

Septomber 6, 1957

Onided Missiles

NEWCRANDUM TO CHAIRMAN, ADVISORY OROUP ON SPECIAL CAPABILITIES

SUBJECT: Satellite Programs

You end the numbers of your Group represent a unique body of experience in satellite systems and the actual problems of their development, having studied the possibilities before the amnouncement of the scientific satellite program, and having menitored its programs from the beginning. You also considered the larger, longer range possibilities such as El 117L early in 1955 and made certain recommendations on it to the Department of Defense, which for a number of reasons could not be implemented at that time.

I feel that it may be timely to ask the Group to help me by preparing for the time when it will ultimately be necessary to decide on a number of questions on military applications of satellite techniques.

The feasibility and timing of such applications seem to depend mainly when the capabilities of rocket systems, their availability, and, of course, upon the extense of Project VARGUARD, our first venture into this field.

I should now therefore like to ask the Advisory Group on Special Capabilities to look again into the satellite plans and programs of the military departments and submit your conclusions on the technical capabilities based on the best available facts at this time.

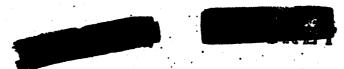
In approaching the broad question of possible military applications of satellites, which is yet unresolved, I should especially like to have your views on such questions as the following:

Are the rocket vehicle systems sufficiently advanced to warrant a decision to support satellite techniques for such military applications as proposed by the Air Force in Project MS 117L, or as may be proposed by other military departments?

Which ones of the missile or rocket systems currently in development would seem to be the best for military satellite use, and why?

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In your first report in August 1955, the Group visualized a possible contiming need for small scientific satellites, presumably for scientific needs spart from the more direct military applications. In the light of present experience with VANGUAND and its high coat, do you foreses any military, or for that matter, any scientific uses for such small satellites that could not be served by larger satellites, if larger ones are to be developed?

Alternatively, if scientific or technical limitations in your view will delay successful attainment of larger (say, 500 to 2000-pound) satellites within 2 or 3 years, to what extent should the Department of Defense support a continuing program of smaller satellites for military applications or developments necessary to success later with larger systems?

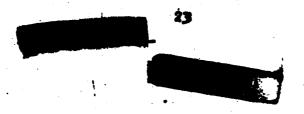
Please submit any additional findings which you feel would be helpful to the Department of Defense in determining its policy for the future with respect to satellite vehicles.

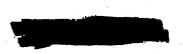
As all of the above matters are within the current directive to the Advisory Group on Special Capabilities, no further amendments to it are believed necessary.

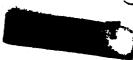
In arranging with the military services for hearings, interviews, or consultations, it should be made clear that your investigations do not imply any tacit acceptance by the Socretary of Defense or this office of the view that there are important and immediate military applications of satellites, as it has not yet been satisfactorily demonstrated as being sufficiently practicable to warrant early and substantial support.

As to timing, I shall be grateful if you could submit your main conclusions by March 1958.

S/M. M. Holaday W. M. Holaday Special Assistant for Quided Missiles







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MINISTER FOR MA. W. M. MILADAY, MINISTER OF CUIDE MINISTERS.

Majarty Setallite Plans of the Military Reportments.

In Jespense to your measurement of 6 Appender 1957, I have the hiller to releast Mine establishing and procumentations of the Advisory Group on Special Depolitions.

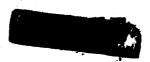
The Group explicit at its commissions by veleting the techblood expedilities of large recent systems, both existing and planned, addition potential military applications to present the to the Group by the Military Reperturbs.

The Group did not vestoers itself with organizational get edical strait to policy questions fivelving such things as ridge and similate of the military services. Other bread Missional Public questions not being ambulanced by the Geograms are not likely to be received quickly of the Broup has, without my thought of anticipating the edicals of this Tellegal debate, analy described losir plants that his sein rather wholest or that have been widely supported by competent military and selectific epision.

The comprehensive and debtalled productablems in the Group by the keep, Navy, and Mr Perce are not under a part of this report, is all of this interial is available to your stilling and no useful purpose while soon to be served by reproducing it him. The saliest faste thick determine technical especial there is the fations of sitellities between amountaint from the detailed phisometriess of sitellities between amountaint from the detailed phisometriess only in the extent desirable for ready refluence in connection with the squalenters.

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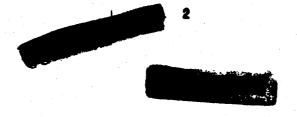


I am pleased to convey the thanks and appreciation of the Group to the officers, engineers, and scientists of the Military Departments and their contractors for their generous assistance and cooperation.

Thanks are also due the staff of the RAND Corporation at Santa Monica, California for their help and facilities for a number of the meetings of the Group.

