THE MONITOR AND MERRIMACK

Newsletter of the
Greater Hampton Roads Chapter
District 02 – Chapter 03
SOLE – The International Society of Logistics
June 2010

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In this Issue:

From the Chapter Chairman:

June 21, 2010 at 7:28 am EDT is the Summer solstice but based on the heat this past month I think summer has already started. Hope everyone is staying cool and is enjoying this great weather.

This month's luncheon will be given by **Mr. Richard Brown** from NASA. His topic will be the **Space Shuttle Refurbishment Program**. As Discovery prepares for its September, NASA has been supporting launches of the Space Shuttle since April 12th 1981.

If you missed May's luncheon you missed a great presentation **Mr. Steve Carmel**, MAERSK Line Limited. NDTA and GHRC-SOLE combined to have the highest luncheon attendance for the past two years. Mr. Carmel has graciously allowed us to post his presentation on web site. This insightful look at Global Logistics and Its Impact to Tidewater is eye-opening! Check it out at www.ghrc-sole.org News.

Don't forget to RSVP to our July tour at **Liebherr Mining Equipment Co**. August is SOLE's International and Conference in Texas, so there will not be a local chapter meeting.

If you have not turned in your election ballot please do so soon. We need your support! See you at our next meeting!

Charlie Littleton
Chairman GHRC SOLE

Coming Events:

23 June, GHRC Luncheon. Mr. Richard Brown, NASA Research Agency, Space Shuttle Refurbishment

21 July, Liebherr Mining Equipment Co. Tour, Newport News, Va.

15-19 August: SOLE Intl. Conference and Exhibition

22 September: Century Express

20 October: ATS, IT Tools: Data Mining

17 November: Global Insight
GHRC Mini Training Workshop

December: TBD

* GHRC Luncheon at Ward's Corner #1 Chinese Restaurant unless otherwise

Certified Professional Logistician Corner

The next CPL Exam will be given in November 2010

1. A basic aim of methods engineering is to:

a. Provide greater return to the stockholders.

b. Eliminate all but direct labor in production.

c. Eliminate all unnecessary time in the production process.

d. Make it easier for management to get more out of the labor force.

e. Insure all tasks are done as the national standards require.

2. Methods engineering includes time, motion, labor, cost, and;

a. Production standards in.studies.

b. Human relations in studies

c. Supplier delays in studies.

d. Training standards in studies.

e. Warehousing standards in studies.

3. The customary unit of measure for labor standards might be:

a.The time required for a highly skilled worker to do the task.

b. The time required for a new worker to do the task.

c. The time required for the normal worker working at fast pace.

d. The time required for quickly performing the taks with average skill.

e. The time required for the task by-the normal worker working with normal effort and skill.

4. The oldest approach to setting time standards is:

a. Predetermined standard element times.

b. Established element times for this industry.

c. Using data from past performances.

d. Work sampling.

e. None of the above.

5. Efficiency is a measure of:

a. Input over output.

b. Output over costs.

c. Actual output over expected output.

d. Actual input over actual output.

e. Quantity of labor over quantity of sales.

6. Productivity (effectiveness) is a measure of:

a. Quantity of labor over quantity of output.

b. Output over costs.

c. Quantity of costs over quantity of sales.

d. Quantity of production over quantity of sales.

e. Output over input.

7. Efficiency can never be rated over 100%.

a. True.

b. False.

8. Methods engineering normally does not include which of the following objectives?

a. Setting time and cost standards.

b. Deciding who will do what job.

c. Initiating change requirements.

d. Estimating personnel quantities.

e. Determining job skill requirements.

9. The work method approach uses the concept of:

a.The Zero Defects Program.

b. Engineered task breakdown.

c. The work breakdown structure.

d. Scientific problem solving.

e. Obligated support structure.

Please see Answers on Page 3

Near term Calendar of Events

ASNE	**Dinner Meetings**:	**Every 3rd Tuesday, Springhill Suites, Newtown Road, Va. Beach, (1800-1900 Social Hour); 1900-2030 Dinner and Program; Reservations: Mary Morgan (757) 495-1970**
HR Quality Mgt Community	**24 June 2010**	**Continuous Improvement Forum, 0800-1200, ODU Webb Center, Registration: www.hrqmc.com; Key-note speaker: Ms. Michelle Mason**
NDTA Tidewater	**17 June 2010**	**Chesapeake Bay Bridge Tunnel Tour (see flyer on page 6)**
GHRC SOLE	**23 June 2010**	**William Brown, NASA Space Shuttle Refurbishment**
	21 July 2010	**Liebherr Mining Equipment Company Tour**
SOLE	**August**	**Annual Conference and Exhibition, Dallas (Irving), Texas**

Answers			
1	c	6	e
2	a	7	b
3	e	8	b
4	c	9	d
5	c		

SOLE – The International Society of Logistics
Greater Hampton Roads Area Chapter

Wednesday June 23, 2010
11:00 – 1:00 PM

#1 Chinese Buffet, 7635 Granby Street
Norfolk, Virginia
Phone: (757) 423-8880

Mr. William Brown
Langley Research Center

"NASA Shuttle Station Refurbishment"

Please RSVP by contacting our Membership Chairman, Mr. Charlie Littleton at clittleton@LCE.com or phone him at 757-857-1311 (ext: 4203) or our Chairman, Carl Lilieberg @ 757-896-5335/Carl J. Lilieberg @ngc.com NLT 4 PM, Monday, 21 June 2010. Guests are welcome. Cost is $15, payable in cash or check at the door (covers the meal and gratuity). Please join us for a luncheon of great food, professional contact, and a timely and informative logistics presentation. Spouses and guests, bosses, and co-workers are welcome and you DO NOT have to be a SOLE Member to attend!

Driving Directions: From 1-64 E through the HRT. Take the I-564 exit onto US 460W (Granby St/Naval Base). Take the left ramp to Granby. Turn right onto Granby and the restaurant is on your right after passing the railroad crossing. From 1-64 W: Take I-64W to VA 165-Little Creek Road off ramp onto Taussig Blvd. Turn left onto Granby St. and after crossing the railroad restaurant is on your right.

SOLE
The International Society of Logistics

2010 Calendar Greater Hampton Roads Chapter Monthly Schedule

	Business Meeting	Lunch/ Tour	Topic
June	14	23	NASA Space Shuttle Refurbishment
July	12	21	Liebherr Mining Equipment Co Tour, Newport News, Virginia
August	9	NA	SOLE Intl. Conference and Exhibition, Dallas (Irving), Texas
September	13	22	Century Express
October	11	20	ATS, IT Tools: Data Mining
November	8	17	GHRC Mini Training Workshop
December	13	NA	TBD

National Defense Transportation Association

Tidewater Chapter Presents

Tour of the Chesapeake Bay Bridge Tunnel

Presentation and Tour of the #1 Island Ventilation Building

When: 17 June 10 Time: 8:30am to 12:00pm

Where: South Toll Parking lot (Virginia Beach side). We will carpool across the bridge tunnel.

