MARTA's Integrated Systems Approach

Train Control & SCADA Upgrade

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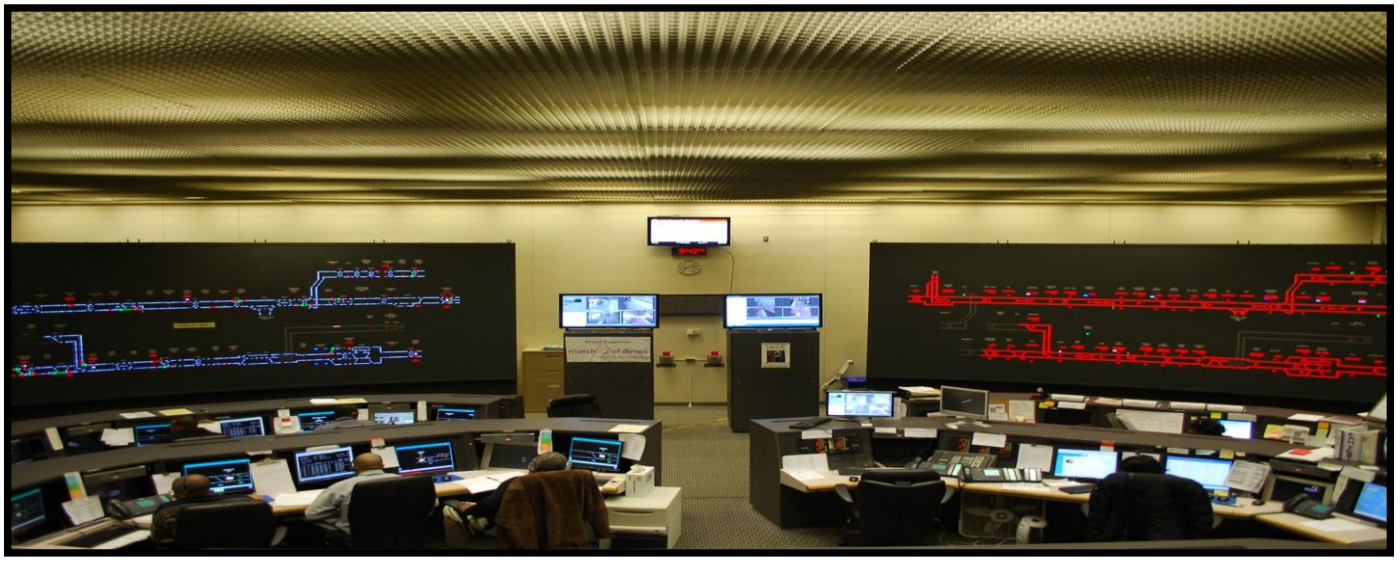
History and Background

- While still in a state of good repair, **systems are becoming increasingly difficult to upgrade & maintain**
- Systems are becoming unstable & unreliable leading to potential **service delivery & operational inefficiencies**
- **Outdated business processes** inhibit productivity due to manually intensive processes



Authority Commitment

- MARTA gives safety critical and operational critical systems & infrastructure projects highest prioritization within their Capital Improvement Plan.

Safe - Secure - Sustainable (S^3)

- The Train Control and SCADA Systems Upgrade (TCSU) project demonstrates MARTA's commitment to modernize as an agency and to serve the greater Atlanta region.

Vision for Transformation

TODAY:

- Manual Processes
- Stand Alone
- Unstable
- Paper Driven
- Legacy Systems
- Reactive Response
- Multiple Data Entries
- Fragmented Training

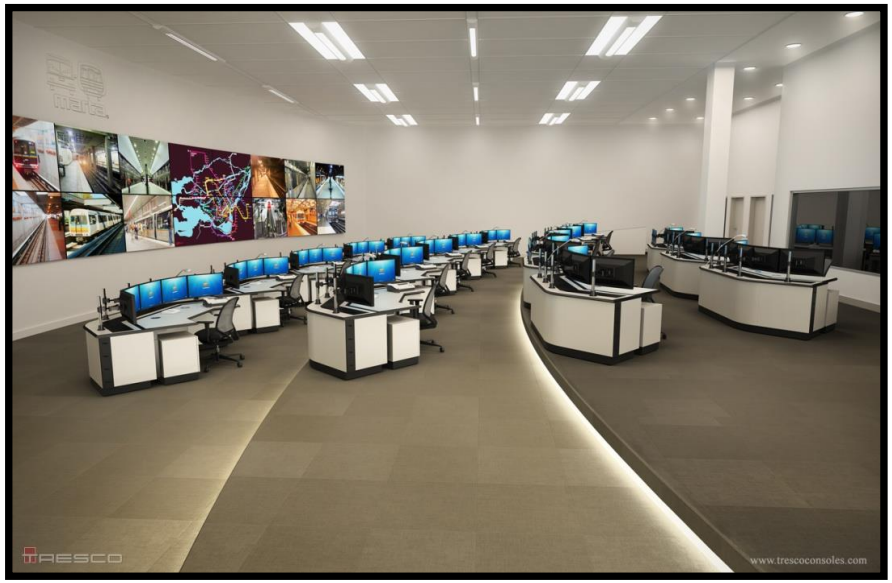
FUTURE:

- Automated Processes
- Integrated
- Safe & Reliable
- Electronic
- New Technologies
- Proactive Monitoring & Response
- Single Data Entry
- Integrated Training

Establishing a Vision

Integrated Operations Center (IOC)

Bus - Rail - Police Communications Center



Defining the IOC

Rail Operations

Bus Operations

Integrated Operations Center

Police Operations

Future Needs & Expansion: **MARTA and Region**

Challenges with Projects

Why Projects Fail:

42% Leadership

27% Organizational & Cultural Issues

23% People Issues

4% Technology Issues

Other 4%

Source:
Organization Dynamics, Jim Markowsky

Guiding Principles

- Develop a **Vision** and Integrated **Scope**
- Implement a **Governance Structure**
- Involve **Leadership** and **Stakeholders**
- Establish an experienced **Project Management Team**
- Leverage and learn from **Industry** and **Peers**
- Select the **Right Partner**
- Implement **Change Management**
- Use a **Whole Life Cycle (Systems) Approach**

Unique Approach

- Comprehensive stakeholder and user driven requirements
- Multi-step & detailed procurement and negotiation methods
- Single, Collaborative Project Office: MARTA, Vendor and Consultant staff
- Highly focused on Organizational Change Management, Business Process Re-engineering, and Training
- 5 Yr. & 10 Yr. hardware and software refresh cycles

Organizational Readiness

"Classically under-estimated"

- What are the key themes & messages to communicate?
- When should they be communicated?
- What are the appropriate channels of communication?

- Who should be trained at what level?
- What is the training content?
- How will effectiveness be measured?
- What are the delivery channels?

