(S) NATIONAL RECONNAISSANCE OFFICE [redacted]
WASHINGTON, D.C.

THE NRO STAFF

16 October 1967

DR FLAX HAS SEEN & READ
16 OCT. [redacted]

MEMORANDUM FOR DR. FLAX

SUBJECT: More Information on Mr. Lindsay's Article, "Satellite Photography"

BACKGROUND:

You will recall an article by Mr. Frank Lindsay, ITEK, "Satellite Photography", which was brought to your attention recently by Dr. Koslov (See Tab A). You passed the article to us and we took action to (1) capture all copies here at the Pentagon, (2) control any copies at ITEK, and (3) have the CIA "educate" Mr. Lindsay. Over and above the reaction to this manuscript from a security point-of-view, we were surprised that Mr. Lindsay -- a knowledgeable individual -- had attempted such an article at all and that he had chosen to send it to Mr. McNamara for clearance!

PRESENT STATUS:

Mr. Lindsay called me recently on this subject. He said he had tried to call you but you were absent. He asked me to pass the following information to you.

Mr. Lindsay has felt, for some time, that "an article on this subject is overdue and might do a lot of good." He chose "Foreign Affairs" as the magazine in which he would publish. After completing the article, he realized the necessity of getting expert advice on its security level. His own opinion was that the article was unclassified but he recognized that the security of this particular subject area is unusually complex.

Mr. Lindsay submitted his article to Mr. John Bross, CIA, and asked for his evaluation of it. Mr. Bross replied that he and Mr. Carl Duckett found nothing objectionable in the article; however, since Mr.

Lindsay would be in Washington the following week, they would like to discuss the matter with him over lunch. At that meeting, Bross and Duckett advised Lindsay that, while they had no objection to his article, the whole subject of partial disclosure was extremely touchy. After months of slow movement toward partial disclosure, with the entire intelligence community agreeing to such an action, Mr. McNamara had rather abruptly forbidden relaxation. Bross didn't know why Mr. McNamara had taken this position, but it appeared that only he (McNamara) could approve Lindsay's article.

In the meanwhile, Lindsay had made a parity check by sending his article to Mr. Roswell Gilpatric, who had replied that it was an excellent article, should be published, and Lindsay "shouldn't have to ask anyone's permission." Lindsay says he chose Gilpatric mainly because the latter had published an article, some time ago, which alluded to satellite reconnaissance (See Tab B).

Lindsay, however, felt a strong necessity for getting official permission, and, based on what Bross had told him, the proper authority was Mr. McNamara. So he called Mr. Yarmolinsky, at Harvard, and asked him how to make the contact. Mr. Yarmolinsky said he was going to Washington within a few days and would set up "a channel" for Mr. Lindsay. When Mr. Yarmolinsky returned, he told Lindsay how to address his letter (presumably Yarmolinsky arranged for the OSD-mailroom to divert the letter to ASD/ISA).

In the meanwhile, Mr. Lindsay had been in Washington also, on other business, and had conversed with Don Steininger regarding his paper. He did not have the paper with him but did describe its contents in detail. Steininger said the paper sounded "great". He volunteered, additionally, that he heartily endorsed the President's "off-the-record" statement in Tennessee; that such a statement was long overdue; that more disclosure was called for; that in a year or two we would need to surface most of what is now being done undercover; and that Lindsay's article was a reasonable step toward orderly disclosure.

Mr. Lindsay wants us to have this little history to reassure us that (1) he had good reason to go to Mr. McNamara with his article, and (2) he had reason to believe his article was in the public interest.

I told him that I would pass his message to you. I expressed my surprise that he failed to realize immediately that his article was out of bounds. Even if he "sanitized" the article, he would never be able to release it, since his company affiliation automatically made anything he wrote on the subject uniquely sensitive. He asked what action we had taken on the matter. I told him we had captured all copies, up-graded their security classification, and asked the CIA to take follow-on action.

I urged him to visit us soon for a full discussion of security policy regarding satellite reconnaissance.

PERSONAL REACTION:

First, it should be borne in mind that Mr. Lindsay's account of events is just that: his account. If it is essentially true, it does not speak well for the security consciousness of each person he contacted.

Second, regardless of the events, Mr. Lindsay's initial action -- writing the paper -- is still incredible.

WHAT NEXT?

The CIA, based on our strong reaction, plans to admonish Mr. Lindsay.

[redacted]MAN
Colonel, USAF

~~TOP SECRET~~

HANDLE VIA BYEMAN CONTROL SYSTEM

~~(S)~~ NATIONAL RECONNAISSANCE OFFICE

WASHINGTON, D.C.

THE NRO STAFF

22 Sep 67

MEMORANDUM FOR DIRECTOR OF SECURITY/CIA

SUBJECT: Mr. Franklin A. Lindsay
President, ITEK Corporation

I am forwarding herewith a copy of correspondence addressed to the Secretary of Defense by Franklin A. Lindsay, President of ITEK Corporation, wherein he requests the Secretary's approval of an article on Satellite Photography for publication in Foreign Affairs.

