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FIRST ANNUAL LOGISTICS MANAGEMENT SYMPOSIUM
SEPTEMBER 13 AND 14, 1966

NASA

George C. Marshall Space Flight Center, Huntsville, Alabama

NASA-GEORGE C. MARSHALL SPACE FLIGHT CENTER

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FIRST ANNUAL LOGISTICS MANAGEMENT SYMPOSIUM
SEPTEMBER 13 AND 14, 1966

INDUSTRIAL OPERATIONS

MARSHALL SPACE FLIGHT CENTER
INDUSTRIAL OPERATIONS

The proceedings of the First Annual Logistics Management Symposium are forwarded with the hope that the information will be of assistance to attendees and their staffs in the planning and management of logistics support programs. I recognize that there is still much study required before all management techniques and procedures for support programs are known and understood, but I believe that support problems are made easier by exchange of knowledge. The Symposium was based on this belief and we plan to continue the search for ways to achieve better program support at a lower cost.

Edmund F. O'Connor

Edmund F. O'Connor
Director, Industrial Operations

PREFACE

Effective logistics support at reasonable cost is a constant problem for the program manager. Logistics support costs may well reach 25 to 35 percent of the total cost of the program. Therefore, any savings in cost or increase in efficiency realizable through effective logistics management justifies the closest attention by each level of supervision.

Effective and efficient logistics support management is not easily attained. The program manager needs a thorough background in logistics. He needs to know how the elements of logistics interrelate, both with each other and with other program elements. He needs to know how logistics program visibility can be achieved. And he needs to know how to establish and carry out an effective logistics program in today's rapidly evolving contractual atmosphere.

Recognizing the requirement to supply this much needed knowledge to program management personnel in government and industry, Brig. Gen. E. F. O'Connor, Director of Industrial Operations, MSFC, NASA, directed that the feasibility of a national symposium to discuss this vital subject be investigated by his Project Logistics Office.

The First Annual Logistics Management Symposium was therefore scheduled for September 13-14, 1966, to be presented to these top leaders of government and industry. Recognized logistics experts from government and industry were invited to make the presentations, which were arranged into a natural sequence, (1) definition of support requirements, (2) management and control of support programs, and (3) evaluation of support performance.

The Symposium was planned by the following who comprised the steering committee. The success achieved in the symposium can be credited largely to this support.

Steering Committee

John C. Goodrum, Symposium Chairman, Chief, Project Logistics Office, NASA - MSFC

Ward H. Cook, Symposium Secretary, Staff Logistician, Project Logistics Office, NASA - MSFC

D. J. Arbuthnot, Product Support Manager, McDonnell Aircraft Corporation

E. E. Brashear, Executive Assistant, Logistics, Space & Information Division, North American Aviation, Inc.

J. L. Carpenter, Jr., Director, Logistics Support, Martin Company

R. N. Johns, Assistant Director, Support Technology, Missiles & Space Systems Division, Douglas Aircraft Company

J. F. Sutherland, Director, Product Support, McDonnell Aircraft Corporation

F. E. Waller, Manager, Apollo Logistics Management Office, NASA - Office of Manned Space Flight

R. L. Weiss, Director, Site Support and Activation, Space & Information Division, North American Aviation, Inc.

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INTRODUCTION

CALL TO ORDER:

JOHN GOODRUM, NASA, SYMPOSIUM CHAIRMAN, Chief, Project Logistics Office, Marshall Space Flight Center, has a B. S. in Civil Engineering from Mississippi State University, and an M. S. from University of Iowa. He served in Europe and Okinawa in WW II as a Material officer with the 8th Air Force. He has been Director of the Engineering Division, Army Ballistic Missile Agency; Project Director for the Honest John Missile System; Chief of the Program Coordination Office in NASA — MSFC Central Planning Office; and Assistant Director, Saturn Systems Office.

The First Annual Logistics Management Symposium was conceived and developed to fill a need of MSFC management; "How can we achieve better program support at a lower cost ?"

An analysis of this need resulted in identification of several problem areas

1. lack of a common base of understanding regarding the elements of program support,
2. lack of an effective vehicle for communication between the agencies of government and industry,
3. incomplete knowledge of support management techniques and procedures, and
4. the need for better understanding on the part of program management of the consequences of inadequate support planning and management.

It was decided that the optimum first effort to satisfy the requirements of NASA management was to make a presentation to top and program management of government and industry. A systematic approach to program support and its management would be presented. It was further decided that effective response to these NASA top management requirements could be achieved only if all elements of NASA and industry managers had a common basic understanding of:

1. the elements of program support,
2. how these elements fit into the overall program,
3. how programs other than those of NASA are providing program support, and
4. how support programs could be improved.

The symposium was therefore organized to provide comprehensive coverage of the definition and management of program support. It was scoped to broad objectives which could be integrated easily into total program objectives and constraints by the top management audience. Recognizing that a great amount of hard-earned knowledge existed in other agencies and in industry, the Steering Committee invited logistics experts from various government agencies and from industry to make the logistics management presentations. Also included in the agenda were support requirement as seen by NASA Apollo management, by the KSC launch Center Director, and by the Saturn Program Managers.

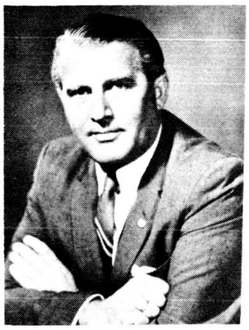
The symposium covered a period of two days and was organized to provide comprehensive coverage through papers, a panel, and a tour of the MSFC complex. This book parallels the organization of the symposium.

The first part of the symposium included statements of purpose for the meeting and an explanation on how the papers would provide a systematic review of support requirements and techniques for implementation. The Keynote Address provided an identification of the problems of support as viewed by top NASA management. Following the Keynote Address was a real-world presentation of the support problems in Viet Nam. Papers on the elements of logistics, how they integrate with each other, and how this integrated support program can be fitted into an overall program were subsequently presented. Then a challenge to government and industry for elevation of logistics as a separate science was given. It was discussed how logistics can be managed and controlled through properly scoped and administered contracts, and approaches and techniques for evaluation of support performance were given, with audience discussions of some specific problem areas. The final part of the symposium summarized the material presented and outlined some long-range objectives, the achievement of which will insure better program support for future programs.

WARD H. COOK, NASA, SYMPOSIUM SECRETARY, Staff Logistician, Project Logistics Office, Marshall Space Flight Center, has a BS in Ch. E. from Kansas State University. He served in Europe during WW II with Army Ordnance maintenance and supply units. He has had R & D positions in the chemical industry; and has nearly twenty years management experience in field and logistics support of missile and launch vehicle systems including BOMARC, Redstone, Jupiter, and Saturn with the University of Michigan, Chrysler, Hayes, and NASA - MSFC.

IDENTIFICATION

WELCOME ADDRESS: DR. WERNHER VON BRAUN, NASA Director, Marshall Space Flight Center, has a bachelor degree from the Berlin Institute of Technology, and a doctorate in physics from the University of Berlin. He came to the United States in 1945 under contract to the US Army and directed high altitude firings of V-2's at White Sands. He later became director of the Army's guided missile development unit at Ft. Bliss and moved the group to Huntsville in 1950. He directed development of the Redstone, Jupiter, and Pershing missile systems and utilization of them for launching the Free World's first satellites. For leadership in America's rocket and space programs, he has received 17 honorary doctorate degrees from the United States, Europe, and South America, and numerous national and international awards, trophies, and citations.



Good morning, gentlemen:

It is my pleasant task to welcome you to the First Annual Logistics Management Symposium and to tell you that, as your host, I am very happy to see all of you here.

Logistics has come of age in our space programs. For a long time we have grappled with the problem of determining a realistic and workable concept of logistics support for manned space flight. As later speakers will tell you, this has been rather difficult. We have, however, succeeded in defining many of our logistics problems and we feel that we are achieving adequate program support. But we do realize that we could have done the job more efficiently, and we are aware that the future could bring us serious logistics problems. We believe we know what these problems are, and we'd like not to make the same mistakes all over again.

We have found logistics management to be a demanding and challenging job, and we feel that you who are deeply involved in logistical operations share this attitude. That high-level industry and government attention is focused on logistics today is ample evidence of the growing awareness of the fact that the logistics manager has a tough assignment.

Management of the entire space effort, in fact, has received a great deal of attention in recent years. Unlike the weather, NASA is not only talking about it -- we are actually doing something about it.

Why does NASA place so much emphasis these days on good management?

It is because the exploration of space is the most challenging peacetime undertaking in our history. It is also the most complicated. And it is expensive.

Science and technology have made possible the exploration of space, but economic and social problems here on earth still place heavy demands on the nation's resources and energies. The government has heavy commitments which must be filled -- here at home in the war against poverty, and in Viet Nam in the war against oppression.

Managers of space programs have no choice but to use the resourcefulness placed at their disposal with the utmost inventiveness and ingenuity. The technical complexities facing us are immense. Our timetable is tight. Now, more than ever before, we must plan precisely. Our decision makers must respond immediately. But no matter how effective we might be in organizing the management of our programs, we still must remain flexible enough to adapt to a changing environment.

We are living in a rapidly changing world — changing so fast technically, socially, and politically that we can hardly keep pace with the changes. As Richard Wilson, a Vice-President of Trans World Airlines, so aptly put it in a speech last year: "If you have trouble communicating with your 18-year-old son or daughter, you might take solace in the fact that technologically speaking, you grew up in an age further removed from theirs, than your childhood was removed from Paul Revere's."

I make this point primarily to emphasize the need for flexibility in our management outlook and to restate a principle: The mere fact that something has been done a certain way for the past hundred years is no reason for continuing to do it that way; in fact, it is the best reason I can think of for subjecting it to a very critical analysis.

When we first discussed the possibility of holding this symposium, one of the factors that most strongly influenced our decision to go ahead with it was the feeling that out of this symposium would grow a program for the continuing analysis of logistics management -- as it has been practiced in the past, as we practice it now, and how it should be practiced.

I am firmly convinced that this area of logistics management offers us a significant opportunity to reevaluate our goals and our means of reaching them, and I suspect that if we ask ourselves really meaningful questions and respond with really truthful answers, we will arrive at some interesting conclusions.

I do not mean to imply that we have resisted all change. We have made great many changes, in fact. But we have only scratched the surface.

One further critical observation needs to be made, I believe. All too often I have seen attempts made to update procedures and practices by putting them on computers. I fail to see what this accomplishes. Rather than apply rapid data processing to a practice that is obsolete to start with, why not back off all the way, look at the whole forest, and revise the entire concept, if that is truly what is needed?

NASA is a relatively young organization. Our key people came from literally everywhere, from a great variety of environments, and with a wide variety of backgrounds. I hope that our collective attitude is one which will allow us to listen patiently and attentively to the other fellows' ideas and to adapt them realistically to our own needs.

I think that we do need to apply advanced management concepts and tools realistically to the solution of our management problems, including those associated with logistics. Many new management tools, techniques and terms are emerging today in the concious effort of government and industry to stay on top of huge scientific and engineering undertakings whose scope would have taxed the imagination two decades ago.

Some of our management terms tend to confuse as much as they enlighten, which disrupts communication. And some of our most recent innovations and elaborations of management techniques, while praised highly as the cure-all for all of management's woes, must be applied with discretion. With all our refinements we must not overlook the basic principles of good management -- planning, organizing, staffing, coordinating, budgeting, and constant review.

Logistics management is really no different from any other kind of management. So why, you ask, are we putting so much emphasis on it now and holding this national symposium?

There are two quite important reasons: The first is that logistics support is a very significant part of the entire program in terms of dollars. It might run to one-third of the program budget. Consequently, any improvement in logistics management will greatly alleviate an already serious money problem. Secondly, we will all agree, I feel sure, that the logistics support portion of the program is often taken for granted, frequently to the detriment of the program as a whole. For these reasons, we have decided to put logistics management in the spotlight, to take a day and a half from our busy schedules and at least bring to light some of the perplexing problems that plague our program managers as they attempt to bring some order out of the potential chaos.

So far, on the Saturn launch vehicle development program we have enjoyed outstanding success. We have now launched 13 vehicles successfully. Not the least of the contributing factors to this success, is a good logistics support program. But there have been some awfully close calls, and we are realists enough to know that program acceleration and program maturity will enormously complicate our support job.

We've had a little experience then, and I hope we've learned some lessons. Let me recite a few:

Extensive modifications, made under the conditions that exist at the launch pad, lead to too many compromises, and occasionally an undefinable configuration. In greatly oversimplified terms it is better to make a rocket at the plant than at the pad.

Logistics is not a separable program element. Logistics influences, and is influenced by, all other program elements. Consequently, it must be a full partner with reliability, quality, configuration management, and all the other managerial segments.

You get about what you ask for in a contract. And a contractual request to "please do a good job" usually guarantees you a job that is not only not what you had in mind (although it may be entirely adequate), it is costly.

A related lesson learned is that you do not achieve a good logistics program by generating and shuffling papers with all kinds of statistics.

One final observation, gained through our Saturn experience: logistics is not a part-time job. It demands the full-time attention of someone who knows logistics, who is interested in it, and who also understands and appreciates the overall program requirements. The logistics function deserves top level support.

Our audience today is a happy mixture of industry and government representatives. This is an indication of the close working relationship that has been developed over the recent past.

It is true more than ever now that a government agency like NASA or the Marshall Center cannot run a program unilaterally. Today, before we can even begin to write the specifications for the space items we want, or the support service we desire, we must seek the advice, knowledge and ideas of industry.

We are truly partners. In the next day and a half I think our relationship will become even closer.

The exploration of space is a tremendous challenge. This country is firmly committed to a broad program that will place heavy demands on our best talents and valuable resources for years to come. Good management is essential for the timely exploitation of this fascinating new environment. If we will apply both our imagination and common sense to better management, as we have to technology, I am sure that we will not only complete the programs now outlined, but will continue our march of progress toward the infinite reaches of the universe.

I wish you success in this symposium, and I hope that out of it will grow a positive plan for the continual improvement of logistics management.

Now, I would like to introduce to you the Director of our Industrial Operations, who counts logistics as one of his "blessings" — a gentleman all of you know, I believe — Brigadier General Ed O'Connor.

SYMPOSIUM PURPOSE AND OBJECTIVES: BRIGADIER GENERAL EDMUND F. O'CONNOR, NASA,

Director, Industrial Operations, Marshall Space Flight Center, graduated from the US Military Academy, has an aeronautic engineering degree from Air Force Institute of Technology, is a graduate of the Air War College and the Command and General Staff School. He was a WW II command pilot in Italy and in the Korean conflict. He had R & D and procurement positions at the Air Material Command and USAF Hdq. He was in charge of the Mobile Mid-Range Ballistic Missile Program, GSD, Air Force Systems Command before joining NASA. He holds the Air Medal with seven Oak Leaf Clusters, the Distinguished Flying Cross and the Commendation Ribbon.

Thank you, Dr. von Braun.

Let me add my own welcome to this distinguished group and tell you that we are extremely gratified that so many top-level industry and government managers responded with such enthusiasm both to our invitations to speak on the subject of logistics and to our invitations to come and meet with us.

John Goodrum, Director of Marshall's program logistics effort, and I first talked about holding such a symposium late last year. It had become apparent at Marshall, and to me, as Director of Industrial Operations, that logistics management for the lunar program and later Space Operations in general needed some attention. In other words, we were having the same kind of trouble with logistics that we have had with documentation, reliability, and the like. We had a serious communications problem, no logistics baseline, no logistics thread running through the entire program.

Logistics planning documents were developed to improve our communications. Meanwhile, our logistics staff people have worked with the contractors' logistics people, and great progress has been made. But the missing link in our communications chain was getting the message through to all layers of management. And that is the background for this symposium.

Today and tomorrow we hope to parade before you a rather impressive group of speakers, each a real expert in his field, who will address his remarks to a specific element of logistics management. I know a great many of these men, and I know what they have to say will be both interesting and informative.

The primary purpose, then, of this symposium is to bring together industry and government management and discuss the how's, why's, and wherefore's of the often knotty problem of managing the logistics part of the program.

Although Marshall Space Flight Center is acting as host for this event, it is actually a Manned Space Flight-sponsored symposium, involving Kennedy Space Center and Manned Spacecraft Center as well as the Office of Manned Space Flight in Washington.

Please note that this symposium is titled "First Annual Logistics Management Symposium." We feel that this subject is important enough to warrant annual attention, and we propose that another such symposium be held at about this time next year.

The key word in the title is "management." As Dr. von Braun stated, we are placing a lot of emphasis on management throughout our space programs, and the logistics program falls readily into this category.

We simply must do our job better, quicker, and at less cost. We don't have any choice.

Everywhere we turn we are told that there is less money to do the things we know very well we have to do, not just the things we want to do. I know from experience that this is to become a way of life, and the man who can do a first class professional job and still do it economically is the man to whom management will turn.

This is a time for critical self-analysis. And this, I expect, will be a secondary result of this symposium.

When we talk about logistics here at Marshall, these are the things we include:

Logistics engineering planning -- the activities executed at program level in defining what is to be done.

Spares provisioning -- The process of selecting spare parts, quantities, location and disposition; preserving, packaging and shipping them; maintaining the proper configuration; and documenting the entire process.

Inventory management of these high-value resources.

Maintenance -- Two types of maintenance are included: Scheduled maintenance includes the activities taken to enhance or preserve the functional ability of the hardware; unscheduled maintenance includes the corrective actions required as the result of failure or malfunction.

Maintainability -- The process of assuring that the combined features of design and installation result in a configuration which permits inspection, test, repair, overhaul, and servicing to be accomplished with a minimum of time, skill, and resources.

Technical support documentation -- The documents required to assist in the performance of the above activities.

Training -- Those activities designed to assure that all personnel have the proper knowledge and skill level to execute the support mission.

Transportation -- The movement of spares, components, and complete items of equipment wherever needed and in a timely and completely safe fashion, including the control of the environment in which the hardware moves.

Propellants and pressurants provisioning -- The process of planning for and managing the acquisition, storage, movement, and utilization of propellants and pressurants. We give this special consideration because of its unique nature in the aerospace field.

Logistics control and evaluation -- The process of managing all of the above, with special emphasis in the central coordination of these activities and the evaluation of the associated efforts.

There are other ways to slice this logistics pie, I'm sure, but this happens to be ours.

The proof of any logistics system is its ability to support the operation.

Theoretically, the system should be one hundred percent perfect, with everything in the right place at the right time. This degree of perfection is difficult to achieve. There will at times be missing spares, or late deliveries, simply because we don't have the ability to foresee the future with the required accuracy to achieve perfection. But we can and do plan for contingencies, and we are able to quickly detect, and correct, our system malfunctions.

Let me cite only one example. Just recently our propellants and transportation people had to solve a difficult problem of providing liquid oxygen to KSC in a hurry and in very large quantities, hundreds of thousands of gallons. Special purpose barges not really designed for open seas were taken from our Mississippi Test Facility, loaded with liquid oxygen, and taken through the Intercoastal Waterway and, with great caution, across the Gulf to KSC.

This is typical of the contingency-type operations with which logistics planners are continually faced.

Gentlemen, a lot of hard work has gone into this symposium. Some fine speakers have taken time out to come and talk to us about this subject of growing importance. Many of our top industry and government people have given this day and a half to meet with us. We have an opportunity to achieve really significant improvements in an area where the payoffs are large.

And now it gives me very great pleasure to present to you NASA Associate Administrator for Manned Space Flight, Dr. George E. Mueller, who will deliver our keynote address.

— Dr. Mueller

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KEYNOTE ADDRESS: DR. GEORGE E. MUELLER, NASA, Associate Administrator for Manned Space Flight, has a BS in EE from Missouri School of Mines, an MS in EE from Purdue, and a PhD in physics from Ohio State University. He performed research at Bell Lab.; was assistant professor of electrical engineering at Ohio State University; at Space Technology Laboratories he served successively as Director of the Electronics Laboratories, was Program Director of the "Able" Space Program, Vice President of Space Systems Management, and Vice President for Research and Development; and he joined NASA in his present position in 1963. He holds several patents, is the author of more than 20 technical papers, and is co-author of the book Communication Satellites.

Good morning:

It is a pleasure for me to be able to participate in this First Annual Logistics Management Symposium, and I am very flattered to have been asked to be the keynote speaker.

Of course it is always gratifying to meet with such a distinguished group as we have both in the audience and on the platform. I am also pleased to see attention being given by the top management level of industry and government to the betterment of logistics management, which is one of our most perplexing problems.

Whether you represent industrial contractors, the DOD, or NASA, all of you appreciate the importance of management in furthering the programs established to achieve our national objectives. As your keynote speaker for this symposium, I am here to stress one point -- NASA needs top management attention for its logistics requirements, now as never before.

With the Gemini program, as with Project Mercury, NASA's direct involvement in logistics was confined principally to the spacecraft. That is, the Air Force provided us with the launch vehicle and gave us superb launch operations support. The entire Department of Defense saw to it that recovery could be carried out on a global scale. Now NASA is entering the operational phase of the Apollo program, but unlike Mercury and Gemini, NASA is responsible for the launch vehicle and launch operations as well as the spacecraft. For the first time in a NASA manned space flight program, the greater part of logistics is not being provided by the Department of Defense.

This is why you and I are here today -- to put into action the maxim that effective logistics management is indispensable to program success.

Manned space flight logistics management, as in the military, is evident in the spares requirements effort for any system, as reflected by the maintenance analysis. It is evident in the maintenance of systems, including the training of field maintenance people who follow the hardware. It is evident in both space and military hardware in the maintainability concept, which must be incorporated into system design at the outset. It is evident in transportation to get the right thing to the right place at the right time, whether the place be Viet Nam, Sacramento, White Sands, or along the crescent from Louisiana to Florida. It is evident in the handling and storage of propellants. And it is evident in the generation of adequate technical manuals and documentation.

NASA does not stockpile large end item inventories, however, and our logistics support, except for tracking and recovery operations, is confined to the continental US. We do not have to compensate for the use of newly trained field personnel, and we do not have to overcome losses in transportation or losses to enemy action. Our spare parts requirements are concentrated at test and launch sites which are sophisticated industrial complexes, and our launch operations are carried out by technicians with years of experience. NASA end items are characterized by high cost, low density, and, until now, short life span.

Nonetheless, we in NASA have learned that any of our program logistics elements can become critical to cost, schedule, or performance in the absence of effective logistics management, a conviction shared by our friends in the military and industry. The viewpoint of the Office of Manned Space Flight is that without logistics excellence, our efforts can fail just as surely as if we had neglected cost control, reliability, quality assurance, or scheduling.

To translate this conviction into action takes high level management effort. For this reason, I am particularly pleased to see so many of our contractor officers joining with NASA management for this first annual Logistics Management Symposium.

Through the medium of this symposium, and its focusing upon logistics management, the Manned Space Flight Directors and I believe that the tenents of good program management and good logistics engineering may be more effectively applied to NASA programs. It is truly important, that top management members of NASA and industry identify clearly the requirements of program logistics, and meet these requirements with timely, positive, cost-effective action.

I am pleased as well to see the formation here of a new society of Logistics Engineers. Through the formal framework of this new society will spring greater professional interest in our common logistics problems, and greater assurance of their solution. My congratulations to the charter members of this new professional organization who have pledged themselves to the cause of advancing logistics management and technology.

Turning to our NASA programs, I should like to comment briefly on some of the logistics considerations that we in Manned Space Flight are facing today as our Gemini program moves toward the final flight and we move into the operations phase of the Apollo program. Before I proceed, however, it is appropriate at this time to commend all of the people — many of them are here today — who have contributed to the achievements of Gemini.

There wasn't an area of logistics that at some time didn't present a challenge for NASA and the Gemini contractors, the Air Force, and the DOD recovery team. However, all members of the team applied their logistics skill in achieving Gemini's proud record of success.

An example of contractor management's attention to logistics is provided by the Martin Company's Gemini Assets Task Team. This team was set up at Martin, Baltimore to assure that adequate program assets, both production and spare units, are available when needed for successful launch of the final Gemini launch vehicles.

Martin's Assets Task Team includes personnel from the functional program elements — Logistics, Engineering, Quality, Procurement, and Planning — as well as from the Martin Canaveral Division. Since its formation prior to the Gemini IX mission, this team has developed the responsiveness necessary to assure timely completion of the Gemini Launch Vehicle program.

In the supply support area, the team is working to provide acceptable replacements units quickly for failed parts. The team also is maintaining a continuous survey of program assets with the objective of preventing launch vehicle failures. This is the kind of management attention I want to see for each of our launches in the future to insure against delayed launches with their attendant cost.

These and many other valuable lessons of Gemini are being put to good use in the Apollo program.

However, the need for increasing the emphasis on logistics management for Apollo is great. Because of its size and scope, the Apollo program poses logistics problems well beyond the demands of Gemini. The experience and technology resulting from Gemini have contributed substantially to Apollo in all aspects, including logistics — but Apollo's combined requirements are an order of magnitude greater in terms of hardware, facilities, ground support equipment, personnel, and logistics.

The Apollo Saturn space vehicle involves 20,000 contractors and subcontractors and has more than 900,000 individual parts. The Saturn V first stage holds 56 tank cars of propellants. The second and third stages of Saturn V transported by water during the Apollo program will spend a total of 700 days at sea. Apollo program transportation by all modes will require coordination with nine Government agencies. The launch windows for the Apollo lunar mission are relatively small; malfunctions on the pad must be kept to a minimum while corrective maintenance must be extremely fast and reliable. All of these elements make the Apollo logistics program both complicated and costly.

Considering the obvious demands for control and integration of these large-scale, complex logistics support elements, it is only prudent to recognize that we are now entering our most critical period for logistics support of Apollo. The operational phase of the program will make the greatest demands upon the logistics elements required to sustain the flight hardware preparatory to launch.

The stringent requirements for controlling and reducing program costs impose further demands upon Apollo logistics management. The Apollo contractors are well informed as to our critical requirements to control program costs parts. This can be accomplished only by controlling all parts of the program budget, including that allocated to logistics. The manned space flight budget represents an operating cost of $ 10 million a day, and the cost continues regardless of whether or not we accomplish anything. In this sense, a missed launch due to technical or logistics deficiencies costs millions for every day we are delayed.

In emphasizing logistics, therefore, I certainly am not suggesting a more costly logistics effort; on the contrary, I am suggesting that more management brainpower be applied to achieve cost-effective logistics support for the operational phase of the Apollo program. It is reasonable to assume that the application of brainpower will result in fewer dollars spent in meeting unplanned logistics requirements, fewer dollars spent in solving unexpected logistics problems, and fewer dollars invested in support which exceeds program requirements.

I have encouraged all Manned Space Flight managers to be alert to innovations which will enhance our logistics posture or reduce logistics operating costs. For example, we have recently negotiated an agreement with the Air Force to provide propellant management for certain selected fuels and propellants, an agreement we expect to result in substantial savings for both of us. In addition, a study is now underway here at Marshall Space Flight Center to determine the size and preferred location of a central repair and supply facility for launch vehicle ground support equipment.

The area of spares management provides another illustration of the application of brainpower. At the present time, Apollo program managers are reevaluating the planned program support against available ground and flight test results. In this evaluation they will assure that the planned logistics support in extra components, spare parts, and other support elements meets but does not exceed the requirements, as indicated by current program experience.

Such planning recognizes that logistics support requirements might change in the future with changes in the overall program or program operations environment.

For example, during Gemini launch preparations in September 1965, we had just completed arrangements to consolidate our liquid hydrogen supply source for the East Coast with one contractor in New Orleans. Then Hurricane Betsy hit the Gulf Coast and our New Orleans source was cut off. Fortunately, a Florida plant that was to be phased out with the new supply plan was still operating. We quickly brought it back into full-scale operation. Otherwise, we would have had to bring the propellant all the way from the West Coast, which could have easily delayed the Gemini launch schedule. We have since provided contingency plans for all of our sources of supply.

While planning for contingencies, we consider accelerated schedules as well as program delays, something we learned when a Saturn stage was delivered well in advance of plan. Our contingency planning now provides for the logistic lines to be open whether the stages are delivered on, behind, or ahead of schedule.

On the subject of contingency planning, it is worthwhile to consider the impact of the Viet Nam military operational requirements on Manned Space Flight program logistics. We are learning that it is unwise to assume yesterday's plans will always support tomorrow's operations. Our nation's support of Viet Nam is affecting lead times, materials, priorities, and schedules. Yet our collective planning has been responsive enough so that I know of no direct program impact resulting from the effects of Viet Nam.

With the quickening tempo of Apollo program operations and the peaking of logistics support, we must not overlook the application of another management technique that is not always found in the formal literature. This is the ingredient which I call teamwork — teamwork within NASA and teamwork of NASA with its contractors and the Department of Defense.

The geographical scope of the Apollo program and the size of the Apollo government-industry organization make teamwork vital to success. This need for cooperative effort is particularly evident for logistics , which pervades the entire program effort. There must be a strong sense of teamwork within the entire program organization so that logistics considerations are made concurrent with other program decisions.

All of us know that consideration of logistics problems at the appropriate level has a way of being postponed to a day of reckoning farther down the road. We are inclined to defer those decisions for which one will not be called to account until later, even though the delay compounds the problems and often prevents any practical solution. It is management's responsibility to determine the impact upon logistics of other program elements, and in turn, the impact of logistics on everything else, before the fact.

We must plan in as much detail as our knowledge permits. We must determine where we are going, how and when, and having done this, we must allocate our resources and specify all of our technical requirements. We must determine our logistics support concept and our plans to execute it.

In this regard, we need to improve our definition of what we want the contractor to do, by improving the scope of work we give him. We need to define the effort expected considerably earlier in the program. And we must follow through with better contract management so the program manager will know at all times just where he stands with relation to achieving his goal in logistics.

The Office of Manned Space Flight recognizes that logistics must be integrated thoroughly into the program from the preconceptual phase, and must be effectively managed throughout operations to ultimate disposition of the hardware.

Logistics planning is just as vital to the space effort as it is to military operations. We must plan our support activities in detail, taking every advantage of our ever-expanding capabilities in accurate requirements computation, reliable communications and fast, responsive transportation. These are important considerations both operationally (unneeded stocks are a millstone around our necks) and from the point of view of program costs.

Indeed, the early consideration of program logistics has become increasingly important from the standpoint of cost effectiveness. We are required to look at our total program costs, and will do so increasingly in the budgeting of future programs.

As we move into programs beyond Apollo we must reassess our logistics support concepts based on the needs of these new programs. These programs will be characterized by longer and longer flight durations and constrained by the reliability we can achieve in components, subsystems and systems and by the new concepts for maintainability we develop.

The need for reliability has been with us, of course, right from the start, in Mercury, in Gemini, and on into the Apollo program. As we go onto longer and longer duration missions, however, reliability (extended reliability) becomes more and more important. In the past we have stressed reliability. We have utilized redundant subsystems, and this approach has been reasonably successful to date. We have had, and will have, thoroughout Apollo, extremely limited capability for maintenance in flight.

As we go into the post-Apollo era with flight durations of a year or more, we will, of course, have larger crews, greater mobility for individuals, and certainly some capability for inflight maintenance and repair. However, this capability will always be limited and reliability of components and subsystems will be vital to mission success and indeed to crew safety.

The analytical trade-offs necessary for NASA to reach optimum cost effecitveness cannot be carried out without thorough consideration of balanced logistics support. Contractor studies for future programs beyond Apollo must, therefore, emphasize logistics as a prominent factor in life-cycle cost determination.

The speakers who will follow during this symposium will have much wisdom to impart on the specifics of meeting logistics support requirements. My purpose has been to stress NASA's need for continuous top level attention to provide timely and effective logistics management, particularly as we reach the operational phase of the Apollo program.

This symposium presents us with a rare opportunity. Assembled here are the people who have the ability and the authority to make whatever changes and improvements are needed to establish a strong chain of logistics support in all our organizations. Through your personal interest and attentions, we will reach the excellence of logistics management and technology needed for successful achievement of national goals in space.

I wish you the greatest success in this symposium.

N 67-21964

LOGISTICS SUPPORT FOR LAUNCH SITE OPERATIONS:

DR. KURT H. DEBUS, NASA, Director, Kennedy Space Center, has initial and doctorate degrees in mechanical and electrical engineering from Darmstadt Technical University. He was an assistant professor at Darmstadt where he became involved in Peenemuende rocket research programs; participated in research and development missile launchings at Peenemuende; participated in V-2 and other missile launchings at White Sands Proving Ground; and began Cape launchings in 1952. Here, he has directed launchings of Redstone, Jupiter IRBM, Jupiter-C, Juno, Pershing, and Saturn missiles and launch vehicles.

