



EFFECTS OF DEFENSE GLOBALIZATION: AN EXAMINATION OF CURRENT AND FUTURE COMMAND AND CONTROL COLLABORATIONS

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The objective of this research is to address the need for multilateral command and control interoperability. We will examine the issues associated with technology transfers and the political environment that could influence future collaboration of multinational defense industries toward migrating into global defense industry markets. To better understand interoperability and its multiple dimensions, we conducted literature reviews (primarily focused on Europe and NATO members), held interviews with subject matter experts, and surveyed several current transatlantic collaborative efforts. Our research presents the culmination and implications of our findings, as well as identifies areas requiring additional research to address specific interoperability challenges.

In the not-too-distant future, the global industrial market might swallow the defense sector and leave many senior Pentagon officials wondering who is in charge. Fact or fiction, this scenario is one of the realities of an open and free global market economy.

In our 21st century global market economy, there are significant technological, political, and economic benefits for pursuing transatlantic defense cooperation despite the considerable barriers that exist. In the search for the *ideal cooperative mechanism*,

the balance of risks and incentives for governments and industry to cooperate varies in relation to whether the lead for a specific command and control (C2) effort is government or industry. When industry and government decide to pursue a joint C2 effort, success will only be possible if both sides have the ability to overcome the wide range of political, legal, and technical hurdles.

The Defense Science Board (DSB) defines *globalization* as the integration of the political, economic, and cultural activities of geographically or nationally separated peoples (DSB, 1999). In the economic element, the pressures of globalization are attempting to bring the United States and Europe closer together and create a thriving Euro-Atlantic economy that defense industries are ready to enter. In the defense sector, interoperability challenges and requirements can make operating in the global environment difficult.

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The United States has designed its armed forces to be able to respond unilaterally anywhere in the world to fight and win major conventional conflicts. By contrast, most U.S. allies tend to be more regionally focused and have smaller-scale ambitions. This smaller scope affects the procurement of platforms and systems. These differing realities frame the perspectives and approaches for transatlantic governments and industries regarding the level of interoperability needed to meet the challenges and requirements of the future. Our research focused on uncovering those factors that are driving globalization, and how industry and governments on both sides of the Atlantic have set about to respond to a shrinking and more competitively based defense market (see Appendix A for expert interview questions).

OPERATING IN A GLOBAL MARKET AND INCENTIVES FOR INDUSTRIAL INNOVATION

To operate in a cooperative transatlantic defense industry partnership, one can look at the broad economic trends, such as foreign direct investment, trades, mergers, and acquisitions, which are translating into a greater change within the defense sector. From a technological perspective, the industrial and technology base addressing those trends is increasingly global in nature, making stronger defense industrial interdependence a future reality (Becht, Rohatyn, Hamre, & Serfaty, 2003). Cooperative C2

between the United States and North Atlantic Treaty Organisation (NATO) military forces is not immune from the pressures of this future global defense industrial market reality.

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Another key factor of operating in the current global environment is the United States' current drive toward military transformation. Under the current administration, this transformation is taking place through select fundamental reorganization changes and transformation in military resources and capabilities. In some instances, the speed and scope of how these changes take place might increase the funding and technology gap that currently exists between Europe and the United States. We should note that although NATO is undergoing transformation, the European defense budgets are in no position to match the current Department of Defense (DoD) investment of over \$400 billion. In the near term, this might be a temporary *hiccup* towards more aggressive cooperation across the Atlantic. In the longer term, however, the forces of economic integration and further commercialization of defense technologies might push the U.S. and European defense industries closer together (Becht et al., 2003). It is interesting to note here that in our interview with a European industry representative, he added that a key factor to future transatlantic cooperation may lie in Europe's willingness to organize industry and policies with a European Union focus instead of the voice of selective, individual countries (European Industry Representative, personal communication, March 3, 2004)—in other words, a common European approach with common direction for military capabilities. All of these strategic factors are important when focusing on multilateral C2 interoperability or most other cooperative military activities.

