NPS-AM-12-C9P20R01-082

EXCERPT FROM THE

PROCEEDINGS

OF THE

NINTH ANNUAL ACQUISITION RESEARCH SYMPOSIUM THURSDAY SESSIONS VOLUME II

Joint and Coalition Tactical Networking: There's an App for That! Improving Affordability and Accelerating Innovation in Tactical Networking Using the Joint Tactical Radio System Enterprise Business Model

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Joint Tactical Radio System

Published April 30, 2012

The research presented at the symposium was supported by the acquisition chair of the Graduate School of Business & Public Policy at the Naval Postgraduate School.

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Preface & Acknowledgements

Welcome to our Ninth Annual Acquisition Research Symposium! This event is the highlight of the year for the Acquisition Research Program (ARP) here at the Naval Postgraduate School (NPS) because it showcases the findings of recently completed research projects—and that research activity has been prolific! Since the ARP's founding in 2003, over 800 original research reports have been added to the acquisition body of knowledge. We continue to add to that library, located online at www.acquisitionresearch.net, at a rate of roughly 140 reports per year. This activity has engaged researchers at over 60 universities and other institutions, greatly enhancing the diversity of thought brought to bear on the business activities of the DoD.

We generate this level of activity in three ways. First, we solicit research topics from academia and other institutions through an annual Broad Agency Announcement, sponsored by the USD(AT&L). Second, we issue an annual internal call for proposals to seek NPS faculty research supporting the interests of our program sponsors. Finally, we serve as a "broker" to market specific research topics identified by our sponsors to NPS graduate students. This three-pronged approach provides for a rich and broad diversity of scholarly rigor mixed with a good blend of practitioner experience in the field of acquisition. We are grateful to those of you who have contributed to our research program in the past and hope this symposium will spark even more participation.

We encourage you to be active participants at the symposium. Indeed, active participation has been the hallmark of previous symposia. We purposely limit attendance to 350 people to encourage just that. In addition, this forum is unique in its effort to bring scholars and practitioners together around acquisition research that is both relevant in application and rigorous in method. Seldom will you get the opportunity to interact with so many top DoD acquisition officials and acquisition researchers. We encourage dialogue both in the formal panel sessions and in the many opportunities we make available at meals, breaks, and the day-ending socials. Many of our researchers use these occasions to establish new teaming arrangements for future research work. In the words of one senior government official, "I would not miss this symposium for the world as it is the best forum I've found for catching up on acquisition issues and learning from the great presenters."

We expect affordability to be a major focus at this year's event. It is a central tenet of the DoD's Better Buying Power initiatives, and budget projections indicate it will continue to be important as the nation works its way out of the recession. This suggests that research with a focus on affordability will be of great interest to the DoD leadership in the year to come. Whether you're a practitioner or scholar, we invite you to participate in that research.

We gratefully acknowledge the ongoing support and leadership of our sponsors, whose foresight and vision have assured the continuing success of the ARP:

- Office of the Under Secretary of Defense (Acquisition, Technology, & Logistics)
- Director, Acquisition Career Management, ASN (RD&A)
- Program Executive Officer, SHIPS
- Commander, Naval Sea Systems Command
- Program Executive Officer, Integrated Warfare Systems
- Army Contracting Command, U.S. Army Materiel Command

- Office of the Assistant Secretary of the Air Force (Acquisition)
- Office of the Assistant Secretary of the Army (Acquisition, Logistics, & Technology)
- Deputy Director, Acquisition Career Management, U.S. Army
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- Director, Office of Acquisition Resources and Analysis (ARA)
- Deputy Assistant Secretary of the Navy, Acquisition & Procurement
- Director of Open Architecture, DASN (RDT&E)
- Program Executive Officer, Littoral Combat Ships

We also thank the Naval Postgraduate School Foundation and acknowledge its generous contributions in support of this symposium.

James B. Greene Jr.
Rear Admiral, U.S. Navy (Ret.)

