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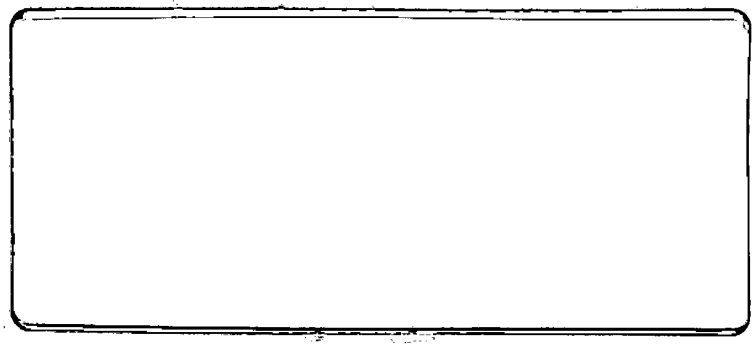

STAT

STATUS REPORT

for Period

1 AUGUST through 31 AUGUST 1969

Submitted under Contract to

U. S. Government

[redacted] STAT

File No. 11038

[redacted] STAT

This document is presented as the Monthly Status Report under Contract to the U. S. Government, [redacted] STAT
The report period represented herein covers the period 1 August through 31 August, 1969.

[redacted] STAT

[redacted] STAT

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Index (cont'd)

APPENDICES

PROGRAM SUMMARY

Scheduled Percentage of Completion	75.3%
Actual Percentage this Date	69.2%

During August, a customer liason representative visited [ ] and received a general briefing on the program status and technical aspects of the Stereocomparator. STAT

A monitoring visit was made to the optical vendor [ ] and it was determined that the most probable date for [ ] to receive the optical assembly [ ] would be February 1, 1970. This date is dependent on [ ] maintaining their present schedule. However, most operations are proceeding smoothly and no difficulties are presently anticipated. STAT STAT STAT

Our customer has been notified that [ ] will require beneficial occupancy of the final installation site by May 1, 1970. In addition, [ ] expects to have limited access to the site, prior to this date, by informal arrangement with the customer's Site Preparation Superintendent. STAT STAT

No problems in this regard are expected [ ] STAT

The Image Analysis equipment (Task 24) was scheduled by the subcontractor [ ] for July, 1969. Due to various technical difficulties that they encountered, their acceptance test schedule has slipped several times, eventually being set for September 8, 1969. STAT

The Image Analysis equipment was not on the critical path for overall completion and thus no specific schedule problem was anticipated. However, [redacted] has now established a new acceptance STAT test date of October 6, 1969. This date will still allow [redacted] to integrate STAT the Image Analysis equipment into the overall system by the end of October, 1969, and, therefore, can still be accommodated.

[redacted] is presently taking all precautions necessary to STAT ensure that the Itek subcontract does not slip to the point that it is on the critical path for the schedule of the Stereocomparator.

TASK 1

STATEMENT OF WORK, SPECIFICATIONS, REPORT PREPARATION

Scheduled percentage of completion	79%
Actual percentage this date	79%

No new specifications were developed or issued during this report period.

Monthly reports from our subcontractors are incorporated into this document under appropriate task headings or in the Appendix.

TASK 2

SCHEDULING AND PLANNING

Scheduled percentage of completion	79%
Actual percentage this date	79%

Certain schedules have been brought up to date; please see the "Program Summary" report.

TASK 3

TEST AND INSPECTION PROCEDURES

Scheduled percentage of completion	68%
Actual percentage this date	55%

Work is continuing on the development of the detailed test procedures utilizing the targets and photography.

TASK 4

MANAGEMENT, ADMINISTRATION AND SUPERVISION

Scheduled percentage of completion	79%
Actual percentage this date	79%

Management and administrative functions are proceeding normally with no major departures from the original management plan. The management work load is dropping due to the fact that the program has entered a waiting phase.

This relates to the optical subcontract, the Image Analysis subcontract and the computer programming subcontract.

Presently, work is continuing on the electronic hardware checkout and the assembly of the stages and related equipment.

TASK 5

MEETINGS

Scheduled percentage of completion	79%
Actual percentage this date	79%

A visit was made to the customer's facility on August 20th, at which time meetings were held with respect to the site preparation and maintenance aspects of the Stereocomparator work.

A meeting was held with a customer representative on August 25th during which time a general presentation on the Stereocomparator was made.

TASK 6

FACILITIES REQUIREMENTS

Scheduled percentage of completion	98%
Actual percentage this date	92%

The clean room air conditioning equipment is in operation after a shutdown for replacement of defective controls.

The first engineering tests of the air conditioning equipment have raised questions concerning the capability of the equipment to maintain temperature during the winter months.

The possibility of adding additional heater capacity is presently under review.

The clean room facility is presently fully occupied with Stereocomparator assembly and electronic equipment checkout. The occupancy is presently about 16 hours per day.

