

A System as the Enemy: A Doctrinal Approach to Defense Force Modernization

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A System as the Enemy: A Doctrinal Approach to Defense Force Modernization

Force modernization is more like a warfighting campaign than an industrial process. Volatility, uncertainty, complexity, and ambiguity inherent in all its key factors and enablers make modernization as much an operational art as a scientific method. Therefore, modernization, like warfare, would operate more effectively and responsively under an authoritative body of doctrine rather than under layers of detailed prescriptive and legally binding regulations.

At the core of a body of doctrine is a foundational doctrine document putting forth broad guidance with fundamental principles to guide planning and execution. This study will consider principles, presented below, as candidates for such a document.

Principles of Modernization

1. Objective
2. Stable Program Inputs
3. Risk Management
4. Simplicity of Command
5. Economy of Effort
6. Initiative
7. Credibility
8. Synergy
9. Tempo
10. Synchronization

Together, these are the fundamental and underlying doctrinal principles for an effective and efficient force modernization program. These principles can guide modernization process improvement efforts as well as modernization programs to shorten program timelines and still deliver a quality product.

Force modernization here includes the Joint Capabilities Integration and Development System (JCIDS), formerly the Requirements Generation System, and the US Department of Defense (DoD) acquisition process. With respect to JCIDS, this paper is concerned only with material

solutions feeding into the acquisition system. The analysis does not include doctrine, operations, training, leadership & education, personnel, and facilities solutions to documented needs.

The Coming Apoplectics: Shock and Awe for Modernization

The DoD acquisition process is currently in its fourth decade and fourth generation of overhaul. The policy underpinnings, the DoD 5000-series and Chairman of the Joint Chiefs of Staff (CJCS) 3710-series instructions, have been completely rewritten. They focus now on a top-town modernization process and mission needs (now “capabilities”) spawned from mission area Concepts of Operation (CONOPS) for achieving strategic objectives.

Further, force modernization directives now emphasize evolutionary acquisition, system upgrades, development spirals, and incremental deployment of new systems’ capabilities. This purports to bring new capabilities to field and fleet sooner—as soon as they become available as subsystems, rather than after the last capability is integrated into an entire end-system.

This force modernization is parcel to the overall defense transformation. At the heart of this effort is the concept for networking all the levels of command and all of the warfighting actors in order to achieve shared situational awareness, to overcome barriers to rapid communication, including stovepipes, and to tighten decision (Observe-Orient-Decide-Act [OODA]) loops to reflex-arc speeds that literally shock an opponent into paralysis through lightning-fast responsiveness. This prescription for warfighters, which DoD’s force modernization process is to deliver, is appropriate medicine for the modernization process itself. *Force modernization itself needs to tighten its own decision cycle to keep itself from being shocked into paralysis due to its increasingly glacial responsiveness to increasingly dynamic warfighter needs.*

Acquisition Program Timelines: Too Long and Getting Longer

In 1986, Packard Commission member and future Secretary of Defense William Perry lamented the unacceptably long times, 10 – 15 years, required to field major defense systems. (45:8) Since then, F-22 development has spanned 24 years (7:4), and the V-22 should achieve Initial Operating Capability (IOC) in 2007, after 27 years of development. (20) The RAH-66 Comanche was cancelled in February 2004, due to mission obsolescence, 21 years after program inception. (21) The Joint Strike Fighter faces a similar timeline of development. With acquisition timelines now trending towards 20 – 25 years from identifying mission needs to fielding a proper fix, 10-15 years of development seems optimistic.

Dynamic Strategic Environment: Time-to-Need Increasingly Shorter

At the same time, the security environment is increasingly dynamic. Weapons coming to the flightline, field, and fleet in this decade were specified to counter threats from the Soviet Union: before the advent of humanitarian operations, before the internet, before stabilization operations, before Al Qaeda, homeland security, or even satellite or cable television. How appropriate will solutions to present-day deficiencies be between 2025 and 2030?

Increasingly, DoD future plans documents have shortened their forecast horizons from 25-year looks-ahead to ones looking out 10 – 15 years. Thus, the situation has reversed from the late 1980s, where the forecast included the first 10 – 15 years of a developing system's existence, to one in which a new system's IOC happens 10 – 15 years beyond the forecast horizon. Given this, *the dominant risk to any program is time itself.*

A review of exemplary successful historical acquisition programs reveals a common key factor among them: they benefited handsomely from stable external factors over their development

phases. However, requirements, funding, personnel, and technology become increasingly volatile influences to programs with developments lasting a quarter-century or more. It's a vicious cycle that starts with planning for a lengthy program (ironically to avoid developmental risk). Lengthy programs' performances suffer from unstable influences, and program performance problems cause the program to get stretched out further. *The answer to this volatility is not necessarily to stabilize the process inputs and perturbations (it's beyond control), but to field solutions faster than the environment can change.* Short programs require agility—speed and flexibility—only afforded through having actors with unambiguous goals and latitude-in-action in novel circumstances. This latitude is available under doctrinal guidance in ways not possible with prescriptive regulations.

On Modernization: The Case for Doctrinal Principles

Warfighting doctrine emphasizes centralized control and decentralized execution. We seem to operate the acquisition system in direct opposition by implementing decentralized control and centralized execution of key macro processes. We manage the requirements and technology processes in a decentralized fashion, while exerting tight and central controlling on program management and budget (particularly for large programs). (11:57)

Can disciplined force modernization replace current and future statutory and regulatory directives with doctrinal principles? For this to be true, modernization would have to have characteristics in common with warfighting such that a body of doctrine would be similarly useful.

According to historian Martin Van Creveld, applying the logic of industrial processes to warfare is dangerously myopic. Whereas industrial processes are repeatable, that is, the same input yields the same output, warfighting strategy is not, so long as it is a contest among two living wills. While manufacturing endeavors to achieve optimal production efficiency, combat must entail tremendous waste and slack as hedges against overwhelming uncertainty. While industry is the very epitome of determinism, warfare is anything but predictable. (57:311-320) An addi-

tional consideration is the consequences of failure. Commercial failures end in bankruptcy; failures in warfare result in loss of lives and often in the destruction of the losing state. Likewise, any single force modernization failure is a loss of taxpayers' revenues and warrior capability. But the fate of the Soviet Union is a cautionary example of how inability to keep modernization apace with a rapidly changing security environment can lead to extinction.

What happens at the interface of industry and warfare, where determinism meets friction and chance? A process that bridges the battlefield and the assembly line should be subject to principles from both environments, and the closer the process operates to one environment, the greater weight that environment's principles come to bear. Much of top DoD acquisition management comes from industry, and the language and guidance from them has a distinct industrial flavor: *streamlined processes, benchmarking, and business models*. The requirements generation community led by service generals has a distinctly different lexicon: *strategy, CONOPS, and campaigns*. Bridging the two force modernization communities requires a construct that includes operational art and industrial science, production line efficiency, and battlefield chaos. A body of doctrine would function to bridge and encompass these disciplines. It would clarify, to modernization's actors, the context in which they operate. It would give them guidance and latitude in interpreting their location along the process' continuum, from the laboratory to the battlespace, and in applying governing guidance with due weight. It would guide the novices and liberate the masters of the art to do what's best to meet their strategic goals.

Knowledge management databases, Defense Acquisition University guides, "Best Practices" lists, and statutory and regulatory guidance already capture much of the enduring lessons of force modernization history. What a doctrine document does is to redact that large body of literature into a concise handbook, as an introduction for novices and a ready reference for practitioners.

A singular volume of doctrinal guidance is definitive, a source of ground truth, for creating policy, interpreting guidance, resolving dilemmas, and generally giving a sense of coherence to the welter of widely disparate simultaneous activities constantly undertaken in the name of force modernization.

The force modernization community and its processes are large and complex, facing the same challenges as large military units in the field: volatility, uncertainty, complexity, and ambiguity, if to a lesser degree. Operational commanders work with the understanding that their influence on battlefield events is at best second-order; they cannot control them directly. They give broad guidance (commander's intent), set boundaries (rules of engagement), and do their best to create conditions for those on the front echelons to succeed. In de-centralized execution, they *support* those peripheral echelons.

Much of acquisition has worked the other way around. The citation below implies that the need for central planning and control (i.e., generating requirements from the top down) was an undesirable aberration.

Secretary McNamara was hard pressed to get the Services to write requirements for more conventional weapons in lieu of nuclear weapons and therefore found himself and his staff in the business of writing requirements for the Services (McNaughton 1989:59). (29:41)

Except in rare cases, those in the periphery identify the requirements; and acquisition executives execute centrally, requiring support from the program offices. Thinking of force modernization in its true dual nature – science and art, industrial and martial – would go far to help policymakers resist the temptation to “drive” the process.

[W]e need to return the military service chiefs to the chain of command for acquisition... OSD should not be running things, but overseeing procedures and decisions. (23:74)

Hon John Hamre, former Deputy Secretary of Defense

By not being prescriptive, doctrinal guidance gives innovative solutions the necessary latitude in novel situations. Innovators would then only risk having their judgment questioned – not

their lawfulness – should they need to break with traditional guidance. And that wiggle room provides just the flexibility and responsiveness necessary to keep decision cycles short. Finally, the common sense that legislators and policy-makers try to capture in modernization policy and instruction better resides in a non-binding doctrine document. This serves to limit the scope of directives and instructions to only the truly mandatory guidance and to better highlight them as legal boundaries.

