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Copy 5 of 17

7 JUN 1965

MEMORANDUM FOR : Deputy Director for Science and Technology

SUBJECT : Transmittal of 5-15 Year Papers Relating to Quick Reaction Systems and Security/Contracting Policies

25X1A

Transmitted herewith is [redacted] with attachments concerning above subject.

(Signed) Jack C. Ledford

JACK C. LEDFORD
Brigadier General, USAF
Assistant Director
(Special Activities)

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D/TECH/OSA:John Parangosky:hmj (4 June 1965)
Distribution:
1 - DD/S&T
2 - AD/OSA
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5 - D/TECH/OSA
6 - APD/OSA
7 - D/TECH/OSA (Chrono)
8 - RB/OSA
9 thru 14 - D/TECH/OSA

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Attachment I to [redacted] 25X1A

QUICK REACTION, IMAGE FORMING INTELLIGENCE COLLECTION SYSTEMS IN THE PERIOD 1965-1980.

1. Introduction

This memorandum surveys the prospects and needs for image-forming intelligence collection systems (photographic, etc.) for quick-reaction to world crisis, which can be available in the following fifteen years. Specifically excluded are strictly military systems, (e.g. post-strike reconnaissance) and those which could politically only be employed in a hot-war situation, either because of the high risk of operator loss or the absence of a "plausible denial" capability. Included are all systems forming intelligence information images of the terrain and culture; [redacted] rather, this memorandum is limited to vehicles and systems designed to give rapid access to intelligence in specific crisis situations. (These crisis systems may be, in fact, special applications of normal systems, where this capability can be built in.) The crisis may be "tactical", where one wishes information regarding the details of the situation in a specific, local area, or it may be "strategic" where one needs information on the overall stature and war-readiness of a prospective major opponent such as the USSR or China. Normal systems include the currently undeveloped and unexploited "socio-economic" photographic intelligence application.

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2. The Meaning of "Quick Reaction"

Frequently, in the discussion of system improvements to the intelligence collection schemes, reference is made to the need for quick reaction. For this memorandum, the meaning of "quick reaction" is:

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Attachment I to [redacted] 25X1A

While maintaining a state of readiness, at a reasonable cost, the system can obtain and return to the policy makers, the necessary information in a minimum time (on the order of 24 hours) after the call for the information. Reaction time includes time for flight and recovery of the information, time needed to prepare the system for a particular mission, time to return the necessary data from the recovery site and time to analyze and submit to the policy makers.

It is within this last item, analysis and submission, that there is often misunderstanding. On the one hand it may be considered necessary to submit to policy makers a hard copy of high resolution photography; on the other hand, it may be considered necessary to submit only the results of the analysis, as read by competent analysts. In actuality, the analysis is all that is logically required; the policy makers are generally not the competent analysts, do not have time for detailed analysis, and thus cannot extract the needed information from raw photographs. However, one cannot deny the psychological impact on the policy makers of having in hand a picture, no matter how little understood, which demonstrates the information on which the analysis is based. In addition, photographic data is needed at a central location for correlation with prior photography and other sources.

The reaction time includes the time necessary to generate the mission plan. As systems develop, computer software improves; given the target location, the mission can be generated automatically. As our backlog of information increases from the routine CORONA [redacted] flights, the knowledge of what needs to be observed in a particular situation also improves, as well as our knowledge of the geographic location of the areas of interest. The increasing automation is not without its pitfalls, as it is all too easy to attempt to substitute computer logic for reasoning decision.

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3. Basic Needs

With the development of high-altitude aircraft and satellite reconnaissance photography over the past 15 years, the intelligence community has come to rely to an increasing extent on the "hard" intelligence derived from such systems. The search is for ever quicker receipt analysis of the information. Concurrently, the increasing capability of ground-air defensive networks in denied areas force consideration of less vulnerable systems. In addition to the active defensive networks coming into operation, increased Soviet bloc activity in the passive, camouflage defensive techniques is probable. For some intelligence requirements there is need for a more detailed rendition of the targets, i.e., high resolution systems. The needs fall naturally into four categories, in order of importance:

a. increased speed of response

b. less vulnerability to active defenses

c. less vulnerability to passive defenses

d. more detailed rendition of targetry

In time of crisis, the first two are of utmost importance, as one expects more definite effort to negate reconnaissance and time is critical. The third item, camouflage penetration, is not critical in this year, but will become significant within the next ten years. The fourth item, higher resolution, reflects the continuing demand for more detail (at the same time, the coarse looks tend to be more accurate, with better detail). As any design is a set of compromises, it appears likely that the ultimate needs will be best satisfied by a mix of systems designed for specific tasks. Specifically, there is a real need for continuation of aerodynamic vehicles and balloons, as well as satellites; the aerodynamic for tactical applications and specific targets, balloons for economic observation of certain types of targets. The impact of the above listed four basic categories of needs on development areas, platforms, sensor systems, and data handling is illustrated in Appendix I. The following sections of this memorandum discuss the developmental areas in general details. The timing of expected developments is estimated in Appendix II.

4. Platforms

a. Aerodynamic Vehicles: Following the development of IDEALIST and OXCART manned aircraft, and TAGBOARD drone aircraft, future developments in aerodynamic vehicles for overflight purposes can come in two different regimes: first, hypersonic vehicles, initially the boost-glide system such as ISINGLASS, and second, powered flight vehicles, based either on rocket engine or on an air-breathing engine such as the SCRAMJET. These vehicle developments are required in order to reduce the vulnerability of the vehicle to manageable levels, by reducing the reaction time of the defense systems. (An alternate approach to reducing defensive reaction time is the terrain-following, low altitude, high-speed aircraft (B-58, F-111). For reconnaissance, these low-altitude aircraft suffer from very limited cross-track coverage and they can be employed only under war-time circumstances. The camera problems associated with the high angular rates inherent in these vehicles are severe, but can probably be managed. We consider this type of aircraft to be limited to the Defense Department, for development and use in war-time tactical applications.)

The boost-glide ISINGLASS vehicle using rocket propulsion is feasible in the next five years for application in the following five. Subsequent development should allow powered flight. Air breathing, hypersonic aircraft are a longer range development; the prime need is for validation of the supersonic combustion ramjet (SCRAMJET) engine concept. This concept is promising at this time, and is being actively pursued by NASA and the Air Force. However, there has been, to date, no solid demonstration. When available, the SCRAMJET will provide the payload capability for meaningful sustained hypersonic flight. Other advanced propulsion concepts are generally only meaningful in extended orbital or inter-planetary flight. The application of nuclear propulsion

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Attachment 1 to

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may have some significance for the reconnaissance operation, but the nuclear aircraft is not being actively pursued by the government at this time; its eventual application to the reconnaissance mission has not been examined in detail. However, it would appear to have primary benefit for long-term flight in more normal speed-altitude regimes. The extremely high specific impulse rocket engines (plasma, photon, etc.) are generally low thrust, and not usable for near-earth applications. The use of hydrogen-flourine seems the best available specific impulse for chemical rockets, in this application with hydrogen-oxygen being more generally applied for economic reasons. (The five year program cost for ISINGLASS using flourine oxidizer is about double the oxygen system.)

b. Satellites: Currently satellites are limited in application to quick reaction by several factors:

Count-down time, time from request for data to launch, including mission planning and vehicle preparations.

Time from launch to coverage of desired targets caused by orbital restraints.

Recovery time and transportation of take.

The high cost of an individual launch and cost of facilities, precluding continued frequent launchings during a crisis period, and also limited economic usefulness for coverage of localized targets.

The above factors are all generally associated with the physical recovery of photographic film. The development of facsimile or "television" readout via radio communication link would negate most of these objections. Current technology would allow the early (next two to three years) development and operation of somewhat primitive, limited capability readout systems; a concerted technological development program over the next five to ten years would be needed for a really desirable system. While these readout systems would suffer

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Attachment 1 to [redacted] 25X1A

from the orbital mechanics constraints in acquisition of targets, a modest number of operating systems would allow world-wide coverage on an almost continuous basis.

Concurrent developments in communications satellites will eventually allow a real-time observation, of a number of targets. These developments are probably in order in about ten years. Such systems are subject to jamming or other active countermeasures.

