

The technology was there in embryo. The sense of urgency was understood. The priorities were being established, and the funding was available without before-the-fact feasibility and cost/effectiveness demonstrations. What was lacking, as the country set out to establish ICBM capability, was the management structure to do the job. The creation of that structure ensured the program's eventual success . . .

USAF's Missile Program: A Management Milestone

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"Management is our theme because management is our need. Increased scientific and engineering competence will not speed up the rate of our technical progress, unless we learn to manage our resources more wisely and efficiently. In systems acquisition today, management is the pacing factor."

—GEN. BERNARD A. SCHRIEVER, USAF

THERE is general agreement that ten years ago, when the ballistic missile program really began, there was no management capability put together, in uniform or out, that could handle the job.

We had other things. We had the necessary potential in technology and some wise men who knew it. Their voice was heard when the "Teapot Committee," headed by Dr. John von Neumann, said the job could be done. We had the necessary sense of urgency. The program involved the security of the entire free world and we were the acknowledged leaders of that world. The National Security Council and the President gave

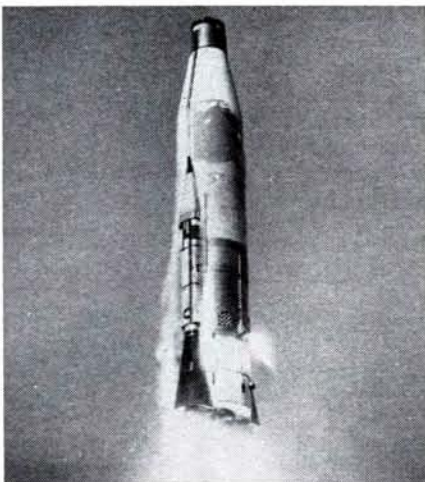
the ballistic missile the highest national priority. This priority ensured the necessary funding without before-the-fact demonstration that the weapon would work and that it was high in cost/effectiveness. It was a case of faith firmly buttressed by fact.

When these green lights were turned on, the history of missiles, guided if not ballistic, was at least as old as World War II, when the Germans made the first faltering steps. The Joint Chiefs of Staff had a committee on the subject early in 1945.

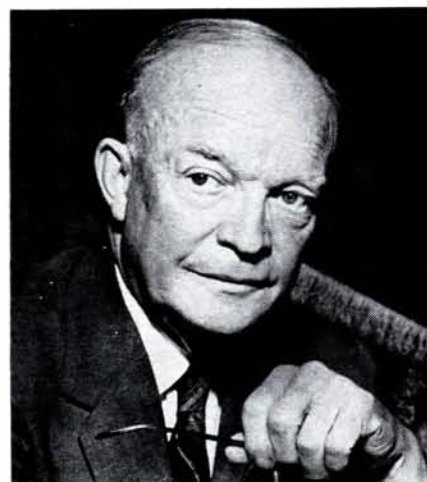
In retrospect, if we study the record between the end of the war and the organization of the von Neumann Committee in 1953, pressing on to some inde-



Leading scientific light in the decision to inaugurate large-scale ballistic missile program was famed nuclear physicist, Dr. John von Neumann, who chaired the historic Teapot Committee.



By 1958 the Atlas intercontinental ballistic missile was on road to eventual operational status. Above, one of the early Atlas test missiles blasts off the launch pad at Cape Canaveral.



Missile planners got a leg up when President Dwight D. Eisenhower, convinced of urgency of ICBM program, gave approval of assignment of top priority to program, helping cut red tape.

After showing little initial enthusiasm for research of any sort, Defense Secretary Charles E. Wilson finally gave Department of Defense green light to USAF effort.



terminate point where USAF's Western Development Division got a reasonably firm grip on all the tentacles, it is obvious that management was the stumbling block.

There was more than a decade of fumbling and experimentation, not with technology, but with organization, coordination, czars, directors, committees, assistants, special assistants, and collateral duty for a host of Defense Department officials. Most of this occurred in the regime of Charles E. Wilson as Secretary of Defense, although George C. Marshall had taken the first steps at least three years earlier.

