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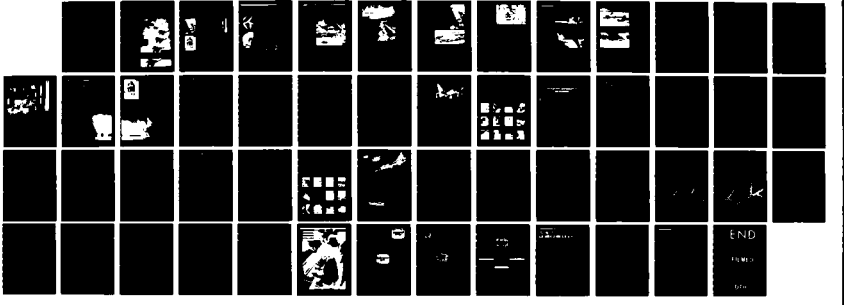
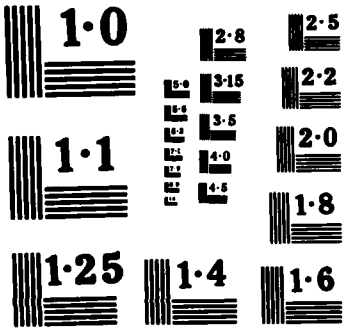




NATIONAL BUREAU OF STANDARDS
MICROCOPY RESOLUTION TEST CHART

July-August 1985

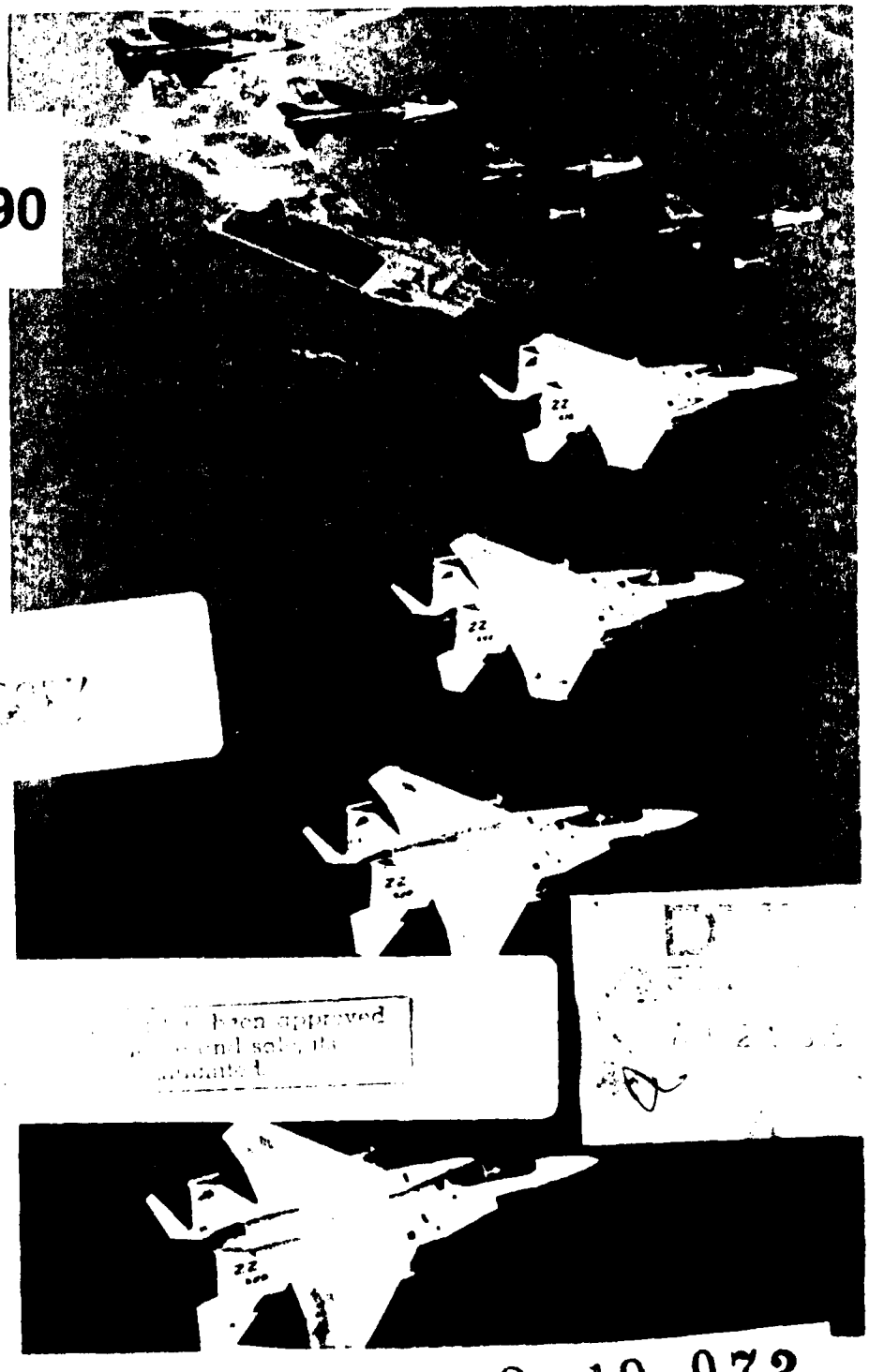
Defense Management

The Journal of the Defense Systems Management College

Soviet Copycat Technocrats

National Security Strategy

Thinking and Acting Revolutionary

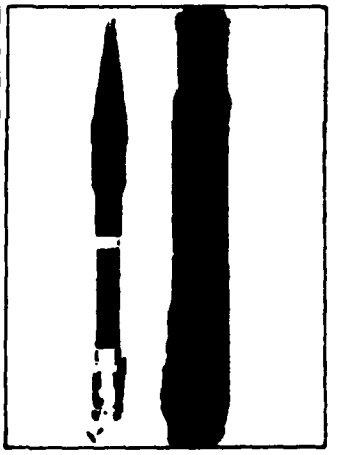


Status Report on Acquisition Streamlining

Vol. XIV, No. 4 DSMC 67
July-August 1985

Focusing on America's national security strategy and policies, particularly those affecting East-West relations.

How the massive, well-planned and coordinated Soviet program to acquire Western technology poses a growing threat.

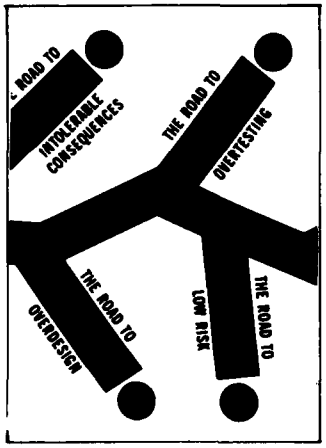


Thinking and acting "revolutionary" is as applicable to the management process as it is to the development of advanced technologies.

A status report.

Cover: F-15s from the 18th Tactical Fighter Wing, Kadena Air Base, Japan, and F-16s from Kunsan Air Base, Korea fly in formation off the coast of South Korea, during Team Spirit 85.

Photo by: MSgt Mike Harrington



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Our National Security Strategy

So closely linked to what we expect from others.

Caspar W. Weinberger
Secretary of Defense

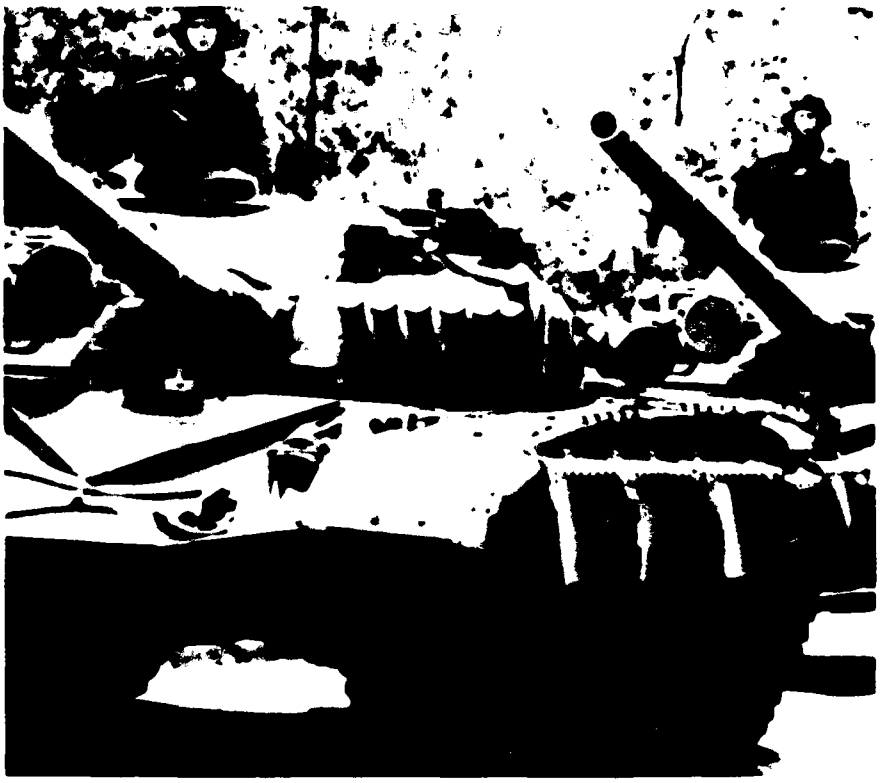
My purpose is to suggest some correct perceptions on issues of great importance to all of us—to all your nations—indeed to the entire family of nations. My focus is America's national security strategy and policies, particularly those affecting East-West relations.

America's Aim

America's overall national security aim, very simply, is to safeguard the United States and our allies, friends and interests from aggression and coercion. We seek to preserve and strengthen the democratic community of nations and promote stability, peace and international cooperation.

The goals of peace, freedom and prosperity are shared by most of the nations of the Free World. Today the most serious challenge to those common goals remains the aims and ambitions of the Soviet Union and the military power that gives them force. People whose business is the news naturally enjoy speculating about how dramatically America's relationship with the Soviet Union may be changing at any given time. They like to chart its temperature on a daily basis and pronounce chills or thaws, new eras of cold war or detente. It is wiser, I believe, to look away from today's headlines to discover underlying threads and enduring dilemmas.

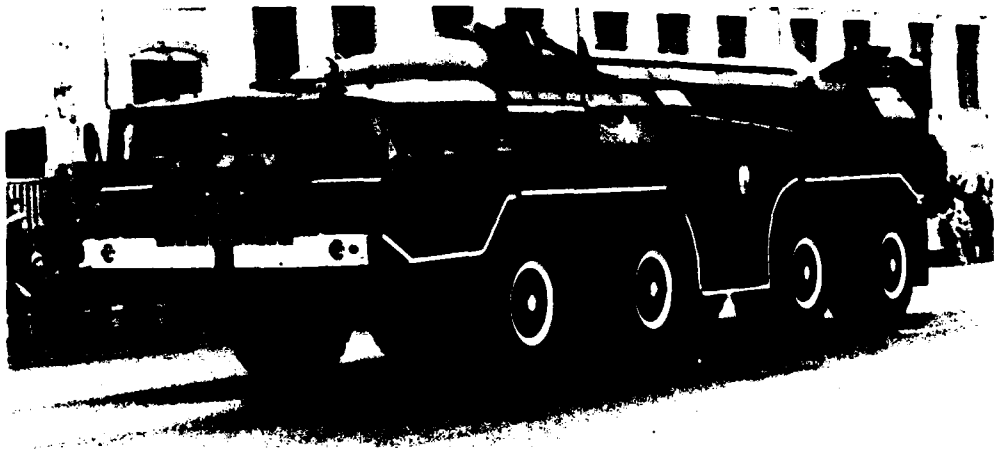
As you look, I think you will see that the most important elements of U.S. relations with the Soviet Union have been constant or have changed only very slowly in the postwar years. Soviet repression has become more sophisticated, but life has not, as Stalin once promised, become "better and gayer" for the people of the Soviet Union. The ambition of Soviet leaders to extend the sway of Marxism-Leninism, if lacking in true ideological fervor, nevertheless, is supported today by tremendous military power. The people of Czechoslovakia, Angola, Cambodia, Afghanistan and Poland can bear eloquent witness to the Soviets' willingness to use force, directly, or indirectly through proxies, and use it mercilessly.



The fifty tank divisions of the U.S.S.R. ground forces include growing numbers of modern battle tanks such as the T-72 seen here.

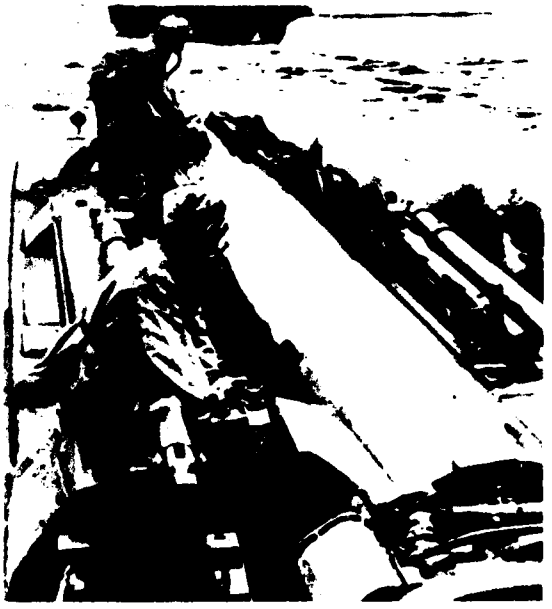
President Reagan has not shrunk from stating the truth about these harsh realities of Soviet behavior. At the same time, he actively has sought new opportunities for negotiation and cooperation and laid the groundwork for a realistic, long-term, peaceful relationship with the Soviet Union. He has demonstrated that we can be businesslike without being morally blind, vigilant without being belligerent, and that we can negotiate without surrendering our principles or our interests.

Above all, President Reagan has refused to shut his eyes to the fruits of an ambitious and sustained Soviet program of military investment. Coupled with U.S. restraint during the 1970s, this expanding military power enabled Moscow to shift critical components of the overall global military balance in its favor.



SCUD-1B nuclear brigades are deployed with armies in all theaters

While building on their superiority in numbers, the Soviets also are improving dramatically the quality of their military systems and closing the West technological edge. They continue to test and field new and more accurate missiles and to improve all their stategic nuclear forces. And since the mid '70s the Soviets have widened their conventional advantage in nearly every force category by producing major weapons at rates much greater than those of the United States and its NATO allies combined.



In field-training exercises, chemical troops practice chemical biological decontamination of SCUD launchers

To exert its military power around the world, the Soviet Union also is expanding the geographic reach of its forces. We have seen substantial growth in Soviet airlift, the emergence of a strong blue-water navy, the development of overseas bases, and the opportunistic expansion of Soviet presence and influence worldwide. Today the Soviets have bases and ports near or astride the world's major trade routes and strategic energy resources, threatening U.S. interests and, indeed, those of our friends and allies.

Further complicating America's security challenge is the increased political turmoil and the rise in international terrorism in may regions of the world. The Soviets have demonstrated their ability and willingness to exploit that turmoil when it advances their goals.

Strategy of Deterrence

While the Soviets maintain an offensive-oriented strategy, the United States has a defensive strategy that reflects its basic values as a nation. We seek to reduce the causes of conflict—political, economic, social—before they lead to armed combat. America does not seek territorial gains by the use of military power; we maintain our forces in a reactive posture. We will use our defensive military forces only in response to clear threats to our security and interests. And when those threats can come from many quarters, as is the case with the Soviets' widely despersed forces and strength, our defensive must be strong and capable of responding. Only if we have this strength and are prepared to use it will we be able to deter attack from a worldwide military power as strong as the Soviet Union.

The keystone of America's military strategy since World War II has been deterrence. Deterrence provides security by convincing potential adversaries that the risks and costs of aggression will far exceed any conceivable gains. The United States seeks credible deterrence through our military strength, political resolve and diplomacy. But if deterrence fails—if an adversary is foolish enough to hazard aggression—we must be, and indeed we are, ready and able to defend ourselves and stand shoulder to shoulder with our allies.

Alliances and collective security arrangements are key elements of America's strategy. The United States cannot protect its world-wide interests alone. Our alliance partners are, from our perspective, our first line of defense. Unlike the Soviet Union, the United States does not seek to dominate its allies. Rather, our alliances are partnerships based on mutual respect and common interests.

The Reagan administration is determined to keep America's alliances strong. Furthermore, we will continue

These remarks were delivered to the Ambassador's Roundtable, Washington, D.C., earlier this year.

to encourage all partners to shoulder a fair share of the security burden and adhere to the obligations assumed under our partnership agreements.

Arms Negotiations

America's strategy of deterrence through strength and robust alliances is supported by our quest for meaningful international arms agreements. America always has depended on the strength of its ideals —not the use of force— to spread its vision of a better world. In this spirit, the United States has, since the dawn of the nuclear age, sought to establish effective controls on these awesome weapons. Unfortunately, our quest for all humanity has yet to succeed. More than a decade of SALT negotiations neither achieved genuine reductions nor prevented the unprecedented Soviet weapons buildup that continues to this day. Moreover, the Soviets have violated major arms control obligations and political commitments. But because genuine—militarily significant, equitable and verifiable—arms reduction agreements can increase our security and the security of the entire world, the Reagan administration remains fully committed to pursuing this avenue for peace and stability.

In the long and difficult period of negotiations ahead, America and its allies must understand just how futile it is to bargain with the Soviets from a position of weakness. Moreover, we must never give in to the temptation of believing that the process of negotiation itself is more important than the results we seek. We must remember that arms negotiations and maintaining military strength must serve the same end—that is to ensure security. Another way to phrase it is that it is not just an agreement we seek for the sake of saying we have an agreement. It is the content of the agreement that is vital.

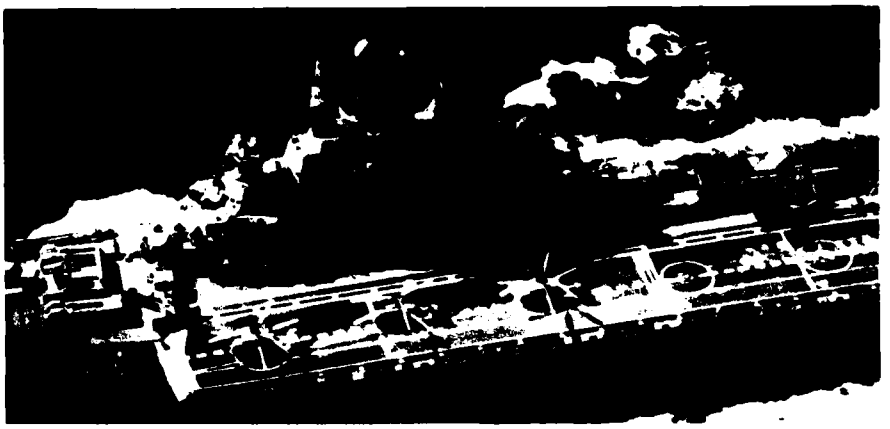
In these arms negotiations, we cannot ignore Soviet aims and ambitions—and their fears. I always have argued that to achieve genuine arms reductions we must look more realistically at the imperatives of the Soviet leaders and more honestly at the profound differences between their system and our own.

They say in the Soviet Union that only one thing is certain, and that is the future...it's the past that keeps changing. In America and among our allies, we do not rewrite history. But neither, I'm afraid, do we always learn from it. And whenever I hear calls for unilateral American concessions to encourage the Soviets to reach an agreement, I wonder if we really have learned anything at all from a decade and a half of arms negotiations and East-West relations.

During the '70s we hoped we could lure Soviet leaders into cooperation and arms agreements by offering them various trade credits that would help secure prosperity for their own people. During that decade Soviet hard-currency imports from the West increased ninefold. But the plight of the Soviet consumer did not improve; it was the Soviet military that prospered.

Kara Class

Kiev Class



During the same period, the United States also restricted improvements in its own nuclear forces and dramatically reduced the numbers and explosive power of its nuclear arsenal. We hoped the Soviets would imitate our restraint. They did not. Instead, they actually stepped up their strategic modernization program.

A fallacy underlay the entire U.S. approach to the Soviet Union during the 1970s, when we allowed our strength to decline and our will to falter. It was the fallacy that the imperatives of democracy are also the imperatives of a totalitarian state—that we could negotiate with the Soviets as if we were negotiating with ourselves.

Strategic Defense Initiative

Two years ago President Reagan gave America's national security strategy a bold new vision—a Strategic Defense Initiative, or SDI, aimed at developing technical options for effective defenses against nuclear ballistic missiles. As you know, I recently came back from Europe where I discussed SDI with America's allies. What I found was that with increased discussion and understanding has come increased support.

I believe that a thoroughly reliable strategic defense is achievable through man's genius and skill and will to survive. Remember, no one honestly can say now that it cannot be done until a sustained research effort is undertaken. The SDI quest is perhaps the most moral goal we can pursue. This

would be a system designed to destroy weapons, not people—a system to protect people, not to avenge them. Of course, we cannot give up our deterrent, retaliatory strength while we actively pursue this vision.

Should new defensive technologies prove feasible, we would have before us an opportunity, almost unmatched in history, to free the world of its bondage to a "balance of terror" to keep the peace. Offensive-based deterrence has enabled us to keep the peace, and we will continue to rely on it unless and until we can deploy the new systems that we hope can give us a thoroughly reliable defense against Soviet intercontinental and intermediate-range missiles.

For now, we are doing the necessary research. But those who are so desperately seeking to block even any thought of substituting defensive systems for offensive weapons always cite our statements about the present research effort as evidence that we really don't mean to deploy. They also continue to demonstrate their ignorance of what the president is trying to pursue by saying that the defensive system we envision is intended only to protect missile silos.

Let me try once more: We want to develop, through the research we are now doing, and then to deploy if the research justifies it , a system that will destroy by non-nuclear means all of the long- and middle-range Soviet missiles that get into the atmosphere—and destroy them before they get near our silos or any other target. Yes, it is a new concept—and we think a better one—and we will work eagerly for it.

Also, I believe that the president's vision of peace through defense can, in the end, appeal more realistically and persuasively to expressed Soviet worries than any approach based on mutual vulnerability. At least we know that they are working intensively on defensive technologies, and we never again could rest easily if they achieved a defensive system first.

