Operation

A camera which is to cover an angle of 70° using a long focal length lens (telephoto effect) and designed to render a clearly defined image over the whole negative can employ the panoramic principal of camera design. The camera in this case is designed with a curved focal plane and an oscillating or rotating lens cone. The film remains stationary during exposure while the lens cone sweeps across the emulsion from one side to the other. The end of the cone opposite the lens has a slit in it which permits the light passing through the lens to expose the film. The speed at which the slit traverses the film emulsion and the width of the slit determines the "effective shutter speed" of the camera.

The lens in the "C Triple Prime" camera is a Petzval type lens having a maximum speed of f3.5 and a maximum T stop of 3.8. The relatively high speed and high resolving power of the lens permits the use of advanced film emulsions having very high resolving power (225 plus) but an extremely low exposure index. See page entitled "Camera and Photography".

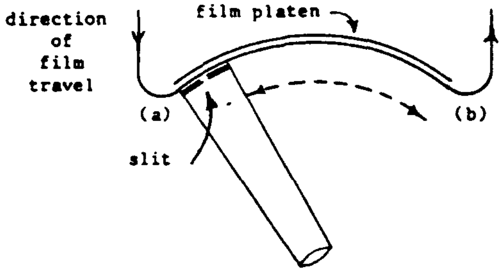


FIGURE A

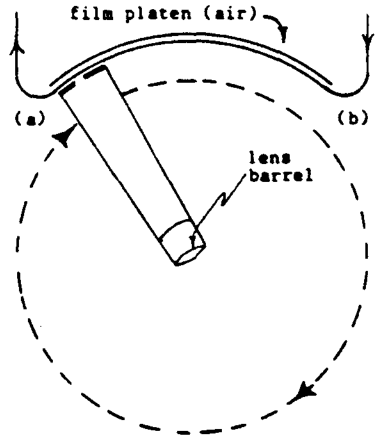


FIGURE B

NOTE: Fig.B is an over simplified drawing of the camera operation. Actually, only the lens barrel rotates 360° while the relatively light-weight "stovepipe" returns to position (a) as in Fig.A

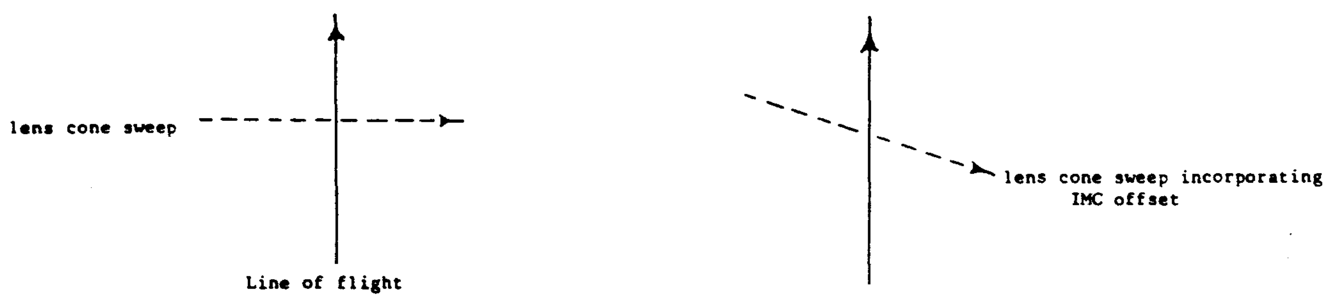
Figure A is a simple diagram of the "C Prime" configuration showing how the lens cone sweeps from (a) to (b), exposing the film. When the slit reaches (b) the slit closes and the cone returns to (a) as new film is fed to the focal plane.

Figure B operates in essentially the same way except the lens cone after passing (b) does not reverse itself to (a) but continues for 360° back to (a).

It was found in the Figure A configuration that when the cone started its sweep a certain amount of torque might be induced on the whole satellite possibly causing a rocking motion both at the start of the sweep and at the stop. The arrangement in Figure B showing the lens cone rotating throughout the operation of the camera would do away with the momentum caused by the start and stop on every sweep and would eliminate possible torque-rocking effect from the camera.

It has now been learned that the torque induced by the oscillating cone is negligible; however, the rotating cone is simpler and more reliable. The vibration in the camera system caused by noise introduced by moving parts during photographic cycle also affects resolution and the rotating cone has been found to be smoother operating and quieter.

The sweep of the lens cone is not perpendicular to the line of flight but slightly off-set to establish an initial compensation for image motion.



The camera has an image motion compensation (IMC) cam. The offset of the panning arc of the camera determines initially the amount of IMC employed for an average altitude during orbit. In addition, the panning or sweep rate affects IMC. Thw sweep rate is regulated by the applied voltage to the lens cone drive motor. The applied voltage to the drive motor is programmed and may be selected by remote command while the vehicle is in orbit. The voltage program system incorporates 11 cams for voltage program selection. After the exact ephemeris and other post-launch data is determined from the vehicle in orbit, the cam most nearly satisfying the desired voltages for the system is remotely activated. If parameters of the orbit change, another cam can be remotely selected to better match the new set of orbital parameters. The IMC is changed by programming prior to launch, and each pass both ascending and descending has a programmed IMC. This program is perforated on the same 11 channel 35 mm mylar tape as the on-off schedule.

If IMC is not synchronized with image motion, the image will move while the shutter is open causing some degree of blurred image and a loss of film resolution.

Programming

The camera is electrically driven and operates as long as the system circuit is closed. Perforated 35 mm mylar program tape is programmed by punching out. Electrical contact is permitted through holes in the tape and when a closed circuit exists the camera continues to operate. In addition, the camera can be controlled from ground control stations while the vehicle is in orbit. This control is limited, however, and presently is confined to the elimination of a certain pass or passes within range of the control station. Each tape is over-programmed to permit elimination of photography over areas of known bad weather or where previous days' coverage was considered adequate. The whole pass must be eliminated, that is, portions of a programmed pass cannot be turned on or off at will at the present time.

The Committee on Overhead Reconnaissance (COMOR) levies requirements on the Agency or Department of the Government with the capability of obtaining the desired coverage; in this case, CIA/DPD. DPD then plots the COMOR targets by latitude. These on-off points are sent to the CIA representative at Lockheed Space Missiles Division, Palo Alto, California. The programmer then punches the program tape for the camera and the system is checked out prior to launch. Lockheed requests the on-off points 21 days prior to scheduled launch.

