# Certification of Records Review

The Director of Central Intelligence authorized the National Reconnaissance Office (NRO) and the Central Intelligence Agency to conduct a joint review of records pertaining to the CORONA, ARGON, and LANYARD photographic satellite reconnaissance systems in accordance with Executive Order 12958 to determine their eligibility for declassification and release to the public. The records in this box having a blue barcode label in the upper right corner of the first page have been reviewed by the NRO as part of that joint NRO-CIA review.

Any record having an NRO-assigned blue barcode label should be returned to the NRO for its review prior to any subsequent declassification and release to the public.

Please contact Chief, Information Declassification Review Center/IMG/MS&O at (703) 227-9015 or 853-6015 (secure) to make arrangements for their return.

Date of NRO record review: November 1997

NRO Review Completed as Redacted.

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Defense Products Division
Fairchild Camera & Instrument Corp.

April 18, 1960

# PROPOSED 1961 CORONA

# RECONNAISSANCE SYSTEM

Copy No. 10

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## TABLE OF CONTENTS

## LIST OF ILLUSTRATIONS

Defense Products Division
Fairchild Camera & Instrument Corp.

April 18, 1960

## 1. INTRODUCTION:

This proposal by Fairchild Camera and Instrument Corporation is for an improved operational photographic system for the 1961 Corona Program. It is conceived from Fairchild's successful experience in this program from its inception, and is based on the hard-won specific design knowledge which is now vested in Fairchild's physicists and engineers. It is considered evident that in terms of an exacting schedule this knowledge is indispensable; certainly it should not be completely lost to the program.

The proposed system improvement grows from Fairchild's basic design work and subsequent development and investigation work throughout the entire Corona Program. Fairchild's participation in this program goes back to the original pioneering efforts which followed from the Rand report. In fact, Fairchild made contributions to the Rand report from its store of knowledge and practical experience.

Although it is true that in the beginning of the contracted Corona program the "Stove-pipe" type of panoramic camera was stipulated, Fairchild took complete responsibility for establishing and satisfying the basic design requirements and successfully followed through the design and development of the present and highly successful Corona camera systems; thus demonstrating once again that Fairchild's forte includes the reduction to practice of theoretical principles.

That the Corona camera system has been a successful reduction to practice is borne out by the fact that in an environment of extremely close scrutiny, Fairchild's designs have received the full approval of the chain of responsible agencies.

It is considered of basic import that the detailed design experience gained in the Corona program to date is available in terms of the same key technical personnel who have carried the load so well. These personnel are available for immediate assignment to the execution of the proposed improved camera system.

Defense Products Division
Fairchild Camera & Instrument Corp.

April 18, 1960

When it is proposed to improve or change a working equipment, it is most important to use the experience which has led up to the existing equipment. Much of the knowledge of importance has to do with approaches which have been considered and discarded; at this juncture "what not to do" is as important as "what to do."

The Corona design team is available due to the natural progression of work in the present program. In the areas of initial engineering and product design, the work load in both the Corona program and the Argon program is rapidly decreasing. This is so much the case that Fairchild's management is seriously concerned about the future of the highly successful task groups which have accomplished these programs. This work load problem is shown graphically in FIGURE 1-A and FIGURE 1-B, which represents the status of the engineering and product design loads in these areas of our work.

There is more to this potential loss of capability than just the dissolution of the technical teams. Of perhaps more fundamental importance would be the loss of what might be called momentum. Efforts such as those which have been so successfully made are only made in terms of the enthusiasm which comes with belief in the goals of the program and from confidence in the ability to perform. The effect on momentum of withdrawal from Fairchild of the natural next step of improvement in the Corona program would be unfortunate. It would be tantamount to breaking up a winning team.

The improved system which is proposed represents a major advancement in systems capability for the 1961 Corona project. The improvement in systems capability is accomplished by means of judicious and simple changes to the existing Fairchild designs. It is, therefore, completely compatible with the required operational delivery schedule.

Fairchild proposes using a 5 inch wide film in lieu of the present 70 mm film. By substituting a superior Fecker 24" f/5.0 lens for the present lens, the intelligence gathering capability of the system is increased since the Fecker lens performs at a high acuity level over an entire 5 inch wide field. This change which can be accomplished by minimum design effort, permits a 100% increase in the area coverage capability of the system.