The specific technologies involved are being explored under the [redacted] program. 25X1A

c. Balloons: Since the earlier unfortunate experiences within the government with balloon over-flights, the application of balloons to Soviet over-flight has been politically untenable. However, recent developments in balloon technology will, if pursued, allow flight in the [redacted] regime with useful payloads. Such payloads would be inexpensive to fly, but costly to shoot down. Developments are in hand to allow steering of the balloon with small CEP's. The projected usage is for short-range penetration, using real-time readout; a "tactical" system applicable in local hot spots(e.g. Cyprus, Cuba, etc.) 25X1A

5. Sensors

Current operational sensors are panchromatic silver halide recording cameras. Resolution of one foot is accomplished at aircraft altitudes, three feet at satellite altitudes. Developments are conceivable in angular resolution, allowing better detail recording or higher altitude operation. However, the most useful developments will be in the extension to color recording, adding another dimension to the data. This color recording has several benefits:

a. basic information content increase

b. detection of many types of camouflage, which can "fool" the panchromatic camera

c. application to socio-economic analysis and forecasting, (crop analysis, etc.). The "color recording" noted above might either be in color film, (e.g., Koda-color) or in

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Attachment [redacted] to [redacted] 25X1A

multiple, photographic color separation cameras (spectral-zonal photography), including near infra-red recording. The over-all cost will be considerably higher than current panchromatic black and white. (This color recording potential is not directly related to quick reaction, except as its use may complicate quick reaction capability from added complexity.)

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a. [redacted]

b. [redacted]

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6. <u>Data Handling</u>

As noted above, in the discussion of quick reaction satellites, a major advance is needed in the data handling process. The factor discussed there was in data transmission. This data transmission problem is also applicable to other platforms; in addition, there are a number of other data handling problems, limiting overall reaction time, whose solution is probably closely tied in. These are in the fields of rapid analysis, storage, and retrieval. Of significance is that the critical analysis is usually a <u>change detection</u> and interpretation of the meaning of the change. The change detection involves a comparison of the current photograph with earlier photographs, hence the need for storage and retrieval. The application of spacial spectral analysis is of interest here. Some mechanization of the change detection would speed up the analysis process considerably, allowing available manpower to concentrate on verifying and interpreting the changes. The analysis problems apparently have much technology in common with the data transmitting, both handling the information in an electrical or digital analog. Data compression, redundancy reduction techniques, and encoding procedures, useful in transmission bandwidth compression, have promise of

25X1A [redacted] Attachment I to [redacted] 25X1A

allowing mechanization of the change detection operation. We see little hope of the replacement of human judgment in estimating the significance of observed changes.

7. Conclusion:

On the basis of the projected political situations over the next fifteen years it is postulated that the primary needs for developments for quick reaction systems are:

The development of the high-speed aircraft (ISINGLASS) to provide a relatively invulnerable platform for reconnaissance.

The development of high-speed data transmission systems to allow rapid transmission of photographic data from the field sites to Washington.

The extension into high resolution systems of the [redacted] 25X1 NRO

Concurrently, considerable effort is warranted in the fields of data analysis, storage, and retrieval, to shorten the time from receipt of data to completion of analysis.

Goals for quick reaction reconnaissance systems, plotted against realistic operational availability dates, are shown in the first figure of Appendix III. The obsolescent systems shown as phased-out, except for special applications, will have usefulness in lightly defended areas indefinitely, until the maintenance of the system becomes overly expensive. The second and third figures illustrate the developmental interrelationships of some of the systems and subsystems.

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PLATFORMS

1965-70

A. Current Inventory and late development stage:

U-2: Subsonic, high altitude aircraft, 1 ft. photo platform (manned).

Atlas-Agena-OCV: Satellite platform for 3 ft. photo system (unmanned).

Thor-Agena: Satellite platform for 15 ft. photo system (unmanned).

OXCART: Mach 3.2 high altitude aircraft, 1 foot photo-platform, requires advanced electronic countermeasures equipment (manned).

SR-71: Advanced version of OXCART, increased payload capability, requires advanced electronic countermeasures equipment (manned).

Drones: Subsonic, high altitude drones in USAF inventory, high vulnerability.

Miscellaneous USAF reconnaissance aircraft, subsonic and limited supersonic.

B. Well into development stage:

TITAN-III: Various versions for extended satellite payloads.

TAGBOARD: Mach 3.3 drone

C. Early development stage or forecast:

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Boost-glide aerodynamic vehicles, 7500 mile range.

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1970-75 High accuracy, ZI recovery re-entry bodies.
Mobile Launch of satellite systems.
Orbital maneuver capability for satellites.