Limitations and Considerations

The launch and orbit of a semi-controlled vehicle is still a relatively new and uncertain science. When there have been sufficient general verified laws accumulated to better permit more precise launch and orbital control, and desired ephemeris can be had on each launch, then the overall average of the scale and quality of the photography will be enhanced. At present we strive for a desired altitude of 120-150 miles over target. However, inclination angle errors and other controlling effects are introduced which do not always permit us to obtain best altitude. Better control is to be had through frequent launchings, and the state of the art has come a long way since the first vehicle was launched.

The amount and quality of photographic coverage in the Northern latitudes that can be obtained by the CORONA vehicle varies as the time of year. During the summer months the sun-angle or amount of light illuminating the earth's surface at, say 70°, is sufficient to obtain quality photography with high resolution and good contrast. As winter approaches the sun-angles become smaller in the Northern latitudes and faster films must be used to obtain photographic coverage even at 50° North latitude. Initially a sun angle of 15° minimum for the "C Triple Prime" employing slow speed high resolution film and 7° for the "C Prime" cameras and faster films have been established. Until further evaluation is made of the "C Triple Prime" camera and the new film, the sun angles selected are considered valid. The launch time limits are governed primarily by the following factors: sunset on day of planned recovery, time of the vehicle on the pad, temperature variations and limitations both on the ground and aloft, the color of the vehicle facing the sun, and the readiness of the vehicle at count-down time. Recovery is planned for about three hours prior to sunset, and to program the recovery for a specific day, time, and area, necessitates a launch time limit of approximately two hours. The other factors listed above will also affect launch time for reasons not mentioned here.

The sun angle and season will affect the resolution of the film obtained from CORONA. In the winter months at low sun-angle, the resolution in Northern latitudes is poor and in some instances has been so poor that very little value from an intelligence standpoint can be obtained. With good sun-angle, clear sky, optimum conditions of orbit, camera function, and best possible development of film a good resolution of about 15 feet and, at times even 10 feet, may be obtained.* Compared with photography from a high-altitude manned aircraft, the CORONA film is in a different category. First, the scale of CORONA negatives averages about 1:300,000, whereas the high-altitude reconnaissance aircraft film material is far superior. Tactical information cannot be had from CORONA material but can be had from the film from the U-2. Even the latter is limited in tactical data compared to a military reconnaissance aircraft flying at 10 to 20,000 feet. It is important that the consumer and those making policy decisions concerning this matter should be thoroughly aware of the large differences in these three systems of aerial reconnaissance and appreciate the loss or gain of intelligence when employing any one of the systems.

* Resolution of film is not a nebulous expression but one which has been used in regard to the CORONA and IDEALIST programs without the respect it deserves. The most accurate system for determining resolution of overhead photography is to pass the camera over a ground area which includes a resolution chart. The resolution ground chart consists generally of painted panels laid out on the ground. The area, shape, size, color and dimensions of each panel is very important, and expensive. The cost estimate for such a resolution ground chart installation at Edwards AFB was made at [redacted] The chart would not be just for CORONA evaluation but for any other similar satellite coverage, high-altitude manned photo planes such as U-2 and any military reconnaissance aircraft both in existence and in the planning stage. For a realistic and accurate evaluation of resolution for comparison purposes, the cost of such a resolution chart installation might be well worth while.

PROJECT CORONA

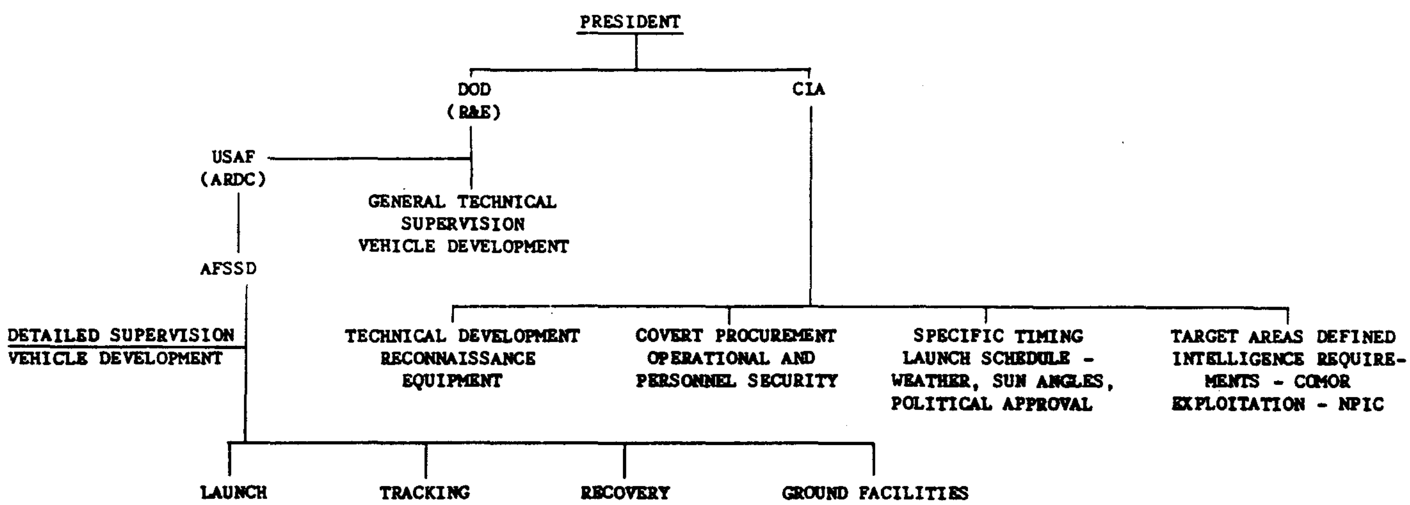
Project CORONA is a joint United States Air Force/Central Intelligence Agency program. The primary objective of CORONA is the covert development and operational use of a photographic reconnaissance satellite incorporating a recoverable capsule.

Prior to initiation of CORONA, the development of such a capability was started by the Air Force as part of Weapons System 117-L. This phase was officially cancelled in March 1958.

Subsequent to the 117-L cancellation the Advanced Research Projects Agency (ARPA) and CIA were charged with the responsibility for administration of the CORONA program, ARPA being responsible for technical direction of vehicle development and CIA being responsible for development of reconnaissance equipment, security, cover and covert procurement.