# SYSTEMS MANAGEMENT & ENGINEERING MANPOWER LOADING CHART

FAIRCHILD CAMERA & INSTRUMENT CORPORATION

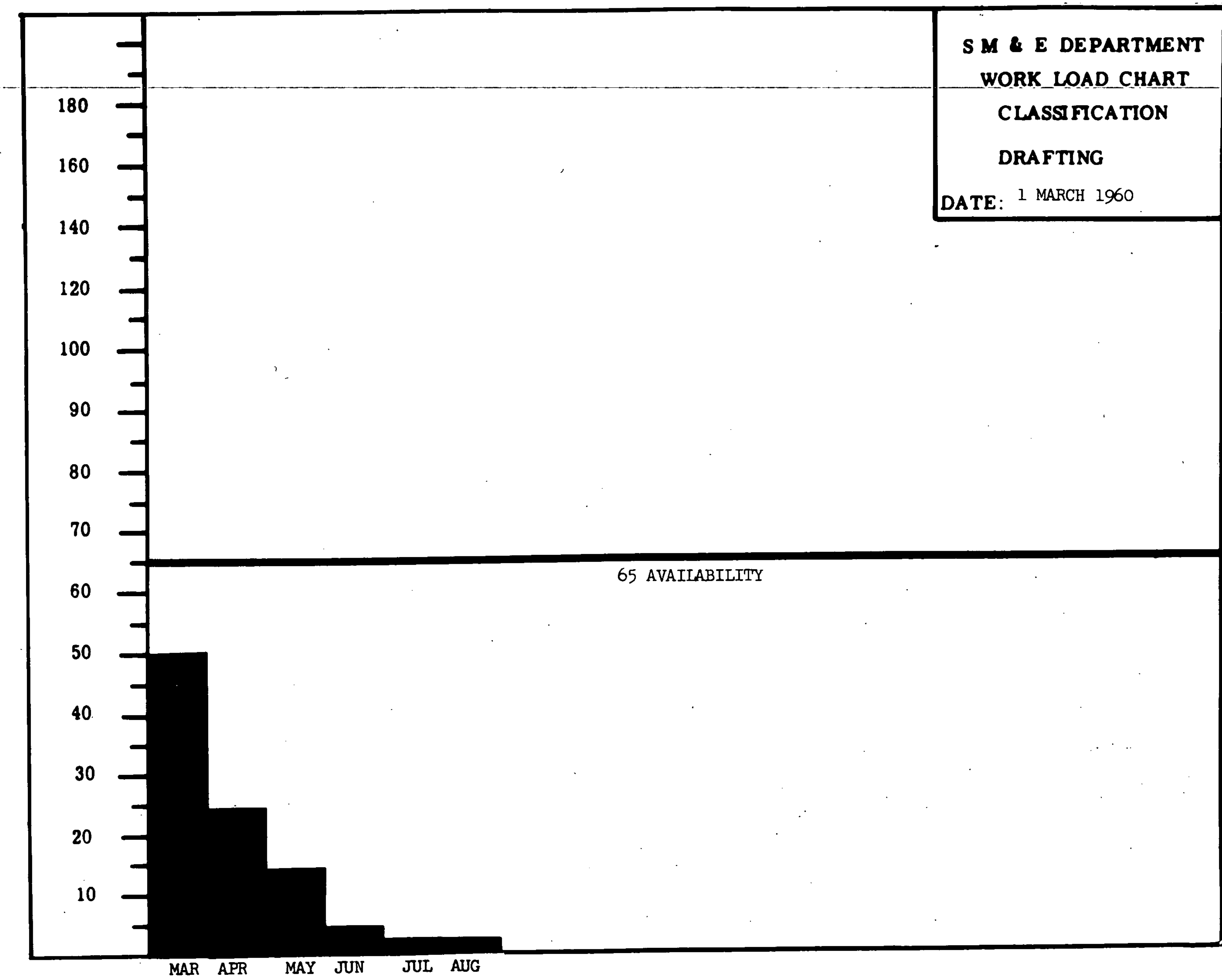


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FIG 1A

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# SYSTEMS MANAGEMENT & ENGINEERING MANPOWER LOADING CHART

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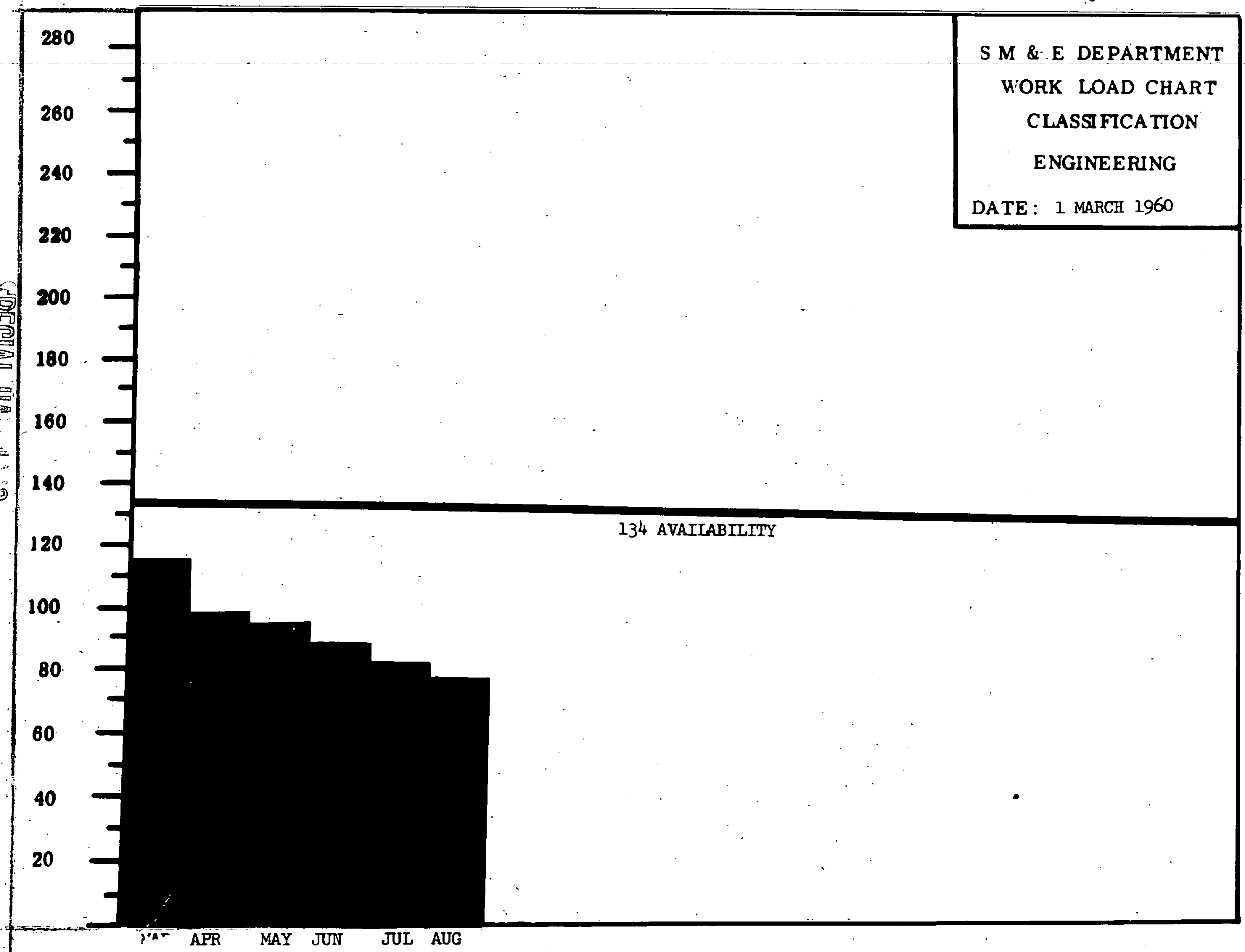


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FIG. 1B

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Hence, operation of the system can be extended to a full four-day mission instead of the present two-day mission which is caused by the limitation in film capacity.

Use of 5" wide film automatically increases the reliability of the system. This follows from the reduction of the maximum cycling rate of the system by a factor of 2, and by the attendant reduction in maximum film velocity and scan rate.

The essential advantages of Fairchild's proposed improved operational Corona camera are:

1. INCREASES INTELLIGENCE GATHERING CAPABILITY.

2. INCREASES AREA COVERAGE CAPABILITY BY 100%.

3. INCREASES RELIABILITY BY REDUCING THE MAXIMUM OPERATING RATES BY A FACTOR OF 2:1.

4. CONTINUES IN EXISTENCE THE TECHNICAL TASK GROUPS WHICH HAVE BEEN SPECIFICALLY PREPARED AND OUTSTANDINGLY SUCCESSFUL IN THE CORONA PROGRAM.

5. USES FAIRCHILD'S NEW SPACE ENVIRONMENTAL TEST FACILITY FOR THE COMPLETE ENVIRONMENTAL TESTING OF THE SYSTEM. THIS FACILITY HAS BEEN ESPECIALLY DESIGNED FOR DYNAMIC TESTING OF PHOTOGRAPHIC SYSTEMS IN THE CORONA ENVIRONMENT.

These advantages are further developed in the following sections of this proposal.

A suggestion for even further improvement of the Corona system is given in an addendum to this proposal. It would be advisable to initiate design investigations into this larger improvement in parallel with the proposed effort. This would enable a more detailed evaluation of the suggested improvement and would make possible timely provision of the improved capability it represents if such is found to be necessary.

## II. TECHNICAL DESCRIPTION.

### A. General Configuration.

The general configuration of the improved Corona photographic system is shown in FIGURE 2. It is to be noted that the improvement in capability is accomplished with no change to the configuration of the front end of the payload. This can be seen by comparison with the present configuration which is shown in FIGURE 3.

### B. Film.

The present Corona camera with very minor changes, can readily accommodate an increased width of film. Layout has shown that a 5 inch wide film can be easily handled in the existing vehicle configuration. (See Figure 2.) The extent of the changes can best be appreciated by over-laying Figure 3 (the present Corona camera) over Figure 2 (the proposed camera). The overall longitudinal dimension is somewhat increased, mainly due to increase in supply spool width but this packages nicely, simply by increasing the hub diameter and straddling the retro-rocket nozzle.

In the nose cone where the take-up cassett is housed, no change in mounting is required since the cassette will be the same as the one presently employed in the ARGON program with the exception of a larger spool diameter. The present film load limitation is restricted only by the largest take-up spool diameter which can be packaged in the present nose cone. This dimensional limitation still permits the use of 6200 ft. of 5 inch film weighing 63 pounds. Area coverage with this increased film load is twice that of the present Corona camera. For coverage comparisons, see Figure 5.

