Automation Trends and the Impact of Enabling Technology

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Agenda

- Navis Automation Update

- Automation Trends

- Logical Progression of Enabling Technology

- Strategic Concerns

- The Implementation Experience

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Recent Navis Automation Experience

APMT - VA
Live 7-07

Euromax
Live 7-08

Recent Experience

Freeport
Analysis Phase

Phase V - 350M Berth & Stacking Area
Status: FUTURE PLAN

Antwerp
In Final Testing

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Stevedoring Transport Options Supported by Navis

AGV

Lift AGV

Shuttle

Tractor

Automated Terminal Rail Crane Direction

APMT
(Manned RTG)

Euromax
(Manned RMG)

ECT
(Manned RMG)

Antwerp
(Manned RMG)

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Supported Gate and Yard Systems

OCR Portals

Automatic Inspection and Entry Pedestals

Hand-off Tracking

Exit Pedestals

Photos: APMT, VA

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Automation Trends

Growth of Automation by Type: 2000-2015

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Gate Processing, Vessel & Yard Planning

Container Inventory, Equipment Tracking, Work Instructions, Pooling

Yard Cranes, Housekeeping

Stevedoring Vehicles
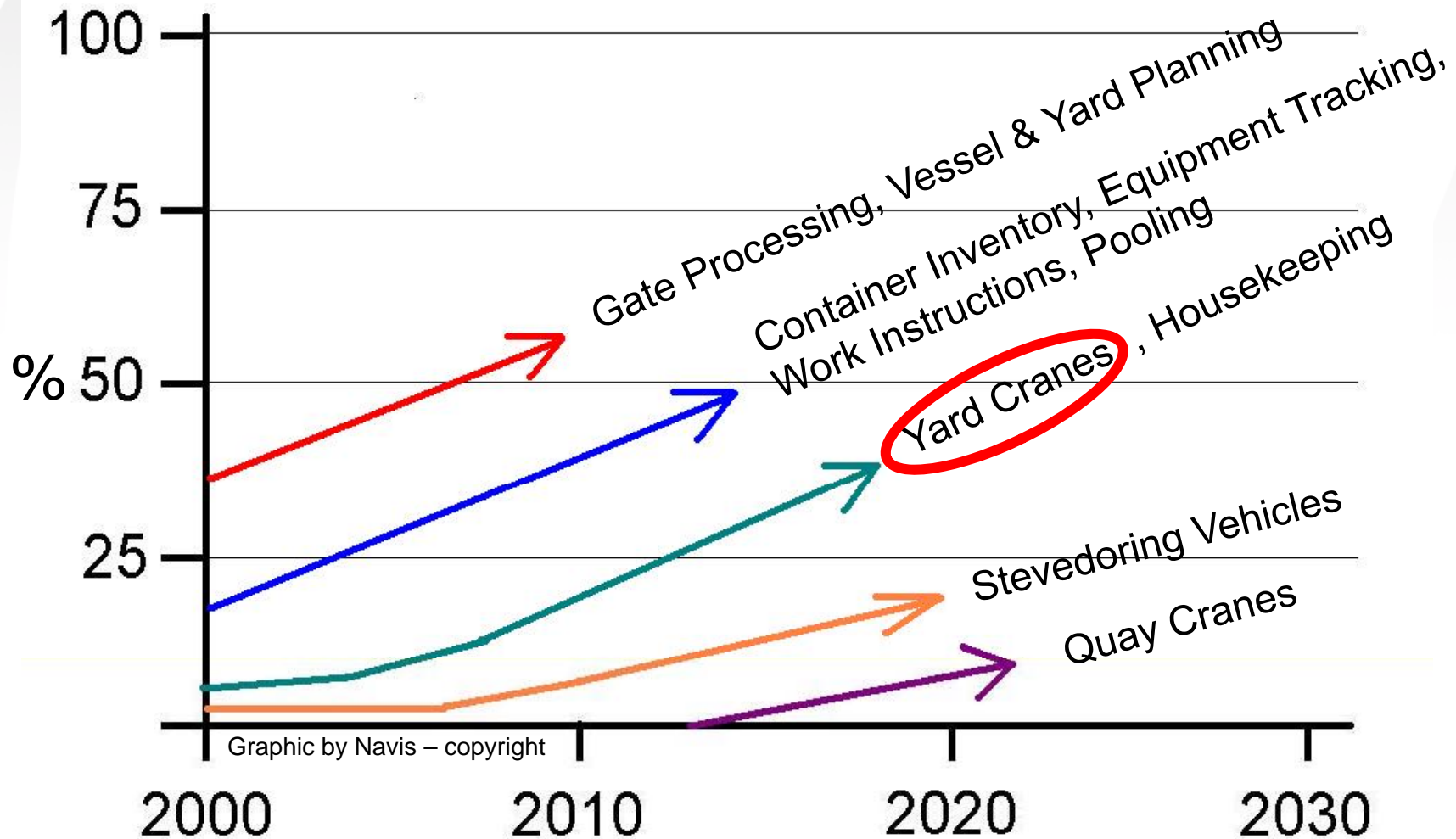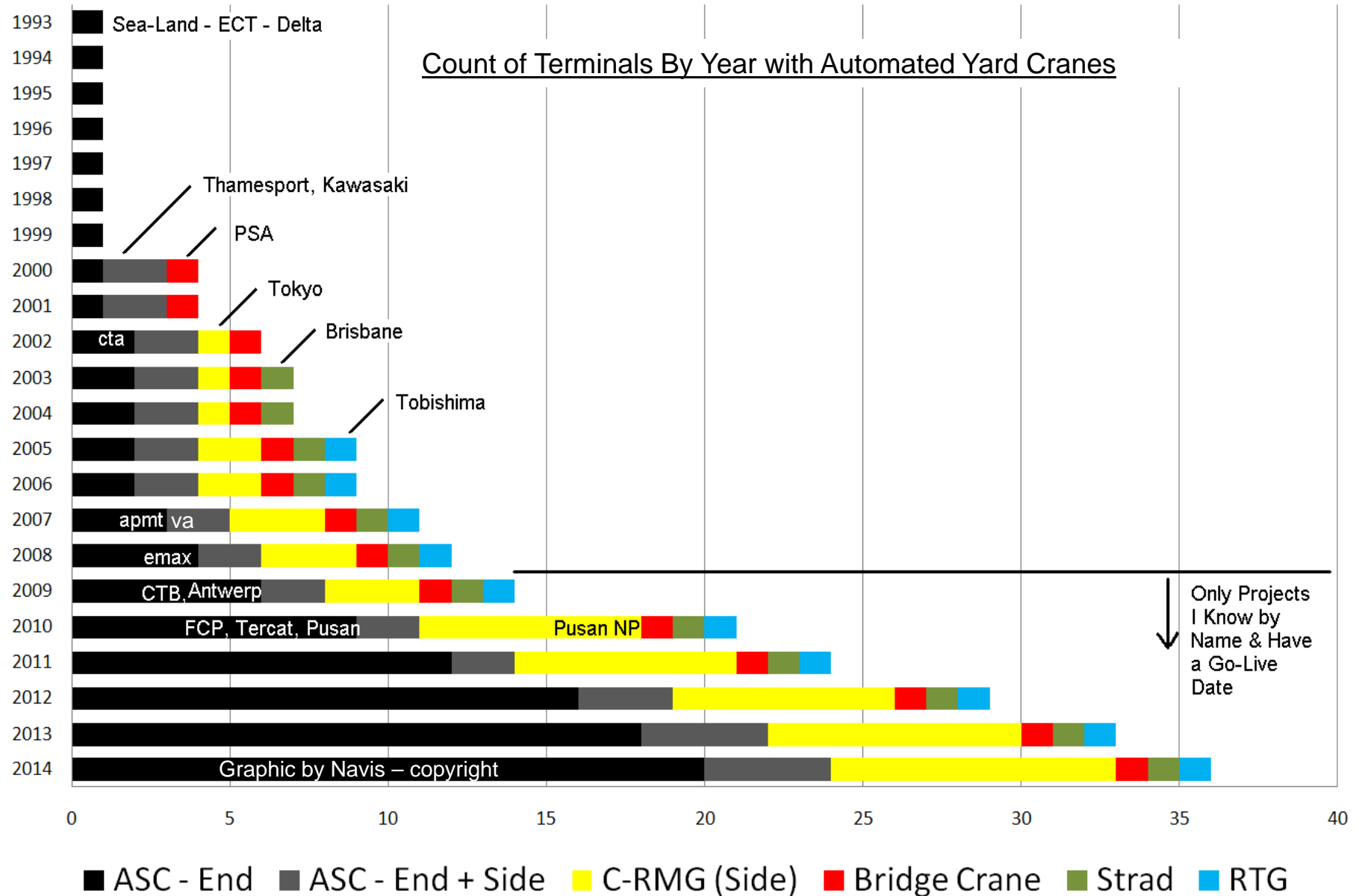
Quay Cranes

Timeline, Terminals with Automated <u>Yard Cranes</u>

Count of Terminals By Year with Automated Yard Cranes

Legend: ASC - End ■ | ASC - End + Side ■ | C-RMG (Side) ■ | Bridge Crane ■ | Strad ■ | RTG ■

Timeline, Terminals with Automated Yard Cranes

Count of Terminals By Year with Automated Yard Cranes

Potential for More "Rumored" Sites

Only Projects I Know by Name & Have

Graphic by Navis – copyright

Legend: ASC - End | ASC - End + Side | C-RMG (Side) | Bridge Crane | Strad | RTG

Timeline, Terminals with Automated Yard Cranes

Graphic by Navis – copyright

Legend: ASC - End | ASC - End + Side | C-RMG (Side) | Bridge Crane | Strad | RTG

Labels on chart: Sea-Land - ECT - Delta; Thamesport, Kawasaki; PSA; Tokyo; Brisbane; Tobishima; cta; apmt va; emax; CTB, Antwerp; FCP, Tercat, Pusan; Pusan NP