It is true the Soviets already have cooperated with us to reduce the risk of nuclear war. We have agreed to upgrade the hot line. We are in essential agreement on non-proliferation policy. We both exercise great caution about nuclear arms in many important ways. It should not be impossible to work with the Soviets to create a new arrangement that offers far more safety to both our societies and to our allies.

Shown at the February 1945 Yalta Conference are English Prime Minister Winston Churchill, U.S. President Franklin D. Roosevelt and Soviet Premier Joseph Stalin.

East-West Relations

As we think about U.S. strategy and the future of East-West relations, we should be mindful that there are multiple dimensions of a nation's power: its values and ideas, its economy, its culture, its policy. A proper appreciation of the moral and practical limits to the use of military force implies an appreciation of the relatively greater importance of these other dimensions of power. By restoring American military strength and confidence, President Reagan has led the United States from self-doubt to self-respect. Standing tall, the United States does not and will not apologize for its values and ideals. We reject the fashionable tendency always to blame the United States first; we reject any penchant for self-flagellation. We do not feel guilty—nor do we feel that we can be moral only if we continually acknowledge the non-existent guilt.

We are confident that the future belongs to the democracies of this world, to the market economies, to those who believe in freedom, self-determination and individual rights. Our adversary is able to compete in only one dimension—the military dimension—and that alone by dint of a truly gargantuan effort that consumes more than 15 percent of the Soviet gross national product. The Reagan administration is determined to demonstrate the capacity and the will not to allow the Soviets to gain a clear-cut advantage in the military dimension or to exploit their concentration on amassing military power.

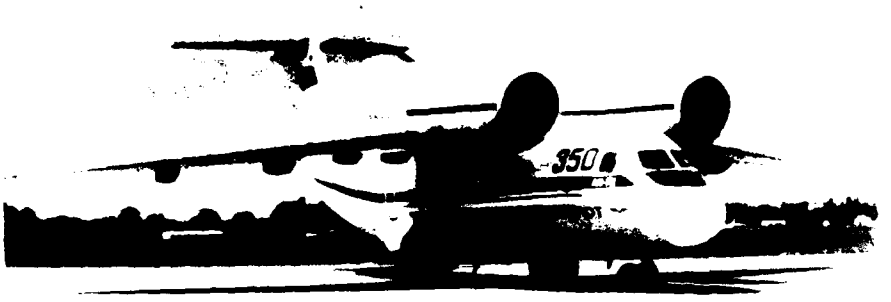
Our aim is to demonstrate to the Soviet Union that they will not be permitted to win by military intimidation what they cannot earn through the productivity of their economy or the merit of their ideas. In this way, we hope to convince the Soviets of the futility of their quest for a decisive military superiority. Fundamental differences in views will remain. But the peaceful competition of ideas and ideals between East and West is a contest from which we will not shrink—and indeed, we believe this peaceful competition is one from which all mankind can gain.

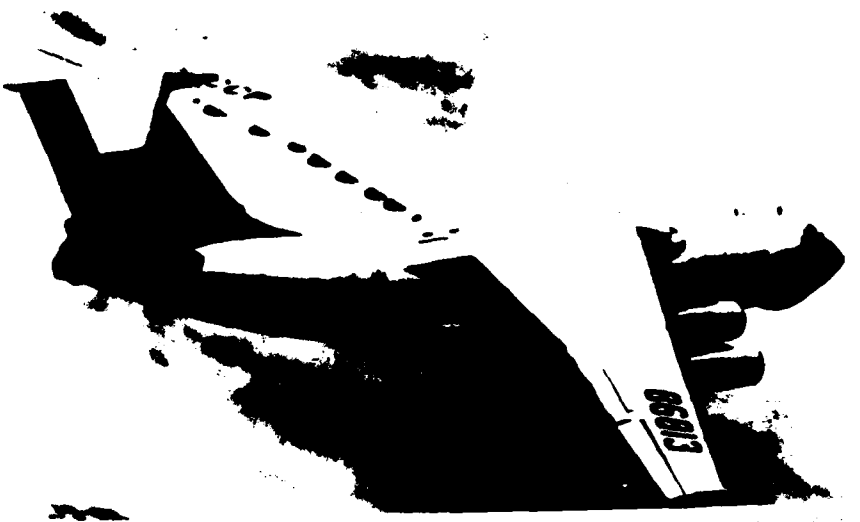
The key element of U.S. strategy remains the ideas that the West cannot be content with the *status quo*. We want to encourage the forces of democracy wherever they exist. And for one very important continent of the world, that means that Yalta (site of the February 1945 conference of U.S. President Franklin D. Roosevelt, English Prime Minister Winston Churchill and Soviet Premier Joseph Stalin)

(See Security, page 31)

The Soviet Copycat Technocrats

Some inventions of the Soviets look amazingly similar to our own. Here's how they do it—saving time, money, and brainpower—at our expense.





The COALER transport aircraft is a copy of the Boeing YC-14.

This CANDID transport aircraft bears a close likeness to the U.S. Air Force Lockheed C-141 transport.

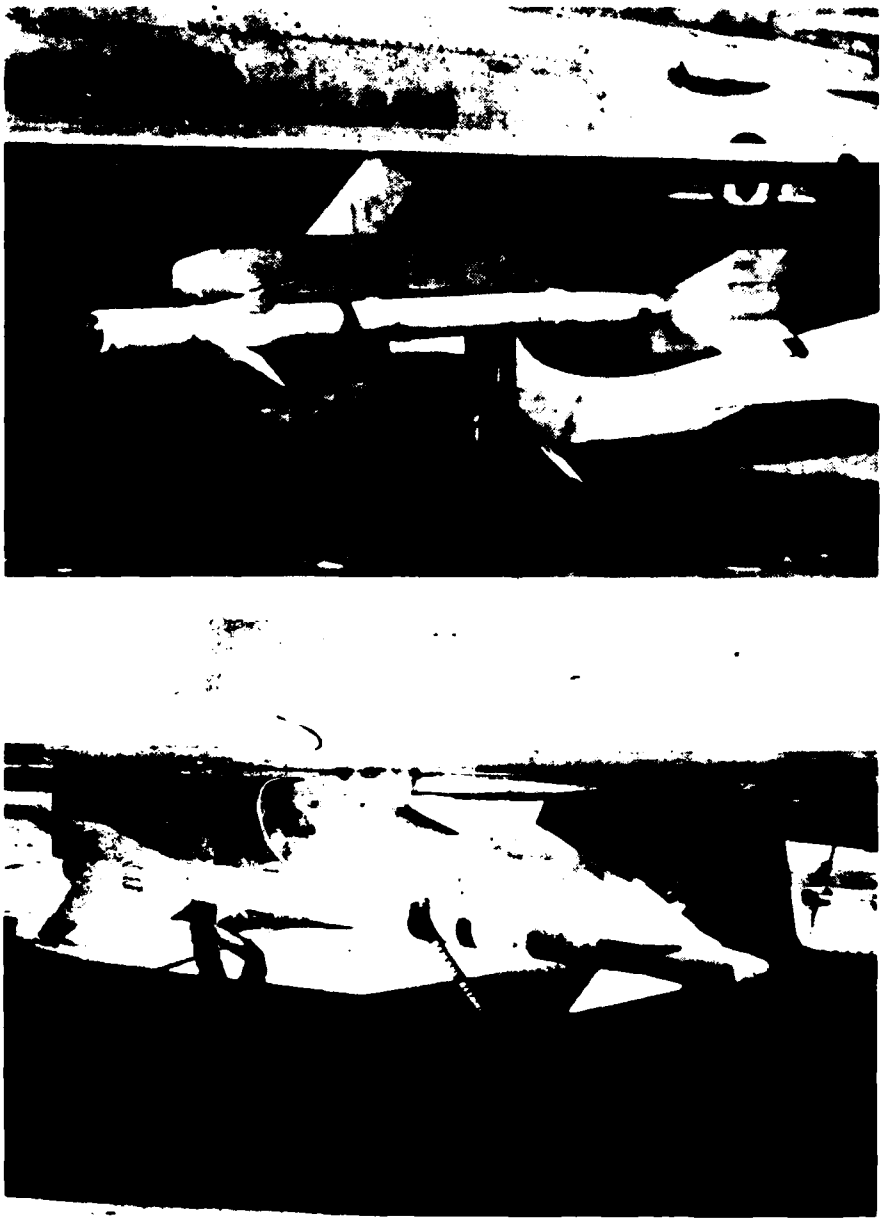
Major Edith B. Buffalo, USAF
Thomas C. Rogers

Technology transfer connotes a wide range of scientific and technical, economic and industrial, and trade and communications undertakings in which advanced and/or critical technologies are transferred from Western nations to nations less technologically advanced. Policymakers within Western nations have expressed increased concern over the issue of technology transfer particularly due to the flow and loss of critical technologies essential to the research, development, manufacture, and development of modern, high-quality weapons and military equipment. Perhaps the greatest concern over this issue stems from the Soviet Union's ability to capitalize on this undertaking with end results of military power enchancement and military manufacturing technology improvement.

The transfer of technology by the Soviet Union from Western nations is not a new endeavor. Instead, the Soviet Union has traditionally devoted vast amounts of its resources — both manpower and financial — to this effort. The result is a massive, well-coordinated, national-level program that is approved at the highest party and governmental levels. In this paper, we intend to describe this program by covering the bureaucratic structure that administers it, acquisition mechanisms employed for effective implementation, and overall gains within the Soviet Union as a result of this program.

Organizations Involved in Acquisition of Foreign Technology

The capability of the Soviet Union to acquire Western technology is aided by the Soviet's well-defined organizational responsibilities. This capability is further enhanced by the centralized and coordinated effort that goes into the acquisition of selected technologies, equipment, and entire plants to fill deficiencies and gaps for short-term and long-term needs. The functional organization chart for technology trade, as shown in Figure



The Soviet ATOLL missile looks like the U.S. Air Force Navy Sidewinder, an air-to-air, solid-fueled missile.

1, depicts the organizations involved, to one degree or another, in managing and supporting technology transfer. The four groups of organizations shown suggest the variety of interests involved in the acquisition of foreign technology and the complexity of the technology transfer process itself.

All levels of Soviet administration may provide inputs in the process of foreign technology acquisition. Although the Communist Party does not have a formal governmental role in the formulation and administration of foreign trade policy, its de facto authority is extensive. The Politburo (Political Bureau) of the Central Committee undoubtedly deliberates technology transfer matters and issues relevant policy directives. These directives are then reflected in decrees issued by the Council of Ministers.

The Council of Ministers is the highest level of economic/industrial management in the Soviet Union. As such, it implements official policies of the Soviet state, to include policies on technology transfer. The council comprises top-level administrators; e.g., chairmen of state committees, and other state agencies. Their functions are largely to administer day-to-day operations of the economy and to develop integrated plans for the development of the economy.

The second group of organizations in Figure 1 consists of state committees and various state agencies. Their role in technology transfer is the management of policies as set forth by their superior, the Council of Ministers, and the union republics. The principal function of the State Committee for Science and Technology (GKNT) is to act as the national-level, centralized planner, coordinator, and monitor of a unified, national Research and Development (R&D) program. The GKNT is, thus, the chief advisor to the central government on national technological policy. This function consists of developing strategies to acquire Western technology and to integrate it with domestic R&D capabilities. In concert with the Soviet's State Committee for Material and Technical Supply and the State Committee for Planning, the GKNT is directly responsible for the legal acquisition of scientific equipment and instrumentation from foreign countries. It is the responsible organization in the Soviet technology transfer program having cognizance over the prioritization and approval of specific industrial foreign equipment requests.

The military Industrial Commission (VPK) probably holds primary responsibility in the State structure for the coordination of all activities in the area of armaments production. Consequently, it probably participates in decision-making on technology purchases from foreign countries.

Table I shows the remaining organizations in the second group of Figure I and their technology transfer responsibilities. These responsibilities encompass such services as planning, finance, and supply activities necessary for technology transfer.

The operational agencies (Group III of Figure 1) are directly involved in the conduct of foreign trade. However, they appear to have limited decision-making authority with regard to what

Figure 1. Functional Arrangement of Key Organizations in Soviet Technology Transfer Program

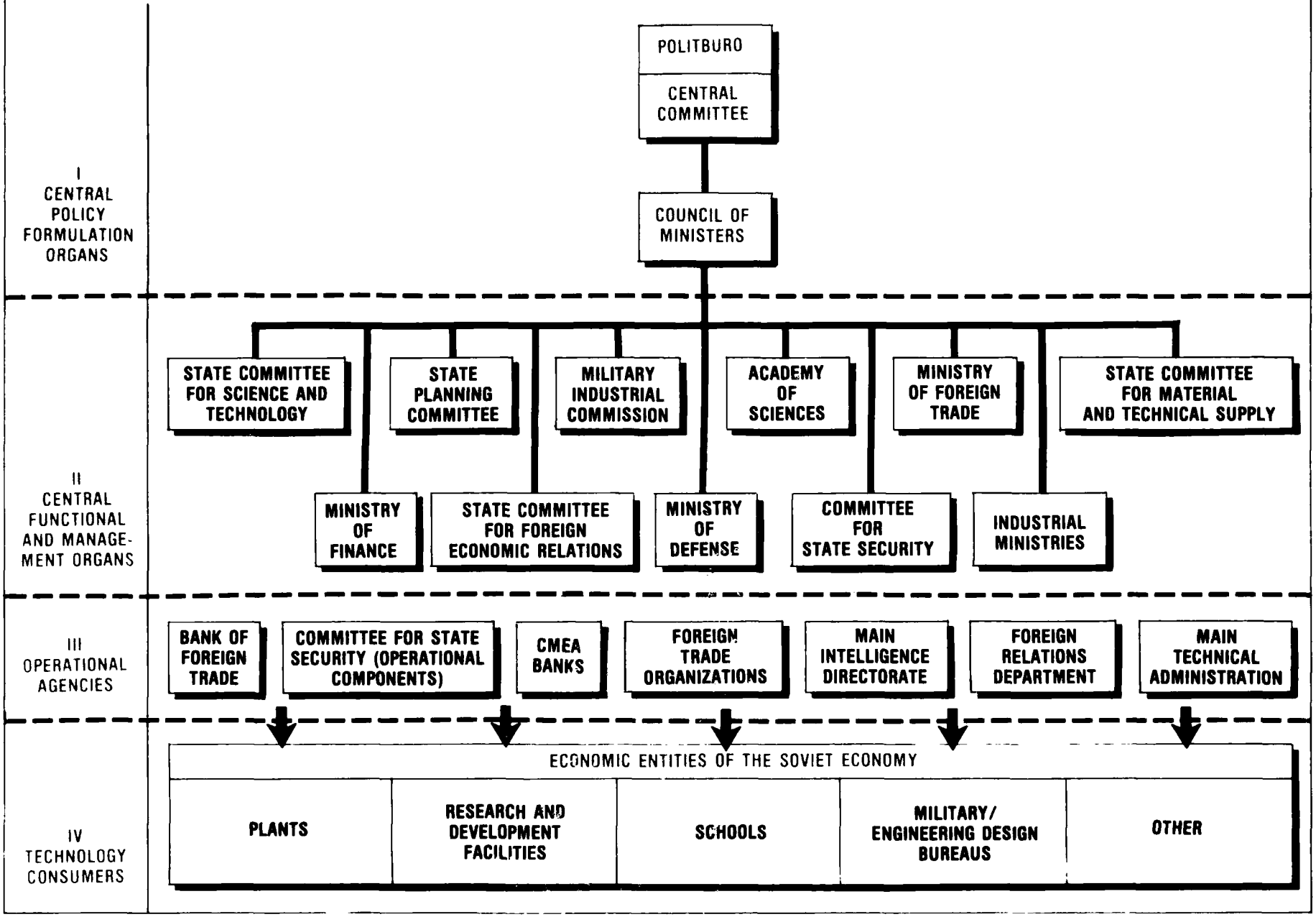


Table I. Central Functional and Management Organizations Involved in Soviet Technology Transfer

ORGANIZATION	FUNCTIONS/RESPONSIBILITIES
State Planning Committee (Gosplan)	Central Government's chief agency for conducting the work of general economic planning; plans imports; integrates foreign trade into national economic plans; plans R&D and innovation; allocates foreign exchange.
Academy of Sciences (An SSSR)	Highest scientific establishment in Soviet Union; monitors scientific developments in the West; plays active role in scientific exchanges and joint research project; operates all non-military research institutes, laboratories, experimental stations, observatories, libraries and museums; obliged to submit proposals to GKNT concerning applied R&D leading to innovation.
Ministry of Foreign Trade (MFT)	Coordinates the mechanisms of all Soviet foreign trade; Soviet legal agent in acquiring foreign goods upon conclusion of technical negotiations; implements the trade plan established by Gosplan — with GKNT approval in the case of technology trade; encompasses dozens of import-export foreign trade associations organized according to product category (e.g., Aviaeksport with function of aviation equipment).
State Committee for Foreign Economic Relations (GKES)	Coordinates the work of various ministries in strengthening the Soviet economic cooperation with foreign countries; determines Soviet policy with respect to technological aid projects.
Ministry of Finance (Minfin)	Probably handles Soviet's holdings of foreign currency; involved in policy discussions related to hard-currency indebtedness and balance of payments; may have considerable influence in setting upper limits on Soviet hard-currency trade.
State Committee for Material and Technical Supply (Gossnab)	May be responsible for the transport of import goods from their points of arrival to their destinations, their storage prior to construction, and record keeping on the status of imported equipment.
Ministry of Defense (MO)	Has technical administrations assigned which are centers of technical policy; technical administrations assigned probably coordinating agencies for import requests within the Ministry.
Committee for State Security (KGB)	Has primary responsibility for collecting Western classified, export controlled, and proprietary technology, using clandestine and overt collection methods.
Industrial Ministries	Have technical administrations assigned which are centers of technical policy; technical administrations probably coordinating agencies for import requests within the ministries; maintain foreign relations departments which probably act as the focus for foreign trade implementation within the ministries; some have foreign trade organizations.

* Does not include the State Committee for Science and Technology (GKNT) and the Military Industrial Commission (VPK).

Table II. Technology Transfer Mechanisms Used by the Soviets

- Hostile intelligence service acquisitions
- Recruited agents and industrial espionage
- Illegal arms trade
- Illegal trade in other commodities
- End-user diversions
- Third country diversions
- Communications intelligence acquisitions
- Technical data and engineering documents
- Industrial cooperation agreements
  - Multinational cooperations
  - Complete (turnkey) plant sales
  - Coproduction and specialization
  - Licensing
  - Joint ventures/joint tender ing/joint projects
- Patents
- Technical exchanges with ongoing contact
- "Know-how" — training, consulting in high-technology areas
- Legal purchases (sales of products)
- Government and industrial equipment sales
- Proposals, presale negotiations, and sales presentations
- Processing equipment (with "know-how")
- Educational exchanges
- S&T organizations, conferences, trade shows, commercial visits, and exhibits
- Data Bases
- Capture in War

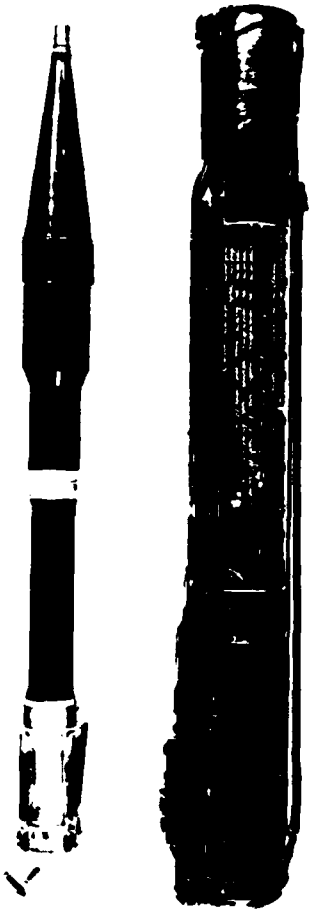
Table III. Selected Soviet and East European Legal and Illegal Acquisitions From the West Affecting Key Areas of Soviet Military Technology

Key Technology Area	Notable Success
Computers	**Purchases and acquisitions of complete system designs, concepts, hardware and software, including a wide variety of Western general purpose computers and minicomputers, with military application.**
Microelectronics	**Industrial processes and semiconductor manufacturing equipment capable of meeting Soviet military requirements, if acquisitions were combined.**
Signal Processing	**Acquisitions of processing equipment and know-how.**
Manufacturing	**Acquisitions of automated and precision manufacturing equipment for electronics, materials, and optical and future laser weapons technology; acquisition of information on manufacturing technology related to weapons, ammunition, and aircraft parts including turbine blades, computers, and electronic components; acquisition of machine tools for cutting large gears for ship propulsion systems.**
Communications	**Acquisitions of low-powered, low-noise, high-sensitivity receivers.**
Lasers	**Acquisitions of optical, pulsed power source, and other laser-related components, including special optical mirrors and mirror technology suitable for future laser weapons.**
Guidance and Navigation	**Acquisitions of marine and other navigation receivers, advanced inertial-guidance components, including miniature and laser gyros; acquisitions of missile guidance subsystems; acquisitions of precision machinery for ball-bearing production for missile and other applications; acquisition of missile test range instrumentation systems and documentation and precision cinetheodolites for collecting data critical to post-flight ballistic missile analysis.**
Structural Materials	**Purchases and acquisitions of Western titanium alloys, welding equipment, and furnaces for producing titanium plate of large size applicable to submarine construction.**
Propulsion	**Missile technology; some ground propulsion technology (diesels, turbines, and rotaries); purchases and acquisitions of advanced jet engine fabrication technology and jet engine design information.**
Acoustical Sensors	**Acquisitions of underwater navigation and direction-finding equipment.**
Electro-optical Sensors	**Acquisition of information on satellite technology, laser rangefinders, and underwater low-light-level television cameras and systems for remote operation.**
Radars	**Acquisitions and exploitations of air defense radars and antenna designs for missile systems.**

is to be imported. The Bank of Foreign Trade performs functions such as the crediting of foreign trade, foreign exchange operations, and commodity trade settlements. Operational responsibilities of the banks of the Council for Mutual Economic Assistance (CMEA) consist of performing bookkeeping operations arising from trade carried out by its members, assisting in the funding of CMEA joint projects, and the promotion of interregional trade among the CMEA nations. The CMEA was established in 1949 and consists of Bulgaria, Cuba, Czechoslavakia, East Germany, Hungary, Mongolia, Poland, Romania, the Soviet Union, and Vietnam. The CMEA's goal is to promote economic cooperation and trade between the Soviet Union and the Communist Bloc as a counterbalance to the economic attraction of the West.

