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VOLUME I

Emerging Patterns in the Global Defense Industry

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Prepared for the Naval Postgraduate School, Monterey, California 93943

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ACQUISITION RESEARCH PROGRAM
GRADUATE SCHOOL OF BUSINESS & PUBLIC POLICY
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Preface & Acknowledgements

During his internship with the Graduate School of Business & Public Policy in June 2010, U.S. Air Force Academy Cadet Chase Lane surveyed the activities of the Naval Postgraduate School's Acquisition Research Program in its first seven years. The sheer volume of research products—almost 600 published papers (e.g., technical reports, journal articles, theses)—indicates the extent to which the depth and breadth of acquisition research has increased during these years. Over 300 authors contributed to these works, which means that the pool of those who have had significant intellectual engagement with acquisition issues has increased substantially. The broad range of research topics includes acquisition reform, defense industry, fielding, contracting, interoperability, organizational behavior, risk management, cost estimating, and many others. Approaches range from conceptual and exploratory studies to develop propositions about various aspects of acquisition, to applied and statistical analyses to test specific hypotheses. Methodologies include case studies, modeling, surveys, and experiments. On the whole, such findings make us both grateful for the ARP's progress to date, and hopeful that this progress in research will lead to substantive improvements in the DoD's acquisition outcomes.

As pragmatists, we of course recognize that such change can only occur to the extent that the potential knowledge wrapped up in these products is put to use and tested to determine its value. We take seriously the pernicious effects of the so-called “theory–practice” gap, which would separate the acquisition scholar from the acquisition practitioner, and relegate the scholar's work to mere academic “shelfware.” Some design features of our program that we believe help avoid these effects include the following: connecting researchers with practitioners on specific projects; requiring researchers to brief sponsors on project findings as a condition of funding award; “pushing” potentially high-impact research reports (e.g., via overnight shipping) to selected practitioners and policy-makers; and most notably, sponsoring this symposium, which we craft intentionally as an opportunity for fruitful, lasting connections between scholars and practitioners.

A former Defense Acquisition Executive, responding to a comment that academic research was not generally useful in acquisition practice, opined, “That's not their [the academics'] problem—it's ours [the practitioners']. They can only perform research; it's up to us to use it.” While we certainly agree with this sentiment, we also recognize that any research, however theoretical, must point to some termination in action; academics have a responsibility to make their work intelligible to practitioners. Thus we continue to seek projects that both comport with solid standards of scholarship, and address relevant acquisition issues. These years of experience have shown us the difficulty in attempting to balance these two objectives, but we are convinced that the attempt is absolutely essential if any real improvement is to be realized.

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

- Office of the Under Secretary of Defense (Acquisition, Technology & Logistics)
- Program Executive Officer SHIPS
- Commander, Naval Sea Systems Command
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- Program Manager, Airborne, Maritime and Fixed Station Joint Tactical Radio System



- Program Executive Officer Integrated Warfare Systems
- Office of the Assistant Secretary of the Air Force (Acquisition)
- Office of the Assistant Secretary of the Army (Acquisition, Logistics, & Technology)
- Deputy Assistant Secretary of the Navy (Acquisition & Logistics Management)
- Director, Strategic Systems Programs Office
- Deputy Director, Acquisition Career Management, US Army
- Defense Business Systems Acquisition Executive, Business Transformation Agency
- Office of Procurement and Assistance Management Headquarters, Department of Energy

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 7 – Global Influences and the Defense Industrial Base

Wednesday, May 11, 2011	
1:45 p.m. – 3:15 p.m.	Chair: John Birkler, Senior Management Systems Analyst, RAND Corporation <i>Shipbuilding: Global vs. National, Military vs. Commercial</i> David Berteau, Director of the Defense-Industrial Initiatives Group, Center for Strategic & International Studies <i>Emerging Patterns in the Global Defense Industry</i> Raymond Franck, Ira Lewis, Bernard Udis, and David Matthews, NPS <i>Rebuilding Naval Fleets: Lessons Learned from the UK Experience</i> John Schank, RAND Corporation

