Joint Robotics Program

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by

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The following article is taken as an excerpt from the proceedings of the annual Acquisition Research Program. This annual event showcases the research projects funded through the Acquisition Research Program at the Graduate School of Business and Public Policy at the Naval Postgraduate School. Featuring keynote speakers, plenary panels, multiple panel sessions, a student research poster show and social events, the Annual Acquisition Research Symposium offers a candid environment where high-ranking Department of Defense (DoD) officials, industry officials, accomplished faculty and military students are encouraged to collaborate on finding applicable solutions to the challenges facing acquisition policies and processes within the DoD today. By jointly and publicly questioning the norms of industry and academia, the resulting research benefits from myriad perspectives and collaborations which can identify better solutions and practices in acquisition, contract, financial, logistics and program management.

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Joint Robotics Program

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Introduction

Sun Tzu wrote first about the importance of logistics over two thousand years ago (Griffith, 1963, pp. 72, 74),[1] followed by Von Clauswitz 150 years ago—who again echoed the importance of logistics to overall mission success (Greene, 1943, pp. 136, 179)[2]; now, logistics is a *Defense Acquisition Workforce Improvement Act* functional area. Since Sun Tzu, much literature, many experiments, lessons learned, and the DoD's continual searching for better logistics answers have stressed the continued importance of getting the right things to the right place at the right time. Much like human transportation history evolution—beginning first with people walking or running from point a to point b, followed by thousands of years being transported by real "horse" power, then automobiles, airplanes, and rockets—logistics too has progressed over the years: focusing first on Mass-based Supply, then Just-in-Time Supply Chain Management, and now on Sense and Respond logistics.

The Robotic Systems Joint Project Office (RSJPO), an Army-Marine Corps effort that supplies various robots to the AORs of Iraq and Afghanistan, has also evolved through the three logistics methods. During each approach, many positive benefits were discovered. Along with those benefits, there were and are still today challenges to be confronted and overcome. The Robotics Program's experience and lessons learned since it began "real time" theater support in 2003 can aid all logistics programs by exemplifying the better ways to provide the best logistics with the knowledge, skills, and tools available today. All logistics functions, as shown by the Robotics Program, can be provided incredibly fast, quite inexpensively, and with superior quality and customer satisfaction.

Mass-based Inventory

For many long years, logistics relied on provisioning and sparing as the logical answer to supporting any weapons system. Numerous logisticians were trained in the art and science of sufficient inventory and spares, which would keep systems functioning for the fielded units anytime and anywhere. Budgets were predicated against these projected numbers. Many logisticians established careers tracking, analyzing, projecting, adjusting, and readjusting Mass-based Support for all weapons systems. This logistics approach did provide weapons system support that could function appropriately in the field (Van Creveld, 1977, pp. 206, 214). Warfighters (customers) were required to learn which spares were critical and in what numbers, while also trying not to have too much inventory of all the wrong things lying about taking up needed space and expending too much available budget. The robotics program first began by

[1] Sun Tzu gives the projected costs for supporting war efforts as well as stating logistics for his time equated to 60% of the total costs incurred.

[2] Von Clausewitz surmises total war requires everything relates, including logistics, to providing the soldier at the right place at the right time to be perfectly effective.

