MCC 21

Tomorrow Starts Today

MCC-21

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April 2012

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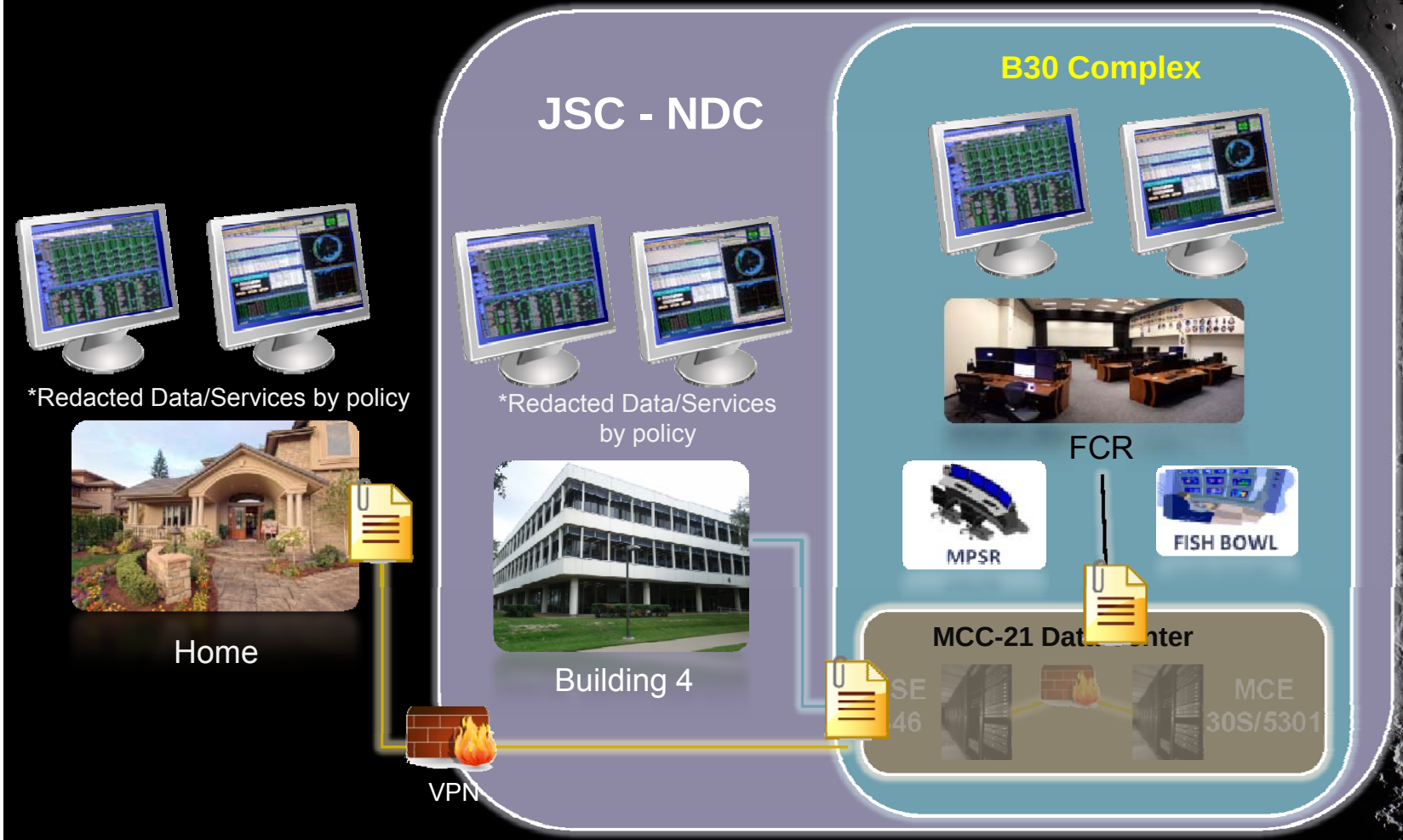
MCC-21 Goals & Objectives

The Goal of the MCC-21 Project is to provide a new Mission Control Center that is robust, flexible, and cost effective by the end of FY14.

