TOP SECRET
Handle Via BYEMAN
Control System

File 575-F

DEPARTMENT OF THE AIR FORCE
WASHINGTON, D.C. 20330

OFFICE OF THE SECRETARY

AUG 10 1978

MEMORANDUM FOR THE SECRETARY OF DEFENSE

SUBJECT: Space Shuttle Transition Plan

On 26 June you asked that I request Dr. Mark lead a review of the Shuttle Transition Plan to see if benefits could be derived from accelerating current schedules. The attached report is the product of an extensive reexamination of all facets of our transition policy and supporting plans. During the course of the review, Dr. Mark held meetings with all of the managers of the Space Flight Projects in the Department of Defense and the CIA.

The attached study examines possible schedule changes and weighs the benefits that might be derived against costs and risks. Tables following the executive summary represent our best judgment on the practicality of accelerating individual spacecraft transition to the Shuttle. The actions recommended will permit all programs to take maximum advantage of the operational opportunities and resource efficiencies offered by the Shuttle.

If additional information or clarification is desired please let us help. We are deeply interested in and working hard to insure a timely and cost effective transition to the Shuttle.

John C. Stetson

Attachment

Upon physical removal of all caveats, this document is unclassified.

BYE-13131-78
Cy 9 of ___ Cys

TOP SECRET
Handle Via BYEMAN
Control System

HANDLE VIA
BYEMAN
CONTROL SYSTEM

~~TOP SECRET~~

~~(S)~~ NATIONAL RECONNAISSANCE OFFICE
WASHINGTON, D.C.

THE NRO STAFF

13 SEP 1978

MEMORANDUM FOR SURVEY AND INVESTIGATION TEAM

SUBJECT: Transition Plan for Defense and Intelligence Satellites to the Space Transportation System

The subject report is provided for your information. Please understand that this report was prepared by Dr. Mark at Secretary Brown's request, as a new look at possible early transition of DOD payloads to the shuttle. The report is not yet fully coordinated within OSD and thus does not reflect a DOD position; but rather a report of the study committee.

J. D. HILL
Director

1 Atch
Space Shuttle Transition
Plan, BYE-13131-78, Cy 9A

WORKING

~~BYE 13210~~-78

CONTROL NO ____
COPY 1 OF ____ COPIES
PAGE 01 OF 01 PAGES

HANDLE VIA
BYEMAN
CONTROL SYSTEM

~~TOP SECRET~~

CLASSIFIED BY BYEMAN ... EXEMPT FROM GENERAL DECLASSIFICATION SCHEDULE OF EXECUTIVE ORDER 11652 EXEMPTION DATE

~~TOP SECRET~~

Handle Via BYEMAN
Control System

File 515-F

DEPARTMENT OF THE AIR FORCE
WASHINGTON, D.C. 20330

OFFICE OF THE SECRETARY

AUG 10 1978

MEMORANDUM FOR THE SECRETARY OF DEFENSE

SUBJECT: Space Shuttle Transition Plan

On 26 June you asked that I request Dr. Mark lead a review of the Shuttle Transition Plan to see if benefits could be derived from accelerating current schedules. The attached report is the product of an extensive reexamination of all facets of our transition policy and supporting plans. During the course of the review, Dr. Mark held meetings with all of the managers of the Space Flight Projects in the Department of Defense and the CIA.

The attached study examines possible schedule changes and weighs the benefits that might be derived against costs and risks. Tables following the executive summary represent our best judgment on the practicality of accelerating individual spacecraft transition to the Shuttle. The actions recommended will permit all programs to take maximum advantage of the operational opportunities and resource efficiencies offered by the Shuttle.

If additional information or clarification is desired please let us help. We are deeply interested in and working hard to insure a timely and cost effective transition to the Shuttle.

John C. Stetson

Attachment

Upon physical removal of all caveats, this document is unclassified.