Green-Field Sites

CTB & DPW Antwerp: First Live Conversions, (Both Strad Ops)

Only Projects I Know by Name & Have a Go-Live Date

Logical Progression of Enabling Technology

Technology Building Blocks that Facilitate Incremental Automation

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- Gate Processing, Vessel & Yard Planning
- Container Inventory, Equipment Tracking, Work Instructions, Pooling
- Yard Cranes, , Housekeeping
- Stevedoring Vehicles
- Quay Cranes

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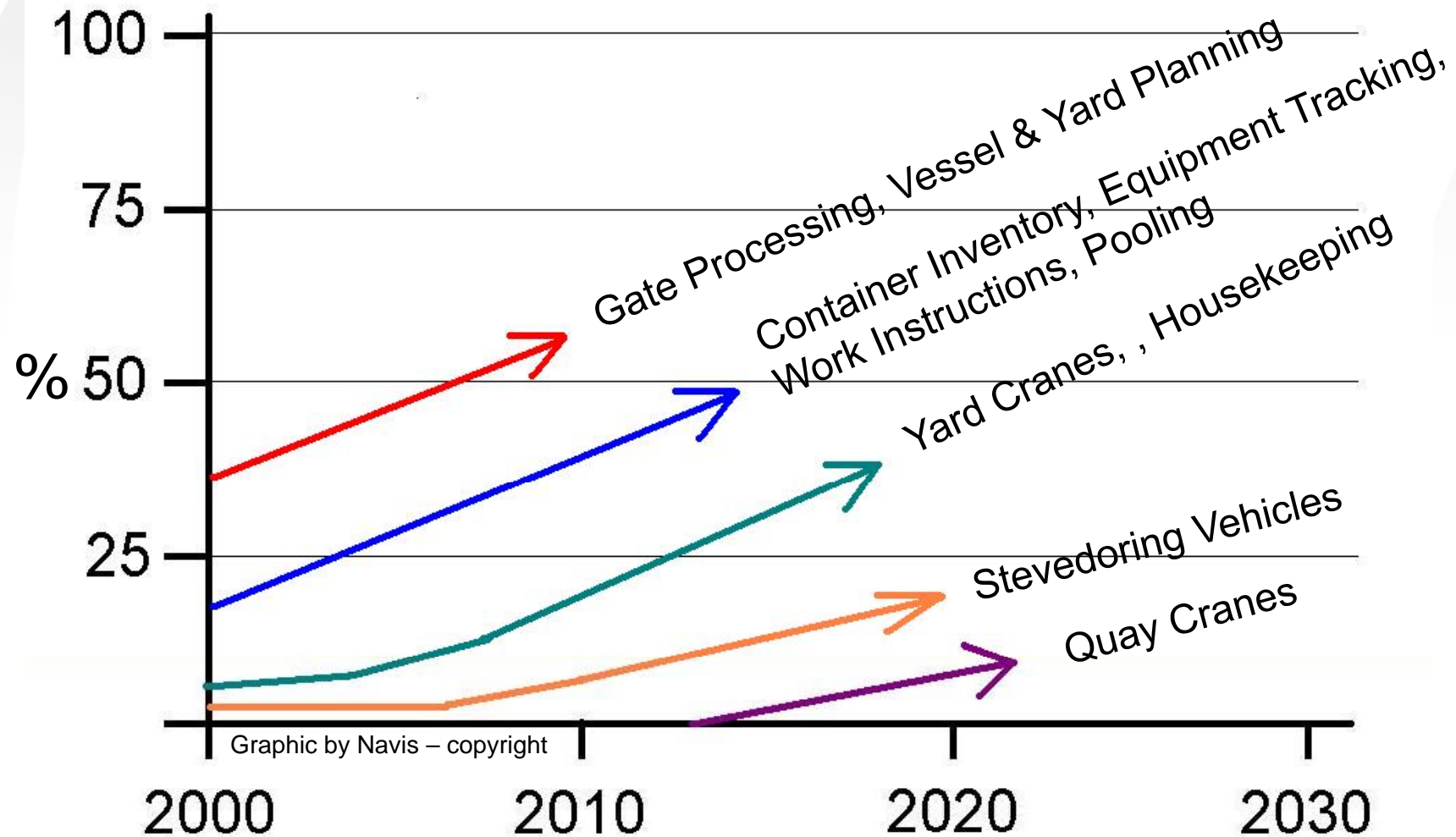
Greenfield vs. Retrofit

- **Greenfield:**
  - » Shopping Cart Decision
- **Retrofit:**
  - » 1. Phase type of Automation:
    - » Tracking, then Control, then Yard Cranes
  - » 2: Phase by Area
    - » Total Replacement, one space at a time
    - » New Paradigm

