APPENDICES

APPENDIX A : FINDINGS OF THE JOINT LOGISTICS REVIEW BOARD OF OPERATIONS IN VIETNAM

The Joint Logistics Review Board was established by the Deputy Secretary of Defense in 1969 to “review worldwide logistic support to U.S. combat forces during the Vietnam era so as to identify strengths and weakness and make appropriate recommendations for improvement”. The Board’s report was published in 1970 and volume I contains a summary of the logistical lessons learned during the Vietnam War, extracts of which are provided here. The Board’s findings were instrumental in bringing about changes in logistical doctrine, organisation, and procedures, which substantially improved the logistical support of our military forces in later years.

Major Findings of the Joint Logistics Review Board

Responsive Logistics Planning. “The planning system of the Department of Defense must provide for: (1) a realistic appraisal of logistic resources to achieve balance between operational concepts and logistics capabilities; (2) the establishment of credible requirements for critical logistics resources; and (3) recognition in the planning, programming, and budgeting system of the impact of inadequate logistic resources on operational capabilities”.

Ammunition. “Procurement and production of an ammunition item involving large volume, extensive non commercial facilities, high costs, and multiple users should be assigned to one of the primary users of that particular munition or related group of munitions.”

Transportation. “An adequate transportation capability, with a proper balance between sealift and airlift resources, is essential to deployment and successful support of forces deployed in an overseas area. Since the bulk of material must be transported by surface means, an adequate and responsive sealift must be in-being. Such a capability is dependent on a modernised MSTS [Military Sea Transportation Service, now the Military
Sealift Command] nucleus fleet backed by access to the resources of an equally modern US merchant marine.

**Joint Logistics Responsibilities.** “Although the basic responsibility for the support and maintenance of forces must remain with the Services, unified commands must plan for and be staffed for active involvement, when required, in the multiservice aspects of transportation and movement control, construction, ammunition and POL resupply, communications, medical evacuation and hospitalization, and control of critical items.”

**ADPS Support in the Combat Area.** “Effective and efficient logistics support to deployed forces has become absolutely dependent on ADPS [automatic data processing systems] in supply and maintenance operations. ADPS capability for logistic management must be introduced in a combat theatre as soon as possible with adequate communications support and with the capability of interfacing with ADPS outside the combat area.”

**Communications.** “Logistics management has become increasingly dependent on ADP and high speed digital data transmissions, both within the contingency area and between CONUS and overseas locations. Therefore, logistic contingency planning must be explicit as to communications requirements, and heavy transportable self-contained equipment must be developed to provide prompt availability of high-quality circuits, automatic switches, and terminal equipment to tie into the automatic digital network (AUTODIN).”

**POL.** “Because POL is so essential to support of military operations, the responsibilities of and interfaces between the military departments, the unified commands, and the Defense Supply Agency/Defense Fuel Supply Centre must be clearly defined so as to eliminate misunderstanding.

**Concepts for Future Management Support in the Combat Area.**

“Available techniques must be aggressively pursued to reduce the requirement for logistic resources in the combat area without a reduction of operationsl capability.”

**Conclusion.** “History suggests that, in major logistics operations like those in Vietnam, Korea, and World War II, several management problems will always occur during the initial stage of a conflict. Among these recurring problems are following:
• Transportation capability will be a critical factor.

• Logistic capabilities in the theater will for some time be overtaxed and control must be established to regulate the flow of men and materials in accordance with priorities established by the commander.

• Construction of facilities will seriously lag behind requirements.

• Communications will not meet all requirements.

• Ammunition, POL, and food – bedrock essentials that are consumed in large quantities- will require special attention.
In short, it was a joint, multi echelon, total force effort proving beyond a doubt that Good Logistics is Combat Power.

In 1990-1991 Operation DESERT SHIELD/DESERT STORM provided the first major test for the new doctrine, organisation, and equipment developed for our armed forces in the late 1980s, a test which was passed with flying colors. Lt Gen William G Pagonis and Maj Harold E Raugh outline the logistical problems faced in deploying and sustaining the ground forces which conducted the largest armored combat operation ever seen. General Pagonis is well qualified to discuss the subject in as much as he commanded all Army Logistical Forces in the Gulf and was responsible for the logistical plans which enabled allied combat forces to defeat Iraqi forces decisively in just 100 hours of ground combat.

Formation of the Support Command

On the morning of 2 August 1990, Iraqi forces invaded Kuwait. Six days later, after hasty planning and coordination due to the short notice involved and urgency of the situation, a small group of logisticians from US Army Forces Command (FORSCOM) J4 (Logistics Directorate) and the Pentagon arrived in the Kingdom of Saudi Arabia. On the plane en route to Saudi Arabia, they formulated the original plan of what was later to become the mission of the Support Command (SUPCOM), this plan contained three major tasks; the reception, onward movement and sustainment of the force deploying to Southwest Asia.