WORKING

BYE-13131-78
Cy 9 of ____ Cys

TRANSITION PLAN FOR DEFENSE AND INTELLIGENCE SATELLITES TO THE SPACE TRANSPORTATION SYSTEM

I. Introduction.

This report describes the plans for transition from expendable launch vehicles to the Space Transportation System (Space Shuttle) for satellite systems operated by the Department of Defense (Air Force and Navy) and by the National Reconnaissance Office. Currently the Department of Defense operates eight satellite systems: Four communications satellite systems, one indications and warning satellite system, one meterological satellite system, and two satellite systems used for navigation, positioning and targeting. In addition, five new satellite systems are in the proposal stage. [redacted]

(b)(1)
(b)(3)
10 USC 424

[redacted]

From the very beginning there has been a commitment by the Department of Defense to use the Shuttle once it is available. The fact that the Shuttle payload bay, when it was designed in 1970, was sized to accommodate the HEXAGON spacecraft illustrates this point in the best possible way. The posture for the transition to the Shuttle has generally been conservative because of the importance of satellite systems to national security. Two points have generally been considered as important in developing plans for the transition period between the phase-out of the expendable launch vehicles and the advent of the Shuttle.

1. All spacecraft that will be flown during this period are dual capable in the sense they can be either launched on an expendable launch vehicle or on the Shuttle.

2. An expendable launch vehicle backup capability will be maintained in case the Shuttle does not meet its projected schedule. This backup capability is also important in view of the uncertainty about the initial Shuttle performance.

In order to judge whether a given transition plan for a satellite system is appropriate, it is necessary to understand the effect of a potential gap in the data provided by the system on national security. Obviously, some satellite systems are more critical than others. Roughly speaking, those satellites dealing with Strategic Indications and Warning, Communications Intelligence and Strategic Arms Treaty Verification have been placed at the highest level of priority. Navigation satellites, weather observation satellites and some communications satellites are somewhat less important on the average. Satellites which tend to be the sole source of data collected are more important than those which form just one portion of a data collection system. Priority judgments of this kind must then be combined with an assessment of the technical risks. Generally, a more conservative transition approach has been adopted on high priority and/or high technical risk programs. These factors should be kept in mind when examining the transition plans for individual spacecraft systems in Section III.

In assessing the increased risks entailed in the Shuttle transition period, two other factors were considered. One deals with the technical changes that must be made to a spacecraft system in order that it can fly safely on the Shuttle. The launch environment of the Shuttle is somewhat harsher than that experienced in currently used expendable launch vehicles.

(b)(1)
(b)(3) 10 USC 424

Thus, we need to make certain that the spacecraft are redesigned in such a way that they can stand the new environment. In some cases this will have to be done before actual measurements of the Shuttle environment are available, which will accordingly increase the program risks. The second factor is the technical progress made in the Shuttle program. Uncertainties introduced by technical problems with the main engine and programmatic delays that may arise in the preparation of the West Coast Launch Facility at Vandenberg AFB and a classified control facility need to be considered. A more detailed assessment of these risks will be provided in the following sections.

II. Technical Factors.

There are a number of important technical factors that need to be considered in planning the transition of spacecraft to the Shuttle. Many of these are common to all of the spacecraft systems included in this report and it may thus be useful to look at them across the board. There are substantial long term benefits that will accrue from the use of the Shuttle. However, it is important to recognize that these are long term benefits, and that in the near term, the introduction of the Shuttle will cause problems that need to be overcome and will probably also incur some added costs. There is no doubt that the benefits will eventually outweigh the drawbacks and it is for this reason that a strong commitment to using the Shuttle has been made by the Department of Defense.

