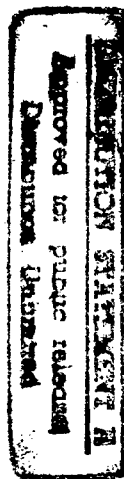


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FISCAL YEAR 1996



INSPECTED 3

**50<sup>th</sup>**  
Project AIR FORCE  
1946-1996

# **Project AIR FORCE**

## ***Annual Report***

**AR-7001-AF**

**DTIC QUALITY INSPECTED 3**

**FISCAL YEAR 1996**

**50<sup>th</sup>**  
**Project AIR FORCE**  
**1946-1996**

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## DIRECTOR'S MESSAGE

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Any commentary on the work of Project AIR FORCE in fiscal year 1996, as in all recent years, is best laid against the backdrop of the continuing, often dramatic changes in what the Air Force and the other military services are being asked to do and in the budgetary and personnel resources with which to do them. New directions, unfamiliar paradigms, rapid technological transitions, and a widening array of difficult resource-allocation choices have become common features of the Air Force scene.

The past year is also notable for the emphasis that Secretary Widnall and General Fogleman placed on strengthening long-range planning in the Air Force and on articulating more clearly the Air Force contribution to the joint team that underwrites the nation's military security.

I am pleased to report that Project AIR FORCE, with its broad mission, corporate and cross-functional perspective, and relevant research expertise, was well placed to help on both accounts. Our research sought to provide a better understanding of the implications for the Air Force of the evolving national security environment, to clarify the choices that derive from it, and to assist in the long-range planning process that the Secretary and Chief of Staff have launched. This report highlights some of that research.

Most of our FY 1996 work took the form of individual research projects—teams of RAND researchers organized to bring different skills and outlooks to bear on a defined issue of importance to the Air Force. Most frequently, these projects are part of a longer-term emphasis on a set of related issues, say in logistics, space, and regional

military strategy. A few are more narrowly defined to provide short-term direct assistance on a matter on which Project AIR FORCE has a comparative advantage.

But there is an institutional dimension to our work as well. This comes from being part of the Air Force family and takes many forms, including participation in the Air Force Scientific Advisory Board, lectures at the Air War College and other Air Force educational forums, interactions with the Air Force Academy, participation in major Air Force games and exercises, and the like. There were many such examples in the past year, including a seat on the Board of Directors for the preparations for and discussions at the October CORONA on long-range planning and a presentation of RAND research on future force capabilities at that watershed meeting.

Finally, 1996 is the 50th year for Project AIR FORCE. It began as Project RAND in 1946 and took its current name in 1976. For two years, it was housed at Douglas Aircraft Company but then was the foundation for and has been continuously operated by RAND since 1948. PAF represents a remarkable and productive partnership between the Air Force and RAND, one underwritten by a relationship of trust and a broad and flexible charter.

We were honored to have Secretary Widnall and General Fogleman and many other current and retired Air Force leaders participate in our 50th anniversary commemorative events. Our appreciation goes as well to the Air Force Association for its public service award honoring RAND and Project AIR FORCE. We are proud of that heritage and the legacy that it offers for helping the Air Force meet the challenges that lie ahead.

For FY 1997, those challenges include the implementation of the initiatives chartered at the CORONA meeting and the assessments and deliberations of the Quadrennial Defense Review and related activities. Both will have major effects well into the next century, and both are paramount in PAF research now under way.

*Brent D Bradley*

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## CONTENTS

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|                              |     |
|------------------------------|-----|
| DIRECTOR'S MESSAGE . . . . . | iii |
|------------------------------|-----|

### RESEARCH HIGHLIGHTS

|                                                      |    |
|------------------------------------------------------|----|
| 1996 IN REVIEW . . . . .                             | 1  |
| Strategic Planning . . . . .                         | 1  |
| Future Role of Air and Space Power . . . . .         | 4  |
| Resource Management and System Acquisition . . . . . | 9  |
| Improving Analytic Technology . . . . .              | 13 |

### BRIEFINGS

|                                                      |    |
|------------------------------------------------------|----|
| FISCAL YEAR 1996 BRIEFINGS . . . . .                 | 17 |
| PAF-Wide . . . . .                                   | 17 |
| Strategy and Doctrine . . . . .                      | 18 |
| Force Modernization and Employment . . . . .         | 21 |
| Analytic Technology . . . . .                        | 23 |
| Resource Management and System Acquisition . . . . . | 25 |

### PUBLICATIONS

|                                                         |    |
|---------------------------------------------------------|----|
| FISCAL YEAR 1996, PUBLICATIONS WITH ABSTRACTS . . . . . | 31 |
|---------------------------------------------------------|----|

### ADMINISTRATION

|                          |    |
|--------------------------|----|
| ADMINISTRATION . . . . . | 45 |
|--------------------------|----|

|                                  |    |
|----------------------------------|----|
| Advisory Group . . . . .         | 45 |
| PAF Management . . . . .         | 47 |
| Fellows at RAND . . . . .        | 48 |
| RAND Organization . . . . .      | 49 |
| RAND Board of Trustees . . . . . | 53 |
| FINANCIAL INFORMATION . . . . .  | 55 |

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## RESEARCH HIGHLIGHTS

## **STRATEGIC PLANNING**

*Although the Air Force has cut its forces by nearly 40 percent since 1989, more constraints on defense spending seem inevitable. At the same time, the Air Force is increasingly involved in operations all over the world, usually as a member of a joint and sometimes a coalition force. These trends—along with the emergence of new technologies that hold the potential for new concepts of operation and greater cost-effectiveness—led General Fogleman to initiate a major effort in long-range planning in 1996. This initiative included the Scientific Advisory Board's New World Vistas, Air University's Air Force 2025, and the creation of the Special Assistant to the Chief of Staff for Long-Range Planning.*

*In a sense, all PAF research in the past year was designed to help the Air Force make decisions that will help shape the force of the future. But some of the work, described below, directly supported the Air Force in strategic planning.*

### **Shaping the Role of Air Power: A Paradigm for Meeting the Needs of Future Joint Operations**

To complement the Air Force's own planning activities, General Fogleman asked PAF to provide an independent assessment of the capabilities that the Air Force would need in 2015, along with research and development initiatives that should be carried out to develop the Air Force of 2025. The findings of this analysis formed the

basis of the only non-Air Force presentation given at the October CORONA meeting on long-range planning.

PAF's research was distinguished by a broad range of approaches—from subjective Delphi techniques, to gaming, to more quantitative, force-on-force assessments—and a great number of differing future scenarios, from hostage rescue to major military operations. Researchers found that the ability to respond to special circumstances was often more important than the size of the forces brought to bear in a crisis. For example, capabilities that enabled rapid shifts in strategy in response to unexpected circumstances allowed deployment of part of the force rapidly to a region very early in a conflict, or provided the means to neutralize the threat of the use of weapons of mass destruction often made the critical difference between success and failure.

Of all the new system capabilities the researchers analyzed, the following accomplished the widest range of missions rapidly, globally, and at low risk and cost:

- space systems for surveillance and reconnaissance in place of aircraft, battle management systems, and certain other combat applications
- unmanned aerial vehicles (UAVs) for surveillance and reconnaissance, battle management, defense suppression, and peacekeeping
- advanced air-to-ground weapons
- directed energy weapons for defense suppression, peacekeeping, and space operations.

### **Assessing Joint and Service Doctrine**

PAF undertook a major assessment of Air Force doctrine in the context of joint doctrine and the doctrine of its sister services. This work concluded that joint doctrine could well play an increasingly important role in the determination of service roles and missions, in the development of new warfighting concepts, and, ultimately, in the allocation of defense resources. PAF also concluded that, to participate effectively in the joint doctrine development process, a service

must sustain a vigorous process of developing its own doctrine. This research identified areas in which Air Force doctrine—especially at the operational level—could be improved and recommended ways to strengthen the doctrine-development process within the Air Force. Related work also suggested the broad outlines of an approach to basic Air Force doctrine that, if adopted, would provide a better basis for defining and advocating the roles of air and space forces in joint missions.