The members of the Group are, of course, willing to assist you further with these matters should you so desire.

i. J. STRAKT Chairman Advisory Group on Special Capabilities



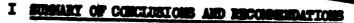


#### SATELLITE PLANS OF THE MILITARY DEPARTMENTS

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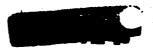
The conclusions of the Advisory Group on Special Capabilities are based upon the following assumptions which may now be conservatively regarded as exiomatic:

- A. There is a clear military meed for satellite techniques.
- B. Valuable scientific data will be obtained from an expanded satellite program.
- C. Ultimately commercial returns will be realised from a national capability in satellite techniques.
- D. Manned exploration of space and space travel will be an accepted national objective.

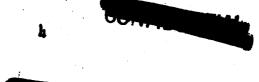
Conclusions 1 through 3 are in answer to specific questions in Mr. Heladay's mane of 6 September 1957 to the Ghairman of the Group, a copy of which is included in this report.

- 1. Recket systems are sufficiently advanced to warrant immediate support of satellite techniques for military applications.
- 2. Four of the five large ballistic missile systems currently under development, namely JUPITER, THUR, ATLAS, and TITAN, can provide the launching booster capability for a variety of useful military satellites. The Navy does not recommend the use of PCLARIS-because of severe interference and late availability. Puture military satellite developments should take full advantage of both IRSM and ECSM classes of missiles.
- 3. With respect to the question of procurement of additional small satellite vehicles, it appears that:
  - a. The present lot of VANSUANDS and JUPITHE C's will probably be expended by the end of the calendar year 1958.
  - b. Any satellite program based on an IRBM will probably not be operating smoothly before the end of calendar year 1959.
  - e. The United States should have a continuing program of satellite launchings without lengthy periods of inactivity.
  - d. Setellites of the 20-pound class will have some military applications.
  - e. Lemmohings of small satellites from Comp Cooks will provide useful training and facilities shake-dom.
  - f. There is good likelihood that the second and third stage vehicles of VANCOUND will be usable in more advanced systems based on IREM.





In view of these considerations, the Group recommends early action to initiate procurement of 6 to 12 additional IGY-type satellite systems. As soon as this action is assured, the National Academy of Sciences should be so advised and their proposals for satellite utilisation solicited. At the same time, the Military Repartments should be requested to propose uses within their needs.





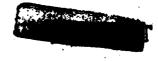
#### General Conclusions

The Group has reached a number of general conclusions and recommendations regarding the nature of the program in the field of satellites and space flight which we feel the United States should undertake. They are as follows:

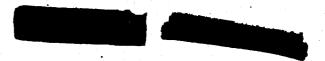
- 1. There should be a sound, well-coordinated National program leading into large satellites. It should not be limited in scope, but should cover all aspects of satellite and space flight. The Group recemends that at least 10% of the funding of such a program be devoted to relevant research and exploratory experimentation.
- 2. The first major step in the Matienal program should exploit the impressive potentialities of the IRBM boosters, which would appear to be capable of satisfying most of the military satellite objectives even for the long term, as well as many of the initial problems of space flight. The Group recommends that a program emphasizing minimum vehicle development effort be initiated immediately, with concurrent planning for longer term exploitation, including improved high speed stages of the IRBM vehicles.
- 3. The larger NEM's will make it possible to carry out elaborate military and other missions, including many studies in space medicine. ME-1171 is an initial effect in this direction and the Group gammeria its continuation, but recommends that the Matienal program include alternative efforts toward the full development of the MEM potentials for both military and men-military applications.
- k. In all phases of the Mational program the military and scientific needs should be organised so as to be minally reinforcing; and the Group recommends that vehicles be specifically allocated as needed for the various military and scientific uses. Details of such allocations should be determined by the Department of Befonse in consultation with the Mational Academy of Sciences, and the Mational Science Foundation.

The Group also makes the following more specific comments and recommendations:

- All three of the military services have stated their support of a national satellite and space flight program serving both military and scientific needs.
- All three of the military services have stated that the highest priority military requirements for satellites are for recommaissance and surveillance. Other common military requirements exist for satellites as aids to mavigation, in communications, and for weather data collection (see Table II).





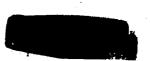


- 3. All three military services presented short-term programs using an IRBM booster capable of launching 300 to 500-pound satellites on about 200-mile erbits. From the technical standpoint the Group considers both JUPITER and THOR equivalent for these purposes when they have been developed to the point where they are sufficiently reliable.
- h. Specific recommaissance methods for the 300 to 500-pound satellites included an Air Force proposal using film recovery techniques and an Army proposal for television type recommaissance. The latter sould be tested in a 100-pound satellite which might be available—somer. The Group recommends testing of both of these techniques as the highest priority portion of the immediate program. A fractional allocation of potential vehicles in the short-term program should also be made for scientific test purposes other military requirements and space exploration. The scale of the program should aim toward a launching capacity of at least one a menth in 1959.—