In November 1959 program responsibility was transferred from ARPA to the Air Force at the direction of the Secretary of Defense. However, CIA retained its responsibilities.

Origninally it was planned to limit CORONA to 12 shots and upon completion phase out of the program. Since the initial CORONA program we have had 2 additional follow-on programs and there is a definite possibility of a third follow-on.



SECURITY PROTECTION

PRINCIPLE FACTS TO PROTECT:

A. U. S. CURRENTLY ENGAGED IN A RECONNAISSANCE SATELLITE PROGRAM.

B. CIA IS AFFILIATED WITH SUCH A PROGRAM.

C. THAT CERTAIN SUPPLIER GROUPS ENGAGED IN THE DEVELOPMENT AND MANUFACTURING OF RECONNAISSANCE EQUIPMENT ARE AFFILIATED WITH PROJECT CORONA.

COVER STORY DATA

A. FURTHER DEVELOPMENT OF SYSTEMS AND TECHNIQUES WHICH HAS BEEN EMPLOYED IN OPERATION OF SPACE VEHICLES.

B. PROPULSION AND GUIDANCE TESTING HAVE BEEN THE MAJOR ITEMS OF INTEREST DURING THE INITIAL LAUNCHINGS.

C. DATA ON ENVIRONMENTAL CONDITIONS, USING BIO-MEDICAL SPECIMENS, WHICH WILL BE USED FOR MANNED SPACE FLIGHTS.

D. MUCH OF THE DATA HAS BEEN OF GENERAL SCIENTIFIC INTEREST AND IS UNCLASSIFIED. OTHER DATA INVOLVES NATIONAL SECURITY AND IS CLASSIFIED.

E. NOSE CONE RE-ENTRY TESTS, BIO-ASTRONAUTICS, AND MEASUREMENT OF CERTAIN SUSPECTED SPACE PHENOMENA WILL ALSO BE INCLUDED IN FUTURE COVER STORIES.

Total Weight - 124,122 lbs

Payload - 440 lbs (195 Recoverable)

Height - 81.2 ft

Thrust (1st Stage) - 169,000 lbs

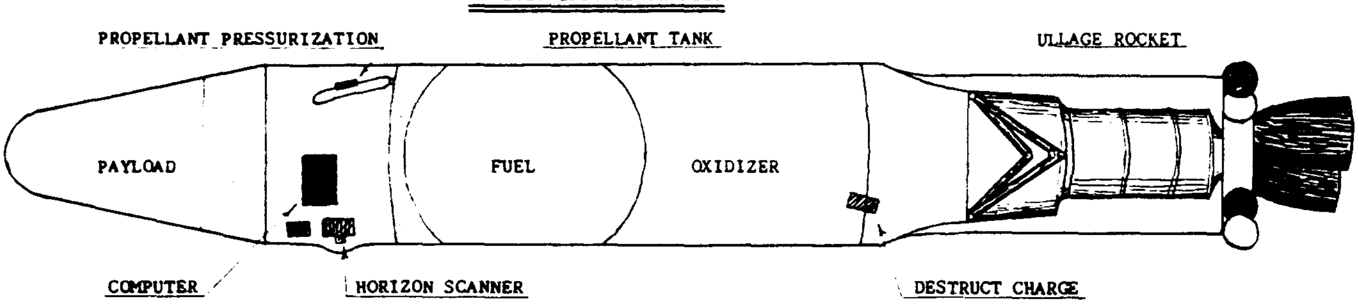
(2nd Stage) - 16,000 lbs

Engines THOR-AGENA

Orbit Time - 91.6 minutes (approx)

Altitude (average) - 150 miles

VEHICLE INBOARD PROFILE



GROUND SUPPORT FACILITIES

Facility	Equipment*	
Satellite Test Center	ABCD	Over-all control, orbit computations and predictions, acquisition data for tracking stations, prediction of recovery area.
[redacted]	[redacted]	Ascent and orbital tracking, telemetry reception, trajectory measurements, command transmission.
	[redacted]	Ascent tracking, telemetry reception, computation and transmission of ignition and shutdown corrections.
Downrange Telemetry Ship	BGIJK	Telemetry reception and tracking during ascent and early part of first orbit.
[redacted]	[redacted]	Orbit tracking, telemetry reception, commands to satellite.
	[redacted]	Orbit tracking, telemetry reception, initial acquisition on pass 1, monitor events in recovery sequence.
	[redacted]	Orbit tracking, telemetry reception and transmission of commands to satellite.
	[redacted]	Over-all direction of capsule recovery operations.
	[redacted]	Recovery capsule tracking.

NOTE: In addition to equipment listed, all stations have inter- and intra-station communications equipment and checkout equipment.

* Equipment

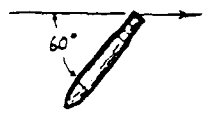
A. General Purpose Computer(s) and support equipment
B. Data Conversion Equipment
C. Master Timing Equipment
D. Control and Display Equipment
E. Guidance and Command Equipment (DISCOVERER ascent only)
F. VERLORT
G. VHF FM/FM Telemetry Station
H. VHF Direction Finding Equipment
I. Doppler Equipment
J. VHF Telemetry Antenna
K. APL Doppler Equipment