Support Command Plans

The development of the theatre logistic support plan was integral to the overall success of DESERT STORM, and this planning began when Bush decided to send VII Corps to the theatre of operations. By the end of November 1990, the five-phased theatre logistics concept had been established, and the SUPCOM had published logistics
operational plans (OPLANs) 91-1 and 91-2 detailing the initial phases of the projected offensive. The five phased logistics support plan was:-

Phase I  Preparation and Prepositioning.
Phase 2  Movement of the Corps
Phase 3.  The Ground Offensive
Phase 4.  Defence of Kuwait
Phase 5.  Redeployment

Much has been spoken of the ‘What If’ factor, as in what if the Iraqi forces that seized Kuwait in August 1990 had just continued on into Saudi Arabia. Certainly, there was little to stop them. The bulk of Saudi oilfields could have been in their hands and the government of King Fahd might have fallen. The world knows that the West’s reaction to the invasion of Kuwait was swift. In less than a week, US air and ground forces were in Saudi Arabia. Some 11 days after the invasion the US forces had grown to 25,000 and the first British elements (one squadron of Tornados and one squadron of Jaguars) had arrived. Even if the Coalition had not chosen first to exhaust the diplomatic and economic options, but had gone straight for a military solution, it would have taken a long time to build up the strength needed to defeat the main Iraqi forces in battle. The British Gulf forces, with the exception of the relatively few vessels of the Royal Fleet Auxiliary, relied almost entirely on hired civilian merchantmen. The US at least had their “Ready Reserve Fleet”. But some of this fleet was reported to unserviceable or unseaworthy, understandable in an ancient and largely moth-balled force. Even with this fleet, the US had to hire vast amounts of civilian shipping. It was fortunate, particularly during the first ‘defensive’ phase, that the Coalition had the required amount of time and that the necessary logistic buildup could be made. Had Iraq continued its advance, the Coalition would have faced a very much more difficult task.

The lifeblood of War

In peace, logistics represents about a quarter of most armies’ budgets. In conflict, logistics is the lifeblood of war and an understanding of just what it involves is vital to all those concerned with thinking or planning of operations.
It is logistics which moves Armies to where they can fight, it is logistics which keeps weapon systems firing and maintained, so important is logistics that it features as a principal factor in almost every soldier’s appreciation of the task facing him, and in the plan he makes.

The lesson for future campaigns is simple. Light forces alone will not be enough to meet every eventuality. Armies could return to the practice of vast strategic stockpiles dotted around the globe. The US has stocked the British island of Diego Garcia in the Indian Ocean and keeps ready-loaded ships.

“There must have a large and efficient army, one capable of meeting the enemy abroad, or they must expect to meet him at home.”

Arguably, the “Teeth-to-Tail” arguments are no longer applicable. A modern combat force is one whole, combat troops and logisticians. If peace dividend reductions in armies are to be made it could be that complete military formations should go; for it is in these formations that the bulk of a peacetime army’s manpower lies. Reductions made in this fashion would be balanced. As the combat units left the order of battle then so would the logistic units that supported them.

There will be conflict and it will need to be logistically supported. The basics facts of military life are that, to be able to fight, military forces must be able to move to the theatre of operations. Once in the theatre of operations armies, navies and air forces must be supplied with the basic necessities of war otherwise the campaign will be lost before it starts. Lastly, the logistics forces involved in the conflict must be structured to support combat and must be practiced in that task, if the combat forces are not to find that their logistics support becomes a constraining, if not battle-losing, factor.

There is a growing body of ‘informed’ opinion that the need to move far and fast reinforces a future requirement for light and airmobile forces which would be able to move swiftly to the danger area. Certainly there is a place for such forces because the political imperative will be to get ground forces into the theatre of operations as quickly as possible.
APPENDIX C: LOGISTICS IN OPERATION
IRAQI FREEDOM

OIF-I: An Overview

By most accounts the invasion of Iraq, now known as Operation Iraqi Freedom-I, was a huge success. During March 2003, 167 ships operated by the Military Sealift Command created a “Steel Bridge of Democracy” that ferried required equipment forward into theater. To appreciate the range of this endeavor, there was on average a ship every 72 miles from the United States to Kuwait.\(^{202}\)

Additionally, pilots flew thousands of C-130, C-5, and C-17, and commercial sorties both inter- and intra theater to deploy and position almost 424,000 U.S. personnel and their equipment.\(^{203}\) This herculean feat facilitated the reception, staging, onward movement, and integration (RSO&I) of forces in the Area of Operations (AOR) and supported the concept of operations developed by the combatant commander. Subsequently, “during OIF, we witnessed the most dominating, rapidly moving, and ultimately successful combined air, sea, and ground fighting force ever to go into battle. The battle plan called for a 30-day campaign to combat victory. The coalition did it in 3 weeks.”\(^{204}\) Common conventional military doctrine would have dispatched a few hundred thousand troops on the move to Iraq supported by a large logistics tail known as the “iron mountain.” Instead, then Central Command Combatant Commander, General Tommy R.Franks, “envisioned a swarming, rapid, responsive force capable of removing threats immediately: relying on speed more than mass.”\(^{205}\)

The concept of speed became the underlying theme throughout the war for all commanders, and in particular for the 1st Marine Division, “speed was a culture.”\(^{206}\)