Modernization Principles Evolution: A Brief History of Acquisition Reform

A body of doctrinal principles exists – waiting to be explicated. They are the critical aspects of modernization, enduring and frequently repeated, such that these principles emerge as a pattern over time. The raw data containing those enduring fundamentals reside both in program case histories and in government efforts at acquisition reform. This section mines results from acquisition reform commissions' findings and recommendations for a list of candidate principles for force modernization.

Round One (1969 – 1972): Containing Cost

While the history of DoD transformation, reorganizations and reengineering date back to the National Defense Act of 1947, initiatives specifically for reforming acquisition start in 1969 with Congress mandating Selected Acquisition Reports from the Secretary of Defense. Straining under the costs of the Vietnam War, Great Society social spending, and the Apollo moon landing program, Congress began to question Cold War weapons procurement practices. The result was a series of commissions to investigate inefficiencies in the acquisition process. (29:44) In the first of them, in 1970, Undersecretary of Defense David Packard put forth the list of initiatives in Table 1. (29:45)

Table 1: 1970 Packard Initiatives

Improve the quality of information available from development.

- 1) Use more hardware testing.
- 2) Establish operational test and evaluation agencies separate from developing commands
- 3) Establish the Cost Analysis Improvement Group (CAIG) within OSD to improve the quality of cost estimates during development.

Enhance program flexibility.

- 4) Practice “design-to-cost.”
- 5) Account for all “life-cycle costs.”
- 6) Strengthen Program Manager (PM) independence and lengthen their tenures.
- 7) Reduce production concurrency...fly before you buy.

Restore competition to weapons acquisition.

- 8) Reduce risk and stimulate contractor efforts during development.
- 9) Prime-contractor competition through full-scale development to avoid developer monopoly at the time the initial production contract is negotiated.
 - Regulate the OSD’s involvement in acquisition.
- 10) Establish a Defense System Acquisition Review Council (DSARC). It shall meet to approve the start of development (DSARC I), meet again to decide on full-scale development (DSARC II), and meets a third time to approve the move to production.

At about the same time, a presidential Blue Ribbon Commission, “The Fitzhugh Panel,” released their recommendations and findings from their 1969 investigation. (29:46) The following recommendations related to the acquisition process are in Table 2. (29:47)

Table 2: 1969 Fitzhugh Commission Recommendations

- 1) Decentralized Authority:
Observation: Effective civilian control is impaired by the generally excessive centralization of decision-making authority at the level of the Secretary of Defense.
Recommendation: The functions of the Department of Defense should be divided into three major groupings: Operations, Resource Management, and Evaluation...Each of these major groups should report to the Secretary of Defense through a separate Deputy Secretary.
- 2) Operational Test and Evaluation (OT&E):
Observation: OT&E has been too infrequent, poorly designed and executed, and generally inadequate.
Recommendation: A defense test agency should be created to perform the functions of overview of all Defense test and evaluation ... with particular emphasis on operational testing, and on systems and equipments which span Service lines.
- 3) Career and Professional Development:
Observation: The promotion and rotation systems of the Military Services do not facilitate career development in the technical and professional activities.
Recommendation: Specialist career should be established for officers in such staff, technical and professional fields as research, development, intelligence, communications, automatic data processing and procurement...the duration of assignments for officers should be increased, and should be as responsive to the requirements of the job as to the career plan of the officer.
- 4) Research and Development:

Recommendation: A new development policy for weapons systems and other hardware should be formulated and promulgated to cause a reduction of technical risks through demonstrated hardware before full-scale development, and to provide the needed flexibility in acquisition strategies.

5) Program and Project Management

Recommendation: The effectiveness of program or project management should be improved by:

- a) Establishing a career specialty code for program managers in each Military Service and developing selection and training criteria that will ensure the availability of an adequate number of qualified officers. The criteria should emphasize achieving a reasonable balance between the needs for knowledge of operational requirements and experience in management;
- b) Increasing the use of trained civilian personnel as program managers;
- c) Providing authority commensurate with the assigned responsibility and more direct reporting lines for program managers, particularly those operating in matrix organizational arrangements; and
- d) Giving the program manager directive authority, subject to applicable laws and regulations, over the contracting officer, and clarifying the fact that the contract auditor acts in an advisory role.

The final installment to the first group of acquisition process investigations was the Commission on Government Procurement. (29:48) Their findings, published in 1972, contained the recommendations presented in Table 3. (29:49)

Table 3: 1972 Commission on Government Procurement

1) General Procurement Considerations:

- a. Finding: Void in policy leadership and responsibility and a fragmented and outmoded statutory base.
Recommendation: Create the Office of Federal Procurement Policy within the Office of Management and Budget.
- b. Finding: The military procurement is governed by the Armed Services Procurement Act of 1947, but civilian procurement came under the Federal Property and Administrative Services act of 1949. There are inconsistencies between the two statutes.
Recommendation: Enact legislation to eliminate inconsistencies
- c. Finding: There is a burdensome mass and maze of regulations
Recommendation: Establish a system of government-wide coordinated and uniform procurement regulations under the direction of the Office of Federal Procurement Policy.

2) Research and Development Acquisition:

- a. Recommendation: Emphasis should be placed on basic, innovative research and the sharing of new ideas among government agencies. There should be more cooperative industry-government relationship which maximizes the creative energies of U.S. suppliers.
- b. Finding: In cost allowability principles, the independent research and development (IR&D) and bid and proposal (B&P) expenditures are in the nation's best interest to promote competition, to advance technology, and to foster economic growth
Recommendation: Establish a policy recognizing IR&D and B&P efforts as necessary costs of doing business.

3) Acquisition of Major Systems:

- a. Finding: Too often the focus has been on the system product and not on its purpose...adequate attention [not given] to why and what new level of capability is needed.

- Recommendation: Start new system acquisition programs with agency head statements of needs and goals.
- b. Finding: Funds spent on development of alternative systems serve as insurance against the possibility of a premature and potentially costly choice involving only one system.
Recommendation:
- i) Create alternative system candidates;
 - ii) Finance the exploration of alternative systems; and
 - iii) Maintain competition between contractors exploring alternative systems.
- c. Finding: The cost to maintain competition throughout rises substantially. Thus, systems entering production and deployment normally do so under an evolved monopoly situation, with only a single system and contractor to meet the need.
Recommendation: Procuring agencies and Congress should withhold approval for full production and use of new systems until the need has been reconfirmed and system performance has been tested and evaluated in an environment closely approximating the operational conditions.
- d. Recommendation: Alleviate the problem of management layering and excessive staff reviews.
- e. Recommendation: Strengthen each agency's cost estimating capability

Round Two (1981 – 1982): Avoiding Risk

It would be another 10 years before the next spate of commissions on acquisition reforms. News of overpriced hammers and toilet seats, along with a number of difficult and failed major acquisition programs in the late 1970s, gave cause for further investigations and initiatives. (29:53) The first of these were a list of initiatives from Secretary of Defense Frank Carlucci in 1981, presented in Table 4. (29:54)

Table 4: The Carlucci Initiatives

1. Acquisition Management Principles.
 - *Long-range planning*
 - *Delegating responsibility, authority and accountability*
 - *Low-risk evolutionary technology*
 - *Economic production rates*
 - *Budgeting realistically*
 - *Improving readiness and sustainability*
 - *Strengthening the industrial base*
 - *Good relations with industry*
2. Pre-planned Product Improvement (P3I).
This initiative is designed to ensure an evolutionary, lower-risk approach to weapon system design in order to reduce unit costs and decrease the time needed to field new equipment.
3. Multiyear Procurement.
This initiative is designed to reduce the cost of mature, low-risk weapon programs already in production by funding economical lot buys instead of small, piecemeal, annual buys.
4. Program Stability.

This initiative is designed to increase the stability of weapon system acquisition by adequately funding Research and Development (R&D) and procurement in order to maintain the established baseline schedule and reduce cost growth.

5. Capital Investment.
This initiative encourages, through a variety of mechanisms, capital investment by DoD contractors to increase their productivity.
6. Budget to Most Likely Cost.
This initiative is designed to achieve realistic defense acquisition budgets, reduce apparent cost growth in weapon systems, and achieve greater program stability.
7. Economic (Stable) Production Rates.
This initiative involves buying weapon systems at a rate that assures economical production and reduces unit costs.
8. Appropriate Contract Type.
This initiative balances program needs and cost savings with a realistic assessment of contractor and government risk by insuring the use of the appropriate contract type.
9. System Support and Readiness.
This initiative involves establishing readiness objectives for each weapons development program and then designing in reliability and maintainability.
10. Reduced Administrative Costs.
This initiative reduces the administrative cost and time for procuring items by raising the dollar limit on purchase order contracts and cutting unneeded paperwork.
11. Technological Risk Funding.
This initiative provides for evaluating, quantifying, and budgeting for technological risk.
12. Test Hardware Funding.
This initiative requires that adequate test hardware be obtained to reduce overall schedule time and risks.
13. Acquisition Legislation.
This initiative calls for a review of acquisition-related laws and regulations to identify and change those which are an unnecessary burden on the DoD acquisition process.
14. Reduced Number of DoD Directives and Eliminate Non Cost-Effective Contract Requirements.
This initiative requires a reduction in the number of DoD acquisition directives and the amount of contract documentation, and non cost-effective contract requirements.
15. Funding Flexibility.
This initiative involves obtaining legislative authority to transfer funds from procurement to R&D for an individual weapon system without the prior approval of Congress.
16. Contractor Incentives for Reliability and Support.
This initiative requires that incentives be developed to encourage contractors to improve reliability and support.
17. Decreased Defense Systems Acquisition Review Council (DSARC) data.
This initiative requires that DSARC briefing and data requirements be reduced.
18. Budgeting for Inflation.

