

Observation Design allows the user to orient the spacecraft and visualize the projection of the instrument field of view for that orientation using the same views as Opportunity Search. Constraint Checking is provided to validate various geometrical and physical aspects of an observation design. The user has the ability to easily create custom rules or to use official project-generated flight rules. This capability may also allow scientists to easily assess the cost to science if flight rule changes occur. Data Output allows the user to compute ancillary data related to an observation or to a given position of the spacecraft along its trajectory. The data can be saved as a tab-delimited text file or viewed as a graph.

SOA combines science planning functionality unique to both JPL and the sponsoring spacecraft. SOA is able to ingest JPL SPICE Kernels that are used to drive the tool and its computations. A Percy search engine is then included that identifies interesting time periods for the user to build observations. When observations are then built, flight-like orientation algorithms replicate spacecraft dynamics to closely simulate the flight spacecraft's dynamics.

SOA v8 represents large steps forward from SOA v7 in terms of quality, reliability, maintainability, efficiency, and user experience. A tailored agile development environment has been built around SOA that provides automated unit testing, continuous build and integration, a con-

solidated Web-based code and documentation storage environment, modern Java enhancements, and a focus on usability.

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*This software is available for commercial licensing. Please contact Dan Broderick at [Daniel.F.Broderick@jpl.nasa.gov](mailto:Daniel.F.Broderick@jpl.nasa.gov). Refer to NPO-48529.*

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## **Autonomous Byte Stream Randomizer**

Net-centric networking environments are often faced with limited resources and must utilize bandwidth as efficiently as possible. In networking environments that span wide areas, the data transmission has to be efficient without any redundant or exuberant metadata.

The Autonomous Byte Stream Randomizer software provides an extra level of security on top of existing data encryption methods. Randomizing the data's byte stream adds an extra layer to existing data protection methods, thus making it harder for an attacker to decrypt protected data. Based on a generated cryptographically secure random seed, a random sequence of numbers is used to intelligently and efficiently swap the organization of bytes in data using the unbiased and memory-efficient in-place Fisher-Yates shuffle method.

Swapping bytes and reorganizing the crucial structure of the byte data renders the data file unreadable and leaves the data in a deconstructed state. This deconstruction adds an extra level of security requiring the byte stream to be reconstructed with the random seed in order to be readable. Once the data byte stream has been randomized, the software enables the data to be distributed to  $N$  nodes in an environment. Each piece of the data in randomized and distributed form is a separate entity unreadable on its own right, but when combined with all  $N$  pieces, is able to be reconstructed back to one.

Reconstruction requires possession of the key used for randomizing the bytes, leading to the generation of the same cryptographically secure random sequence of numbers used to randomize the data. This software is a cornerstone capability possessing the ability to generate the same cryptographically secure sequence on different machines and time intervals, thus allowing this software to be used more heavily in net-centric environments where data transfer bandwidth is limited.

*This work was done by George K. Paloulian, Simon S. Woo, and Edward T. Chow of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).*

*This software is available for commercial licensing. Please contact Dan Broderick at [Daniel.F.Broderick@jpl.nasa.gov](mailto:Daniel.F.Broderick@jpl.nasa.gov). Refer to NPO-48495.*