ENGINEERED INTELLIGENCE

F O R

SPACE

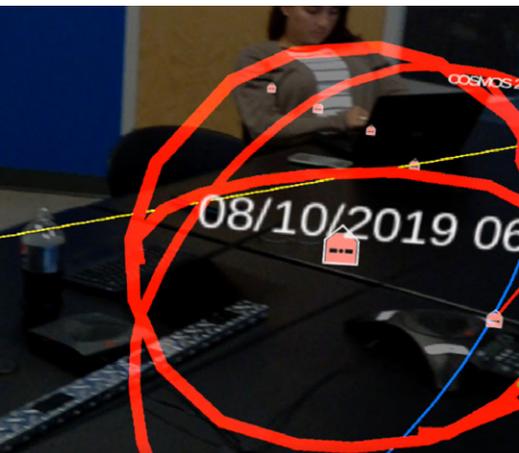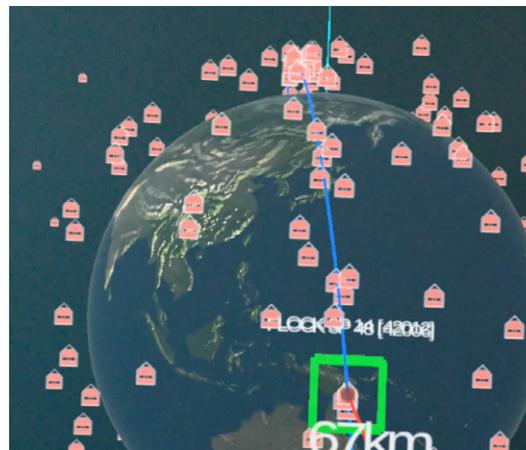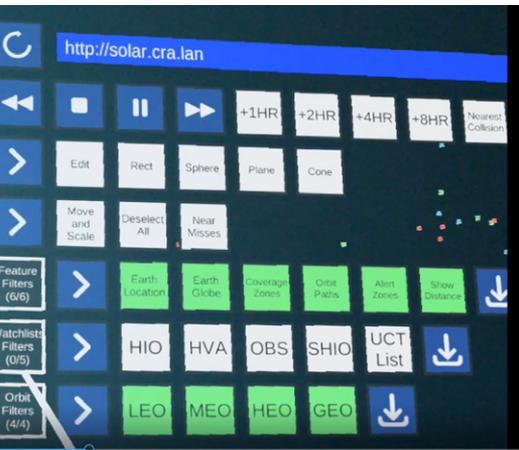## ENHANCING SPACE DOMAIN AWARENESS

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IS YOUR SPACE-BASED INFORMATION ACCURATE AND PROTECTED?

The growing number of satellites and debris in orbit makes tracking assets, preventing collisions, and identifying threats a daunting task—incomplete or inaccurate information will compromise decision making and result in costly missteps.

Charles River Analytics' wide range of human-machine teaming tools, course of action (COA) optimization algorithms, and robotic autonomy gracefully integrate with current and evolving space platforms.

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With these tools, customers can monitor, assess, and act with confidence to maintain critical space assets and ensure multi-domain success.

Our pioneering research in probabilistic programming, machine learning, data mining, and natural language processing has led us to create hybrid, novel AI tools and innovative architectures that provide cost-effective and tailored solutions to the complex problems facing the space community today.

CORE TECHNOLOGIES

As threats to US space assets grow, space domain awareness (SDA) is needed for more than just daily operations and maintenance—it directly affects our ability to resolve conflicts. No one understands this better than SDA space operators, who need access to intelligence, support for flexible tasking and rapid decision-making, and tools that integrate data from multiple sensors to gain the upper hand in space.


Images from DARPAtv, Hallmark Transitions Key Strategies for Space Situational Awareness, Management: https://www.youtube.com/watch?v=W0NZISH-ibQ

Charles River Analytics adapts and integrates multiple AI technologies to leverage each tool's functional strengths, avoid bias, and maintain the transparency necessary to keep humans "on-the-loop" and informed about the dimensions of the space enterprise that are relevant to their mission.

We help operators reason about uncertainty, trust the decisions they are making, and conquer complexity through the use of intuitive, multi-modal interfaces.