NYCT Plans to Develop Adjacent Greenfield then Retrofit Original Terminal

Proposed Berth 4 Development

ARTHUR KILL

BERTH 1

BERTH 2

BERTH 3

BERTH 4

CHASSIS

CHASSIS

ENTRANCE ROAD

WESTERN AVE

RICHMOND TERRACE

DMJM Harris Graphic

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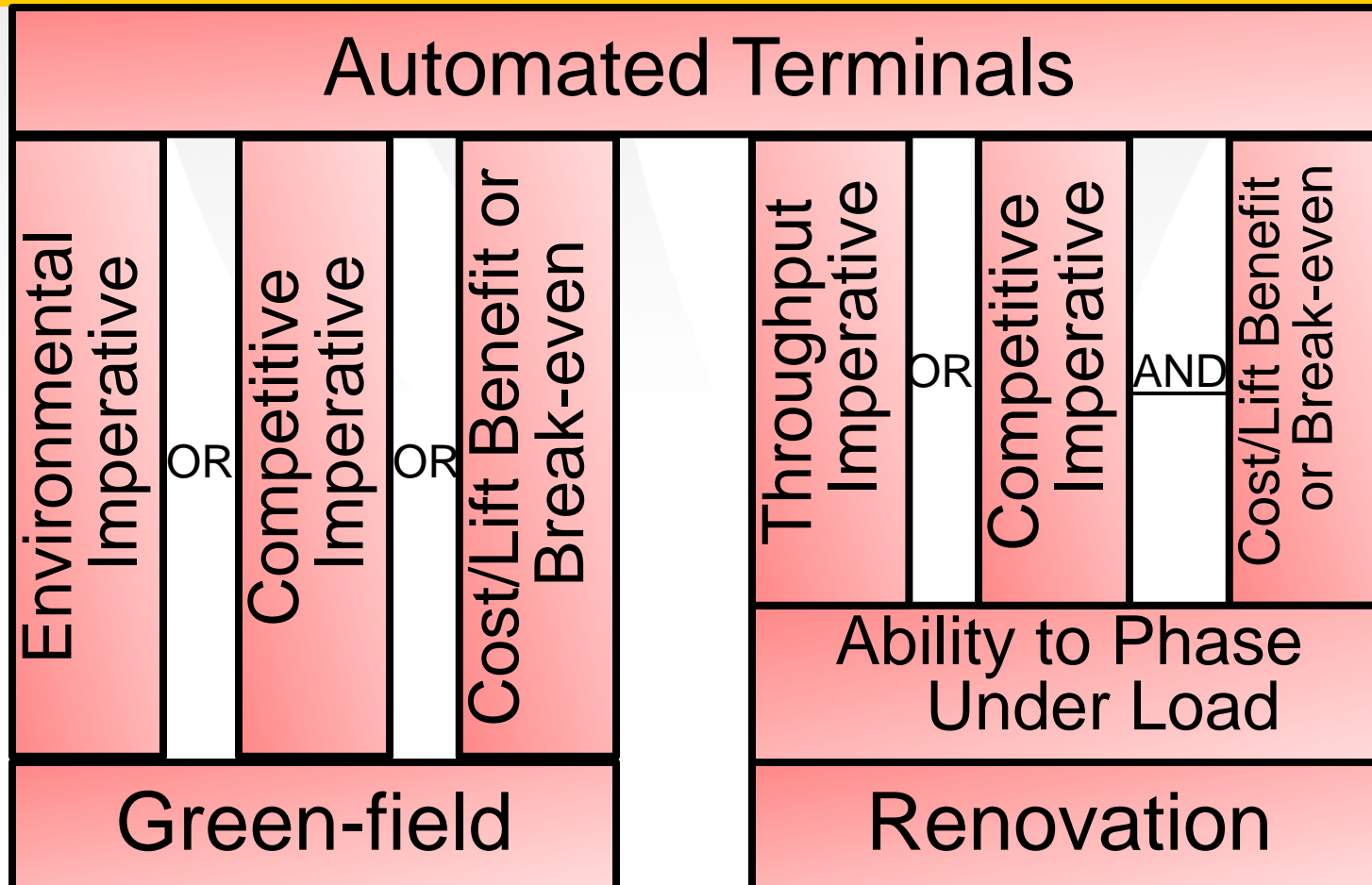Zebra Enterprise Solutions

What Can we do for Conventional Terminals?

- Position Tracking (PDS), Expert Decking and Automated Work Instructions Enable:

- Congestion Management Systems
  » e.g. GPA, Savannah

- Yard Vehicle Pooling (Prime Route)
  » e.g Deltaport, Vancouver

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Strategic Concerns

What are Enablers and Drivers for A.T.'s?

Automated Terminals

Environmental Imperative OR Competitive Imperative OR Cost/Lift Benefit or Break-even

Throughput Imperative OR Competitive Imperative AND Cost/Lift Benefit or Break-even

Ability to Phase Under Load

Green-field

Renovation

Long-term Planning/Pay-back Horizon

Financial Strength and Adequate Throughput

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Strategic Questions for Operator

- How Much Will Customer Take On?

- Repeat vs. Invent Automation Scenario?

- Speed of Required Delivery ?

- Stevedoring Transport Automation?

- Scale of System Integration Required?