Keith F. Snider, PhD
Associate Professor

Panel 20. Application of an App Store Software Model Within the DoD

Thursday, May 17, 2012	
1:45 p.m. – 3:15 p.m.	**Chair: Brigadier General Michael E. Williamson,** USA, Joint Program Executive Officer, Joint Tactical Radio System ***Joint and Coalition Tactical Networking: There's an App for That! Improving Affordability and Accelerating Innovation in Tactical Networking Using the Joint Tactical Radio System Enterprise Business Model*** Jeffery Hoyle, *Joint Tactical Radio System* ***Widget and Mobile Technologies a Forcing Function for Acquisition Change: Paradigm Shift Without Leaving Bodies Behind*** Michael Morris, Christopher Raney, Kenneth Trabue, Timothy Boyce, Kari Nip, *Space and Naval Warfare Systems Center Pacific* ***Apple App Store as a Business Model Supporting U.S. Navy Requirements*** Douglas Brinkley and Brad Naegle *Naval Postgraduate School*

Michael E. Williamson—General Williamson assumed his duties as joint program executive officer for the Joint Tactical Radio System in March 2011.

General Williamson was born in Tucson, AZ. He was commissioned at the University of Maine as a second lieutenant in the Air Defense Artillery in 1983.

His assignments include service as the automation officer for the 32nd AADCOM in Darmstadt, Germany. He then served as a chaparral platoon leader, vulcan platoon leader, maintenance officer, and executive officer in C Battery, 108th Brigade, Hahn Air Force Base, Germany. After attending the Air Defense Artillery Advance Course, he served as the chief, Forward Area Air Defense Weapons, Development Branch at Fort Bliss, TX. He then commanded B Battery, 3/1 ADA (Hawk) in the 11th Brigade at Fort Bliss and also in the 31st ADA Brigade at Fort Hood, TX. After completing command, he served as the Assistant S-3 in the 31st ADA Brigade.

His acquisition experience began as senior military software analyst at NATO's military headquarters in Mons, Belgium. He then served as the associate director, Battle Command Battle Lab at Fort Leavenworth, KS. After attending Command and General Staff College, he served as the chief of information technology, Acquisition Career Management, within the Office of the Assistant Secretary of the Army for Acquisition, Logistics, and Technology. He was then selected as a congressional fellow and served as a legislative assistant to a member of Congress. After completing the fellowship, General Williamson served as the product manager for the Global Command and Control System-Army, and then as the acquisition military assistant to the Secretary of the Army. He served as commander of the Software Engineering Center-Belvoir (SEC-B). He was then assigned as the project manager, Future Combat System (Brigade Combat Team) Network Systems' Integration within program manager, Future Combat System (Brigade Combat Team). He then served as the director of systems integration, within the Office of the Assistant Secretary of the Army for Acquisition, Logistics, and Technology. Prior to his current assignment, General Williamson served as the deputy program manager, Program Executive Office, Integration.

General Williamson's awards and decorations include the Legion of Merit with two Oak Leaf Clusters; the Meritorious Service Medal with two Oak Leaf Clusters; the Joint Service Commendation

Medal, the Army Commendation Medal with two Oak Leaf Clusters, the Joint Service Achievement Medal, the Army Achievement Medal with two Oak Leaf Clusters, the Army Superior Unit Award, the National Defense Service Medal with Bronze Star, the Global War on Terrorism Service Ribbon, the Army Service Ribbon, the Overseas Ribbon, and the Army Staff Identification Badge.

General Williamson's education includes a Bachelor of Science from Husson College in business administration, a Master of Science in systems management from the Naval Postgraduate School, and a PhD in business administration from Madison University. He also has graduate certificates in public policy from the JFK School of Government, Harvard University, and the Government Affairs Institute at Georgetown University. He is a graduate of the Army Command and General Staff College, a graduate of the Advanced Management Program at the Harvard Business School, and was a Senior Service College Fellow at the University of Texas at Austin. He is Level III certified in program management and communications and computers.

Joint and Coalition Tactical Networking: There's an App for That! Improving Affordability and Accelerating Innovation in Tactical Networking Using the Joint Tactical Radio System Enterprise Business Model

Jeffery Hoyle—Captain Hoyle completed operational tours onboard five nuclear-powered warships, including command of the USS *Maine* (SSBN 741) Gold, where his crew earned the United States Strategic Command Omaha Trophy and Submarine Squadron Sixteen Battle Efficiency "E" award for mission excellence. His acquisition experience includes serving as the assistant submarine communications program manager at Space and Naval Warfare Systems Command and branch head for Tactical Systems in the Chief of Naval Operations Submarine Warfare Directorate. As Joint Tactical Radio System Network Enterprise Domain program manager, he led the development and delivery of wideband tactical networking waveform and network management/services capabilities for joint and coalition forces. Captain Hoyle holds multiple advanced degrees in engineering, business administration, and product development from the United States Naval Academy, Massachusetts Institute of Technology, Chaminade University, and the Naval Postgraduate School. [jeffery.hoyle@navy.mil]

