In-Transit Visibility: Today's Tools & the Art of the Possible

MARCH 6, 2020

THE EISENHOWER SCHOOL

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THE VALUE OF KNOWING

Speakers

Rosemary Johnston

SVP, Operations

Ed de Bruijn

Director, Technical Program Management

Heather Krieger

Principal Data Scientist

Agenda

Military Logistics Today: RFID & ITV System Overview
Rosemary Johnston

Lessons to Learn: How Commercial Supply Chains Use In-Transit Visibility
Ed de Bruijn

Driving the Future: Data Science & the Supply Chain of Tomorrow
Dr. Heather Krieger

Military Logistics Today:
RFID & ITV System Overview

Rosemary Johnston
SVP, Operations

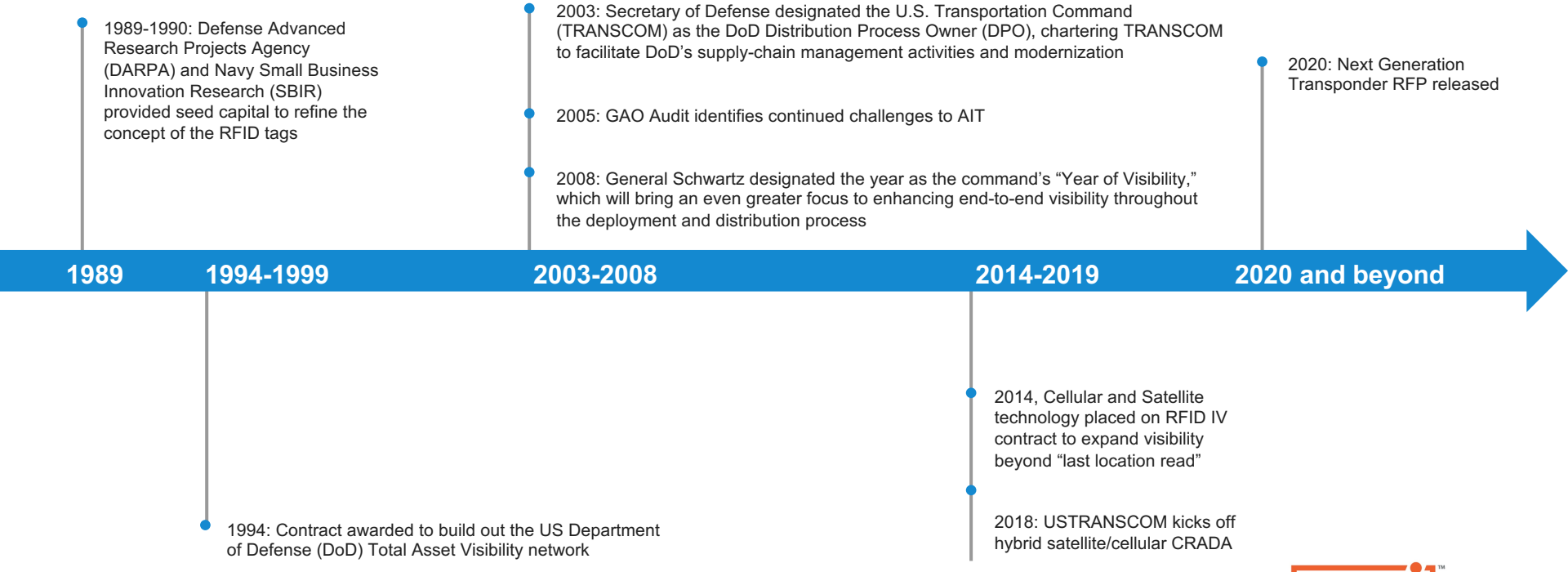
CASE STUDY 1:

Iron Mountain of Spares, 1990 Gulf War

- **40K containers (6.5M tons)** of equipment, supplies and assets descend into supply depots within area of responsibility (AOR) to support Desert Shield
- **Over 50% containers never opened** due to resource constraints
- Lack of knowledge into containers' contents resulted in **reorder of same parts – several times**
- Estimated that **~$2.7BN in parts** were left sitting unused and unaccounted for in the AOR
- Challenges in accountability and supply management led to DARPA investment in finding better ways to track assets and equipment

➔ **RESULT:** Development of current aRFID & RF-ITV infrastructure

Historical Perspective: RFID Tracking & Visibility



How the RF-ITV System Works

Interrogators are placed in warehouse yards, lay-down yards, aircraft marshalling areas