Cost: Free *Tour/presentation will conclude around noon

* Please RSVP by 15 June, 2010. For more details and to register online, visit our website at http://www.ndta-

GHRC MAY 2010 LUNCHEON
Mr. Steve Carmel
Maersk Senior VP, Maritime Services
"Global Logistics Operations and Their Impact on the Tidewater Area"

Steve Carmel provided our attendees (a ten year record attendance) a superb presentation, highlighting the impact of dependence on certain commodities as they relate to our nation's international commerce. He provided many interesting facts such as energy development (nuclear and petro chemical, and high tech dependence on short supply chains for items such as isotopes used in MRIs/CT scans. We were all inspired to look for deeper aspects of our current global trade and supply chain impacts on our local and national economies. Mr. Akalanka Warusavitharana, CPL, CMA-CGM, our Chapter Professional and Technical Development Vice Chairman, introduced Steve (lower right), and Charlie Littleton, our Chairman, presented him our Chapter Certificate of Appreciation (lower left)

CALL FOR PAPERS

SOLE – The International Society of Logistics

presents

SOLE 2010

Global Logistics Sustainability

45th Annual International Logistics Conference and Exhibition
Omni Mandalay Hotel at Las Colinas
Dallas (Irving), Texas

15 – 19 August 2010
Workshops: 15 - 16 August 2010
Conference: 17 - 19 August 2010

SOLE - The International Society of Logistics (SOLE) presents its 45th Annual International Logistics Conference and Exhibition, held this year at the Omni Mandalay Hotel at Las Colinas, Dallas (Irving), Texas from **15-19 August 2010**. With a conference theme of **"Global Logistics Sustainability,"** the symposium will offer two days of pre-conference workshops and three full days of exciting, educational and topical offerings designed to provide logisticians from all countries a unique understanding of the issues surrounding the many aspects of achieving and maintaining organizational, mission and functional sustainability. Representatives from Government, the Armed Services, Industry and Academia – both nationally and internationally – will serve as keynoters, plenary and panel participants, and paper presenters.

SOLE 2010 will offer paper presentation sessions that address the many aspects of logistics sustainability, to include but not be limited to: ***Transparency and Accountability in Logistics; Design and Sustainability; Maximizing Our Resources; Defining and Growing the 2020 Logistician; Sustainable Logistics IT Constructs/Models; Logistics Mission Sustainment; The Role of Public-Private Logistics Partnerships; Tradeoffs in Information Sharing and Information Protection;*** *and* ***New Structures for the Future.***

If you are interested in submitting a paper for consideration, please submit an abstract by **15 April 2010**. If accepted for **SOLE 2010**, the paper must be submitted no later than **31 July 2010** – with the slide presentation to be submitted by **5 August 2010**. For additional information and submissions, please contact either ***John (Jay) Erb, SOLE 2010 Deputy Chair, at (703) 246-0756*** or ***SOLE Headquarters at (301) 459-8446.*** Only electronic submissions will be accepted at **john.erb@gdit.com.**

GHRC Executive Board Officers:

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We're On the Web!
www.ghrc-sole.org

SOLE Information

SOLE-The International Society of Logistics is a nonprofit professional society composed of individuals devoted to enhancing logistics technology, education, and management. For further information on SOLE or this chapter, contact any of the individuals listed on the front page of this newsletter.

Lieutenant Colonel James C. Rainey, USAF, Retired
Cindy Young
Roger D. Golden, DPA

Defining Logistics

(Reprinted from AF Logistician, Vol XXX, No 3, Fall 2006)

The word logistics entered the American lexicon a little more than a century ago. Since that time, professional soldiers, military historians, and military theorists have had a great deal of difficulty agreeing on its precise definition.1

Even today, the meaning of logistics can be somewhat fuzzy in spite of its frequent usage in official publications and lengthy definition in Service and Joint regulations. Historian Stanley Falk describes logistics on two levels. First, at the intermediate level:

Logistics is essentially moving, supplying, and maintaining military forces. It is basic to the ability of armies, fleets, and air forces to operate—indeed to exist. It involves men and materiel, transportation, quarters, depots, communications, evacuation and hospitalization, personnel replacement, service, and administration.

Second, at a higher level, logistics is:

…economics of warfare, including industrial mobilization; research and development; funding procurement; recruitment and training; testing; and in effect, practically everything related to military activities besides strategy and tactics.2

While there are certainly other definitions of logistics, Falk's encompassing definition and approach provide an ideal backdrop from which to examine and discuss logistics. Today, the term combat support is often used interchangeably with logistics
.

The Themes of US Military Logistics

From a historical perspective, ten major themes stand out in modern US military logistics.3

• The tendency to neglect logistics in peacetime and expand hastily to respond to military situations or conflict.

• The increasing importance of logistics in terms of strategy and tactics. Since the turn of the century, logistical considerations increasingly have dominated both the formulation and execution of strategy and tactics.

• The growth in both complexity and scale of logistics in the 20th century. Rapid advances in technology and the speed and lethality associated with modern warfare have increased both the complexity and scale of logistics support.

• The need for cooperative logistics to support allied or coalition warfare. Virtually every war involving US forces since World War I has involved providing for, and, in some cases, receiving logistics support from allies or coalition partners. In peacetime, there has been an increasing reliance on host-nation support and burden sharing.

• Increasing specialization in logistics. The demands of modern warfare have increased the level of specialization among support forces.

The growing tooth-to-tail ratio and logistics footprint issues associated with modern warfare. Modern, complex, mechanized, and technologically sophisticated military forces, capable of operating in every conceivable worldwide environment, require that a significant portion, if not the majority of the budget, be dedicated to providing logistics support to a relatively small operational component. At odds with this is the need to reduce the logistics footprint in order to achieve the rapid projection of military power.

• The increasing number of civilians needed to provide adequate logistics support to military forces. Two subthemes dominate this area: first, unlike the first half of the 20th century, less reliance on the use of uniformed military logistics personnel and, second, the increasing importance of civilians in senior management positions.

• The centralization of logistics planning functions and a parallel effort to increase efficiency by organizing along functional rather than commodity lines.