This initiative requires that weapon system budgets be prepared using realistic forecasts of inflation.

19. Forecasting the Business Base.

This initiative entails maintaining a data exchange covering business base conditions at major defense plants for use by the Services in planning and budgeting.

20. Improved Source Selection Process.

This initiative places added emphasis on contractors' past performance, schedule realism, facilitization plans, and cost credibility. It requires that a system be established for documenting and sharing information on contractor performance.

21. Standardization of Operational and Support Systems.

This initiative requires the development and use of standard operational and support systems to achieve earlier deployment and better support of weapon systems. The benefits are increased force readiness and support.

22. Design to Cost Contract Incentives.

This initiative requires that DoD provide appropriate incentives to industry by tying award fees to actual costs achieved during early production runs.

23. Implementation of the Acquisition Improvement Program.

This initiative assigns overall responsibility to the Under Secretary of Defense (Research and Engineering) (USDRE) to assure that the Acquisition Improvement Program is implemented.

24. Decision Milestones.

This initiative requires that Department of Defense Directive 5000.1 and Department of Defense Instruction 5000.2 be revised to reflect a reduction in the number of DSARC milestones.

25. Mission Essential Needs Statement (MENS).

This initiative links the acquisition and Planning, Programming and Budgeting System (PPBS) processes by requiring the MENS to be submitted with the Service Program Objective Memorandum (POM).

26. DSARC Membership.

This initiative adds the appropriate Service Secretary or Service Chief to DSARC membership.

27. Acquisition Executive.

This initiative retains USDRE as the Defense Acquisition Executive.

28. DSARC System Criteria.

This initiative increases the criterion for DSARC review to ~200M Research, Development, Test and Evaluation (RDT&E) and ~1B procurement in FY 1980 dollars.

29. DSARC/PPBS Integration.

This initiative links the DSARC and the PPBS processes.

30. Program Manager Control Over Logistics and Support Funds.

This initiative requires that logistics and support resources be shown in the Service POM by weapon system, and program managers to be given more control of support resources.

31. Improved Reliability and Support.

This initiative involves improving reliability and support for shortened acquisition cycle programs.

32. Competition.

This initiative is designed to enhance competition in the acquisition process in order to reduce cost.

The following year, 1982, President Reagan assembled the President's Private Sector Survey on Cost Controls (PPSSCC), "The Grace Commission," in order to "identify opportunities for increased efficiency and reduced costs achievable by executive action or legislation." (29:54)

The commission's recommendations are presented in Table 5. (29:55)

Table 5: 1982 Grace Commission Recommendations

1. Improved Organization.
Observation: Massive duplication of effort among the services and OSD
Recommendation: Total consolidation of day-to-day acquisition functions at the OSD level.
2. Defense Contract Administration Consolidation.
Observation: Wide variations in the procedures between the Defense Contract Administration Service...and the various related components at the service level.
Recommendation: Consolidate all contract administration at the OSD-level.
3. Regulatory Constraints.
Observation: The Department of Defense acquisition of weapons systems operates under a complex regulatory system
Recommendation: Defense Acquisition Regulations (DAR) should be replaced with general guidelines for DoD procurement actions.
4. Independent Research and Development Costs.
Observation: The DoD reimbursement policy for independent research and development (IR&D) costs involves an elaborate and time-consuming technical review process.
Recommendation: Eliminate technical review and group IR&D under overhead costs.
5. Department of Defense Laboratories.
Recommendation: Improve data exchanges...reduce duplication, and DoD laboratories should phase out their involvement in the late stages of the development cycle.
6. Common Parts and Standards.
Recommendation: Use standardized parts in weapons systems and decrease the use of military specifications.
7. Major Weapons System New Starts.
Recommendation: Limit the number of new weapons programs started each year and impose stricter entry requirements for new systems.
8. Estimating Weapons systems Costs.
Recommendation: Establish procedures to ensure more accurate estimates of weapons cost in order to permit better planning and reduce cost overruns.
9. Instability of the Weapons Acquisition Process.
Recommendation: The DoD should commit to a stable 5-year spending plan for the acquisition of weapons systems at economical production rates.

10. Transfer of Consumable Inventory Items.
Observation: DLA has proven its ability to manage successfully consumable items with statistically superior results over services.
Recommendation: Of the 1.2 million inventories being managed by the Services, 900,000 should be transferred to DLA.
11. Implementation of OMB Circular A-76.
Recommendation: Remove various legislative requirements that serve to restrict DoD's implementation of the A-76 program. Thereby outsource commercial functions.

These preceding two lists of recommendations and ensuing reforms constituted the second generation of acquisition reforms. Their unifying theme was to prevent embarrassing mistakes associated with fraud, waste, and abuse. (23:74; 24:14)

Round Three (1985 – 1997): Acquisition Streamlining

In 1985, in preparation for the legislation that would become the Goldwater-Nichols Act of 1986, former Secretary of Defense David Packard headed a Blue Ribbon Panel, “The Packard Commission,” whose charter was to review defense management and organizational structure. (29:56) The Packard Commission recommendations are presented in Table 6. (29:57)

Table 6: 1985 Packard Commission Recommendations

Acquisition Organization and Procedures

1. Create the position of (USD (A)) as the Defense Acquisition Executive (DAE).
2. Services should have similar executives. They will act as Service Acquisition Executives (SAE).
3. The SAE appoints PEOs, each responsible for a set number of acquisition programs.
4. PMs are responsible to the respective PEO and report only to him on program matters.
5. All federal statutes governing procurement be recoded into a single procurement statute.
6. Business-related education/experience criteria for senior-level acquisition personnel.
7. Establish the Joint Requirements and Management Board (JRMB) co-chaired by the CJCS and the USD(A) to define requirements and select programs for development.
8. Use a greater number of “off the shelf” items.
9. Increase use of prototypes.
10. Operational testing should be completed prior to high-rate production.
11. Increase use of commercial-style competition.
12. DoD should fully institutionalize “baselining.”
13. Greater use of multi-year procurement.
14. Reduce requirements for data rights.

Government-Industry Accountability

1. Aggressively enforce federal civil and criminal laws governing defense acquisition.

2. *Defense contractors should promulgate and vigilantly enforce codes of ethics and develop internal controls to monitor themselves.*
3. *DoD should develop specific ethics guidance on matters of DoD acquisition and train personnel on such matters.*
4. *Oversight of defense contractors must be better coordinated among the various DoD agencies.*
5. *USD(A) should establish audit policies and foster contractor self-governance.*

Former Packard Commission member and Secretary of Defense William Perry initiated a “Mandate for Change” in the mid-1990s. His Oversight and Review Process Action Team made the recommendations presented in Table 7 for streamlining the acquisition process. (29:74)

Table 7: 1994 Oversight and Review Process Action Team

1. Help field what the Warfighter needs when he needs it.
 - 1) The quality of the products being fielded
 - 2) How quickly new capabilities become available
2. Demand accountability by matching managerial authority with responsibility.
 - 1) The clarity of such role definition
 - 2) The ability of personnel to play their role without external interference
 - 3) Whether decisions are made at the lowest level possible
3. Promote flexibility and encourage innovation.
4. Foster constant teamwork among everyone who is a stakeholder.
5. Actively promote program stability.
6. Balance the value of oversight and review with its costs.
7. Emulate the best practices of successful commercial companies and successful government ventures.
 - 1) Clear command channels that is a short, unambiguous chain-of-command to the decision maker
 - 2) Stability in performance demanded, schedule and funding
 - 3) Limited reporting requirements
 - 4) Small, high-quality staff to manage the program rather than sell it or defend it
 - 5) Greater communication with users throughout the lifecycle of the system
 - 6) Greater use of prototyping and testing
8. Preserve the public trust.

In 1996 RAND analyzed a major defense acquisition program from each Service based on ten of their own derived criteria for program process health. The study declined to analyze each program individually; rather it awarded composite grades in each criterion and noted trends across the three programs. The key observations of concern in the study’s findings were (8:xxi)

1. Program funding was unstable. Program managers spent more time defending their programs rather than managing them.
2. Program schedules were budget-driven, a powerful disincentive for attracting talent managers.
3. Risk management philosophies and practices were disparate, an indicator of weak emphasis at top managerial levels.

RAND's criteria are presented in Table 8. (8:16)

Table 8: RAND's Ten Criteria for Evaluating Acquisition Program Management and Oversight Processes within the Department of Defense

1. Lines of authority have been established and are clear. Defense Management Review issues and/or problems must not cause confusion, bickering, or a diminution of Program Manager (PM) responsibility and accountability.
2. Communication is open (no secrets – all information is divulged; using all media and avenues, e.g., e-mail, written, verbal) and continuous at and between all levels of authority.
3. Cost/Schedule Control System, Cost Performance Measurement, and other management reports are used as indicators of trends in program progress and for reporting program status.
4. Risk-management techniques have been implemented.
5. Program stability has been achieved through control of requirements.
6. A strong government-industry support team (Program Office, functional support, Defense Plant Representative Offices [DPROs]) is present and has explicit mechanisms for coordinating responsibilities.
7. Incentives for the Program Manager are adequate and positive.
8. Funding is stable and adequate.
9. Selection of best-qualified personnel for key acquisition-management positions is objective and regulated
10. Security requirements do not restrict adequate and sufficient management.

