

Human-Centered Intelligence, Surveillance & Reconnaissance (ISR)
Leveraged Science & Technology (S&T) Program
Statement of Objectives

1. Scope

The overall RHX research objective is to develop human-centered S&T that enables the Air Force to more effectively execute the ISR mission. This research objective is dual natured: (1) improve the capability to identify, track and locate human targets in the ISR environment and (2) improve the performance of humans who process, exploit, analyze, produce, and disseminate the ISR data and information.

Current ISR systems are ideal for identifying and tracking entities such as aircraft and vehicles but are less capable of identifying and tracking the human. This research will develop technologies to enable the Air Force to identify, locate and track humans of interest within the operational environment.

The large number of sensors and sensor platforms continues to proliferate along with an exponential increase in sensor data. The improved sensing technology along with the growing rate of data production presents challenges to human analysts who must turn sensor data into information. Research into improving data fusion and analysis of sensor data has seen steady growth but these efforts continue to be system-centric solutions and do not adequately address the human element. Human-centered ISR research places the human component in the system at the forefront and seeks to develop technologies that enhance the performance of ISR analysts and improve the quality of their work product.

The scope of human-centered ISR research spans the complete range of human performance starting at the individual molecular, cellular, genomic level and progressing to complex human-to-human and human-to-machine interactions. Human-centered ISR reaches across multiple domains (air, space, cyber) and has broad application to other DoD organizations and the Intelligence Community (IC).

Human-centered ISR research encompasses three major research areas: (1) human signatures, (2) human trust and interaction and (3) human analyst augmentation. The human signatures research develops technologies to sense and exploit human bio-signatures at both the molecular level and macro (anthropometric) level. The human trust and interaction research develops technologies to improve human-to-human interactions as well as human-to-

machine interactions. The human analyst augmentation research develops technologies to enhance analyst performance and to test the efficacy of newly developed technologies within a simulated operational environment.

2. **Specific Research Objectives**

OBJECTIVE 1: Human Signatures

The objective of the Human Signatures Program is to develop technologies to discover, characterize and transition biological-based signatures (biosignatures) to enable effective human and environmental threat detection, identification and exploitation, and operator performance assessment across a variety of Air Force mission areas. Human signatures research seeks to identify and characterize unique biosignatures that can be exploited to identify, locate and track specific individuals or groups of people possessing certain characteristics of operational interest. Biosignatures range from the micro-level (molecular, cellular, genomic) up to whole body physiological signatures based on anthropometric and biomechanical properties and characteristics.

Exploitation of biosignatures also requires development of (1) sensors designed to detect and collect biosignatures; (2) analytics and informatics to process, analyze, fuse and utilize biosignature sensor data; (3) end user systems that integrate biosignatures into the layered sensor network and provide analysis, visualization, and prediction tools to exploit biosignature data.

OBJECTIVE 2: Human Trust and Interaction

The Human Trust and Interaction Program conducts research examining human-to-human interactions and human-to-machine interactions with the focus on developing technological solutions to enhance ISR capabilities and human performance assessments. Research is divided into two major areas: (1) human insight and trust and (2) human language technologies.

The objectives of the Human Interaction and Trust Program are broken down into three subareas. These are: (1) Trust and Suspicion; (2) Trust in Automation; and (3) Social Signature Exploitation. Trust and Suspicion

research focuses on the recognition of suspicious activities in the cyberspace realm. The needs include the full gamut of open source data including social media to the more traditional intelligence sources. Trust in Automation is driven by human-machine teams and how humans relate to technology. A key need in this area is the establishment of trust between human operators and the machines/software they are teamed with to complete their mission. Finally, the Social Signature Exploitation theme focuses on recognizing behavior indicators that are based on social and cultural factors to assess and predict military relevant events. The need includes the use of open and closed data resources to assist decision making on the use of force or non-physical actions.

The objective of the human language technologies research is to develop advanced technologies to improve exploitation of foreign language sources. Much of the information needed by DoD to effectively operate within and execute its global reach and responsibilities is found in foreign language speech and text; however, there is a critical shortfall of linguists to understand and translate this material. This research addresses the linguist shortfall and the sheer volume of potentially applicable foreign language material for military applications by developing and applying advanced algorithms, techniques, and tools relating to automatic speech recognition (ASR), machine translation (MT), natural language processing (NLP), speech processing (SP), and multimedia information retrieval and extraction. Standard techniques for developing new foreign language capabilities require massive amounts of labeled training data which is very costly and time consuming to acquire. The human language technologies research seeks to rapidly develop low-cost capabilities in new languages and domains of military interest despite limited amounts of labeled, transcribed, or translated training data.

OBJECTIVE 3: Human Analyst Augmentation

The Human Analyst Augmentation Program develops, tests, evaluates, and transitions integrated human-centric technology solutions to the ISR community. Research is divided into two major areas: (1) Analyst Test Bed and (2) ISR Analyst Performance Program.

The objective of the Analyst Test Bed (ATB) is to provide a realistic man-in-the-loop analyst simulation environment with validated subjective and objective performance measures and metrics for testing potential improvements in processing and exploitation capabilities prior to acquisition. Potential improvement areas to be evaluated include cognitive, cultural, decision-making, perceptual, attentional, and augmentation factors affecting ISR analyst performance.

The objective of the ISR Analyst Performance Program (ISR-AP) is to provide human-centric support for analysis and assessment of ISR data through integrated technology solutions for use by the ISR community. Solution areas include computational models for behavioral influence analysis, models of human-decision making, models of cognitive processes involved in integrating multiple and possibly conflicting sources of information, models of the intelligence analysis process including sensemaking behaviors and failure modes, and models of socio-cultural and context effects in ISR analysis. In order to achieve these solutions, research is conducted for developing technologies for augmenting analyst capabilities. Transitioning the solutions for analyst performance augmentation is effected by analyzing, designing, developing, testing, and evaluating software and system engineering tools to aid material and non-material design of cognitive-based tools.

3. **Operations Security (OPSEC):** The contractor shall provide OPSEC protection for all sensitive/critical information as defined by AFI 10-701 (Operations Security), the 711 HPW OPSEC Plan, and critical information list. The contractor shall participate in the 711 HPW sustained OPSEC awareness training or include OPSEC training as part of their on-going security program.