



**4th Hemispheric Conference on Competitiveness,
Innovation and Logistics: TECHNOLOGY AT THE
SERVICE OF THE VALUE CHAIN
1st Latin American Meeting of the International
Association of Ports and Harbors**

April 2, 2019

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MARAD

U.S. MARITIME ADMINISTRATION



46 USC 50302

Mission

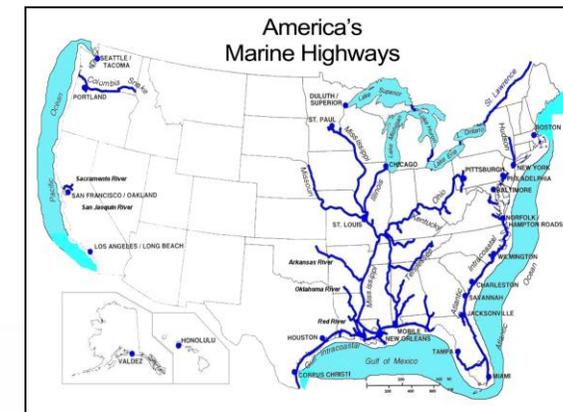
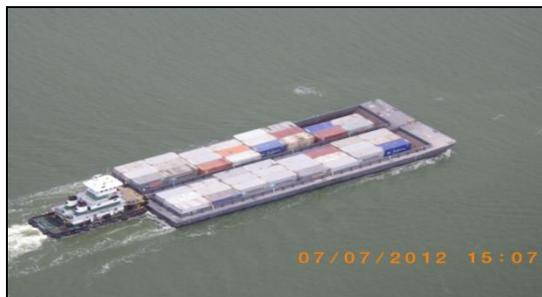
To lead the development and expansion and modernization of port infrastructure, including water, road, and rail, for the benefit of every American.

Vision

A modern, efficient system of diverse modern inland and coastal ports that are integrated into the surface transportation system.

Growing Congestion and the Marine Highway Solution

- International trade growth can only increase congestion.
- Landside infrastructure can't support the growth. Roads and railroads are near capacity, are costly, and take decades to expand.
- The U.S. moves about 6% of freight by water
 - ✓ Europe - 40%
- The U.S. has about 25,000 miles of coastal and inland waterways that are operating below capacity.





Benefits of continued program funding support

Year	Containers (TEUs)	Truck Miles Avoided		Road Maintenance Savings	Congestion Savings	Total Value
		Urban	Rural			
2016	35,215	1,655,105	1,655,105	\$ 942,262	\$ 594,995	\$ 1,537,257
2017	83,394	3,919,518	3,919,518	\$ 2,231,408	\$ 1,409,031	\$ 3,640,439
*2018	113,300	5,325,100	5,325,100	\$ 3,031,615	\$ 1,914,325	\$ 4,945,940
Sub total						\$ 10,123,636

2016 – One Marine Highway service operating (64 Express)

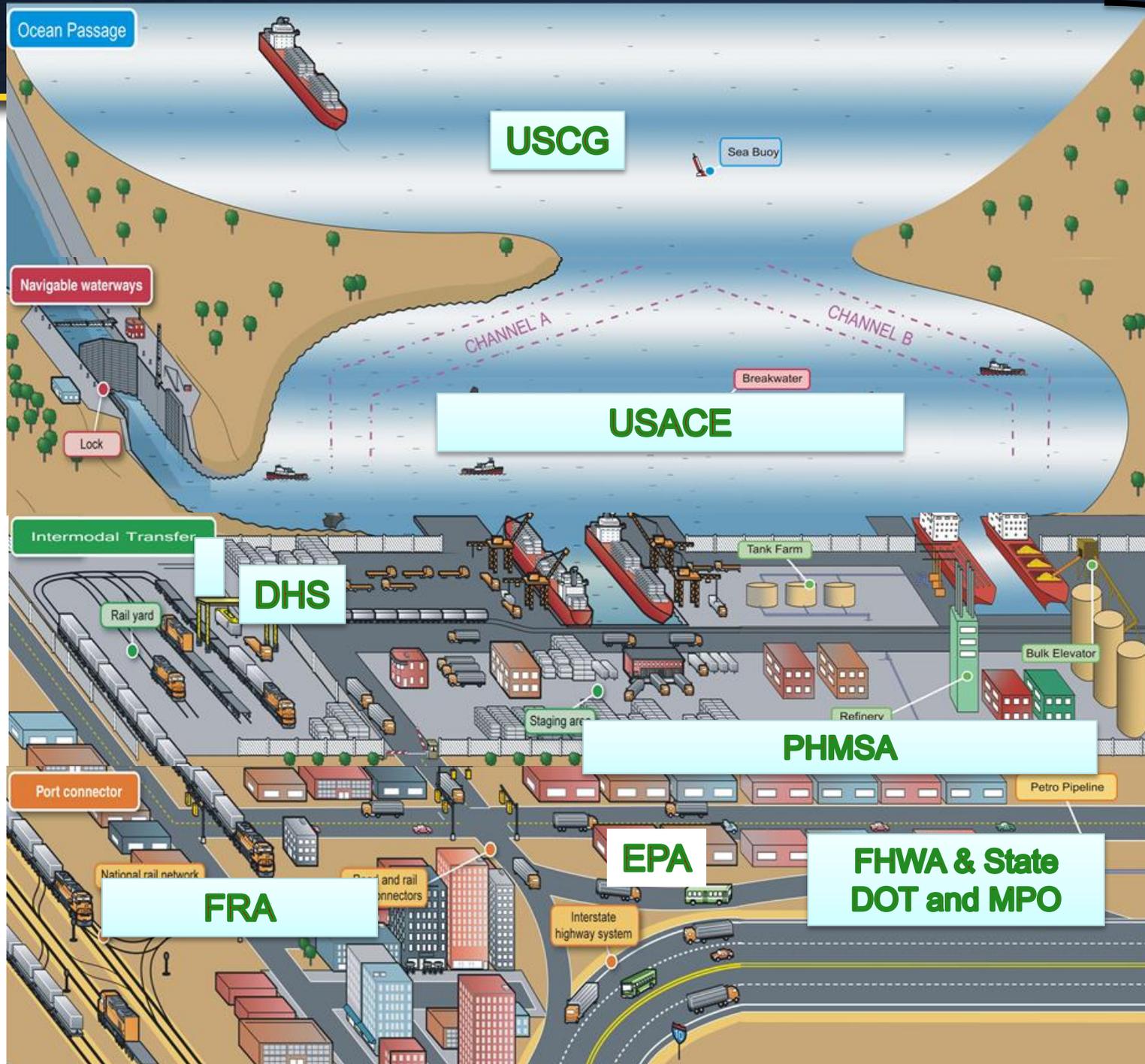
2017 – Two Marine Highway services operating (+ Baton Rouge-New Orleans)