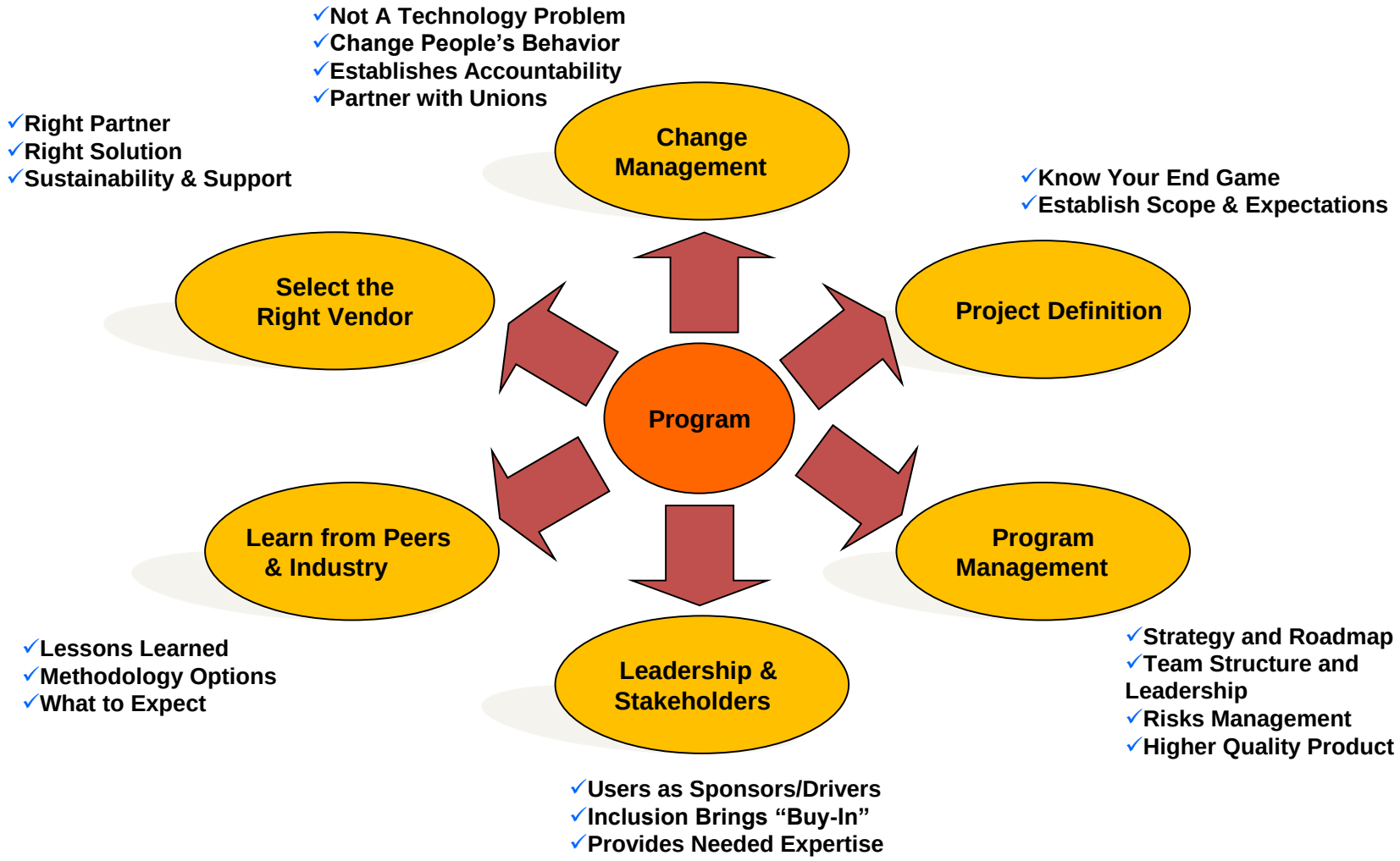
- What processes will change?
- How will they change?
- Who is impacted?
- How will transition be executed?

- How will the positions change (type, number, skills, etc.)
- What capabilities are required?
- How will labor resources be re-tasked?

- Who does new technology impact?
- What is driving the change?
- What is the extent of the change?
- How do we change behaviors?

- Who are the stakeholders (internal & external)?
- How can we effectively communicate with stakeholders?
- How will the relationships with stakeholders be managed?

Integrated Approach



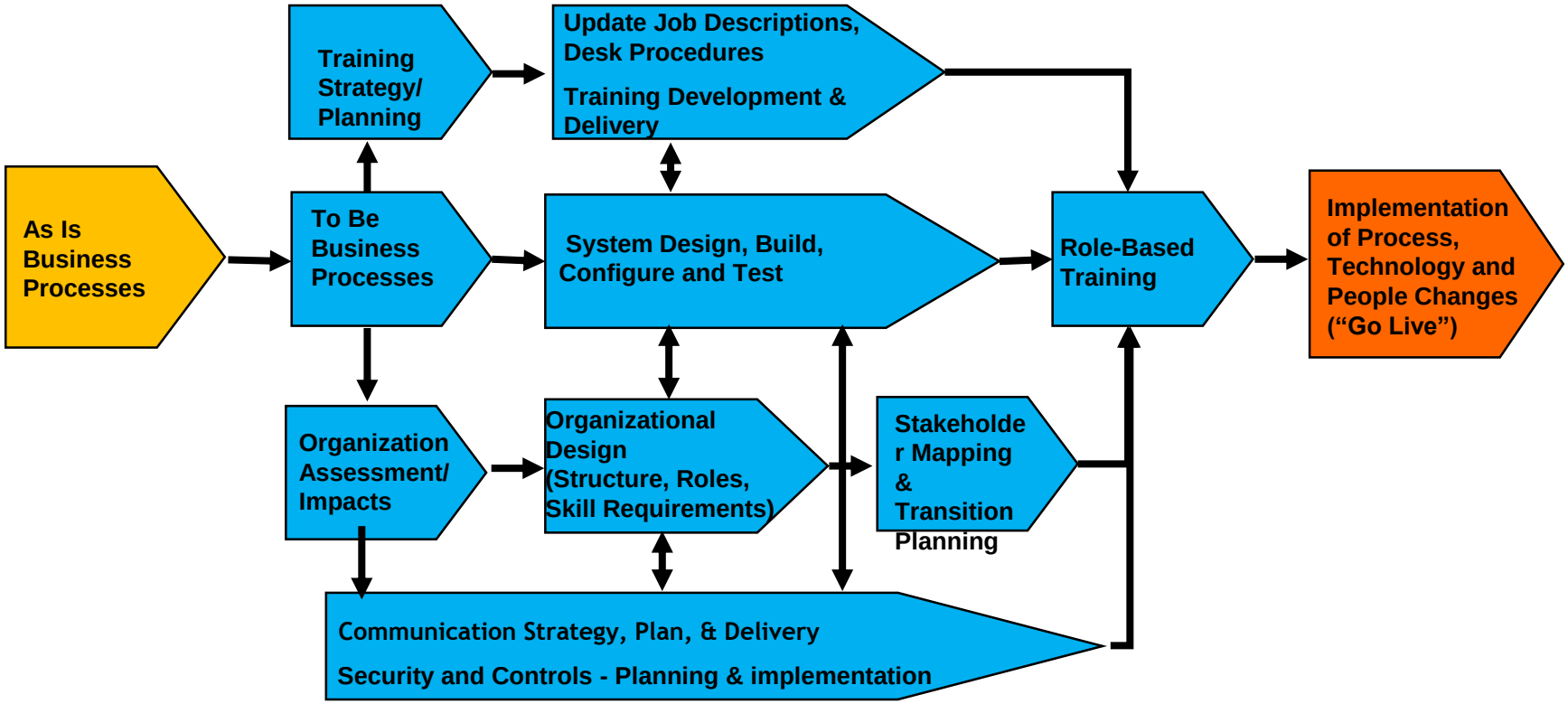
Further Defining the IOC?

- Integrated where all "systems" are accessible?
- Integrated operations for "MARTA's business units"?
- Integrated operations for "MARTA and local peer agencies"?
- Integrated operations for "MARTA and potential future partners"?
- Something else?