  It appears that a great expansion of this rate will be required as soom as feasible, and coordinated military planning is therefore urgently required.
- So Orbits of higher inclination than those possible at Patrick Air Force Base, Florida (which is limited to orbits of between 28 and 45 degrees inclination) are essential for military applications and will require launching sites which will make it possible to launch satellites into phlar orbits. Camp Gooks is one such site. The additional site and facility requirements at Patrick, Gooks and possible elsewhere for the rapidly expanding program must be determined and implemented simultaneously. The Group recommends that, as one of the first steps in any enlarged satellite program, steps be taken to activate Camp Gooks or equivalent sites suitable for polar orbit launchings immediately.
- 6. The inventory of national resources in rocket systems capable of erbiting useful payloads now or within the next several years include the VANGUARD, JUPITER "C", JUPITER, THOE, ATLAS and TITAN. The larger of these boosters will be coming into maturity about two years hence and should provide a capability of erbiting useful payloads up to about 3,000 pounds at 300 miles altitude and escape velocity applications for smaller payloads. Larger payloads will require that an intensive research and development effort be directed toward considerabley larger propulsion units or high-energy propellants, preferably both. Propulsion component development for maximum capability should be focused on high-capacity turbo-pumps and combustion chambers toward an objective of attaining a propulsion capability of 1 million pounds thrust or greater, in a single unit. The Group recommends that a formal program leading to high thrust rocket engines be initiated. The Group also recommends increased support for research and engineering developments with high-energy propellants, storable propellants, and the other basic technological fields contributing to high performance rocket applications. An increased effort on the development of highly reliable, long-lived components will be of high significance in determining the overall utility of satellites.



- 7. Unmanued (instrumented) explorations of the moon, Venus and Mars appear to be feasible within the capabilities of chamical propellants and presently planned systems. Freliminary lunar tests could be performed within the capabity of the IRBM systems and should be included in the early part of that program.
- Memmed exploration of the moon, Mers, and Verms may ultimately be feasible within the capability of chemical propellant systems.
- 9. The I-15 project represents the most advanced current project leading in the direction of manual space flight. While the Group did not fermally review the I-15 project, it observes that any manual space flight program should draw on the experience of the I-15 program.
- 10. A preliminary presentation of the problem on anti-extellite missiles was presented to the Group by the Mavy. The Group feels that this subject is in urgent need of further study by the military services.
- 11. The Many also presented some consideration of the possibility of airborne satellite lambhing. Thile the Group does not necessarily indered this approach, a more complete study leading to clarification of this question would be desirable.





The Group's first general conclusion is a logical corollary of the h points which it accepted at the exteet, and which have been supported by all of the presentations of the Hilitary Departments. The Mation needs a sound, well-coordinated, and firstly conducted program leading to large satellites and massed space flight.

The National interests require that certain devices be placed in operation at the earliest possible date. The Group has tried to show in this report how the most useful of these devices for both military and scientific purposes can be realised at the earliest practicable dates.

The argency of these projects has dictated the maximum possible use of emisting equipment, particularly the large engines and other components. However, the Group emphasizes that in a field as new as the one here considered it is impossible to specify in detail the best possible lang-range programs. For this reason, great emphasis must be placed on relevant research and experimentation of an employeesty nature. The Group therefore recommends that not less than 10 percent of available funds of the Matienal program be devoted to these purposes.

The second general conclusion, and the one upon which the greatest emphasis should be placed, calls for immediate action to take advantage of the impressive potentialities of the IRBM beceters. If the decision on this point is promptly made, either THOR or JUPITHE estald be used to place 300 to k00-point satellites on pelar critic at 200 nautical miles altitude by early 1959. Moreover, such a payload capability would satisfy the most urgent of the military satellite requirements in the recommissance and surveillance entegeries; and with some development might take care of many of the stated military requirements for some time to come.

The INSM beosters are new well advanced in flight tests and should attain a degree of reliability adequate for satellite applications at least a year or more before equivalent status is reached with the INSM. A 300 to h00-pound satellite paylead seems to be about the minimum that would accommendate the desired military applications with adequate lifetime to accomplish the ebjectives. Such a paylead capability would also accommendate many of the messessary tests preliminary to manned space flight. Moreover, some of the recent studies confirm the presticability of extending the satellite paylead capability of the INSM beaster to at least a thousand pounds by 1960. One study combined that the INSM beaster could probably launch a modified WE-117L vahiale during 1999 and advecates a program morging this interim effort with the leager term ATAME-117L program with accompanying advantages in the latter development. The Group, therefore attaches the greatest importance to immediate action in support of using the earliest available INSM's beasters because such a program has the best premise of yielding earliest results with relatively simple satellites for recommendations.