• The application of civilian business processes and just-in time delivery principles, coupled with the elimination of large stocks of spares.

• Competitive sourcing and privatization initiatives that replace traditional military logistics support with support from the private business sector.

Logistics and Warfare

General Matthew B. Ridgway, of World War II fame, once observed, "What throws you in combat is rarely the fact that your tactical scheme was wrong … but that you failed to think through the hard cold facts of logistics." Logistics is the key element in warfare, more so in the 21st century than ever before. Success on the modern battlefield is dictated by how well the commander manages available logistical support. Victories by the United States in major wars (and several minor wars or conflicts) in the 20th century are linked more directly to the ability to mobilize and bring to bear economic and industrial power than any level of strategic or tactical design. The Gulf War and operations to liberate Iraq further illustrate this point. Long before the Allied offensive could start, professional logisticians had to gather and transport men and materiel and provide for the sustained flow of supplies and equipment that throughout history has made possible the conduct of war. Commanders and their staffs inventoried their stocks, assessed the kind and quantities of equipment and supplies required for operations in the severe desert climate, and coordinated their movement plans with national and international logistics networks. "The first victory in the Persian Gulf War was getting the forces there and making certain they had what they required to fight [Emphasis added]. Then and only then, would commanders initiate offensive operations."4 The same may be said of lightning quick victory in Iraq, although without the massive stockpile of inventory seen during the Gulf War.

Continued on Page 12

Greater Hampton Roads Chapter
SOLE – The International Society of Logistics
Chapter Business Meeting Minutes

Date: Monday, 19 May 2010
Meeting Convened: 1:15 PM (after our Luncheon)
Attendees:
• Charles Littleton, Chapter Chairman
• Carl Lilieberg, Admin Vice Chairman
• Rick Treto, Vice Chairman Treasurer
* Akalanka Warusavitharana, CPL, Professional Development Vice Chairman
• Brandon Cholek, Membership Vice Chairman

The meeting took place after our Monthly Luncheon due to scheduling conflicts.

Our Vice Chairman for Finance went over our assets and monthly liabilities. Registration of our chapter with a Bank of America for our chapter SOLE account has been completed.

We discussed ensuring we did advance checks for the Liebherr tour scheduled for July and the need to firm up advance plans for the November Mini-Workshop.

Carl Lilieberg is to liaise with our NASA speaker, with Charlie Littleton to be on travel.

After no more new items, a motion was made and seconded to close the proceedings at 6:18 PM.

Defining Logistics (Cont'd from Page 10)

In 1904, Secretary of War Elihu Root warned, "Our trouble will never be in raising soldiers. Our trouble will always be the limit of possibility in transporting, clothing, arming, feeding, and caring for our soldiers…."5 Unfortunately, the historical tendency of both the political and military leadership to neglect logistics activities in peacetime and expand and improve them hastily once conflict has broken out may not be so possible in the future as it has been in the past. A declining industrial base, flat or declining defense budgets, force drawdowns, and base closures have all contributed to eliminating or restricting the infrastructure that made rapid expansion possible. Regardless, modern warfare demands huge quantities of fuel, ammunition, food, clothing, and equipment. All these commodities must be produced, purchased, transported, and distributed to military forces. And of course, the means to do this must be sustained

The End of Brute Force Logistics

The end of the Cold War and experience gained from the conflicts in Grenada, Panama, and the Persian Gulf essentially brought the era of brute force logistics to a close. The traditional practice of using massive quantities of troops and large stockpiles of supplies available in theater to engage sizable hostile forces is obsolete. Additionally, extensive buildup time and lengthy resupply and repair pipelines to sustain forces are unrealistic. The focus of logistics has now shifted toward rapid movement of small, independent force packages to employ precise combat power anywhere in the world. The rapid changes in political dynamics of the world powers, domestic fiscal constraints, and technological advances have rendered the Cold War military strategy and preparation ill-equipped to handle 21st century missions, requirements, and demands.

Logistics Challenges

The US role in the post-Cold War world has changed dramatically. Although currently heavily involved in the Global War on Terrorism, military forces are no longer dedicated solely to deterring aggression but must respond to and support homeland defense and humanitarian missions. From peacekeeping to feeding starving nations, to conducting counterdrug operations, the military continues to adapt to evolving missions. Logistics infrastructure and processes must evolve continuously to support the new spectrum of demands. The keys to supporting both combat and peacetime operations successfully are robust, responsive, and flexible logistics systems.

Decreases in funding and the drawdown of the US military in the 1990s drove new approaches to logistics support and refinement of the military logistics systems. These fiscal constraints dictated that the military reduce infrastructure, maintain a smaller amount of inventory and fewer personnel, and find ways to reduce costs without degrading mission capability.

Reduced budgets impact weapons modernization programs in several ways. As dollars decrease, fewer systems can be developed, which increases the importance of decisions made in the acquisition process. The process must develop the most lethal systems while emphasizing reliability and supportability. Therefore, logistics considerations play a more important role than ever in the design, production, and fielding of new systems. Logistics capabilities for supporting future forces require systems to be smarter and require less maintenance.

1. George C. Thorpe, Pure Logistics, Washington DC: National Defense
University Press, 87, xi.
2. Alan Gropman, ed, The Big L: American Logistics in World War II,
Washington DC: National Defense University Press, 97, xiii.
3. Charles R. Shrader, US Military Logistics, 1607-1991, A Research
Guide, New York: Greenwood Press, 92, 3.
4. Ibid.
4. Shrader, 9.

Mr Rainey is currently the Editor-in-Chief of the Air Force Journal of Logistics. He is a retired Air Force officer with more than 20 years of logistics experience. Ms Young is presently the editor of the Air Force Journal of Logistics. She has an extensive background in editing Air Force logistics manuals, particularly those used in the supply community. Dr Golden directs the Analysis Division at the Air Force Logistics Management Agency. He has published a variety of works and is an adjunct professor at Auburn University, Montgomery.

Next NASA Mars mission rescheduled for 2011
(Reprinted from ASTRONOMY - on line)

Previous launch date of October 2009 no longer is feasible because of testing and hardware challenges.

Provided by the Jet Propulsion Laboratory

Mars Science Laboratory, scheduled to launch in October 2011, is planned to last at least one martian year (687 days). A landing site has not been chosen, but will be selected based on an assessment of its capacity to sustain life. NASA / JPL [View Larger Image]NASA rescheduled the launch of Mars Science Laboratory for 2011, 2 years later than previously planned. The mission will send a next-generation rover with unprecedented research tools to study the early environmental history of Mars.