Mr. Wilson had been president of the General Motors Corporation, which probably was a handicap. He had little respect for research and was impatient with the vagaries of development that he could not see headed for some profitable spot on an assembly line.

There was a literal parade through the Pentagon. Defense Secretary Marshall had named K. T. Keller as the first Director of Guided Missiles. But Mr. Wilson abolished the office, and the work was turned back to the Service Secretaries. Almost immediately, the missile effort was entwined in the evolution of the Office of the Secretary of Defense, which was trying to contend with growing complexity. This is another way of saying that the office had a management problem.

Commenting on the big parade of people and agencies, Congressman Chet Holifield's Subcommittee on Military Operations found about them "an air of improvisation and *ad hoc* adjustments to emergencies and to recurrent public demands for bringing order out of chaos in the Pentagon. Even those agencies that are dignified by statute or by a reorganization plan, justified at the time of creation by impressive-sounding arguments for stability and permanence, soon give way to new agencies and new forms of organization."

Then, writing in 1959, the Subcommittee made an observation that stands as rugged as a gantry crane:

"In part, these changes reflect changing needs and circumstances; in part they reflect the baffling nature of the problems of organizing a defense effort which is so large and complex as to be almost unmanageable or at least to yield to no unique organizational solution; and finally, they reflect in part the personality and the concept of office of each new Secretary of Defense. Shall he crack the whip or leave the military departments undisturbed; does his role demand that he get into 'operations' or is he simply to 'coordinate'? How far shall he go in apportioning authority and delegat-

ing functions to his subordinates, and how shall they discharge their responsibilities without running into each other?"

It is true; the answers to these questions have been as varied as the men who have occupied the office. The fact that the military services have emerged with creditable weapon systems probably is due to their ingenuity in the struggle to make decisions. Timely decision-making is the most important part of good management. Almost as if the technological environment did not create enough delays, others are created by people.

People, of course, can and do find rational excuses for the delays they impose. General Schriever himself has pointed out that the number of alternatives facing decision-makers has increased in fifteen years from a half-dozen to—in some cases—more than a hundred. Systems proposed to perform a given mission begin as concepts, pushing the state of the art. There are more and more unknowns, longer lead times, higher costs.

We have turned to computers and the Air Force has pioneered in their use. But the hard choices still have to be made by men. That is why the Air Force, soon after it launched the ballistic missile program, spelled out a management requirement, almost as it would have laid down specifications for a new airplane or fire-control system.

Both the Air Force and its industry partners had management capability long before the ballistic missile program and the management system worked well.

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Designation of a talented general officer, General Schriever, to head program at newly established Western Development Division, was a major ICBM milestone.

Trevor Gardner, Special Assistant for Research and Development to Air Force Secretary, is credited with sparking Teapot Committee studies that indicated feasibility of ballistic missile.



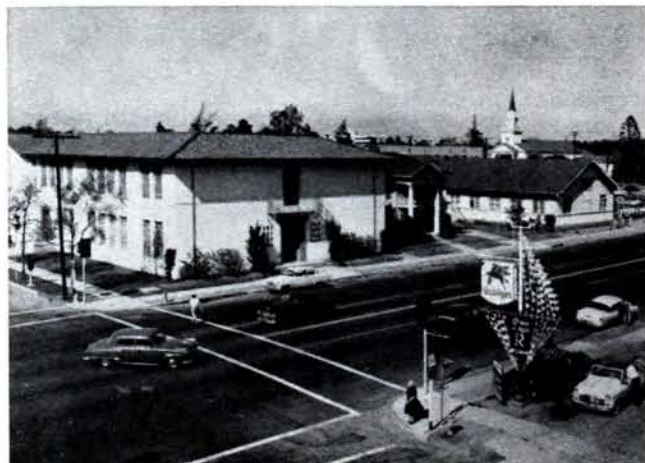
We are concerned here mainly with the military evolution.