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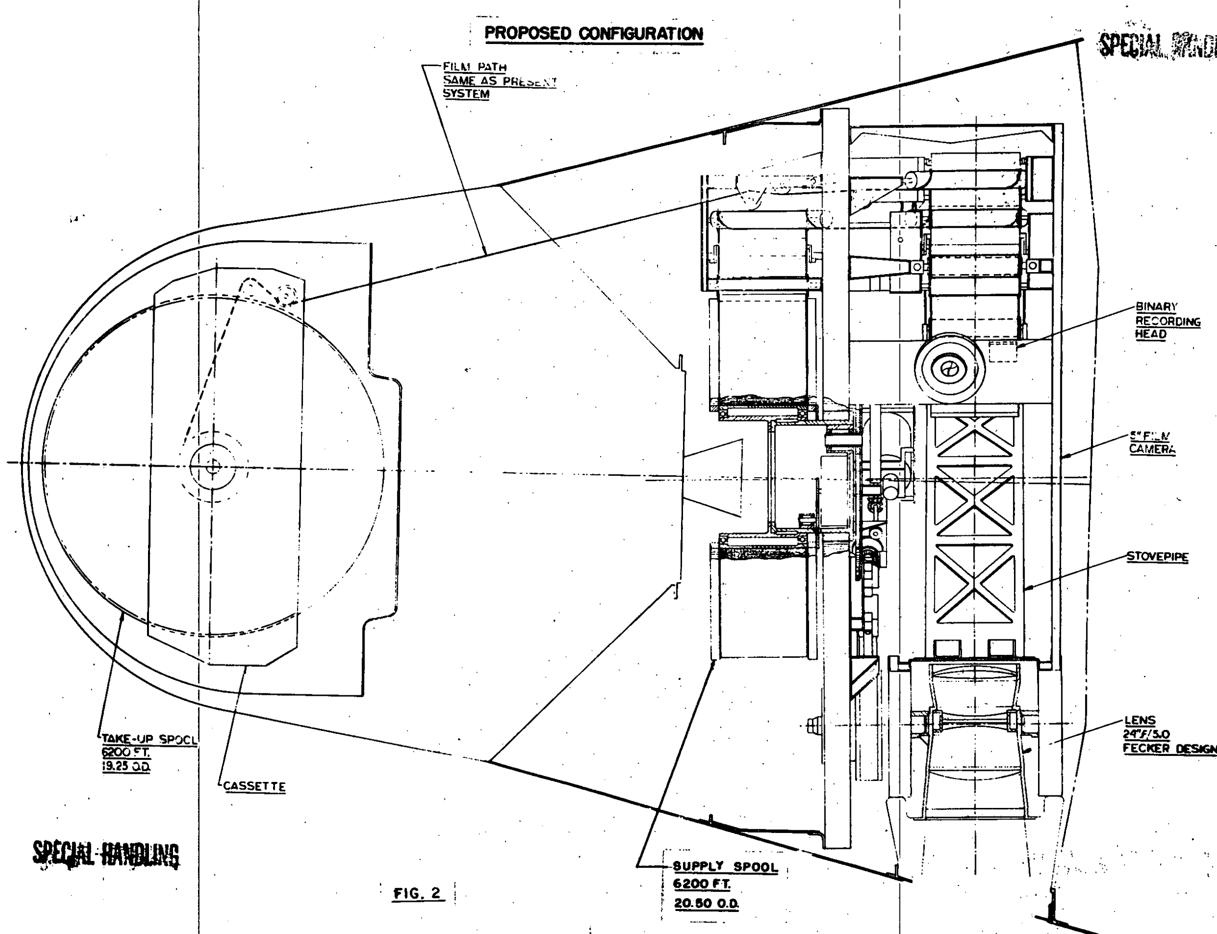


FIG. 2

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PRESENT CONFIGURATION

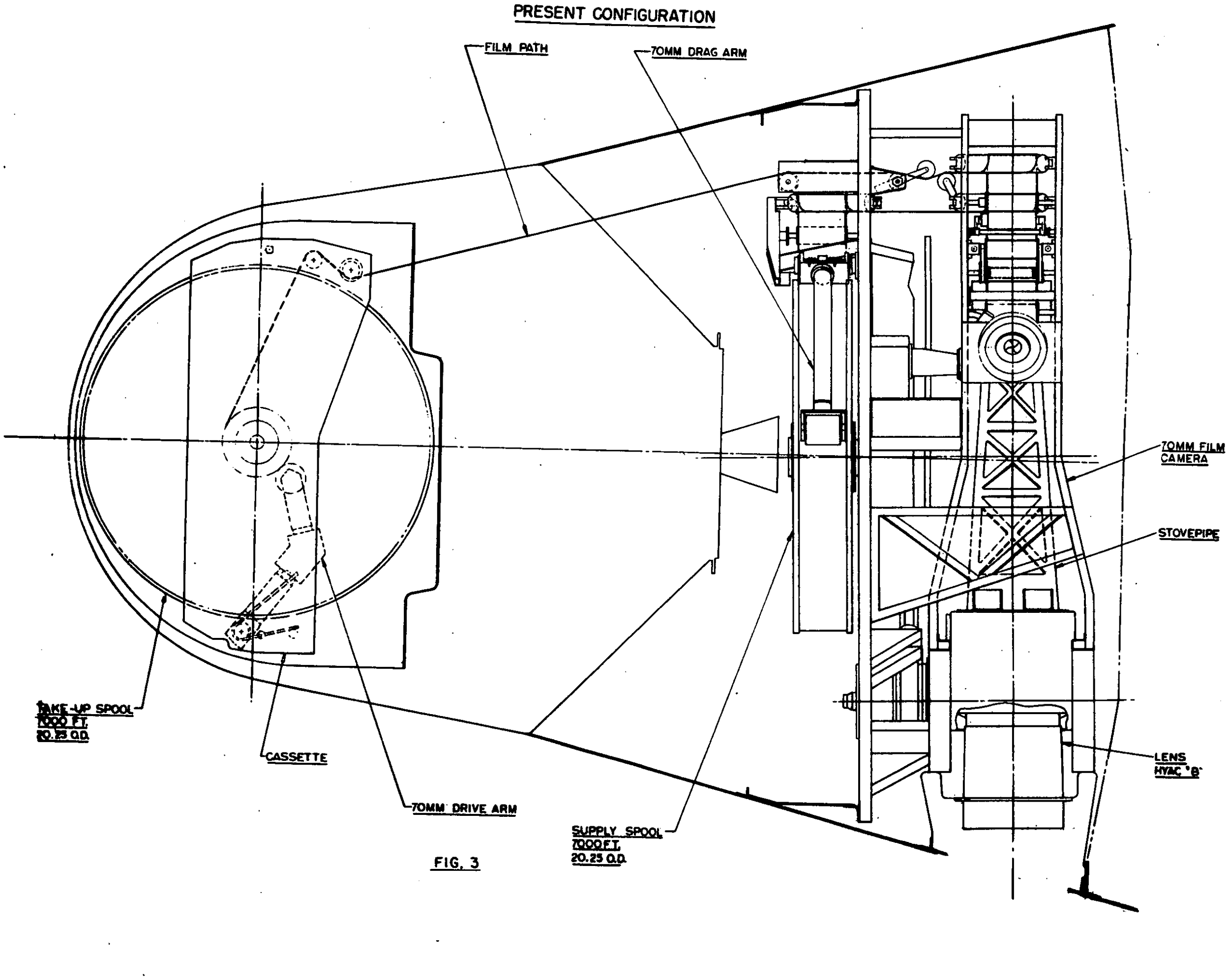


FIG. 3

# FORMAT CONFIGURATION

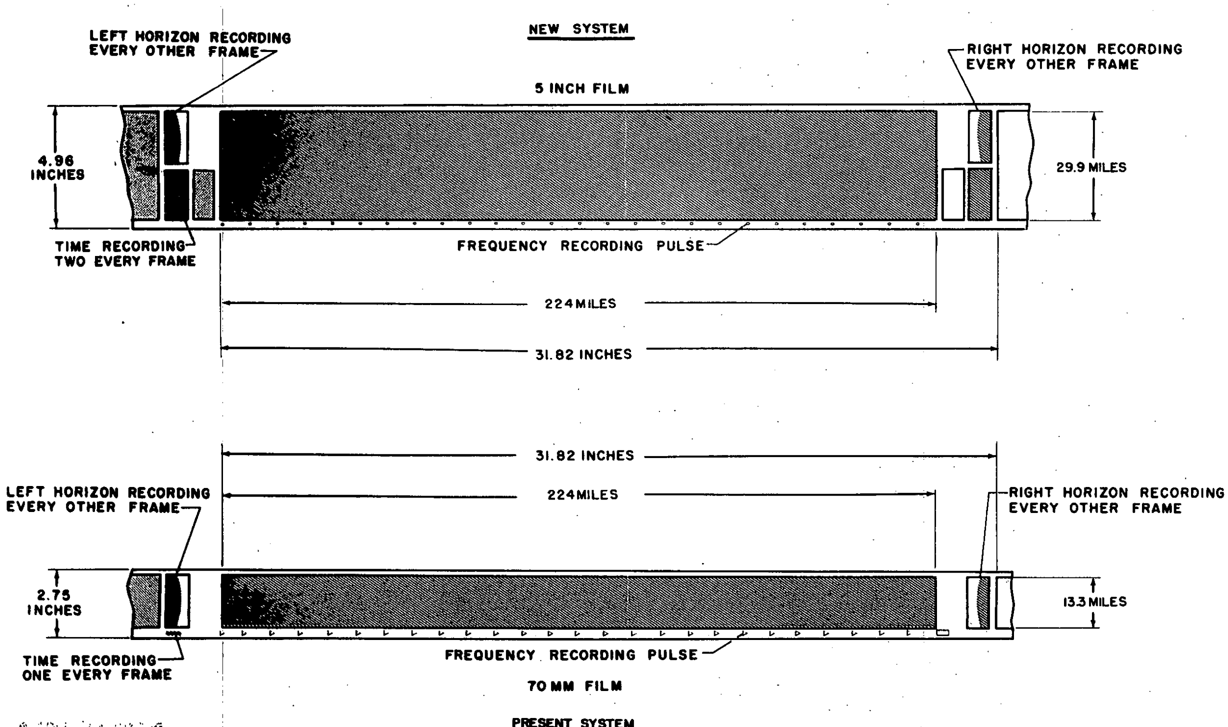


FIG.4

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Fairchild Camera & Instrument Corp.