TASK 7

MAIN FRAME AND STRUCTURAL ELEMENTS

Scheduled percentage of completion	98%
Actual percentage this date	93%

The main frame for the Stereocomparator was completed in September 1968.

No additional work will be scheduled for this Task until the return of the Optical Bridge by the optics sub-contractor.

TASK 8

SKIN

Scheduled percentage of completion	50%
Actual percentage this date	30%

The fabrication of the external skin sections has been completed to the point where the total assembly is needed in order to finish this Task.

No further work is anticipated until the Stereocomparator has been completely assembled.

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TASK 9

GRANITE AND WAYS ASSEMBLY FOR STAGE

Scheduled percentage of completion	98%
Actual percentage this date	98%

No further work is anticipated on this Task at this time.

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TASK 10

AIR BEARINGS

Scheduled percentage of completion	98%
Actual percentage this date	94%

As previously reported, the air bearings were installed on both stages in February.

The utility cabinet has been completed and the air bearing system has been tested. These tests disclosed that the individual bearing air line filters were not satisfactory in that they leaked to the atmosphere at the high pressure required for the air bearings.

New filter housings have been designed and will be installed as soon as possible.

TASK 11

STAGE DRIVES

Scheduled percentage of completion	98%
Actual percentage this date	70%

Installation of the stage drive assemblies on the right and left hand stages was completed during the month of June.

Testing of the assemblies has been suspended pending the installation of new air line filters (Task 10).

TASK 12

FILM DRIVE AND TRANSPORT SYSTEM

Scheduled percentage of completion	98%
Actual completion this date	70%

The wiring for the film drive and transport system has been completed.

Servo compensation networks have been installed and testing is proceeding on the film transport system. No difficulties were found in this area.

Final chassis cleanup and testing will be performed as soon as the pneumatic lift-off and vacuum clamping apparatus is operational.

TASK 13

FILM PLATEN AND FILM CLAMPING

Scheduled percentage of completion	98%
Actual percentage this date	90%

The wiring for the modified air control system is complete and checkout and test is proceeding.

TASK 14

FILM COOLING

Scheduled percentage of completion	98%
Actual percentage this date	60%

There will be no further work on Film Cooling until the optical system arrives.

TASKS 16, 17 and 18

VIEWING OPTICS, VIEWING ILLUMINATION,
RETICLE PROJECTOR AND ILLUMINATION

Scheduled percentage of completion	95%
Actual percentage this date	88%

The optical vendor's [redacted] plant was visited, and the testing program for the opto-mechanical subassemblies was observed and reviewed. STAT

[redacted] is conducting their work in the most carefully detailed manner. There is every indication that the optical system will achieve the highest possible performance. STAT

The [redacted] plant visit is reported in Appendix III. STAT

TASK 20

GENERAL PLATEN ILLUMINATION

Scheduled percentage of completion	98%
Actual percentage this date	80%

The platen illumination equipment has been installed on the Stereocomparator and will be tested on the machine when its wiring is complete. The units were previously bench tested and performed satisfactorily.

No work is presently scheduled for this Task.

TASK 21

OPTICAL BRIDGE AND SUPPORTS

Scheduled percentage of completion	96%
Actual percentage this date	96%

No further work is scheduled until receipt of the optical bridge and the optics from subcontractor.

TASK 22

INTERFEROMETER ASSEMBLY

Scheduled percentage of completion	90%
Actual percentage this date	70%

Tests will be scheduled with the Interferometer regarding the effects of the laser return beam when the [redacted] Clean STAT Room temperature control system is fully satisfactory.

In addition, the optical wedge units in the photo field effect transistor assemblies have suffered surface corrosion and must be relapped (polished) and coated.

TASK 23

OPTICS DRIVE ASSEMBLY

Scheduled percentage of completion	93%
Actual percentage this date	90%

Work is proceeding on the phasing of the manual operator controls and other associated items.

All components in this system are performing satisfactorily and it is expected that the work to be done on this Task, after receipt of the optics assemblies, will be primarily that of calibration and phasing of the servo drives.

The automatic illumination control system design is complete and fabrication of the modified circuit boards is nearly complete. Testing of these assemblies will be scheduled as soon as possible.

TASK 24

IMAGE ANALYSIS SYSTEM

Scheduled percentage of completion	81%
Actual percentage this date	95%

Progress on this task is detailed in [redacted] Progress Report for the period ending July 31, 1969, which is included as Appendix I to this report. STAT

The date for acceptance testing of this system has been delayed by Itek and is now tentatively scheduled for the week of October 6th.

TASK 26

DIGITIZING LOGIC SUBASSEMBLY

Scheduled percentage of completion	98%
Actual percentage this date	95%

The checkout of the individual subsystem is essentially complete.

Further work is reported in Task 36, Overall Assembly. Please refer to this Task.

TASK 27

METRIC READOUT

Scheduled percentage of completion	98%
Actual percentage this date	95%

The checkout of the individual subsystem is essentially complete.