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Automation Challenge Varies by Yard Type
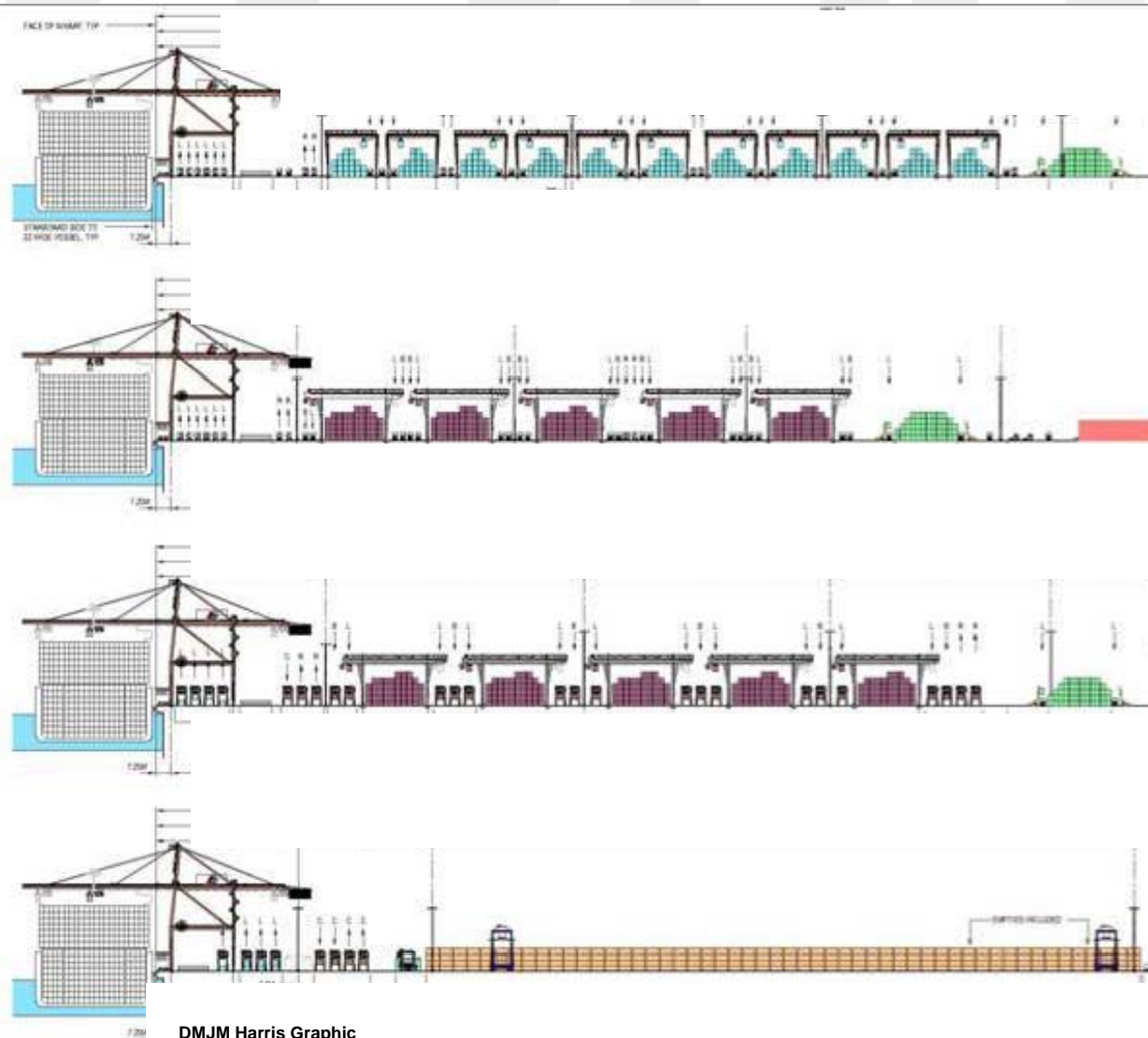
Ensure Truck vs. RMG Safety