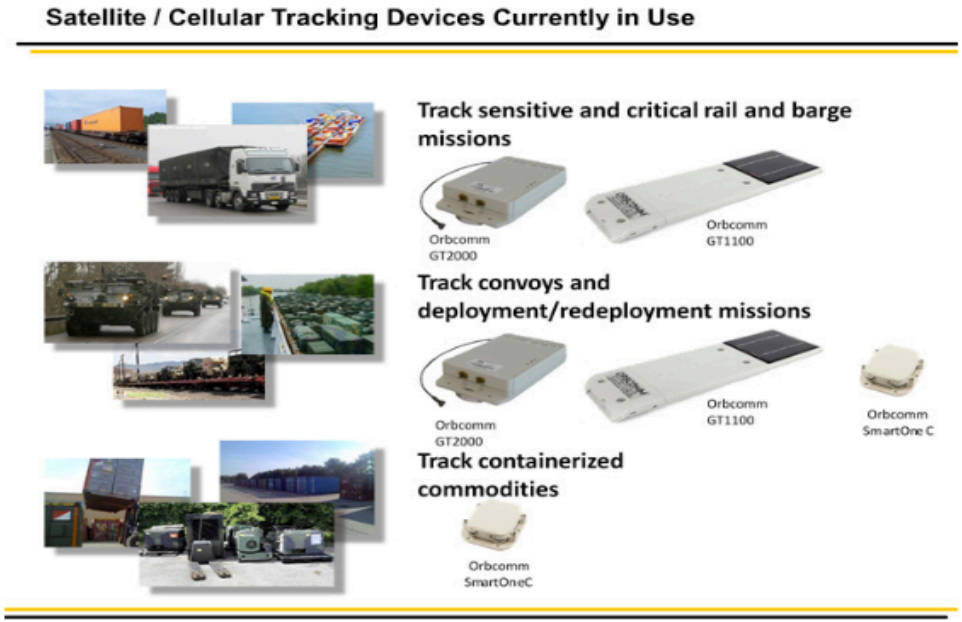
Transponders are mounted to pallets, containers, equipment, other assets

Transponders “wake up” either through scheduled wake-up calls or when a transponder comes within interrogator range

Transponder responds with wake-up acknowledgement

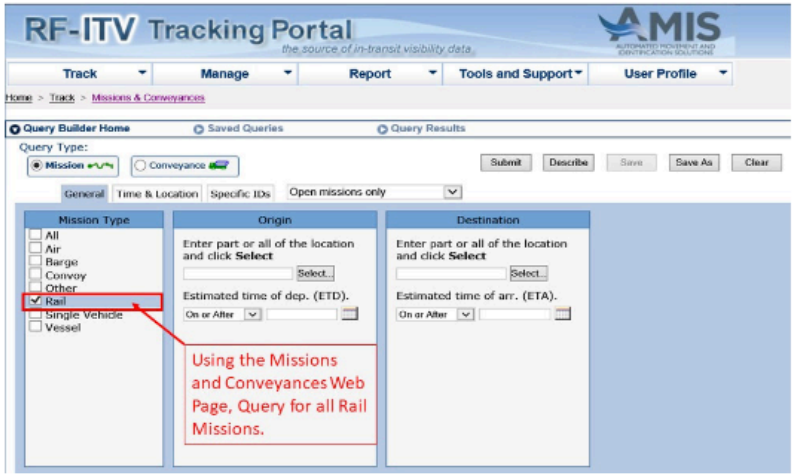
Interrogator assigns date/time stamp and location to the read event and relays information to RF-ITV

RF-ITV: Tracking Using Satellite/Cellular Technology



RF-ITV System: Providing Global In-Transit Visibility Capability
ITV-Portal Sample – Rail Mission

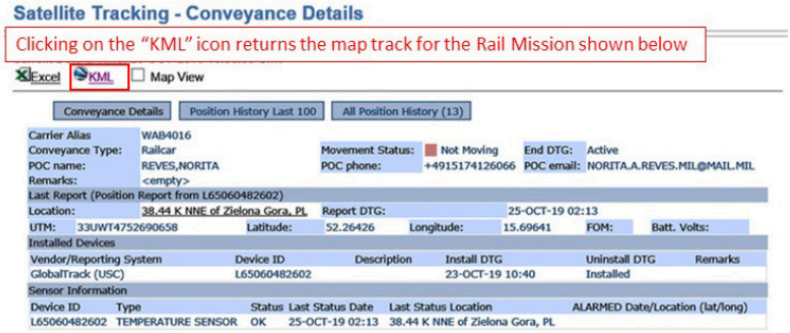
Below is what a rail mission looks like on the RF-ITV Tracking Portal:



The result will look like the next screen shot, showing all of the rail movements reported in a given time period. Now select the mission of interest, as shown in the example below.

The resulting screen will provide you with a wealth of information about the rail movement you selected.

RF-ITV: Satellite Tracking – Details



Satellite Tracking - Conveyance Details

Clicking on the "KML" icon returns the map track for the Rail Mission shown below

Excel | KML | ☐ Map View

Conveyance Details | Position History Last 100 | All Position History (13)

Carrier Alias	WAB4016				
Conveyance Type:	Railcar	Movement Status:	Not Moving	End DTG:	Active
POC name:	REVES,NORITA	POC phone:	+4915174126066	POC email:	NORITA.A.REVES.MIL@MAIL.MIL
Remarks:	<empty>				

Last Report (Position Report from L65060482602)

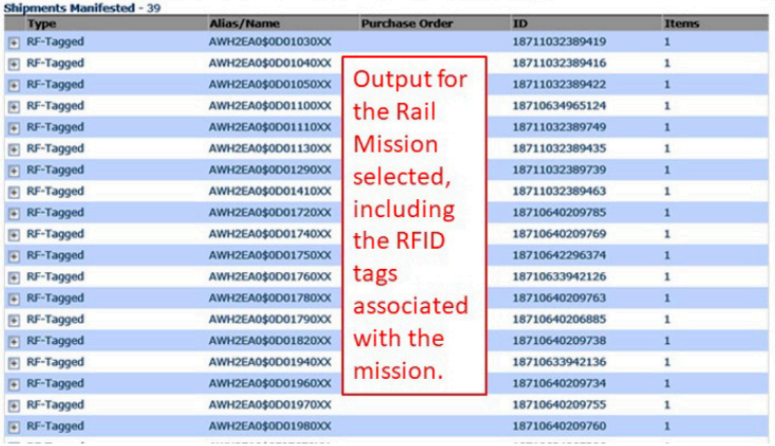
Location:	38.44 K NNE of Zielona Gora, PL			Report DTG:	25-OCT-19 02:13		
UTM:	33UWT4752690658	Latitude:	52.26426	Longitude:	15.69641	FOM:	Batt. Volts:

Installed Devices

Vendor/Reporting System	Device ID	Description	Install DTG	Uninstall DTG	Remarks
GlobalTrack (USC)	L65060482602		23-OCT-19 10:40	Installed	

Sensor Information

Device ID	Type	Status	Last Status Date	Last Status Location	ALARMED Date/Location (lat/long)
L65060482602	TEMPERATURE SENSOR	OK	25-OCT-19 02:13	38.44 K NNE of Zielona Gora, PL	

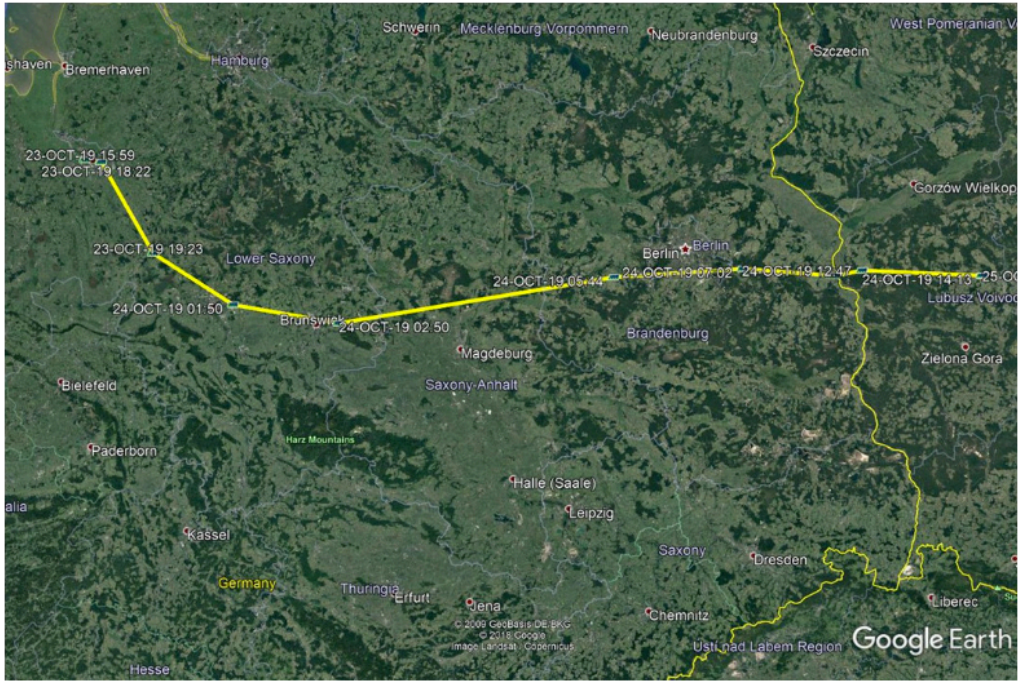


Shipments Manifested - 39

Type	Alias/Name	Purchase Order	ID	Items
RF-Tagged	AWH2EA0$0D01030XX		18711032389419	1
RF-Tagged	AWH2EA0$0D01040XX		18711032389416	1
RF-Tagged	AWH2EA0$0D01050XX		18711032389422	1
RF-Tagged	AWH2EA0$0D01100XX		18710634965124	1
RF-Tagged	AWH2EA0$0D01110XX		18711032389749	1
RF-Tagged	AWH2EA0$0D01130XX		18711032389435	1
RF-Tagged	AWH2EA0$0D01290XX		18711032389739	1
RF-Tagged	AWH2EA0$0D01410XX		18711032389463	1
RF-Tagged	AWH2EA0$0D01720XX		18710640209785	1
RF-Tagged	AWH2EA0$0D01740XX		18710640209769	1
RF-Tagged	AWH2EA0$0D01750XX		18710642296374	1
RF-Tagged	AWH2EA0$0D01760XX		18710633942126	1
RF-Tagged	AWH2EA0$0D01780XX		18710640209763	1
RF-Tagged	AWH2EA0$0D01790XX		18710640206885	1
RF-Tagged	AWH2EA0$0D01820XX		18710640209738	1
RF-Tagged	AWH2EA0$0D01940XX		18710633942136	1
RF-Tagged	AWH2EA0$0D01960XX		18710640209734	1
RF-Tagged	AWH2EA0$0D01970XX		18710640209755	1
RF-Tagged	AWH2EA0$0D01980XX		18710640209760	1

Output for the Rail Mission selected, including the RFID tags associated with the mission.

RF-ITV: Providing Global In-Transit Visibility Capability – Satellite Tracking – Map



This same capability is available for barge and convoy missions.