Let me express my genuine pleasure at being invited to participate in your Logistics Management Symposium. These meetings, and others like them, can make valuable contributions to the nation's space program by probing into critical areas of logistics management and seeking the highest level of refinement.

As NASA's launch organization, Kennedy Space Center is responsible for the preflight preparation and launch of NASA's space vehicles. In addition to the execution of this prime mission, the Center has a total responsibility that is heavily grounded in support. From early design stages to that major milestone which is the launch date, KSC must provide a strong program of logistics management and logistics action to insure availability of equipment and services at the proper time and place, accompanied by the necessary skills.

I will attempt to show the complexity and magnitude of KSC's "Logistics" by looking at various seemingly disconnected areas of endeavor and activities, by using a kaleidoscopic view at some of these elements.

Let's take a look at a launch concept and launch complex, which by themselves are conceived and are configured in response to true logistic challenges, i.e.,

Launch Rates

Manpower Utilization

Flexibility to meet mission changes

Quick response to threatening hurricanes with minimum time loss

Maximum use of real estate

Maximum operational return for investment

LAUNCH CONCEPT AND LAUNCH COMPLEX

In support of the Apollo Program, which will culminate in a manned lunar landing, we have activated a new mobile concept at Kennedy Space Center's Launch Complex 39. This concept embodies the assembly and checkout of flight stages in the protective environment of a massive building, whose size has been dictated by the configuration of the Apollo/Saturn V space vehicles. These are the largest space vehicles ever built, with a fueled weight in excess of six million pounds.

These following figures indicate a quantum growth in size and weight. It follows that this type of growth must be paralleled by a multiplication of complexities in support requirements.

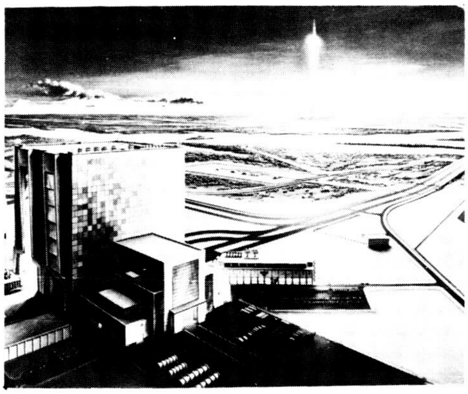


FIGURE 1. ARTIST'S CONCEPT OF ENTIRE COMPLEX AND HOW MOBILE CONCEPT WORKS

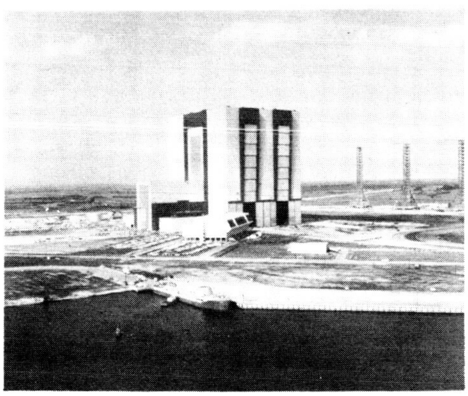


FIGURE 2. VAB, BARGE, AND MOBILE LAUNCHERS - ELEMENTS OF COMPLEX AS IT APPEARS TODAY

PRODUCT PIPELINE

Coming at the end of a product-and-man-effort pipeline 300, 000 people long, employing products manufactured by a diverse network of contractor suppliers, and implementing programs under a tri-Center directorate, Kennedy Space Center requires launch support teamwork, cooperation, and interaction based on a high level of logistics management.

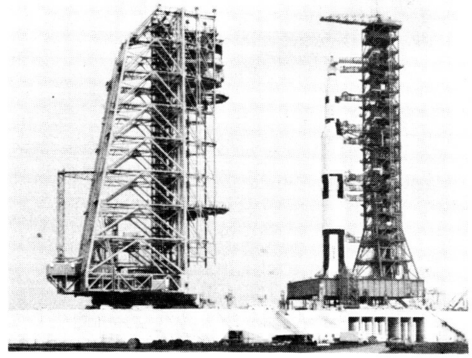


FIGURE 3. MOBILE LAUNCHER AND 500-F LAUNCH VEHICLE ON PAD WITH SERVICE STRUCTURE BEING MOVED IN

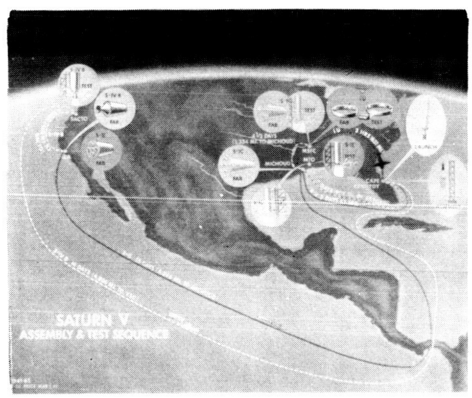


FIGURE 4. SATURN V ASSEMBLY AND TEST SEQUENCE

LOGISTICS CONSIDERATION FOR SELECTION OF LAUNCH SITE

From the very beginning of advanced planning for the manned lunar landing program, logistics played an important role in creating what was ultimately to become Kennedy Space Center.

The selection of Merritt Island as a prime operational base for America's space effort was, to a large degree, influenced by logistical facts of life.

From certain viewpoints, such as flight safety, noise, and other ground safety considerations, ideal conditions for this base could have been found on a remote island, either in the Atlantic or Pacific. However, early planning pointed to the fact that there would be difficulty in acquiring and keeping personnel at such a site, and there would be problems in establishing and maintaining the flow of material. The remote location would create problems in communications, especially in the area of data transmission.

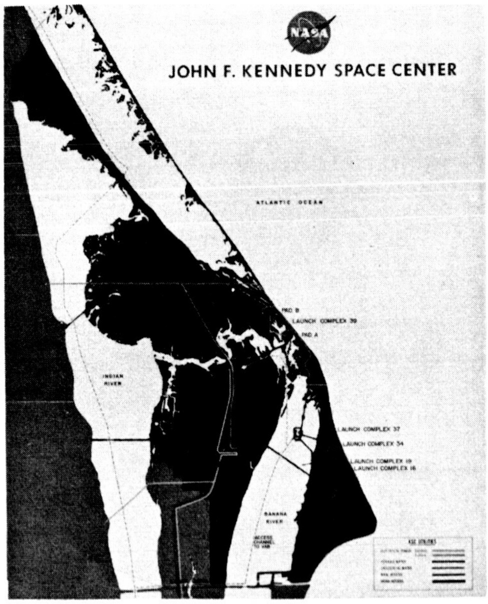


FIGURE 5. MAP OF MERRITT ISLAND AND CAPE KENNEDY

In evaluating eight potential sites, the final choice fell on the Merritt Island location, adjacent to the existing facilities on Cape Kennedy. This provided an operational base with close proximity to the Eastern Test Range and its instrumentation investment. Nearby communities with schools, housing, and other facilities for family living constituted an adequate inducement in acquiring skilled personnel. Another major factor in the decision was that the area would be less expensive to develop. It also has the advantage of additional undeveloped land which would provide adequate buffer zones and room for future expansion.

KSC ORGANIZATION

The KSC organization is constructed against a realization of proper separation between prime line-doing functions and logistics <u>or</u> support functions.

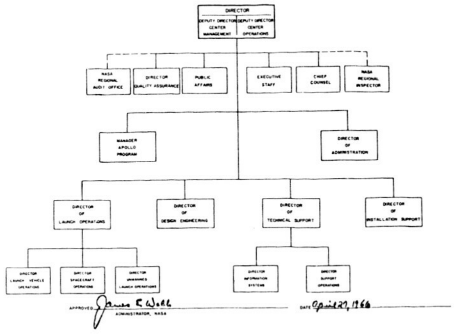


FIGURE 6. KSC ORGANIZATION CHART

The program function at KSC falls under the office of the Manager of the Apollo Program. As the central point for management of all program activities, this function, then, is not one of direct support, but it must be actively interested in and concerned about such matters. Therefore, as far as policy is concerned, program management initiates the guidelines for logistics, and in this context is related to the effective execution of required support.

The launch function comes under the Director of Launch Operations Here we have the element that initiates, supervises and coordinates the preparation of preflight and launch operations and is responsible for execution of these plans.

Internally, the launch function wrestles with problems that could be termed logistical, and the launch team must coordinate with support elements. But as a purified launch team, launch operations deals with flight hardware and that portion of GSE which is intimately connected with it. This, of course, is a function that executes rather than supports.

Excluding the program and launch functions, however, everything else, under the other directorates, <u>is</u> support.

LAUNCH AND SUPPORT ORGANIZATION

The ultimate focal point of the total mission effort is found at the launch pad, where a purified launch crew and a flight ready vehicle activate the mission. At this point, in both time and place, we must have experienced an adequacy of support in both quality and quantity. This includes facilities, ground support equipment, flight hardware, propellants and pressurants, instrumentation and communications and, of course, spare parts, both for flight hardware and ground equipment.

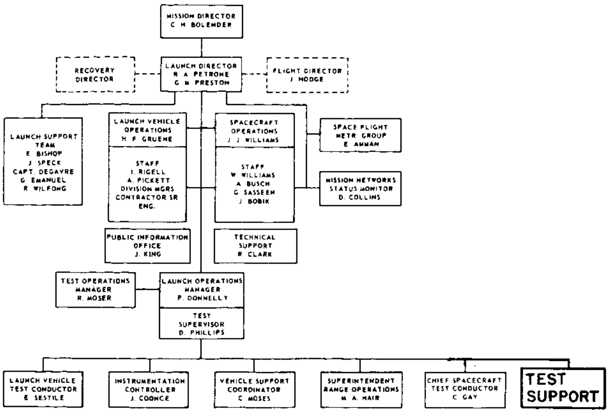


FIGURE 7. LAUNCH TEAM ORGANIZATION

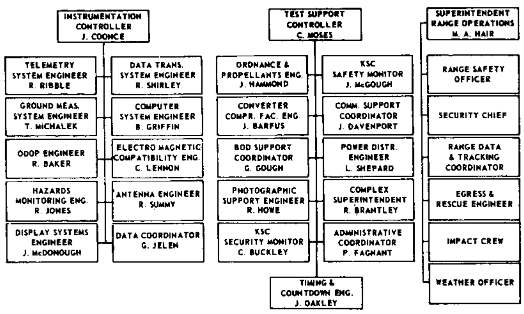


FIGURE 8. LAUNCH TEAM ORGANIZATION

THE LOGISTICS OF SPARES

The task of spares determination is one that holds a place of special importance in launch operations. Incorrect selection and quantification of spares can be very costly. If NASA is forced to stop a count and go into a hold, the cost, for contractor personnel and range support, lies in the neighborhood of $ 18, 000 an hour. If the hold is due to a faulty part, and a spare is lacking, this extends the hold and multiplies the cost by the number of hours lost. If we are faced with a narrow launch window, the hold can extend into days. So, we <u>must</u> have adequate spares, but the types of spares we are dealing with are not in the category of paper clips and thumb tacks. They are expensive. Indiscriminate overstocking in prohibitively costly, but cannibalizing other flight hardware is not the answer. Cannibalization has, at times, been practiced on a planned basis. In these instances, items have been taken from the next copy of flight hardware, or ground support equipment has been moved in from another pad. But even the slightest reliance on cannibalization as a contingency measure is bad support. The solution to the problem of spares provisioning lies only in the proper application of logistics and management skills.

The ability to provide cost effective support in all areas is a basic objective in launch site operations. Attainment of this objective depends heavily on early identification of logistics requirements.

I mentioned that at Kennedy Space Center we experience an input of products from all over the nation. This input requires that prior consideration be given to the support of all of these items. Early in the design of complex equipment, KSC makes gross determinations of logistical support requirements and coordinates these with the design centers.

These gross requirements are refined as design progresses toward stabilization. During this period, if items change in configuration, we must make changes that keep the support pipeline concurrent with the products. KSC, in close cooperation with the efforts of the other Centers and their contractor suppliers, must analyze maintenance requirements, must design and procure support equipment, must construct facilities, and acquire the necessary amounts of human skills and material.

BLACK BOX POLICY

Applied maintenance offers an example of the necessarily flexible quantities of the support concept. Black boxes are supplied as total units, where possible, and the replacement is normally a unit replacement. There is a general awareness that, in a field situation, the support elements cannot have a team that is as knowledgeable in design intent as the development engineer. The unit replacement concept is, therefore, by and large, an intelligent one. However, if it is necessary, to meet requirements or time schedules, our people will open a black box with the consent of the developer. We may then decide to send it back to the source, or we may repair it on the spot. The decision for action is based on an appraisal of our systems knowledge in a specific case and criteria such as fault isolation capability, environmental conditions, and capability to retest to specifications, always within the time frame of the launch schedule.

BULK SUPPLIES

Not all support requirements are related to complexity or systems knowledge. We also have problems associated with bulk. Here we can point to the logistics products of propellants and pressurants.

The nation's first satellite was launched on a Jupiter C vehicle in 1958. At that time we held three trailer loads of liquid oxygen in storage. This was approximately 15, 000 gallons.

FIGURE 9. UNLOADING FUEL FOR MERCURY REDSTONE QUANTITY COMPARISON

Today, as we activate Launch Complex 39 for the flights of the Apollo/Saturn V configuration, we must store the equivalent of 200 trailer loads of liquid oxygen, or about one million gallons. We store another million gallons of liquid hydrogen. A single launch of a Saturn V requires 15 million cubic feet of helium, fifteen thousand tons of liquid nitrogen, seven thousand tons of liquid oxygen, and 900, 000 gallons of liquid hydrogen at Launch Complex 39.

Figure 11 depicts a broken hose at the base of a liquid oxygen storage tank. This loss did not occur during the period of an approaching launch, but it points to the need for quick logistics reaction to the

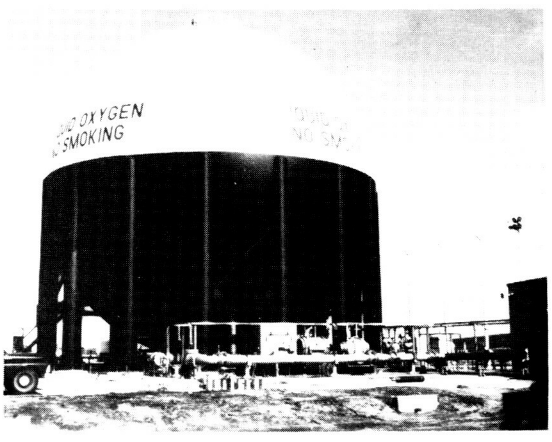


FIGURE 10. LOX TANK AND PIPING, L/C 39

unexpected. This loss could have serious consequences if it had occurred during the terminal period of a Saturn V launch.

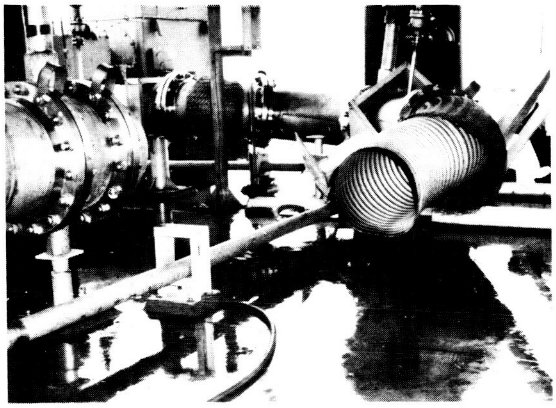


FIGURE 11. BROKEN FLEX HOSE AT BASE OF LOX STORAGE TANK

Fortunately, a LOX transfer operations system has already been planned that will extend between Pads A and B at Complex 39. Next year, when we reach a launch operational mode, standby supplies will be available.

COMMUNICATIONS LOGISTICS

Another segment of logistics where we deal with many varieties and great quantities of units can be found in the areas of instrumentation and data, or more generally launch related communications.

KSC's data acquisition starts with prelaunch test and checkout operations. It continues through launch and orbital flight with KSC responsible for all data fed into the Eastern Test Range or generated by KSC. The increase in this area of support is almost directly related to advancements in flight hardware. The early Jupiter C launches required about 100 measurements for which KSC was responsible. During the first ten Saturn flights the number of measurements jumped to an average of 1200. The uprated Saturns require approximately 1800, and the estimate for the Saturn V is close to 2400. This is by no means the total amount of KSC data, but only an indication of the growth in support requirements.

The responsibility has never ended with acquiring data, but continues through dissemination. We must maintain an ability to keep this data flowing. Fortunately, through the installation of high speed data links, the impact of data flow has been eased, but it is worth noting that a lack of logistical foresight could have created an almost insurmountable barrier in this area of vital communications.

In the days before we had these high speed data links, it was necessary to take data out of computers and recorders, pack it in boxes, and try to meet the need for this data by sending it out by plane on Saturdays, Sundays, holidays, or at any time required to maintain the flow. Frequently it took from 35 to 40 days to get a summary of performance characteristics of the vehicle following a launch. Today, by the time we have the information at Kennedy, it is also available at other required locations. A summary can now be obtained in a matter of a few hours. To this extent we have acted to solve the logistics problem of data flow.

DATA STORAGE

We are still faced with a problem of storage and retrieval of huge quantities of data. We can arrive at a partial solution to this problem by increasing our capability commensurate with anticipated needs. As a step in this direction, KSC has ordered, and will receive in the future, a mass memory device which will be added to the memory core in the Central Instrumentation Facility. This equipment will be able to store an additional 450 million bits of information, and make data available within 17 milliseconds of command.

The addition of equipment does not, however, solve the total problem. The expense of such equipment, within the strict limitations of budget, requires the most incisive application of intelligent logistics management. We must evaluate the need for data storage, and we must determine that every request that is granted is a justifiable request.

One of our stage contractors, and this is only one, has requested storage of nearly three billion bits of data. It is entirely possible that he has levied similar requirements on other Centers. In the final evaluation it may be more economical to provide the contractor access lines to a centralized place of data storage. Close scrutiny and coordination must be applied before such requirements are met by the government.

EXAMPLE OF MANPOWER ECONOMICS

Today, we can consider Launch Complex 39 as an example of this flow of logistics from early recognition of requirements to the working support of an operational base for the lunar expedition.

More than 63,000 contract end items will go into Launch Complex 39 before the installation becomes fully operational.

As a dynamic facility, the support problems will never end, but confidence has been established through a support program that started early and has remained flexible.

An illustration of early considerations now existing as an outflow of support is found in the manner in which supporting contractor engineers have been placed inside the Vehicle Assembly Building where the vehicles are assembled and checked out. For logistical reasons, more than any other, the building has been designed for simultaneous assembly of as many as three Apollo/Saturn V's.

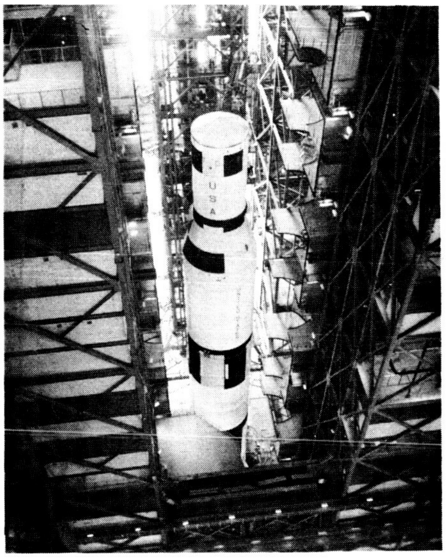


FIGURE 12. 500-F IN VAB

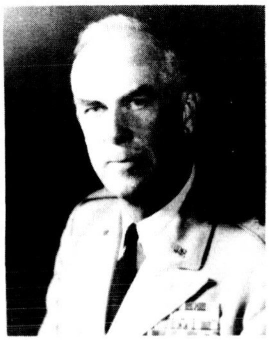
Since we are assembling vehicles on structures that require access from the floor to a height of more than 445 feet, key engineering personnel have been placed in offices that lead directly to the platform levels where their stages are located. Systems engineers can then move laterally throughout the building. With this type of personnel placement, several crews can be supported as they work on different vehicles. When you consider that the Vehicle Assembly Building contains more than 129 million cubic feet of space, you can readily understand the importance of keeping our skills proximate to the areas of responsibility.

CONCLUSION

You saw many elements of a mosaic which, if taken together, indicate the logistic challenges--in our field alone--which partially have been solved and those which need to be resolved further. I hope that this symposium is the beginning of a well coordinated team work to lead the unresolved problems to good solutions.

N 67-21965

THE US ARMY'S LOGISTICAL SUPPORT OF OPERATIONS IN VIET NAM:



BRIGADIER GENERAL THURSTON T. PAUL, USA, Director, Plans and Programs, Office of Chief, Research and Development, US Army, was responsible at Redstone Arsenal for logistics and training for the Redstone Missile System, resulting in its deployment to Europe. He was project manager for deployment of the Jupiter, first to Italy and then to the Air Force, and he coordinated the Government-industry engineering of the Pershing missile system His military career has included combat duty in Europe in WW II; research and development assignments in materials research, weapon development, and missile testing; and logistics assignments in Korea, Hawaii, Japan and Washington.

A year ago our mission in Viet Nam was that of providing military assistance and advising the Vietnamese armed forces in their efforts against the subversion and banditry of the Viet Cong. Our Army personnel there totaled about 10, 000, and the principal Army logistic action was in providing helicopter transportation for ARVN forces. Now, as a result of the past year's build-up, there are 185, 000 Army troops in Viet Nam, and our Army logistical operations have grown to the dimension of supporting a full-fledged combat force. To understand and appreciate this logistical build-up, one must know something of the country's geography and of its transportation and economic situations.

By US standards, Viet Nam is a primitive country, predominantly agricultural and rural. It has a long coastline with no developed deep-water ports. Rugged mountains, covered with dense tropical forest, rise steeply from the east coast. The delta region south of Saigon is a swampy riceland. The center of industrial, communication, economic, and governmental activity is the city of Saigon, 40 miles up the winding Saigon River. Viet Nam's railroad net is limited and has been paralyzed for years by Viet Cong harassment. Its highways are mostly unsurfaced, many no better than farm roads and trails, and easily (and frequently) blocked by the VC. Hostile Cambodia and the Communist-controlled border with Laos confine logistical support to that which can be provided from the east, and the lack of ports there gave us some real problems.

Viet Nam is also 1500 miles from our nearest major logistical base on Okinawa, 5000 miles from the Army's Pacific Command HQ in Hawaii, and 7500 miles from San Francisco and CONUS Logictical Support.

So you see we had our work cut out for us in creating a logistical support system in Viet Nam.

The backbone of this system is a handful of newly developed installations. The main air terminal at Tan Son Nhut, just north of Saigon, is now one of the world's busiest airports. Here cargo arrives from Okinawa, from Japan, and from the United States, and is transshipped to bases within South Viet Nam. Personnel and priority shipments of supplies move by air, and planes land and take off incessantly. Less than 2 percent of our supplies and equipment move by plane, however, sea transportation is still the lifeline of our forces overseas.

The old port at Saigon is the big one, in spite of its limited berthing and docking facilities. Many ships must be anchored in the river, and their cargo brought into the port on lighters and barges. The port's face is being lifted, however, and new warehouses, increased and improved docks, more and bigger cargo handling gear are showing the effect of development by the US Forces.

A major deep-water port has been developed on Viet Nam's East Coast at Cam Ranh Bay, on a sandy peninsula which might have been the desolate setting for a Foreign Legion movie. It has Viet Nam's best harbor, one of the four or five best natural harbors in the world. There's plenty of deep water surrounding the peninsula, and new piers on the leeward side give protection from the monsoon storms blowing in from the South China Sea.

Other coastal ports include the Navy-operated port at Da Nang which supports the US Marine Corps in the northern sector of South Viet Nam, and Army-operated ports at Qui Nhon, Nha Trang, and Vung Tau. Major improvement is well under way at Qui Nhon and its increased capacity now rates it in the major port category. Vung Tau is also being improved. Cam Ranh, Qui Nhon, and Vung Tau still rely heavily on lighterage operations to provide the required capacity, and Nha Trang will remain a shallow draft and lighterage port.

Our logistical operation is directed by the First Logistical Command. It has two main supply centers, Saigon and Cam Ranh Bay, the "wholesale" supply bases. It operates "retail" supply centers at the minor ports at Qui Nhon, Nha Trang, and Vung Tau, and at Can Tho in the delta region.

Distribution of supplies from these bases is no mean task. Where highways can be used, trucks move in armed convoys. Short, isolated stretches of the meager railroad net operate sporadically, but most of the deliveries of supplies are by air. At each of the ports and supply centers there is an airfield, and planes stream in and out on their flights to up-country fields or drop zones.

As you can well imagine, there have been some real problems in getting this logistical support system working. Support units were faced with the gargantuan task of receiving the US forces, of furnishing them their supplies, and at the same time of building their own logistical facilities and building up their own stocks. In one 51-day period between September 13 and November 4, 1965, the First Log Command landed the US 1st Air Cavalry Division, the US 1st Infantry Division, and a Korean Infantry Division. Sixty-four ships were unloaded, over 67,000 tons of equipment, over 10,000 vehicles, and over 40,000 men.

It was all done smoothly and well, but it meant working men and equipment 20 hours a day. Couple the intensity of equipment use with the abrasiveness of the ever-present sand and dust and with the hot, moisture-laden climate, and you have trouble. Equipment failures began to climb. The list of deadlined vehicles, aircraft, tractors, and construction equipment increased. The supply of repair parts shipped from CONUS depots had not been planned for this sort of situation and quantities on hand soon were depleated.

Something drastic had to be done to get the repair parts into Viet Nam so that this vital equipment could operate, and on December 1st, SECDEF McNamara directed the establishment of a high priority supply operation for that purpose. Dubbed the "Red Ball Express," it handles only parts required to return deadlined equipment to operation.

Requests for parts originate with the First Log Command in Viet Nam and are forwarded to San Francisco. Each requisition is identified as Red Ball, and all are given priority handling as they are forwarded to the national inventory control points and the CONUS depots. Parts are picked from stock, packed separately, labeled with Red Ball insignia, and flown to Travis AFB, California. From there they are flown by the Air Force Military Airlift Command directly to the air terminal at Tan Son Nhut, near Saigon. Par for the course, from requisition to receipt, is seven days, but an amazing number of Red Ball shipments break par.

Since the first shipment on December 8, over 5800 tons of urgently needed repair parts have reached Viet Nam by way of the Red Ball system; over 120,000 requisitions have been filled, over 90 percent of them within the seven allotted days. At the same time, normal replenishment procedures are building up the stocks of these same parts in the Depots in Viet Nam, and some day soon we expect to see the number of Red Ball requisistions taper off as the normal logistical support system hits its stride.

This has been a sort of thumb-nail sketch of how we support our forces in Viet Nam. We have had our good days and our bad; we have seen the satisfaction of success and the frustration of failure; but it has been repeated, time after time, by our leaders in the rice paddies and in the mountain jungles of Viet Nam, no fighting operation has been cancelled, no battle has been lost because of any lack of logistical support. This is the highest accolade that can be given to the hard-working men of the First Log Command and to the thousands who support them in our entire Army.

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DEFINITION

INTRODUCTION TO AFTERNOON SESSION:

WILLIAM A. PARKER, NASA, Deputy Procurement Officer, Manned Spacecraft Center, has a BS in Business Administration from Louisana State University. He served with the Air Force during the Korean conflict as a Manpower and Management Officer. He has been an operations analyst with the Strategic Air Command; had Management Analysis, Procurement Plans and Operations, and Program Office assignments at Mobile Air Material Area; and had a Procurement Division assignment at the NASA - Goddard Space Flight Center.

This morning we heard from Dr. von Braun that logistics had arrived. We heard that it was essential. And we reemphasize the need to make logistics work for the particular needs of the program that you are serving. Dr. Mueller dealt with the logistics philosophy and the practice and plans for the Manned Space Flight program, and Dr. Debus has posed several unique concepts and ideas that we might not have previously considered to be in the logistics field. General Paul has dealt with the classical logistics application. This afternoon's session we are going to devote to definition. And I am sure that this is one of the most perplexing questions about logistics, and that is, really, "what is it?" "What does logistics really consists of?" You talk to one person, you get one concept. You talk to another and you have another. But this afternoon's session is on definition. We have a very distinguished panel of speakers who are going to deal with these matters. They're going to go into what logistics is and why planning is essential: How do you integrate it into your total program? What pitfalls arise when we don't made the necessary and proper applications of logistics? Heading up this panel as moderator is Mr. James L. Carpenter, who is director of logistics support on the staff of the general office of the Martin Company. Mr. Carpenter is not only the moderator of this afternoon's panel but he was also on the steering committee that worked very hard on bringing this whole symposium to pass. My pleasure to present Mr. Carpenter.

INTEGRATED LOGISTICS SUPPORT:

JAMES L. CARPENTER, JR., Director of Logistics Support, General Offices of Martin Company, is responsible for those aspects of product engineering which ensure useability and supportability in the field. With Chrysler Corporation from 1956 through 1960, he was Director, Plans and Programs, for Advanced Projects; and managed support programs for the Redstone and Jupiter systems. Previously, he spent six years in electronics systems design with the Bureau of Ships and the Newport News Shipbuilding and Drydock Company.

Earlier today Dr. Mueller and Dr. Debus have discussed why an adequate support activity is essential to aerospace operations. General Paul has provided us with a timely and comprehensive view of the necessity for adequate support planning before undertaking a military operation such as Viet Nam. They have identified the asset afforded by proper logistic support.

This session will be devoted to definition. My function is to set the stage for Generals Cody and Phillips and for Admiral Sager who will discuss, in detail, some facets of the logistician's role in a product program.

The immediate objective is to take a closer look at the elements of what we shall call integrated logistic support. To do this we must look at the interplay between support considerations and other essential program activity. We must at least touch on the interaction among the elements of support. We must also talk about cost and schedule, subjects not unfamiliar to a program manager. In short we will look at what constitutes integrated logistic support and why it must be given premium consideration throughout the planning for acquisition of any hardware system.

Early last year Lieutenant General Richard D. Meyer, Logistics Director for the Joint Chiefs of Staff, stated: "Logistic support problems and added costs have been generated during the conceptual, design, and production phases of system or equipment acquisistion because adequate consideration had not been given to the systematic cohesion of all the elements of logistics and follow-on support of the equipment when it becomes operational."

General Meyer's statement is pertinent for two reasons. First there is a lack of realistic consideration of the total life cycle for hardware and systems, resulting in logistic support problems and additive costs that need not exist. In a sense that is what has motivated this symposium. Second, there needs to be a systematic merger of the elements of support early enough in programs evolution to preclude the generation of large additive costs. This integration activity is the topic of this afternoon's session.

The cost picture is an old story but it may bear repeating.

Each year approximately one fourth of the nation's defense budget is allocated to the logistic support of operational programs. This budget percentage has remained fairly stable for more than five years. For fiscal 1966, the Department of Defense O&M budget, which includes these costs, was estimated at $ 12.5 billion. This figure is more meaningful if we convert it to terms of our individual pocketbooks. It represents an expense of more than $ 135 per year for every man, woman and child in this country.

It is worthwhile for us to look at what makes up the total. One billion is provided to train military and civilian personnel to operate and maintain material. An estimated $ 400 million is used to purchase technical manuals. Approximately $ 2.75 billion is required to pay the salaries of the 300,000 civilians (civil service and contractor employees) who operate and maintain equipment in support of uniformed personnel. Nearly $ 8 billion is allocated annually to manage the spare and repair parts inventory and for the maintenance of equipment and facilities. These costs are significant. But we should note that they are usually termed additive costs and that they do not include other logistic support costs which are incurred in product acquisition. For example, they do not include the acquisition cost for initial spare and repair parts or associated documentation; they do not include the initial investment in support equipment and facilities; they do not include the cost of maintenance planning and analysis, intended to provide for an adequate support environment. Some people estimate that these costs raise the grand total of dollars involved to more than half of the defense budget.

Needless to say, in a cost conscious economy, these costs are receiving considerable attention. For at least two years there has been a deliberate effort to improve, reduce, or eliminate the cost of technical data without degrading the flow of essential information. Within the past year the Department of Defense has reorganized its approach to materiel maintenance for purposes of cost reduction. We are beginning to realize the impact of new concepts of item entry control and federal inventory management, both largely precipitated by cost reduction goals. Just three months ago, the Government embarked on a major examination of the effectiveness of training concepts and practices. Here too, the cost of training is a major consideration.