2018 – Three Marine Highway services operating (+ NY Cross Harbor Service)



**America's
Marine Highways**

U.S. Department of Transportation



U.S. Department of Transportation
Maritime Administration

Port Planning & Investment Toolkit

A Maritime Industry Joint Venture

- A **joint venture** between AAPA and MARAD
- The toolkit modules can be used to help ports:
 - Evaluate port conditions
 - Define problems
 - Plan thoroughly
 - Navigate the preplanning process
 - Engage private partners
 - Present actionable needs to administrators
 - Access available funding
 - Complete project
- Toolkit helps **ports obtain funding**

Ongoing ITS JPO Initiatives

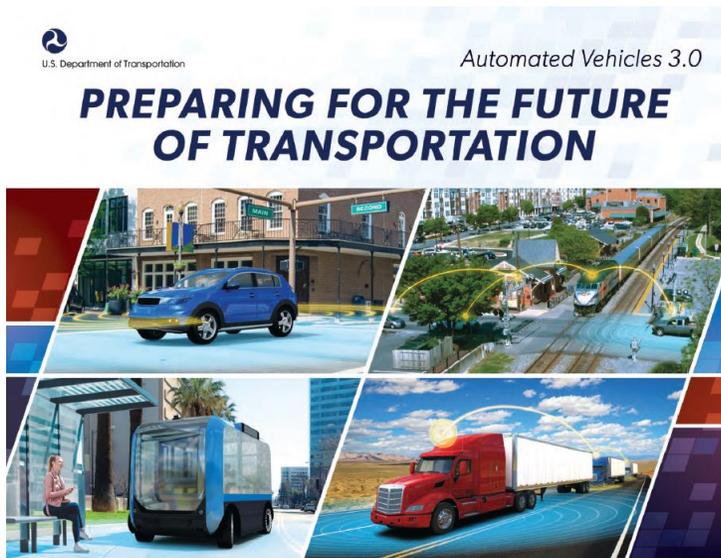
- Intelligent Transportation Systems Joint Program Office (ITS JPO) Mission Statement:

“Conduct research, development, and education activities to facilitate the adoption of information and communication technology to enable society to move more safely and efficiently.”

- *ITS Strategic Plan (2015-2019)* ... One of two key strategic priorities:

“Advancing Automation: Shapes the ITS Program around the research, development, and adoption of automation-related technologies as they emerge.”

AV 3.0 highlights automation for ports



Automation to Support Intermodal Port Facility Operations

Automation has the potential to transform the Nation's freight transportation system, a vital asset that supports every sector of the economy. Intermodal port facilities could benefit from applications of automation, enabling more seamless transfers of goods and a less strenuous experience for operators. The Maritime Administration (MARAD) and FMCSA are jointly exploring how SAE Level 4 truck automation might improve operations at intermodal port facilities. Currently at many of the Nation's busiest ports, commercial vehicle drivers must wait in slow-moving queues for hours

to pick up or deliver a load. MARAD and FMCSA are evaluating how automation might relieve the burden on a driver under these circumstances, and, in particular, the regulatory and economic feasibility of using automated truck queuing as a technology solution to truck staging, access, and parking issues at ports. The study will investigate whether full or partial automation of queuing within ports could lead to increased productivity by altering the responsibilities and physical presence of drivers, potentially allowing them to be off-duty during the loading and unloading process.