Abstract

Downloading application software from online app stores created by companies such as Apple has radically transformed the market for goods and services around the world. Now, Joint and Coalition tactical networking for our Soldiers, Sailors, Airmen and Marines is benefiting from a similar business model. The Joint Program Executive Office (JPEO) for the Joint Tactical Radio System (JTRS) is expanding competition, reducing costs, and increasing innovation in defense communications through sharing and reuse of tactical networking waveform software applications that significantly improve warfighter interoperability, lethality, and survivability.

Introduction

Ultimately, the network will connect leaders, Soldiers, Sailors, Airmen, Marines at all levels, at every echelon of command, in any formation, and across the entire team, with the right information quickly and seamlessly. I am confident it will make our various formations more lethal, faster, and more survivable in today's battlefield.

–Vice Chief of Staff of the Army GEN Peter W. Chiarelli (n.d.)

Downloading application software from online app stores created by companies such as Apple has radically transformed the market for goods and services around the world. Now, Joint and Coalition tactical networking for our Soldiers, Sailors, Airmen and Marines is benefiting from a similar business model. The Joint Program Executive Office (JPEO) for the Joint Tactical Radio System (JTRS) is expanding competition, reducing costs, and increasing innovation in defense communications through sharing and reuse of tactical networking waveform software applications that significantly improve warfighter interoperability, lethality, and survivability.

Figure 1. Commercially Developed Tactical Networking Radios Implementing JTRS Waveform Software Enable Simultaneous Sharing of Voice and Data Products to Individual Soldiers, Sailors, Airmen, and Marines at the Battlefield's Tactical Edge

Background

Recognizing the critical need for improved interoperability, situational awareness, and informed decision-making at the tactical edge of current and future battlefields, the Department of Defense initiated development and acquisition of JTRS networking capabilities at the beginning of the 21st century. Early JTRS development efforts were hampered by poorly aligned priorities of individual Services and an incomplete understanding of the technologies required. In 2005, a JPEO was established to improve focus and leadership for the various JTRS development efforts already underway.

JPEO JTRS defined and enforced standards governing JTRS capability development. To encourage competition and foster innovation, the JPEO created an entirely new business model for tactical networking capability acquisition. This JTRS Enterprise Business Model provides companies without government contracts access to tactical networking waveform software applications, enabling them to develop networking radio products that compete directly with those being developed under government contracts. This new approach is more agile than traditional defense systems acquisition, generating a greater variety of robust, affordable networking solutions for joint and coalition warfighters.

A JTRS networking waveform is a reusable, portable, executable software application that is independent of the host radio system operating environment. By sharing waveform software applications through its own app store, known as the JTRS Information Repository, JPEO JTRS greatly expands the number of competitors in the JTRS radio hardware market. More competition lowers procurement costs and accelerates innovation as

developers vie with one another to efficiently deliver new tactical networking capabilities. Communications system developers with access to the JTRS Information Repository pay nothing for the software they download. The price of admission is using the software for only legitimate United States government purposes and delivering all modifications and improvements back to the JTRS Information Repository.

