Real Time Data System (RTDS)

- Background
- Technologies/Techniques
- Data Flow
- Shuttle Operations
- Pacing Factors
- Technology Gap
- Lessons Learned
- RTDS for Space Station Freedom

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Background

- Started in 1987 as RTOP from Office of Aeronautics, Exploration and Technology to demonstrate readiness of expert systems technology to perform in real operational environments
- Expanded in 1991 to provide office-based development, test, and training environment for Space Shuttle flight controllers

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Technologies/Techniques

- COTS Telemetry Processor
  - LowCost
- Unix, C, X-Windows, MOTIF, TCP/IP, NFS
  - Large base of expert programmers
- COTS Expert System Tool
  - User Developed Software
- Iterative Prototyping
  - vs. ABC Requirements

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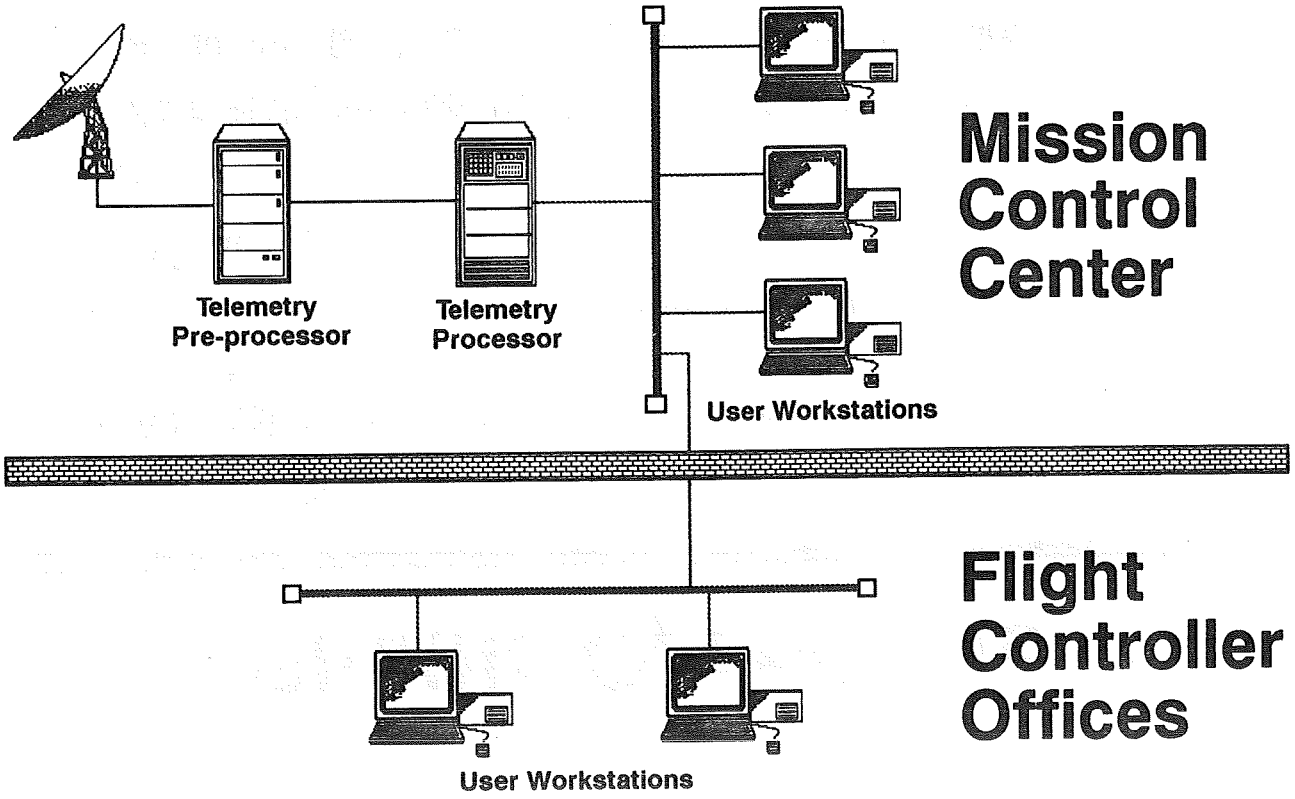
Data Flow



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Shuttle Operations

- Integrated Communications Office (1987-present)
  - All traditional mainframe computations and displays in workstation
  - Additional fault detection programs not in mainframe
  - DATACOMM Expert System
- BOOSTER
  - All mainframe computations and displays in workstation
  - Additional fault detection programs not in mainframe
- Mechanical Systems (1988-present)
  - Program to automatically monitor orbiter tire pressures
- Guidance, Navigation, and Control (1989-present)
  - Jet-Control Expert System to monitor 38 primary RCS jets

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Shuttle Operations

- Remote Manipulator Systems (1989-present)
  - Position Monitor color graphics animation to show position of RMS
- Electrical, Generation and Illumination (1990-present)
  - Fuel Cell Expert System to monitor orbiter power generation systems
- FlightDirector(1990-present)
  - Wind Monitoring System to monitor cross winds at landing sites
- Data Processing Systems (1991)
  - DDMAT Expert System to monitor GPC configuration

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Pacing Factors

- New Technology Motivates Changes In Organizational Responsibilities
  - This results in turf wars
- Risk To Change
  - Still no flight critical workstation applications
- New Technology Systems, When Utilized On A Large Scale, Require Fundamental Changes In Management Philosophies

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Technology Gap

- Over Twenty Years Of Main Frame Experience
- Less Than Five Years Of Workstation Experience
- Important Differences Between The Two Platforms
  - System Architecture (Centralized vs. Distributed)
  - Functionality

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Technology Gap

- Development Methodology
- Software Configuration Management
- Role of the User (in application software development)
- Relationship between main frame and workstation (tightly coupled?)

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Lessons Learned

- Find A Customer Who Wants And Needs The Technology
  - RTDS worked because it was customer driven
- Data Acquisition Is Key To Success Of Expert Systems
  - RTDS continues to spend 40% of resources on data acquisition
- Get Into OPS Location As Soon As Possible
  - Experience from operational use is most important

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Lessons Learned

- Be As Stand-Alone As Possible
  - Dependence on other systems is a liability
- Success Is Not Hampered By Mission Criticality Of Applications
  - Users were highly motivated to produce highly reliable systems
- Data Systems Architecture Must Support Rapid Changes
  - A key advantage over traditional data systems

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Lessons Learned

- Once In Operations, Reliability Is Most Important
  - User confidence hinges on system availability

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RTDS for Space Station Freedom

- Demonstrated Utility Of Automated Monitoring Systems In Shuttle
  - Increased importance in Station program
- Integrated Shuttle Telemetry With SAMMI/FRED Display Builder
- RTDS Is The Development Platform For Mission Control Center Upgrade (MCCU)
  - Demonstrated applicability for Station

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RTDS for Space Station Freedom

- Flight Controller Can Now Monitor Shuttle Operations From The Office
  - Possible cost-savings for on-going Station operations
- RTDS Provides For Stand-Alone Flight Controller Training
  - Space Station training personnel are investigating this for use in training Station flight controllers

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