Previous Work

- **State of the Practice and Business Case Assessment (November 2017)**

Ongoing

- **Port Planning & Investment Toolkit ITS Module (May 2019)**
- **Truck Staging Study (May 2019)**

Future

- **Port Autonomous/Connected Drayage Truck Development and Testing (FY 2019-2021)**

State of the Practice/Business Case Analysis

- Study completed in 2017.
- 20 ITS technologies used at U.S. ports identified; four analyzed in detail:
 - Port Community System (PCS)
 - Queue Detection (QD)
 - Truck Appointment System (TAS)
 - Advanced Transportation/Freight Information and Security Systems (ATMIS/FRATIS)



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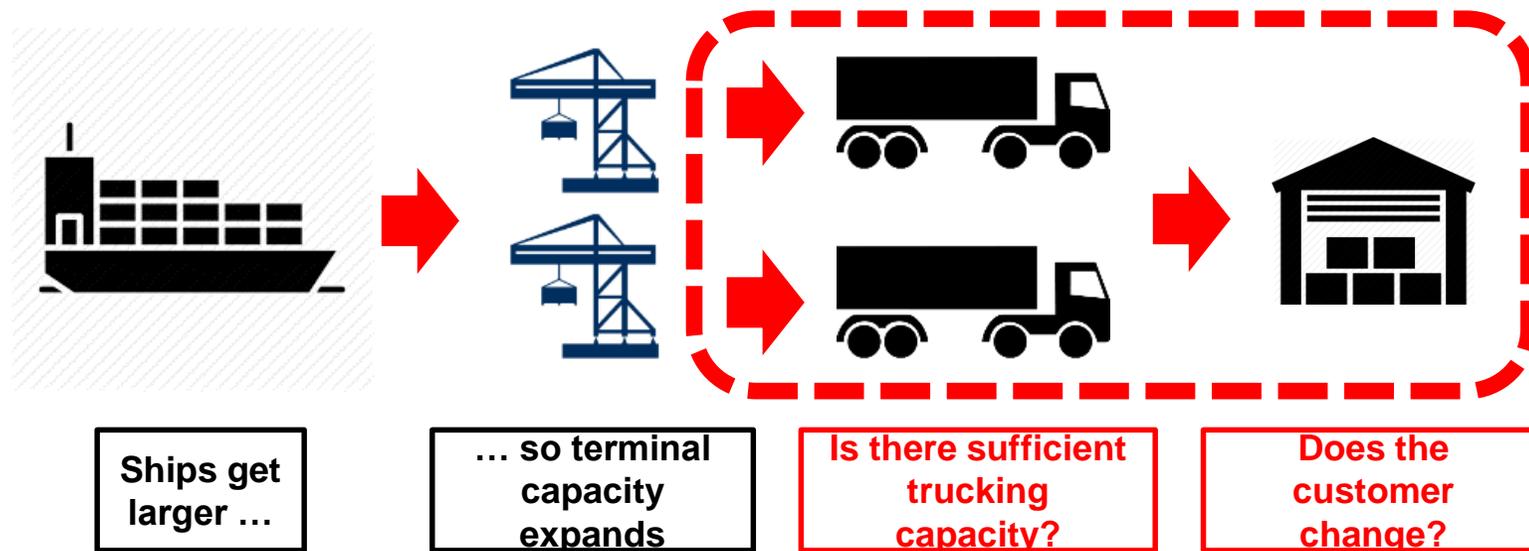
Current Effort: 2017-2019

- A fifth technology beyond the four from the Phase 1 study was analyzed in detail:

Project Objective: “To determine the state of the practice regarding truck staging, including access, queuing, and parking, at maritime ports and to identify port operators’ and trucking industry needs; and to perform an economic feasibility study of automated truck queuing as a technology solution.”

Responding to Volume Growth

- The transition from terminal to drayage trucking firm to customer is often the weakest link when cargo volumes grow.



Can Automation Play a Role in Addressing Terminal Gate Queues?



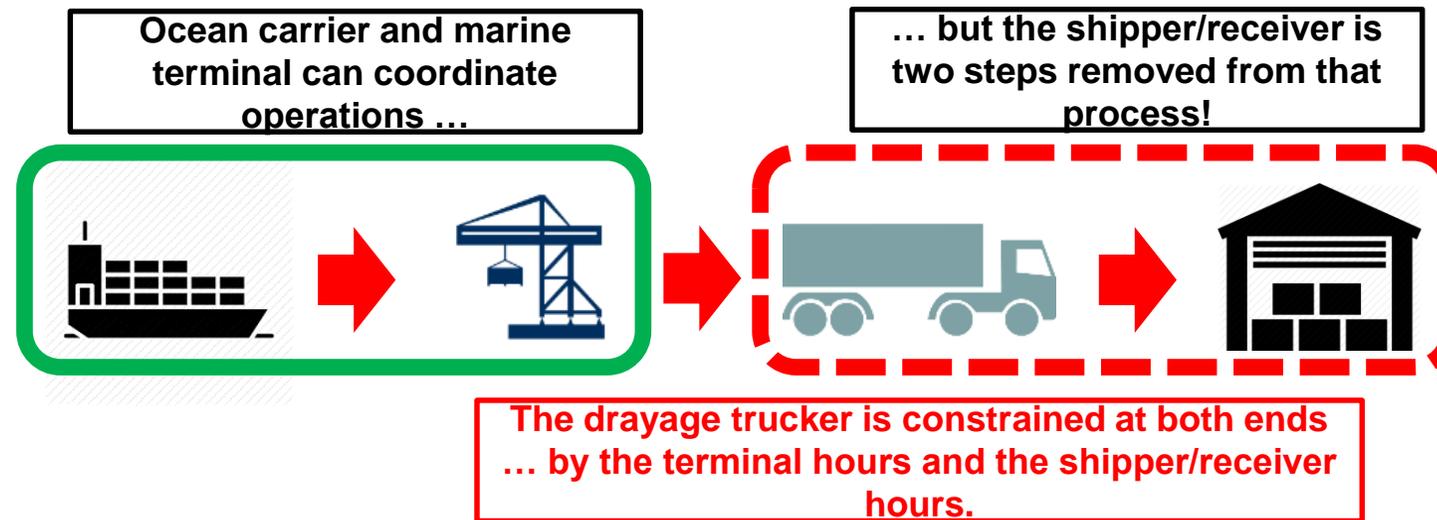
Map data © Google (2019)