In addition ot these efforts new contracting techniques include life cycle costing, total package procurement, and step-by-step program definition. All of them are in a sense the result of an increasing sensitivity to the cost of support.

Separately, or together, these techniques will reduce the future cost of support. However, to execute them effectively it is essential that materiel support be conceived as an integrated discipline and that the planning for it start well back in the beginning stages of the hardware development cycle. This is the second part of General Meyer's statement.

In the program manager's world, already replete with terms like maintainability, supportability, and reliability, integrated logistic support is the newest concept for obtaining an improved support posture.

Like the "abilities," integrated logistic support has almost as many definitions as it has users. The definition most widely read is that in Department of Defense Directive 4100.35. There the definition reads "a composite of the elements necessary to assure the effective and economical support of a system or equipment at all levels of maintenance for its programmed life cycle. It is characterized by the harmony and coherence obtained between each of its elements and levels of maintenance."

The DOD directive lists the elements of integrated logistic support as: Planned maintenance ... Logistic Support Personnel ... Technical Logistic Data and Information... Support Equipment... Spare and Repair Parts... Facilities ... Contractor Maintenance.

These terms become more meaningful when we look at the definitions of each of them.

1. Planned Maintenance — The philosophy, plan, and procedures related to the management, accomplishment, and quality control of preventive and corrective maintenance at each level to retain material in a serviceable condition or restore it to an operable condition once it has failed. Planned maintenance includes servicing, repair, inspection, corrosion control, testing, calibration, overhaul, modification, handling, and storage.

2. Logistic Support Personnel — Qualitative and quantitative skill, performance requirements, and standards; training requirements, standards, curricula and devices; human factors engineering requirements; personnel protection, including safety, survival, clothing, escape and rescue and stress pertaining to the system or equipment under development.

3. Technical Logistic Data and Information — Includes, but is not limited to, production and engineering data, prints and drawings; documents such as standards, specifications, technical manuals; changes and modifications; inspection and testing procedures; performance and failure data; or other forms of technical logistic data and information acquired from contractors, prepared by the Military Departments, or obtained from other Government Departments and Agencies.

4. Support Equipment — Equipment such as special purpose vehicles, power units, maintenance stands, test equipment, special tools, and test benches

used to facilitate or support maintenance actions, detect or diagnose malfunctions, or monitor the operational status of systems, subsystems, or equipments.

5. Spares and Repair Parts — Spares are components or assemblies used for maintenance replacement purposes in major end items of equipment. Repair Parts are those "bits and pieces," e.g., individual parts or nonreparable assemblies required for the repair of spares or major end items.

6. Facilities — Physical plants such as real estate and improvements thereto, including buildings and associated equipment which are required for or contribute to system or equipment maintenance activities.

7. Contract Maintenance — That maintenance (i.e., modification modernization, rebuild, overhaul, repair or servicing of materiel) performed under contract by commercial organizations (including original manufacturers) on a one-time or continuing basis without distinction as to the level of maintenance. Included in this term is that contracting for services to augment military capability for the direct maintenance support of materiel.

At this point you might ask: "What's new?" The novelty is in the emphasis being placed upon the integration of the elements of support and the timing of the support consideration.

Historically the support consideration has been late, costly and frequently ill-matched for its intended purpose. Much of this has been due to the method of contracting. Spares, training, support equipment, and other operational requirements were specified and procured after the design was firm and to accommodate that design as it went to production. More often than not each support element was procured under a separate contract.

Equally significant has been an environment wherein those responsible for the development procurement had no responsibility for the production procurement. They, therefore, were either unappreciative of or unconcerned with the gain to be realized in giving greater weight to operational requirements during the design of a basic system.

The logic of the timing of the support consideration is simple. More time is available in the conceptual or contract definition phase of hardware development to seek optimum relationships between systems readiness requirements and total systems costs. The analysis and fix can also be done at less cost. Any change or addition to the system package made after the production of hardware begins is an accommodation and will cost more.

I will not pursue the subject of timing or schedule beyond those statements since I know that the following speakers will discuss it in more detail.

Up to this point we have reviewed the elements of support, looked at their current and recent costs, and noted that the Department of Defense has entered into a concerted and vigorous effort to improve logistic support planning and implementation. The goals are set forth in formal statements of policy.

The impact of DOD's effort, in which industry cooperates, will be far reaching upon contractors and procurement agencies alike, especially in terms of systems acquisition and management. Signalling these developments are current RFP's for major military contracts, calling increasingly for logistic support planning in earlier development stages, in far more extensive detail, and with far greater cohesiveness than ever before.

A recent Air Force project, for example, called for a detailed material support plan to be prepared as a CDP task, but also required detailed discussion of logistics concepts in the management section of the pre-CDP proposal.

A recent Army solicitation specifically calls out an early support plan as a CDP requirement. "The plan shall include an analysis of the (system) support requirements and a comprehensive program for contractor support beginning with the development phase and extending into the acquisition and operation phases until such time sufficient records and support items are on hand in the supply system to enable the Army to take over full uninterrupted support."

There are many similar statements including the guidance provided in DOD's CDP guide. All indicate that there is a change in the ground rules for approaching support considerations. If confirmation of this is needed or of DOD's intent to implement their plan it is easily found in The Honorable Paul R. Ignatius's statements to the DOD Equipment Maintenance and Readiness Council: "It is clear that industry must be organized to respond effectively to the qualitative and quantitative support requirements levied on it..." My office will assess this response through our Program of Contractor Performance Evaluation..."

Gentlemen, I have defined the subject of this session. To do so, I have freely plagiarized the literature. My objective was to facilitate communications.

Our next speaker is Major General J. J. Cody, Deputy Chief of Staff for Systems at AFSC. General Cody is going to discuss the significance of preplanning support and its place in a program schedule. His wealth of field experience in the housing, servicing, and launching of large boosters, admirably qualifies him for the topic.

N 67-21967

PRE-PLANNING LOGISTICS SUPPORT:

MAJOR GENERAL JOSEPH J. CODY, JR., USAF, Deputy C/S for Systems, Air Force Systems Command, has a B. Sc. in physics from St. Mary's University, San Antonio, and is a graduate of the Air War College. He served during WW II in Europe with the 70th Fighter Wing; participated in R & D nuclear testing projects; had several ARDC assignments; was Commanding General, 6595th Aerospace Test Wing; and Vice Commander, Space Systems Division, BSD. He directed more than 100 field tests of Thor, Atlas, Titan, and Minuteman systems. He holds the Bronze Star, Legion of Merit, and Belgian Fourragere.

About a month ago, your conference chairman kindly forwarded me a suggested topical outline of all the speeches to be used at this symposium. Naturally I read first the suggested outline assigned to me. Then I read the preceding and succeeding outlines to place my outline in perspective. I couldn't help but notice that all the preceding speeches had as their key words: "importance of," "need to," " objectives of," and the like. The key words in my outline were "show how," and "relate how." That makes the subject of my talk real straightforward: how do you plan for logistic support.

As is obvious to you all, there is no simple formula by which we can satisfy such a requirement. Yet by looking at various facets of the requirement we can develop an approach to the solution. The approach I will develop for you will naturally be the one we have acquired in our Air Force experience.

Before addressing the "how" and "what" aspects, let me discuss for a moment the "who" of planning logistic support. As you know, we call Mr. Responsible--the System Program Director, or merely the SPD. We have made his mission as simple as we possibly could. We have condensed it down to four words. All that is expected of him is that he "accomplish system program objectives." He has to surround himself with those people who have the necessary knowledge, and the necessary authority to input their knowledge into systems management. This collection of people, of course, is the System Program Office, or simply SPO. Mr. SPD's art of infinite management ability requires him to place limitless trust in his creatures, to the effect that each knows his area perfectly, and makes his input to a perfect degree, in a timely manner, and on a fully coordinated basis.

These specialists who constitute the SPO are not all from the Air Force Systems Command--since the SPD's mission (i.e., to accomplish system program objectives) is a statement from higher headquarters, either Headquarters USAF or even OSD. The specialists will therefore be drawn from other elements of the Air Force or even other branches of the Government.

The logistics specialty is a particular case in point. The very great majority of work we do in the Air Force under the systems management concept ends up as a continuing inventory item-- such as the B-52 fleet or the North American Air Defense complex at Cheyenne Mountain. We in the Systems Command are no longer responsible for these products. Operational responsibility is vested in a using activity. Logistic support responsibility is vested in the Air Force Logistics Command. Yet at a certain point in time past they were Systems Command's responsibility--both from a test inventory and from a logistic support standpoint. This means that there was a point in time when logistic support responsibility for these now inventoried items was transferred from Systems Command to Logistics Command. It means also that we have a twofold logistic support responsibility to worry about in the Air Force; namely, one during acquisition, and another during operational employment. I would suggest that the former aspect--logistic support during acquisition--is more comparable to the type of logistic support that goes on in NASA.

The final question on "who" is, "how do we mean to accomplish this dual logistics job?" In both cases we do it through the SPO. The personnel complement to accomplish the logistic support during acquisition comes from Systems Command; it comes from Logistics Command for support during operational employment. Logistics Command representation in the SPO starts in the earliest days of the SPO so that (a) his voice is heard from the earliest days in development of logistics concepts and plans, and (b) the transfer of responsibility I referred to above is as smooth a transition as is possible. We will see shortly how the extensive capability of Systems Command is brought to bear on the logistic support problem during acquisition. In similar fashion, the massive depot capability of the Logistics Command is brought to bear on logistic support during operation due to the early participation of Logistics Command in the systems management process.

Now let's get closer to the immediate subject of how we plan for logistics support in systems management.

The very word "system" has a dual connotation: one of pieces, the other of integration of these pieces. Each of these pieces has a function to perform and interfaces to satisfy. When any function or interface is awry, the system can at best attain only partial mission capability. I would call your attention to the fact that this interrelationship is not just one of physical pieces of equipment, one to another; it is also the interrelationship of functional disciplines such as reliability, maintainability, and logistics. The question, then, is how do we decide what these equipments should be, what are their interfaces, and what is their interrelationship with any given functional discipline.

The name of this process is systems engineering. A design engineer is concerned with the detail design of end items and components, either from a pure design standpoint or from the standpoint of one of the specialties such as logistics. But this type of activity is far, far down the pike in relation to what is initially required of the system engineer. The system engineer must look to total system design to satisfy a stated <u>system</u> requirement. The system engineer must consider military and economic, as well as technical variables, and how the change in any aspect of one affects the other variables. His major design decisions at the system level will not be validated until years hence when <u>system</u> tests have proven the adequacy of the detailed design and production specifications at the end item level which are based on his system design decision.

None of this is to say that the system engineer should divorce himself from the design engineer, or the logistician, or any other of the design specialists. It is absolutely essential for the system engineer to recognize the predominant and highly complementary role played by all the design specialists in satisfying the need for total system design. It is <u>not</u> the function of the system engineer to constrain technical thought of these specialists. The interplay between the system engineer and the design specialists requires the closest coordination. Even in the initial effort to translate the requirement document into a gross system specification, the system engineer has to look forward to the point in time when the design specialists will have to do the detailed engineering and when the results of all detailed engineering will have to interface to satisfy his system specification requirement.

In the systems engineering process the system operational requirements are first translated into basic functional operations. From these a block flow diagram is created which depicts the various sequential and parallel relationships. Note that this brings us only to functional design, not hardware design. It is very easy for the system engineer to become a design specialist at this point and shape design solutions on his preconceived notions. At best his preconceived design solution is a first hypothesis for drawing the parameters around the eventual solution.

As a second step the system engineer proceeds to analyze each functional operation and associated criteria to determine the design requirements necessary to satisfy the operation, including interfaces between operations.

A design approach is then selected and trade-off studies of functions, alternate functions, and sequence of functions are conducted. It is here that the various design specialists have a paramount role. For example, a maintenance design analysis is conducted to determine what maintenance functions must be performed. The maintenance concepts of the requirement document are further defined and detailed into specific levels of maintenance and the determination of required end items and components. This maintenance analysis is iterated to reflect later decisions in maintenance design or concept, such as unavailability of adequate test equipment for predicted fault isolation.

The fourth and final generic step of the systems engineering process is to integrate and group design requirements wherever possible to provide design requirements for specific items.

The entire systems engineering process is repeated and refined as many times as necessary to obtain the required level of information for detailed design and development of each end item, and as many times as necessary to assure an integrated design.

The same systems engineering procedure is followed at each succeeding level required to define and design the system. There are, of course, interactions and feedbacks between levels as the cycle is repeated.

Then, too, as systems engineering proceeds, in addition to refinement of information on and between initially predicted end items, additional requirements and functions are generated resulting from the specific techniques or device selected. These, in turn, again cause an iteration of the entire systems engineering process.

The systems engineering process cannot, and obviously will not make logistic support decisions—any more than it will make engineering decisions. But it does provide a basis for the decisions and provides a discipline for maintaining a system perspective across end items and across functional specialities. It establishes a single source of standardized series of engineering reference points or baselines which are based on the progressive and evolutionary development of specifications which, in turn, are a forcing function upon design.

If I seem to have wandered somewhat far from the subject of how to pre-plan logistics support, let me bring you back into the corral with two references from the preceding speaker's text. First, he quoted the following from the Logistics Director for the Joint Chiefs of Staff: "Logistic support problems and added costs have been generated during the conceptual, design, and production phases of system or equipment acquisition because adequate consideration had not been given to the systematic cohesion of all the elements of logistics and follow-on support of the equipment when it becomes operational." Second, Mr. Johnson stated: "Historically the support consideration has been late, costly, and frequently ill-matched for its intended purpose. Much of this has been due to the method of contracting. Spares, training, support equipment and other operational requirements were specified and procured after the design was firm and to accommodate that design as it went into production." By way of contrast to this historical method alluded to by Mr. Johnson, I bring to your attention the Total Package Procurement Concept that was used on the C-5 program where proposals were required at the end of the contractors' definition effort covering not just design and development, but also production and logistic support costs.

Returning to the systems engineering process, a technical baseline will have been established at the end of the process. We refer to it as our program requirements baseline. This technical baseline has to be supplemented with other data, primarily the system package documentation, to constitute the total baseline. It is through the system package documentation that required technical developments are married to the other two parameters of cost and schedule. The pace quickens, not only to accomplish this marriage, but also to develop all the necessary implementing documents which will describe the specific actions necessary to implement the logic of the systems engineering process. Let's follow this through several examples.

As a result of the systems engineering process the person in the SPO charged with responsibility for management of the test program has made his initial determination of test requirements — whether any test is required, the type (qualification, preproduction, individual acceptance, sampling), the "how" (parameters to be used, inspections required, criteria of failure), instrumentation and facilities required, and the like.

The test plan is the next step, a logical expansion of the test program requirements which, in turn, were built on the systems engineering process. A portion of the test program requirements is levied on appropriate test agencies — our test centers and ranges for example. They each develop the plan appropriate to their assigned portion of the test program, including inspection and test procedures, utilization of or requirement for new support equipment and facilities, degree of contract maintenance required, plans for acquiring trained in-house logistic support personnel, method of accumulating or verifying performance and failure data. These and similar factors can be planned only generically against the program requirements baseline at the beginning of the definition phase. It is only through a strong and continuing relationship between the Test Force Director at the range — who is responsible for development of the test plan and for the actual conduct of the test — and the test manager in the SPO who is responsible for the overall test program — it is only through their continuing relationship that these generic test factors can be translated into detailed integrated test and test support requirements toward the end of the definition phase. It is important to note here that all this transpires prior to inception of design and development, even before letting the contract for design and development. All the foreseeable requirements dictated by the test program, as stated by the Test Force Directors themselves, are in the hands of the SPO so that an integrated test plan can be developed and issued prior to initiation of production. We know, then, not only what we want (from the design requirements baseline) but, also, how to prove we in fact received everything we asked for (from the detailed integrated test plans).

Lest I leave the impression that the test program is so perfectly planned that the Test Force Director's job is one of monotonous routine, let me share a few reminiscences from my days in that phase of the business. Keep in mind that the name of this speech is pre-planning logistic support. First, the tester's primary job is not to make the system work; it is to see if the system meets its specification requirements. That doesn't mean that the Test Director deliberately aborts the missions as soon as he discovers a variance from the plan. He must continuously make the distinction, however, between whether the system works as planned and whether he can make it work. Testers are ingenious with the jumpers — but while this may (or may not!) make the mission go, it bears only a far-fetched relationship to proof of engineering design. Second, the test site is not a true replica of the real operational environment. If the tester with his ingenuity and model shop backup can make the system work, this is no proof that the operational troops (who lack this support) can make it work. Third, the tester likes to believe he is testing what is going to be put in the hands of the troops. This is not necessarily true. He is more often than not behind the power curve. His aerospace ground equipment is not system-peculiar. His technical manuals, if available at all, do not match the equipment. Through his liaison with the SPO the tester knows of many updating changes that have been approved but have not been incorporated into the test article. Fourth, among his other objectives the tester is looking beyond the development test he is conducting and is attempting to effect a smooth transition to the follow-on operational test which will be conducted by the user. The user as well as Logistics Command and the Training Command are always looking over the Test Director's shoulder to assure the system documentation is honest and the test is being conducted as planned.

If the test program has been conducted strictly according to the book, the deployment process should be a natural and relatively simple follow-on. The more the test program deviates from the test plan, however, the more we have to undertake initial testing at the deployment sites. This is just an additional complicating factor. There are adequate planning problems in the deployment phase independent of playing catch-up to the test program deficiencies. A complete plan is required for each site: not just prime mission equipment, but government furnished equipment, spares, test equipment, and tooling; detailed procedures and technical manuals for assembling, calibrating, and checking out the equipments; an overall schedule for activation and turnover to the using command — including the long lead-time facilities and the continuous flow of updating changes.

Some of my reminiscences of encounters I had with deployment site Commanders I will leave with you in the form of questions. Has total system verification been accomplished through the test program? Since every site is different, how different is the configuration of this site from the verified system? Is the configuration at this site the same as that which was tested — including update changes? If not, what is the real significance of all lights green? What degree of validity do we assign to a site test anyhow since it can only be a simulated one?

This havoc created by inadequate planning for logistic support of the test program also shows in the training area when the troops, conducting their operational test, see equipment that is substantively different in many areas from what they encountered either in observing the development test or in undergoing their training on simulators. Obviously the training curricula and procedures, and the development of quantitative and qualitative skills must be keyed to training devices that adequately represent operational equipment.

If adequate planning for logistic support of the test program is so paramount to the discharge of the Systems Command mission, it is no less paramount to the using command and the Logistics Command. The using command looks to our development test program as both proofing of many aspects of their operational employment concepts (unit maintenance, availability, reliability and the like) and as a prelude to what they can expect when it is their turn to conduct the operational test. Likewise the Logistics Command looks to our development test program as both the proving ground for their maintenance planning concepts (depot and base maintenance smoothly transitioning from the contractor; spares and technical data complementing the planned maintenance and inspection concept; performance, failure, and usage data adequate for supply actions) and as a prelude to what they can expect when they inherit engineering responsibility and the configuration management function from the Systems Command.

It has been our experience in Systems Command that there is no known substitute for a thorough systems engineering analysis beginning in the concept formulation stage in order to achieve either system integrity or integrated logistic support. But this is only the beginning. Logistic support must continue to be a concern through feasibility studies, preparation of the request-for-proposal, bidders' conference, contract negotiations, and in-process reviews and inspections.

If systems engineering provides the technical baseline for these logistic support actions, the systems management documentation (or progressively the Preliminary Technical Development Plan, Proposed System Package Plan, and System Package Program) provide the vehicle for integration of these logistic support actions into the overall cost and schedule for the total program. Not only is the cost of developing integrated logistic support inherent in the overall cost for delivery of an operationally effective system; this logistic support cost could well be a major determinant in whether or not program go-ahead is received. This system program documentation, I remind you, is the package which Systems Command must submit to higher headquarters in order to obtain a go-ahead on any Air Force system program. The system program documentation must, and in fact does reflect the best thinking of all participants in the SPO -- not just Systems Command, but Logistics Command, Training Command, and the using command. The system program documentation, however, is only a small — although consolidated — portion of the overall planning (test plans, standard item procurement plans, training plans, materiel support plans, deployment plans, transportation plans, and on ad infinitum) that has been undertaken. No one person knows all this — not even Mr. SPD. Recall, he is not expected to have the infinite knowledge of God, only His management ability to tie it all together and implement it once it is approved.

In my opening remarks I related that your conference chairman gave me a suggested outline of show how, discuss how, and relate how one plans for logistic support. To prevent me from being carried away, however, either by pure theory or personal reminiscences, he added a final topic: Present support planning checklist for use by program managers. He would not give me authority though to preempt the time allotted to the next two speakers or to this evening's social hour to accomplish this.

There is no such thing as a checklist which can be used across the board on any and all programs. For example, there is no requirement for unconventional storage of ammunition at a radar warning site, and we haven't been able to employ the same transportation mode in getting a Minuteman to its site as we do in getting a C-141 from the contractor's plant. But we have not abandoned the concept of a checklist because of variations in different kinds of systems. I will conclude by very briefly telling you about two such lists.

Approximately three months ago we issued a manual titled "System Program Management Procedures." Its code number is AFSCM 375-4. It gives a chronological roadmap of all the major events that take place along the total life cycle. It is an event-type checklist and is so written that no two different specialists arrive at the same inferences at any given event. Take, for example, the event titled, Conduct Preliminary Design Review. The aerodynamicist and the maintenance engineer have a completely different perspective in accomplishing their respective roles at this event. This manual, AFSCM 375-4 is available through publications channels or from the Superintendent of Documents at the Government Printing Office.

The other list is not as accessible to you. It originated as part of a Memorandum of Agreement between Systems Command and Logistics Command some two years ago where we were sorting out the logistic tasks that were the responsibility of one or the other command; that is, logistic support during acquisition and logistic support during operational employment. It is some 25 pages long, covering specific tasks in the areas of maintenance, supply, transportation, training, and technical manuals. Each area is separately divided into the acquisition support tasks of Systems Command and the operational support tasks of Logistics Command. This list is in the process of being converted to a joint AFSC/AFLC regulation. It will then, of course, be available through publications channels. As an interim measure I have provided the conference chairman a copy of this list to be incorporated into the symposium brochure. You can peruse it at your convenience.*

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* See Appendices A and B

N 67-21968

THE TECHNICAL PHILOSOPHY OF SUPPORT:

REAR ADMIRAL JOHN P. SAGER, USN, Assistant Commander for Material Acquisition, Naval Air Systems Command, received University of Michigan BS and MS engineering degrees; completed Pensacola flight training and was commissioned Ensign. Pre-WW II had squadron, flight instructor, engineering, and experimental assignments. During WW II, for combat duty in the Pacific, he received the Air Medal and Legion of Merit. He had numerous CONUS and foreign assignments before his present assignment.

Gentlemen, I appreciate and welcome the opportunity to participate in this First Annual Logistics Management Symposium. The previous discussions this afternoon by Mr. Carpenter and General Cody about integrated support and the degree to which preplanning support make possible the intermesh with program scheduling provide a launching pad or platform from which I shall explore and share with you my concept of the technical philosophy of support.

Simply stated, our support philosophy relates to the methods by which we determine, plan, procure, and distribute the total spectrum of logistic-support resources — material, manpower, facilities, and services — in the quantities required, at the time required, and at places where needed so as to operate and maintain weapon systems in a fully configured, combat-ready, mission-capable state of readiness.

The Navy long ago adopted the philosophy that Naval aircraft aboard ship must be supported logistically while the ship is underway at sea, and that land-based patrol-type aircraft must be supported in time of war from far-flung advanced bases, while patrol seaplanes must be supported from those ships which are designated by the Navy as seaplane tenders.

Having adopted the concept of mobile advanced/underway Fleet support for Naval aircraft, the Navy then had to resolve the question of what program would be undertaken to support such a philosophy. In other words, how could we do it?

I started my naval aviation career as a patrol seaplane pilot and, therefore, consider myself qualified to address the specific subject of patrol aircraft support, which I should like to discuss first. Patrol aircraft do far-ranging aerial support of the surface Fleet and in more recent years have been specifically assigned the function of anti-submarine warfare duties. Anti-submarine warfare, commonly referred to as ASW, constitutes one of the Navy's top-priority efforts.

For many years, Navy patrol-type aircraft have been large multi-engine aircraft, which can operate either from the sea (an example being the Martin P-5 flying boats which are flying over the South China Sea today) or from landbases (examples being the Lockheed P-2V or the newer turbo-prop multi-engine Lockheed Electra-type P-3's). Our P-2's and P-3's are also operating in Vietnamese airspaces.

In 1957, the Navy decided to buy a military version of the highly successful Lockheed Electra. Designated the P-3, this aircraft has four turboprop Allison engines and has remarkable performance and reliability.

When the Navy initially bought the P-3, insufficient funds were available to purchase all the aircraft required and at the same time procure a full range of supporting equipment — what the Air Force knows as AGE and what the Navy has long known as ground-support equipment (GSE). Not only were the aircraft

FIGURE 1. LOCKHEED P-2V AIRCRAFT

FIGURE 2. LOCKHEED P-3 AIRCRAFT

extremely expensive, compared to the old P-2's, but also the ground-support equipment was very costly. This GSE usually includes not only field engine-starting equipment, liquid-oxygen-servicing equipment, electrical and radio-test equipment, but also specialized avionic test equipment required to test and check the ASW gear in the airplane, as well as special engine stands, engine tools, engine stands peculiar to the airplanes, and other supporting ancillary equipment.

As a general practice, the Navy has always deployed a land-based patrol-plane squadron to a fixed base such as Sangley Point, near Manila in the Philippines, and then after a six-to-nine months period of deployment, relieve the squadron on station by another squadron flying out from continental United States. The fixed base almost always has a full range of shops and supporting equipment to maintain the aircraft.

Our limited funding of the P-3 presented a serious dilemma to the Navy. We were able to afford only one full set of ground-support equipment for each squadron. A P-3 squadron usually has a total of nine aircraft. Although we generally deploy an entire squadron as a unit, say, to the Philippines or Alaska, we frequently find it necessary to send a small detachment of three aircraft to an advanced base a considerable distance from the rest of the squadron. The problem then becomes, how can we divide our limited range of equipment to support the aircraft in two separate locations? The aircraft at home must have ground-support equipment as must the advanced-base unit. The main group, that is, the six planes remaining at the fixed base, has the advantage of the shops at that base; yet they also need the ground-support equipment, especially that particular gear which must go with the aircraft, such as starting carts, tow bars, work stands, and special engine tools.

Before the acceleration of the war in Viet Nam, the Navy was using a program policy of supporting its land-based patrol aircraft from three major locations in the Western Pacific. One entire squadron operated out of Southern Japan, one from Okinawa, and one from a location in the Philippines. It became quickly apparent after the Tonkin Gulf incident that the Navy must support its land patrol-type aircraft, not from three bases, but from five, and this requirement immediately created a severe logistics problem from the simple standpoint of the supporting equipment.

We approached the problem by two methods. One was the use of air-transportable vans; and the other was to use what we call pack-up kits. The van concept consists of two vans, one with a full range of electronics test equipment; the other is a mechanical-repair-shop van. In addition to the vans, we developed an air-liftable pack-up kit containing a full range of high-usage spares support, which included not only electronics and engine accessories spares, but also wheels, tires, propellers, batteries, fuel filters, starters, and such. These pack-up kits were capable of being lifted in the bomb bays of one of the aircraft being deployed so that the equipment would be available on site at the advanced base. Thus, if the squadron were based at the Naval Air Station, Kodiak, Alaska, we could deploy a detachment for an indefinite period to an advanced base, by using the air-transportable vans and kits. Naturally, we have problems, such as an urgent requirement for air conditioning in high-humidity areas like Viet Nam and the Philippines. Our electronic test equipment cannot survive without air conditioning.

Our van and pack-up kit concept has worked well, and the Navy is using this technique today in meeting its mission requirements for land-based patrol aircraft in the South China Sea and off-shore operations in Vietnamese Waters. The "Market Time Operations" that you see referred to in the weekly news magazines are a definite program being carried out by the Navy patrol-type aircraft. This responsibility is primarily junk surveillance and positive identification of all vessels operating in the waters surrounding Viet Nam including the South China Sea and the Gulf of Tonkin.

I mentioned our patrol seaplanes earlier. Figure 3 is of a P-5 seaplane. These older reciprocating engine seaplanes do not have the range that our newer P-3 turboprop aircraft have. We are therefore operating our Martin P-5 type seaplanes from tenders which are based in locations adjacent to the coast of Viet Nam, such as Cam Run Bay, which you can see and hear about in the news on TV.

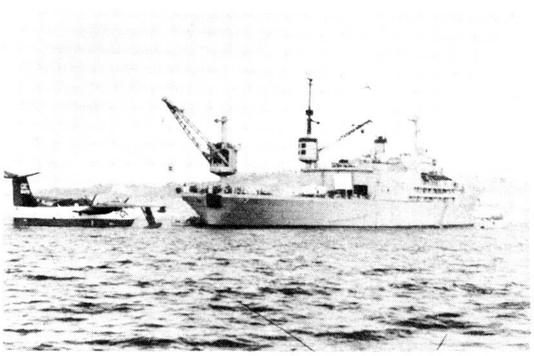

FIGURE 4. USS CURRITUCK, AV-7 SEAPLANE TENDER

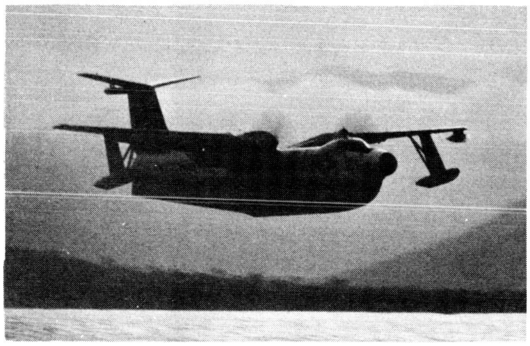

FIGURE 3. MARTIN P-5 SEAPLANE

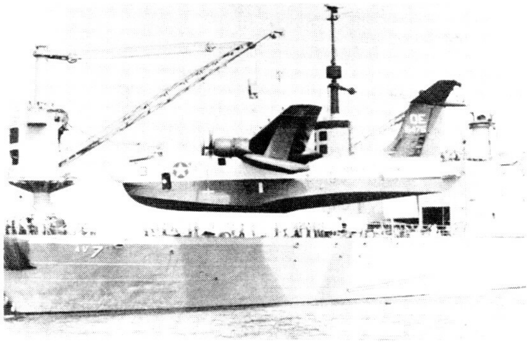

FIGURE 5. P-5 SEAPLANE BEING HOISTED ONTO USS CURRITUCK

Figure 4 is of the USS Currituck, AV-7, a seaplane tender. The aircraft moor to buoys nearby. Crews sleep on board the tender and take their meals there. All engine changes plus hull and other repairs, are provided by the ship, another example of our concept of underway support. The Navy considers its patrol seaplane operations in Viet Nam waters to be highly successful.

Figure 5 shows a P-5 seaplane being hoisted out of the water onto the fantail of the ship.

I spoke earlier about the Navy's philosophy of underway support for carrier-based aircraft. Figure 6 depicts one of our big carriers being replenished at sea. The logistic-support vessel may be a tanker or an ammunition ship, or one of our new multipurpose logistic vessels such as the USS Mars or USS Sacramento. These latter two vessels are fast underway replenishment ships which are combination tankers carrying fuel and black oil, as well as aircraft jet engines and airframe spares such as landing gear, wing panels, propellers, cockpit enclosures, or tail hooks, in addition to general supply items, provisions, and ship-system spare parts.

Our carrier-based aircraft are fully maintained aboard ship. We service the aircraft between strikes over Southeast Asia, changing engines, helicopter blades, or guns, when necessary. Ranger was on the line for 58 days in the South China Sea. It is common for our carriers to operate 30 to 40 days without going into port. A full range of high-usage spare items is aboard each aircraft carrier. To determine effectively how much logistic support we

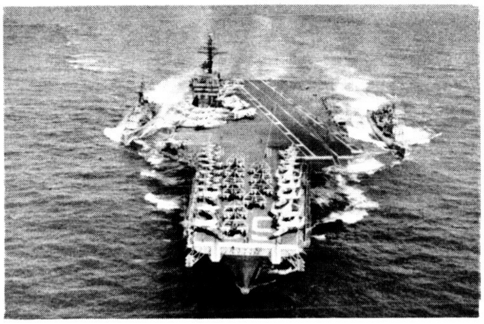

FIGURE 6. REPLENISHING SHIPS AT SEA

must provide and which are the high-usage items, we must refer to our established criteria for time between overhaul, or TBO as we know it, for all the aircraft components. A jet engine in a fighter, for example, has a reliability overhaul interval of approximately 1500 hours. During the accumulation of this 1500-hour cycle, we change turbine blades, fuel controls, combustion-chamber liners, and perform other minor maintenance. For each item on the aircraft whether it is a prop or a jet, we must think in terms of the item reliability and operating life between overhauls. These considerations are tailored into our support philosophy and determine our program policy.