John Birkler—Senior Management Systems Analyst, RAND Corporation. Mr. Birkler has held a variety of research and management positions since joining RAND in 1977; currently, he manages RAND's Maritime Program, overseeing research for the U.S. Navy, Office of the Secretary of Defense, U.S. Special Operations Command (SOCOM), U.S. Coast Guard, the Australian DoD, and the UK Ministry of Defence, and mentors U.S. Navy, Marine Corps, and Coast Guard executive fellows at RAND.

Mr. Birkler's research spans RDT&E strategies and planning, industrial base, acquisition, management, and organization issues. In addition to the above maritime clients, his research has covered a wide range of aircraft systems (including the Joint Strike Fighter, F-15, F-14, B-1, B-2, A-12, C-5, C-17, F-117, F/A-18 E/F), missiles and munitions (including the advanced cruise missile, the Tomahawk cruise missile, and precision conventional munitions), and surface and subsurface combatants. He also has led studies on the links between the health of the defense industrial base and levels of innovation and competition. His most recent work has involved managing or leading multiple Analyses of Alternatives (AoAs) for the Navy, USMC and Army, and SOCOM, and leading a high-profile RAND analysis of Australia's capabilities and capacity to design conventional submarines.

Mr. Birkler received a BS in physics from Roanoke College, an MS in physics from the University of South Carolina, and completed the UCLA Executive Program in Management. After completing his third Command tour, he retired from the Navy Reserve with the rank of Captain.
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Emerging Patterns in the Global Defense Industry

Raymond Franck—PhD, Senior Lecturer, Graduate School of Business & Public Policy, Naval Postgraduate School. Professor Franck retired from the Air Force in 2000 in the grade of Brigadier General after 33 years of commissioned service. He served in a number of operational tours as a bomber pilot; staff positions, including the Office of Secretary of Defense and Headquarters, Strategic Air Command; and as Professor and Head, Department of Economics and Geography at the US Air Force Academy. His institutional responsibilities at NPS have included the interim chairmanship of the newly formed Systems Engineering Department (July 2002 to September 2004), serving as Associate Dean for Academic Operations (December 2007 to present), teaching a variety of economics courses, and serving on a number of committees to revise curricula for both the Management and Systems Engineering disciplines. His research agenda focuses on defense acquisition practices and military innovation. [rfranck@nps.edu]

Ira Lewis—PhD, Associate Professor of Logistics, Graduate School of Business and Public Policy, Naval Postgraduate School, Monterey, CA. His interests include transportation, public policy, and the international defense industry. [jalewis@nps.edu]

Bernard Udis—PhD, Professor Emeritus of Economics, University of Colorado at Boulder, and Visiting Research Professor, U.S. Naval Postgraduate School. Professor Udis has also served as Distinguished Visiting Professor of Economics at the U.S. Air Force Academy and as a William C. Foster Fellow at the U.S. Arms Control & Disarmament Agency. His NATO Research Fellowship examined the costs and benefits of offsets in defense trade. Professor Udis' published work includes three books: *The Economic Consequences of Reduced Military Spending* (editor, 1973), *From Guns to Butter: Technology Organizations and Reduced Military Spending in Western Europe* (1978), and *The Challenge to European Industrial Policy: Impacts of Redirected Military Spending* (1987). In addition, he has published numerous articles in scholarly journals on defense industries and military power. These include "Offsets as Industrial Policy: Lessons From Aerospace" (with Keith Maskus, 1992), and "New Challenges to Arms Export Control: Whither Wassenaar?" (with Ron Smith, 2001). A number of his works are considered classics in defense economics and have been reprinted in collections such as *The Economics of Defence* (2001) and *Arms Trade, Security and Conflict* (2003). Professor Udis' current research focuses on competition and cooperation in the aerospace industries of the US and the EU. [Bernard.Udis@colorado.edu]