*The first comprehensive report on Operation Iraqi Freedom is Sustainment of Army Forces in Operation Iraqi Freedom Battlefield Logistics and Effects on Operations by Eric Peltz, John M. Halliday, Marc L. Robbins, Kenneth J. Girardini, published by Rand Arroyo Centre, Extracts relevant in context of this study are enunciated in succeeding paragraphs.*
Ammunition Supply During Combat Operations

Ammunition support during combat operations is more problematic in general, because consumption of ammunition is much more variable and unpredictable than that of food and water; moreover, resupply determination is more complex, depending upon the type of ammunition needed. This need is based on both what has been expended and what types of fights the unit expects to engage in. A term like “days of supply” has no relevance, since a full load of some types of ammunition could go in less than an hour or last more than a week, depending upon the situation. Additionally, the need for ammunition resupply can be absolutely immediate, without warning, and develop while in contact. Thus, critical spot shortages are more likely to develop for ammunition than for other supply classes, and they can develop in difficult resupply situations, which did occur. But a general, overall shortage did not develop, at least in terms of having some ammunition available, if not always the munitions of choice.

Distribution Based Logistics

OIF marked a de facto application of what has become known as distribution based logistics (DBL). DBL means limited inventory to cover small disruptions in distribution flow and enough supply to cover consumption between replenishments. The primary reliance is placed on frequent, reliable distribution rather than on large forward stockpiles. This is roughly how OIF combat operations were conducted.

when ground operations began in Operation Desert Storm, forward logistics bases near the Iraqi border had 29 days of rations and 45 days of ammunition stockpiled to support operations, in addition to what was farther back at theater bases. By contrast, in OIF, meals-ready-to-eat (MRE) stocks at the port and at the general support food warehouse were down to less than a day of supply early in combat operations, with as little as five days of supply contained in onhand stocks within units, supply at logistics support areas (LSAs), and MREs in the distribution pipeline en route to units.

Supply Levels During Combat Operations

The 3rd Infantry Division’s plan was to start operations with five days of supply of food and water in all units, with an additional one to two days in the support battalions.
The plan was to get the first resupply on G+2 at Objective RAMS near An Najaf (see Figure S.1), with distribution flowing from that point on, keeping the division basically at or close to the initial full load of supplies\textsuperscript{211}.

As a result of the factors affecting distribution throughput, the first replenishment of food and water, along with limited quantities of other materiel, did not arrive until G+6\textsuperscript{212}. At this point, some units were down to a day or less of supplies.

**Equipment Readiness**

During combat operations, units were able to maintain equipment well enough to keep combat power high. The equipment readiness standard was “shoot-move communicate” (SMC): could the weapon system shoot, could it move, and could it communicate? However, the division’s adaptations could work for only so long. Across V Corps, deferred maintenance, continued problems with spare parts distribution, and a change in the standard to something closer to fully mission capable during stability operations resulted in all combat systems falling below 80 percent readiness by early July\textsuperscript{213}. The very heavily worked distribution assets started showing signs of stress earlier, with many falling below 75 percent\textsuperscript{214}.


This case study proposes that the use of sense and respond (S&R) logistics during Operation Iraqi Freedom (OIF-I) would have provided logisticians critical decision making information (situational awareness) thereby reducing the fog of war and facilitating more efficient and responsive support to the war fighter. In drawing this conclusion, the following study analyzes the events of OIF-I, citing logistical lessons learned and difficulties experienced, and offers suggestions to reduce those challenges. The implementation of S&R logistics will shape future joint logistics requirements while
driving changes in joint doctrine and how we support the operational environment. Current efforts under the Forces Transformation and Resources Office (formerly the Office of Force Transformation) and the Program Manager, Light Armored Vehicle (PMLAV) pave a path for S & R logistics implementation within the military.

For a discussion of shipping costs, see Marc L. Robbins and Eric Peltz, Sustainment of Army Forces in Operation Iraqi Freedom: End to End Distribution, Santa Monica, CA: RAND Corporation, Battlefield Logistics and Effects on Operations Spare parts shortfalls did lead to significant deferred maintenance problems during major combat operations and subsequent significant degradation in equipment capabilities.

This did not produce documented adverse effects in OIF operations. However, the question has been frequently posed about how much longer

3rd Infantry Division (3 ID) could have been effective in high-intensity combat if the regime had not collapsed. As little as two weeks has been posited, but the answer depends very much on what 3rd ID might have been asked to do had combat operations continued. And had the 3rd ID remained the main effort in continued combat operations, it is likely that it would have received greater distribution priority, potentially providing the ability to correct some of the deferred maintenance deficiencies.

Expert Critiques and Assessments

Joint Doctrine

In analyzing OIF-I, how do we define effective logistics support on the battlefield? “The supported Joint Force Commander (JFC) expects logistics to give him freedom of action—to enable the effective execution of his mission according to the timetable. “215 There are three imperatives for success in the joint logistics environment. The first is unity of effort by defining the process, establishing roles and responsibilities of the players, and identifying common output metrics while keeping the process transparent through shared awareness. “Unity of Effort is the coordinated application of all logistics capabilities focused on the JFC’s intent, and is perhaps the most critical of all joint logistics outcomes.”216 The second imperative is rapid and precise response to
effectively meet constantly changing requirements of the joint force in a complex, unfolding battle.