Project Approach

- Background Research
- Port Stakeholder Interviews
- Stakeholder Questionnaire
- Economic Analyses
- Findings and Recommendations

Inefficiency of Multiple Processes

- Individual steps may operate relatively efficiently, but the supply chain from start to finish is prone to be highly inefficient. For example ...



Equipment Mismatch Complications

- The container and the chassis often have different owners, different contractual terms for the terminal operator, trucking firm, and shipper/receiver.
- Extra charges for extended use of this equipment (demurrage and per diem) may vary widely!



Photo credit: <https://commons.wikimedia.org/wiki/File:APLcontainer.jpg>
(CartleR255)

Outreach Process: Questionnaire

- Online questionnaire distributed to U.S. port authorities.
- 25 total respondents ... ports ranging from major coastal ports to Mississippi River and Alaska ports.
- 65% of respondents said their ports are facing challenges with delays/queues at terminal gates.
- Increasing cargo surges – one of the primary causes of queuing and truck congestion.
- Even smaller ports are receptive to technology-based solutions to these challenges.
- Many ports have implemented staging areas to mitigate terminal congestion, but as cargo volumes increase the real estate adjacent to port terminals becomes more attractive for other related industrial uses (e.g., warehousing).

Outreach Process: Interviews

- Industry stakeholder interviews conducted in six port regions:
 - New York / New Jersey
 - Savannah
 - Houston
 - Los Angeles & Long Beach
 - Seattle & Tacoma
 - Columbus, OH (Inland Port)



Input from Key Port-Related Stakeholders for this Effort

- **Port Authorities**
- **Marine Terminal Operators**
- **Drayage Trucking Firms**
- **Freight Railroads**
- **Industry Advocacy Groups**
- **State & Municipal DOTs**
- **Metropolitan Planning Organizations (MPOs)**
- **Freight Technology Developers**

Sample Interview Questions

- Current initiatives to improve efficiency in staging, parking and terminal gate operations.
- Potential strategies for implementation of solutions.
- Potential for implementing technology solutions, with a focus on automated vehicle technology.
- Institutional impediments to implementing improvements.
- Improvements tested or tried in the past but discontinued or eliminated from consideration.

Interview Highlights

- Land use limitations are a constraint, especially for ports in large metro areas.
- Use of automated vehicles at marine ports – likely limited to specific applications.
- Port markets and metro areas are critical considerations (local drayage moves vs. hinterland penetration).
- Increasing cargo surges were identified as one of the primary causes of queuing and truck congestion.
- Single-terminal ports and multiple-terminal ports can function very differently.

Interview Highlights

- **Cargo visibility is critical to efficient operations.**
- **Queues can sometimes be addressed through low-cost operational solutions.**
- **Minimizing container lifts is critical to any strategy for improving operations at port terminals.**
- **Labor agreements are a major consideration.**
- **The complexity of a port operation with multiple players affects the viability of solutions.**

Key Themes

1. **Minimizing turn times and maximizing the number of turns for a drayage trucker is a key to maximizing port efficiency.**
2. **Minimizing the number of lifts for any given container is an important part of accomplishing this.**
3. **Uniform Intermodal Exchange & Facilities Access Agreement (UIIA) generally governs all relationships!**

4 Categories of Potential Solutions

- General measures to expand port capacity or manage demand.
- Measures aimed at staging inbound (into the terminal) trucks and managing queues outside the terminal gate.
- Measures aimed at addressing inside-the-gate queuing and congestion for outbound (out of the terminal) truck moves.
- Measures aimed at automating the transportation process outside the terminal gate by moving cargo from the terminal to an external staging yard through some kind of automated process other than trucks (e.g., monorail or linear-induction technology).

Potential Solutions

- **Group A: Port Staging Technologies and Practices at Marine Terminals using Conventional Trucks**
- **Group B: Automated Truck Technologies**

A – Staging Technologies/Practices – Screened Solutions

- Expanded gate hours
- Appointment system
- Off-site staging/parking
- Appointment system + off-site staging/parking
- Off-site staging/parking with a “virtual gate”
- “Gray box” container system
- Modified chassis pool operations
- Other technology applications

B – Automated Truck Technologies – Screened Solutions

- Automated truck (Level 4) in queue
- Automated truck (Level 4) in queue + off-site staging
- Alternative transport mode to/from off-site staging