Activities of the Soviet foreign trade organizations, or enterprises, which are closely coordinated by the Ministry of Foreign Trade, have major responsibilities for both legal and illegal acquisitions and purchases. These organizations often work closely with the operational components of the Soviet intelligence services — Committee for State Security (KGB) and the Main Intelligence Directorate (GRU) of the Soviet General Staff — in arranging trade diversion. In addition, the KGB and GRU, in various undercover operations (e.g., posing as diplomats, jounalists, trade officials), are assigned throughout the world to effect technology transfer. Technical administrations exist within the various industrial ministries. They appear to play a role in technology transfer as centers of technical policy. They also appear to be the coordinating agencies for import requests within the industrial ministries.

The Soviet RYAD ES 1020 computer clearly resembles the IBM



The Soviet KPG-1 antitank rocket bears a striking resemblance to the U.S. LAW rocket launcher.

The technology consumers (Figure 1, Group IV) consist of economic entities of the Soviet economy such as plants, engineering/military design bureaus, research, development, test and evaluation facilities, schools, and farms. In many cases, these consumers are also the originators of technology acquisition requirements.

Mechanisms

The Soviet Union has carefully designed its national-level program for acquiring technology from the West. To implement this program for technology acquisition, mechanisms must exist to transfer the technology from Western nations to the Soviet Union. Table II shows many of the mechanisms employed by the Soviet Union that further demonstrate the extent and depth of its commitment for successful accomplishment of Soviet objectives. These mechanisms can further be divided into legal (e.g., through open literature, legal trade channels, scientific and technical exchanges and conferences), and illegal means (e.g., through channels that evade Western export control means).

Soviet military designers carefully choose the Western design, engineering approaches, and equipment most appropriate to their deficiencies and needs. Table III lists classes of Western technology acquired by the Soviets and illustrates the wide range of Soviet military-technology needs. To accomplish these requirements, as well as those of the civilian sector, a large volume of technology is acquired by personnel not directly involved with intelligence matters. However, in the past, the majority of what is considered militarily significant technology has been the target of the Soviet intelligence services (KGB and GRU). These Soviet services often receive assistance from the intelligence services of their East European allies who are compensated for their efforts.

Of primary concern to Western nations are the military gains achieved by the Soviets through technology transfer. This concern is reinforced by

(See Technocrats, page 20)

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■ *Mr. Rogers, an aerospace engineer, Foreign Technology Division, Wright-Patterson AFB, Ohio, has, for the last 6 years, been with the Advanced Systems Resources and Management Branch, Directorate of Technology and Threat*

The Revolutionary Application of Old Ideas!

Major Alan C. Ray, USAF

The words, "think revolutionary," stayed with me after that casual conversation—it was the *way* Major General John Toomay (USAF, Ret.) said them that made the impression—almost as if they were a command.

As a Rand Research Fellow, I had an opportunity to think about General Toomay's words. Certainly, revolutionary thinking has been responsible for many major technological achievements in military history and there is no reason to believe it cannot be applied just as effectively to reduce acquisition costs; however, this is not a simple task given the complexities of the modern acquisition environment. I did not design this article to present panaceas where none exist but, rather, to stimulate thinking on how acquisition management might be improved to reduce costs. I drew on the last 30 years of acquisition history, which is full of good and bad examples of acquisition management; I explored a few of the numerous studies to identify cases that illustrate how the revolutionary application of old ideas could have a significant impact on the reduction of acquisition costs. Acquisition costs have received much attention in recent years and, in the next section, I will review recent major cost-reduction studies to set the stage for the important implications of case studies and ideas that follow.

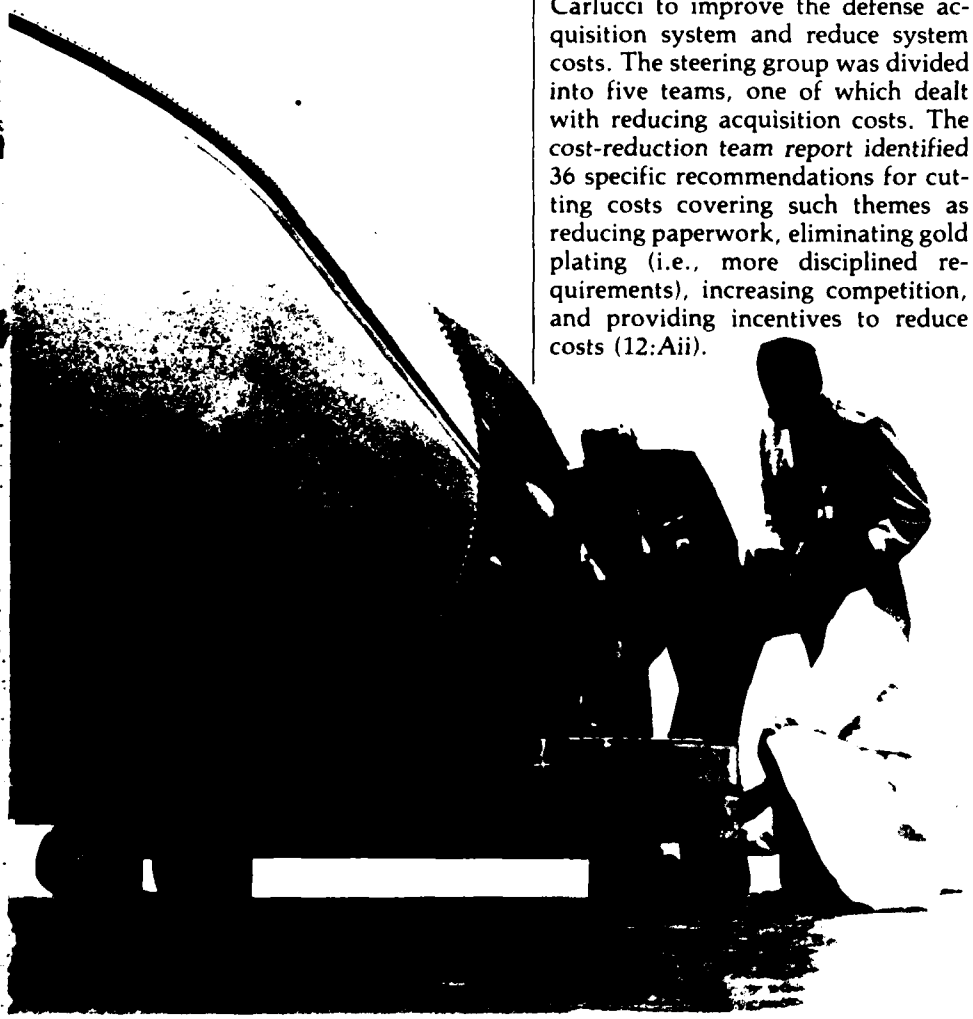
Major Cost Reduction Studies

Three recent and notable cost studies were the Grace Commission (December 1983), the Air Force Systems Command (AFSC) Affordable Acquisition Approach Study (February 1983), and the Carlucci Initiatives (March 1981). The Grace Commission or, more correctly, the President's Private Sector Survey on Post Control, had one specific task force look at government research and development. The task force estimated the 3-year, cost-savings opportunities of its 25 recommendations at $12.1 billion (18:ii). The recommendations focused on overall management issues such as the government budget process, "privatizing" federal research and development activities and federal laboratory management—rather than on specifics of the acquisition process, as did the AFSC study.

The Agena D was more mission adaptable and at least twice as reliable as the Agena B while costing 30-40 percent less.

The AFSC study reviewed the cost and schedule histories of 109 Air Force programs and found there had been a significant increase in unit costs with a corresponding decrease in production rates. Since 1970, the 109 programs had averaged about 5 percent per year cost growth, which led the study to conclude that real cost growth is a pervasive problem that impacts budget formulation and future force structures. The study's recommendations included emphasizing conceptual and demonstration/validation phase activities where early decisions can have major cost impacts; baselining system cost, schedule and performance; and improving program management tools to include continued implementation of the Carlucci Initiatives (2:ES 5-10).

The Carlucci Initiatives is the term given to the 32 recommendations (since reduced and combined to 6) that resulted from a Department of Defense steering group chartered by former Deputy Secretary of Defense Frank Carlucci to improve the defense acquisition system and reduce system costs. The steering group was divided into five teams, one of which dealt with reducing acquisition costs. The cost-reduction team report identified 36 specific recommendations for cutting costs covering such themes as reducing paperwork, eliminating gold plating (i.e., more disciplined requirements), increasing competition, and providing incentives to reduce costs (12:Aii).



Advanced Technology Study

A fourth study that *really* did look at revolutionary ideas, but also had some important cost implications was initiated in May 1983 by General Robert T. Marsh, USAF, Commander of the Systems Command. He formed a task group to explore revolutionary technologies that might have application to future military requirements. The group worked 8 months and published an unclassified, eight-page summary report of their findings and conclusions. The report identified several promising technologies such as amorphous metals, molecular electronics, thermionics, metastable helium, artificial intelligence, and unmanned systems. While all these areas involve pushing state-of-the-art technology, the group asserted "that a combination of advanced technology and predominant emphasis on cost over performance would reduce the cost of tactical weapons by as much as a factor of five (23:5)." This ability to field more systems for the same cost would indeed be revolutionary. Improving manufacturing technology under programs such as the System Command MAN TECH program, removing excessively strict government controls and standards, and providing proper incentives to contractors are actions identified as possible ways to reduce the cost of weapon systems. It is interesting to note these cost-reduction ideas bear a very close resemblance to those of the other cost-reduction studies.

It should be apparent from a brief review of the cost studies and the emphasis on cost in the System Command look at advanced technologies, that weapon-system development and production costs are a continuing concern. The aforementioned studies looked at acquisition history to provide data for analysis and recommendations. Within that history, there are some remarkably successful programs. The themes of reducing paperwork, eliminating gold plating, providing incentives, and improving manufacturing technology expressed in the Carlucci Initiatives and the AFSC studies are clearly il-

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Table 1. The Agena D Development Program

	As Planned	As Done
Cost	$60 million	$32 million
Time	18 months	9 months
Launch vehicles	12	12
Drawings	3,900	350
Engineers (factor)	4	1
Quality control personnel	1,200	69
Product improvement program	Yes	No
Tooling	$2 million	$0.15 million
Drawing release lag	30 days	1 day
Technical progress reporting	"Normal"	"Minimal"
Project office staff in plant	?	4
System Project Office (SPO)	?	15

SOURCE: Perry, Robert, et al., System Acquisition Strategies, R-733-PR/ARPA, The Rand Corporation, Santa Monica, Calif., June 1971, p. 26.

lustrated in the following cases and studies.

Agena D

In early 1961, the Air Force decided it needed to reduce its launch costs and standardize its Agena B launch vehicle. In June, the Space Systems Division authorized Lockheed to begin this work and a proposal was submitted in July. The key parameters of the proposal are shown in the left column of Table 1 with the first flight being scheduled for late January 1963 or 19 months after the program go-ahead. In October, the undersecretary of the air force appointed a special committee headed by Lockheed's vice president for engineering to look at what could be done to accelerate the schedule and reduce the costs. The committee reported that if the Air Force were willing to manage the program differently, the first flight could be accelerated to June 1962 with some cost reductions. The revised procedures, which were basically those used by Lockheed's advanced development projects group (Skunk Works),[1] were approved and written into the contract statement of work. The actual results of this program are shown in the right column of Table 1. Costs and schedule were reduced by approximately a factor of 2. Overall system performance was judged to be significantly better than the Agena B: the Agena D was more mission adaptable and at least twice as reliable as the Agena B while costing 30-40 percent less (17:27).

It would appear that by most standards the Agena D Development Program was a vast success. The cynics might claim that in reality this was but a modification program and therefore did not have the cost risk of many other programs. This argument may have an element of truth in it, but it should not detract from the central point that excessive use of military specifications and standards, management control systems, and complicated procedures all add to the cost of a weapon system. This is certainly no revelation to anyone who has had the opportunity to dissect a major proposal for a weapon system development program. It is also consistent with 1983 contractor comments on using technology and a predominant emphasis on cost over performance as a design criteria. Their response to the Systems Command advanced technology task group was typically, "We have never been seriously asked to put cost first and performance second." Most pointed to excessively strict specs and standards and documentation requirements as major roadblocks to reducing costs (23:5). It is important to note, lest someone mistakenly think this is just another quantity vs. quality argument, that placing performance "second" does not mean performance is not important. It merely recognizes that there is a point where a marginal increase in performance is simply not worth the associated marginal (and often substantial) increase in costs. Obviously, increasing system operational performance is desirable and there are programs such as pre-planned product improvements designed to do just that.

European Experiences

Another study looked at six European programs and compared them with the F-111 program as illustrated in Table 2 (17:29). These comparisons are based on airframe and engine development and exclude the avionics subsystems where, it can be argued, the F-111 is technically more complex. While it is recognized that the technical quality of an aircraft cannot be adequately represented by a single parameter such as maximum speed, the study argues that speed can serve as a base for comparing aircraft in this sample with the F-111.

Of the six European aircraft, three have held world speed marks, one is the only operational V/STOL aircraft in the free world (which presents its own set of technical complexities), one uses a canard design with unique performance characteristics, and the other or its various models have been widely used in combat in the Mideast with considerable success. While there are certainly differences in these aircraft, the study suggests these differences are no more significant than the differences between various USAF aircraft of this period. As a matter of fact, European technology is used in several American aircraft such as the engine and heads-up-display in the A-7, the variable-sweep F-14 wing box, the F-4 ejection seat, and the Harriers used by the Marines (17:28). Thus, the technologies of these programs are considered to be similar for the purposes of this comparison.

Table 2 highlights some very interesting differences in these programs. The manning of the European programs is significantly less than that of the F-111 program. The Viggen, the most heavily manned program, was staffed at less than one-half the level of the F-111 even when adjusted for the obviously longer development schedule. The average total manning of the European programs was 637 people compared to the F-111 average estimated figure of 5,000. When the three high-performance aircraft (Lightning, Mirage III, and Mirage IV) are considered alone, the average drops to 507 people. The program office size delta is even more significant: The F-111 program office was 10 times the size of

Table 2. AIRCRAFT DEVELOPMENT EXPERIENCE

(West European and U.S.)

	Harrier (Kestrel)	Jaguar (B.A.C.)	Viggen	Lightning (P-1B)	Mirage IIIA	Mirage IV	F-111A
Performance (Mach)	.9 (VTO)	1.6	1.8	2.2	2.2	2.2	2.3
Manning:							
Engineering staff	160 to 330	320	650	400	50	70	4,000 to 6,000
Experimental shop	350+	300	350	300	300	400	
Total	680	620	1000	700	350	470	Total
Program office (Government)	24	35	20	20	10	12	220
Months from design start to:							
First flight	22	54	43	34	16	17	25
First production item delivered	48	64	96[a]	45	38	54	58
Number of test vehicles	13	6	6	5	3	4	23
Development cost factor	1.0	1.1	1.3	1.4	1.0	1.1	1.8

SOURCE: Perry, Robert, et al., System Acquisition Strategies, R-733-PR/ARPA, The Rand Corporation, Santa Monica, Calif., June 1971, p. 29.
[a]Includes 24-month schedule stretchout to reconcile a changed threat estimate with altered budget constraints.

its average European counterpart and over 15 times the size of the average of the three, high-performance aircraft program offices. Four of the six European programs had schedules that were shorter than the F-111 schedule, and the fifth program (Jaguar) was only 6 months slower in delivering its first production item.[3] The United States Air Force used anywhere from 1.7 to over 7 times the number of test assets in the F-111 program. In getting to the bottom line, the F-111 program development costs (Table 2, bottom line) ranged from 22 percent to 80 percent higher than the European programs with the average being 48 percent higher.

The study attributes these marked differences to a few major factors. One factor was the financial constraints that European aircraft developers faced. This resulted in fewer available engineers and resources, which automatically kept the personnel costs down while tending to keep the design simple and reducing the non-essential engineering design changes. Progress reporting for Dassault to the government was on an irregular basis and was done by letter; for the Harrier, there was one, monthly summary about a quarter of an inch thick that summarized the entire program status.

Another benefit of the financial constraints was a willingness to tradeoff demanding performance requirements for cost considerations that appear to have been done without appreciably reducing the performance of these aircraft. A second factor was a sequential development process that ensured the design was complete and had been validated by a prototype or reasonable engineering hardware before large commitments were made to a production program. This approach was also applied to the use of subsystems such as the engines and avionics. In the case of Dassault, risk was minimized by incorporating only one or two new, major technological advances at a time and relying on proven subsystems to ensure aircraft reliability and performance (16:7). A third factor was summarized by saying: "those aspects of Dassault achievement that represent transferable practices and procedures are chiefly government organization, definition of requirements and system specification, and program control (16:33)." While this example has not delved into the subtleties of such a comparison between the European and American acquisition environments, it does serve to highlight that there are other ways of doing business, some of which may be more cost-effective.

The study citing the European and Agena D Experiences concluded by saying "High system cost and cost growth appear to arise primarily from efforts to subdue difficult technology on highly compressed schedules and an apparent willingness to pay whatever is required to insure satisfaction of original (or even expanded) system performance goals (17:39)." The study proposed two alternative acquisition strategies as possible solutions to this problem: 1) considerable austerity in the early phases of the program, and 2) an incremental strategy involving a sequence of decision points. The first

Table 3: SUMMARY OF DATA ON LICENSED PRODUCTION

Licensor	Licensee	Aircraft	Date of License	Aircraft Unit Flyaway Cost[a] ($ millions) In FY 74 Dollars	Aircraft Unit Flyaway Cost[a] ($ millions) In Then-Year Dollars[b]	Aircraft Empty Weight (1000 lb)	Production of This Aircraft by Licensor Prior to This License All Models
Lockhead	South Group	F-104G	3/59	1.90	1.42	14.1	300
Lockheed	West Group	F-104G	6/60	1.90	1.41	14.1	300
Lockheed	Italian Group	F-104G	3/61	1.90	1.41	14.1	300
Sikorsky	Mitsubishi	S-61	10/60	1.23	0.92	11.3	24
Sikorsky	Agusta	S-61	4/66	1.23	1.00	11.3	~300
Sikorsky	Westland	S-61	5/66	1.23	0.98	11.3	~300
Bell	Agusta	205A	9/63	0.27	0.21	4.6	Few hundred
Bell	Dornier	205A	10/65	0.27	0.21	4.6	Few hundred
Bell	AIDC	205A	1/70	0.27	0.25	4.6	>4000
Northrop	CASA	F-5	5/65	0.98	0.80	8.0	500
Boeing	Agusta	CH-47C	2/69	2.08	2.02	20.0	500
McDonnell Douglas	Mitsubishi	F-4E	3/69	3.04	2.78	30.4	>3000
Sikorsky	VFW-Fokker	CH-53D G	12/69	2.83	2.58	23.3	200

[a]Average U.S. production cost. Data from *USAF Cost and Planning Factors*, AFM 173-10, department of the Air Force, April 1973
[b]Adjusted to year of first delivery by licensee
[c](Total number of this aircraft produced by licensee) × (aircraft unit flyaway cost) × (ratio of airframe cost to aircraft cost — assumed to be 1/2)

SOURCE: Carter, Gregory A., "Direct Licensing: An Evaluation of a Proposed Technique for Reducing Procurement Costs of Aircraft," R-1604-PR, The Rand Corporation, Santa Monica, Calif., December, 1974.

strategy requires focusing the early development phase on demonstrating basic system performance and not devoting resources to production design and reliability demonstration programs while the design is still very volatile. It is suggested that the money saved by this approach can be applied to carrying second sources to ensure that there is a competitive environment further into the negotiation process (17:53-54). The second strategy requires that the development and production phases of the program be nonconcurrent physically and contractually. It is often argued that non-concurrency increases the acquisition time; however, the evidence from this and other studies indicates that the acquisition times are "not appreciably" increased (17:vi). Other studies on the use of prototyping and licensing arrangements suggest that the separation of the development and production phases has the potential for increasing competition at the start of production, which is often where the government feels it has been "locked in" to a specific contractor (11,13,15,21). Current DOD policy, while not advocating concurrency, does recognize and direct that producibility and supportability factors be integrated in the initial design stages of the engineering development program. This policy is set forth in new DOD Directive 4245.7, "Transition from Development to Production," January 19, 1984.

Licensing Arrangements and Competition

At the time of this next study on licensing arrangements in the late '60s, there were over 70 aircraft and 40 engine examples of major aerospace licensing agreements whereby contractors voluntarily transferred their technology to foreign companies (14:56-61). A review of four such programs (T-33A, F-86F, P2V-7, and F-104J) and a detailed study of the F-104J transfer from Lockheed to Mitsubishi Heavy Industries, Ltd., provides interesting insights into the costs associated with transferring technology.

The overall costs of the transfer can be broken down into two groups: direct (license fees, royalties, and technical assistance) and indirect (learning-curve effects, reduced economies of scale). The direct costs for the F-104 airframe and engine transfer were about 7.8 percent of the unit flyaway cost; however, an esti-

Had This Licensor and Licensee Worked Together Before?	Total Technical Liaison (man-months)	Date of Completion of First Knockdown Aircraft by Licensee	Total Number of This Aircraft Produced or Planned to be Produced by Licensee	Estimated Total U.S. Procurement Cost of These Airframes in Then-Year Dollars[c] ($ millions)	TOTAL TRANSFER COST[d]	
					In Then-Year Dollars ($ millions)	As a Percent of Estimated Total U.S. Airframe Procurement Cost
No	1550	10/61	210	150	10.3	6.9
No	240	6/62	189	133	5.0	3.8
No	310	9/62	365[e]	256	8.6	3.4
Yes	(f)	8/64	112[g]	51	(f)	(f)
No	38	11/68	90[g]	45	2.4	5.3
Yes	11	7/67	101[g]	50	1.6	3.2
Yes	175	(e)	300[g]	31	3.8	12.2
No	187	(e)	402	42	4.2	10.0
No	221	4/71	152	19	1.6	8.4
No	450	5/68	70	28	4.4	15.7
No	635	4/73	(f)	(f)	(f)	(f)
No	1327	9/72	104	144	18.9	13.1
No	495	12/71	110	142	8.3	5.8

[d]Includes license fees, royalties on completed aircraft, and extra fees, if any, for technical liaison beyond that specified in the original contract
[e]Includes 165F-104S models to be deliverd through November 1975
[f]Data not available
[g]Still in production and there is no numerical limit on allowed deliveries

mated 19 percent of that (1.5 percent) of the flyaway cost) was attributable to problems with cultural, language, and geographical separation issues that would result in a less costly domestic transfer (11.139). Tooling costs (estimated at 5 percent) were considered as indirect costs and a component of the learning costs because a higher investment in tooling/jigs would reduce the amount of required learning (11:143). In applying this concept domestically, the additional cost associated with tooling would be the costs for the "soft" tooling of the developing contractor that could not be turned into "hard" tooling because of the shift to a different producer. Determining the learning curve costs (i.e., manhours) was more complicated because Japanese manpower policies often provide a worker with a lifetime job; thus, he might "work" on a project even though he is not required. Nevertheless, the Japanese man-hours for the first aircraft produced were 25 percent less than Lockheed's had been. The apparent transfer of learning from Lockheed to Mitsubishi allowed the latter to produce at lower costs than those incurred during Lockheed's initial start-up (11:151).

