UCI ISR
University of California, Irvine

GSAW2003
Ground System Architectures Workshop

Distributed Ground Systems

Breakout Session Summary

Session 8C

Donna Sellers

LOCKHEED MARTIN

Breakout Session Goals

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Definition:

- Ground Systems that provide flexible, secure, remote architectures for distributed telemetry (data), commanding, voice, video, and planning, with effective use of system automation.

Goals:

- Identify effective use of custom components, design optimization, cost benefits, and system automation for distributed ground systems
- Look at lessons learned and effective use of COTS products with existing and future systems

Breakout Session Topics

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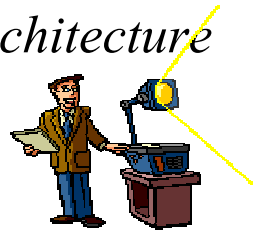
- *Introduction* – Donna Sellers, NASA, Marshall Space Flight Center (MSFC)
- *Case for Deploying Complex Systems Utilizing Commodity Components* – R. Lee Pitts, Barry S. Bryant, Lockheed Martin Space Operations (Live ISS Data Demo)
- *Telescience Resource Kit* – Michelle Schneider, NASA, MSFC (PC Ground System Demo)
- *Utilization of Internet Protocol-Based Voice Systems in Remote Payload Operations* – Kelvin Nichols, Susan Best, Bob Bradford, NASA, MSFC (Live Voice Demo)
- *Awareness Requirements for Supporting Distributed Ground Control Expertise* – Michael Kantor, University of California, Irvine, Institute for Software Research (ISR)
- *Planning Systems for Distributed Operations* – Theresa Maxwell, NASA, MSFC
- *ISS Space-based Science Grid Briefing for the Ground Systems Architecture Workshop* – Clara Welch, Bob Bradford, NASA, MSFC
- Open Discussion/Closing Remarks



Case for Deploying Complex Systems Utilizing Commodity Components

R. Lee Pitts, Barry S. Bryant, Lockheed Martin Space Ops

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- Focus was on the transition of a International Space Station (ISS) ground system from a client/server UNIX based system to a client/server system based on commodity priced and open system components

- Discussions on Motivation of Change
  - New projects such as ISS brought more, dispersed geographical users
  - Primary platforms (servers and workstations) reaching End-of-Life
  - Support for COTS products on the primary vendor dropping
  - High cost for replacement/maintenance
  - **BIG** budget constraints

- Initiatives included:
  - Moving from expensive UNIX workstations to lower cost Windows 2000 PC platforms, allowing for lower costs, user-friendly, and easy deployment
  - Redesigned or isolated expensive COTS products
  - Consolidating services or platforms into one single platform
  - Porting high costs UNIX server applications to low cost commodity based Linux systems

Case for Deploying Complex Systems Utilizing Commodity Components

R. Lee Pitts, Barry S. Bryant, Lockheed Martin Space Ops

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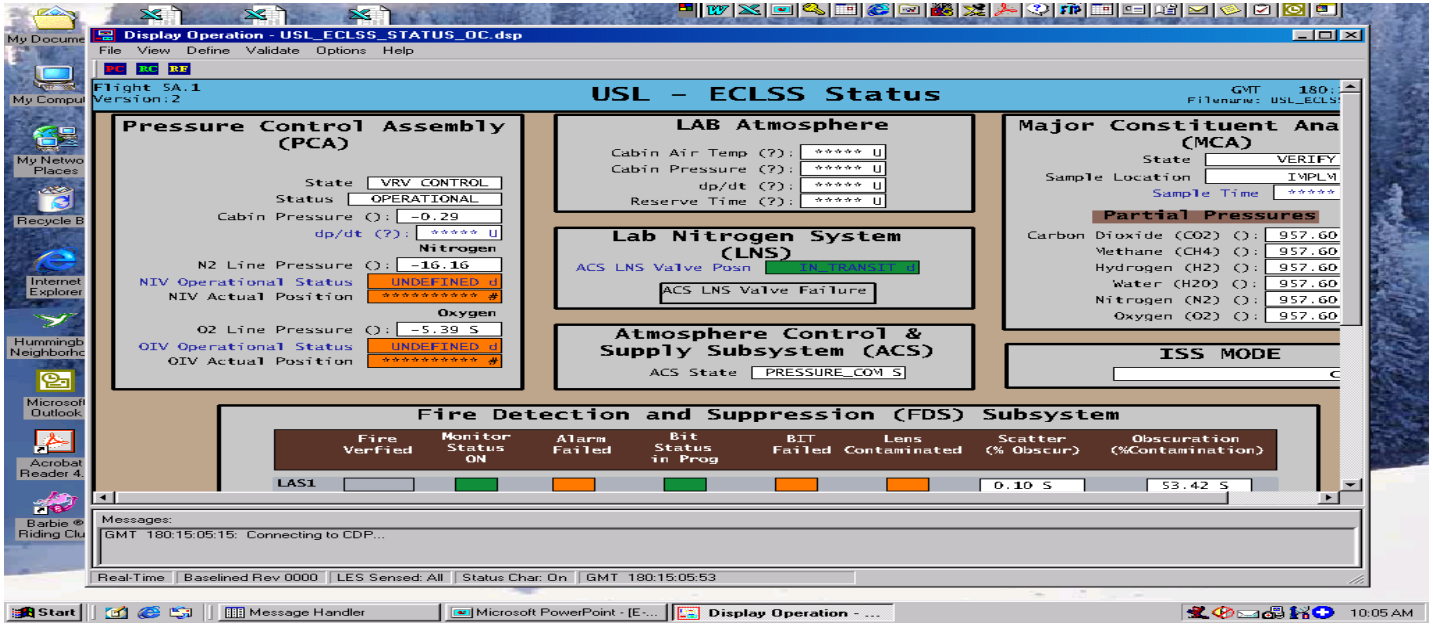
- Summary and Conclusions
  - Start with the high value targets and make changes incrementally
  - Give commodity priced platforms more than a cursory look
  - Stay current by utilizing technology insertion
  - Reduce dependency on expensive, under-utilized COTS
  - Looks for ways to migrate while maintaining access to legacy systems
  - Don't try to do it all at once