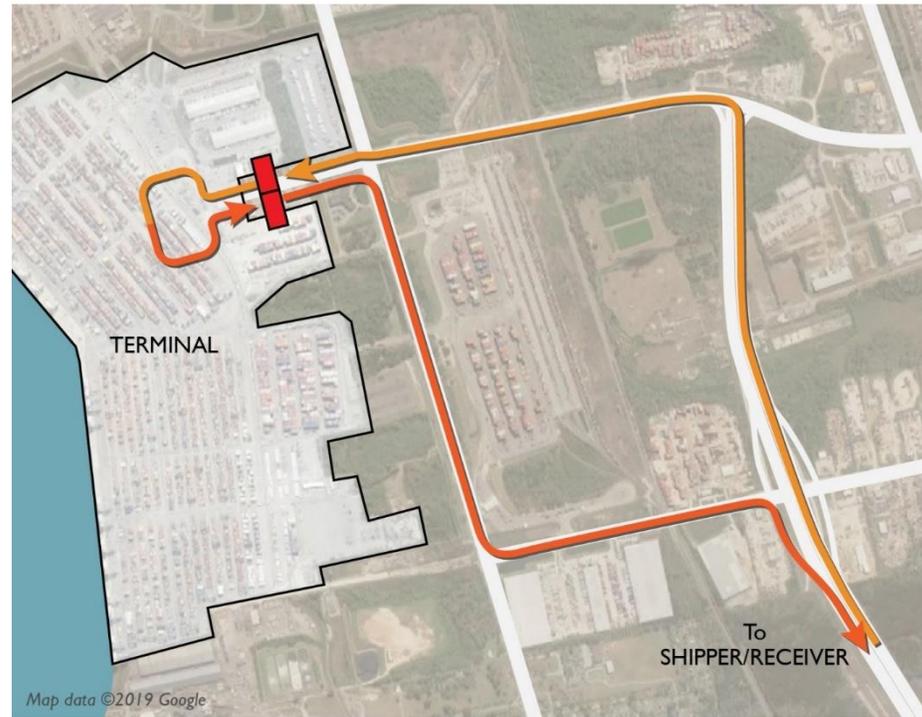


Photo courtesy of Georgia Ports Authority

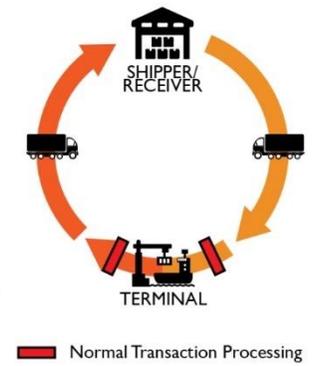
Level 4 Automation

SAE International, Automation Levels	
Level	Description
0	<i>No Automation:</i> Human driver controls all aspects of the driving task.
1	<i>Driver Assistance:</i> Execution of one driving task such as steering or acceleration/deceleration through a driver assistance system.
2	<i>Partial Automation:</i> Execution of multiple driving tasks through driver assistance systems.
3	<i>Conditional Automation:</i> Control of all driving tasks with the expectation that the human driver will respond to a request to intervene.
4	<i>High Automation:</i> Control of all driving tasks even if a human driver does not respond to a request to intervene.
5	<i>Full Automation:</i> Control of all driving tasks under all roadway and environmental conditions.