David Matthews—Senior Lecturer, Graduate School of Business & Public Policy, and Colonel, U.S. Army (Ret.). COL Matthews earned a BA in 1966 and an MA in 1974. He is a graduate of the U.S. Army Command and General Staff College, the U.S. Army War College, and the Defense Systems Management College. An Ordnance Corps logistician for the first two decades of his career, he served successively in the Office of the Deputy Chief of Staff for Logistics, HQ, Department of the Army; as Chief of the Logistics Division, Multiple Launch Rocket System Project Management Office; as Commander of the U.S. Army logistics and materiel acquisition organization, assisting in the modernization of the Royal Saudi Land Forces; and, finally, as Project Manager, Army Tactical Missile System from 1990-1994. During the latter assignment, he was selected to receive the Secretary of the Army's 1991 Project Manager of the Year Award. In June 2003, and again in December 2004, he was selected to receive the Meyer Award for Teaching Excellence in Systems Engineering. He has served for the past 11 years as a Senior Lecturer at the Naval Postgraduate School, teaching Project Management, Acquisition Logistics, and Defense Systems Acquisition. [DMatthews@nps.edu]

Abstract

We have continued our research into the global defense industrial base—and its increasingly complex nature. Our aim has been to understand defense industrial developments, place those developments in context, and find explanatory paradigms suitable for better explanation of ongoing trends. It is also our hope to provide



insights useful for better management of the defense–industrial partnership, and for improving acquisition management practices. In this report, we consider the ongoing travails of the KC-X program, the C-27, and the rise of unmanned aerial combat systems (UAVs).

Report Summary

We have continued our research into the global defense industrial base—and its increasingly complex nature. Our aim has been to understand defense industrial developments, place those developments in context, and find explanatory paradigms suitable for better explanation of ongoing trends. It is also our hope to provide insights useful for better management of the defense–industrial partnership, and for improving acquisition management practices. In this report, we consider the ongoing travails of the KC-X program, the C-27, and the rise of unmanned aerial combat systems (UAVs).

The KC-X Melodrama

The KC-X has been an excellent illustration of the bureaucratic, legal, and political factors that are significant in shaping the U.S. defense acquisition system. It has also illustrated how those forces can impose long delays on even relatively simple projects. Our primary concern in this particular report was keeping a continuous track on the remarkable set of events—and players—finally leading to selecting a replacement for the KC-135.

The protracted nature of the process of choosing the KC-X owes little, if anything, to technological immaturity (a favorite explanation for such things). In fact, the KC-X—whether based on Boeing or Airbus proposals—is a design largely in hand. Tanker conversions of the A330 (or A310) and B767 are already operational in other air forces. Instead, the KC-X melodrama illustrates effectively how other obstacles can delay, and sometimes sidetrack, the acquisition process.

Continuing the theme of previous reports, we find that Allison's Model III (governmental politics, or “quarrelsome committees”) is a highly successful explanatory perspective for the KC-X story; it is certainly better than the standard perspective of the defense marketplace being the domain of a sovereign monopsonist.

C-27 and Aerospace Globalization

The C-27 is an excellent case illustrating the increasingly globalized nature of aerospace industries—and their complex relationships with defense customers. The story is rather complex—influenced, among other things, by the history of the Italian defense industrial base, and especially its relationship to the United States. Italian defense industrial strategy aimed for a special relationship with the United States—starting with offsets and proceeding to a significant amount of system commonality, especially in transport aircraft.

The Italian G222 tactical transport aircraft was developed within this framework, and has been a technical and commercial success, both nationally and globally. Foreign customers have included the Afghanistan Air Corps and the United States Air Force (as the C-27). A parallel development in the U.S.–Italian military and industrial relationship was the Italian purchase of the C-130J, a significant part of the current U.S.–Italian defense relationship.