### Organizing for Planning

PAF identified and examined key components of the force planning process, as DoD conducts it. These components include *strategists*, who define the demand for military capabilities; *conceivers*, who devise novel operational concepts to meet emerging needs; *analysts*, who assess candidate concepts and help to inform the process of resource allocation; and *integrators* who develop the service's plan based on inputs from all of these activities. Our research noted that these functions have been performed in disparate organizations within the Air Staff and recommended that planning be reorganized to include them all within an integrated team under a single deputy chief of staff. As this goes to press, the Air Staff is preparing to reorganize largely along these lines.

### Improving the Representation of Air Power's Capabilities in a Joint Context

One of the questions we dealt with this year was the degree to which current joint assessment tools, such as computer-based simulation models, have kept up with new capabilities of U.S. air forces. Indications of a problem here arose, for example, in assessments done in support of the Bottom-Up Review (BUR) and, more recently, in the Deep Attack Weapons Mix Study (DAWMS). Both have shown air power operating at levels of effectiveness many times below those demonstrated in warfare and operational testing. Such assessments can result in misinformed choices about resource allocation. Accordingly, PAF has worked closely with Air Staff offices engaged in ongoing joint assessments to ensure that these efforts portray current and future capabilities more accurately. This has involved

historical and extrapolative analysis, as well as careful monitoring of the joint assessment ground rules, inputs, and results.

PAF researchers are also analyzing the impact of DAWMS force-structure options on U.S. air superiority capability. This work will continue through FY 1997 as the Air Force participates in the Quadrennial Defense Review and other joint assessments.

### **Supporting the Special Assistant to the Chief of Staff for Long-Range Planning (AF/LR)**

PAF researchers also provided support to AF/LR in a number of ways throughout the year: by commenting on multiple drafts of the CORONA issue papers in September; by conducting two separate studies on how long-range planning might best be institutionalized in the Air Staff; by hosting three workshops—on alternative futures, approaches to long-range planning, and economic factors affecting future planning—at RAND's Washington office; and by helping create the ten future operating environments that underpin the Special Assistant's alternative futures analyses, among other tasks.

### **FUTURE ROLE OF AIR AND SPACE POWER**

*The key decisions facing the Air Force today rest importantly upon an understanding of the changing international environment, the character of potential future threats to U.S. interests, and the implications of these threats for concepts of operation, the application of new technologies, and Air Force strategy and doctrine. PAF's recent work in this area has covered a range of topics from development of new space capabilities to assessment of the Air Force's proposal to modify Minuteman systems to provide a national missile defense against rogue-nation threats.*

### **Identifying Sources of Conflict and Their Implications for Air Force Operations**

PAF undertook a systematic assessment of the range of future demands and constraints likely to be imposed on U.S. air power as a result of strategic trends in critical regions of the world. The research team identified key sources of conflict in Europe and Eurasia, the

Asia-Pacific region, and the greater Middle East and developed a broad range of conflict and nonconflict scenarios with relevance to Air Force planning concerns. The study revealed the very significant challenges that shifting geopolitical alignments and regional developments will impose on the use of air power, especially in terms of en route and in-theater access and power projection. Even short of the rise of true "peer competitors," the USAF is likely to confront various "niche" competitors employing asymmetric strategies. Among other findings, the researchers foresee increasing demand for the application of air power in urban settings and for purposes of economic warfare and counterproliferation. This research contributed to the Air Force long-range planning effort in the past year and will be highly relevant to the Quadrennial Defense Review and to new PAF research on terrorism and on China's military evolution.

### **Reassessing Air Force Support for Military Operations Other Than War**

Peace operations, humanitarian relief, and similar military operations other than war (MOOTW) have evolved from being sideshows for the military to being on center stage. Peace operations in Iraq and Bosnia, in particular, are producing an operational tempo unprecedented in peacetime, a tempo that is stressing people and equipment and making it difficult for the Air Force to prepare fully for combat operations in major regional conflicts (MRCs).

In recent research on how the Air Force might deal with this problem, PAF found that the increased operational tempo is in fact reducing operational training for many units below levels needed to accomplish MRC missions. One of the most effective options for mitigating this effect is to reassess the need for Air Force support in all ongoing peace operations. Researchers found that, in several recent cases, Air Force and other air assets were being deployed in numbers (and flown at levels) well above what was required to enforce the peace. A more modest approach to peace operations would reduce Air Force support, relying on its global mobility for reinforcements but deploying only those forces absolutely necessary to accomplish the basic peacekeeping mission. In the future, the Air Force may be able to use unmanned aerial vehicles for many peacekeeping surveil-

lance missions, rather than more-complex manned platforms, such as the Joint Surveillance and Target Attack Radar System (JSTARS). It could then be reserved for more demanding tasks.

### **Assessing the Minuteman National Missile Defense Option**

There is growing concern in the United States about a nuclear missile strike by a rogue state. The Air Force has suggested that a national missile defense (NMD) system based on the existing Minuteman missile and infrastructure could be fielded earlier than any other approach and at a relatively modest cost. PAF was asked to provide an independent assessment of this proposal.

The PAF research team concluded that the Minuteman NMD option was robust in its ability to detect, track, discriminate, intercept, and destroy a limited number of threat missiles, while admitting that there are basic uncertainties with regard to the performance of *any* NMD option. What is more, they found that the Minuteman NMD option could actually defend against a greater range of missile threats than the Air Force had postulated.

PAF's cost analysis focused on two issues: (1) Is the current estimate of development and production costs complete? (2) Does the estimate take into account the potential for cost growth and slippage in schedules? Initial Air Force estimates showed a total cost of \$2.4 billion. PAF's adjustments brought the cost to \$3.3 billion. Additionally, we concluded that certain concept-exploration and risk-reduction activities might need to be undertaken, bringing the final cost estimate to the \$3.3–3.9 billion range. (The Air Force continues to believe that it has sufficiently accounted for both risk and system integration in its baseline estimate of \$2.4 billion.)

The Air Force NMD option, like all others currently under consideration, raises complex questions of treaty compliance that would have to be addressed in negotiations with the Russians. The deployment of any nationwide anti-ballistic missile (ABM) defense system could be in conflict with the 1972 ABM treaty with the Soviet Union. The use of X-band radars at multiple sites raises similar treaty questions. Of course, in the final analysis, it is up to the U.S. government, which will conduct a thorough compliance review, to decide whether or not the Minuteman NMD option is consistent with the ABM treaty. The

PAF study notes, however, that the relationship between nation states has changed dramatically in the 20 years since the ABM Treaty was negotiated; it may well be time for the United States and Russia to renegotiate the conditions of the existing treaty to provide better protection for both nations against rogue states.

### **Identifying the Vulnerability of Air Force Information Systems**

The Air Force's growing dependence on its own information systems, as well as on commercial communication systems, creates potential vulnerabilities that a competent enemy could exploit. PAF research explored the dimensions of this problem and identified options for reducing such vulnerabilities.

The team found that most vulnerabilities were more nuisances than serious problems. However, that could change in the absence of prudent defensive measures. The greatest threats appear to be the "old-fashioned" kind: physical attacks on critical nodes and links, jamming of critical communications and links, and denial and deception measures to defeat sensors. Newer techniques, such as computer cracking or the use of high-powered microwave weapons, need to be defended against as well, however. Unlike in the past, major conflicts are probably not the stressing case. Lesser operations are likely to be more demanding.

The study outlines two sets of options that would substantially enhance security against all levels of threats: One set is relatively easy and inexpensive to implement, such as using software encryption more broadly; the other set is somewhat more costly and includes manpower and training suggestions, such as maintaining skilled personnel as "backups" in case key automated systems fail. Taken together, these sets of options represent the fundamental corrective measures the Air Force should take to manage the potential risks to its information systems.