Ten years ago there were the Air Materiel Command, located at Wright-Patterson AFB in Ohio, and the Air Research and Development Command, with headquarters in Baltimore, Md. The management set-up for each major system under procurement was centered in a Weapon System Project Office (WSPO), staffed jointly by AMC and ARDC personnel. This office was responsible for systems integration and was the central point where the two commands received the input from the contractors, the using command, Air Training Command, and everyone else involved in the project from concept to operation. While a project was in the development phase, ARDC was the "executive agent," or boss. When production was undertaken, responsibility shifted to the AMC part of the WSPO.

There was attached to each WSPO a Weapon System Phasing Group, and there was further input from an Equipment Advisory Group. Once production was finished on a system, AMC put the support responsibility, so far as logistics is involved, up to a designated Air Materiel Area.

This format worked. When the first B-52 was delivered, for example, it was a complete weapon system. The vehicle, plus its airborne and ground equipment, were all on site—it was Castle AFB in California—and there was not an item that failed to function. Only numbers were needed, and training, to be ready for combat.

Facing the challenge of the ballistic missile, however, it was clear that a new kind of management system was needed and that the calendar was not kind. Time was precious. A new formula was ready by 1955. Basically, it came out of a USAF committee headed by Hyde Gillette, then Deputy for Budget and Program Management. General Schriever also was a member



It all started here in 1954 in what had been a schoolhouse in Inglewood, Calif., original site of the Western Development Division of the old Air Research and Development Command. From this modest site, the vast effort that produced American ballistic missiles was initially directed.

and a moving force in formation of the committee. Later, he described what motivated him at the time: "If you want to move fast, you have got to get yourselves out from under that red tape, or you just can't move."

The Gillette Committee report covers fourteen pages of fine type, after deletion of classified material. It properly proposed that the Secretary of Defense be at the top of the table of organization, and that he have his own Ballistic Missiles Committee, chaired by his deputy. It said the interested Assistant Secretaries and a man from the Budget Bureau also should be members. Right here it eliminated separate justifications and clearances by five Assistant Secretaries and the Budget Bureau. The Committee was a single point of contact and a single program and review authority.

The Secretary of the Air Force was to do the same thing. He was to serve as chairman of his own Ballistic Missiles Committee, including his assistants for research and development, financial, management and materiel, and—one man in uniform—the Assistant Chief of Staff for Guided Missiles.

Leaving headquarters, primary responsibility was handed to the commander at ARDC, whose principal operating deputy was General Schriever, then chief of the Western Development Division, later called the Ballistic Missile Division. Provision was made for other commands, such as Strategic Air Command and Air Training Command, to set up offices as single points of contact. The goal still was the expedited decision.

The Gillette Committee also laid out procedures to get planning, programming, budgeting, and reporting all put together in a yearly document for single action. The OSD and USAF committees were the sole reviewing authorities for the budget, which was insulated from interference by other programs. When it came to spending this money for procurement, the Air Materiel Command worked out of a special office at WDD with broad authority delegated to it by AMC's Directorate of Procurement and Production. To make sure con-

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Missile planners saw early that the management approach which had been so successful in the development of the B-52 weapon system, including its ground-support systems, was not going to be adaptable to development of ballistic missile systems, the very concept of which had to be proved.

tractors went to work as swiftly as possible, this office had the right to issue letter contracts of any amount. If special industrial facilities were needed, the Gillette Committee called for elimination of the normal two-or-three-month review process that bogged down important projects at the OSD level. The power was delegated to the Secretary of the Air Force, with broader authority granted to AMC.

In the case of new military construction that would be required for the missile program, the routine procedure would gobble up at least eighteen months of critical time before funds were assured, much less ground broken. Here the Committee laid out a path that put each year's construction program into the annual development plan for approval in a package with lump-sum authorization and appropriation. The Defense Secretary, the Budget Bureau, and Congress would get their review when USAF reported on how the money was used.