More Difficult Truck Position Verification

Defined & Controlled Interfaces

DMJM Harris Graphic

Automation Implementation: The Experience

Representative Sample Automated Terminal Development Schedule:
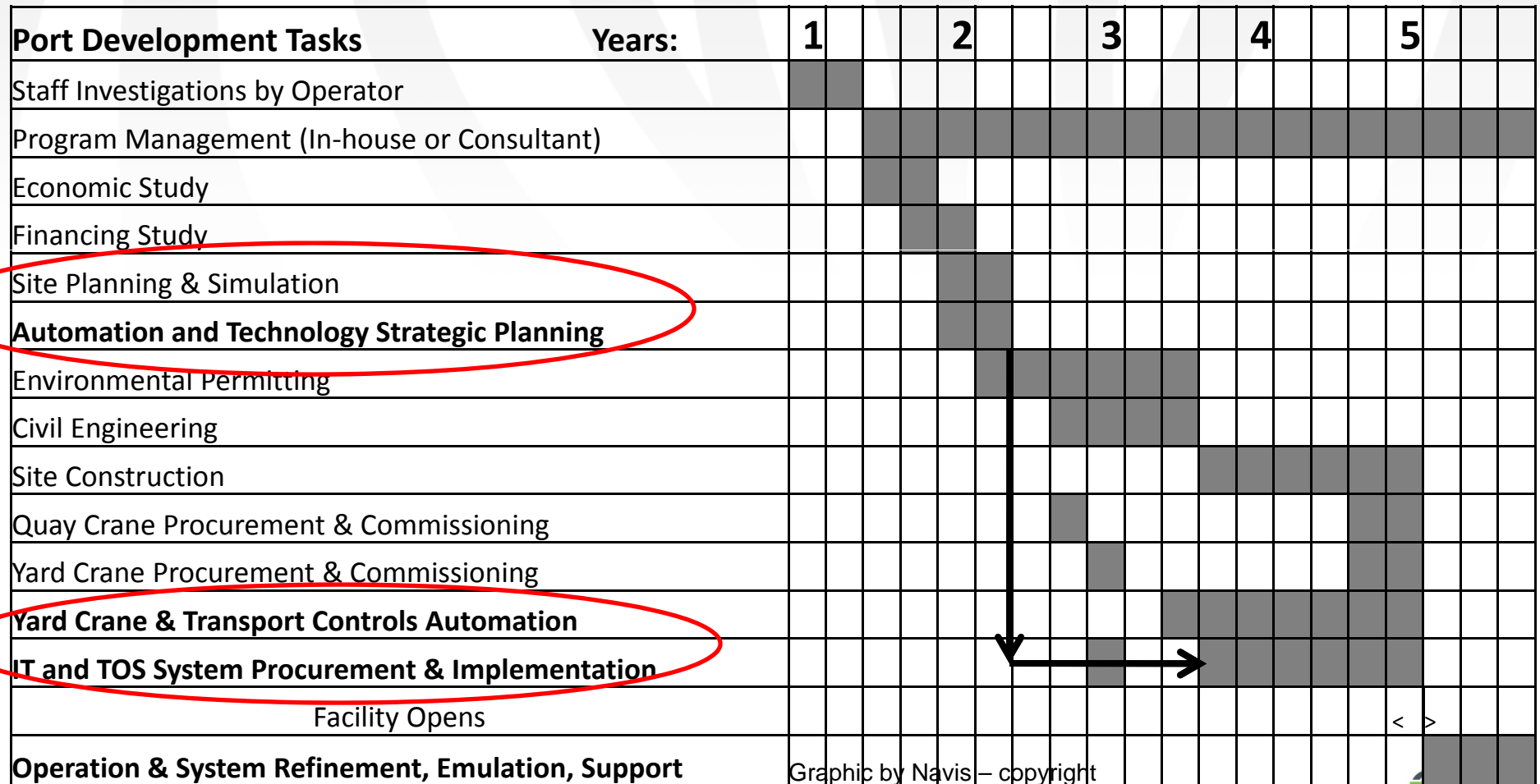
Port Development Tasks	Years:	1			2		3		4		5		
Staff Investigations by Operator													
Program Management (In-house or Consultant)													
Economic Study													
Financing Study													
Site Planning & Simulation													
Automation and Technology Strategic Planning													
Environmental Permitting													
Civil Engineering													
Site Construction													
Quay Crane Procurement & Commissioning													
Yard Crane Procurement & Commissioning													
Yard Crane & Transport Controls Automation													
IT and TOS System Procurement & Implementation													
Facility Opens											<	>	
Operation & System Refinement, Emulation, Support													

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Automation Deployment Process

