MICE: Controls & Monitoring

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Overview: Definitions

Definitions:

- Controls and Monitoring (C&M) is the software (and hardware) used as the human interface to all experimental apparatus
- Designer overall responsible party
- Developer develops EPICS interface
  - DL, Hanlet, Robinson
- Integrator integrates subsystem into MICE – Hanlet/Preece/Courthold

Overview
Definitions/Purpose

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Definitions and Purpose:

- **Controls refers to:**
  - **user interface to equipment**
  - **proper sequencing of equipment**

- **Monitoring serves to:**
  - **protect equipment (early notification)**
  - **protect data quality**
  - **requisite for proper sequencing**

Overview Considerations

MICE is a precision experiment. We intend to measure a 10% cooling effect with 1% precision.

Therefore it is imperative that we tightly control any systematic effects which could affect the data quality.

Overview Considerations

- **Each subsystem C&M must be designed by the expert(s)**
- **C&M is developed by EPICS expert**
- **Must integrate into MICE C&M**
- **Desire uniform interfaces**
- **Must consider system resources**
- **Similar components amongst different kits yields robustness**

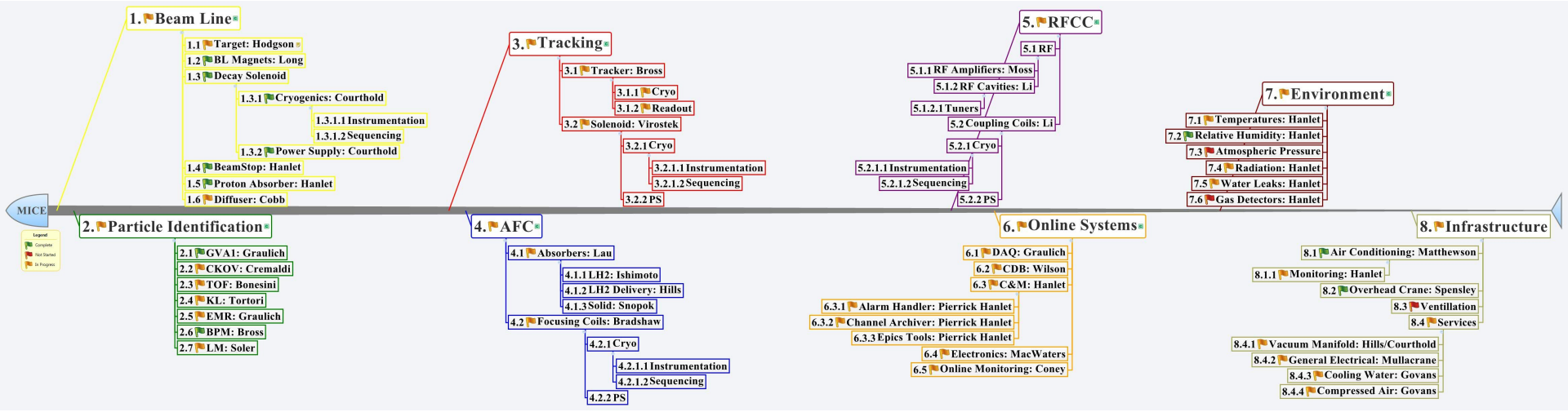
Overview Organization

Beamline

Tracking

RF

Environment



PID

Absorber

Online

Infrastructure

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Since CM30

FC and SS testing at vendors:

At the end of CM30 it became evident that the first FC and SS would compete for resources. DL was not equipped to provide for both on short time scale

Each system requires standalone test equipment:

- **reduced C&M system**
- **monitor everything**
- **little control**
- **learn/develop sequencing procedures**

Since CM30

FC and SS testing at vendors:

Problem diverted by:

- schedules
- reduced requirements
- DL outsourcing the building of cabinets

Other progress:

- New HV wish list
- Work by Anastasia on completing Step I

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Efforts – Schedule

Focusing Coil:

- initial cooldown & testing at Tesla
  - beginning of March 2012 in R9
    - requires standalone system
    - full field map

- delivery to MICE hall
  - June 2012?
    - requires full C&M system
    - full field map

Efforts – DL Report

Focus Coil Standalone System:

- Specification of requirements is complete
- Procurement of all major items for the control system is complete
- Build and wiring of the rack is currently under way
- The EPICS VME controller has been built and configured and is currently under test at DL

I don't have the project plan to hand and can't remember the exact dates but there are no major delays and I would expect the rack to be ready for shipping before the end of November.