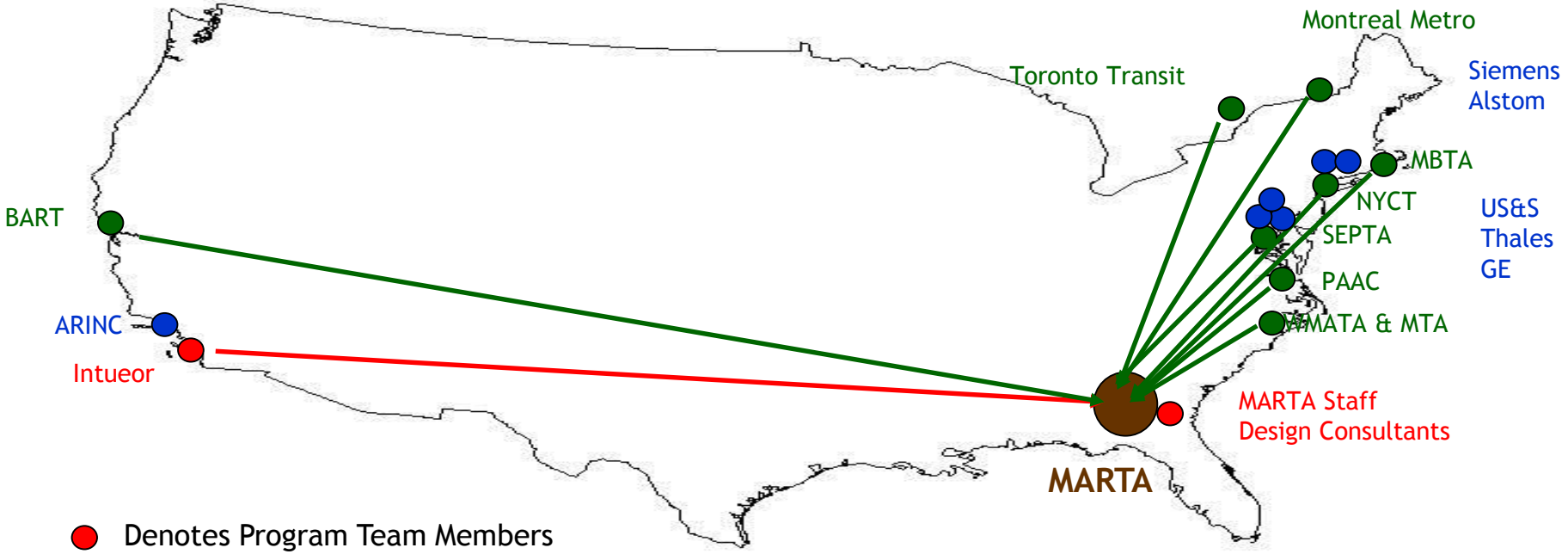
Key Criteria Considered

- Overall
  - General site requirements
  - Accessibility from MARTA HQ
  - Central to Region
- Spatial
  - Operations theater space
  - Display wall space and ceilings heights
  - Operational, support, and ancillary spaces
- Facility
  - Safety & security
  - Environmental systems
  - Emergency operations
  - Communications (Radio, Phone, Fiber, Etc.)
  - Sustainability
- Future Expansion
  - MARTA operations
  - Regional operations

Ex: Structured Approach to ***Change***



Industry and Peer Involvement



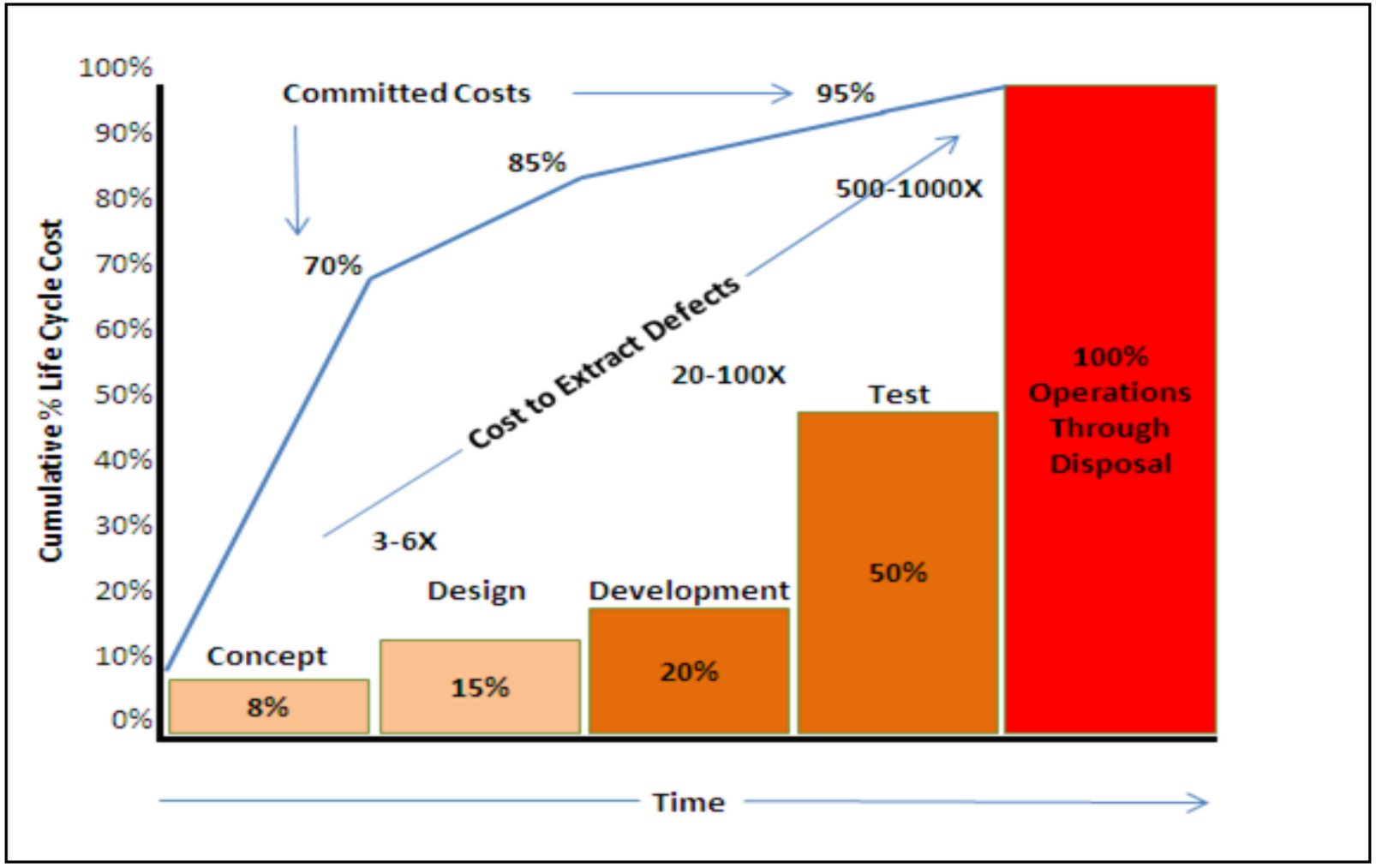
How MARTA defines Systems Engineering

"Systems engineering is an inter-disciplinary approach to managing ~~large-scale complex~~ projects that meet the business requirements of stakeholders and customers, increase the likelihood of success, mitigate risk, reduce life-cycle costs and increase asset sustainability."

Designed for Growth and Regional Opportunities

- Single, fully integrated control center (IOC) housing Rail, Bus and Police control and communications staff
- IOC site includes a new Emergency Operations Center (EOC)
- Located along MARTA's north rail line at Chamblee Station
- Scalable theatre design, universal work stations, customizable display boards, fiber optic connectivity, training center and room for expansion
- Regional opportunity – potential to add other regional partners (heavy rail, light rail, BRT etc.)

Committed Costs vs. Lifecycle



Requirements Gathering

- Requirements driven **by "users"** and not by **"technology"**
- Assemble the **"right team"** to **"ask the right questions"** to **"the right stakeholders"**
- Tackle each **sub-system then system**
- Understand business processes to ensure technology is **"solving business problems"**
- Detailed **requirements development and user reviews**
- Develop a detailed **Requirements Traceability Matrix** (RTM) to capture ALL requirements

