Operating Experience with the New RHIC Control Room.

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Collider-Accelerator Department.

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After six years of planning and construction RHIC operation began in the "third generation" control room in January 2012. This presentation will review the goals for the project; the parts of the design that did and did not work; the challenge to obtaining beneficial occupancy; new technologies employed; the modifications that have been made since 2012; and the overall level of customer satisfaction with the result.

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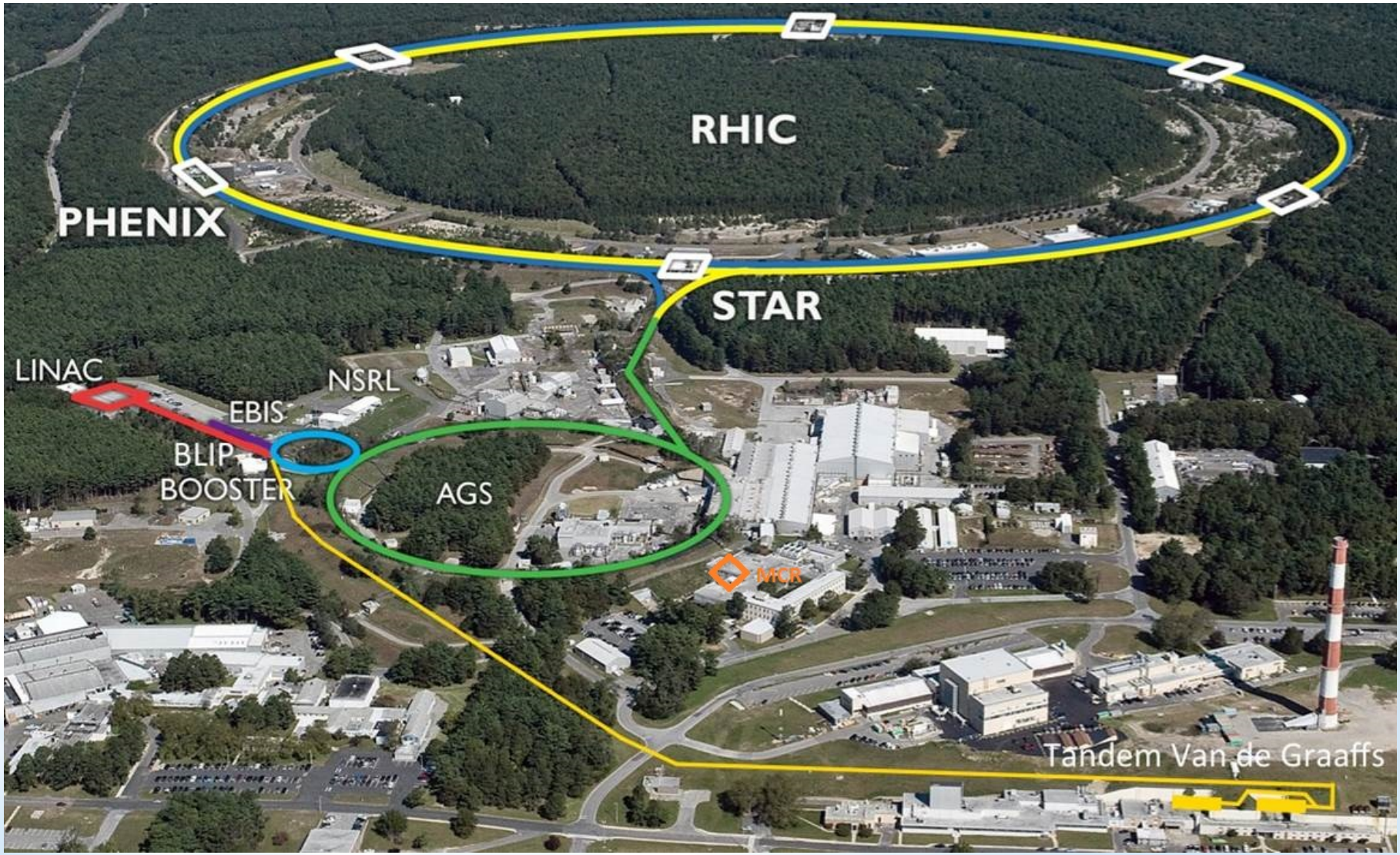
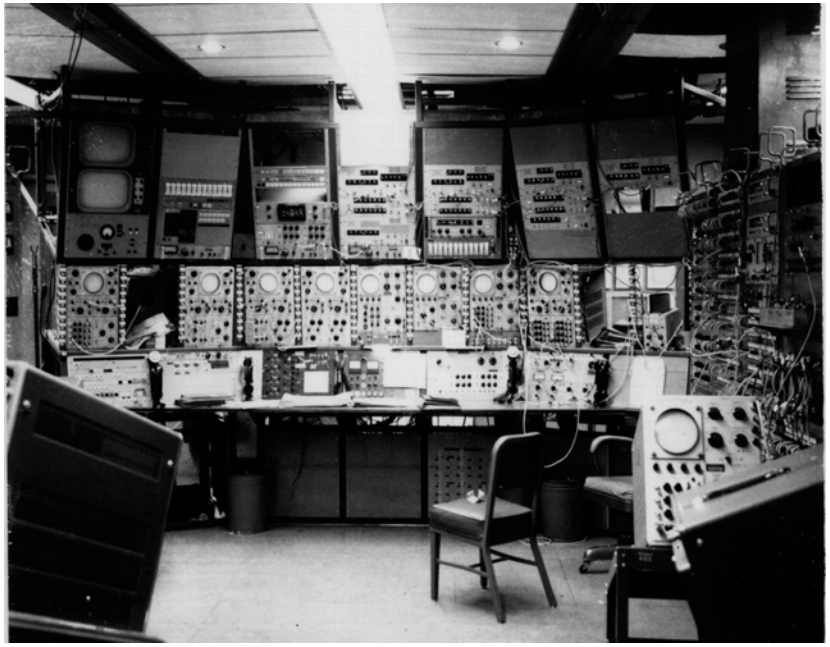
This presentation

