Managing Risk in Safety Critical Operations - Lessons Learned from Space Operations

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Abstract

The Mission Control Center (MCC) at Johnson Space Center (JSC) has a rich legacy of supporting Human Space Flight operations throughout the Apollo, Shuttle and International Space Station eras. Through the evolution of ground operations and the Mission Control Center facility, NASA has gained a wealth of experience of what it takes to manage the risk in Safety Critical Operations, especially when human life is at risk. The focus of the presentation will be on the processes (training, operational rigor, team dynamics) that enable the JSC/MCC team to be so successful. The presentation will also share the evolution of the Mission Control Center architecture and how the evolution was introduced while managing the risk to the programs supported by the team. The details of the MCC architecture (e.g., the specific software, hardware or tools used in the facility) will not be shared at the conference since it would not give any additional insight as to how risk is managed in Space Operations.

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Where we've Been

- Centralized
  - Architecture
  - Development
- Breaks between the missions
- Redundant Isolated Flight Control Rooms

- Human rated vehicle with command & control
- Mission Control for monitoring, planning, command & control
- Training

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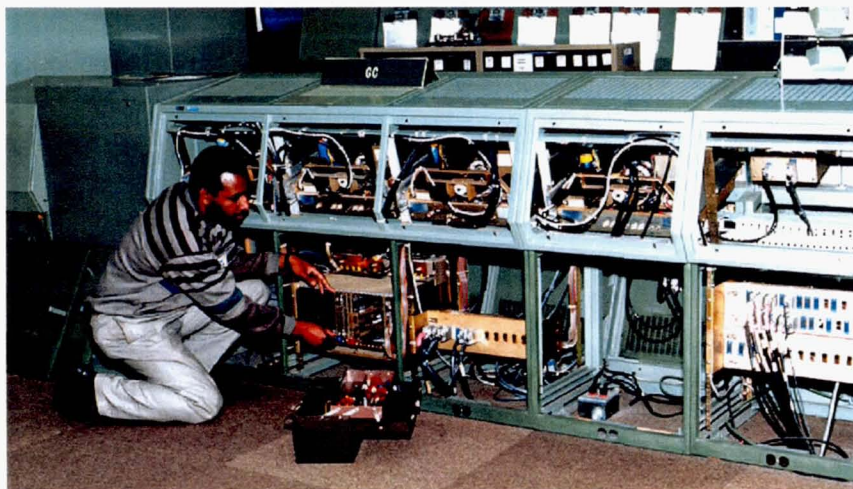
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A new Era Begins

- Distributed
  - Architecture
  - Development
  - Ownership
- Breaks between the missions
- Software Isolation versus Hardware Isolation
- Customer involved in Certification process
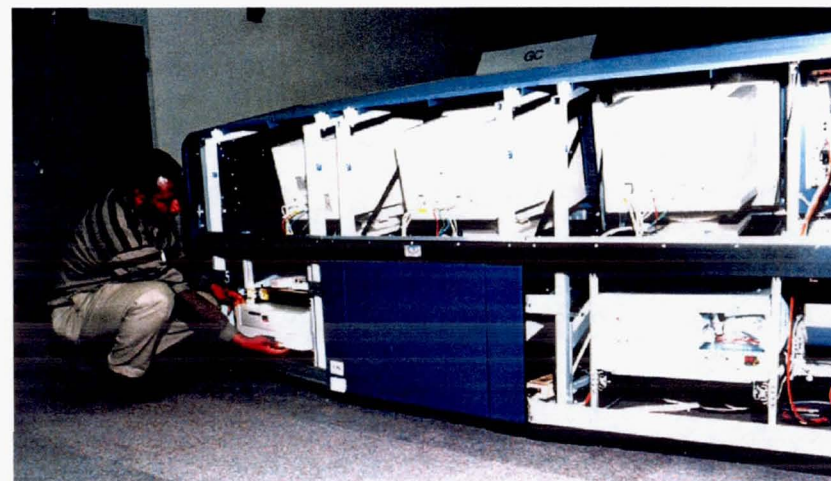- Operational system begins to open up to outside of the building