16 April 1960

## FIGURE V

## COVERAGE COMPARISON *

| | | 5 Inch | 70 MM |
|---|---|---|---|
| 1. | Total Area Coverage with 39 lbs. of film | 9,080,000 Sq. Mi. | 7,350,000 Sq. Mi. |
| 2. | Maximum Area Coverage for maximum film load | 14,600,000 Sq. Mi. (63 lbs.) | 7,350,000 Sq. Mi. (39 lbs.) |
| 3. | Average Frames Per Pass from 40°N to 80°N Latitude | 105 | 234 |
| 4. | Average Coverage Per Pass from 40°N to 80°N Latitude | 617,900 Sq. Mi. | 617,900 Sq. Mi. |

* For perigee = 130 statute miles, $\epsilon$ = .05, coverage from 40°N to 80°N latitude, and perigee varies from 25°N to 37°N over 4 days.

Defense Products Division
Fairchild Camera & Instrument Corp.

April 18, 1960

It is worthy to note that although the 5 inch film is only 80% wider than the 70 mm film, the increase in area coverage per frame is 115%. This is best illustrated by referring to Figure 4. In the 70 mm film only 2.1 inches of width is used for active photography while in the 5 inch film, 4.5 inches of width is utilized. Further analysis points to a 20% increase in area coverage per unit weight of film, which is, literally, a gain in area coverage at no cost in weight. The use of 5 inch film in lieu of the present 70 mm film is inherently better not only in the additional area coverage but also in increased reliability.

The additional width of film permits the use of lower film velocities and scan rates since cycle periods are increased by a factor of 2. This serves to greatly reduce the wear and tear so closely associated with high speed mechanisms.

It is strongly recommended that polyester base film of nominal .0035 inch thickness be used in this program exclusively. This would preclude the need for any pressurization considerations, since polyester base film maintains its greater strength even under high altitude conditions as opposed to the reverse behavior of tri-acetate base film.

C. Lens

In selecting a lens to meet the requirements of the proposed improved photographic system, several considerations are of major importance:

1) The lens must be physically comparable with the lens presently employed.

2) It must be equal to or better in performance with the present HYAC B lens from a resolution point of view.

3) It must cover a 5 inch wide format without loss of resolution.

4) Last, but not least, it must be readily available at a reasonable price.

Defense Products Division
Fairchild Camera & Instrument Corp.

April 18, 1960

The high acuity 24-inch f/5 lens that is proposed is that produced by the Photronics Corporation. The original perfection of the design was carried out by Mr. Ralph Wight, Vice President, then Chief Optical Designer of J. W. Fecker, Inc.

The basic design is a Fecker-Ross astrographic camera lens consisting of four air-spaced elements, a positive, two negatives, and a positive. These lenses have been long esteemed for their high resolution over a total field of 15 degrees at a normal speed of f/7.

In the Photronics lens design, the last element is a cemented pair to provide closer control on the desired range of color correction. Two of the surfaces are aspheric to provide adequate zonal correction at the required maximum aperture, although for an f/5, the degree of aspherization does not amount to more than a few wave lengths departure from the nearest sphere. Excellent correction of astigmatism is achieved by accepting some field curvature which is then eliminated by a single element field-flattener close to the focal plane. For a panoramic camera, the field flattener also serves as a convenient and inexpensive means for precisely adjusting the focal length to a constant value without fear of any reduction in image quality, since its thickness can be varied to accommodate the normal tolerance in equivalent focal length of the lens.

The design was first used as a re-imaging lens, in tandem, in the IGOR Mark II type of missile tracking telescope. In this application it was designed to cover a total field of 30 degrees at a speed of f/5. The lens, as designed and aspherized, gave a photographic resolution on 548-C plates of 250 lines per millimeter in the center and 150 lines per millimeter at the edge of the 15 degree semi-field. Photographic resolution on other types of emulsion is not available.

The lens design has also been produced in a 36-inch version to cover a 9 x 9 inch format. Aerial photographs taken with this lens mounted in a KA-2 Fairchild camera show a resolution on Aerecon Plus X emulsion of 55 lines per millimeter in the center falling off to no less than 45 lines per millimeter at the edge of the format. The 3.5 inch maximum diameter of the shutter limited the effective aperture to 4/9. A reproduction of one of

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April 18, 1960

## FIGURE 6

## PHOTOGRAPHIC RESOLUTION COMPARISON

### SO-221 Emulsion

| | | 0° | 2.5° | 5° |
|---|---|---|---|---|
| Photronics | Prototype | 125/137 | 130/122 | 122/130 |
| Hyac II | HLC-B-12 | 134/134 | 119/106 | - |
| | HLC-B-13 | 120/120 | 107/113 | - |
| | HLC-B-14 | 120/120 | 113/107 | - |
| | HLC-B-15 | 134/134 | 127/120 | |
| | HLC-B-16 | 120/120 | 100/107 | |
| | HLC-B-17 | 134/134 | 127/107 | |
| | MEAN | 127/127 | 115/110 | |

The numbers give the tangential/radial resolution in lines per millimeter determined with high contrast targets and SO-221 emulsion developed in D-19 emulsion for 6 minutes at 68°F.

The Photronics results were obtained at the Fairchild Calibration Laboratory on a 12-inch prototype lens.

The Hyac II results are those determined at Itek and submitted with the lens.