A. Benefits.

The operation of the Shuttle will be dominated by the presence of man. Each flight will be manned and this fact will change the way we do things in very fundamental ways. The recent historical evidence is that most spacecraft which fail experience failures right after launch. Very probably it is the launch environment that is the source of most of these failures. The Shuttle will make it possible for mission specialists to check out spacecraft before they are deployed from the Shuttle, thus hopefully eliminating the launch environment as a cause of trouble. Once they are deployed, the spacecraft can fly in parallel with the Shuttle for a while and can be checked out to see whether they are operating properly. Should problems be turned up in this procedure, it might be possible to either fix the spacecraft on orbit, or to retrieve the spacecraft and land with it, so that it can be repaired and refurbished on the ground. In either case, the spacecraft needs to be designed to accomplish these operations. This is essentially what is meant by "Shuttle" unique designs of space systems. In the future, the ability to do the things that have just been listed will be designed into a spacecraft at the very beginning. For example, a modular design will probably become common so that assembly of spacecraft on orbit becomes possible. The replacement of failed modules is another possibility that needs to be considered. The testing of such modules or various single components and groups of components on orbit will become possible in the actual space environment before they are flown. These subsystems could be mounted on the Long Duration Exposure Facility (LDEF) or the Space Test Rack on various Shuttle flights and they could then be retrieved after the test is completed. Finally, there is the possibility of developing manned operations on orbit outside the Shuttle. There is every reason to believe that Extravehicular Activity (EVA) will become very common and that this will make possible the erection of large structures in space. Perhaps the first practical application of space construction is the assembly of large antennas on orbit for ELINT purposes.

There is no doubt that doing the same things that we now do with expendable launch vehicles using the Shuttle will be less costly. The fact is, however, that the Shuttle will add an entirely new dimension to our operations in space. The exploitation of these new capabilities will cost money and thus, strict cost comparisons between what we are doing today and what we will be doing five years from now when we have the Shuttle, are just not possible. We can certainly make some estimates but they are not the equivalent of cost benefit analyses since fundamentally different things are being compared.

B. Problems.

The advent of the Shuttle will also cause some significant problems. The current Shuttle development schedules will not provide a good experimental definition of the flight environment that will be experienced by the more fragile satellites of the Defense establishment until late in 1979. Although tests on the ground will make it possible to make estimates, it would be desirable to have actual flight data to factor into the design of the most important spacecraft. To minimize the cost and schedule impact on these important spacecraft, schedules have been adjusted in such a way that data from the flight environment is available prior to hardware design. The uncertainties in the flight environment and the recent Shuttle main engine development problems which have caused the first orbital flight test to be delayed have caused the introduction of additional risk in various satellite transition schedules.

Cost is a second factor that needs to be carefully considered. Schedules have been established to permit cost savings through the transition of a given spacecraft to the Shuttle at the same time as a planned spacecraft upgrade (spacecraft block change) whenever possible. By doing this, one can save at least one requalification procedure for that particular spacecraft. Even though it is desirable from the standpoint of cost effectiveness to have block changes coincide with the Shuttle transition, this is not always possible. The upgrading of spacecraft, together with the transition, is not consistent with operational requirements in every case. Therefore, additional costs will be incurred for the second requalification procedure.

There are some instances in which insertion into low earth orbit of a spacecraft using an expendable launch vehicle turns out to be less expensive than a Shuttle ride. This is true, for example, with many "piggyback systems" where the accounting is currently done in such a way that no charge is levied on the user for the launch costs. Once the Shuttle is introduced this situation will change since all users will be charged for the launch costs according to the NASA formula.

Military construction and the funding thereof is another problem which must be considered in developing the transition plan to the Shuttle. A number of spacecraft in the intelligence and the Defense Department programs must be launched from the facilities at the Western Test Range (Vandenberg Air Force Base). These facilities must be available before the launches for such payloads can be scheduled on the Shuttle. This requirement, of course, stems from the basic orbital mechanics which will be described in the discussion of transition plans for individual vehicles which follows. In several cases it will be seen that the availability of the launch facilities at Vandenberg Air Force Base is the pacing item in the Shuttle transition schedule.

Military construction is also required to provide secure and reliable mission control facilities for the Shuttle. It is very clear that special precautions need to be taken in mission control to maintain the security requirements and the redundancy of very high priority National Reconnaissance Program and Defense Department classified missions. This will require the construction or modification of certain facilities. The schedule for the construction of these facilities will not be a pacing item since the "Controlled Mode" operation at the Johnson Space Center will be available until a secure mission control facility is built for Intelligence and Defense missions. The requirements for such a mission control center will be outlined later on in this paper.