However, defense industrial affairs are not just about suppliers, customers, and products. The C-27 is also related to the long-term evolution of U.S. tactical airlift doctrine



and the recent politics of defense budgets. In short, the G222/C-27 story illustrates well the complex of transnational relationships that are becoming the norm in the aerospace industry.

Unmanned Aerial Vehicles (UAVs)

We devoted a great deal of attention to our third topic, Unmanned Air Vehicles (UAVs). The report takes on a range of aerial vehicles developed for reconnaissance, or both reconnaissance and strike. We also attempt to place the rapid growth of UAVs in the U.S. inventory in context.

The rise of unmanned aerial combat systems (UAVs) has been a significant event for military affairs, defense industrial firms, and military organizations. In this report, we discuss UAVs in the context of the ongoing competition between the U.S. plus allies against a number of terrorist–insurgent opponents. Within that competition, unmanned vehicles are a remarkable development.

In particular, they are an important enhancement to the reconnaissance-strike embodiment of the Information Technology (IT)-enabled RMA, which was first demonstrated in the Gulf War of 1991. Broadly speaking, UAVs have been a useful counter to the ongoing counter-RMA associated with Al Qaeda, the Taliban, and other terrorist–insurgent movements. UAVs, with their longer endurance, provide a close approximation to continuous battlefield presence. This leads to a number of useful military capabilities, which we discuss in some detail.

However, the effect of UAVs on the international defense marketplace has been quite possibly even more profound. The relative simplicity and cheapness of UAVs mean that these systems can be developed with company resources outside the “normal” defense acquisition system, with its highly complex and potentially burdensome processes. A closely related point is that defense systems in this realm are open to a much wider range of suppliers than the highly complicated and expensive aerospace systems, such as fifth-generation fighters. In fact, a large number of enterprises have been able to finance UAV development projects with their own funds (beyond the defense giants such as Boeing and Lockheed–Martin). And, countries with high technology and small size, such as Israel, are world leaders in unmanned systems. We focus on the UAV market specifically through perspectives offered by a number of the leading suppliers.

Finally, we consider the confluence of operational and organizational issues associated with UAVs, using the Raven UAV development, operational growth, and integration with the U.S. Army’s support structure as a representative case study. We discuss the unorthodox methods used to develop and field this particular UAV, and how the Raven was later integrated into the Army’s support system. While the Raven is an interesting example of dealing with the problem, a continued search for main themes in solving these problems is a valuable line of research





Acquisition Research Program:
Creating Synergy for Informed Change

EMERGING PATTERNS IN THE GLOBAL DEFENSE INDUSTRY

Raymond Franck, Ira Lewis, David Matthews, Bernard Udis

Naval Postgraduate School

APRIL 7, 12 MAY 2011

INTRODUCTION

- A SERIES OF PROJECTS
 - ECHOES ACROSS THE POND ... (F-35 consortium, UK Defense Industrial Strategy, EADS KC-30 proposal)
 - NEW PATTERNS OF COLLABORATION & RIVALRY ... (B787, KC-X, Entry Strategies)
 - GLOBAL COOPERATION AND COMPETITION ... (KC-X, A-400M, Nordic Defense Bloc, or not...)
- OBJECTIVES
 - UNDERSTANDING A COMPLEX AND CHANGING ENVIRONMENT ... MILITARY, ECONOMIC AND INDUSTRIAL AFFAIRS
 - FINDING NEW EXPLANATORY MODELS



OUTLINE

- THE KC-X DRAMA (CONTINUED)
- C-27 AND GLOBAL AEROSPACE GLOBALIZATION
- RISE OF UNMANNED SYSTEMS (UAVs)
 - UAVs IN CONTEXT: MILITARY AND INDUSTRIAL AFFAIRS
 - INDUSTRIAL PERSPECTIVES
 - RAVEN SMALL UAV AND THE ARMY



KC-X COMPETITION: a Government Politics Perspective

- DRAFT REQUEST FOR PROPOSAL (RfP) OF SEPTEMBER 2009
 - PRICE PER AIRCRAFT EMPHASIS SEEMED TO FAVOR THE BOEING ENTRY
 - CRITICAL RESPONSE FROM NG & EADS
- FINAL RfP NOT MUCH CHANGED
 - THREAT TO NOT RESPOND NOT AS EFFECTIVE AS IN TH EPAST
 - APPEARED TO BE SHAPED BY THREAT OF PROTEST



KC-X SELECTION CRITERIA

Responsive to RfP?
Meets 372 Mandatory
Requirements?