Telescience Resource Kit

Michelle Schneider, NASA, MSFC

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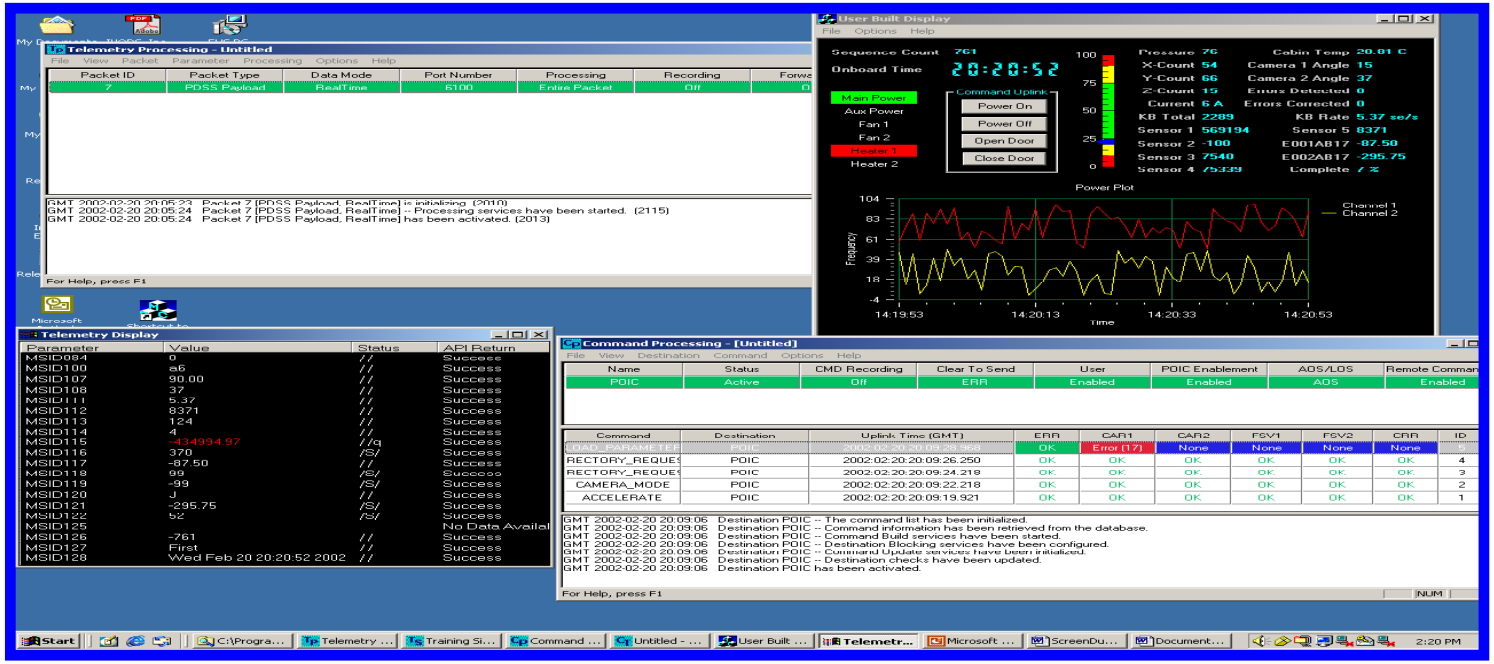
- Focus was on commodity PC-based ground system for Telemetry and Commanding functions
- Discussions on flexible ground systems that allowed remote users more control and local autonomy versus more centralized control
  - Application Programming Interface (API)
  - Use of COTS Tools
- Low cost solution for remote operations