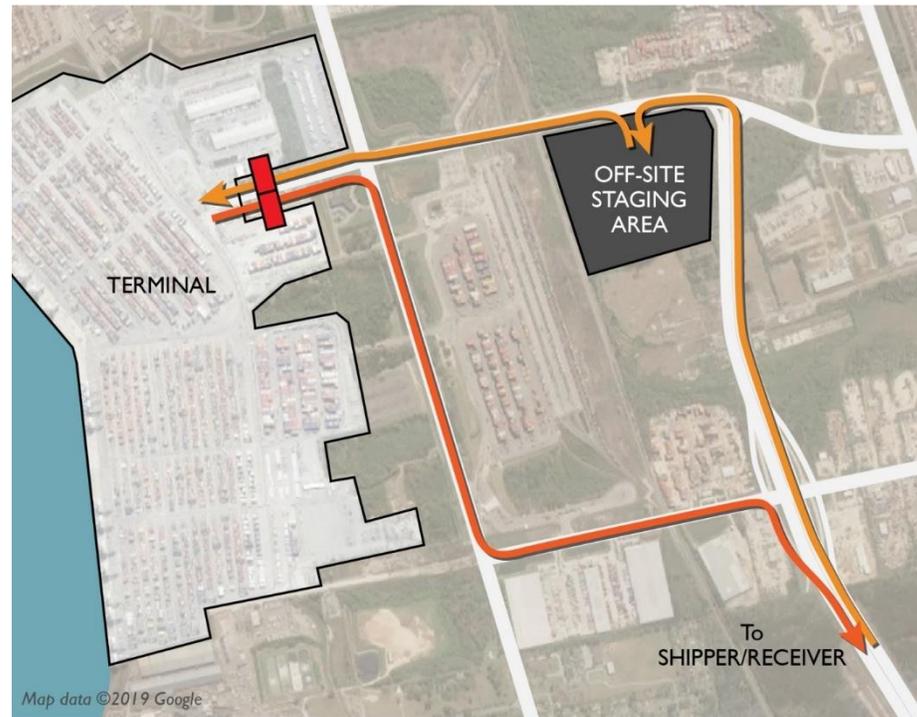
Typical Terminal Operation



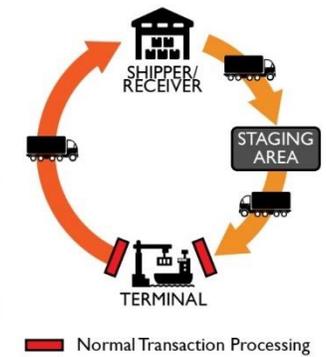
TYPICAL MARINE
 TERMINAL OPERATION



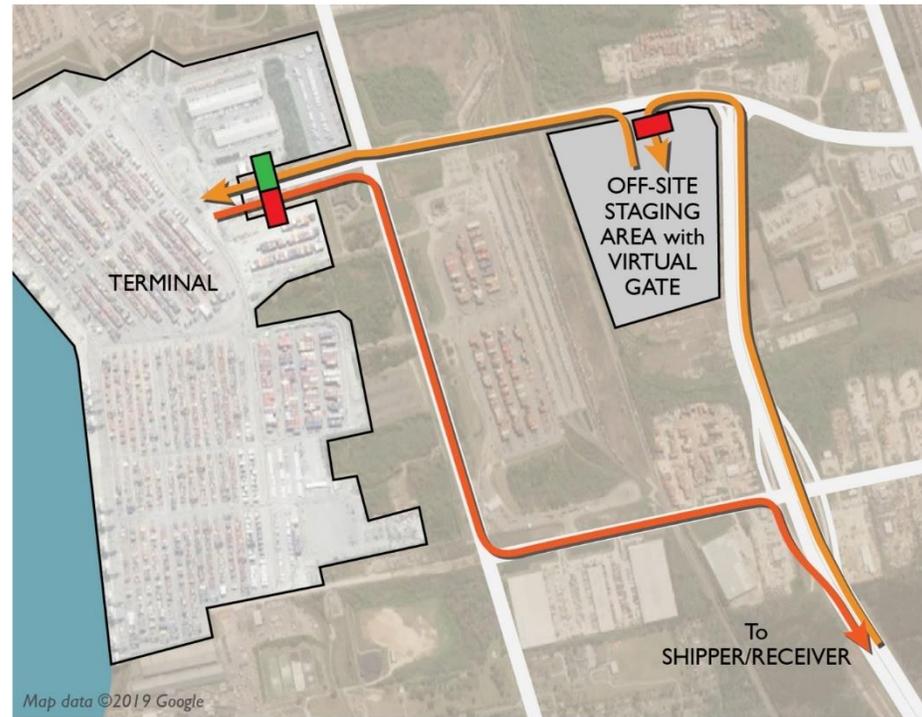
Off-Site Parking/Staging



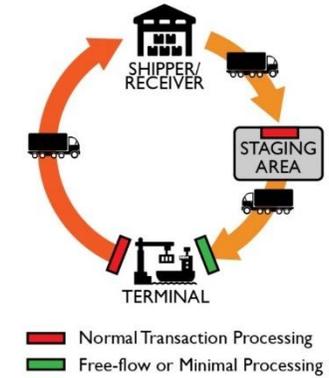
SOLUTION A-I:
 OFF-SITE PARKING/STAGING



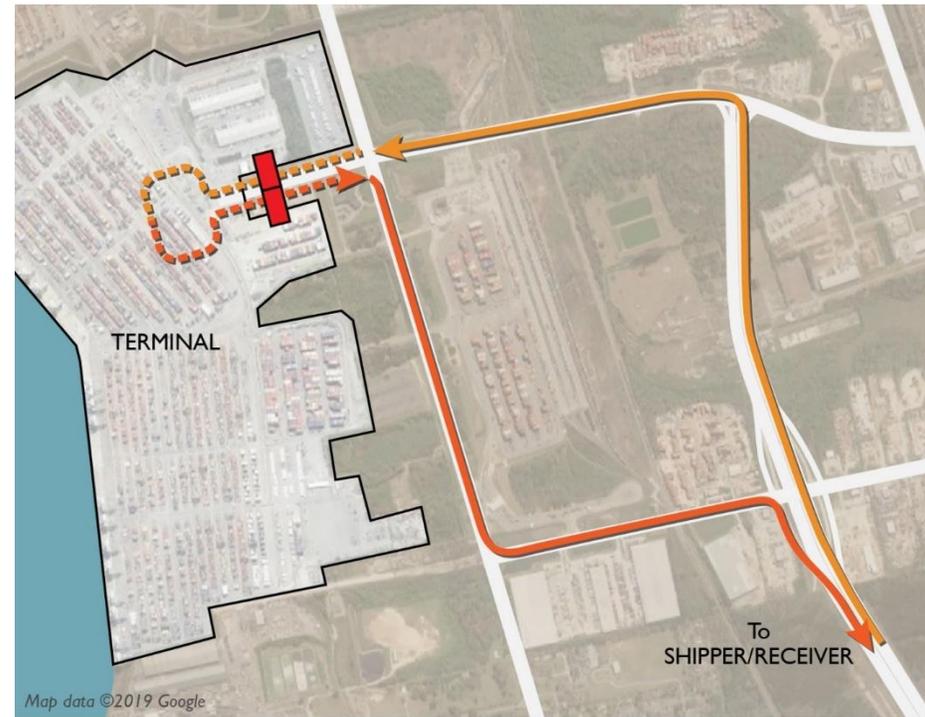
Off-Site Staging + Virtual Gate



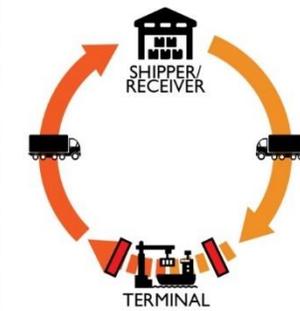
SOLUTION A-2:
 OFF-SITE PARKING/STAGING
 with VIRTUAL GATE