RECOVERY OPERATIONS

1. TIMER TURNS ON RE-ENTRY CAPSULE TELEMETRY AND BEACON FILAMENTS

18 SECONDS

2. PROVIDE MAX. TELEMETRY AND BEACON SIGNAL STRENGTH



75.5 SECONDS

3. EJECT COMMAND - CAPSULE EJECTS

1 SECOND

4. SPIN ROCKETS FIRED

1 SECOND

5. RETRO ROCKETS FIRED - DECELERATION - DESCENT

11 SECONDS

6. DE-SPIN ROCKETS FIRED - POSITION CAPSULE FOR RE-ENTRY

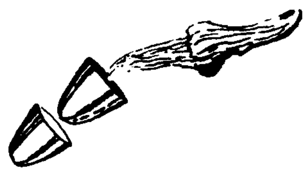
2.75 SECONDS

7. THRUST CONE SEPARATION TELEMETRY CEASES. BEACON SIGNAL TRANSMITTED.

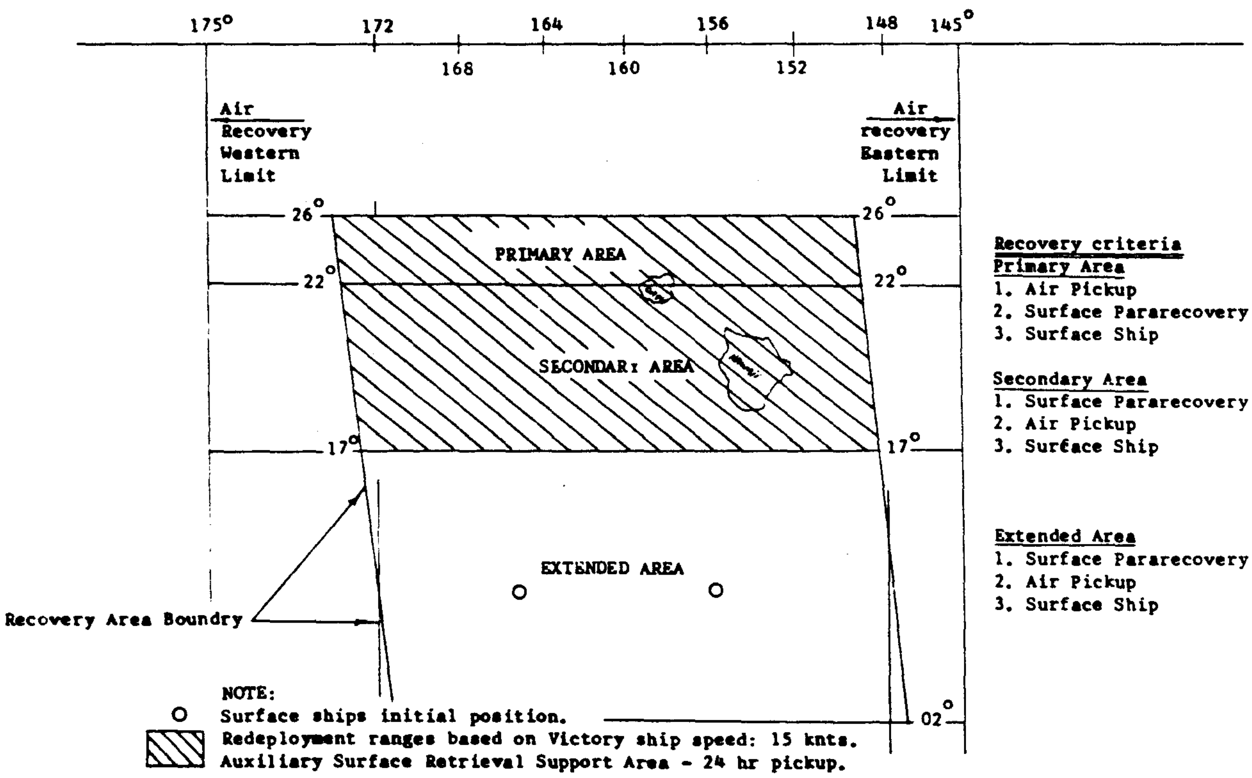
8. ABLATIVE SHELL BURNS. BLOCKS BEACON SIGNAL. 180,000 FT. TELEMETRY TURNED ON AGAIN.