A launch date of October 2009 no longer is feasible because of testing and hardware challenges that must be addressed to ensure mission success. The window for a 2009 launch ends in late October. The relative positions of Earth and Mars are favorable for flights to Mars only a few weeks every 2 years. The next launch opportunity after 2009 is in 2011.

"We will not lessen our standards for testing the mission's complex flight systems, so we are choosing the more responsible option of changing the launch date," said Doug McCuistion, director of the Mars Exploration Program at NASA Headquarters in Washington. "Up to this point, efforts have focused on launching next year, both to begin the exciting science and because the delay will increase taxpayers' investment in the mission. However, we've reached the point where we can not condense the schedule further without compromising vital testing."

The Mars Science Laboratory team recently completed an assessment of the progress it has made in the past 3 months. As a result of the team's findings, the launch date was changed.

"Despite exhaustive work in multiple shifts by a dedicated team, the progress in recent weeks has not come fast enough on solving technical challenges and pulling hardware together," said Charles Elachi, director of NASA's Jet Propulsion Laboratory in Pasadena, California. "The right and smart course now for a successful mission is to launch in 2011."

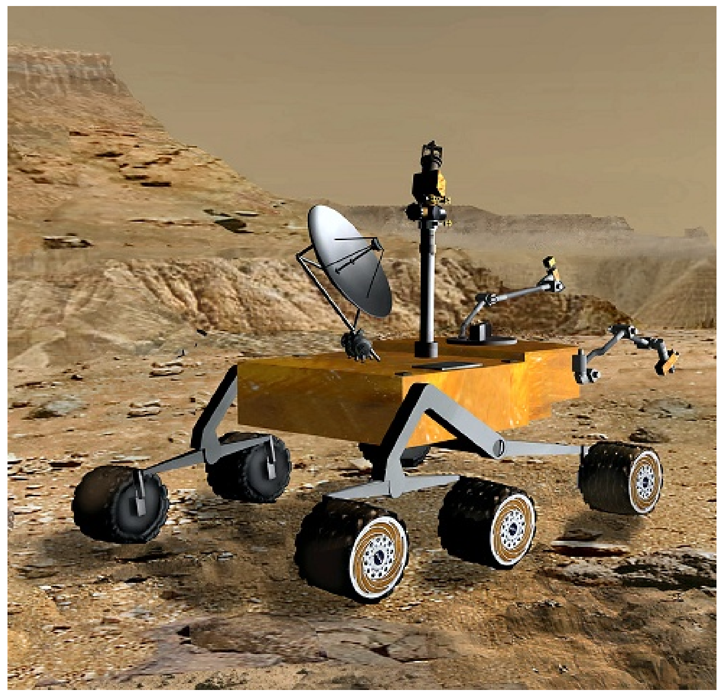
The advanced rover is one of the most technologically challenging interplanetary missions ever designed. It will use new technologies to adjust its flight while descending through the martian atmosphere and to set the rover on the surface by lowering it on a tether from a hovering descent stage. Advanced research instruments make up a science payload 10 times the mass of instruments on NASA's Spirit and Opportunity Mars rovers.

The Mars Science Laboratory is engineered to drive longer distances over rougher terrain than previous rovers. It will employ a new surface propulsion system.

Rigorous testing of components and systems is essential to develop such a complex mission and prepare it for launch. Tests during the middle phases of development resulted in decisions to re-engineer key parts of the spacecraft.

"Costs and schedules are taken very seriously on any science mission," said Ed Weiler, associate administrator for NASA's Science Mission Directorate at NASA Headquarters. "However, when it's all said and done, the passing grade is mission success."

The mission will explore a Mars site where images taken by NASA's orbiting spacecraft indicate there were wet conditions in the past. Four candidate landing sites are under consideration. The rover will check for evidence of whether ancient Mars environments had conditions favorable for supporting microbial life and preserving evidence of that life if it existed there



U.S. Department of Defense

Office of the Assistant Secretary of Defense (Public Affairs)

News Release

On the Web:

http://www.defense.gov/Releases/Release.aspx?ReleaseID=13566

Media contact: +1 (703) 697-5131/697-5132 Public contact:

http://www.defense.gov/landing/comment.aspx (Reprinted from Def.gov – on line website)

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Army Launches Acquisition Review 26 May 2010

The Department of the Army announced today that it is launching a detailed, comprehensive review of its acquisition organizations, policies, workforce and processes, including how it acquires and manages equipment.

The study, commissioned by Secretary of the Army John McHugh, is intended to examine the full range of acquisition practices - from requirements to funding to management and oversight of key acquisition programs. The analysis will build upon progress made in acquisition reform following the 2009 implementation of the Weapons Systems Acquisition Reform Act and will identify areas for growth, improved efficiencies and cost savings. The assessment will also incorporate lessons learned from eight years of war that often included non-traditional acquisition processes.

A primary goal of this effort is to provide a plan for near-term actions that will improve the effectiveness of the Army acquisition process. The study will look at key acquisition processes such as Department of Defense (DoD) 5000 series documents, rapid acquisition processes, technology development and testing.

The Army review is taking place simultaneously with a DoD-led examination of acquisition challenges and opportunities, and will include an assessment of recent relevant studies and laws, including those articulated by the 2010 Quadrennial Defense Review and the Gansler Commission Report on expeditionary contracting.

This Army assessment will be conducted by an independent panel co-chaired by Gil Decker, a former Army acquisition executive, and retired Army Gen. Lou Wagner, who once served as the Army deputy chief of staff for research, development and acquisition, and later as commander of the Army Materiel Command.

The 120-day study will provide interim status updates at the direction of the secretary of the Army.

Media point of contact for this is Lt. Col. Jimmie Cummings, 703-697-7591, Office of the Chief of Public Affairs, Office of the Secretary of the Army.

THE F119 ENGINE: A SUCCESS STORY OF HUMAN SYSTEMS INTEGRATION IN ACQUISITION

2ndLt Kevin K. Liu, USMC, Ricardo Valerdi, Donna H. Rhodes, Col Larry Kimm, USAF, and
Lt Col Alvis Headen, USAF

(Reprinted from DAR, April 2010)

The Department of Defense recently mandated the incorporationof Human Systems Integration (HSI) early in the acquisition cycle to improve system performance and reduce ownership cost. However, little documentation of successful examples of HSI within the context of systems engineering exists, making it difficult for the acquisition community to disseminate and apply best practices. This article presents a case study of a large Air Force project that represents a successful application of HSI. The authors explore the influence of both the Air Force and the project contractor. Additionally, they identify top-level leadership support for integrating HSI into systems engineering processes as key to HSI success, reinforcing the importance of treating HSI as an integral part of pre-Milestone activities.