These support concepts which find fruition on the carrier hangar deck, the advanced land base, and the seaplane tender must have their genesis far back in the life cycle of the aircraft, the engine, and other components. During the past fifty years of Naval Aviation, maintainability has always been a requirement, but there has been considerable change in recent years in the manner in which maintainability requirements are expressed contractually.

Today, technical development plans and requests for proposals stipulate firm operational, maintainability, and support requirements.

During the conceptual and design phase of weapon-system and equipment development, the Naval Air Systems Command requires that the contractor give serious consideration to those fundamental design parameters which will insure maintainability and supportability of the end item. To do so, the contractor must have control of and remain within the firm numerical maintainability and support constraints set forth in the program definition and contract. Maintainability therefore becomes the foundation and basis of the logistic subsystem and is directly related to system effectiveness.

Maintainability is a parameter that must be specified, measured, and demonstrated. Maintainability has both qualitative and quantitative characteristics. These make it possible to meet operational objectives with a minimum expenditure of resources such as manpower, time, test equipment, technical data, material, and support facilities.

Qualitative characteristics of maintainability are the direct result of management and engineering attention during design. A quality design reflects detailed attention to the reduction of manpower and skill requirements and a minimum number of special tools and equipment.

The quantitative characteristics of maintainability are reflected in the operational rate, operational turn-around-time, reaction time, and other mission requirements which can be numerically defined.

During the design stage, the contractor gives complete consideration to the operational environment, such as carrier deployment, austere advanced bases, scattered detachments, and major Fleet-support stations. Toward insuring adequate consideration of the service environment, the contractor is encouraged to familiarize himself with Navy and Marine Corps organizational capabilities and procedures. He must reflect consideration of maintainability when submitting proposals and during the detailed design phases.

To insure that the specified maintainability is realized, the contractor conducts design reviews prior to the release of drawings for initial fabrication or release of purchase orders.

We thus establish overall support philosophy concurrently with the very beginning of any development. Support philosophy thus constantly governs program policy as I shall now relate in terms of specific Navy examples.

Our concept of aircraft life span in the Navy is a key element of our support philosophy. We no longer overhaul aircraft in the Navy. Instead of overhaul, we do progressive aircraft rework, or PAR as we call it. When aircraft were considerably cheaper than they are now, by a factor of almost five, we had 8000 to 9000 Navy aircraft instead of the 2000 to 3000 we now have. Formerly we could afford a long pipeline of aircraft awaiting overhaul at one of our major Overhaul and Repair Depots. The squadron simply turned in an aircraft for an overhaul requiring from 12- to -24 months, and then draw out one completely overhauled. In terms of today's multi-million-dollar supersonic aircraft, we cannot afford to buy as many planes to begin with; hence we cannot afford a long overhaul cycle with the large backlog of aircraft. Instead of one overhaul taking between 5000 to 10,000 manhours, depending upon aircraft type, during about every three years of operating life, an aircraft is now given a progressive aircraft rework of about 2000 manhours, taking about three to six months based on a periodic calendar interval. This interval is about every 16- to -17 months for our carrier-type aircraft and 20- to -24 months for utility and transport aircraft.

The big difference in concept is not just another way of performing rework; instead, the hard realities of the situation are that our total aircraft inventory is limited by high unit costs. Today, we cannot permit an operating squadron to turn an aircraft into rework (PAR) and draw another aircraft; the squadron must operate through its retraining and pre-deployment period one or two aircraft short, depending on how many aircraft that particular squadron has that are to receive major rework or PAR. Thus, a 12-plane fighter squadron may have to do all its pre-deployment gunnery training, night training, and re-qualify its new pilots in their carrier-landing requirements with perhaps only eight or nine aircraft, some of which are down for other maintenance reasons. In the PAR concept, the aircraft is brought in at the end of the first PAR cycle of operation and given rework which will include all the hydraulic and flight-control systems and a major cleaning and corrosion control. (Salt water and sulfuric acid from the stack gases of our non-nuclear carriers do not mix well with aluminum airframes and wing skins.) The aircraft then goes back for an operational tour and comes in again at a prescribed period for the next PAR; this time the fire-control and electrical and communications systems are given a complete check, as well as items such as the landing gear and other components; then the aircraft is returned for Fleet use. When the aircraft comes in the third time, the items that were worked on first cycle are re-done, plus any additional required work is done.

At present the Navy plans an 84-month or seven-year life span for its aircraft. The PAR cycles are divided up accordingly.

What has all this to do with logistic support?

The Navy only has so many aircraft which can operate from its carriers and support our operations in the Pacific theater as well as support our NATO requirements in the Atlantic and Mediterranean. We must carefully tailor the PAR and rework cycles of our aircraft to meet the deployment schedules of our carriers. When carriers such as the Enterprise or Forrestal are ready to deploy to the Atlantic or Pacific, the air group must be ready to embark, and all aircraft must be capable of operating the entire deployment cycle without having any major maintenance due. Accordingly, during the time that the carrier is not deployed and is back for minor refit and the crew is getting some rest and recreation, the squadron must accomplish training of new pilots in bombing and gunnery capabilities and in carrier-landing qualifications. It thus takes a great deal of logistics planning to tailor all the requirements to be ready to meet the deployment date of the ship.

I have attempted to give you a brief picture of the manner in which the Navy schedules and programs its aircraft logistics support for its aircraft. Naturally, there are many entities hard at work in carrying out this program on a round-the-clock basis. Identifying some of the major activities fully engaged in logistic support would certainly include the Aviation Supply Office, Philadelphia, commanded by RADM Foley; the Naval Air Systems Command Headquarters, Washington, recently known as the Bureau of Naval Weapons and, prior to 1959, as the Bureau of Aeronautics; the Fleet Air Staffs in Norfolk and San Diego; and our major East and West Coast Overhaul and Repair Depots at Quonset Point, Norfolk, Jacksonville, Alameda, and San Diego.

N 67-21969

SCOPING SUPPORT TO PROGRAM REQUIREMENTS:

MAJOR GENERAL SAMUEL L. PHILLIPS, NASA, Director, Apollo Lunar Landing Program, has a BS in EE from University of Wyoming, an MS in electronics from University of Michigan, and an honorary Doctor of Laws from University of Wyoming. He served in Europe during WW II with the 8th Air Force where he earned the Distinguished Flying Cross and Oak Leaf Cluster, Air Medal with seven Oak Leaf Clusters, and the Croix de Guerre. His assignments have included R& D work, including B-52 Project Officer, and Chief, Air Defense Missile Division, at Wright-Patterson, Chief of Logistics for SAC 7th Air Division of Thor; Director of Minuteman Program at BSD, ARDC; Vice Commander, BSD, ARDC; and Deputy Director, NASA - Apollo Program.

Good afternoon gentlemen.

It is a pleasure to participate in this, the first Annual Logistics Symposium. I am reminded by this Logistics Conference that in June of 1956, after some seven years at Wright Field in the research and development field, I was ordered to England and assigned as the Director of Logistics for the 7th Air Division of the Strategic Air Command. It occurred to me on that assignment that I was probably being sent there to live with some of the mistakes that we had made in research and development. I quickly learned that the operator in the field and the logistician really are slaves to the system designer, to the materiel producer, and to the distribution system on which they must rely.

Some examples that come to mind from that experience relate to the B-52. The takeoff conditions of that aircraft dictated the runway lengths in England. The equipment dictated the kind of stocks we had to have such as alcohol or wetting agent. The requirement to establish a reflex-type alert force with the B-47's takeoff in England dictated the need for us to establish alert quarters for crews and tables of equipment for maintaining the aircraft on alert, and for enabling us to start them according to the reduced checklist. It also dictated the kind of stocks of supplies we had to have to make quick turn-arounds of aircraft; it even dictated the choice of personnel in the organization.

I am reminded also that we had to equip the B-47 with the rocket-assist takeoff units again because of weights and runway considerations. This resulted in the many considerations of safety handling of rocket units on armed aircraft.

I recall the Egypt crisis which occurred in those years and the almost complete absence of conventional bombracks available for strategic bombers. Logisticians and materiel personnel were forced to obtain them from various places, to make some more, and even to devise methods of getting them into the airplanes. We set up somewhat of a production line in England to be able to equip the strategic bomber which for many years had not carried conventional armaments. The systems designer, the system developer, and the producer establish the stock levels with which the operators and logisticians have to deal. Support is a function of failure rates, of the reliability, and of the quality that the developer and producer have been able to put into the system.

I recall the deployment of the Thor intermediate range ballistic missile to England. Bird watchers were necessary to accompany the guidance and control systems because of the way they were designed. The float in the platform had to be maintained at a certain temperature. The lesson here is that the operator and the logistician really are slaves of the designer and the producer of systems, whether they be weapon systems or those in someone else's terminology.

I learned also that the field operator's experience is invaluable in improving system design. The only really practical way to transfer learning in the rapid culture in which we live is by transferring people. The example I saw in my SAC assignment was the transference of a man from the research and development field to the operational area and back again. This is an effective way to perfect the systems design insofar as logistics supportability and support requirements are concerned. I learned also that field innovation is quite possible and is very important. For example, part of our mission was to be able to handle a large number of airplanes on a small number of runways. Runways under emergency conditions sometimes become clogged with crashed aircraft. This situation emphasized the ingenuity of the maintenance man. For 30 thousand dollars, some $1\frac{1}{4}$-inch steel cables woven into a net, and some Caterpillar tractors, we were able to come up with a very effective system of dragging anything as big as a B-52, burning, off a runway.

I was asked to talk about the scoping of logistics requirements. It seems that during the morning discussions the main points in the science of logistics have been well discussed from a variety of angles. I'd like to discuss these from a still different standpoint.

My experience has convinced me that the most successful systems, whether they be weapon or other kinds, are measured by the results in the environment in which they must perform and by the management of the cost and schedule factors. The support requirements are scoped during the system design. They are modulated during the development by factors such as thoroughness of development, testing, and reliability achieved during the process. They are further modulated during production by the quality which the producer achieves, and very importantly by the stability of the configuration. For these reasons, the first job of the logistician is in the engineering phase. He must play an active part in the systems concept itself as well as in the system design and execution phases.

Both the system itself and the design of the system must be geared to the goal and objective during the early phases of total system planning. The logistics support required for a system is in fact traded off against the various final design alternatives existing in the formulation of the system design, always with the ultimate purpose of the system in direct view.

We will recall that the Minuteman was a sealed missile which was built and closed up tight in the factory. This was the result of a tradeoff study early in that system's conception. The tradeoff consideration was that of building it as a sealed missile versus building it for assembly in the field and at operational sites. The objective was to achieve a high rate of missiles on alert and to achieve the lowest possible operating cost. The decision was made to build the missile as a complete entity in a factory, closed, so that it could not be entered for field maintenance. This immediately dictated overhaul in a factory or factory-level depot. The tradeoff was one of spending money to design a suitable level of reliability in the development process. This would enable more economical total system operations than if money were put into a logistics support system which would provide maintenance in the field under a lower level of reliability achieved during development.

Decisions like these in the conceptional phase set much of the logistic pattern and also established requirements for transporters of certain types. These include the equipment involved in a transporter to erect the missile in its operational site and most of the handling equipment, the training of people, and much of the logistics that becomes a part of the system.

These early tradeoff considerations of development versus logistics yielded decisions dictating a black box maintenance concept providing the ability to maintain black boxes in the field, for example, versus moving and replacing whole boxes. This set the logistics pattern for the provisioning of space parts or of complete entities of subsystems, and set the requirement for bench equipment versus a depot or factory level capability, for training of people, and for the data to support the system.

In the early concept of the Apollo systems, spacecraft reliability requirements were based on a fair amount of inflight maintenance of the electronics, particularly the guidance, navigation, and communications equipment. The early designs were made on this basis, and some hardware was about to be until experience began to accumulate concerning the action of moisture, weightlessness, and the corrosiveness of the atmosphere. The electrical connectors for easy removal and replacement of boxes required that these processes be carried out with a pressurized space suit and gloves. In addition, the spacecraft had to be designed to carry parts, tools, etc. Experience in the early stage of system development and associated studies, therefore, have shown that the result of pursuing that concept further would actually result in degradation of reliability in flight. The concept had to be turned around and the actual design had to be changed to eliminate the flight maintenance concept.

The scoping of logistics support for Apollo versus Minuteman presents a situation of one versus many. In the Manned Space Flight Program in general and the Apollo program in particular, each individual operation is essentially a one or zero, insofar as a success or a failure is concerned. Each operation is exceedingly important in a rapid, orderly progression to the objective of the system and the entire system design. The logistician has to bear that objective in mind. Each vehicle is destined to serve its purpose best if it is launched on time in a particular, established launch window. Therefore, this objective sets the pattern for design of logistics support. On the other hand, the end field objective in the Minuteman system was a high in-commision rate of having some 90 percent of the deployed force on alert. In-commision was the ultimate and only purpose of that system, and dictated certain features in the design of the system that reflect themselves in the scoping of the logistics support for later phases.

In the Saturn/Apollo space vehicle and its associated ground equipment, it is important to accomplish removals and replacements as well as certain maintenance while the vehicle is in a stacked condition and while it is in various conditions of its fueled or loaded status. On the other hand, in the sealed Minuteman the idea of sending the whole mismile back to the factory was a satisfactory concept. In the case of the Apollo/Saturn space vehicle, we are able to remove the critical valves, electronic black boxes, components, guidance and control platforms, etc., for replacement or repair.

These different concepts also set the pattern for the checkout equipment, which is the instrumentation with which the system interior can be probed and controlled. In the Minuteman operational system the important consideration is merely whether or not it is working. If it is not, the missile is sent back to the depot; for this reason the concept calls for fairly little in the way of checkout equipment.

The cost of the Apollo Project, about 10 million dollars a day, emphasizes the importance of success and expediency. It is dollar-effective for us to put in a much higher cost, must more elaborate system, to provide a much greater ability to control interior operations, and to probe the exact causes of failures. These demands result in a tremendously more complex checkout system for that particular operation and mission. In summary, the total system is best if it is designed to its ultimate objective and purpose. The logistician, if properly oriented, makes one of his greatest contributions by participating aggressively in the concept and development phases of the system program.

In earlier years and in more current times, we have faced the question of how the system is assimilated so that all the various tradeoffs are given the most effective consideration and the correct decisions. A handbook or guide cannot instruct everybody on every system in exactly what steps to follow to have the most effective results. Most of our programs, however, have the challenge of requiring rapid progress; generally for large systems the problem is to integrate and interrelate effectively several organizations so that there is effective coupling in terms of time, technology, and progress among them all. Therefore, some kind of procedural guidance and direction seems to be necessary and has, in fact, evolved over the years. I think it is based generally on an iterative system of functional analysis as one of the cornerstones of strong systems engineering. This is the starting point. It is one of the points General Cody developed thoroughly, so I'd like only to reemphasize one fact: one of the most important tools to enable the correct analysis for tradeoff decisions involving logistics considerations versus other facets of development and performance is a well constructed system functional analysis, which is the real foundation of system engineering.

The third point I would like to make is to emphasize the role of the logistician in the development and production phases. Development is an iterative process. We go through various rigors and rituals of preliminary design reviews, reviewing test results and test data, and of accepting hardware. At each one of these checkpoints, regardless of the manner of establishing them for one particular program, there is an opportunity for tradeoff decisions which are based on the facts to that time and the experience, results, and data to that point. One is able to make tradeoffs dealing with, for example, achieveable life based on results up to particular points of development, versus the cost of achieving results in terms of component life, for example, or meantime between failure, or failure rates of hardware. The logistician should make decisions to modify the logistics support concept and ultimately the scope of the logistics support as a real-time function of the progress of the program, just as the engineers are motivated to change the design for improvement of the performance as these results come in. These steps in the development process actually provide the data for scoping logistics support of the end system and its purpose.

Now I suggest that we need aggressive logisticians involved in all phases of development and production who are willing to fight to be heard. They may sometimes get overruled, but as General Cody said, the program director is supposed to be smart enough to know when not to. Dr. Debus this morning spoke about KSC's job and their concept of supporting systems of the Apollo/Saturn when it arrives. You can be assured that he and these people are loud and aggressive on the points concerning logistics support and maintainability. These points are regarded as important, ultimately to get a vehicle ready for launch, to meet a particular launch window. I emphasize the need for the logistician to be competent, experienced, agressive, willing to fight to be heard. Again, I think that most of our experience tells us that results are caused by people, not by procedures that lie on somebody's desk. Today's programs generally demand an early payoff, whether they be for a military weapon in the field or for a space mission. There is a premium, therefore, on being right the first time, and there is very much a premium on government programs to be carried out within a plan and on achieving the results within the time and budget committed in the beginning.

We should be alert for ways to accelerate the maturing of the system. I suggest that one very important way to accomplish this for new programs is, to the extent practicable, to have the same equipment, whether it be flight hardware or ground equipment, come from the factory through the field test sites into the operational site with such augmentation in the way of instrumentation as might be required upstream. But we must start with an operational system and augment it in the factory or test site operation. By this means the hardware itself attains experience, the people become experienced, and we are able to explore the problems with the operational hardware earlier.

The costs of systems become increasingly important to all of us. Logistics support costs are in the range of 25 or 35 or even 40 percent of the total system. There are various ways being considered in the Apollo program to minimize cost. I would emphasize, for all programs, that this phase must start with a sound system concept and a sound system design. Then establish the proper balance of logistics support scope versus putting money into the other facets of the development or production process. One must be willing to pay for the reliability, actually pay to develop components and systems that have embodied in them the things that result in reliability.

We are emphasizing in Apollo, as a cost reduction means, such disciplines as finishing the hardware in the factory and not sending it to the field where it actually costs more to finish it. I am very enthusiastic, obviously, about the Apollo flight successes to date, but I am not deluding myself that we would have been able to support these without some cannibalization, which in a total system sense is more costly than having been smart enough in the earlier phases to program spares and logistics support in the required quantities. And I might add, above all in the cost area, that supporting but not over-supporting is the most dollar-effective way to reduce program costs. I think we are emphasizing the control of changes for the obvious reasons, including logistics supportability in the field. We are attempting to emphasize as much as possible in every area that we can eliminate requirements that are helpful but not necessary.

The Manned Spaceflight program is a very important element of national strength. Effective performance by us in the Apollo organization is essential to the U. S. strength as measured in the balance internationally. And it is most important that we provide not only the properly operating system but also a properly scoped logistics support program.

In conclusion, I feel that the professional logistician does know how to get the right things and the right people to the right place at the right time to support an operation. With variations, this is a quite well understood process, and there are many professionals, including those in this room, who know how to do this. My challenge in this Logistics Management conference to all of us is for the professional logistician to become involved in the program engineering phase so some professional logistics engineering will be introduced in the concept, the design, and the whole development process including testing, production, and deployment. This is where the logistics support requirements are really scoped and where the logistician needs to have his first influence. The logistician needs to be a full-fledged member of the systems engineering program management team as well as a professional in supporting field operations once the system is built. Logistics Management is, at this point in time, a science, parts of which are moderately complex. If the logistician is not effective in the early phases of influencing the system, then he must absorb and correct the deficiencies in almost everything that happens downstream. Therefore he must be effective in the beginning. To the newcomer in logistics I stress that opportunities are unlimited in the perspective I have described. It is not an overcrowded profession, and I would like to leave with you my best wishes not only for the success of this symposium, but for the future of the new Society which you are establishing. Thank you very much for inviting me.

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EVENING ACTIVITIES

INTRODUCTION TO THE BOARD OF DIRECTORS AND SEMINAR DINNER SPEAKER: ROBERT M.

JOHNS, Master of Ceremonies, Assistant Director, Support Technology, Missiles & Space Systems Division, Douglas Aircraft Co. , was the 1966 recipient of the National Security Industrial Association's Greer Award, and is a member of the Symposium Steering Committee. He is co-founder and President Pro-Tempore of the Society of Logistics Engineers. He has twenty-five years' experience in all phases of logistics management, ranging through maintenance planning, personnel training, technical publications, overhaul, repair, field support, and development of new and improved support technologies for Douglas' Missiles & Space Systems Division.

Good Evening, Ladies and Gentlemen:

On behalf of the members of the Society of Logistics Engineers, I wish to express our sincere appreciation for your attendance tonight at the Society's first annual dinner.

We believe the Logistics Symposium has brought together the most important group of the nation's leaders ever to be assembled to discuss logistics. The Society feels very honored and very humble that they have been permitted the privilege of participating in such an occasion.

As a member of the Symposium Steering Committee, I have viewed, with extreme interest, today's proceedings. I have been highly impressed by the manner in which the distinguished speakers have presented the multi-faceted disciplines with which the logistics engineer must live.

I am quite certain that tomorrow's presentations will be equally effective.

Because of the nature of planning and contracting for support, the Symposium was purposely planned around requirements and not the people it takes to perform them. I would, therefore, like to take this opportunity to briefly describe the people who perform the requirements, as this description will also identify the types of professionals that comprise the Society of Logistics Engineers.

I know that many of you are saying "How does this concern me when I don't have any logistics engineers?" However, I think you will agree that you do maintain this capability.

The logistics engineer is a composite of many, many interrelated disciplines. All of these disciplines are solely directed to assuring maximum in-use capability of product lines. Logistics engineering encompasses the talents of the maintainability specialist, the maintenance planner and analyst, the spare parts and supply management specialist, the training instructor and training equipment designer, the handbook technician, the facilities and ranges planner, the packaging and transportation expert, and the field support technician.

And, ladies and gentlemen, it is for the improvement of these disciplines that the Society stands.

Now comes the greatest thrill of my life, that of introducing our dinner speaker. You all know him . . . the entire world knows him . . . therefore, anything I could possibly say in describing his achievements and leadership would only be a duplication of what men have been saying and will continue to say the world over . . . therefore, may I just say that it is a privilege and an honor to present the foremost rocket and space authority in the world --Dr. Wernher von Braun.

N 67-21970

THE GROWING NEED FOR LOGISTICS ENGINEERS: DR. WERNHER VON BRAUN

Ladies and Gentlemen:

The invitation to speak to you tonight at this major event sponsored by the Society of Logistics Engineers was unusually gratifying to me.

I feel that I am participating with you in a history-making occasion that heralds the long overdue recognition of an ancient profession--that of the logistics engineer.

Logistics is an age-old function, but its practice has become sophisticated in our time. Modern logistics systems are the warp and woof of the fabric that holds our society together. They distribute not only goods and services to fill material desires and needs, but also ideas that spread cultural, social, and economic progress. Logistics systems are oftentimes the instruments through which foreign policies of aid and assistance are accomplished, or the avenues through which the impetus of national will is exerted.

The travels of Marco Polo in the thirteenth century will illustrate this spread of ideas. He carried the culture of Europe to Asia, and he brought home to Venice jewels, spices, and silk that bespoke the wealth and splendor of China. He broadened the horizons of Europeans, and increased their knowledge of the geography of Asia. His journey covered 17 years. How would you modern logisticians like to work with that much lead time?

The efficiency of our modern logistics system in the commercial world is taken completely for granted--until our routine is upset. Did you ever notice how irritated your neighbor gets when his morning newspaper is not delivered on time? And take, for instance, the familiar illustration of the source of the food on your breakfast table this morning: orange juice from California, bacon from Illinois, waffles from North Dakota, maple syrup from Vermont, coffee from Brazil, sugar from Louisiana, and cream from Minnesota. Assembled, prepared, and served for less than one dollar, that breakfast is a bargain, even with inflation thrown in.

An efficient logistics system makes possible our world-wide markets. Wherever you travel, you will see Japanese transistor radios, Coca-Cola vending machines, American gasoline pumps, and French perfume. You are familiar with the confusion and discomfort that follow when our industrial logistics system is suddenly disrupted by natural catastrophes, or strikes. Restoration of our logistics operations would be one of the major and most urgent tasks confronting us if we ever suffered a nuclear attack.

The military has always been concerned with logistics. When Desoto was exploring the Southeastern part of the United States, he carried along live pigs for rations. They slowed his travels, but he was uncertain about the resources of the land. When some of the pigs got loose--or were turned loose when abundant game was discovered--Arkansas got the razorback hogs for which its football team of today is named. The Spanish also brought horses to America. When some of these horses ran wild, and multiplied, American Indians of the Southwest gained a logistical asset in their search for game on the Great Plains.

The classic example cited by American military authorities today of the importance of a good logistics system comes from World War II. General George Patton's Third Army tanks were rolling hell-bent for leather across Europe when they simply ran out of gasoline. Since World War II the US Army has completely revised its logistics operations, creating logistics command units for management of logistics activities, stressing logistics equally with tactics in the training of commanders and staff officers, and reorganizing its technical services.

The results of this new look by the Army at logistics have been impressive. The greatest logistics challenge in America today is the support of US operations in Viet Nam. Despite the difficulties of distance, primitive Viet Nam development, rugged terrain, and unfavorable climate, that challenge is being met, as General Thurston T. Paul explained to you at lunch today. I though that we had a tremendous logistics operation in Project Apollo, before hearing his talk. Now, getting three stages of a launch vehicle, the spacecraft, and three astronauts down to the Cape for a trip to the moon before the end of this decade doesn't seem so difficult, after all.

We have a logistics problem coming up in space, however, that will challenge the thinking of the most visionary logistics engineer. As you know, we are currently investigating three regions of space: that near earth, the lunar region, and the planets. Although our investigations of the moon, the planets, and deep space will yield immeasurable scientific returns, the earliest practical dividends from space will come from operations near earth. Many of the characteristics of the earth's surface and atmosphere, such as cloud patterns, are best seen or measured from a distance. The observation of the earth by men and instruments in space in the broadest sense may easily turn out to be the best payoff of the entire space program.

At the present rate of population growth, it is estimated that the people of the world will number between six and seven billion in the year 2000 A. D. And in the year 2035, just 35 years later, world population may total 12 to 14 billion. This population growth will occur in a period when our children and our grandchildren will be directly involved.

The task of systematically developing the resources of planet earth to feed all these hungry mouths is of the utmost importance and urgency. In order to develop these resources, a much better, up-to-date knowledge of the status quo and of trends is necessary. Manned and unmanned spacecraft and satellites will permit continuous observation of earth in such areas as crop planting schedules, crop diseases, salinity of the soil, harvest results, floods, droughts, soil erosion, hydrology, oceanography and life patterns in the oceans, population census taking, etc. The technology to perform such work is already in existence. The tools consist of the simultaneous use of sophisticated photography, remote sensing of a wide band of the electromagnetic spectrum, and side-looking radar. The data collected will help international humanitarian agencies to channel food to the neediest areas. This is a job for the logistics engineer.

Viet Nam, Project Apollo, and an exploding world population thus set the stage for the discussions of logistics in our symposium. We have been concerned with the significance of logistics tasks and functions in some of our nation's major civilian and military activities.

While it is safe to say that all of us have undoubtedly been aware of many or most of the logistics requirements and problems under discussion, at least in a general way, I think it is also safe to state that many of us have not realized the enormous scope of the tasks performed in the logistics area. I hope the discussions bring about a better understanding of the fact that logistics support is a major portion of most large development projects. Logistics support, in fact, is a major cause for the success or failure of many undertakings.

Here at the Marshall Center, we have assigned a major role to the logistician in the support of our design, development, manufacture, testing, and operation of space systems hardware. We have come to expect a great deal of these unique individuals. We expect the logistician to have the right number of spare parts of the proper configuration at the right place at the right time. We expect him to have trained personnel to perform the maintenance that will avoid launch delays. We expect him to have a system of transportation so efficient that, as soon as the hardware receives the blessing of the final inspector, it will be transported quickly and safely to its destination.

Transportation for some of our rocket stages has been difficult, as they are simply too large for conventional highway, railroad, or air travel. Slow movement by water was the only solution until the ingenious Pregnant Guppy and Super Guppy planes arrived on the scene. These modified and enlarged Boeing Stratocruisers lop weeks off our schedule in the movement of stages from the West Coast to the Marshall Center and to the Kennedy Space Center.

We also expect the logistician to see to it that completed hardware is installed and checked out, using technically accurate documentation, updated to the current hardware configuration. And we expect the logistician to see to it that all these happen without fuss, strain, or bother to the design, development, and test engineers--and to the program managers. In short, we have come to expect of our logistics managers something approaching perfection in the performance of a multiplicity of difficult tasks. We have come to expect these miracles routinely, every day--like the food on our breakfast tables. And perhaps this is one of the greatest compliments we could pay the logistician.

I think that you will agree with me that logistics is a demanding field, with a strong technical and managerial challenge. And yet, in many instances, we have had to assign this highly important task to an otherwise highly qualified engineer who has no formal training for this field, simply because a trained logistician was not available. This does not make a lot of sense.

What can we do to assist the logistician to develop and improve his capability to perform his tasks that are so essential to our mission success?

Colleges and universities are jammed with a great variety of courses in mechanical engineering, electrical engineering, chemical engineering, indeed, in almost every conceivable kind of engineering. Manufacturing skills and techniques are taught in literally hundreds of vocational schools, and college level courses are available for some of the more esoteric techniques. And, as a supplement to these formal and generally available curricula, both government and industry have sponsored "in-house" training and educational activities to boost the capability level of our engineering and manufacturing personnel.

The unfortunate truth is that formal academic training is virtually nonexistent in the field of logistics. A brief conceptual course in maintainability engineering here--a general familiarization program on logistics functions there--but nowhere is there an in-depth college-level curriculum designed to educate the logisticians to whom we have assigned the responsibility for properly expending billions of dollars in the performance of tasks we recognize as essential to mission success.

The development of the logistician, in both industry and government, has been primarily a matter of chance, not plan. The logisticians themselves have slowly created worthwhile techniques and substantial levels of expertise. And this body of information and know-how is passed on from man to man and group to group. I'm sure all of us readily agree that this is a slow, costly and limited manner of providing the kind of professional support we need today.

It is my feeling that we, in this room tonight, have both the opportunity and the responsibility to take action to remedy this situation. The mere volume of money involved in logistics activities makes it an important requirement. The training of logistics personnel is now a national problem. And the formation of this new Society of Logistics Engineers gives us the golden opportunity to take the lead in solving that problem. You in this audience have the experience and know-how which needs to be shared with those just entering the field of logistics. What is the best method for importing this valuable information? Would it not be feasible to develop a complete educational program designed to produce qualified logistics engineers to meet the increasingly stringent requirements of both government and industry?

Three sets of goals could be the building blocks for this program.

Short term goals would provide for interchange of logistics information and know-how as to techniques, advances in the state of the art, and projected new requirements. These objectives could be accomplished through the holding of symposia, seminars, and short courses. Such activities have, in the past, been largely a fall-out or a subordinate topic in meetings held by professional groups whose primary interests lay in other specialties. As a result, the logistics aspects considered have usually been presented piecemeal, with no substantial value to the broad impact of logistics as an essential part of the systems whole. The Marshall Space Flight Center will certainly do all it can to support and assist with the meetings that will help attain these short term goals.

In the category of intermediate goals a joint effort between industry and government agencies might develop specific educational objectives for career development of the logistician. It would undoubtedly call for rather heavy participation by educators to assure proper relationships of the disciplines identified with the mosaics of disciplines already available. Such a study might be undertaken under auspices of the Society of Logistics Engineers.

The intermediate program might also contain college-level specialized courses involving such subject matter as maintainability analysis and measurement; logistics cost effectiveness analysis techniques; life cycle costing determination; incentive contract management; maintenance analysis procedures; quantitative and qualitative logistic personnel identification methods; spares selection techniques; and computerized inventory control systems.

As for the long term objectives, college degree programs might be established in logistics, including graduate-level courses, based on joint studies with the academic community to define and refine the logistics disciplines into a professional career structure. We have had some very preliminary informal discussion with University of Alabama officials, and they were receptive to this proposal and eager to discuss it further. Logistics scholarship funds and programs could be sponsored by interested agencies. There is a need for research aimed at developing scientifically sound predictive tools for use in logistics cost and performance planning and measurement. And there is a need for survey type courses for the orientation of engineering, marketing, contract, financial and other personnel having frequent interface requirements with logisticians.

