

SBIR Topic Number:
AF03-075

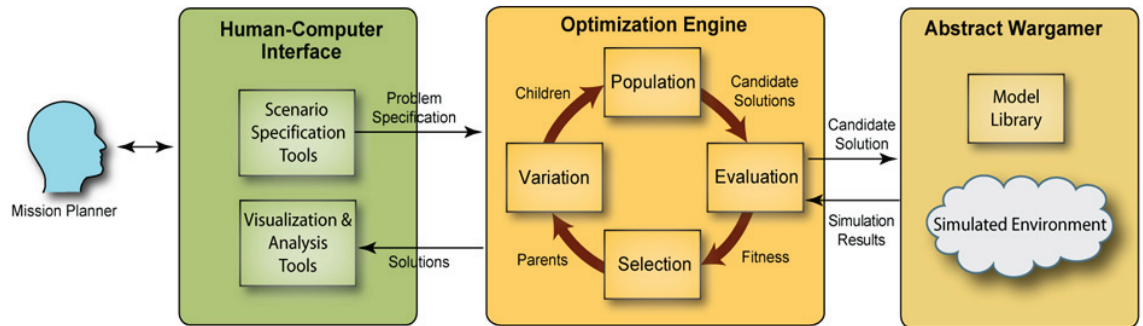
SBIR Title:
Automated Mission Planning Tools for Simulation Based Acquisition (SBA) of C2 Systems

Contract Number:
FA8750-04-C-0174

SBIR Company Name:
Charles River Analytics, Inc., Cambridge, MA

Technical Project Office:
AFRL Information Directorate, Rome, NY

This Air Force SBIR/STTR Innovation Story is an example of Air Force supported SBIR/STTR technology that met topic requirements and has outstanding potential for Air Force and DoD.



STOMP System Architecture

Software Toolkit for Optimizing Mission Plans (STOMP) for the Joint Synthetic Battlespace

- The Air Force has a requirement for a decision-support system to assist Air Operations Center (AOC) mission planners in addressing the emergence of time-sensitive/time-critical targets
- Charles River Analytics' STOMP tool uses evolutionary algorithms (EAs)-- a type of optimization technology-- to generate a suite of alternatives for the AOC mission planning decision-maker
- The STOMP optimization technology can also be applied to ISR operations and collection planning, mission planning for UAVs, allocation of space-based resources, and missile defense
- STOMP supported the development of Charles River's commercial EAToolkit™, a technology for rapidly developing EAs to solve a wide variety of real-world optimization problems

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Air Force Requirement

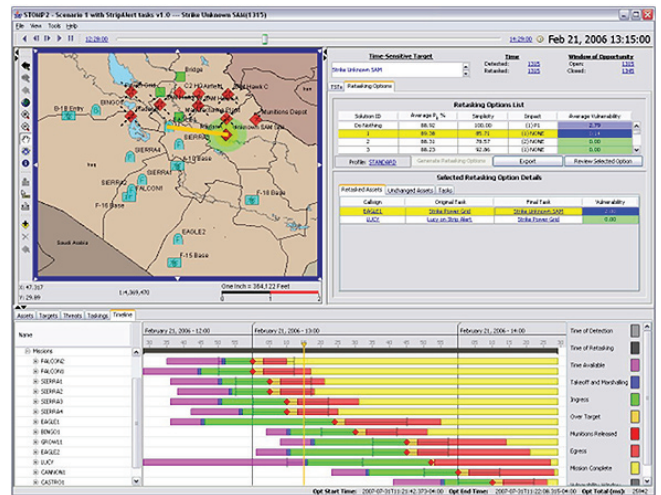
Today, planners in Air Operations Centers (AOCs) must overcome many obstacles to accomplish their mission. Operations occur at a rapid pace, requiring planners to swiftly adjust the location and timing of strike assets to adjust to the dynamic battlespace. Operators must perform this function with limited time available. Allocating appropriate assets to targets is made more complex as planners must review a tremendous number of possible plans, consider a variety of planning constraints (e.g., time windows, flight zones, platform/weapon capabilities, etc.), and address multiple, potentially conflicting, objectives. Decision-support systems are needed to assist AOC planners in generating mission plans when time-sensitive targets/time-critical targets (TSTs/TCTs) emerge that need to be immediately addressed. Additional benefits can accrue through the employment of such decision-support systems for virtual and constructive simulation-based training, experimentation, and Command and Control (C2) system evaluation and acquisition within the Air Force's Joint Synthetic Battlespace (JSB) environment.

SBIR Technology

Utilizing Air Force SBIR Phase I, Phase II, and enhancement funding, Charles River Analytics, Inc. has developed their Software Toolkit for Optimizing Mission Plans (STOMP). This tool provides an optimization framework using evolutionary algorithms (EAs)—a type of optimization technology—coupled with low-fidelity simulation to generate a selection of alternatives for the mission planning decision-maker. This optimization framework serves as a platform technology for a decision-support tool to rapidly generate, analyze, and visualize air campaign mission plans for dynamic targeting in the AOCs. STOMP's software interoperability provides the requisite interface and connectivity with Air Force C2 systems and JSB environment. The STOMP system architecture is shown on the previous page and a screenshot of STOMP's user interface is pictured above.

Potential Application

This STOMP technology can assist Air Force mission planners in the AOCs by generating and analyzing a diverse set of mission plans to enable the optimal allocation and near real-time redeployment of air strike assets to enable the timely prosecution of TSTs/TCTs. STOMP generates a diverse set of solutions across the trade-off space of multiple objectives, allowing the AOC decision-makers to make the final recommendation.



Screenshot of STOMP's User Interface

Furthermore, comparison, visualization, and playback of recommended solutions enable the warfighter to fully understand the impact of each option. The same underlying optimization technology can be adapted to similar applications in intelligence, surveillance, and reconnaissance (ISR) operations, as well as missile defense and space-based resource allocation.

Company Impact

The STOMP effort has allowed Charles River Analytics to develop their commercial product, EAToolkit™. This tool is a platform technology for the rapid development of evolutionary algorithms (EAs) to solve a variety of optimization problems. Often, real-world optimization problems are too large and too complex to be solved by standard or conventional approaches. EAs can overcome these limitations using mechanisms inspired by biological evolution; they have met with considerable success as a general search method. However, implementing the associated algorithms, tailoring them to a specific problem domain, and analyzing the results can be a somewhat labor-intensive process. The success of STOMP and EAToolkit has enabled Charles River Analytics to address similar problems in other defense-related areas including ISR operations and intelligence collection planning, missile defense, mission planning for a constellation of unmanned aerial vehicles (UAVs), and the allocation of space-based resources.



SBIR/STTR

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