Utilization of Internet Protocol-Based Voice Systems in Remote Payload Operations

Kelvin Nichols, Susan Best, Bob Bradford, NASA, MSFC

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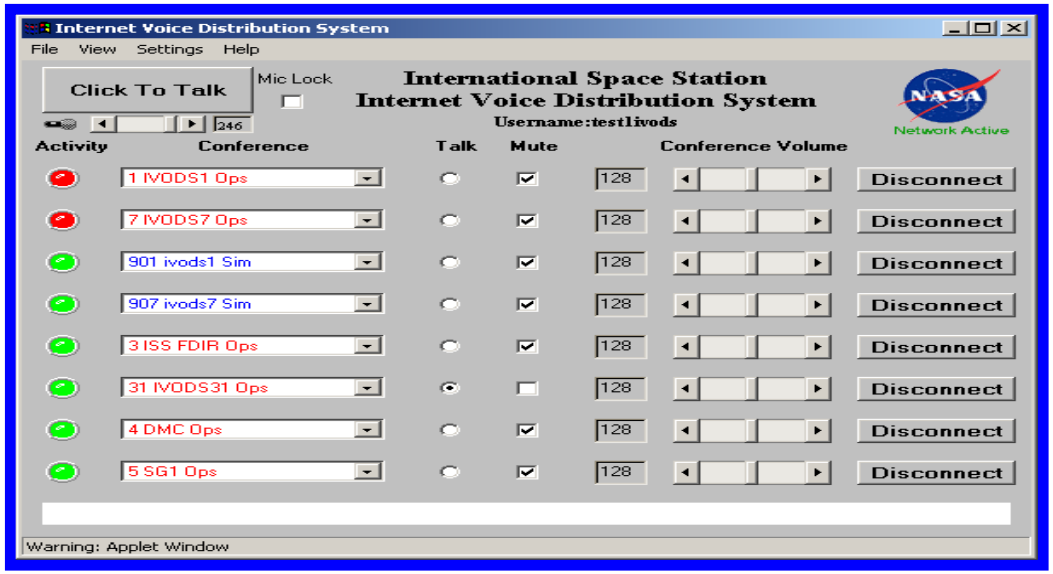
- Focus was on an innovative and cost-effective voice communications system
- Discussions on motivation for change to IP based distributed Voice systems
  - Expensive, end-of-life systems, with very high bandwidth costs
  - High number of remote users
  - Budget impacts
- IP based system offered low costs and easy deployment
- Suggestions for close customer integration, definition of roles and standards, and for modification of COTS for vendors if needed



Awareness Requirements for Supporting Distributed Ground Control Expertise

Michael Kantor, University of California, Irvine, ISR

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- Focus was on awareness for coordination and monitoring of ground control and distributed resources
- Discussed three awareness goals
  - Support awareness styles (example: Intrusive vs. peripheral)
  - Support diverse sources (example: people, servers)
  - Subscription refinement (example: list of objects)
- Discussed Creating Awareness through Subscription Services (CASS) infrastructure to enhance coordination:
  - Among developers building ground control systems
  - Among ground control staff, software and hardware components
  - Between ground control and external expertise

Awareness Tools

Complex: CASS-Portholes

Mobile Awareness

Simple desktop widgets

Planning Systems for Distributed Operations

Theresa Maxwell, NASA, MSFC

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- Focus was on a planning system evolution from a centralized to a more distributed planning system
- Described the major functions of an ISS distributed planning system that provides user requirements collection, activity planning and scheduling, data system routing and configuration, and planning products
- Major goals were to enhance support for distributed planning, reduce operating costs, and to provide robust planning capabilities
- Discussed request-oriented scheduling engines and next generation planning systems