Manpower Personnel Training
Environment Safety Occupational
Health Habitability Survivability
Human Factors Engineering
Human System Integration =
Optimize total system performance

Human Systems Integration (HSI) is defined as the “interdisciplinary technical and management processes for integrating human considerations within and across all system elements; an essential enabler to systems engineering practice” (Haskins, 2007). The primary objective of HSI is to integrate the human as a critical system element, regardless of whether humans in the system function as individuals, teams, or organizations. The discipline seeks to treat humans as equally important to system design as are other system elements, such as hardware and software.

Many stakeholders have attempted to define HSI, and the number and definitions of HSI domains vary by organization (Department of Defense [DoD], 2008). However, DoD guidance makes it clear that the ultimate goal of any HSI program should be to “optimize total system performance, minimize total ownership costs, and ensure that the system is built to accommodate the characteristics of the user population that will operate, maintain, and support the system” (DoD, 2008; Department of the Army, 2005; Department of the Navy, 2008). Since this article documents a case study of HSI practice within the Air Force, we provide the nine domains of HSI, as highlighted on the previous page.

Large defense projects require significant systems engineering effort that can quickly drive up costs. At the same time, defense projects typically have high requirements for survivability, safety, and other human considerations. As mentioned earlier, DoD is interested in HSI as a means of both reducing cost (Wallace et al., 2007), shortening acquisition cycles (Mack et al., 2007), and improving system performance (DoD, 2008). Published case studies and best practices have highlighted the technical and economic benefits of successful HSI practice (Booher, 1997; Landsburg et al., 2008). These studies and others have consistently emphasized the importance of taking HSI into consideration early in the acquisition process.

Although HSI evolved from the study of Human Factors, it expands upon the latter discipline by incorporating a broader range of human considerations such as occupational health, training, and survivability over the system life cycle. Depending on the particular definitions being used, the areas covered by Human Factors and HSI can overlap. The best way to understand the differences between the two terms is that HSI is at heart a subset of systems engineering. HSI work must take place in conjunction with systems engineering and applies to all the same acquisition phases. Historically, many engineers have tended to view human factors (and therefore HSI) as a means of identifying problems with a design, rather than as an enabler of good design (Harrison & Forster, 2003). Although HSI analyses in the later phases of acquisition are an important part of HIS success, the case study presented in this article focuses on the role and impacts of HSI in systems engineering throughout the acquisition life cycle,

Method.

Pratt & Whitney’s F119 engine, which powers the $143 million Lockheed Martin F-22 Raptor fighter aircraft (Drew, 2008). The F-22 Raptor (Figure 1) fulfils the air superiority role in the Air Force by using a package of technologies to allow pilots to “track, identify, shoot, and kill air-to-air threats before being detected” (Department of the Air Force, 2008b). Although the Air Force HSI Office was not formalized until 2007, much of the work done on the F-22 and F119 in the 1980s and 1990s spans the domains of HSI, making the F119 a best practice of HSI in the Air Force. In designing the study, we followed Yin’s (2003) approach for identifying five important components to case study design: 1) a study's questions, 2) its proposition, 3) its units of analysis, 4) the logic linking the data to the propositions, and 5) the criteria for interpreting the findings.

Figure1. F-22 Raptor

Flying High. The Lockheed Martin/Boeing F-22 Raptor is a fifth-generation fighter aircraft that uses stealth technology. It was designed primarily as an air superiority fighter, but has additional capabilities that include ground attack, electronic warfare, and signals intelligence roles. The Raptor was first introduced into the U.S. Air Force in December 2005. Retrieved 2009 from Inside AF.mil [Web page] at http://www.af.mil/shared/media/photodb/photos/090123-F-2828D-942.JPG. U.S. Air Force photo by Air Force Master Sgt. A. Dunaway (2008)

The case study was designed around three central research questions:
1. How did Pratt & Whitney determine how much HSI effort would be needed?
2. How much did HSI effort eventually cost?
3. How did HSI fit into the larger systems engineering picture?

Continued on Page 16

F119n Engine Success (Cont'd from Page 15)

The first two of our research questions reflect our ongoing research on the economics of HSI. Discussion of this case study from the perspective of cost estimation can be found in Liu, Valerdi, and Rhodes (2009), and Valerdi and Liu (2009). In this article, we address the third research question. Since we sought to describe how the F119 became a best practice of HSI, we designed our study as a single-case descriptive study. Our proposition was that HSI effort could be isolated from the larger systems engineering effort spent. Initially, we hoped to establish a quantitative relationship between HSI cost and systems engineering cost, but were also interested in identifying the critical factors that led to successful HSI implementation. Although our third research question was originally meant to better our understanding of HSI cost, we found in the course of our case study that the role of HSI in systems engineering is not well understood and would benefit from the documentation of a best practice.

We sought to analyze the early development of the F119, from concept development until major engineering and manufacturing development (EMD). Our unit of analysis was the engineering organization responsible for HSI on the F119 at Pratt & Whitney. Since historical data on specific costs associated with HSI activities were not available either because data were not kept or the records could not be found, we depended on Pratt & Whitney employees familiar with the F119 to build an understanding of its development. We conducted a series of interviews with Pratt & Whitney engineers who were active in the development of the F119, in both technical and management roles. Based on our central proposition and research questions, our interviews focused both on life-cycle cost measurement as well as on systems engineering and HSI methodology. With this information, we were able to identify key HSI success factors. We concluded the case study by validating our results using existing literature on the F119 and the F-22 and by comparing the results of our interviews with multiple engineers.

EARLY AIR FORCE EMPHASIS ON RELIABILITY AND MAINTAIN ABILITY

The Defense Resources Board approved the creation of the Advanced Tactical Fighter (ATF) program in November of 1981 to create a military jet that would be able to guarantee air superiority against the Soviet Union. This fighter was meant to replace the F-15 Eagle, which had previously filled this role. A team composed of Lockheed, Boeing, and General Dynamics competed against Northrop Grumman to develop the fighter. In 1991, the ATF contract was awarded to the Lockheed team's F-22, powered by Pratt & Whitney's F119 engine (Figure 2). Then-Secretary of the Air Force Donald Rice noted that an important consideration in the awarding of the contract was the fact that the F-22's engines offered superior reliability and maintainability (Bolkcom, 2007).