Round Four (2001 – Present): Transformation

Finally, in this decade Undersecretary for Defense Acquisition, Technology, and Logistics

[USD(AT&L)] Pete Aldridge issued five goals in support of “Acquisition Excellence.” (24:17)

Table 9: Aldridge's Five Goals in Support of Acquisition Excellence

1. Achieve credibility and effectiveness in the acquisition and logistics support process.
2. Revitalize the quality and morale of the DoD (AT&L) acquisition workforce.
3. Improve the health of the defense industrial base.
4. Rationalize the weapon systems and infrastructure with defense strategy.
5. Initiate high-leverage technologies to create the warfighting capabilities, systems, and strategies of the future.

And within the Air Force, Assistant Secretary of the Air Force for Acquisition (SAF/AQ) Marvin Sambur issued a series of his own initiatives in keeping with Air Force transformation. (2:4, 58-108)

Table 10: SAF/AQ Marvin Sambur's Air Force Acquisition Transformation Initiatives

- Challenge Over-Restrictive implementation of the Law and “Zero-Based” perspective.
All programs start with a “zero-based” perspective. All activities, reports, plans, coordination or reviews except those mandated by statute or previously approved by a person in the execution chain, must buy their way into the program by demonstrating that the benefit gained clearly equals or outweighs the resources expended (p. 58)
- Shift from avoiding risk.
Success in meeting our objective requires a shift from avoiding risk to managing it, and sometimes, simply accepting it. Taking risks will sometimes produce failure. That is acceptable as long as those in the execution chain understood the risks and we learn from the failure. (p. 64)
- Operational urgency.
The primary mission of our acquisition system is to rapidly deliver to the warfighter affordable, sustainable capability... Speed is important. In devising and implementing acquisition approaches, the concept of time or schedule as an independent variable is one that must override prior concepts of delivering the ultimate capability at whatever cost and schedule is necessary to do so. Every key decision must have an operational sense of urgency. (p.74)
- Credibility.
Credibility is essential. We must create and maintain realistic expectations. PMs must continually manage expectations so that senior acquisition and warfighter leadership are never surprised by sudden cost growth or schedule slippages. Each program must have a clear, unambiguous set of priorities among cost, schedule, performance and supportability. Normally, the senior leadership of the requiring MAJCOM should set these priorities as part of the initial requirement. (p. 84)
- Full teaming.
Teaming among warfighters, developers/acquirers, technologists, testers, budgeters and sustainers must begin when the requirements are being defined, not after. PMs, through the MDA, are responsible for making decisions and leading implementation of programs, and are accountable for results. The PM, as the accountable agent for executing the program, has a responsibility to seek resolution if asked to do something that goes counter with meeting the Commander's Intent. (p. 94)
- Staffs are advisors.
Staffs at all levels exist to advise the MDA and PM and assist them with their responsibilities. Councils, committees, advisory groups, panels and staffs are advisors at the discretion of the PM, PEO, DAC or MDA. The MDA, PEO or DAC, and PM are accountable for the overall program results. Those not accountable for the program outcome are expected to provide program inputs to the program decision process, but do not have decision-making authority. (p. 100)
- Solid systems engineering.
Solid systems engineering is required at the outset of a program to ensure a robust foundation and flexible architecture that can accommodate future requirements with minimal redesign. (p. 108)

To date, the DoD 5000 series instructions for acquisition have been revised and coordinated, with a similarly revised CJCS 3710 series instructions. Together, they are the defense acquisition system and the Joint Concept Integration and Development System, and they form the body of instruction for defense modernization. DoD Instruction 5000.2-R, a prescriptive and regulatory guide book on acquisition procedures, was rescinded in lieu of the Defense Acquisition Guidebook, which made the procedures only advisory in nature. (2:23)

Summary of Acquisition Reform Efforts

Since 1969, DoD Acquisition has gone through four generations of acquisition reform to contain costs, impose quality controls, improve efficiency through streamlining, and maintain responsiveness as DoD undergoes transformation. The reviews and initiatives offer conflicting, but often reinforcing, findings about the acquisition process. On the one hand, the repeated findings are evidence of tenaciously insoluble problems with the process; on the other hand, they give insight into consistent and enduring themes, fodder for a body of principles. The scope and level of findings varied widely, and the truly profound ones suffered for attention amidst the clutter. The warfighting analog offers dividends. Acquisition is an extension of policy, and strata for acquisition (strategic, operational, and tactical levels) serve to de-confound narrow prescriptive findings from broader more general ones. Important themes, repeatedly manifest were

- More power and autonomy needed for program managers to execute the strategy
- Longer tours/less turnover needed for program office personnel
- The need for fewer levels of management and fewer audits and reviews
- The need for stable funding and realistic budgets, properly padded to program risk
- The need for fewer laws and directives, more general guidance
- The need to return program managers to the job of management instead of program advocacy
- An emphasis on avoiding risk instead of managing it
- The importance of the industrial base as a factor affecting force modernization
- The growing need to meet requirements in a timely manner

Around 1997, former Lockheed-Martin CEO Norman Augustine presented a tongue-in-cheek version of his laws for acquisition program management. They offer a canny view of the process from a contractor's perspective as well as a good indication of the effectiveness of prescriptive efforts of acquisition reform up to then. Augustine's observations are presented in Table 11.

Table 11: Augustine's Checklist for an Acquisition Adventure

- ☐ Settle for less than the best people – Reduce payroll costs
- ☐ Build an adversarial relationship between buyer and seller
- ☐ Change management frequently – Provide opportunities
- ☐ Avoid evolutionary growth to new capabilities – Take grand leaps
- ☐ Continually revise schedule and funding – Generate excitement
- ☐ Include all features anyone wants – Make everybody happy
- ☐ Allow no margins in funding, schedule or technical approach – Nothing will go wrong
- ☐ Divide management responsibility among several individuals – Two heads are better than one
- ☐ Whenever difficult problems are encountered, start all over with a new approach having no (known) problems
- ☐ Promote continued debate over goals throughout the life of the project – Variety is the spice of life
- ☐ Give reliability low priority – Especially avoid redundancy
- ☐ Develop underlying technology and end-product concurrently
- ☐ Do not plan intermediate test milestones – Just one glorious display
- ☐ Create as many interfaces as possible – Help people get to know each other
- ☐ Focus on the big picture – The details will take care of themselves
- ☐ Disregard seller's track record – The law of averages will work out
- ☐ Cut costs by reducing testing – Especially environmental and full-system testing
- ☐ Ignore the users – They don't understand high-tech
- ☐ Choose among the sellers based on what they promise – Nobody likes a pessimist
- ☐ Get a head-start on work prior to finalizing goals, schedule and cost – This is especially true for software – which is easy to change
- ☐ Share authority for project direction with staff advisors
- ☐ Eliminate independent checks and balances – They just create friction
- ☐ Don't compete potential suppliers at the outset – Pick a friend
- ☐ Once underway, continue to compete selected supplier with outsiders – Change as often as possible to assure "Freshness"
- ☐ Minimize managers' latitude for judgment – Rely on regulations
- ☐ Deal harshly with anyone surfacing problems – One can't afford troublemakers
- ☐ Never delegate – Hold authority at the top where people really know what's going on
- ☐ Maximize individual incentives – Teamwork is just the sum of the parts
- ☐ Make up for schedule slips by overlapping design and build – Especially when test results are disappointing
- ☐ Include at least as many auditors on the project as workers – Reviews give everyone a chance to participate
- ☐ Do all possible to minimize profits of participating contractors – Save the money
- ☐ Don't waste time communicating (especially face-to-face) – It just takes time; and time is money
- ☐ Eschew strong systems engineering – It complicates decision-making
- ☐ Delay establishing configuration control until the last minute – Reduce the cost of management
- ☐ Always pick the low bidder – They must know something special and are often courageous
- ☐ Don't worry about the form of the contract – Just enforce it

Principles of Warfare

[D]octrine is a statement of officially sanctioned beliefs, warfighting principles, and terminology that describes and guides the proper use of ... forces in military operations.
(1:ix)

Doctrine is the best way to do things... all things being equal

- 1. All things are NEVER equal*
- 2. You NEVER know what things aren't equal*
- 3. The same things are NEVER equal*

LtGen Michael Short
JFACC, Operation ALLIED FORCE

At the core of any basic doctrine document, principles of warfare exist to serve as a guide to formulating warfighting strategy. Doctrine contains the accumulated lessons from experience in a discipline and puts forth the most effective methods for success. It describes how to achieve an objective, but it doesn't prescribe which objectives to achieve. Doctrine applies to disciplines not governed by definitive deterministic laws; they offer the 70-90% solution. As such, they are not directive or binding in nature. Decision-makers should neither blithely ignore doctrine, nor follow its dictates by rote without an understanding of the peculiarities of their own situations. Doctrinal proposals originate from observation and experience, and scientific method refines it into theory. Once doctrine is published and applied, constant feedback from operational experience serves to update it. (1:87)

Principles are the enduring characteristics of successful combat operations and form the foundation of warfighting doctrine. (41:2-4) They indicate the dimensions of conflict considered universally true and relevant. (1:19) The US Army first listed its original nine principles of war in 1921 and has refined them with the experience of 20th century conflicts. Today, all of the service and the joint doctrine documents acknowledge these principles. (41:21) The current principles are listed on the following page, and definitions of these principles are in Appendix B

Expanded Principles of War.