The third general conclusion supports the continuation of the MS-117L program, and recommends simultaneous and complementary application of this vehicle system to both military and non-military uses. The more elaborate military missions require development of the maximum satellite paylead capability, higher altitude orbits, more precise stabilisation and control of the satellite, and longer useful life with attendant increases in power and other paylead increases. The more elaborate scientific experiments impose similar requirements on the satellite vehicle. The MBM beesters, the largest presently entering test, have the greatest potential fer both military and non-military uses as the second step in the Matienal program. These vehicles will be required as soon as available for advanced military applications, instrumented soft landings on the meon, tests with large animals, and other tests and experiments leading to space flight. Up to the present, significant development of the more elaborate satellite systems has been confined to very limited support of the MS-117L project; and the development phases of this project have emphasized the recommaissance-surveillance aspects of military applications. The petentialities of MS-117L for other important applications are also greater in such things as communications, weather ferecasting, and the many fields of pure science that would require an accurately stabilized and controlled satellite vehicle. It is, therefore, clear that the National program must, while placing the highest immediate priority upon satellites devised from IRBN becoters, also avoid stifling any satellite development that could fally explait the next largest capability which will be available with the Man boosters. Not to recognise this advanced need and support it now could well bring on heavy penalties later. Early and effective support of the more elaborate satellite systems is necessary now if they are to be ready when the booster capability to launch them is realised.

For these reasons the Group <u>recommends</u> that the National program include alternative efforts leading to the development of satellite payloads for military and non-military applications which could exploit the full potential of the NBM.

The fearth general conclusion recognises the mutually reinforcing aspects of the military and scientific parts of the program. Advanced military developments depend upon advances in science.

The military necessity for intensive support of science particularly in this field is axiomatic. At the same time the pace of the engineering development of the basic boosters will be set primarily by military necessity. They require extensive and expensive ground launching installations; range or safety patrels and precautions; and they are beset by many hazards in handling. But it would be wrong to let the more obvious and immediate military necessities overshades the equally vital military dependence upon longer term scientific observations or discoveries that can be previded by timely action. The proper action here, in the view of the Group, is to make specific allocations of satellite vehicles for both military and scientific uses. Details of such allocations should be determined by the Department of Defense drawing upon the experience and assistance of the Mational Academy of Sciences and the Mational Science Foundation, and

The Group has made a number of more specific comments and recommendations in amplification of the general conclusions discussed in the feregoing paragraphs. Most of these specific observations are self-explanatory in their summary form.

Among the specific recommendations the highest priority is placed on the earliest possible development of a military satellite of the 300-pound class which new seems to have promise of obtaining pictorial information of the UMER possibly within one year. Such a satellite may well give highly valuable and timely military information that could be obtained by no ether foreseeable makes within that period. Two schemes were described to the Group, one is basically photographic and effers the chance of recovering photographic films the other is basically a spot-seem television technique with radio transmission to earth.

The Group recommends testing of both of these techniques as the highest priority of the immediate program.

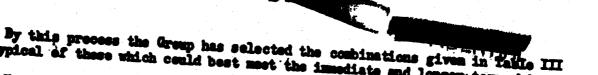
That

For all of the military applications and for most of the scientific or connectial uses of satellites a launching site from which satellites can be placed on polar orbits is necessary. An orbit with inclination less than the latitude of the launching site is possible, but it is impracticable with existing techniques. On the other hand, it is possible to launch satellites on any orbits with inclination greater than the latitude of the launch site. However, the ground hasards from discarded rechet stages severely restrict the geographic sites that can be used. Metile launching facilities are also similarly restricted, but not to the same degree as large fixed base installations. As to military values—ability of launching sites, the same considerations would seem to be in order as apply to large military missile launching sites.

The recent systems either new available, well advanced in development or currently planned that could be adepted to satellite launchers or space missions include a very wide variety of attractive combinations from the smallest like VANGUARD and JUNO I (fermerly called JUNITER NCs) with satellite psylend of about 20 psylend at 200 miles altitude to an improved TITAN supplemented by additional stages which should be capable of orbiting in excess of 10,000 psymds at 200 miles.

There are many ways to appraise this rich assertment of possibilities. The Group has, however, considered first the propulsion and guidance perferance of the assertment, for upon those 2 parameters mainly depend a satallite's orbital characteristics, the useful weights that it can carry, and its lifetime.

Secondly, the Group has accepted the statements of the military services on required applications, considered the methods proposed by the Military Departments for meeting their needs, and has attempted to show what can best be done, when it might be done with what is available, and what appears will be meet needed in the fature.



as typical of these which could best meet the immediate and longer term objectives. Here a word of contion is in order. The estimated paylend weights and dates of availability used in this report are those given to the Group by the Military Departments. The Group feels that these estimates of dates are very eptimistic on the basis of all experience to date with development of missiles and satellites. Certainly name of the objective will be accomplished any earlier than proposed. The calendar times estimated by the military services should probably be increased by a factor of 1.5 to 2; the validity of any particular estimate can best be judged by comparison with past performances of the same group. The Group has used these dates only as a guide to relative time of earliest availability and

Semewhat similar caution is indicated in accepting proposed payload weights. Here, herever, the Group, after considering the detailed tabulations of estimated and actual perference data, believe that the weights attributed to the various

In summary, it seems to be an understatement to say that there is a wealth of resources in the Matienel inventory of capabilities. Before attempting to select the best possibilities for a Mational program it is mesessary to appraise the proposed military and other possible applications to see which of the propesed cambinations might best accomplish the most for minimum effort.