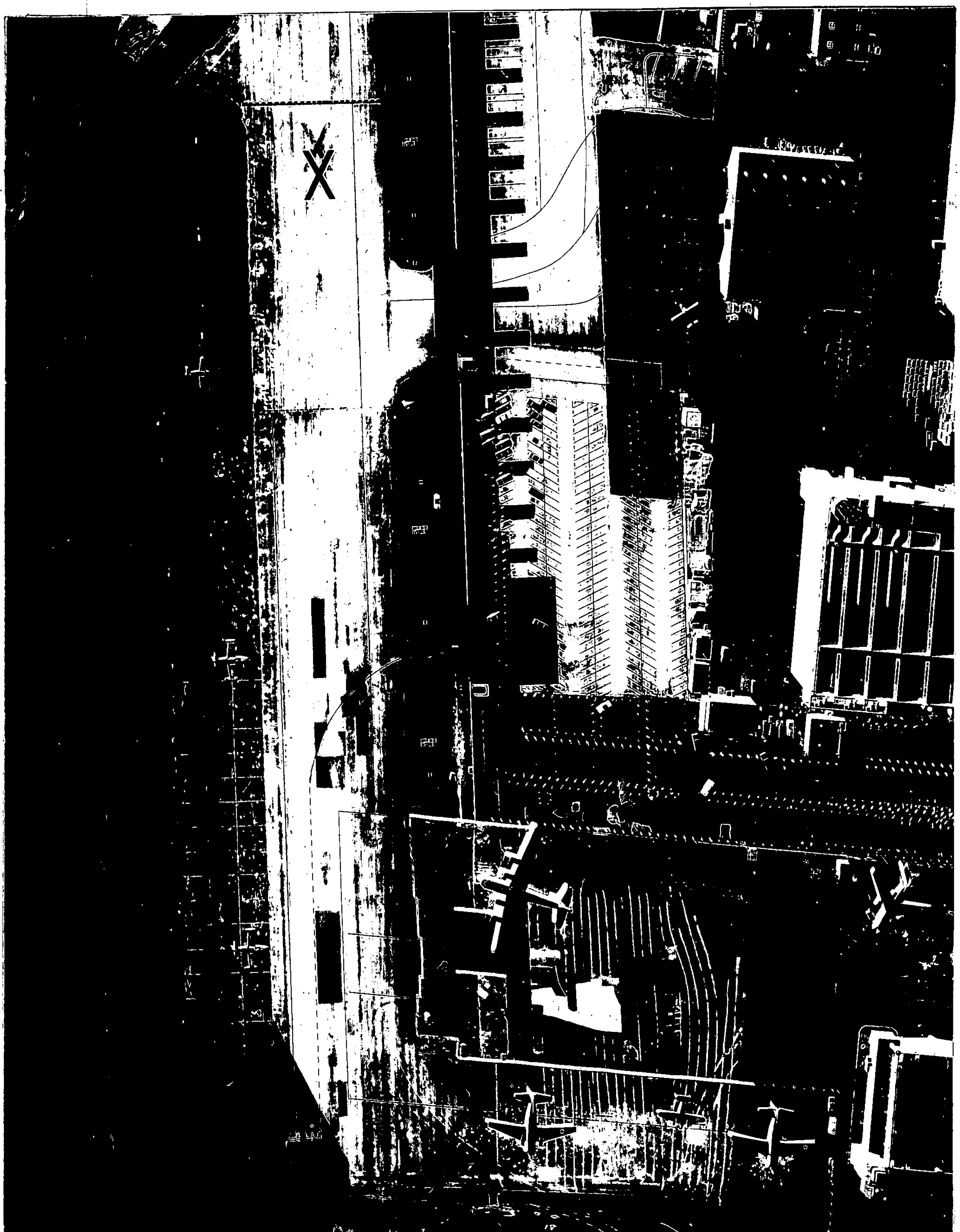




FIG.7

the negatives is shown in Figure 7. This reproduction was made by a special process which Fairchild is currently proposing as a ground processing system to the Air Force. Even after two generations, there is virtually no degradation of the original negative image. This photograph was made at an altitude of about 7,000 feet with an effective shutter speed of 1/450 second. In the laboratory the lens has given an axial resolution of 70 lines per millimeter on Aerecon Plus X emulsion with a minimum of about 60 lines per millimeter over the entire format. On a finer grain emulsion (ASA 10-20) the axial resolution was 140 lines per millimeter with a minimum of 110 lines per millimeter over the format.

Unfortunately, no 24-inch version of the lens exists which could be tested with the emulsions that are actually used. However, Photronics did have the glass elements for a prototype 12-inch f/5.6 which they agreed to mount and assemble in a test barrel for tests at the Fairchild Calibration Laboratory. As it turned out, the few days that were available did not represent sufficient time to adequately center and square-on the elements and provide an image representative of the lens capability. Yet even in its imperfect state the lens gave quite gratifying resolution. The results that were obtained on SO 221 emulsion are shown in Figure 6, along with the corresponding resolutions presently obtained with the Hyac II lens, as reported by the lens manufacturer.

The primary thing these tests show is that the Photronics lens design is capable of providing essentially the same high resolution throughout a 10 degree total field. From these photographic results and perhaps even more from the appearance of the aerial image, it can be predicated in complete confidence that a final well-centered 24-inch f/5 Photronics lens will supply as high a quality image across the 4-1/2-inch slit as is presently obtained with the Hyac II across a 2-1/4 inch slit, and further, that the resolutions obtained will indeed be some 10 to 20 percent higher.

The weight of the 24-inch lens mounted in an aluminum barrel is estimated as a little less than 6 pounds. All of the elements are of sufficient optical density to provide near maximum efficiency in anti-reflection coatings. The transmission is anticipated to be about 85%. The distortion is less than 50 microns at a half-field angle of 5 degrees, insuring that no degradation in resolution will occur from this cause as the slit travels across the image.

Defense Products Division
Fairchild Camera & Instrument Corp.

April 18, 1960

D. Time Recording.

To improve the reliability of the present Corona. Time Recording system, a binary lamp display system will be used. This system, presently employed in the ARGON program has undergone extensive tests with very satisfactory results.

The proposed time recording unit will be a completely static device employing magnetic core transistor and pure transistor logic elements, a crystal controlled transistorized oscillator, and a binary lamp recording head for making time word exposures on film. The output time words, under control of a request pulse forming switch in the camera, are both exposed on the film and sent out in serial form which is processed for direct insertion into a telemeter modulator. It will provide maximum reliability and long operational life as well as increased accuracy. The characteristics of the proposed system are as follows:

Time Resolution Element
0.05 seconds

Unambiguous Count Capacity
13,207.2 seconds (approximately 3+ hours)

Size
Less than 400 cubic inches

Weight
6.0 pounds, including 2 external Recording Heads

Power
5.08 watts average continuous power

Outputs
(a) Parallel - Into a dual binary lamp recording head for direct recording on film.

Defense Products Division
Fairchild Camera & Instrument Corp. April 18, 1960

(b) Serial - A serial time word consisting of suitable voltage levels to distinguish between binary data ("ones" and "zeros") and no data. This includes a time request freeze pulse followed by eighteen modulator input bits. Pulse rate into telemeter 400 pulses per second.

E. Structure.

As previously noted, there will be no basic changes in structure. The vehicle configuration is left intact. A thicker main mounting plate is proposed for the new camera system. By increasing the present thickness of 5/8 inch to 1-1/2 inches, the stiffness of the plate will be increased by a factor in excess of 13 to 1. With this increase in stiffness, it will be possible to eliminate the vibration rods and cross-stiffener presently employed in the Corona program. The rods are cumbersome to install and are a further nuisance since they must be severed prior to camera operation. It is estimated that the increase in main mounting plate weight will be about 4 pounds. However, this change obviates the need for vibration rods cross-stiffener, and dimple motors used for severing the rods, an aggregate weight in excess of 4 pounds. In summary, this change saves weight.

Since the proposed change is structurally superior to the present Corona configuration, there is no concern with a requalification program. No other significant structural change is contemplated.

F. Weight.

The overall weight of this proposed 5 inch film camera system will be approximately 101 pounds. This reflects an overall weight increase of 6 pounds necessitated by wider film handling devices such as rollers, platen, stove, etc.

Defense Products Division
Fairchild Camera & Instrument Corp.

April 18, 1960

G. Power.

Due to reduced cycling rates achieved by increased film width, stove scan rates can be proportionately reduced. It is estimated that the larger stove will have an inertia of about 1.8 that of the present system. However, the angular velocity will be about one-half the present rate. Since power requirements for acceleration are directly proportional to inertia and increases as the square factor of the angular velocity, the overall power requirement for stove acceleration is reduced by a factor of 2. It is expected that film drive power savings due to slower rates will be offset by increased power requirement due to increased width and higher film tension resulting in the same power as presently required. In summary, the overall power will be reduced by about 20%.

H. General Design Considerations.

General product improvement along the lines of reliability will be undertaken as a matter of course. These improvements, however, will be governed by a basic ground rule that no design changes shall be major in scope. With this philosophy in mind, the following will be accomplished:

1) Improve Tension Loop Design

This will be accomplished by a rather simple but very effective change. Without altering the present film path, the input metering roller will be relocated between the supply spool and input skew rollers. The output metering roller will be relocated between the take-up spool and output skew roller. This will serve to isolate the irregular film tension loads created by the spools from the well controlled tension loops within the camera proper.

2) Improve Supply Spool Drag

This will be accomplished by eliminating the present drag arm which rides on the film and replacing with a direct drive to the spool hub.

3) Improve Take-up Spool Drive

This will be accomplished by eliminating the drive arm and replacing with a direct drive to the spool hub, as presently employed in the ARGON program.

4) Improve Data Recording

In addition to the change in Time Recording System as previously outlined, the frequency recording in the margin of the main format will be changed to a gas lamp light source. Since gas lamps do not have the extinguishing time constant of filament lamps, timing marks will now be clearly defined.