A second study on licensing conducted in 1974 summarized the results of several licensing programs as shown in Table 3 (6:54). The average direct costs of transfer for these cases was 9.8 percent of the American procurement cost with a median value of 6.8 percent. If competition can reduce costs by 25 percent or more as other studies and former Secretary of Defense McNamara have indicated (6:62-63), it is clear that potentially significant savings are possible through the judicious use of licensing arrangements.[4]

The implications of this transfer of learning at relatively low costs are significant when applied to an acquisition strategy of separating development from production. It is this point that provides the potential for introducing powerful incentives to contractors for reducing their production prices. It is commonly accepted that competition can bring cost reductions, and yet program managers frequently feel locked into the developer of a system at the very time when they should be in their most competitive posture for reducing systems costs. It seems that if companies successfully license their operations when it is to their advantage, the government

should be able to provide for potential licensing of future production. Naturally, the licensing fees and other legitimate costs would have to be covered in such a situation and could be negotiated as part of the development effort. In the competitive production market, the developer should have the advantage of learning (which has now been priced) over the competitors. However, the developer is no longer in the position of "sole source" and should price his proposal to reflect a competitive environment. The cruise missile programs are a current example where competition and licensing have been used to reduce costs and maintain a broader production base. It has been estimated that over $1.3 billion will be saved on these programs through the use of competition in the production phase (7:47). The study of the late '60s summarizes this point very well: "It is unimportant for this purpose that production actually be transferred. What is important is that an option to transfer exists, and that prices are established with the knowledge that this potential is available to the government" (11:168).

Manufacturing Technology

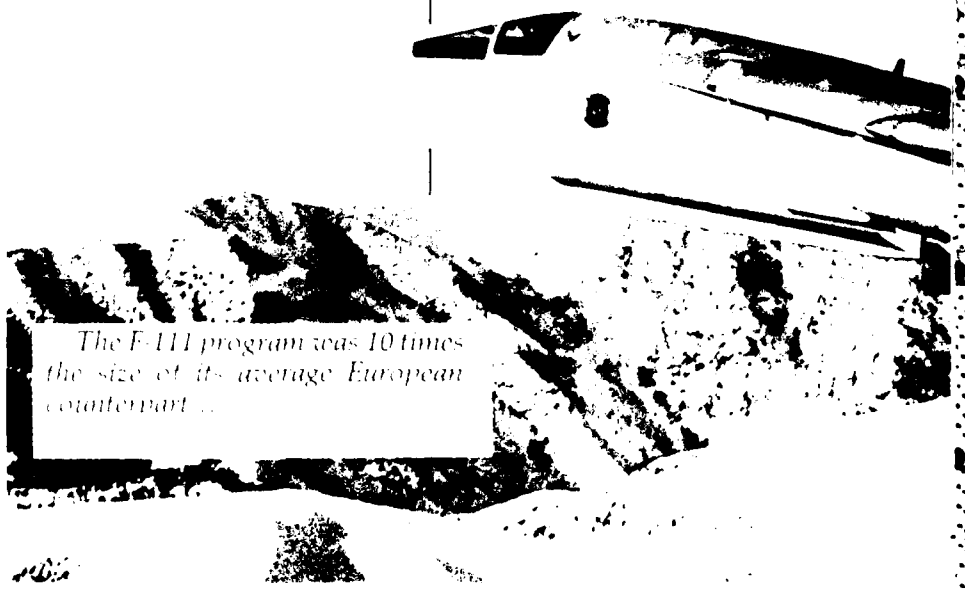
The Air Force Systems Command advanced technology study mentions manufacturing technology as a way to use technology to reduce production costs. Two Rand researchers, Edmund Dews and John Birkler, have taken this one step further in looking at how revolutionary thinking can be applied to reduce costs. In their "Viewpoint" article for *Aviation Week* (9), they postulate that many management improvements being implemented today have been tried before with a limited degree of success. They argue that the weapons acquisition process operates in an extremely uncertain world and constantly changing requirements will continue to generate program instability. In order to reduce costs in this environment, a breakthrough such as "flexible manufacturing" is required. Dews and Birkler suggest the next focus for cost-reduction efforts should be with the producers where computer-integrated design and manufacturing can provide the flexibility to produce a variety of products in a given facility without the high initial start-up costs of the past. Computer-integrated design and manufacturing has the potential to facilitate competition because it reduces the cost of technology transfer. Dews and Birkler point to Deere & Co., Honda, and Messerschmitt-Boelkow-Blohm as leaders in this field. In the Department of Defense, they believe it will take major policy changes and incentives to stimulate the defense industry to respond to this cost-reducing opportunity. They view flexible manufacturing as a real possibility for revolutionary thinking and action.

For the Harrier there was one monthly summary about a quarter of an inch thick that summarized the entire program status.

Summary

The preceding review of a minute sample of case studies and research provides interesting food for thought. The studies suggest several things: 1) Unconventional approaches to systems acquisition (such as the Agena D) offer the potential for reducing costs and schedules while meeting performance requirements; 2) government involvement and technical risk have more than a casual relationship to cost and schedule; and 3) increased competition through the use of licensing arrangements has the potential for reducing the high-cost production portion of the acquisition process.

What is needed now is to apply ideas such as these and other successful techniques to a broader spectrum of programs. Certainly, advanced technology offers an opportunity to reduce program costs if we apply it to that goal. However, these examples highlight other major opportunities to reduce costs by removing the inefficiencies of our acquisition process and enhancing competition.



The F-111 program was 10 times the size of its average European counterpart ...

Defense
Systems
Management
College

THE PROGRAM MANAGER'S NOTEBOOK

Fort Belvoir,
Virginia












Program Manager's Notebook

Continuing Progress

In the March-April issue of *Program Manager*, we presented a status report on our soon-to-be published *Program Manager's Notebook*. We provided the first page of a Fact Sheet to present the format selected. A complete Fact Sheet appears in this supplement.

We selected the Fact Sheet "Contract Types" prepared by Patricia A. Kelley, formerly a professor of system acquisition management at DSMC and now on the staff of the Army Competition Advocate. Ms. Kelley's paper exemplifies our objective of intelligent summarization of complex material into a concise presentation where clarity is not lost in the search for brevity.

"Contract Types" is a memory jogger and a ready reference. It provides essential guidance and points the way for those interested in going into greater depth on the subject. For those of you interested in writing a Fact Sheet for *Program Manager's Notebook*, it will serve as an excellent guide concerning detail and substance to include in your paper.

We solicit your contributions of Fact Sheets on subjects of particular interest to you and other acquisition managers. We are particularly seeking papers on subjects of current interest such as:

Warranties
Breakout
Competition
Streamlining

Help spread the word! Write a Fact Sheet. Send it to Edward Hirsch, Professor, Systems Acquisition Management, DSMC, DRI, Ft. Belvoir, Va. 22060-5426.

We will announce the availability of the Notebooks in a forthcoming issue of *Program Manager*. ■

■ *Ms. Kelley has served in the U.S. Air Force Systems Command, Aeronautical Systems Division, both as an FMS manager, F-16 aircraft, and a contract negotiator for the F-15 aircraft. Before that, she was a contract negotiator for the F-16 simulator, and in various less-than-major program offices. Ms. Kelley was a professor of acquisition management at DSMC, and is now a GS-15 in the Research Directorate, Office of the Army Competition Advocate, the Pentagon.*

Fact Sheet Program Manager's Notebook

DEFENSE SYSTEMS
MANAGEMENT COLLEGE

Author: P.A. Kelley
Number: 6.2.3
Version: Original
Date: April 1985

I. TITLE

Incentive Contracting

II. REFERENCES

—Federal Acquisition Regulation (FAR) Part 16, 1984.
—DOD FAR Sup, Part 16, 1984.
—Manual for Contract Pricing (ASPM #1), 1975. (Being Revised)
—DOD/NASA Incentive Contracting Guide, October 1969.
(Revision due Winter 1985)

III. POINTS OF CONTACT

—Local Contracting Office

IV. PURPOSE AND SCOPE

—Provide information on incentive-type contracts.

V. DOD POLICY

—Increases in profits or fees resulting from predetermined, formula-type incentive provisions are authorized only because cost, performance or other contractual target or standards have been surpassed.
—Contracts with performance incentives are suitable for use in procurements where it is desired to provide the contractor with an incentive in the form of financial reward for surpassing the stated performance targets, and a penalty, if appropriate, in the form of decreased profit or fee for failure to achieve such targets.
—Cost plus award fee (CPAF) contracts are suitable for level of effort contracts for performance of services where mission feasibility is established, but measurement must be subjective.
—Award fee provisions may be included in any type of contract; e.g., a CPIF/AF or FPIF/AF is permissible.

VI. FAR POLICY

—Incentive contracts are appropriate when a firm-fixed price contract is not appropriate and the required services or supplies can be acquired at lower costs and, in certain instances with improved delivery or technical performance, by relating the amount of profit or fee payable under the contract to the contractor's performance.

—Fixed-price incentives are preferred when contract costs and performance requirements are reasonably certain.

—The CPAF contract is suitable for use when the likelihood of meeting acquisition objectives will be enhanced by using a contract type that effectively motivates the contractor toward exceptional performance and provides the government with flexibility to evaluate both performance and conditions under which it was achieved.

VII. GENERAL

The two basic categories of incentive contracts are fixed-price incentive and cost-plus incentive. Using both basic contract categories, the contracting officer issues either a contract with an incentive on cost only or a contract with incentives on cost and performance parameters, also called a multiple-incentive contract. A cost only incentive contract can be fixed-price incentive (FPI) or cost-plus-incentive-fee (CPIF); a multiple or performance incentive contract can also be either FPI or CPIF. Cost only and multiple incentive contracts are predetermined, formula-type contracts. During negotiation, an agreement is reached by the government and contractor specifying the exact percentage or "share" of any underrun or overrun from target that the contractor will receive or pay in the form of increased or decreased profit or fee.

An award fee contract differs from a predetermined, formula-type contract, which is an objective determination of the contractor's reward or penalty based on measurable performance, in that an award fee is judgmentally and unilaterally determined by the government on subjective areas of performance, and is not subject to the disputes clause.

Incentive contracts assume the contractor will be motivated by the opportunity for increased profit or fee on this contract. The government must recognize that external considerations of the company such as market share, technology spin-offs, overhead coverage, growth, full employment, booked sales, or corporate image may impact and influence contractor motivation more than the incentive arrangement on one contract.

VIII. PREDETERMINED, FORMULA TYPE CONTRACTS

—Fixed-Price Incentive, Cost Only

1. FPI contracts resemble FFP contracts in that the contractor is obligated to perform for a specified price. In an FFP contract this price is stated; in an FPI it is determined by a predetermined formula, after all of the costs have been incurred. The FPI contract provides for an initially negotiated profit to be adjusted later by a formula based on the relationship of actual negotiated cost to target cost.

2. The following elements of an FPI are negotiated together as part of the complete incentive formula between the government and contractor.

Target Cost. Target Cost should represent the best, mutually negotiated estimate of what cost will actually be. Target cost against which the costs of performance incurred by the contractor will be measured to determine if a reward has been earned (contractor incurred costs below target cost—an underrun) or if the contract calls for a penalty (contractor incurred costs above the target cost—an overrun).

Target Profit. Negotiated profit against which the performance rewards or penalties are applied. The DOD uses the weighted guidelines profit objective (DD 1547) to establish a prenegotiation target profit. The negotiated target profit is adjusted by the formula negotiated between the government and contractor to determine final profit payable to the contractor based upon the final cost outcome.

Share Ratio. Also known as share line, sharing arrangement, or sharing formula; negotiated agreement to "share" any dollar differences between target and the final cost outcome. It is expressed as a ratio of percentage share equalling 100 percent with the government share stated first. For example, in a 70/30 share ratio, 30 cents of every dollar difference between target and final outcome is the contractor's responsibility, either as an addition to or reduction from target profit.

Ceiling Price. Highest amount that the government is required to pay under the contract. It overrides the sharing arrangement so that regardless of the provision that the government is to share in overruns, the government will not pay more than the ceiling.

Note that the terms overrun and underrun apply to overrunning or underrunning the negotiated target cost, not the ceiling price; at ceiling price the FPI becomes an FFP type contract.

3. Other terms used in FPI contracting.

Point of Total Assumption (PTA). Cost point at which the government ceases to share in cost overruns. It is usually below ceiling and is often the pessimistic cost estimate used in structuring the contract. Additionally, once the contract has been structured, PTA can be determined using this formula:

$$PTA = \frac{\text{Ceiling Price} - \text{Target Price} + \text{Target Cost}}{\text{Government Share}}$$

Target Price. The sum of the target cost and target profit.

This type of incentive contract is called a predetermined, formula-type incentive as opposed to an award fee, which is a judgmental, subjective-type incentive. The formula, negotiated by the government and the contractor and included in the contract is, therefore, predetermined before contract performance is started. The formula is used at the completion of the contract to determine the final cost to the government and the final profit paid to the contractor.

4. A simple way to structure an FPI, cost-only incentive contract:

Step 1: Estimate optimistic, pessimistic and target costs. Optimistic and pessimistic cost estimates define the range of *probable* cost outcomes, assuming sound management and aggressive cost control by the contractor. Pessimistic cost is usually the PTA.

Step 2: Establish an acceptable profit for each level of cost. Use the weighted guidelines profit objective to establish a prenegotiation target profit. Pessimistic cost plus its associated profit equals ceiling price.

Step 3: Compute the share ratio for overruns and underruns using the following formula:

$$\text{Contractor Share (CS)} = \frac{\text{Change in Profit or}}{\text{Change in Cost}} \quad \frac{\text{Profit}}{\text{Cost}}$$

Profit is the difference between target profit and optimistic profit or target profit and pessimistic profit.

Cost is the difference between target cost and optimistic cost or target cost and pessimistic cost.

A share ratio for an underrun is determined by dividing the difference between target profit and optimistic profit by the difference between target cost and optimistic cost.

Step 4: Review the structure to determine if it makes sense.

Step 5: Graph it (optional).

Step 6: Negotiate all elements of the incentive formula as a complete package.

—Cost-Plus-Incentive-Fee, Cost-Only

1. A cost-plus-incentive-fee (CPIF) contract is a cost reimbursement contract that provides for an initially negotiated target fee to be adjusted later by a formula based on the relationship of total allowable costs to total target costs. It should be used when the uncertainties of contract performance and the related cost of performance cannot be estimated with sufficient range of probable cost outcomes to permit the use of any fixed-price contract, and when an appropriate positive fee incentive is likely to provide significantly more motivation for cost effectiveness than is found in a CPFF contract.

2. The following fee limitations, statutorily applied to CPFF contracts, are applied administratively to CPIF contracts as well.

R&D Contracts. Max fee may be no greater than 15 percent of target cost.

Production Contracts. Max fee may be no greater than 10 percent of target cost.

3. Elements of CPIF contracts.

Target Cost. Same as for FPI contracts.

Target Fee. Same as for target profit under FPI contracts.

Share Ratio. Same as for FPI contracts.

Minimum Fee. That fee the contractor will be paid once costs reach the pessimistic cost point. Beyond the pessimistic cost point, the contractor will still be paid the minimum fee; at minimum fee the CPIF becomes a CPFF-type contract.

Maximum Fee. That fee the contractor will be paid if costs reach or go below the optimistic cost point. As with minimum fee, the maximum fee does not vary once attained.

4. Other terminology associated with CPIF contracts:

Range of Incentive Effectiveness (RIE). An evaluation of what contract costs are likely to be. The optimistic and pessimistic cost estimates bound the RIE.

Fee Swing. Difference between maximum fee and target fee or minimum fee and target fee. It also is referred to as "fee."

Fee Pool. The total of fee swing; the range from minimum fee to maximum fee.

5. A simple way to structure a CPIF, cost only incentive contract: (similar to FPI structuring).

Step 1: Estimate optimistic, pessimistic and target costs. This determines the RIE.

Step 2: Establish an acceptable fee for each level of cost. Use the weighted guidelines to establish a prenegotiation target fee. Do not exceed max fee limitations without appropriate approval.

Step 3: Compute share ratio.

$$CS = \frac{\text{fee}}{\text{cost}}$$

Step 4: Review the structure.

Step 5: Graph it (optional).

Step 6: Negotiate all elements of the incentive formula as a complete package.

—Multiple Incentives

1. Multiple incentive contracting combines the motivation for technological progress, timely delivery, and effective cost control with the ultimate objective of attaining an appropriate balance between performance schedule, and cost control—not necessarily the lowest cost. Obviously, in cost only incentives, the emphasis is on the attainment of the stated performance achievement level at the lowest cost.

Multiple incentives should be negotiated within a structure, which gives appropriate weight to basic procurement objectives. This includes a balancing of the range of cost and performance goals. The proper balancing of objectives achieves two important results. First, it communicates the government's objectives to the contractor; second, and of greater significance, *it establishes the contractor's profit or fee in direct relationship to the value of the combined level of performance in all areas.* It should be assumed that the contractor will be concerned with tradeoffs between cost and performance during the execution of the contract; and, therefore, the multiple incentive structure should guide the contractor in revising its plans as expectations change. In the absence of a clear communication of the desired government objectives, this is im-

possible. The contractor's program management procedures must provide visibility for tradeoffs. Further, the time for the government to establish the desirable tradeoffs is prior to the award of a contract or definitization of a change order.

Incentivized parameters may be system characteristics such as range, speed, reliability, maintainability, thrust and survivability or schedule delivery dates, etc. Optimistic schedule and performance should not be easy for the contractor to accomplish, nor impossible to achieve; they should be achievable and of value to the government.

Also, the pessimistic performance and schedule parameters must be acceptable; use only those that are acceptable to the government.

2. If the contract is a CPIF multiple contract, fee limitations apply.

3. Elements of multiple incentive contracts:

FPI—same as for FPI, cost only
CPIF—same as for CPIF, cost only

In addition to the elements discussed previously, the contract will include the performance and schedule parameters to be incentivized. It is best to keep the number of incentivized parameters to a minimum, perhaps only 2 or 3. Incentivizing too many parameters dilutes the fee pool, resulting in a lack of true motivation for the contractor.

Cost is always an incentivized parameter in a multiple incentive contract.

4. Structuring a multiple-incentive contract is a complex undertaking beyond the scope of this fact sheet. Refer to the *Manual for Contract Pricing* (ASPM #1) or the DOD/NASA *Incentive Contracting Guide*. The "Express Value Method" and "Implied Value Method" for evaluating the cost value of performance incentives are described in the enclosures.

The structuring of a multiple-incentive contract, in essence, answers the following three questions:

a. What parameters shall be incentivized?

b. How much money is available to use as incentive?

c. Of that money available, how should it be distributed among the selected incentivized parameters?

IX. AWARD FEE INCENTIVE CONTRACT

The DOD FAR Sup states that the "award amount" of the cost-plus-award-fee (CPAF) contract may be used in conjunction with other types and kinds of contracts for the government's benefit. While recognizing that an award fee can be used in other contract types, the following discussion centers on a CPAF type contract since the FAR describes the CPAF more fully.

1. **The CPAF Contract** is a cost-reimbursement type providing for a base (minimum) fee, and for an additional fee amount that may be awarded, in whole or in part, based upon periodic evaluations of ongoing contractor performance. A CPAF arrangement does not include predetermined targets and automatic fee adjustment formulas; instead, the award fee determination is a judgmental one, made unilaterally by the government.

The CPAF contract is unique in providing not only profit (fee) motivation, but also the considerable motivation resulting from periodic evaluations by the government. In addition, it offers significant evaluation flexibility, in two forms:

(i) the flexibility to evaluate on a judgmental basis, taking into consideration both contractor performance levels and the conditions under which such levels were achieved; and

(ii) the flexibility to adjust evaluation criteria from evaluation period to evaluation period, to reflect changes in government management emphasis or concern.

2. **Elements**

CPAF contracts include an estimated cost, base fee, an award fee, a maximum fee (the sum of the base and award fee amounts), and a fee payment plan. The contract also includes a provision specifying that award fee determinations will be made unilaterally by the designated fee determination official, in accordance with an approved evaluation plan, and that such determinations will not be subject to appeal under the disputes clause of the contract. The performance evaluation plan normally is not included in the contract, thus preserving the government's right to alter the plan unilaterally to reflect any changes occurring in management emphasis or concern.

The estimated cost is the same as target cost discussed earlier. The fee limitations applied to CPIF contracts also apply to CPAF contracts. The DOD FAR Sup precludes the use of weighted guidelines for determining a fee objective. Also, the DOD FAR Sup limits the base fee to a maximum of 3 percent of estimated costs. The base fee may even be zero.

The fee payment plan discusses the evaluation periods and interim pay out periods based on those periodic evaluations.

An evaluation plan also is developed by the government before the evaluation period it will cover. It should

be tailored to motivate the contractor to make the best possible uses of the company's resources to improve performance. It also should provide for an equitable and timely evaluation process. In addition to being fair, the plan should communicate plans and procedures and anticipate the establishment of effective communications between the government monitors and the contractor.