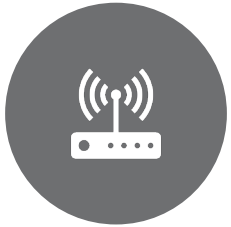
CASE STUDY 2:

DLA Asset Tracking - Challenge

- DLA Distribution is responsible for storing 2.5 million items, valued at approximately $105 billion and service more than 249,000 worldwide customers.
- They required a solution to track their high-value equipment and vehicle assets throughout their distribution centers:
  - Sensors needed to have a long battery life
  - Sensors needed global coverage
  - Rugged and battle-tested

CASE STUDY 2: DLA Asset Tracking - Solution

The DLA Distribution's Red River Army Depot is a 15, 375-acre facility located 18 miles west of Texarkana, Texas.



Savi deployed 23K GPS-powered sensors to the Red River vehicle and heavy equipment storage and reclamation site.

Sensors were activated and then installed on approximately 12K pieces of equipment located throughout the 15K-acre facility.

Savi Visibility™ was provided on a platform-as-a-service(PaaS) basis to transmit read messages, containing latitude, longitude, battery status and date/time to the U.S. Army's RF-ITV system and DLA's asset tracking system

CASE STUDY 2:

DLA Asset Tracking - Results/Impacts

- Provided precise, GPS-verified location of all assets, from anywhere in the 15K-acre depot
- Increased accountability and auditability
- Saved significant manhours

New Technology

Cellular, Satellite, and Hybrid Devices Extend ITV

Leverages state-of-the-art communications capabilities

Eliminates the need for installation of expensive infrastructure

Allows users to select and configure reporting intervals based on their requirements

Testing in place for Defender 2020 exercise

Next Generation Transponder Contract

Anticipate award in March 2020

Includes 4G cellular, Iridium or Iridium-like satellite, and hybrid 4G cellular/Iridium satellite capabilities

Four-year contract

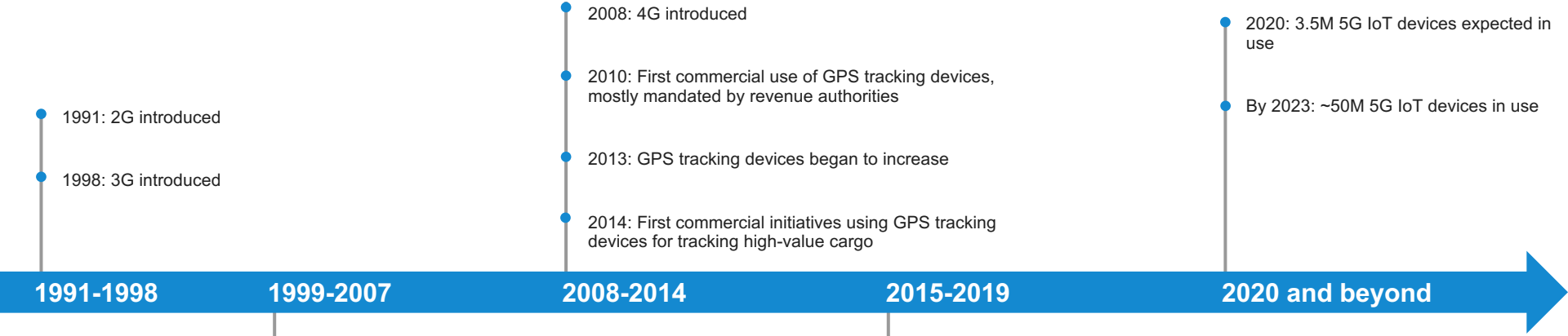
Lessons to Learn: How Commercial Supply Chains Use In-Transit Visibility

Ed de Bruijn
Director, Technical Program Management

Historical Perspective

- Prior to Active RFID and GPS technology, both military and commercial entities have been using barcode and EDI milestone tracking for a long time.
- U.S. DoD, followed by NATO, was the initial user and driver of in-transit visibility using active RFID technology.
- Early commercial adopters were trialing active RFID solutions – mainly driven by initiatives like Operation Safe Commerce (OSC) and Smart and Secure Tradelanes (SST).
- Commercial use of in-transit visibility really started taking off when GPS technology became widely available at reasonable prices.

Historical Perspective: Commercial Infrastructure



Source: Gartner, "Market Trends: 5G Opportunities in IoT for Communications Service Providers," 2019

Lower Costs Expand Use: IoT's Potential

Adding RFID tags to expensive pieces of equipment to help track their location was one of the first IoT applications. But since then, **the cost of adding sensors and an internet connection to objects has continued to fall**, and experts predict that this basic functionality could one day cost as little as 10 cents, making it **possible to connect nearly everything to the internet**.

-ZDNet

5G will **seamlessly connect a massive number of embedded sensors** in virtually everything through the ability to scale down in data rates, power and mobility to provide extremely lean/low-cost solutions.

-Qualcomm

Reliable Data Sources + Big Data Platform = Real-Time In-Transit Visibility

Historical Reliance on EDI

Milestones from ERP/TMS or carrier data feeds – usually manually entered EDI messages with latency of hours/days

Increasing Data Sources

Milestones, AIS and vessel data plus real-time data on cargo location/condition cargo via sensors – immediate and fact-based decisions

Quality Data + Platform

Real-time and historical data sources combined with applied machine learning to predict outcomes and provide insights – door-to-door visibility in real time

Where Is In-Transit Visibility Most Important?