MCC-21's primary objectives are to:

- Significantly lower MOD's operating costs
- Revolutionize data mobility by bringing the data to the user instead of the user to the data
- Enable easy and rapid integration of new customers and new missions

MCC-21 Concept of Operations



* Seamless transfer of data between locations

Key Cost Savings Initiatives

- By 2015, MCC-21 will enable a ~50% reduction in control center operations and sustaining costs thru the implementation of key cost savings initiatives

- Re-factoring MCC hardware and software
  - Harvest COTS technologies to reduce and/or eliminate custom solutions
  - Consolidate duplicate implementations of similar or identical functions
  - Revisit legacy code base to identify opportunity to reduce sustaining costs
  - Expand MCC core services to allow code reduction and simplification of MOD and client applications
  - Embrace security as a core, foundational capability of the control center

- Reducing the size of the MCC Operations Support Team
  - Simplify, automate, and streamline facility functions to allow reduced manning
  - Collapse all facility management and operations functions to one location
  - Move to a ‘string’ approach to meet MCC redundancy and failover needs

Key Cost Savings Initiatives [cont]

- Leveraging Center and Agency IT resources
  - Eliminate IT infrastructure duplication to reduce the number of unique control center components and solutions
  - Utilize Campus IT resources for network communications, storage, and remote access
  - Relocate redundant Video capabilities to Campus IT resources
  - Employ the Agency domain for authentication and ‘standard workstations’ within MCC-21 consoles

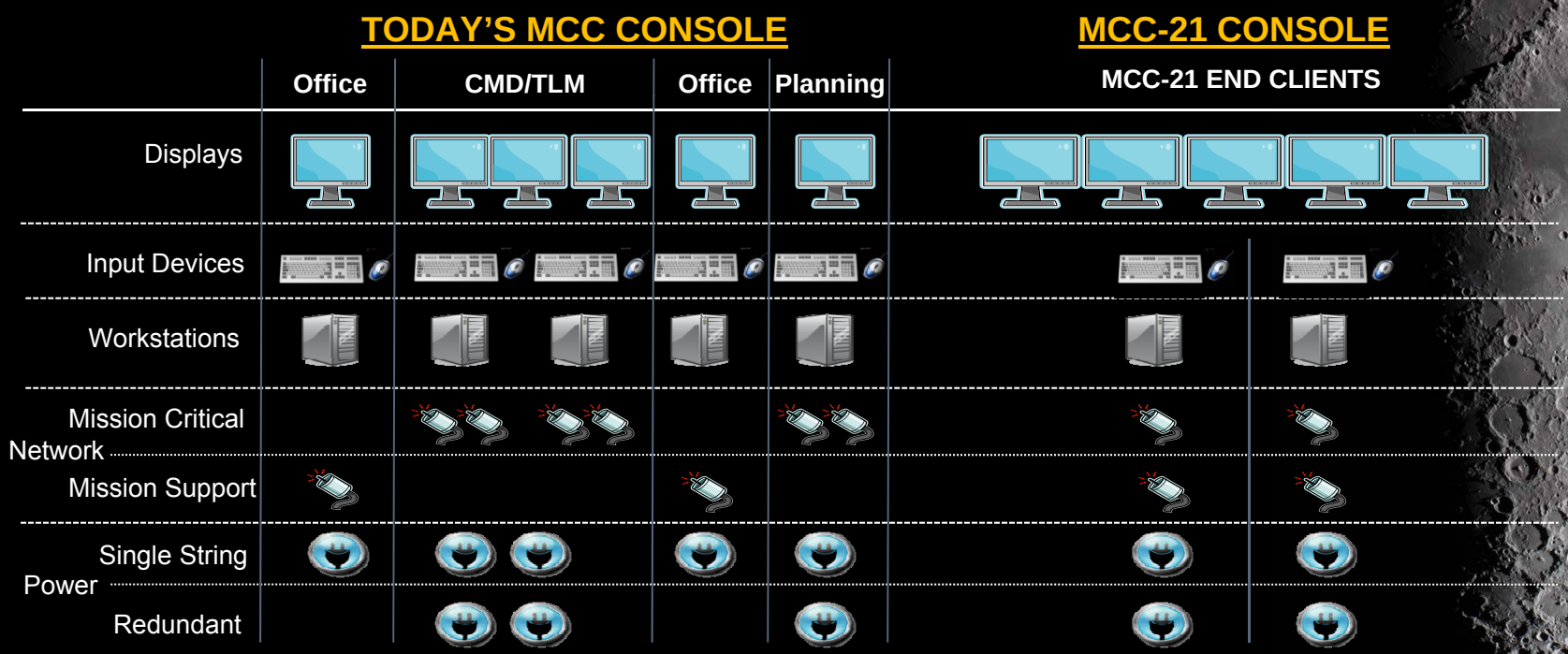
- Minimizing our hardware footprint (in the data center & in the consoles)
  - Reduce the number of environments supported by MCC
  - Shrink the high dollar, high security, high reliability environment
  - Utilize virtualization for flexibility and uniformity
  - Enable users to support MCC activities utilizing their office equipment
  - Simplify and collapse MCC end client architectures