FIGUR E 2. F119 ENGINE

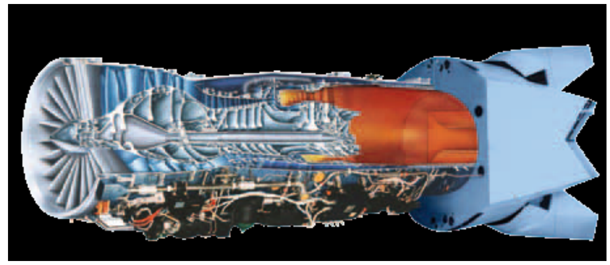

Figure 2 F119 Engine

Cutaway of Pratt & Whitney's (P&W) F119-PW-100 engine. Two F119-PW-100 engines power the Lockheed Martin F-22 Raptor, the U.S. Air Force's new stealth fighter. The F119 features a unique thrust vectoring nozzle, integrated stealth characteristics, and the capability to supercruise, or achieve Mach 1.5 without afterburner. Adapted from "Pratt & Whitney's F119 Engine Receives ISR Approval from USAF, Surpasses 4,000 Flight Hours, Demonstrates Unprecedented Reliability," Pratt & Whitney Press Release, September 16, 2002. Retrieved 2009 from http://www.pw.utc.com/Media+Center/Press+Releases/Pratt+&+Whitney's+F119+Engine+Receives+ISR+Approval+from+USAF,+Surpasses+4,000+Flight+Hours,+Demonstrates+Unprecedented+Reliability.

The Air Force placed an emphasis on reliability and maintainability from the beginning of the ATF program as well as throughout the Joint Advanced Fighter Engine program (JAFE)—the program to develop the engine for the ATF. In June of 1983, four general officers representing the Army, Navy, and Air Force signed a joint agreement in order to "emphasize to the DoD and defense contractor communities the critical importance of improving operational system availability by making weapon system readiness and support enhancement high-priority areas for all our research and development activities" (Keith et al., 1983). Later that year, the director of the JAFE program sent a memorandum to participants in the program, including Pratt & Whitney, asking them to consider that over 50 percent of the Air Force budget was then devoted to logistics, and that the problem would only worsen (Reynolds, 1983).

To address this increase in logistics cost and determine ways to develop creative solutions, the Air Force created the Reliability, Maintainability, & Sustainability (RM&S) program in 1984 (Gillette, 1994). Besides reducing life-cycle cost, the RM&S program also sought to address the reliability and durability problems that had plagued Pratt & Whitney's previous F100 engine, which powered the Air Force's F-15 Eagle. Developed in the 1970s, the F-15 was developed specifically to counter the Russian MiG-25. Therefore, emphasis was placed on performance during the development of both the F-15 and F100. Unfortunately, the high performance of the F100 meant that the engine was more prone to failure and downtime. By the 1980s,

Continued on Page 17

F119 Engine Success (Cont'd from Page 16)

the Russian air superiority threat was no longer as pressing as when the F-15 was developed, and supportability was emphasized over performance. As a result, the Air Force wanted improved RM&S not only on the F119 engine, but on development of the F-22 as a whole. Specific supportability goals for the F-22 were announced as early as 1983 (Aronstein et al., 1998).

UDERSTANDING CUSTOMER NEEDS

The F-22 engine competition was not the only instance in which Pratt & Whitney had competed with General Electric. Both companies had developed engines to power the Air Force's F-16 Fighting Falcon. In the end, General Electric provided the majority of engines for that platform. Pratt & Whitney saw success in the JAFE program as critical to the company's ability to continue to compete in the military engine market. For the F119 engine, Pratt & Whitney decided not only to meet the Air Force's RM&S requirements, but to emphasize designing for the maintainer throughout all aspects of the program. The company's approach exemplified the best practices of what is now known as HSI.

Pratt & Whitney conducted approximately 200 trade studies as contracted deliverables for the Air Force. Pratt & Whitney engineers also estimated they had conducted thousands of informal trade studies for internal use. These trade studies used evaluation criteria, including safety; supportability; reliability, maintainability, operability, and stability; and manpower, personnel, and training (Deskin & Yankel, 2002).

Figures of merit were developed for the trade studies to define a consistent set of criteria upon which to assess the trade studies. Pratt & Whitney engineers used these figures of merit to determine which engineering groups would participate in each trade study.

As is often the case in the development of complex defense systems, responsibilities for the various domains of HSI are distributed among many different organizations at Pratt & Whitney. Of the nine domains of HSI (see Table), seven were represented in Pratt & Whitney's engineering groups. Maintainability, Survivability, Safety, Training, and Materials were all engineering groups at Pratt & Whitney. Manpower, Personnel, and Human Factors Engineering were taken into account by the Maintainability group. Human Factors Engineering also impacted the Safety group. Occupational Health was considered by both the Safety group and Materials group,which dealt with hazardous materials as one of its responsibilities. While there was an Environmental Health and Safety (EH&S) group at Pratt & Whitney, it dealt with EH&S within the organization itself and did not impact engine design. Habitability was not an important consideration in the engine design.

TABLE NINE DOMAINS OF HUMAN SYSTEMS INTEGRATIO N

Manpower The number and mix of personnel (military, civilian, and contractor) authorized and available to train, operate, maintain, and support each system

Personnel The human aptitudes, skills, knowledge, experience levels, and abilities required to operate, maintain, and support a system at the time it is fielded.

Training The instruction and resources required to provide personnel with requisite knowledge, skills, and abilities to properly operate, maintain, and support a system.

Environment In the context of HSI, the conditions in and around the system and the concepts of operation that affect the human's ability to function as a part of the system, as well as the requirements necessary to protect the system from the environment (e.g., radiation, temperature, acceleration forces, all-weather ops, day-night ops, laser exposure, air quality within and around the system, etc.).

Safety The application of systems engineering and systems management in conducting hazard, safety, and risk analysis in system design and development to ensure that all systems, subsystems, and their interfaces operate effectively, without sustaining failures or jeopardizing the safety and health of operators, maintainers, and the system mission.

Occupational Health The consideration of design features that minimize risk of injury, acute and/or chronic illness or disability, and/or that reduce job performance of personnel who operate,maintain, or support the system.

Habitability Factors of living and working conditions that are necessary to sustain the morale, safety, health, and comfort of the user population that contribute directly to personnel effectiveness and mission accomplishment, and often preclude recruitment and retention problems.

Survivability The ability of a system, including its operators, maintainers, and sustainers, to withstand the risk of damage, injury, loss of mission capability, or destruction.

Human Factors Engineering The comprehensive integration of human capabilities and limitations (cognitive, physical, sensory, and team dynamics) into systems design to optimize human interfaces and facilitate human performance in training, operation, maintenance, support, and sustainment of a system.