	PROPULSION AND GUIDANCE COMMINATIONS THAT COULD GIVE						
VAN 100	Sad Stees	721 Store	th Stee	Caldeno	Satellite Payleade		
THE	VAN 2(11ghtened	>/	Nene	VAH	55		
THOR	i-VAE 31.	None	Neme	Spin 2nd	50-200		
THE	4-741 31a	None Yawa	None	Spin 2nd	200-200		
THE		VAN 3	Xane	Spin 2nd & 3rd	300-500		
1902 (175k)	XX-34	VAN 3	\$ene		500-700		
THUR (165k)	15,000 lbs.	None	None	TORN	2,800		
TROR (165k)	VM 2(enlarged)	VAN 3(improved)	Xene*	TAN	475		
THER (1692)	VAN 2 (calarged)	3-VAN 3(improved)		YAE	800		
		3_VAN 3(improved)	Fored)	TAN	900		
REDSTORE	11-5/20mm	3-SARG-	== THOR ; 1_SARG		<b>)</b>		
JUPITER	11-8400	3-84RG	1-8420	Spin appear	17		
JUPITER	12-VAN 3.	3-741 3	1-VAN 3.	•	110		
atlas Atlas	Sestainer	Sterable prep.	None	TOTAL .	540		
THE	Sectainer	7 <sub>2</sub> /m <sub>3</sub>	Neme	Ram	4,000 4,700		
TTM (400k)	TTEAN-2	15,000 lbs. Sterable prep.	Xene	TORK	4,600		
FITAN	VAN-1 (medicied)	70,000 lbs.	Xone	TEN	10,000		
THE	TITAL-2	VAIL-2	Name	TA	2,000		
,250,000 lbs.	TITAE-1	None TITAL-2	Nene	REM	3,000		
Segurard fre	ARISC, For pales o	_	Neme	Special	25,000		

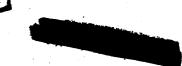
Sestuard from ARCC. For polar and retrograde eracts, the payload would be considerably reduced.

Siderably reduced.

Sufficiently reduced







## Military Applications of Satellites

#### (Table II)

The military applications given in Table II have been assembled by the Group in the order of priority in which the statements of the Military Departments

All military services put the recommaissance-surveillance applications at the top of the list. Within this general category there is some difference in priority of the sub-items depending upon the primary service mission. But the urgent need for intelligence data of the Soviet Union at the earliest date that seems possible

Many of the other military applications, particularly weather forecasts, communications, and navigation will sometimes, though not always, be pessible with the same satellite used for surveillance. This is also tree for many of the science applications. The feasibility of accomplishing satellite-countermeasure techniques by satellites is not as clear as the use of satellites for countermeasures against detection systems for ballistic missiles or other satellites.

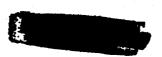
A point stressed by the Navy in support of countermeasures against satellites deserves emphasis here: If the UNER develops a satellite surveillance system, they will have attained the means, which they have never before enjoyed, for keeping continuous plots of surface vessels in all oceans, and thereby make even more

Armed space patrel applications are so dependent upon experience yet to be gained in high performance propulsion systems, space medicine, and so on that little can be said about their potentials now except to recognise their ultimate possibility.

On the besis of the presentations by the Military Departments the Group is satisfied that a number of the proposed military applications of satellites have now been demonstrated to be sufficiently practicable to warrant immediate and substantial support by the Department of Defense. The Group's conclusions and recommendations are believed to represent in general terms the support it has given to the broad point of military uses. But the justification for a Mational progress of the magnitude indicated requires a considerably broader view. It is necessary to look beyond the immediate or direct military applications in the conventional

The strongest point made by the Military Departments in support of direct military use is surveillance; but in a condition of declared war, for example, between the DEER and the United States, the Group has some reservations on the value of satellites for some types of surveillance, because under such conditions the question of "evert acts" would have been determined and other methods requiring overflight could be used.





Setellite recommaissance or surveillance seems therefore attractive in the present epoch because this technique effers some promise of getting important and timely intelligence on the USSR with minimum political risks, but also because it could be used as a forceful political weapon in revealing to the world by photographs of the Soviet Union many things that are now effectively kept secret. Such employment would incidentally go far toward recovery of National prestige or technological leadership which has suffered mementarily.

Nest of the other military applications have great potential non-military value, particulary as tools for science, weather forecasting, and communications.

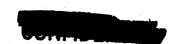
However speculative the success of some of the military proposals may now some to be, the Group is convinced that there is more than adequate justification.

When all of these points are conservatively weighed, the conclusion cannot be escaped that any Mational space program must be substantial, must be immediately authorized, and must be firmly directed. Any half-hearted or diluted effort will

To indicate some idea of the magnitude of a Matienal program such as the Group has in mind it can be said that the epinions of individual members of the Group fall between about 1 and 3 billion dollars for a three-year period for the overall Matienal expenditure.







