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A Fresh START Improves Replanning for Recon Missions

START II makes it easier to decide which airborne UAV should be diverted to check out a time-sensitive target.

The way a reconnaissance mission starts isn't always the way it ends. Conditions change. Targets change. Priorities change. Now, however, MITRE has improved a tool that helps the U.S. Air Force make better, faster decisions about which unmanned aerial vehicle (UAV) can be redirected to a new time-sensitive target that pops up. The tool is designed for intelligence, surveillance, reconnaissance (ISR) collection managers who are responsible for replanning the flights of UAVs that are already flying ISR missions.

The original tool was called START (for Spatio-Temporal Analysis for Rapid Tasking). It enabled collection managers to pair an ISR asset, such as a Predator, with a new target. The ISR collection manager could ask "what if" questions to get a better understanding of target coverage and mission effectiveness. A typical question might be how to decide which of three UAVs already in the air should be diverted to investigate a new time-sensitive target—given that the weather is changing and each UAV has a different load of fuel remaining.

Now, the application is even better after MITRE solicited ideas from ISR collection managers to expand on the first version. Naturally, it's called START II. The new version has three features that improve on the first version: 1) a decision support matrix that gives several alternative courses of action, 2) a way to specify risks rather than give a general overall risk assessment, and 3) a real-time weather feed.

"Our goal is to create a human-controlled automation system where people and automation work collaboratively to solve complex space-time planning problems," says Craig Bonaceto, a senior information systems engineer. Bonaceto and colleague Alexander Enzmann are co-principal investigators on the project. "We've developed new decision-support concepts that enable warfighters—such as ISR collection managers—to maximize target coverage and minimize risk to their aircraft. START II gives assistance with planning algorithms that let warfighters refocus a mission on the fly in response to new time-critical collection requests."

START II helps maximize target coverage and minimize risk to aircraft.

The START II upgrade evolved from experiments conducted with START I at West Point and conversations with Predator operators at Creech Air Force Base, Nevada. "Unlike the first version, START II uses a real-time feed with upcoming risks and a weather feed for routes that ISR platforms will be flying," says Bonaceto. "As a decision-support tool, START II helps assign assets that will cover targets at different points in time. Behind the scenes is an optimization algorithm, what we call the START Assistant, which does the number crunching for the operator."

Two Ways if Looking at Things

START II is highly visual and uses two major geographic views. The first is the Constellation Viewer, which displays ISR platform mission plan data. The second is the Mission Tasker/Retasker, which supports the planning and replanning of ISR missions. The Constellation Viewer provides warfighters with a shared picture of the "maneuver scheme" for all airborne sensor platforms. These include unmanned aerial vehicles such as Scan Eagle, Predator, and Global Hawk, as well as manned aircraft such as the U2.

In the illustration, a fictitious map shows the planned maneuver scheme for a Scan Eagle UAV with call-sign "Arrow." The application receives real-time position and telemetry data from the sensor platforms. In addition to a map-based display of each UAV's planned maneuver scheme, the Constellation Viewer also provides a timeline-based view. Each row in the timeline at the top portion of the display shows the maneuver scheme for a particular craft. The map-based and timeline-based views provide warfighters with a comprehensive understanding of what each sensor platform has been tasked to do and whether or not adequate coverage has been planned for each target.

(continued...)