Automation Planning

Automation Implementation

| Strategic Planning for Automation | Project Initiation, Automation Workshop | Analysis | Custom Development | Testing | Training | Installation & Configuration | Go Live | Support |
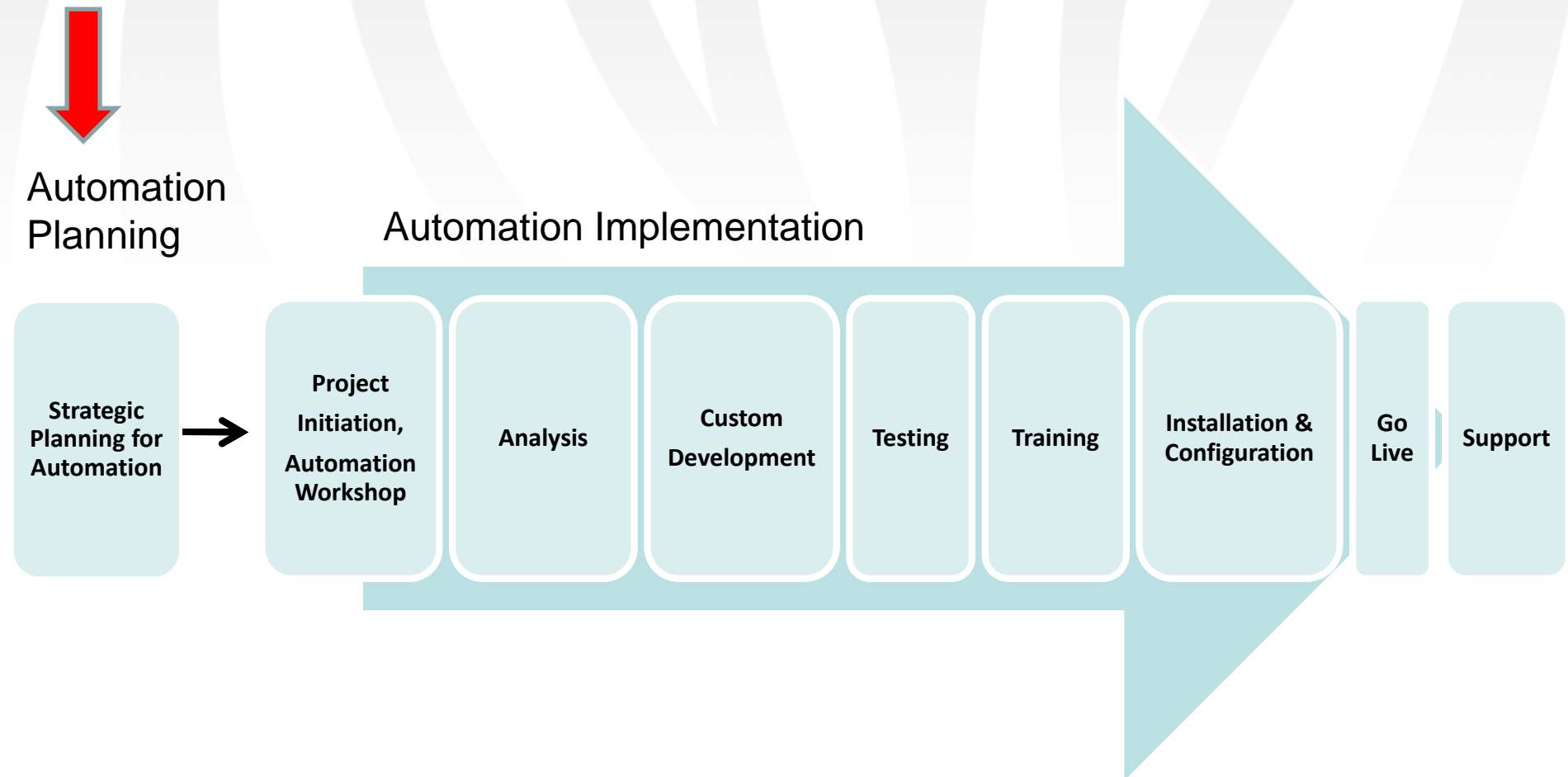
Division of Work: Automation Implementation

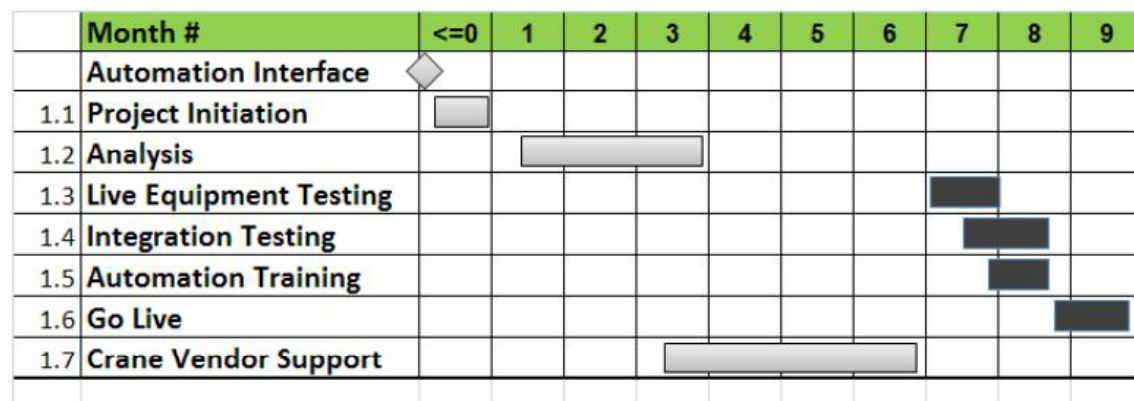- Define Requirements
- Management & Decisions
- Support Testing