The Right Requirements

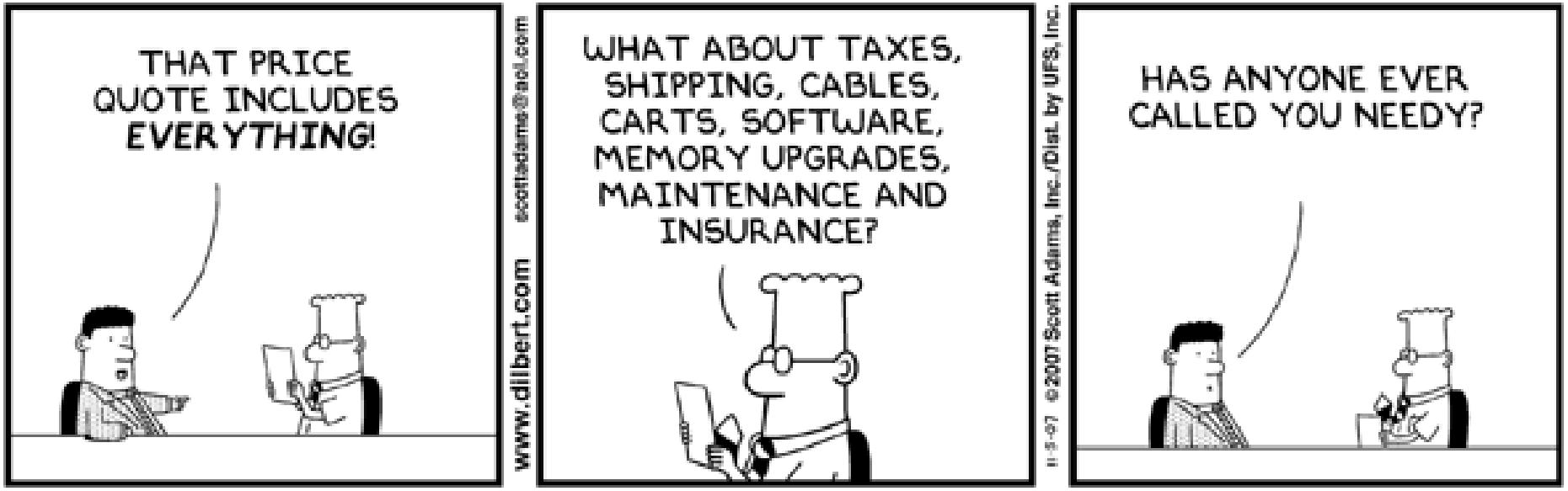
Robust Procurement Process

- Written Evaluations with formal scoring by Technical Evaluation Team (TET)
- Oral Evaluations with formal scoring based on demonstration with actual proposed products
- Visited other peer agencies where the proposed or similar systems were already installed and in operation
- Best and Final Offers with formal scoring by TET for technical elements and SEC for price elements

Robust Contract Requirements

- Local PMO co-located with MARTA team
- Identified key personnel with penalties for changes in key personnel
- Key contractual milestones to establish progress check-points
- Liquidated damages to mitigate missing key milestones
- Six-month error free (99.99%) 'Demonstration Period' - mandatory condition for acceptance
- Maintenance of equipment by vendor until total system acceptance
- No-cost changes through design if in the base system

Pricing - What does it Include?



Negotiating at the Right Level

- Developed agency estimates with both top-down and bottom-up approaches
- Carefully selected negotiating team to analyze proposals
- Developed a price landscape - baseline price vs. proposal price
- Identified high risk items and cost drivers
- Negotiated at a detailed level (systems and even sub-systems)
- Used analysis to strike a balance between budgetary constraints and high-priority scope items without introducing excessive risk (i.e.; no science projects)

Scope Overview

- A multi-phase program to acquire technology components & professional services to implement upgrades to five (5) major systems and the business processes that drive them:

1. Train Control (TC) System
2. SCADA System
3. Rail Yard / Tower Systems
4. Rail Cars
5. Train-Wayside Communication

Business Processes and Training

- Integrate all legacy head-end systems into the IOC and manage integration of concurrent system wide upgrade projects.
- Upgrade communication technology from RS32 to Ethernet-IP
- Physically move and transition into another facility
- Establish a Back-Up facility

More Detailed Scope

- Install 97 SCADA Field Units in traction power rooms
- Install Two-Way Train-Wayside Communication System
    - 318 Rail Vehicles (314 to be upgraded, 4 Long Term Out of Service)
    - 57 Wayside Locations
- Install 51 Train Control Field Units (TCFU) in train control rooms
- Upgrade 3 Yards – South Yard, Armour Yard, Avondale Yard
- Install and Integrate new Train Control and SCADA System at new IOC
- Update Business Processes, Manage Change, Deliver Formal Training

Team Composition

Steering Committee (10 Members)

- Directors of
  - Rail Operations
  - Rail Maintenance
  - Facility Maintenance
  - Engineering
  - Technology – Infrastructure
  - Technology - Applications
  - Safety
  - Training
  - Program& Contracts Management
  - C&P & Legal

Core Team (~25 Members)

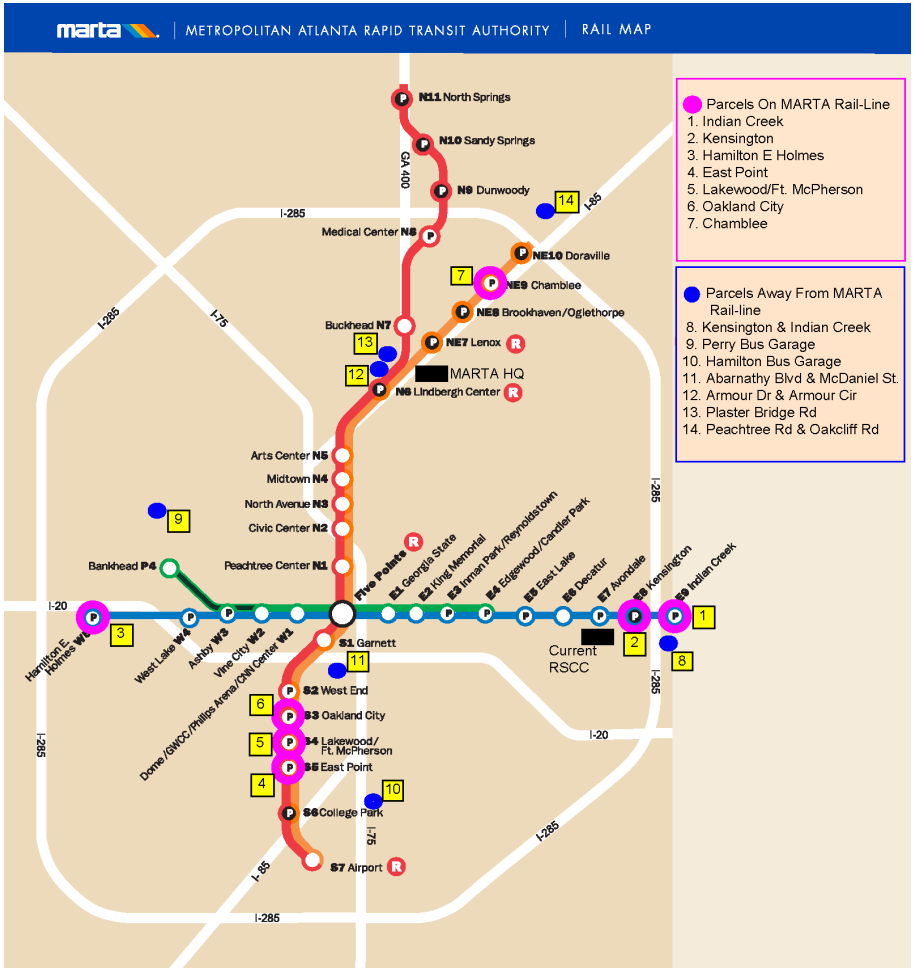
- Managers and SMEs from
  - Rail Operations
  - Rail Maintenance
  - Facilities Maintenance
  - Engineering
  - Technology – Infrastructure
  - Technology - Applications
  - Safety
  - Training
  - Program & Contracts Management
  - C&P & Legal

Program Benefits

Safety & Security	Operations	Customer Service
• Improved monitoring and alarm capability • Improved communication interface • Reduced response time • Improved incident management • Integrated system playback capability	• Real-time car health data • Reduced maintenance costs • Increased operational capacity • More efficiently managed resources • Foundation for growth	• Improved on-time performance • Real-time information • Improved vehicle and station communication • Increased reliability of systems • Service adjustment flexibility

Renovate vs. Build

- Evaluated options
  - Renovate:
    - Existing MARTA buildings
    - Spaces that could be leased/rented
  - Build:
    - Prelim location analysis based on MARTA properties
    - Extended location analysis based on properties that could be acquired