At the request of Dr. Flax, the NRO Staff has captured all DOD correspondence and action related to this matter. Despite Mr. Lindsay's assurances that he has satisfied himself with respect to security, the D/NRO is deeply concerned and we here feel that the article breaches BYEMAN security in that it confirms an on-going U.S. satellite reconnaissance program and further, accurately assesses the current technological effectiveness (as well as technological shortcomings and plateaus yet to be achieved) of the program. Mr. Lindsay could not have prepared such an accurate assessment without the benefit of his long classified association with the NRP.

Furthermore the subject matter of Mr. Lindsay's article is indeed, as he states, "sensitive." In light of Mr. Lindsay's privileged sources and of this government's recent high-level reaffirmation of policies related to this subject, we do not feel it is appropriate that he publish any material related to satellite reconnaissance.

In light of the DCI's primary responsibility with respect to the protection of intelligence sources and methods and in order to keep corrective action in proper contractual perspective, it would be appreciated if you would accept action on this matter for the DCI upon referral from the Office of the Secretary of Defense.

RUSSELL A. BERG
Brigadier General, USAF
Director

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HANDLE VIA BYEMAN CONTROL SYSTEM

~~TOP SECRET~~

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FRANKLIN A. LINDSAY PRESIDENT

BYE-052770/67

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6 September 1967

The Honorable Robert S. McNamara
Secretary of Defense
Washington, D. C.

Dear Mr. Secretary:

In order to increase general public understanding of the capabilities of satellite reconnaissance as an instrument for arms control inspection, I have prepared the enclosed article on Satellite Photography for publication in Foreign Affairs. While I have satisfied myself that the text presents no security problem, I felt it desirable, in view of the sensitivity of the subject matter, to send it on to your office before submitting it for publication.

Sincerely,

[signature]

encl.

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~~SECRET~~ HANDLE VIA BYEMAN CONTROL SYSTEM

ITEK CORPORATION - 10 MAGUIRE ROAD
LEXINGTON, MASSACHUSETTS 02173 - 276-3001

FRANKLIN A. LINDSAY PRESIDENT

1 September 1967

Doctor Morton H. Halperin
Office of the Assistant
Secretary of Defense, ISA
Washington, D. C.

Dear Mort:

This is going to you as an advance copy. The original will be dispatched on 6 September 1967.

Sincerely,

Frank

encl.

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SECRET HANDLE VIA BYEMAN CONTROL SYSTEM

30 August 1967

SATELLITE PHOTOGRAPHY

INTRODUCTION

Some years ago Senator Benton reported a conversation with Nikita Khrushchev in which Mr. K. boasted of Soviet satellite photography and its ability to record details of military bases. Since then, American Presidents have consistently paid tribute to the tremendous importance of photographic reconnaissance and of the reliance this government is now placing on this new instrument of defense and of national policy. While theoretical calculations of degree of detail, or resolution possible from satellite altitudes are perfectly simple for any optical engineer to make, practical performance will be degraded very considerably by a variety of technical factors. But an oversimplified conclusion is that it will ultimately be possible to see from satellite altitudes almost any degree of detail that a government is prepared to pay for.

The existence of sophisticated satellite systems are of great strategic importance. They can have stabilizing effects on the nuclear arms balance and can contribute importantly to lessening the danger of nuclear war. They also provide unique capabilities for inspecting arms control agreements and for planning the economic development of the world as well. The reconnaissance satellite has become a vital instrument of national defense and national policy in the United States and in the Soviet Union. It will become increasingly important in the future and it is inconceivable that either side would now abandon the reconnaissance satellite as an instrument of national defense. It is therefore important to understand something of the technological aspects of remote surveillance, its present impact on international affairs, and the new avenues of action it opens for the future.

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It is often believed that the only measure of performance of a reconnaissance system is the degree of detail that can be recorded on a photograph or other record. In reality there are several key measures of performance, and these are often in conflict. These measures, or objectives, are:

- the ability to defect and recognize smaller and smaller objects and the ability to measure with high precision the dimensions of objects of significance (this is called the <u>resolution</u> of the system)
- the ability to measure with high precision the relative position of objects within a limited area
- the ability to measure with high precision the exact geographical location of objects on the ground, such as radars and missile sites, to relate such objects to a world-wide coordinate system
- the area of the earth which can be covered in a single photograph; or, alternately, the area that can be covered by exposing all the film carried on a single mission
- the time delay between the moment it is decided that a reconnaissance mission is required and the moment the processed information is delivered to the ultimate user
- the qualitative character of the information required (will it be best revealed by photography, by infra-red recordings, by space-borne radar, by monitoring ground radar signals or by some combination of these)

- finally, the costs of getting the information required in relation to the value of the information. The costs are primarily related to the weight of the system put in orbit.

These factors are in conflict in the sense, for example, that higher resolution can be achieved only by reducing area coverage or by increasing the weight of the camera and film load. Similarly, a quick reaction capability can be achieved better by transmitting a television-type picture from an orbiting satellite to the ground than by waiting until the satellite is over a recovery area to bring the entire spacecraft or a film package back to earth. But radio transmission has such limited capacity to transmit the great detail available from a high performance camera that only a very few high resolution pictures can be transmitted per day. Alternately, quality or resolution must be sacrificed in order that radio transmission capacity can keep up with the picture taking capacity of the camera.