## III. ENVIRONMENTAL TEST FACILITY

An Environmental Test Facility is now under construction as an extension to the Fairchild plant in Syosset, New York. This new facility which adjoins the Corona and Argon areas, is expected to be in operation in the early summer of 1960.

The capabilities of this new test center will be at the disposal of any program at Fairchild which requires advanced test techniques necessitated by advances in space technology. This, of course, fits perfectly with the needs of the Corona program for 1961.

The facility will be capable of resolution testing of very long focal length large relative aperture diffraction-limited photographic sensors. It will be capable of testing these sensors while they are being subjected to the altitude, temperature and vibration conditions which would be encountered throughout the mission profile of space vehicles.

Of course, the facility will have a general capability which any altitude and temperature chamber and any vibration machine would have. Further, the collimation equipment which would be used in combination with the environmental testing will be useful in ambient conditions as well. However, the uniqueness of the facility resides in the large size of the chamber and in the combination of environmental variables which can be imposed during a resolution test.

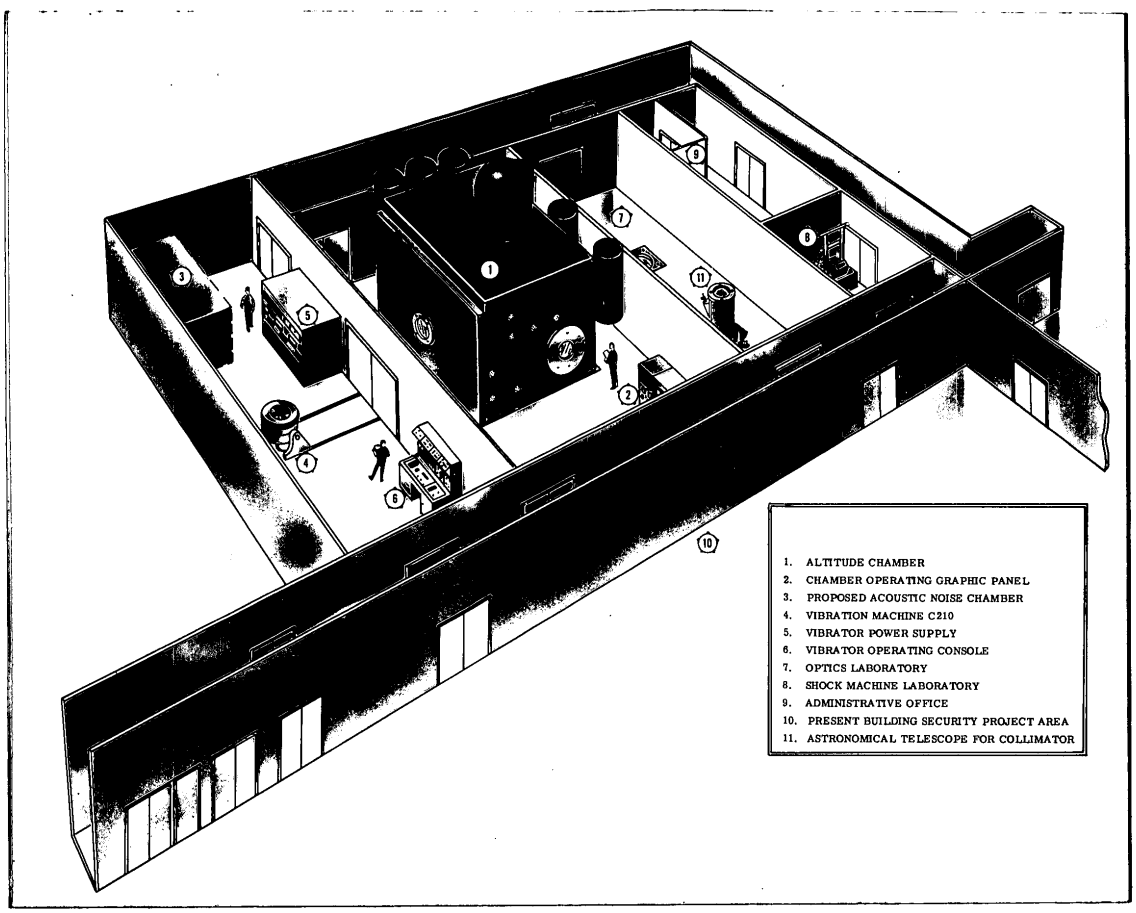
Another distinguishing feature of the facility is that it is designed so that it is capable of handling equipment which is either completely unclassified or highly secure.

Under certain conditions the altitude chamber in the new facility will be capable of simulating an altitude of 1,000,000 feet (see Figure 8). It is large enough to accept the present reconnaissance vehicle in whole and in any desired attitude of test. Vibration environments will be simulated by means of a specially designed MB C210 vibrator which can be mounted within the chamber.

The chamber also will have variable temperatures controllable from -100°F to +200°F.

Optical checks can be made through a window in the floor while in altitude by means of high quality optical collimator systems located below (see Figure 9).

The optical evaluation test system, in its vibration isolated mounting below the first floor in a 34 foot deep subterranean chamber, can be used either in the ambient position for testing or can be motor driven into position under the Altitude, Temperature, and Humidity chamber for evaluation of equipments undergoing vibration, altitude, temperature, humidity or programmed combination of all in a simulation of flight conditions. An optical window in bottom of the chamber permits photographic testing of the units under test for true performance evaluation.




UPPER FLOOR LAYOUT

FIG. 8

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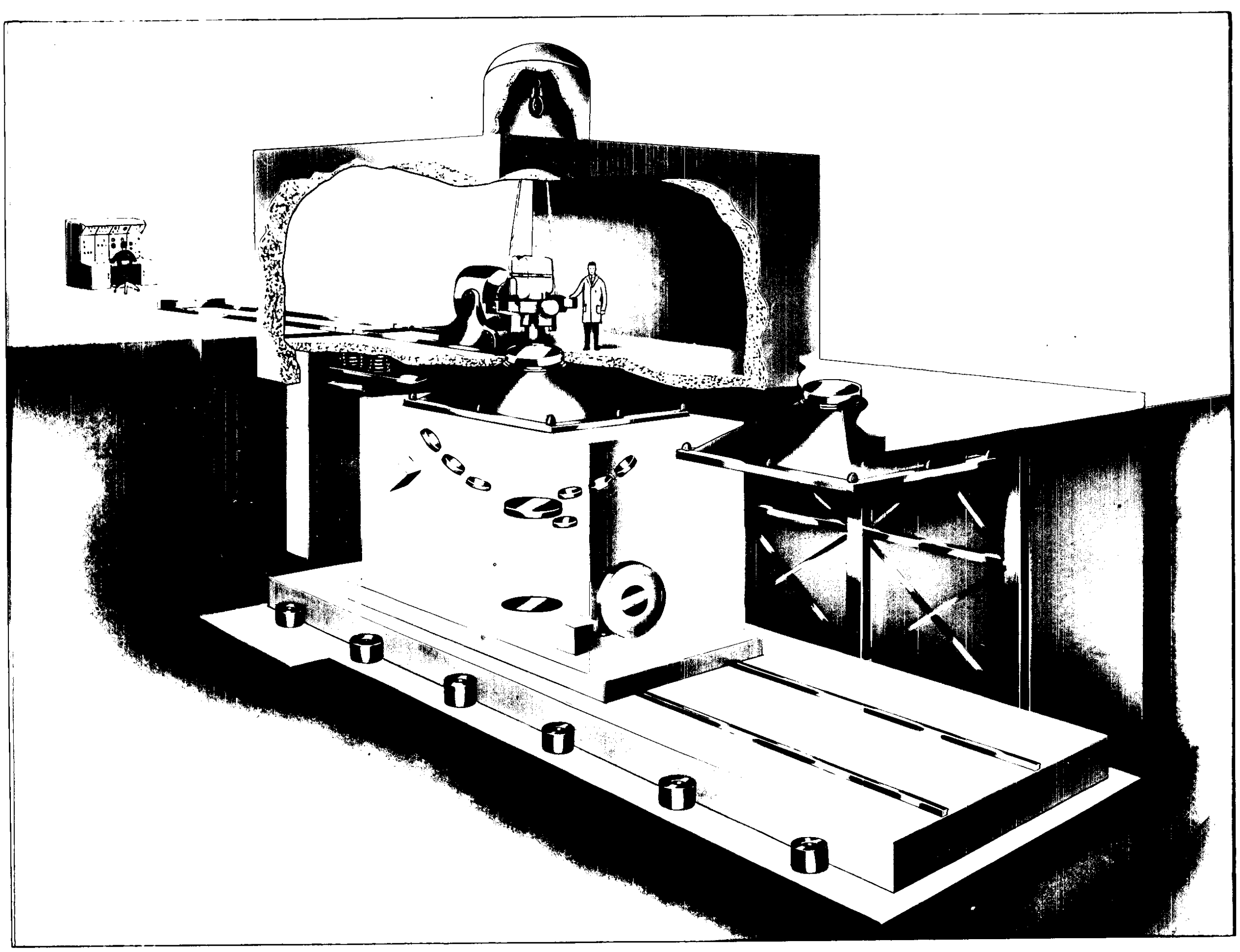