- Objective
- Unity of Command
- Offense
- Mass
- Maneuver
- Economy of Force
- Security
- Surprise
- Simplicity

Candidate Principles for Force Modernization

This section lists and defines candidate force modernization principles in order to vet them against the lessons of hard experience in force modernization. It distills the previous lists of initiatives, findings, and recommendations into a draft list of principles for modernization, intended as a keystone for building a basic modernization doctrine. Like the principles of war, these principles may or may not work together in congruence; the demands of some may constrain or oppose the demands of others. Every modernization program is unique; therefore, the appropriate weight to give towards pursuit of any one principle will vary from program to program. Achieving the right balance requires judgment and mastery, not a rigid algorithm. Hence, modernization, like warfighting, is as much an art as a science.

The earlier review of acquisition reform yielded 135 different findings and initiatives. Ten major themes emerged as candidate principles. They were germane to the findings and initiatives, and they showed up on numerous occasions across the range of panels, commissions, and Secretaries' initiatives.

1. Objective: The unifying focus behind any modernization effort. All subordinate tasks must be consonant with the overall objective of a modernization effort, and any modernization effort's goals must be consonant with the objectives of the concept of operations to which it is linked. In this context, Objective refers to system performance, the operational effectiveness and suitability of the product system, and its linkage to higher strategic objectives.

2. Simplicity of Command: Modernization's corollary to the warfighting principle of Unity of Command/Effort. Beyond unity, Simplicity of Command requires as short a chain of command and as short a line of communication as possible between program managers and decision-makers. *It also exclusively associates authority and responsibility.* As in battlefield operations, it enables a more agile tempo and therefore mitigates vulnerability to external perturbations such as funding instability. It is a necessary condition for program stability and responsiveness.
3. Tempo: To remain viable, a program must be more dynamic than the events driving it, at the tactical level (contract changes, technical developments), the operational level (budget turbulence, schedule changes), and at the strategic level (mission changes, new priorities). Tempo includes those items affecting program agility, flexibility and responsiveness, the speed and effectiveness of its OODA cycle.
4. Risk Management: The very objective and the underlying method of force modernization. Modernization programs are undertaken in order to mitigate an unacceptable risk to warfighters and/or national security, and the elements of modernization strategy: analysis, prototyping & testing, competition, tracking & reporting are all in place to manage (identify, track and mitigate) risks to program objectives of cost, schedule and performance. *Residual risk inevitably requires insurance in the form of a commensurate management reserve.*
5. Centralized Control/Decentralized Execution: Centralized Control is traceability and linkage of disparate efforts back to the over-arching objective. It includes direction (policy, commands, decisions, approval and funding) as well as feedback (reporting, reviews, audits, evaluations and inquiries). Centralized Control is necessary to some degree to focus and organize efforts. Decentralized Execution prescribes execution at the point of action, at the lowest level appropriate. It gives robustness and agility to execution.
6. Economy of Effort: Keeping the scope of the organization and process for a modernization effort to the minimum sufficient for the objective. Economy of Effort has its basis in the KISS (Keep It Simple...) principle. It includes conservation of manpower, man-hours, funds, or any critical finite resource. It also recognizes the risk, due to complexity, of losing focus on the objective and loss of responsiveness when programs and processes grow unnecessarily large or lengthy.
7. Stable Program Inputs: The need for requirements, funds, schedule and personnel turnover to be stable if a program is to operate efficiently and effectively. It also recognizes realistic cost estimates, technology maturity and a robust industrial base as necessary preconditions.
8. Initiative: The modernization process' corollary to the warfighting principle of Offense. It dictates being proactive, anticipating and responding in advance of challenges, at all levels, and using creativity and innovation where necessary. To maintain an optimum tempo, a program requires momentum. Initiative is the means by which program leadership maintains and controls that momentum.
9. Workforce Quality & Credibility: The lubricant of the entire modernization process and machinery. People, expectations and agreements must all have credibility in order to maintain an optimum tempo while containing risk. Without trust, processes stall while parties pursue bona fides and formal contracts. The most effective programs have all run on informal communications and arrangements made possible with credibility.

10. **Synergy & Synchronization:** Synergy is the tight integration of inter-disciplinary and inter-organizational teams toward a unifying objective, the antithesis of stove-piping. It requires rapid communication and coordination among all stake-holding communities involved in a modernization effort, and in turn enables (i.e. it's necessary but not sufficient for) the remaining principles. Where synergy is coordination across disciplines, synchronization is coordination across processes. While any modernization process is ideally event-driven, interfaces with the modernization process may be calendar-driven (Planning, Programming, Budgeting and Execution System) or subject to their own event-driven sequence (CONOPS Development). To be most effective, a modernization strategy should plan ahead for times to make required inputs or receive necessary outputs of those interfacing systems.

The frequency of occurrence of these principles across the findings and initiatives from the presidential and congressional panels and secretariat initiatives is presented in Table 12.

Table 12: Acquisition Reform Findings/Initiatives and Principles Correlation

	Objective	Simplicity of Command	Tempo	Risk Management	Centralized Control/Decentralized Execution	Economy of Effort	Stable Program Inputs	Initiative	Workforce Quality & Credibility	Synergy & Synchronization
Packard Initiatives	1			5	2	2	3			1
Fitzhugh Commission Recommendations		2		2	1		2		3	
Commission on Government Procurement	1		1	2	1	6	1	2		1
Carlucci Initiatives	6	1	4	7	3	13	10	2	4	4
Grace Commission Recommendations	1		2			5	4			3
Packard Commission Recommendations	3	1	1	4	4	4			4	2
Oversight and Review Process Action Team	3	2	2	1	2	4	2	1	2	2
RAND's 10 Criteria	2	2		2	1	1	2		2	2
USD (AT&L) 5 Goals	1						2	1	2	
SAF/AQ Initiatives	1	1	2	1		1			1	1
	19	9	12	24	14	36	26	6	18	16

Among the candidate principles, Economy of Effort, Stable Program Inputs, and Risk Management (Avoidance) received the most attention in acquisition reform investigations and initiatives. The candidate principles of Objective, Workforce Quality & Credibility, Synergy & Synchronization, and Centralized Control/Decentralized Execution all appeared very frequently. The candidate principles of Tempo, Simplicity of Command, and Initiative also appeared on oc-

casation. None showed a bias in time in that no particular principle's appearance tapered off or gained in frequency with respect to the time of the findings. These results do not guarantee sufficiency. A candidate principle, neither visible to senior investigators nor overwhelmingly affecting them, would likely escape attention but rather manifest at other echelons of management. Just as victors write the history books, senior leaders write the findings and initiatives.

The Candidate Principles Applied to Recent Programs

These candidate principles should be decisive factors in the success, troubled nature, or outright failure of modernization efforts. The scope of this section is to look at six major defense acquisition programs (MDAP) started within the last 30 years. The first two programs are ones widely considered successful if not exemplary. The next two programs are ones surviving to date but considered troubled in terms of cost and schedule. The final two programs were terminated after considerable investment. In each case, program circumstances are compared with the list of candidate principles to see if they are applicable. Where a candidate principle is a factor in a program history narrative, that principle appears in brackets. If a program is found to have been deficient in observing that principle, a minus sign appears in parentheses next to the principle in brackets. In the summary tables,

- “+” indicates the program was found to have observed a candidate principle
- “-“ indicates the program failed to appropriately observe a candidate principle
- “+/-“ indicates the program both observed and violated the principle at different times
- A blank cell indicates that the program's observance or violation of a principle was not evident from its case history

The Good: Exemplary Acquisition Programs

The ones [indicators] we settled on as being most indicative of problems in the program was the acquisition cycle, the length of time from the beginning of full scale development, to the fielding of the system, to establishment of initial operating capability. On a typical defense program, that takes 8, 10, or 12 years, somewhere in that range. *On the truly well run, most excellent programs we looked at, that was done in 4 or 5 years.*

Dr. William Perry, testimony before Congress, 1985 (55:34-37)

F-117 Nighthawk. The F-117 Nighthawk is a low-observable light bomber/attack airplane. It had its genesis in 1976. Following a successful Advanced Research Projects Agency (ARPA) investigation into radar signature suppression, HAVE BLUE began as a technology demonstration of an experimental jet aircraft applying those signature suppression methods. [Stable Program Input] Even as testing was underway, the contractor began designing the F-117, based on lessons learned from building the two demonstrators. [Risk Management] With the success of HAVE BLUE, the F-117 development program initiated with Engineering Manufacturing Development (EMD) in 1978, and the first lot was delivered to the Air Force in 1982, four years from the establishment of a requirement. (8:8-10) [Tempo] Development on the F-117 continued after fielding; the efforts centered mainly on reliability and maintenance of the low radar signature [Objective(-)], but the aircraft fielded successfully with a total of 13 months schedule slippage. (8:9) Despite its technological novelty, the F-117 acquisition cost was only 3% above initial estimates. (8:41) [Stable Program Input] [Economy of Effort] Eleven years from contract award, the USAF had successfully employed the F-117 in air combat operations. [Objective]

RAND's analysis of the F-117 acquisition program derived the following findings: (8:47-43)

- A narrow mission with a limited number of performance requirements [Objective] [Economy of Effort]
- Flexibility and responsiveness in decision-making [Initiative]
- Program manager latitude on making cost, schedule and performance trades [Simplicity of Command]
- An exceptionally small, handpicked program staff (36 people) with great autonomy [Workforce Quality & Credibility]
- Stable requirements due to security and limited insight among staffs with divergent interests
- Stable support from DoD and USAF executives [Stable Program Inputs]
- Delegation of authority to lowest levels practicable [Decentralized Execution]
- Tolerance for risk/ waiver of numerous controls [Risk Management]
- Significant trust between agencies involved as well as between the government and the contractor [Synergy]
- Inadequate consideration to reliability and maintainability of the radar absorbing materials [Objective (-)]