The key characteristics of rapid response are velocity, reliability, and visibility. These features should ultimately provide an end state of improved efficiency. Essential to rapid and precise response is performance tracking to identify areas of success and progress while improving the overall process. Speed, is the most critical aspect of improving response and delivering critical supplies to the war fighter. On the battlefield, war fighter success is intricately tied to the speed of resupply. Lastly, joint logistics enterprise visibility must be established with an enterprise data architecture, authoritative source data, and 24/7 access to the network. The use of S&R logistics can be a key enabler to accomplishing these three goals and optimizing war fighter support.

Fundamentally, success in OIF-I was not achieved through trial and error or luck. The rapid offensive movements during OIF-I for the Army and Marine Corps were due to the lessons learned in the first Gulf War and the actions of logisticians on the ground. But at times the ability to actually track and control the moving units was nonexistent, and only accomplished based on the leadership of unit commanders.

“As Brigadier General Jack C. Stultz, noted, with the combat troops of Iraqi Freedom moving at a faster pace than ever before, the ability of logisticians to keep them supplied was taxed but never in danger of breaking down.”

To avoid failure, the logisticians had to overcome significant hurdles to maintain the pace of the combat units. Ultimately, the stressed lines of communications unavoidably degraded war fighter support.

Other opinions of OIF-I logistics support are even more optimistic, as “support was delivered where it was required, when it was required, and the waste associated with Desert Storm’s “iron mountain” of unused supplies was avoided.” The Deputy Undersecretary of Defense for Logistics and Material Readiness goes on to say that “each combat unit was equipped with transponders, allowing both combat leaders and logisticians at Central Command to track the troops’ movement in real time. Similarly, radio frequency identification (RFID) tags were attached to all inbound material containers at their point of shipment. These data, plus information from other
systems, were integrated into a common operating picture, which allowed the coalition to achieve real-time information dominance.”220 Thus, at the strategic level, the accomplishments of OIF are viewed favorably. However, close examination reveals that serious challenges degraded the effectiveness of logistics support.

The Marine Corps’s ability to extend its logistics culminating point up to eight times the doctrinal distances is a success story for all Marines in OIF. The operational reach of the Corps is better than ever. Moreover, we can sustain the force over those distances, provided we are able to anticipate operational requirements.221

Conclusion

“War logistics, when truly working, should be transparent to the warfighter.”222

Based on the OFT Vision, S&R logistics is a means to this end by providing the commanders and logisticians a tool to know “what is where as well as what is on the way and when they will see it.”223 Although varying degrees of success were identified for logistics support during OIF-I, the use of S&R logistics would address many of the challenges that created so much confusion and fog during the war.

However, critical areas must still be addressed. While the EPLS is an important first step to establishing a sense capability on critical systems, the communication links and pipes to pass the sense data to the relevant decision makers appear to be at a standstill. The implementation of S&R logistics seems to be a sequential rather than concurrent process.

Passing of the sense data across the enterprise must be given the same priority of effort and funding, otherwise data will be sensed and collected, but not acted upon. Having the capability to monitor and predict failure, knowing actual fuel and ammo levels of weapon systems, and being able to track materiel on the battlefield are all immediate needs of logisticians. Policymakers, the Armed Services, and industry, must work together to fund, develop, and field this capability. Initial efforts on the EPLS by PM-LAV will begin establishing a capability that not only benefits the logistician, but also improves the lethality of the warfighter through increased speed and confidence.
“Logistics must be ready to move and extend the logistics chain, synchronized with the advance of the combat force, to maintain continuous flow and support.”

The challenges associated with OIF-I are not going away, and the future consists of a more VUCA environment. S&R logistics provides the capability to take the logistics community into the 21st century and revolutionize the conduct of war. The use of S&R logistics will not only enable a transformation in military logistics, but also fundamentally change the end to-end support to the war fighter, while effectively integrating the enterprise and changing the approach to weapons systems support and joint doctrine.

Implications for the Future

Perhaps more than the actual effects in OIF, logistics issues in OIF could have important implications for future force operational concepts. At a process level, there are tremendous numbers of lessons for joint doctrine, organization, policy, tactics, techniques, and procedures (TTPs), equipment, and information systems. There are at least three critical questions for the future force’s design.

- To what degree can support over non contiguous lines of communications be counted on to sustain distributed operations?
- What level of sustainment risk are commanders willing to accept in order to achieve mobile tactical formations and rapid deployment and employment?
- How much will better logistics situational awareness change the risk dynamic?

In light of the experiences of OIF, it became prudent to review Joint Publication (JP) 4.0, Doctrine for Support of Joint Operations.

Joint Logistics was reviewed as “the deliberate sharing of Service logistics resources … to support the joint force operational requirements, enhance synergy, and reduce redundancies and costs.”
APPENDIX D : LOGISTICS IN SINGAPORE ARMED FORCES

The researcher visited Singapore as part of the logistics delegation in 2006, and observed the magnitude of Integration, Jointness and coordination at the National Level. Enunciated below is an extract of relevant segment on logistics that help draw useful levels in our context.