OPTICAL EVALUATION TEST SYSTEM

FAIRCHILD
CAMERA AND INSTRUMENT

FIG. 9

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Figure 8 shows that area space has been provided for the addition of an Acoustical Noise room. Area No. 4 has space for customer's office and conference.

A sub-basement below the building provides for all the machinery; such as boiler, refrigeration and mechanical pumps. A service entrance to the outside again provides the maximum in security and accessibility.

Figure 9 shows three testing systems in combination to produce a sample programmed test run on a particular piece of photographic equipment which is currently being designed for the Air Force. For the first time, we will be able to conduct a test of this nature at several environments under controlled laboratory conditions and evaluate the performance.

The camera selected is mounted in position on the vibration machine with the lens directly over the altitude chamber window. The chamber can then be programmed through an altitude range at the same time vibration tests are being conducted. Photographs for evaluation can be made over a precise target, either static or at image motion rate as provided by the highly accurate IMC Test System. This type of testing will not only be more informative at a technical level, but will save expensive flight testing and time because true evaluation of uncontrolled flight testing is time consuming.

While the grouping of equipments is ideally designed primarily with the Optical System in mind, it is obvious that testing of nearly any type of electro-mechanical equipment can easily be handled.

This combined systems testing facility will serve the most exacting Military specification requirements as an engineering tool and evaluation for quality assurance and reliability.

## IV. SCHEDULE

An Operational Schedule for the proposed program has been developed using a go-ahead date of 1 May 1960. (See Figure 10.)

The schedule as presented is self-explanatory; however, it might be wise to discuss briefly the reason for the scheduled quantities.

1) Camera. The total quantity is (10) units comprised of (2) prototypes and (8) flight units. One of the prototypes would be used for a qualification program and be retained by FCIC as an engineering test unit. The other prototype would be sent to the field for training and test purposes.

2) Cassette. The total quantity is (14) units comprised of (6) prototypes and (8) flight units. Of the (6) prototypes, (2) units will be retained by FCIC for laboratory use. Two units will be sent to the field for similar usage. The remaining (2) prototypes would be sent to Philadelphia for their environmental tests. The qualification program would be performed on one of the Philadelphia units.

3) Supply Spool. Based upon our experiences with the present CORONA program, it is felt that the quantity of (100) supply spools is a minimum requirement.

4) Test Console. Modifications would be performed on (4) test consoles. The test console now located in Boston would be transferred to New York for FCIC use.

5) Simulator. Three existing simulators would be modified as required to improve their performance and reliability.

## OPERATIONAL SCHEDULE

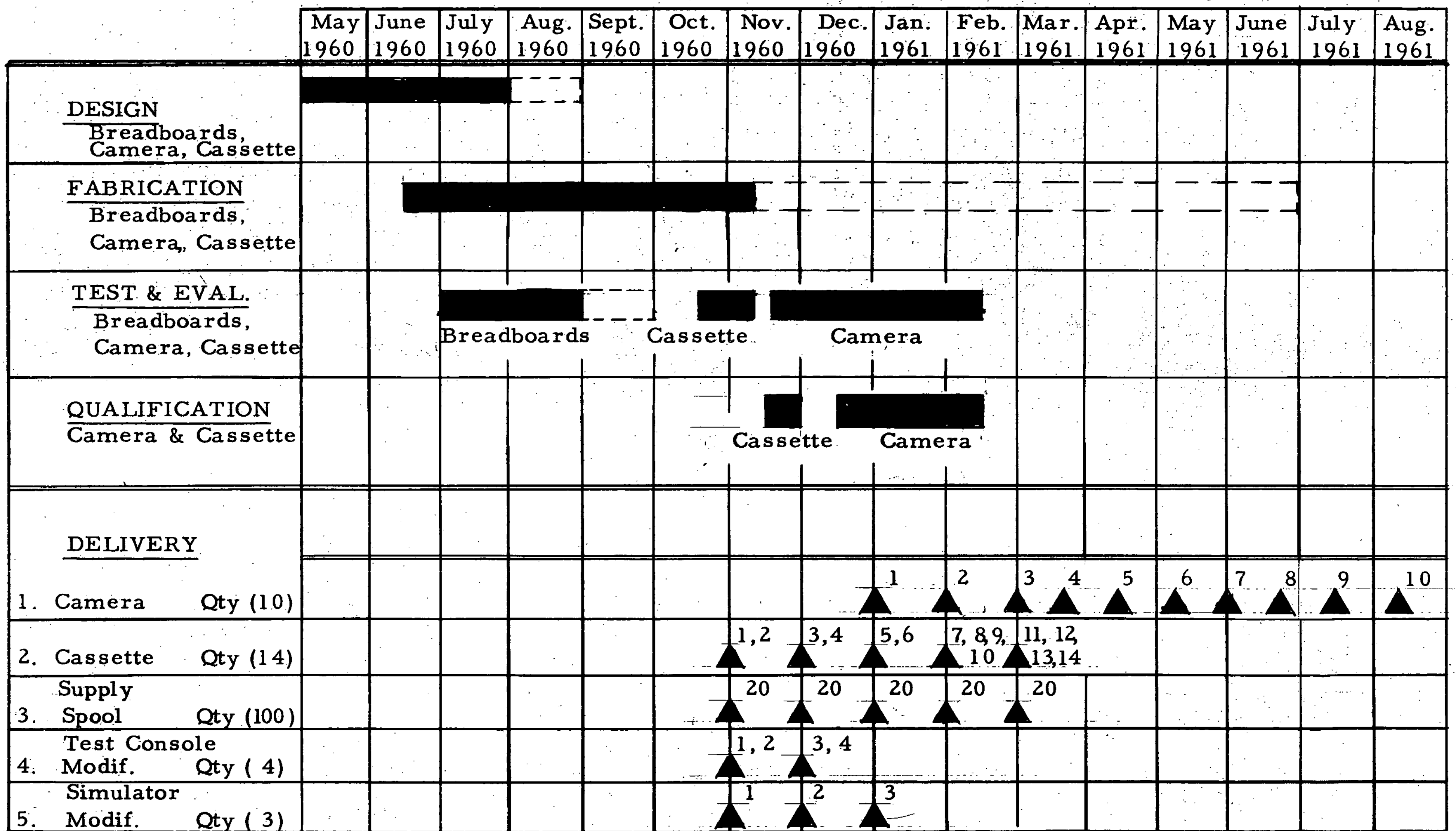


FIGURE 10

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## V. CONCLUSION

We hope this proposal has achieved the desired objective: to show that Fairchild can provide improved performance of the CORONA reconnaissance system within the required time schedule.

Placement of responsibility with Fairchild for design, development, and manufacture of the proposed CORONA Reconnaissance system will provide the following improvements:

1) Significantly increased intelligence gathering capability.

2) An increase of 100% in area coverage.

3) Increased system reliability.

4) The continuance of the technical task groups which have been specifically prepared at Fairchild to satisfy this type requirement and which have been outstandingly successful in the CORONA program.

5. Dynamic testing of the system in the CORONA environment through the use of Fairchild's new space environmental test facility.