High-Value and/or Mission-Critical Shipments

- Monitoring the location and integrity of cargo
- Reduce damage, contamination and loss of product

Shipments That Need to Arrive within Certain Window of Time

- Monitoring of ETA/timeliness
- Avoid stock outs, prevent demurrage/detention, production or delivery issues

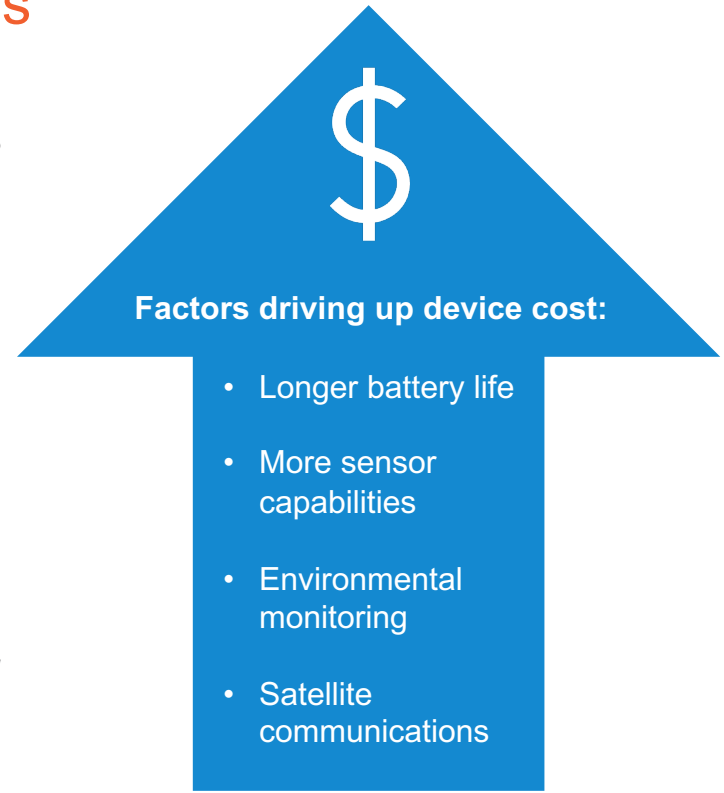
What Critical Info Can In-Transit Visibility Give You?

Shipments	Security	Assets
Where is my shipment? Multi-modal in-transit tracking	**What condition is my container in?** Environmental monitoring and alerts (temperature, humidity, shock, etc.)	**Where is my asset?** Loss prevention
When will my shipment arrive? Machine-learning ETA predictions	**Is my cargo on track?** Planned route deviation	**Where is my asset?** Yard management
Did my shipment make it from the truck on to the boat? Transshipments	**Could my cargo be stolen?** Geofencing and risk zone detection	**How often is my equipment used?** Utilization
Has something happened to my shipment? Exception alerting	**Has my cargo been stolen/ damaged?** Unplanned stop and tampering detection	**Does my equipment need repair or regulatory checks?** Scheduled maintenance

Important Sensor Specifications

- Battery life: Range from 2 weeks to 3 years
- Comms: 2G, 3G, 4G or satellite
- IP rating and other certifications
- Security features
- Environmental sensors
- Disposable or reusable
- Battery or solar-powered

The customer use case drives the choice of the sensor to be used.



SAMPLE USE CASE 1:

Mining

Mining company manages shipment of critical heavy equipment components:

- Heavy industrial equipment, such as haul trucks, are shipped worldwide for refurbishing and/or relocation.
- Haul trucks are so big that they need to be disassembled into smaller pieces, and then shipped.
- The company not only needs to know each component's location and ETA, but also ensure that all the components for an equipment unit stay together.
- The company had an occurrence of a component that was left behind at a transshipment port. The component was rolled on to a different vessel and then shipped to the destination.

SAMPLE USE CASE 2:

Pharmaceuticals

Pharma company manages critical high-value shipments

- Raw drug substances are shipped to and from CMO locations. Finished drug product is shipped to local distributors.

- Critical to shipments of pharmaceuticals:
  - Patient safety
  - Brand protection
  - Revenue protection

- The company had an occurrence where a truck broke down. A replacement truck was sent in, but the predictive ETA of the shipment proved that the refrigerated product wouldn't arrive before closing time at the destination, so the decision was made to return the product to the origin.

Live Demonstration:

2 Use Cases

The Link with Military Supply Chains

High-Value and/or

Mission-Critical Shipments

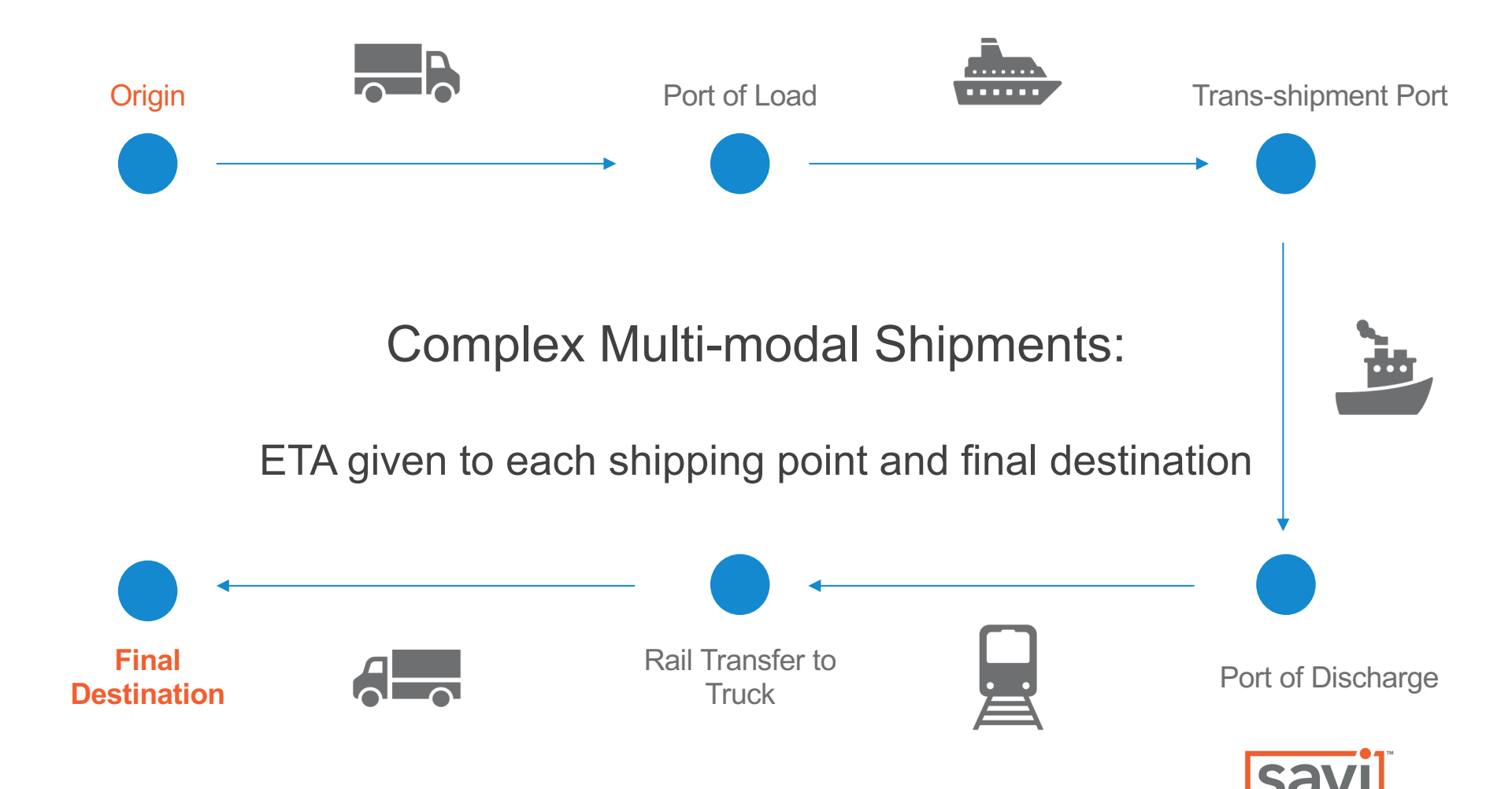
- Monitoring the location and integrity of cargo
- Ammunition
- Supplies
- Replacement parts
- Assets

Shipments That Need to Arrive within Certain Window of Time

- Monitoring of ETA/timeliness
- All of the above

Driving the Future: Data Science & the Supply Chain of Tomorrow

Heather Krieger
Principal Data Scientist



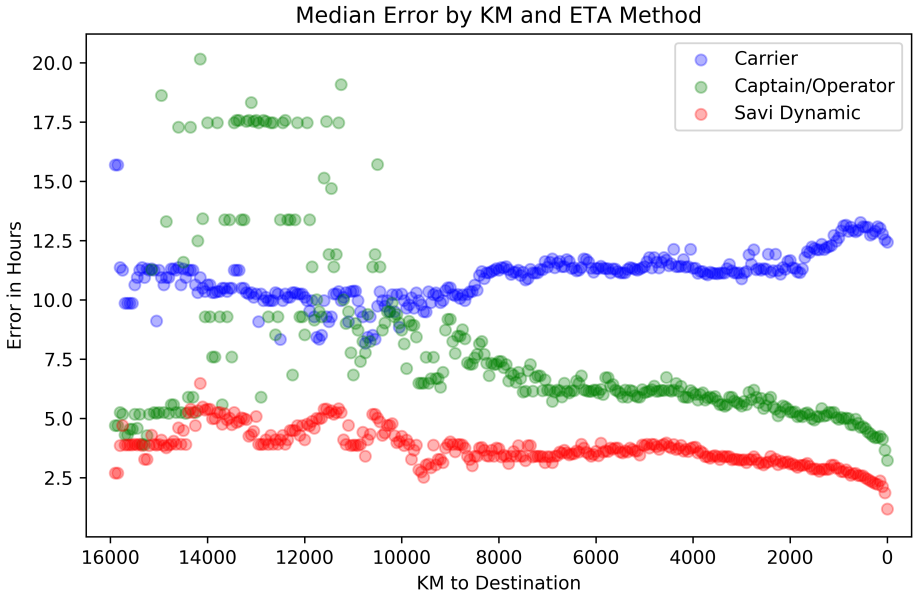
Core Problem: When Will My Shipment Arrive?