25X1A [redacted]

Powered flight hypersonic vehicles (rocket powered).
12,000 mile range.

25X1 NRO [redacted]

1975-80 Powered flight hypersonic vehicles, extended range, 24,000 n.mi. supersonic combustion ramjet.

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PLATFORMS:

Aerodynamic

U-2	OBSOLETE, OPERATIONAL
OXCART	DEVELOP → ← OPERATIONAL →
SR-71	DEVELOP → ← OPERATIONAL →
TAGBOARD	DEVELOPMENT → ← OPERAT →
BOOST-GLIDE (ISINGLASS)	← DEVELOP → OPERATIONAL →
HYPERSONIC ROCKET	← DEVELOP → OPERATIONAL →
HYPERSONIC SCRAMJET	← DEVELOPMENT → OPERATIONAL

Satellite

Atlas-Agena-OCV	OPERATIONAL
Thor-Agena	OPERATIONAL
NRO NRO Titan III	DEVELOPMENT → ← OPERATIONAL →
25X1 25X1A [redacted]	DEVELOPMENT → ← OPERATIONAL
	DEVELOP → ← OPERATIONAL
25X1 [redacted]	← DEVELOPMENT → LIMITED CAPAB. → ← FULL CAPABILITY
NRO [redacted]	← DEVEL → OPERATIONAL
25X1A Z1 Recovery	← DEVELOP → OPERATIONAL
MOBILE LAUNCH	← DEVELOP → OPERATIONAL

[redacted]	DEVELOP → OPERATIONAL
	DEVELOP → ← OPERATE
	← DEVELOP → OPERATE

YEAR → 65 66 67 68 69 70 71 72 73 74 75 76 77 78

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DATA HANDLING

1965-70

A. Current

Physical Transport of films
Human Search and Analysis

B. Early development and forecast:

Limited, unsecure facsimile transmission satellite
Automated storage and retrieval of photographic images

1970-75 Limited automatic change detection
Wide-band facsimile transmission systems
Communications satellites, limited capability
- satellite-satellite relay
- ground to ground transmission

Simple Image Integration
Frequent Observations and Good "baseline" data
Near real time observation

1975-80 Spacial Spectral Analysis
Automation of change detection
Compensation for spacial frequency response characteristics of sensors and recording media
Secure data links
Continuous monitoring of selected targets

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DATA HANDLING

Transmission

Low Band width	DEVELOP → OPERATIONAL →
High Bandwidth	DEVELOPMENT → OPERATIONAL
Data Compression	CONTINUING DEVELOPMENTS
Communication Satellite	DEVELOP → OPERATIONAL (1st GENERATION)
(ground-ground)	DEVELOP → OPERATIONAL (2nd GENERATION)
[redacted]	DEVELOP → OPERATIONAL
Secure Transmission	CONTINUING DEVELOPMENT

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Analysis

Store and Rapid Retrieve (photo records)	DEVELOP → OPERATIONAL →
Rapid Access Storage (electrical)	DEVELOPMENT → OPERATIONAL →
Automatic Target Acq.	DEVELOPMENT → OPERATION →
Automatic Change Detection	DEVELOPMENT → OPERATIONAL →
Image Integration	DEVELOPMENT → OPERATIONAL
Image Enhancement	DEVELOPMENT → OPERATIONAL
Image Analysis	DEVELOPMENT → OPERATIONAL