Photography provides by far the best detail of any of the possible space sensors and hence the camera is the most important of the various sensors that might be employed in a satellite. Its major limitations are that it cannot see through cloud cover or at night.

To achieve the best resolution the satellite camera should be as close to the surface of the earth as possible. But below 90 miles the atmosphere begins to have a drag or retarding effect on the satellite, and the satellite must either carry some auxiliary fuel to maintain its altitude or its mission must be limited to a very few orbits. Below 80 miles, moreover, the friction of the atmosphere becomes so great that temperatures are generated that could seriously deferiorate or destroy both the film and delicate electronics.

At an altitude of 100 miles the satellite will make a complete revolution of the earth approximately every 90 minutes. But while it is making one near polar orbit, the earth is turning beneath it so that on each successive revolution it covers a new area of the earth below.

In 24 hours it will be roughly back to the point at which it started. It is, however, possible to set the orbit so that in the second, and even third, 24-hour period the satellite will traverse paths that lie in between the tracks covered in the earlier 24-hour periods. Thus complete coverage can be achieved by making the distance between tracks as small as desired, but only by increasing the number of days required to accomplish the mission.

In general, however, a single satellite can be orbited to pass within a 60 degree line of sight, during daylight hours, of any point in the temperate zone of the earth within four days, and thus should be able to get good pictures of any possible target, providing of course that there is no cloud cover at the time it passes.

An alternate to a near earth orbit is to place a photographic satellite in a syncronous orbit, 24,000 miles above the earth, as is being done with the present communication satellites. In such an orbit the satellite remains stationary with respect to any area on the earth and is thus always in position to photograph any spot within an area as large as the North American or Eurasian continents on instantaneous command. The difficulty with this approach is that to see the same degree of detail the camera lenses must be over 200 times more powerful than those needed at a 100 mile altitude. A second difficulty with the synchronous satellite is that the pictures must be transmitted by radio, rather than physically recovered, and this places severe limitation on the number and quality of pictures that can be transmitted to earth in a single day. The time will come, however, when lasers can provide ultra high capacity, and instantaneous transmission links from such satellites to earth.

For full reliability several ground receiving stations will be required so that at least one will always be free of local cloud cover or fog or, alternately, aircraft can be stationed above the clouds to relay the transmitted data to the ground.

Modern lens design and aerial camera technology makes it possible for just about any size ground detail to be recorded or any extent of ground area to be covered on one photograph. But the requirement both for small detail and for large area coverage from a single camera are, to a great extent, incompatible. In general, detection of the smallest possible detail means limited area coverage, and broad area coverage means sacrifice of detail. To illustrate this point, a perfect lens could theoretically make possible a satellite system which could detect objects six inches in size on the ground and encompass an area of six square miles on the ground, whereas a theoretically perfect lens designed to detect five foot objects could under the same circumstances cover an area of six hundred square miles on the ground.

To give some idea of size, the theoretical lens would need to be about five feet in diameter and the second about eight inches in diameter. The total weight of high performance space cameras is very sensitive to detail size to be recorded, so that a camera system designed to record detail as fine as one foot might weigh as much as several hundred times the weight of a camera designed to record ten foot detail.

But more importantly, the theoretical performance of the lens itself is degraded significantly by many factors so that actual performance of the camera is considerably reduced. The slightest vibration or instability in the space vehicle itself produces a blurring of the image on the film. Similarly, unless the relative velocity of the space craft in relation to the earth is perfectly compensated, and this is almost impossible, further blurring will occur. Another degrading factor is the temperature changes encountered in space. The temperature of that side of the space craft which is in the sun may be 200 to 300 degrees Fahrenheit higher than the side in shadow. And this temperature differential tends to warp the lens inside and to throw the delicate camera out of focus. Thus actual performance of the entire camera system is substantially less than that theoretically computed for the lens itself.

Another degrading factor external to the camera is the depth of atmosphere through which the satellite camera must look. Often it is filled with dust, smoke and haze, all of which tend to decrease the contrast of the object with respect to its background, and thus make it more difficult to resolve the object.

The turbulence of the atmosphere - the shimmering of heat waves - distorts and degrades the quality of the satellite picture in much the same way as it degrades the quality of pictures of the stars taken through high powered earth telescopes. But this has turned out to be less damaging for satellites than might be expected because nearly all of the heat turbulence of the air occurs just above the ground, where it is most damaging to earth based telescopes looking up, and least damaging to satellite cameras looking down.

But in spite of these many degrading factors, there appears to be no ultimate limiting factor on the degree of detail that can be photographed from an orbiting satellite, providing a government is willing to pay the costs of putting a sufficiently large and sufficiently finely tuned camera into orbit. In the last six years, the cost to place equipment in near earth orbit has dropped from 3000 dollars per pound to 700 dollars per pound. And this trend of rapidly decreasing costs will continue.