# SUSURY OF RELIGIEST APPLICATIONS Stated by Military Departments

		Army	¥	
1.	Surveillance, Recommaissance, Mapping		Havy	Air Force
			. •	
•		*	<b>X</b> .	*
	V-TACENTA CLEMENT, DAGE SAMEL.	**	×	<b>3</b>
	Early warning against attack Electronic emissions (Ferret type)	· <b>x</b>	_	
		· •	X	x
	Submarine detection via sone busys	*		X
			*	•
z.	Communications			
	(Righ frequency broad band relays,			
	Electronic countermeasures, menitering)	•	X	*
	and the second s			
3.	Weather and forecasts	•		
	(Maridalde aloud earns			
	(Meriduide cloud cover, systems status, accurate		*	<b>3.</b>
h.	Howleast on Jana			
	Mavigation (all weather)			
				X
5.	Satellite countermeasures			•
		x	*	<b>x</b> .
6.	Science diseased to			_
- •	(Magnetic field for a surface applications	<b>x</b> .	<b>x</b>	
	thermal, solar rediction thespheric,	. •		*
	ionospheric observations; space biology,	•		•
	meteorite distribution; anti-missile research; air density)			
	TO THE PARTY OF TH			
7.	Armed space patrol			
		_		



## SELECTED SATELLITE SYSTEMS, PAYLOAD CAPABILITY, AND AVAILABILITY DATE

Szeten	Gross Weight 1560	No. of Staces	Satelli at 200 Polar	ite Payload Jai. alt. 30 deg.	Ismar Psyload 1bs.	Initial launch
V.ANGUARD	22,500	3		22	-	Meh. 58
Improved	22,543	3	35	<b>55</b>	•	Nov. 58
THE -VAN	111,360	3	350	475	50	Jan. 59
Improved	116,184	3	600	800	•	Jan. 60
Improved	116,184	4	700	900	125	Jan. 60
JENO I	62,500	li.	•	17	• .	Peb. 58
JIIO II	110,541	<b>k</b>	80	110	15	Jan. 58
JUNO III	116,619	<b>k</b>	400	240	100	Jan. 59
7702-117L	110,400	2	300	Moo )	50	Jun. 58
ATTAS-117L	270,000	21	2,000	2,700	1,000	Jun. 59
TITAL-VAN	195,000	3	1,100	1,800	375	1959

(JUNO I is a REDSTONE beester with 3 clusters of SARGRANTS) (JUNO II is a JUPITER beester with 3 clusters of SARGEMATS)

(JUNO III is a JUPITER becster with 3 clusters of stage 3 of VARRIAND)

SOLID:

VANGUARD and JUNO I:

Probably should not be extended beyond present program?

Improved VANGUARD: and JUNO II:

Useful for a variety of small military and scientific satellites. Probably should not be centimued beyond 1959 in view of cost compared with psyload capability and availability dates of other systems.

THOS-VANGUARD and improved. once, JUNO III and THUR-117L:

Vesful fer all military satellite missions, more complex scientific experiments, and preliminary lumar shots. Continuing large requirement for vehicles in this size range fereseen.

ATLAS, TITAN:

Will be required as seen as available for advanced military applications, instrumented soft landings on moon, tests with large animals and tests leading to manned space flight.





## SELECTED SATELLITE SIBTES, PAYLOAD CAPABILITIES, AND DATES OF AVAILABILITY (TABLE III)

Table III gives in summry form the relevant performance data of those satellite systems upon which the proposals of the Military Bepartments seen to focus.

The contion on estimated availability dates previously expressed in this report is repeated.

The Group requested information from the Air Ferce on their intentions respecting use of the NAVAHO becoters in satellite programs, but they did not respend.

Airborne launch or "fly-up" techniques briefly referred to in some of the presentations are not listed in Table III. The Group did not go into the perfermence characteristics of this method except to recognise the desirability of a review which would take into account any revision of conclusions made in past studies that might be needed.

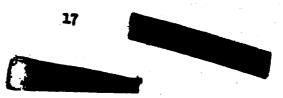
An examination of Table III indicates that the Matienal capability for satellite systems falls into three broad classes representing an increasing performance potential over a period of time.

The vehicles having the earliest availability are in the IST class, capable of erbiting a 20-pound payload and available in early 1958. This IST class includes VANGUARD and JUNO I.

In the next available group are those derived from the IMM, capable of erbiting a 500-pound payload and available in late 1958 to early 1959. This IMM derived class includes THER-VANGUARD, JUNO II, JUNO III and THER-117L.

In the third group are those derived from the MBM, capable of orbiting a 2,000 pound or larger paylead and available in late 1959. The NBM class includes AMAS-117L and TITMS-117L.

The Group recommends that the Mational satellite and spaceofflight program take full advantage of this growing capability, actively exploiting each advance in performance potential as it becomes available rather than uniting for the ultimate or attempting to develop separate means for launching satellites. The recommendations of the Group taken as a whole support a Mational program that starts with the ROY class, proceeds to the REM derived class and thus to the REM derived class and thus to the REM derived class. The Group cannot, on technical grounds, chaose among several alternatives in each class. Mithin a given class each of the proposed alternatives would have essentially the same technical performance and are roughly in the





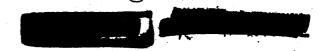
It will be obvious that to achieve a well coordinated and forceful directed program with the least risk of loss in time or waste of facilities and skills requires the maximum effective use, on a continuing basis, of the existing highly skilled teams currently working on satellite and space-flight developments for the Army, Navy, and Air Torce.