**Combat Service Support (CSS)**

**Background.** Combat Services Support Command (CSSCOM) integrates all functions of CSS expertise for the Army and provides support to Army units across full spectrum of operations. It is both task-organised to support Army in operations and training, as also type-organised to deepen specialisation and domain competencies.

**Mission Tailored Systems.** As CSS operations can be calibrated to support the full spectrum of operations, it is anchored on strong forward-CSS leadership, mission-tailored systems and integration with strategic industry partners. In peace, CSSCOM aims to achieve resource optimisation and reap process efficiencies while allowing the Army to better raise, train and sustain their forces through the integrated management of all CSS resources.

**Leveraging Expertise.** CSSCOM continues to integrate with the larger MINDEF/SAF/Army community to tap on expertise of other agencies. CSSCOM aims to leverage on the larger defence eco-system created in-house by SAF to provide resilient supply chains and the necessary capacity to sustain operations. In future, the CSSCOM plans to extend support to SAF, as the central service provider of common CSS needs during peace and war, to include transportation and maintenance services and provision of common logistic material/wherewithal.

**Organisational Excellence.** CSSCOM leads the army in embracing the Public Service 21 (PS21) initiatives to meet increasing demands for good governance, accountability and transparency and thus, sustain public confidence through prudent resource management for optimum and effective management of logistic resources. By
establishing the foundation for system/process improvement, units can achieve organisational goals in the spirit for excellence.

**Enterprise System (ES)**

ES is a first class defence global information system to enable MINDEF/SAF users to perform end to end automated logistics and financial transactions. It has been developed to meet the following objectives :-

- Enable a single and integrates system for engineering/maintenance/ supply and financial business.

- Enhance financial and logistics management through expansion in capabilities, integration and enhanced connectivity.

- Effective decision making by ensuring resource visibility and optimal resource allocation to achieve desired outcome. The ES employs new SAP tools such as Enterprise Portal, Advanced Planner and Optimiser and Business Information Warehousing to enable integrated business planning, supply chain intelligence and facilitate reporting to track real time equipment status, trend and analyse key performing parameters.

- The Enterprise system (ES) harmonises and integrates the finance and logistic business processes of the Tri-Services and various MINDEF departments. It increases the effectiveness and efficiency of the Singapore Armed Forces (SAF) through the integration of information, processes and people, as well as collaboration with strategic partners.

- With commercial off-the-shelf (COTS) software, ES provides a comprehensive suite of functions and transactions, covering the areas of logistics, finance, systems acquisition and planning and allows information and transactions to be assessed with single sign-on, thus providing convenience to all users. It also enables business-to-business transactions with vendors.

- ES enables the SAF to have more accountability in its work and thereby make better strategic decisions. Similar work processes are streamlined and repetitive work is eliminated to achieve higher op efficiency. Planners can derive accurate long-term
material demand and budget forecasts, and perform Just-In-Time provisioning, thus lowering inventory cost and delivering a high material fulfilment rate. Inventory levels are electronically monitored and accounted for in central system, and replenished in time. Resources are managed more efficiently as there is transparency in allocation and distribution within the Services.

• Financial planning, scheduling and budgeting are more effective as they can be done automatically. ES helps personnel to monitor project expenditure against budget and facilitate status and reporting of project deliverables. In the area of logistics, ES tightens maintenance and supply of material and facilitates timely payment to suppliers.

**Defence Science and Technology Agency (DSTA)**

DSTA is a statutory board set up under the ministry of Defence (MINDEF) and aims to provide leading-edge technological solutions to the Singapore Armed Forces so that it continues to be a formidable fighting force for defence and security of Singapore.

The scope of work encompasses a multitude of areas to include technology, acquisition systems development management for the armed forces. As an executive arm of MINDEF, the DSTA undertakes following functions:-

• Acquisition of weapon systems.

• Advice MINDEF on all defence science and technology matters.

• Manage defence research and development.

• Develop military infrastructure.

• Provide engineering and related services in defence areas.

• Promote and facilitate the development of defence science and technology in Singapore.
Defence Industry Initiatives.

- PRIMUS Vehicles
- Bronco All Terrain Tracked Carrier (ATTC)
- Bionix II Infantry Fighting Vehicle
- PEGASUS
- SAR21
- Formidable-Class stealth frigates
- An automated underground ammunition depot at Changi Naval Base, that allows automated storage and loading ammunition on war ships.

Analysis

Technology as Force Multipliers.

SAF utilizes technology as “force multipliers”, especially for C4I integration, to enable its various formations to fight an integrated battle. The SAF also acknowledges that technology is crucial for overcoming limitations of strategic depth and human resource. Research and experimentation to develop to a technological edge over others began as early as 1971. Today MINDEF is one of the largest employers of engineers and scientists in Singapore and continues to devote considerable resource/s to R&D and experimentation i.e., 5% and 1% of defence budget respectively

Modelling and Simulation Technologies.

- The Singapore Armed Forces (SAF) have harnessed Modelling and Simulation (M&S) technologies for simulation and training systems since the early 1980s for areas such as operational mission planning and rehearsals, decision support, as well as test and evaluation. It also became an essential technology and tool for military experimentation.

