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~~151~~ NATIONAL RECONNAISSANCE OFFICE
WASHINGTON, D.C.

THE NRO STAFF

21 December 1966

MEMORANDUM FOR DR. FLAX

SUBJECT: FY'67 Electro-Optical Readout Program Continuation

PROBLEM

To respond to TAB A (CHARGE MSG 3921), which provides additional information on the Electro-Optical Readout Program which you requested prior to funding implementation.

BACKGROUND

TAB B (WHIG 5990) authorized FY'67 funding for Readout in the total amount of [] to be applied as follows:

- a. [] Wide Band Data Link
- b. [] Readout Tasks with CBS Labs (Clean-up) (6-3)

The technical direction of the above tasks (a and b) were defined in paragraphs 4 and 5 of attached TAB C(CHARGE 3738).

CONCLUSIONS

The continuing work in Electro-Optical Readout Technology should go forward in accordance with the general guidelines stipulated in the recent draft of a proposed memorandum to Mr. Sheldon. With your concurrence, [] and I should send the opposite page message.

RECOMMENDATIONS

- A. That you approve the opposite page proposed message. (WHIG-604) (23 Dec /
- B. That the NRO Staff forward to SAFSP for their guidance a copy of your memorandum to Mr. Sheldon when it is signed and delivered.

Rakoch
R. A. KOCH
Captain, USN

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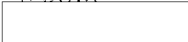
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FOR GEN STEWART FROM COL ALLEN

1. THIS MESSAGE IS TO PROVIDE THE INFORMATION YOU REQUESTED VERBALLY ON 13 DECEMBER. IT PROVIDES THE RATIONALE FOR TECHNOLOGY EFFORTS LEADING TO A LONG LIVED SURVEILLANCE SYSTEM, THE TECHNICAL PROGRAM PROPOSED IN ELECTRO OPTICAL READOUT FOR FY 67, THE TENTATIVE PROGRAM FOR FY 68 WITHIN THE ADVANCED TECHNOLOGY EFFORT AND THE LONG RANGE IMPLICATIONS. WE ARE PREPARED TO PROVIDE YOU A BRIEFING ON THE MATTER WHEN YOU RXLJUURE IT. PARA 9 ALSO ANSWERS MSG 5978 REGARDING DATA LINK NEEDS.

2. AS WE HAVE DISCUSSED WE INTERPRET THE EXCOM TERMINATION OF G-CUBED READOUT AS A FIRM DISAPPROVAL OF ANY READOUT SYSTEM DEVELOPMENT FOR CRISIS RECONNAISSANCE. FUTURE PLANNING FOR THIS NEED WILL BE BASED ON RECOVERY SYSTEMS AND WILL EXPLOIT FOUR BUCKET HEXAGON CAPABILITY AND TWO BUCKET G-CUBED. ACCORDINGLY ALL DEVELOPMENT OF FLIGHT HARDWARE FOR G-3 READOUT WAS STOPPED 30 NOV 1966. ONE THIRD OF PERSONNEL ARE NOW FIRED. AN ADDITIONAL TWENTY PERCENT WILL LEAVE OVER THE NEXT TWO WEEKS. THE TERMINATING EFFORT AT CBS WILL BRING THE WORK TO A RAPID BUT ORDERLY CONCLUSION WITH A SMALL AMOUNT OF ADDITIONAL RESEARCH EFFORT WHICH IS PERTINENT TO OTHER APPLICATIONS. THE BTL EFFORT IS ALSO BEING TERMINATED RAPIDLY WITH COMPLETION OF DESIGN REPORTS AND NO FURTHER EFFORT ON HARDWARE FABRICATION.