On November 8, 1955, Secretary Wilson acted to put the Gillette Committee recommendations into effect. The details are not important to this narrative, except to report that he appreciated the requirement for speed and that he defined missions for the Army and Navy as well as the Air Force. USAF was to manage the ICBM and a land-based IRBM. The other two services were to share responsibility for another IRBM that would back up the USAF project and provide a weapon that could be fired from a ship. This resulted in the Army Jupiter, but the Navy pulled out of the effort when the submarine-based Polaris, with its solid fuel, looked more feasible as a system.

By this time, General Schriever's WDD, later BMD, was more than a year old. It has been described as a Weapon System Project Office (WSPO) created, and distorted to some extent, to fit the ballistic missile management problem. Certainly, like the WSPO, BMD was set up to make sure that development, production, maintenance, training, delivery, and support were supplied on time.

In retrospect, it is fairly clear that the interface of AMC and ARDC that existed in the WSPO was a light flirtation, consummated into a binding marriage at BMD. There were a few who anticipated the next step, which was the major reorganization of 1961, when AMC became the Air Force Logistics Command and ARDC, under General Schriever, was transformed into the Air Force Systems Command.

The reorganization was announced as an effort to centralize direction, which is another way of saying it was to improve management. AFLC lost its procurement responsibility except for spares and spare parts, which can be as small as a screw or as big as a wing or a missile engine. The first commander was Gen. William F. McKee, later Vice Chief of Staff.

The new Systems Command, successor to ARDC, concentrated all development and procurement of systems—space, aeronautical, electronic, and ballistic—in one headquarters. The management goal was faster decision-making, a quality that had been realized at BMD and for which USAF internally felt a new urgency. It was earlier in 1961 that the Defense Depart-



Sen. Henry M. Jackson, Democrat of Washington, who has conducted scholarly inquiries into national policy-making machinery, was among first legislators to recognize that new methods of management were crucial to successful harnessing of technology.

Impact of the space age changed forever the face of the Air Force, spurred creation of new Systems Command, new Logistics Command, of which Gen. William McKee was first commander. General McKee is now the Vice Chief of Staff.



ment climaxed that parade of committees, czars, directors, and special assistants with the selection of USAF as the single manager for development of space systems.

Speaking of his new assignment, General Schriever cited the fact that Senator Henry M. Jackson, who was conducting a scholarly investigation of how decisions are made in the government, had come up with an observation that confirmed the General's firm opinion. It was that technology had outstripped management and that the key to survival itself laid in the management of that technology.

This was a realization that had led USAF to launch a study two years earlier, a study that left it prepared to act when it was handed the space-development role. There was going to be a requirement for close cooperation with the Army, the Navy, and the National Aeronautics and Space Administration. USAF already had seventy-seven officers working at NASA and there were more to come. By 1964 Brig. Gen. Samuel Phillips was in the civilian agency as Deputy Director for the Apollo moon program.

The immense technological jump from manned aircraft to ballistic missiles, with the strain it put on both USAF and industry talent and capability, outdated many of the standard WSPO practices. The priceless ingredient so far as management is concerned,

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is the technical direction and systems engineering. In building airplanes, the WSPO had delegated this responsibility to the single prime contractor—Boeing did the job, and did it well, on the B-52, for example, but BMD was working in another world.

Technical direction and systems engineering can be viewed as a form of architecture. The rub is that, at least in 1954, no single architect could possibly have been competent in all of the new and exotic technologies that were making an input to the ballistic missile program. On top of this, there was a new and stern demand for complete objectivity. The first real awareness of this requirement probably germinated in the proceedings of the Strategic Missiles Evaluation Committee, headed by Dr. John von Neumann, in late 1953 (see page 83).