- The SAF formulated and launched a major programme called the Vision for SAF Simulation 2000 (VSS2000) in 1995 to capitalise on M&S technology advancement.
• The Army operationalised a constructive war gaming system called Simulation for Land Battle (SIMLAB) which facilitated HQ command and staff training at different command levels, the Battalion to Division. Besides command-team training, the system also proved to be a useful tool for exploratory studies of different forces structures, and for evaluation of new platforms and weapon systems.

**Integrated Online Logistics Inventory Management System.**

An enterprise solution, this SAP based inventory management system enables online forecasting, planning, warehousing and issue of the entire range of general stores and items in the Armed Forces. It is fully integrated amongst three services, with procurements being undertaken by DSTA and a civil vendor handling warehousing functions.

**Warehousing Processes.**

All processes are outsourced and handled by a civil vendor namely, Singapore Technologies Private Ltd and based on a state of the art automatic inventory handling and retrieval system, based on high pallet and bin stacking concept.

**Army Logistics Base (ALB).**

The ALB is a Public Private Partnership venture, where in the authority and control if the establishment rests with the army, where as the responsibility of running the facility rests with a civilian vendor. The system software is controlled with minimum manual interface and extensively utilised for material management, warehousing, distribution and maintenance services.

**Changi Naval Base.**

The logistics need of the Navy are categorized under stores & spares, clothing, eqpt and administrative items. Improvement in the logistics system has been brought about in three periods i.e. up to 80’s, period between 80’s and 90’s and after 2000. While technology has been the mainstay for build up of efficient logistic support structures, partnering and extensive outsourcing has been resorted to since year 2000. Availability based contracting and online shopping has facilitated a win-win situation both for
Navy and military contractors. The logistics base is spread over an area of 15,000 sqm, maintained on pallets and bins. It has the facility to store 68,000 pallets and there are 400,000 locations for bins. Very narrow and high stack storage has resulted in savings of 60% warehouse space, as also use of an automated system has resulted in saving of 80% manpower.

Changi Air Base.

The most striking observation during the visit to Changi Air Base was the maintenance of military transport aircraft outsourced to the civil aviation sector.
THE NEW RULES OF WAR: FIGHT SYMMETRICALLY AND STAY ENGAGED

The International Strategic Studies Association (ISSA) — the publisher of Defense & Foreign Affairs — has said, in a new study, that Western military forces must change their focus on asymmetric warfare because existing doctrine has failed them, and it was now necessary to look at a new form of symmetric warfare, which would largely be fought on geographic and climate terms not of their choosing.

The study advocated new approaches to fielding and sustaining forces in the field, noting that these approaches would also be beneficial to dealing with rear-area “denial-of-service” warfare, in which it could be expected that in major confrontations, Western “home-land” populations would be subjected to major disruptions to electricity, food, and water supplies which would have consequences far more severe than the Japanese tsunami of 2011.

One of the approaches to developing forces which could be sustained for extended durations of expeditionary or rear-area operations would be to create a new class of military vehicles which would be lighter and more flexible than anything yet fielded, but which would also provide maintenance-free, non-diesel sources of electrical power and purified water. The new vehicles should be called High-Mobility Expeditionary Resource Vehicles (HMERV), stressing that the delivery of safe water and electrical power in remote or destroyed urban environments would be the key to the next phase of most conflict operations. The study results are enunciated in succeeding paragraphs.

Background: It was recognized that strategic outcomes were being determined by the failure of conventional military units to achieve mission success in the face of low-cost forces (supposedly inferior in the asymmetric framework). Within this new framework, several factors apply:

- the initiative has moved to the unconventional forces, and conventional forces are moved to a defensive position with disproportionate resources thrown into non-aggressive activities such as counter-IED efforts, logistics, etc.;
short engagement periods at remote locations limits mission success prospects, and adds a substantial logistical train, particularly for diesel fuel and water, which is expensive at a politically-punitive level to the employing force in both manpower and financial terms; and

- The preponderance of conventional force efforts and funds are thrown into logistics the most significant diversion of strategic effort and funding, then, is on the movement of essential supplies of potable water and diesel fuel. A 2009 US Army study noted: “Re-supply of fuel and drinking water for troops in-theater costs lives.”

The West has convinced itself that it must fight “asymmetric” wars, yet it was military thinking in the PRC and India, after the US military strikes against Serbia in the 1990s, which showed that technologically inferior forces could successfully wage “asymmetric warfare” against a technologically and more wealthy adversary.

As a result, ISSA has been working with Strategic Asset Protection Systems, Inc. (StrAPS), a US corporation which specializes in innovative responses to changing threat environments, in developing lightweight, easily-deployable, self-contained systems for forward battlefield operations and extended disaster relief support. The systems — including a light, economical (and combat proven) rugged terrain vehicle system with integral capabilities to produce large quantities of potable water and sufficient electrical power to sustain unit Command, Control, and Communications — has been given the designation of High-Mobility Expeditionary Resource Vehicle (HMERV), named Argonaut, and was to be in pro-to type form by mid-2011.
**Goodbye to Logistics Convoys:** The *Argonaut* HMERV, the High-Mobility Expeditionary Resource Vehicle, or, in civilian guise, the High-Mobility Emergency Response Vehicle, in prototype form. The objective of the International Strategic Studies Association and Strategic Asset Protection Systems was to create a vehicle which could fit in or under major helicopters and fixed-wing aircraft, and operate without a logistical tail for protracted periods in hostile environments, providing potable water and electrical supplies for expeditionary or disaster relief operations in areas of devastation or mass population upheaval. Significantly, the R&D also threw out a range of manportable and light-pay load water purification systems to give forward operations the independence they need.