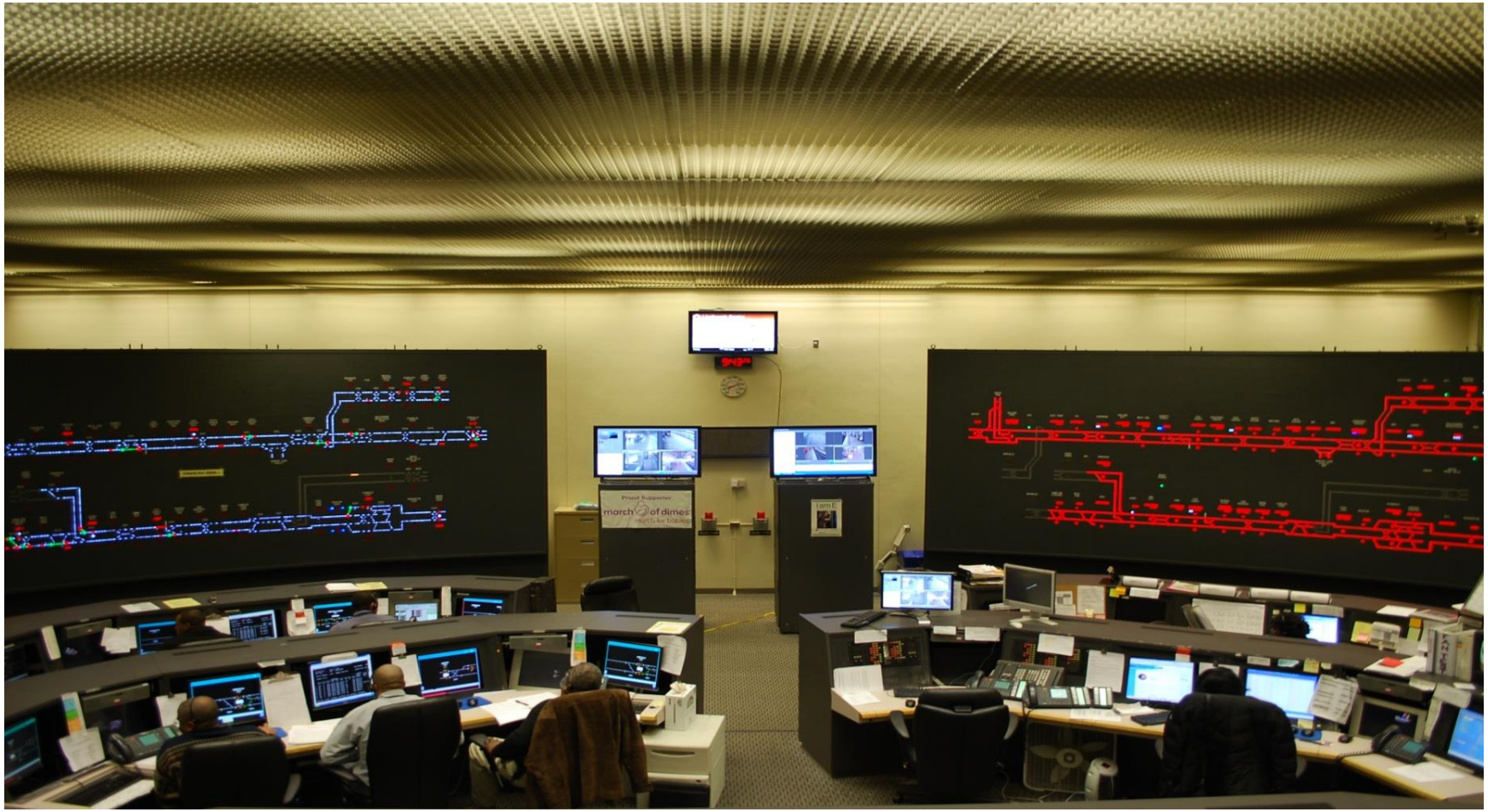
Conducting Comparative Analysis

CRITERIA	OPTION 1 Renovate Existing RSCC	OPTION 2 Renovate Another MARTA Facility	OPTION 3 Build A New Facility On an Open Lot
Access Flooring	↑	↑	↑
Security (Structure)	↑	↑	↑
Security (Location)	↓	■	↑
Emergency Power	↑	↑	↑
Mechanical Systems	↑	↑	↑
Field Systems and Enterprise Communications	↑	↑	■
Cutover/Transition Requirements - Personnel	↑	■	■
Operational Challenges During Construction	↓	↑	↑
Esthetics	■	↑	↑
Available Parking	■	↑	↑
Backup RCC	↓	↑	↑
Estimated Cost	$6.60M	$11.85M	$14.85M

Design – Overall Goals

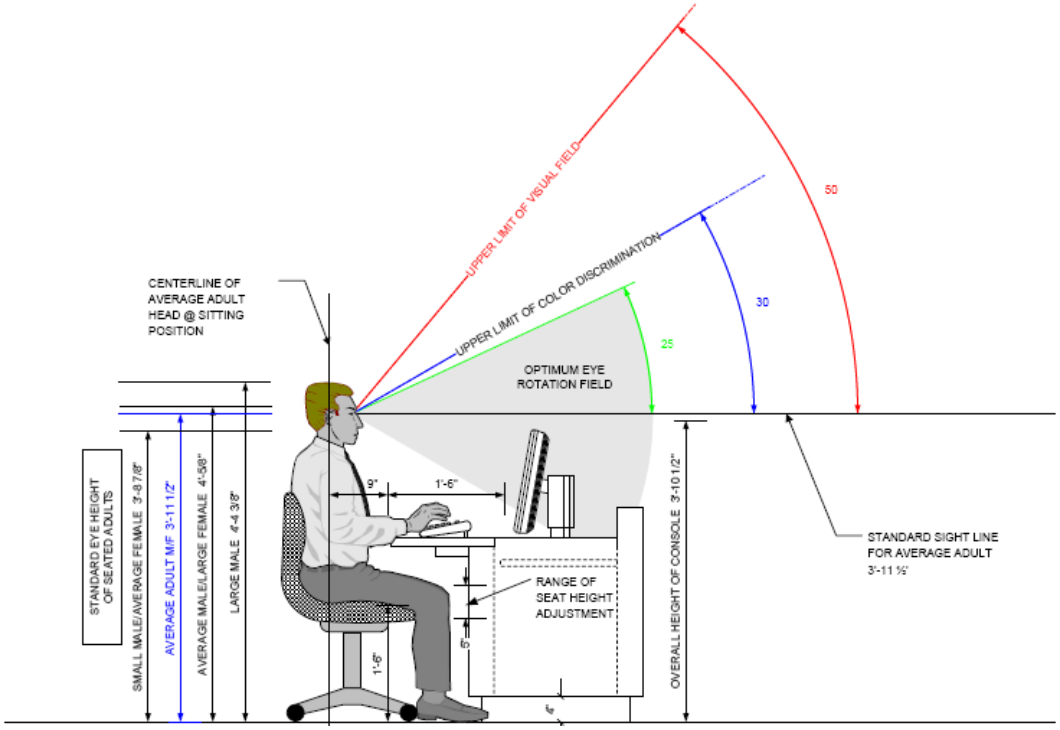
- Theater layout and design
  - User and functional needs
  - Operational relations between business units
- Standardizing the spaces
- Standardizing the furniture – consoles, offices, etc.
- Future needs – MARTA and Regional expansion

Current Rail Services Control Center



Design – Ergonomic Studies

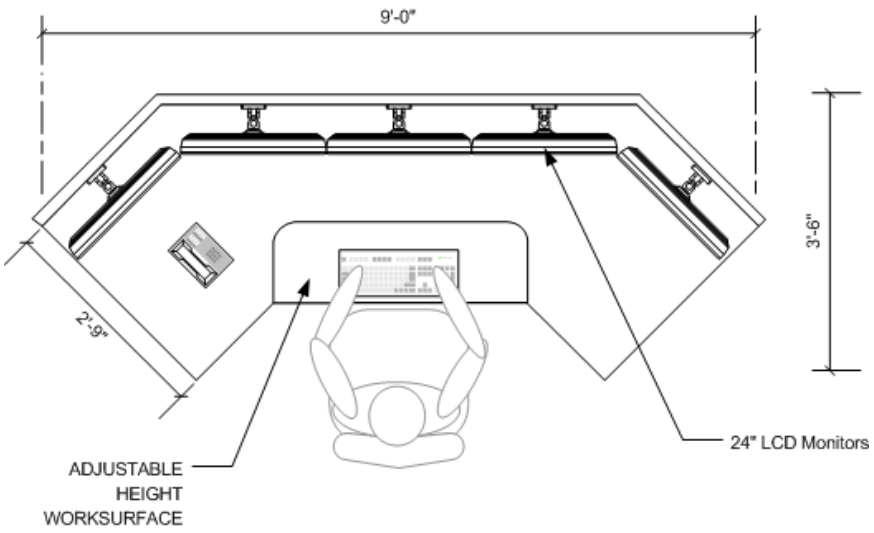
- Detailed ergonomic studies were conducted to determine the optimal work area