3. A CONCEPT OF CONTINUING INTEREST IN OUR CONSIDERATION OF THE FUTURE IS A VERY LONG LIVED SURVEILLANCE SYSTEM WITH CHARACTERISTICS TO MEET ROUTINE SURVEILLANCE REQUIREMENTS ECONOMICALLY AND OFFER NEARLY CONTINUOUS ON ORBIT AVAILABILITY. SUCH A SYSTEM WOULD HAVE TWO TO THREE FEET RESOLUTION AND A LIFETIME OF AT LEAST NINETY DAYS WITH CLEAR COST ADVANTAGE TO FURTHER INCREASED LIFE. THE TECHNOLOGY TO PERMIT SUCH A SYSTEM EXISTS FOR MANY SUBSYSTEMS. WE HAVE UNDERWAY VARIOUS IN-HOUSE AND OTHER INVESTIGATIONS TO IDENTIFY LIMITING COMPONENTS FOR A SIX MONTH DESIGN. THERE IS OBVIOUS ADVANTAGE TO INCORPORATE A READOUT SUBSYSTEM IN SUCH A DESIGN. CONSISTENT WITH DEVELOPMENT STATUS OF OTHER COMPONENTS THE FILM READOUT APPROACH IS AVAILABLE AND REQUIRES NO FURTHER EFFORT CURRENTLY. IT IS APPROPRIATE AND VALUABLE TO DEVELOP FURTHER AN ELECTRO OPTICAL CAMERA FOR SUCH A SYSTEM GOAL SINCE FILM EXPENDABLES COULD BE ELIMINATED. THIS SYSTEM CONCEPT WITH FLIGHT IMAGINED IN THE MID 70'S IS THE GOAL OF OUR FUTURE READOUT EFFORTS AND OTHER LONG LIFE SATELLITE SUBSYSTEM DEVELOPMENTS.

4. ELECTRO OPTICAL READOUT. PRESENT STATUS: CBS LABS HAS BEEN FUNDED AT THE RATE OF [REDACTED] PER YEAR FOR THE PAST THREE YEARS

ANALYZE THE READOUT PROCESS, PROVIDE A COMPLETE AND DETAILED MATHEMATICAL MODEL OF THE ELECTRO OPTICAL PROCESS, DEVISE A MATHEMATICAL DESCRIPTION OF EACH STAGE IN THE PROCESS, PROVIDE A PAPER DESIGN OF THE CRITICAL ELEMENTS OF SUCH A SYSTEM, AND PROVE BY EXPERIMENT THAT THE MODEL WAS CORRECT AND COULD BE REDUCED TO LABORATORY HARDWARE. THE PHYSICAL MODEL IS COMPLETE. EACH MAJOR COMPONENT OF A HYPOTHETICAL SYSTEM HAS BEEN BUILT AND TESTED SEPARATELY. EACH OF THESE COMPONENTS HAS DEMONSTRATED CHARACTERISTICS CONSISTENT WITH [REDACTED] INFORMATION BANDWIDTH PER CHANNEL. THUS, IT IS POSSIBLE TO VISUALIZE AN ELECTRO OPTICAL SYSTEM BEING AVAILABLE IN FIVE YEARS WITH CAPABILITIES EQUAL TO THE PRESENTLY AVAILABLE FILM READOUT SYSTEM.

5. ELECTRO OPTICAL SYSTEM. DESCRIPTION: THE PRESENT ELECTRO OPTICAL READOUT SYSTEM INVOLVES:

- A. AN IMAGING SECTION
- B. A STORAGE BELT
- C. A READOUT ELECTRON GUN
- D. THE ASSOCIATED VIDEO AND DEFLECTION AMPLIFIERS
- E. A WIDEBAND DATA LINK FURNISHED SEPARATELY.

AT THE PRESENT TIME THE IMAGING SECTION HAS BEEN DEMONSTRATED AT A

[REDACTED] SEEMS STRAIGHT-FORWARD.

THE STORAGE SECTION EMPLOYES A THIN LAYER OF SILICON DIOXIDE ON A STEEL RIBBON. UNDER BOMBARDMENT BY THE ELECTRONS FROM THE IMAGE SECTION THIS MATERIAL EXHIBITS A CHARGE GAIN BY MEANS OF IZECTRON BOMBARDMENT INDUCED CONDUCTIVITY OF ABOUT 10¹⁰ WHICH GIVES A MODULATION TRANSFER OF 80 PERCENT AT [REDACTED] AND A NEGLIGIBLE LOSS IN RESPONSE AFTER STORING THE PICTURE FOR ONE OR TWO DAYS.

A BELT 150 FEET LONG HAS THE SAME DAILY CAPACITY AS THE FILM SYSTEM SINCE THE TAPE IS ERASEABLE AND REUSABLE.