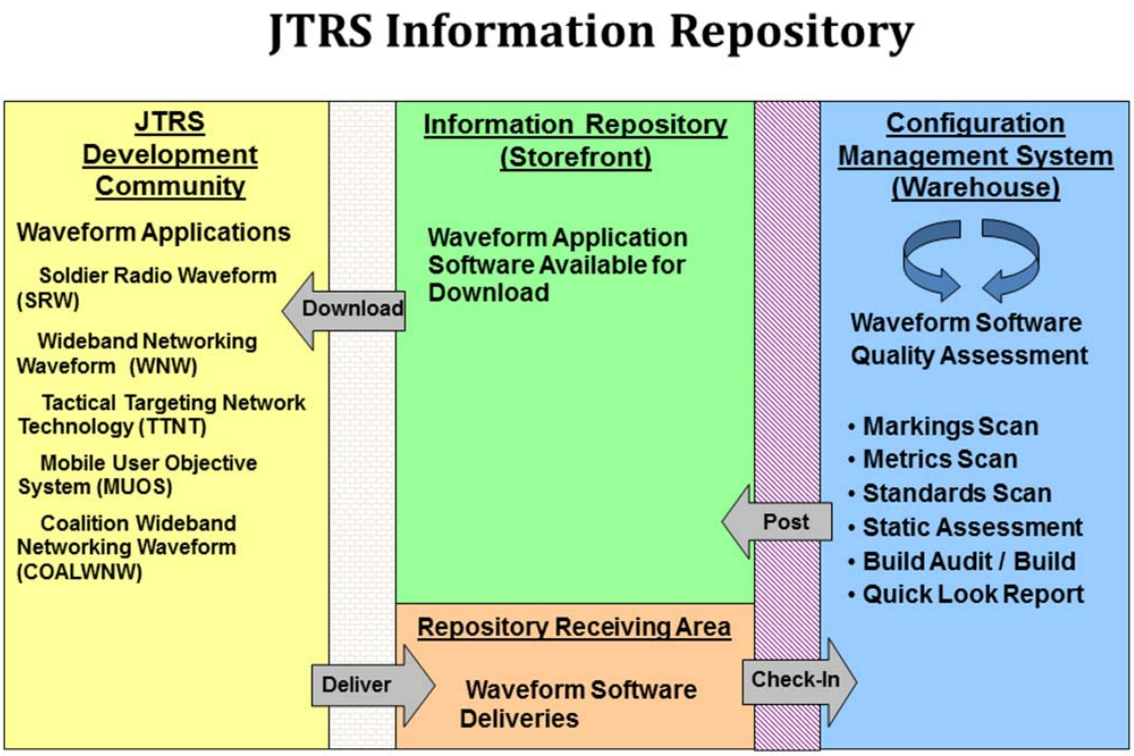

Figure 2. Tactical Networking Waveform Application Software Is Shared With Commercial Industry Partners via the JTRS Information Repository, an App Store That Can Be Accessed by Approved Defense Communications Providers

How It Works

Like the commercial app store model, a key enabler for this JTRS Enterprise Business Model is common standards established by JPEO JTRS with the participation of communications industry partners. These standards ensure that shared waveform applications operate properly on suitably developed hardware and operating environment software. Another important enabler is acquiring sufficient Government Purpose Rights in the waveform development contract to allow sharing of the delivered software with radio hardware providers at government discretion.

In addition to the benefits of increased competition, lower costs, and continuous innovation, reuse of the same waveform software applications among all radio providers delivering tactical networking capabilities also improves their ability to interoperate with one another. This is a significant advance over the older military standard (MILSTD) model wherein each radio provider develops unique waveform versions according to a common specification, requiring redundant software development efforts and frequently leading to interoperability issues across different implementations.

Radio developers integrating the common waveform software can also leverage the JTRS standards in the development of their hardware and operating environment, thereby reducing the level of effort required to integrate the government-provided waveform software. Access to mature networking waveform software substantially reduces their cost of entry into the tactical networking market. By leveraging the JTRS software, radio developers eliminate the additional risks they would incur by attempting to develop new waveform software applications concurrently with their radio hardware/operating environment production.

Companies that integrate networking software using this model do not realize a return on their investment until integration is complete. Consequently, these companies are strongly motivated to improve efficiency and accelerate the development of winning products before the competition beats them to it. JPEO JTRS experience indicates that companies leveraging this business model can integrate waveform software much more cost-effectively than companies doing so under government-funded radio development contracts as a direct result of these strong free market dynamics.

Already, the success of this business model has expanded the scope of competition for integrating tactical networking capabilities into military ground and air vehicles. Rather than limiting competition to a small number of hardware providers qualified to build one specific radio design, the JTRS Enterprise Business Model enables much broader non-developmental item procurement competitions among all defense communications developers. A broader portfolio of interoperable tactical networking devices yields a wider variety of features to meet the needs of evolving military network modernization strategies.

Figure 3. JTRS Tactical Networking Software Allows Junior Leaders to More Effectively Command and Control Their Formations and Enables Sharing of the Common Operating Picture to the Fire Team Level

Eliminating Barriers to Entry

Statutory, regulatory and certification requirements established by Congress, the Department of Defense, and the National Security Agency for communications systems present significant challenges to implementing innovative business models. For example, operational testing events and security certification evaluations are typically funded and executed within the traditional Program of Record model. This approach assumes serial progression of a single system from the development and demonstration phase to the procurement and fielding phase. With the JTRS Enterprise Business Model, multiple tactical networking systems are commercially developed simultaneously without being part of a traditional Program of Record. Although this is highly desirable for agile acquisition of rapidly evolving wireless networking capabilities, statutory, regulatory, and certification requirements must still be met.