Perhaps the most important factor which could delay transition of a number of spacecraft to the Shuttle is the performance of the orbiter itself. The Shuttle main engines have still not performed according to their design specifications, and tests to see whether they will actually work as planned are still to be conducted. It is possible, therefore, that the first flights of the Shuttle will be carried out with considerably degraded performance which will, in turn, make it impossible to fly some of the heavier payloads. The orbiter also is experiencing weight problems which will add to the difficulties that may be encountered in launching some of the heavier Defense Department payloads. If it turns out that the main engines never perform according to the original plans, or if the orbiter weight problems cannot be solved, then modifications of the solid booster system may become necessary in order to meet the payload requirements. In that case, launch pad modifications will have to be added in order to handle larger or additional solid boosters. Should this contingency come to pass, further construction funds will be required.

C. Shuttle Mission Operations.

Another important issue that affects the transition to the Shuttle is the conduct of Shuttle mission operations for the Defense Department programs in which security and military operational requirements are factors. Mission operations include the planning, preparation and the control of the Shuttle flights. These operations must be conducted in a secure environment for classified flights in order to protect the purpose of the mission, the capabilities of the spacecraft and the operations on orbit. Not only is a secure mission operations system required to protect payloads that are being transitioned to the Shuttle, but also to provide an opportunity to fully exploit the Shuttle for expanded military and intelligence applications. It is conceivable that the Shuttle itself will be used as a platform for military operations of various kinds and that operation of such a platform must clearly be carried out in a secure environment.

The ability to carry out high priority military and intelligence missions must not be dependent on factors having to do with weather, power outages, sabotage, and other unforeseen contingencies. Thus redundancy becomes an important requirement. A redundant mission control center will eventually become necessary once Shuttle operations become routine. There are missions that simply cannot be postponed even if an accident or some other emergency causes a shut down at the Johnson Space Center. In the long term, the redundancy factor is probably more important than security considerations. The Air Force and NASA have considered a number of approaches for the conduct of intelligence and Defense Department missions using various existing control facilities. The objective has been to employ facilities and equipment to meet the operational requirements of the Defense community at the lowest cost within appropriate security constraints. The approaches investigated have included dedicated and shared facilities. The alternatives have been narrowed down to two leading options:

1. A shared "Controlled Mode" at NASA's Johnson Space Center at Houston, Texas. This operating method will be used in the beginning probably with some compromise of security requirements.

2. A modification to the Air Force Satellite Test Center at Sunnyvale, California. This is an existing facility which was originally intended to control the Manned Orbiting Laboratory. It has all the necessary facilities for developing a Shuttle mission control center that meets the most stringent security standards.

The "Controlled Mode" was developed to permit simultaneous classified and unclassified operations to be conducted at the Johnson Space Center. The configuration includes a mixture of dedicated and shared facilities, equipment, computers and personnel. This option would cost the Defense Department approximately $93M to implement in order to support the first classified Defense Department missions in 1982. The Sunnyvale site is presently the control center for many of the Defense Department spacecraft planning and operations. It is a secure facility with secure data lines and communications to the launch centers. Preliminary Air Force estimates show that it would cost approximately $107M to augment this center to support Defense Department Shuttle operations in FY 84. This cost includes $15M for a short term contingency capability at the Johnson Space Center for classified programs beginning in 1982 to protect the ability to conduct early classified missions from Johnson Space Center.

The open environment at Johnson Space Center poses a unique security problem. The current Shuttle traffic model shows a classified payload launch in 1982 and one in 1983. Because the classified traffic increases substantially in 1984 it is imperative that plans for a permanent secure mission operations center be developed.