The remaining limitations on performance are night and cloud cover. Various electro-optical devices for amplifying very faint light levels, now used for example, in night telescopes for infantry riflemen, may someday offer the potential of satellite photography with only moonlight, or even starlight alone, to illuminate the scene. Cloud cover offers a more fundamental obstacle. Visible light cannot penetrate clouds. Radar offers the only alternate. One present limitation on radar is that of resolution. A radar system of comparable weight and cost would provide far less resolution than a photographic system, but it could look through clouds. This capability is probably not very important in most areas of the earth where periods of clear atmosphere alternate rapidly with periods of cloud cover. However, in areas along the arctic circle on both the American and Eurasian Continents, large areas are covered with cloud more than 95% (?) of the time and scheduling photographic satellites over these areas at the right time to peer through occasional breaks in the clouds would be almost impossible.

A second fundamental limitation on radar is that unlike a photograph, a radar picture of the same object viewed from different angles appears quite different in each view. This is not a matter of perspective but rather that individual objects, or parts of objects, may reflect radar signals strongly in one direction and hardly at all in other directions.

Infra-red snesors, while having far less resolution than the cameras operating in the visible portion of the spectrum, do provide another dimension to reconnaissance. Essentially they record temperature differences on the ground. For example, the fact that a new atomic reactor has been placed in operation can be revealed by measuring the temperature of river water upstream of the reactor compared to downstream. An operating reactor will be using large quantities of water for cooling, and as a result the temperature of the river downstream will be a few degrees warmer than upstream as a result.

Two pictures of the same ground area can be taken from different angles to reveal altitudes. If the angles at which these stereo pictures are taken differ by 20 degrees, for example, the heights of buildings, or missiles, can be measured even more accurately than the horizontal dimensions.

A manned reconnaissance space vehicle would have potential advantages over an unmanned craft; but it would also have disadvantages. The principal potential advantage is that of flexibility and fast response. For example, a man might either be able to observe the ground in real time using a telescope, or he might take pictures with a high resolution camera, and develop them while in space. In either case, he could report his findings immediately by radio. But the confidence level of those on the ground would probably be greater if they were able to see the actual pictures rather than to rely on the interpretation of an astronaut trying to operate in a constricted, gravity-free craft moving above the target at 18,000 miles per hour. Nevertheless, there could well be situations in which the presence of a man could save invaluable minutes, or even hours, in assessing the possibilities of an imminent attact.

The technical advantages and disadvantages of placing a man in the space craft seem now to be about a draw. The life support chamber and supplies needed for the astronaut are complex and heavy and most, if not all, of the functions of the man can be performed by added equipment taking the place of the man-supporting pressure chamber and supplies. On the other hand, an astronaut could provide key information more quickly than if the pictures themselves had to be returned to earth for evaluation.

The Soviet interception of the Gary Powers U-2 mission demonstrated both a capability and determination to stop photographic reconnaissance conducted by aircraft. It is thus important to assess the problems of satellite interdiction and the likely development of capabilities both to attack satellite reconnaissance vehicles and to defend these craft against disablement. First, the capability to destroy or disable a reconnaissance space craft by exploding a nuclear warhead in its vicinity undoubtedly exists today. But this is a violent and overt act and the country using such a tactic would undoubtedly pay a heavy political price in world opinion, and would cause other nations to assume a major arms program, or even an attack itself, was in the making.

NASA has demonstrated the capability of rendezvousing a manned satellite with an unmanned vehicle launched from the same ground point. Although it is somewhat more difficult to intercept a craft launched from another part of the world, it should be within current capability to intercept and disable such a space craft, providing it remains passively in the same orbit long enough to plot that orbit and to launch and maneuver the pursuing satellite. But the capability to capture a satellite and bring it back intact to one's own territory for public exhibit is considerably more difficult and would undoubtedly require that the intercepting craft have a "hold" large enough to completely swallow up the captured craft before returning to earth. In addition, the attacking space craft would be faced with the possibility that the intercepted vehicle was booby-trapped to prevent capture of either the exposed film or the craft itself.

A third form of attack could be to jam the radio signals transmitting pictures to earth, assuming physical recovery were not used. But this would require the attacking satellite to remain in the vicinity of the reconnaissance craft and to determine the radio frequencies being used for picture transmission before jamming could be effective.

The defenses against interception and non-nuclear disablement appear to be relatively simple in comparison to the problems of attack. A principal defensive tactic would be to alter randomly the orbit of the space craft, somewhat as a ship zig-zags to avoid torpedo attack. In order for an attacker to plot an intercept course he must very accurately measure the orbit of the vehicle he aims to intercept. This takes at minimum ten separate observations of its position from widely separated parts of the earth and usually extend over at least one full orbit. A precise intercept calculation would require closer to one hundred observations. If at any time during this process of orbit calculation, the course of the reconnaissance craft is altered, even very slightly, the entire process of orbital measurement must be started all over again. A change of course of as little as one degree or a change in altitude will, an hour later, place the craft several hundred miles away from its original course. Thus the interception of a space craft taking evasive action appears very difficult indeed.

Nevertheless, the possibility of a space war developing over the attempt of one space power to capture or disable a reconnaissance vehicle of another nation is real. The dangers of a major confrontation and crisis are probably greater if the photographic craft is manned rather than unmanned, although the possibilities of evading interception may be greater if there is a crew aboard to control the evasive actions. Finally, an attempted interception and destruction of a reconnaissance satellite may, in itself, provide warning that aggressive actions are about to be launched.