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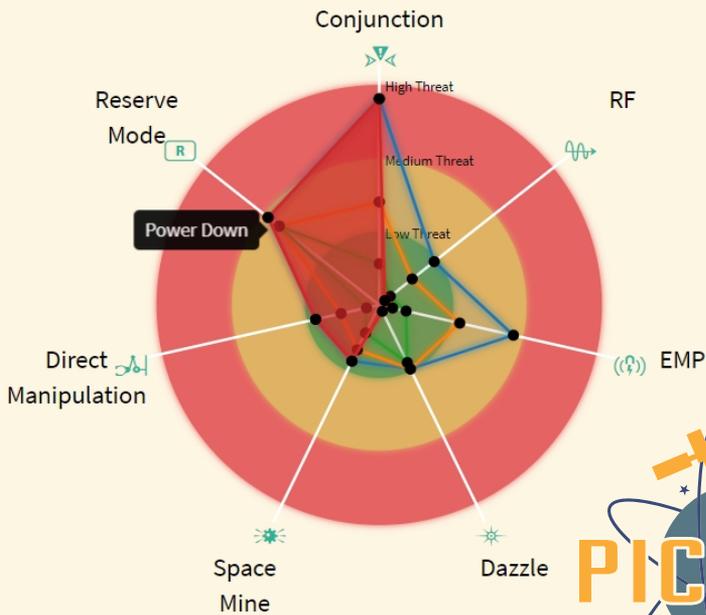# Fusing AI to Create Actionable SDA Visualizations
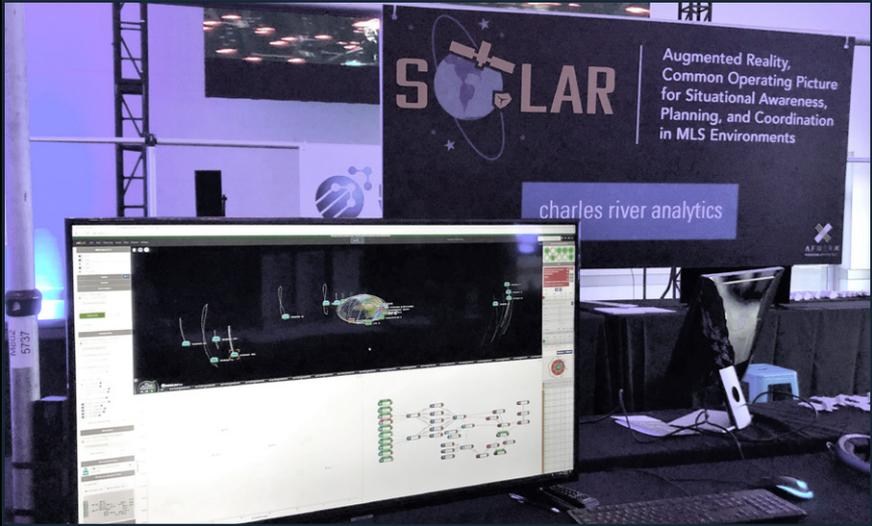
The US military, under efforts such as DARPA's Hallmark program, seeks to help operators quickly develop SDA in the complex space domain. During military operations, operators must quickly combine information from disparate data sources to accurately track assets in space, understand events, and develop COAs to mitigate threats.

As part of the Hallmark program, we developed Space Operation Visualizations Leveraging Augmented Reality (SOLAR). With SOLAR's intuitive visualizations, operators quickly make sense of outputs from novel AI, machine learning, and other advanced analytic tools developed by Charles River Analytics and third-party organizations.

Operators interact with SOLAR's visualizations within next-gen augmented reality displays using a workflow-centric graphical user interface to make faster decisions with greater confidence.

Conjunction

High Threat

Reserve
Mode   R

Medium Threat

RF

Power Down

Low Threat

Direct
Manipulation

EMP

Space
Mine

Dazzle

PICASSA

CASE STUDY:
PICASSA

Our Probabilistic Inference for COA Analysis in Space Situational Awareness (PICASSA) tool, which improves threat detection in space using advanced probabilistic reasoning, was also developed under the Hallmark program. When viewed within SOLAR's interactive visualizations, space operators can easily understand and incorporate outputs from PICASSA's reference models and decision algorithms into their SDA and course-of-action workflow.

PICASSA builds probabilistic models with Figaro™, our free, open-source probabilistic programming language. Figaro makes it possible to express probabilistic models using the power of programming languages and includes built-in reasoning algorithms for application to new models.

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Charles River Analytics conducts cutting-edge AI, robotics, and human-machine interface R&D to create custom solutions for your organization. Our customer-centric focus directs us towards problems that matter, and our passion for science and engineering drives us to create actionable, impactful solutions.

We were founded in 1983 to perform results-focused research for the US government. We became an employee-owned company in 2012, setting the stage for the next generation of innovation, service, and growth. Today, our nearly 200 employees make a difference for a "who's who" in government and industry by delivering results on government programs and working with commercial partners.

We come to work every day because we want to advance technology to solve today's hardest problems. We have a stellar track record implementing successful solutions that enrich diverse markets—defense, intelligence, medical technology, training, transportation, space, and cyber security. We owe our success to our expertise in advanced algorithms, machine learning, autonomous systems, advanced human-system interfaces, agile software and hardware engineering, and to our enduring base of knowledgeable customers.

At Charles River Analytics,
we turn research into results.

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U.S. Prime Contractor

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