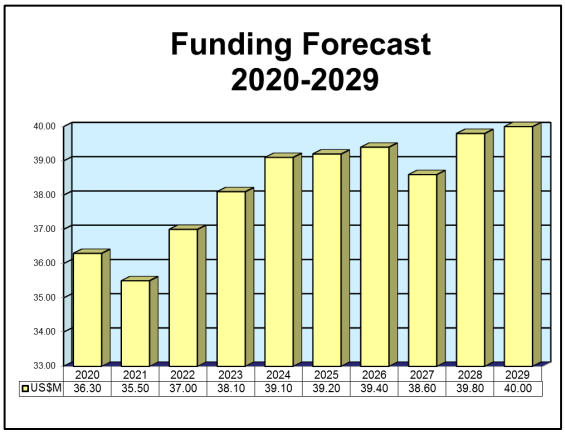
C4I Battlespace Development and Demonstration

Outlook

- Increasing use of cyberspace for military operations drives demand for technology development
- Steady funding that increases throughout forecast period



Orientation

Description. The U.S. Air Force's C4I Battlespace Development and Demonstration (formerly Global Battlespace Awareness) project develops, integrates, and demonstrates advanced technologies to achieve comprehensive net-centric operations and predictive battlespace awareness using information from all sources.

Sponsor

U.S. Air Force Research Laboratory
Rome Research Site
Griffiss Air Force Base, New York

Status. Ongoing research and development.

Application. Command, control, communications, and intelligence.

Contractors

Contractor(s) not selected or not disclosed.

Contractors are invited to submit updated information to Editor, International Contractors, Forecast International, 22 Commerce Road, Newtown, CT 06470, USA; rich.pettibone@forecast1.com

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Technical Data

The C4I Battlespace Development and Demonstration (formerly Global Battlespace Awareness) project is part of PE#0603788F Battlespace Knowledge Development / Demonstration. According to the U.S. Air Force, technologies being developed under the Global Battlespace Awareness project enable the following:

- Tasking of information collectors (intelligence, surveillance, and reconnaissance platforms; national intelligence sources)
- Correlating and geo-registering of collected data
- Exploitation of data to extract information of military significance, and the use of information from multiple sources to create a digital representation of the battlespace
- Prediction of adversary courses of action (COA)
- Archiving of results for ready use by decision-makers

Technologies are being developed under this project to facilitate information exploitation, fusion, processing, storage, and retrieval as well as for machine reasoning, pattern recognition, and timeline analysis purposes.

The C4I Battlespace Development and Demonstration (formerly Global Battlespace Awareness) project consists of the following subprojects:

Advanced Data Handling, Visualization, and Distributed Data Fusion. This effort develops and demonstrates advanced data handling and event visualization technologies and distributed data fusion to enable a more effective utilization of available data.

Starting in FY20, this work is performed under the Data to Decisions effort.

Advanced Signal and Data Exploitation Technologies. This subproject demonstrates advanced signal and data exploitation technologies for detection, tracking, identification, and targeting of time-critical targets as well as for information extraction.

Starting in FY20, this work is performed under the Data to Decisions effort.

Adversary Courses of Action. This subproject develops models that can be used to acquire a detailed understanding of the adversary's probable intent and future strategy in order to identify adversary courses of action as well as the courses of action most dangerous to friendly forces and most likely to impede mission accomplishment.

Starting in FY20, this work is performed under the Multi-Domain Command and Control effort.

Artificial Intelligence/Autonomy/Machine Learning. This subproject develops and demonstrates the harnessing of the speed and scale of computers and machines to address problems of complexity.

Assured Communications & Networks. This subproject develops and demonstrates secure and reliable communications to ensure the delivery of timely, reliable, and actionable information to warfighters and systems.

Autonomous Text Exploitation. This effort develops and demonstrates capabilities in the categories of reasoning and learning, text understanding, link and group discovery, and advanced analysis for purposes of situational awareness and understanding.

Starting in FY19, this work is performed under the Advanced Signal and Data Exploitation Technologies effort, which was transferred to the Data to Decisions effort starting in FY20.

Data to Decisions. This subproject develops and demonstrates the collection, management, analysis, and exploitation of complex data for availability to Air Force and other stakeholders.

Multi-Domain Command and Control. This subproject performs research and development that will advance existing – or discover new – command and control capabilities to support multidomain operations for air, space, cyberspace, land, sea, and undersea.

Nuclear C3 Modernization. This subproject develops and demonstrates the advancement of existing nuclear capable forces to ensure command, control, and connectivity for the president without constraints.

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Developing Comprehensive Net-Centric Operations and Predictive Capabilities

Source: U.S. DISA

Program Review

The U.S. Air Force must be able to process and exploit data and information from a variety of sources and domains to create a common operating picture of the battlespace and allow commanders to maintain information dominance. The Global Battlespace Awareness project develops, integrates, and demonstrates advanced technologies to achieve comprehensive net-centric operations and predictive battlespace awareness using information from all sources. Technology development includes tasking information collectors such as intelligence, surveillance, and reconnaissance (ISR) platforms and national intelligence sources; correlating and geo-registering the collected data; exploiting the data to extract information of military significance; fusing information from multiple sources to create a digital and dimensional representation of the battlespace; assessing the situation; predicting adversary courses of action; and archiving the results for ready use by decision-makers. This is a dynamic, complex process that involves technologies for information exploitation, fusion, processing, storage, and retrieval as well as technologies for machine reasoning, pattern recognition, and timeline analysis.