Further work is reported in Task 36, Overall Assembly. Please refer to this Task.

TASK 28

OUTPUT LOGIC AND INTERFACE

Scheduled percentage of completion	98%
Actual percentage this date	87%

The checkout of the individual subsystem is essentially complete.

Further work is reported in Task 36, Overall Assembly. Please refer to this Task.

TASK 29

CABLING

Scheduled percentage of completion	98%
Actual percentage this date	97%

Harnessing of the stage drives, film drives, and utilities equipment was done during this report period.

Several cables are presently being fabricated for shipment to [redacted] for the optical test program. STAT

TASK 30

CONTROL CONSOLE AND CHAIR

Scheduled percentage of completion	98%
Actual percentage of completion	87%

Phasing and checkout of the manual operator controls has been completed.

Final checkout of the function and readout control pushbuttons has begun.

TASK 32

COMPUTER

Scheduled percentage of completion	98%
Actual percentage this date	95%

The computer has had some minor modifications made to its internal circuitry. These modifications provide gating functions on the I/O buss lines and address lines such that no data appears on them unless an I/O instruction is being executed. As shipped, these lines were hard-wired to the A-register (for the I/O buss lines) and to the M-register (for the address busses). This meant that even though the computer was not doing I/O instructions (but rather arithmetic operations, for example) the lines had data appearing on them. Although the interface circuitry was designed to ignore this data, the noise produced in the system by the continuous changing of the lines proved troublesome. It was therefore decided to modify the computer circuitry to remedy this. As it turned out, all of the logic functions and signals required were available in the machine so that the addition of some wiring was all that was required. These additions were checked and appear to be entirely satisfactory, and documentation is in process.

TASK 33

ELECTRONIC RACKS AND CONTROL CABINETS

Scheduled percentage of completion	98%
Actual percentage this date	95%

Some changes in Electronics Cabinet #3 (digital equipment) wiring are being effected in order to reduce noise and transmission losses in the digital logic systems.

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TASK 34

UTILITIES, VACUUM AND AIR SYSTEMS

Scheduled percentage of completion	87%
Actual percentage this date	90%

The wiring for the valves, pressure switches, and air control solenoids is complete, and testing has begun. This testing program includes adjustment of the trip points for the various alarm (failure) sensors.

TASK 35

VIBRATION ABSORPTION AND LEVELING

Scheduled percentage of completion	70%
Actual percentage this date	47%

No further work is scheduled for this Task until the Optical Bridge is received from [redacted] At this time, full tests of response time and stage deflection will be conducted. STAT

This delay is necessitated by the requirement for full weight loading of the stages during these tests.

TASK 36

OVERALL ASSEMBLY

Scheduled percentage of completion	70%
Actual percentage this date	47%

Systematic checkout of the interface functions has begun.

Two types of problems exist in certain areas of the interface circuitry; noise and propagation delays.

By means of a ground-plane bussing system for the circuit common lines, it has been found possible to reduce the noise levels in the system to well within the acceptable levels for correct operation.

Propagation delays primarily affect the interface between the computer and the machine. Due to the polarities of the signals present and needed, it has been found that a minimum of six gates is necessary for the routing of circuitry which tests the condition of a pushbutton or indicator on an SKS instruction. In some cases, it was found that the number of gates could be reduced to the point where propagation delays were inconsequential; in other cases, minor circuitry and programming (software) changes have rectified the problem.

At present, it is anticipated that both types of problem (noise and delays) will be remedied with little trouble, and detailed testing and implementation of the minor modifications are proceeding.

A great deal of digital circuitry exists in the Stereocomparator; consequently, a great deal of testing and checking is necessary to make certain that spurious or unwanted modes of operation of the machine do not occur. This detailed checking is continuing.

TASK 37

ELECTRICAL NOISE SUPPRESSION

Scheduled percentage of completion	31%
Actual percentage this date	25%

Noise suppression in terms of internally generated unwanted signals, appears as crosstalk as well as spurious switching signals.

This noise is systematically in process of elimination and is reported in other Tasks (32, 29,etc.).

TASK 38

ENVIRONMENTAL CONTROL

Scheduled percentage of completion	98%
Actual percentage this date	92%

[ ] is presently awaiting completion of the film cooling air supply system by the customer. STAT

It is presently planned that the equipment will be shipped to [ ] for test concerning its effectiveness for the Stereocomparator. STAT

TASK 39

RELIABILITY ANALYSIS

Scheduled percentage of completion	19%
Actual percentage this date	15%

There is no formal reliability analysis planned for the project.

The system testing program presently under way has shown that the component and subassembly reliability actually achieved is fully compatible with the needs of the program.

TASK 41

TAPE PUNCH & READER

Scheduled percentage of completion	70%
Actual percentage this date	70%

The high speed tape punch and reader assembly has been integrated into the Stereocomparator system by completion of its electronic interface chassis.

The problem of furnishing a suitable portable cabinet, or cart, for carrying the punch and reader equipment and the computer library of manuals and tapes, is presently under consideration.