INTEROPERABILITY

The key to any multilateral C2 between the United States and Europe lies in the ability to have some form of multilateral operability. The challenges for multilateral interoperability in C2 are difficult, due to the diverse issues across services and disciplines within the United States and Europe. For example, internal to the United States there is still significant disparity and lack of interoperability amongst the Army, Navy, Air Force, and Marine Corps. To address these changes, U.S. Joint Forces Command (JFCOM) is looking at solutions that will change how C2 is executed in future joint forces. A recent report by the Center for Strategic and International Studies (CSIS)

found that the DoD has been struggling for two decades to build interoperable, joint C2 systems, but are still deploying forces that cannot communicate with each other (Selinger, 2004). The report recommends a task force be developed that would operate much like the DoD has done for Special Forces in developing U.S. Special Operations Command. Responsibility would pass from the Services to the new joint task force. The report also admits that it will be difficult to draw the boundary between the core C2 functions of the task force and the C2 interfaces and applications that will remain the responsibilities of the military Services (Selinger, 2004).

It is interesting to note that the government officials interviewed for this paper all agreed that the United States has interoperability challenges internal to the Services, let alone with the other Services or our NATO allies. In the U.S. Army, for example, one interviewee claims that in the quest to get upgrades, the U.S. Army uses Operations and Maintenance (O&M) funds to buy the latest and greatest *stuff*, which may or may not fully integrate or be operable with other services or our allies (U.S. Army, personal communication, February 25, 2004).

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This lack of United States “jointness” in C2 makes it extremely difficult to establish a more enhanced common thread for multilateral cooperation with our NATO allies. Through more robust defense spending and desire to transform and enhance C2 capabilities, the United States may be widening the gap between its historical transatlantic partners. Our Network-Centric Warfare (NCW) capability further exemplifies this push by the United States. Although our French interviewees confirmed U.S. leadership in this area, they felt that not enough is being done to encourage more synergy in these areas (French Navy, personal communication, March 3–4, 2004). The DoD’s move to the Global Information Grid (GIG)¹ architecture will only further widen this transatlantic gap between the United States and NATO or future coalition forces.

These developments, along with technology transfer and security restrictions, are evidence of a divergence versus convergence in interoperability.

STANDARDIZATION

A cornerstone to almost all NATO cooperation and interoperability is the use of a Standardization Agreement (STANAG), which is the NATO term for a standardized

agreement for the procedures, systems, and equipment used in any allied operation.² Standardization among NATO forces makes a vital contribution to the combined operational effectiveness of the military forces of the alliance. Historically, extensive efforts in many different spheres improve cooperation and eliminate duplication in research, development, production, procurement, and support of defense systems (NATO, 2001). Bringing cohesion to the alliance, STANAGs are necessary; however, frequent changes can be very costly to each of the participants involved.

Interoperability in C2 requires standardization, due to the amount of constant changes in software and procedures. A significant challenge to the multilateral C2 is that so many changes take place due to technological innovations in information. One French representative interviewed for this article claims that the United States often has a strong say in “the development and establishment of standards and changes, but all too often does not adhere to them” (French Navy, personal communication, March 3–4, 2004). Furthermore, he claims that there is the common notion that NATO standards are good, but they take too much time, are too difficult to modify, and there is too much lag time between updates. Lastly, another French representative interviewed mentioned that there are problems interpreting standards and there is a lack of common training in the standardization process.

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One more factor that will inhibit interoperability between the United States and its NATO allies is NATO expansion. Recently, seven new members have joined NATO. Initially, there may be concerns by U.S. defense officials about C2 standardization, technology transfer, and security issues with former members of the Warsaw Pact. It will take time and effort to integrate these new members into the C2 common thread and educate them on NATO standardization and interoperability.