In FY20, Project 635321 was renamed from Global Battlespace Awareness to C4I Battlespace Dev and Demo. Additionally, three other projects (Anticipatory OPS Intent and Response, Assured Worldwide Connectivity, and Knowledge Management and Computing) were transferred to Project 635321 C4I Battlespace Dev and Demo in order to realign technology areas that better support the National Defense Strategy and Air Force Future Operating Concept.

The following provides details on the progress made to date under the subprojects discussed above and outlines upcoming plans.

Advanced Signal and Data Exploitation Technologies. From FY14 through FY16, efforts for this subproject centered on developing imagery intelligence (IMINT) exploitation and text-data extraction fusion techniques. These were followed by the development of technologies to enhance the ability of electronic intelligence (ELINT) detection and processing systems to challenge emerging emitter weapon systems. At the end of FY16, the enhanced motion imagery capabilities under development were integrated with the existing imagery exploitation tools.

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During FY17 and FY18, work focused on refining and testing technologies for ultra-wideband ELINT signal detection and prosecution. Additionally, "speaker similarity tagging" was developed to improve model generation, cohort detection methods, and prioritization methods based on acoustics, radio traffic, keywords, and metadata.

Much of the previous years' work is expected to carry on into FY19 and culminate with a demonstration of "enhanced emitter feature extraction" capabilities for transition to the U.S. Special Operations Command.

Advanced Data Handling, Visualization, and Distributed Data Fusion. In FY14, this subproject developed scalable pattern mining analytics for multi-intelligence data. In FY15, this subproject continued analysis of recorded multi-INT test data using developed algorithms. In FY16, this subproject continued to develop technologies that could be used to create activity-based intelligence from motion data.

In FY17, work continued on the automated detection and recognition of indicators that associate threats against blue forces in multiple domains. Also, near real-time data mining and analysis capabilities were developed.

In FY18, this subproject demonstrated distributed multi-node, multi-INT PED software framework capabilities and compared them to current methods for multi-INT data mining, correlation, and fusion analytics.

In FY19, work will commence on the automation of collected audio data for enhanced exploitation.

Adversary Courses of Action. Techniques for analyzing evolving social networks began to be devised in FY14, and in FY15, a Web-based text exploitation and analysis framework was developed. FY16 efforts included research and development of plug-and-play modules and the application of large-scale, time-dependent, network-based analytics.

In FY17, efforts focused on developing and transitioning "end-to-end flexible and scalable technology transition platform-enabling text exploitation and layered multi-intelligence network analysis and visualization in support of multi-source analysis." This work continued into FY18 with research into social media analytics tools and techniques for increased text understanding. Additionally, software tools and techniques that fuse textual and non-textual information sources for increased semantic understanding were developed and demonstrated.

Plans for FY19 called for developing and demonstrating kinetic and non-kinetic full-spectrum targeting and intelligence software tools.

Artificial Intelligence/Autonomy/Machine Learning. For FY19 and prior years, this work was performed under the Next Generation Planning and Assessment Tools effort within Project 635319 Anticipatory OPS Intent and Response. The schedule for FY20 indicates efforts will continue to identify and implement state of the art learning models, continue development of data-efficient learning, continue to integrate within the StreamlinedML framework, and continue development of end-to-end baseline learning capability.

Assured Communications & Networks. For FY19 and prior years, this effort performs the work under the Connectivity Technologies effort within Project 635320 Assured Worldwide Connectivity.

FY20 plans will continue development and demonstration for rapid waveform development of multimission radio frequency capability. Work will also continue on Wideband high frequency waveform development and testing. Other efforts will investigate ionospheric research, propagation modeling, and simulation.

Autonomous Text Exploitation. From FY14-FY18, this subproject developed scalable pattern mining analytics for multi-intelligence data that included analysis of recorded multi-INT test data using developed algorithms. Also developed were near real-time data mining and analysis capabilities.

In FY18, distributed multinode, multi-INT PED software framework capabilities were demonstrated and compared to current methods for multi-INT data mining, correlation, and fusion analytics.

Effective FY19, this effort will be reported in Project 635321, Global Battlespace Awareness, under the "thrust" "Advanced Signal and Data Exploitation Technologies" (see above).

Data to Decisions. For FY19 and prior years, this work was performed under both the Advanced Signal and Data Exploitation Technologies effort and the Advanced Data Handling, Visualization and Distributed Data Fusion effort.

Plans for FY20 call for continuing to refine and test technologies for ultra-wideband electronics intelligence signal detection and prosecution, continuing development and demonstration of intelligence analysis capabilities from multiple intelligence sources for both

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near-real time and post mission, and continuing research and development in data analytics and strategic indications and warnings.