- The MCR -- 1960 to 2011
  - a brief pictorial history
  - MCR evolved as accelerators were added
- Project Goals for 3rd generation MCR
- Experience with the MCR -- 2012 to the present
  - What worked / did not work.

RHIC Complex at BNL



First Generation ~1960 - 1989



Second Generation 1989-2011

A building within a building(1)

A building within a building(2)

Third Generation 2012 to the present

Project Goals

- Build new control room while operating from old one
- Integrated workspace for 4 of 5 Operations Groups
  - Cryogenic
  - AGS Main Magnet Power Supply
  - CAS (Collider Accelerator Support) base of operation
  - “MCR”
- Given Operations Integration -- seek to reduce shift man power requirements through cross training. (Y)
- Additional office space (Y)
- Better work flow – (Y)
  - Support more/bigger collaborations in the MCR
- Modern workspace. (Y)
- Showcase for visitors (Y)
- Larger kitchen for integrated groups (Y)

Project Goals – Ergonomics (1)

- Larger room (Y)
- More seats (Y)
- HVAC (Y/N)
  - Reduced dust
  - Better climate control
- Lighting – windows and their consequences (Y)
- Console – open design, more elbow room (Y)
- Work station displays (Y)
  - additional screen area – work stations
  - adjustable screens
  - additional screen area – comfort displays

Project Goals – Ergonomics (2)

- Continued emphasis on Noise abatement (Y)
  - Wall covering – as with 2nd generation room
  - Carpet – unlike 2nd generation room
  - Reduced workstation fan noise
- Added conveniences for workers on desktop
  - USB ports (N)
  - Ethernet ports (N)
  - Power outlets (Y)
- Access Controls console / Safety Console (Y)
  - Separated from other consoles
- Raised computer floor – cable distribution below (Y)

Project Goals - Technological

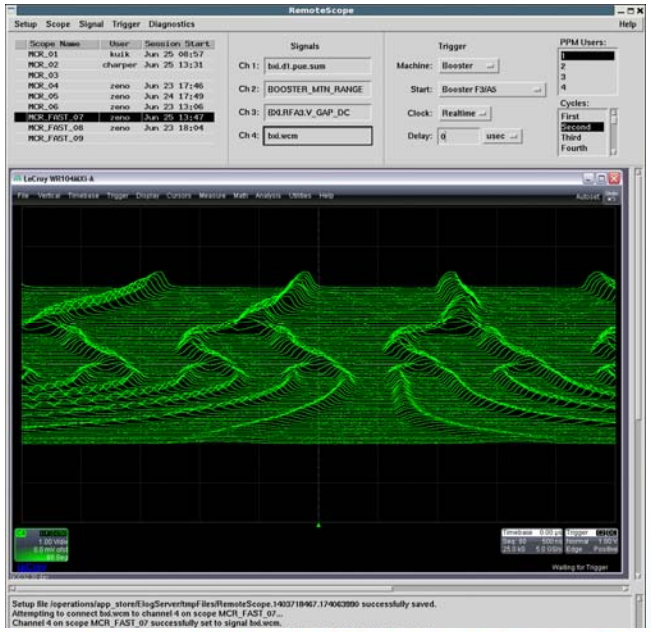
- “All Digital Control Room (Y)
- Workstation Screen Sharing (N)
- Remote Oscilloscopes – a la JLab (Y)
- Upgraded Oscilloscope trigger system (Y)
- Remote Workstations (N)
- Centralized printers (Y)
- Replace Video Switch with Video over internet (Y)
- Software control of convenience “off buttons” (Y)
- Improved alarm management (Y)
- Rack space for legacy hardware not integrated in the design. (Y)
- Access Controls gate video integration (Y)