BFCR: MCC-21's Architecture In Action

- Today's BFCR embodies many of the project's architecture and design features
  - Modern, open design and finish
    - Commodity consoles, ~1/6 the cost of the 'big blues'
  - Improved operator usability
    - Improved ergonomics
    - Larger work spaces
  - Quicker and easier console maintenance
    - Significantly improved cable management
    - Configurable access for servicing
    - Pull out PC trays
  - Flexible configuration options
    - Adjustable Monitors and voice keysets
  - Center/Agency IT resources
    - Agency provided, Windows workstations
    - Direct connection onto the JSC Campus network
    - JSC Campus Internet Video Solution
  - Powered by virtualization

The MCC-21 Client Architecture

- The MCC-21 improvements to the end-client architecture are dramatic and apparent
  - Impact of reduced network and environment infrastructure yields ~60% life cycle reduction in MCC operations and sustaining costs



New Customer/Mission Integration

- MCC-21 will provide a rapidly reconfigurable infrastructure to meet new customer and mission needs at minimal cost

- Rapid reconfiguration of facilities
  - Build flexible and highly adaptable “operations suites”
  - Extensive use of virtualization for flexibility and uniformity
  - Industry standard interfaces for Command and Communications subsystems

- Standardized Interfaces & Services
  - Deploy seamless, standards based, interfaces and capabilities/services
  - Provide common services to support existing and future needs
  - Ensure protection of data across the enterprise (proprietary, medical, export controlled data)
  - Support multiple, concurrent, logically separate activities on one shared set of infrastructure

KEY CAPABILITIES

Enhanced Security & Data Protection

- Control Center security is classically accomplished through isolation
  - A control center is connected to a ground antenna, and to nothing else
  - Infrequent or rare connections are provided by a tightly-managed firewall
    - Crossing the firewall with data is deliberately difficult
- Current (ISS) and future needs shatter this paradigm
  - ISS has many partners
    - International partners, university researchers, commercial vendors, etc
  - Classic isolation does not work
    - Data must cross the boundaries to allow interaction with all the partners
    - Security decreases as the number of connections increase
    - User interactions can be significantly hindered by drop-boxes and manual data scanning
  - Different tasks of the mission are frequently done on different sides of the firewall
    - Early mission planning is done in the office environment to facilitate data exchange
    - Final planning and execution are done in the control center (restricted) environment
  - More data needs to cross the boundaries without compromising mission security
- MCC-21 embraces the shift in this paradigm and will:
  - Embrace concurrent, geographically distributed multi-center collaborative operations
  - Ensure protection of data across the enterprise (proprietary, medical, export controlled data)
  - Provide data integrity and multiple-class confidentiality controls
    - Ensure users can view only the data they are authorized to see, regardless of location
  - Enable transparent transfer of data across the system's internal security boundaries
  - Embed security services within our common services infrastructure
    - Designed to maximize transparency of security to users and applications

Increased Control Center Access

- The MCC was originally built as a closed system
  - Air gapped, badge reader, access controlled facility
  - Extremely limited remote operations capability
- Over time, the MCC has evolved into a more open system
  - Various backup, temporary, and emergency MCC capabilities
  - Extended access to remotely located International Partners
  - Provided 'select' remote capabilities
    - MCC Audio, MCC Data Portal System, Voice call-in circuits (shout loops), MCCx etc.
- To support future customers and missions, increased remote access and capability, coupled with scalability, are needed
  - Enables cost reductions for control center operations and maintenance
  - Aligns with future MOD ConOps which assume increased remote access
    - Future Operations Concepts largely assume remote access/capabilities for quiescent flight phases of new vehicles
  - Leveraging virtualization technologies allow dramatic increases in concurrent operations/activities at minimal cost
- Remote access/operations is viewed as a mandatory capability for integration and support of new vehicles/customers

