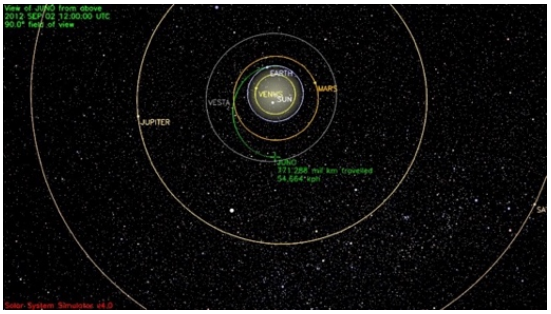
Stottler Henke

Smarter Software Solutions

Going to Mars: Automating Off-World Operations and On-Earth Launch Preparations

Stottler Henke is developing, for NASA's immediate and far-future use, a general framework to automate planning, scheduling, and execution decision-making. The framework is first being applied to automate those cognitive processes for the launch preparations for the Space Launch System (SLS) and Orion deep space manned spacecraft, both systems referred to by NASA Administrator Charles Bolden, when he said, "We're on our way to Mars ... we're building a rocket that's going to take humans to Mars." The framework integrates automatic diagnostic planning, scheduling, and adaptive execution systems to create a fully automatic, closed-loop, autonomously executing software system.



Anomaly Detection via Topological Feature Map

Deep space exploration is a significant advancement over previous NASA missions and presents unprecedented opportunities and challenges. Astronauts can face significant communication lag with ground crew that could directly impact their ability to handle emergencies. Astronauts need to be self-sufficient when handling equipment failures and other emergencies arising in their habitats. This can be a challenge, as astronauts will typically not possess deep knowledge of the design of their habitats. Our Anomaly Detection via Topological Feature Map (ADTM) system provides astronauts with automated assistance in detecting current and emerging anomalies in their environments, localizing their causes, and suggesting fixes. In effect, ADTM is designed to step in to fill the gap left by the communication lags with ground crew. ADTM uses a combination of machine learning techniques to model space systems and enable condition-based health maintenance. In a related project, in concert with actual NASA astronauts, we are developing an Astronaut Agent to verbally and visually assist in-space crew with a wide variety of tasks.

Boeing 787 Dreamliner™ Assembly Scheduling

The Boeing Company contracted with Stottler Henke to tailor our Aurora intelligent scheduling software specifically to help manage the process of building the Boeing 787 Dreamliner™ commercial airliner. Aurora is a sophisticated scheduling system that combines a variety of scheduling techniques, intelligent conflict resolution, and decision support. The software's scheduling decisions take into account resource requirements, a variety of constraints, and any pertinent domain knowledge. Aurora's analytic capabilities help the scheduling team understand why the software scheduled the way it did, so the team can focus on those parts of the production plan that could result in schedule cycle improvement if streamlined. The Aurora version for Boeing prioritizes factory production tasks by balancing resource capacities with manufacturing requirements and constraints.

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The result is a dynamic assembly schedule that adapts to real-time production variability. Boeing is also applying the Aurora-based scheduler to other production lines.

MIDAS: Managed Intelligent Deconfliction & Scheduling for Satellite Communications

The Air Force Satellite Control Network (AFSCN) coordinates hundreds of satellite communication requests from various users every day. MIDAS is a tool for rapidly scheduling and deconflicting AFSCN satellite communication requests. In the past, these needs were met by teams of highly trained and experienced schedulers manually checking every schedule request received. Approximately half of all requests require adjustment to remove conflicts. MIDAS automates much of this, allowing schedulers to apply their expertise where it is really needed. MIDAS employs a two-stage process that first shuffles tasks within their defined constraints before carefully applying a user-definable set of business rules that allow certain constraints to be relaxed when necessary. The system provides a familiar, user-friendly interface, runs on inexpensive consumer hardware, and communicates with legacy systems via a well-defined plain-text file format. **This material is based upon work supported by the United States Air Force under Contract No. FA9453-12-C-0066. Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the United States Air Force.**

TRACER: AI-based, Automated, EMI Emitter Localization and Identification System

Electromagnetic incursions (EMIs) are signals at AFSCN sites which overlap in frequency with those reserved for satellite communications. Because EMIs can potentially interfere with these communications, it is important to detect incursions and identify their source to stop on-going incursions and prevent them from occurring in the future. To streamline terrestrial EMI emitter localization and identification, we developed the TRACER system, which provides an integrated set of data management, task management, analysis, and data visualization capabilities. These capabilities improve space situational awareness, reduce manpower requirements, dramatically shorten EMI response time, enable the system to evolve without programmer involvement, and support adversarial scenarios such as jamming. **This material is based upon work supported by the United States Air Force under Contract No. FA9453-16-C-0495. Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the United States Air Force.**

Extensible Platform for Automated Tactical Sensor Screening (ExPATSS)

Developed for the Navy, ExPATSS detects and classifies ships by using Convolutional Neural Networks (CNNs) for image classification. ExPATSS detects ships from onboard an aircraft carrier and processes several videos streams to determine the content of those images. This reduces the time human sensor operators spend manually monitoring the video streams at once. ExPATSS quickly determines threats and has a high classification rate, which allows the system to be used during video playback to skip uninteresting segments of footage, which can save enormous amounts of human-hours. **This material is based upon work supported by the Naval Sea Systems Command under Contract No. N00024-14-C-4082. Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the Naval Sea Systems Command.**