THE ELECTRON GUN AND DEFLECTION SYSTEM HAS SHOWN TO PRODUCE A VERY

[REDACTED]

THE ASSOCIATED VIDEO ELECTRONICS WILL BE TAKEN DIRECTLY FROM THE FILM READOUT PROGRAM AND THE DATA LINK REQUIRED IS IDENTICAL TO THE ONE FABRICATED FOR THE FILM READOUT PROGRAM.

THE DEFLECTION AMPLIFIER REQUIRED TO SWEEP THE ELECTRON BEAM ACROSS THE STORAGE BELT AND CONVERT THE IMAGE FREQUENCY TO A VIDEO FREQUENCY HAS NOT YET BEEN FABRICATED BUT IS NOT BEYOND THE STATE OF THE ART. FABRICATION OF THIS AMPLIFIER WILL START IMMEDIATELY.

BY COMBINING THESE ELEMENTS WITH [REDACTED] AND THE AVAILABLE GROUND

6. NEXT STEP: DESIGN OF A LABORATORY MODEL ELECTRO OPTIC SYSTEM

A. CONCEPTUAL DESIGN OF A PROTOTYPE ELECTRO OPTICAL SYSTEM AND USED FOR DESIGN OF A LABORATORY BREADBOARD TO PROVE THE ENGINEERING CONCEPT.

B. SIMPLE BREADBOARDS WILL BE BUILT AND TESTED OF COMPONENTS WHICH WERE NOT CRITICAL IN DEMONSTRATING THE PHYSICS, BUT BECOME CRITICAL WHEN A SYSTEM IS CONTEMPLATED. DATA FROM THESE BREADBOARDS TOGETHER WITH DATA ALREADY TAKEN AND THE CONCEPTUAL DESIGN FOR A PROTOTYPE SYSTEM WILL PROVIDE A SOUND BASIS FOR FINAL DESIGN OF A LABORATORY BREADBOARD.

C. THE LABORATORY BREADBOARD WILL BE DESIGNED. WHEREVER POSSIBLE COMPONENTS AND SUBASSEMBLIES DEVELOPED FOR THE FILM READOUT SYSTEM WILL BE INCORPORATED IN THE ELECTRO OPTICAL BREADBOARD.

D. A DESIGN REPORT, SUMMARIZING BOTH THE DETAILED TECHNICAL PARAMETERS OF ALL SUBSYSTEMS OF THE CAMERA AND THE PERFORMANCE LEVEL OF THE CAMERA WHEN USED WITH THE OPTICS WILL BE PREPARED.

7. FY 68. FINAL DESIGN AND FABRICATION OF THE LABORATORY MODEL IS PLANNED FOR FY68. WORK ON THE LABORATORY MODEL WILL CONTINUE THROUGH FY69 AND POSSIBLY INTO FY70. ONLY WHEN THE LABORATORY MODEL HAS DEMONSTRATED SATISFACTORY PERFORMANCE WILL DESIGN OF AN ENGINEERING MODEL BE CONTEMPLATED.

8. NORTHROP SPACE LABORATORIES PRESENTED AN IDEA WHICH OFFERS PROMISE TO PRODUCE A HIGH INTENSITY ELECTRON BEAM, FOCUS IT TO

IT ALONG A LINE OF EXTREMELY SMALL DIAMETER DYNODES. NORTHROP IS UNDER CONTRACT TO PERFORM THEORETICAL ANALYSIS OF THE FEASIBILITY AT [REDACTED] THEY HAVE BEEN ASKED TO BREADBOARD THE DEVICE [REDACTED] THIS WORK WILL BE COMPLETED IN MARCH. IT IS ESTIMATED THAT AN ADDITIONAL [REDACTED] WILL BE REQUIRED DURING THE REMAINDER OF FY 1967 TO EVALUATE THE BREADBOARD COMPONENT, REVISE THE MATHEMATICAL MODEL AND BEGIN DESIGN OF A DEVICE CAPABLE OF [REDACTED] OPTIMISTICALLY A DEVICE CONSISTENT WITH THE CBS LABS ELECTRO OPTICAL SYSTEM PERFORMANCE MAY BE AVAILABLE IN FY 1970. ADDITIONAL EFFORT IS PLANNED IN FY 68 WITHIN BUDGET.

9. WIDE BAND DATA LINK. TO ANSWER YOUR MESSAGE 5978 WE REVIEWED NEXT GENERATION ELINT, RADAR AND OPTICAL POSSIBILITIES. FOR ELINT APPLICATIONS IT APPEARS THAT [REDACTED] INFORMATION BANDWIDTH IS ADEQUATE.