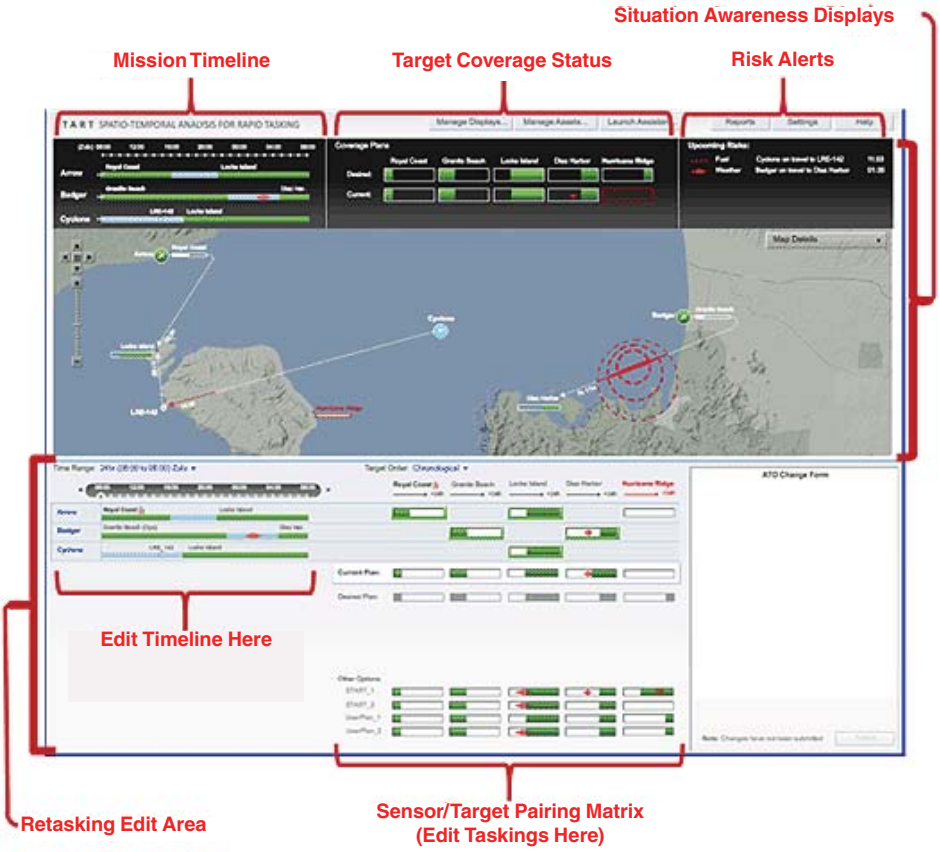
Specific Risks Highlighted

In START I, re-tasking scenarios were assigned risks, but they were too general in scope. Users told Bonaceto that they wanted to know what and where the risks were specifically. "Why is the risk high for this plan? What assets are being affected? What part of the plan is being affected?" Now, with START II, all of this information is shown on the collection manager's display.

Another new feature is optimization planning for alternative courses of action. "At a glance, I can see that this option has quite a few risks on these three platforms," explains Bonaceto. "If I see a better option, I can click it, and it becomes my new plan. Yet the operator has control. He or she may know that the weather data is stale and can ignore it. The operator may have information that the matrix doesn't have. So the operator can make the best decision in conjunction with START II's algorithm.

"We think we've greatly improved the visualization and interaction techniques that facilitate joint human-computer spatio-temporal reasoning for allocating ISR assets. START II enables a faster ISR collection management response to emerging battle space demands."

"If I see a better option, I can click it, and it becomes my new plan."



The retasking view of START II has three major areas: 1) The bars on the black background at the top show the current flight time and risks; 2) the map in the middle shows the routes; and 3) the white Retasking Edit Area space at the bottom is where the timeline is edited (at left) and the decision support matrix is changed (in the middle). The Retasking Edit Area enables the warfighter to work in conjunction with the optimization automation to come up with the best assignment of platforms to targets. For example, as the operator clicks cells in the matrix (middle portion of the display) to assign collection platforms to targets, the automation eliminates cells from selection that are no longer feasible. As the operator clicks to assign ISR platforms to targets, the system re-computes the route and scheme of maneuver for each platform and shows the updated scheme of maneuver on an interactive 3D map. The optimization automation has also computed several alternate courses of action that are shown on the bottom middle part of the display. Warfighters can compare the target coverage and risks of each of these options to any plan they've come up with in the matrix.

—by David A. Van Cleave

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