TASK 42

BREADBOARDS AND TEST DEVICES

Scheduled percentage of completion	88%
Actual percentage this data	65%

No work was scheduled for this Task at this point in the program.

TASK 43

COMPUTER PROGRAMMING AND SERVICES

Scheduled percentage of completion	96%
Actual percentage this date	80%

The progress report for the computer programming subcontract, [redacted] is included as Appendix II to this report. STAT

The programming effort has been terminated until about October 1st to permit completion of the computer interface checkout and integration with the overall Stereocomparator electronic assembly.

TASK 47

INSTRUCTION MANUAL AND DRAWING SUBMITTAL

Scheduled percentage of completion	70%
Actual percentage this date	32%

The revision of the design drawings to cover the "as built" status of the various subassemblies of the Stereocomparator is continuing.

TASK 48

SPARE PARTS LIST

Scheduled percentage of completion	39%
Actual percentage this date	60%

The anticipated life and replacement time of the spares is presently being computed.

TASK 49

OPERATOR TRAINING

Scheduled percentage of completion	40%
Actual percentage this date	70%

[redacted] is awaiting the customer review of the July submittal of the partial manual for Operator Training. STAT

PROGRESS REPORT FOR PERIOD ENDING 31 JULY 1969

[redacted] STAT

1.0 PROGRESS DURING REPORTING PERIOD

During July the RG 142 B/U coax was procured, installed and tested for the W1, W2, W5 and W6 cable assemblies. Connectors J24 and J25 on the chassis, J2 on both image dissector assemblies, and P24, P25, P51, P53 and the P2 connectors on the cables were also replaced to accommodate the larger high voltage coax. The new lines and connectors were tested on July 30 using a Fluke Model 410A high voltage DC supply and a 10 microampere meter. At 3500 volts neither line showed a leakage above 1 microampere. The P51 and P53 bulkhead connectors to be mounted by NRI will require "D" holes with 0.515 inch diameters (0.218 inch center to flat edge).

During July, a check sheet package was made to organize and systematically record the measurements of Section 4.5 of the acceptance test procedure. The check sheets will be used to refine the procedure and should lead to a smoother performance of the acceptance test. The task of cleaning up the software items, however, will be subordinated to the task of debugging the equipment to reduce the need for pursuant revisions and addenda and interruption of the debug cycle.

The acceptance test date was moved up to the week of September 8, since the cable replacement had introduced additional slippage. During subsequent telephone conversations between [redacted] and Itek STAT
on August 7 and 14, [redacted] expressed an interest in the debugging STAT
activities. A short description follows.

The subassembly tests, preceding preacceptance testing, verified that the originally desired circuit functions were obtained. In addition, improvements in linearity were obtained in the deflection amplifiers, the integrators, and the distortion analyzer weighting function. The drift rate on the deflection amplifier was also improved over the drift noticed on the previous configuration. The instability of the original video amplifier configuration with capacitive loading was not occuring with the added output stage and the original desired response was maintained. The design of the absolute-value generators used in the channel selection logic was corrected. The video correlator configurations did not produce satisfactory nulls and the repair involved adjustment to the foil. This resulted from an error carried over from the original documentation. Also, an excessive amount of unbalanced orthogonal output was measured at the low frequency end of the A_1 band. This was reduced by driving the multipliers from a less reactive source (increasing the size of the coupling capacitors). The adjustment range of the raster delay board had to be changed to agree with the stipulated range, since this coincided with the anticipated requirements. General housekeeping adjustments of levels and balances made up the remainder of the subassembly tests.

Preacceptance testing began with the adjustment of the low voltage power supplies and a rough check of the operation of each card as it was inserted. Chassis wiring errors were found and corrected. The X test and Y test outputs were connected to a type 535A oscilloscope and these raster delay outputs were determined to be oscillatory under the capacitive load realized with the use of short lengths of coaxial test cables. The high frequency cutoff of AR1 and AR2 in the raster delay was lowered to stabilize the circuits. No deterioration of the sweep voltage waveforms were noticed and a clean test raster was produced.

The image dissector assemblies were checked next. A minor keying error was corrected and subsequent voltage checks made before the housing was put on and the assemblies installed on the test fixture. The immediate indication was no video which was subsequently traced to the dissimilarity of pin connectors between the S20 and S11 image dissectors, corrections were made to the wiring and the assemblies mounted on an open frame fixture to continue testing without the housing. Mutual coupling effects were noted in the equipment (modulation and crosstalk) which were reduced by changing the use of the existing decoupling and by bypassing the supply voltages.and resistive dividers.

A bar pattern was projected onto one image dissector and the delay time settings of the raster delay board were adjusted until a reconstructed image was obtained on the 535A oscilloscope. It was then possible to adjust the X and Y size and the focus and shading adjustments.