Customized versus COTS

- Flexibility
- Swap ability
- Expertise offsite
- Dependency on Vendor upgrades and support
- Pushed envelope on fail over

- Each console uniquely configured for support
- Large team of experts on site ensure availability
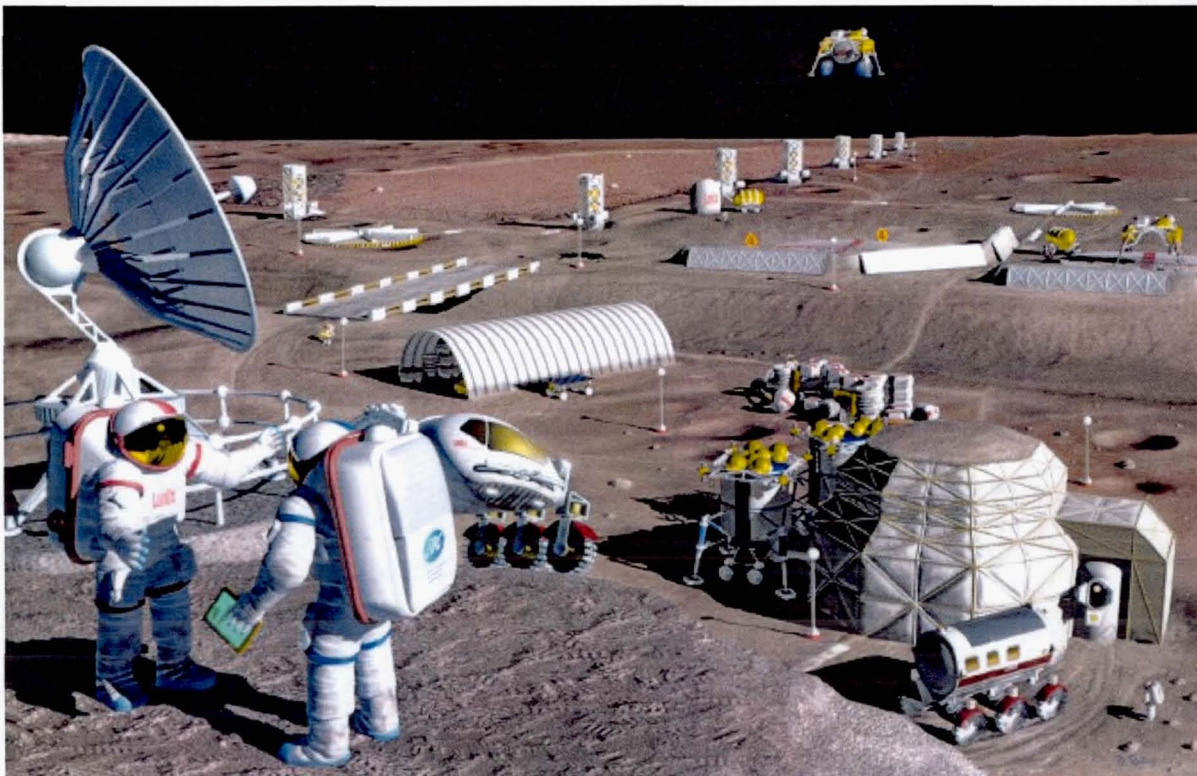- Difficult to upgrade and maintain

The Future is Here

- 24/7
- Constantly evolving vehicle and changing ground system
- Mix of Hardware & Software Isolation
  - CM challenge
- International Community has stretched the boundaries of the Operational environment

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Challenges of the Future

- Learning Systems
  - Certification process
  - CM
- Upgrading to maintain state of the art (COTS)
- Fail over/Redundancy (Nano-electronics)
- Securing systems in High speed/Bandwidth environments
- Distributed ownership