INDUSTRY’S PUSH FOR TRANSATLANTIC COLLABORATION

Although governments may have barriers in collaboration, regardless of standards and interoperability, industry appears to be pressing forward in some areas. United States firms are moving cautiously towards creating closer relationships with European firms. In the past, U.S. firms have preferred to sell specific programs to European governments, either directly or with European counterparts. More recently, however, there have been some changes in U.S. corporate strategy amongst some of the top U.S. defense contractors. They are expressing more interest in the technological and

business opportunities within Europe. Recognizing that traditional links to the European defense market may be inadequate to get market access, U.S. firms are taking steps to cultivate new partnerships and opportunities (Becht et al., 2003).

MULTINATIONAL BUSINESS MODEL PARTNERSHIPS

When operating in the global environment, several forms of cooperation can navigate across the Atlantic. Our research addresses several types of collaborations that we thought could lead to broader transatlantic defense industrial markets in the area of C2. These include joint ventures and government-sponsored codevelopment programs (i.e., cross-border cooperative transatlantic partnerships).

THALES RAYTHEON JOINT VENTURE

Defense contractors in Europe have gone the furthest in developing firms that conduct the full range of business activities across borders. A prime example is Thales. Thales has significant operations in France, the United Kingdom (UK), and the Netherlands. And now Thales has created a transatlantic joint venture (created in 2001) with Raytheon in the area of ground-based air defense. But this did not come without significant difficulties. The joint venture took many months to negotiate, mainly because of U.S. government controls over and concerns about technology transfer (Lorell, Lowell, Moore, Greenfield, & Vilachos, 2002, p. 170). “The U.S. is adamant about maintaining its technical superiority in the world and is very protective about how such technology is transferred.”³

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On the positive side, Mr. Gilles Deschars, Raytheon International Country Manager for France, stated that the joint venture was pursued to enhance Raytheon’s and Thales’ positions as leading horizontal defense electronics companies in a global marketplace characterized by large, vertically integrated global primes.⁴ One of the first reactions to this proposed joint venture came from United States administrators, who asked why Raytheon had to team with a French company. “While it may be true that France has been, and is probably still, considered in the U.S. as a troublemaker, France is by far the most advanced high technology country after the U.S.” (Deschars, Raytheon, 2001). Both transatlantic firms saw this collaboration as an opportunity to gain greater and easier access into both the European and American markets. To ease some of the

political concerns with technology transfers, the Thales Raytheon joint venture split their operation into two subsidiaries: one in the United States that is 51 percent owned by Raytheon, and one in France that is 51 percent owned by Thales. One of the primary benefits of such a collaborative effort will be the free flow of information and technology within the company; however, the customer will still have to adhere to the regulatory requirements for the country in which the lead subsidiary for a specific program resides (Lowell et al., 2002, p. 171). The Thales Raytheon joint venture expects to compete for programs worldwide and develop innovative new products through combined research and development (R&D), making them a leading player in supporting NATO equipment standardization and interoperability objectives.

The NATO Alliance Ground Surveillance (AGS) program is an example of how industry might respond to future transatlantic cooperation and collaborating for C2 interoperability within NATO.

ALLIANCE GROUND SURVEILLANCE (AGS) PROGRAM TRANSATLANTIC PROPOSAL

The NATO Alliance Ground Surveillance (AGS) program is an example of how industry might respond to future transatlantic cooperation and collaborating for C2 interoperability within NATO. With a focus on a cooperatively developed radar for intelligence, surveillance, and reconnaissance (ISR) architectures for a common operational ground picture, the transatlantic industrial response is an attempt to provide an approach to transatlantic industrial cooperation and sharing while capitalizing on technology developed in both the United States and Europe. In a bid to support NATO's next generation surveillance system for its future Response Force, two competing multinational teams bid for the design and development contract that is expected to be worth E200 to E350 million (approximately \$250 to \$435 million). Raytheon and BAE Systems lead one team: the Cooperative Transatlantic AGS (CTAS). Northrop Grumman and EADS lead the other team:⁵ the Transatlantic Industrial Proposed Solution (TIPS). Both teams have other European support contractors as part of their respective teams. It is hoped that this arrangement, which brings industries from the United States and the other NATO countries together, will build upon cooperability and technology exchange across the Atlantic (see Appendix B).