In addition, further improvement is proposed through initiation of a parallel design investigation of the requirements anticipated for the following generation of the CORONA Reconnaissance System:

Our proposal is submitted with the complete confidence that the Fairchild team can provide a significant increase in the capability of the proposed system.

This confidence results from the outstanding technical success of the Fairchild developed CORONA system and the important contributions we have made in our over forty years of leadership in Aerial Reconnaissance. A recent example is the KS-25 High Acuity Camera System: a five inch wide film camera system that delivers to the PI a system resolution of over 90 lines/mm anywhere in the field. Preliminary tests conducted by the Air Force at WADD indicate an order of magnitude advance in camera design technology in such areas as IMC, film transport, shutter performance, mount steadiness, printer resolution performance and stereoviewer capability. Another example is the KS-50 High Acuity Panoramic Camera System: a 9-1/2 inch wide film camera system that delivers to the PI a system resolution of over 80 lines/mm.

This wealth of experience, together with the vital interest of Fairchild management in these programs as evidenced by the environmental center which is being fabricated for complete environmental testing of the CORONA and ARGON type of photographic system and the weekly progress meetings held between management and the engineering team, assure you that selection of Fairchild to develop the proposed system will surely result in the proposed increase in system capability and reliability.

Defense Products Division
Fairchild Camera & Instrument Corp.

April 18, 1960

## ADDENDUM

### Supplementary Program

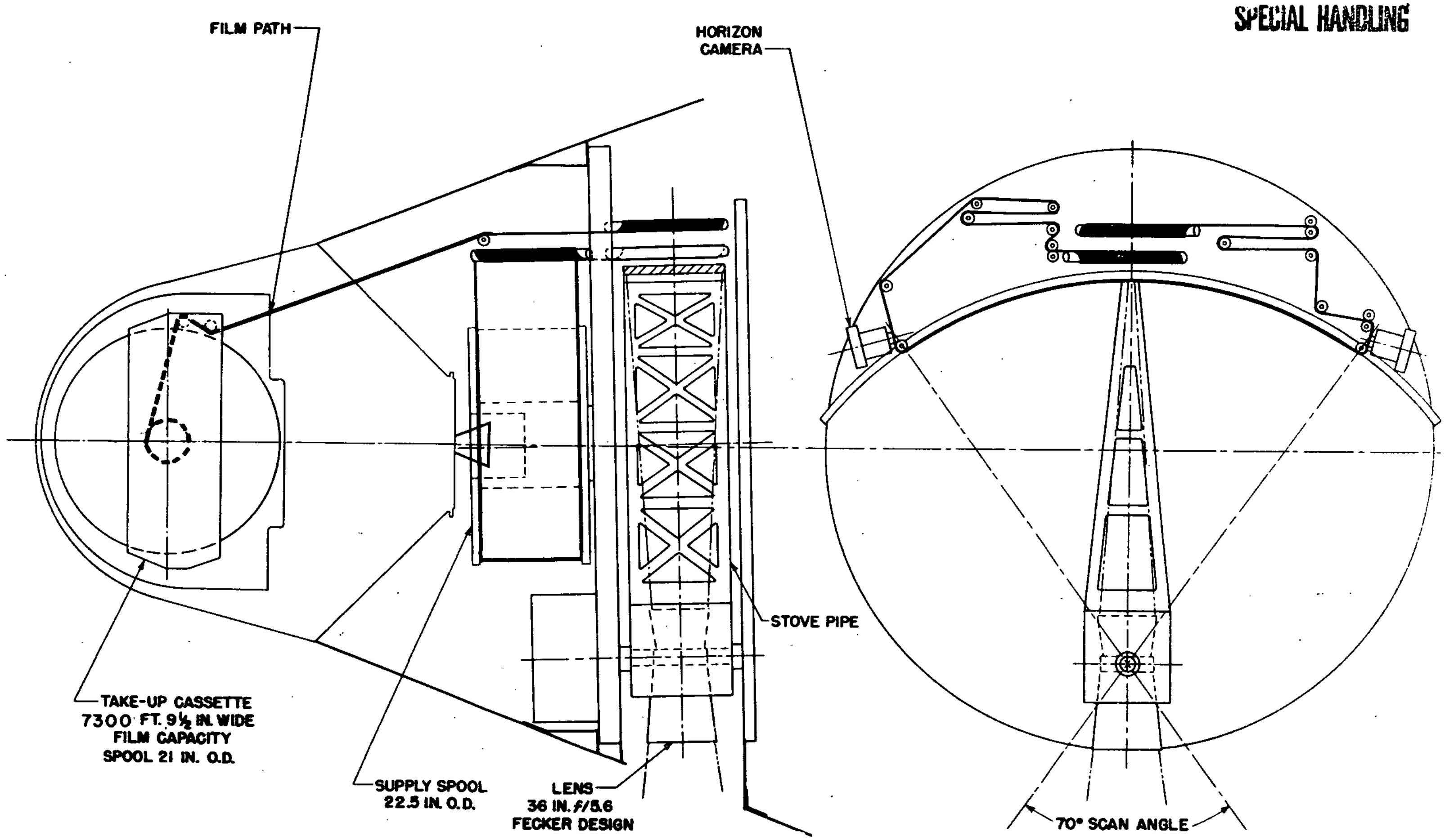
The projected reconnaissance needs for the near future call for camera systems capable of greater ground detail than can be supplied by the several versions of the present CORONA Camera. Fairchild therefore is supplementing the present proposal with a suggestion for a "sister design" which is capable of increased ground detail resolution.

The suggested camera, which would utilize a Fecker f/5.6, 36 inch focal length lens, requires only a modest increase in weight over the present CORONA Camera. However, the somewhat greater camera weight is offset by the projected increases in the payload capability of the vehicles. Consequently, conditions appear to be ripe now for the realization of the suggested 36 inch camera system.

The 36 inch focal length camera configuration is shown in Figure 11. It would utilize the basic Fairchild design for the present CORONA Camera. As a result of extensive testing, this type of design has been found to be well suited for high acuity resolution in the space environment.

The supplementary proposal is a "stove-pipe" panoramic utilizing a 36 inch focal length, f/5.6 lens and 9.5" wide film. The film storage capacity is 7300 feet.

The ground detail resolution, for high contract ratios of 1000:1, of the 36" Camera as compared to that of the CORONA Camera is increased by 32% and 40% for the 40° and 80° North latitudes, respectively. For low contrast ratios of 2:1 the expected increase in ground resolution approaches 50% for both 40° and 80° North latitudes. Since terrain reconnaissance information is usually in the low contrast category, the increase in ground detail resolution for the 36" Camera over the present CORONA Camera is approximately 50%.




# 9½ IN. FILM 36 IN. *f* CAMERA

FIG. 11



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Defense Products Division
Fairchild Camera & Instrument Corp.

April 18, 1960

Inasmuch as the 36" Fecker lens with SO-221 film has a static resolution capability of 140 lines per millimeter as compared to 125 lines per millimeter for the Hyac lens, the expected ground detail resolution for the 36" Camera is 60% greater than that of the CORONA Camera.

Following is additional comparative data for the 36" Camera versus the CORONA Camera:

The 36" Camera has:

1. A scan angle of 70°
2. A 100% larger ground coverage capability
3. A film weight of 140 lbs. (larger by 101 lbs.)
4. An increase in Camera structure and mechanism weight of 50 lbs.
5. A diameter of -
   a. Stove-pipe section 58" (8" larger)
   b. Mainplate section 56" (14" larger)
6. A 6-1/2 inch increase in length.
7. Power requirements:
   a. Peak - 350 watts (an increase of 100 watts)
   b. Average - 180 watts (an increase of 50 watts)

Due to the similarity of the 36" Camera to the 24" CORONA Camera, which has been functionally proven, conversion of the 36" Camera into reliably operating hardware can be accomplished with a minimum of development.

It is recommended that this suppplementary program be activated concurrently with the proposed CORONA program for 1961. This program would be R & D in nature and should involve the design, fabrication and testing of three (3) prototype models. The duration of this program would cover an eighteen (18) month period.

During this period, the camera systems will be completely qualified in the CORONA environment and completely tested for all performance and acceptance requirements.





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