Approved for Release: 2023/02/07 C05141957

SECRET

MURAL

BYE-3021-63
Copy 3 of 6

6 AUG 1963

MEMORANDUM FOR : Deputy Director (Research)

SUBJECT : Discussion of M versus M-2

1. This memorandum contains information requested by the Deputy Director (Research).

2. As an introduction to the conflict between requirements and the state-of-the-art in satellite reconnaissance, a few general statements seem pertinent.

A. An "ultimate" satellite system combines search with technical objective reconnaissance. A major technical breakthrough is required to give one foot ground resolution combined with wide area coverage considering payload weight limitations imposed by satellite boosters in the immediate future. New film types seem to offer the best possibility for achieving this goal. If the unconventional or non-silver halide films become available and the law of physics on silver emulsions (the finer the grain, the slower the film) is beaten, we should have our breakthrough.

For example, Horizons, Inc. is working on a sophisticated chemistry program with various dyes. In one area of work they have progressed from taking a picture in 30 seconds to taking a picture in 1/4 second in only six weeks. They hope to eventually achieve 1000 lines per millimeter at A.S.A. 100. If they achieve this goal we can use high shutter speeds and forget problems of yaw control, IMC and vibration. Such materials are not currently available but should be included in our long range plans.

B. On the other hand, our technical objective satellite reconnaissance systems currently use the long focal length approach. GAMBIT, with 77 inches of focal length

SECRET

...ia BYEMAN
...al System

Approved for Release: 2023/02/07 C05141957

Approved for Release: 2023/02/07 C05141957

is designed to give 2.5 feet of ground resolution if everything operates perfectly. LANYARD, with 66 inches of focal length is designed for an optimum of 4 feet on the ground with an ideal operation. The nominal swath width of GAMUT is only 12 1/4 nautical miles with 3000 feet of payload, while LANYARD covers about 40 nautical miles and carries 8000 feet of film. Therefore, with these existing systems, the payload and coverage drop rapidly with increased focal length and large camera systems. In addition, precise programming and orbit are required to hit the assigned targets. This fact, coupled with the requirement for all subsystems (IMC, yaw programming, thermal control, etc.) to operate perfectly lead to doubts in the ability to achieve a highly reliable mission operation. We are pushing the state-of-the-art in these systems and still falling short of the one foot objective for technical evaluation. The certain degree of success achieved by these systems to date, certainly gives an excellent measure of the current capabilities and limitations.

C. The Purcell Panel recommended that we improve MURAL to achieve the best resolution obtained on a continuous basis. This has been a continuing objective of the Configuration Control Board from the start of the basic CORONA program. (The CORONA, the CORONA-Prime, the MURAL and the "J"). While we have certainly had our disappointments and headaches, the general trend has been upward from the first successful mission. NPIC quotes CORONA as achieving 9 feet resolution 15% of the time. In considering all of the variables affecting quality, we must look at the particular camera quality, the sun angle, scene contrast, IMC, film flatness, temperature, pressure, altitude, exposure, yaw, roll, pitch, film type, processing, and weather. When all of these parameters to be considered zero out to 15% of the time, the system must be performing fairly close to optimum.

3. The CCB has approved installation of extra roller on the MURAL/J scan arm. This tests the film flatness to 0.001 of an inch. A new invar/titanium drum was installed for temperature control of the focal distance. (There are a few systems delivered without this new

Approved for Release: 2023/02/07 C05141957

Approved for Release: 2023/02/07 C05141957

arm that will be flown). Passive thermal control is under constant investigation. Improved IMC ramps are being incorporated and yaw control is under consideration. A simple, two slit, exposure control is also being investigated. There are only a few other items which might give a little improvement in the percentage of good quality. This is in the area of improved lenses (a development program), automatic exposure control (a new design with reliability doubts), and active thermal control (a design and development program). Generally speaking, however, we are very close to optimum and have been ahead of the design goal for MURAL/J.

4. In the area of auxiliary equipment, the SCB is keeping pressure on the contractors to improve performance of the following items:

A. Binary recording of clock data.
B. Horizon imagery which is consistently good and reliable.
C. A reliable Stellar/Index Camera. The stellar exposures are now very good with baffle operation satisfactory for solar and earth flare. An improved shutter is now being installed on the index camera which should increase reliability.

5. It seems reasonable to conclude that to improve MURAL to the point where the best resolution is obtained continuously, we should improve the scale. Therefore, M-2 appears to be the most logical approach. This proposal is for a scale up of the existing system from a 24-inch to a 40-inch lens. This camera subsystem would retain the Petzval lens design at an f/3.5, reduce the scan angle from 70° to 60° (swath width from 140 to 115 nautical miles), use 5 inch film and retain much of the basic proven MURAL design. This system would require TAT and probably cannot fit into the double (J) configuration. This system would require about 18 months to develop. The design objective is to acquire about 5 feet of ground resolution. It would be highly desirable to at least pursue M-2 as a development program and place this capability on the shelf. Itek has already expended some limited funds on a tentative go-ahead and a wooden mock up of the camera is nearly completed.

(Signed) Jack C. Ledford

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

[redacted]:DD/OSA:mvp (5 August 63)

(b)(3)

Distribution:
Cy 1 - DD/R
2 - AD/OSA
3 - D/TECH/OSA
4 - DD/OSA
5 - DD/OSA (chrono)
6 - DD/OSA

SECRET

Approved for Release: 2023/02/07 C05141957