Award fee contracting is advantageous because of its emphasis on communication between the parties and the flexibility afforded the government to change emphasis during contract performance. The CPAF contracts may be attractive to industry because they allow the contractor to earn a higher fee (for outstanding performance) than would be possible under a CPFF contract.

CPAF contracting assumes an ability to evaluate performance and determine, on a judgmental basis, whether and to what extent such performance merits an award fee amount over and above the base fee established. The award fee potential should be of sufficient amount to reward the contractor through all levels of performance in excess of minimum acceptable. Award fee adjustments represent increases from base fee and depending upon actual performance as evaluated in accordance with the evaluation plan, the contractor may earn all, part or none of the award fee amount available.

3. **Structure**

The award fee requires a formalized government evaluation structure for administration. The fee determining official (FDO) makes the final decision regarding the award fee to be paid to the contractor based on input from the contractor and the government's Performance Evaluation Board (PEB).

The PEB is established by the FDO and is responsible for the development of the award fee evaluation plan, ongoing evaluation of contractor performance, and submission of a report to the FDO.

Performance monitors, designated by the Chair of the PEB, are responsible for monitoring, evaluating and assessing contractor performance in their assigned areas; periodically preparing a performance monitor report for the PEB; and recommending any needed changes in the evaluation plan.

IX. AWARD FEE INCENTIVE CONTRACT

The DOD FAR Sup states that the "award amount" of the cost-plus-award-fee (CPAF) contract may be used in conjunction with other types and kinds of contracts for the government's benefit. While recognizing that an award fee can be used in other contract types, the following discussion centers on a CPAF type contract since the FAR describes the CPAF more fully.

1. **The CPAF Contract**

The CPAF contract is a cost-reimbursement type providing for a base (minimum) fee, and for an additional fee amount that may be awarded, in whole or in part, based upon periodic evaluations of ongoing contractor performance. A CPAF arrangement does not include predetermined targets and automatic fee adjustment formulas; instead, the award fee determination is a judgmental one, made unilaterally by the government.

The Express Value Method

*STEP 1. Select parameters to incentivize (*cost* must be one).

Keep it simple! Too many parameters dilute the value of the incentives.

*STEP 2. Establish optimistic, pessimistic, and target outcomes for non-cost (performance) parameters.

Optimistic outcomes must be *achievable* and be of *value* to the government.

Pessimistic outcomes must be *acceptable* to the government.

STEP 3. Estimate target cost and target fee/profit.

Target cost is based on target performance and represents a 50/50 chance of cost overrun versus cost underrun.

Target fee/profit is determined using weighted guidelines.

STEP 4. Estimate optimistic and pessimistic outcomes for cost.

Optimistic and pessimistic costs represent the range of *probable* (not *possible*) cost outcomes to achieve *target performance*, assuming sound management and aggressive cost control by the contractor.

STEP 5 Establish the fee/profit pool.

Determine the fee/profit increase from target fee/profit you are willing to pay if the contractor actually delivers optimistic outcome for all parameters. This is called the positive fee/profit swing. Remember the max fee limitation of 15 percent (R&D) (10 percent all others) for cost reimbursement contracts apply.

Determine the fee/profit reduction (from target fee/profit) you will assess if the contractor actually delivers pessimistic outcomes for all parameters. This is called the negative fee/profit swing.

*STEP 6. Establish the relative importance of the incentivized parameters.

Determine from life-cycle cost estimates the "discounted present value" of improvements for each performance parameter.

STEP 7. Allocate the fee/profit swings among parameters.

Total the positive and negative expressed values. Divide the positive fee swing (STEP 5) by the total of the positive expressed values (STEP 6). Also divide the negative fee swing by the total of the negative expressed values. These calculations establish the positive and negative *share ratios*.

Multiply each expressed value by the contractor share to obtain the "target fee/profit adjustment" amount for each parameter.

STEP 8. If the contract is FPI, calculate ceiling price.

Ceiling price (the maximum amount the government will pay) is the sum of pessimistic cost *plus* target profit *plus* the positive target profit adjustment amounts for the non-cost parameters *plus* the negative target profit adjustment amount for cost.

*STEP 9. Review and refine.

Are the RIEs for all parameters reasonable?

Are there too many incentivized parameters?

Are the implied values acceptable?

Note: Asterisks denote activities in which PMO involvement is *essential*.

Implied Value Method

STEPS 1-5. Same as expressed value method.

STEP 6. Establish the relative importance of the incentivized parameters.

If expressed values are not available, use "best judgment" to assign "relative weights" to the incentivized parameters.

STEP 7. Allocate the fee/profit swings among parameters.

Calculate the "target fee/profit adjustment" amounts for each parameter by distributing the positive and negative fee/profit swings to the incentivized parameters in proportion to the weights established in STEP 6. (Multiply the positive and negative fee/profit swings by the weights for each parameter.)

Calculate the positive and negative *share ratios*. (Divide the target fee/profit adjustment assigned to the cost parameter by the difference between target cost and optimistic cost to get the positive share ratio and by the difference between target cost and pessimistic cost to get the negative share ratio.)

Calculate the implied value of each of the incentivized parameters. (Divide the target fee/profit adjustment amounts for each performance and cost parameter by the contractor share.) The result is called the *implied value* and represents the maximum amount of money the government is willing for the contractor to spend in order to achieve the optimistic performance level.

STEPS 8 & 9. Same as expressed value method.

Notes

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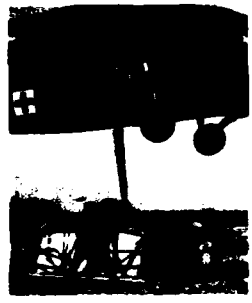
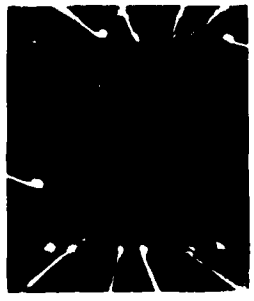
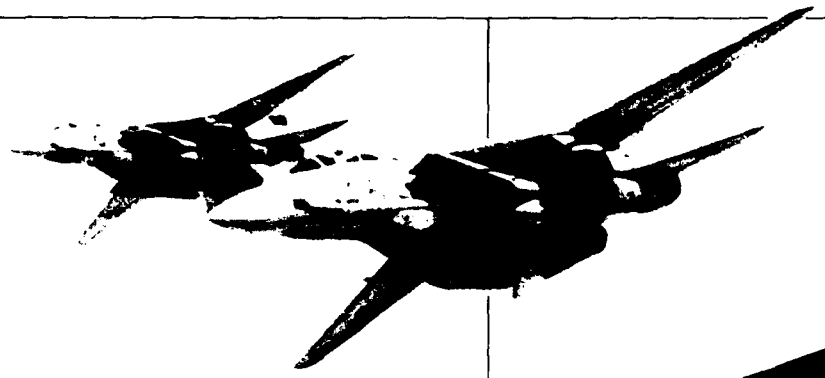
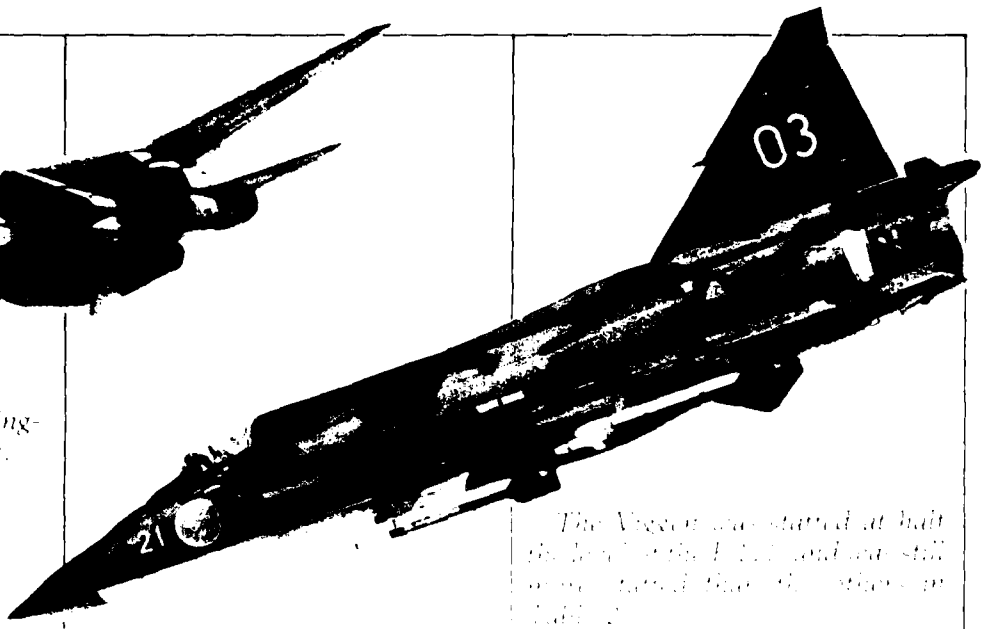




The variable-sweep F-14 wing-box uses European technology.



The Vipers are starred at half the [illegible] and are still [illegible]

I believe it is fair to say that General Toomay's exhortation, "Think Revolutionary," is just as applicable to the management process as it is to the development of advanced technologies. It is up to all of us, not just senior acquisition and program managers, to "think revolutionary" and to act revolutionary if acquisition costs are to be reduced in the future.■

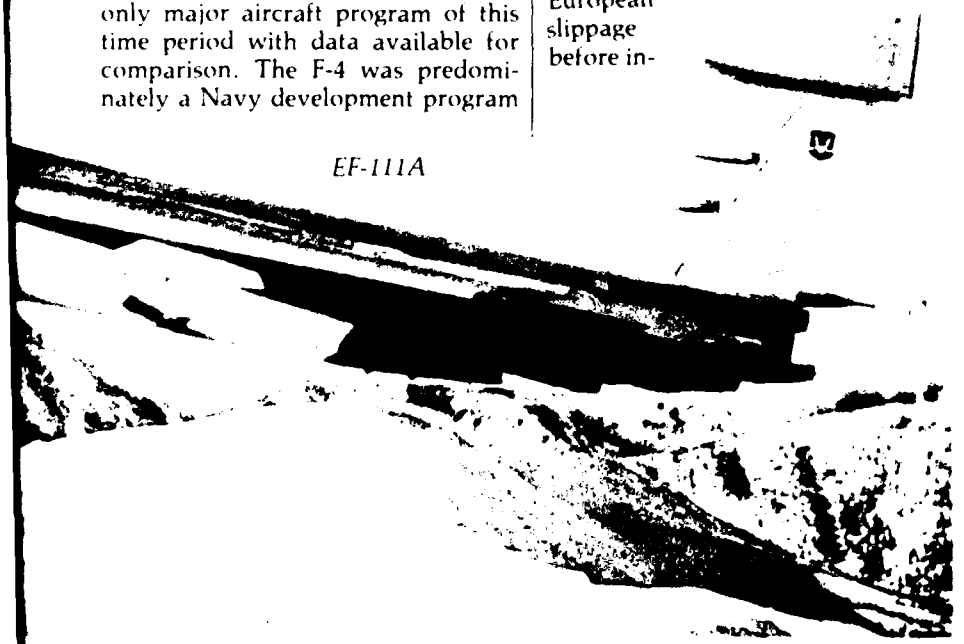
Footnotes

1. The Lockheed Skunk Works have had other similar successes such as the F-104, U-2, YF-12, SR-71, and many classified programs.

2. The F-111 was selected for this study comparison because it was the only major aircraft program of this time period with data available for comparison. The F-4 was predominately a Navy development program and the data were not readily available for the analysis. While this may affect the specifics of the analysis, it does not affect the trends as developed from the comparison of the European programs with the F-111 data base.

3. In all fairness, it should be noted that a later Rand study, "Multinational Coproduction of Military Aerospace Systems," R-2861-AF, October 1981, found that European programs "generally encounter larger and more frequent schedule slippages before initial operational deliveries than do U.S. programs. United States programs, however, experience schedule changes after deliveries begin that are similar in size to European slippage before initial deliveries." (20:34). Factors that may affect this are differences in workforce policies and acquisition approach. A greater U.S. willingness to accept concurrent design and production is discussed as a factor, but the authors caution about making this generalization. It is interesting to note that the extreme concurrency of the F-111 program is identified as contributing to major equipment problems (20:28) that resulted in fielding an immature system. The Europeans assert willingness to accept results of delays in fielding more mature systems with higher operational effectiveness. Even with longer European schedules, the question legitimately can be asked: Is the slightly shorter schedule worth a 22 percent-80 percent increase in costs?

4. While conventional wisdom tells us that competitive procurement will reduce costs, at least one study found "It is not clear whether competitive reprocurement pays off as a financial investment on systems as complex as missiles, because there is as yet no evidence that internal rates of return are high enough to justify the drain on front-end funds." (3:vii) This study reviewed four earlier studies on competition and found that with the possible exception of electronic items, there was no clear evidence of savings from competition. The study concluded that competition prior to full-scale development is relatively inexpensive and has widely perceived benefits, but the costs increase and the perceived benefits decrease as the development process moves on to the production phase.■



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Technocrats

(Continued from page 11)

the fact that the Soviets also accord priority to the military over the civilian sectors for technology acquisition. Thus, Western dual-use technology (technology with both military and civilian applications), more often than not, finds its way first into the military industries and, subsequently, into the civilian sectors.

Soviet Gains

The planning, financing, and subsequent acquisition of Western technology affords the Soviets many advantages. Though problems are sometimes encountered in assimilating or absorbing technology or equipment embodying new technology (e.g., problems with reverse-engineering or copying, lack of sufficient know-how in some circumstances), the Soviets are still able to realize significant civilian and military gains. These gains include:

—Saving millions of dollars in R&D costs

—Saving many years in R&D development lead time

—Modernizing critical sectors of the Soviet military industry and reducing engineering risks by following or reverse-engineering proven Western design, thereby limiting the rise in military production costs

—Achieving greater weapons performance than if they had to rely solely on their own technology

—Incorporating countermeasures to Western weapons early in the development of their own programs

—Enhancement of military capabilities necessary to maintain a balance of international power.

Conclusion

The massive, well-planned, and well-coordinated Soviet program to acquire Western technology poses a serious and growing threat to the mutual security interests of Western nations. Given the dynamic nature of this program, the involvement of high-level and influential organizations in the decision-making, planning, and fund-allocation process; and given the diverse selection of technology transfer mechanisms, it is expected that the Soviets will continue their attempts by any means necessary to acquire a broad range of Western technologies critical to the enchancement of Soviet weapons capabilities.

THE FOURTEENTH INITIATIVE

Status Report on Acquisition Streamlining

Acquisition streamlining, as currently envisioned in the Department of Defense (DOD), involves "the evolutionary development and optimization of acquisition program requirements for cost-effective contracts."[1] It involves taking action to preclude or eliminate non-cost-effective requirements in design, development, and production. The primary actions that can be taken are:

—Specify requirements in terms of mission performance.

—Preclude premature requirements.

—Tailor requirements.

—Limit the contractual applicability of referenced documents.

Such streamlining can be augmented by utilizing a contractor's ingenuity and experience to arrive at cost-effective design approaches while the decision-making authority of the government program manager remains intact on a new program. The program manager should start by placing sufficient emphasis on streamlining during the development of mission performance requirements for a new defense system or equipment. The candidate specifications should be justified on a case-by-case basis. Department of Defense Directive 5000.1, dated March 29, 1982, supports this approach. It states that "effective design...shall be obtained to the maximum extent practicable to ensure that defense systems are cost-effective and are responsive to mission needs."

Among the 32 Carlucci initiatives set forth in April 1981, Number 14, entitled "Reduce Number of DOD Directives and Eliminate Non-Cost-Effective Contract Requirements," zeros in on acquisition streamlining. The team assigned to this initiative reviewed 132 acquisition directives and recommended 31 for cancellation. Then, the team focused on reduction of contract documentation and non-cost-effective contract requirements. The current acquisition streamlining efforts are a continuation of the actions taken on this initiative.

In recent months, the Office of the Secretary of Defense (OSD) has been placing increased emphasis on acquisition streamlining because it is vital that both solicitations and contracts be "streamlined." When streamlining takes place, both counterproductive and overspecified requirements are eliminated. Most of us in the acquisition management business recognize the need to take some kind of positive action that will result in more efficient practice.

Deputy Secretary of Defense William H. Taft IV has been taking the lead in trying to reduce over-specified and non cost-effective acquisition requirements. In a memorandum dated November 8, 1984, he expressed concern about the high cost of acquisition requirements, particularly in the defense systems that have been fielded.

On December 4, 1984, Deputy Secretary Taft issued a memorandum assessing what had happened as a result of his initial memorandum pertaining to fielded systems. The second memorandum identified where to place the emphasis to address the issue properly. Mr. Peter Yurcisin, director of standardization and acquisition support was identified as the point of contact for reduction of over-specified and non-cost-effective requirements on systems that have already been fielded.

Deputy Secretary Taft said that there are more than 40,000 military specifications and standards in the Defense Standardization and Specification Program, and "there are literally millions of DOD acquired contractor-generated item drawings which may contain problems in terms of over-specified requirements for items to be procured." Considering the magnitude of these requirements documents, an accurate assessment of the number of specifications and drawings requiring refinement is not economically feasible. However, this should not deter anyone from taking positive steps to do something about the deplorable situation that exists today.

Five basic causes of the problem have been identified. They are:

1. An overly conservative design approach.

2. A failure to challenge requirements during design and development.

3. Buying drawings that have been outdated because of new technology or advances in operational requirements.

4. Inadequate technical data with which to access specifications.

5. Inadequate resources to staff material reviews.

Deputy Secretary Taft identified several areas where action can be taken. He requested that the following actions be taken:

—Challenge requirements in specifications and standards.

—Conduct technical reviews and assess reasonableness of cost.

—Conduct value engineering throughout the life cycle of a defense system program.

—Upgrade the technical review capability of any organization that is responsible for procurement of replenished items.

—In program management education, present techniques for assessing the reasonableness of the design and production approaches because they affect the cost of a defense system.

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1. Based on definition in the proposed DOD Directive.

On December 5, 1984, a memorandum on the subject of eliminating non-cost-effective contract requirements was issued by Deputy Secretary Taft. In this memorandum, he said that the most significant long-term solution to eliminating these requirements was adherence to the approach set forth in the DOD streamlining initiative (the DEPSECDEF memorandum dated January 11, 1984). The approach calls for identifying the most cost-effective contract requirements during the early design stages. In the December 5 memorandum, Deputy Secretary Taft asked that the services accelerate and intensify the acquisition streamlining according to this initiative.

On December 6, 1984, Deputy Secretary Taft announced that acquisition streamlining would be one of the top initiatives during this administration. The emphasis within OSD will be on working with the advocates to expand the number of programs, finalizing DOD policy and guidance, developing parameters for measuring effective streamlining implementation, coordinating a DOD-wide training program, and developing incentives for DOD personnel.

The OSD focal point for the acquisition streamlining effort is Dr. Richard A. Stimson, OUSDRE(AM)IP. As such, Dr. Stimson will work with the military departments, through streamlining advocates, to finalize the streamlining initiative. He began to provide periodic status reports to the deputy secretary of defense in March. These reports will contain the plans and accomplishments of the military departments in acquisition streamlining.

Each service has appointed a streamlining advocate. They are:

—Army: Mr. Roy D. Greene, assistant deputy chief of staff for program management, Army Materiel Command (DE-P).

—Navy: Mr. Gerard C. Hoffmann, navy acquisition streamlining advocate, Office of Naval Acquisition Support (OSD), Department of the Navy.

—Air Force: Colonel James J. Lindenfelser, director of program integration, Office of the Deputy Chief of Staff for Research, Development, and Acquisition, Headquarters, U.S. Air Force.

The advocates met with Dr. Stimson on February 25, and the first report to Deputy Secretary Taft was submitted by Dr. Stimson on March 5 through Dr. James P. Wade, acting under secretary of defense for research and engineering. The acquisition streamlining advocates have continued to meet regularly to develop a uniform policy.

The momentum of the streamlining effort is accelerating. At the outset, the advocates were asked to increase the number of programs in demonstration/validation, full-scale development and production phases designated for "streamlining." That has been done and, instead of the 12 programs originally identified as candidates for streamlining, there are now 33. The programs will be identified specifically later in this report.

The January-February and March-April issues of *Program Manager* highlighted the subject, "Acquisition Streamlining." In the lead article of the January-February issue, Deputy Secretary Taft was quoted as saying, "Since we at DOD must exercise more

Chart 1. Programs Targeted for Streamlining

May 1985

ARMY

Experimental Light Helicopter
Advanced Anti-Tank Weapon System
Family of Medium Tactical Vehicles
Joint Tactical Missile System
Light-Weight Air Defense System
Armored Gun System

NAVY

Undergraduate Jet Flight Training System (T-45)
Joint Services Advanced Vertical Lift Aircraft Program (V-22)
Replacement Inner Zone Air ASW Vehicle (CVIZ Helo)
Amphibious Assault Ship (Multipurpose)
AE36 (Ammunition Ship)
Patrol Combatant Multi-Mission Ship
Advanced Tactical Aircraft
Worldwide Info System (WIS) Modernization
Afloat Correlation Program
EHF SATCOM Terminals
Relocatable Over the Horizon Radar
Ship Launched Electronic Decoy
RP3D Research Aircraft
VH-60 Presidential Helicopter

AIR FORCE

Advanced Tactical Fighter
Integrated Electronic Warfare System
Worldwide Info System (WIS) Modernization
Advanced Medium Range Air-to-Air Missile Production Program
Advanced Tactical Fighter Engine
Peacekeeper ICBM Program
Accelerated Small ICBM Program
MILSTAR
Local On-Line Networking System
Joint Surveillance Target Attack Radar System
Anti-Radiation Missile Decoy
Titan T34D7 Space Booster
Air Force Mini-Computer User System

discipline in determining *what* capabilities we need, we also must exercise more discipline in trying to direct *how* those capabilities should be achieved." This sets the stage, and the performance should follow. By May of this year, the Army increased the number of programs it originally planned to subject to streamlining from 4 to 6; the Navy increased its target from 4 to 14; and the Air Force increased its target from 6 to 13. The programs targeted for streamlining, by service, are shown on Chart 1.