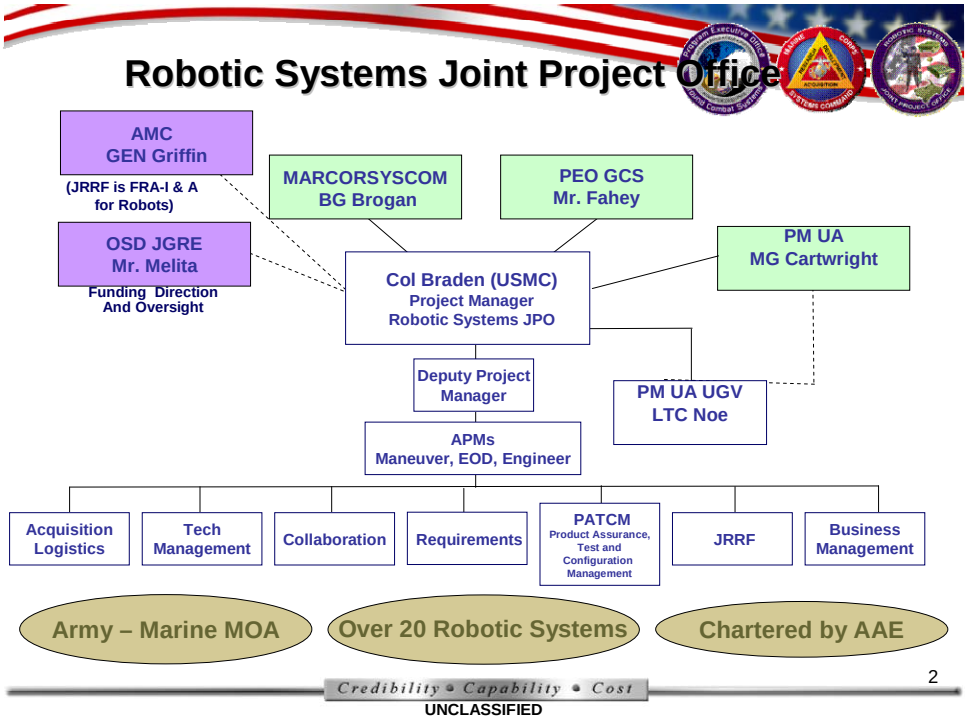
utilizing Mass Based logistics to support the initial fielding of 162 robots. Since the majority of suppliers were small businesses (in DoD parlance, "Mom & Pops") and were finding it difficult to spare or keep up with production, the Program Manager declared that a portion of the total available robots would function as spares. Central Command (CENTCOM) controlled all robots as theater-provided equipment (TPE), rather than granting one of the Services total ownership. However, as the robots were fielded, Command found that the robots worked exceptionally well and replaced warfighters in critical danger missions. The Services would not release critical robotic assets and demanded many more robotic platforms be sent into the field. Very quickly, CENTCOM and the Project Manager realized Mass Based Logistics would not support well the customer's demand. Another logistics approach was quickly required. What support program would allow the small businesses to produce, supply, and keep up with an ever-increasing field demand?

Just-in-Time

Just-in-Time (J-I-T) logistics support promised to better align suppliers with customers in providing the right item at the right time in the right place. J-I-T also promised to reduce inventories and spares to near zero. In order to achieve these objectives, quality would need to be more strictly monitored; deliveries would need to be timed better; suppliers would need real-time communication with the customers' system to better predict when they needed to provide needed items. Production needed to be stable so suppliers could more easily meet demand (Kotler, 1997, pp. 214-215). The Robotics program moved toward J-I-T within six months as Massed-based supply could not keep up. The Project Manager and Suppliers gathered data on which robotic parts lasted or failed and how often. Often, the same supply approach (one new robot for one damaged or eliminated robot) was carried over from the Mass-based Approach. Rebuilding damaged robots grew from the J-I-T approach. Both the Project Manager and the Robotic Suppliers needed faster and more accurate information each day. Tracking robots and their status and location in the field became a pressing point. No in-house DoD information system existed to provide this ever-increasing communication need. The Project Manager partnered with Avantix and T&W Communications to create the Catalog Ordering Logistics Tracking System (COLTS) program. The program utilizes UID formats and capabilities to provide the Project Office, as well as the suppliers, with critical, daily information to meet the warfighters' demands. The J-I-T approach provided more accurate robot fielding. Separate warfighter units only received robots that were truly mission required, rather than potentially hording robots as back ups. The logistic footprint was reduced as robots were repaired, rebuilt, or supplied as needed. The biggest challenge for the Robotic Project with J-I-T was caused by interruptions or breaks in the transportation chain—disruptions to the process of getting required robots to their place of need. This is a story we're all familiar with in air travel: one weather delay for the airlines causes a major ripple effect to all airlines and passengers trying to get to the right place at the right time. Once again, the Robotics Program needed another improved logistics solution!