Range of eye and distance studies for the work area size and distances from overviews for optimal design

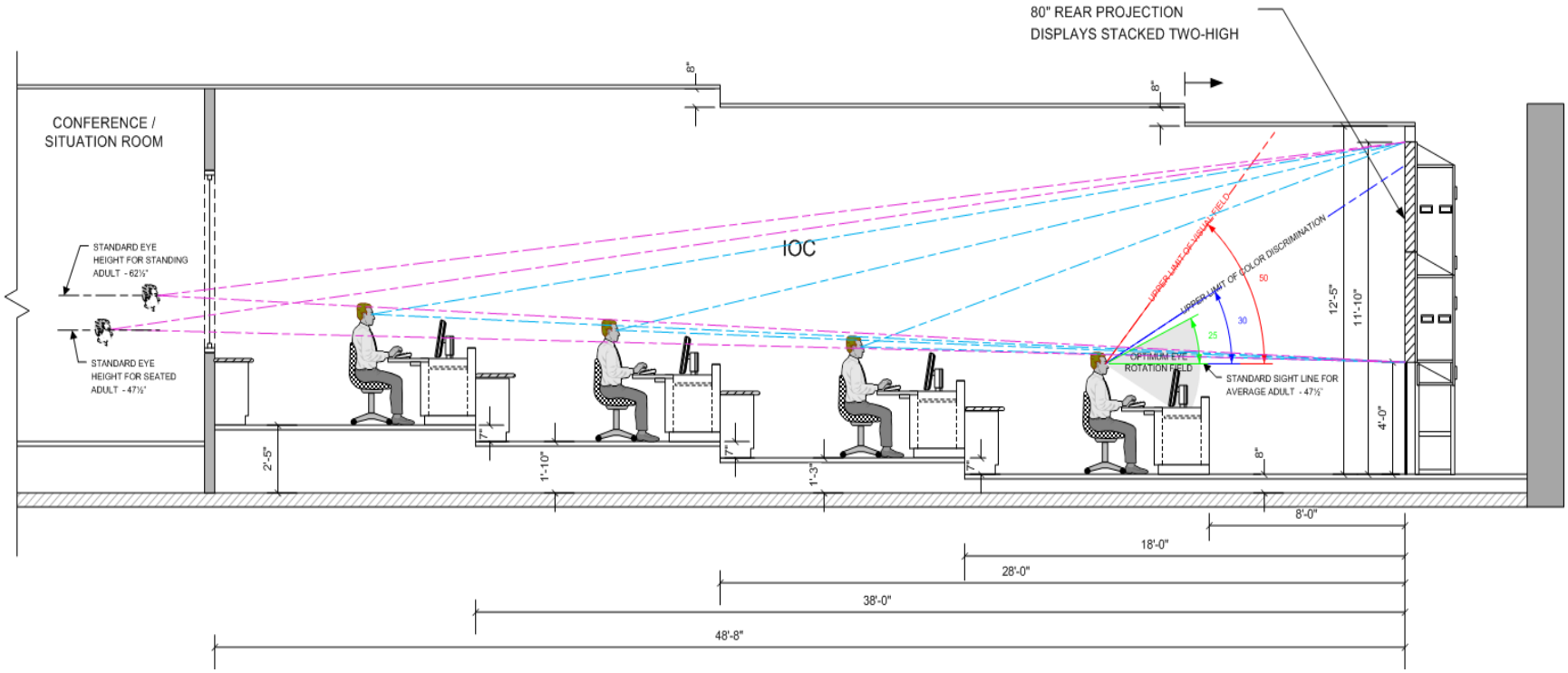
Design – Ergonomic Studies

- Ergonomic studies drove the theater and console design
- Emphasis on the universality of the design
  - Rail, Bus, Others



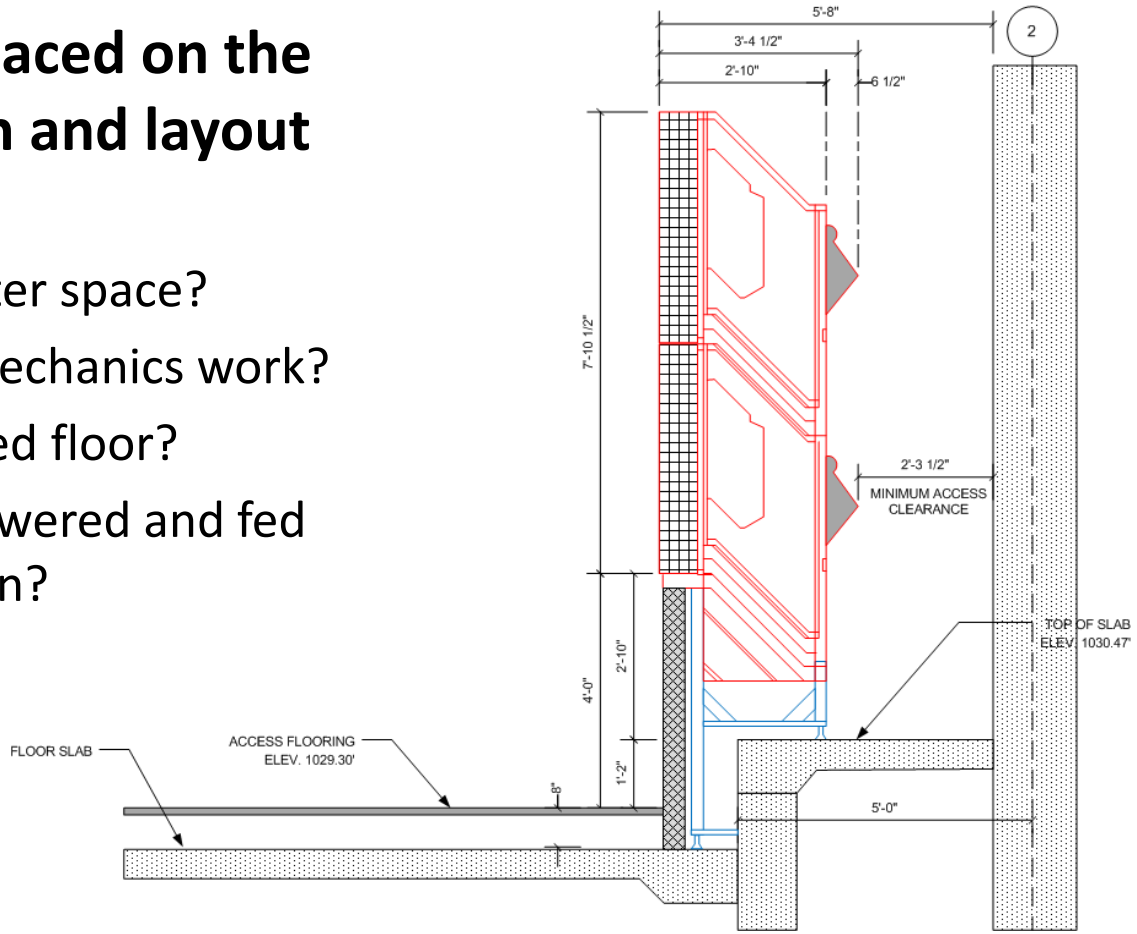
Design – Sight Line Analysis

- Sight-line studies were conducted to confirm there were no interferences from any area within the theater