Multi-Domain Command and Control. For FY19 and prior years, this work was performed under both Adaptive Planning and Decision Tools and Next Generation Planning and Assessment Tools efforts within Project 635319, Anticipatory OPS Intent and Response, and, under the Adversary Courses of Action effort within Project 635321, C4I Battlespace Dev and Demo.

FY20 efforts will continue to execute experiments, based on operational scenarios, that incorporate process management execution into the extensible Space command and control framework and that integrate disparate data and applications, providing a pedigree for proposed tasking options to decision makers. Work will also continue to develop software capabilities that employ cyber, directed energy, and electronic warfare weaponry. Additional work will provide on-the-fly valuable quantitative evaluations of cyber assets to cyber operators, enabling them to present viable cyber options to commanders in multidomain settings.

Nuclear C3 Modernization. For FY19 and prior years, this was performed under the Connectivity Technologies effort within Project 635320 Assured Worldwide Connectivity, which was transferred to Project 635321 C4I Battlespace Development and Demonstration in order to realign intelligent networking transport and management advanced technology development starting in FY20.

The subproject agenda for FY20 called for continuing to perform real-time monitoring of ionospheric conditions over the Continental United States (CONUS), continuing testing of very-low-frequency (VLF) stubb antenna for reachback, and continuing testing of prototype compact high-frequency (HF) antennas.

Funding

U.S. FUNDING

	FY18 QTY	FY18 AMT	FY19 QTY	FY19 AMT	FY20 QTY	FY20 AMT	FY21 QTY	FY21 AMT
RDT&E (U.S. Navy)								
PE#0603788F								
Battlespace Knowledge Dev & Demo								
Project 635321								
C4I Battlespace Dev & Demo	-	5.4	-	11.2	-	36.3	-	35.5

	FY22 QTY	FY22 AMT	FY23 QTY	FY23 AMT	FY24 QTY	FY24 AMT	FY25 QTY	FY25 AMT
RDT&E (U.S. Navy)								
PE#0603788F								
Battlespace Knowledge Dev & Demo								
Project 635321								
C4I Battlespace Dev & Demo	-	37.1	-	38.1	-	39.1	-	N/A

All $ are in millions.

N/A = Not Available

Source: U.S. Department of Defense FY20 RDT&E Budget Item Justification, R-2

NOTE: In FY20, Project 635321 was renamed from Global Battlespace Awareness to C4I Battlespace Dev and Demo. Additionally, three other projects (Anticipatory OPS Intent and Response, Assured Worldwide Connectivity, and Knowledge Management and Computing) were transferred to Project 635321 C4I Battlespace Dev and Demo in order to realign technology areas that better support the National Defense Strategy and Air Force Future Operating Concept.

Contracts/Orders & Options

No contracts valued over $5 million have been identified for this project.

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Timetable

Year	Major Development
FY14	Advanced Signal and Data Exploitation Technologies IMINT exploitation and text-data extraction fusion techniques developed
FY16	R&D on plug-and-play modules and large-scale, time-dependent, network-based analytics
FY17	Technologies tested that could be applied for ultra-wideband ELINT signal detection and prosecution
FY18	Automation of collected audio data for enhanced exploitation
FY20	Major program realignment and project transfers that better support the National Defense Strategy and Air Force Future Operating Concept

Worldwide Distribution/Inventories

Global Battlespace Awareness is a project of the **U.S. Air Force**.

Forecast Rationale

The U.S. Air Force must be able to process and exploit data and information from a variety of sources and domains to create a common operating picture of the battlespace and allow commanders to maintain information dominance. The U.S. Air Force's C4I Battlespace Development and Demonstration (formerly Global Battlespace Awareness) project develops, integrates, and demonstrates advanced technologies to achieve comprehensive net-centric operations and predictive battlespace awareness using information from all technology sources.

Technology development includes tasking information collectors such as intelligence, surveillance, and reconnaissance platforms and national intelligence sources; correlating and geo-registering the collected data; exploiting the data to extract information of military significance; fusing information from multiple sources to create a digital and dimensional representation of the battlespace; assessing the situation; predicting adversary courses of action; and archiving the results for ready use by decision-makers. This is a dynamic, complex process that involves technologies for information exploitation, fusion, processing, storage, and retrieval as well as technologies for machine reasoning, pattern recognition, and timeline analysis.

An increasing use of cyberspace for military operations is driving the demand for technology development. This effort will see steady funding that increases throughout the forecast period.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR RDT&E FUNDING (in millions US$)												
Designation or Program		**High Confidence**				**Good Confidence**			**Speculative**			
	Thru 2019	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**Total**
MFR Varies												
C4I Battlespace Development and Demonstration **<> United States <> Air Force** Note: Project formerly called Global Battlespace Awareness												
	99.03	36.30	35.50	37.00	38.10	39.10	39.20	39.40	38.60	39.80	40.00	383.00
Total	99.03	36.30	35.50	37.00	38.10	39.10	39.20	39.40	38.60	39.80	40.00	383.00