Planning Systems for Distributed Operations

Theresa Maxwell, NASA, MSFC

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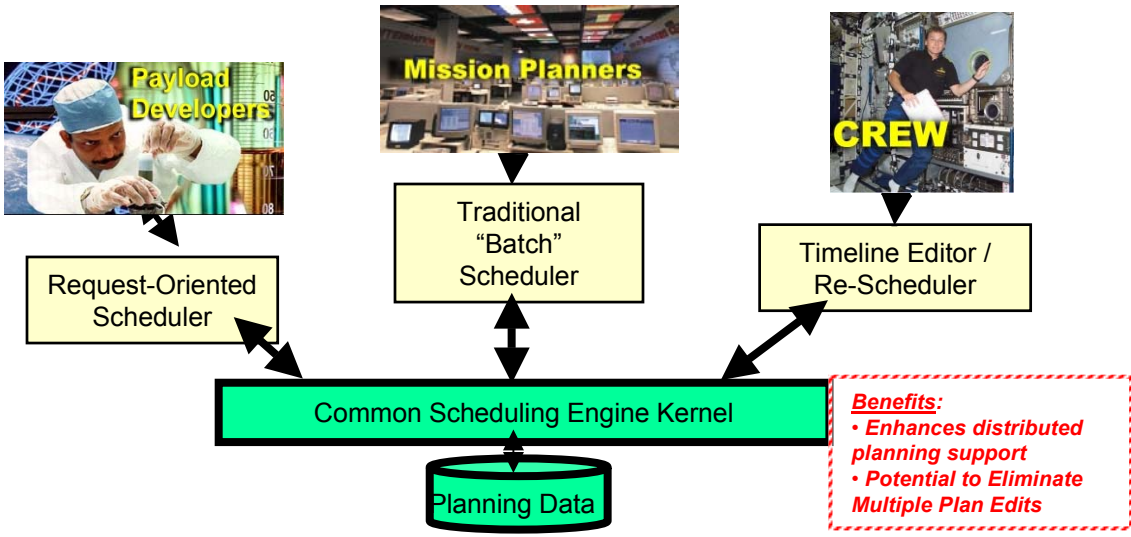
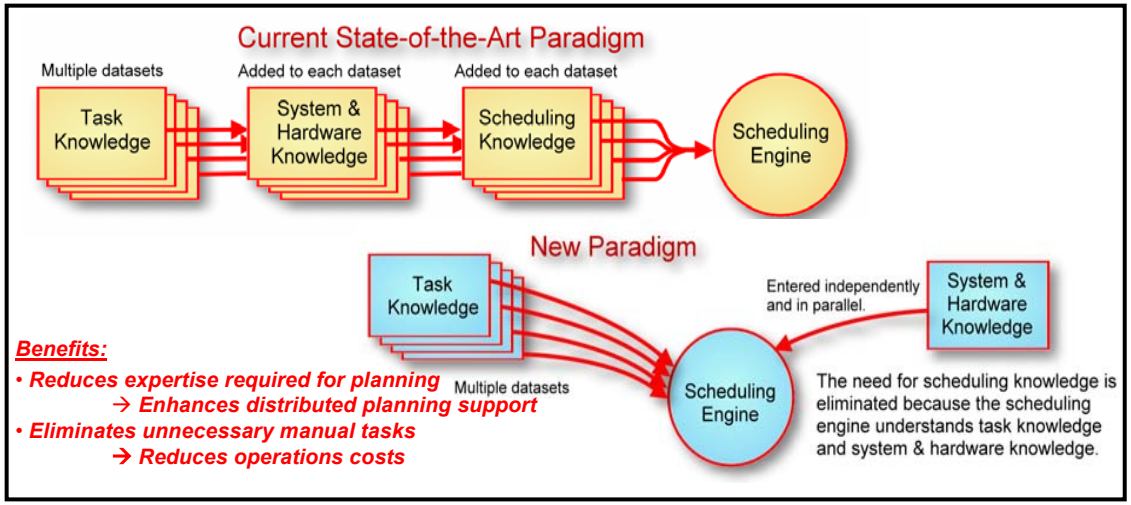
Strategy: Develop core capabilities which can be packaged in various ways to distribute planning functions, based on individual expertise and need



Strategy: Enable more automated planning through:

-Maximally expressive modeling of requirements and constraints

-Robust scheduling engine which can handle the expressive models



ISS Space-based Science Grid Briefing for the Ground Systems Architecture Workshop

Clara Welch, Bob Bradford, NASA, MSFC

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- Focus was on Grid infrastructure as a new innovative solution for fast reliable secure computing
- Discussed the definition Grid and suitable technology
  - what is (Decentralized *virtual organizations* requiring distinct services)
  - what's not (Applications that run quickly and easily on one machine)
- Also, discussed the increase and simplified access needs for distributed ground services as well as the need for security that can be available through Grid technology
- Provided a detailed prototype and draft proposal for Grid technology and its related uses for distributed ground systems

Session Summary/Conclusion

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- Session covered a wide range of distributed ground systems topics to include large, complex component systems; small, more versatile component systems; awareness within ground systems, and secure distributed system automation

- Presenters showed and utilized effective use of custom components, design optimization, cost benefits, and system automation for distributed ground systems, providing both lessons learned and effective use of COTS products with existing and future systems

- Large range of interaction between demos, questions, and participants