Deputy Secretary Taft continued to press for streamlining throughout the winter and spring of 1985; speeches and magazine articles, and actions taken by OSD and the services, have kept the subject alive. It also has been kept alive through the efforts of people in industry such as Mr. Brent A. Hardesty, corporate director, Technical Management Systems, McDonnell Douglas Corporation. As chairman of CODSIA Task Group 23-83, he has been directly concerned with the streamlining initiative since 1983. Mr. Hardesty views streamlining as:

—Changing attitudes.

—Removing barriers to smooth flow.

—Eliminating turbulence.

—Making simpler or more efficient.

—Reducing to a minimum.

—Stripping of non-essentials.

According to Mr. Hardesty, streamlining will take place if we start by "changing attitudes."

Department of Defense Directive 4120.21, *Streamlining Requirements for Cost-Effective Acquisitions*, has been written and a draft should be ready for formal coordination in July. If approved, the directive will be issued early in the government's new fiscal year.

In addition to the directive, DOD handbook, DOD-HDBK-248 B, is in preparation. Formal coordination of the handbook is expected to begin in September.

There are 8 military standards being reviewed for possible revision to support the streamlining initiative. The standards are identified in Chart 2.

On June 3, 1985, Deputy Secretary Taft issued a memorandum on the subject, "Acquisition Streamlining." He stated that "it is vital that we streamline solicitations and contracts to eliminate counterproductive and overspecified requirements." It is of paramount importance that we place a limit on the contractual applicability of documents referenced in specifications and standards. The inadvertent establishment of contract requirements by indirect referencing is a costly, counterproductive effort. The final determination of which contract requirements will apply on a specific program will continue to be the prerogative of the government program manager.

(See Streamlining, page 31)

■ *Mr. Acker is a professor of engineering management, Research Directorate, DSMC.*

Chart 2. Military Standards That May Require Revision

MIL-STD-245, "Statement of Work"

MIL-STD-499, "System Engineering Management"

MIL-STD-480, "Configuration Control—Engineering Changes, Deviations and Waivers"

MIL-STD-490, "Specification Practices" (Program Peculiar)

MIL-STD-961C, "Preparation of Military Specifications"

MIL-STD-962A, "Preparation of Military Standards and Handbooks"

MIL-STD-963, "Preparation of Data Item Descriptions"

MIL-STD-1521B, "Technical Reviews and Audits"

. . . streamlining will take place if we start by changing attitudes.

The Department of Defense Streamlining Initiative

■Utilize contractor ingenuity and experience government program manager decision-making authority.

■Encourage contractors to critique draft RFPs.

■Specify what is needed, rather than "how-to."

■Specify system-level functional requirements at onset of development.

■Require contractors to tailor during one phase for application to the next.

■Preclude premature application of MIL-SPECS and MIL-STDs...identify for guidance for demonstration/validation, tailored for full-scale development.

■Limit contractual applicability to one level of references.

■Pursue economically producible, operationally suitable and field supportable designs.

■Assure complete production specifications while providing contractor flexibility to optimize design.

Where's the Map?

Roland P. Swank

The way to control acquisition cost is to control the Mission Assurance Probability ("The MAP"). Decision Technology[1] provides the information needed to make correct decisions with confidence.

As stated by many congressmen and Department of Defense officials: "High costs, cost overruns, poor quality performance and degraded results are haunting today's weapon systems and it seems to be getting worse." Why do some acquisitions turn into such debacles?

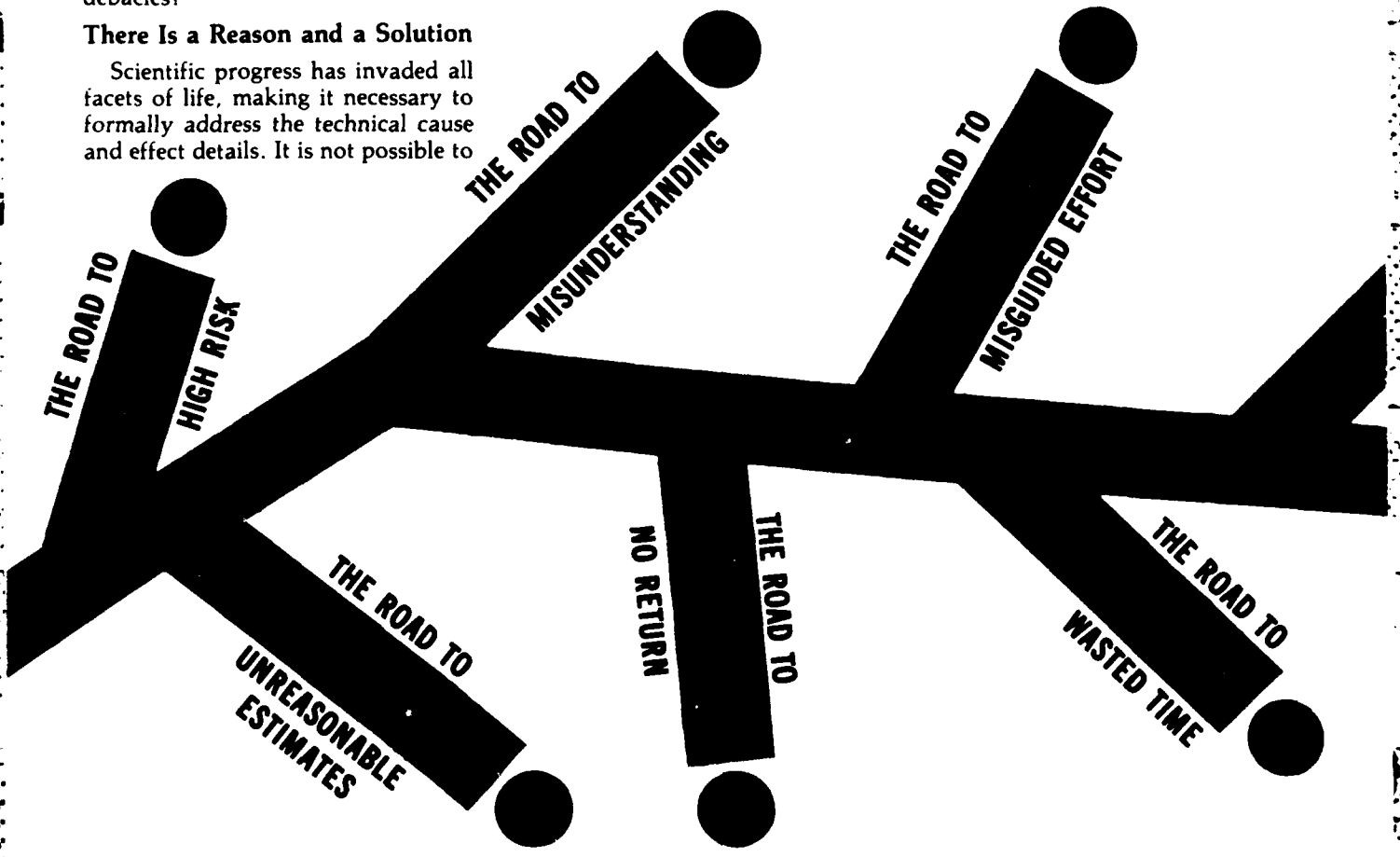
There Is a Reason and a Solution

Scientific progress has invaded all facets of life, making it necessary to formally address the technical cause and effect details. It is not possible to design a bridge, a skyscraper or an airplane without the use of equations. The particular materials used, their condition, size and shape must be specifically determined and any source of potential effect must be analyzed to determine how it is to be controlled or whether it is to be used at all.

Are decisions any different? Don't they represent the sensitive integration of many factors such as user intentions, requirements, technology capabilities, technology applications, producing methods, control procedures and results verification? It seems only logical, in order for effective decisions to be made, that detailed contributions and effects of each source influencing the final outcome should be known. Then, as with technical equations, the "decision equation" can be used to determine just what is actually needed, and how much, to accomplish the desired result within the constraints of time and cost.

Philosophy

How many times have we looked back on those things that caused high costs, cost overruns, poor quality performance, and/or degraded results and realized they could have been avoided if different decisions had been made?



How many coaches, after the game, have muttered, "If only..."? Since this is unfortunately an all too common syndrome, it makes one wonder why suffering the painful results of inadequate decisions is necessary. Wouldn't it be better to recognize the potential results beforehand and modify the approach to avoid difficulties?

The MAP (Mission Assurance Probability) Can Predict the Success of Decisions and Show the Consequences of Going Astray

Like a road map, from which you locate your destination and plan the route to get there, a Decision MAP shows where each alternative action, activity, task and function leads, thus allowing you, as the decision-maker, to find the best (low cost) route to your destination and avoid (failures) getting lost.

Weapon system acquisitions, in many instances, have fallen far short of desires and it only seems natural that those who have managerial responsibility should receive the blame. But, if one considers the functional restraints, the highly complex environment, and the imprecision of communications, decision-makers have been doing a superb job under the severest of handicaps. Without using a sophisticated tool with which to apply their talents effectively, results have been far better than might be expected.

When the root cause of failure is ultimately exposed, it often only requires simple common sense to produce a better decision. Today's less-than-expected performance and higher-than-expected expenditures, coupled with obvious after-the-fact

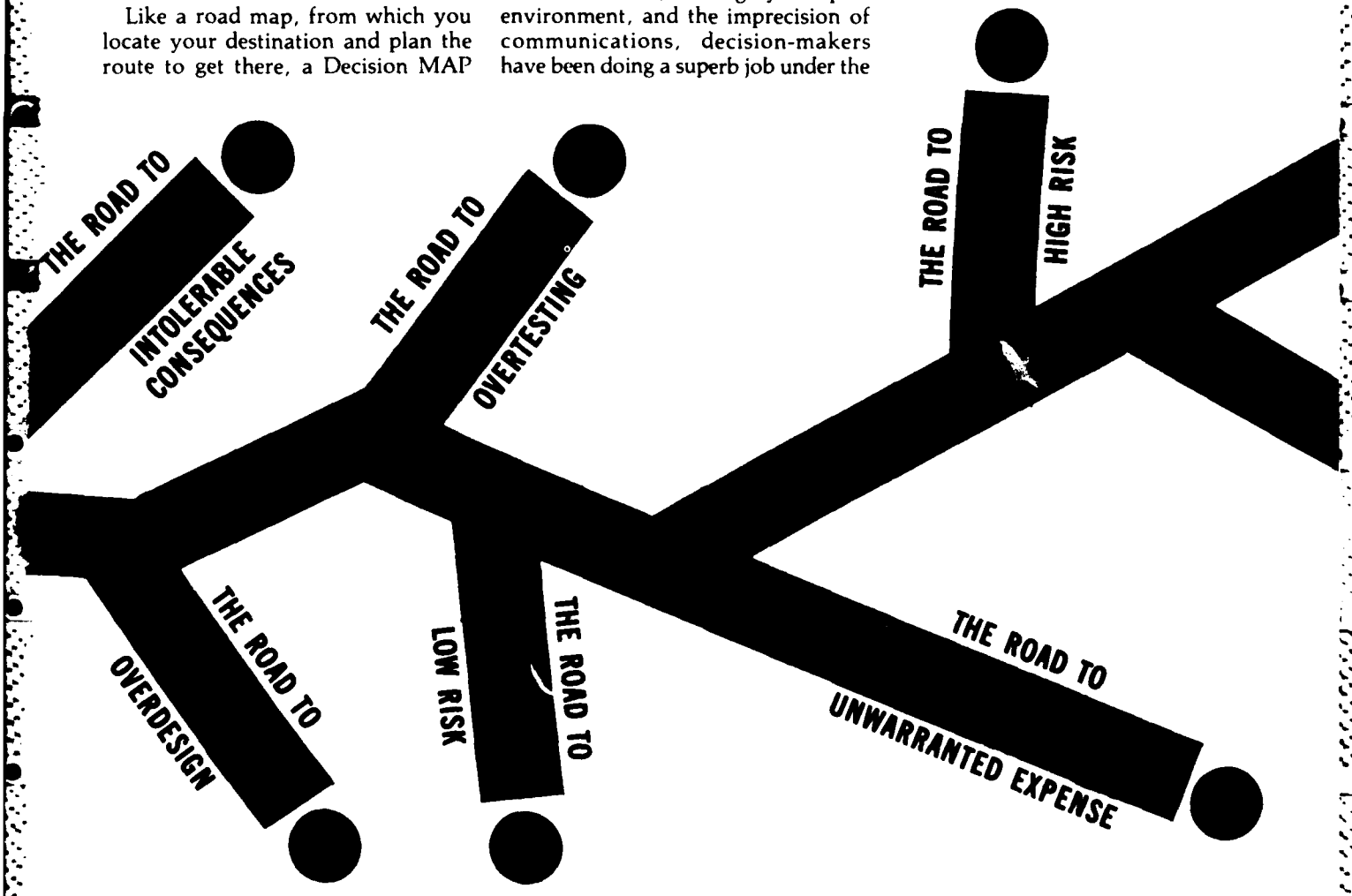
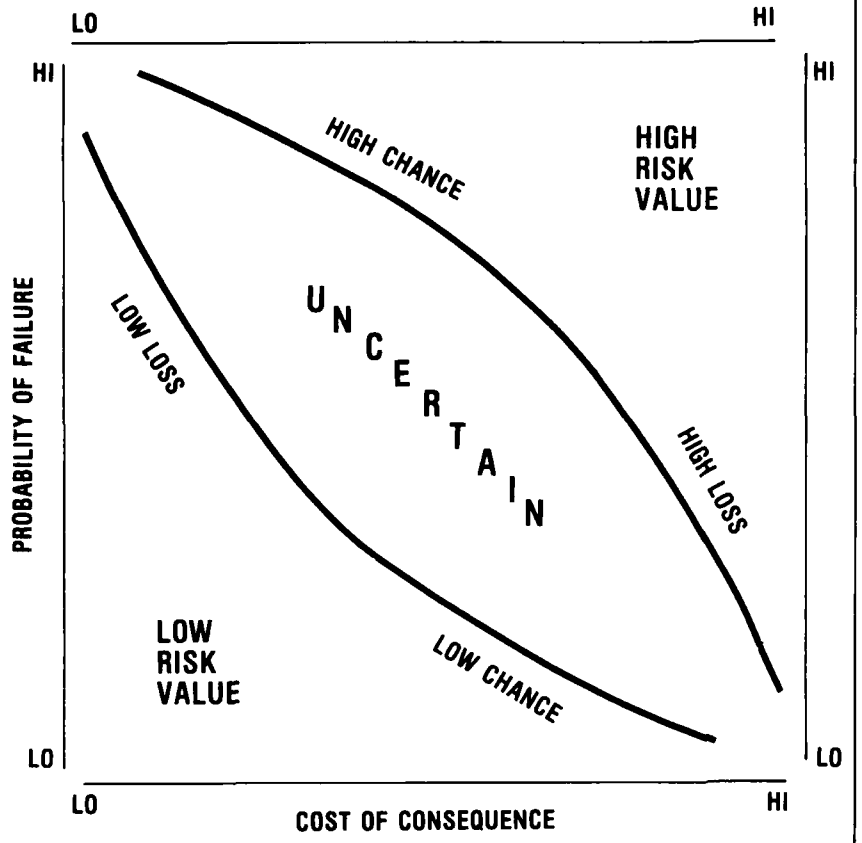


Figure 1: Risk Value Chart



identified causes, would lead one to ask, "What Ever Happened to Common Sense?" Looking at scientific progress, successful application of most technologies comes from the introduction of accurate numbers to sound concepts. The same must occur for common sense to triumph. It must be scientifically generated with accurate numbers and by qualified people. Lack of numbers, wrong numbers, or even correct numbers misinterpreted can derail a concept or plan regardless of how much common sense it makes. Anyone can generalize where they are going, some better than others. But, on high-risk, high-consequence endeavors wouldn't it be advantageous to have a precise quantitative MAP to provide the visibility for identifying the high-risk and non-contributing areas before they jeopardize success and/or inflate cost?

MAP Philosophy

The philosophy of the MAP is to provide the decision-makers with a quantitative understanding of the contributions or effects of all involved considerations, putting them in the best position possible for making the decisions necessary to achieve the desired results. These quantifications are in the form of the probability or assurance of achieving the defined objective and they directly relate with all of those considerations a decision-maker must deal with. For instance:

—What is the effect of the design margin being reduced by 4.5% to allow a less-expensive material to be used?
—What amount of control does it take to achieve a 99.76% probability for system operational success?
—How much extra assurance and what kind is obtained by running 10 tests instead of 3?
—What performance measurement is needed, at what phase and under what conditions to best verify system acceptability?
—What verification and control functions can be reduced or eliminated and still have the system meet its assurance objective?

When the decision-makers are provided with the quantitative answers to these and many similar questions, they will have the information and support needed to make and carry out proper decisions.

Why Is It Impossible to Reasonably Estimate These Assurance Amounts?

This becomes evident when it is realized that the amount of ASSURANCE existing equates to a constant which is raised to a variable exponential power. The numerical value of this exponential power is determined by the sizes of the existing uncertainty and margin, plus another factor which itself results from an exponential power reflecting the quantity of experience existing. Since controlling uncertainty, margin and experience is what achieves ASSURANCE, it follows that the amount of assurance produced can not be accurately determined without using an equation. When the luxury exists for including excess margin, providing inordinate control of uncertainty, and including superfluous testing, and all are done simultaneously, this may provide an unknown high level of assurance. However, experience has shown that the actual assurance existing can vary between 20% and 99+% when any or all of these three elements are modified for project efficiency. This ambiguity about the amount of assurance existing can and does allow intolerable consequences to occur.

Mechanism

When a situation is approached for making a decision, the logic is to rule out the extremes and then concentrate on those areas where the capabilities exist to precisely control the influences having the major effect on the successful outcome of the decision. This can be illustrated on the Decision Technology Risk Value Chart shown in Figure 1.

Risk value has two components, the probability of a failure occurring and the cost of the consequence if the failure does occur. Looking at the chart, it can be seen that if the probability of failure is low and the cost of consequence is low or insignificant, there is a low risk value and a decision is easy—DO IT! Conversely, if the probability of failure is high and the cost of the consequence is high or extreme, there is a high-risk value and the decision is equally easy—DON'T DO IT!

In-Between, Decisions are Uncertain

These uncertain decisions usually are critical and tend to consume the major effort and expense of any endeavor. Consider the type of decisions you are called upon to make. Don't you find the troublesome ones would fall in the central uncertain area?

Obviously, all managers would like to have the quantified assurance probabilities of successful performance in this uncertain area. It would enable them to avoid the risks that lead to failure and cost-overrun headlines. Unfortunately, very few managers realize that such a quantification can be achieved.

The good news is that quantification is not only possible but is available through decision-technology methodology. Required data, necessarily used but not normally documented in project data systems, are processed through unique analysis techniques and provide assurance determinations in a useful and structured form. Whether the determined assurance levels are 20%, 70%, or 99.99+%, when they are presented in the decision-technology format with the source back-up information, they are completely understood and readily accepted.

The bad news is that even though decision technology has been proved productive in over 80 applications, currently it is not being effectively implemented to help control the troublesome aspects of the National Defense Acquisition Program.

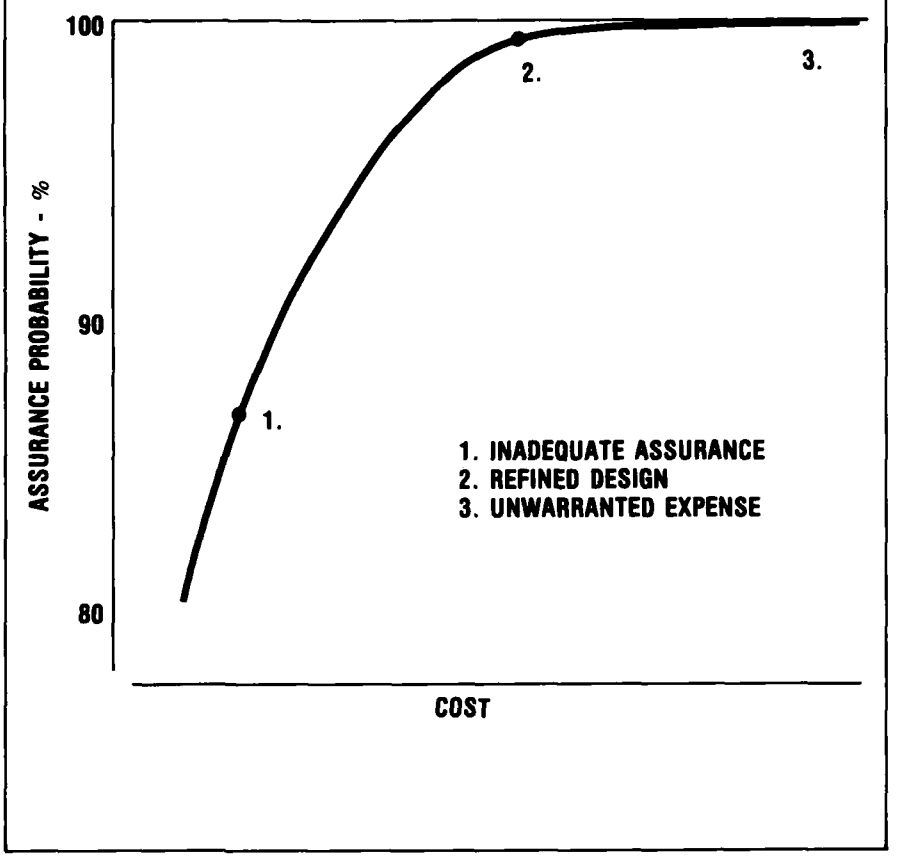
Accomplishments

The scope and versatility of the process can be shown through the description of the characteristics that have been associated with the applications already accomplished. Maybe there are some conditions or desires in the following list that relate to your areas of interest:

—Hardware levels—materials, parts, components, subassemblies, systems and weapon systems or overall projects.

—Functional systems—mission requirements, manufacturing procedures, process control, quality control, assembly, design, screen-testing, and verification testing.

Figure 2: Statistical Management Chart



—Project phase—scientific research, concept development, hardware development, production, operations and phase out.

—Performance quality enhancement—increased operational capabilities, documented operational capabilities and limitations, and/or reduction of failures by 10 to 1 and up to 100 to 1 or more.

—Cost savings—10s of thousands, 100s of thousands, millions and up to 10s of millions or more.

—Time savings—hours, days, weeks, and months.