D. Expendable Launch Vehicles

The essential philosophy of the Department of Defense with respect to expendable launch vehicles has been to maintain a conservative backup position to support operationally critical Defense and Intelligence missions. The idea is to maintain a stable of expendable launch vehicles with subsystem fabrication and complete vehicle assembly keyed to the development schedule milestones of the Space Shuttle. The expendable launch vehicles currently in use are shown in Figure 1. It is important to recognize that the situation for Titan launch vehicles is quite different from that for Atlas and Thor rockets. In the case of the Atlas and the Thor which are refurbished intercontinental and intermediate range ballistic missiles, there are vehicles available in storage so that additional production is not required. The maintenance of Thor and Atlas backup vehicles therefore is not a large cost item.

In the case of the Titan rocket, a production line must be maintained in order to build the necessary backup vehicle inventory. It could be argued that the cheaper option would be to build the required number of Titan vehicles rapidly and then close the production line. The difficulty with this approach is that if the Shuttle does, in fact, remain on schedule, then more vehicles would be built than we actually need. Should the Shuttle schedule slip substantially, then it is quite possible that we will not have produced enough Titan vehicles to meet our requirements. Therefore, there could be a time period in which we lose the capability to launch any of our heavy payloads. The current plan avoids this problem by phasing production of the Titan vehicles with the Shuttle schedule milestones in such a way that only those Titans that are really needed are actually assembled. Thus, a speedup of the Shuttle schedule would not change the current Titan acquisition plan. All that would happen is that fewer Titan vehicles would actually be assembled as the milestones are successfully passed. The situation is illustrated in Table 3 which shows the total cost for expendable launch vehicles on a year by year basis and the money that could be saved as Shuttle milestones are successfully passed and the transition to the Shuttle is accelerated.

A more rapid transition to the Shuttle could change the situation in the case of the Atlas launch vehicles because fewer would be required. An extremely optimistic Shuttle transition schedule would mean that we may use five fewer Atlas's than currently planned. Even in this accelerated transition, only minor if any cost savings may be secured because flights on the Atlas [redacted] There would also be no savings in the vehicle procurement portion of the program since the Atlas vehicles that are being used already exist. In fact, depending on the ability or inability to share launches with other payloads, Shuttle launch costs may exceed any projected savings. Thus, there is probably no advantage to speeding up the Shuttle transition schedule for those spacecraft launched with Atlas rockets if cost is the only consideration.

A final word should be said with respect to Scout launch vehicles. The current NASA plan is to eliminate the capability to use Scout vehicles after the Shuttle becomes operational. The Scout is an excellent rocket for the deployment of small satellites and it can be launched from a number of different sites around the country. Therefore it may be advantageous to retain the flexibility to put small satellites in orbit with the low cost Scout vehicles. Currently, each Scout launch rocket costs approximately $5M and this is well below the prorated cost that may be incurred in various Shuttle launches for satellites of interest to the Department of Defense. Thus, it may be important to reconsider the decision to phase out the Scout launch vehicles after the Shuttle is in operation.

III. Satellite System Descriptions.

A. National Reconnaissance Program (NRP)

The shuttle transition policy for the National Reconnaissance Program as set forth in March 1975 consisted of three major provisions:

(1) All National Reconnaissance Program satellites which enter final production prior to 1980 were to be "dual compatible," that is, they were to be designed to be either launched from a Shuttle or from an Expendable Launch Vehicles.

(2) All interfaces between National Reconnaissance Program spacecraft and the Shuttle were to be kept as simple as possible during the transition period. Thus, the Shuttle was to be used only as a booster and other unique properties of the Shuttle would not be considered in the design of the spacecraft. However, all new systems or block change systems which enter design subsequent to FY 76 would be designed in a modular configuration, providing that the additional weight capability of the Shuttle would be advantageous to the accomplishment of the missions.

(b)(1)
(b)(3)
10 USC 424

~~TOP SECRET~~

[illegible]-13131-78

(3) Expendable Launch Vehicles for backup would be retained until the Shuttle demonstrated the reliability and the weight carrying ability to launch National Reconnaissance Program spacecraft.

This transition policy has become more aggressive during the last 18 months as systems concepts have been developed for the post 1979 time period, and as the Shuttle program has matured. The current Shuttle transition policy of the National Reconnaissance Program can be stated as follows:

(1) Transition all spacecraft to the Shuttle as soon as prudent risk judgments and cost factors will permit.