## **Defining the Role of Space in Support of Future Military Operations**

PAF's recent research on the increasing role of the Air Force in space had several dimensions. One was an analysis of emerging commercial and foreign space capabilities. A key objective was to identify the space communication and remote-sensing capabilities that will be available to users worldwide within the next decade. The research team developed an Iranian case study, widely briefed within the Air Force. It illustrates the military consequences of emerging capabilities that could allow potential adversaries to strike with precision at U.S. military assets with conventionally armed GPS-guided weapons and to detect large concentrations of U.S. ground and naval forces and deprive those forces of the element of surprise.

In related work, PAF examined the potential of nonlethal measures in defending against such threats. Focusing on systems that would temporarily nullify but not destroy global communications and third-party assets, researchers identified a number of promising space control options to protect U.S. forces.

A third task focused on Transatmospheric Vehicles (TAVs) or spaceplanes. Specifically, the research team is assessing the technical feasibility and cost of modifying for DoD and Air Force use, the reusable commercial launch vehicles NASA is developing. The researchers have created a cost model to estimate the research, development, test, and evaluation, production, and life-cycle costs of a TAV that will allow the Air Force to compare the cost-effectiveness of TAVs to other delivery platforms for the global strike mission. Members of the research team are now working with the Air Force Space Command Integrated Concept Team on the Military Spaceplane.

## **Capturing the Essential Factors in Reconnaissance and Surveillance Force Sizing and Mix**

PAF has tackled the challenge of force sizing for reconnaissance and surveillance in light of technology advances in Command, Control, Communications, Computers, and Intelligence (C<sup>4</sup>I), platforms, sensors and processing, and concepts of operation that exploit the synergy arising from ISR fusion. Researchers developed a methodology and model that captures the effects of ISR fusion quantitatively and

makes platform and sensor tradeoffs in an overall campaign context. A prime example of the model's usefulness is in determining the best approach to continuous or frequent-visit surveillance using a mix of UAVs and manned aircraft. This work will be used to support PAF's ongoing research on the potential performance of UAVs in a range of current and future missions.

### **Assessing the Need for Theater Air Defense (TAD) BMC<sup>4</sup>I**

Emerging aircraft and ballistic and cruise missile threats will probably require operational concepts and systems for theater air defense that are more than enhancements of existing capabilities. In research that complemented the activities of the TAD BMC<sup>4</sup>I Executive Agent and its panels (in particular, the panel on concepts of operations [CONOPs]), PAF took a longer-term view (2003 and beyond) of likely changes in the demand for information and the impact of these changes on the panel's projected near-term TAD CONOPs and architectures. We applied a "strategies-to-tasks" approach to identify potential far-term BMC<sup>4</sup>I shortfalls and to focus on the most effective technological and operational remedies for those gaps. The result is an accessible and traceable TAD BMC<sup>4</sup>I vision with a supporting rationale for specific enabling and force-multiplier initiatives. It is intended to provide a framework for addressing contemporary issues, such as the proper role for systems like the Cooperative Engagement Capability (CEC), implications of the cruise missile threat, and how to balance TAD architectures to address the growing WMD threat.

### **RESOURCE MANAGEMENT AND SYSTEM ACQUISITION**

*General budget reductions are taking place within nearly every Air Force program. To cope with such reductions, the Air Force is using a combination of far-reaching management initiatives, such as base closing, acquisition reform, and privatization and outsourcing. General Moorman, the Vice Chief of Staff of the Air Force, has stated that "these measures are our approach to that second revolution—the revolution in defense management." PAF research in this area is directed at improved processes—such as repair and transportation of spare parts, contracting for support services, and the use of commercial products and standards—and improved organizational struc-*

*tures, such as a balanced mix of active, reserve, civilian, and contractor personnel.*

### **Evaluating Lean Logistics Designs**

Lean logistics reform measures are already affecting the Air Force logistics structure, resource posture, material flows, and even information flows. The vast range of these changes and the radical shift from relying on materiel to relying on responsiveness have raised serious concerns in the Air Force about how far the reforms should go. What is needed for that purpose is a systemwide view of logistics support that considers all operational phases—from peacetime to lesser contingencies, all-out war, and reconstitution—and addresses the widest possible range of uncertainties that may affect logistics supply and demand. The PAF logistics team has designed such a framework.

It is presented in terms of an evaluation matrix, through which the merits and risks of alternative designs are displayed. To illustrate how the framework can be used, PAF focused on the F100-220 engine, which accounts for 40 percent of the depot workload of component repair and up to 25 percent at base level. It sets out eight different approaches to logistic support of the F100-220 and identifies the key risk areas for each design in each operational mode. Using a stoplight format, the resulting matrix compares competing designs on the basis of their robustness in the face of uncertainty and their comprehensive coverage of all modes of operation. Given that information, policymakers can weigh the importance of each of the operational modes and the potential risks of encountering each operational surprise and can select the option that best meets Air Force needs. Other matrices, embedded in the higher-level evaluation matrix, offer more detail about both the lean logistics designs and the nature of the uncertainties.

Our next step will be to expand the framework to assess logistics support structures for fighter aircraft used in support of an Air Expeditionary Force.

### **Taking a Strategic Approach to Outsourcing**

If the Air Force decides to pursue the kind of qualitative shift toward external sourcing that the OSD now advocates and that many commercial firms have successfully tested, it can do so only by taking a corporate or "strategic" view of the process. This is the position the PAF research team took on outsourcing and privatization. What is needed is a systematic, coordinated way to expand outsourcing dramatically enough to achieve the goal of saving \$1.2B in the FY 98 Air Force Program Objectives Memorandum. Working closely with the Air Force Outsourcing Integrated Product Team (IPT) in the past year, PAF has helped articulate a strategic approach to outsourcing that calls for the creation of a formal independent outsourcing and privatization advocate. The advocate would be separate from the line offices and functions of the Air Force and would not have substantive responsibility for sourcing decisions. The advocate would identify the best sourcing policies and processes available to the Air Force, emphasizing the best interests of the Air Force itself, as reflected in the goals set by the senior leadership. Many parts of the Air Force will need to evolve simultaneously toward those goals and the large benefits sought, adjusting their policies and practices in concert. An independent sourcing advocate would provide the single focal point for all the relevant parties to help them progress together.

Following the lead of commercial outsourcing practices over the last 15 years, the research team outlined the steps of a strategic outsourcing process that could dramatically increase the Air Force's capability and quality of life and cut the cost of support services. These steps describe a winnowing and prioritizing process that would identify the billets that are to be outsourced and the organizational level of the Air Force that should maintain responsibility for sourcing decisions. To start the process, the Air Force would focus on activities that present few risks when outsourced, such as generic business and administrative activities or logistics activities that do not depend on access to technical data from the manufacturer, then work toward riskier activities as it gained more experience in outsourcing.

## **Improving Contract Design**

In light of the growing role of contractors in the weapon-system maintenance process, PAF also examined how the Air Force, specifically, and the DoD, more generally, could better design contracts. This work suggests that contracts that measure performance by the number of flight hours that aircraft operate induce better contractor behavior than “per repair” contracts that measure performance by the number of broken items that are fixed. The implication of this research is that the most cost-effective contracting approach the government might use for logistics support resembles the C-21 and LN-15C contracts. It is characterized by (1) a fixed payment to the contractor; (2) a specified weapon-system availability rate the contractor must meet; and (3) if the contractor is risk-averse, partial cost-sharing if expensive spare parts are needed to meet the availability rate. One caveat is that, up to now, this approach has only been tested on support for commercial-derivative aircraft.

## **Assessing the Value of Commercial-Military Integration**

Greater commercial-military integration (CMI) is viewed by many acquisition officials as vital to maintaining the industrial base, promoting the most advanced and reliable technologies into weapon systems at an affordable cost, and ensuring that new systems can be supported over a lifetime that may span many decades and rapid technological change. Yet little evidence exists to support these claims. In the last year, PAF has investigated this issue, including the likely costs and benefits of greater CMI.