Pass-Fail Tests

Total Proposed Price

PRICE ADJUSTMENTS

Warfighting Effectiveness
Fuel Expense
MILCON Expense

Contract Award if TAP
difference is $\geq 1\%$

TOTAL ADJUSTED PRICE (TAP)

Non-Mandatory Reqt's Score
(93, 5 Groups)

“Tiebreaker”



PLAYERS: A GOVT POLITICS VIEW

- WTO LITIGATION: vs. US (Boeing), vs. EU (EADS); BOTH COMPLAINTS UPHELD
- CONGRESSIONAL PRESSURE
- INDUSTRIAL PLAYERS
 - NG WITHDRAWS
 - EADS WITHDRAWS AND RECONSIDERS
 - BOEING ENTERS, RECONSIDERS, STAYS IN
 - OTHER BIDDERS: United Aircraft (Russia), Tupolev (Ukraine)
- AWARD (FINALLY) IN 2011



KC-X REMARKS

- ENOUGH TO MAKE ONE WISH DARLEEN DRUYUN HAD GONE UNDETECTED
- HOW CAN AN ACQUISITION SUITABLE FOR FIXED-PRICE CONTRACT TAKE SO DARN LONG?
- A PERFECT STORM OF SYSTEMIC DYSFUNCTIONALITIES: BUREAUCRATIC, LEGAL POLITICAL



C-27 AND GLOBALIZATION IN THE AEROSPACE INDUSTRY

- Upgrade of Fiat G.222 twin-prop, high-wing, rear-ramp small airlifter
- L3 Communications U.S. prime after withdrawal of Boeing
- Lockheed Martin provided technical assistance to Alenia, originally as offset for Italian buy of C-130J Super Hercules
- C-27 has same cockpit, avionics and engines as C-130J
- Original U.S. buy was 75; reduced to 38.



C-27 and Contemporary Military Operations

IMPACT OF IRAQ AND AFGHANISTAN

- Importance of fixed-wing airlift for convoy replacement and tactical resupply
- ... better suited than C-130s and C-17s

CHANGING US DOCTRINE & POLICY

- TRADOC (Army) considering expanding the role tactical fixed-wing airlift
- C-27J initially to ANG only
- Alenia to convert 18 G.222s to “C-27/G.222” standard for use by Afghan National Army Air Corps



C-27 POLICY CONTEXT

- Italy considers itself in an defense industrial “special relationship” with the U.S.
 - systematic purchase of many U.S. weapon systems
 - Prominent role in F-35 consortium
 - Original C-27 production plans in US
 - C-27/C-130J commonality
- Focus shifted, around 1990, to developing indigenous industry, with champions Finmeccanica and AugustaWestland (part of EADS)
- Finmeccanica is well positioned as a U.S. partner with aggressive U.S. acquisition strategy.
- Lockheed Martin a subcontractor, not partner of Alenia



RISE OF UAVs

- ... WITHIN CONTEMPORARY MILITARY AND INDUSTRIAL AFFAIRS
- ... FROM AN INDUSTRIAL PERSPECTIVE
- ... CONSIDERING CASE STUDIES, SUCH AS RAVEN (SMALL ARMY UAS)