153 SECONDS

9. PARACHUTE DEPLOYED - ABLATIVE SHELL EJECTED. CHAFF RELEASED, BEACON SIGNAL, FLASHING LIGHT ENERGIZED.



PAYLOAD RECOVERY AREA



Recovery criteria

Primary Area

1. Air Pickup
2. Surface Pararecovery unit
3. Surface Ship

Secondary Area

1. Surface Pararecovery Unit
2. Air Pickup
3. Surface Ship

Extended Area

1. Surface Pararecovery Unit
2. Air Pickup
3. Surface Ship

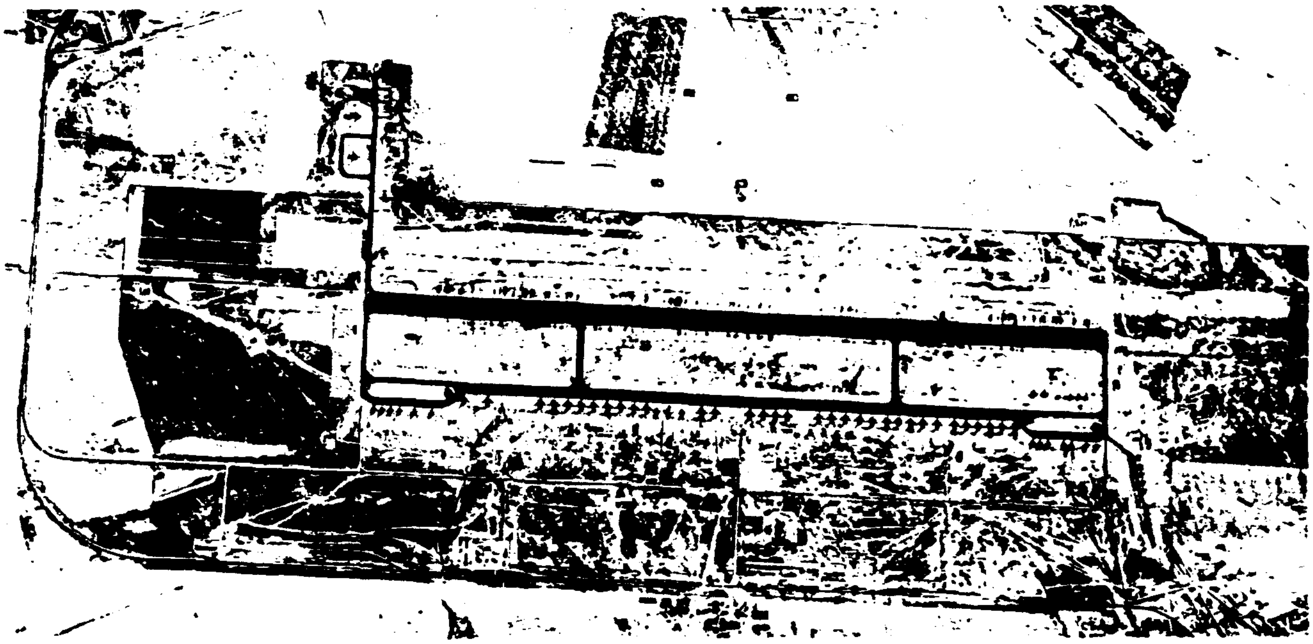


FIG. A

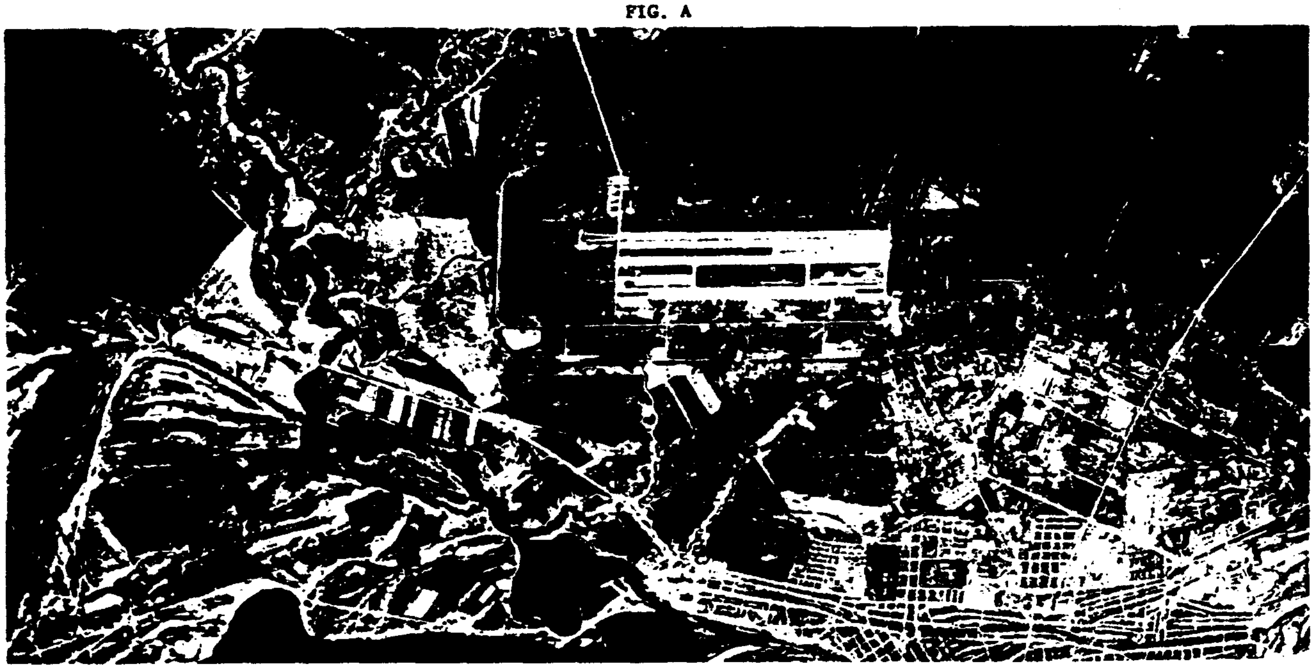
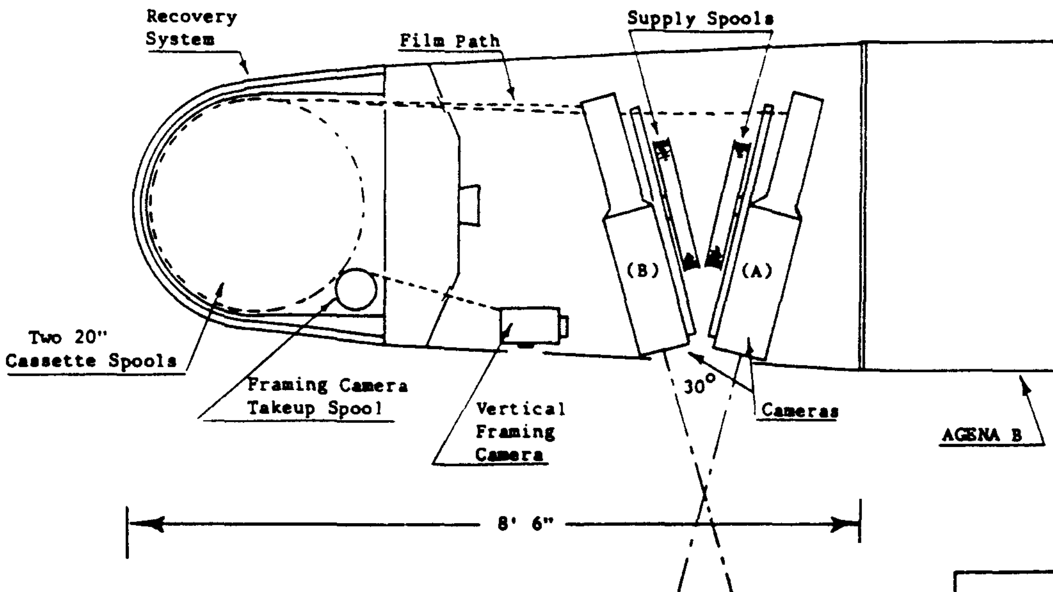


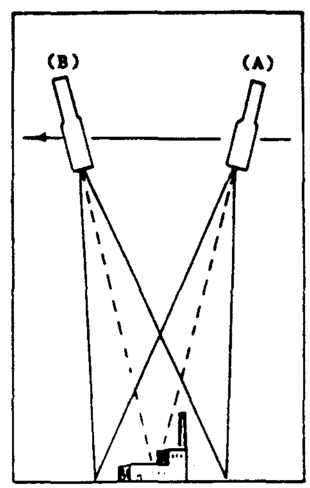
FIG. B

COMPARISON OF TALENT AND KEYHOLE PHOTOGRAPHY

Figure A is a portion of a 9 x 18 inch contact point covering Saratov-Engels Airfield. The picture was taken by a U-2 on 6 December 1959 at approximately 70,000 feet. Figure B is a seven diameter enlargement of the same area as Figure A but taken with a 57 x 758 mm format camera positioned in the CORONA vehicle. Figure B was taken 16 June 1961 at about 140 miles altitude. The important thing to note here is the comparison in resolution and detail. The "B" configuration in the U-2 produces far superior results but a much greater risk to the vehicle. The "C" camera in the CORONA vehicle covers many more square miles in each picture, is much less of a risk but obtains less resolution and detail. Both prints were made from third generation negatives. The "C triple prime" camera now being used produces a much finer image than that in Figure B.