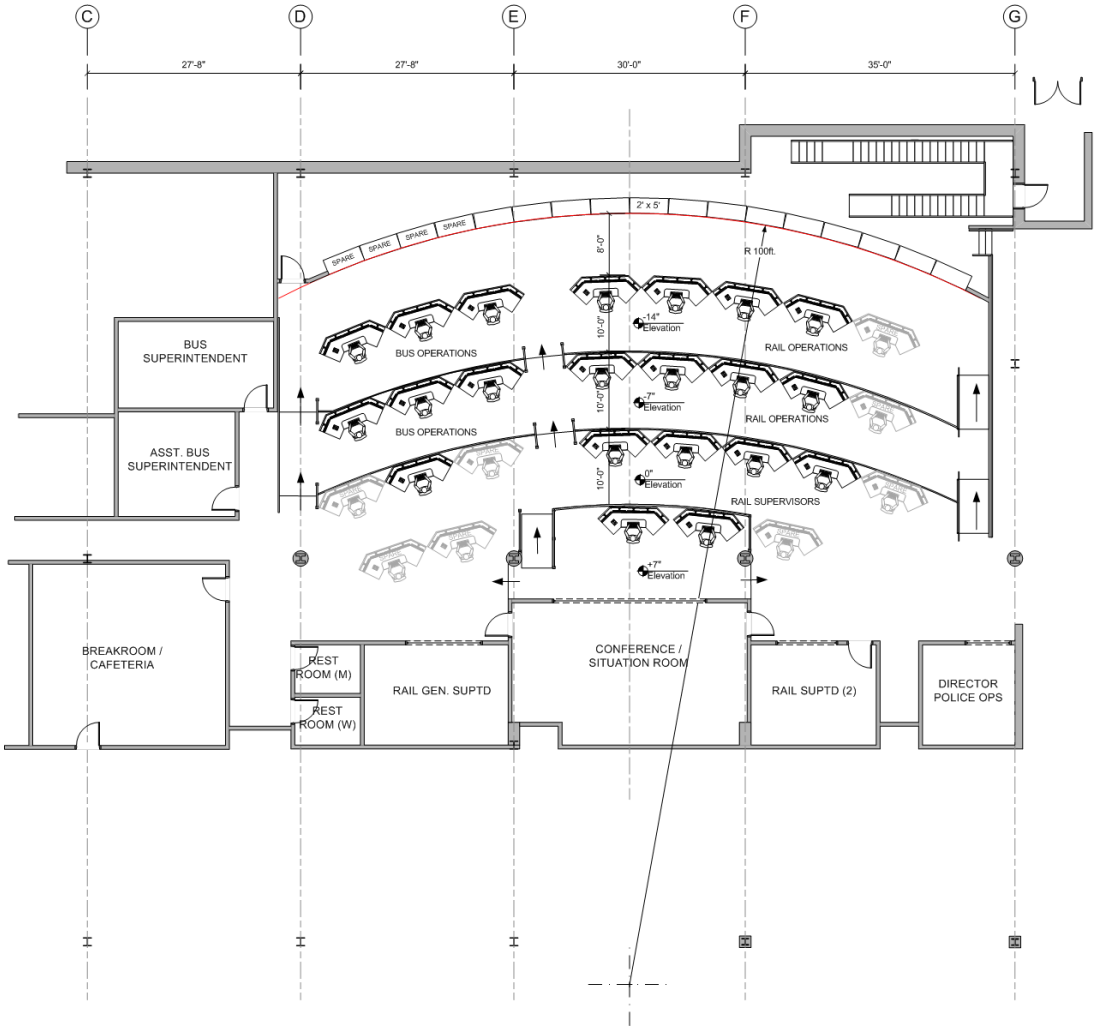
Design – Overview Display

- **Special Emphasis was placed on the Overview Display design and layout**
  - Who are the users?
  - How will it fit in the theater space?
  - How will the mounting mechanics work?
  - How will it sit on the raised floor?
  - How will the cubes be powered and fed with the TCSU information?

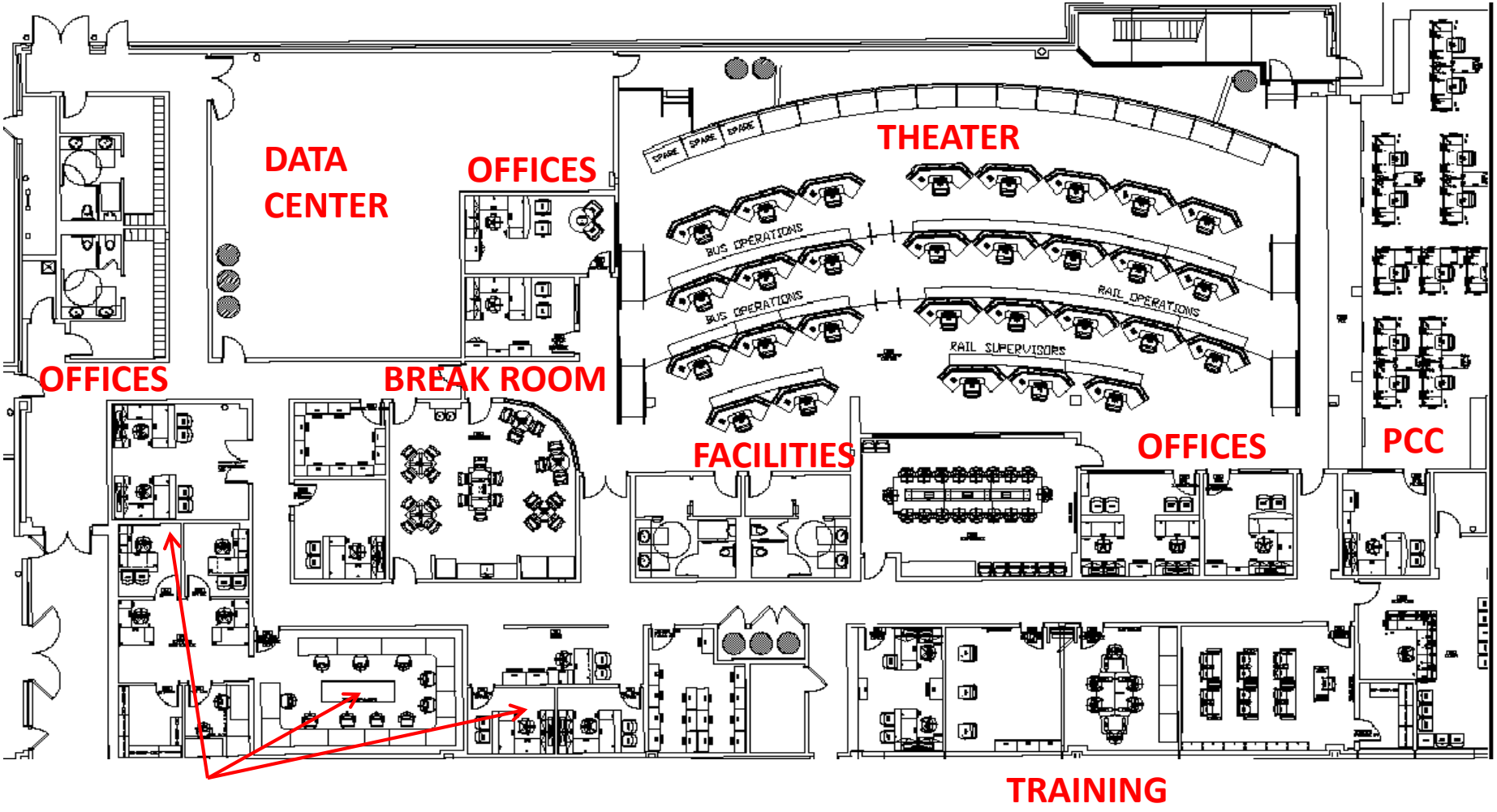


Design – Main Theater

- Theater was based on all design elements together
  - Functions & Users
  - Ergonomics
  - Related spaces
  - Universality
  - Future Needs



Bringing It All Together!