Sense and Respond

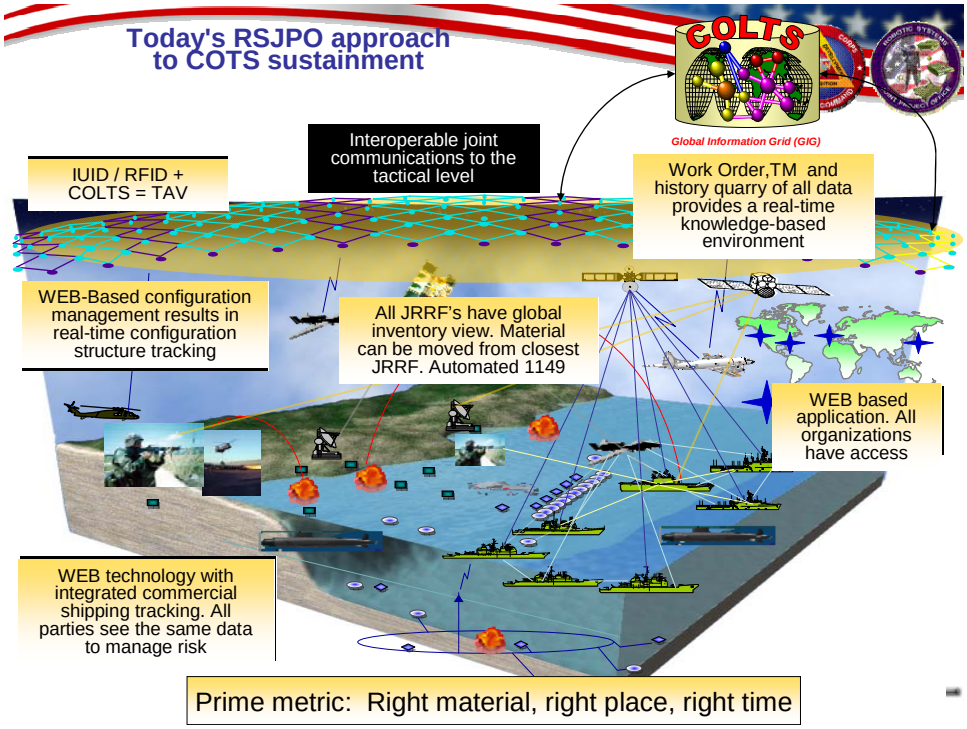
This Sense and Respond section will flow from a TAV brief given at TACOM in Winter 2007 by the current Robotics Program Manager (Varian, 2007). Sense and Respond logistics arose from the inability of J-I-T to completely satisfy the warfighter customer.



The relationship/JPO chart shows how the Robotics System Joint Program fits into the joint Army/Marine PEO. Joint Robot Repair Fielding (JRRF) is just one of the areas necessary for total Program success.

- **Provide in-Theater Support for Joint Service Theater Provided Equipment (TPE) Ground Robots.**
- **Single "Belly Button" for OIF/OEF Training, Sustainment, Assessment, and Accountability**
  - **162 Bots (2004) - 1800 Bots (2005) - 4300 bots (Now) - 6000+ est'd (2008)**
- **Pre-Deployment Training Sites; JRRTs; and Mobile Training Teams – *Joint Reserves (61%)***
- **4 Hour Robot Turn-Around Standard – *Leveraging "Joint Float Pool Concept"***
- **Web-Accessible Real-time Supply Chain Management with integrated IUID/RFID – *Key step toward sense and respond logistics***
  - **Accountability - Parts Reordering - Reliability Tracking - Trouble Desk Info**
- **2007 Robotic Measures of effectiveness – Robots save lives**
  - **25,000 (+) IED Missions Conducted; 15,000 (+) found and cleared with ground robots; 150 Robots Destroyed**

The above graphic relates the Robotic program and explains how the customers' needs continue to rapidly expand. The Program has instituted no more than four hours for any robotic replacement, anywhere, anytime.