MURAL CAMERA CONFIGURATION (1962)





The MURAL configuration for satellite photography employs two cameras each essentially a C''' CORONA camera. The two camera modules operate in a similar manner to the CORONA camera and they are offset from the verticle axis by fifteen degrees forming an intersecting optical axis of thirty degrees. The camera (A) firing forward covers a certain terrain area and the same area is covered by camera (B) a short time later, but from a different verticle aspect. (See sketch.)

This system photographs areas of interest with stereo coverage which permits a more detailed product for easier and more accurate readout by the Photographic Interpreter. It is particularly valuable when the objects are photographed with a very low sun-angle (7°-15°) and the shadows are too long to aid the P.I. in interpretation. Interpretation of detailed objects is much easier and more accurate, and positive intelligence can be obtained.

The design parameters of the cameras are the same as CORONA except the mechanics of the film track, additional film spools and double the film capacity (2 x 7600) or 15,200 feet total. The framing camera also is carried in this vehicle for system orientation purposes. When the film is recovered the film cassette is opened and film from each camera removed from the three-flange spool and packaged into two containers. Couriers will deliver packages separately to [redacted] for processing, each courier travelling on different aircraft for security of the product.

The IMC and film programming are somewhat different and more flexible than the CORONA System. More latitude is allowed in the film programming to permit coverage over clear targets and eliminate waste of film over cloud covered areas. Also, more flexibility and reliability are available in the ground command procedures and control systems.

The MURAL System is an important step forward in the art of satellite photography. Stereoscopic photographic coverage, high resolution through use of the C''' cameras and improved films produces a product far superior to anything the intelligence community has had available through satellite photography in the past.

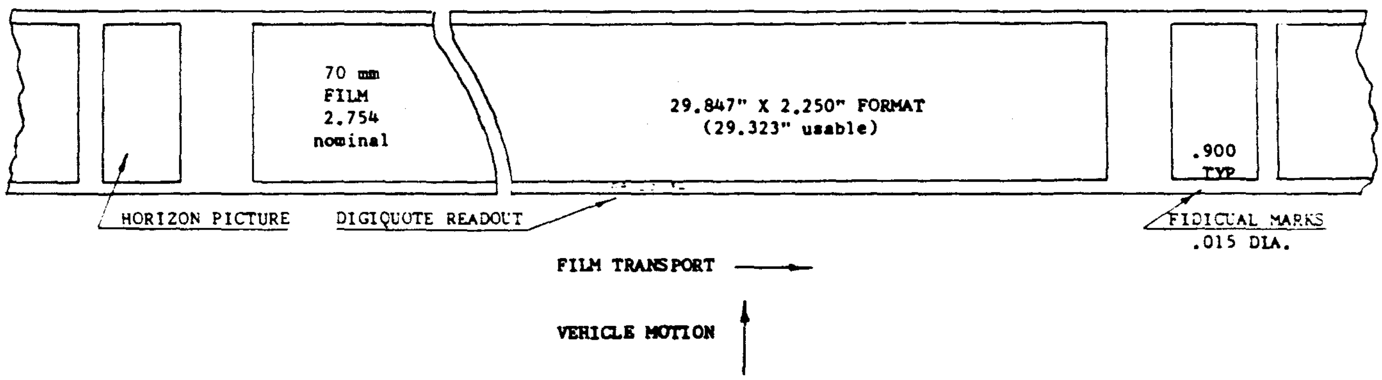
CAMERA AND PHOTOGRAPHY

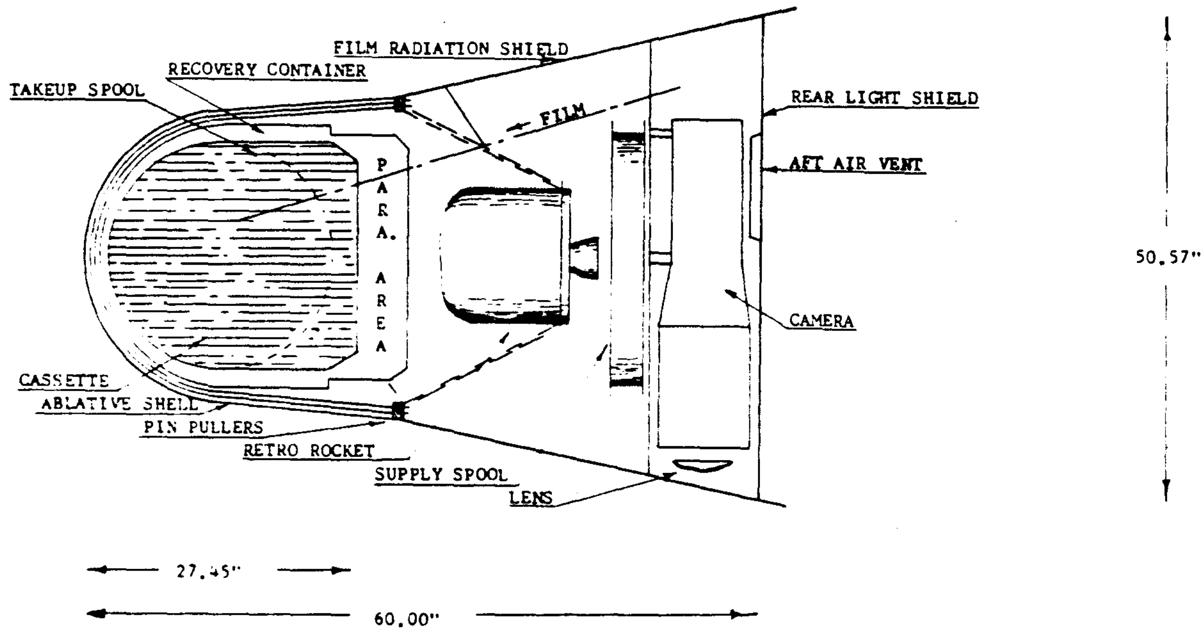
Three photographic negative materials have been used in the CORONA cameras thus far. These are 70 m.m. films and are listed below:

Material	Code	E-I Speed	Base	Resolving	Camera
Plus X	SO-102	64	Estar	95	C
Pan X	SO-130	20	Estar	160	C Prime
Exp. Hi Definition	SO-132	1.6 (?)	Estar	225+	C Triple Prime*