Standardized Interfaces & Services

- MCC-21 will provide standardized interfaces and common services to
  - Support or provide all the functions needed to plan, train and fly missions involving spacecraft
  - Support multiple, concurrent, logically separate activities on one shared set of infrastructure
- MCC-21 will provide a software development and integration framework
  - Make it easy for operators and developers to add data and logic to the system
  - Transparently support a variety of programming languages and operating systems
- MCC-21 will deploy common services to support existing and future Plan, Train, Fly needs
  - Application Services to allow the system's computational logic to
    - Be distributed throughout the system
    - Run uninterrupted, even as users come and go
  - Storage Services to
    - Allow the system's data to be distributed throughout the system
    - Simplify the aggregation, transfer, version management, and retention of data
    - Enable automation through common interfaces and notifications of change
  - Communications Services to
    - Allow easy location of and connection to desired MCC capabilities
    - Allow users to publish services they create for use by others

A New Approach to Data Management

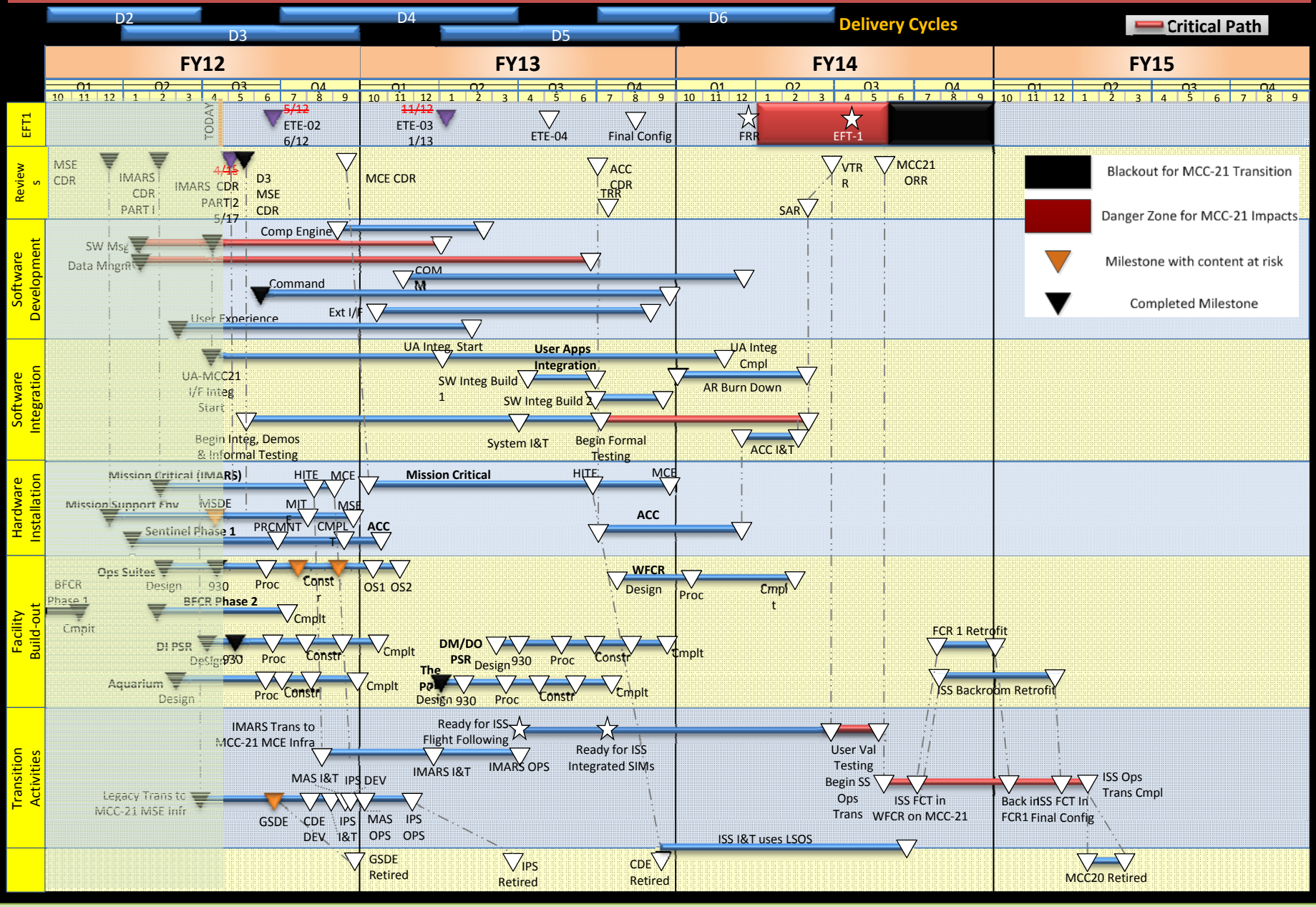
- MCC-21 'Operational History' provides a method to record the "knowledge" of MCC operations
  - Unifies all of MCC storage methods and systems into one solution
  - Configuration managed, authorization-based storage and retrieval system serving customers regardless of their location
  - Records data received and generated during flight production, test, simulation, training, and mission operations
    - Flight production products, real-time telemetry (calibrated/un-calibrated), computations, command data, system health and usage monitoring, etc.
    - Records the production of comp data while the user is not logged into the system