These are, of course, only suggestions for your consideration. You are the experts who could outline the educational requirements for enabling logistics to "come of age" as a true profession with all that the term implies for career planning and development.

The Society of Logistics Engineers is the appropriate vehicle for moving an imaginative program forward.

I understand the Society has already set for itself a series of goals in the areas of education and research. I urge it to pursue those goals to fulfillment, and I hope that all of us in industry and government will fully support and participate in its performance.

I believe that this new professional society can make really significant contributions to the improvement of the general well-being of the nation and the world. In a sense, all of us are involved deeply in and depend upon logistics to sustain ourselves.

The need for more highly trained, capable logistics engineers is obviously great today, and the need will become greater in the future. We are already late in preparing to meet that need.

This Society can also perform a useful service in the unification and direction of the logistics engineers in their efforts to support our world of tomorrow. You can help to make it the most exciting and most abundant era mankind has ever seen.

DINNER CLOSING REMARKS: ROBERT M. JOHNS

Thank you, Dr. von Braun. We of the Society of Logistics Engineers are instilled with increased confidence and pride by the tremendous support you have given us. You may be assured, sir, that I speak for our membership when I say that we will bend every effort to attain the goals you have so ably set forth. Thank you once again.

Ladies and gentlemen, Dr. von Braun stated that the logistics engineer was a new profession, and, when one considers today's and tomorrow's challenges, he is correct. If you remember, however, Dr. von Braun also said that certain facets of the logistics spectrum have been with us for hundreds of years and, prior to closing this dinner meeting, I would like to leave concrete evidence of this fact with you.

I would like to quote an entry from the log of the United States Ship Constitution entered in the years 1779-1780, which relates to the supply management facet of the logistics engineering discipline. The excerpt is as follows:

"On the 23rd of August 1779, the United States Ship Constitution set sail from Boston. She left with 475 officers and men, 48,600 gallons of fresh water, 7400 cannon shot, 11,600 pounds of black powder, and 76,400 gallons of rum on board. Her mission was to destroy and harrass English shipping.

Making Jamaica on 6 October, she took on 826 pounds of flour and 68,300 gallons of rum. Then she headed for the Azores, arriving there on 12 November. She provisioned with 550 pounds of beef and 64,300 gallons of Portugese wine. On 18 November she set sail for England.

In the ensuing days she defeated five British men-of-war and captured and scuttled twelve (12) English merchantmen. By 27 January her powder and shot were exhausted.

Unarmed, she made a raid on the Firth of Clyde. Her landing party captured a whiskey distillery and transferred 40,000 gallons on board by dawn. Then she headed home.

The Constitution arrived in Boston harbor on 20 February 1780 with no cannon shot ... no powder ... no food ... no rum ... no whiskey ... but with 48,000 gallons of stagnant water ...."

Ladies and gentlemen, good evening.

MANAGEMENT AND CONTROL

INTRODUCTION TO MORNING SESSION AND INTRODUCTION OF MODERATORS:

BERT GREENGLASS, NASA, Chief, Program Control Office, Kennedy Space Center, has a Bachelor of Industrial Engineering degree from New York University. He has had engineering positions with several industrial firms; was management engineer at the Brooks Army Medical Center; and was Program Coordinator for the Missile Firing Laboratory, ABMA, US Army prior to his present assignment.

As Dr. Debus noted yesterday morning, we at KSC are most sensitive to the problems of logistics. We cannot help being so when you consider that we are simultaneously activating a one billion dollar launch facility launching integrated space vehicles and operating a 100,000 acre launch area. To accomplish this we bring together approximately 19,000 persons representing 8 major stage support contractors, 6 general support contractors, and hundreds of secondary and subcontractors. Our spares number in the hundreds of thousands and are required not only for the launch vehicle, but for spacecraft, ground support equipment, and facilities for several programs. For LC-39 site activation alone, we have some 60,000 strategic PERT activities, each of which is a series of potential logistics problems.

By necessity all of the above represent variables. Only two things seem to be held constant, funds and launch schedule. Dr. Debus discretely alluded to this point yesterday morning.

The point is that poor logistics planning and execution on any part of the Apollo team invariably has an adverse impact at KSC and normally makes inroads into our two constants, money and time. Did I say we were sensitive to logistics problems? Gentlemen, we are hypersensitive!

Yesterday we heard much about the immensity and complexity of the programs with which we are associated. Specifically, we heard of the need for logistics; the importance of in depth planning; and scoping and integrating support for program requirements.

Today we come to the next natural step in the development of a logistics program: "control and evaluation." Philosophy, policies, and plans alone cannot guarantee an effective logistics program. In programs of the complexity we are discussing here this week, effective communication and surveillance is mandatory. Management control systems and their related techniques must be developed to assure that policy and plans are being implemented. Constant evaluation must be conducted to assure that management decisions were effective and that procedures are being followed. General Phillips once noted that Program Management, in a very real way, is doing what you said you would do. To accomplish this one must have the control and surveillance capability to assure that his integrated management systems, of which logistics is a prime, are being effectively executed.

We are fortunate to have with us today a truly well informed panel. Each has become an expert on the subject through the most valid means, experience.

Our panel moderator and first speaker has been intimately concerned with logistics for some 20 years. In his present capacity as Corporate Director, Logistics for North American Aviation, Inc., he is responsible for the development, coordination, and administration of corporate policies relative to logistics. He will speak to you on "Management of Logistics Support." It is my pleasure to present to you Mr. Sterling B. Smeltzer.

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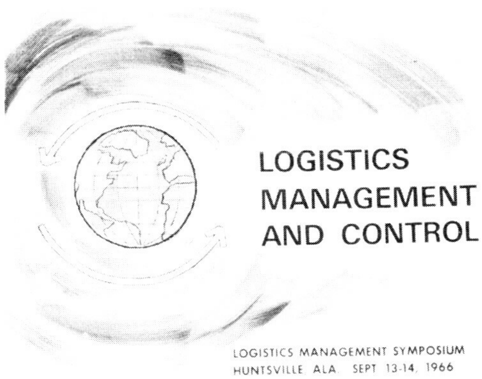
MANAGEMENT OF LOGISTICS SUPPORT:

STERLING B. SMELTZER, Corporate Director, Logistics, North American Aviation, Inc., is responsible for the administration of logistics policies for North American Aviation. He has held previous logistics management positions with both North American Aviation and Curtiss-Wright Corporation. Mr. Smeltzer graduated from Carnegie Institute of Technology where he was awarded a scholarship and elected to several honorary professional fraternities. Since that time he has completed various aerospace technical and management courses at Ohio State University and the University of California.

GENERAL REMARKS

May I express my appreciation for being permitted to participate in activities of this important NASA sponsored Logistics Management Symposium. Yesterday was both productive and rewarding. This symposium, without question, represents a significant milestone in the continued development of logistics as a prime discipline. Furthermore, it goes without saying that those who have brought the symposium into being are to be commended for their effort and zeal.



Yesterday we discussed methods for defining logistics requirements and techniques for preplanning logistics and reviewed methods available to us for achieving a technically sound integrated logistics posture for space-age support.

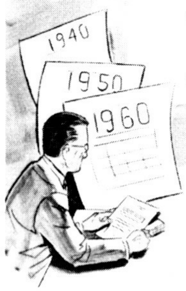
This morning we are concerning ourselves with control and evaluation and their effect on overall program costs. I would like to preface this presentation with a very brief review of the key events which set the stage for the management of logistics as we know it today. This baseline is important to provide a clear correlation with the types of management projections provided in the symposium.

EVOLUTION OF LOGISTICS MANAGEMENT

Logistics received its initial impetus as a recognized separate discipline during World War II, but remained for years a series of very loosely coordinated separate functions--with practically no relation of one to the other, as regards overall control or management.

By 1955, as the military customer moved toward a "weapon system" concept, industry responded by organizational integration of most, or in some cases, all support elements. Organizations called "Product Support" and "Logistics" began to appear. This marked the first step in a continuing effort to acquire

EVOLUTION OF LOGISTICS MANAGEMENT



WORLD WAR II
INITIAL IMPETUS

WEAPON SYSTEM CONCEPT
ORGANIZATIONAL INTEGRATION

PACKAGE CONCEPT
COST CONCERN

a better managerial hold over the total logistics support effort. The Weapon System concept also brought into sharp and almost startling focus for the first time the magnitude of logistics resources required for any given program. As a result of this total logistics recognition, by 1958 or 1959 there was serious emphasis on the cost of logistics support. Studies reflected that lifetime support of electronic gear cost from 5 to 10 times the cost of the original equipment. The Department of Defense recognized that approximately 25 percent of its budget was required for maintenance. As a result, logistics costs became the basis of serious study by both the Government and industry. These studies resulted in two key admonitions to engineers and logisticians:

1. Design equipment which requires less and simpler logistics support and maintenance.

2. Develop techniques for more effective logistics management systems.

LOGISTICS COST CONCERN

DESIGN FOR **SIMPLIFIED** MAINTENANCE (MAINTAINABILITY)

IMPROVE–LOGISTICS MANAGEMENT SYSTEMS

The first ground rule set in motion the effort which led to quantified maintainability. The second ground rule provided the basis for an integrated logistics management concept; that is, implementation of logistics in a planned orderly fashion in any program.

However, we've moved on since these two basic ground rules were established. Today we speak of "package procurement," "cost of ownership," "contractually established maintenance goals," "life cycle costing," and so forth.

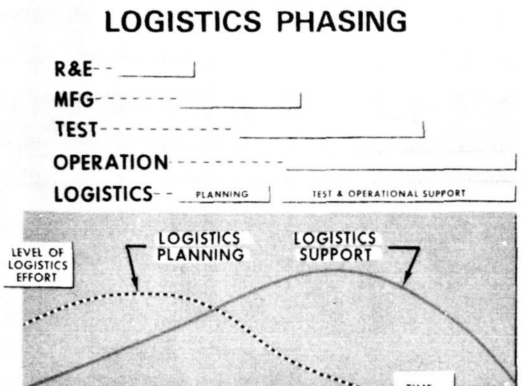
TODAYS ENVIRONMENT

- PACKAGE PROCUREMENT
- LIFE CYCLE COSTING
- INCENTIVIZED MAINTENANCE GOALS

ALL
IMPACT LOGISTICS

All of these concepts are an outgrowth of the earlier realization that logistics costs are truly significant, and, being significant, they must be considered, and they must be effectively controlled and managed. Accordingly, these concepts are making serious demands of logistics. They require much more exacting program controls and visibility, as well as the need for increasingly effective measurement techniques. For if logistics performance is to be judged in terms of incentives and cost effectiveness, then it also must be established in measurable terms. Added to these effectiveness/measurement requirements is the fact that logistics management must now cope with the dynamically different support environment involved in limited population space programs without the benefit of comfortable learning curves.

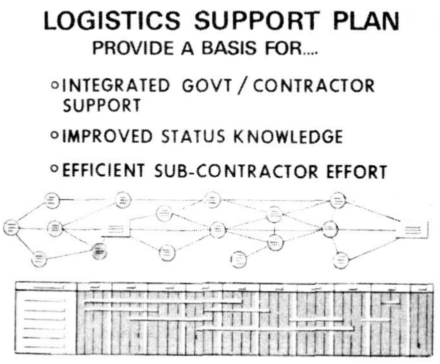
Having drawn this current baseline, let us explore the role of the logistics manager and the controls which affect the success of his program. The responsibility of the logistics manager is unique because of his position in the sequence of events. Although he participates actively in the program from its earliest conception, his major contribution is made when the equipment appears at the test or operational site. This is also the point where the effect of schedule slips, funding overruns, over-looked details, misunderstood requirements, and misplaced assets are most strongly felt. Too frequently the real-life world adds the results of additional engineering changes, especially on development-type programs. This is pretty much the environment in which today's logistics manager must perform. This environment presents a major challenge to the success of the program as a whole. However, as we shall see later, if identification and definition of logistics requirements have been properly accomplished early in the program, resolution of most of the support problems, at least, is reasonably clear, assuming that logistics funding has been properly considered.



LOGISTICS SUPPORT PLAN

The importance of thorough planning to the successful control of a logistics program cannot be overemphasized. The function of a logistics support plan is to provide a basic outline of how the overall system is to be maintained; what facilities and equipment will be available; and the maintenance capabilities planned for each site; as well as the role which each participating contractor or government center is expected to fulfill.

The support plan serves as a basis around which the contractors and government logistics personnel can integrate their support efforts, determine where inadequacies exist, and improve efficiency where opportunities exist to consolidate maintenance effort. The plan is an invaluable aid in rapidly appraising subcontractors of their position in the maintenance pattern and providing them with a framework upon which to determine their own maintenance needs.



In a quasi-contractual manner, the support plan permits the contractor to determine the scope of his contractual commitment. As the support plan is sometimes subjected to major change, the extent of the change and its effect on the scope of each affected contract can be readily determined.

The technique for developing support plans has been pretty well formalized in recent years with the issuance of various government directives such as the Navy's WR-30. However, I would like to direct your attention to four specific elements which are essential to the effective development and use of a logistics support plan:

1. The support plan, if it is to be really effective, must be developed early in the program.

2. As the program develops, the plan must continue to be definitized and updated.

3. The revision process must be subject to control procedures.

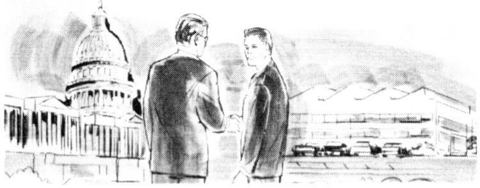
4. The plan must be used.

THE CONTRACT AS A MANAGEMENT CONTROL

Those who are speaking during this morning's session will review in considerable detail the techniques and problems involved in contracting for logistics support. We are extremely fortunate that this is going to be done from the Military Service, NASA, and contractor points of view. Nevertheless, I would like to touch briefly on the contract as a management control.

THE CONTRACT AS A MANAGEMENT CONTROL

- CLEAR DEFINITION
- GROUPING OF SUPPORT ELEMENTS
- COMMONLY ACCEPTED TERMINOLOGY



As stated heretofore, proper identification and definition of requirements is imperative to successful implementation of any logistics program. It is in this regard that the contract becomes, as I see it, an exceedingly important logistics management control. It seems apparent that the contract serves best as an effective control when it specifies requirements sufficiently to permit both contractor and customer to achieve agreement on the scope and variety of support effort expected. We have seen contract language wherein the logistics effort has been very loosely and inadequately defined. Although brief, such definition presents a very nebulous baseline from which to plan. It provides no means for evaluating the efficiency of the logistics program. Imprecise coverage can leave the program in a position to receive inadequate support, over-support, or misdirected support. The contractor's logistics manager is cast in a position of constantly groping to find just what his role is, as well as having to continually justify his program and his budget. This practice is not conducive to good scheduling, budgeting, or management.

It is also advisable that the support program elements be grouped in a contract work statement and that commonly accepted logistics terminology be utilized. Industry associations such as AIA, EIA, and NSIA have aided the government measurably in developing such commonly accepted terminology. In this regard NSIA has performed a recent valuable service in drafting a series of documents covering each aspect of space program logistics support. The terminology used in these documents is accepted in logistics circles and the format is sufficiently flexible to permit tailoring to a specific program.

ORGANIZATION FOR CONTROL

A function of equal importance to early logistics definition and planning is proper organization. With respect to organizing for optimum control, the simplest organization commensurate with meeting program objectives is the best. This is easy to say, but not so easy to do. A special problem related to the logistics manager's job results from the large number of functional interfaces he must maintain. These interfaces are above, below, and to both sides, within his own company and outside, with customers, associated, subcontractors, project offices, technical directors, integrating contractors, and test centers. Sooner or later in the development of a program these relationships become fairly well defined and stable. However, in the early portion of many programs, the relationships many times are unclear and much management confusion must be overcome to achieve smooth working conditions. Such dual reporting relationships must be accepted as normal in structuring for today's programs which interrelate primes, associates, subcontractors, and others, as well as those who establish policy, those who provide technical administration, those who provide schedule and funds administration, and those who are responsible for work performance. With respect to logistics organization, particularly for major programs, may I suggest that:

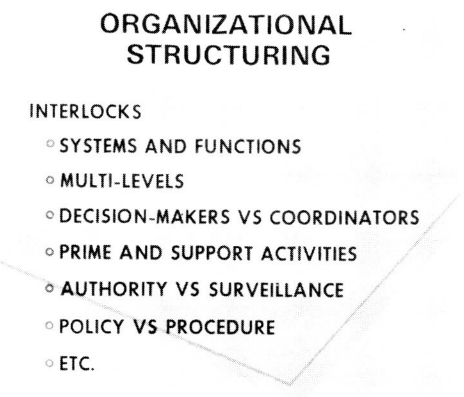
1. Logistics is a prime function.

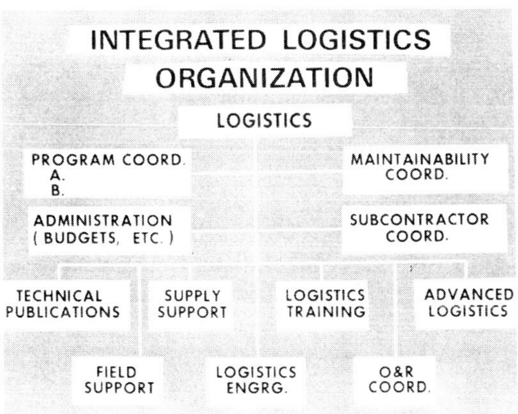
2. As such it should be made responsible for the total spectrum of support elements if it is to function effectively.

3. To insure direct management visibility on all logistics matters the logistics manager should be placed on a top line of functional organizations. This emphasis seems evident too if we consider the amount of money involved in logistics and the matter of operational effectiveness.

MANAGEMENT CONTROLS

Let us review briefly the subject of logistics management controls. Consideration of controls for conduct of any support program should be predicated upon a prior analysis of what the controls are for and who needs to use them. Fundamentally management controls are necessary to assure that program objectives are being achieved at a rate comparable to

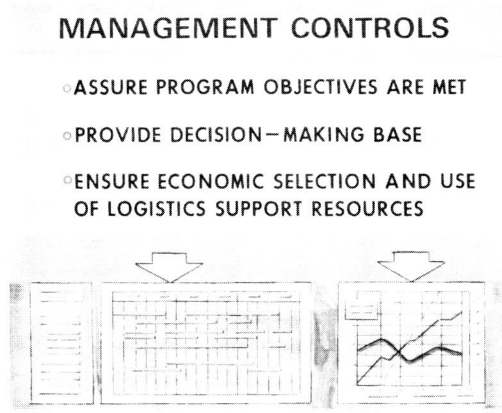




the expenditure of resources. A control system also requires presentation of information which is vital to making decisions with respect to changes in program objectives.

Management controls may take many forms. Frequently they are imposed as limitations in head-count or dollars, of which we shall speak briefly later. They may take the form of a series of incremental approval steps wherein certain tasks must be satisfactorily completed before funds are released for the next step. They may take the form of management systems and be reflected as PERT charts, status reports, and so forth.

Management controls applied to the selection and provisioning of support resources have evolved to a science in recent years. Management techniques, such as the use of resident provisioning teams, joint utilization of support assets by contractor and customer, and downstreaming of support assets have also contributed to the logistics success of large programs.



The application of controls to effective and cost-responsive use of logistics assets, however, still presents a real logistics challenge. This challenge is especially evident on programs involving a limited population of vehicles.

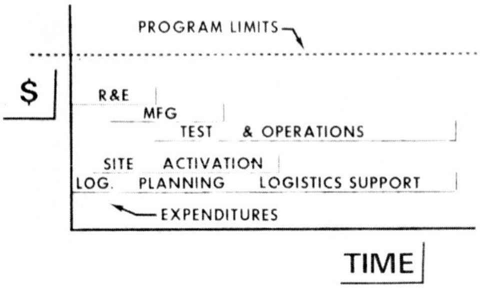
Providing quick response to site needs and continuous surveillance over all assets is essential. Both industry and government have responded by developing EDP status systems to control the flow of equipment and reparables. Accordingly, utilization of machine systems in the control of support assets is increasing, and the economical use of these techniques will characterize the successful programs of the future.

Another technique, known as downstream planning, has been used effectively in maximizing use of GSE, spare parts, and training equipment. This technique provides for long range utilization of logistics assets to subsequent program phases beyond an immediate support commitment. One of the contributors to high costs in space and military programs is the residual hardware at completion of test phases. By utilization of complete planning data showing release of assets from a specific support commitment, many items may be programmed in an orderly manner, with modification when necessary, for application to the next phase of the program.

EXERCISING LIMITATIONS

One area of program control that deserves mention deals with the time and manner in which head-count and cost reductions are frequently applied to a program and the very special affect this method of application has on logistics. Generally speaking, and in the case of most programs, manpower and dollar constraints or reductions are introduced during the latter stages of a program as a corrective measure. It is well understood that this action on an across-the-board basis is at times the only avenue open to a program manager. However, he should be aware that this happens to be the very period when, due to normal program phasing, logistics responsibilities are becoming most extensive. Since the tendency is to apply such constraints as an across-the-board action, logistics feels the impact most severely in its ability to perform. This is an important point, because eventually the need for additional support funding generally becomes manifest and re-establishment of logistics hardware and services is accomplished at premium cost. It may also impact operational performance to a marked degree. Thus, the program manager would do well to consider carefully headcount and cost reduction in terms of logistics support impact.

THE COST SQUEEZE



ULTIMATE CONTRIBUTION OF LOGISTICS

This brings us to the ultimate contribution of a well-planned logistics effort. Whether it be a Minuteman missile, an F-100 in Viet Nam, or a space vehicle on the pad, there is one common point of measurement--that when the demand is made the vehicle will respond. In the case of space effort, this is an assurance that the "launch window" will be met. Assurance that despite a large variety of possible problems which can occur during the checkout and countdown, the parts, equipment and skills necessary to meet launch requirements within a limited time span will be available. When the cost of a missed launch is compared to the cost of an adequate support program, the choice seems clear--an economic yet effective logistics program appears to be the best insurance available.

Let us recognize that the launch window for a moon shot may be about 3 days out of each lunar month. If we consider only the interest accrued on the investment in a space vehicle "stack" while it sits awaiting the next launch window, after perhaps missing the last opportunity due to an unavailable spare, we find the lack of a spare to be extremely expensive. It is such a situation that points up the essentiality of analyzing logistics requirements in the broadest of program economic terms.

CHALLENGE OF THE FUTURE

Thus we face the challenges of the future in logistics. There are many,of course.

A serious challenge emanates from the logistics of distance built into our unfolding world-wide military responsibilities. In this expanding arena our enemies are heat, humidity, rain, mud, and dust. They are equipment enemies that corrode and infiltrate with deadly results in a costly and never-ending cycle. The logistics of transportation and packaging offer challenges set in a framework of serious importance. The logistician must be responsive to this challenge. He must carry the message to those involved in this activity within his own area of responsibility.

A key challenge relates to the need for improved methodologies as applied to managing and planning for programs of limited population which operate in an environment characterized by change. The objectives are the same as when the equipment population was larger and more stable. The risks, however, are harder to define, backup is thinner, and the margin for error on the short side is minimal. Under these circumstances the logistician must make fuller use of mathematical modelling techniques and automation. He must learn to predict with greater accuracy and, as I have stated, without the ease and benefit of comfortable learning curves.

A key challenge also relates to the logistician himself. For if these foregoing challenges are valid then they directly affect the logistician. To meet such challenges he must make full use of his past experience, yet, as a person, he must be eager to accept new concepts. He must be always seeking to improve. Dr. von Braun spoke eloquently last evening on the logistician and his role.

A challenge that is already upon us deals with the increasing use of package procurement and the testing of life-cycle costing. Logistics must work closely with procurement in devising standards, measurement devices, and accountability practices which will support these procurement devices with an acceptable degree of confidence.

A less obvious challenge that bears upon us as a nation and a society suggests that the logistician should make a critical review of his logistics planning and analytical techniques to assess their applicability to problems which we as a people face today. His normal involvement in such areas as training, transportation, and methods of communicating information are potentially fruitful fields of exploration.

Another broad challenge relates to the serious need for sound control and management of national aerospace resources. We have massive commitments, both military and nonmilitary, which dictate economic consideration. Accordingly, as it relates to logistics, Government and industry as a team must continue to introduce fresh new management concepts for control of logistics costs. This means that we must make increased use of advanced logistics techniques to provide us the basis for management decisions and to insure visibility for controlling our material resources most economically.

In summation, may I recap several key points made during this presentation that bear directly upon logistics management.

1. Logistics is a prime function. This assessment is dictated by the percentage of program dollars involved in its accomplishment and by the direct impact it has upon operational effectiveness. As such it must be organizationally structured to deal on an equal basis with other key functions.

2. Logistics responds most effectively when its elements are integrated as a single organizational entity. Only in this manner can the most effective deployment of logistics support resources be realized in a manner that insures optimum interaction and timing.

3. Proper logistics support is dependent upon proper logistics planning. The entire logistics performance structure rests upon a sound support plan. This planning must be accomplished early in the program. All too frequently the management concept of logistics is that of something which occurs or is required late in the program. As a result, badly needed logistics planning funds are frequently not made available to the detriment of the program.

4. Logistics management itself must accept the challenges presented by new technologies and advanced program requirements. The ultimate space challenge, for instance, relates to the broader perspective of efforts extending beyond lunar exploration. We are studying ways to send men on flyby missions past the planets Mars and Venus as a stepping stone to manned landing missions. These are scientific investigations which capture the imagination. The logistics problems inherent in such a venture are immense. But logisticians must, even today, begin to lay the foundation for management of advanced space mission logistics resources. It remains largely with men such as are represented here today to insure that such future space history will be a triumph of American ingenuity, accomplished under dynamic and complex circumstances. The challenge is ours.

N 67-21972

THE PROGRAM MANAGERS' PROBLEM:

DR. ARTHUR RUDOLPH, NASA, Director, Saturn V Program Office, Marshall Space Flight Center, has a Bachelor's Degree in mechanical engineering from College of Berlin, and an honorary D.Sc.degree from Rollins College. He was Chief, Fabrication, Chief Planning Engineer, and Technical Director for pilot V-2 manufacturing and testing at Peenemuende; and established the underground plant for mass producing V-2. He worked at White Sands with the V-2 and Hermes II programs. He was with Dev. Opr. Div. and Industrial Division of ABMA; was Technical Director of Redstone Missile Weapon System, Project Director of Pershing System, and was Assistant Director, Systems Engineering, Office Manned Space Flight.

Gentlemen:

The Saturn V Vehicle System is big. The number of governmental and industrial organizations and the number of people within these organizations, working on the Saturn V, is big. The problems are big. With a few figures I will try to illustrate for you the immensity of our hardware.

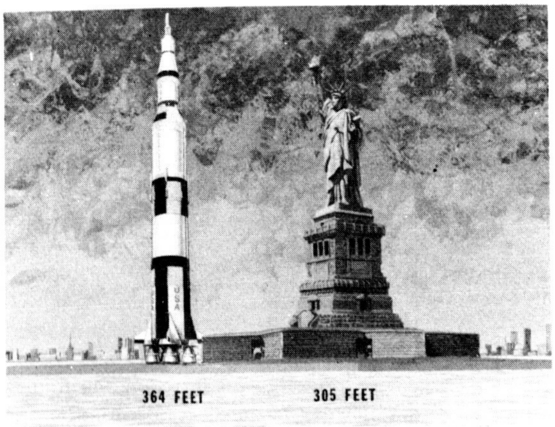


FIGURE 1. SATURN/STATUE OF LIBERTY

In this figure you may compare the height of the Statue of Liberty of 305 feet with the Apollo/Saturn V Space Vehicle which stands 364 feet high and weighs 6,000,000 pounds at lift-off. The Saturn V itself stands 282 feet high and develops 7.5 million pounds of thrust at launch.

The four Saturn V stages see each other for the first time at the Kennedy Space Center, where they are assembled, "stacked," as we call it, to make the Saturn V Launch Vehicle. This stacking, followed by checkout, is accomplished in the Vehicle Assembly Building, the VAB. It is the largest building in the world.

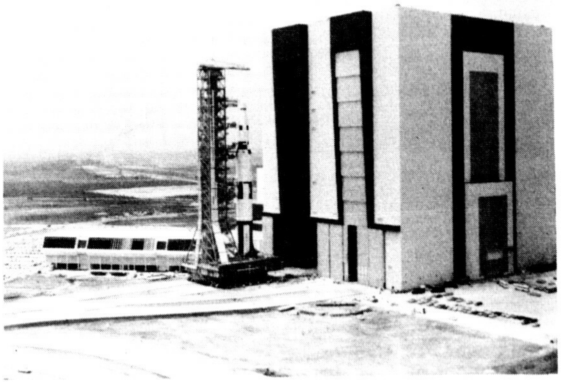


FIGURE 2. 500F ROLLOUT OF VAB

In this picture you see the rollout of the Saturn V Facilities Vehicle from the VAB. The size of this vehicle system, its performance requirements, its complexity, and the continent-spanning activities to make and support it, surpass, to my knowledge, anything previously attempted.

In Figure 3 you see the First Stage or basement booster (S-IC). It is being built by Boeing in the Michoud Plant at New Orleans.

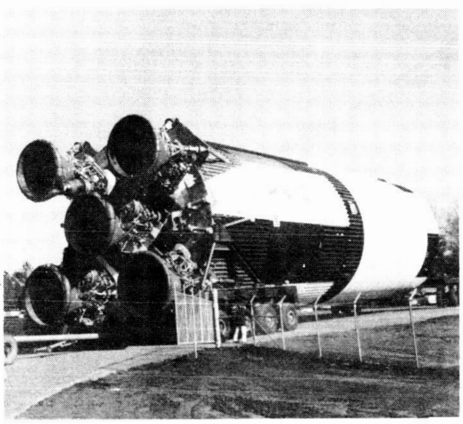


FIGURE 3. FIRST STAGE (S-IC)

It is moved by "river barge" to the Mississippi Test Facility (MTF) for captive acceptance firing, returned to Michoud by "river barge," refurbished, then shipped to Kennedy Space Center by a modified "ocean-going barge."

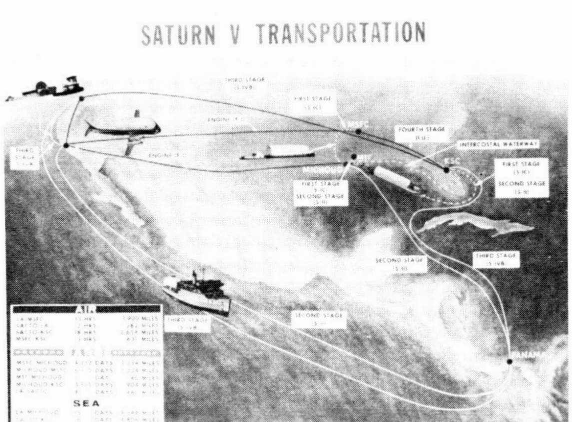


FIGURE 4. MAP OF UNITED STATES WITH SHIP LANES

Figure 5 shows the Second Stage (S-II). It is manufactured by North American at Seal Beach, California. It is shipped on a "Converted LSD" (Landing Ship Dock) through the Panama Canal to New Orleans. There it is transloaded to a "river barge" and moved to the Mississippi Test Facility for captive acceptance firing. After refurbishment it is taken back to New Orleans by river barge, loaded once more on the "Converted LSD," and shipped to KSC.