* July or August 1961

FORMAT OF CORONA CAMERA PICTURE





1. Camera: HYAC Type (Panoramic), C, C Prime, C Triple Prime
2. Film size: 70 mm
3. Focal length: 24 inches
4. Film Capacity: 7,600 feet (41.8 lbs including spool), 26,000 N.M.
   15,200 feet (MURAL), 26,000 N.M.
5. Scale Photography: 1:300,000 (approx.)
   Resolution: 15 feet plus or minus 10 feet depending on camera, film, sun angle and altitude

~~TOP SECRET~~

OBJECTIVES SATISFACTORILY DEMONSTRATED TO DATE

A. Achieved orbit
B. Cognizance and control of satellite equipment during orbit
C. Air and surface recovery of re-entry nose capsule for direct examination
D. Ground-space communications achieved
E. In-space command capability achieved
F. High resolution satellite photography achieved.

FUTURE OBJECTIVES FOR CORONA FLIGHTS

A. Better control of satellite equipment during orbit
   1. More precise orbital tracking
   2. Vehicle orbit capability exceeding 4 days
B. Higher resolution photography (better than 5 feet)
   1. Color, Infra-red
   2. Stereo coverage

VEHICLE PRODUCTION

1. Manufacturing Jig
   a. Spaceframe fabrication
   b. Vehicle assembly
2. In-plant vehicle checkout
   a. Design improvements
   b. System and subsystem checkout
3. Santa Cruz Test Base
   a. Hot firing
   b. Vehicle acceptance
4. Launch Base (Vandenberg AFB)
   a. Final vehicle checkout
   b. Mating with booster
   c. Launch
5. Contractors

There are 5 major contractors engaged in the CORONA effort.

a. Lockheed Missile Systems Division, Lockheed Aircraft Corporation is a prime contractor for the "C" Prime, "C" Triple Prime and MURAL programs. LMSD developed the second stage AGENA which is used in the CORONA program. Assembly of the complete recoverable capsule is accomplished [redacted]

c. The Itek Corporation has two facilities wherein CORONA work is carried on. The main facility at Lexington, Mass. and their West Coast plant in Palo Alto, Calif. Itek was responsible for designing the camera used in the "C" prime facet of CORONA. The cameras to be used in the "C" triple prime and MURAL are designed and fabricated by Itek. Our security contact at Itek, Lexington, is [redacted] [redacted] is the West Coast contact. There are approximately 110 CORONA cleared personnel at Itek.

d. The General Electric Company, Philadelphia, Pa. designed and manufactured the recoverable capsule. This is the same capsule used on the "white" Discoverer shots, however, certain modifications are made in a secure area at GE. [redacted] and [redacted] GE security officers are our primary contacts. There are approximately 260 CORONA cleared personnel at GE.

e. The Faichild Camera and Instrument Company, Syossett, New York fabricated the CORONA "C" prime camera under a sub-contract to Itek. FCIC will not be involved in the "C" triple prime or MURAL programs. Our principle security contact at FCIC is [redacted] There are approximately 260 CORONA cleared personnel at FCIC.

PROBLEMS ENCOUNTERED

1. Attaining most effective orbit
   Consistantly obtaining desired apogee and perigee
2. Maintaining gas pressures for stabilization
3. Better controlled and more accurate recovery