IOC-EOC Floor Plan

The Existing Revenue Building / Warehouse

The New IOC

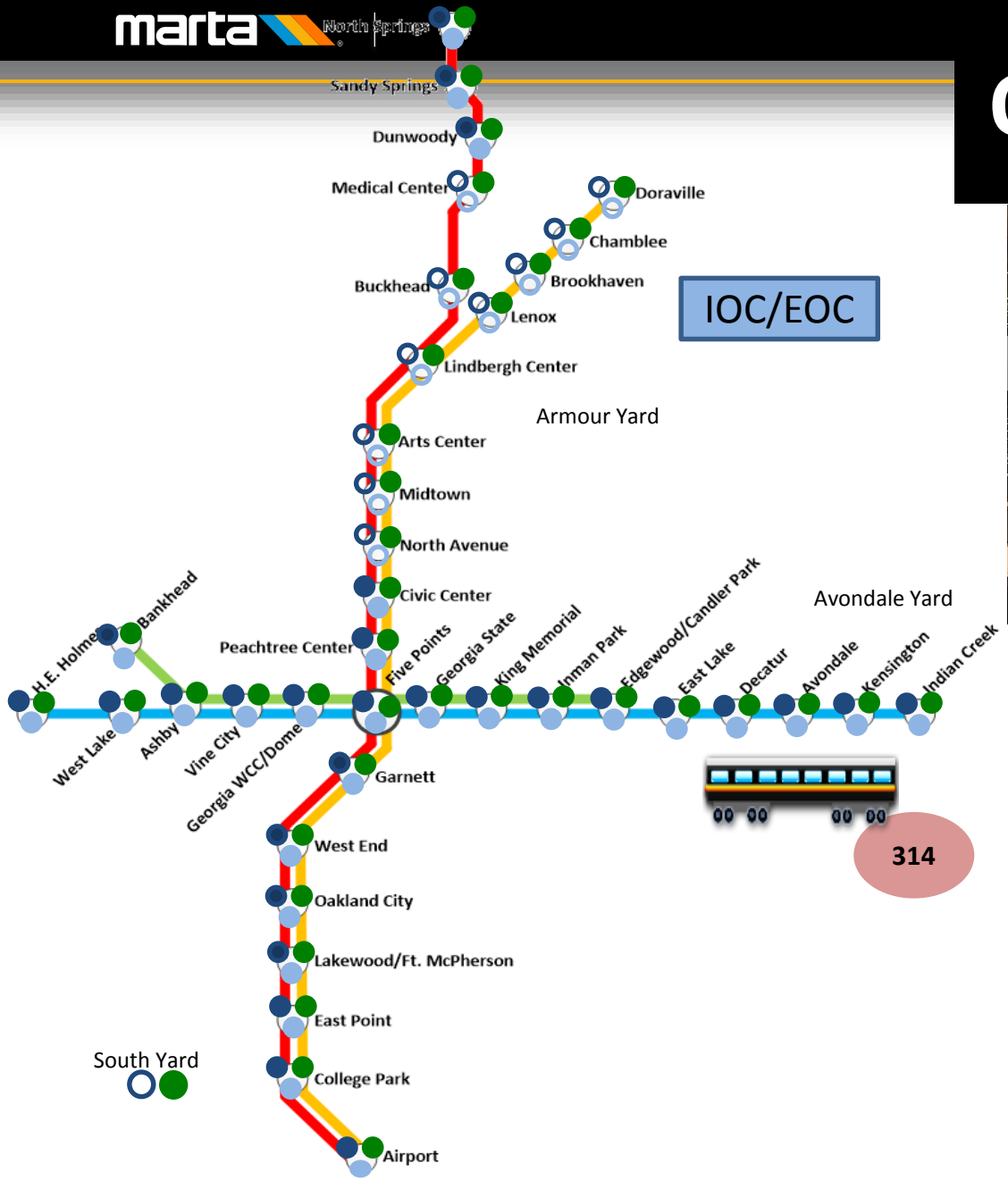

IOC
EOC


JCB
JCB

MARTA's Train Control Functionality

- Rail Services Control Center (RSCC → IOC):
  - Monitoring and alarm functions
- Automatic Train Operations (ATO):
  - Regulates train start/stop and speeds
- Automatic Line Supervision (ALS):
  - Regulates dispatch, routes, and communication
- Automatic Train Protection (ATP):
  - Enforces safe operation through speed control and train separation
- Car Borne Equipment and Cab Signaling:
  - Communicates with the field and controls train operation

Overall Progress



IOC/EOC:
Construction: 100%
EW Testing: 94%
Commission Before APTA

- SCADA Field Units In Service
- Train Control Field Units In Service
- Train Control Field Units Installed
- TWC Units In Service
- TWC Units Installed
- Upgraded Cars In Service

Moving Towards the Future

October

APTA

September

- Transition Ops to IOC

August

- Complete EW Integration Testing
- Complete Office FAT

July

✓ **Conduct Integrated Level 3 Ops from IOC**

June

✓ **Complete East-West Transition Rail Training**
✓ **Complete Console Installations**

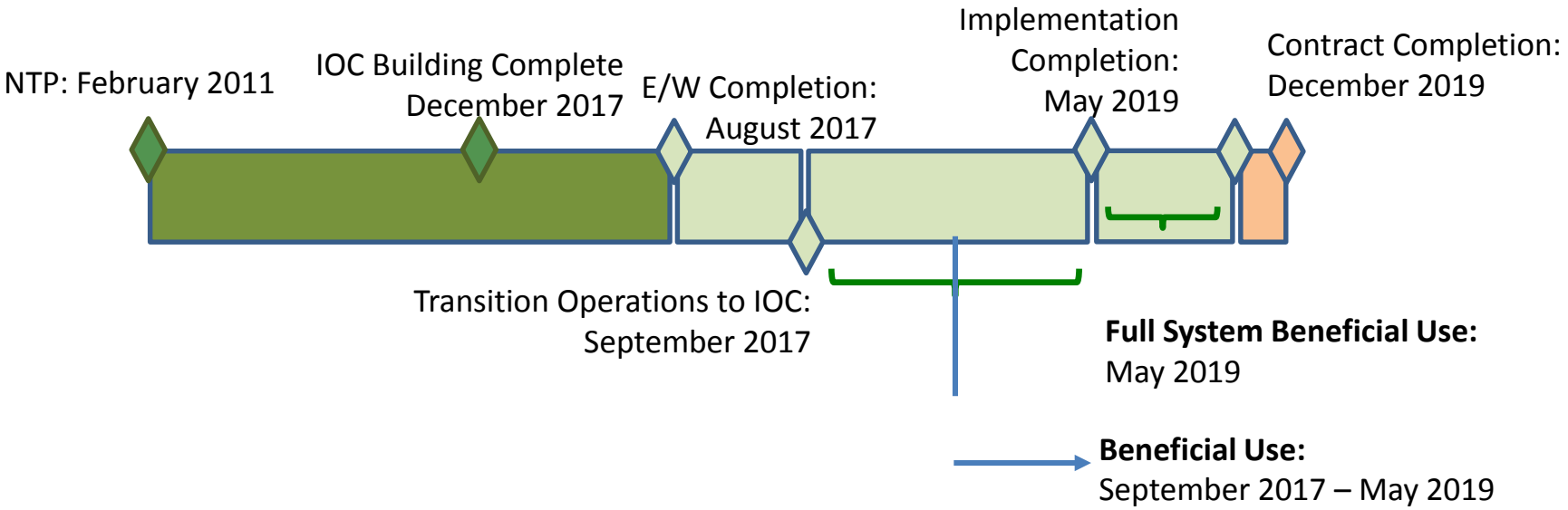
May

✓ **Receive IOC Consoles and Begin Installation**
✓ **Begin East-West Transition Rail Training**

April

✓ **Begin East-West Integration Testing**

TCSU – IOC Timeline



Conclusion

MARTA's **Integrated Systems Approach** validates that a **collective vision** and **commitment at the appropriate levels** coupled with a **well established roadmap** and **approach** can help agencies set strong foundations for even the most challenging and complex projects and programs.

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