TO P-LEVEL LEADERSHIP AND INTEGRATE D PRODUCT DEVE LOPMENT

The major requirements for RM&S came directly from the Air Force. The JAFE program in particular was intended to improve RM&S by "reducing the parts count, eliminating maintenance nuisances such as safety wire, reducing special-use tools, using common fasteners, improving durability, improving diagnostics, etc." (Aronstein et al., 1998). While General Electric made significant RM&S improvements to its F120 engine during this time period, Pratt & Whitney centered its competitive strategy on RM&S superiority.

During the Joint Advanced Fighter Engine competition, Pratt & Whitney participated in the Air Force's "Blue Two" program. The

Continued on Page 18

F119 Engine Success (Cont'd from Page 17)

name refers to the involvement of maintenance workers in the Air Force—"blue-suiters." The program brought Pratt & Whitney engineers to Air Force maintenance facilities so that the engine designers could experience first-hand the challenges created for maintainers by their designs. Maintainers showed how tools were poorly designed, manuals had unclear instructions, and jobs supposedly meant for one person took two or more to complete safely.

Many of the features for which the F119 would come to be praised were a result of leadership commitment to HSI. Frank Gillette, t he Chief Engineer of the F119, served in various leadership positions on the F119 project, eventually leading a team of over 900 engineers. In interviews with Pratt & Whitney employees familiar with the F119, Gillette was identified as a driving force behind ensuring buy-in to HSI principles.

When the Pratt & Whitney team returned from its Blue Two experience to work on the F119, Gillette captured the lessons learned from the site visits in a series of presentations. These presentations were then shown to every engineer on the F119 team. Gillette also established design ground rules based on the requirements of the maintainer.

One of the most important requirements for the F119 was that only five hand tools should be used to service the entire engine. All Line Replaceableb Units (LRUs) would have to be "one-deep," meaning that the engine would have to be serviceable without removal of any other LRUs, and each LRU would have to be removable using a single tool within a 20-minute window (Gillette, 1994). Maintenance would have to be possible while wearing hazardous environment protection clothing. Maintenance tasks would have to accommodate the heights of maintainers from the 5th percentile female to the 95th percentile male+ (Gillette, 1994; Aronstein et al., 1998). In addition:

Built-in test and diagnostics were integrated with the aircraft support system, eliminating the need for a special engine support system. Lockwire was eliminated, and torque wrenches were no longer required for "B" nut installations. The engine was designed with built-in threadless borescope ports, axially split cases, oil sight gauges, and integrated diagnostics. Other improvements were a modular design…color-coded harnesses, inter-changeable components, quick disconnects, automated integrated maintenance system, no component rigging, no trim required, computer-based training, electronic technical orders, and foreign object damage and corrosion-resistant. These advances were intended to reduce operational-level and intermediate-level maintenance items by 75 percent and depot-level tools by 60 percent, with a 40 percent reduction in average tool weight. (Aronstein et al., 1998)

These innovations were only possible using the Integrated Product Development (IPD) concept. Whereas on previous projects, engineering groups at Pratt & Whitney each worked in their own respective disciplines, under IPD teams of engineers from varying disciplines were able to provide design engineers with the perspectives they needed to see the full impacts of their design decisions.

CONTINUIN G ACCOUNTABILITY AND ENFORCEMENT OF HSI

Adoption of the IPD concept brought various stakeholders together early in the design process and ensured multidisciplinary input through design and development. As a matter of policy, whenever a design change needed to be made, the originating group would submit the change to be reviewed by a Configuration Control Board (CCB). CCBs were composed of senior engineers from multiple engineering groups. At CCB meetings, each group with a stake in a particular design change would explain the impacts of that change to the chair of the CCB, typically a design engineer. The chair would then weigh the different considerations of the design change and either approve/disapprove the change or recommend further analysis be done.

In instances when Air Force requirements needed to be changed, the originating group would submit a Component Integration Change Request (CICR), which would then be internally debated much as with design changes. CICRs were typically initiated when it was determined that a particular requirement might not be in the best interests of the customer or when one requirement conflicted with another. Once a CICR was finalized. internally by all of Pratt & Whitney's engineering groups, it was presented to the Air Force, which would then make the final decision on whether a requirement could be eliminated, modified, or waived.

The processes for design and requirement change ensured that the work of one group did not create unforeseen problems for another. However, change requests were typically made in response to problems that arose during development. Although reacting to and fixing these problems were important, it took proactive leadership to make sure HIS principles were being followed even when no problems were apparent.

Frank Gillette created several policies that ensured engineers kept RM&S considerations constantly in mind. All part design drawings were required to be annotated with the tools needed to service that part. This helped to achieve the goal of being able to service the entire engine with only five hand tools (in the end, the F119 required five two-sided hand tools and one other tool, sometimes described as 11 tools total).

Continued on Page 19

F119 Engine Success (Cont'd from Page 18)

Gillette also insisted on the development of several full-scale mock-ups of the F119. These mock-ups came at a considerable cost (over $2 million each, while the cost of an engine was then about $7 million) but allowed engineers to see whether their designs had really achieved maintainability goals. Engineers were asked to service LRUs on the mock-ups by hand to ensure that they were each indeed only "one-deep." When an LRU was shown to not meet that requirement, the teams responsible for those LRUs were asked to redesign them.

HSI EFFORTS LEAD TO COMPETITION SUCCESS

Leading up to the major EMD contracts awarded in 1991, Pratt & Whitney conducted 400 distinct demonstrations of the F119's RM&S features. The F119 also accrued over 110,000 hours of component tests and 3,000 hours of full-up engine tests, representing a thirtyfold increase in total test hours over its predecessor, the F100 (Aronstein et al., 1998). Pratt & Whitney was willing to spend significant effort on demonstrating the F119's RM&S features because the company had recently been beat out by General Electric in their competition to provide engines for the Air Force's F-16 Fighting Falcon, and therefore saw the Joint Advanced Fighter Engine competition as its last chance to stay in the military engine market

In 1991, both Pratt & Whitney and General Electric were awarded contracts worth $290 million to complete the EMD phase of competition. The companies were given independence as to the number and types of tests that would be run on their engines, while the Air Force provided safety oversight. As a result, Pratt & Whitney chose to log about 50 percent more test hours than General Electric (Aronstein et al., 1998).