In military avionics, PAF research found that CMI could provide equal-performance systems at 20 to 50 percent less cost. What this would require, however, is full acquisition reform—with emphasis on cost as an independent variable, elimination of cost-plus contracting, the Truth in Negotiations Act (TINA), MILSPECS, and other regulatory burdens—and contractor configuration control from cradle to grave. The next phase of the research will focus on the problems that market failures may cause for the use of commercial components and the steps that might be taken either to avoid them or to mitigate the consequences.

## Relating Readiness to Flying Training Resources

As part of its effort to improve measurement and forecasting of force readiness, PAF is developing a model that relates flying squadrons' operational capabilities and timely availability to the numbers of sorties, flying hours, and other resources available for training. Working closely with training experts at the Air Combat Command and in operational units at Moody and Hill AFBs, the research team is using the F-16 Block 40 Low Altitude Navigation and Targeting Infrared for Night (LANTIRN) weapon system as a test case. The team is creating the first model to link operational capabilities to flying training resources by explicitly relating pilots' skills to the accomplishment of a variety of training activities. The Air Staff and MAJCOMs can use the model to gauge the effects of a number of variables, such as changing training budgets, resources, and crew ratios; the experience mix and turnover rate of pilots; increased use of simulators; and commitments to operations other than war.

## IMPROVING ANALYTIC TECHNOLOGY

*PAF continues to support improvements in analytic technology to better represent the contributions of air and space operations in joint operations. While a number of our research projects address this issue as part of their objective, one project, described below, had the specific purpose of demonstrating a powerful new use of modeling for analysis.*

### Using Exploratory Analysis in Theater Campaign Assessments

Over the last several years, RAND researchers have developed a new approach to using modeling and simulation in analysis, called exploratory analysis. PAF demonstrated the advantages of this approach last year in the context of a problem of particular importance to DoD and the military services: determining the appropriate weapon mix for the services' deep-attack mission. The study contrasted the approach and outcome of traditional model-based analysis, which identifies a single, best-estimate solution and examines variations from that solution through sensitivity analysis, with that of exploratory analysis. The latter approach searches more broadly

across variations in scenarios, input values or representations, for all possible solutions that provide a desired outcome. Multiple model runs—perhaps thousands or tens of thousands—across a network of computers are used to perform the search. Because exploratory analysis reveals a range of possible solutions, it offers decision-makers greater flexibility in making tradeoffs and greater likelihood of identifying a solution that is robust across uncertainty, different scenarios, and even divergent models. We will use this technique in theater analyses carried out as part of our work with the Air Force for the Quadrennial Defense Review.

## **BRIEFINGS**

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## FISCAL YEAR 1996 BRIEFINGS

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### PAF-WIDE

*Shaping the Role of Air Power for the 21st Century* (Natalie Crawford)

The Honorable Sheila E. Widnall, SAF/OS, Gen Ronald R. Fogleman, AF/CC, Gen Thomas S. Moorman, Jr., AF/CV and other attendees at Corona Fall 1996

Air Force Advisory Group

Lt Gen Ralph E. Eberhart, AF/XO

Lt Gen George K. Muellner, SAF/AQ

Maj Gen Bobby O. Floyd, AF/XOF

Maj Gen Robert E. Linhard, AF/XOX

Maj Gen Charles D. Link, AF/XO

Maj Gen David W. McCloud, AF/XOR

Brig Gen Thomas R. Case, AF/XOM

Brig Gen John H. Garrison, ACC/IN

Col Thomas Allen, AFSAA/CC

Col Craig Ghelber, ACC/XP-SAS

Col Paul McVicker, AF/PEY

Dr. Clark Murdock, AF/LR

AF Long-Range Plans Board of Directors

## STRATEGY AND DOCTRINE

### *The New Middle East and Persian Gulf Security* (Zalmay Khalilzad)

Lt Gen John P. Jumper, 9 AF/CC

Lt Gen Ralph E. Eberhart, AF/XO

Maj Gen Robert E. Linhard, AF/XOX

LTG Daniel W. Christman, Assistant to the Chairman, JCS

Mr. Bruce Reidel, Deputy Assistant Secretary of Defense for the Middle East

### *Enhancing Air Power's Contribution Against Light Infantry Targets* (Alan Vick)

Maj Gen Robert E. Linhard, AF/XOX

Maj Gen John A. Gordon, AF/LR

Dr. Clark Murdock, AF/LR

Dr. Richard Hallion, USAF Historian

### *"Check Six Begins on the Ground": Responding to the Evolving Ground Threat to USAF Bases* (Alan Vick)

Lt Gen Eugene D. Santarelli, PACAF/CV

Maj Gen John A. Gordon, AF/LR

Maj Gen John M. McBroom, PACAF/DO

Brig Gen Robert G. Jenkins, PACAF/LG

### *Chemical and Biological Threats to Air Force Operations* (Brian Chow, Gregory Jones)

Robert Irvine, Director, OSD/Counterproliferation Policy

George Look, Principal Director, OSD/Counterproliferation Policy

Edward Warner, III, Assistant Secretary for Strategy & Requirements, OUSD

### *Air Force Operations in a Chemical and Biological Environment* (Brian Chow)

Richard Sokol, Assistant Deputy for TMDO Operations, BMDO/AQO

Dennis Keane, Director of POET

Larry Gershwin, National Intelligence Officer for Science & Technology, CIA

*Nuclear, Biological, and Chemical Threats to U.S. Air Force Operations* (Dean Wilkening)

Maj Gen Robert E. Linhard, AF/XOX

Col Kevin Higgins, AF/XOXP

AF/XOXI staff and ANSER WMD Project Team

Conference on NBC Threats to Air Force Operations at National Defense University

*Using Alternative Futures for Long-Range Planning: A Workshop* (Ken Watman, Organizer)

Maj Gen John A. Gordon, AF/LR

Dr. Clark Murdock, AF/LR

AF/LR and AF/XO staff members

*Approaches to Force Planning: A Workshop* (David Ochmanek, Organizer)

Maj Gen Robert E. Linhard, AF/XOX

Dr. Clark Murdock, AF/LR

AF/XO and AF/LR staff members

*Economics Day: A Workshop* (Bob Roll, Organizer)

Maj Gen John A. Gordon, AF/LR

Dr. Clark Murdock, AF/LR

AF/LR and AF/XO staff members

*Institutionalizing Long-Range Planning in the Air Staff* (Glenn Kent)

Maj Gen John A. Gordon, AF/LR

Maj Gen Robert E. Linhard, AF/XOX

Dr. Clark Murdock, AF/LR

AF/LR and AF/XO staff members

*Defining the Air Force* (Glenn Kent, David Ochmanek, David Shlapak)

Maj Gen John A. Gordon, AF/LR

Dr. Clark Murdock, AF/LR  
AF/LR and AF/XO staff members

*Preparing for the Next Defense Review* (David Ochmanek, Ken Watman)

Air Force Advisory Group  
Maj Gen John A. Gordon, AF/LR  
Maj Gen Charles D. Link, AF/AXO  
Maj Gen Thomas R. Case, AF/XOM  
Col Thomas Allen, AFSAA/CC  
Staff of AF/XOXS, AF/XO-DAG, AF/PEY, ACC/XP

*Doctrine: Dangers and Opportunities* (Rebecca Grant)

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The USAF Doctrine Center  
Air Force Senior Statesmen

*The Bottom-Up Review and Its Implications for the QDR* (David Ochmanek)

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*Halting, Attriting, and Demoralizing Iraqi Forces* (David Ochmanek, John Bordeaux)

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*Regional Trends (Asia-Pacific, South Asia, Eurasia), Sources of Conflict and Implications for USAF* (Zalmay Khalilzad, project staff)

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*Turkey: Regional and Bilateral Security Issues* (Ian Lesser)

The Honorable Rudy de Leon, SAF/US

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*The Role of Aerospace Power in Operation Joint Endeavor* (Alan Vick)

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*Bosnia: Looking Ahead to the Withdrawal and Post-Mandate Periods* (Abram Shulsky)

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Maj Gen Michael J. McCarthy, AF/XOO

