of structural polymers for nanostructural composites and deployable space membranes, electrically conductive polymers and optoelectronic polymers.

b. Metallics. Metallics will be developed to meet the near-term aircraft turbine engine needs and far term spacelift and satellite propulsion systems. The near-term aircraft turbine engine needs include advanced metallic materials and materials processes as well as methods and materials to increase the reliability and life of legacy systems already in operation. For lower cost access to space, advanced metallic materials and processes are required for durable reusable engines, more efficient expendable heavy launch vehicle rocket engines and ultra-lightweight micro-satellite thrusters.

c. Organic Matrix Composites. Organic Matrix Composites will be developed and transitioned that are affordable for aircraft and spacecraft applications including lightweight structures (airframe, control surfaces, trusses, struts, engine components, substructure), space vehicle and launch tankage, space vehicle bus structures, radiators and other structures requiring thermal and/or structural management.

d. Nondestructive Evaluation. Nondestructive Evaluation (NDE) techniques will be developed to evaluate and characterize damage in complex materials and structures, and to inspect and maintain the integrity of aging aerospace structures and propulsion systems. NDE technologies are being developed for aging aircraft structures for detection of hidden corrosion and to remotely inspect for cracks within complex structures, and for propulsion systems to inspect engines to capture the unused safe life remaining in turbine engine rotors.

e. Ceramics. Ceramics will be developed for very high temperature air and space structural applications such as aircraft turbine engines, spacelift rocket engines and aerospace hot structures. Durable ceramics will enable affordable replacements to metal components in operational and developing systems by extending turbine engine life, increasing maneuverability and mission range, and enhancing spacelift capability.

f. Nonstructural Materials. Nonstructural Materials will be developed to improve corrosion resistant coatings, aircraft topcoats, spacecraft thermal control coatings and tribological materials (solid lubricants and wear-resistant coatings). Operational

support is also provided to Air force field and depot centers concerning aircraft hydraulic and coolant fluids, liquid lubricants (greases and oils), seals, and fire suppressants. Advanced tribological materials for spacecraft will enable the long life of high-speed ultra-low friction bearing and rotating components (gyroscopes). Optically tailorable thermal control coatings with controlled emissivity will enable innovative thermal control designs for micro-satellites. The development of permanent corrosion resistant primer resins with a 30-year life will enable long-term environmentally safe corrosion protection.

g. Sensor Materials. Sensor Materials will be developed for unique Air Force surveillance and situational awareness requirements for which there is no commercial development. This includes optical and electro-optical materials for satellite sensors, IR countermeasures (IRCM), aerospace power applications and all-weather infrared (IR) sensor transparencies to provide an increased reliability and temperature capability while reducing power consumption, weight, cost, cooling, complexity and size of microwave, power control and IR devices.

h. Laser Hardened Materials. Laser Hardened Materials are being developed to increase the survivability of aircrews and sensors from directed energy weapons and battlefield laser hazards. The technologies developed will provide validated options to users, developers and designers of Air Force systems for the protection of aircrew via protective eyewear; aircraft, missile and spacecraft electro-optic sensors; and spacecraft critical components.

i. Air Force Field and Aging Systems Support. Air Force Field and Aging Systems Support is being provided to resolve problems in the use of materials, to address maintenance and repair issues and to conduct failure analysis of components not only for the sustainment of existing systems but also for the acquisition of new systems and subsystems. The principal requirements for systems support are related to aging aircraft, coatings, maintainability and the need for quantitative materials characterization and analysis.

j. Air Expeditionary Force. Air Expeditionary Force (AEF) Technologies are being developed to enhance an airbase infrastructure by providing air deployable systems, efficient chemical and biological processing systems and force protection. Lightweight, energy efficient environmental control units, power systems and shelters are needed to reduce AEF footprint, setup time, manpower and sustainment cost. Efficient chemical processing systems are required to affordably and safely produce chemicals in the quantities needed for the operation of an Airborne Laser fleet. Efficient biological processing systems are required to minimize the health and threat insurgency concerns related to the disposal of waste from deployed forces. Protection technologies for deployed forces are being developed to maximize blast protection, detect airborne chemical threats, enhance crash rescue and fire fighting capabilities, robotic mine clearing and for rapid restoration of runways.