Year: 65 66 67 68 69 70 71 72 73 74 75 76 77 78 7

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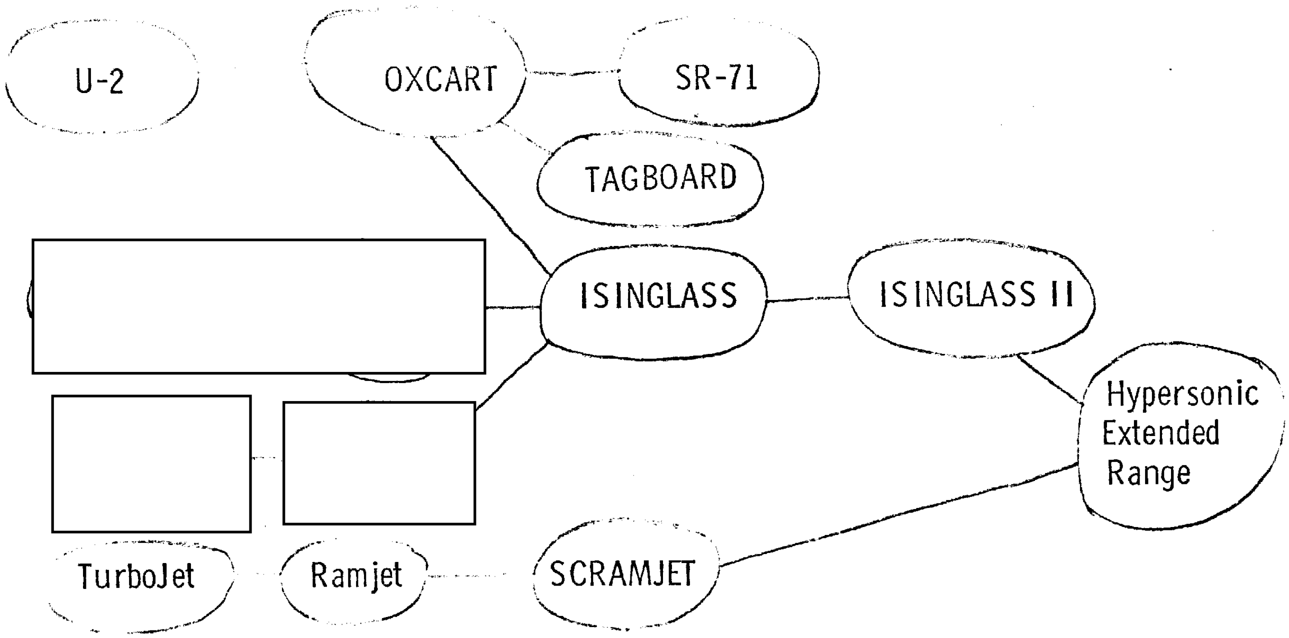

Inter-relations of various Aerodynamic Reconnaissance Vehicles

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USSR or China. Normal systems include the currently undeveloped and unexploited "socio-economic" photographic intelligence application.

2. The Meaning of "Quick Reaction"

Frequently, in the discussion of system improvements to the intelligence collection schemes, reference is made to the need for "quick reaction." This is a need which, like all virtue, is seldom argued; again, like all virtue, it is seldom adequately understood in the context of the discussion. In our frame of reference, we mean by quick reaction, the following: While maintaining a state of readiness, at a reasonable cost, the system can obtain and return to the policy makers, the necessary information in a minimum time (on the order of 24 hours) after the call for the information. Reaction time includes time for flight and recovery of the information, time needed to prepare the system for a particular mission, time to return the necessary data from the recovery site and time to analyze and submit to the policy makers. It is within this last item, analysis and submission, that there is often misunderstanding. On the one hand it may be considered necessary to submit to policy makers a hard copy of high resolution photograph; on the other hand, it may be considered necessary to submit only the results of the analysis, as read by competent analysts. In actuality, the analysis is all that is logically required; the policy makers are generally not the competent analysts, do not have time for detailed analysis, and thus cannot extract the needed information from raw photographs. However, one cannot deny the psychological impact on the policy makers of having in hand a picture, no matter how little understood, which demonstrates the information on which the analysis is based.

The reaction time includes the time necessary to generate the mission plan. As systems develop, computer software improves; given the target location, the mission can be generated automatically. As our backlog of information increases from the routine CORONA

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3. Basic needs

With the development of high-altitude aircraft and satellite reconnaissance photography over the past 15 years, the intelligence community has come to rely to an increasing extent on the "hard" intelligence derived from such systems. The search is for ever quicker receipt of the information, and analysis. Concurrently, the increasing capability of ground-air defensive networks in denied areas force consideration of less vulnerable systems. In addition to these active defensive networks coming into place, increased Soviet bloc activity in the passive, camoflage defensive techniques is probable. For some intelligence requirements there is need for a more detailed rendition of the targets, i.e., higher resolution systems. The needs fall naturally into four categories, in order of importance:

1) increased speed of response
2) less vulnerability to active defenses
3) less vulnerability to passive defenses
4) more detailed rendition of targetry.