- To implement Ops History, a new data architecture is provided which supports
  - Unambiguous identification, recording and retrieval of all the system's data
    - Including MSID-like access for generic displays & plots
  - Structured data while also providing named access to its members
  - Data integrity and multiple-class confidentiality controls
    - Ensure users can view only the data they are authorized to see, regardless of location
  - Transparent transfer of data across the system's internal security boundaries
  - Integrated representation of past, present, and future data
    - Allows TIVO-like display capability
    - In conjunction with the new 'Comp Engine' capability, 'comps' will be executed regardless of user login state and automatically recorded for later retrieval
  - Allows MCC to be largely programming language and OS agnostic for the computation and exchange of data

New Operations Suites

- To support diverse new missions and new customers, a new type of Flight Control Room (the Ops Suite) is needed
  - Today's FCRs are dedicated to a specific program's needs and capabilities
  - They are not easily adaptable to integration of new customers/missions
- Ops Suites will be designed for maximum flexibility
  - Reconfigurable console layouts, networks and room configurations
  - Can function as front rooms for smaller mission classes or back room/payload support for larger mission classes
  - Can Integrate with the rest of the MCC or operate as a standalone control room
    - Approach allows customers to bring in their own equipment/software while minimizing the overhead of doing so and protecting MCC/NASA assets
- Construction of Ops Suites is scheduled to begin in FY12

MCC-21 Project Schedule



Rev 4
9/6/2012

ACC – Alternate Control Center
CDE – Consolidated Development Environment
FSSC – Facility Systems Services Center
GSDE – Ground Support Development Environment
HITE – High Integration & Test Environment
MITE - Moderate Integration & Test Environment
MCE – Mission Critical Environment
MSDE – Mission Systems Development Environment
MSE – Mission Support Environment

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DD52/R. Frazier
281-483-6854

QUESTIONS?

High Level Project Accomplishments

- Project Milestone Reviews
  - Project Baseline Review (Dec 2010) defined project goals/objectives, scope/definition, operational concepts, and system level requirements/architecture
  - Sub-System Reviews (ten in all, Aug-Oct 2010) defined subsystem scope/content, requirements, architecture, and preliminary design
  - Mission Support Environment Design Reviews (Dec and April) defined detailed design for MCC-21 mission support areas
- Infrastructure Buildup
  - BFCR refurbished over an 11 week period, demonstrations conducted with 400+ stakeholders and customers, introduced agile facility/hardware processes to the MCC
- MCC-21 Software Development
  - Rapid prototypes built (Oct-Nov 2011) and demonstrated (Dec 2011)
    - Re-introduced agile software processes to the MCC
    - Primarily targeted at solving 'hard' problems and ensuring the project 'vision' is achievable (from cost, schedule, and technical viewpoints)
  - Formal software development initiated in January 2012

MCC-21 Next Steps…

- FY12 MCC-21 Room Build Up
  - Blue FCR Phase II - Front wall modifications, action area in rear of the room, provide console and room storage
  - Operations Suites – New, flexible control rooms sized for up to 20 personnel to support a wide range of new missions and new vehicles
  - MCC Facility Operations Control Room – Single room which allows co-location of MCC facility management and operations functions

- FY12 MCC-21 Environment Build-Up
  - Initiate and complete transition of IMARS to MCC-21 provided infrastructure
  - Initiate and complete Mission Support Environment buildup
  - Initiate Mission Critical Environment buildup

- FY12 MCC-21 Software Schedule
  - Initiate software development/implementation activities in February
  - Build ~50% of the core MCC-21 software capability by October

In Summary

- MCC-21 has moved into its implementation phase, no significant technical challenges have been identified
- ISS transition to the MCC-21 architecture will begin in FY14, and complete in the first half of FY15
- MCC-21 is on target to enable the reduction of MOD's control center operations and sustaining costs by 50% in FY15
- At completion, MCC-21 will provide JSC and the Agency a flexible and adaptable spacecraft command and control capability that allows for low cost integration and collaboration with new customers and new vehicles