—Degree of involvement—one item, trouble-shooting, point-in-time status, project phase and beginning to end for a complete weapon system project.

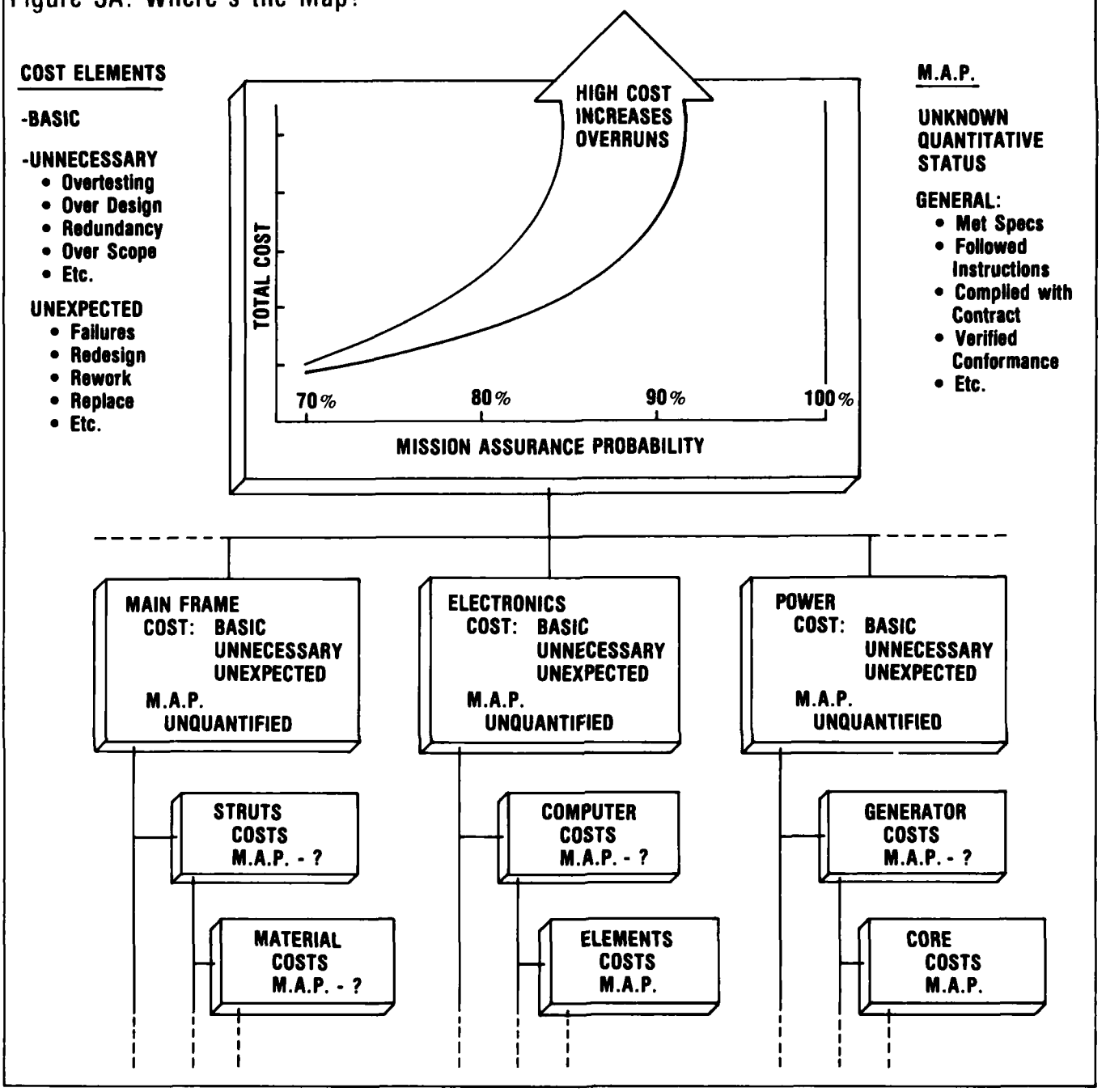
Formulating decisions is a broad subject. From the previous experience listed above, it can be seen that decision technology has had a broad spectrum of application up to this time.

Why is the decision-technology effort so minimal? This is explained by the fact that it neither creates the ideas for accomplishment nor determines the approaches to be used to attain them. Its accomplishments lie in its ability to quantify the probability of the proposed approaches successfully meeting the planned objective. Further, it identifies the effects on the success probability resulting from incremental changes in the existing approaches and is able to precisely link these changes with their incumbent costs. The resulting output is the Statistical Management Chart shown in Figure 2 where the intended objective, mission assurance probability, is shown as the ordinate for emphasis and clarity. When effort is applied properly, mission probability of success should increase with cost.

Probability of Success

At Point 1, there is inadequate assurance (high-risk value boundary) while at Point 3, there is unwarranted expense (low-risk value boundary). The most favorable condition for a decision (refined design) is at Point 2, which can be identified by many names, such as best value, "knee of the curve," point of diminishing returns, optimum balance of value and cost, etc. The assurance levels along the

Figure 3A: Where's the Map?



curve are substantiated by the detailed description of what is required from each contributor to achieve them.

A comparison of the assurance/cost expectations and results with and without using decision technology is shown in Figures 3A and 3B. In this case, the managerial objective of controlling cost is emphasized by having cost on the ordinate. Without decision technology, costs can ramble and compound and performance difficulties can emerge from many areas, as indicated in Figure 3A. This can lead to inflated and high costs along with unknown and unacceptable quality of performance leading one to ask: "Where's the MAP?" On the other hand, with the Decision Technology MAP as shown in Figure 3B, the contributed value to mission assurance probability of each activity is known and selected to achieve desired results, and cost is controlled through knowing the cost of the activities. In addition, the decision-technology process provides an excellent opportunity for potential deleterious effects to surface and be handled before they can cause the performance and cost problems that are so familiar today.

Applications

To do everything on everything would obviously be impractical. Also, it is not necessary to analyze everything in detail, but it is necessary to consider in some form every possible eventuality. For all but a few pro-

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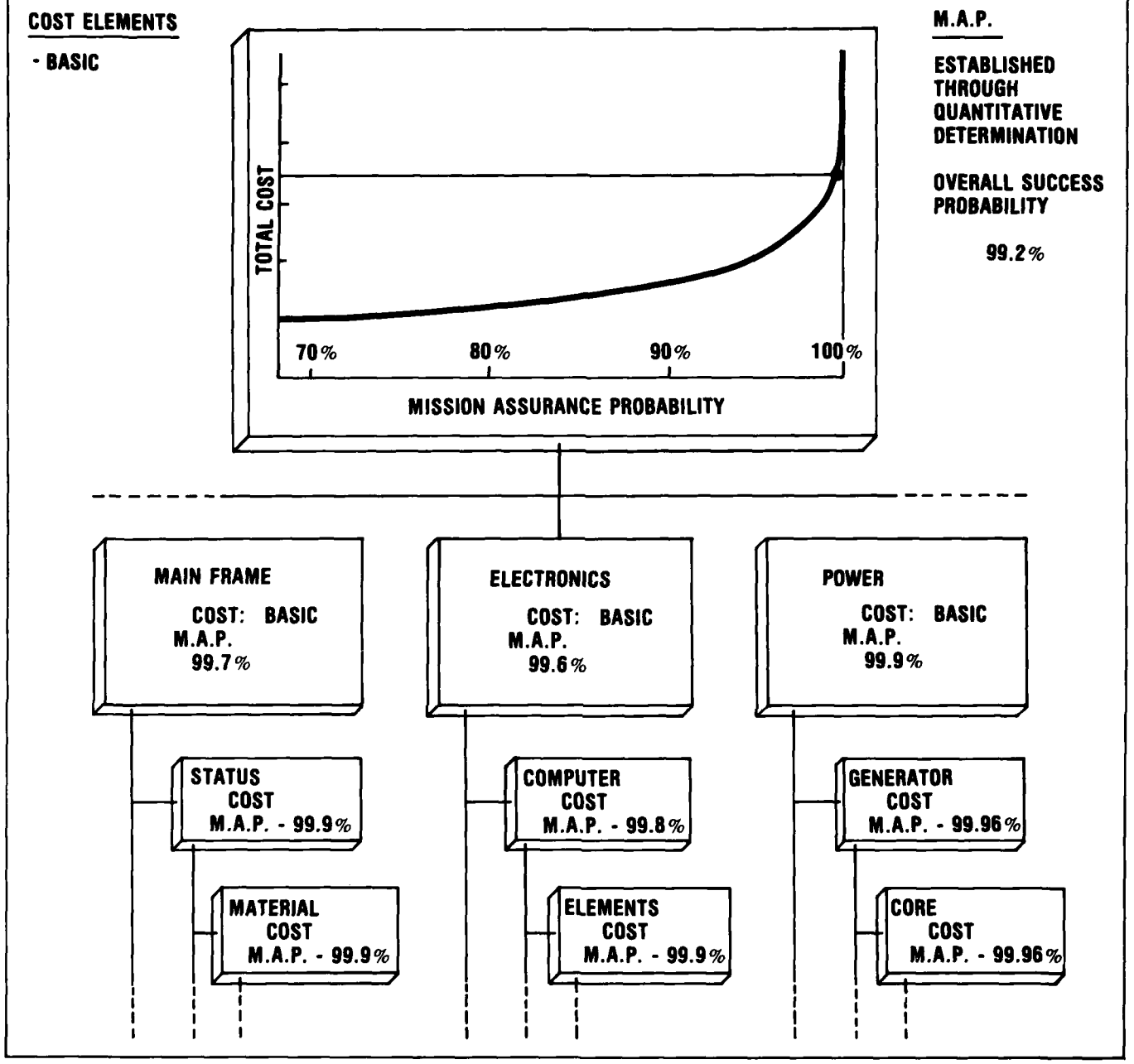
Figure 3B: Here's the Map!



gram elements, the conditions are such that there is little need for any more than a conscious consideration of the possibility. It can be intuitively recognized that the existing uncertainties can be handled by the extra capability included (margin), and there generally is ample experience to have confidence that these values are truly representative.

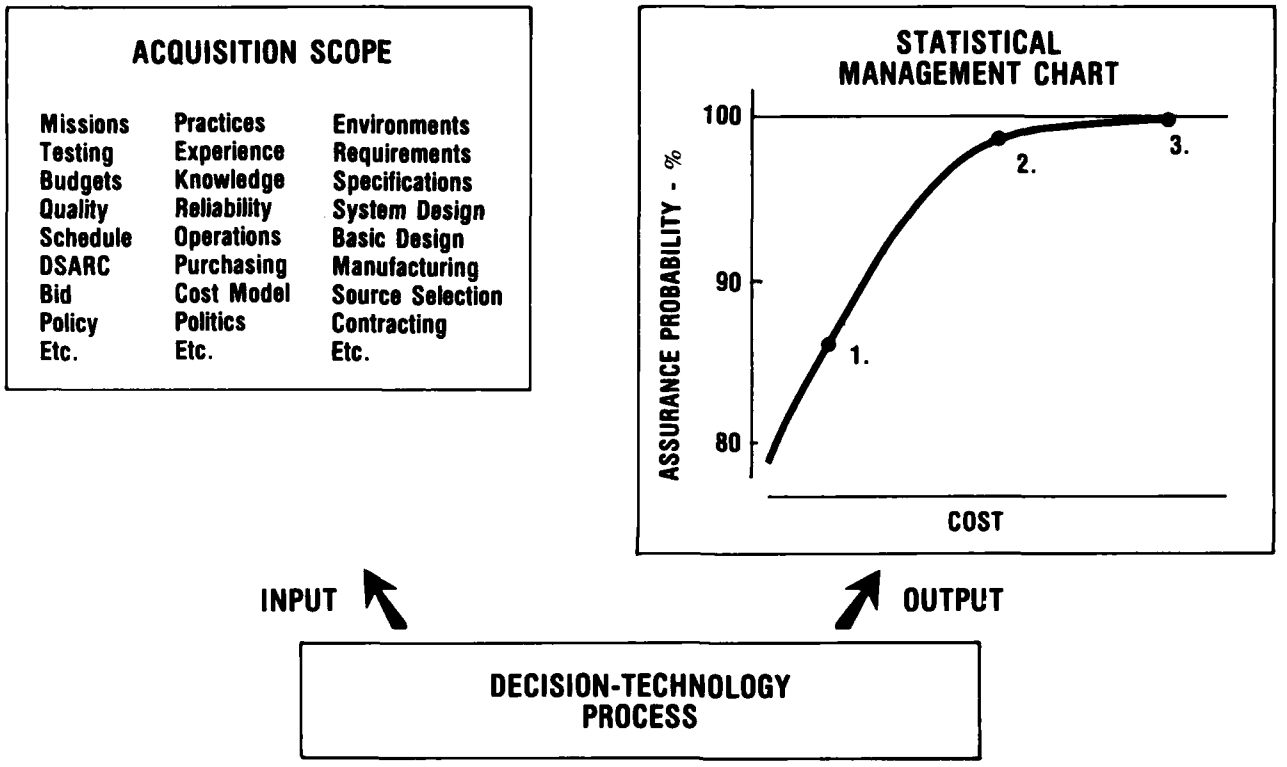
The "Horseshoe Nail" Can Be Overlooked!

Salient elements of assurance must be reviewed systematically and the critical areas resolved completely as is accomplished through the decision-technology process.

An excellent mechanism for systematically screening the planned or existing situations is the new DOD Directive 4245.7, "Transition from Development to Production,"[2] which provides critical path templates to isolate specific areas of consideration. Again, in most cases, these areas can be handled intuitively; but, when there are extenuating circumstances, outside pressures, weak communications, complex issues, limited capabilities, and/or critical consequences, the formal application of decision technology can provide the added precision, sensitivity, and visibility needed to develop efficient and acceptable decisions.

Likewise, DOD Directive 5000.2, "Major System Acquisition Procedure," calls for the review of specific accomplishment characteristics that are generally recognized as being necessary to know before building on them in subsequent program phases. Decision technology provides the information on the degree of achieved assurance and cost that the DSARC

Figure 4: Decision Technology Function



review process seeks. The information is presented in a form that can be used to satisfy the intent of these reviews.

The basic logic and format of the decision-technology methodology can help to provide an efficient and uniform method of addressing all issues. As everyone knows, there are no such things as absolute answers, but the current process of finding out the viability of a decision through actual experience can range from insignificant, through unacceptable, to catastrophic. For instance, you wouldn't want to perform a trial operation, possibly risking a major power-plant failure, without knowing and understanding the risk values of operation ahead of time. When severe costs of consequences are likely to result, the quantitative probability of this should be known in advance, if possible, and corrective action taken, if necessary. It might be the same as considering driving 20 feet behind a car on the turnpike at 60 mph and an accident hasn't occurred yet. There is enough tension developed from the recognized risk that the conditions should be changed before the inevitable happens.

It has been found in the application of the decision-technology process that for almost every failure, when the causes were identified, there was adequate information available beforehand that identified the high risk area. This might be the same as running out of gas on the turnpike even though the gas gauge reads near empty before it happens. The reason these high-risk areas do not get properly addressed is that there does not exist a method to identify their true criticality, and/or to communicate the true situation with enough precision to precipate corrective action.

Just Identifying a High Risk Area Is Not Enough

There must be, as decision technology provides, a description of what makes a high-risk area and by how much. When this is known, it should provide the understanding of what must be changed, and by how much, to achieve the results desired.

Recommendations

Having a formal, well-documented system for providing management decision support is an ultimate necessity. Because of the need to develop a philosophy, a concept, and the functional systems to handle widely diverse and complex decisions, the formulation of such a system tool took more than 10 years of evolutionary development. As shown in Figure 4, decision technology interfaces with many influencing factors, evaluating and integrating them to provide the assurance/cost sensitivity for management decision support. Formalizing the documentation and procedures for the almost limitless applications, and training specialists to perform the analyses and handle the implementation, could require an extended period of time.

Too Many Decisions Are Inadequate

Now is the time to provide decision-makers with the support they need. It is recommended that the decision support system be implemented in three forms so that critical decisions could be enhanced immediately, and all decisions could continue to improve until the full potential of the discipline could be achieved.

—First, decision-makers and program

analysts can use informational briefings on decision-technology techniques and language to clarify the specific elements involved in formulating decisions. Even though these elements are used now in one form or another, the briefing will provide a formal definition of each element and show how they are interrelated, thus creating a uniform language for integrating and communicating all considerations. This level of understanding alone has lead to many significant improvements.

—Second, program analysts and management support specialists can acquire formalized training in the disciplines of decision technology and the production of the statistical management chart for the integrated program assurance/cost MAP; again, in the disciplines of decision technology and the production of the statistical management chart for the integrated program assurance/cost MAP; again, immediate benefits can be obtained and on-line supported training can advance the time for self-sustained implementation.

—Third, program management and decision-makers can acquire the benefits through the services of outside professionals. These services can be implemented through the mechanism of the Value Engineering Change Proposal DARS; in most instances, high-quality performance can be achieved for the project while resulting in a net savings. Decision technology provides the decision-makers with the information and visibility to make these choices with a high degree of confidence.

Any one, or any combination of the three recommendations, can bring the benefits of the MAP to the decision-making process.

Achieve High-Quality Weapon System Performance at Reduced Cost

Reduce and control cost through control of mission assurance probability. If costs and/or performance on a project are not what they should be, the question to raise to better understand the situation and support the decisions made is: "Where's the map?"■

Notes

1. See R.P. Swank, "Assurance Administration An Integral Part of Program Management," *National Defense*, October 1981.

2. See "Solving the Risk Equation in Transition from Development to Production," DOD Directive 4245.7; product of Defense Science Board Task Force, May 25, 1983, Chairman, William J. Willoughby, Jr., Naval Material Command.

Streamlining

(Continued from page 23)

To implement the new policy, Deputy Secretary Taft said:

—Prior to full-scale development, military specifications and standards shall be cited for guidance only.

—During full-scale development, the contractual applicability of specifications, standards, and related documents shall be limited to those cited in the contract and specified portions of documents directly referenced (first-tier reference). All second-tier references shall be for guidance only unless they are specifically called out in the contract.

—During production, those specifications, standards, and referenced documents, to the tier identified as the baseline, shall be considered contractual requirements for both procurement and reprocurement.

Deputy Secretary Taft indicated that this policy will apply to "existing programs identified to implement acquisition streamlining." In addition, this policy will apply to solicitations and resulting contracts for new defense systems and equipment issued after September 30, 1985.

This was the situation in mid-June. We will have a directive and a revised handbook soon. Thirty-three programs will be subjected to scrutiny by those who advocate streamlining. The applicability of standards and specifications in new contracts will be challenged. The program management courses at DSMC will emphasize the need for acquisition streamlining.

Security

(Continued from page 5)

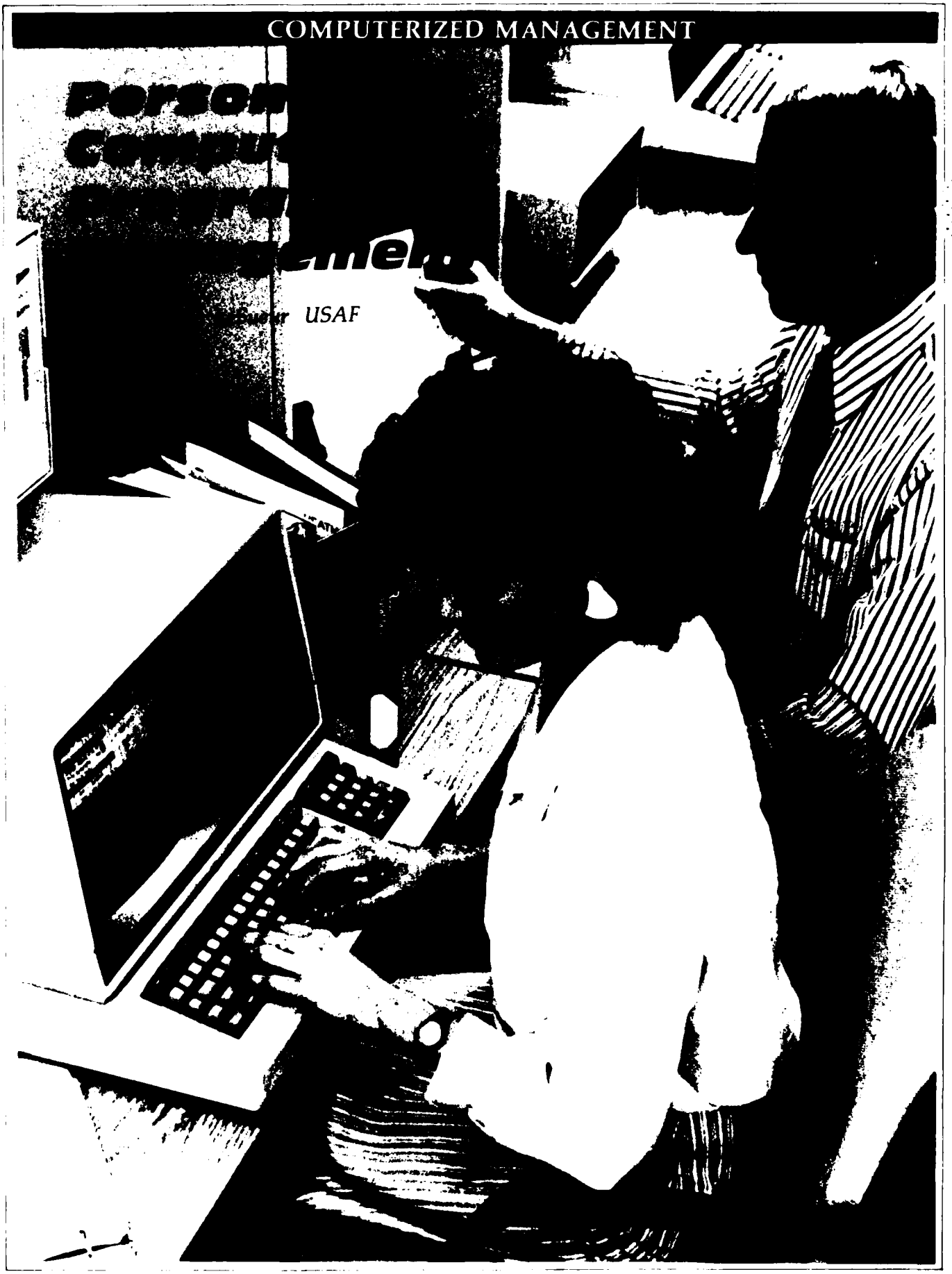
is still unfinished business. As President Reagan said recently, "There is one boundary which Yalta symbolizes that never can be made legitimate, and that is the dividing line between freedom and repression."