In time of crisis, the first two are of utmost importance, as one expects more definite effort to negate reconnaissance and time is critical. The third item, camouflage penetration, is not critical in this year, but will become significant within the next ten years. The fourth item, higher resolution, reflects the continuing demand for more detail (at the same time, the coarse looks tend to be more accurate, with better detail.) As any design is a set of compromises, it appears likely that the ultimate needs will be best satisfied by a mix of systems designed for specific tasks. Specifically, there is a real need for continuation of aerodynamic vehicles and balloons, as well as satellites; the aerodynamic for tactical applications, and specific targets, balloons for economic observation of certain types of targets. The impact of the above listed four basic categories of needs on development areas, platforms, sensor systems, and data handling is illustrated on Attachment 1. The following sections of this memorandum discuss the developmental areas in general details. The timing of expected developments is estimated in Attachment 2.

4. PLATFORMS

Aerodynamic Vehicles:

Following the development of the IDEALIST and OXCART manned aircraft, and the TAGBOARD drone aircraft, future developments in aerodynamic vehicles for overflight purposes can come in two different regimes: first, hypersonic vehicles, initially the boost-glide system such as ISINGLASS, and second, powered flight vehicles, based either on the ISINGLASS system or on the air-breathing engine such as the SCRAMJET. These vehicle developments are required in order to reduce the vulnerability of the vehicle to manageable levels, by reducing the reaction time of the defense systems. (An alternate approach to reducing reaction time is the terrain-following, low altitude high-speed aircraft (B-58, F-111). For reconnaissance, these low-altitude aircraft suffer from very limited cross-track coverage and they can be employed only under war-time circumstances. The camera problems associated with the high angular rates inherent in these vehicles are severe, but can probably be managed. We consider this type of aircraft to be limited to the Defense Department, for development and use in war-time tactical applications.)

The boost-glide ISINGLASS vehicle using rocket propulsion is feasible in the next five years for application in the following five. Subsequent development may allow powered flight. Air breathing, hypersonic aircraft are a longer range development; the prime need is for validation of the supersonic combustion ramjet (Scramjet) engine concept. This concept is promising at this time, and is being actively pursued by NASA and the Air Force.

However, there has been, to date, no solid demonstration. When available, the scram-jet will provide the payload capability for meaningful sustained hypersonic flight. (Other advanced propulsion concepts are generally only meaningful in extended orbital or inter-planetary flight. The application of nuclear propulsion may have some significance for the reconnaissance operation, but the nuclear aircraft is not being actively pursued by the government at this time; its eventual application to the reconnaissance mission has not been examined in detail. However, it would appear to have primary benefit for long-term flight in more normal speed-altitude regimes. The extremely high specific impulse rocket engines (plasma, photon, etc.) are generally low thrust, and not usable for near-earth applications.) The use of hydrogen-flourine seems the best available specific impulse for chemical rockets, in this application with hydrogen-oxygen being more generally applied for economic reasons. (The five year program cost for ISINGLASS using flourine oxidizer is about double the oxygen system.)

Satellites:

1. Currently satellites are limited in application to quick reaction by several factors:

a. Count-down time, time from request for data to launch, including mission planning and vehicle preparations.

b. Time from launch to coverage of desired targets caused by orbital restraints.

c. Recovery time and transportation of take.

d. The high cost of an individual launch and cost of facilities, precluding continued frequent launchings during a crisis period, and also limited economic usefulness for coverage of localized targets.

2. The above factors are all generally associated with the physical recovery of photographic film. The development of facsimile or "television" readout via radio communication link would negate most of these objections. Current technology would allow the early (next two to three years) development and operation of somewhat primitive, limited capability readout systems; a concerted technological development program over the next five to ten years would be needed for a really desirable system. While these readout systems would suffer from the orbital mechanics constraints in acquisition of targets, a modest number of operating systems would allow world-wide coverage on an almost continuous basis.

3. Concurrent developments in communications satellites will eventually allow a real-time observation, of a number of targets. These developments are probably in order in about ten years. Such systems are subject to jamming or other active countermeasures.

4. The specific technologies involved are being explored

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Balloons:

Since the earlier unfortunate experiences within the ~~Agency~~ with balloon over-flights, the application of balloons to

Soviet over-flight has been politically untenable. However, recent developments in balloon technology will, if pursued, 25X1A allow flight in the [redacted] regime with useful payloads. Such payloads would be inexpensive to fly, but costly to shoot down. Developments are in hand to allow steering of the balloon with small CEP's. The projected usage for short-range penetration, using real-time readout; a "tactical" system applicable in local hot spots (e.g., Cyprus, Cuba, etc.)