The story of how the Ramo-Wooldridge Corporation came to be selected for the first systems-engineering assignment is told in Chapter 6 of the history in this issue of AIR FORCE/SPACE DIGEST. There were differences of opinion, some of which persist to this day, about how USAF should have handled this responsibility. In fact, there were dire laments that the Air Force was shirking responsibility. USAF's General Counsel, Max Golden, replied that the service "remains firmly in the driver's seat." In the case of the Atlas ICBM, Convair was eager to retain authority over systems engineering. And Ramo-Wooldridge itself did not press for a role greater than that of providing a technical staff for General Schriever. The General, however, decided that the talent mustered by Ramo-Wooldridge was needed in a line capacity and that they were hired to determine basic specifications and then coordinate and direct—serve as the architect—with authority over several large companies.

It is worthwhile, at this point, to explain why a high level of competence and strict objectivity are so essential. A 1961 report by the House Committee on Government Operations considered the responsibilities of the systems engineer in the missile program:

"His organization must be specially competent in a wide range of technologies to understand the problems



This little storefront at Westchester, Calif., represented the corporate beginnings of the Ramo-Wooldridge Corp. in the early 1950s. The new company's technical staff, serving as advisers to General Schriever's Western Development Division, coordinated efforts of several large companies.



During after-the-fact controversies over USAF use of Ramo-Wooldridge Corp. as technical adviser, Max Golden, Air Force's General Counsel, commented that the Air Force "remains firmly in the driver's seat." Opinions still vary on USAF management approach, but it worked.

in each field and to make appropriate compromises among conflicting requirements for optimum results. These fields embrace rocket engines; structures for fuel tanks, engine mounts, and payload supports; autopilot technology, aerodynamics and structural dynamics for stability and control; radar, computer, and general electronics for guidance; thermonuclear warhead designs for the payload; and a whole new reentry technology for the nose cone.

"In setting the specifications for the system, the technical compromises are many. Shall an effort be made to reduce guidance error, with likely increases in cost, weight, and complications of the guidance system? Is it better to increase the warhead yield to compensate for guidance error? Or should the reentry vehicle be of improved design, so that the warhead is a larger piece of the payload? Perhaps a more promising approach is to raise the specific impulse of the engines.

"The compromises are made and the systems specifications formulated after careful analytical studies. The finding must assess likely progress in the state of the art of diversified technologies during the ensuing development period and the capacities of industrial engineers to reduce complex subsystem designs to successful practice. Decisions are made in a fluid environment of rapidly advancing technologies.

"After industry proposals, based on these specifications, are received and contracts let, the problems of technical conflict and compromise continue. The integrating contractor doing the assembly work, and each subsystem or component contractor, naturally looks at the development and manufacturing job from the standpoint of his own company's advantage. Whether to 'make or buy' pieces of hardware, whether to choose this vendor or that, whether to substitute a less costly item or more promising design—questions such as these give rise to proposed changes and modifications. Immediately the engineering, work schedules, and performance of the other associated contractors are affected. The systems engineer, as technical judge or arbitrator, constantly must resist pressures or resolve conflicts to preserve the technical integrity of the weapon system and assure its timely delivery."

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This is the morass in which the systems-engineering portion of the management problem must struggle. In many ways it explains the evolution of the Ramo-Wooldrige adjunct to BMD's management machinery. The company's division working with BMD was called Space Technology Laboratories. STL, part of Ramo-Wooldrige and controlled by Thompson Products, was in business to make money and lived in honest anticipation of the day when it would be an important segment of the industrial world specializing in defense and space-age production. This ambition was detrimental to STL's reputation with USAF associate contractors, who expressed a natural reluctance to share their know-how with such a promising and talented potential competitor.

In late 1958 STL was divorced from Ramo-Wooldrige but remained a wholly owned subsidiary. It argued for a reasonable return on its investment but accepted a USAF contract clause that barred it from entering into the production of hardware.

"In acquiring the services of STL," the House Committee on Government Operations said in 1959, "the Air Force was not seeking low-echelon technical competence, for salaries at this level admittedly are no higher than salaries paid for comparable work in the government. What the Air Force got was the combination of scientific talent and business-managerial ability possessed by a small group of company executives."