JPEO JTRS, working closely with Department of Defense and Service stakeholders, has developed new approaches to satisfying these requirements that better support the objectives of the JTRS Enterprise Business Model. In particular, the United States Army has established a semi-annual large-scale Network Integration Evaluation at White Sands Missile Range, New Mexico. With support from the Defense Operational Test and Evaluation organization, the Army Training and Doctrine Command (TRADOC), and under the direction of the Army Test and Evaluation Command (ATEC), these Network Integration Evaluations have created operational assessment opportunities for all tactical networking systems regardless of development approach. Similarly, the National Security Agency is supporting the full implementation of the JTRS Enterprise Business Model by integrating commercially developed tactical networking equipment into their Commercial Communications Security Evaluation Program.

Another potential barrier to entry is the need to accommodate multiple different networking radio types within a single JTRS network management system to allow for common planning and monitoring by deployed warfighters. JPEO JTRS eliminates this barrier by partnering with commercial radio providers to integrate their products into JTRS Enterprise Network Manager (JENM) system development. This ensures that joint and coalition tactical networks can be properly planned, established, and monitored, regardless of the specific radio hardware components employed.

> *In the past, we have spent years building requirements and products. Now we will conduct evaluations every year, testing technologies from industry and programs of record to gain some economies of scale and make smarter acquisition decisions.*
>
> –COL John Wendel, System of Systems Integration, Army Acquisition Executive (n.d.)

Figure 4. Providing Both Voice and Data Beyond Line-of-Sight Communications to the Fire Team Level, JTRS Tactical Networking Software Meets Operational Requirements and Fills a Gap Where No Capability Currently Exists

Soldier Radio Waveform Example

In 2009, JPEO JTRS completed development and qualification testing of its first mobile ad-hoc networking waveform software application. The Soldier Radio Waveform (SRW) evolved from a Defense Advanced Research Project Agency development to deliver internet protocol networking capability to warfighters and unattended sensors/vehicles at the tactical edge of the battlefield. SRW incorporates three modes:

1. a resilient electronic warfare data mode that enables unattended sensor field control and reporting;
2. a wideband combat communications voice and data mode that allows collaborative planning and enhanced situational awareness; and
3. a telemetry operations mode that provides simultaneous control and video links to unattended ground/air vehicles.

SRW capability is a key performance parameter for JTRS airborne, ground vehicular, man-portable, and unattended vehicle/sensor radios. SRW provides a robust tactical edge network for the air, ground, and maritime domains.

Using a traditional acquisition approach, SRW software would only have been integrated into government-funded Program of Record systems, limiting the pool of available SRW-capable networking radios and inhibiting competition for SRW-capable radio

production contracts. Making SRW available to commercial radio developers via the JTRS Enterprise Business Model has tripled the number of SRW implementations competing for procurement contracts at no additional cost to the government. To date, approximately two thirds of those competing implementations were developed without direct government investment beyond sharing of the SRW software.

In March 2011, during a field training exercise performed by his troops, Major General James L. Huggins (2001), Commanding General of the 82nd Airborne Division, commented that SRW

> performed in a remarkable fashion, allowing Soldiers within the platoon to exchange both voice and data information. This exchange allows junior leaders to more efficiently command and control their formations and provides a [Common Operating Picture] to the fire team level. Providing both voice and data beyond line of sight communications to the fire team level, [SRW] meets operational requirements and fills a gap where no capability currently exists.

In July 2011, the National Security Agency certified the first SRW-capable radio for secure deployed operations. This significant milestone was achieved by a commercial implementation that leveraged the JTRS Enterprise Business Model to integrate SRW software without government funding.

During laboratory and field testing, in September 2011, JPEO JTRS verified over-the-air interoperability of seven SRW radio implementations: three from Programs of Record and four from commercial developers without government contracts. In November 2011, five of these SRW-capable radio types were further tested in a relevant operational environment during a large-scale Army Network Integration Evaluation.