ALTHOUGH IN THIS CASE SATELLITE TRANSMISSION POWER HAS NOT BEEN DETERMINED. IF HIGHER POWER IS REQUIRED A RELATIVELY SIMPLE MODIFICATION OF THE BTL [REDACTED] CAN PROVIDE INCREASED POWER.

[REDACTED] THAT MIGHT BE PROPOSED FOR FIRST FLIGHT IN THE MID 1970'S MAY REQUIRE [REDACTED] PRELIMINARY DISCUSSIONS WITH ENGINEERS AT BTL INDICATE THAT THIS INCREASE BANDWIDTH IS WITHIN THE GROWTH CAPABILITIES OF THAQR SYSTEM AND WOULD NOT REQUIRE ANY MAJOR CHANGES.

FUTURE PHOTO READOUT FOR ROUTINE SURVEILLANCE WOULD PROBABLY BE SATISFIED BY [REDACTED]

ON THE BASIS OF THESE NEEDS IT SEEMS THAT THE BTL DESIGN AFFORDS A GOOD BASE WHICH IS VALID FOR A YEAR OR SO WITHOUT ADDITIONAL LARGE DEVELOPMENT EFFORTS.

10. LONG LIFE SYSTEM STUDIES TO DEFINE AN OPTIMUM SURVEILLANCE SATELLITE IN TERMS OF COST EFFECTIVENESS.

TOTAL COST, I.E. THE SUM OF DEVELOPMENT, MODIFICATION, SATELLITE SYSTEM UNIT, BOOSTER, LAUNCH, TRACKING AND CONTROL, RECOVERY, FILM PROCESSING, ETC. WILL BE CONSIDERED AND MEASURED BY EFFECTIVENESS

MEETING SURVEILLANCE REQUIREMENTS AS WE UNDERSTAND THEM.
LONG LIFE VERSIONS OF EXISTING SYSTEM WILL BE STUDIED AND A
HYPOTHETICAL NEW SYSTEM SUCH AS THE ONE PROPOSED BY PHILCO WHICH
ENVISIONED DEVELOPMENT OF NEW OPTICS AND A COMPLETELY NEW VEHICLE
AIMED AT SIX MONTHS ORBITAL LIFE.

BASED ON THESE STUDIES LIFE LIMITING SUBSYSTEMS WILL BE IDENTIFIED
AND DEVELOPMENT CONSIDERED.

11. AN ESTIMATED [] OF FY 1968 ADVANCED TECHNOLOGY MONEY WILL BE
EXPENDED FOR THE TASKS ABOVE. FOR THE REMAINDER OF FY67 AN ADDITIONAL
[] IS REQUESTED FOR THE ELECTRO OPTICAL TECHNOLOGY WORK AT CBS LAB
AND AT NORTHROP.

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COLS SMITH/ALLEN FROM GEN STEWART/MR.
REF: CHARGE 3738
SUBJECT: READOUT

1. REFERENCE PARA 1, THE CRISIS RECONNAISSANCE MISSION IS NOT NECESSARILY INVALID FOREVER; HOWEVER, THERE IS NO CURRENT STATEMENT OF REQUIREMENT ON WHICH THE DNRO CAN APPROVE ANY SYSTEM-ORIENTED PROJECTS. IN INTERIM, DR. FLAX FEELS YOU SHOULD CONCENTRATE ON DATA LINK TECHNOLOGY (APPLICABLE TO READ-OUT, SIGINT, ETC) AND PROMISING READ-OUT APPLIED RESEARCH OR ADVANCED TECHNOLOGY NOT ORIENTED TO ANY SPECIFIC SYSTEM.
2. DR. FLAX HAS TENTATIVELY APPROVED YOUR PARA 3 ELECTRO-OPTICAL READOUT PROGRAM; HOWEVER, HE DESIRES MORE INFORMATION ON PROJECT GOALS AND SCOPE, FUTURE YEAR ACTIVITIES, ETC. FY 67 FUNDING IS BEING RESERVED PENDING RECEIPT AND REVIEW OF THIS INFORMATION. ANY FY 68 EFFORT MUST BE FUNDED FROM WITHIN CEILINGS ON APPLIED RESEARCH AND ADVANCED TECHNOLOGY.
3. PARA 4 WIDE BAND DATA LINK IS APPROVED AT A LEVEL NOT TO EXCEED ANY EFFORT IN FY 68 IN THIS AREA MUST BE FUNDED FROM WITHIN AR/AT CEILINGS.
4. PARA 5 APPROVED AT A LEVEL NOT TO EXCEED AS A REASONABLE PHASE-OUT OF WORK NOW UNDERWAY. THIS SHOULD BE COMPLETED PRIOR TO END OF FY 67.
5. CURRENT AIR STAFF PLANS TO CONTINUE READOUT FILM TECHNOLOGY APPLICATIONS AT CBS MAY BE APPLIED THROUGH PRESENT SAFSP CONTRACTUAL ARRANGEMENTS. SEPARATE GUIDANCE WILL BE PROVIDED ON THIS MATTER.