The figure above relates how the COLTS software program specifically helps achieve the overall goals for Sense and Respond. It is the full implementation of COLTS that allows IUID/RFID to provide a Total Asset Visibility (TAV). To facilitate Sense and Respond, TAV and real-time information flow will be critical to sustainment of tomorrow. The following chart provides the driving tenets for all people involved with the Sense and Respond Robotics logistics support.

What Joint Robotics Repair Facility Is Doing

1. Define the **WAR-FIGHTER** : As the private or crew member in the heat of it.

2. Understand what is important to the WAR-FIGHTER:

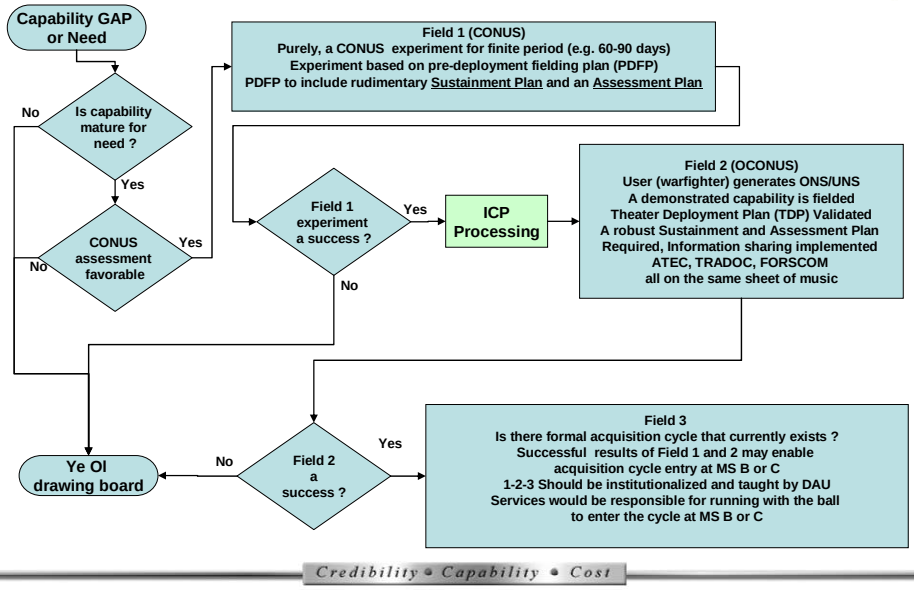
   Time
   Equipment that works
   Time

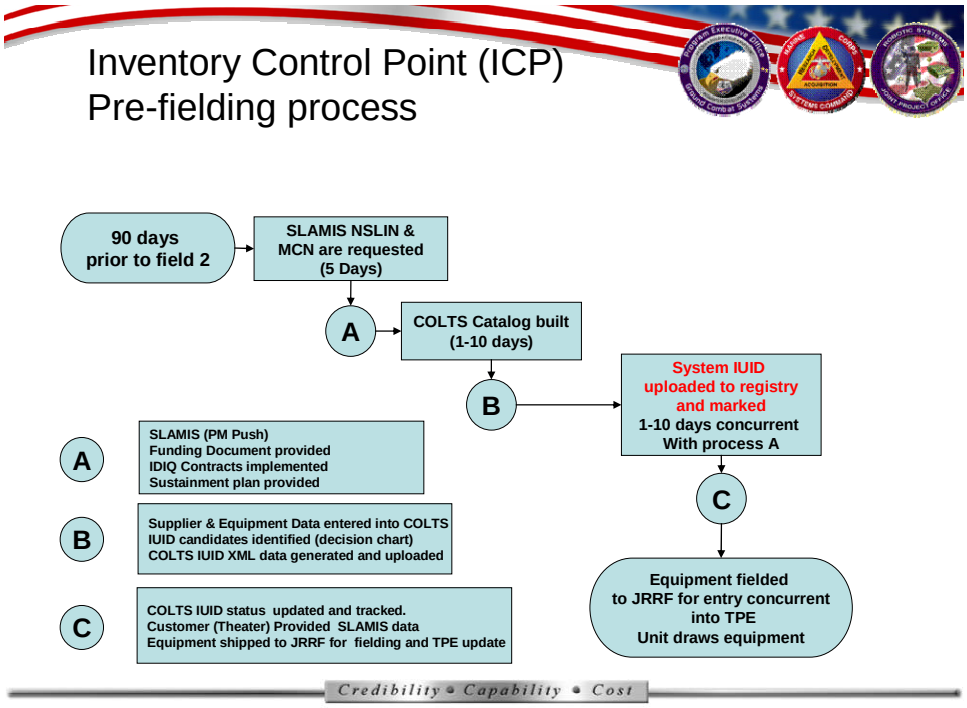
3. Define PBL in a term the WAR-FIGHTER understands.

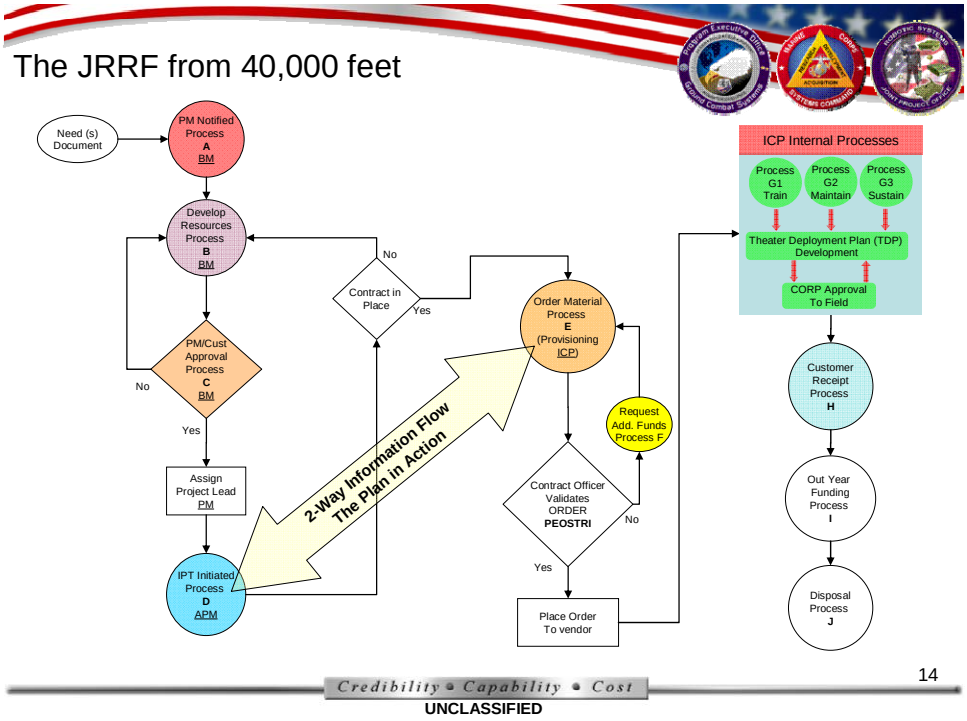
   We structure our support to be reactive to the private or crew member in the heat of it. The WAR-FIGHTER receives a robot in 4 hours or less. PERIOD

By defining processes, the following charts illustrate how the Robotics Program office achieves the above program goals.

