



## CSSI MISSION

AGI's Center for Space Standards and Innovation (CSSI) functions as a centralized source of research, standards, data and innovative technical solutions for the space, defense and intelligence communities. Space standards lack consistency, consolidation and accessibility. The space community needs widely accepted and openly developed standards, as well as easy access to standard data, to ensure interoperability and facilitate innovation. CSSI addresses these problems through an Internet-based data dissemination service that ensures standard data and documentation are readily available to space, defense and intelligence professionals to perform their missions.

## CSSI TEAM

Dr. Salvatore Alfano, Dr. T.S. Kelso, Daniel Oltrogge and David Vallado comprise the CSSI team. Backed by renowned astrodynamics experts from AGI, this group promotes space-related best practices through data, tools and consultation in areas such as: high-precision operations; space asset protection strategy; autonomous operations; space mission design and analysis; advanced navigation applications; conjunction and launch-window analysis techniques; and optimal orbit determination.

## CSSI SERVICES

### CelesTrak

CelesTrak, operated by Dr. T.S. Kelso since 1985, is an Internet-based data dissemination service that ensures standard data and documentation are readily available to space, defense and intelligence professionals to perform their missions. Data includes two-line element sets, Earth orientation parameters, solar weather data, geomagnetic indices, precision orbit ephemerides and associated models and documentation.

## SOCRATES

In 2005, CSSI began providing Satellite Orbital Conjunction Reports Assessing Threatening Encounters in Space (SOCRATES), a service for satellite owner/operators that lists the top 10 pending potential satellite collisions each week. In early 2008, CSSI began offering SOCRATES-GEO, an enhanced version of the service that monitors satellites in geostationary (GEO) orbit. SOCRATES-GEO uses a variety of improved orbital data sources to provide improved conjunction monitoring for participants. Using this information can significantly reduce the number of false alarms, particularly with conjunctions between two operational satellites.

## Space Data Center

The Space Data Center (SDC) implements a highly available, secure and automated space situational awareness (SSA) analysis system based on SOCRATES-GEO/LEO. The system was developed by AGI and provides Space Data Association members with full conjunction assessment (CA) capability (assessing the physical proximity of objects in space) and data sharing in support of radio frequency interference (RFI) mitigation. The SDC began initial operations in July 2010 for SDA founding members Inmarsat, Intelsat, and SES and, with the transfer of CSSI's prototype SOCRATES-GEO and LEO conjunction assessment programs to the SDC in December 2010, the SDC now provides CA processing for more than 65% of all operational satellites in GEO.

For the latest information about CSSI, phone 1.719.573.2600, email [cssi@agi.com](mailto:cssi@agi.com), or visit [centerforspace.com](http://centerforspace.com).



## CSSI TEAM



### **Dr. Salvatore Alfano**

Dr. Salvatore Alfano has been a major contributor to the space operations community for more than 20 years at both the policy and technical development levels. As a senior research astrodynamist for CSSI, his current work deals with determining accuracy requirements for meaningful conjunction assessments and improving satellite conjunction assessment algorithms. Sal is well-versed in astronautical, electrical and computer engineering. He pioneered work in kinetic energy guidance, satellite visibility and close-approach prediction, high-accuracy orbit determination, continuous-thrust orbit transfers, and collision probability. He significantly advanced the state-of-the-art in all these areas and is recognized for such by the scientific community. Additional accomplishments include three patents, 38 industry publications; 10 awards and honors; and eight professional association memberships.



### **Daniel Oltrogge**

Daniel Oltrogge is a senior research astrodynamist with CSSI and the CEO of 1Earth Research. At CSSI, Dan is the program manager of the Space Data Center, providing space situational awareness and analysis support to government, civil and commercial space operators. Dan has authored more than 60 technical papers as well as consensus international standards on estimating orbit lifetime and orbital debris mitigation plus two book chapters ("Small Satellite Mission Design and Operations" in *Small Satellites: Past, Present and Future*, and "Collision Avoidance and Radio Frequency Interference" in *Space Systems Modeling and Simulation*). Dan's specialties include launch and early orbit operations, nanosatellites, international space operations standards development, space situational awareness and astrodynamics.



### **Dr. T.S. Kelso**

Dr. T.S. Kelso serves as a senior research astrodynamist for CSSI, bringing 30 experience in space education, research, analysis, acquisition, development, operations and consulting with organizations such as Air Force Space Command Space Analysis Center (ASAC); NASA's Near-Earth Object Science Definition Team; Air Force Chief of Staff's SPACECAST 2020 and Air Force 2025 future studies; and the Air Force Satellite Control Network. He has taught on the faculty at Air War College; Air Command and Staff College; the Airpower Research Institute; the College of Aerospace Doctrine, Research, and Education; and the Air Force Institute of Technology. T.S. has supported the space surveillance community since 1985 by operating electronic data dissemination systems to provide NORAD two-line orbital element sets, associated orbital models, documentation, software and educational materials to users around the world.



### **David Vallado**

David A. Vallado is a senior research astrodynamist with CSSI. Previously, he was a principal engineer with Raytheon Intelligence and Information Systems in Denver, CO, where he worked to integrate new technologies into ground software control systems. He is also the author of the advanced astrodynamics textbook, *Fundamentals of Astrodynamics and Applications* (McGraw-Hill, 1997, 3rd ed, *Microcosm*, 2007, 980 pgs). Dave has been recognized in *Who's Who* (since 2001) and as a 1998 Outstanding Young Man of America.