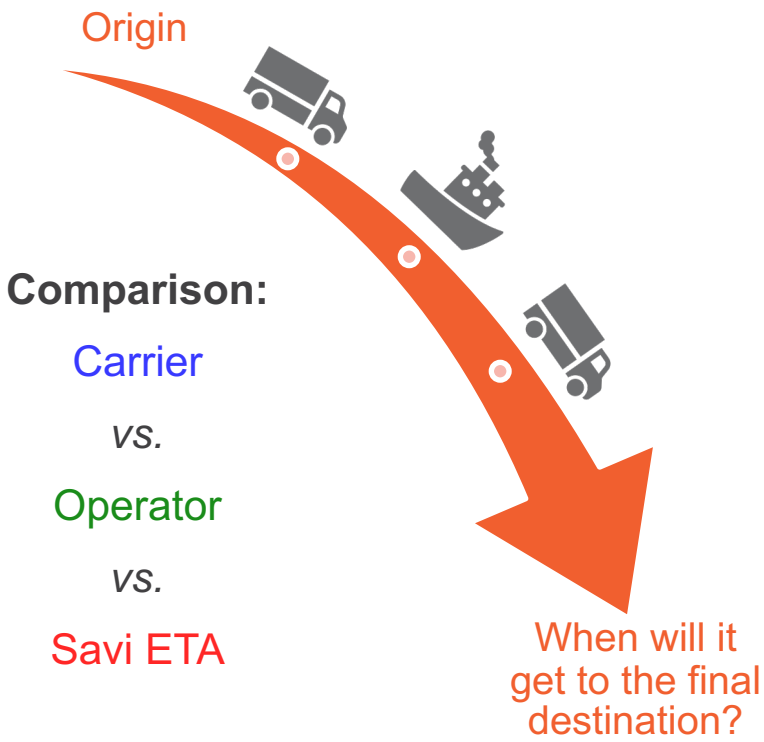
- ***Is* my shipment actually arriving where/when** my ERP/planners think it is?
- **How accurate are the ETAs I have?** Carrier can tell you what week it will arrive, we can tell you what day
- Using **multiple data sources** to get most up to date information
  - E.g. global positioning, shipment schedule, carrier information, historical vessel behavior, weather, security, port operations, etc.

What Is Data Science?

Image source: Adobe Stock

Getting the Most Accurate ETAs





Core Problem: Is the Quality of My Materials Maintained?

Sensors & Data Science

- Identify ‘safe’ routes/locations
- Detect and/or deter theft/tampering
- Monitor environmental readings (temp, pressure, light, humidity, shock)

Alerts → Actions

- Alert on out-of-bounds shipment activity
- Alert on tamper, expedite customs check
- Trigger action and alerts when readings out of range

Blind Spots Leave Large Manufacturers Open to Costly Disruption

Supply Chain Resilience:

70%

of organisations polled indicated that they had suffered some sort of

SUPPLY CHAIN DISRUPTION

2% of those polled revealed that they had taken a hit of over

$50 M

FROM THESE DISRUPTIONS

Poll taken by BCI* Supply Chain Resilience, 2016

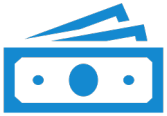
How Resilient Is Your Supply Chain?

What Disruptions Might You Face?

- Suppliers (Ex. chemical plant explosion in China)
- Natural disaster (Ex. Australia wildfires)
- Public health crisis (Ex. COVID19)
- Trade negotiations/tariffs (Ex. US/China trade war)

How Do You Measure Resilience?

- Reaction time
- Minimizing product/cost loss
- Actionable alternative plans
- Accurate disruption predictions



How Much Does Disruption Cost?

- Lost/damaged/replaced goods
- Delayed delivery
- Idled labor/manufacturing
- Lost customer trust

Can you **predict risk**?

Do you have a **contingency plan**?

Value Added

Get visibility into arrival and quality of goods at destination

Get what you need when you need it

Save money with insurance rates

Save money holding excess inventory

Save time with operations

Save human time monitoring supply chain

Prescriptive Analytics:
Data science can help inform operations

What carriers are **more expensive, less efficient**?

What routes are **risky** or **unnecessarily long**?

How much **inventory** do we need?

What will pricing be in 6 months **when we need to ship**?

Tariff prediction – **oil price** prediction

Model **global supply chain disruptions**

Using Data to Optimize Cost, Time and Quality of Service

Example Analysis: What Carrier Should We Use to Ship?

Carrier	Vessel	Route	Historical journey length	Historical accuracy of planned arrival	Disruption Risk (weather, etc.)	Cost
A	1	W->X->Y->Z	3 weeks	+/- 10 days	High	50k
B	1	W->X->Y->Z	3 weeks	+/- 7 days	High	75k
B	2	W->Y->Z	2 weeks	+/- 3 days	Medium	150k
C	2	W->Y->Z	2 weeks	+/- 5 days	Medium	125k
C	3	W->Z	1 week	+/- 1 day	Low	500k