Secretary of the Navy Ray Mabus noted, “The cost of fuel in a ground vehicle in theater starts at $15 a gallon and goes into the hundreds.” Taking into account long supply lines and force protection measures, in January 2001 the US Defense Science Board estimated fuel could cost as much as $400 a gallon at the point of use. In reality it is now vastly higher.

Indeed, US Army and Marine Corps deployments to Iraq and Afghanistan during the first decade of the 21st Century, showed that the real cost was much higher than
indicated by just the cost of diesel to deliver water in-theater. The requirement to support a Stryker Brigade Combat Team (SBCT), comprised of 3,972 soldiers in Iraq, consuming 31,776 liters a day of potable water (at eight liters per man per day), demanded: Water re-supply every other day (182 trips per year); Ground convoy consisting of 20 vehicles (16 supply trucks; four gun trucks with four soldiers per truck; one gun man per water truck); Air support to convoy included two Apaches (AH-64D), two soldiers per Apache; average convoy speed: 35 mph. On top of this, the Army funded a water purification and bottling plant, at a cost of many millions to procure and sustain, including the deployment of military personnel to protect the bottling facility.  

**System Framework Objective:** The objective was to create a highly mobile capability for each company — or even platoon — of troops aboard a single, light, off-road vehicle, to deliver electrical power and clean water to forces and/or target civil groups in remote/forward operational military or disaster relief areas, enabling sustained independent operations under adverse conditions.

- Capability should substantially reduce the diesel fuel logistical chain, moving eventually toward the use of a hybrid engine, and ultimately an electrical motor, sustained by the system’s solar power array;
- Capability should enable military/ disaster relief units to operate detached from support, in forward areas, for protracted periods;
- Capability should deliver — from its solar power array — sufficient electrical power to sustain all unit communications and computer capabilities required by the mission; to drive water purification/desalination for the entire unit for protracted periods; and to generate sufficient additional potable water to support additional population groups;
- Capability should ensure operation without ongoing supply of replacement parts and filters, and minimal technical skills and man power levels for operation; and
- Capability should be lightweight (less than 2,500 lb. (1,133.98 kg) all up weight), easily air-transportable by medium-lift helicopters (sling load or internal: CH-46/47, etc.), and medium-level transport aircraft (V-22, C-27, C-130, etc.).
What was already being achieved by May 2011 was a vehicle prototype which has combined a range of new, but proven, technologies, and which is expected to be ready for series production and service within the second half of 2011, delivering:

One of the developments of the R&D program which was begun by ISSA with StrAPS was the creation not only of the *Argonaut* HMERV, but also a range of *Argonaut* manpack and light-palletable systems for water purification, electric power generation, and (palletable) water desalination.

**Conclusions: Game Change Begins**

The new HMERV is a tool for expeditionary forces to regain the initiative and reduce the cost of engagement, in human, financial, and time terms. It is also the tool for humanitarian engagement on those many occasions when relief is needed from disasters, from the societal impact of war, and from the effects of drought, flooding, or mass population events.
APPENDIX E: LOGISTICS CIVIL AUGMENTATION
PROGRAM

Logistics Civil Augmentation Program

Army Regulation 700–137 Logistics, Headquarters, Department of the Army Washington, DC, 28 December 2012, designates the Logistics Civil Augmentation Program as a Department of the army regulatory program and prescribes policy for implementation and execution. This Program is intended to support U.S Military and appropriate circumstances, multinational forces, and other Government and/ or non-Government agencies. This regulation describes existing program planning and management concepts, responsibilities, and policy and will evolve as Army doctrine matures. Logistics Civil Augmentation Program Tactics, techniques and procedures are documented in ATTP 4–10 and specific theater policies and procedures AR7159 prescribes policies, procedures, and responsibilities for a disciplined approach to managing and using contractors who deploy to support Army requirements.

Purpose

This regulation establishes the Logistics Civil Augmentation Program (LOGCAP) as a Department of the Army (DA) Regulatory Program to augment the force by providing a service capability to meet externally driven operational requirements for rapid contingency augmentation support. The LOGCAP plans for and executes contracted support services in conjunction with the Army Field Support Brigade and contracting support brigade (CSB) for deployed forces performing missions directed or supported by the Department of Defense (DOD) during global contingency operations.

Responsibilities

Assistant Secretary of the Army for Acquisition, Logistics and Technology

The ASA (ALT) will—

- Identify, formulate, coordinate, and disseminate acquisition policy and guidance.
• Advise U.S. Army Training and Doctrine Command (TRADOC) regarding integration of LOGCAP information, as a subset of operational contract support (OCS), in professional military education (PME) and other training and exercises

• Assist TRADOC in the preparation of LOGCAP-related doctrine.