On June 20, the turning on of the equipment was accompanied by a cracking sound in the cable and a loss of video. The high voltage lines were determined to be excessively leaky and a replacement sought for them. The Abbott DC-DC converter was not damaged.

Temporary high voltage lines were installed and testing continued. The open frame fixture made it possible to obtain a source of usable video to be applied coherently (same video to both inputs) or independently (both assemblies connected but only crude alignment with images possible) to the image analysis system.

The video from independently operated image dissectors with the identical targets would not match. This was traced to the inversion of the reference voltages applied to the left and right associated circuitry in the sum and difference board. The deflection coil connections were reversed to the G2 image dissector (identified by the S1 keying on connector J1) to scan corresponding areas on both images.

The remote X and Y positioning adjustments require the insertion of equal and opposite DC voltages to the deflection amplifiers to affect a synchronous motion of the two rasters. The two inverters in the sum and difference circuit and four externally connected resistors are used to add the required voltages to the deflection voltages at the output of the sum and difference circuit. Before this point the deflection signals are AC coupled.

Independent video signals multiplied at the correlators were effectively blocked at the channel selector, because the channel selection logic circuit was intended to select the channel with the lowest output. In effect, the selection criteria used hindsight rather than foresight, since it seeks a post-stabilization condition rather than a processing condition, moreover, the post-stabilization condition selection leaves the processor open to the unbalanced correlator output, which consists, generally of components of the deflection voltages, noise and various other undesirable signals. To preserve the adaptive intent of the channel selection logic, the A_1 and B channels were interchanged and the thresholds readjusted. The following selection criteria are used. Band B is on if OC_B output exceeds threshold 1 (set to the unbalanced output level). Band A is on if OC_A exceeds threshold 3 (set to the unbalanced output level) and if Band B is off

(OC_B less than unbalanced level). Band A_1 is on when bands A and B are off (OC_A and OC_B less than unbalanced level). The channel selector now switches the appropriate band information to the analyzers.

An oscillation in the deflection pattern amplitude, which occurred with some regularity, when the equipment was turned on, was traced to variations in the integrating time of the sweep reference. The time base generator output was frequency modulated by the discriminator, AR_2, when the initial state of Z11B permitted the wrong phase of the sync signal to dominate. This condition was alleviated by reducing the inverting gain of AR2. The time base generator will be cycled over temperature and voltage to check its synchronization and stability and determine if additional compensation is necessary.

Current pulses in the deflection amplifier and associated connections were seen to be introducing interference signals into adjacent circuitry. A perforated shield was placed behind the deflection amplifier boards and the external connections shielded.

The video amplifiers were observed to have dissimilar pulse responses which also raised the orthogonal unbalanced output. The low frequency cutoff of the video amplifiers was extended to improve the pulse response in both image dissector assemblies and reduce this dissimilarity.

The AGC function of the video amplifier reacted to instantaneous changes in intensity, by blanking out video signals for periods which sometimes exceeding the frame duration. By increasing

the AGC time constant, the attack time was extended. The resultant AGC tendency is to react on the average illumination in the frame and the long recovery times do not occur during processing periods.

An AC threshold circuit added to the output of the channel selector supressed the contribution of the remaining unbalanced orthogonal output to the total error signal entering the analyzers.

The procedure for adjusting the zero offsets in the integrators, distortion analyzers and parallax analyzers was time consuming. A shorting board was constructed and a procedure for using it which reduces the task to less than 15 minutes.

A check of the Weston 756 illumination meter indicated a linear relationship exists between the illumination and the terminal voltage of the meter. The low-scale scale factor approximates 1.0 foot candle per millivolt at the terminals. This relationship will be used to expand the scale during illumination measurements at the image dissector assembly.

The integrator reset function was ineffective as long as signals were still present at the integrator inputs. The physical resistance of the shorting FET and its current limiting series resistor acts as a feedback resistor which reduces the gain -- but not to zero. An FET switch was added at the channel selector output to shut off the signals during reset. In conjunction with the FET is an inverter which accepts the correlation enable command provided by NRI and inverts it to produce a uniform voltage levels for the reciprocal (inhibit) signal required in the system. The gates and reset circuitry perform as intended.

The high voltage cables were replaced and alignment and testing continued in the test fixture. The following activities continued into August.

The parallax reference inputs were reversed to provide the correct polarity of parallax signal relative to the established left and right assemblies. By open-loop checks, the phasing of the modulator outputs to the sum and difference circuit and subsequent phasing of the distortion analyzer references were set in order.

The adjustment for the analyzer reference delay time was broad enough to obtain opposite polarity signals at both ends of the adjustments. The appropriate adjustment, however, lay outside of the existing range and the circuitry changed to enable the correct setting and avoid the unstable range.

Measurements performed on the correlator test fixture indicate that physical alignments cannot be maintained adequately during slide changes etc., to verify the independence of the error signals but an alternate means (e.g., insertion of electrical error signals) may be more desirable.