These findings, related to the success of the F-117 acquisition program, as they related to the candidate principles are summarized in Table 13:

Table 13: Candidate Principles as Factors in the F-117 Program

+/-	Objective
+	Simplicity of Command
+	Tempo
+	Risk Management
+	Centralized Control/Decentralized Execution
+	Economy of Effort
+	Stable Program Inputs
+	Initiative
+	Workforce Quality & Credibility
+	Synergy & Synchronization

RQ-1A Predator ACTD. The RQ-1A, a remotely piloted/remotely operated reconnaissance unmanned aerial vehicle (UAV), had its inception in 1993 when the Joint Requirements Oversight Council (JROC) validated a requirement for a medium altitude endurance UAV and incorporation it into a pilot program for Advanced Concept Technology Demonstration (ACTD). (56:11) The objective of ACTDs is to shorten the time for fielding ripe and useful technologies. [Stable Program Inputs] [Tempo] The ACTD concept is to match maturing technologies with warfighter needs and to evaluate prototypes in actual operations over a 30-month trial. [Synergy] Concepts with operational utility enter the acquisition process at the appropriate point and the prototypes are left with the warfighters. The prototype first flew in 1994, and the UAVs were operating over Bosnia by 1995. The ACTD completed in 1996, with Predator UAVs flying in operations in Bosnia. [Tempo] DoD transitioned the RQ-1A into formal acquisition that year, and the US Air Force began taking deliveries of an upgraded RQ-1B in August 1997—less than five years from program start. The transition had some issues. The Air Force was designated as the lead agency for transition late in the ACTD. Being that it was originally a demonstration, foundational documentation such as an Operational Requirements Document, a Logistics Sup-

port Analysis, and a Test and Evaluation Master Plan had to be developed in parallel with EMD.

[Risk Management] Nevertheless, the system fielded on schedule, with only a 6% cost overrun.

(56:45) [Stable Program Input] [Economy of Effort]

A RAND study of the program made the following findings: (56:78)

- “Flexibility and creativity were key to the success of the Predator ACTD.... (1) An emphasis on informal communication and (2) Limited CDRL (Contract Data Requirements List) items.” (56:55) [Economy of Effort] [Decentralized Execution]
- “Given the necessarily fast pace of the ACTD process, confident, effective, and innovative individuals are critical to the success of a program.” [Workforce Quality & Credibility]
- Requirements analysis and logistics planning need to start as soon as there are inklings that the demonstration will transition to a formal acquisition. [Tempo (-)]
- ACTDs operate differently due to fast pace, small staffs, and limited guidance. [Tempo]
- The ACTD used a nonbinding CONOPS rather than formal requirements in assessing performance. [Initiative]
- “The small size of the government and contractor teams of the Predator ACTD required an *integrated team approach*, which is founded on mutual trust, limited documentation, and novel management techniques. (56:32) [Synergy] [Credibility] [Economy] [Initiative]
- Success—in part, due to stability of funding [Stable Program Inputs]
- The need for reliability and maintainability goals [Objective (-)]
- The need for a life cycle cost estimate [Economy of Effort (-)]

These findings, as they related to the candidate principles are summarized in Table 14.

Table 14: Candidate Principles as Factors in the RQ-1Program

-	Objective
	Simplicity of Command
+/-	Tempo
+	Risk Management
+	Centralized Control/Decentralized Execution
+/-	Economy of Effort
+	Stable Program Inputs
+	Initiative
+	Workforce Quality & Credibility
+	Synergy & Synchronization

The Bad: Troubled (but Surviving) Acquisition Programs

The next programs under review are characterized as troubled—experiencing cost and/or schedule overruns well in excess of the Nunn-McCurdy limits of 25%. The purpose of this analysis is to determine any correlation between principles and program troubles and survival.

F-22 Raptor. The F-22 Raptor is the air superiority fighter currently being fielded to succeed the F-15 Eagle. Its beginning was in studies that commenced in the late 1970s, culminating with USAF requirements developed for the Advanced Tactical Fighter Program in 1981. (19) The demonstration and validation phase stretched out as the Air Force subsequently added stealth requirements. [Stable Program Inputs (-)] Lockheed's YF-22 prototype won a fly-off competition at the end of demonstration/validation in 1991. [Risk Management] [Economy of Effort] The original program goals called for a fleet of 750 F-22s, a 1995 IOC date, and a total program cost of \$80.7 B (\$12.6 B for development). (4:238) The program experienced numerous technical difficulties in EMD throughout the early 1990s; finally, Congress imposed spending caps. The dynamic changes in the security environment brought questions about the value of a fighter being built to counter would-be Soviet fighter threats. [Stable Program Inputs (-)] At IOC in December 2005, 10 years after the projected IOC (111% schedule overrun) [Tempo (-)], the Air Force plans to field 178 (23.7%) of the original 750 aircraft [Objective (-)]; total program cost is congressionally capped at \$63.8 B, but USAF spent \$28.7 B for development (127% overrun). (54:4-5) [Economy of Effort (-)] A RAND study made the following findings: (63:57)

- The need for realistic cost and schedule estimates up front with minor adjustments over time [Stable Program Inputs (-)]
- Stable team structure, proper team expertise, clear lines of responsibility/authority, and a single lead contractor as critical to success [Stability (-)] [Simplicity of Command (-)]

- The necessity for experience among government and contractor management teams [Quality Workforce (-)]
- The added risk of developing technology for a baseline design concurrently with manufacturing development [Risk Management (-)] [Stable Program Inputs (-)]
- The utility of planned technology insertion, as technology stabilizes, as a risk management tool [Risk Management (-)] [Stable Program Inputs (-)]
- The need to carefully monitor key leading indicators of design instability [Centralized Control (-)] [Risk Management (-)]
- The need for an appropriate management reserve for flexibility in containing cost growth [Risk Management (-)] [Stable Program Inputs (-)]

These findings, with respect to the F-22 program's difficulties but continued survival, as they related to the candidate principles are summarized in Table 15.

Table 15: Candidate Principles as Factors in the F-22 Program

-	Objective
-	Simplicity of Command
-	Tempo
+/-	Risk Management
	Centralized Control/Decentralized Execution
+/-	Economy of Effort
-	Stable Program Inputs
	Initiative
-	Workforce Quality & Credibility
	Synergy & Synchronization

V-22 Osprey. In 1981, following the success of the XV-15 tilt-rotor technology demonstration [Risk Management], DoD began the Joint Services Advanced Vertical Lift (JVX) program to meet the vertical lift requirements of all the services. In 1983 the US Army withdrew as lead for the development program (but still committed to procuring the production model), and the Department of the Navy assumed program lead. [Stable Program Inputs (-)] By 1984, the program goals included delivery of 913 V-22 Osprey tilt-rotor aircraft to the services, with an IOC in 1992. Bell and Boeing partnered to bid on the V-22 development. The Navy obliged them to accept a fixed-price development contract and to compete against one another for production.

[Synergy (-)] [Risk Management (-)] Development began in 1986. (48:18) During development, the Army abandoned its procurement commitment and, citing cost overruns, then-Secretary of Defense Richard Cheney cancelled funding in 1989. [Stable Program Inputs (-)] Congress re-stored funding for the V-22 to continue as a test program. In 1993, the Clinton administration restored program funding, and a re-designed V-22 entered EMD in 1994. (42:3) The Defense Acquisition Board (DAB) permitted the program into Low-Rate Initial Production (LRIP) in 1997, based on testing of the *original* design. [Risk Management (-)] LRIP halted after a number of in-flight incidents; two catastrophic accidents revealed design limits not discovered in testing. In 2003, after a new round of development testing, the V-22 re-started LRIP. The DAB approved Full Rate Production in 2005. Bell and Boeing will build 458 V-22s for the Marine Corps and for Air Force Special Operations, with an IOC in 2007. Unit cost will be \$85 M, up from the \$24 M per aircraft estimated in 1986 (42:9) [Economy of Effort (-)] When delivered, the V-22 will have had a 15-year (200%) schedule overrun and a \$26.7 B (354%) cost growth. [Tempo (-)] A survey of V-22 program history literature reveals the following highlights: (42:9-13)

- Program stability was chaotic due to widely varying support across Defense Secretaries' tenures [Stable Program Inputs (-)]
- The initial contract structure inhibited contractor latitude in development [Initiative (-)]
- The requirement for competition among partners for manufacturing poisoned the teaming relationship [Synergy (-)]
- The program proceeded into production without adequate developmental/operational testing (44:6) [Risk Management (-)]
- Marine Corps response to operational test failures was to revise requirements [Objective (-)]
- The V-22 program benefited from constant congressional support [Stable Program Input]

V-22 program lessons, with respect to its difficulties but continued survival, as they related to the candidate principles are summarized in Table 16.