Interestingly enough, none of the SMEs interviewed mentioned either the Thales Raytheon joint venture or the AGS proposal as truly successful multinational programs representative of C2 collaboration. In fact, our European interviewees looked at the Thales Raytheon joint venture somewhat negatively—as each subsidiary focusing on

their own interests within their respective side of the Atlantic versus the open sharing (i.e., continued controversies associated with technology transfers) being touted by company officials.

MULTIFUNCTIONAL INFORMATION DISTRIBUTION SYSTEM (MIDS)

The purpose of a Multifunctional Information Distribution System (MIDS), a major international program led by the U.S. Navy, is to put small, lightweight Link 16 terminals on U.S. and participating allies' fighter aircraft. The countries funding the development of MIDS are the United States, France, Germany, Italy, and Spain (RAND, 2000, p. 108). However, MIDS is more of an acquisition case study versus a collaboration of multinational defense industries. The DoD pushed MIDS for adoption as an interoperability solution for both the United States and our NATO allies. Growing budget pressures and European defense firms' desire to gain access to U.S. military technology is what led the program partners to favor an international acquisition program that would be a cooperative development effort between United States and European defense companies. On the other hand, an equal number of interviewees cited the MIDS as a failure for several reasons: 1) Money—MIDS is expensive—the United States could have procured equivalent terminals at a lower cost; 2) Jobs—in order to satisfy transatlantic governmental concerns of job creation, MIDS is produced via two separate product lines: one in the United States and one in Europe; and, 3) Technology capability—having a separate European line allows the Europeans to “flex their muscle” in their effort to disconnect themselves from and promulgate their independence from the United States (Office of the Secretary of Defense (OSD), personal communication, February 26, 2004).

THE COALITION AERIAL SURVEILLANCE AND RECONNAISSANCE PROGRAM (CAESAR)

Although only mentioned by one of the interviewees, the NATO Advanced Concept Technology Demonstration CAESAR⁶ program appears as moving toward success. Again, this program is more of an acquisition case study and is not a representative example of a truly collaborative effort from the multinational defense industry.

INDUSTRIAL INCENTIVES TO ADVANCE INNOVATION

In preparation for our interviews, we set forth with the premise that industry might be proactive in pushing innovation to reap the financial benefits and incentives that come with interacting in a global market. However, in an attempt to solicit input to our question on this topic as to the incentives for industry to advance innovation in the global defense industry, we came up relatively short on responses from both our interviews and literature searches. The answers we did receive were on a global technology basis. One senior defense official claims that any collaborative effort must start early to shape technology transfers for equity (OSD, personal communication, March 3, 2004). The European response to our question was twofold: 1) increase

number of buys for capital growth (i.e., short term/profit incentive), and 2) subsidies that provide seed money for innovation (European Industry Representative, personal communication, March 3, 2004). Due to the limited availability of industry representatives and this limited feedback from our interviews, we were unable to adequately determine what incentives might exist for industry to advance innovation. A future survey with U.S. and European defense industries might provide better insight into industry's view for advancing innovation incentives.

POLITICAL OBJECTIVES THAT RESTRICT OPPORTUNITIES FOR INTERNATIONAL COOPERATIVE DEFENSE PROGRAMS

The lack of a single dominant threat to NATO has allowed a divergence of national strategic and operational concepts among members. How a nation addresses their national strategic concept will dictate their doctrine and doctrinal divergence can be a problem. If two (or more) nations are intent on using their forces in fundamentally different ways, no amount of technical connectivity will allow their units to operate as a coherent fighting force (Codner, 2003, p. 20). These strategies, in turn, trickle down to inform multinational industries how multilateral C2 interoperability issues should be addressed. Ideally, if nations had a common defense strategy, common acquisition system, and participated in integrated force planning, technical interoperability would greatly enhance the defense industry market.