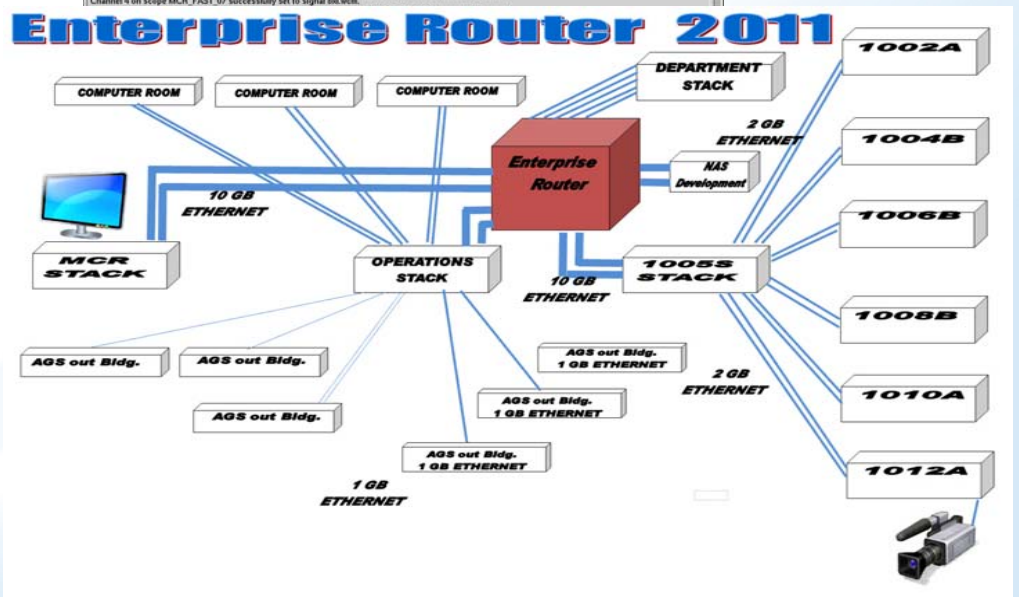
Experience since 2012
Goals Realized?

- The project was a success – “all” are happy with our new modern workspace.
  - MCR now a regular stop for tours and dignitaries
- Majority of Project goals realized
- “Integration” a work in progress (flop)
  - Support groups like their remote control rooms out of the spotlight of the main building
- Reduced number of on-shift staff
  - AGS MMPS shift now 5 of 21 shifts a week

Experience since 2012 (2)

- [nearly] “All Digital Control Room – positive
  - Remote Oscilloscopes – biggest success
  - No observable latency with Booster and AGS analog signals
  - Much credit goes to Controls and new 10 GB Ethernet routers