(2) New spacecraft designs scheduled to enter production after the Shuttle is successfully demonstrated will exploit fully the unique properties of the Shuttle.

(3) Extensive studies will be conducted to examine the new features inherent in the Shuttle and how these can be exploited to enhance the National Reconnaissance Program missions.

(4) Expendable Launch Vehicles will be maintained in case Shuttle development schedules are not met. This will be accomplished by developing and maintaining a schedule for the acquisition of the backup launch vehicles which is keyed to the Shuttle performance milestones.

The current Shuttle transition policy is aggressive for the moment but will most likely become more aggressive as we are better able to assess the technical risk and envision the unique capabilities of the Shuttle.

The following pages discuss each satellite system, the current transition plan, the possibilities of accelerating that transition, and conclude with a recommendation for each system.

GAMBIT

This satellite is a low earth orbit, high resolution, film imaging system. The GAMBIT spacecraft is in the 10,000 pound class and is launched from Vandenberg AFB into a near polar orbit by a TITAN IIIB Expendable Launch Vehicle..

The FY 79 budget terminates regular flights of GAMBIT, adds a medium resolution broad area search capability, and assigns the system to a backup role for [redacted] HEXAGON through 1985. There are five spacecraft already built or in production and the necessary launch vehicles have been purchased. Since the program is to end in 1985, no formal transition plan has been developed. If GAMBIT becomes the only user of the

(b)(1)
(b)(3)
10 USC 424

TITAN IIIB launch complex it would be prudent to consider transitioning for Shuttle launch, since the cost of the already purchased Expendable Launch Vehicles would be offset by the cost of maintaining the launch complex.

It is recommended that no transition plan for GAMBIT to the Shuttle be developed at this time.

HEXAGON

This satellite is a low earth orbit, medium resolution broad area search film imaging system. The HEXAGON spacecraft is in the 25,000 pound class and is launched from Vandenberg AFB into a near polar orbit by a TITAN 34D.

The current transition plan calls for minimum spacecraft modification to accommodate Shuttle launch while retaining compatibility with the Titan 34D backup vehicle. No Shuttle-unique capabilities are planned. It is likely that the HEXAGON program will be phased out in the 1985 time frame since the current program [redacted] In addition, HEXAGON must be launched from Vandenberg AFB and it is likely that the program will be phased out before the full lift capability from Vandenberg is validated.

Thus, although there is a transition plan for HEXAGON, it is unlikely that it will be executed. Transition of HEXAGON to the Shuttle is not recommended.

(b)(1)
(b)(3) 10 USC ⊥ 424

[redacted]