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However, as mentioned previously, what is significantly causing an impasse toward C2 interoperability is the widening gap in new technologies between the United States and its allies. The United States spends more than twice as much on military procurement as the NATO members combined, and over four times as much on defense R&D (Kresa, 2002). Because of this investment disparity, our European allies' capabilities have simply not kept pace with our own. This gap is not simply a gap in numbers, but it also promotes the idea of superiority that the United States projects worldwide. There is a pervasive feeling among French defense industry and government representatives that the United States is not interested in Europe's technology, nor do they have any interest in European defense collaboration (European Industry Representative, memorandum, March 3, 2004). Several high-level U.S. government officials interviewed for this study confirmed, although did not condone, such a pervasive

mindset within U.S. government sectors. As one official put it, this attitude is akin to the “not invented here syndrome”—meaning many U.S. government personnel prefer a “made in America,” versus a European-made product (OSD, personal communication, March 3, 2004). Per Mr. Francois Heisbourg, a recognized expert on defense issues, “much, possibly most, of the disparity is due to the massive Chinese wall which the Americans have built around their marketplace through a combination of restrictive laws, regulations and bureaucratic obstacles”—a situation that he says has worsened since the end of the cold war (Macrae, 2001, p. 36).

During the Clinton Administration, government officials made efforts to encourage globalization within the transatlantic defense industrial market. The Clinton Administration recognized globalization as a means of promoting interoperability, strengthening alliance political relations, and injecting foreign competition into the consolidating U.S. industry (James, 2001). The expectation was that merged U.S. companies would lead the way toward globalization through joint ventures and acquisitions with their European counterparts and begin bridging the growing capability gap. Clinton officials worried that should the gap grow wider, the cohesion of the alliance would undermine over time. Unfortunately, the Bush Administration has been “cool to outsiders” (Hahn, 2003) resulting in a lack of real successes of foreign defense industries penetrating the U.S. defense market.⁷

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The major roadblock to defense industry globalization is the issue of government and political pressure regarding ownership and production. Kent Kresa (2002), former President of Northrop Grumman, says, “...opportunities for mergers will continue to be limited on both sides of the Atlantic. Winning political approval for such transactions is difficult because they raise many issues of national sovereignty, security, technology protection, and employment” (p. 84).

The number of U.S. regulations and DoD licenses required for acquisitions, cooperative ventures, and exchange of technology continues to be overly burdensome to potential foreign defense industries (European Industry Representative, personal communication, March 3, 2004). Rather than encouraging collaboration, such examples of uncooperativeness will continue to drive each respective transatlantic defense industry into a fortress mentality. Almost without exception, the terms “Fortress Europe” and “Fortress America” were articulated by research interviewees to express the fear of Europe and the United States retracting into their respective defense industry

shells. Such a reaction seems at odds with the shrinking European defense market. Because of the enormous U.S. defense budget, the United States is a primary market for military equipment, and therefore everybody overseas wants to sell here. With the United States dominated by a handful of defense giants, the United States could use more (including European) competition (Macrae, 2001).

But as mentioned previously, the perception of restrictive laws, regulations, and other bureaucratic obstacles tends to hamper the collaborative efforts of multinational defense industries, especially in the C2 arena. Information-sharing creates threats to information assurance. The biggest area of concern with interoperability is “How are you going to transmit the information/data?” (U.S. Army, personal communication, February 25, 2004). Interoperability is never a problem when the information is “in the clear,” but most of the time it needs to be secured. Almost all literature searches and interviews with SMEs concur with the legitimate need to preserve some nationally obtained information, in particular intelligence, but also recognize the need for broad sharing of data, information, and knowledge. A major obstacle to the exchange of information has been the lack of an accepted method of achieving multi-level security. Unfortunately, too many people are “hanging their hat on a ‘silver bullet’ technical solution to guarantee that security will be developed” (USCREST, 2000). Security issues are largely a political versus technical issue and not likely to be resolved in the foreseeable future. Primarily at issue is the sharing of source code or a competitive advantage in cryptology. However, “first and foremost, classified technology has to be fully respected” (Muradian, 2001, p. 1), an opinion shared by all SMEs. However, given the undisputed need for secrecy and security by each nation, several interviewees felt that *trust* will be the axiom that moves us towards collaborative multinational interoperability.