In order to narrow further the selection to the best available alternative, decisions of an administrative nature would be required which the Group feels so beyond the terms of your request.



# REPRESENTATIVE SPACE MISSIONS AND APPROXIMATE REQUIREMENTS

	THE WASHINGTON				
Elector	Total Velocity (ft/sec)	Payload	Guidance Equiv.		
Ballistic Missiles, 1,000 non.	201901	Mondod (lbs)	sheet to MEN.		
	12,500				
10,000 B.B.	22,500				
Sounding Rockets, 1,000 n.m.	2h,000	•			
10,000 n.n.	17,500				
Reads a	32,000	10			
Earth Satellites at 300 n.m. alt.		10			
200 8.8 9.00	26,000	10			
250 m.m. perigee, 1400 m.m. apagee	26 000	•			
•	26,000 26,000		7 000		
receverable	,		1,000 50		
at 1,000 m.m. alt.	<b>29,000</b>	•			
	26,000	<b>30</b> 10			
The site	38,000 38,000	20			
Itmar Vehicles Inpact	20,000	20			
	35,000	ko			
Instrument Landing Lumar Satellite	1.1:	40	30		
	14,000 38,500	200			
Circum Lunar and return to Earth	JU 300	50	5		
v. s.	35,000		<i>5</i> 0 .		
Interplanetary Vehicles	35,000	25 50	50		
very venicles	•	~	0.1		
Artificial Asteroid			•		
	37,000		•		
Here Shot	37,000	<b>200</b>	25		
Flate Shet		200	0.3		
	<i>73</i> ,400	7	0.1		
en e		• ,	Smell .		



### BRIEF SUMMARY OF ARMY, NAVY AND AIR PORCE PROPOSAIS

Mile differing in details the Army, Mayy, and Air Force advocate a coordinated and comprehensive Mational program leading to manned space vehicles. Their presentations were based upon voluminous engineering and scientific studies which were made available to the Group, and copies of which are on file in the Office of the Secretary of Defense, Director of Guided Missiles.

All three services recognise the need for the integration of the scientific—and military elements of the Mational program that will reduce the risks of dilution of Mational effort and resources and enhance the prospects of early recovery of American leadership in space technology and exploration.

#### Army Program

The Army proposes "A National Integrated Missile and Space Vehicle Development Program" for 14 years extending through 1971, and estimated to cost in the order of 14 billion dollars total.

The early phases of the Army program covering the first 3 years is a 16-vehicle program based upon the JUPITER missile as first stage booster, supplemented by spinning clusters of rockets. The estimated cost of this part of the program for the 3-year period is about \$\frac{2}{2}\text{h0} million. It includes the 20-pound experimental recommaissance satellite by June or September 1958, and a 509-pound satellite by January 1959. The Army estimates a capability for a 15-pound lumar shot by June or September 1958 and a 120-pound lumar shot with lumar photographs by January 1959. Their estimate of a capability for lumar impact with a 50 to 100 pounds is sometime in 1959. The longer term parts of the Army's suggested program include manned carriers and would require more powerful boosters like TITAN with various combinations of high-speed stages as do all other proposals.

#### Navy Program

The New stresses relatively light vehicles for the short range part of the program. In their view most of the immediate military requirements can be fulfilled with payloads of 300 pounds or less.

While likewise proposing an extensive Mational program for satellites and space vehicles, based upon booster rockets, the Mavy also attaches considerable importance to the X-15 vehicle approach as possibly the earliest method of obtaining manned earth-orbiting vehicles; and they estimate that it might be achieved within 3 years. The Mavy also advocates that more attention be given to engineering developments using even lighter launch mechanisms and include within their program 17 vehicles suggested by the Maval Ordnance Test Station for orbiting 10-pound satellites. They also recommend concurrent development of the "fly-up" method in addition to the rocket launch development.

As the short range part of the program through 1961, the Mavy proposes a 50-vekicle schedule including satellites ranging from 10 pounds to 300 pounds, as anti-catellite demonstration, and a fly-up launch demonstration, for a total estimated cost of about \$212 vallion. They also propose as inclusions in this schedule 5 lumar shots and a first manned crisital flight with the X-15 technique, but cost estimates are not yet available.

The 50 to 300 pseud satellites of the Many program would be launched by improved VANGUARD vehicles for the smaller, and a combination of THE and . . .

As the first part of a longer-range program the New proposes four 1500-pound establites using TTHE-MARGEMEN combinations. Cost estimates for this part of the program are not yet available.

#### Air Perce Progress

The Air Feroe program emphasizes the largest, most elaborate satellites and space vehicles which are based upon the AMAS and TITAN missiles. But they also suggest the possibility of a 300-pound recoverable photographic satellite — using the MRR booster for availability during 1959.