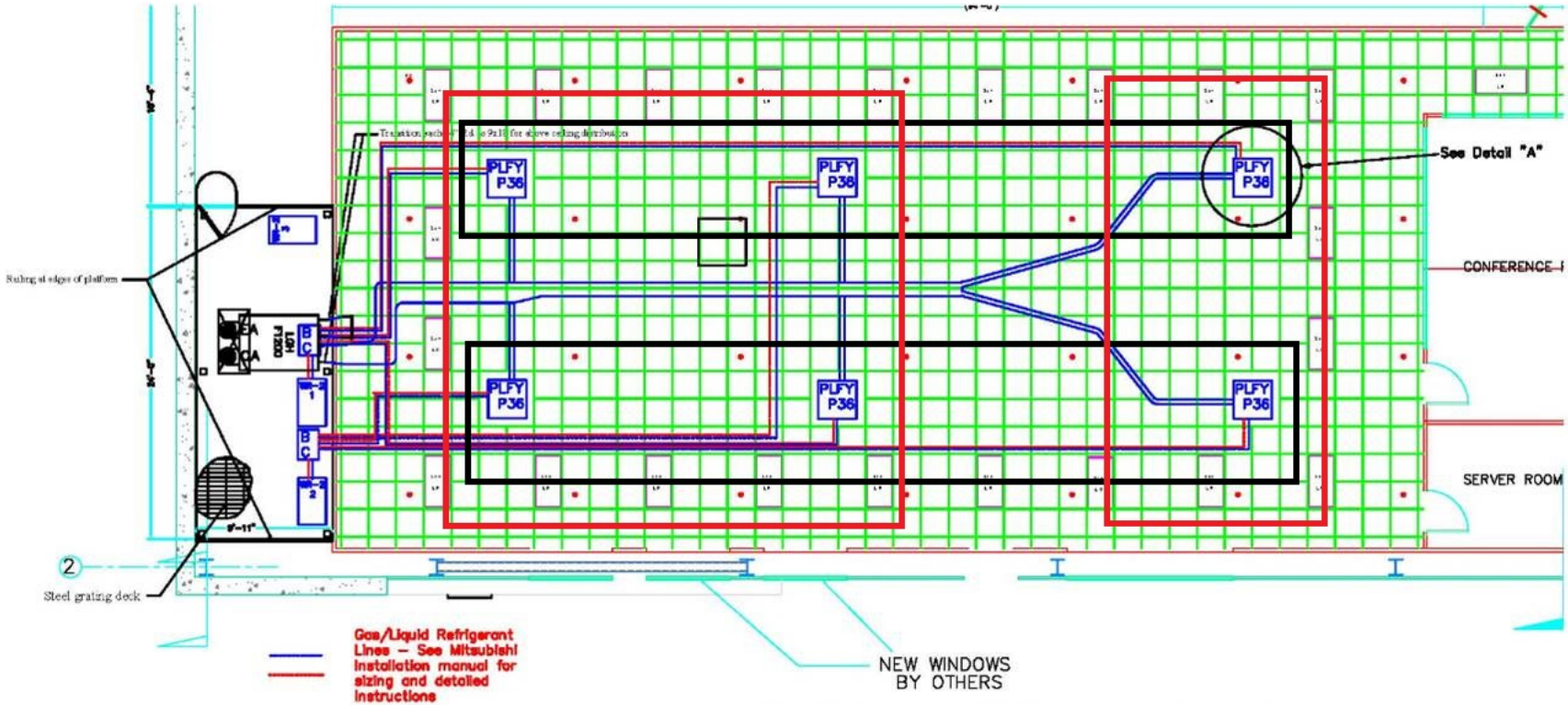
Experience since 2012 (3)

- Spaciousness – <u>positive</u>
  - Plenty of room for collaborations e.g. Rf group
  - Operators not “sitting in each other’s lap” – elbow room
- Sound abatement better than 2nd generation MCR

Experience since 2012 (4)

- Positive
  - New Video over internet system proved more useful to accelerator physicists – and less so for operations.
  - MCR reliance on video much less than in the past.
- Negative
  - Audio speaker placement in ceiling produced feedback when using portable radios for communications in certain MCR locations
  - Technicians resolved