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## **FORCE MODERNIZATION AND EMPLOYMENT**

*Matching USAF Aircraft Modernization Funding Needs with Fiscal Realities* (William Stanley, Dan Norton)

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*JSF Design Space and Affordability Considerations* (Donald Stevens)

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*An Assessment of the Air Force's Minuteman NMD Option (U)*, Secret  
(Charlie Kelley)

Gen Ronald R. Fogleman, AF/CC  
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Maj Gen John W. Hawley, SAF/AQP  
Dr. Kent G. Stansberry, Deputy Director, Arms Control Implementation and Compliance, USDA A&T  
Lt Col (P) Todd Bodenhamer and staff, AF/XOXI

*UAV Support of Weapons Platforms: A Future Concept of Operations*  
(Maj Jeffrey Kendall, RAND Air Force Fellow)

Lt Gen David J. McCloud, AF/XOR  
UAV working panel of SAB

*Potential Vulnerability of U.S. Air Force Information Systems* (Glenn Buchan)

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*Potential Vulnerability of U.S. Air Force Information Systems—Third  
Quarter Review* (Glenn Buchan)

Maj Gen Donald W. Shepperd, Director, Air National Guard  
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*Future Role of the Air Force in Space: Transatmospheric Vehicles—  
Work in Progress Briefing* (Melvin Eisman, Daniel Gonzales)

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*Implications of the Enemy Use of Space: Iran Case Study* (Daniel  
Gonzales)

Maj Gen Robert S. Dickman, DoD Space Architect  
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## ANALYTIC TECHNOLOGY

*Modeling for Campaign Analysis: Lessons for the Next Generation of  
Models* (Richard Hillestad and Bart Bennett)

Maj Gen Thomas R. Case, AF/XOM  
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Col Ed Crowder et al., AFSAA  
Col Steve Geary, AFSPC  
Col Scott Farris, et al., AFSPC  
GRC (JWARS Contractor)  
Mr. Ray Gordon et al., Los Alamos Labs  
Mr. Bob Weber et al., Aerospace Corp.  
Mr. Gary Engel, McDonnell Douglas  
MORS tutorial session

*Modeling and Simulation: Better Representing and Communicating the Contribution of Air and Space Power* (Bart Bennett)

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*Modeling and Simulation: Issues and Recommendations* (Bart Bennett)

Maj Gen Thomas R. Case, AF/XOM  
Col Ed Crowder et al., AFSAA  
Mr. Fred Frostic, OASD/S&R  
Mr. Cy Stanic, OSD/PA&E  
Col Steve Randolph, SAF/OSX  
Col Kevin Higgins, AF/XOXP  
Mr. Bob Weber, et al., Aerospace Corp.

*Defining Force Planning Scenarios: Implications from a Comparison of 2-MRC Studies* (Dick Hillestad, Bart Bennett)

Maj Gen Thomas R. Case, AF/XOM  
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Col Kevin Higgins, AF/XOXP

*Improving Analysis with ADS* (Bart Bennett)

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## RESOURCE MANAGEMENT AND SYSTEM ACQUISITION

*Future Viability of the Military Aerospace Industry* (Michael Kennedy, Susan Resetar)

The Honorable Arthur L. Money, SAF/AQ  
Lt Gen George K. Muellner, SAF/AQ  
ASC President's Day (CEOs of ASC's 25 largest contractors)

*Lean Logistics: End-to-End Analysis Framework and an Example*  
(Ray Pyles, Hy Shulman)

Air Force Advisory Group  
Air Force Logistics Board of Advisors  
Air Force Logistics Analysis Symposium

*Expanding Private Production of Defense Services* (Frank Camm)

The Honorable Sheila E. Widnall, SAF/OS  
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Lt Gen Lloyd W. Newton, AF/CVA  
Lt Gen George T. Babbitt, AF/LG  
Lt Gen Howard W. Leaf (USAF, Ret.), AF/TE  
HQ/USAF Outsourcing and Privatization Integrated Process Team

*Implications of a Strategic Approach to Outsourcing: Preliminary Observations* (Nancy Moore)

Lt Gen Lloyd W. Newton, AF/CVA  
HQ/USAF Outsourcing and Privatization Executive Steering Group

HQ/USAF Outsourcing and Privatization Integrated Process Team

*Strategic Sourcing: Outsourcing Analysis at Project AIR FORCE*  
(Frank Camm)

The Honorable Rudy de Leon, SAF/US

*Contracting for Depot Maintenance: The Key to Successful Outsourcing* (Mary Chenoweth, Ken Reynolds)

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Maj Gen (S) Dennis G. Haines, AFMC/LG

Maj Gen (S) Richard H. Roellig, AFMC/PK

Brig Gen Claude M. Bolton, Jr., AFMC/DR

*Air Force Outsourcing Policy* (Frank Camm)

The Honorable Sheila E. Widnall, SAF/OS

Gen Ronald R. Fogleman, AF/CC

*Contracting in the Air Force* (Edward Keating)

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Maj Gen John W. Handy, AF/PE

*Enhanced Air Force Use of the Commercial Industrial Base* (Michael Kennedy, Mark Lorell)

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Maj William Snyder, SAF/AQRE

Capt Mark Harris, SAF/AQRE

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*Cost Drivers: A Design Perspective* (Dan Raymer)

Mr. Jack Graser, SAF/FMC  
Mr. John Dorsett and Ms Tina Colarossi, AFCAA  
Mr. Dave Steffee and Ron Rosenthal, NAVAIR  
Mr. David McNicol, Gary Bliss, and Gary Pennant, OSD/CAIG

*Force Mix and Readiness: Elements of the Research* (Craig Moore)

The Honorable Rudy de Leon, SAF/US  
Maj Gen Donald W. Shepperd, ANG/CC

*Air Force Acquisition Organization and Management (A Structured Discussion)* (Leslie Lewis, Bob Roll, Jack Welch)

The Honorable Arthur L. Money, SAF/AQ  
Ms Darlene Druyun, SAF/AQ  
Lt Gen George K. Muellner, SAF/AQ  
Mr. Blaise Durante, SAF/AQX

*Application of F-117 Acquisition Strategy to Conventional Programs in the New Acquisition Environment* (Giles Smith, Hy Shulman)

Lt Gen Richard E. Hawley, SAF/AQ  
Lt Gen George T. Babbitt, Jr. SAF/AQ  
Lt Gen John M. Nowak, AF/LG  
Mr. Blaise Durante, DASAF/AQX  
Mr. Robert Hale, SAF/FM  
Dr. Paul Kaminski, OUSD/A&T  
Dr. Larry Lynn, DARPA  
Mr. Jack Graser, SAF/FMC  
Lightning Bolt Initiatives Working Groups

*Air Force Acquisition Organization and Functions* (Leslie Lewis)

Ms Darleen Druyun, SAF/AQ  
Lt Gen George K. Muellner, SAF/AQ  
Mr. Blaise Durante, SAF/AQX

POE/DAC Conference chaired by SAF/AQ  
Lt Gen Carl E. Franklin, ESC/CC and staff  
Lt Gen Lester L. Lyles, SMC/CC and staff  
Lightning Bolt Initiatives Working Groups

## **PUBLICATIONS**

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## FISCAL YEAR 1996, PUBLICATIONS WITH ABSTRACTS

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MR-468-AF, *United States Air Force Fighter Support in Operation Desert Storm*, R. A. Pyles, H. L. Shulman.

Operations Desert Shield and Desert Storm were characterized by unanticipated levels of demands for U.S. Air Force (USAF) fighter logistics materials and services—sometimes high, sometimes low, but seldom what was predicted during peacetime planning. Peacetime predictions about the required kinds, quantities, and locations of critical logistics resources were frequently wrong—often substantially. In this report, the authors discuss logistics support to USAF fighter aircraft in Operation Desert Storm, reviewing the ability of the logistics system to satisfy fighter units' needs for aircraft components, electronic countermeasures, and Low Altitude Navigation and Targeting Infrared for Night (LANTIRN) pods, and for munitions during the conflict. This report challenges widely held assumptions about wartime support to fighters. Not only do the authors question the validity of analysts extrapolating peacetime demand experience into wartime predictions, but they also observe that the logistics system for fighters performed best when logistics managers on the scene developed ad hoc processes (e.g., Desert Express, Camel routes) to supplant standard processes and resource plans. Finally, the authors indicate the need for more-flexible resources and structures in future USAF logistics policies and plans.