The Air Ferce Advanced Reconsciseance System, MS-1175, has been under intensive study since about 1951, although studies of feasibility were begun in 1956. The objectives of this program include photographs expected to give an ultimate recolution of 17 feet, ferret detection and location of verious high frequency emissions (up to 18,000 megacycles) with initial assurably of 60 miles and impressing procision later, infrared surveillance of aircraft and NAMPS, and ultimate visual surveillance with television techniques of g mile or better.

Under an accellerated program the Air Force estimates that the first of test vehicles of this program could be ready during 1959 for launching 2,000-pound satellites at 300 mile altitudes. Including costs already incurred, this program would probably cost about 200 million through 1959, but the Group is not clear as a first force cost estimates.

The Air Ferce estimate of a recoverable photographic satellite for use with THUR is about \$20 million in addition to the cost of the bessters. Beliable estimates of costs for longer term elements of the Air Ferce suggestions are not available.

The studies and development to date on W-117L cover almost every phase of the recommissance satellite problem, including malear power, radio isotope reactor power, solar cells and their possible applications. The studies also go far into the accompanying ground tracking and commissation facilities.

...

September 6, 1957

Onided Missiles

## REMORANDOM TO CHAIRMAN, ADVISORY GROUP ON SPECIAL CAPABILITIES

## SIBJECT: Satellite Programs

You and the numbers of your Group represent a unique body of experience in satellite systems and the astual problems of their development, having studied the possibilities before the announcement of the scientific satellite program, and having menitored its progress from the beginning. You also considered the larger, lenger range possibilities such as W 117L early in 1956 and made certain recommendations on it to the Department of Defense, which for a number of reasons could not be implemented at that time.

I feel that it may be timely to ask the Group to halp me by preparing for the time when it will ultimately be necessary to decide on a m ictions on military applications of satellite techniques.

The feasibility and timing of such applications seem to depend mainly. upon the capabilities of rocket systems, their availability, and, of course, upon the outcome of Project VANSUARD, our first venture into this field.

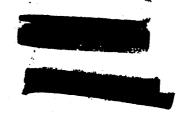
I should now therefore like to ask the Advisory Group on Special Capabilities to look again into the satellite plane and programs of the military departments and submit your conclusions on the technical capabilities based on the best available facts at this time.

In appreciating the broad question of possible military applications of satellites, which is yet unresolved, I should especially like to have your

Are the rocket vehicle systems sufficiently advanced to warrant a decision to support satellite techniques for such military applications as proposed by the Air Porce in Project 18 1174, or as may be proposed by other military departments?

Which ones of the missile or rocket systems currently in development would seem to be the best for military satellite use, and why?

DOWNER DED AT 12 YEAR PREMALS, NOT AUTOMATICALLY CECLASSIFIED. DOD DIR 5200.10





In your first report in August 1955, the Group visualized a possible continuing need for small scientific satellites, presumably for scientific needs apart from the more direct military applications. In the light of present experience with VANGUARD and its high cost, do you foresee any military, or for that matter, any scientific uses for such small satellites that could not be served by larger satellites, if larger ones are to be developed?

Alternatively, if scientific or technical limitations in your view will delay successful attainment of larger (say, 500 to 2000-pound) satellites within 2 or 3 years, to what extent should the Department of Defense support a continuing program of smaller satellites for military applications or developments necessary to success later with larger systems?

Please submit may additional findings which you feel would be helpful to the Department of Defense in determining its policy for the future with respect to satellite vehicles.

As all of the above matters are within the current directive to the Advisory Group on Special Capabilities, no further amendments to it are believed mesossary.

In arranging with the military services for hearings, interviews, or eccisultations, it should be made clear that your investigations do not imply any
tacit acceptance by the Secretary of Defense or this office of the view that
there are important and immediate military applications of satellites, as it
has not yet been satisfactorily demonstrated as being sufficiently practicable
to warrant early and substantial support.

As to timing, I shall be grateful if you could submit your main conclusions by March 1958.

S/M. M. Heladay W. M. HOLADAY Special Assistant for Guided Missiles



## MERTINGS AND ATTENDANCE OF THE ADVIBORY GROUP OF SPECIAL CAPABILITIES POR THE PURPOSE OF THIS REPORT

3-k Oct. 1957 18 Oct. 1957 1k-15 Nov. 1957 18-20 Dec. 1957

Room 35 131, Pentagon Rand Corp., Santa Romica, California

## Newbership of the Group

Dr. Homer J. Stewart, Chairman Dr. Rebert W. Buchheim

Mr. George H. Clement

Dr. Joseph Kaplan

Dr. C. C. Limitson (Absent for meetings of 3-4 Oct.)
Dr. Robert R. Melfath (Absent for all meetings)

Dr. J. Barkley Rosser

#### Staff

Mr. J. O. Spriggs (DCM) Rescutive Secretary Mr. Paul A. Smith (Consultant, ASD, RAE) Secretary