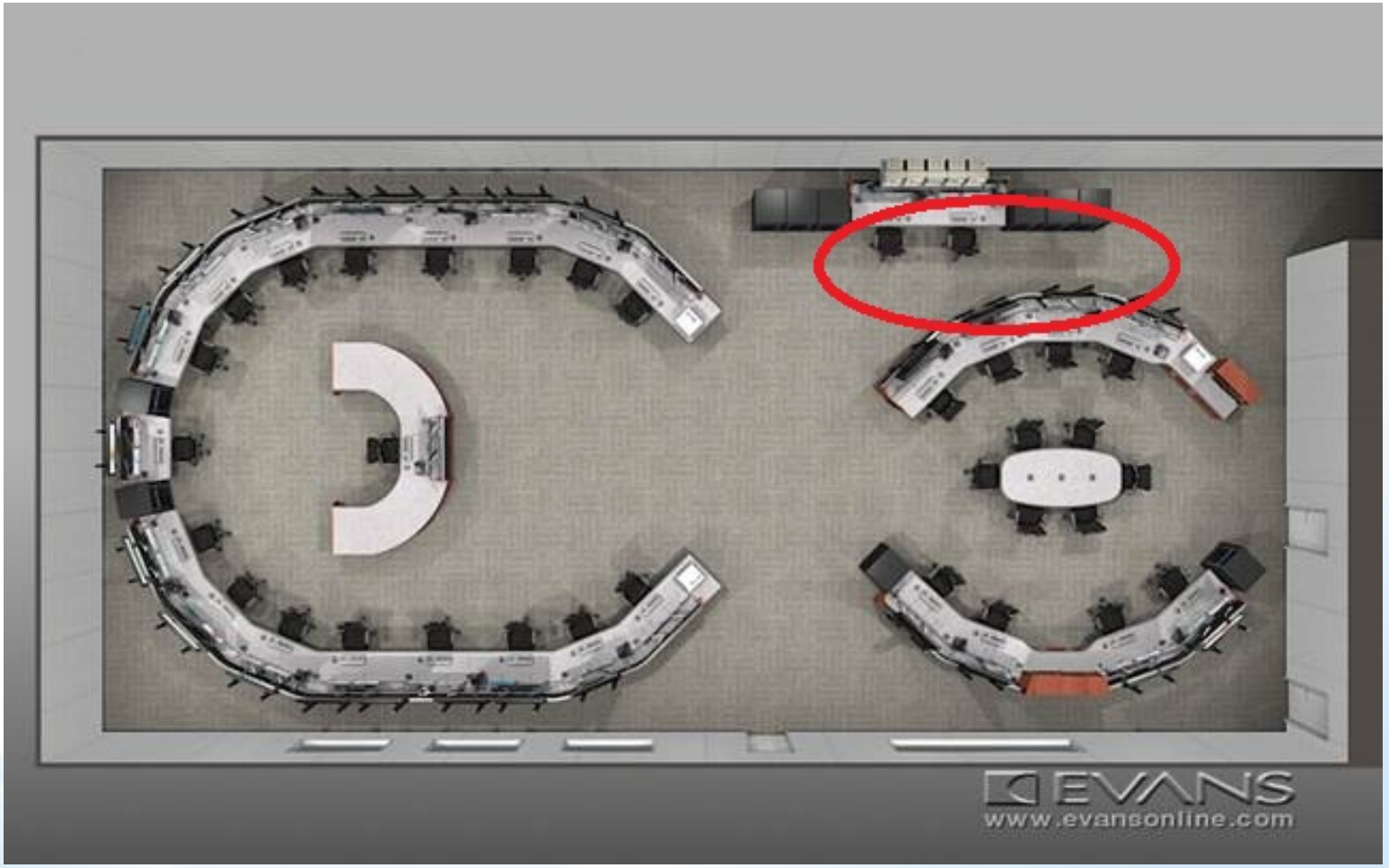
Experience since 2012 (5)
Climate Control Zones – Negative.
Should redistribute sources.



SECOND FLOOR HVAC PLAN

Note: Refrigerant line routing is schematic. Lines are to be routed in the field so as to provide most direct path achievable with given obstructions. Ceiling grid, tiles, fire control sprinklers and HSSD are already in place.

Experience since 2012 (6)
Foot Traffic Bottleneck – Negative requires "chair management"



Stumbling blocks to Beneficial Occupancy

- Awning required to cover external exit stairs
  - Chose inexpensive boat cover option
- Safety Requirements
  - Flame retardant Cable insulation
  - High Sensitivity Smoke detectors.
  - **<u>Etc. see attached BORE report</u>**

Credits

- To Fulvia Pilat – now at Jefferson Lab
  - Conceived of the idea of a new control room and convinced the Department managers of its merit

- To Derek Lowenstein (retired)
  - The Collider-Accelerator Department Head who listened to Fulvia

End

Addendum
Beneficial Occupancy Report.
List of Safety items that were addressed

BENEFICIAL OPERATIONAL READINESS EVALUATION

BUILDING 911, NEW AGS MAIN CONTROL ROOM FACILITY – SECOND FLOOR
(June 22, 2011)

The following pre-occupancy findings need to be corrected or resolved by the responsible party in a timely manner. The Safety and Health Services Division will enter all findings into the BNL Institutional BOREs/OREs/EREs Reporting System for tracking until completion.