One final thought. We must recognize that Soviet claims about the inevitable victory of communism and the futility of resistance do not confer legitimacy on Soviet leaders and their repressive machinery of internal security. For they have been elected, not by the people, but by the small number of their associates who feel that the inexorable forces of history—as they read it—are on their side.

It is not the military strength of the United States and our allies, then, that offers the greatest challenge to the Soviet Union. The Soviet leaders know that we do not seek to control our neighbors or theirs.

No, our challenge is that we, too, have staked a claim to the future. We believe that political and economic liberty and individual human freedom for all, if not the world's inevitable future, are, nevertheless, the world's best future. We hold this belief so strongly, so confidently, that we put it constantly to the test in our free press and our free elections and in countless other ways we all take for granted. Together they send a clear signal of confidence in ourselves.

In summary, I believe that with a renewed confidence in ourselves, with our strength restored and with a far greater understanding of a system with characteristics and imperatives far different from our own, America and its allies and friends can look forward to exciting new prospects for peace and cooperation in this decade and beyond.■


USAF

The use of personal computers is rapidly expanding and the program office should be no exception. In fact, most program offices are already accomplishing a significant portion of their daily work with computers. Every word processor is a computer and in many cases, although unkown to program office personnel, these machines can provide significant additional capabilities to the program office. Office personnel should not be intimidated by a lack of computer knowledge. Expertise in computer hardware and software is not required, and the application programs discussed here are generally user friendly, requiring minimal knowledge of computers.[1]

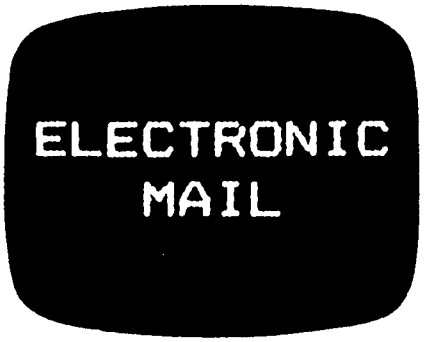
Word Processing

As mentioned above, word processors are computers and the virtues of a word processor are well known. The point for a program manager is that word-processing software is availiable for personal computers, that is equal to, or more capable than, the dedicated word processors found in program offices. Therefore, when a new word processor is needed, program managers would be wise to consider a personal computer that can provide the additional capabilities listed below, in addition to word processing. In the interim since word processors are computers, program managers can check and see if other application software is availaible which can be used on their current word processors. For example, many of the applications listed below are available and will work on office equipment currently utilized as dedicated word processing equipment.

An important application program that should not be overlooked, and is available for both personal computers and word processors, is a spelling checker. Computer spelling checkers contain about 50,000 to 100,000 words and can rapidly show misspelled words and typographical errors. However, a spelling checker will not alleviate the requirement to proofread your documents; for example a simple typographical error where the r and o are transposed (spelling "form") will be recognized by the spelling checker program as a legitimate word. Still, a spelling checker program will expedite proofing of documents.

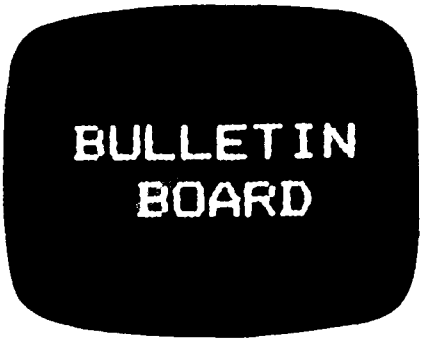
Electronic Mail

Closely related to word processing functions is the use of a personal computer for electronic mail. Most program office personnel have used a facsimile to electronically send a document they have prepared to another office where it is urgently needed. Often the process must be repeated several times to ensure that a readable copy is received. This same transmission of a critical document can be accomplished via the personal computer.



By use of a modem (modulator demodulator) the information that was created by the personal computer's word processor is sent over a telephone connection to another modem and computer. Once the document is received, it is printed out on the receiving computer's printer.

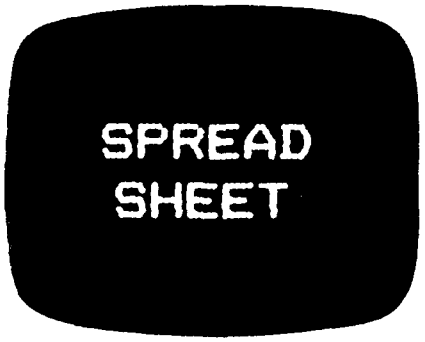
Advantages of electronic mail are that the document will be as clear as if it were created on the computer's resident word processor. In lieu of a long-distance telephone connection, one of two DOD nationwide computer networks (ARPANET or MILNET) may be used for transmission if the program office and/or the contractors have gained access to one of these networks. If an electronic mail network such as the ARPANET or MILNET is used the document may be delivered to several offices from one transmission and forwarded by these offices to other offices on the network. One drawback of electronic mail is that signatures, pictures, drawing photos, maps, etc., can not be transmitted. However, the data form application programs such as spreadsheets can also be transmitted via electronic mail between two computers. Each computer can then independently act upon this information.



Another subset of electronic mail is the use of computer bulletin boards. Numerous computer bulletin boards exist across the country. Some are commercial, requiring access fees, and others may be accessed at no charge. Public domain application programs and templates for use with many of the more sophisticated application programs can be taken via modem and used as needed. These bulletin boards are also a source of computer expertise if you have questions for which you can not readily find an answer. One example is the National Bureau of Standards (NBS) which maintains a bulletin board for the expressed interest of facilitating an exchange of information, ideas, and services associated with use of computers in the government workplace. General Services Administration is now collaborating with the NBS in maintaining an office automation and information management exchange via the bulletin board. In addition, information from a special interest group, the Association of Federal Computer Users, is available on this bulletin board.[2]

Spreadsheets

We are all aware of the time required to develop budgets, add inflation or deflation factors, change quantities, etc., to create and maintain program budgets. The use of a personal computer and a good spreadsheet can save considerable time in this process. Most good spreadsheets accomplish this by utilizing a cell approach. The computer emulates a piece of paper that is divided into cells, each identified by a row and column. By spen-



ding a little extra time up front the budget analyst using a personal computer can develop a set of formulae for various cells that manipulate numbers found in other cells. For example, if the formula (A1 X B1) appeared in cell C1 of a spreadsheet and cell A1 contained the number 5 and cell B1 contained the number 6 then the number 30 would appear in cell C1 of the spreadsheet.

Once the spreadsheet formulae have been developed, creating and changing a program budget is a simple task. For example, a budget can be developed using constant-year dollars, quantities, and inflation indices to provide then-year dollars. After initial entry the spreadsheet is saved to disk for later use. When the inflation indices change and the budget must be updated to reflect the new inflation indices, all the analyst does is change the indices cells on the spreadsheet. The spreadsheet then will automatically provide the new budget based upon the changes made. This only requires a few seconds more than the time required to input the changed data to the spreadsheet. Considerable time will be saved over manual calculations done with paper, pencil, and calculator.

Technical computations can also be accomplished via the spreadsheet. Again, basic data is input to various cells, and a series of formulae developed in other cells. After the initial calculations are performed the data may be repeatedly changed and recalculated. An example might be a series of complicated weight and balance caluclations necessary to determine acceptability of a design.

Other Program Management Tools

Often the use of a critical path can determine where slack can be removed to save a program schedule. However, it is a difficult and time consuming task for program managers to determine the critical path for a project. Again, the personal computer can be of service. Several application programs are available that will develop PERT, Gantt, and time charts. The largest effort in utilizing these programs is the collection and ordering of the data for input to the computer. Once all the data are available for use, the computer will identify the critical path and where slack exists. The scheduled tasks can be changed and the computer will rapidly respond to changes in the data identifying new critical paths, schedules, and slack time. In some of these applications programs other dimensions, such as cost or manpower, may be added.

A personal computer may also aid the program manager in keeping track of actions due, and suspenses. Most program managers keep a do-list of open-action items and suspenses either

in a notebook or on their calendars. Use of a time management program may be helpful. It may take a few minutes more to input actions which should be tracked into the computer, but the benefits are worth it. First, the computer will want a priority for the action and then when asked, the computer will provide a list of the actions back in priority order with all overdue items identified. A list may be printed out by the month, week, or day. Completed actions may be deleted or just lined through. Another advantage is that personnel quickly learn to use the computer as an aid to ensure meeting all of their actions.

There is a relatively new item that may have potential benefits for program managers. Currently, we are seeing vugraphs made via computer. Hardware is now available that will make an instantly developing 35 mm slide directly from the screen of a personal computer. If a program manager is pressed for time and can not get normal graphics support, this hardware may prove extremely useful, especially if the change is to data contained on his personal computer. All that is required is for the data to be displayed on the computer screen and have the photographic hood attached, which allows a slide to be taken of the screen.

Within the past few months a major new application for the personal computer has arrived. This is a Computer Aided Design (CAD) application program. This application is now reasonably priced and sized for a personal computer. We can expect contractors will start utilizing the CAD capabilities of the personal computer for many of the activities that have been previously accomplished by draftsmen. Closely related to CAD is Computer Aided Manufacturing (CAM). CAM utilizes the CAD designs that have been stored on magnetic disk to control computer run manufacturing processes. Although CAM application for a personal computer is not currently available, we can expect it to be available within the next 5 to 10 years. CAD/CAM may not have any direct use to the government program manager, but we must be aware these capabilities exist and understand how government contractors may be using them. Use of these programs certainly should affect program costs and schedule.

Future Applications

It is safe to say that the use of personal computers is just beginning. Much work is occurring to increase the productivity of computers for project managers. A professor at the Defense Systems Management College is currently working to scale down three ap-

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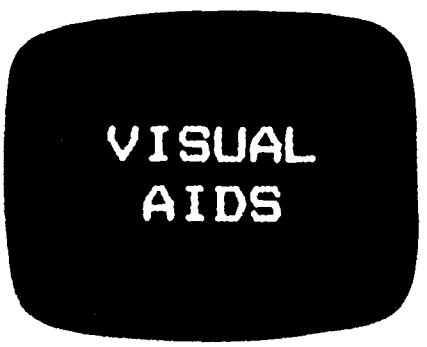
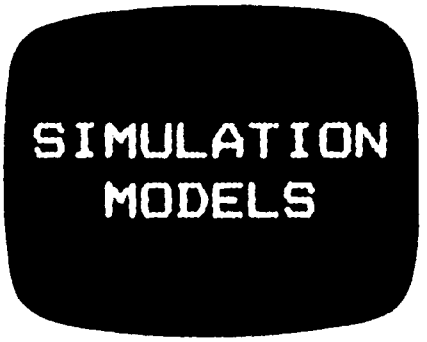
■ Major LeSueur, a graduate of PMC 85-1, is assigned to Air Force Systems Command Space Division in Los Angeles.



plications for use on personal computers, which he hopes to make available to program managers in the near future. The first application is the Cost and Strategy Assessment (CASA) model. This model takes input data and determines life-cycle cost allowing for program optimization trade-offs. The second application is a network model called VERT which calculates program risk as a function of cost and schedule when probabilistic inputs are applied. The third application is the DOD Product Engineering Services Office (DPESO) model. The DPESO model uses regression analysis to calculate rate, quantity, and inflation trade-offs, and the cost burden of production rates. This may be very useful when a program manager must restructure his program because of budget or production rate changes. The government has unlimited rights to each of these models. These applications could be of great value to any program office during trying periods of budget preparation and program restructure.[3]

The Research Department at DSMC is also working on various applications that will be useful to program managers. Chief among their goals is to have application software which is transportable across all makes of personal computers. Therefore, DSMC may, in the near future, be an excellent source for recommending and possibly providing application software to program offices.



What all this means to the program manager is that use of personal computers in program management is here and can be a tremendous aid in reducing the workload. The personal computer will never replace good judgment in managing programs, but it can allow the program office to develop in a rapid fashion a series of "what-if" questions providing clearer definition of options. Ultimately, the end-result will be better informed decision-mak ing, and increased office productivity by use of personal computers.■

Notes

1. User friendly. When application software asks for data to be supplied to the computer and will only accept data that are of the correct form and type. For example, if the program requires numeric data it will not accept a character; or if the program requires a date in the form of month and year, it will not accept day, month, and year; but it will ask you to re-enter the date as month and year.

2. Institute for Computer Sciences and Technology. A-209 ADMIN, National Bureau of Standards, Washington, D.C. 20234. (301) 921-2834. On-line computer bulletin board can be accessed at (301) 948-5718.

3. Caver, Troy. Personal interview, Defense Systems Management College, Ft. Belvoir, Va., April 15, 1985.

Peacekeeper Nears Silo Testing

The Peacekeeper will soon make its first flight from a modified Minuteman III silo at Vandenberg AFB, Calif., moving closer to becoming an operational system. The flight — No. 9 — is scheduled to take place sometime during the summer. Seven of the 20 research and development flights that are scheduled through mid-1986 have been flown. Flight No. 8, now being processed, will be the last one the Peacekeeper makes from the test pad. The Peacekeeper developmental flight test program began at Vandenberg in 1983, following a recommendation by the President's Commission on Strategic Forces to replace 100 Minuteman III missiles with 100 Peacekeepers. Minuteman missiles have been the cornerstone of the land-based intercontinental ballistic missile force for 20 years. The Peacekeeper and its new MK-21 re-entry vehicle will give the United States the ability to achieve high levels of damage against the Soviet targets. Full-scale development of the Peacekeeper missile began in 1979 and the first missile was flight tested in June 1983. The Peacekeeper is a four-stage ICBM designed to deliver 10 re-entry vehicles to separate targets at ranges greater than 5,000 miles.■

46 Sites on Small ICBM Basing List

The Air Force has narrowed the small intercontinental ballistic missile basing list to 46 possible sites. Current plans call for basing the missile at existing Department of Defense and Department of Energy installations. The Air Force has screened more than 4,200 sites across the country since last fall. The remaining 46 areas, in nine states, will be further evaluated as potential locations for deployment of the first missiles in 1992, officials added. The sites are located in Arizona, California, Nevada, Florida, Texas, Utah, New Mexico, Washington and Wyoming.■

Colorado to be Home of Joint Command

The new U.S. Space Command, which could be activated by the end of 1985, will make its home in Colorado Springs, Colo., if results of an environmental impact assessment are favorable. A Joint Chiefs of Staff recommendation to locate the command in Colorado Springs was approved by the secretary of defense in April. The costs of establishing USSPACECOM will be reduced since existing facilities in the area could be used.■

"The best organization chart in the world is unsound if the men who have to make it work don't believe in it."

—James Forrestal

People on the Move


Clearwaters


Dawson


Jones


Miller


Opitz


Thomas

LTC Boyd L. Clearwaters, USA, a professor in the Business Management Department, was executive officer of the Missiles and Air Defense Division, DCSRDA, before being assigned to DSMC. He holds a B.S. degree from The Citadel and an M.B.A. degree from Florida State University.

Commander Rosemary Nelson Dawson, USN, a professor in the Business Management Department, joined the DSMC staff after graduating from PMC 85-1. She received a B.S. degree in mathematics from Fort Wright College, and an M.S. degree from the Naval Postgraduate School.

Commander Harland W. Jones, USN, is a professor in the Policy and Organization Management Department. His last assignment was at the Naval Air Systems Command as assistant program manager for test and evaluation. He holds a B.S. degree from the U.S. Naval Academy, an M.S.A.E. degree from the Naval Postgraduate School, and an M.B.A. degree from the University of West Florida.

LTC Phillip Eugene Miller, USA, professor in the Technical Management Department, was previously assigned to the Product Improvement Branch of the Army Materiel Command. A graduate of PMC 82-1, he holds a B.S. degree in aeronautical science from Embry-Riddle Aeronautical University, and an M.S. degree in acquisition management from the Florida Institute of Technology.

Warren F. Opitz is a professor in the Acquisition Management Laboratory. He came to DSMC from Martin Marietta Aerospace, Baltimore Division, where he was VLS production operations director. Mr. Opitz received a B.S.E.E. degree from Purdue University, and an M.C.S. degree from Rollins College.

LTC Michael E. Thomas, USA, a professor in the Policy and Organization Management Department, came to DSMC from the Pentagon, where he was military assistant to James R. Ambrose, undersecretary of the Army. Lieutenant Colonel Thomas received a B.S. degree in electrical engineering from the University of Alabama, and an M.A. degree in business from Central Michigan University.

Additions

Sarah Beaudet and **Michelle Washington,** COEs, to Department of Research and Information.

Sarah Cornell, COE, to Office of the Commandant.

Tina Hairston and **Spencer Teale,** COEs, to School of Systems Acquisition Education.

Patrick Lowry, summer hire, and **Monique Lemelin,** COE, to Department of Administration and Support.

Mark Lipari, COE, to Acquisition Management Laboratory.

Staff Sergeant John Mills, USAF, to Administrative and Personnel Services.

Ann Marie O'Brien, COE, to Technical Management Department.

Losses

Mary Agresto, Navy Office for Acquisition Research, to Surface Ships Logistics Management Division, Naval Sea Systems Command.

LTC John W. Bohuslar, USA, Acquisition Management Laboratory, to the U.S. Army Space Program Office, Alexandria, Va.

Liz DePaulo, Policy and Organization Management Department, to Education Directorate, Headquarters, Department of the Army, Alexandria, Va.

Cindy Sellers, Information Directorate, to the Adjutant General Center to be a management specialist intern.

Staff Sergeant Dennis Snell, USAF, Administrative and Personnel Services, reassigned to Eglin Air Force Base, Fla. He has been selected for promotion to TSgt.

Promotions

LTC Stanley J. Souvenir, USA, selected for promotion to colonel and reassigned to the Office of the Commandant.

Four PMC Graduates In Chain of Command

Captain Ian B. Littlejohn, USAF, who was graduated from PMC 83-1, was promoted to major with a date of rank February 1, 1985. He is serving at the Aeronautical Systems Division, Wright-Patterson Air Force Base Ohio, as the INEWS assistant program manager for thrust and special projects; contract monitor and assistant test manager; and INEWS DSARC action officer. He has received the Air Force Commendation Medal with second Oak Leaf Cluster.

Captain Littlejohn's chain of command may constitute a record for PMC graduates. He serves with Colonel David Teal, PMC 72-2; Lieutenant Colonel Larry Opperman, PMC 83-2; and, Lieutenant Colonel James Sikra, PMC 84-1, division chief.■

Leadership in a democratic Army means firmness, not harshness;
Understanding, not weakness;
Justice, not license;
Humaneness, not intolerance;
Generosity, not selfishness;
Pride, not egotism.

General of the Army
Omar N. Bradley

Program Manager

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—*Acquisition Strategy Guide*, stock # 008-020-01028-6, for $6.50;

—*Skill in Communications*, stock # 008-020-01036-7, for $2.00.

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Orders also may be charged to Mastercard and VISA credit cards. These orders may be placed by telephone. The number is:

(202) 783-3238

See the enclosed blue card for information about ordering this publication from the Government Printing Office.■

Competition Jumps By 55 Percent

Contracts awarded competitively within Air Force Systems Command increased 55 percent in the first quarter of fiscal year 1985 compared to the same quarter a year ago. That translates to $4.5 billion in competitive contracts versus $2.9 billion in the first quarter of fiscal 1984. The command credits the rise to increased emphasis on competition by Air Force senior leaders, as well as a growth in subcontract competition by prime contractors.■

Send Us Your Articles

Some Tips for Authors

The editors of *Program Manager*, DSMC's bimonthly journal, are interested in your thoughts on policies, trends, and events in the areas of program management and defense systems acquisition. We invite you to submit articles and share your experiences. We are interested in lessons you have learned through your acquisition experiences, both successful and otherwise.

Beyond the demand for good grammar, we have some tips for prospective authors. Consistency and uniformity should be uppermost. The renowned stylist William Strunk, Jr., said, "If those who have studied the art of writing are in accord on any one point, it is this: the surest way to arouse and hold the attention of the reader is by being specific, definite and concrete."

Style

Write in the first person, *I, we, our*; and use *you* often. Active verbs are best. Write naturally and avoid stiltedness. Except for a change of pace, keep most sentences to 25 words or less, and paragraphs to six sentences. We reserve the right to edit for clarity and space limitations.

Published articles will include your byline, and brief biography. When there are substantial editorial changes, *Program Manager* clears edited copy with the author.

Where possible, clear articles through your public affairs office or an equivalent authority. Most of the articles we publish are routinely reviewed and cleared by the Director, Security Review, Office of the Assistant Secretary of Defense for Public Affairs.

Length and Graphics

The Basics: Double-space your article using only one side of the paper. One double-spaced page, with a one-inch border on all sides, equals about 250-300 words. We are flexible regarding length, but prefer 2,000-3,000-word articles, which is about 10 double-spaced pages. Don't feel constrained by length requirements; say what you have to say in the most direct way, regardless of length.

We use figures, charts, and photographs. We prefer glossy, black and white photographs, five-by-seven or eight-by-ten, but we cannot guarantee the return of photographs. Do not write anything on the back of photographs. Photocopies of photographs are not acceptable. Charts and figures should be sharp and clear, with legible information and captions. We prefer camera-ready art, but the DSMC Graphic Arts Division can work with sketches if they are clear and precise.

Attribute all references you have used in researching your article. We use separate footnotes, which should be identified at the appropriate place in the copy.

Stories that appeal to our readers, who are senior military and civilian people in the program management/acquisition business, are those taken from *your own* experience rather than pages of "researched information."

Again, be sure to double-space your copy and use only one side of the paper.

If you need to talk to an editor, call:

Robert W. Ball, (703) 664-5974 or 664-5082; Autovon 354-5974 or 354-5082.

Catherine M. Clark, (703) 664-5992 or 664-5082; Autovon 354-5992 or 354-5082.

Or, write us at the Defense Systems Management College, Fort Belvoir, Virginia 22060-5426: ATTN: DRI-P.■

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