UTILIZATION OF MULTINATIONAL GROUPS TO ENSURE ALLIES ACHIEVE COOPERATIVE C2

In an effort to inform and help further collaborative efforts, participation in or contributions to multinational groups can be a value-added role for government and industry officials. Literature searches presented a whole host of C2-related working groups, committees, consortiums, and so on, all dedicated to identifying and resolving interoperability issues. One group that appeared to meet the criteria of addressing overarching interoperability issues and a forum for working those issues was the Multinational Interoperability Council (MIC). Developed in 1996, the role of the MIC is that of an independent, senior management-level oversight body, chartered to identify interoperability issues and formulate actions. Internal mid-level multinational working groups resolve any outstanding issues. The MIC has since morphed to address overarching interoperability issues such as policy, doctrine, and procedures. The lead for the MIC is the Joint Staff Operations Branch. Because of the current myriad of interoperability-related working groups, the MIC decided to limit its scope to developing a formal relationship with just one board at this time—the Combined Communications Electronics Board (CCEB)—because its perspective is the most

relevant to the work of the MIC. The CCEB addresses joint and coalition Command, Control, Communications, and Computers (C4) issues across the spectrum of operations and, to some extent, works with several single-service forums (Multinational Interoperability Council (MIC), 2003). Current membership includes Canada, Australia, Germany, France, United Kingdom, and United States.

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Yet with such a focused vision to encourage dialog and solutions regarding multilateral C2 interoperability within a multinational forum, very few of the 10-plus subject matter experts we interviewed had heard of the MIC. Furthermore, almost none of them participated in multinational interoperability groups or could readily identify a thriving collaborative working group. When asked if industry representatives were involved in any of the consortiums or committees that the senior government officials occasionally participated in, the answers were the same: Industry was involved only if it had been brought along by a government organization for a presentation (i.e., dog and pony show) or if it had a direct relationship to a specific project. This is despite the repeated statements, from both sides of the Atlantic, for a need to keep industry informed and encourage it to develop commercial off-the-shelf (COTS) solutions to resolve these interoperability dilemmas. Or as one senior DoD official said, the “U.S. needs to get out of the way of industry to let them move forward” (OSD, personal communication, March 23, 2004). We did come upon the reverse, where industry was proactive in ensuring their presence at C2 multinational forums.⁸ But, such examples are meager and appear to come about through an industry presenter’s prior military background and experience.

SUMMARY AND CONCLUDING OBSERVATIONS

At the strategic level, the European allies do not put high-intensity conflict at the center of their planning. They do not see a superpower threat to NATO arising or any serious military threat to their well-being. Hence, their strategic focus is on peace operations and crisis response. The result is proportionately lower investment, relative to the United States, in developing and acquiring advanced military systems. This is manifesting itself within the European community as a lack of attention to the growing

technological gap, and the effects of the realities of transformational change taking place in the United States DoD. These trends could have future impacts on how the global industrial marketplace reacts.

Efforts to enhance interoperability solely through common or fully interoperable systems at the technological level are likely to be limited by political, economic, and security factors, particularly the desire to support national industries, equitable burden sharing, and ensuring that the most advanced military capabilities are not compromised. The challenges of NATO expansion and disparity in R&D investment will continually challenge the advancements in interoperability and standardization. From a technology and cost perspective, the United States and Europe need to work closer with industry and encourage greater opportunities for allowing them to offer standardized transatlantic interoperability enhancements.

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Due to the lack of time availability of Raytheon and Northrop officials, we were unable to capture the personal perspective from industry. As such, the findings of this study points to the need for greater understanding of the industry point of view, which can only be accomplished through personal interviews of the cited industries in this case study or several of those listed in Appendix B (Examples of Transatlantic Relationships). Only through their personal viewpoints will we be able to discern a more complete picture of how industry is leaning (or not leaning) forward to meet the challenges of influencing future collaborations of multinational defense industries toward migrating into global defense industry markets.