~~TOP SECRET~~

DISCOVERER LAUNCH HISTORY

MISSION	DATE		
DISCOVERER O	21 JAN 1959	NR	ELECTRIC MALFUNCTION - FIRED ON PAD. EXTENSIVE FIRE DAMAGE TO VEHICLE.
DISCOVERER I	28 FEB 1959	NR	ORBIT - TELEMETRY FAILURE - NO DATA - UNKNOWN
DISCOVERER II MECHANICAL MICE	13 APR 1959	NR	ORBIT - STABILIZATION, ORBITAL TELEMETRY ACHIEVED. FAULTY COMMAND PROCEDURE - SPITSBERGEN - RUSSIA
DISCOVERER III FOUR MICE	30 MAY 1959	NR	NO ORBIT - INSUFFICIENT POWER AGENA. GOOD TELEMETRY
DISCOVERER IV 9001	25 JUN 1959	CNR	NO ORBIT - LACK POWER - TELEMETRY RECEIVED. COAST AND ORBITAL BOOST SUCCESSFUL.
DISCOVERER V 9002	13 AUG 1959	CNR	ORBIT - STABLE, CONTROL, EJECT CAPSULE - LOW TEMP PREVENT BATTERY RECOVERY OPERATION. NORMAL CAMERA OPERATION. FILM BREAKAGE - MYSTERY SATELLITE
DISCOVERER VI 9003	19 AUG 1959	CNR	ORBIT - TEMP HIGHER - RESULTS SAME. EXTENSIVE TESTING RECOVERY NECESSARY
DISCOVERER VII 9004	07 NOV 1959	CNR	ORBIT - MALFUNCTIONING 115V/400 CYCLE INVERTER - NO STABILIZATION - MANUFACTURING DEFECT
DISCOVERER VIII 9005	20 NOV 1959	CNR	ORBIT TIME EXCESSIVE - ALTITUDE TOO HIGH - EJECTED EARLY. CAMERA DID NOT OPERATE
DISCOVERER IX 9006	04 FEB 1960	CNR	NO ORBIT - AGENA HELIUM SUPPLY LOST, THOR BOOST CUT OFF TOO SOON - AGENA PITCH GYRO TUMBLED
DISCOVERER X 9007	19 FEB 1960	CNR	DESTROYED BY RANGE SAFETY OFFICER - EXCEEDED SAFETY CRITERIA AT 21,000 AFTER 56 SECONDS
DISCOVERER XI 9008	15 APR 1960	CNR	ORBIT - LAUNCH FUNCTIONS NORMAL - ALL COMMANDS OBEYED - ONLY ONE TELEMETRY FAILURE - RE-ENTRY WITHIN 4 SEC. FILM EXPENDED AS PROGRAMMED
DISCOVERER XII 1056 (NO CAMERA, DIAGNOSTIC SHOT)	29 JUN 1960	NR	LAUNCH, ASCENT, SEPARATION, COAST AND ORBITAL STAGE IGNITION WERE SUCCESSFUL. FAILED TO ACHIEVE ORBIT BECAUSE OF AGENA ALTITUDE DURING ORBITAL STAGE BOOST.
DISCOVERER XIII 1057 (NO CAMERA, DIAGNOSTIC SHOT)	10 AUG 1960	TR	ATTAINED ORBIT SUCCESSFULLY. RECOVERY CAPSULE EJECTED ON 17TH ORBIT. CAPSULE WAS RECOVERED AFTER A WATER IMPACT WITH NEGLIGIBLE DAMAGE. ALL OBJECTIVES EXCEPT THE AIRBORN RECOVERY WERE SUCCESSFULLY ACHIEVED.
DISCOVERER XIV 9009	18 AUG 1960	CR	ATTAINED ORBIT SUCCESSFULLY. RECOVERY CAPSULE EJECTED ON 17TH ORBIT AND WAS SUCCESSFULLY RECOVERED BY THE AIRBORNE FORCE. ALL OBJECTIVES SUCCESSFULLY ACHIEVED.
DISCOVERER XV 9010	13 SEP 1960	CNR	ATTAINED ORBIT SUCCESSFULLY. EJECTION AND RECOVERY SEQUENCE COMPLETED. CAPSULE IMPACT OCCURRED SOUTH OF RECOVERY FORCES; LOCATED BUT SUNK PRIOR TO BEING RETRIEVED.
DISCOVERER XVI 9011	26 OCT 1960	CNR	LAUNCH AND ASCENT NORMAL. AGENA FAILED TO SEPARATE FROM BOOSTER AND FAILED TO ATTAIN ORBIT.
DISCOVERER XVII 9012	12 NOV 1960	CRF	ATTAINED ORBIT SUCCESSFULLY. RECOVERY CAPSULE EJECTED ON 31ST ORBIT AND AERIAL RECOVERY WAS ACCOMPLISHED. FILM BREAKAGE FAILED TO TRANSPORT. INTENSE SOLAR FLARE EXISTED DURING THIS SHOT INDICATED BY EMULSION BLOCK PROBABLY PRECLUDING SATISFACTORY FILM EXPOSURE.
DISCOVERER XVIII 9013	07 DEC 1960	CR	ATTAINED ORBIT SUCCESSFULLY. RECOVERY CAPSULE EJECTED ON 48TH ORBIT AND AERIAL RECOVERY WAS ACCOMPLISHED. ALL OBJECTIVES ACHIEVED.
DISCOVERER XIX MIDAS	20 DEC 1960	MNR	ATTAINED ORBIT SUCCESSFULLY. NON-RECOVERABLE, RADIOMETRIC DATA GATHERING MIDAS SUPPORT FLIGHT. SATELLITE STABILITY GAS EXHAUSTED ON FIRST PASS.
DISCOVERER XX 9014A	17 FEB 1961	ANR	ATTAINED ORBIT SUCCESSFULLY. CAPSULE DID NOT RE-ENTER DUE TO PROGRAMMER MALFUNCTION.
DISCOVERER XXI MIDAS	18 FEB 1961	MNR	ATTAINED ORBIT SUCCESSFULLY. NON-RECOVERABLE, RADIO-METRIC DATA GATHERING MIDAS SUPPORT FLIGHT. AGENA RESTART TEST SUCCESSFUL.
DISCOVERER XXII 9015	30 MAR 1961	CNR	FAILED TO ORBIT DUE TO LACK OF ORBITAL VELOCITY OF SECOND STAGE. RADIATION LEVEL 30-35 RAD DUE SOLAR FLARE.

DISCOVERER LAUNCH HISTORY (CONT)

MISSION	DATE		
DISCOVERER XXIII 9016A	08 APR 1961	ANR	LOST STABILITY AFTER PASS 9 DUE TO CONTROL GAS LOSS.
DISCOVERER XXIV 9018A	08 JUN 1961	ANR	FAILED TO ORBIT DUE TO ELECTRICAL FAILURE IN LAUNCH SEQUENCE GUIDANCE SYSTEM.
DISCOVERER XXV 9017	16 JUN 1961	CR	ALL OBJECTIVES ACHIEVED EXCEPT CAMERA MALFUNCTION ON PASS 22 AND WATER RECOVERY EFFECTED DUE TO CAPSULE LANDING OUTSIDE AIR RECOVERY AREA.
DISCOVERER XXVI 9019	07 JUL 1961	CR	TWO DAY ORBIT. AIRBORN RECOVERY SUCCESSFUL. THIRTY-TWO PASSES. ALL OBJECTIVES SUCCESSFULLY ACHIEVED.
DISCOVERER XXVII 9020A	21 JUL 1961	ANR	FAILED TO ORBIT. DESTROYED BY RANGE SAFETY OFFICER DUE TO FAILURE OF PITCH RATE AMPLIFIER SUMMING CIRCUIT.
DISCOVERER XXVIII 9021	03 AUG 1961	CNR	FAILED TO ORBIT. IMPACTED 1400 MILES EAST OF MARQUESAS ISLES (117W-10S).
DISCOVERER XXIX 9023	30 AUG 1961	C"'R	TWO DAY ORBIT WITH FIRST TRIPLE-PRIME CAMERA. WATER RECOVERY EFFECTED.
DISCOVERER XXX 9022	12 SEP 1961	CR	TWO DAY ORBIT. AIR RECOVERY EFFECTED.
DISCOVERER XXXI 9024	17 SEP 1961	CNR	PASS 23 TELEMETRY INTERMITANT; ON PASS 33 NO GROUND COMMAND CAPABILITY AND INDICATION OF CONTROL GAS LOSS. VEHICLE WILL PROBABLY BURN UP ON RE-ENTRY.

BOX SCORE
As of 17 September 1961

32 Discoverer shots

20 Corona
- 13 vehicles failed to launch, orbit, or re-enter with recovery
- 6 recovered with good photos
- 1 recovered with film transport malfunction

4 Argon (all failed to orbit or re-enter)
8 experimental (no cameras)

NR	NOT RECOVERED. TEST SHOT.
CR	CORONA RECOVERED.
AR	ARGON RECOVERED.
TR	RECOVERED. TEST SHOT.
CNR	CORONA NOT RECOVERED.
ANR	ARGON NOT RECOVERED.
CRF	CORONA RECOVERED. CAMERA MALFUNCTION.