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FOR GEN STEWART FROM COL ALLEN
SUBJECT: READOUT

1. PENDING RECEIPT OF YOUR WIRE, THE FOLLOWING INFORMATION IS PROVIDED IN RESPONSE TO OUR TELECON OF 5 DEC 66. WE UNDERSTAND THAT DNRO DESIRES MINIMUM COST TERMINATION OF ALL WORK RELATED TO G3RO AND THAT NO ADDITIONAL EFFORT SHOULD BE PROPOSED FOR FY 67 OR FY 68 WHICH IS ADDRESSED TO READOUT FOR CRISIS RECONNAISSANCE SINCE THAT REQUIREMENT IS NOW INVALID. ACCORDINGLY, ANY ADDITIONAL EFFORT WHICH WE PROPOSE WILL BE ADDRESSED TO THAT RESEARCH AND TECHNOLOGY WHICH MAY BE USEFUL IN THE FUTURE ADDRESSED TO A GOAL OF A VERY LONG LIVED AND HENCE ECONOMICAL NON-CRISIS SURVEILLANCE SYSTEM. NO SYSTEM EFFORT WILL BE PROPOSED FOR SUCH A FUTURE GOAL BUT ONLY COMPONENT TECHNOLOGY. WE UNDERSTAND THAT THERE MAY BE SOME INTEREST IN FILM READOUT TECHNOLOGY FOR AIRCRAFT OR OTHER APPLICATIONS. WE WILL COOPERATE IN SUCH AN EFFORT BUT CAN MAKE NO PROPOSAL FOR SP EFFORT NOW.
2. TERMINATION IS UNDER WAY AT BOTH CBS AND BTL ALTHOUGH THERE IS NO CONTRACTUAL COVERAGE FOR THE TERMINATION PHASE, SINCE WE HAVE NO GUIDANCE ON ADDITIONAL WORK, IF ANY. CURRENT CONTRACTS TERMINATED NOVEMBER 30. THERE IS NO OTHER WORK RELATED TO THIS EFFORT AT LOCKHEED, GE OR EK.
3. ELECTRO OPTICAL READOUT: AS YOU KNOW, WE HAVE BEEN SUPPORTING A WHITE EFFORT AT CBS LABORATORIES, COMPLETELY SEPARATE FROM FILM READOUT. THIS CONTRACT ENDS DECEMBER 15. AN ELECTRO OPTICAL CAMERA APPEARS TO BE A POSSIBLE COMPONENT FOR A LONG LIFE ROUTINE SURVEILLANCE SYSTEM SINCE IT WILL ELIMINATE THE NEED FOR SOME EXPENDABLES AND WE PROPOSE TO CONTINUE THIS EFFORT IN FY 67. WE FREQUENTLY REVIEW PROGRESS MADE IN ELECTRO OPTICS BY RCA, AMPEX, GENERAL ELECTRIC, AND OTHERS. IT IS OUR CONSIDERED JUDGMENT THAT CBS LABORATORIES' APPROACH IS STILL THE MOST PROMISING. THEY HAVE FULLY DEMONSTRATED FEASIBILITY OF AN IMAGE SECTION AND STORAGE SECTION CONSISTENT WITH [REDACTED] THE READOUT GUN HAS DEMONSTRATED SPOT SIZE AND BEAM CURRENT CONSISTENT WITH THESE OVERALL PERFORMANCE PARAMETERS. HOWEVER, THE ELECTRON BEAM HAS NOT ACTUALLY BEEN DEFLECTED AT THIS RATE. WE PROPOSE TO DESIGN, BUILD, AND TEST A COMPLETE LABORATORY MODEL OF THE ELECTRO OPTICAL READOUT SYSTEM. THE READOUT GUN IS THE HIGHEST RISK COMPONENT IN THIS SYSTEM. THEREFORE WE PROPOSE