It appears likely, however, that unless we go to sleep we should be able to build into spacecraft the necessary defensive characteristics that will allow them to escape being disabled by the Soviets, should they elect to use their growing capability for interception.

The strategic uses of satellite photography can be several. First, periodic search and surveillance of very large areas can be conducted for the purpose of identifying new or previously unobserved activities of a strategic nature: the building of a road or railway span that may be preliminary to construction of a missile launch site, the construction of a complex of underground missile silos, the construction of a shipyard, or the beginning of an anti-missile defense system. For this purpose coverage is essential and resolution must, to some degree, be sacrificed to obtain such coverage.

The second use is for more detailed surveillance of specific targets, already identified, to detect changes in activity, completion of construction, arrival of weapons, etc. In this case, broad area coverage is not needed and can be sacrificed to obtain greater detail in more precise areas of interest.

A third use is to perform highly accurate mapping of potential military targets, such as missile launch complexes or nuclear gaseous diffusion plants. In order to correctly target a missile against a specific target such as another missile launch site, the precise location and elevation of both the launch pad and the target, relative to each other in latitude and longitude. These targets may be half way around the earth from the launch pads. In order to make such measurements from photographic satellites with the necessary precision, the exact location and altitude of satellite must be known at the instant the picture is taken. (even though it is traveling at 18,000 miles an hour and its height might vary from 90 miles to 200 miles during each orbit.) Secondly, the optical distortions in the picture caused by the lens itself must be known exactly so that later these distortions can be precisely corrected in the map-making process.

Another important potential use of satellites is to monitor military activity for indications of possible imminent offensive action. In this case the primary requirement is for speed in getting the information to the user. If radio is used to minimize the time lag in reporting, the amount of information transmitted must be sacrificed. In the future laser communications will be able to overcome the bottleneck.

Satellite photography is not limied to strictly military targets. It can reveal enormous detail about the current economic conditions in an industrialized state which vitally affect the interplay of internationsl politics. The building of new transportation nets, the volume and variety of heavy industry production, the type of crops and size of harvest can potentially be scanned from space. This can provide much reliable knowledge about internal conditions in a country which will often foreshadow its attitudes and actions in the international arena.

Satellite photography cannot detect the assembly of a nuclear warhead inside an industrial building. It cannot spot a nuclear submarine deep below the ocean's surface. It cannot reveal the thoughts of the political leads or of a nation on the issues of war and peace. But it can collect, quickly and reliably, thousands of indicators that together can reveal a great deal about the state of economic and military preparedness of a nation, and reveal as well many indications of possible imminent offensive action.

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The significant implication of satellite reconnaissance is that, after twenty years of deadlock on the question of international inspection of armaments, the United States and the Soviet Union have entered a technological era in which both sides have the capability of extremely sophisticated mutual inspection. The point is significant because it raises three far-reaching questions:

1. What is the effect of this emerging capability on the contemporary strategic situation?
2. Can the new technology break through or transcend the disarmament-inspection stalemate of the past two decades?
3. Is it feasible to adapt the new technology to an international disarmament-inspection plan?

The era of sophisticated mutual reconnaissance has arrived without, so far, any serious destabilization of cold war politics and without perceptibly increasing the danger of nuclear war. Although the Russians used the shooting down of a U-2 over Sverdlovsk in 1960 as an excuse for cancelling the scheduled Paris summit conference, the resulting diplomatic embarrassments were temporary and hardly war-prone. Of more enduring significance, the incident dramatized the fact that, over the previous five years, the U-2 had successfully kept the Soviet Union under photographic surveillance and had thus helped equalize the distinction between "open" and "closed" societies. The Soviet Union was deprived of the military advantage it had once enjoyed of an unknown number of missiles secretly dispersed throughout a vast continental territory. The U-2, it seemed likely, had inventoried and targeted these installations with some accuracy.

There are, in fact, good grounds for speculating that greater rather than less stability has resulted from extended U-2 penetration of Soviet military secrecy, followed, presumably, by at least equally extensive satellite reconnaissance. Moscow's retreat from Cuba in the face of the U.S. ultimatum may have been dictated in part by the Kremlin's awareness that the missile sites within its own borders were by that time pinpointed and highly vulnerable. The willingness of the United States to take this risk may also have been dictated by its satellite-gained knowledge of Russia's relative missile strength.

From the Soviet standpoint, satellite photography of the United States may also provide a degree of stability to their own military posture. Sure knowledge, for example, that the United States had not embarked upon an antiballistic missile program could possibly strengthen the position of Soviet doves against their own hawks in the decision as to whether or not to proceed further with their ABM system. Similarly, secure knowledge that United States possesses a missile capability invulnerable to a surprise Soviet attack can convince Soviet leaders that we are not under compulsion to strike first because our missile force cannot survive to strike second.

Perhaps the most important effect of satellite reconnaissance is its effect on an arms race. Through such reconnaissance a much more accurate estimate of order of battle can be obtained. For example, the number, type and degree of readiness of land-based missiles; the number and capacity of missile submarines in commission; the existence, capacity and operating level of gaseous diffusion plants for producing weapons grade uranium; the existence, capacity and operating level of nuclear reactors capable of producing plutonium for weapons; the location and capacity of military air fields and the number of types of military aircraft in operation, can all be accurately determined.