(b)(1)
(b)(3) 10 USC ⊥ 424

Page Denied

(b)(1)
(b)(3)
10 USC ⊥ 424

Approved for Release: 2017/02/08 C05094779

(b)(1)
(b)(3) 10 USC ⊥ 424

Page Denied

(b)(1)
(b)(3)
10 USC ⊥ 424

(b)(1)
(b)(3)
10 USC ⊥ 424

Page Denied

(b)(1)
(b)(3)
10 USC ⊥ 424

Page Denied

(b)(1)
(b)(3)
10 USC ⊥ 424

Page Denied

(b)(1)
(b)(3) 10 USC ⊥ 424

Page Denied

(b)(1)
(b)(3)
10 USC ⊥ 424

(b)(1)
(b)(3) 10 USC ⊥ 424

(b)(1)
(b)(3)
10 USC ⊥ 424

Page Denied

Page Denied

Approved for Release: 2017/02/08 C05094779

Page Denied

Page Denied

(b)(1)
(b)(3)
10 USC ⊥ 424

(b)(1)
(b)(3) 10 USC ⊥ 424

(b)(1)
(b)(3)
10 USC ⊥ 424

Page Denied

(b)(1)
(b)(3) 10 USC ⊥ 424

Page Denied

(b)(1)
(b)(3) 10 USC ⊥ 424

Page Denied

~~SECRET~~
Handle Via BYEMAN
Control System

ETR - CAPE CANAVERAL
WTR - VANDENBERG AFB

SHUTTLE TRANSITION

NRO SYSTEMS

~~SECRET~~ HANDLE VIA BYEMAN
CONTROL CHANNELS ONLY

TABLE 1

SATELLITE SYSTEM	ORBIT LAUNCH SITE	LAUNCH VEHICLE	CURRENT SHUTTLE TRANSITION DATE	ACCELERATED SHUTTLE TRANSITION DATE	COST DELTA ($ MILLIONS)
			IMAGING SYSTEMS		
GAMBIT	POLAR LOW EARTH WTR	T111B	NOT TRANSITIONING	NO CHANGE	
HEXAGON	POLAR LOW EARTH WTR	T111D	NOT TRANSITIONING	NO CHANGE	

[redacted]

~~TOP SECRET~~
Handle Via BYEMAN
Control System

~~SECRET~~ BYEMAN
[redacted] GAMBIT HEXAGON [redacted]

(b)(1)
(b)(3) 10 USC ⊥ 424

(b)(3)

Page Denied

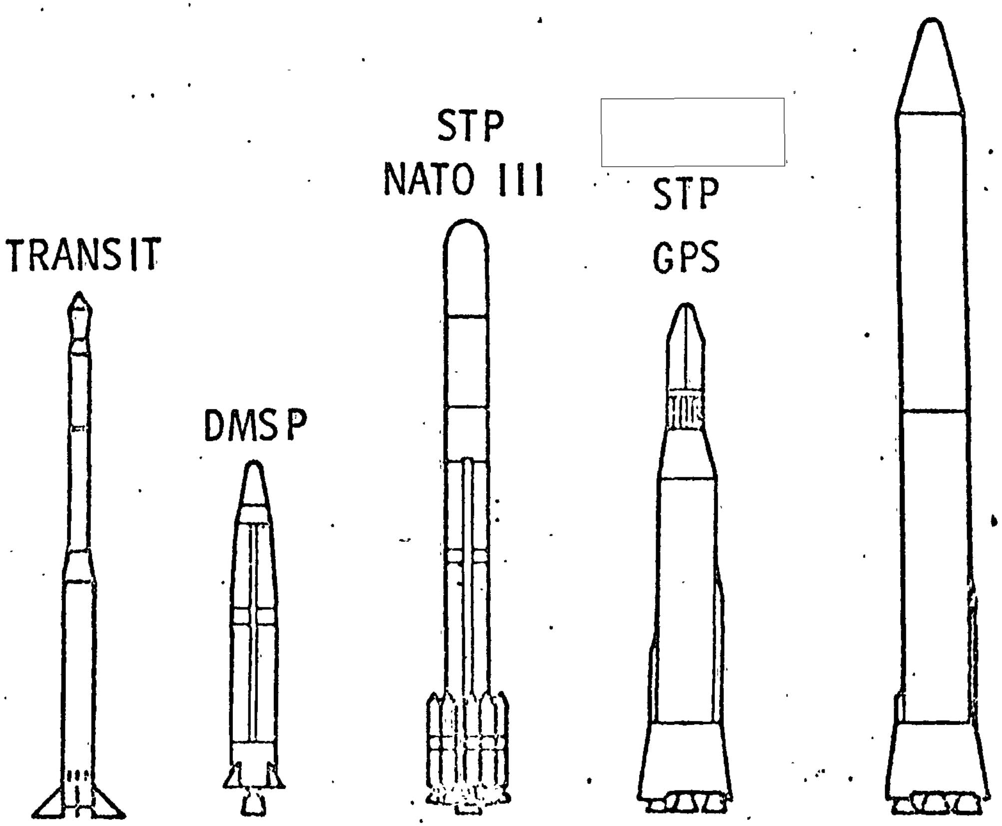
(b)(1)
(b)(3)
10 USC ⊥ 424

(b)(1)
(b)(3) 10 USC ⊥ 424

(b)(1)
(b)(3)
10 USC ⊥ 424

Page Denied

Medium Launch Vehicle Configurations



(b)(1)
(b)(3)
10 USC ⊥ 424

FIGURE 1

PAYLOAD (LBS)	SCOUT	LV-2F	DELTA 2914	ATLAS F	SLV-3D CENTAUR D-1A
100 N MI CIRC ETR	405	NA	NA	NA	11,400
100 N MI CIRC WTR	325	575	NA	3600	NA
SYNCH APOGEE	NA	NA	1550	NA	4200
SYNCH EQ (AKM)	NA	NA	730	NA	2000