Efforts – Schedule

Spectrometer Solenoid:

- cooldown & training at Wang NMR
  - beginning of March 2012
    - requires standalone system

- delivery to RAL
  - beginning of June 2012
    - requires full C&M system
    - full field mapping

Efforts – DL Report

Spectrometer Standalone System:

Work on this is progressing in parallel to the Focus coil system with similar comments….

- **Specification of requirements is complete**
- **Procurement of all major items for the control system is complete**
- **Build and wiring of the rack is currently under way**
- **The EPICS VME controller has been built and configured and is currently under test at DL**

We are still anticipating having the system ready for shipping to the US in time for the initial testing phase in early January.

Efforts – DL Report

Additional Comments:

An additional comment worth making is that with the slip in the FC programme there are two new risks to be considered:

We were planning on using the testing at Tesla to iron out any minor bugs in the design closer to home before shipping the SS system to California. If this doesn't happen then there is increased risk of significant problems when we install the system at Wang NMR.

The installation and commissioning of both systems require the presence of the same people (primarily Adrian and Ian) therefore we may end up with a conflict of interests that will need to be resolved.

Efforts – DL Report

Additional Comments – 2:

Status of LH_2 system

Sorry, unable to comment on this due to lack of information.

Status of FC and SS Hall Systems

Not much to say at the moment. The basic design has been in place for quite some while and will essentially be enhanced versions of the portable systems incorporating all the lessons that we hope to learn during initial testing of the FC and SS. We hope to switch back to looking in more detail at the hall integration early in 2012.

Efforts – DL Report

Additional Comments – 3:

Plans for the near future

FC and SS will take up the majority of our time and effort from now until early 2012, after which focus will switch on preparing the full hall systems as mentioned above.

It is possible that a limited amount of effort can be found in the next 6 months to start work on the design of a controls interface for at least some parts of the RF power systems currently being trialled at Daresbury.

Efforts – Robinson

Matt Robinson – Target:

Paul Smith is building new target controllers. The main difference is that target position is to be output digitally. I have written a new DAQ to record the target motion at a few MHz and make a correlated recording of beam loss and related parameters.

Due to recent improvements in National Instruments support for centos 5, this is now practical using the existing NI cards.

A new, compact server class computer has been assembled to run both James's target daq and the new target motion daq which will be installed with the new controller in R78 within the next several weeks. Each new controller iteration requires adjustments to James's code, but these are usually not structural and take less than a day each time.

Efforts – Robinson

Matt Robinson – Tracker:

James's code as it exists in lab 7 needs to be reconciled with that which exists in svn. Changes to James's code will be made slowly and cautiously for the foreseeable future on account of the "ain't broke" principle, although I am planning a major re-write eventually.

The Daresbury controls and monitoring system is planned to installed to replace the existing system for the move of the tracker into the MICE hall. We need to determine the current state of the system and judge whether it will be ready in time.

Efforts – Robinson

Matt Robinson – CDB Integration:

A significant structural change to James's tracker code will be required to switch from xml based configuration to use of the ConfigDB.

I would like to de-couple the target & tracker software as they have little in common and keeping them together makes things messy.

The introduction of the ConfigDB might well be the time to separate from the target software and make other major changes which are agreed.