The influence of satellite reconnaissance on our military posture is well illustrated by current speculation about whether the Soviet Union is embarked upon a program to install an anti-missile system. Space surveillance should be able to give us a much more accurate assessment of the degree to which such a system is being deployed and an assessment of its degree of technical sophistication. And this is critically important to our own decision whether or not to further increase our own missile force in order to be sure we can penetrate their defenses, or alternately to proceed with construction of a similar anti-missile defense capability. For if a nation can secretly develop and install a major offensive or defensive capability not possessed by others, it will secure a decisive military superiority that upsets the careful balance of power upon which the preservation of peace now depends. On the other hand, it is equally necessary to assure that the United States does not undertake a major expansion of its weaponry because of inflated estimates of Soviet or Chinese advancements.

In all this, the point that deserves repeated emphasis is that satellite reconnaissance provides the information needed to maintain our rather tenuous hold on the balance of coutervailing military capabilities, and right now this is the crucial pivot on which peace is hinged. It gives us the means to puncture bluff and protect against blunder. It helps shield both the United States and it adversaries from the intimidation of unwarranted fear and the presumptuousness of unjustified arrogance. Thus it acts to preserve the uneasy stalemate that has so far proved the only feasible alternative to cataclysmic conflict.

A further result of satellite reconnaissance less clear to assess is the effect on missile targeting and missile strategy. Satellite reconnaissance provides the exact location of all fixed land-based missile launch sites - though not of submarine based missiles or mobile land based missiles. This means that the probability of hits on these fixed sites goes up substantially, and therefore the number of missiles needed for a successful knock-out blow is lowered and the probability of success goes up. If it were not for the existence of Polaris-type missile systems, this might result in reducing the number of missiles required for a surprise knock-out blow, and therefore in increasing the incentive to an aggressive power to try such a surprise disarming attack. But even without a Polaris type system, satellite photography can provide a strong stabilizing influence to a nuclear power because it provides reliable information on the level of its missile force required to deter its potential adversary from risking a surprise attack.

Satellite reconnaissance also provides a system of verification of actions that a major power may assert it has taken as a means of de-escalating a major crisis. In the Cuban crisis, for example, the immediate availability of reconnaissance aircraft provided a means of monitoring the Soviet commitment to remove its offensive missiles. In similar crises, satellite monitoring of agreed actions by all parties may prove politically and technically more feasible than aircraft surveillance, provided that the time required to bring the satellite over target and to return the essential information to earth is sufficiently short.

In the event of an accidental nuclear launch that results in major casualties to another nation, the only way to avoid a major catastrophe could be for the responsible nation to take certain clear actions as an evidence of good faith in the wake of the accident. And probably the only politically acceptable way to confirm this would be through satellite verification.

Finally, the regular coverage of closed societies such as many of the Communist states, cannot but add a powerful psychological force to open up these societies, since it will be futile to try to maintain the degree of secrecy that hitherto has been possible.

The satellite has many of the characteristics of an ideal instrument for arms control inspection. It operates at altitudes which can have no conceivable interference with the internal affairs of the countries being inspected. Indeed, for the last ten years all the nations of the world have been subjected to constant overflight of satellites. Ground parties of inspectors, in contract, appear to be unacceptable to the Soviets and others because of their visibility to the population and because of their obvious challenge to the omnipotence of the State. Aircraft reconnaissance, while having the obvious advantage of flying lower, also have the disadvantages of vulnerability and of more overt presence.

The satellite can cover huge areas within a matter of hours, or at most, a few days; and it is not subject to the delaying tacts - "the bridge is out" - that can face ground inspectors. Finally the product is a picture that can be viewed by military experts, by political leaders and the public at large. It is an objective record subject only to the judgments of the photo-interpretors at the limits of resolution - and is therefore far more convincing as authentic evidence than a written report by an multi-national party of inspectors who may be acting under directions from their separate governments to play up or play down their observations for political ends. Indeed, the past has shown that UN inspection teams are often unable to reach any agreement on "the facts".

The time may be propitious to consider the internationalization of some aspects of contemporary reconnaissance technology. A few tentative steps in this direction have already been taken through the agreement - admittedly not adhered to perfectly - to register all satellite launchings and to share weather and other data collected by space vehicles. A logical next step, first suggested some years ago by Richard Leghorn and others, would be to establish within the United Nations a space agency with its own reconnaissance capabilities and responsibilities.

The orbiting vehicles could be provided to the U.N. by the two major space powers. They would consist of a small number of suitably adapted first-generation satellites (which have undoubtedly now been superceded by more advanced equipment) and access, or possibly even title, to the ground stations needed to launch these satellites and to receive the collected data. The U.N. would also need its own capability to evaluate and interpret the pictures and other information received. Meanwhile, the United States and the Soviet Union would unquestionably continue without interruption their independent surveillance activities, and would be using the most advanced technologies available to them.