No.	Pre-Occupancy Findings	Responsible Party
1.	C-AD plans to relocate the piping drop to the Highly Sensitive Smoke Detection (HSSD) panel into the corner of the room. After completion, kindly contact BNL Fire Protection Engineer (Michael Kretschmann) for the post modification acceptance test.	Collider-Accelerator Department (C-AD)
2.	The exterior stairway is credited as an egress pathway from the Main Control Room. The stairway discharges to a parking area and is likely to be obstructed by a parked vehicle. Please use signage and/or pavement marking to prohibit parking in this area.	C-AD
3.	The New Main Control Room has an egress door on the south wall that discharges to an exterior stairway. In accord with the Building Code of New York State (BCNYS) Section 1006, please install an exterior light adjacent to the egress door to ensure adequate egress illumination. Note: The BNL Fire Protection Engineer has determined that the general area lighting is sufficient to illuminate the stairs, intermediate landing and exit discharge.	C-AD
4.	For emergency communications purposes, please install at least one telephone in the New MCR. Kindly affix 911 stickers to these telephone(s).	C-AD
5.	Please complete the installation of the electrical panels for the Main Control Room. (The panels are located in the Server Room.) This includes the following: • The type MC cables must be secured by straps, staples or other approved means within 12 inches of the panel. (Ref. NEC, Article 330.30(B)). • The space from the raised floor to the bottom of the panelboard must be protected from foot traffic and physical damage to the MC cables, rising up from the interstitial floor below, e.g., a manufacturer's panelboard wireway extension or panelboard skirt. The wireway will allow the MC cable connectors to end below the raised floor surface. The skirt will require a bonding jumper to bond the sheet metal enclosure between the panel and the conductive floor tiles. (See NEC Article 330.12.) • The use of scrap pieces of 12 gauge wire to tie the conductors together within the panel is not an approved wiring method. Kindly replace with wire ties or another approved method. Per NEC Article 210.4(D) "The ungrounded and grounded conductors of each multi-wire branch circuit shall be grouped by wire ties or similar means in at least one location within the panelboard…."	C-AD
6.	Please label the two MCR electrical panelboards located in the Server Room in accord with Section 5 of the Electrical Safety Subject Area and the associated Electrical Panel/Disconnect Labeling Program exhibit, i.e., a unique component ID number, device fed from, voltage and amperage rating (if used for lower voltage utilization voltage must be indicated) and circuit breaker labeling. **Note:** Regarding circuits within panels: please provide circuit number and specific function (i.e., per NEC 408.4, "Switchboards and Panelboards, Circuit Directory or Circuit Identification": The identification shall include sufficient detail to allow each circuit to be distinguished from all others. Spare circuit breakers shall be labeled as such.	C-AD
7.	Ensure the arc flash calculations are completed and, as necessary, affix arc flash specific labels (category hazard, arc flash boundary) to: • The MCR electrical panel in the Server Room. • The 208 volt disconnect (toggle) switches for HVAC controllers BC-1, BC-2 and the ceiling mounted fan unit (LOSSNAY) all located on the HVAC Mezzanine. Note: the 208 volt disconnects for WR2-1, 2 have 0+ arc flash stickers.	C-AD
8.	Panel 911N-911A-B-A (located in the north corridor outside the MCR facility) was installed by this project. The panel does not have a main breaker. Please ensure that supply and secondary side overcurrent protection of the panelboard is correct as provided per NEC Article 408.36 "Overcurrent Protection".	C-AD
9.	Complete the Readiness Evaluation Approval Document. Forward copies of the completed document to Mike Bebon (as Deputy Director for Operations) and Rich Travis (BORE Chairman).	C-AD

BORE (2)

The following post-occupancy findings shall be corrected or resolved by other mitigating action by the responsible organization in a timely manner. The Safety and Health Services Division will enter all findings into the BNL Institutional BOREs/OREs/EREs Reporting System for tracking until completion.