Plan – Summer 2011

Goal is to have all existing subsystems finalized:

- **Operational states defined**
- **Alarm limits set accordingly**
- **Alarm limits for different states set and tagged in CDB**
- **Alarm limits read from CDB**
- **Archived data finalized**

Efforts – Belozertseva

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Anastasia Belozertseva:

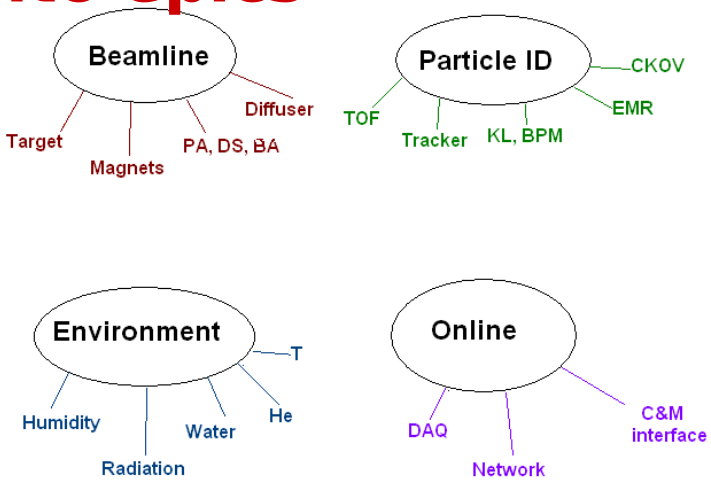
"Generalized catalog of MICE variables"

- Objective:
  - create a uniform catalog of all the variables that are part of IOC-Tops databases
- Systems involved:
  - Beamline (target, magnets, PA, BS, DS, Diffuser)
  - Environment (Water, Radiation, T, He…)
  - Online (DAQ, CMB, C&M interface…)
  - PID (tracker, EMR, KL, BPM, TOF, CKOV…)
- Some of the parameters recorded include:
  - Name and Description
  - Alarm Handler Present (If yes, alarm limits)
  - Is the variable archived?
  - Is the variable Controlled and Monitored?

Efforts – Belozertseva

Anastasia Belozertseva:

- Process update:
  - still at the stage of obtaining all the variables from EPICS
- Estimated completion date:
  - within 1 month
- Next step upon completion:
  integration of the catalog into epics