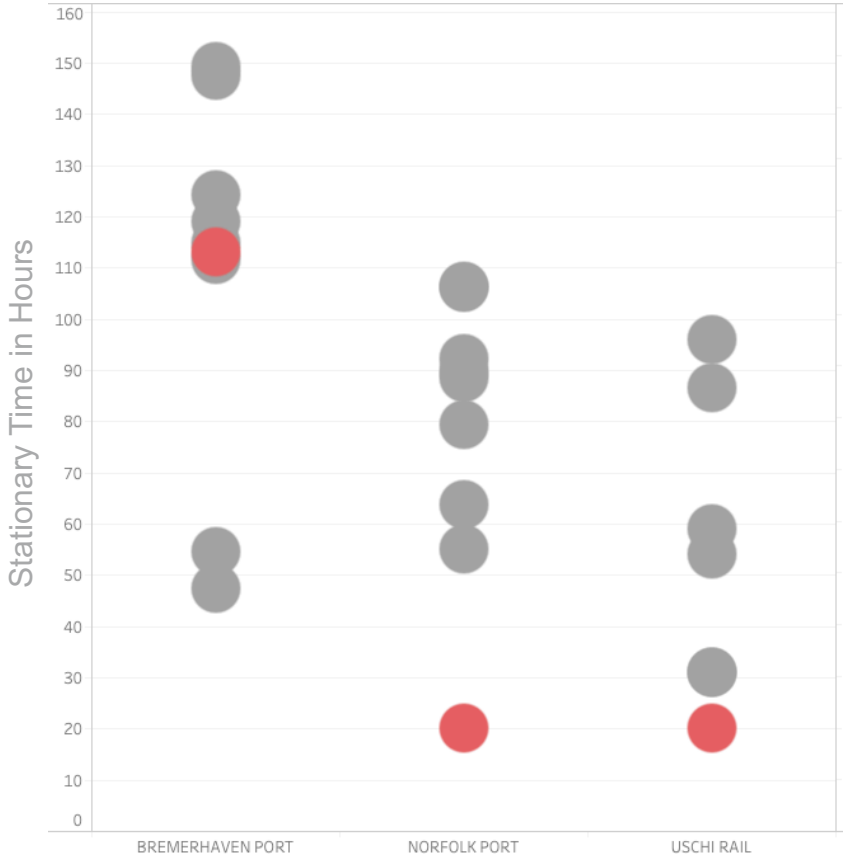
Example Mode Transfers:

How long will a container stay at the port or rail yard?

Is it what you expected?

Is it consistent?

Is it better somewhere else?



USE CASE 1:

Rapid Relief in Disaster Situations

Hurricane Harvey, Houston, 2017

Strategically coordinate rescue and relief efforts

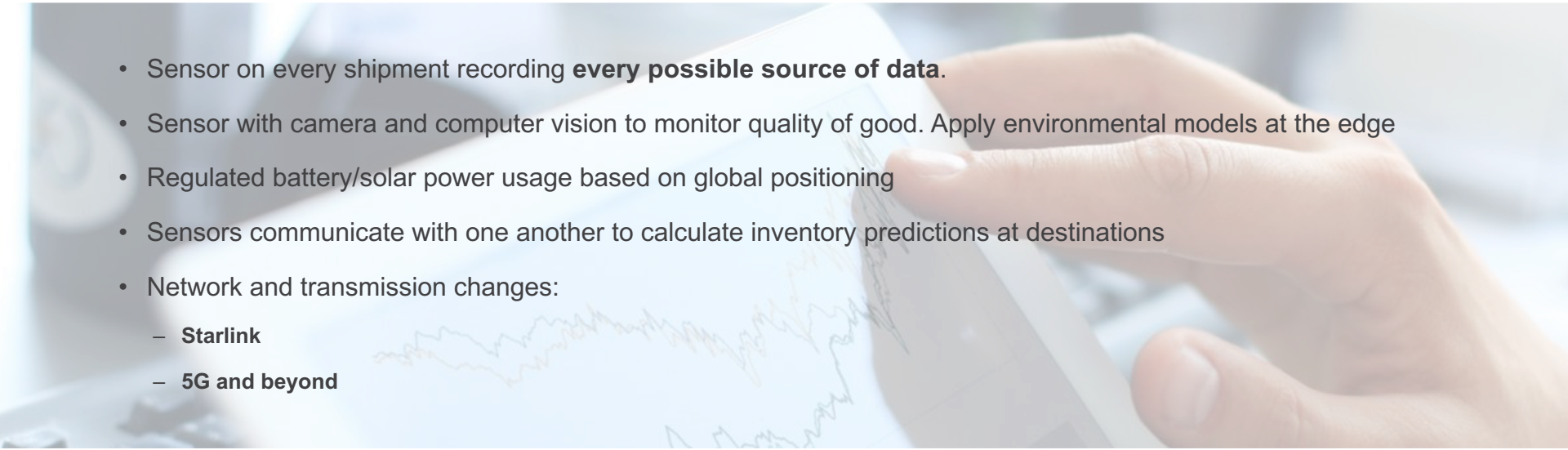
- Identify locations likely to be impacted most
  - Stages of evacuation
  - Primary rescue efforts
- Where should relief goods & services be staged?
  - Out of, but near, impacted areas
  - On roads likely to be accessible first

USE CASE 2:

Predict Inventory Demand to Build Efficient Supply Chain Distribution

- **How does Amazon provide free, same-day delivery?**
  - Data science predicts consumer demand in various geographic and temporal markets. Stock distribution centers according to demand. Deliver goods in minimal time with minimal cost.
- **Example: Rainy/Typhoon season in SE Asia:**
  - Identify Port Klang as key hub of ocean shipping from other continents that also runs shipments directly to smaller localized operational centers. Predict disaster relief inventory requirements based on historical use. Deliver goods where they are needed in less time and at less cost.

The Future of Data Science



- Sensor on every shipment recording **every possible source of data**.
- Sensor with camera and computer vision to monitor quality of good. Apply environmental models at the edge
- Regulated battery/solar power usage based on global positioning
- Sensors communicate with one another to calculate inventory predictions at destinations
- Network and transmission changes:
  - **Starlink**
  - **5G and beyond**

Q&A

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