In February 2012, US Army Rangers completed an operational assessment of SRW while deployed to Afghanistan in support of Operation Enduring Freedom. Multiple Ranger Special Operations platoons employed SRW under combat conditions for the first time during various tactical missions. Feedback from the Rangers indicated that SRW greatly improved their ability to network and exchange key information, such as position location information, more efficiently. They evaluated SRW as very effective for conducting operations, especially at the small unit level. “This is a near perfect example of how early engagement by the warfighter working closely with the acquisition community can deliver capability smarter and faster,” said Brigadier General Michael Williamson (Osborn, 2012), Joint Program Executive Officer for the Joint Tactical Radio System.

These successes validate the value of adopting the app store approach to sharing networking waveform software applications. The JTRS Enterprise Business Model has proven its ability to broaden the number of competitive, cost-effective, and interoperable tactical networking solutions that meet warfighter requirements.

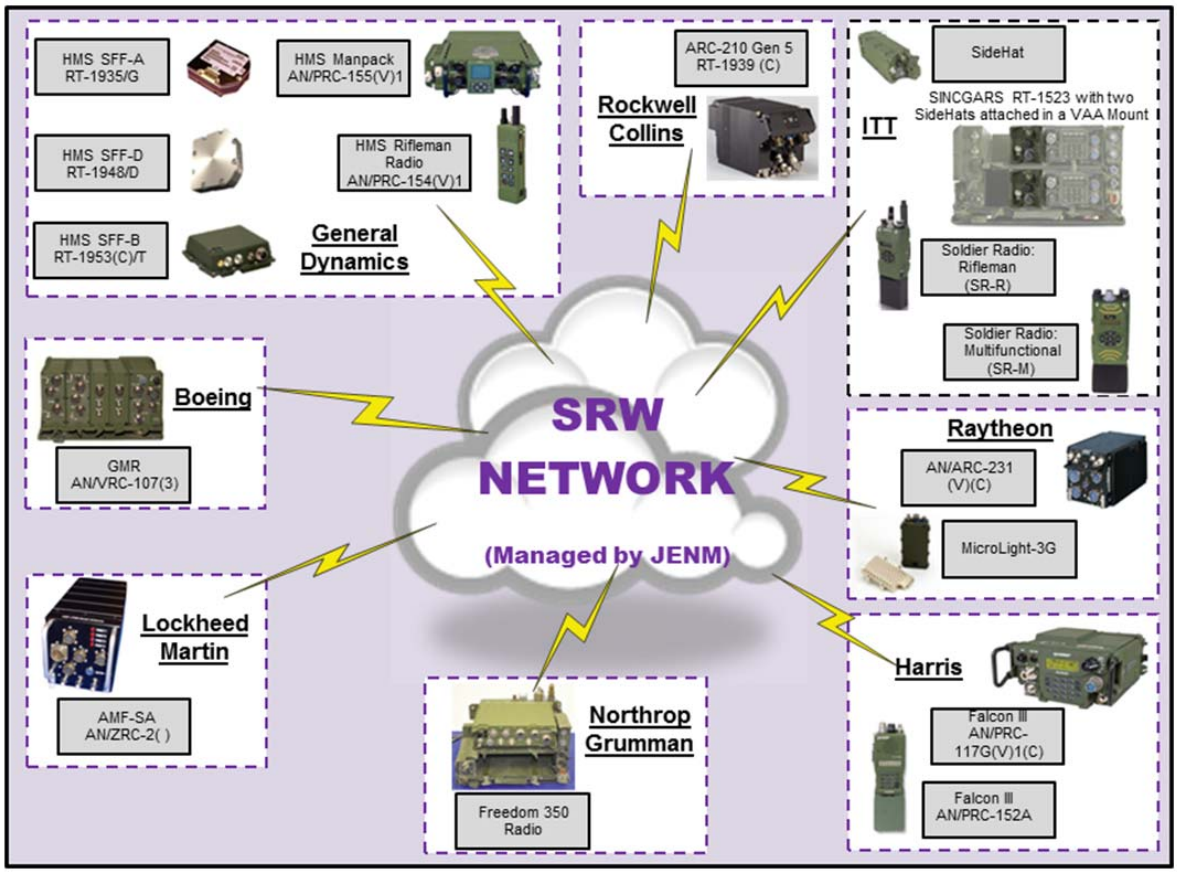

Figure 5. SRW Network

Note. Making Soldier Radio Waveform (SRW) software available to commercial radio developers via the JTRS Enterprise Business Model has tripled the number of SRW implementations competing for procurement contracts at no additional cost to the government. JPEO JTRS partnering with all commercial radio providers to integrate their products into JTRS Enterprise Network Manager (JENM) system development ensures common tactical network planning and monitoring regardless of specific hardware solutions procured.