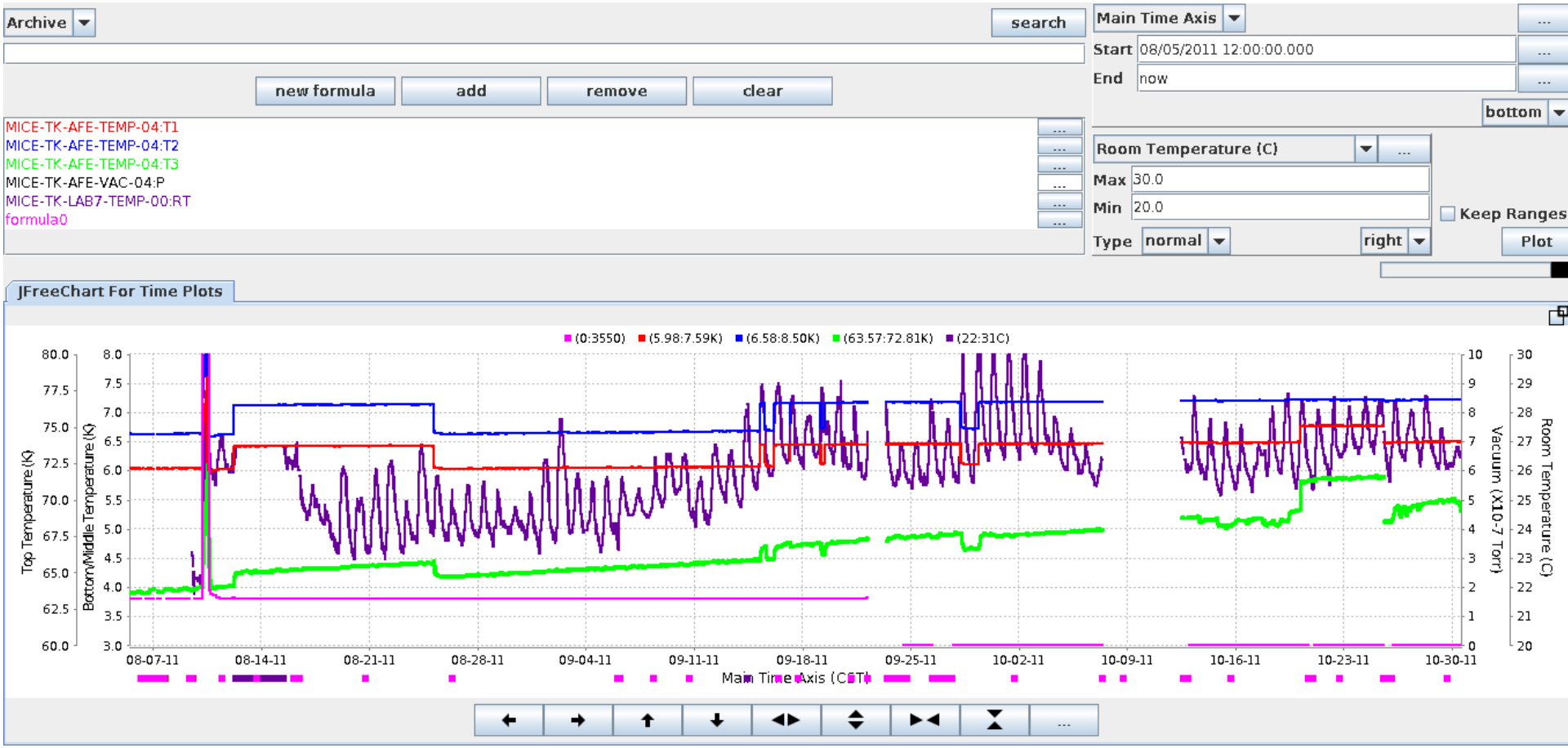


Efforts – Hanlet

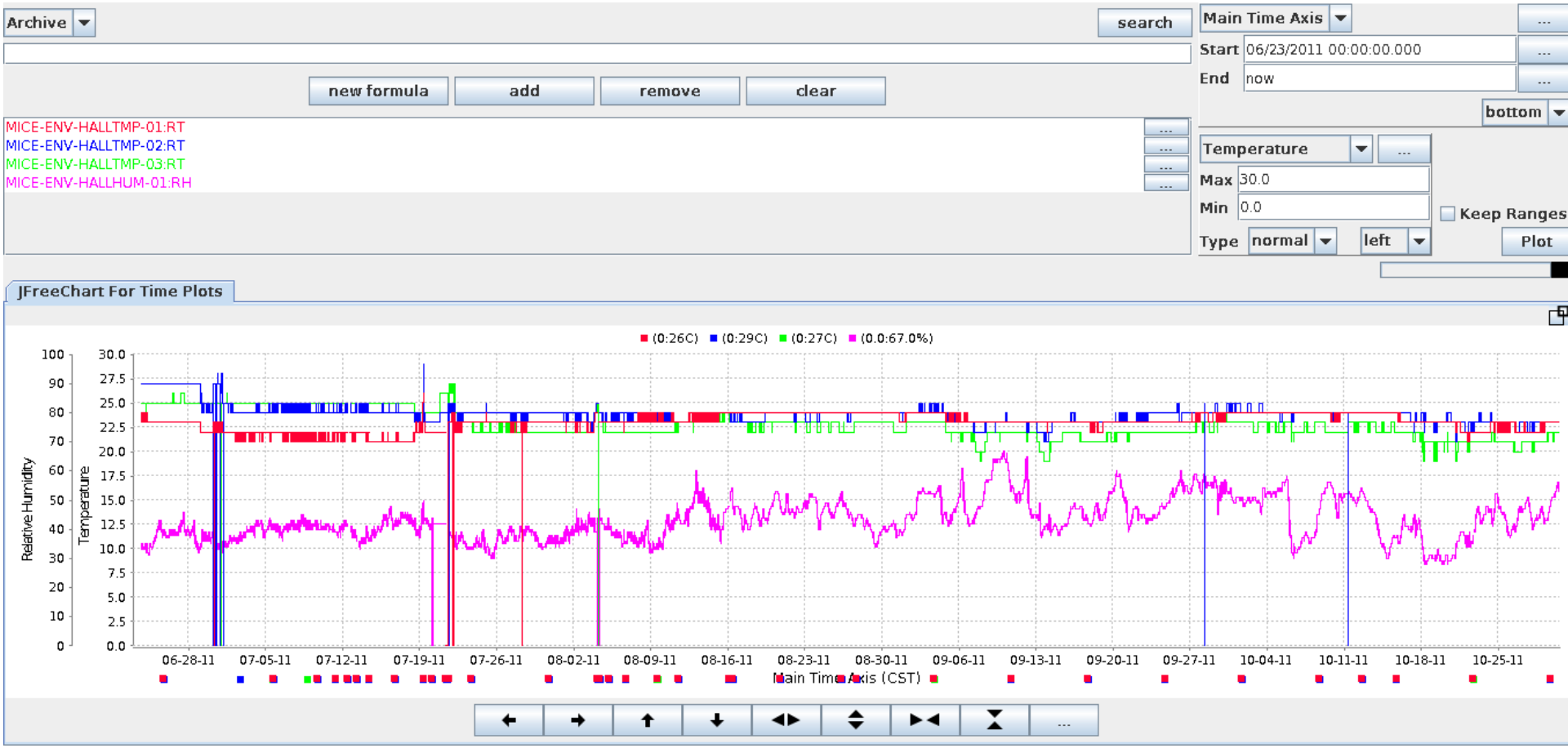
- new remote gateway machine

  hep110.phys.olemiss.edu
- global MICE efforts (more to follow)
- new state machines for MICE
- CDB interface
- HV upgrades
- diffuser controls
- proton absorber
- RF tuners

Efforts – Hanlet



Efforts – Hanlet



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Global MICE

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MICE goes global

- Roy Preece & Mike Courthold
- to date, independent subsystems
- will use state machines for MICE
- will use state machines for subsystems

The Configuration Database (CDB)

- memory of MICE
- all experimental parameters stored and loaded from CDB

Will give more details at next VC

Global MICE

Several Considerations:

1. Subsystem C&M designed by different collaborators, implemented by others
2. Must be integrated to ensure safe use of resources and operations
3. MICE operates in different states over differing time periods:
   1. "Off" -- shutdown/installation
   2. "Powered" -- ***not*** running
   3. "Standby" -- sleep over weekend
   4. "Testing" -- running w/DAQ for tests
   5. "Running" -- physics quality data taking

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Schedule

Milestone	Responsible	Target Date	Description