BYE-13131-78

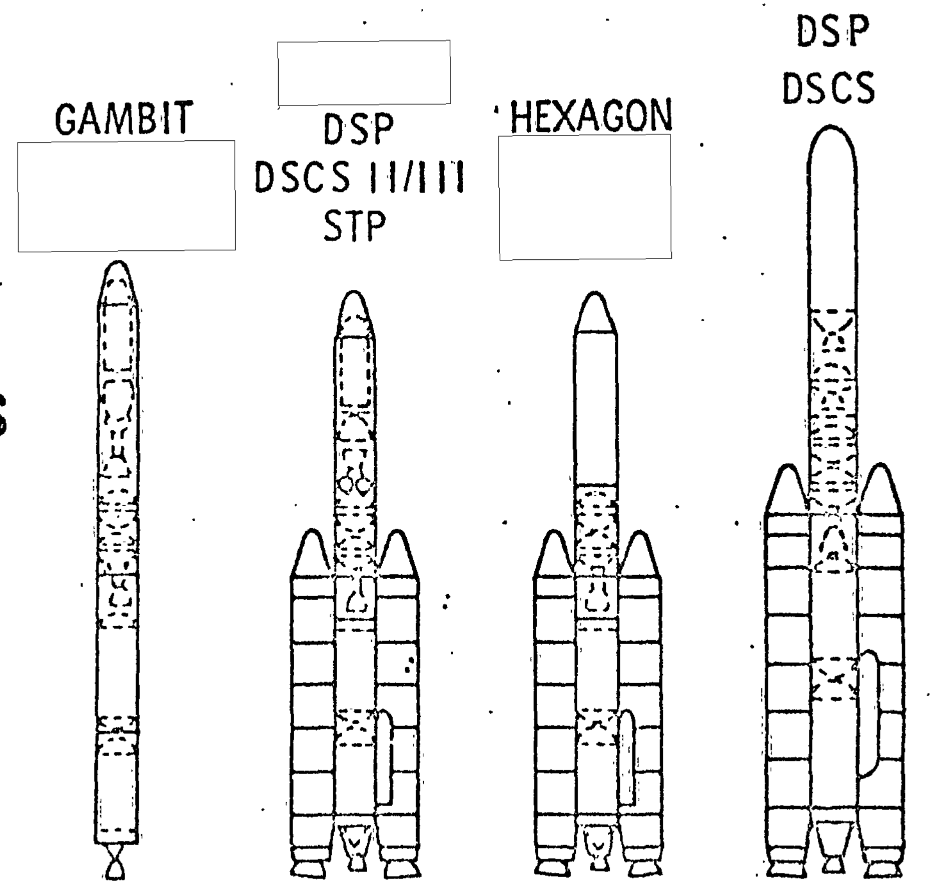
~~SECRET~~
Handle Via BYEMAN
Control System

~~S E C R E T~~
GAMBIT/[redacted]HEXAGON/[redacted]

(b)(1)
(b)(3)
10 USC 424

FIGURE 1 (CONT'D)

Titan III Configurations



PAYLOAD	T III-B AGENA	T III-C	T III-D	T-III 34D IUS
90°/100 N MI (WTR)	8,200	22,500	24,600	27,000
100 N MI (ETR)	9,900	29,200	30,600	34,000
SYNC EQ	970	3,600	-	4,200

BYE-13131-78

~~TOP SECRET~~
Handle Via BYEMAN
Control System

~~S E C R E T~~