Table 16: Candidate Principles as Factors in the V-22 Program

-	Objective
	Simplicity of Command
-	Tempo
+/-	Risk Management
	Centralized Control/Decentralized Execution
-	Economy of Effort
+/-	Stable Program Inputs
-	Initiative
	Workforce Quality & Credibility
-	Synergy & Synchronization

The Downright Ugly: Cancelled Acquisition Programs

A-12 Avenger II. The A-12 Avenger II was a low-observable, aircraft carrier-based attack aircraft intended to succeed the Navy's A-6. Planners envisioned 1,200 aircraft for the Navy, Marine Corps, and Air Force, with first flight due in 1990. (14:2) The program began in 1983 with Deputy Secretary of Defense direction to the Navy to undertake development. The Navy did this reluctantly, absent the spare money or technology necessary for such a major effort. To contain cost risk, the Navy bid the development contract as fixed-price. [Risk Management (-)] [Initiative (-)] The two contractors with ongoing stealth aircraft development experience, Lockheed and Northrop, declined to bid the contract—citing excess risk—and the Navy awarded the contract to the McDonnell-Douglas/General Dynamics team, the only responsive bid. Neither had any experience with the composites technology necessary for stealthy airframes. [Workforce Quality (-)] Following a major program review in 1989 and Secretary of Defense testimony before Congress that program performance was healthy, the A-12 program office announced an 18-month slip in the date of first flight. [Credibility (-)] The ensuing inquiry from OSD staff revealed a program badly broken. Having spent \$3 B of the \$4.77 B development budget, the aircraft design was 5,000 lb overweight [Objective (-)], two years behind schedule [Tempo (-)], and \$500 M over budget [Economy of Effort (-)]. (14:7) Furthermore, Navy program management

had been aware of this and had not only withheld the information from the Secretary of Defense major review but had successfully quashed a DoD comptroller memorandum stating the situation. [Credibility (-)] By this time, the advocacy had reversed. Amidst a shrinking post-Cold War force, the Air Force and the Navy were in a cutthroat roles competition over deep strike, and Naval aviation was now committed to the A-12. [Stable Program Inputs (-)] In reaction to the findings, key members of the A-12 acquisition chain of authority were relieved and/or disciplined, and Secretary Cheney ordered the program terminated for cause in 1991. (14:1-5)

The ensuing litigation between the contractors and DoD revealed further misdoings. In order to force a bid within the Navy's established budget for the program, the Navy had misled the McDonnell-Douglas/General Dynamics team and others into believing that the contractors were bidding competitively, when in fact they were the sole bidders. [Credibility (-)] Although the Navy bid reviewers had uncovered a critical error in the team's weight estimation, the Navy neglected to share this with the contractors, fearing that the revised bid would be higher. (35) [Credibility (-)] The Navy had not developed stealth technology, but the program depended on it. OSD had directed the Air Force to make its low-observables expertise available to the program. The Air Force, having assumed all of the previous risk and expense of developing stealth, and in fierce competition with the Navy for the deep strike role, was reticent to share its data, and the contractors had to develop that knowledge by themselves. (35) [Synergy (-)] The events of the A-12 program failure as they related to the candidate principles are summarized in

Table 17.

RAH-66 Comanche. The RAH-66 Comanche was a Reconnaissance-Attack helicopter designed to replace US Army observation helicopters and its AH-1 Cobra attack helicopter. The effort began as the Light Helicopter Experimental (LHX) program in 1983. (21) It specified a fleet of 5,023 single-seat rotorcraft, with ambitious goals for aircraft stealth, flight performance,

Table 17: Candidate Principles as Factors in the A-12 Program

-	Objective
	Simplicity of Command
	Tempo
-	Risk Management
	Centralized Control/Decentralized Execution
-	Economy of Effort
-	Stable Program Inputs

-	Initiative
-	Workforce Quality & Credibility
-	Synergy & Synchronization

targeting and fire control, and communications. (9:1) In 1985, the Army determined that single-seat operation was hazardous, and they subsequently specified a crew of two. [Stable Program Input (-)] The contractor team won in a “fly-off” solely via modeling and simulation. [Risk Management] [Economy of Effort] In 1993, facing financial constraints, the US Army cut the buy to 1,292 aircraft, extended program technical development until 2000, and scheduled EMD from 2000 – 2006, with fleet production through 2028. [Stable Program Input (-)] [Tempo (-)] During the 17-year technical development, the program underwent five restructurings. (9:5) The avionics mission equipment package underwent continual flux, due to evolving communications and interface standards [Stable Program Input (-)], while the program struggled unsuccessfully to manage airframe weight [Objective (-)]. In 2000 the DAB sent the program into EMD amidst growing concern over the validity of the original requirements for this weapon system. Not only was the helicopter designed for an extinct threat but the UAV technology, conceived, developed, and fielded during the span of the RAH-66 technical development had supplanted the helicopter for tactical reconnaissance. [Stable Program Input (-)] [Tempo (-)] The EMD plan came under fire for excessive risk taking: going into full-rate production before finalizing configuration, making a full rate-production decision before completing operational testing, and continuing avionics technical development during manufacturing development [Risk Management (-)]. (9:8) In February 2003 the Army cancelled the program, claiming it no longer needed the aircraft and wished to reprogram the money for more urgent issues. (36) The lessons of the case history, in that the RAH-66 program ultimately failed, as they related to the candidate principles are summarized in Table 18.

Table 18: Candidate Principles as Factors in the RAH-66 Program

-	Objective
	Simplicity of Command
-	Tempo
+/-	Risk Management
-	Centralized Control/Decentralized Execution
+	Economy of Effort
-	Stable Program Inputs
	Initiative
	Workforce Quality & Credibility
	Synergy & Synchronization

Analysis of Candidate Principles across the Six Acquisition Program Case Studies

In the review of acquisition program case histories, some new recurring themes stand out. First, the two exemplary programs developed in five to six years, and they both had logistics supportability problems early in fielding. This implies that time-to-field and thorough logistics supportability work against one another, and that at some point, a manager must deliver with the logistics on hand in order to balance against risk due to time (i.e., make schedule). Second, informal communications, trust, and a sense of esprit-de-corps were common among the two exemplary programs, weak in the two troubled programs, and notably absent in the A-12 case. This implies that the proportion of formal communications and agreements among members of a development team correlates to the degree of artificial trust needed to compensate for genuine rapport and should be a leading indicator for senior decision-makers for potential program troubles. Third, on two occasions the Navy required fixed-price development contracts and imposed onerous conditions upon the contractors; in both cases the contractors failed to deliver. This implies that short-term risk-avoidance is not the same as prudent risk management. The F-117 development ran the opposite tack, calculatingly assuming risks and giving contractors wide lati-

tude. Finally, the most successful programs had the least number of stakeholders and the narrowest operational objectives. This implies that too many interests can spoil the program and that start-up programs require a gatekeeper who will prevent too many disparate requirements from attaching themselves to a funded development. The F-117 program's classification served this function, and the Predator's high-level interest and advocacy did likewise for it.

LtGen Trey Obering, Director of the Missile Defense Agency, declared himself program manager for major programs under his agency. He felt that he needed the weight of a Lieutenant General to fend off the flock of narrow but powerful interests threatening to defocus and derail his programs. Coincidentally, joint task force (JTF) commanders leading campaigns are three-star generals and admirals. Thinking of a major defense acquisition program as a campaign for national security suggests that its campaign commander, the program manager, ought to carry the rank and authority of a JTF commander. Smaller programs can accommodate managers with lesser rank and authority. A summary of correlation between the six acquisition program case histories and the candidate principles is presented in Table 19.

The candidate principles of Risk Management, Economy of Effort, and Stable Program Inputs were factors across all program experiences. The candidate principles of Objective, Tempo Initiative, Workforce Quality & Credibility, and Synergy & Synchronization were factors in most of the cases examined. The candidate principles of Centralized Control/Decentralized

Table 19: Acquisition Program Histories and Principles Correlation

	Objective	Simplicity of Command	Tempo	Risk Management	Centralized Control/Decentralized Execution	Economy of Effort	Stable Program Inputs	Initiative	Workforce Quality & Credibility	Synergy & Synchronization
F-117	X	X	X	X	X	X	X	X	X	X
RQ-1	X		X	X	X	X	X	X	X	X
F-22	X	X	X	X		X	X		X	
V-22			X	X		X	X	X		X
A-12	X			X		X	X	X	X	X
RAH-66	X		X	X	X	X	X			
	5	2	5	6	3	6	6	4	4	4

execution and Simplicity of Command were factors in half or fewer of the cases reviewed. The results, combined with those relating to acquisition reform in Table 12, support the following conclusions, in that time after time these principles were causal in the studied programs' successes or lack thereof:

The data *most* strongly supported the candidate principles of

- Economy of Effort
- Stable Program Inputs
- Risk Management

The data strongly supported the candidate principles of

- Objective
- Credibility
- Tempo
- Initiative

The data moderately supported the candidate principles of

- Workforce Quality & Credibility
- Centralized Control/Decentralized Execution
- Simplicity of Command

Therefore, the data support the hypothesis that there is a useful body of broad and enduring principles to be reaped from the lessons of DoD's experience with force modernization, and that those principles have utility in current modernization programs and in efforts to transform the

modernization process. However, the number of case studies, reviewed to evaluate the candidate list of principles, is not statistically compelling; it simply gives an indication for further investigation. An analysis with a greater number of case studies would help to discern other principles or to definitively eliminate candidates from the proposed list.