**Assistant Secretary of the Army for Installations, Energy and Environment**

The ASA (IE&E) will identify, formulate, coordinate, and disseminate environmental policy and guidance regarding LOGCAP.

**The Surgeon General and/or Commander, U.S. Army Medical Command**

TSG and the Commander, MEDCOM will—

• Assess the effect of LOGCAP on health service support policies, programs, and requirements during contingency operations.

• Assist AMC in determining LOGCAP health service capabilities in support of the TAA process.

• Provide technical expertise and medical standards under LOGCAP task orders.

**Commanding General, U.S. Army Materiel Command**

The CG, AMC will—

• Serve as the lead agent for overall LOGCAP administration, management, and execution.

• Establish and maintain a PMO for LOGCAP to manage and synchronize program training, planning, execution, and oversight.

• Determine Manning requirements for a LOGCAP Support Brigade capable of meeting the demand for LOGCAP support, in coordination with the Chief, Army Reserve and/or CG, U.S. Army Reserve Command (USARC).

• Assist TRADOC with formulating concepts and doctrine related to LOGCAP.
• Assist TRADOC, Defence Acquisition University, and other appropriate organizations with incorporating LOGCAP-related training into programs of instruction.

• Coordinate mission-related internal training for personnel involved with LOGCAP to include the LOGCAP support officers (LSOs).

• Coordinate training, planning, and LOGCAP execution with external agencies.

• In coordination with the DCS, G–4, conduct an annual LWRM to coordinate, prioritize, and synchronize LOGCAP support to ASCC OPLAN development, training, and exercises.

• Provide LOGCAP forward presence at key commands and installations to assist with program coordination, integration, planning, and training, as required.

• Coordinate the integration of LOGCAP into ASCC OPLANS and operation orders (OPORDs).

• Coordinate the inclusion of LOGCAP as a subset of OCS into Joint and Army exercises, as appropriate.

• Provide LOGCAP assistance and training assessment visits.

• Validate contractor readiness, capabilities, and risk mitigation plans.

• Provide or coordinate contracting and contract administration services in support of the program.

• Coordinate technical assistance, expertise, and early assessments from U.S. Army Corps of Engineers (USACE) or other design-construction agency, as needed, to ensure consistent and proper approach to real property transfer and subsequent operation and maintenance.

• Coordinate requests for military construction services with USACE as specified in DODD 4270.5.

  o 2 AR 700–137 • 28 December 2012
• Coordinate forward LOGCAP management and contractor equipment and personnel time-phased force deployment data with ASCCs. This applies to government provided transportation as well as contractor provided transportation.

• Coordinate transportation and life support for forward LOGCAP management personnel with the supported operational commander.

• With the assistance of the DCS, G–1 and the ASA (ALT), ensure compliance with the Defence Federal Acquisition Regulation Supplement on using the synchronised pre deployment and operational tracking (SPOT) to account for and verify identity of LOGCAP contractor personnel during contingency operations.

• Incorporate LOGCAP observations, insights, and lessons (OILs) into the formal Army Lessons Learned Program in accordance with AR 11–33.

• Provide LOGCAP contract support capability data in support of the TAA process.

• Coordinate reimbursement to USACE for all LOGCAP support, as applicable.

2–11. Commanding General, U.S. Army Training and Doctrine Command

The CG, TRADOC will—

• Include LOGCAP policies and procedures as a part of OCS in the development of Army concepts and doctrine.

• Include LOGCAP policies and procedures as a part of OCS in TRADOC school instruction and training publications.
References


197 Ibid


199 Ibid, pp 1-2

200 Doing More with Less, 15

201 Logistics 2000 Plus, 143


Interview with BG Charles Fletcher, and interview with MG Buford C. Blount, Commanding General, 3rd Infantry Division (Mechanized), 18 November 2003.

Army Materiel Command (AMC), Theater Logistics in the Gulf War, 1994. The goal was actually 60 days of fuel, food, and ammunition.

Ibid,

From General Support (GS) supply daily status reports covering the theater distribution center, the food warehouse, and the seaport. It is possible that not all MRE inventory in the port was accounted for, but then again, if not accounted for, it could not be issued

Interview with LTC Steve Lyons, former commander of 703rd MSB, 3rd ID, 28 October 2003.

Ibid

3rd COSCOM readiness briefing, 14 July.

Ibid


Ibid.


Army Logistician, Logistics System Strained but Succeeds in Operation Iraqi Freedom, 1.

Morales and Geary, Speed Kills: Supply Chain Lessons from the War in Iraq, 17.

Morales and Geary, Speed Kills: Supply Chain Lessons from the War in Iraq, 17.


Kross, Iraqi Freedom: Triumph of Precision-Guided Logistics, 22.
223  Ibid


225  See Copley, Gregory R.: “For Want of a Nail … Tactical successes or failures can often accumulate to determine strategic outcomes, but too often we ignore the linkages between tactics and strategy. A case study of US vehicles in Iraq”, in Defense & Foreign Affairs Strategic Policy, 2-2008.