No.	Post-Occupancy Findings	Responsible Party
1.	In support of the transfer of operations to the New Main Control Room, please revise the facility FUA to reflect this modification. Refer to the FUA Subject Area (https://sbms.bnl.gov/standard/1h/1h00t011.htm) and contact Barbara Royce for additional guidance, as necessary. This finding is considered complete when the FUA is submitted to SBMS for processing.	Collider-Accelerator Department (C-AD)
2.	In support of the transfer of operations to the New Main Control Room, please review the Local Emergency Plan for Bldg. 911 and update, as necessary. Kindly coordinate this effort with the Emergency Preparedness Subject Area Point of Contact (Rich Ohlsen).	C-AD
3.	Please contact the Office of Emergency Management (Rich Ohlsen) for an assessment of Tone Alert Radio needs for the New MCR.	C-AD
4.	Please provide the plans for this project to the: • Facility Operations Center (Don Hensley) so that the Building 911 Key Plans can be updated. Please also provide the sprinkler system drawings, as the Key Plans include this information. • Laboratory Protection Division (Jim Vaz) so the Site Fire Alarm System can be revised. • Infrastructure Management (Bill Bockelmann) so the Site Plans can be updated.	C-AD
5.	Upon the start of operations in the New MCR please contact Infrastructure Management, so the correct space charges can be assigned to the facility.	C-AD
6.	Please ensure the O&M manuals/Associated Equipment Manufacturer's Documentation for the equipment installed by this project are provided to the Bldg. 911 FPM for distribution to the relevant F&O organizations, including the Facility Operations Office.	C-AD
7.	Please affix room numbers within the facility, i.e., New MCR (Room 2-224), Conference Room (2-224A) and Server Room (2-224B).	C-AD
8.	Please provide information on all new fire protection equipment to the BNL Fire Chief (Chuck La Salla) to ensure that Fire Rescue has incorporated them into their Inspection Test and Maintenance Program. This equipment includes any: • Portable Fire Extinguishers • Fire Door(s) • Fire Wall(s) (2 hour and greater) • Sprinkler System(s) • Automatic External Defibrillator(s).	
9.	The Committee understands that access to the New Main Control Room is controlled by a special key. Please contact BNL Fire/Rescue (Chuck La Salla) and ensure they have a copy of this key.	C-AD
10.	The exterior stairway is credited as an egress pathway from the Main Control Room. The stairway has an OSHA-conforming stair rail (combination guard and handrail) at ~ 34 inches high with an intermediate rail. However, the promulgation of 10CFR851 requires conformance to additional Codes and Standards including the Building Code of New York State (BCNYS). Where conflicts arise amongst the various requirements, BNL must conform to the most conservative requirement. Section 1013 of the BCNYS requires 42 inch high guard rails on stairways and open sided walking surfaces more than 30 inches above grade. In addition to the stair guards, BCNYS Section 1012 requires handrails at ~ 36 inches above the stair nosing. Please rework the stairway guards and handrails. **Note:** • Section 1013.3, "Opening limitations" requires the use of balusters or ornamental patterns such that a 4-inch-diameter sphere cannot pass through any guard rail opening. The intent is to prevent small children from falling through the guard. Exception 3 to 1013.3 addresses areas where the presence of small children is unlikely and often prohibited. In these cases, the code allows an intermediate rail so positioned that a 21 inch sphere cannot pass through the guard. Assuming the presence of children in the MCR is unlikely, the current stairway geometry complies with this requirement. • See related Post-Occupancy Finding 11 below.	C-AD

BORE (3)

11.	As part of the egress pathway from the New MCR, the exterior stairway is subject to the Fire Code of New York State. Specifically, Section 1028 "Maintenance of the Means of Egress", states in part: "Required exit accesses, exits or exit discharges shall be continuously maintained free from obstructions or impediments to full instant use in the case of fire or other emergency when the areas served by such exits are occupied.... A means of egress shall be free from obstructions that would prevent its use, including the accumulation of snow and ice." Please install provisions (such as a canopy or heated surfaces) to meet this requirement before onset of winter, i.e. by December 1, 2011. See related Post-Occupancy Finding 10 above.	C-AD
12.	The ceiling mounted Mitsubishi air conditioning units located in the MCR and HVAC controllers BC2-1and 2-2, on the Mezzanine have local service (toggle type) disconnect switches. Prior to performing any maintenance or repairs that would require electrical lockout/tagout please rework to allow provisions for local LOTO. References: NEC Article 422.31, "Disconnection of Permanently Connected Appliances", OSHA 29CFR1910.147(c)(iii), and Step 1, Section 5 of the Electrical Safety Subject Area.	C-AD
13.	Access to the local disconnects for the equipment on the MCR HVAC Mezzanine (e.g., WR2-1, WR2-2 and the LOSSNAY ceiling mounted fan unit) does not conform to the National Electric Code. NEC 110.26 requires unobstructed access to these disconnects (i.e., a working space 36 inches in front of the disconnect, the greater of the width of the equipment or 30 inches minimum, and from the floor to 6.5 feet above the floor). The associated equipment intrudes on this working space. Please rework to conform to 110.26 **prior to performing any maintenance or repairs that would require electrical lockout/tagout.** One potential solution would be to relocate the WR2-1, 2-2 disconnects to the west wall and the ceiling-mounted fan toggle switch to the unit itself. **Note:** • The disconnects must be labeled in accord with Section 5 of the Electrical Safety Subject Area and the associated Electrical Panel/Disconnect Labeling Program , i.e., a unique component ID number, device fed from, voltage and amperage rating (if used for lower voltage utilization voltage must be indicated) and circuit breaker labeling. • The disconnect (toggle) switch for the ceiling mounted fan unit must also be reworked to allow provisions for local LOTO.	C-AD