Electrical interaction between outputs is presently excessive. This crosstalk is directly proportional to the processing gain. A minor conflict exists, since the ability of the system to maintain error signal scale factors for a variety of information content in the slides is also directly proportional to the processing gain.

Measurements indicate that all error signal responses will be reasonably linear. The precise adjustment of the scale factors will not be made, however, until the source of the electrical crosstalk is controlled and the processing gains are set.

2.0 PLANS FOR NEXT PERIOD

Continue the debugging phase, which includes setting the scale factors, checking out the time base generator, installing a component board with the additional circuitry determined during testing, and improving the implementation of the test procedure.

Percentage of job completed to date - 95%.

App. II

STAT

MONTHLY PROGRESS REPORT

July, 1969

This technical report is for the reporting period from July 1 to July 30, 1969. The report is prepared according to specification number DB1001 (as modified).

1. At the end of the report period, all subroutines were individually checked-out, except those mentioned in part 2 below. During checkout several routines have been modified from time to time. Some of these changes, naturally, propagated to the drivers, EXEC1 and STAGIN.

   The blank common blocks of all routines were made congruent in preparation for total integration of the system.

   A new entry was created in subroutine CVB, called CVB1. This entry allows floating-to-fixed point conversion where the fixed point result is of arbitrary scale, i.e., the location of the binary point may be set by the user.

2. Because the non-real time and foreground real time programs cannot be tested further without the interface, emphasis has been shifted to the real time background program. There, the Earth Curvature, partial blowups, and no camera data options have been merged into subroutines TMAT and TRK.

   As of this reporting period approximately 75% of the total contract work has been completed.

2. The following subroutines are yet to be definitively checked-out:

   a. EXEC1
   b. EXEC2
   c. STAGIN
   d. RDOP
   e. RDST and
   f. RDCR/X.

   These routines cannot be further checked until the stereocomparator's interface and stage measuring systems work.

   Next month, the real time background program will be integrated and tested in the DDP-516.

   If the interface becomes available, then the non-real time program will also be integrated.

3. The correlator crosstalk problem is outstanding; however, of low priority.

4. Apparently, several slips have put the interface and stage location logic behind schedule. It is likely that Informatics will be unable to find fruitful work to pass the time until these are ready for further program testing. It may become necessary to negotiate a new program delivery schedule.

5. As of Monday, August 18, [redacted] will return to the day shift for the duration of the contract. STAT

6. No changes or agreements have been made, requiring the contracting officer's approval.

7. No other unresolved matters are known to exist.

App. III

TRIP REPORT

Company Contacted: [redacted] STAT

Contacted By:

Contact Dates: August 4 to August 13, 1969

Purpose Monitoring the [redacted] STAT
Optical Contract
[redacted] - Stereocomparator STAT

Persons Contacted: [redacted] STAT

The [redacted] plant was closed for their annual August STAT vacation during this period. The Stereocomparator work, however, was proceeding with respect to test and optomechanical adjustment.

All the optic subassemblies are tested three times.

First, the optical fabrication department performs a test to determine whether or not the optical characteristics of the individual optical elements are satisfactory.

Second, the production department performs a test which is done with care and under thorough mechanical and optical inspection conditions. This test is made on the completed optomechanical subassemblies.

Third, the completed subassembly is tested under laboratory conditions by members of the design engineering laboratory staff.

The greatest possible care is taken with the measurements during this last series of tests. Usually minor realignment of the optical elements is made at this time.

The lenses for the main zoom, the prisms for the anamorph systems and the objective lens assemblies were completed and were in the process of testing in their respective mechanical assemblies. The optical aspects of the tests concerning resolution and magnification, etc., had been completed earlier. The current tests were related to image wander and the mechanical adjustments of the complete subassemblies.

These various tests required individual setups involving several telescopes, mirrors and as many as five autocolimators with two or three light sources plus flat granite inspection tables. In addition to the equipment, each test involved optical and mechanical engineers and test and inspection specialists from the production group.

The tests on the individual assemblies take from two to six weeks, during which time the optomechanical characteristics were optimized by adjustment of the placement of the various optical items in the overall subassemblies. These tedious and painstaking operations were being conducted effectively during the vacation shutdown. Further, the work utilized most of [ ] special test equipment and facilities including the most knowledgeable members of the engineering staff. STAT

OPTICAL BRIDGE

The three elements of the [ ] optical bridge have been completed in terms of the mechanical interface for the optical subassemblies and the outside painting. STAT

The optical bridge has been installed on the [ ] Stereocomparator test fixture utilizing the [ ] ooling. STAT STAT

This optical bridge locating tooling had been built at [ ] at the time the optical bridge was installed on the Stereocomparator frame at [ ] The purpose of the tooling was to insure that the optical bridge would be installed in an identical manner for the test at [ ] for the completion of the Stereocomparator and the test at [ ] and for STAT STAT STAT STAT

the final assembly after delivery to the customer.