MR-543-AF, *Strategic Appraisal 1996*, Z. Khalilzad, editor.

Today, the United States possesses military predominance, and American political and economic ideas have broad global appeal. Almost all of the economically capable nations are our allies. Yet the

end of the Cold War has also brought an increase in disorder as a result of the rise in ethnic nationalism and the fragmentation of several states. And these are not the only complications in the current strategic situation. The old U.S. grand strategy—its stand against the Soviet Union—has become moot, and a new one must be devised in the face of a changing world. This book discusses this need and examines three possible strategies. It goes on to discuss the complexities of current geopolitical trends and describes the demands these situations might place on the U.S. military and, in particular, the Air Force. Supersedes DRR-891/1-AF.

MR-576-AF, *Psychological Effects of U.S. Air Operations in Four Wars, 1941–1994: Lessons for U.S. Commanders*, S. Hosmer.

The psychological effects of air operations can significantly shorten wars and reduce their costs, particularly in American lives. In some conflicts, the psychological effects of air operations may exceed the physical effects in importance. This report examines ways to maximize the psychological impact of U.S. air power in future conflicts. Drawing upon POW interrogations and other data from the Persian Gulf, Vietnam, and Korean wars and World War II, the author assesses the psychological effects of past U.S. air attacks against both enemy strategic targets and deployed ground forces. The author identifies the conditions that have consistently produced a catastrophic disintegration in enemy resistance and large-scale enemy surrenders and suggests how U.S. commanders might design and conduct future military operations to exploit the psychological potential of air power more fully. Summarized in RB-38.

MR-595-AF, *Next-Generation Attack Fighter: Design Tradeoffs and Notional System Concepts*, D. Raymer.

Current Air Force, Navy, and Marine Corps fighter/attack aircraft are 1970s vintage and will reach the end of their service lives in the early part of the next century. Although the Air Force is developing the highly advanced F-22, it cannot be used to replace all current assets, because of cost. A “low-end” complementary design is required. This report presents the results of research into the tradeoffs in requirements specification for a next-generation attack fighter. It develops and analyzes a representative notional design concept for such a fighter, then conducts numerous trade studies of range, per-

formance, payload, and technologies. The study concludes that a single-seat, single-engine fighter that uses a near-term engine and currently available advanced technologies could provide a substantial advantage in range, payload, and signature over current aircraft. Furthermore, tri-Service needs appear to be attainable with a lower-risk, two-aircraft-variant approach in which the Navy and Marine Corps both use virtually identical short takeoff, vertical landing designs, and the Air Force uses a nearly identical derivative.

MR-618-AF, *Evolution of the Air Campaign Planning Process and the Contingency Theater Automated Planning System (CTAPS)*, D. R. Gonzales.

This report summarizes an examination of the air campaign planning process, including observation of how the process was conducted in recent exercises and a review of how the process was performed during the Gulf War. A number of suggested changes to the process are recommended that, in conjunction with changes to the Contingency Theater Automated Planning System (CTAPS), could improve the process significantly and reduce the time needed for production of the Air Tasking Order from 48 to 24 hours. CTAPS capabilities were examined as a part of this study. The CTAPS 5.0x and planned 6.0 architectures were reviewed, and suggestions were presented that could enhance the operational capabilities of the system. This report should be of interest to project managers and monitors of CTAPS and related programs, to those interested in the air campaign planning process, and to those responsible for developing Department of Defense or Air Force information system architectures.

MR-623-AF, *Russia's Air Power at the Crossroads*, B. S. Lambeth.

This report assesses trends and prospects in Russian military aviation, drawing on the extensive reportage on air power in the Russian defense literature since the onset of glasnost in 1986. Originally intended to examine Soviet tactical air power in strategic perspective, the research changed focus with the end of the Cold War and with the consequent opening up of new sources of insight into the Soviet defense establishment. The report reflects the benefit of first-hand contact between the author and senior Russian Air Force and aviation industry leaders. In December 1989, at Kubinka Air Base, the

author became the first American citizen to fly the Soviet MiG-29 fighter and the first Westerner invited to fly a combat aircraft of any type inside Soviet airspace since the end of World War II.

MR-638-AF/A/OSD, *Aggregation, Disaggregation, and the 3:1 Rule in Ground Combat*, P. K. Davis.

This report illustrates a number of basic principles about aggregation and disaggregation in combat modeling by working through the mathematics and phenomenology of a concrete example. In the example, simplified ground combat takes place in a number of sectors and subsectors within a theater. The author assumes that combat at some level of detail is dictated by the Lanchester square law and then discusses whether an aggregate law, Lanchester or otherwise, applies at the next level up (that is, one with more aggregation and less detail). The answer depends on the ratios of several time scales related to information, decisions, maneuver, and the duration of a breakthrough battle. The author also discusses how the 3:1 rule does and does not apply at different levels of combat.

MR-639-AF/A, *Concept-Level Analytical Procedures for Loading Nonprocessing Communication Satellites with Nonantijam Signals*, E. Bedrosian, G. K. Huth.

This report presents the analytical procedures and mathematical formulations required to construct a computer model of a military communication satellite system, load it efficiently with the radio signals required to support an operational scenario, and assess its vulnerability to jamming. The model is intended to facilitate relative, rather than absolute, comparisons between various communication satellite systems. Therefore, only the essential technical characteristics of these systems and the terrestrial terminals with which they are intended to operate are considered. The report presents an illustrative scenario and the payload configuration of a supporting DSCS III satellite as an example; illustrates a representative system configuration; details the assumptions used about data rates, modulation, and guard bands; gives formulas required to load a satellite transponder with the signals specified by a network diagram; and performs a jamming analysis. See also MR-640-AF/A.

MR-640-AF/A, *Concept-Level Analytical Procedures for Loading Nonprocessing Communication Satellites with Direct-Sequence, Spread-Spectrum Signals*, E. Bedrosian, G. K. Huth.

The analysis presented in this report is concerned with the use of direct-sequence, spread-spectrum signals in nonprocessing satellites. Such signals are designed to provide protection against jamming. Direct-sequence, spread-spectrum signals mitigate the effects of jamming by spreading the energy of the desired signal over a much wider bandwidth than is required when using conventional nonantijam signaling techniques. This spreading is done by using a suitable pseudorandom sequence, which makes it possible to recover the desired information content while rejecting much of the interference from jammers and friendly signals that occupy the same signaling band.

MR-670-AF, *Bomber R&D Since 1945: The Role of Experience*, M. Lorell.

Anecdotal evidence suggests that experience plays a critical role in the cost-effective design and development of successful military aircraft. Understanding the true situation may be essential to meet Air Force needs despite declining R&D budgets, few new program starts, and industry contraction. To examine this issue, the authors explore the history of U.S. bomber production since the end of World War II. They conclude that relevant experience does, indeed, matter—firms develop valuable system-specific knowledge in ongoing work, and experience in important new technologies has a distinct advantage. There is far less correlation between commercial and military aircraft than was once thought, so such experience is unlikely to be useful. And since major breakthroughs in technology, design approaches, and concepts have come far more often from government labs than from the commercial sector, the contribution of “dual-use” technology to future military aircraft design and development may be limited.

MR-672-AF/A, *Mutual Interference in Fast-Frequency-Hopped, Multiple-Frequency-Shift-Keyed, Spread-Spectrum Communication Satellite Systems*, E. Bedrosian.

