

RTS Automation

Interface Requirements Related to Automated Space Vehicle Anomaly Resolution

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Agenda

- SV Anomaly Analysis
- SV Anomaly Resolution Prototyping
- Major Ground Station Interface Requirements
- Ground Station Control Architectures
- Recommendations

SV Anomaly Analysis

- Over 15,000 problem reports studied
- 113 Different causes identified
 - 81 Different symptoms
- 45% Have well defined responses which can be expected automatically
- 4% - 9% Occur at least twice a year
- 54% Of the contingency plans studied have been implemented

SV Anomaly Analysis (cont.)

- Simple rules based decision support can be used to automate SV operations
- Automated SV anomaly resolution can be cost effective

SV Anomaly Resolution Prototyping

- 10 Contingency plans were selected for anomalies that occur at least twice a year
- Operator actions were modeled using RDD-100 to analyze operator workloads
- Prototypes utilized a Lockheed Martin Space and Range Automated Remote Tracking Station (ARTS)

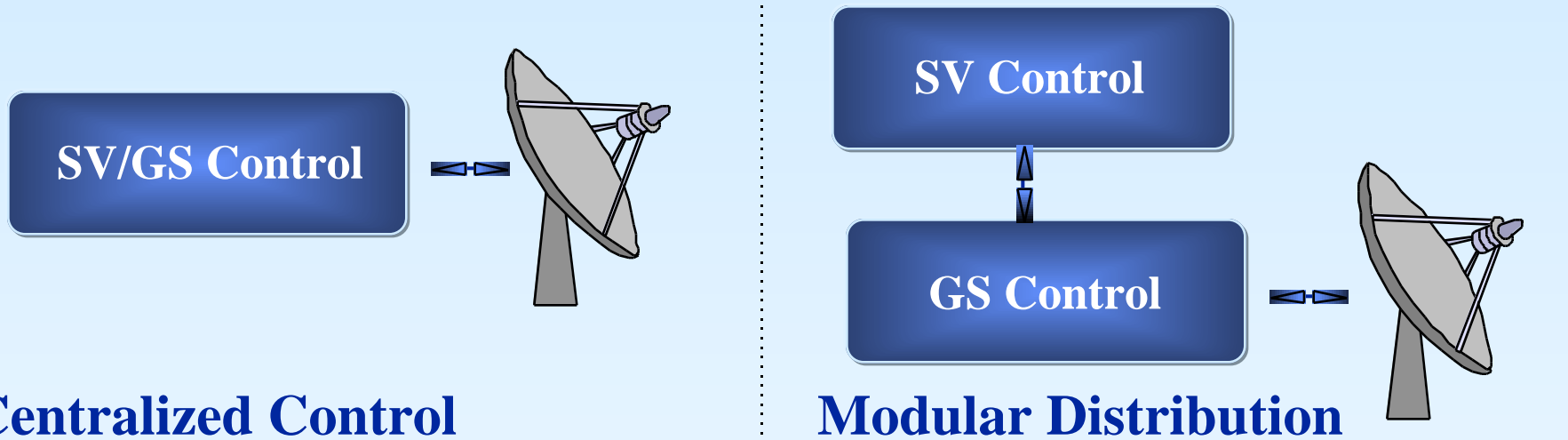
SV Anomaly Resolution Prototyping (cont.)

- Reduced contingency plan completion times from 20-30 minutes to 3 - 5 minutes
- Workload modeling indicated 1 relatively inexperienced operator could manage 5 or more SV contacts
- G.S. complexities could be hidden from the SV decision support system

Major Ground Station Interface Requirements

- High Power Amplifier (HPA) control
- Uplink modulation control
- Transmit and receive frequency control
- Orbit vector set/update
- Default transmit pattern control

Ground Station Control Architectures



Centralized Control

Modular Distribution



Three Tiered Distribution of Control

Ground Station Control Architectures (cont.)



- High level message protocol
- Does not resolve device errors

- Provides a common interface for multiple G.S configurations
- Insulates SV control processes from the complexities of G.S Control

- Controls the G.S devices
- Uses device level control protocols
 - RS422
 - GPIB
 - Proprietary

Recommendations

- Use a DSS to automate frequently implemented anomaly resolution plans
- Distribute ground station control in a three tiered architecture
 - High Level task control
 - Generic ground station capabilities
 - Device level control