General Electric chose to emphasize the performance of its F120 engine over RM&S, though the F120 did meet the Air Force's RM&S requirements. The F120 was the world's first flyable variable cycle engine (Hasselrot & Montgomerie, 2005). This meant that the F120 was able to change from turbofan to turbojet configuration to achieve maximum performance in multiple flight situations. The F120 was tested in both Lockheed's YF-22 and Northrop Grumman's YF-23 prototypes, demonstrating better maximum speed and supercruise than Pratt & Whitney's F119 in both cases (Aronstein et al., 1998). The dry weight of the F119 is classified, making it impossible to calculate its exact thrust-to-weight ratio. However, Pratt & Whitney advertises the F119 as a 35,000-lb thrust class engine, putting it into the same thrust class as the F120 (Gunston, 2007).

Despite the F120's superior performance in the air and higher thrust-to weight ratio, on April 23, 1991, the Air Force chose the combination of Pratt & Whitney's F119 and Lockheed's YF-22 to be developed into the F-22. Pratt & Whitney had repeatedly demonstrated a better understanding of the Air Force's RM&S needs, investing more time and money into demonstrations and internal efforts than its competitor. It also avoided the increased risk of developing a variable cycle engine, at the time considered a relatively new and untested technology. By 1991, the Air Force's RM&S program was less focused on reducing downtime and more concerned with reducing life-cycle costs. Pratt & Whitney had presented a management plan and development schedule that the Air Force considered sensitive to their needs (Aronstein et al., 1998). On August 2, 1991, contracts worth $11 billion were awarded to Lockheed and Pratt & Whitney (Bolkcom, 2007), demonstrating the Air Force's commitment to HSI. Pratt & Whitney's portion was worth $1.375 billion alone (Aronstein et al., 1998).

KEY HSI SUCCESS FACTORS

The Air Force's early and continuing emphasis on RM&S was captured via requirements. Although dating back to 2003 the General Accounting Office (GAO, now the Government Accountability Office) was still advocating for more equal consideration of reliability and maintainability in requirements definition (GAO, 2003), our case study showed that the Air Force had already understood this principle a decade prior. The Air Force's initial guidance to emphasize RM&S shaped the design approach of all of its contractors.

The actions of both the Air Force and Pratt & Whitney were examples of combining top-level leadership's role within systems engineering practices. The Air Force set formal requirements and expected deliverable trade studies, but it also set early supportability goals, released memoranda explaining their intent, and funded programs to show Pratt & Whitney engineers actual maintenance conditions. In its own right, Pratt & Whitney embraced the IPD approach along with IPD's subordinate systems engineering processes, but also invested significant effort to develop mock-ups, conduct additional testing, and hold engineers accountable for RM&S standards.

As a result, we identify three factors as key to the success of HSI in the context of systems engineering in the F119 program:

1. Air Force policy to elevate the visibility of HSI
2. Pratt & Whitney's willingness to internalize HSI practices and enforce accountability for HSI
3. The integration of HSI and systems engineering in the Early phases of the acquisition life cycle.

Continued on Page 20

F119 Engine Success (Cont'd from Page 18)

Conclusions

In this case study, we document an example of successful HSI. HIS strongly influenced the development of Pratt & Whitney's F119 turbofan engine from early in the acquisition life cycle through EMD. Many traditional systems engineering activities also were clearly impacted. Conversations with Pratt & Whitney engineers indicated that by the time HSI requirements were integrated into the engine, the cost of specific HSI activities could no longer be distinguished from other systems engineering costs. In addition, Pratt & Whitney never had a formal organization responsible for all HSI considerations. Instead, responsibilities for HSI were spread between multiple engineering groups. The lack of a formal HSI group did not prevent the F119 from becoming a best practice of HSI. To the contrary, the fact that HSI considerations were tightly coupled to other systems engineering practices was one the project's major strengths. This case study represents a first step toward establishing the role of HSI in the context of systems engineering. As more success stories are documented, the ability to disseminate best practices throughout the defense acquisition community will improve and will lead to reduced lifecycle costs and improved performance.

Acknowledgments

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Famous Logistics Moments in History

World War II in the Pacific: the importance of Oil:

(Extracted from OIL LOGISTICS IN THE PACIFIC WAR:
IN AND AFTER PEARL HARBOR, AIR COMMAND AND STAFF COLLEGE
AIR UNIVERSITY, by Patrick H. Donovan, Maj, USAF

Oils role in Japan's decision for war

"The shortage of oil was the key to Japan's military situation. It was the main problem for those preparing for war, at the Same time, the reason why the nation was moving toward war. Without oil, Japan's pretensions to empire were empty."

—Louis Morton
Command Decisions

"The thing that tied the fleet to the base [Pearl Harbor] more than any one factor was the question of fuel."

Adm. Husband E. Kimmel
Joint Committee on the Investigation of the Pearl Harbor Attack

A water purification specialist from the 82d Water Detachment, 16th Quartermaster Company, 530th Combat Sustainment Support Battalion, provides fresh water in Haiti. (Photo by SPC A.M. LaVey)

Sustainment Soldiers Support Humanitarian Aid Operations in Haiti

Sustainment Soldiers from across the Army have been providing earthquake victims in Haiti with food, water, and other logistics support as part of Operation Unified Response. Eight personnel from the rapid port opening elements of the Military Surface Deployment and Distribution Command deployed from Fort Eustis, Virginia, and arrived 2 days after the earthquake as part of a U.S. Transportation Command team to identify which transportation and logistics capabilities would best support the relief.

Fort Bragg, North Carolina, initially deployed 896 Soldiers from the XVIII Airborne Corps, the 82d Airborne Division (Air Assault), and other units to provide humanitarian support to survivors. In less than a week, these Soldiers delivered 54,738 pounds of supplies and equipment, including 3,600 gallons of bottled water and 14,400 meals ready-to-eat. Overall, Fort Bragg is expected to deploy as many as 3,000 Soldiers to Haiti in support of Operation Unified Response.

The 3d Sustainment Command (Expeditionary) (ESC) from Fort Knox, Kentucky, had key leaders on the ground within days of the earthquake and sent over half of the ESC over the course of a month to be part of Joint Logistics Command-Haiti.

The first group of 3d ESC Soldiers worked with the Navy and Coast Guard to reopen Haiti's main port, established two logistics hubs away from the airport, and planned for a 2-week United Nations World Food Program surge operation. The 7th Sustainment Brigade has since joined the ESC, as have a number of logistics units from across the services.

The 530th Combat Sustainment Support Battalion, 49th Quartermaster Group, from Fort Lee, Virginia, joined these units in early February. The 49th Quartermaster Group is providing mortuary affairs support to Joint Task Force-Haiti and water purification and distribution, fuel storage and distribution, and logistics support to the World Food Program. The 49th Group Soldiers will remain in Haiti at least through August.

(Reprinted from MAY/JUNE ARMY Sustainment)