This report presents the results of a theoretical analysis of a frequency-hopping, multiple-frequency-shift-keyed, spread-

spectrum communication system using a nonprocessing communication satellite transponder. A large number of users are assumed to be hopping pseudo-randomly about the transponder passband in time synchronization and approximate frequency synchronization. The users are assumed to be free to hop independently with the result that they occasionally interfere with one another. Formulations are presented that permit assessment of the level of mutual interference, thereby facilitating the selection of system parameters that will maximize the communication throughput of the system. See also MR-639, MR-640.

MR-693-AF, *Government Contracting Options: A Model and Application*, E. Keating.

Contractors represent a sizable and potentially growing portion of the Air Force's repair system. This report asks the question: How should the Air Force design its repair contracts to ensure high-quality, responsive repair? By developing an economic model of contractor motivations and behavior and simulating how contractors would respond to different types of contracts, the report aims to derive the government's optimal repair contract. The simulation suggests that a contract combining a sizable lump-sum payment with cost-sharing or required expensive spares can be a desirable approach. The contractor should be required to maintain a specified weapon system availability role. Such a contract assumes the contractor has fairly detailed information about the weapon system. These contracts are probably most appropriate for mature weapon systems with predictable usage patterns.

MR-697-AF, *Enhancing Airpower's Contribution Against Light Infantry Targets*, A. Vick, J. Bordeaux, D. T. Orletsky, D. A. Shlapak.

In reviewing the history of the USAF in lesser conflicts, the authors of this report were struck by two facts: (1) The USAF has faced light infantry opponents (or light forces) many times over the years and (2) it is increasingly being called upon to detect and engage such forces (e.g., in Somalia and Bosnia). Despite the salience of this target set, light forces have received little attention from the USAF or aerospace community since the end of the Vietnam War. The objective of this effort was to explore the signatures and vulnerabilities of adversary light forces, to identify promising sensor and weapon technologies

applicable to this target set, and to develop new concepts of operation that would bring together sensors, weapons, aircraft, and tactics to defeat this opponent. Although R&D has not been directed at this specific problem, the project team believed that many of the sensor programs designed to detect critical mobile targets or armor could be applied to infantry also. Major advances in detector material design and fabrication, combined with 30 years of progress in the computer field, suggested to the authors that, if it desired, the USAF could make a great leap forward in offensive capabilities against light infantry by applying technologies already developed for these other purposes.

MR-710-AF, *Modeling for Campaign Analysis: Lessons for the Next Generation of Models: Executive Summary*, R. Hillestad, L. Moore, B. Bennett.

The U.S. military's increasing use of computer modeling has clear benefits, among them the ability to better inform decisionmakers and reduced exercise costs. However, there are also some drawbacks that need to be overcome both in the models (many of which were developed with the Cold War and less-advanced technologies in mind) and the ways they are used (sometimes with unrealistic expectations or with inadequate analysis of the results). The authors discuss some of the significant challenges and offer suggestions for working through them to achieve not only a new generation of models but a new generation of analytic capability: educating analysts and decisionmakers about the needs, methods, and limitations of model-based campaign analysis; balancing the emphasis between the models and the related analysis; improving and sharing databases; developing a set of models with a range of capabilities, rather than attempting to create one supermodel; focusing R&D on the effects and representation of key combat phenomena; and critical peer review of the models and broader disclosure of methods and results.

MR-737-AF, *Estimation and Prediction of Ballistic Missile Trajectories*, J. A. Isaacson, D. R. Vaughan.

To examine the capabilities satellites can bring to bear in a theater missile defense (TMD) environment, the authors describe a methodology, based on Kalman filtering, for the estimation and

prediction of ballistic missile trajectories and then apply the methodology to a notional theater ballistic missile. One useful application is in estimating the uncertainty associated with the location of a missile launch. Determining missile location uncertainty at any point along the trajectory is another application. Filters optimized for random errors alone as well as random plus bias errors are outlined. Harnessed in a theater of operations, the type of information described in this report can be used to enhance the capability of active and passive defenses and attack operations.

MR-744-AF, *Understanding the Air Force's Capability to Effectively Apply Advanced Distributed Simulation for Analysis: An Interim Report*, R. Kerchner, J. Friel, T. Lucas.

Identifies major advantages and challenges of using advanced distributed simulation (ADS) in Air Force analysis, training, and mission rehearsal. As part of a carefully designed analytic plan, ADS could improve presentation of results, allow for parallel processing, and achieve faster model development. The report recommends that the Air Force develop an investment strategy and a comprehensive plan to implement ADS improvements.

MR-749-AF, *Application of F-117 Acquisition Strategy to Other Programs in the New Acquisition Environment*, G. Smith, H. Shulman, R. Leonard.

The argument is frequently made that special access or "black" programs accommodate more efficient and effective ways to buy weapon systems than do conventional acquisition programs. If so, perhaps some of the characteristics of these covert programs could be transferred to the more conventional procurement programs to enhance their efficiency. That hypothesis is what Project AIR FORCE researchers wanted to test by examining the F-117 Stealth Fighter acquisition program. They concluded that, although it was unlikely that the special set of circumstances surrounding the F-117 procurement could be fully replicated for many other programs (nor should they be), two elements of F-117 program management not only could be but also should be applied more broadly: greater delegation of authority to the program office and requiring only a very few performance requirements by contract. Applying these features to other programs requires considerable mutual trust among the

government agencies involved and between the government and the contractor. The absence of such trust spawned many of the controls specifically waived for the F-117 program.

MR-759-AF, *The Virtual Combat Air Staff: The Promise of Information Technologies*, A. Huber, J. L. Hollett, K. Keskel, W. Shelton, P. S. Sauer, J. T. Dillaplain.

This study—conducted by RAND's Air Force Fellows—investigated the nature of the future combat air staff in the context of air war in the information age and how application of information-age technology could reduce deployment of personnel while maintaining, or improving, staff support to the air campaign. The concept suggested by the study is that not all elements of a staff may be physically located in the same place, that communication technology may allow for the retrieval of information resources from diverse centers of responsibility, and that staff assets may be reabsorbed into host centers after the cessation of hostilities. The results of this research indicate that the rapid advances now progressing within the technological realm, as well as within organizational theory and practice, bode a different paradigm for the future combat air staff.

MR-762-AF, *An Overview and Comparison of Demand Assignment Multiple Access (DAMA) Concepts for Satellite Communications Networks*, P. Feldman.

This report provides a broad survey of demand assignment multiple access (DAMA) techniques for satellite communications. The primary intended audiences are military planners, communications system designers and architects, and the military acquisition community at large. However, much of the material in this report will also be of interest for commercial communications system planners and designers, especially where there is a potential for military use of these commercial systems. The report emphasizes those DAMA techniques that offer the greatest practical benefit for military applications. Methods for making DAMA systems resistant to interference and jamming are discussed, including some new methods. The report covers both pure DAMA protocols, which efficiently handle voice traffic and long data transmissions, and hybrid DAMA protocols, which can efficiently handle not only voice and long data transmissions, but also short data transmissions (packets). Because

of the increasing importance of packetized communications for the military, an entire section is devoted to the subject of hybrid DAMA.

MR-765-AF/A/OSD, *Not with a Bang but a Whimper: Western Europe Approaches the Third Millennium*, R. Levine.

The current stability of Western Europe appears likely to continue but is by no means guaranteed. The probable stable future is neither grim nor inspiring, but it is preferable to the instability that could be brought about by gambling for a more inspiring outcome. The key to post-Cold-War security and stability lies in economics, and Western Europe needs faster economic growth and lower unemployment. Indeed, if the signs portend downturn rather than accelerated growth, internal instability may become a major problem for the European Union and some of its member states. Economics is also the key to eastward expansion of EU; the former Communist states are likely to become members only as their economies converge with those of the West. In the meantime, NATO may prove a more flexible organization for tying these states to the west and assuring their security. In general, however, Western Europe and the United States should be wary of damaging NATO by trying to improve it in the abstract. Continued U.S. participation in Europe is vital, as is taking care not to damage this relationship in the name of transitory moral or political objectives.