1,2,3, Process Flow







The Robotics Program has completely embraced the IUID (Item-unique Identification) method and is continually discovering capability benefits from the warfighter all the way to the supplier and back again. The following presents just some of these capabilities.

COLTS (SCM) value to the RSJPO

- Integrated IUID capability. COLTS **USES** the data not just generates the data.
  - Vendors see data and have "buy in" with the IUID process
  - Ability to mark equipment "on site" virtual IUID NOT REQUIRED
- WEB Based centralized database: There is no requirement to "exchange" between databases. It is one stop for common tasks
  - Email notification on trigger events
  - Equipment modification notification generated and tied to equipment
  - All stake holders have access to the data and all see the same thing
  - Data exportable to Excel™ and data interchange is possible i.e. DAASC, ULLS, etc.
  - Reports generation automatically or data mine to customize
- Configuration management up to 15 levels
- Consumption tracking:
  - Real-time parts usage and consumption data.
  - Real-time maintenance data (TTR, Man-hours, WO processing, etc)
- 100% Property accountability:
  - All items are assets. As such nothing is "forgotten" items are always "issued" or "transferred" but never forgotten

Credibility • Capability • Cost

We could spend a great deal of time relating what the Robotics program has achieved by presenting numerous charts and graphs of how improvements have been made over the course of the program. But rather than take up valuable time and space, we thought just the bare facts presented below say it all…

Return on Investment

- A misplaced hyphen cost $280K
- IUID enables Serialized Item Maintenance (SIM is a DoD Mandate)
  - IUID Enables real time configuration management
  - IUID Saves repair parts cost
    - Aug 06-Mar 07 $29M for repair parts on 1 vendor
    - Aug 07-Mar 08 $ 5M for repair parts on same vendor
- IUID eliminates human induced error
  - Average human has a typing error rate 5.47%. For every 100 key strokes 6 will be wrong

Credibility • Capability • Cost

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Just the facts (1 Jan 07 – 1 Dec 07)

- COLTS Supply & Maintenance Data
  - 6073 Work orders completed
  - 26,375 maintenance actions
  - 64,419 Inventory events (Parts movement)
  - 78,467 Asset events (Robot actions/movement/repair, etc)
  - 4,816 Items shipped
  - 64 EOD/Engineer robots rebuilt from a destroyed condition. Cost savings approximately 3.2 million dollars.
- IUID integration saves the RSJPO time, money and ultimately lives on the battlefield.
  - No more “lost” data due to human error
  - Shorter repair cycle time as a result of IUID “scan in & scan out”
  - More fidelity of data tracked in COLTS due to IUID decision process.
  - Routine logistics processes streamlined with IUID and hand scanner.
  - Configuration management integrated with all SCM actions. SIM is a reality
- Operational rate on all NS-E/COTS supported platforms has been in excess of 98% since Apr 05.
- In excess of 3307 soldiers trained on robotics operation

Credibility • Capability • Cost

What more need we say about Sense and Respond logistics and the benefits it has provided to the warfighter?

Conclusion

Many presenters and numerous authors continue to assert the rate of change in our era will continue to geometrically expand. The Robotics Program since 2003 has rapidly traversed through Mass-based, Just-in-Time, and Sense and Respond logistics approaches, always trying to improve support to the warfighter. Each logistics approach provided benefits and challenges. Each moved into another logistics support scheme built on the previous lessons learned and added new features—with the final goal of reducing the logistics footprint, expending less dollars, and providing the best equipment (which works well when required) to the right warfighter at the right time. The next chart captures each logistic approach and explains why another approach was sought.

Even now, the Robotics Program's Sense and Respond approach is not the final logistics answer. New features (active and passive RFID among others) are being tested, data are being gathered and analyzed, and better processes are being implemented to continually improve the Program's logistics. Other DoD and industry programs should take note and seek out people from this Robotics Program in order to discover better ways to fully support the warfighter. The perfect logistics answer is still to come.

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