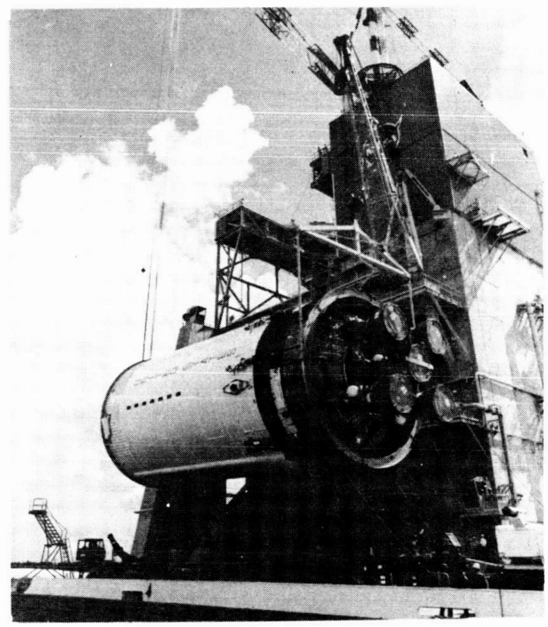


FIGURE 5. SECOND STAGE (S-II)

The Third Stage (S-IVB) is being built by Douglas at Huntington Beach, California. It is shipped to the

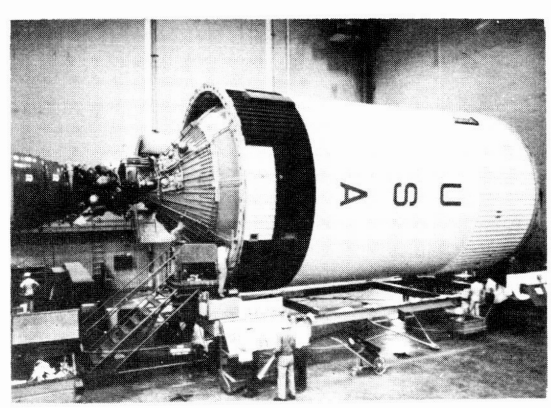


FIGURE 6. THIRD STAGE (S-IVB)

Sacramento Test Facility for captive acceptance firing either by "ocean-going barge" or by a uniquely designed aircraft, called "Super Guppy."

It is also flown by Super Guppy to KSC.

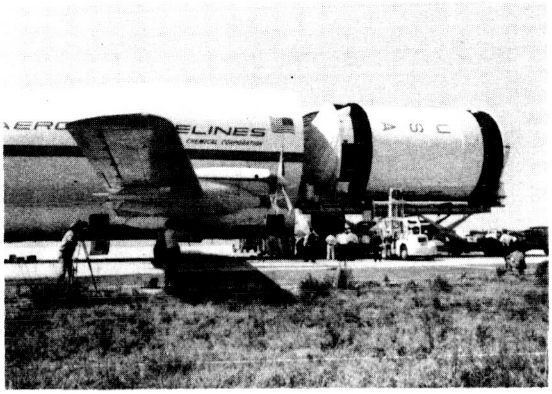


FIGURE 7. SUPER GUPPY WITH STAGE

The Instrument Unit (IU), shown in Figure 8, is manufactured by IBM at Huntsville, and is flown to KSC by Super Guppy.

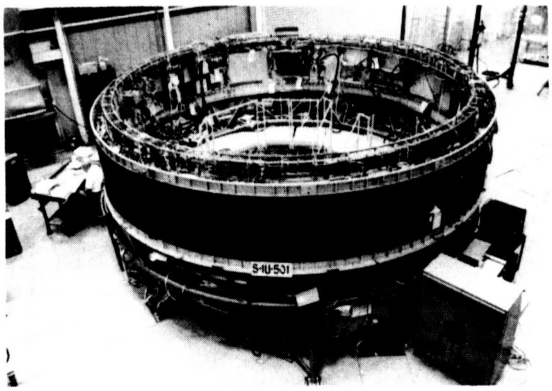


FIGURE 8. INSTRUMENT UNIT

Now, let me give you a thumbnail sketch of the Launch Vehicle Ground Support Equipment (LVGSE). It is that complement of Ground Support Equipment furnished by the Marshall Space Flight Center to equip the Launch Site. It is manufactured by numerous contractors scattered all over the United States, and is transported to the test sites and to KSC by all known means of transportation. Because of its multifarious elements, this Ground Support Equipment does not lend itself to a simple pictorial portrayal.

"The Problem is - THERE'S SO MANY OF THEM"

FIGURE 9. GSE MANAGER

My GSE Manager feels that he is literally inundated by the end items for which he is responsible.

Let me give you a perspective by comparing some PERT figures: Our four Stage Contractors track a total of 40,000 events, but for the Ground Support Equipment in excess of 60,000 events are being tracked.

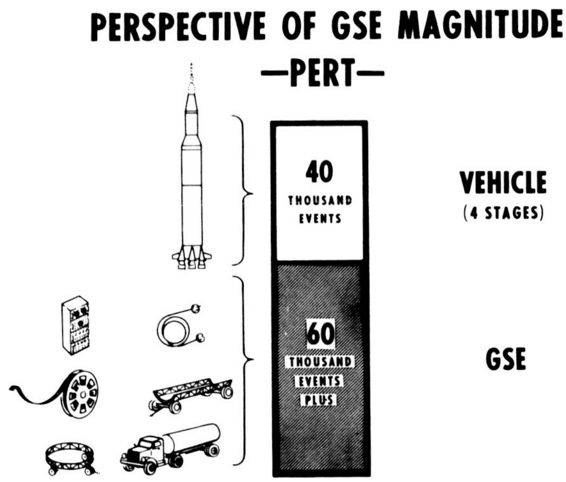


FIGURE 10. PERSPECTIVE OF GSE MAGNITUDE

My illustration of the Saturn V Launch Vehicle System did not provide you with much visibility; in fact it was just a bare glance. Even so, I think it will not be hard for you to visualize the demands placed on Logistics Management in a program of this magnitude and complexity.

In the early days of the Saturn program, a number of people stated emphatically that, since we were not to field a weapons system in the sense that the military does, we did not, therefore, need a weapons system logistics program. And this is basically true. Certainly we do not need a program "identical" to the Minuteman or to the Army's Pershing, having been personally very familiar with the latter one. However, differences between launch vehicle system logistics and weapons system logistics exist only in certain aspects. The basic problems of the two systems are, in essence, identical. I am not at all sure that logistic support of a launch vehicle program, with its high rate of advancement in the state of technology and its associated highly complex ground support equipment, is not more difficult than logistic support to a weapons system.

The axiom: "We do not need a weapons system logistic program," unfortunately carried with it the implication: "We do not need a logistics program." Misinterpretation, then, caused neglect of an integrated logistics program. Thus, we have created for ourselves a considerable problem by not allowing enough thought and planning toward logistics at the very outset.

By the way, based on my experience, I strongly suspect that this may be the case in many other programs.

Well, the belated identification of the requirements of a logistics program led naturally to an aggravation of one of our biggest problems, money.

FIGURE 11. LOGISTICS AND THE "NOT ENOUGH DOLLAR"

In the Saturn V Program, where we have become accustomed to talking in terms of hundreds of millions of dollars, there now is simply not enough money to satisfy all of the legitimate demands, or to do all the things that our systems analysis indicates should be done in logistics. Somewhere, something's got to give. And, of course, it is the program manager's job to decide what is going to give, and how much. That is, how much of a calculated risk can he afford to take.

With guidance and support of the Apollo Program Office in Washington, intensive, accelerated studies were conducted in order to mold the Saturn V logistics program to fit the status of launch vehicle system development and the prevailing monetary situation.

Within my Saturn V Program Office, each Project Manager has wide latitude to exercise management actions just as long as these actions meet established technical performance requirements and schedule and budget constraints.

I impose controls on my Project Managers only to the extent that I have assurance that the aforementioned parameters are met, that interfaces are maintained, and that redundancy is eliminated. This policy of management, by exception, has enabled us to operate effectively and efficiently and has given my people the incentive to perform to their fullest capabilities.

In accordance with that management concept, and in pursuance of the logistic studies I mentioned before, the major responsibility for adequate logistics support was placed directly on my hardware managers. Each of these managers examined with his contractor the existing arrangements to determine what logistic requirements were essential, which could be trimmed back, and, on the other hand, what additional procurement of logistics resources was required. This "agonizing reappraisal" lasted over many, many months, but, in this way, we were able to tightly tailor, I repeat, tightly tailor, our logistics program to meet the essential requirement of each stage, yet stay within budget limitations.

This improved Logistics Plan is, by now, a working part of Saturn V.

During preparation of that plan, it became clear that we did not have proper management visibility of the logistics activities of our contractors. It was mandatory that we know what had been accomplished--where we stood--and how we, or rather our contractors, were progressing toward our logistic goals.

To obtain management visibility is certainly not easy; it is especially hard in an area like logistics. Well, we tackled this task by, first, requiring the contractors to report to us periodically against the Improved Plan, and, second, by maintaining control charts which depict the status of progress. Of course, neither of these means replaces the dynamic individual logistics manager but they are very effective tools for him.

Each one of my hardware managers now has a logistics manager, and I have one in my program office who reports to me and looks over the shoulders of these logistics managers, our contractors and our Marshall laboratories with their outstanding technical experience. All that effort is necessary to insure that the logistics program is progressing satisfactorily in step with the remainder of the program. Needless to say, my boss uses the same "over the shoulder" concept.

We place a great deal of reliance on our contractors to execute a realistic logistics program. And now that we have incentivized most of our contracts, we shall depend upon them to an even greater degree. This will require that the contractors place even greater demands upon their own organizations.

I have made no effort to catalog all the Saturn V logistics problems. Such a catalog would bore you and give all of us a wrong perspective. I think, though, that by facing squarely the prime cause of our logistics problems, that is, inadequate early planning, and by taking correspondingly firm and effective corrective action, late, yes, but not too late, we have put the show on the road for a realistic, facts-of-life logistic program.

I sometimes wonder if I don't present many appearances to many people, depending on the particular exposure.

To the contractors, I must seem to be a tight-fisted, penny-pinching, grouchy old so-and-so who is never satisfied with their progress no matter how hard they work, how often they are successful, and how much they cut their cost.

To my own people, I'm sure I frequently appear to be an irritable, nit-picking, hard-to-please manager, who likes conferences which last far into the night.

To the logistician, I must seem thoroughly patient, heartily sympathetic, and completely understanding of all program elements, except logistics, and that I am not only completely ignorant of the subject but plan to keep it that way.

Please let me assure you that I am all and none of these.

Being a Program Manager and exposed to many conflicting demands, if I succumbed to all of them, willy-nilly, I would copy the Stephen Leacock character who "flung himself from the room, flung himself upon his horse, and rode madly off in all directions."

Perhaps this Figure 12 will strike a sympathetic chord with those of you who are managers.

- **WORK FAITHFULLY FOR 8 HOURS A DAY AND DON'T WORRY.**

- **YOU MAY BECOME PROGRAM MANAGER AND WORK ~~12~~ 16 HOURS A DAY AND HAVE ALL THE WORRY.**

FIGURE 12. TWO RULES FOR A PROGRAM MANAGER

Not the least of the problems in the Saturn V System is logistics. Nevertheless, I would like to state that we of the Saturn V team, and I mean the team of Government and industry, have found timely solutions, even to problems which hit us like thunderbolts out of the blue. Admittedly, we do not always come forward with the best solutions, but we can live with our solutions, and I am confident we will make our first Saturn V launch early next year.

N 67-21973

CONTRACTING FOR LOGISTICS SUPPORT: (GOVERNMENT POSITION)

REAR ADMIRAL JOSEPH L. HOWARD, USN, Director of Procurement, Office of the Assistant Secretary of the Navy (I& L) has a BA degree in economics from the University of California, graduated from the Naval War College, and completed Advanced Management at Harvard Business School. He has written numerous articles on procurement, supply, and logistics and recently published the book "Our Modern Navy." During the Korean effort, he received the Navy Commendation Medal for organizing and operating a new supply depot in the Far East, and in WW II won the Bronze Star w/combat "V" for service in the Okinawa Campaign.

In contemplating the subject of contracting for logistic support, it is appropriate at the outset to look at a bit of history, review present trends in contracting in general, and put the support question in perspective.

HISTORY

Throughout the 19th Century, the Army and the Navy relied very heavily on government-owned manufacturing facilities for the production of its heavy weapon systems. The Navy had its shipyards and ordnance plants, the Army had its arsenals and ordnance depots.

The 20th Century brought the airplane, and the airplane in its turn brought some new approaches to the production of major systems.

Without going into the details of basic national policy decisions which were made in the 'twenties, suffice to say that the idea of government reliance on private enterprise for the production of aircraft became well established between World War I and World War II.

As this reliance matured, grew, and flourished, we saw also the leaps and bounds in technological progress that came with the 'forties and 'fifties.

We are now in an era of technological complexity that involves the convergence of many divergent disciplines in the production of operating hardware. Electronics sciences now have interfaces with power-plant disciplines. These in turn have bearings on the human sciences, and we see the need for concurrent efforts and trade-offs between the various possibilities and limitations in chemistry, metallurgy, biology, and hosts of other lines of scientific and engineering endeavor.

PRESENT TRENDS

The trends began in the 'twenties, and reliance on industry and the growing complexity of technology, are continuing today.

In the field of government contracting, the trends are keeping pace, both in complexity and in seeking to strengthen the economic basis on which the United States has become prosperous and powerful.

Specifically, the trend in Department of Defense procurement policy is to stimulate competition among private industrial complexes, and to shift the burdens of risk to the private sector of the economy.

More specifically, the Navy today has an expressed policy, recently issued by Secretary Nitze, that seeks not only to intensity competitive effort among Navy suppliers, but equally important, to assure that the benefits of competition be kept inviolate through a policy of "hands off" during the contractor's performance of the contract.

Along with this expressed policy is the move toward more specific determination of the performance, quality, and reliability we want in our hardware, and less dependence on detailed blueprints, drawings, and design specifications.

Compare, for example, the Navy's traditional approach to ordnance production and shipbuilding. In these areas we have for decades been the recognized experts. We could conceive, create, design, develop, and build naval guns and ships. We had, and still have, a womb-to-tomb capability, including a capability for support.

We have never had this in the same degree in aeronautics. We have acknowledged experts in aircraft and powerplant design. But generally, we have for years relied very heavily on the initiative, impetus, and imagination of industry.

In aeronautics we have stated, in terms of performance, quality, and reliability, what we want the airplane to do, where it is to fit in a carrier configuration, and how it should operate at sea. But we have left most of the graphic details to industry.

We are beginning to apply that philosophy in other fields as well. The FDL project is a case in point. The same is true in certain missiles, and torpedoes, and communications equipments. We are saying, in effect, that we will specify to industry what we want the system to do, and it is our intention to draw on industry's imagination and profit motive to do the rest.

There are a number of illustrations of these trends of action. We are driving hard to reduce the use of CPFF contracts, and shift to incentive-types and fixed prices. These place the burdens of economic risk on the contractors.

We are using weighted guidelines which have specific factors for company contribution, company risk, and so forth. We are moving in the direction of total package procurement in which the Air Force has been a pioneer.

PERSPECTIVE

Now, to put these things in perspective it is important to look at this question of risk.

The risk to a contractor in a fixed price contract, or in incentive-type contracts, cost or fixed price, is clear. It is primarily a matter of economic risk. The survival of the company is at stake if it overruns its costs to such an extent that it folds.

There are risks to the government as well. The risk, from the government's standpoint, is in failing to get either <u>what</u> it wanted, or to get the item <u>when</u> needed. This is particularly critical in the military field.

This means, therefore, that the contract must be a finely balanced instrument that contains the right amount of risk for the company, and the right amount of incentive reward, to give the company the necessary motivation to succeed in performing the contract. We do not want to drive <u>any</u> company out of business. That is not in our interest whatsoever. This is why, from our standpoint, the penalties for degrees of shortfall must be reasonable.

On the other hand, the penalties for shortfall must be stringent enough to hurt. And the incentives for success must be worth the effort to gain the rewards.

While we consider these factors, however, the government must also have a contract that gives it reasonable confidence that the right quality will be delivered on time at reasonable cost.

The achievement of such delicately balanced contractual instruments is most difficult. In reviewing most of the contracts we have today, one might question whether we have yet achieved the perfect balance desired.

Now, the perspective required here is that we have been discussing the problem of development and production. Following these things is the problem of support, continuing support.

Clearly, in the area of major weapon systems, we are always in a state of calculated risk. We assess the threats at sea, in the air, below the sea, in space, and on land. We determine what we need to meet those threats. And we define the time-frame within which, or the time by which, we need the capability required.

If we do not make it, the threat is magnified. Think back to Sputnik and remember the pressures we were all under in those months following that turn of events.

Now, when we do in fact have a hardware capability, in the hands of the men who must use them, and we have the trained men, the vehicles, and all it takes to operate the weapon systems, the question of support becomes absolutely critical.

Awesome though it is to contemplate that a hardware capability might not be at hand when we need it, it is equally critical that we have assured and continuing support for those weapons that are at hand.

THE PROBLEM

The problem in the area of support, therefore, is in getting absolutely certain support. There can be no ifs or buts about it. We must have it.

The problem is to structure contracts so carefully as to provide airtight response. If we do not get the material we need in support, we can lose skirmishes, battles, and wars. We can penalize the contractor under the contract, but this would be small penalty compared with being loser in war.

In the services, of course, we meet this problem by building up our own in-house capabilities for supply and maintenance support, complete with overhaul depots, repair facilities, supply installations, stock levels of supplies, and war reserves.

Of course, we do in fact rely on commercial suppliers for a lot of these things too. We send many equipments directly back to commercial plants for rework, overhaul, and modification. We use basic ordering agreements, and indefinite quantity contracts for parts support on the expectation that the moment we order something it will be forthcoming immediately.

But generally, the theory has been that operational support must be a matter of command, not contract This is why we have depots and overhaul shops as organic parts of the military services.

This does not mean, however, that we cannot rely on industry for support. On the contrary, we can and do. And, as we have seen in major end-item production, and trend is definitely toward more of the same in the support area.

We are using contractors more and more these days to man our missile ranges and advance bases. We are using contractors for certain support services, for example, data collection and processing services. We use contractors, as indicated, for overhaul, for on-the-spot supply, and so forth.

But the problem remains one of structuring contracts so carefully as to provide assured support on time at reasonable cost.

With the shift from CPFF contracting, the demand upon us for finely structured contracts is greater than ever before. We shift the economic risks to our contractors, but we assume a greater response risk on the government's side because the higher-order contracts carry the strong implication of hands off.

We cannot, for example, pump in more money just to give the contractor more people and facilities to make him more responsive. These actions are not in keeping with the purpose of incentive and fixed price contracts.

We are, nevertheless, moving gradually to greater reliance on contractors in certain of these support areas. The total package concept is one example. The newly evolving concepts of integrated logistics management is another thrust in this direction.

Specification WR-30 is another thrust. Here we enter into contracts which call for the producer to make those parts and components he needs to keep ahead of final assembly, but at the same time make these same parts and components immediately available to us for deployment support where necessary. We have to make our withdrawal decisions in time to permit the contractor to make up some more to keep his production line going under the prime system contract. But the point is, we are relying on the contractor for this material support rather than simply buying up a provisioning quantity at the outset and put it on our shelves to hold until we need it.

CONCLUSION

The subtitle to my remarks was labelled as the "government position." It is difficult, of course, to call something a "position" unless you say I'm for it, or I'm against it. The "position" expressed here may seem to be equivocal and ambiguous.

Let me conclude, therefore, by summarizing what the "position" is. We have a proven and demonstrated support system in the military services today. We have professionals whose lives are devoted exclusively to the methodology and techniques of supply management, maintenance management, and support.

These professionals are responsive to command. And at the same time they are responsive to the demands of economy. For this latter reason, these same professionals are constantly seeking, developing, and implementing new and better ways to do the support job.

Contracting for logistic support is one of these ways to which the professionals are wholly open-minded. They are not only receptive, but are carefully expanding into the contracting approach. We are gaining in experience in this approach, and with this experience we are refining our contractual instruments to give us progressively greater assurance that the support will be there when it is needed.

As we gain in experience and refinement, we expect to gain in contractor response, and gain in confidence as well. In the final analysis, it is something like learning to ride a bicycle. It scares a kid the first time he takes off. But as he learns how to achieve and maintain his balance, and as he gains in experience, he gains in confidence as well.

Pretty soon he sails past the house and hollers, "Look, Ma, no hands . . . "

That is the direction in which we are going in contractor support. But we don't want to crash in the process.

That's the government's position, as best I can state it.

N 67-21974

CONTRACTING FOR LOGISTICS SUPPORT: (NASA POSITION)

GEORGE J. VECCHIETTI, NASA, Director, Procurement Office, holds an LLB degree from the Catholic University of America. During WW II he served as a pilot in the Army Air Force. He practiced law in Washington, D. C.; was with the American Commercial Company as Vice President; was with the Munitions Board of the Department of Defense; was Deputy for Procurement Policy, Directorate of Procurement & Production, Hdq. USAF; was Air Force policy member of Armed Services Procurement Regulation Committee; and served as NASA Assistant Director of Procurement.

Webster defines "logistics" as "military science in its planning and handling and implementation of personnel and materiel and facilities and related factors." Now there's a beauty; Mr. Webster would have made a fine specification writer. That definition touched a responsive chord in me which I couldn't at first identify until I realized that it reminded me of many of the work statements that show up in the government's requests for proposals on contracts!

Fortunately, earlier speakers have more precisely identified the meaning of logistics, at least for the purposes of this symposium, to a point where we can zero in on those aspects of procurement concerned with "contracting for logistics support." Among the items included in the identification were:

- Spares provisioning
- Maintenance and maintainability
- Technical documentation
- Training
- Ground support equipment
- Transportation
- Pressurants and propellants

Excluding the last two, transportation, pressurants and propellants, which are generally the subject of a separate contract, the others are contractually provided for in most instances in the contract for hardware. Stop and think a moment, and you'll recognize a common denominator to that list... the contractual coverage on all of them almost inevitably consists of a generic description of the item, a requirement for it, and then sets up a procedure which, in varying degrees, provides for <u>deferral</u> of precise identification, <u>deferral</u> of pricing, and <u>deferral</u> of implementation action decisions. Test the validity of what I've just said against, for example, spare parts provisioning under any one or all of the systems set up under the contracts you may have awarded or received. Remember, we are speaking of an area (logistics support) which accounts for about 25 percent of our budget expenditures!

Why do I make this point? Because it exemplifies what Dr. von Braun, Dr. Mueller, and the other distinguished speakers who opened this program stated very clearly about this area of logistics support; namely:

1. It needs top management support.
2. It requires cooperative effort within government as well as between contractor and government.
3. We must plan, in advance, as much as our knowledge permits.

4. We must define our requirements far more clearly, and

5. We must achieve cost-effectiveness in the logistics support aspects of our programs.

What is the vehicle by which the government's requirements for logistics support are translated into actuality? It's the government contract. Thus, the logical place in which to attempt to achieve the improvements just listed would appear to be in the procurement process. Let me at this point remind you that contrary to a misconception in quite a few quarters, the procurement process does not begin and end with the negotiation and award of a contract. It begins well in advance of negotiation and continues far beyond award. It begins with the formulation of a requirement and carries on through the initial planning and definition, project approval, contract definition, negotiation and award, and last, but not least, contract execution, that large amorphous area most frequently described as contract administration or contract management.

So, to those of you who are in the requirements generating business, the challenge is clear; there must be an intensive drive by government and industry, working closely together, to devise a system or systems which will place logistics support planning and execution on the same plane of importance as that on which the end item hardware or service is now situated. It can no longer be treated as a "sometime thing," that is, an afterthought or filler in our contract and project management. Early, productive planning is a must. This, of course, is easier said than done.

NASA has already taken certain steps in this direction and is currently working on others. We will be requiring in our project approval documents an exposure of logistics support requirements, including cost estimates, which should be at least as definitive as our initial contract coverage is today. We have built into our Procurement Plans (this is the document by which top management authorizes major procurement actions) a requirement for even more definitive discussion and planning on logistics support aspects. Our revised source evaluation and selection procedures will include significant weighting on the realism, definitiveness, and effectiveness of logistics support plans set forth in industry proposals and will play an appropriate part in our evaluation of contractors' proposals in a competitive atmosphere. We are incorporating in our Phased Project Planning system provision for orderly transition from initial logistics support concepts to a high degree of preciseness in the sequential contract phases that follow. These techniques are not ends in themselves. Nor will they cause miracles. But, they will force attention by proper management levels on logistics support at every stage of our otherwise well disciplined procurement process.

Most of you are familiar with NASA's efforts and activities in the field of incentive contracting. Among the many types of incentive arrangements in existence, there is one which in my opinion is eminently suitable for use in the logistics support area. That is the Cost Plus Award Fee (CPAF) contract as to which NASA was a pioneer and to which we are now heavily committed, particularly in our support service contracts.

The award fee concept was arrived at as a result of our seeking ways and means to incentivize contractual efforts which were not amenable to the more precise definition required for effective "formula" type incentive arrangements wherein once the formula is set at the outset, it becomes an inflexible measuring standard for determining the contractor's reward or penalty. If the assumptions on which the formula is based are not based on solid fact, it founders, either by way of windfall or heavy loss on the part of the contractor, to say nothing of adverse effect on the project itself. The award fee technique provides the flexibility to adapt to circumstance lacking in the "formula" approach. We have studied in depth our experiences with this technique, both by in-house teams and by contract. One clear finding has come through in all studies, one particularly germane to our discussions here today.

That is, that the award fee concept has caused earlier, better planning and definition, continuous management attention both by contractor and by government, and, perhaps most important of all, it has caused a dramatic improvement in communications between contractor and government at all levels.

We are seriously considering the use of the award fee concept in contracting for logistics support, whether it be as an integral part of the end item development contract or as a separate contract standing on its own terms. As a starter, you will be seeing in the reasonably near future a NASA contract, perhaps as an initial experiment, in which logistics support aspects will be covered by award fee arrangements.

We're also hard at work on getting meaningful, yet early, pricing on logistics support line items.

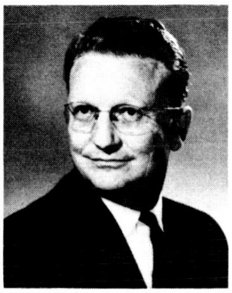
You can be assured of one thing, NASA is not going to remain static in this area. We are probing and seeking out new and better techniques. We urge you to join us in this effort. I'll meet and talk with any individual or group that feels it has even a glimmer of an improved approach to this difficult area in contracting.

At NASA Headquarters, the Office of Manned Space Flight and the Procurement Office have joined forces in attacking the problems from a combined program management and procurement management viewpoint. We're seeking, and getting feed-back from our field installations, the NASA centers where actual contracting and project management are carried out. Forrest Waller, from whom you'll be hearing shortly, has been on a tour of our manned space flight centers in recent months on behalf of General Sam Phillips, devoting his efforts primarily to seeking improved logistics support management. Our other centers have joined the Procurement Office and the Office of Manned Space Flight and its centers in forming a task group working exculsively on spare parts provisioning, which is but one facet of logistics support. We've worked with certain industry associations on this area; but quite frankly, all that has been served up is essentially a re-hash of old time worn procedures that just "don't hack it." What's needed is imagination and innovation.

I'm confident that when this group, or one like it, meets for the Second Annual Logistics Management Symposium next year, we'll all be reporting accomplishments rather than reciting problems and potential solutions. You're the people who can do it.

Thank you.

CONTRACTING FOR LOGISTICS SUPPORT: (INDUSTRY POSITION)



STANLEY C. HELLMAN, Assistant to Director of Contracts, The Boeing Co., received his degree in aeronautical engineering from the University of Minnesota. He joined North American Aviation, Inc. in 1937. At the start of WW II he went to Dayton as coordinator between North American and the Air Force. After twenty-five years of service with NAA and as Director of Contracts, Los Angeles Division, he joined The Boeing Company in 1962. In his present position as Special Assistant to the Director of Contracts, he assists in negotiation of contracts with customers and with the establishment of policy.

The procurement plan for any program must at the outset also include in its planning the logistics program to be followed during the total service life. In fact, the procurement of the logistic items to be supplied by the contractor should, to the extent they can be defined, be an integral part of the contract buying the basic program. Separating these elements will lead toward inadequate planning for the total program.

Contracting for logistic support from the industry point of view can be no different than contracting for any other requirement. It involves all of the same considerations in contracting for any item.

Successful contracting has always involved developing a clear statement of the work desired, the schedule, and the conditions under which the contract is to be performed. The combination should highlight exactly what you, our customer, desire from us as contractors.

The end result both of us desire from the logistic support program is that the total program be properly supported throughout its life. You want this to allow you to obtain the full benefit of the program. We also want it for the same reason because we then have accomplished the purpose of the contract you issued to us.

An ideal logistic program would be one that would never be the cause of a program delay and, upon program completion, would have a zero residual of consumeable inventory. To reach such an ideal is not practical in a dynamic program environment. It is practical to strive to obtain the lowest overall cost, keeping in mind cost of delays created by a logistic deficiency.

The work statement for logistic support must clearly set forth the effort that is to be provided by the contractor to make sure that the contractor can integrate these requirements with those of the rest of the program for total system effectiveness. Before a portion of the total logistic effort can be included in the contractor's work statement, it will be necessary to establish a total plan including the elements to be performed by the customer. Since most total programs involve more than one contractor, it will be highly important to highlight which of the parties involved will have the responsibility for coordinating the required effort. It is similarly a necessity that the various Government agencies also be coordinated in their approach to logistics. The work statement must recognize that the logistics program involves a high degree of team effort.

A total logistics program can be compared to a football team. Each of the participants in the logistics program must have a clear cut assignment of his responsibility and, furthermore, an understanding of his responsibility. The work statement should provide the first, and a review of his logistic plans should provide the assurance that he understands his assignment. This alone is not enough. The participant must also be capable of accomplishing the effort. It might be necessary to make a slight modification so that the assignment is within his capability. It is often overlooked that to accomplish the effort you are to perform, it is mandatory that you are also familiar with the remainder of the plan to allow the best interface with the other participants.

Each of us is desirous of staying on the team. You as the ultimate user, have a responsibility of keeping us informed of the kind of problems we have been giving you in carrying out your part of the total program. A periodic analysis of your experiences, carefully conceived and compiled on all programs will aid immeasurably in improving industry's total capability to assist you. It would also be helpful if you would institute tours and briefings illustrating successes, failures, and innovations. The development of a greater exchange between the user and the contractors will be highly beneficial.

For us to plan the lowest cost program for you, we must understand not only our cost but also those you are expending in your part of the total effort. Through this understanding we will be able to better plan our portion of the whole so as to minimize the total cost. There is no question that you are the quarterback, but we'd like to be in position to make recommendations in the huddle, that, hopefully, would be beneficial to the total program performance.

To the extent that a contractor understands and recognizes the customer's needs and can put himself into the customer's shoes when conceiving and providing his system, to that extent, the customer will get a better total system.

Let us now address our thoughts to the type of contract that should be used for procurements. There can't be too much argument with the criteria set forth in the procurement regulations. The conditions for use of each type are concise enough to properly allow application. I am sure that you, as well as we, have found that our respective interpretations have in actual life varied as to the proper type. The reason for our varying opinions is our assessment of the degree of risk actually involved in the procurement.

After having expended a great deal of effort in an attempt to define the desired services and product, we still may have a loose statement of work allowing wide interpretation by the parties. In such a case it might be desirable to utilize a cost type contract. Emphasis has been to spend a bit more time to allow the use of contracts that involve the contractor to a greater degree in the risk of performance. Generally, as an industry, we are not adverse to such a shift. It has been recognized that this shift in risk makes it desirable to remove controls instituted under the lower risk contracts.

A great deal could be said concerning the various methods that could be applied for management control of performance, cost and schedule. Suffice it to say that after executing a contract, it is necessary for the contractor to implement the contract requirements. He must assign the various elements of the procurement to the responsible organizations. He must establish a means of control to assure the performance, to the schedule requirements and within the costs negotiated with the customer. The contractor should do this regardless of the type of contract. It is necessary that he have control of his total resources to assure their availability in accomplishing the total effort.

To assure consideration of the total system requirements in the initial design, DOD has introduced total package procurement. It allows competitive procurement of development, production, and the logistic effort, to the extent that it could be defined, during the period where the selection could be made from several contractors. The evaluation of contractors' proposals under these conditions allows consideration of the total system's effectiveness over the life of the program as well as the product performance set forth in the specification.

There are many incentives that are important to us as contractors. We are energized to provide you with a product that will enhance our reputation with you. There is no question that we are also energized to improve our return on the investment of our resources. The use of incentive contracts has long been recognized as a means for contractor motivation. Initially, the use of incentive contracts was limited to cost. Dollars are easy to define and measure. The contractor certainly has a high degree of control over their expenditure and the reduction in total dollars required is of benefit to you, the customer.

In recent years, the use of incentive provisions has also been applied to items of performance and schedule. The purpose of these incentives is to direct the contractor's attention to those elements of greatest importance to the customer so that by maximizing these, the contractor may also maximize his profit.