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ENDNOTES

1. For more information, see Assistant Secretary of Defense for Network and Information Integration (OSD/NII)—Global Information Grid (GIG) Web site: <http://ges.dod.mil/>
2. NATO has defined six levels of technical interoperability:
 1. Exchange of documents
 2. Exchange of liaison officers
 3. Exchange of equipment
 4. Electronic message exchange
 5. Direct – controlled access
 6. Direct – no constraints

Generally within NATO, level 4 can, at present, be achieved among allies. Level 5 is achievable in some environments (i.e., maritime environment) among some allies. For information security reasons, level 6 is rarely achieved.

The NATO levels are useful in assessing the degree of connectivity achieved by actors or systems in executing a particular function. Connectivity is meant to be the ability to transfer data across systems. Exchange of data through basic connectivity is, however, insufficient for full technical interoperability. If coalition forces in a single geographical area are to be fully integrated with the highest degree of technical interoperability, it will be necessary for the sensors and weapons of all units in the area of operations to be able to share engagement-quality data.

| Functional Degree | | Minimum NATO Level |
|--|---|--------------------|
| A | Planning (operational) | 1 |
| B | Notifications (of plans, intentions, rules of engagement, etc.) | 1 |
| C | Common Operational Picture (COP) | 5 |
| D | Engagement-quality data | 5 |
| E | General sensor to weapon connectivity | 5 |
| Demands of Technical Interoperability by Function (Codner, 2003, p. 73–74) | | |

3. Presentation by senior DoD official in Baruch Auditorium, National Defense University, March 29, 2004.

4. Raytheon explicitly viewed this new joint venture company as a means of widening their market access to NATO and other European programs. Thales' primary motivation was entry into the U.S. market (Lorell, 2002, p. 171).
5. The TIPS team also includes the following members: France's Thales, Italy's Finmeccanica, Spain's Indra, and Canada's General Dynamics (Taverna, 2003).
6. "The Coalition Aerial Surveillance and Reconnaissance (CAESAR) initiative proposes to improve near-term interoperability among U.S. and European airborne Ground Moving Target Indication (GMTI) capabilities. The objectives of CAESAR are to make U.S. and coalition ground surveillance assets interoperable to maximize the military utility of scarce and expensive resources and to enable synergistic use of differing GMTI capabilities. CAESAR was a standalone demo at the Air Force's Joint Expeditionary Force Experiment 99 and is proposed as a five-year, \$20 million FY2000 Advanced Concept Technology Demonstration (ACTD). Participants include the United States, France, Italy, the UK, and the Netherlands" (RAND, 2003, p. 101).
7. The exception is BAE Systems, which has bought U.S. assets and even gets direct contracts from DoD via its wholly owned U.S. subsidiary, BAE Systems North America.
8. Major General John H. Admire (retired USMC), Evidence Based Research, Joint Forces Command, Brief to NATO NEC Conference, March 29–30, 2004, "Network Enabled Capabilities (NEC): Coalition Lessons Learned from Recent Operations and Experiments." Key takeaways from his interview:

Ineffective Coalitions –

- Misunderstand national interests.
- Misuse armed forces, duplicate capabilities.
- Retain obsolete, ignore new, buy second-rate.
- Misinterpret interoperability.
- Treat research, science and analysis as unnecessary or costly extravagance.
- Fail to transform.

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APPENDIX A**QUESTIONS ON EFFECTS OF DEFENSE GLOBALIZATION
(PROVIDED TO SUBJECT MATTER EXPERT INTERVIEWEES)**