4. SENSORS

Current operational sensors are panchromatic silver halide recording cameras. Resolution of one foot is accomplished at aircraft altitudes, three feet at satellite altitudes. Developments are conceivable in angular resolution, allowing better detail recording or higher altitude operation. However, the most useful developments will be in the extension to color recording, adding another dimension to the data. This color recording has several benefits:

a. The basic information content increase.

b. The detection of many types of camouflage, which can "fool" the panchromatic camera.

c. Application to socio-economic analysis and forecasting, (crop analysis, etc.). The "color recording" noted above might either be in color film, (e.g., Kodacolor, or in multiple, photographic color separation cameras (spectral-zonal photography), including rear infra-red recording. The over-all cost will be considerably higher than current panchromatic black and white. (This color recording potential is not directly related to quick reaction, except as its use may complicate quick reaction capability from added complexity.)

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5. DATA HANDLING

As noted above, in the discussion of quick reaction satellites, a major advance is needed in the data handling process. The factor discussed there was in data transmission. This data transmission problem is also applicable to other

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platforms; in addition, there are a number of other data handling problems, limiting overall reaction time, whose solution is probably closely tied in. These are in the fields of rapid analysis, storage, and retrieval. Of significance is that the critical analysis is usually a change detection and interpretation of the meaning of the change. The change detection involves a comparison of the current photograph with earlier photographs, hence the need for storage and retrieval. The application of spacial spectral analysis is of interest here. Some mechanization of the change detection would speed up the analysis process considerably, allowing available manpower to concentrate on verifying and interpreting the changes. The analysis problems apparently have much technology in common with the data transmitting, both handling the information in an electrical or digital analog. Data compression, redundancy reduction techniques, and encoding procudures, useful in transmission bandwidth compression, have promise of allowing mechanization of the change detection operation. We see little hope of the replacement of human judgement in estimating the significance of observed changes.

6. Conclusion:

The attached time estimates (att. 2) are based on the considerations above. Emphasis can modify these times considerably; the realities of technological advances cannot be forecast and are most important in the actual progress over a fifteen year period.

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26 May 1965

PLATFORMS

1965- 1970 A. Current Inventory - later development stage

U-2: Subsonic, high altitude aircraft, 1 ft. photo platform (manned).

Atlas-Agena-OCV: Satellite platform for 3 ft. photo system (unmanned).

Thor-Agena: Satellite platform for 15 ft. photo system (unmanned).

OXCART: Mach 3.2 high altitude aircraft, 1 foot photo-platform, requires advanced electronic counter-measures equipment (manned).

SR-71: Advanced version of OXCART, increased payload capability, requires advanced electronic counter-measures equipment (manned).

Drones: Subsonic, high altitude drones in USAF inventory, high vulnerability.

Miscellaneous USAF reconnaissance aircraft, subsonic and limited supersonic.

B. Well into development stages.

TITAN-III: Various versions for extended satellite payloads.

TAGBOARD: Mach 3.3 drone

C. Early development stages or forecast:

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Boost-glide aerodynamic vehicles, 7500 mile range.

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1970-75 High accuracy, ZI recovery re-entry bodies.
Mobile Launch of satellite systems.
Orbital maneuver capability for satellites.

25X1A [redacted].

Powered flight hypersonic vehicles (rocket powered), 12,000 mile range.

25X1A [redacted]

1975-80 Powered flight hypersonic vehicles, extended range, 24,000 n.mi. supersonic combustion ramjet.

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PLATFORMS:

Aerodynamic

U-2 (DRONES)	~~OPERATIONAL~~ OPERATIONAL (← OPERATIONAL →)
OXCART	DEVELOP → | ← OPERATIONAL →
SR-71	DEVELOP → | ← OPERATIONAL →
TAGBOARD	DEVELOPMENT → | ← OPERAT (OPERAL) → |
BOOST-GLIDE (ISINGLASS)	| ← DEVELOP → | OPERATIONAL →
HYPERSONIC ROCKET	| DEVELOP → | OPERATIONAL →
HYPERSONIC SCRAMJET	| ← DEVELOPMENT → | OPERATIONAL