Modernizing Modernization: Applying Doctrinal Principles to

Current DOD/USAF Directives, Instructions, and Processes

What do the principles and their degree of support from acquisition reform and acquisition program experience portend for the current concepts for transforming the acquisition process? How well do these concepts adhere to the principles? This section examines the current processes with respect to the candidate list. The current process is top-down driven [Centralized Control]. Joint and Service staffs develop concepts of operation, based on strategic objectives [Objective], with tasks allocated to DoD Mission Areas. Each Mission Area completes a Mission Area Assessment to determine the necessary enabling capabilities, and then conducts a gap analysis to compare mission requirements with actual (or projected) capability. Gaps, from the analysis, become *needs* (identified holes in mission capability), and Mission Solution Analysis considers the spectrum of options (DOTMLPF) to close the gaps [Economy of Effort]. Those needs requiring a material solution generate an Initial (needed) Capabilities Document. A Requirements Oversight Council [Centralized Control] [Risk Management] validates or refines the documented need, and an Analysis of Alternatives for the material solution gets underway [Economy of Effort] with the acquisition community participating. [Synergy] From this analysis of costs, operational effectiveness, and operational suitability criteria comes a preferred solution and a set of performance requirements for that solution. [Credibility] [Objective] (26: A-7ff)

Evolutionary acquisition has become the DoD-preferred method for acquiring new capabilities. It encompasses a variety of techniques, including preplanned product improvement (P3I), spiral development, and incremental acquisition. The concept is to manage (mitigate) risk due to time [Risk Management] in a modernization program by fielding required technologies as they mature [Tempo], thereby continually improving systems until they meet the entire requirement. It requires faith on behalf of the warfighter that partially met needs won't cause cancellation of future development funds [Credibility], and it assumes the solution systems will be designed such that they facilitate system upgrades after initial product delivery. [Objective]

The Capabilities Review and Assessment (CRRA) is a USAF process by which it considers its entire portfolio of programs in one of its roles or mission areas. [Centralized Control] The intent is to compare solutions to the CONOPS [Objective] and the mission needs to assess them for sufficiency, necessity, and risk. [Economy of Effort] [Risk Management] Given funding constraints, it renders a portfolio-wide allocation of resources for the upcoming programming and budget cycle. [Synchronization]

From these processes, principles not evident are

- Simplicity of Command
- Stable Program Inputs
- Initiative
- Decentralized Execution

While the current processes make an effort to mitigate time-to-need with incremental deployment of capability, they do nothing to accelerate the delivery of final capability [Tempo(-)]. Risk management initiatives center exclusively around risk avoidance and neglect prudent risk taking. [Risk Management (-)] Still notably absent are any efforts to empower program managers or any other workers at the tactical level. [Decentralized Execution (-)] The strength of analyti-

cal support for the candidate principles gives rise to the following conclusions about the current processes for transforming force modernization:

The new processes *will likely fall short* in the following areas in that they do not observe the corresponding most-strongly supported principles

- Stable Program Inputs
- Risk Management (i.e., prudent risk taking)
- Tempo

This implies that, at the *operational* level, future programs will be subject to the same vicious cycle of risk avoidance, long *acquisitions*, and *subsequent instabilities*.

The new processes *may fall short* in the following areas in that they do not observe the corresponding strongly supported principles

- Decentralized Execution
- Simplicity of Command
- Initiative

This implies that *tactical* responsiveness in future programs will suffer as program managers with insufficient empowerment and conflicting guidance will not have the latitude to innovate in anticipation of, or in reaction to, incipient crises and fleeting opportunities. It also indicates that the very talent needed to take on such challenges will flee or avoid program management jobs.

And the new processes *will probably succeed* in the following areas in that they observe the corresponding principles

- Workforce Quality & Credibility
- Synergy & Synchronization
- Risk Management (i.e. calculated risk avoidance)
- Objective
- Centralized Control
- Economy of Effort

This portends that *strategic* level portfolio management should improve as senior decision makers approach harmony and integration among over-arching modernization themes and that initial

legislative and executive buy-in will be easier to obtain. However, maintaining that buy-in will prove difficult when programs fail to execute as planned, due to operational and tactical difficulties not adequately addressed.

Conclusions and Recommendations

The analysis of the history of acquisition reform commissions, senior Defense executive initiatives for acquisition reform, and case studies of selected acquisition programs appear to support (1) The hypothesis that there is a useful body of broad and enduring principles to be reaped from the lessons of DoD's experience with force modernization, (2) That those principles have utility in current modernization programs and in efforts to transform the modernization process, and (3) That those principles form the cornerstone of a body of modernization doctrine that is better suited for governing the modernization processes than is the current prescriptive mass of laws, regulations, and instructions.

The candidate list yielded a number of principles with moderate to strong regularity of occurrence among the historical records. Although the small number of program histories considered in this study makes confidence in these candidate principles less than certain, they may be used, with caution, to evaluate current force modernization transformation efforts.

The conclusions from that evaluation reveal a process with strong adherence to principles controlling central direction, risk avoidance, and program credibility that does not address the critical problem stated in this paper's introduction—that of program responsiveness in a dynamic environment. The enabling conditions for such an ability—stable program inputs, decentralized execution, simplicity of command (i.e., protection from disparate narrow interests), appropriate risk-taking, and initiative—are opportunities being missed. If modernization is to have a chance

at outpacing the strategic environment, it must adopt a doctrinal approach and give due regard to these neglected principles. Therefore, the following actions are recommended:

1. The force modernization communities should enlist a doctrine development center to formulate a draft force modernization doctrine document.
2. They should conduct an exhaustive analysis of acquisition program case histories to develop a definitive list of truly broad and enduring principles for force modernization.
3. With a force modernization doctrine document in place, eliminate all but the truly obligatory statutes and policy mandates (i.e., treaty obligations, ethics, and environmental constraints) from acquisition and requirements regulations, directives, and instructions.
4. The force modernization community should evaluate alternative concepts for force modernization as well as suggestions for improvement and innovation within the context of its new doctrine. This would serve to vet the concepts and to exercise and mature the doctrine.

APPENDIX A

ACRONYMS AND ABBREVIATIONS

AFDD – Air Force Doctrine Document

AIP – Acquisition Improvement Program

ARPA – Advanced Research Projects Agency (now DARPA)

CAIG – Cost Analysis Improvement Group

CJCS - Chairman of the Joint Chiefs of Staff

CONOPS – Concept of Operations

DAB – Defense Acquisition Board

DAE – Defense Acquisition Executive

DAR – Defense Acquisition Regulations

DARPA – Defense Advanced Research Projects Agency

DFAR – Defense Federal Acquisition Regulations

DLA – Defense Logistics Agency

DoD -- Department of Defense

DoDD -- Department of Defense Directive

DoDI - Department of Defense Instruction

DPRO – Defense Plant Representative Office

DSARC – Defense System Acquisition Review Council (now DAB)

EMD – Engineering and Manufacturing Development

FM – Field Manual

FSD – Full Scale Development (now EMD)

JCIDS - Joint Capabilities Integration and Development System (JCIDS)

JCS – Joint Chiefs of Staff

JDAM – Joint Direct Attack Munition

MDAP - Major Defense Acquisition Program

MENS – Mission Essential Needs Statement

MNS – Mission Needs Statement

NSC – National Security Council

OMB – Office of Management and Budget

OODA – Observe, Orient, Decide, Act

OSD – Office of the Secretary of Defense

OT&E – Operational Test and Evaluation

P³I – Preplanned Product Improvement

PEO – Program Executive Officer

PM – Program Manager

POM – Program Objective Memorandum

PPBS – Planning, Programming and Budgeting System

R&D – Research and Development

SAE – Service Acquisition Executive

SAF/AQ – Assistant Secretary of the Air Force for Acquisition

SecDef – Secretary of Defense

USD (A) – Under Secretary of Defense (Acquisition)

USD (AT&L) – Under Secretary for Defense Acquisition, Technology and Logistics

USDR&E – Under Secretary of Defense (Research and Engineering)

APPENDIX B

EXPANDED PRINCIPLES OF WAR

Objective Objective is directing military operations toward a defined and attainable end state that contributes to strategic, operational, and tactical aims. The purpose of the objective is to achieve a unity of effort, with clear and complementary subordinate goals even in the absence of a united command.

Unity of Command Unity of command means that all forces operate under a single commander with the requisite authority to direct all forces employed in pursuit of a common purpose. The purpose of unity of command is to ensure unity of effort under one responsible commander for every objective.

Offense Offensive is to act rather than react and to dictate the time, place, purpose, scope, intensity, and pace of operations. The purpose of an offensive action is to seize, retain, and exploit the initiative.

Mass Orchestrating all the elements of combat power where they will have decisive effect on an enemy force in a short period of time is to achieve mass. The purpose of mass is to concentrate the effects of combat power at the place and time to achieve decisive results.

Maneuver Maneuver is the movement of forces in relation to the enemy to secure or retain positional advantage, usually in order to deliver — or threaten delivery of — the direct and indirect fires of the maneuvering force.

Economy of Force Economy of force is the judicious employment and distribution of forces. The purpose of economy of force is to allocate minimum essential combat power to secondary efforts.

Security Security consists of actions taken to protect friendly forces -- reducing vulnerability to hostile acts, influence, or surprise. The purpose of security is to never permit the enemy to acquire unexpected advantage.

Surprise Surprise is to strike the enemy at a time or place or in a manner for which it cannot prepare. The purpose of surprise is to help the commander shift the balance of combat power and thus achieve success well out of proportion to the effort expended.

Simplicity Simplicity is ensuring that guidance, plans, and orders are as simple and direct as the objective will allow. The purpose of simplicity is to allow subordinate commanders the freedom to operate creatively within their battle-space, and to allow better understanding and troop leading at all echelons -- permitting branches and sequels to be more easily understood and executed.

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