UAVs IMPACT IN CONTEMPORARY MILITARY AFFAIRS

- LIMITED SUCCESS WITH INITIAL DEMONSTRATIONS (e.g., in Vietnam War)
- INCREASED USEFULNESS ... WITH INFORMATION TECHNOLOGY ENHANCEMENTS
- A USEFUL RESPONSE (CONTINUOUS PRESENCE) TO THE TERRORIST-INSURGENT COUNTER RMA
- CURRENT AERIAL “HOTHOUSE” FOR UAVs FAVORABLE FOR DEVELOPMENT



UAVs IN CONTEMPORARY DEFENSE INDUSTRY: IMPLICATIONS OF SMALLER SCALE PROJECTS

- OPENINGS FOR SMALLER FIRMS, LIKE
 - GENERAL ATOMICS
 - FRONTIER AIRCRAFT (new platform)
- OPENINGS FOR MORE NATIONS
 - ISRAEL
 - SINGAPORE
- FIRM-FINANCED DEVELOPMENT PROJECTS



INDUSTRIAL PERSPECTIVES

- INTERVIEWS WITH ANONYMOUS RESPONDENTS FROM 7 UAV FIRMS ... 6 IN US
- KEY RESPONSES
 - FROM OLIGOPOLY TO COMPETITION
 - LIMITATIONS, TO INCLUDE SEE-AND-AVOID CAPABILITIES
 - NOT SO CHEAP ... SUPPORT TAIL
 - NOT AS EXPENSIVE ... E.G., LESS FLIGHT TRAINING NEEDED



KEY RESPONSES (CONT.)

- CORE COMPETENCY: LONG-ENDURANCE MISSIONS, ESPECIALLY ISR
- UAVs FREQUENTLY OVER-ENGINEERED ... SERVICE SPECS FOR AIR VEHICLES
- SPECIAL ACQUISITION PROCESSES ... SIGNIFICANTLY FASTER
- UAVs' SHORT OPERATIONAL LIFE



KEY RESPONSES

- SMALL UAV FIRMS INSIDE LARGER FIRMS
 - LARGER FIRMS TYPICALLY MORE EXPERIENCED IN DEALING WITH DOD
 - RESULTS DEPEND, *INTER ALIA*, ON LARGER FIRMS' CULTURE ... ESP. RISK TOLERANCE
- EXPORT RESTRICTIONS ONEROUS ... "BANE OF OUR EXISTENCE"



RAVEN SMALL UNMANNED AERIAL SYSTEM (SUAS) ORIGINS

- Late 90s: Special Operations Community interested in man-portable UAV
- FY 98-02 Military Operations in Urban Terrain ACTD focused on identifying technology solutions
- FY02-06 Pathfinder ACTD supported further development into a sophisticated SUAS



RAVEN CHARACTERISTICS

- Modular, rugged “snap-together” construction
- Hand-launched & “deep stall” landed
- Semi-autonomous with GPS navigation
- Wingspan 4.5 feet; Wt 4 lb; Endurance 80 – 100 Min; Range 10 KM; Speed 20 – 70 MPH
- Quiet (battery powered)
- Man-portable ground station controls with analog data links
- Real-time data from EO or IR sensors



RAVEN SUAS ISSUES

- SOCOM facilitated procurement with an Urgent Mission Needs Statement
 - Development of training program nearly concurrent with deployment
- US Army agencies late adopters after initiation of OIF & OEF
 - Many commanders at battalion and below initially skeptical of “model airplane”



RAVEN SUAS FUTURE

- Raven now fully accepted by USA & USMC
- Program now managed by USA PM-UAVS
- A number of product improvements ongoing, including data link upgrades, ongoing
- Low altitude airspace management and deconfliction still a thorny issue



CONCLUDING REMARKS

- Continuing concern over hyper-bureaucratized, -legalized, -politicized acquisition processes in an era of hyper-adaptive warfare
 - Argues for the reform, quick-response methods
 - Raven Case indicates mainstreaming successful projects along these lines
- C-27 case illustrates increasing globalization
- A coming era of airframe recapitalization, instead of modernization?
- Effects of UAVs will be significant in many dimensions ... not all of which are yet understood