Complete Step I items	Hanlet/Belozertseva	15 December 2011	Documentation + HV modifications
Tracker Initialization Controls	Robinson	?	Complete EPICS AFE interface
Stand alone SS C&M	DL	10 January 2012	
Stand alone FC C&M	DL	30 November 2011	
Absorber Controls	DL	1 January 2012	
Implement MICE State Machines	Hanlet	15 April 2012	MICE+Subsystem definitions + CDB interface
Final Standalone Tracker system	Robinson	15 February 2012	
EMR C&M	Hanlet/Robinson	15 February 2012	
Integrate SS C&M into MICE	DL/Hanlet	1 July 2012	
Integrate Tracker into MICE	Robinson	1 September 2012	
Diffuser	Hanlet	1 August 2012	
Integrate FC C&M into MICE	DL/Hanlet	1 September 2012	
AFC Integration	DL/Hanlet	1 October 2012	
RF tuners	Hanlet	15 January 2013	
Stand alone RF C&M	DL	?	
Integrate RF C&M	DL/Hanlet	?	

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Potential Problems

- **C&M should be considered as an integral part of system development, *not* as an afterthought.**

  Communication is critical to success!

- **Designer is not developer**

- **Integrator is (usually) neither designer or developer**

- **Schedule dominated by subsystem delivery**

Summary

- Efforts from Matt and Anastasia are welcome additions
- Integration with CDB underway
- Some schedule slips
- Global MICE building – still requires better communication
- *Integration for new systems requires proper organization*