[redacted] had used the optical bridge location tooling after they had filled and painted the optical bridge. Unfortunately, some of the tooling interface surfaces had been painted and it was necessary to mount the tooling against the painted surfaces. Allowances will have to be made for this when the optical bridge is installed [redacted] STAT STAT

Some tooling was provided for the alignment of the illumination system and since there was no mechanical attachment on the outboard extremities of these members, they had been built of light weight material. [redacted] had not understood how to use the tooling and had used very heavy plumb bobs and steel wire for measuring from the center holes. STAT

Under these conditions, the members deflected considerably and [redacted] was having problems in aligning the parts. Once the method of use of the tooling had been explained, there was no further problem. STAT

TEST FIXTURE ROOM

The test fixture room has been completed with all surfaces painted and the test fixture painted. There is, however, no air conditioning or air filtering system as in a conventional clean room. [redacted] has provided double vestibule doors at the entrance and every effort will be made to keep the area suitably clean. STAT

SHIPPING METHOD

[redacted] is working with a French package engineering firm in connection with the design of the shipping containers for the completed optical assemblies and the optical bridge elements. STAT

The plan is to ship the equipment to [redacted] by air, in its completed form after final assembly and testing. STAT

The shipping containers for this purpose will be reuseable; that is, will consist of hinged crates, etc., so that parts may be reshipped

[ ] to their final installation site. The shipping crates are being engineered to minimize the shock transmission to the optical parts during handling and shipping. STAT

[ ] plans to test the shock isolation characteristics of the selected shipping system by transporting the completed objective lens turret assemblies by road around Paris. Prior to the transportation test, the equipment will have been put through the complete optical alignment tests. Also, the mechanical characteristics of the image wander, during focusing and objective lens switching, will have been carefully recorded. The objective lens turret will then be placed on a truck and driven over Paris streets including those with cobblestone surfaces. STAT

After the equipment has been returned to the [ ] plant, the full series of optical alignment and image wander tests will be repeated and compared with the values obtained prior to the transportation experiment. The results of this test will determine the design of the shipping containers for the shipment of the optical system to Berkeley. STAT

ILLUMINATION SYSTEM

The parts for the main illumination system have been completed. The switchable afocal systems have been installed in the illumination system casting but the optics, including filter discs, field lenses, diaphragms, and mirrors are not yet installed. All these parts are on hand. The motors, tachometers, gear reducers, potentiometers, and electrical plugs for this subassembly are also on hand.

RETICLE ILLUMINATION SYSTEM

The complete reticle lamphouse assembly has been completed at the Chateaudun plant but has not yet been delivered to the Davout plant of [ ] STAT

RETICLE 4X ZOOM

The zoom lens systems have been optically tested and the mechanical assembly is complete.

RETICLE 10X ZOOM

This subassembly is mechanically and optically complete but has not yet been put through its final optical tests.

RETICLE ANAMORPH

The anamorph prisms are completed and assembled into their four groups. The mechanical portion of the anamorph system is completed and has been assembled and aligned. The work remaining requires the mounting of the prism groups and setting the optical alignment and optical function characteristics.

RETICLE REDUCING RELAY

The 50:1 relay assemblies have been completed. Both the mechanical and optical specifications have been checked out by the production department and found satisfactory. The optomechanical testing by the laboratory group has not yet been performed.

RETICLE LIGHT LEVEL AND COLOR FILTERS

The optical and mechanical parts for these subassemblies are complete but the assemblies have not yet been made and the parts are still at Chateaudun.

OBJECTIVE LENSES

The objective lens turrets are complete and have been mechanically tested in the lens switching and focus modes. One of the units was observed during testing. It was noted that the image wander during focusing over the 3mm range was within $\pm$ 1/2 second of arc. This is well within specification requirements. One of the turrets is in process of assembly to the optical bridge. This turret will be used in the shipping container test described earlier in this report.

MAIN ZOOM

The subassemblies have been tested optically and have been found to exceed the design specifications. In addition, one system

has been tested successfully for performance with its built in mechanical system. The second main zoom assembly is awaiting the mechanical portions of the test.

MAIN ANAMORPH

The first main anamorph subassembly is being checked by the optical laboratory group. At the time of the [redacted] monitor's visit, the chromatic aberration specification was met satisfactorily. STAT

Image wander was still a problem. The elimination of image wander involves adjustment of the mounting faces of the prisms to the mechanical interface of the anamorph unit.

The second anamorph system has been assembled mechanically and is awaiting prism installation.

The work of preparing the main anamorph system mechanism to receive the four sets of prisms is a highly complex operation involving a series of autocollimators, light sources , mirrors, prisms, granite blocks, etc. Once the mechanical interface is true, and the rotation mechanism accurately adjusted for consistent angular movement of the four sets of prisms, it is necessary to install the prisms in their cells and checkout the optical characteristics.