Without the privilege of contracting to build components, STL complained about its low level of profit while the hardware builders continued to voice dissatisfaction with its authority over their operations. The result was the formation of Aerospace Corporation in mid-1960. Profit was eliminated, along with any production or ambition to start production. The emphasis is on management, using an élite corps—twenty percent of Aerospace's 1,600 scientists and engineers have doctorate degrees—that could be mobilized by USAF or its contractors only with great difficulty.

Max Golden, the USAF counsel who served as midwife at Aerospace's birth after the idea had been fathered by Rep. Chet Holifield and his Subcommittee on Military Operations of the House Committee on Government Operations, views the nonprofit firm as a logical step in history. The prime contractor, the independent systems contractor, and the nonprofit corporation, Mr. Golden said, are "progressive attempts to keep forms of management abreast with technology."

"Each of them," he added, "was created within the framework of private industry to perform a common function. The first step was to concentrate this function in a single manufacturer, the second to sever it from hardware production, the third to sever it from the profit motive."

But the thing that had to be achieved was competent management. It is essential to point out, in connection with the tenth anniversary of the ballistic missile effort, that STL has remained in the key systems-engineering position on the Atlas, Titan, and Minuteman programs. USAF itself has had a regrouping of functions, in which ARDC was renamed the Air Force Systems



Architect's sketch of Aerospace Corporation's new \$10 million complex at El Segundo, Calif., directly across the street from Air Force's new Los Angeles AFB. Headquartered in new complex are corporation's general offices and some elements of AFSC's Space Systems Division.

Command and given responsibility for development and procurement, as noted above.

At this point, BMD was rechristened the Ballistic Systems Division and moved to a new home at Norton AFB in San Bernardino, Calif. The all-new Space Systems Division of AFSC remained at El Segundo, a neighbor of Aerospace's Corporation. In the spring of 1963 Aerospace opened its own office at Norton, where BSD has requested a staff total of 1,000 by July of this year. The main block of Aerospace talent remains at El Segundo, where it moves into a new home this month, in support of the Space Systems Division.

It is necessary to recall the realization of ten years ago that neither USAF nor the industry which serves it had the management capability that the von Neumann Committee felt essential to start the ballistic missile program. There was, in effect, a "management gap." The struggle to fill it could have been confined in-house, but for the kind and quantity of talent that was needed the government payroll is not an attractive place and cannot compete with the substantial rewards offered by private industry.

There is no agreement today, in the Air Force or industry, that this "management gap" still exists. This reporter has visited aerospace industry facilities from coast to coast, centering his attention on companies that have had major responsibilities and are credited with good execution. In retrospect, their executives give uniform credit to USAF and its TRW-STL-Aerospace evolution for providing a sensible and workable management thesis. They are equally quick to point to their own vastly improved management capability and suggest that the USAF-industry team is ready to press on in the space age. That they would prefer to serve again as prime contractors and provide their own technical direction and systems engineering is always evident, if not always expressed.

The Air Force, as the Defense Department's executive agent in carrying out development and production of missile and space systems, is not likely to alter its present approach. In the future there will be fewer new systems started and there will be fewer of these systems built. But there will be more systems that are

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critical, that press the state of the art, that are increasingly complex. And the Defense Department is reaching into the management of more and more of them in greater and greater detail.

This means USAF faces an increasing demand for special management emphasis, as though almost all systems had the priority and urgency that justified short-circuit techniques for the ballistic missile program ten years ago. General Schriever expressed an intent, in 1962, to reduce the number of "designated systems," to try to get the burden down to where USAF talent, and the even more limited time for Defense Department consideration, can handle the load.