Satellite

Atlas-Agena-OCV	OPERATIONAL
25X1A Thor-Agena	OPERATIONAL
Titan III	DEVELOPMENT → | ← OPERATIONAL →
25X1A [redacted]	DEVELOPMENT → | ← OPERATIONAL
25X1A [redacted]	DEVELOP → | ← OPERATIONAL
[redacted]	← DEVELOPMENT → | LIMITED CAPAB. → | ← FULL CAPABILITY
[redacted]	| ← DEVEL → | OPERATIONAL
25X1A ZI Recovery 25X1	← DEVELOP → | OPERATIONAL
MOBILE LAUNCH NRO	| ← DEVELOP → | OPERATIONAL
[redacted]	DEVELOP → | OPERATIONAL
	DEVELOP → | ← OPERATE
	| ← DEVELOP → | OPERATE

YEAR → 65 66 67 68 69 70 71 72 73 74 75 76 77 78 7

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DATA HANDLING

Now:

Physical Transport of films
Human Search and Analysis

1965-70

Early development and forecast
Limited, unsecure facsimile transmission satellite
Automated to ground storage and retrieval of photographic images

1970-65

Limited automatic change detection
Wide-band facsimile transmission systems
Communications satellites, limited capability
- -satellite-satellite relay
- -ground to ground transmission

Simple Image Integration
Frequent Observations and Good 'baseline" data
Near real time observation

1975-80

Spacial Spectral Analysis
Automation of change detection
Compensation for spacial frequency response characteristics of records
Secure data links
Continuous monitoring of selected targets

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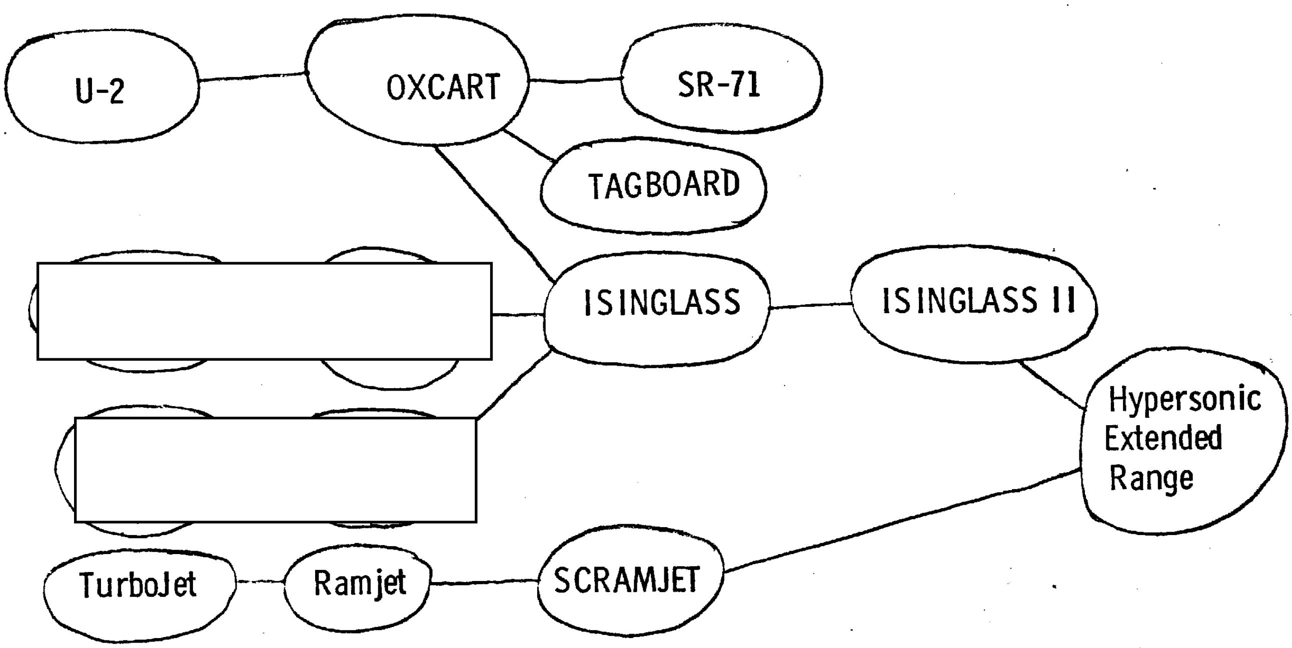
25X1



Inter-relations of various Aerodynamic Reconnaissance Vehicles

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