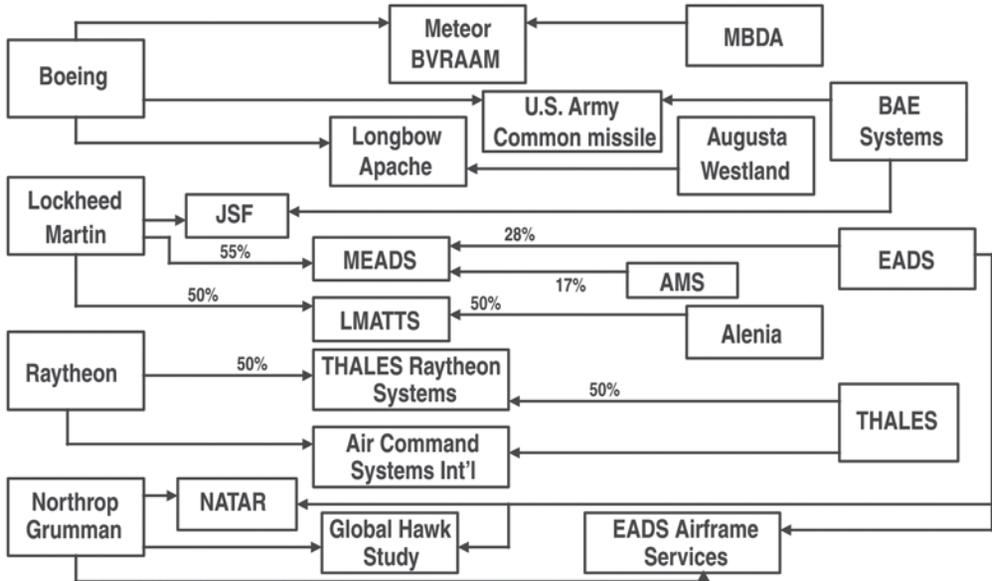
Research Statement: To address the need for multilateral command and control (C2) interoperability, this paper will examine the issues associated with technology transfers and the political environment that could influence future *collaboration* of multinational defense industries toward migrating into global defense industry markets.

1. Operating in a Global Market:
 - a. How do you envision successfully operating in the global environment to meet future interoperability challenges and requirements?
 - b. What role could a global defense industry partnership play in current and future technical efforts?
 - c. Can partnerships within the global defense industry offer a successful business model for transatlantic military cooperative programs?
2. What *major* political objectives or motives significantly restrict the opportunities for international cooperative defense programs?
 - a. Are there any preconceived ideas of superiority in certain technical areas?
 - b. Are the concerns regarding the shrinking number of companies (both U.S. and European) affecting the ability to provide adequate competition?
 - c. Are there too many restrictive laws, regulations, and other bureaucratic obstacles affecting collaboration of multinational defense industries?
 - d. Is the current focus on operational security impacting multinational collaboration?
3. Incentives to Industry To Advance Innovation:
 - a. Do you believe technology transfers can be shaped to ensure equal and fair distribution of innovative advances (i.e., technology sharing)?
 - b. What rewards or incentives could be established to ensure equal contributions from each participating country in joint C2 architectures?
4. How do you utilize multinational oversight groups to ensure cooperative C2 is achieved amongst allies? Is industry part of this activity?
5. Within the C2 architecture, what has been a truly successful multinational program that has included key international defense members?

APPENDIX B

The chart below illustrates some of the most important relationships among the major European defense and aerospace contractors and their counterparts in the United States. Overall, collaborative programs outnumber joint ventures. Regulatory requirements and other hurdles still stand in the way of creating a greater number of structural relationships (RAND, online).

Examples of Transatlantic Relationships



Source: Ripley, 2002 (see www.defence-data.com for complete list of transatlantic relationships).
 NOTE: U.S. contractors: Boeing, Lockheed Martin, Raytheon, Northrop Grumman; major European contractors: BAE Systems, EADS, Thales, MBDA, Agusta Westland, Alenia, Alenia Marconi Systems (AMS); joint ventures: Lockheed Martin Alenia Tactical Transport Systems (LMATTS), Thales Raytheon Systems, Air Command Systems International, EADS Airframe Services; program collaborations: Meteor BVRAAM, JFS, MEADS, U.S. Army Common Missile, Longbow Apache, NATAR, Global Hawk Study.

FIGURE 1. EXAMPLES OF TRANSATLANTIC RELATIONSHIPS