III. CONFERENCES AND WORKSHOPS

EOARD and AOARD understand that it is essential for the scientific community to maintain clear lines of communication for thorough and well-reasoned research to be accomplished. Support for conferences and workshops has proven to be an extremely valuable tool for EOARD and AOARD. Conferences and workshops allow EOARD and AOARD program managers to receive prevailing information on their respective disciplines and inform the research community of the current research interests of AFRL.

Financial support by EOARD or AOARD for conferences and workshops is dependent on the availability of funds, program manager's discretion, and certain other conditions. These other conditions include:

1. EOARD/AOARD sponsorship of a workshop or conference does not constitute an endorsement of any co-sponsoring organization, regardless of the organization's financial orientation (profit or non-profit).

2. The subject matter of the conference or workshop is scientific, technical, or involves professional issues that are relevant to the mission of AFRL.

Proposals for conference or workshop support should be submitted a minimum of six months prior to the date of the conference/workshop. Guidance on preparing and submitting proposals can be found in Section IV. All proposals should include the following technical and cost information:

<u>Technical Information</u>

1. Conference/workshop title, location, and date(s).

2. Summary of the conference/workshop including objective(s).

3. Topic(s) to be covered and how they relate to the research interests of AFRL.

4. Name of chairperson/principal investigator and his/her professional credentials and affiliations.

5. List of proposed participants and method (or copies) of announcement/invitation.

<u>Cost Information</u>

1. Total project costs by major cost elements.

2. Anticipated sources of conference/workshop income and amount from each.

3. Financial orientation of sponsor organization (profit or non-profit).

4. Anticipated use of funds requested from EOARD or AOARD. Note: No EOARD or AOARD funds may be used to support or assist participants from countries on which the US has imposed trade limitations.

Proposals for conferences and workshops will be evaluated using the criteria listed below. All factors are of equal importance.

1. The scientific and technical relevance of the proposed conference.

2. The potential contributions of the proposed conference to the mission of AFRL.

3. The qualifications of the principal investigator(s) or conference chair(s).

4. The realism and reasonableness of cost including proposed cost sharing and availability of funds.

If you have questions concerning the scientific relevance of your workshop/conference to the mission of AFRL or the eligibility of your organization to receive funding, contact EOARD or AOARD.

IV. PROPOSAL GUIDANCE

EOARD and AOARD invite proposals for research in support of the areas of interest covered in Sections II and III of this pamphlet. Proposers selected for funding may be awarded assistance agreements or contracts. This includes proposals for research instrumentation that will support research in areas of interest to the USAF and DOD. Awarding of contracts/assistance agreements will be accomplished either by EOARD/AOARD using in-house and local contracting resources, or by the contracting office of the AFRL Technology Directorate that provides the associated funding.

Proposals submitted under this Broad Agency Announcement (BAA) are evaluated through a peer or scientific review process, and selected for award on a competitive basis according to Public Law 98-369, Competition in Contracting Act of 1984, 10 U S C 2361, and 10 U S C 2374. Proposals will be evaluated by program manager(s) at EOARD/AOARD and the appropriate AFRL Technology Directorate(s). Proposals submitted for workshop/conference support shall be competitively evaluated under the criteria specified in Section III. All other proposals will be evaluated under the following two primary criteria, of equal importance, as follows:

1. The scientific and technical merits of the proposed research.

2. The potential contributions of the proposed research to the mission of the USAF.

Other evaluation criteria used in the technical reviews, which are of lesser importance than the primary criteria and of equal importance to each other, are:

1. The likelihood of the proposed effort to develop new research capabilities and broaden the research base in support of US national defense.