Automated Truck in Queue

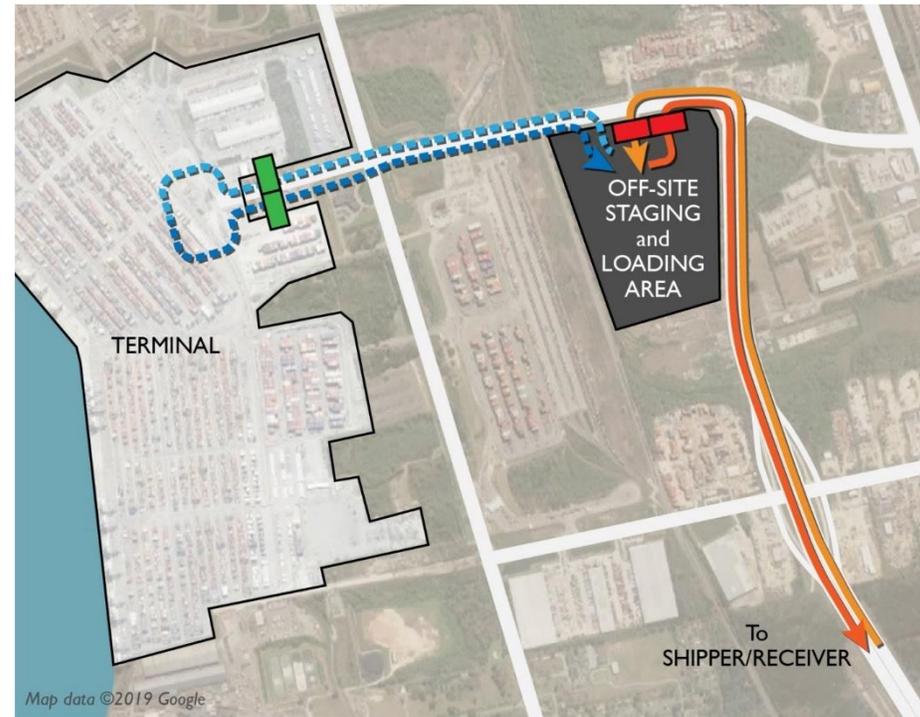


SOLUTION B-1:
 AUTOMATED TRUCK in QUEUE

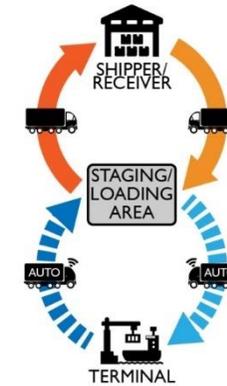


 Normal Transaction Processing
 Automated Vehicle Mode

Automated Truck + Off-Site Staging



SOLUTION B-2:
 AUTOMATED TRUCK in QUEUE
 with
 OFF-SITE PARKING/STAGING



-  Normal Transaction Processing
-  Free-flow or Minimal Processing
-  Automated Vehicle

Solutions Studied for 5 Scenario Locations

- **Generic Port (based on 2017 Business Case Analysis)**
- **Major Urban Port: Local Market (e.g., NY/NJ)**
- **Major Urban Port: Local/Hinterland Market (e.g., Los Angeles)**
- **Minor Urban Port: Hinterland Market (e.g., Savannah)**
- **Inland Port (e.g., Columbus)**

Benefit-Cost Analysis

Costs

- Land (capital)
- Improvements (capital + operating)
- Vehicles (capital + operating)
- Technology (capital + operating)
- Labor (operating)

Quantified Benefits

- Reduction in queue time
- Reduction in gate transaction time
- Reduction in idling emissions
- Fuel savings
- Drayage TMT and THT reductions

Qualitative Benefits

- Congestion reduction
- Improved safety
- Community benefits (i.e., eliminating truck staging in neighborhoods)
- Free up truck parking capacity for long-haul truckers
- Productivity and reliability improvements across the supply chain



Relative Benefit-Cost Ratios

SOLUTIONS	SCENARIOS				
	Generic Port	Major Urban to Local Market	Major Urban to Mixed Market	Minor Urban to Hinterland	Inland Port
Off-Site Staging/Parking	Moderate	Low	Low	Moderate	Moderate
Staging/Parking + Virtual Gate	High	High	High	Very High	High
Automated Truck in Queue	Moderate	Moderate	Moderate	Moderate	Moderate
Automated Truck + Off-Site Staging	Very High	High	High	High	Very High

(Assumes capital amortization at 3% discount)