It is unreasonable to expect these two nations to make available to others their most advanced techniques and devices for reconnaissance, nor is it necessary. The secrecy surrounding these provides a vital peace-keeping function in itself. The very fact that neither power can assess precisely how much each really knows about the other brings an added element of caution into their behavior. This is an asset for stability that should not be sacrificed.

To be sure, even first generation equipment would give the trained observers in the U.N. agency the ability to keep tabs on missile developments, on large military movements in border regions of neighboring countires, on unreported construction of major dimensions and a myriad of other activities falling within the range of gross intelligence data, which may or may not be of military significance. Yet it is most improbable that the information so derived would pose any additional threat to the security of the U.S. or the U.S.S.R. At its best, it would be inferior to the data already gleaned from their unilateral surveillance programs. Still, a new factor that might be brought into play would be the international publicizing of the more obvious secrets within these two countries, which are now known only to themselves and to each other. This would not be entirely without merit, for it would help marshall global opinion against any blatant maneuvers that may endanger the critical balance of power.

The primary advantage of a U.N. reconnaissance capability, however, is quite separate from any direct American-Russian confrontation. It lies in the ability to monitor activities on the periphery of the East-West struggle or among contending elements in the so-called Third Force World which increasingly tend to embroil the major powers in dangerous confrontations. Consider, for example, some of the dificulties and disputes that the U.N. has recently faced:

In the Arab-Israeli conflict of a few months ago, there were charges and counter-charges about who initiated the aggression and who violated the cease fire. Secretary General U Thant complained to the Security Council that the U.N. really had no effective means of verifying information from the contending parties or establishing the facts that the Council was pressing him to provide - and Ambassador Goldberg strongly urged that the U.N. be provided with the requisite capability for doing so in the future.

The U.N. presence that might have helped avoid the conflict in the first place was summarily ordered out of the Gaza Strip by United Arab Republic President Nassar. (He would have had trouble commanding a satellite to quit the skies).

The open terrain of the Middle East is particularly suited to space photography. Perhaps most importantly, however, the pictures themselves, which could be shown at the U.N., could provide objective and convincing evidence both of preparatory troop movements and of the observation by both sides of agreed truce terms.

The successful operation of a U.N. space surveillance agency would serve to improve the chances for new demilitarization or arms limitation agreements. The 1963 test ban treaty excluded underground nuclear detonations only because all parties were not convinced that these could be adequately monitored. Given the understandable aura of suspicion in international affairs today, there is a strong tendency to accept assurances of veracity only when they are coupled with verification. But if the ability is demonstrated to detect such explosions or to establish violations of a nuclear non-proliferation treaty or to reveal a dangerous escalation of the arms race - and if an international body like the U. N. has demonstrated its competence and objectivity in performing such functions - there could evolve a greater willingness to substitute truly controlled disarmament for the mounting effort to match destructive forces.

A two-level form of inspection, involving both the ternational control authority and the principal nations acting independently, could provide a high level of inspection confidence.

The advantage of such a two-part verification system is that it would leave to the major powers the latest technology to protect their own vital interests. At the same time the international authority would be provided with an independent inspection capability and hence there would be a greater credibility than revelations of violations shown by photographs obtained under secret conditions and only revealed to an international body at the last moment. Further, the presumably higher resolution photographs obtained by national systems, which probably would first reveal violations, could become the basis for suggesting or requesting photo coverage of a specific area by the international authority to verify the violation.

Further, national intelligence agencies will be extremely loath to show publicly pictures taken by their highest performance systems because in so doing they will also reveal the capability of the system to resolve details. Once this secret has been made public, the future value of the camera system is partially lost because the other side now knows exactly how much it has to hide.

In the long run, though the most enduring contributions of satellite reconnaissance may have nothing to do with military factors at all. Rather they will focus on the unprecedented command over the development of natural resources for peaceful purposes. And this undertaking, too, can best be achieved through a concert of nations.

The United Nations already envisions a World Weather Watch for observing, communicating and processing data collected by satellites for long-range weather forecasting. From this, according to one NASA official, "The payoff will amount to billions of dollars annually."

NASA itself has planned an Earth Resources Program encompassing five broad areas that are potentially suitable for the application of space technology. This program relies heavily on turning the techniques of satellite reconnaissance to peaceful and productive ends. The five areas of concentration would be as follows:

Agriculture and Forestry Resources. Earth-orbiting remote sensing systems would be used for surveys that, combined with automatic pattern recognition methods, will yield information necessary for improved utilization, development and productivity of world wide agricultural resources. The results of this system would include data on soil classification, land use capability, crop identification and analysis, flood and fire control, hydrologic studies and irrigation development, and many other factors related to the awesome challenge of conserving our natural heritage and feeding our growing multitudes.

Geology and Mineral Resources. Observations from space would give greater understanding of the earth's crust and structure, improved detection of thermal activity preceding volcanic eruptions, more detailed measurements of gravity and magnetic field forces, and even a new insight into the major earthquake belts of the world. Global geologic mapping from space would provide vital data leading to the discovery and exploitation of the undeveloped mineral resources for which there will be an increasing demand. There are untold possibilities in the extension and refinement of the type of an aeromagnetic survey that led to the discovery of an iron ore deposit at a depth of 1,300 feet below the surface of Missouri, which is valued at $2 billion.