Options
- System Integration
- Analysis and Testing

Technology Partners

Operator

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Crane Controls
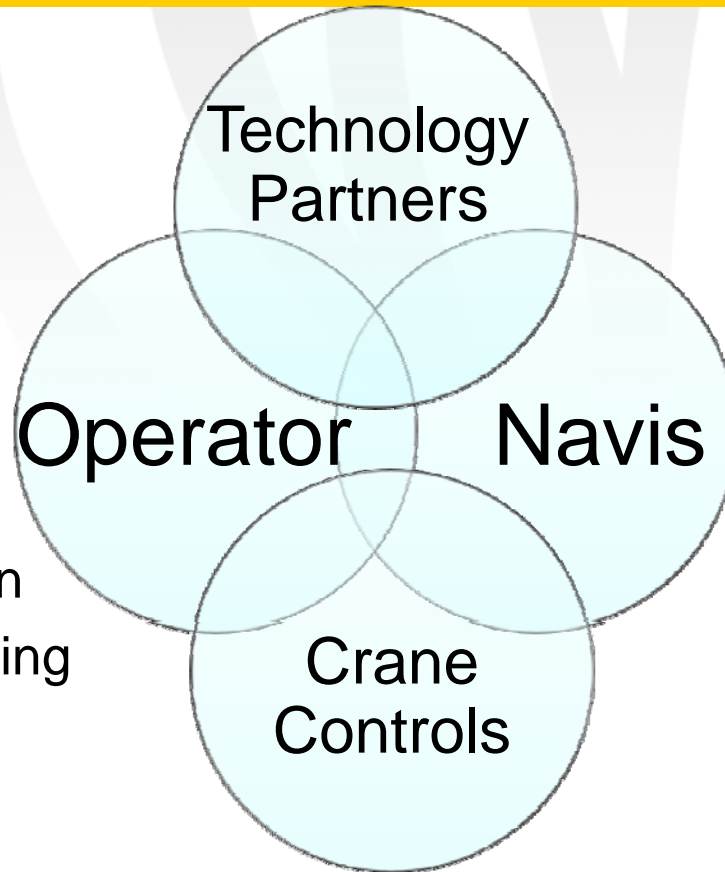
- Analysis Workshops
- Define Solution
- Software
- Testing
- Go-Live
- Tune & Support

Options:
- System Integration
- Build & Manage Technology Team
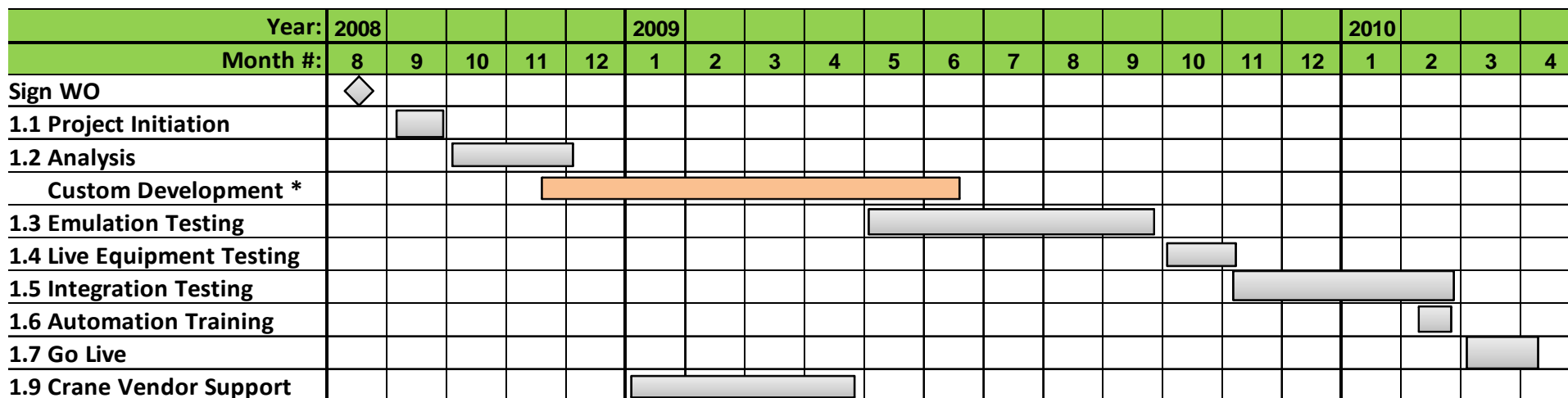
- Testing Cranes
- Integration
- Go-Live

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Representative Schedules

Month #	<=0	1	2	3	4	5	6	7	8	9
Automation Interface	◇									
1.1 Project Initiation	▭									
1.2 Analysis		▭▭▭								
1.3 Live Equipment Testing								▬		
1.4 Integration Testing									▬	
1.5 Automation Training									▬	
1.6 Go Live										▬
1.7 Crane Vendor Support				▭▭▭						

Fast Track
9 months if TOS in Place

Custom Project
18-24 months

Year:	2008					2009												2010			
Month #:	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
Sign WO	◇																				
1.1 Project Initiation		▭																			
1.2 Analysis			▭▭																		
Custom Development *				▬▬▬▬▬▬▬																
1.3 Emulation Testing									▭▭▭▭												
1.4 Live Equipment Testing															▭						
1.5 Integration Testing																▭▭▭					
1.6 Automation Training																		▭			
1.7 Go Live																			▭		
1.9 Crane Vendor Support						▭▭▭															

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Automation Project Keys to Success

- **Plan Ahead for Sufficient Time!**

- **Get Software/TOS Provider Involved Early**
  - » Strategic Technology Planning

- **Plan for Adequate Staffing:**
  - » Customer Side
  - » System Integration

- **+ Usual Project Management**
  - » Executive Sponsorship
  - » Active Involvement from Operations
  - » Strong Tight Scope Definition and Control
  - » Budget, Schedule, and Quality Tracking

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Questions?

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