14.	Units WR2-1, 2 located on the HVAC Mezzanine units have short lengths of flexible metallic conduit (FMC) for vibration isolation purposes. As currently installed, this FMC can rotate with respect to the associated rigid conduit . Please secure the FMC connector to the rigid conduit.	C-AD
15.	Panel 911N-911A-B-A (located in the north corridor outside the MCR facility) was installed by this project. The circuits are labeled directly on the panel. Please provide a permanent panel schedule. **Note:** • Regarding circuits within panels: provide the circuit number and specific function (i.e., per NEC 408.4, "Switchboards and Panelboards, Circuit Directory or Circuit Identification": The identification shall include sufficient detail to allow each circuit to be distinguished from all others.	C-AD
16.	The HVAC Mezzanine has a bare copper grounding conductor that is run along the outside walls of the MCR "building". This conductor was wrapped with electrical tape to allow it to be secured by (oversized clamps) to the bldg. Unfortunately this effectively insulates this conductor from both the bldg skin and adjacent conduits. Please install bonding jumpers to the conduit at ~ 10 foot intervals, so that in the event of a fault, they are at the same potential.	C-AD
17.	Please bond the electrical conduit on the building exterior to the metal frame of the exterior stairway to ensure in the event of a fault, they are at the same potential.	C-AD
18.	In accord with OSHA section 1910.22(d), "Floor Loading Protection", please post the approved maximum floor loading for the MCR and the bridge. **Note:** the HVAC Mezzanine has a design floor loading stenciled on the beam near the access ladder.	C-AD
19.	Kindly install permanent visual indicators on the glass walls of the Conference Room at about the 5 foot level. (The concern is that visitors may inadvertently try to walk through the glass.) **Note:** The ribbon decals on the glass walls of Building 400 can be used as an example.	C-AD
20.	Please secure the condensate drain piping from WR2-1 and 2-2 located on the HVAC Mezzanine.	C-AD
21.	Please label all mechanical piping, valves and components in accordance with the SBMS Subject Area, Piping Systems, Identification of and Section 23130 of the Modernization Project Office Standard Specifications. This includes the: • The piping installed on the HVAC Mezzanine, e.g., condenser water, condensate drain piping. • Equipment WR2-1, 2-2, and controllers BC2-1, 2-2 located on the MCR HVAC Mezzanine • Mitsubishi ceiling mounted AC units	C-AD

BORE (4)

22.	Please re-install the toeboard at the south edge (ladder side) of the HVAC Mezzanine	C-AD
23.	Please add the following minor items to the Project Punch List: • Lower door sweep on the exterior door. • Install the interior door thresholds. • Attach the thermostat to the wall.	C-AD
24.	The transformer associated with Panel 911N-911A-B-A (located in the north corridor outside the MCR facility) was installed by this project. Please ensure this transformer is correctly grounded and bonded per NEC Article 250.30 "Grounding Separately Derived Systems")	C-AD

The Committee recommendations listed below should be addressed by the responsible party in a timely manner.

No.	Recommendations and Notes	Responsible Party
1.	As a recommendation please consider installing electrical and telecommunications receptacles in the conference room floor below the future conference room table.	Collider-Accelerator Department (C-AD)
2.	The OSHA requirement (NEC 110.26) to maintain unobstructed access to electrical panelboards and disconnects (i.e., 36 inches in front, the greater of the width of the equipment or 30 inches minimum, and from the floor to 6.5 feet above the floor) is an ongoing concern throughout the Lab. As a Best Management Practice, please affix the OSHA Clearance sticker on the electrical panel in the Server Room (Rm 2-224B). Ref: BNL Lessons Learned Program, Laboratory Electrical Safety Committee Minutes of ~ 1/5/09 Meeting \\ntecs2\LESC	C-AD
3.	Determine if the exterior landings are adequately sloped to shed water (and prevent icing), or consider boring some drain holes in the diamond plate.	C-AD
4.	In preparation for this BORE: • The Transfer for Maintenance Accountability (TFMA) was completed. • The fire protection, manual pull stations, A/V alarms, exit signage and emergency lighting was accepted by the BNL AHJ.	Not Applicable (NA)
5.	The Fire/Rescue Runcard for the Building 911 was updated on 6/20/11 and reflects the current configuration. The Runcard will be updated again when the transfer of AGS operations to the new Main Control Room facility (MCR) is complete.	NA
6.	The Facility Hazard Categorization SME (Gerry Shepherd) has determined that the Bldg. 911 Hazard Categorization does not require updating.	NA

BORE COMMITTEE CONCURRENCE

BUILDING 911, NEW AGS MAIN CONTROL ROOM FACILITY – SECOND FLOOR
(June 22, 2011)

Name	Date
Richard Travis (R. Travis, SE SHSD)	7/20/11
(S. Thompson, F&O Facility Operations)	7.21.11
(M. Kretschmann, F&O Energy and Utilities)	7/25/11
(A. Etkin, C-AD ES&H Coordinator)	7-21-2011
(W. Hulse, Bldg. 911 Facility Project Manager)	7/25/2011
G Blanda (G. Blanda, North Complex ESH Rep., SHSD)	7-25-11