The General pointed out that the trend toward more detailed decisions from higher echelons in the Defense Department was frustrating the intent of "red-line procedures" as they were originated a decade ago by WDD. The old Ballistic Missiles Committee has no counterpart and documents move slowly in the office of the Director of Defense Research and Engineering. Streamlined channels, General Schriever says, "have frequently resulted in the bypassing of functions that must be performed at the various echelons of management, functions that are essential to the proper management of the total Air Force program." What has happened is that, in the effort to expedite action, the Systems Command's own staff input and recommendations have been lacking in many cases. The approach, the General has said, did not have the desired effect. "It did not result in a streamlining of systems management. On the contrary, it had virtually the opposite effect. While AFSC was effectively eliminating its headquarters staff as a significant point of input and control with respect to its assigned functional authorities, the numbers and types of reviews being accomplished on various aspects of its programs at every level above AFSC headquarters were increasing rapidly. These reviews have involved an increasing number of people. More questions have been asked and additional justifications have been required."

General Schriever has been working more than a year to further improve his management and to meet this challenge. AFSC itself is working harder and more efficiently. The General's goal, he said, was to "reduce the scope of the review effort at Headquarters USAF and to permit readjustment of emphasis there to matters pertaining to relative priority and new resource requirements related to program changes. At the Department of Defense level it should be possible to treat change proposals with a higher degree of credibility because of the completion of staff work at all levels by the echelon best qualified to perform a particular aspect of review."

There is some irony in the fact that, after ten years of experience in the ballistic missile program and the expertise that USAF and industry has derived from the experience in this kind of management, new handicaps arise from this new source. The Defense Department has more and more people performing its staff functions, until it tends to hamper the effectiveness of what has proven to be a good management tool. The goal in the ballistic missile program was to speed



Ten years of ballistic missile and spacepower development by the Air Force are represented by above models of USAF weapon systems displayed by Air Force Systems Command chief, Gen. Bernard A. Schriever. Left to right, the Minuteman, solid-fueled ICBM; Atlas, our first ICBM; and Titan.

decision-making by handing up a full package and getting a quick yes or no. Now the decisions are made bit by bit, line by line, item by item. There is no counterpart to the old Ballistic Missile Committee, a single office, or any integrated OSD activity. There are many noes, many demands for new reviews, few yeses.

In the long run, it may prove out that the Defense Department needs its own élite corps, competent and objective, its own version of Aerospace Corporation. Certainly the history of the ballistic missile program, contained in this issue of AIR FORCE/SPACE DIGEST, certifies to the success of the USAF management approach pioneered by General Schriever.

This account would not be complete without something firm with which to support the statement that the management has been successful. Here, in 1964, the report must be in terms of dollars.

There is a lot of emphasis these days on costs, and Secretary McNamara has correctly focused his eyes on the subject. From the beginning, the ballistic missile program was trying to get combat capability in the shortest possible time. Program management and the decision process pursued tight development, production, and operational schedules. The financial management followed the same lines. Review channels were streamlined, just like everything else.

The Systems Command developed a tool called the Contractor Cost Study. Details are not important here, but the effect was to make cost estimates more accu-

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Above, the new permanent home of the Air Force Systems Command's Space Systems Division, Los Angeles Air Force Base. SSD has Air Force responsibility for development of military space boosters and satellite systems, as well as cooperative efforts in support of the civilian space agency.

rate. The system, or variations of it, has been adopted by NASA and other agencies. The over-all result is that cost, performance, and schedules are now being governed more rigidly than ever before.

There is a good deal of popular misunderstanding on this subject, most of which comes out of headlines. The trouble is that the unsophisticated critic insists on comparing a Model-T Ford to a 1964 Lincoln Continental. The early B-52, circa 1952, was tagged at about \$2.5 million. By 1962, when the lines closed down, the B-52 had grown up. With its new long pants, it cost at least \$8 million. The same thing is true of missiles. Progress on the technological path costs money.

In the ballistic missile program, financial management has shifted from what General Schriever's fiscal officers call "wholesale" appropriation administration to "retail" administration. This entails more extensive review of each task and the money involved. A lot more detail is needed than was available in the early days of Atlas, Thor, and Titan.

What were the results? It is difficult to find them in unclassified financial information, and every procurement officer is timid because of the eyes looking over his shoulder. But strong control of missile configuration and hard work on the shopping list have brought results.