2. The proposer's, principal investigator's, team leader's, or key personnel's qualifications, capabilities, related experience, facilities, or techniques or a combination of these factors that is integral to achieving USAF objectives.

3. The proposer's and associated personnel's record of past performance.

4. The realism and reasonableness of proposed costs.

No further evaluation criteria will be used in source selection. The technical and cost information will be analyzed simultaneously during the evaluation process.

Proposals may be submitted for one or more topics or for a specific portion of one topic. A proposer may submit separate proposals on different topics or different proposals on the same topic. The US Government does not guarantee an award in each topic area. Further, be advised that as funds are limited, otherwise meritorious proposals may not be funded. Therefore, it is important that proposals show strength in as many of the evaluation areas as practicable for maximum competitiveness.

The cost of preparing proposals in response to this announcement is not considered an allowable direct charge to any award made under this BAA or to any other award. It may, however, be an allowable expense to the normal bid and proposal indirect cost. Only contracting officers are legally authorized to commit the US Government to an award under this BAA.

Technology sharing and transfer is encouraged. In this respect, EOARD and AOARD welcome proposals that envision university-industry cooperation. Non-industry proposers are encouraged to specify in their proposals their interactions with industry and the United States Air Force Research Laboratory's Technology Directorates, including specific points of contact.

Certifications: All awards require some form of certifications of compliance with US policy requirements. Assistance awards, i.e., grants and cooperative agreements, require some certifications (e.g., the certification of lobbying) to be submitted at the time of proposal, rather than at the time of award. Proposers may incorporate these certifications into their proposals by reference. This may be accomplished by using AFOSR's Proposal Cover Page (http://ecs.rams.com/afosr/download/afrgcvr.doc). A listing of the current certification assistance agreements is available at AFOSR's World Wide Web site at

http://web.fie.com/htdoc/fed/afr/afo/any/menu/any/afrcert.htm.

Every effort will be made to protect the confidentiality of the proposal and any evaluations. The proposer must mark the proposal with a protective legend in accordance with FAR part 15.6, Use and Disclosure of Data, (modified to permit release to outside evaluators) if protection is desired for proprietary or confidential information.

Proposals should briefly address whether the intended research will result in environmental impacts outside the laboratory, and how the proposer will ensure compliance with environmental statutes and regulations.

The preferred method for speedy processing of proposals is by submission through the AOARD or EOARD website. (For proposals submitted for workshop/conference support via EOARD's website, follow the instructions given for Conference Support.) However, to ensure protection of proprietary information, proposals may be submitted as hard copy or by electronic media (floppy disk or CD-ROM in Word or Portable Document File (PDF) format). Unnecessarily elaborate brochures or presentations beyond those sufficient to present a complete and effective proposal are not desired. For additional guidance on the form and content of proposals, proposers should refer to the EOARD or AOARD website or contact EOARD or AOARD by telephone.

Proposals may be submitted at any time to EOARD or AOARD. Proposals received by EOARD and AOARD from proposers within the United States will be forwarded to the appropriate AFRL technology directorate or AFOSR. There will be no further solicitations.

This Broad Agency Announcement is open-ended until revised and should be referenced on all responses.

V. DIRECTORY

ORGANIZATION	ADDRESS	NAME AND TELEPHONE NUMBER
European Office of Aerospace Research and Development (EOARD) http://www.ehis.navy.mil/	EOARD/CC PSC 802, Box 14 FPO AE 09499-0200 or 223/231 Old Marylebone Road London NW1 5TH United Kingdom	O'Connor, Gerald, Col Commander (011) 44-171-514-4376 DSN: 235-4376 FAX: (011) 44-171-514-4960
Asian Office of Aerospace Research and Development (AOARD) http://www.nmjc.org/aoard/	AOARD Unit 45002 APO AP 96337-5002	White, Koto, Dr. Director (011) 81-3-5410-4409 DSN: 315-220-4409 FAX: (011) 81-3-5410-4407