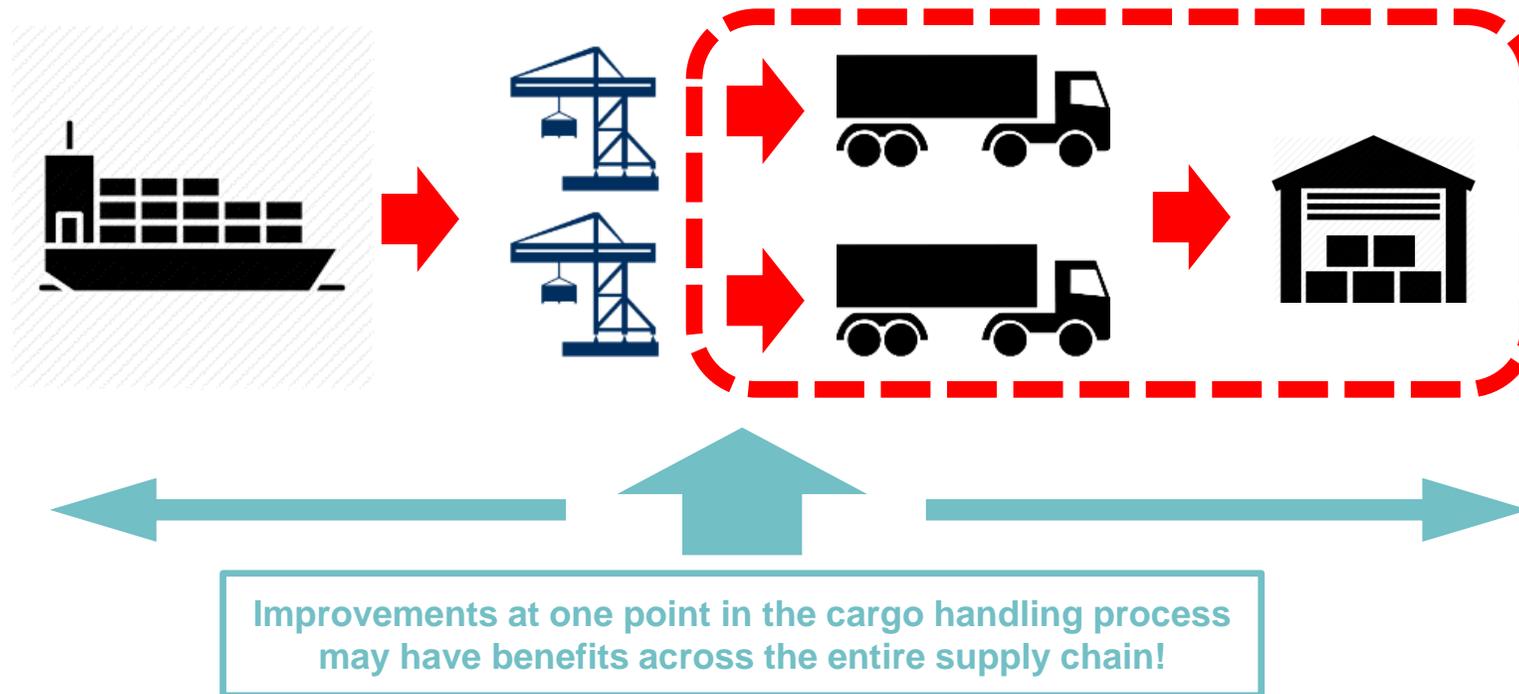
Barriers to Implementation

- Legal and jurisdictional hurdles
- Complexity of marine cargo supply chain
- Labor agreements
- Divergence of costs and benefits across the supply chain – ties to incentives to fund solutions!



Photo credit:
www.pexels.com

Who Pays for Improvements?



Next Steps



- Intermodal Association of North America (IANA) outreach for UIIA issues.
- Research potential automated truck applications with similar constraints such as intermodal and bulk cargo handling.



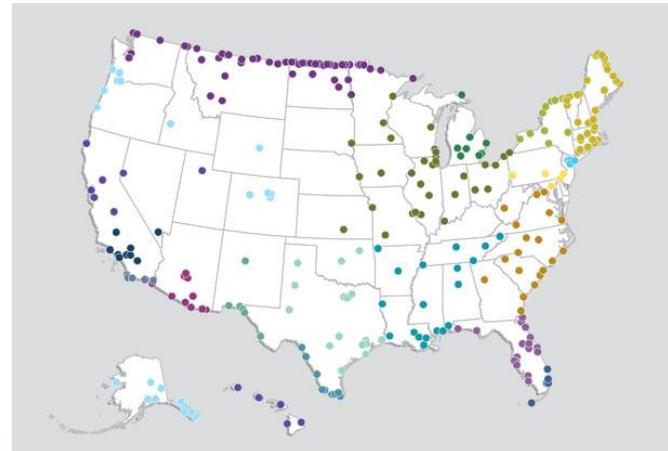
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Next Steps

- Continue industry and public agency stakeholder collaboration in automated vehicle technology development.
- Raise awareness among port owners and operators, State DOTs, and MPOs, as technologies continue to emerge.
- Enable prospective applicants to more effectively compete for USDOT grant opportunities (e.g., INFRA, BUILD, and ATCMTD).
- Continue to survey the global landscape of technology implementation.

Next Steps

- Potential pilot projects at select U.S. ports
 - Major coastal port in large urban area
 - Major coastal port in small city
 - Secondary coastal port
 - Interior river port
 - Inland port



**For more information please
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