A recent review conducted by the Minuteman project office indicates that more than \$90 million will be saved out of the production program. Another study of the Titan site-activation program indicates savings of more than \$30 million will show up in the final tabulation. Financial management is not responsible for all of this, but *management* is.

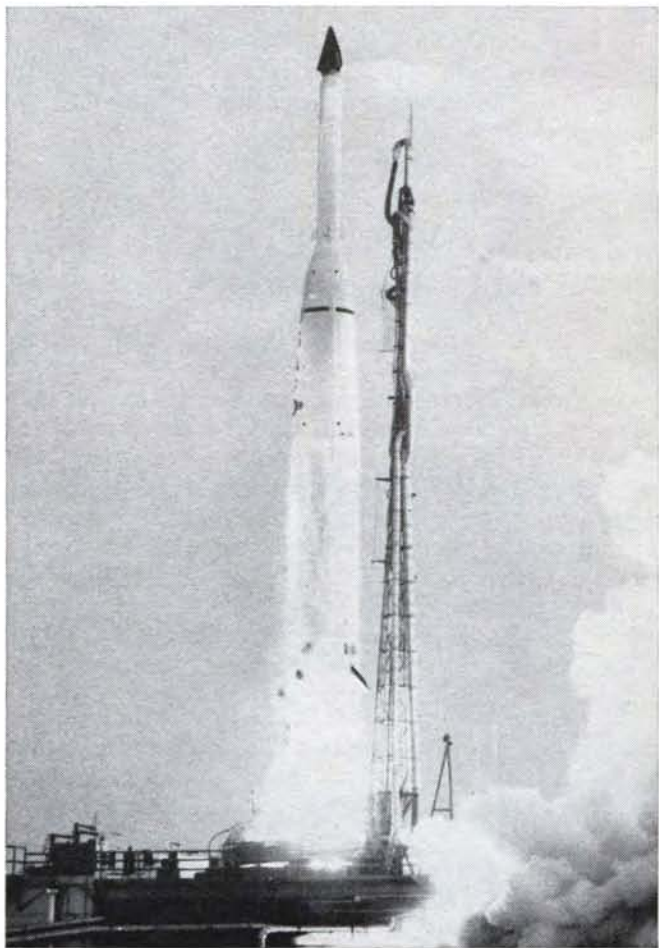
Recent Defense Department emphasis on cost control and cost/effectiveness has its roots in USAF programs that go back to early days of the ballistic missile effort. In fact, RAND Corporation studies made for the Air Force fathered cost awareness in both USAF and the Defense Department. Many of the management improvements adapted by Secretary McNamara were, in this sense, in use long before the current crop of managers appeared on the Pentagon scene.

If we look ahead, for all of the management capability that has been acquired by USAF, its nonprofit-making assistants and defense industry, it is impossible to find a parallel with the situation ten years ago that would facilitate such progress again.

Remember, the green lights of 1954 were in the field of technology—the ICBM was possible—and urgency—it had to be done fast—and funding—the money was ready—without justifying proof that the ICBM would perform the mission at an acceptable cost.

These green lights were turned on by men, basically the von Neumann Committee, President Eisenhower, and the National Security Council. There also was Trevor Gardner, whose role is discussed in Chapter 5, page 78. He was in the civilian secretariat, he saw the green lights and, like the scientists and military men around him, he recognized the threat.

It is a long time since a new weapon system has been put into development. We still have technological capability, and we have added to it a new facility in management that did not exist ten years ago. What is lacking today is recognition in the government that a new threat can develop almost instantly from somebody else's breakthrough. The state of the art, the urgency felt by men in uniform, and even money and management are not critical in this atmosphere.—END



Still working as the DC-3 of the space age is Thor, the Air Force-developed intermediate-range ballistic missile, shown here in Thor-Delta configuration blasting off from Cape Kennedy in February 1963 with Asset reentry test craft.