<u>Geography, Cartography and Cultural Resources</u>. Geodetic and remote sensor satellites would decisively upgrade the quality of topographic maps (at about 10% of the cost of conventional aerial-mapping photography) and accelerate the acquisition of knowledge about land surface and drainage in the developing nations. Space surveys would improve census estimates in remote areas of the world and reveal large-scale patterns of urban development that could materially aid future planning. It would be possible to monitor broad transportation flows, to detect sources of water and air pollution, and to achieve a keener appreciation of the rate and nature of the transformation that human activity is working on the total environment.

<u>Hydrology and Water Resources.</u> Spaceborne radiometry and imagery would yield information on evaporation from reservoirs, the thermal effects on waterways by power plant effluents, and the contamination caused by sewage discharge. Ground-water studies would expedite prospecting and drilling, while establishing rainfall distribution patterns would aid in the study of runoff characteristics and drainage, leading to more efficient water usage. This is rapidly becoming essential, considering the immense consumption of water in industrialized societies.

<u>Oceanography</u>. The feasibility of satellite radars for sea-state measurements is now being evaluated. Televised pictures from space can show

ice areas and their features. Water masses and currents can be detected by infrared, microwave and photography. Space craft photography can also be used to map tidelands and shoals. Sensing devices are being considered for remote detection and identification of various species of fish. This could be indispensable in realizing ambitious visions of literally "harvesting" the oceans.

The initial phase of NASA's Earth Resources Program is a unilateral and rather modest effort. That seems altogether proper. At a later stage, though, when a much more extensive program will be called for, it will make little sense to pursue a go-it-alone policy. While a single nation can orbit its own satellites to collect all the data from space, its usefulness requires work here on earth. And as the data will reveal, this work must be done with a heightened respect for ecological factors - which, in turn, have absolutely no respect for the articial boundaries of political units.

In short, the ultimate utilization of satellite technology for the conservation of natural resources and the material enrichment of man depends on multilateral cooperation on a truly global scale. It would be logical, therefore, to plan for the conduct of this program under U.N. auspices.

Endowing the U.N. with a satellite reconnaissance capability for peace-keeping purposes thus can become the forerunner of larger responsibilities for ecological planning and possibly control in the future. During the interval, the UN space agency should acquire the necessary experience and competence and demonstrate the requisite objectivity that later tasks would demand. Hopefully an atmosphere of political trust and scientific cooperation in space activities will thereby evolve among nations, so there will be less reluctance later to assign the UN other more far-ranging functions that can be done only by an international organization.

Space reconnaissance today gives us windows on the world, permitting us to detect preparations for aggression and to deter assault. In the years ahead, the same technology can also serve even broader purposes. Indeed, we can even go beyond the fantasy of Archimedes to move the earth. We can gain the means to model it to our own aspirations, to shape and use our environment in accordance with the design we set for our lives.

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MESSAGE

DEPARTMENT OF THE ARMY
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TYPED (or stamped) NAME AND TITLE:
Arthur Sylvester
Assistant Secretary of Defense
(Public Affairs)

DEF 960865

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Department of State has sent the following guidance re Gilpatric article in Foreign Affairs:

"April issue Foreign Affairs carries article by former Dep SecDef Gilpatric, proposing possible US military posture for 1970, in absence 'major confrontation' between Soviets and West. Gilpatric would recommend that:

"1. FY 64 defense budget be cut by 25 per cent.

"2. All manned bombers and earlier-generation missiles be retired. Deterrent force be composed of only hardened and dispersed land-based and sea-borne missiles and capable destroying centers Soviet and Chicom society (i.e., counter-cities rather than counter-force).

"3. Continental air defense forces consist only warning systems and current generation anti-aircraft missiles. Manned interceptors be phased out.

"4. Continental missile defense forces consist only warning systems. No production or deployment anti-ballistic missile systems.

"5. Reconnaissance systems, both aircraft and satellite, be maintained and improved.

"6. No significant change general-purpose forces, except for reduction Army divisions at some stage from Korea or Europe, provided Soviet threat to Europe declined.

"7. Strong efforts R&D be continued, but effort on final engineering and testing new strategic weapons systems be reduced.

"8. Re[illegible]ve and National Guard be reduced.

"9. Any greater military reduction be achieved only after conclusion formal disarmament agreement, including provision for inspection.

"NYTimes, commenting on article, notes Gilpatric proposes 'largest reduction in military spending envisioned publicly by a defense source'. Also points out reduction not dependent disarmament agreement or military breakthrough. Washington Post states comments significant because Gilpatric's views have largely paralleled McNamara's, while Times states they appear reflect some of current strategic thinking by Administration leaders.

"If you queried about Gilpatric's views, you may: (1) point out Gilpatric no longer connected with government, and article written as private citizen reflecting his personal views; (2) indicate that recommendations contained in articles are predicated on assumptions (a) that evolving detente with Soviets

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will continue; (b) that Soviets are willing reduce military budget and forces; and, (c) that Soviets are not producing big bombers."

DOD concurs with above guidance.

SCP-4

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