

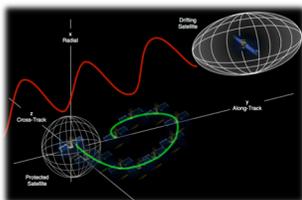
# ControlPlan™

## Optimal Maneuver Planner for Conjunction Resolution

Princeton Satellite Systems ControlPlan solves complex, multi-constraint problems to support the decision-maker

### Capabilities

- Rapidly develop user-defined courses of action in complex decision space.
- Plan minimum-fuel avoidance maneuvers
- General satellite model includes time-varying thrust and station-keeping constraints
- Robust plan accounts for uncertainty in satellite states
- Supports collaborative, networked planning
- Service oriented client / server architecture



ControlPlan is user-centric decision support software that produces courses of action within complex decision spaces. The software uses a flexible framework with optimization libraries to leverage the right mathematical tool for each problem.

### Conjunction Alerts

With the expansion of the Air Force Surveillance System, the catalog will grow to 100,000+ tracked objects. This will result in a huge influx of new conjunction alerts. It will become more important than ever before to have reliable tools that can quickly plan collision avoidance maneuvers.

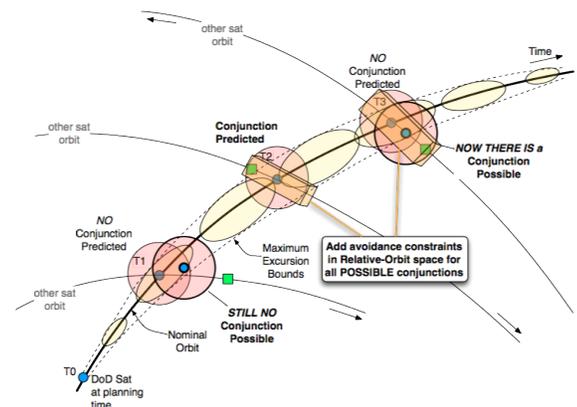
### Avoidance Maneuver Planning

ControlPlan can help operators at the JSpOC and at each satellite operations center (SOC) to quickly develop and assess avoidance maneuvers to resolve conjunction alerts. Using optimization software and intuitive user interfaces, it performs user-driven, automated planning of minimum-fuel maneuvers that resolve the conjunction subject to spacecraft operational constraints.

### Plan Ahead

ControlPlan prevents the dreaded “domino effect”, where a maneuver that resolves the first conjunction creates one or more new ones. We explicitly account for all potential conjunctions so there are no surprises. In addition, the probability of collision, predicted delta-v, and last possible maneuver time are displayed so

the operators can quickly evaluate the cost and benefit of a given maneuver.



### Unique Features

- Innovative method for modeling avoidance region enables compact and efficient optimization
- Avoidance regions added for all possible conjunctions, preventing “domino effect”
- Robust planning method ensures avoidance with satellite state uncertainty
- Calculation of the delta-v and last possible maneuver time gives the planner added insight for better decision-making

### Comprehensive Solution

ControlPlan generates fuel-optimal maneuvers using a satellite model with time-varying thrust, station-keeping, and avoidance constraints. The user-centric interface provides an integrated setting for situation awareness, mission inputs, plan development and trade-off analysis. The client-server architecture of the planning framework supports distributed collaboration between JSpOC and SOCs .

## INFORMATION SHEET

### ControlPlan

- User-Centric
- Mission Focused
- Proven capability developed under the Navy's Program Executive Office Space Systems
- Optimization engine solves a wide range of problems
- Client-server architecture for distributed use and collaborative planning

Princeton Satellite Systems has 20+ years of experience working with Industry, Government and the Military providing best of class solutions.

### What is ControlPlan?

The ControlPlan software supports tradeoff analyses of multiple courses of action. The design provides users the ability to develop and store a diverse set of plans to accommodate a wide range of scenarios. Within each scenario, courses of action that meet system and mission constraints are developed using user-defined, mission-specific criteria.