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TORIES TO DEMONSTRATE THEIR DIGISCAN CONCEPT. ALTHOUGH IS STILL TOO EARLY TO SAY FOR SURE, THIS CONCEPT MAY BE A BREAKTHROUGH SOLUTION TO THE PROBLEM OF PRODUCING AND DEFLECTING A SMALL DIAMETER, HIGH INTENSITY ELECTRON BEAM. WE ESTIMATE [] FOR CBS AND [] FOR NORTHROP.

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4. WIDE BAND DATA LINK: THIS EFFORT WILL BE AIMED AT INCREASING THE TIME BANDWIDTH PRODUCT OF THE DATA LINK SUBSYSTEM. SEVERAL METHODS OF DOING THIS HAVE BEEN DISCUSSED WITH BTL. ANALYSIS WILL BE PERFORMED TO DECIDE ON AN OPTIMUM APPROACH. WHERE APPROPRIATE, CRITICAL COMPONENTS WILL BE BREADBOARDED. COST OF THIS EFFORT IS UNDETERMINED BUT MAY BE ABOUT []

5. ANY FUTURE APPLICATION OF ELECTRO OPTICAL CAMERA FOR LONG LIFE WILL USE CERTAIN TECHNIQUES OF THE TERMINATING FILM READOUT EFFORT, IN PARTICULAR THE GROUND RECONSTRUCTION EQUIPMENT. ALTHOUGH THESE TECHNIQUES ARE IN A MORE ADVANCED STATUS THAN THE LABORATORY ELECTRO OPTICAL CAMERA AND, THEREFORE, THIS WORK COULD BE DELAYED, IT IS MORE EFFICIENT AND ECONOMICAL TO EXECUTE A FEW TASKS NOW WHILE SOME KEY COMPETENCE OF THE TECHNICAL GROUP STILL EXISTS.

A. IMAGERY OBTAINED BY THE BREADBOARD SETUP CONTAINED SOME MINOR FLAWS PRESUMED DUE TO VIBRATION OR INTERFERENCE. A SMALL EFFORT TO IMPROVE THE QUALITY WITH THE ENGINEERING MODELS NOW IN OPERATION WOULD PROVIDE ASSURANCE OF QUALITY IMAGES FROM THE GROUND RECONSTRUCTION EQUIPMENT IF IT IS USED IN THE FUTURE.

B. THERE IS SOME ADDITIONAL EFFORT DESIRABLE IN MATHEMATICAL ANALYSIS OF THE COMPONENTS WHICH WILL PROVIDE A SOUNDER THEORETICAL BASIS OF THE TECHNIQUE AND PERMIT CLEARER COMPARISON AND EXTENSION TO FUTURE TECHNIQUES.

C. VERTICAL APERTURE COMPENSATION. RESOLUTION IN THE "IN SCAN" DIRECTION IS INHERENTLY GREATER THAN TRANSVERSE TO THE SCAN. CBS LABS HAS PROPOSED A DEVICE THAT PROMISES TO BOOST SYSTEM RESPONSE IN THE VERTICAL DIRECTION. WE PROPOSE TO BUILD AND TEST THIS DEVICE WITH THE ENGINEERING MODEL NOW ON BOARD.

D. THE ADDITIONAL FUNDING REQUEST FOR THESE TASKS IS ABOUT [] AND WILL BE UTILIZED IN THE NEXT FEW MONTHS AS THE WORK FORCE TAPERS DOWN RAPIDLY.

6. THE TOTAL ADDITIONAL FUNDING REQUESTED IS ESTIMATED AT [] LION. BY SHREWD NEGOTIATING. WE BELIEVE THAT THE KEY ELEMENTS COULD BE ACCOMPLISHED AT []

7. TERMINATION OF CBS AND BTL CONTRACTS HAS BEEN STARTED BASED ON GUIDANCE IN WHIG 5937. FOREGOING COSTS COULD INCREASE DUE TO TERMINATION ACTIONS NOW UNDERWAY.

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