MR-772-AF, *Airborne Intercept Boost- and Ascent-Phase Options and Issues*, D. R. Vaughan, J. A. Isaacson, J. S. Kvitky.

A combination of boost-phase intercept (BPI) and ascent-phase intercept (API) of theater ballistic missiles has significant operational merits. The authors describe the factors bearing on airborne interceptor development and examine three nominal paths to achieving it. Operational considerations deserving some attention in considering these paths are also discussed, including several potential synergies between API/BPI and ground-attack operations. Although current defense plans do not anticipate using manned aircraft with on-board sensors in this role, the uncertainties associated with other API/BPI concepts suggest that this approach may be revisited.

MR-805-AF, *The Warrior Who Would Rule Russia*, B. S. Lambeth.

This report offers a detailed portrait of retired Russian army Lieutenant General Aleksandr I. Lebed, who first rose to prominence in 1993 as the commander of Russia's 14th Army in Moldova and was appointed security advisor in 1996 by the reelected President Boris Yeltsin. Lebed, who himself finished in a strong third place in the June 16 presidential election, joined forces with Yeltsin and helped ensure the latter's victory in the subsequent July 3 runoff. A richer understanding of Lebed's declared outlook on a broad range of issues can offer valuable insights into what kind of Russia the United States will have to deal with in the years ahead. The report portrays Lebed as a respected professional of strong authoritarian bent and unsure devotion to democracy, yet one who has spoken out against crime and corruption, appears committed to a market economy, and is less aggressively nationalistic than many Western accounts have suggested.

## **ADMINISTRATION**

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Deputy Chief of Staff (Command, Control, Communications,  
and Computers)

Lieutenant General William P. Hallin  
Deputy Chief of Staff (Logistics)

Lieutenant General Richard T. Swope  
Inspector General of the Air Force

Lieutenant General Charles H. Roadman, II  
Surgeon General of the Air Force

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Dr. Edward A. Feigenbaum  
Chief Scientist of the Air Force

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Assistant Chief of Staff, Intelligence

Major General John W. Handy  
Director, Programs and Evaluations

*Executive Agent*

Major General Donald L. Peterson  
Director of Plans, Office of Deputy Chief of Staff (Plans and  
Operations)

December 1996

## **PAF MANAGEMENT**

Brent D. Bradley, *Vice President and Director*

Natalie W. Crawford, *Associate Director*

Donald V. Palmer, *Director, Air Staff Operations*

Lory A. Arghavan, *Operations Manager*

Willard E. Naslund, *PAF Office, Langley AFB*

### **Programs**

*Force Modernization and Employment* (Charles T. Kelley, *Director*)

*Resource Management and System Acquisition* (C. Robert Roll, Jr., *Director*)

*Strategy and Doctrine* (Zalmay Khalilzad, *Director*)

## FELLOWS AT RAND

PAF benefits from the participation of several Air Force officers each year who serve as research fellows within PAF and RAND, a tradition for nearly 40 years. Air Force Fellows, representing several Air Staff organizations, contribute their expertise to PAF research projects.

In 1996, the following Air Force officers were assigned as RAND Fellows for Project AIR FORCE:

Lieutenant Colonel Marcia F. Rouse—Office of the Deputy Chief of Staff, Personnel

Lieutenant Colonel Daniel A. McCusker—Office of the Assistant Chief of Staff, Intelligence

Lieutenant Colonel Thomas L. Fossen—Office of the Deputy Chief of Staff, Plans and Operations

Lieutenant Colonel Armand P. Grassi, Jr.—Office of the Deputy Chief of Staff, Logistics

In addition, PAF has one full-time Air Force officer who provides classification and authentication support.

First Lieutenant John T. Dillaplain—Office of the Assistant Chief of Staff, Intelligence

December 1996

## **RAND ORGANIZATION**

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Donald V. Palmer, *Director, Air Staff Operations*  
Lory A. Arghavan, *Operations Manager*  
Willard E. Naslund, *PAF Office, Langley AFB*  
*Force Modernization and Employment Program* (Charles T. Kelley)  
*Resource Management and System Acquisition Program* (C. Robert Roll, Jr.)  
*Strategy and Doctrine Program* (Zalmay Khalilzad)

#### **ARMY RESEARCH DIVISION**

##### **Arroyo Center**

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Thomas McNaugher, *Associate Director*  
*Force Development and Technology Program* (Kenneth P. Horn)  
*Manpower and Training Program* (J. Michael Polich)  
*Military Logistics Program* (John Dumond)  
*Strategy and Doctrine Program* (David Kassing, Acting)

## **NATIONAL SECURITY RESEARCH DIVISION**

### **National Defense Research Institute**

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Jeff Isaacson, *Associate Director for Operations and Planning*

*Acquisition and Technology Policy Center* (Eugene C. Gritton)

*Forces and Resources Policy Center* (Susan D. Hosek)

*International Security and Defense Policy Center* (Gregory F. Treverton)

*Center for Asia-Pacific Policy* (Rachel Swanger, Acting)

*Greater Middle East Public Policy* (Jerrold Green)

*Center for Russian and Eurasian Studies* (Jeremy Azrael)

## **SPECIAL PROGRAMS**

Stephen M. Drezner, *Senior Vice President*

### **Science and Technology**

Stephen M. Drezner, Director

C. Bryan Gabbard, Associate Director, Development and Operations

*Center for Information Revolution Analysis* (Bonnie Dombey-Moore)

*Critical Technologies Institute* (Bruce W. Don)

*Program on Emerging Issues* (Anna Slomovic)

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Richard Fallon, Director

## **CRIMINAL JUSTICE**

Peter W. Greenwood, Director

Susan Turner, Associate Director for Research

*Drug Policy Research Center* (Audrey Burnam, Barbara R. Williams)

## **HEALTH PROGRAM**

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*Center for the Study of Employee Health Benefits* (Pamela Short)

*Drew/RAND Center on Health and Aging* (Walter R. Allen, Raynard Kington)

*RAND/UCLA Center for Health Policy Research* (Albert P. Williams)

*RAND/UCLA/Harvard Center for Health Care Financing Policy Research* (Grace M. Carter)

## **INSTITUTE FOR CIVIL JUSTICE**

Deborah R. Hensler, Director

Lloyd Dixon, Research Director

## **INSTITUTE ON EDUCATION AND TRAINING**

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(Vacant), Deputy Director for Business Development and Operations

Stephen P. Carroll, Deputy Director for Research

*Center for Reinventing Public Education* (Paul T. Hill)

*Center for Research on Evaluation, Standards, and Student Testing*  
(Brian Stecher)

*Center for Research on Immigration Policy* (Georges Vernez)

*National Center for Research in Vocational Education* (Cathleen Stasz)

*Council for Aid to Education* (Roger Benjamin, President)

## **LABOR AND POPULATION**

Lynn A. Karoly, Director

*Center for the Study of Aging* (Lee A. Lillard)

*Center for the Study of the Family in Economic Development* (Julie S. DaVanzo)

*Population Research Center* (Anne R. Pebley)

*RAND Postdoctoral Research Programs in Population and the Study of Aging* (Lynn A. Karoly)

## **RESEARCH STAFF MANAGEMENT DEPARTMENT**

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David S. C. Chu, Associate Chair

Jerrold D. Green, Associate Chair

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C. Richard Neu, Associate Dean

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### **Finance**

Kenneth M. Krug, Treasurer

### **Human Resources**

Clare Ellinger, Director

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Iao Katagiri, Deputy Vice President

*Development* (James Osterholt)

*Public Information* (Jess Cook)

*Washington External Affairs* (Gar Kaganowich)

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Administration

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**Charles J. Zwick**, Retired Chairman, Southeast Banking Corporation

December 1996

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## FINANCIAL INFORMATION

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During FY 1996, the Project AIR FORCE level of effort was 112 STE (Staff Technical Equivalent). An STE is a measure of research effort agreed upon by the Air Force and RAND that represents a person-year of professional effort. The funds expended to achieve this level of effort were approximately \$24.0 million.