Tradeoff analysis between plans is performed through detailed displays that provide a time-phased representation and user-defined charts, tables and graphs comparing the plans. ControlPlan's efficient computational approach allows the user to receive immediate feedback to plan modifications.

### User Remains in Control

ControlPlan has the human planner at the heart of its design. It allows the user to apply the most advanced mathematical tools in creating a set of optimal plans while freeing them to impart a mission focus to the plan.

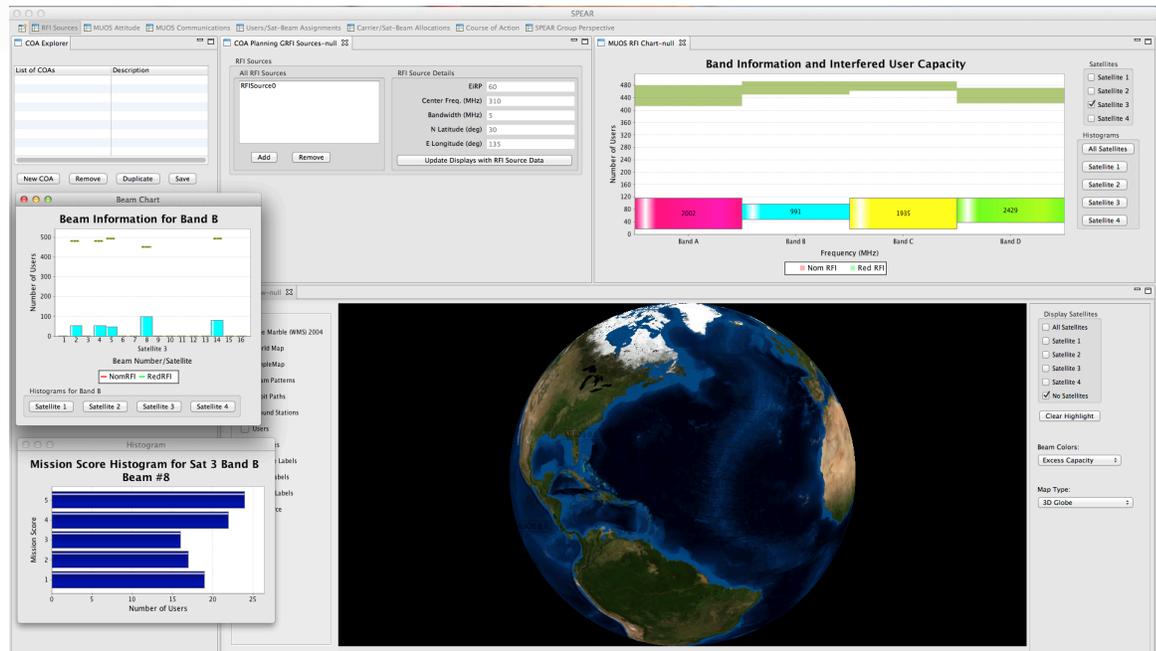
### Origin of ControlPlan

ControlPlan was originally developed as a planning tool for Navy's Mobile User Objective System. Called Satellite Planner for Execution and Reconfiguration (SPEAR), it optimally plans mission options for this satellite system against a variety of space-borne and ground based threats within orbit, satellite fuel and payload mission constraints.

### Princeton Satellite Systems

We are an innovative engineering firm pushing the state-of-the-art in Aerospace, Energy and Control. Since the company was founded in 1992 we have been an integral part of the development of satellite control systems such as GPS IIR, Telstar 4, Cakrawarta-1 and Sweden's Prisma. We sell commercial software and perform research for the Air Force and the Navy. We have received a wide range of patents from Satellite Control to Nuclear Fusion.

Our staff provides user-focused engineering talent in developing and applying new and innovative solutions to any set of complex problems.



For more information about Princeton Satellite Systems, please visit us on the Web at: [www.psatellite.com](http://www.psatellite.com) or contact our ControlPlan development lead, Dr. Joseph Mueller at 763-639-1553, [jmueller@psatellite.com](mailto:jmueller@psatellite.com)



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