Although contracts have not had specific incentives concerning the overall logistics performance, these requirements have been fundamental in the development of the product design. The improved reliability of the product has been stressed; this certainly reduces logistic costs. The ability to perform the maintenance, the emphasis to reduce the skill level requirements, and the use of parts already in your inventory all have the same effect.

In past programming of logistic support effort the separation of effort between the various participants has made it difficult, if not almost impossible, to prepare definitions and measuring techniques that would allow the development of meaningful incentives. In certain test programs, total responsibility for the furnishing of spares has been included as a requirement for the contractor. This then places the requirement under the cost incentive features of the contract.

In summary, I would like to say that logistics must always be considered as part of the whole program that you are buying. It is extremely important that we work as a team in developing a statement of work that clearly sets forth the work we are to perform and that this does not leave voids in the total program.

In development of logistic requirements, let us not accentuate these to the exclusion of other items, but, instead, provide emphasis that the total system is structured to meet the end program objectives at the lowest overall cost to you, the customer.

N 67-21976

EVALUATION OF PERFORMANCE: PANEL DISCUSSION

MEASURING LOGISTICS PERFORMANCE: MODERATOR

JOHN F. SUTHERLAND, Director, Product Support, McDonnell Aircraft Corp., holds a BS in mechanical engineering from University of California. He served with Naval Aviation during WW II in the South Pacific, being credited with at least five "kills." He earned two Distinguished Flying Crosses and the Air Medal. He served with the Bureau of Aeronautics and was released to inactive duty as a Lt. Commander. He has had more than twenty years experience in the field service, customer service, and product support divisions of McDonnell.

You have been listening and been talked to for a day and a half, and, after a few introductory remarks by representatives from the three military departments and NASA, we are going to give you a chance to do a lot of the talking. We'll have each of the gentlemen say a few things and then we'll invite questions from the audience at that time. The subject of Evaluation of Logistics Performance is a real little gem because, as several of the other speakers have said, you have a hard time defining the subject to start with, and how you evaluate it is even more difficult. Everybody has notions and we would like to get your ideas.

The whole of the defense departments and NASA are being evaluated on logistics performance all the time whether you know it or not. Some of this evaluation is in very broad terms and is what you might call emotional. I leave to your imagination the situation that would occur when a million-man North Vietnamese army comes roaring across the border and captures a couple hundred thousand American troops and God knows how many tanks and helicopters because they are out of spare parts or POL. I can assure you it would be in the form of a Congressional Committee and nobody would like it. Likewise if NASA had to hold up for months or years a planned launch for a lack of parts or lack of equipment or lack of ground support equipment, it would be evaluated in a hurry. This kind of evaluation you don't want. So, in general, you are all being evaluated, all of the departments are being evaluated by the public and their elected representatives in Congress. The headquarters for the military departments are evaluating, and the higher up you go the broader is the evaluation, and the less detailed. The commands in turn are evaluating sub-commands, the sub-commands and purchasing agents are evaluation contractors, who in turn evaluate subcontractors, who in turn evaluate, by whatever form they use, their vendors. A big question that always occurred to me is who is evaluating the budgeters and planners. They seem to escape this sort of thing fairly handily and, as some of the previous speakers have mentioned when the budget squeeze gets on, somehow the logistics funds get cut because they are the last ones to change. At the risk of repeating of what has been said before, the logistics functions must be considered in budgetary terms, certainly, and planning terms, absolutely. From the broadest plans and budget dimension to detail plans and budgets you have got to get in the basic design and trade-offs, in the engineering design hardware maintainability, in the manufacturing quality practices, so that your logistics plans have to be evaluated all the way up and down the lines. The subject of this panel is how you go about evaluating this performance. After the fact, after something has failed due to lack of logistics consideration, planning or funding is too late. You have to know where you stand and have visibility on your program as you go. Unfortunately, in the budget squeeze the logistics funds are the first thing to be cut because they are the last thing on the chain, and you are frequently forced into crash over-timŋ programs and higher expenditures than ever. It has been said by cynics that logistics is a game where you can't win, you can't break even, and you can't get out of the game. We hope by having some evaluation procedures and methodology, we don't expect to get out ot the game, we don't even expect to win, but we'd certainly like to break even occasionally.

N 67-21977

EVALUATION IMPLEMENTATION:

PANELIST

REAR ADMIRAL, H. J. P. FOLEY, JR., USN, SC, Commanding Officer, Navy Aviation Supply Office, Philadelphia, is a graduate of the US Naval Academy and of the Naval War College. His WW II service was in the Atlantic, Canal Zone, and the Pacific where he participated in seven major campaigns. The Naval Aviation Supply System, of which the Supply Office is the nucleus, is responsible for the world-wide logistical support of 8800 naval and marine corps aircraft. He is the former Deputy Commander for Planning and Policy, Naval Supply Systems Command, Washington, D. C.

Gentlemen:

I will describe how evaluation of support is actually performed in one defense agency, the US Navy Aviation Supply Office. It is not necessarily a typical approach, but it does include techniques in general use in Navy inventory control points. I will focus on the evaluation of initial support for aircraft spares and special support equipment.

The initial support period begins when the production contract is awarded, that is, about three years before the Navy takes over responsibility for support of the aircraft. The contractor has a very large role in all aspects of support during this period. The evaluation process is therefore an integrated one, a joint Navy-contractor effort. This joint approach is given full stature by inclusion in the production contract of WR-30, the Navy standard for support during this initial period.

The prime purpose of evaluation in this period is to get feedback into the support control mechanism. That is how we take advantage of the knowledge gained through evaluation. To achieve this purpose, WR-30 requires the contractor to develop a Support Management Plan. The plan is approved by a joint Navy-contractor team several months after award of the production contract. From then on to the Navy Support Date, a period of several years, this plan is the principal basis for joint evaluation of support. The measurement is in terms of progress through a long series of check points. The plan cites target dates for significant support actions by the contractor and by the Navy. For example, it states when the contractor will determine the spares requirements for individual assemblies in the weapon; when he will submit specific types of technical documentation to the Aviation Supply Office; when he will provide a list of special support equipment to the Navy. And the plan covers the related actions required of ASO and other Navy agencies as well.

The actual work of measuring progress on the Support Management Plan occurs continuously by all parties. This generates daily questions and demands on a highly specific basis. The contractor may ask ASO to keep on schedule in processing certain design change notices. ASO may inquire of the contractor why a package of provisioning documents is not fully adequate. But beyond this daily evaluation, there is a time for an over-all review of progress. The evaluation process peaks at least once a quarter. This is when the joint Navy-contractor team meets to review progress against the plan. This is where the evaluation process generates tremendous feedback of information into support control. Recovery plans are agreed to where there is slippage; new procedures are developed for more effective joint action against a problem area; and a new vision is gained of what must be done to keep support actions on schedule.

ASO's part in this evaluation process requires a significant internal effort. There is an ASO plan for support for each weapon. This ties back to the joint Navy-contractor plan. It embodies a similar approach - a detailed list of milestones to be achieved over several years. Some examples are: completion of review of the vendor's list of repairables; the dates by which funds must be received to initiate procurements; the period during which ASO will conduct the provisioning preparedness review, and so on. This again is a means for continuing evaluation by the ASO weapon managers. Visibility is achieved by monthly presentations to top management on the status of all weapons in the initial support phase.

There are other tools for ASO evaluation of support. The operating sites scheduled to have the weapon receive tailored lists stating delivery dates and quantities of important spares and special support equipment. Deliveries are matched against the lists and ASO receives progress reports from these sites. Also, our weapon managers make scheduled personal inspections at the sites to evaluate the status of deliveries. So, it is apparent that the evaluation process operates in depth and includes the supply people at the field level. This all serves to supplement the regular input of on-order and delivery information furnished to ASO by the contractor, which we maintain in automated form.

I will mention one other important aspect of evaluation: the informal but strong relationship which develops between ASO personnel and the contractor's representatives. Experience shows that much is lost if we depend solely on what is written into a contract. The common purpose, to support the weapon, stimulates an interchange of data and opinion when it is needed for evaluation. Happily, it goes beyond that, to the point of mutual effort to improve the support picture.

Which brings me to the matter of the main problems being revealed by the support evaluation process. As you would expect, with this strong emphasis on meeting target dates, deficiencies in the timing of support actions are frequently revealed. Much of this results from the twin pressures of meeting production lead times and the urgent Navy requirement for the earliest possible receipt of stable supply and technical data.

Another major area pointed up in the evaluation process is the status of funding. There is a great variety of forces, for example, which create a tendency toward late and incremental funding. The Navy is learning more about what the cures are, and about how to adjust to the funding tempo, through evaluation.

Gentlemen, we look for improvements to come in the techniques of support evaluation. Much of this will result by taking advantage of the various refinements in management methods and data processing equipment. There is bound to be increased use of ADPM for interchange of data. The emergence of high-speed and high-capacity data communications systems will be a significant help in the area of timing. I envision many benefits for the evaluation process in the more effective use of configuration control. Finally, I believe that the increasing attention being given to management information systems may well contribute to a breakthrough in support evaluation.

VISIBILITY FOR EVALUATION: PANELIST

MAJOR GENERAL JOHN G. ZIERDT, USA, Commanding General of the US Army Missile Command, is a graduate of the US Military Academy, of the Command and General Staff College, of the Army War College, and attended Massachusetts Institute of Technology. His WW II service was in Europe. He directs an organization which is responsible for all phases of research, development, production, and support of Army rockets, guided missiles and related programs assigned to it. A recognized management expert in research and development of Army weapons, his assignments have been in the rocket and guided missile field since 1956.

Good morning, gentlemen:

I have but a few last words to say to this distinguished firing squad before the questions begin.

If my neighbors at the Marshall Space Flight Center plan to make this gathering of logisticians an annual event, it should have a theme. May I suggest "Nobody knows the troubles I've seen."

There's a short poem about soldiers I have always enjoyed. It seems appropriate for this occasion, with a few minor word changes. It goes like this:

God and Logistics we adore,
In time of crisis, not before.
The schedule met, all troubles righted,
God is forgotten, Logistics slighted.

I have a hard time convincing myself that NASA really has a logistics problem. There are many days when I wish that Army missiles went directly from the factory into orbit or the Atlantic Ocean. Discounting the obvious differences between our programs, however, I find there are some similarities. I shall confine myself then, to some general comments on common problems.

Foremost in my thoughts is the reluctant conclusion that there is no magic in this business. It boils down to people doing a job, people in a government management operation and people in a contractor organization. Strip away the computers and the alphabet soup of management tools and you begin with people.

Usually, I might add, they are people who started out to be something else. I find very few young officers or newly graduated engineers deliberately requesting assignments in logistics. It's an acquired skill.

When it comes time for credit to be given by a grateful public, the logistician finds himself in line behind the research and development people who design and develop hardware and the men who use it. The spotlight shifts to the logistician only when the launch is delayed because some minor part is missing or the tanks stop because they have run out of fuel. We can leave an exploration of what motivates people to tackle careers in logistics management for examination at some future symposium. I wonder about it now and then.

When do the R&D people take the logistics experts into their confidence? Never soon enough. Many of my people contend that basic decisions on logistic support must be made even before a firm requirement is established for the hardware.

I maintain there are at least three things a designer needs if he is to do an outstanding job. They include:

1. What is this system supposed to do? We call this a requirement.

2. Second, how is this system to be used? We call this employment doctrine.

3. Third, how is this system to be supported? We call this a logistic support plan; it includes the type organization, the level of maintenance capability and the method selected for supply of repair parts.

Many of us in this room learned that grafting a support plan onto a growing program, which is essentially what was done with the Redstone missile system, is not the way to run the railroad.

At the very least, support planning must begin with initial design of the hardware. This is not a procedure that makes design engineers happy. They are inclined to feel that the hardware must come first. Working together, however, the designer and logistician can make trade-offs in design and cost. They usually do not, but the possibility is there. Our experience has been that if we can spell out a military requirement or a set of specifications for a piece of hardware, we can take a first cut at spelling out a plan to support it in the field. By the time we are into a contract definition phase on a new Army system such as SAM-D, we are ready to provide detailed scopes of work on the logistics aspects as well as the development program.

There are elements of logistics common to any program. I would include maintainability and reliability engineering, new equipment training, manuals and initial provisioning or stockage of repair parts. Some, such as training requirements, can be clearly set down by the government program manager and definite direction given to a contractor at the very outset of the program. Others, such as initial provisioning, require close coordination between government and industry, between the support man, the reliability man and the designer. Again, there's no magic to it, just plain hard work and cooperation required to prepare a very detailed, time phased breakout of what will be required, when it will be required and who is going to do it. But you must do it early, you can't wait until it's failed to ask for support.

Experience counts most right here. We plan an initial stock of spares, for example, from design knowledge, reliability knowledge during design and maintainability engineering and knowledge gained from other systems. The initial stock of spares is our best engineering estimate of what will be required to support the item once it is fielded. Even before that is needed, however, someone must assess the system and provide spares, and money, to cover contingencies that will undoubtedly crop up during a development test program. Once the item is operational, of course, failure data from the field can be used to refine the calculations.

When it comes to relations with a contractor, I feel communications mean as much as the type of contract. We have not had enough experience just yet with incentives for me to pass judgement on whether or not incentives hold any real advance for the logistics business. My best guess is that there is an opportunity here, specifically in the area of reliability. The weight of our contract incentives is on the elements of risk. They tend to be in the hardware development and how well we plan our logistics before the item is fielded.

By communications with a contractor I'm referring, of course, to the language in the contract. Very early in the game the ground rules must be reduced to writing. What the contractor is to do must be in contract.

And it must be spelled out in detail . . .

And it must be clearly understood by both parties to the contract. We have found out, the hard way, that there can be gross differences in interpretation of language between government and contractor, yet both parties are reading the same words in the same document.

Now, how do you go about preventing such misunderstandings? You might be interested in one approach that is working well for us in the management of the Lance missile system. Lance has a total program incentive contract which, by its nature, provides the contractor freedom to exercise management judgement. The prime contract includes specifications for the end item. Management uses a comprehensive PERT and PERT/COST system as a tool for visibility.

The initial approach to limit misinterpretations was to plan in considerable detail. One result was more than 10,000 PERT events, but as the program progressed, we found we had the old problem of decision interface cropping up.

As a hypothetical example, industry might be working toward an interim reliability of say 50 percent from a sample based on six tests; whereas, the government considered 80 percent from a sample of 20 tests essential before proceeding. Obviously there was cause for disagreement on what constituted real progress toward the desired end item reliability.

Lance settled on a management approach referred to as "quantified milestones," as a solution. Previously, program milestones had been established and defined by describing the event, but not the logic and the conditions which constrained the event.

The Army project manager and his top people sat down with their counterparts in the contractor organization and agreed to quantify several key program milestones by delineating program objectives to a degree suitable for use by all members of the team.

This involved writing a description of each activity which constrains a milestone and spelling it out in specifics. To do this, you must have for each major system component a performance specification describing the desired progression toward end item performance. The minimum number of tests must be determined, for example, and the hardware configuration identified. In brief, this agreement formally conveys the minimum essential logic necessary to start the milestone in question. In a total program package, you may have to quantify 10 or more milestones, but once you have done it and apply PERT, you have an effective management tool which, so far at least, has provided consistent program visibility.

There are many such tools to achieve visibility. Line of balance charts are in common use. So are regular progress reports from the contractor, periodic meetings and program reviews. But again, there is no magic involved.

We have found that the best way to get management visibility of a contractor's performance, in logistics, development or production, is with plain blue or brown eyeballs. You put people in the contractor's plant and they look over his shoulder and they ask nasty questions. I have been a program manager and I have sent people into plants to stick with a critical item or problem. Sometimes I've gone myself. After ten years in the missile business, I must confess that I do not have a better way to do it.

So you say, what's new? That's just my point. Nothing is <u>really</u> new.

I suppose that is why no one I know in the logistics business is content with the system he is using. We have yet to really apply technology to logistics. When we have, we have settled for marginal improvements. Computers, for example, are in widespread use but they are keeping the records we have always kept.

We are fond of saying that guided missiles have revolutionized warfare. If they have, we are overdue for a corresponding revolution in how we support them. Today the logistics system we use for missiles is essentially the same as we use for trucks and rifles.

Yet missiles <u>are</u> different and I believe they demand different logistics. We are dealing with high cost, sophisticated low density items, and the logistics system should be tailored to the item, not the other way around. I cannot reconcile this with standardization. I'm just stating the problem as I see it.

Some new things are being tried.

Our Hawk battalions in Viet Nam, for example, are in good shape. The units were deployed with mandatory stockage. We are supporting them directly from my Supply and Maintenance Directorate here at Redstone Arsenal. The funds are here and the people are here. The units draw directly on us for whatever they need. We have recorded deliveries on requisitions from those units in less than six days. We are doing it by by-passing a good portion of the normal Army supply system.

At the same time we have begun some research and development on logistics using Hawk as our model. We are looking not for problems, but for causes of problems. We have established a mathematical model of the present system which we shall modify gradually to determine the points of sensitivity to determine what to change. This model was reviewed by Research Analysis Corporation and acclaimed as an advance in the state-of-the-art. I shall withhold my comment until something comes out the pipeline. The point I am making is that for the first time we are doing some R&D in logistics systems which I think is 40 years late.

Having said that, let me conclude with this thought. I am told symposium panelists are expected to throw out thought provoking statements to stimulate discussion. Here's one:

NASA has a very special logistics problem, one in which the experiences of the military and industry may not even apply. In drawing up a logistics system to satisfy its special needs, NASA has a chance that military logisticians never get, a chance to start absolutely fresh.

The only real advice I can give you is try it.

N67-21979

SUPPORT VERSUS TOTAL PROGRAM EVALUATION: PANELIST

FORREST E. WALLER, NASA, Chief, Apollo Logistics Management Office, Office of Manned Space Flight, has a BS degree from the University of Utah. His WW II service was in the Navy. He was on the staff at Hdq. Air Force Logistics Command; and was Deputy Chief for Material AF Ballistic Systems Division before joining NASA.

General, you really threw out quite a challenge and perhaps we can discuss some of the things which we are doing at NASA which may be surprising and pleasing to you. I hope so anyway. Now I have been asked today to discuss the area of support versus total program evaluation. In my view, I'd like to break this thing down in to two parts, because you have to have a base on which you can discuss the subject, support, evaluation, program evaluation, and things of this nature.

The first part concerns management and management practices, systems analysis techniques, which are used whether we start at the end of the program, late, whether we start at the middle of the program, and whether we start at the very beginning. Last November we in NASA and Apollo Program Office published the Apollo Logistics Requirements Plan. We call it 7500. 1. This document is a systems engineering approach to logistics management. It was specifically developed for the Apollo program calling upon our backgrounds, the 375 series documents, and the WR30 documents of the Navy; and it embodies, or the plan embodies, management approaches and techniques to acquire, track, and affect cost trade-offs. This is the middle of the program. Now since implementing this plan, over the past year, our efforts have been devoted primarily to improving our contracts, both the contents and the quality of them. Further development in the refinement of our in-house capability, to determine, to track, and to measure ourselves, measure not only what we're doing but also what the contractors are doing. I believe that we have made major progress but we still have quite a long way to go before we will have anything such as mathematical formulas, symbologies, ranking matrices, incentive structures, or nomographs for use in day-to-day working relationships. They're real hard to develop. Plenty of textbooks are available, many government phamphlets, and many industry phamphlets, but the practical application where there is a good payoff to the program takes hard analytical adjustments and assessments of those documents.

That's my first point. The second point is, in my opinion, the overriding logistics management problem today, and it has emerged here as the single point of this whole symposium. We have to start early, in the initial phases of the program; we need to preplan early. That is the part that program offices must, of necessity, accept, and logistics goals and milestones must be included as an integral element of program management. In the initial phases of the program we have alternatives for best balances which we don't have available if you come in at the middle or the end of the program. To my knowledge, this is the only time in the hardware life cycle wherein logistics objectives can be developed; they can be analyzed in relation to total program objectives and missions. This is the only time where all the various program approaches can be broached on an individual or equal basis for cost and compatibility comparison. Interactions to other essential program elements (design, manufacturing, test, and operations) logistics requirements, and the resources at this point and time can be estimated, they can be refined, and they can be quantified.

Do we really have to develop a separate logistics system for each kind of system that we are going to come up with in the future? What do we modify? Something in the base support area, maybe as a commonplace backup support? Systems-wise it could easily evolve into situation where we have a peculiar system of support almost for each system. I don't know. We haven't studied it. The best means must be selected for achieving the logistics objectives and in turn it must be integrated directly toward common program goals.

Management practices and systems analysis techniques I think can be identified. Procedures for acquiring, tracking, and measuring logistics performance should be developed in a manner and time frame for implementation which will contribute to the realization of overall program goals at the lowest practical total cost. These must be consistent with program schedule requirements. Now, action is currently underway in the second instance of NASA to meet this challenge. We're now in the process of developing a checklist of logistics actions, and I know you heard General Phillips, my boss, yesterday. He has a checklist to cover everything. So did other people mention this; but we are developing a checklist which we will recommend for inclusion and use in their phase project planning, which Dr. Mueller, also, mentioned yesterday and of which Mr. Vecchietti also spoke in passing this morning.

When this effort is consumated, our logistics support systems and the attendant resources will be considered early and they will be subjected to the same critical analysis as other major planning elements of the program. The Department of Defense is also working on this subject through the Logistics Management Institute. Logistics; Management Institute Project 6615 contemplates the development of a integrated system of logistics support planning, requirement, and guidance for use throughout all phases of life-cycle of weapon systems. NASA and LMI have established an informal interface to exchange information, particularly in techniques of measurement and measurement analysis. Other management actions of an interrelated and complementary nature are underway under the guidance of Mr. Vecchietti. These include the development of, one, a handbook to be used as a guide in the preparation of contract work statements, the performance profile for contractor performances evaluation, and the spare parts provisioning document for agency-wide use within NASA.

The foregoing, in my view, are important steps in the amalgamation of systems management methods, particularly for application and use in the management and control of our logistics requirements and attended resources. However, considerable work is still required to insure that we upgrade ourselves and take advantage of the many management techniques which are available for on-the-job application. I am reminded of a quote from Admiral Rayburn of Polaris fame, "if you can think out a plan, you can also write it down." I would like to go one step further. If you can write it down, it can also be broken out into tasks. If you can test it you can establish milestones. If you can milestone it, you can flow diagram the thing for tracking. You can place weights on it for ranking, and then you can incentivize it. Now what this really means is that we should be able to make practical application of these techniques which are helping to make logistics and logistics management a true professional technology. Thank you.

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PROCUREMENT EVALUATION: PANELIST

MAJOR GENERAL JOHN L. McCOY, USAF, Commander Ballistic Systems Division, ASSC, is a graduate of the US Military Academy, of the Command and General Staff School, of the Air Command and Staff School, and the National War College. He was in Guam at the close of WW II and with the Far East AF Bomber Command during Korea. His service has included direction of pilot training; Director of Material, Hdq. Second Air Force; Asst. Director, Systems Management ARDC; Deputy for Ballistic Missiles, BSD; Program Director, Titan ICBM; and Program Director, Minuteman ICBM. He has been awarded the Distinguished Flying Cross, Bronze Star, Air Medal with Oak Leaf Cluster, and Legion of Merit.

If you have been waiting for the end to find the answer to this logistics problem this is your last chance, and I'm sorry I don't have the answer. It also makes it difficult to tell you something new, and the speech I had prepared has been torn up long ago. I want only to reflect on some things that have been said, for I feel that they affect the ability to get procurement, to influence, and to measure the performance of the logistics function. There's currently almost a revolution in our procurement field and the incentive contracts that have been mentioned give a very wide opportunity for all of us to improve the utilization of these incentive features. I know from my own point of view and from the fairly broad range of forms of incentive contracting to which we have gone in the Air Force ballistic program that we have yet to achieve a very fine balance in these incentives.

Probably the best example I can give you of measuring logistics performance through the procurement process is the most expensive single element of Minuteman, the guidance control system, which is a little under a half million dollars per copy. For a thousand-missile force, this is a very high-priced item for logistics support. In the planning for the spares and spares systems and components for this, you can well imagine that there has been a great deal of effort that's gone into establishing a budget for reliability in the mean-time between failure of the gyros and the various elements of the systems.

In concert with the development of the latest version of this guidance and control system, my friends in the atomic scientific brotherhood have been inventing new weapons, and they have had their effects on our systems. So we had to re-design the guidance and control system after it was in development, and you can appreciate the impact on logistics and logistics planning. We had a critical design review on the current model in April 1963, another one a year later in April 1964, and a final one in February 1965. Thus, considering critical design reviews of a system that was changing that much, you can imagine the problems that would have been forced upon a logistics planner if the engineers had come up with a plan to contract for logistics support in 1962 and had been expected to stay with it.

There is a very severe problem, however, with the mean-time between failure which is now beginning to be exposed in the field. Our first experience says that our planned logistics systems are not sufficient to support the experienced mean-time between failures. Also, our fiscal 1967 procurement of these systems was based on incentive contracts that rewarded the contractor principally in the areas of cost and some of the elements of accuracy. It didn't seem right to have the principal incentive based on cost of the system, where our main concern was increase in the mean-time between failure. So we modified the contracts and we have a very strong incentive for Autonetics, North American, to meet and even increase the mean-time between failure of this system. It will be measured through the procurement plan, so we have what I think is an opportunity to experiment with some incentive features which influence logistics planning.

Now back to last night and Dr. von Braun's description of the "brave new world" for the Society of Logistics Engineers. I believe it's really true. I think that the challenge General Zeirdt made to NASA means that the evolution and the expansion, almost explosion, of the procurement process can be accompanied by some imagination and some very desperately needed effort in the engineering of the logistics systems so these can be incorporated earlier in the procurement process. This integration effort probably will swing like a pendulum and we will become tied up in the contractual arrangement between the government, the Air Force, and industry in logistics objectives that may not be met. But after we have allowed the pendulum to swing from where it is now with almost no integration, to the other direction, I think we will have the opportunity to make something out of the marriage of the procurement system with the logistics system, and the engineering of both. And, as Sterling Smeltzer was describing the wall for logistics with the logistics element bricks held together with the mortar of element integration, I mentally built the other wall that keeps the auditorium in balance. This other wall is built of program management discipline blocks including reliability, configuration management, logistics support, and procurement. The mortar which holds the blocks together is the integration of these disciplines with total program requirements and management. However, the walls must be built together and at the same time, to provide a usable auditorium.

QUESTIONS AND ANSWERS: MODERATOR AND PANEL

Mr. Sutherland: Now who has a question? We are running a little behind, but would like to get as many questions as possible.

Question: Mr. Waller, you mentioned something about a logistics checklist. Can you tell me when that will be available?

Mr. Waller: I can't give you the kind of answer that I would like to, but I can tell you about where we stand. The checklist is somewhere between 65 and 70 percent complete. Our target date for getting it into the hands of the normal review cycle is about a month and a half away. I'm convinced we'll meet that deadline. We will then proceed in the normal coordination cycle, but planning instructions are from the agencies in the first place so I don't view that your're going to get them before a year and a half at the outset.

Question: I don't know how to phrase it, but there is a nagging thought in the back of my mind as a result of conversation about evaluation of performance. In this 25 percent of our budget there is an opportunity to make a great savings. General McCoy has pointed out improvements in reliability and also maintainability, but the crux of the problem perhaps lies in the selection of the contractor in the first place. We are in a system where we select contractors on a competitive basis, and our contracting officers are hard-nosed enough to want their answers in dollars. I think we've got a real tough problem in deciding how to evaluate predictive reliability and maintainability in a contract selection process.

General McCoy: Precisely! One of the answers we are looking for concerns how you go about evaluating this very nebulous sort of thing. All contractors promise wonders.

Question: I have one for General Zierdt. The question is, what methods does the Army use to insure logistics consideration in their trade-off studies during the preconceptual and conceptual phase?

General Zierdt: I have in my command maintenance engineers and production people, and they are made part of the boards and sub-boards and subcommittees which we set up for evaluation. I think this is one of the best things you get out of a commodity command in the Army. I have here on one installation people who are experts in maintenance and reliability. They were a real and complete part of the SAM-D evaluation, for example, and will continue to be so as we go through the contract definition phase that we are in now. Does that answer your question? question?

Question: Yet that answers it. I have one more question. What specific method of measurements do you use?

General Zierdt: I think that the specific method of measurement is something that the engineers have to decide. What performance do you want out of this particular item, this monster that you're creating? I could break it down into its components and could give you specifics but I would have to sit down with an engineer and we would have to determine each one on its merits. I don't see any other way to do it. We have people who are qualified in the guidance field. They know what the state of the art is in the guidance so they would determine what the factors are ahead of time.

CLOSING: JOHN F. SUTHERLAND

I'd like to read you one little gem on the general theory of leaving them laughing. I think this is fairly funny, and I think some of you have read it. I chased it back to about 1936 and I'm still looking for the author; I am sure he came out of the Army. It's a summarization of logisticians. It says logisticians are a sad and bittered race of men, very much in demand in war, who sink resentfully into obscurity in peace. They deal only with facts, but must work for men who merchant in theories. They emerge during war because war is very much fact. They disappear in peace because in peace, war is mostly theory. The people who merchant in theories, who employ logisticians in war and ignore them in peace, are called generals. Logisticians hate generals. Generals are a happily blessed race who radiate confidence and power. They feed only on ambrosia and drink only nectar. In peace they strive confidently to invade a world simply by sweeping their hands blandly over a map, pointing their fingers decisively up terrain corridors and blocking defiles and obstacles with the sides of their hands. In war they must stride more slowly because each general has a logistician riding on his back, and he knows that at any moment the logistican may lean forward and whisper in his ear, "Oh, you can't do that." Generals fear logisticans in war, and in peace generals try to forget logisticians. Marching along beside generals are strategists and tacticians. Logisticians despise strategists and tacticians. Strategists and tacticians don't know about logisticians until they grow up to be generals, which they usually do. Sometimes a logistician gets to be a general. In such a case he must associate with generals whom he hates. He has a retinue of strategists and tacticians he despises, and on his back is the logistican whom he fears. This is why a logistician who gets stars also gets ulcers and cannot eat his ambrosia."

CONCLUSION

The objectives set forth for the symposium were:

1. definition of logistics elements to serve as a common base of understanding.

2. development of an effective communications vehicle for exchange of support information between NASA, DOD, and industry.

3. presentation of support management techniques and procedures to program management.

4. presentation of program support requirements to all echelons of Government and industry management.

5. determination of a requirement for program support standards for future support programs.

6. development of closer relations between program and support managers of Government and industry.

A study of the papers presented shows that all of the cited objectives were satisfied, except for objective 5, the development of program support standards; even so, the principles set forth in the papers will serve as a sound basis for the subsequent development of standards.

One symposium objective was the establishment of a logistics management communications link between NASA and industry at the top and program manager levels. An allied objective was to thoroughly explore the broad facets of support management for establishing a base of understanding for top and program managers. This was accomplished in such a way that the timeliness of support program implementation was emphasized. This will insure consideration of these requirements as related to the pertinent program schedule milestones to preclude costly get-well procedures which would compensate for delayed support implementation.

The Air Force, Army, and Navy described their present procedures for program support and related them to possible NASA use. While a presentation of present practices does not satisfy the need for a future guide, it does provide an absolutely necessary base for planning the next symposium, especially if one of the objectives is "where do we go from here."

Objectives which were not fully achieved during the First Annual Management Symposium which were outgrowth from discussions during the Symposium, or which were reserved for later meetings, are of five general categories. These include:

1. an examination of the elements of logistics support.

2. determination of detailed methods of management and control of logistics support, including contracting, identification of critical elements, methods of display and methods of monitoring.

3. development of NASA standards for logistics requirements which will provide a checklist or guide for scoping each support program in accord with the requirements of specific programs.

4. development of practical advanced predictive procedures for support programs based on present and past programs.

5. development of a logistics formal education program which will enable logisticians to broaden their technical knowledge and also privde a reservoir of formally educated personnel for work in the logistics field.

CLOSING REMARKS: BRIGADIER GENERAL EDMUND F. O'CONNOR

On behalf of Dr. von Braun, and also speaking for myself, let me express my gratification as this First Annual Logistics Management Symposium draws to a close.

I think there is no doubt in anyone's mind that it has been a success. I have learned a great deal in the past day and a half, as I am sure all of you have. I feel certain that program management now has a deeper appreciation for the logistics elements of their program, and the logistics manager must appreciate more readily the many problems faced by the program manager. All of this makes for better relations and improves management.