Institutionalizing Competition and Continuous Innovation

The JTRS Enterprise Business Model has demonstrated that the commercial app store approach to tactical networking product development is both feasible and preferable to traditional defense acquisition. Moving forward, JPEO JTRS is further improving this approach to affordably proliferate implementation of other joint and coalition networking waveforms, such as the Wideband Networking Waveform (WNW), Mobile User Objective System (MUOS), Tactical Targeting Network Technology (TTNT) and the Coalition Wideband Networking Waveform (COALWNW).

A key component of the JTRS Enterprise Business Model evolution is the Joint Reference Implementation Laboratory (JRIL). The JRIL removes additional barriers to competition in tactical networking by providing a facility for commercial developers to test and evaluate their products against a government-owned waveform reference implementation. JRIL engineers with knowledge and experience in tactical networking waveform porting and integration are available to assist developers desiring to enter the market. They ensure interoperability for joint and coalition tactical networking by managing waveform software releases and testing compliance with applicable standards. By providing

a laboratory test bed and modeling/simulation capabilities for new networking waveform technologies, the JRIL accelerates their evolution and integration timelines. The JRIL also facilitates adoption of additional non-development item (NDI) technologies into joint and coalition tactical networks by identifying and integrating additional apps that benefit the warfighter.

JRIL enhancements to the JTRS Enterprise Business Model are further advancing acquisition agility in the dynamic joint and coalition tactical networking arena. As the technical authority for defense tactical networking, JPEO JTRS will continue leveraging this successful approach to expand competition, stimulate innovation, and reduce costs while delivering interoperable connectivity to our Soldiers, Sailors, Airmen, and Marines directly engaged in defeating our nation's enemies and supporting our coalition partners around the world.

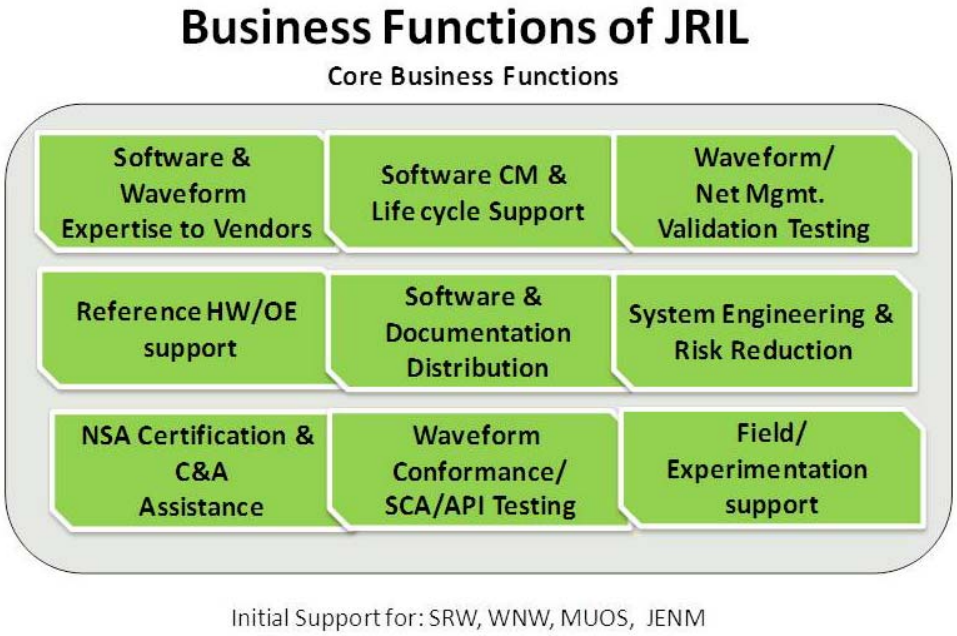

Figure 6. Joint Reference Implementation Laboratory Enhancements to the JTRS Enterprise Business Model Are Further Advancing Acquisition Agility in the Dynamic Joint and Coalition Tactical Networking Arena

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