At the time of the [redacted] monitoring visit, the first system had been adjusted so that image wander during full travel of the anamorph prism system represented 5 seconds of arc; thus with the 10X eyepiece system, this would represent 50 seconds of arc. STAT

Work was continuing on the system to optimize this condition. Note, however, that the value achieved already is only 1/24th of that permitted by the specifications for the entire optical system.

This type of effort is typical of the extremely precise workmanship which [redacted] is using in building this equipment. STAT

MAIN IMAGE ROTATOR

All optical and mechanical parts have been completed

at the Chateaudun plant. As Chateaudun was closed for their vacation, it was not possible to establish a status of the parts assembly operation.

MAIN BEAMSPLITTER

The image dissectors and light level control photomultipliers require two beamsplitter prisms in the main optical path. These prism parts were completed some time ago including their coating. However, the reflectance/transmittance characteristics for the prisms required by the specifications has not been achieved. This has necessitated repolishing and recoating and retesting the prisms.

This retesting has been performed unsuccessfully three times to date and a fourth remanufacture is now necessary.

In addition to the prisms, the system requires for the [redacted] assembly, beamsplitter mirrors and mockups of the light level photomultipliers and image dissectors. Also, projection objectives are required for the image dissector tubes. These parts have been completed and mounted in the optical bridge. STAT

MAIN IMAGE RELAY TELESCOPE

Telescopes are placed between the Pechon prisms and the eyepiece optical switching mechanisms. These telescopes have been completed and tested.

EYEPIECE ASSEMBLY

The eyepiece system (optical block) consists of switching prisms, light level filter wheel, and the switching shutters in addition to the eyepieces. The system has been partially assembled. The mounting of the switching prisms and the light level filter wheels has not yet been completed.

MICROSWITCH CAMS

Practically all subassemblies in the optical system are equipped with microswitches for limiting the travel or controlling the

speed of the drive as it nears its terminal positions. Between 125 and 150 microswitches are required by the complete assembly. The microswitches are on hand at [redacted] but only a few have been installed at this time. STAT

UTILITIES

[redacted] is not yet performing any of the utilities installations for the optical subassemblies. This work would include installation of the air tubing, the cabling and the electrical receptacles. The work will be started by the first of September. STAT

The purchase of the low pressure air supply system has been recommended [redacted] This is a system designed by [redacted] The system would supply filtered air to the optical system at 15" of water pressure and at 1,500 cu.ft. per minute capacity. STAT STAT

For the high pressure air supply system, [redacted] had obtained a proposal from the [redacted] has told [redacted] that their high pressure system is too complex and expensive and has recommended a much simpler system consisting primarily of pressure reducers and ceramic filters. STAT STAT STAT

OBJECTIVE LENS ALIGNMENT TEST

After the objective lens turret assembly was complete, SOPELEM made a series of alignment repeatability tests. These tests consisted of determining image wander through the objective optical system during the 3mm focusing travel and image wander during optical switching.

Prior to beginning the mechanical repeatability tests, [redacted] determined that the image wander was within $\pm$ 1/4 micrometer over 0.8mm focusing travel and within $\pm$ 1/2 micrometer over 3mm focusing travel. The $\pm$ 1/2 micrometer represents 3 seconds of arc. STAT

These image wander tests are repeated twice a day, before and after the mechanical excursions which are performed once a day.

The mechanical repeatability of the lens turret was tested by performing 40 round trip full travel rotational translations of the turret and 40 round trip full travel focusing translations of the lens assemblies within the turrets.

These repeatability tests are performed each morning during the work week for a four week period. This represents a total of 20 days of tests.

These tests are quite significant when it is realized that the guide system for the focusing travel, as designed originally [ ] failed in an initial series of tests. STAT

To solve the problem, an external adjustable guide rod has been installed by [ ] and the latest group of tests is to STAT prove the effectiveness of this modification. The failure of the initial design turned out to be due to deformation of the parts by aging. The new design places the parts in a geometry which results in a system much less sensitive to deformation of the guide system.

MAIN ZOOM MECHANICAL ADJUSTMENT

The mechanical adjustment and test of the main zoom assemblies is a very complex operation. [ ] has prepared special STAT tooling for setting the cam followers in the main driving cam.

As a matter of interest, 12 cams were built by [ ] STAT before they were able to get four cams that would pass their stringent mechanical tests.

There are also three special tools for centering the lens cells and setting them with respect to the cam origin. The detailed work of performing these assemblies and adjustment procedures is such that it will not be possible to perform adjustments while these various

key lens subassemblies are installed in the optical bridge.

PROJECT SCHEDULE

[ ] is presently predicting that the optical system, in its entirety, will be turned over to [ ] by December 15, 1969. STAT STAT

[ ] tests may continue to January 15, 1970. We expect, however, that some of the acceptance tests will occur prior to December 15th and will be performed during the [ ] work period. STAT STAT

It is encouraging that the [ ] optical tests have, in every instance to date, shown that the system outperforms the design predictions. So far, the individual subassemblies have not been coupled optically to each other but we are reasonably confident that there will be no major surprises. STAT

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