My personal thanks go to all of the speakers who so graciously consented to be with us. And I would be remiss in my duties if I did not also express the thanks of all of us to you very busy managers who have interrupted your schedules to listen to the proceedings.

Let me assure you that we do not intend now to rest on our laurels. We shall continue to seek even greater understanding of management and shall strive to carry out a program of effective logistics management in accordance with the principles outlined during this symposium.

I sincerely hope that very shortly we shall see the establishment of the educational program which Dr. von Braun outlined last evening, and once again I should like to reaffirm that Marshall Space Flight Center not only supports this proposal, but will actively participate in its development.

It has been a very great pleasure for me to have acted as your host. Again my thanks and best wishes for a continued and increasing interest in logistics management.

We shall all look forward to the time when we shall meet again next year.

APPENDICES

APPENDIX A. MEMORANDUM OF AGREEMENT BETWEEN AFLC/AFSC

PART I AFLC SUPPLY TASKS

AFLC SUPPLY RESPONSIBILITIES TO BE DISCHARGED DURING CONCEPTUAL, DEFINITION, AND ACQUISITION PHASES IN SUPPORT OF THE OPERATIONAL PHASE OF SYSTEM PROGRAMS.

TASK NO.	DESCRIPTION OF TASKS
1	Expand SOR Supply concept in: a. Section 8 PSPP b. Section 8 SPP c. Materiel Support Plan
2	Update as required Section 8: a. PSPP b. SPP
3	Develop and project common/standard AGE (MGE) quantitative requirements for support of the operational program.
4	Develop fund requirements for all initial spare parts (including provisioning documentation) for inclusion in PSPP/SPP, Section 11.
5	Develop and disseminate Weapon System Equipment Component List (WSECL).
6	Prepare and distribute initial Controlled Mission Equipment (CME) and Absolute Essential Equipment (AEE) list and revisions.
7	Obtain end item applicability of spare parts requested by contractor.

TASK NO.	DESCRIPTION OF TASKS
8	Determine procurement data requirements for Spares and Spare Parts.
9	Apply MIL-D-26715 data: a. Initiate Requirements. b. Place on Contract c. Process Data.
10	Determine supply support system (e.g., Vol XXIII, AFM 67-1, etc.).
11	Activate supply support system.
12	Establish qualitative and quantitative requirements for facilities to support unconventional storage and warehousing requirements; ammunitions, fuels, explosives, etc. a. Organizational. b. Field. c. Depot.
13	Establish criteria for contractor supply support for Cat III Testing and operations.
14	Determine the utilization of residual assets received from Acquisition Phase for operational use.
15	Prepare and implement plan for maximum use of assets received from other Government agencies, e.g., Army, FAA, etc.
16	Code listings of RPIE spare parts which will be CP/BP supported.
17	Prepare Statement of Provisioning Policy (Forms 263 and 263A).
18	Conduct guidance meeting (AFPI 71-673/674).
19	Provisioning Programming Check Lists (Forms 321 series and Form 555): a. Programming Preparation. b. Processing. c. Dissemination.
20	Determine repair kit requirements for recoverable items.
21	Compute Ware Readiness Materiel (WRM) requirements.
22	Process applicable supply management data and determine interchangeability and standardization data (MIL-I-8500).
23	Review and determine Figure 2 data for AFLC to be incorporated into MIL Handbook 300 (Appendix C, MIL-D-9412).
24	Obtain from AFSC official Noun-Name to equipment (MIL-N-18307C) or (MIL-N-7513C).

TASK NO.	DESCRIPTION OF TASKS
25	Obtain from AFSC official type designation for equipment (MIL-STD-196/ANA Bulletin 440, MIL-STD-155).
26	Initiate actions to update, modify or dispose of assets affected by Configuration Control Board actions.
27	Analyze supply data obtained from Development, Test and Site activation programs for utilization in preparing budgets and computation of requirements to support Operational Phase.
28	Establish quantitative requirements for AGE (MGE) for operational program (AFPI 71-650).
29	Prepare shipping instructions for AGE (MGE) to operating command (AFPI 71-650).
30	Provide provisioning Spare Parts order to contractor (AFPI 71-673).
31	Assure that operational supply support considerations are covered in site selection surveys.
32	Resident provisioning team operation for support of the operational phase: a. Initiate necessary contractual actions. b. Conduct operations. c. Provide representatives to provisioning teams. d. Provide SPD with periodic status reports.
33	Develop provisioning policies and procedures to be used in the acquisition of all initial spares for systems/equipment.
34	Initial Spares lay-in (org, field, depot): a. Establish stock levels. b. Establish delivery schedules. c. Initiate shipping instructions. d. Maintain status of lay-in. e. Provide SPD with periodic initial Spares lay-in status reports.
35	Insure timely programming of DD 780 Common Standard type equipment for support of operational program.
36	Develop supply support documentation inputs to the system contract for support of operational phase: a. Contractual exhibits. b. Work statements.
37	Develop contractual requirements for the preparation and submission of engineering data (cataloging, standardization, etc.,) required for operational support. AFLC/AFSC Manual 310-1.

TASK NO.	DESCRIPTION OF TASKS
38	Establish supply milestones to reflect actions necessary for operational program.
39	Develop applicable cataloging specifications (i.e., prescreening, etc.) for inclusion in contracts.
40	Provide supply input to international agreements relating to AFLC's operational support.
41	Compute requirements, manage, and accomplish provisioning/source coding for acquisition of initial spares for operational programs.
42	Provide supply operational support inputs to host-tenant agreements.
43	Review and comment where appropriate, on AGE plan and Figure 1.
44	Chair AGE (MGE) contractor provisioning guidance meetings (AFPI 71-650).
45	Review Section 6 and update Section 8, PSPP/SPP, to insure an orderly transition of supply support from Acquisition to Operational Phase.
46	Establish basis of issue on Figure A for AGE (MGE).
47	Implement the principles of Selective Item Management. (Hi-Valu).
	AFLC TRAINING EQUIPMENT SUPPLY RESPONSIBILITIES TO BE DISCHARGED DURING CONCEPTUAL, DEFINITION AND ACQUISITION PHASES IN SUPPORT OF OPERATIONAL PHASE.
48	Develop the operational supply support plan for training equipment for inclusion in Section 8, PSPP/SPP.
49	Develop operational spares support program data for trainers and training equipment.
50	Develop policies and procedures covering disposition of ATC's trainer and training equipment.
51	Develop the operational supply support documentation inputs to training equipment contract(s).
52	Develop or approve and publish table of allowance documents for training equipment.
53	Prepare and publish stock list catalogs for Training Equipment and Spares.
54	Accomplish training equipment inventory control.
55	Accomplish NORS, critical item, etc., status reporting for Class I Training Equipment.
56	Provide operational supply support input to training equipment portion of transition agreement.

PART II AFLC MAINTENANCE TASKS

AFLC MAINTENANCE RESPONSIBILITIES TO BE DISCHARGED DURING CONCEPTUAL, DEFINITION AND ACQUISITION PHASES IN SUPPORT OF THE OPERATIONAL PHASE OF SYSTEM PROGRAMS.

TASK NO.	DESCRIPTION OF TASKS
1	Develop Maintenance Engineering plans and requirements for inclusion in Section 8 of PSPP/SPP.
2	Provide maintenance representation in System Source Selection Board proceedings.
3	Provide maintenance input for preparation of Category III Test Support Plans.
4	Develop qualitative and quantitative requirements and time-phased schedules for facilities to support depot maintenance.
5	Analyze test program results for maintenance implications.
6	Insure preparation of -06 Work Unit Code Manuals to permit AFM 66-1 data collection for operational maintenance program.
7	Plan depot level maintenance capability, i.e., SRA/MDA/Contractor.
8	Provide maintenance representation for Engineering Inspections and other reviews, e.g., DEI, FACI, etc.
9	Establish Repair Programs for reparable items: a. GFAE Common b. GFAE Peculiar c. DSA Items d. GFP and/or Bailed
10	Determine quantitative AGE requirements for Depot level maintenance.
11	Provide response to Maintenance Engineering queries from USAF, ATC, Using Commands, etc., concerning the operational phase and including the Category III test programs.
12	Respond to EUR, MIP, and Accident/Incident Reports as pertains to operational phase.
13	Determine Depot requirements for Contract Technical Services Personnel (CTSP).
14	Develop and/or review operational maintenance portions of Joint Tenancy Support Agreements (AFR 11-4).
15	Resolve maintenance interface problems between Contractors, Using Command, AFLC, AFSC, and other services pertaining to the operational phase, including the Category III test program.

TASK NO.	DESCRIPTION OF TASKS
16	Determine reparability of all items of materiel; select, source code, and establish maintenance factors for Air Force spares and spare parts support.
17	Issue immediate, urgent and routine action T. O. 's.
18	Participate in the selection of specific items for configuration accounting.
19	Establish Depot tooling schedules.
20	Present the AFLC position on updating changes/modifications to the SPO CCB.
21	Establish operational maintenance data collection system in consonance with AFM 66-1 for the system.
22	Review standard failure data to determine trends and initiate MIP action.
23	Review contractor mathematical logistics models (repair cycle) for operational maintenance implications.
24	Develop maintenance workload requirements for SRA's/MDA's.
25	Provide maintenance input for updating characteristic screening data.
26	Determine adequacy of and provide effective instructions for corrosion prevention/control procedures.
27	Develop the AFLC maintenance aspects of the plan for transition of systems and equipment engineering from AFSC to AFLC.
28	Validate -6 inspection and work card procedures and requirements.
29	Review and recommend tools and equipment for inclusion in ECLs.
30	Assure compatibility of Section 8 maintenance concepts and requirements with Sections 5 and 6 of PSPP/SPP.
31	Establish which items must be organically support from initial turnover and develop time phase plan to insure SRA by need date.
32	Develop a plan for periodic review of depot maintenance to insure maximum field maintenance is being accomplished by the using command.
33	Prepare precise maintenance criteria as to what will be inspected/demonstrated during engineering inspections (AFR 80-28) and test programs (AFR 80-14).
34	Establish maintenance requirements for GEEIA installation engineering and installation technical data.
35	Participate in the Design Reviews for the purpose of assuring contractor compliance with maintainability requirements.
36	Develop calibration plan for test equipment within AFLC. a. Determine requirements. b. Budget for requirements. c. Determine activity responsible for calibration of each item.

TASK NO.	DESCRIPTION OF TASKS
37	Verify during Category III tests, calibration data and procedures that had been developed for systems/equipment.
38	Participate in contractor development of site activation plans to insure maximum compatibility with AF maintenance concepts, and to provide optimum joint use of facilities, test equipment, and spares. (AFSCR 400-3/AFLCR 400-19).
39	Review contractor production tooling method/technique for application to depot use.
40	Review and revise inspection requirements based upon reliability/maintainability data and failure reports obtained during Cat II tests.
41	Provide operational maintainability requirements inputs for system/equipment design specifications (AFR 66-29).
42	Review maintainability and maintenance analysis data provided by contractor to verify consonance with AF maintenance policies and practices. (MIL-M-26512C).
43	Review contractors PME Certification Program.
44	Prepare and publish CEM-Maintenance and Supply Support Lists.
45	Develop plans for the accomplishment of updating change/modification program.
46	Determine the need for parts kits and request the application of AFPI 71-673 (Incl 3).
47	Furnish to SPD, AFLC requirements for contractual coverage of configuration data (baseline, approved modifications, production accomplishments) as authorized by AFR 310-1 and supporting documents.
48	Plan and schedule transfer of configuration records during transition of system responsibilities.
	AFLC MAINTENANCE RESPONSIBILITIES TO BE DISCHARGED DURING CONCEPTUAL, DEFINITION AND ACQUISITION PHASES IN SUPPORT OF TRAINING REQUIREMENTS.
49	Develop training equipment portion of Materiel Support Plan.
50	Accomplish source coding of training equipment and spare parts.
51	Provide maintenance training plan for inclusion in PSPP/SPP, Section 8.
52	Participate in mockup inspection review of training equipment.
	AFLC TECHNICAL MANUAL RESPONSIBILITIES
53	Develop Technical Manual objectives for inclusion in Section 8, PSPP/SPP.
54	Determine the quantitative technical manual/orders requirements to support systems.

TASK NO.	DESCRIPTION OF TASKS
55	Provide Technical Manual publication numbers to contractor.
56	Conduct operational Post Publication Review of Technical Manuals.
57	Determine changes to Technical Manuals that are required by modifications to operational equipment.
58	Determine the specific technical orders required to support a system or equipment and forward these requirements to the SPD.
59	Provide assistance in accomplishing pre-publication and verification review of T. O. 's.
60	Coordinate requests for deviations from specifications to assure that logistics support impacts for the operational inventory are considered.

PART III AFLC TRANSPORTATION TASKS

AFLC TRANSPORTATION RESPONSIBILITIES TO BE DISCHARGED DURING CONCEPTUAL, DEFINITION AND ACQUISITION PHASES OF THE OPERATIONAL PHASE OF SYSTEM PROGRAMS.

TASK NO.	DESCRIPTION OF TASKS
1	Develop transportation packaging and materials handling objectives, principles, general qualitative requirements, concepts and other considerations for input into PTDP and Section 8 of PSPP/SPP with AFSC and using commands.
2	Provide technical guidance to assure transportation, packaging and materials handling requirements, including those of using command, are given adequate consideration in system programs: a. Evaluate design proposals and specifications. b. Evaluate proposed modifications and Engineering Change Proposals. c. Participate in DEI's, CTCI's, mockups, etc.
3	Provide technical logistic guidance to the SPO to assure the incorporation of required operational support handling and transport characteristics in the design of systems hardware and design and selection of transport and handling equipment: a. Provide operational support handling and transportability requirements for use by the contractor in design effort. b. Evaluate contractor proposals for adequacy of handling and transport AGE. c. Provide specific considerations to be included in handling loading and unloading tests and demonstrations. d. Evaluate contractor developments at DEI's, CTCI's, mockups, tests, AGE meetings, and demonstrations.

TASK NO.	DESCRIPTION OF TASKS
4	During source selection, evaluate traffic patterns, packaging capability, overall contractor ability to perform transportation tasks, etc.
5	Develop transportation section of Materiel Support Plan.
6	Develop detailed Transportation Movement Plans for operational phase: Update the plan and insure compliance with the plan.
7	Arrange for and provide the contractor with technical Transportation direction and guidance for movement of materiel to and from and between contractor facilities.
8	Review actions of contractors to determine compliance with movement and documentation instructions supporting the operational phase.
9	Manage movement requirements for MATS special airlift services to support the operational phase.
10	Manage movement requirements for MATS scheduled services to support operational phase.
11	Manage movement requirements for MSTS services, both scheduled and special lift to support operational phase.
12	Develop operational phase fund requirements for First Destination cargo (FDT) and packaging costs. Provide cost estimates to SPO.
13	Develop fund requirements for second destination cargo.
14	Provide buyers/contracting officers with operational requirements for transportation, packaging and handling factors for consideration during contract negotiations and/or in support of Invitations for Bids (IFB's) and Requests for Proposals (RFP's).
15	Prepare Section 5 (Preparation for Delivery) requirements of "Commodity Specifications" as pertains to operational support.
16	Develop operational packaging and materials handling requirements and terminology for inclusion in contractual exhibits and specifications.
17	Provide technical Packaging, Materials Handling and Transportation guidance to using commands.
18	Participate in Source Coding Conference to insure consideration of Packaging and Handling requirements.
19	Develop technical data requirements, detailed instructions, drawings, specifications, for Packaging and Materials Handling.
20	Evaluate adequacy of contractor prepared technical data for handling, loading, etc.
21	Provide handling methods analysis for use in selection and in determination of basis of issue of systems handling equipment and establishing authorization and distribution.

TASK NO.	DESCRIPTION OF TASKS
22	Review Cat III test results and failure data to update packaging and transportation instructions, criteria and techniques.
23	Develop and monitor a "Loss and Damage Prevention Program" to control improper or inadequate packaging or handling.
24	Provide operational support, transportation, packaging, and materials handling input into transition agreements.
25	Prepare detailed handling techniques and methods for inclusion in the training support plan and instructions.
26	Negotiate systems transportation, packaging, and materials handling support portion of Host/Tenant Support agreements.
27	Furnish requirements for and obtain special transportation support (LOGAIR routes, Extra Sections, contract carriage, etc.)
28	Develop and/or evaluate Packaging and Materials Handling techniques, special container, equipment and devices.
29	Review and coordinate transportation packaging and materials handling equipment and techniques for input into "Dash 9" Handbook.

APPENDIX B. MEMORANDUM OF AGREEMENT BETWEEN AFLC/AFSC

PART I. AFSC MAINTENANCE TASKS

AFSC MAINTENANCE RESPONSIBILITIES TO BE DISCHARGED IN SUPPORT OF CONCEPTUAL, DEFINITION AND ACQUISITION PHASES OF SYSTEM PROGRAMS.

TASK NO.	DESCRIPTION OF TASKS
1	Develop qualitative and quantitative maintenance facility requirements to support Category I and II Test programs.
2	Establish time-phased schedule for maintenance facilities required to support Category I and II Test programs.
3	Develop Maintenance Engineering Support Objectives for inclusion in Section 6 of PSPP/SPP.
4	Provide Section 11 (PSPP/SPP) cost estimates for maintenance support of Category I and II Test programs.
5	Participate in maintainability determination for System Design requirements.
6	Provide maintenance representation in Source Selection activity.
7	Prepare Work Statements and/or Exhibits to establish and guide the contractor's Maintenance Program for support of Development, Test and Site activation.
8	Provide Maintenance criteria and inputs to contractor management surveys regarding Development, Test and Site activation.
9	Evaluate and approve contractors proposed maintenance plan in support of Development, Test and Site activation.
10	Provide maintenance input for preparation of Test Support Plans during Category I and II.

TASK NO.	DESCRIPTION OF TASKS
11	Analyze Test program results for Maintenance implications.
12	Participate in the preparation of -06 "Work Unit Code Manuals" to insure implementation of AFM 66-1 Data Collection during Category II testing.
	a. Participate in the preparation of -6 "Inspection Requirements Manual" to facilitate the implementation of AFM 66-1.
13	Participate in the evaluation of those proposed update changes resulting from Category testing.
14	Establish Repair Programs for reparable items:
	a. GFAE Common
	b. GFAE Peculiar
	c. DSA Items
	d. GFE Peculiar
	e. GFP and/or Bailed
15	Participate as required with AFLC in Source Coding Conferences.
16	Participate in the evaluation of contractors Precision Measuring Equipment (PME) Certification Program including Review of Calibration Requirements Summary (Figure 3).
17	Provide maintenance inputs as necessary at applicable GFAE/GFP provisioning conferences.
18	Provide response on Maintenance queries from USAF, ATC, Using Commands, etc., during Development, Test and Site activation.
19	Respond to EUR, MIP, or Accident/Incident Reports during Development, Test and Site Activation.
20	Develop criteria for Contract Technical Services personnel (CTSP) used in completing the acquisition process.
21	Provide Maintenance input for resolution of maintenance interface problems between Contractors, Using Command, AFLC, AFSC and other services during Development, Test and Site activation.
22	Provide available maintenance data to AFLC for issuing immediate and urgent action T. O. as required.
23	Establish requirement for and insure adequacy of corrosion control procedures.
24	Develop the AFSC maintenance aspects of the plan for transition of systems and equipment from AFSC to AFLC.
25	Participate in review of maintenance concepts and plans contained in Sections 5, 6, and 8 of PSPP/SPP.

TASK NO.	DESCRIPTION OF TASKS
26	Plan contractor depot level maintenance support during Development, Test and Site activation.
27	Develop and/or review Maintenance portion of Joint Tenancy Support Agreements (AFR 11-4).
28	Review contractor mathematical logistics model (repair cycle for DT&E maintenance implications).
29	Prepare contractual exhibits which will enable using command "over-the-shoulder" participation in maintenance tasks during test and site activation.
30	Evaluate site activation plans for compatibility with AF maintenance concepts for joint utilization of facilities, equipment and spares.
31	Provide maintenance representation for engineering reviews and inspections, e.g., DEI, FACI, etc., in support of system acquisition.
32	Develop and provide information for contractors on AF Maintenance capabilities and limitations (skill level, etc.) for guidance in design of hardware for non-operational systems.
33	Establish requirement for reporting maintenance actions in accordance with AFM 66-1 during acquisition effort.
34	Participate in the qualitative evaluation of tooling requirements for all levels of maintenance.
35	Participate in configuration control board action.

AFSC MAINTENANCE RESPONSIBILITIES PERFORMED DURING CONCEPTUAL, DEFINITION AND ACQUISITION FOR TRAINING REQUIREMENTS.

TASK NO.	DESCRIPTION OF TASKS
36	Provide maintenance input to exhibit and work statements for initial training equipment contracts.
37	Provide maintenance training plan for inclusion in PSPP/SPP, Section 6.

PART II. AFSC SUPPLY TASKS

AFSC SUPPLY RESPONSIBILITIES TO BE DISCHARGED IN SUPPORT OF CONCEPTUAL, DEFINITION AND ACQUISITION PHASES OF SYSTEM PROGRAMS.

TASK NO.	DESCRIPTION OF TASKS
1	Prepare supply support guidance and parameters for inclusion in "Request for Proposal" to be utilized by contractors in developing their proposals.
2	Evaluate contractors supply support proposals during Source Selection conferences.

TASK NO.	DESCRIPTION OF TASKS
3	Develop Supply Support Concept for inclusion in Section 6, PSPP/SPP: a. Development and Test. b. Site activation.
4	Review, analyze, and refine cost estimates for supply support of Development, Test and Site activation for inclusion in Section 11, PSPP/SPP: a. System Equipment (1) CFE Spares and Spare Parts. (2) GFAE/GFP Peculiar and Common Spares and Spare Parts. (3) Applicable DSA/GSA Stock Funded Items.
5	Utilize the System Program Documents to formulate criteria necessary to compute Development, Test and Site activation quantitative requirements.
6	Review and approve quantitative requirements to support DT&E and Site activation for: a. CFE Spares and Spare Parts. b. GFAE/GFP Spares and Spare Parts. c. Applicable DSA/GSA Stock Funded Items.
7	Assure that supply support consideration for Development, Test, and Site activation is covered in site selection surveys.
8	Insure timely receipt of DD 780 type equipment for support of Development, Test, and Site activation.
9	Take action to program established requirements to appropriate agency for Common and Non-standard items, other than those included in test support tables and contractor material listings required in support of Development, Test and Site activation.
10	Develop the supply support documentation inputs to the system contract for support of Development, Test and Site activation: a. Contractual exhibits. b. Work statements.
11	Prepare budget estimates for conventional and unconventional propellants for support of Development and Test.
12	Forecast requirements for conventional and unconventional propellants for support of Development and Test.
13	Validate requirements for conventional and unconventional propellants for support of Development and Test.
14	Establish supply milestones to reflect actions necessary for Development, Test and Site activation.

TASK NO.	DESCRIPTION OF TASKS
15	Develop supply concept for Test plans.
16	Develop supply concept for Site activation plans.
17	Contractor Materiel Support Guidance Conferences regarding Development, Test and Site activation where applicable: a. Chair and conduct Materiel Support Guidance Conferences. b. Review and refine contractors supply support plan for Development and Test programs. c. Approve for implementation the Development and Test program supply support plan.
18	In conjunction with AFLC develop contractual requirements and Command agreements regarding the establishment of Resident Provisioning Teams.
19	Develop AFSC policy and procedures covering the interface between the integrating contractor, associate contractors, Divisions, Centers, CMR and AFLC complement of the Resident Provisioning Teams.
20	Participate in Resident Provisioning Team joint operation: a. Provide representation to Provisioning Team. b. Implement the Spares Joint Usage policy and procedures. c. Maintain a continuous review of contractor's assets, records, and usage data to insure their current status. d. Effect necessary procurement adjustment and downstreaming actions.
21	Develop Test Support Table: a. Provide contractor guidance for preparation of TST. b. Chair TST Conference. c. Evaluate TST in conjunction with AFLC to determine availability of Command standard items in support of Categories I and II Test programs. d. Approve TST quantitative requirements.
22	Develop policies and procedures covering utilization of AFSC residual assets from Development, Test and Site activation, i.e., downstreaming (movement from test site to test site, one program to another) or planned turnover to AFLC in support of the operational program: a. Identify and list residual assets. b. Review residual list for downstreaming. c. Monitor disposition of residual assets.
23	Provide supply input to transfer agreement as relates to Site activation.
24	Maintain current status of NORS and critical items for Development, Test and Site activation programs.

TASK NO.	DESCRIPTION OF TASKS
25	Initiate actions to update, modify or dispose of assets affected by Configuration Control Board actions for support of Development, Test and Site activation.
26	Provide supply representation on System Management surveys.
27	Prepare supply check list for use in System Management surveys.
28	Determine supply requirements for support of bailed aircraft and equipment.
29	Provide supply input to international agreements relating to Development, Test and Site activation programs.
30	Participate as required in the determination of quantitative AGE (MGE) requirements.
31	Participate as required in AGE (MGE) contractor guidance meeting.
32	Participate in review of AGE Plan and Figure 1. Research functional parameters of existing equipment and provide such to Engineering for qualitative determination.
33	Provide acquisition supply support requirement to Joint Tenancy Agreements (AFR 11-4).
34	Review Sections 6 and 8 of PSPP/SPP to insure transition of supply support from Acquisition to the Operational Phase.
35	Perform visits to contractors' plants, training organizations and sites being activated for the purpose of reviewing the implementation of System Support Plan and procedures and to help resolve major supply problems.
36	Participate with elements of Hq AFSC in study groups, panels, committees and meetings, as directed by higher headquarters, concerning supply matters.
37	Transition Agreements: a. Provides supply input to Transition Agreements. b. Approves supply inputs to Transition Agreements.
38	Participate in the preparation of a Master Equipment List (MEL) that will identify Real Property Installed Equipment (RPIE) for a system.
39	Assure development of the Recommended Spare Parts Lists (RSPL) for RPIE.
40	Assure that spare support of RPIE is sufficient to support the equipment until 45 days after final acceptance by the using organization.
41	Insure that contractors lists of residual RPIE assets are properly prepared.
42	Assure management control over supply matters during Test and Site activation.
43	Evaluate, on a continuous basis, the effectiveness of supply activities providing support for Development, Test and Site activation.

TASK NO.	DESCRIPTION OF TASKS
44	Implement the principles of the Selective Management Policy (hi-Valu) during Test and Site activation as applicable in accordance with AFR 400-21.
	AFSC SUPPLY RESPONSIBILITIES TO BE DISCHARGED IN SUPPORT OF CONCEPTUAL, DEFINITION, AND ACQUISITION PHASES FOR TRAINING EQUIPMENT.
45	Provide inputs for training equipment supply portion of Transition Agreement.
46	Develop supply support concept for trainer and training equipment for support of Acquisition Phase.
47	Develop supply support program data requirements for trainers and training equipment in support of Development, Test and Site activation.
48	Participates in Training Equipment Spare Parts Provisioning Conferences.
49	Review and approve contractors recommended spare parts in support of training equipment during site activation.
50	Develop supply policy and procedures covering interface between contractors, using commands, and AFLC in support of training equipment.
51	Provides supply inputs to Development, Test and Site activation training plan.
52	Review and refine contractors cost estimates for spare parts required in support of site activation for training equipment.
53	Initiate actions to implement CCB decisions affecting the update, modification and disposition of spare parts.
54	Develop policies and procedures covering disposition of Test and Site activation assets.
55	Schedule delivery of spares and spare parts.
56	Review contractors recommended list of GFP needed for trainer assembly and/or training. Initiate action to obtain GFP (AF Standard Item) from the Air Force inventory.
57	Determine spares availability for new training equipment prior to delivery.
58	Develop the acquisition supply support work statement inputs to training equipment contract(s).

PART III. AFSC TRANSPORTATION TASKS

TASK NO.	DESCRIPTION OF TASKS
	AFSC TRANSPORTATION RESPONSIBILITIES TO BE DISCHARGED IN SUPPORT OF CONCEPTUAL, DEFINITION AND ACQUISITION PHASES OF SYSTEM PROGRAMS.
1	Develop transportation, packaging, and materials handling objectives, principles, general qualitative requirements, concepts and other considerations for input into PTDP and PSPP/SPP, Section 6, (including spares for test and site activation). Coordinate inputs to PTDP and Section 6 of PSPP and SPP with AFLC.

TASK NO.	DESCRIPTION OF TASKS
2	Develop First Destination Transportation costs and packaging costs for inclusion in Section 11, PSPP/SPP.
3	Develop fund requirements for second destination cargo.
4	During source selection, evaluate traffic patterns, packaging capability, overall contractor ability to perform transportation tasks, etc.
5	Develop packaging and materials handling requirements and terminology for inclusion in contractual exhibits and specifications.
6	Develop Materials Handling techniques, devices, packaging techniques and special containers.
7	Insure packaging and materials handling requirements, including those proposed by major commands, are considered in designing and constructing new equipment and systems.
8	Develop detailed Transportation Movement Plans in support of acquisition; update and insure compliance with the plan.
9	Provide buyers/contracting officers with acquisition support transportation, packaging and handling factors for consideration during contract negotiations and/or in support of Invitations for Bids (IFB's) and Request for Proposals (RFP's).
10	Review actions of contractors to determine compliance with movement and documentation instructions supporting acquisition.
11	Arrange for and provide the contractor with technical Transportation direction and guidance for movement of material to and from and between contractor facilities.
12	Manage movement requirement for MATS special airlift services to support acquisition.
13	Manage movement requirements for MATS scheduled service to support acquisition.
14	Manage movement requirements for MSTS services, both scheduled and special lift in support of acquisition.
15	Insure consideration of transportability criteria.
16	Assure contractor compliance with transportability criteria.
17	Negotiate systems transportation, packaging, and materials handling support portion of Host/Tenant Support Agreements.
18	Furnish requirements for and obtain special transportation support (LOGAIR routes, Extra Sections, contract carriage, etc.).
19	Coordinate and provide input to requirements for bailed cargo aircraft.
20	Verify contractor developed handling, loading packaging technical manuals and specifications.

TASK NO.	DESCRIPTION OF TASKS
11	Develop time phase plan for verification of Technical Manuals and maintenance check lists during Category II testing to include location and participants.
12	Authorize printing of final Technical Manuals.
13	Prepare Quarterly/Annual Cost Report for Technical Manuals.
14	Assure Technical Manual data is documented in DD Form 1423/AFSC Form 40.
15	Review Engineering Change Proposals to determine Technical Manual Changes or revisions required during DT& E.
16	Conduct initial post publication review of Technical Manuals.
17	Determine qualitative technical manual requirements to support system.
18	Participate in the determination of maintenance training equipment requirements.
19	Assist in preparation of Training Equipment Planning Information (TEPI).
20	Selectively participate in mockup inspection and review of training equipment.

TASK NO.	DESCRIPTION OF TASKS
21	Review and verify AF developed handling, loading, and packaging instructions for applicability to systems/equipment and specifications.
22	Provide transportation, packaging, and materials handling input into transition agreements.
23	Review and coordinate transportation packaging and materials handling equipment and techniques for input into "Dash 9" Handbook.
24	Prepare detailed handling techniques and methods for inclusion in the training support plan and instructions.
25	Provide technical guidance to insure transportation packaging and material handling requirements, including those of using command, are given adequate consideration in system programs: a. Evaluate design proposals and specifications. b. Evaluate proposed modifications and Engineering Change Proposals. c. Participate in DEI's, CTCI's, mockups, etc.
26	Develop Transportation Packaging and Materials Handling input to Materiel Support Plans.

OTHER AFSC SYSTEM MANAGEMENT FUNCTIONS HAVING LOGISTICS IMPLICATIONS

PART IV. TECHNICAL MANUAL RESPONSIBILITIES

TASK NO.	DESCRIPTION OF TASKS
1	Develop budget estimates on Technical Manual preparation and printing for inclusion in Section 11 PSPP/SPP.
2	Develop contractual documents (i.e., work statements, purchase requests, etc.) for Technical Manuals.
3	Review contractors Technical Manual proposal.
4	Approve contractors Technical Manual publication plans.
5	Conduct Technical Manual requirements and guidance conference with contractor.
6	Schedule milestones of events for delivery of Technical Manuals.
7	Conduct pre-publication review of Technical Manuals.
8	Assure validation of Technical Manuals by Contractor.
9	Accept reproduction art work and negatives from Technical Manual contractor.
10	Assure delivery of preliminary Technical Manuals to Test Sites and Training Activities.