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STAFF STUDY

KH-9 (NEW SEARCH) PHOTOGRAPHIC PROCESSING

OF

DUPLICATE MATERIALS

Prepared By

U. S. ARMY TOPOGRAPHIC COMMAND

27 June 1969

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KH-9 (NEW SEARCH) PHOTOGRAPHIC PROCESSING

OF DUPLICATE MATERIALS

1.0. Purpose and Scope. This staff study examines the capabilities of, and assesses the resources required for, the U. S. Army Topographic Command (TOPOCOM) to accomplish duplicate film processing and administration for the KH-9 cartographic terrain and stellar cameras materials that will be acquired from the NEW SEARCH photographic satellite missions beginning about February 1972. Services would be provided to a national reconnaissance, intelligence, and cartographic community consisting of about fourteen (14) customers. Panoramic camera materials processing and handling are not included in this study.

1.1. Functional Responsibility. The duplicate photographic film processing and administration for the cartographic portions of each mission would be performed at the Brookmont, Maryland facilities of the Army Topographic Command (TOPOCOM) in the Army Precision Photogrammetric Laboratory (APPL). The entire work area is a secure vault and storage facility.

2.0. Assumptions.

2.1. Operational Procedures. A critical response time of 24-48 hours will not be mandatory. The laboratory processing of an incoming photographic mission would be conducted on a two-shift operation and be completed in not more than five working days. However, emergency requirements for partial coverage would be accommodated on a priority basis. The administrative effort involving security control, final inspection of containers, storage, and shipping arrangements would parallel and follow the technical efforts. Delivery to customers, including overseas locations, would be accomplished by the regular Armed Forces Courier service that is now available.

2.2. Storage. As holder of the original film, the TOPOCOM will assume archival responsibility and establish a permanent storage vault for this material. The original frame and stellar films will have one master positive duplicated for backup. Follow-on usage of the original film will consist of "special order" preparation of glass plates, step-and-repeat process duplicate prints, and continuous process duplications.

2.3. Parameters of Effort Involved.

2.3.1. Photographic Base. Polyester thin base photographic film materials will be input to the processing operations. Use of ultra-thin base (UTB) materials (1.5 mils) is beyond the scope of this study.

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2.3.2. Source Materials. The source materials will consist of approximately 4200 linear feet of 9½ inch cartographic frame camera film and 2400 linear feet of 70 mm stellar camera film for each KH-9 satellite mission. The original negative film will have been developed prior to arrival at TOPOCOM.

2.3.3. Customer Requirements. The end-product from each mission will consist of an estimated nine (9) copies of duplicate negative film and ten (10) copies of duplicate positive film of the terrain camera, for a total of nineteen (19) copies; and three (3) copies of duplicate negative film and four (4) copies of duplicate positive film of the two stellar cameras, for a total of seven (7) copies. A total of 89,000 feet of duplicate film will be distributed for each cartographic mission as complete and partial sets to approximately fourteen (14) customers (see ANNEX A).

2.3.4. Service Period. It is estimated that the servicing will span a minimum three-year acquisition period consisting of six to twelve cartographic missions at a rate of four per year, beginning in February 1972 and ending in June 1974. The gross footage produced for nine missions will total 860,000 film feet.

3.0. Resource Estimates.

3.1. Production Costs. The estimated cost to the government is $37,100 per mission for direct labor and materials only. Appropriate cost-audit techniques will be instituted when the project begins so that a mission-cost model can be determined. A listing of cost estimates is provided in ANNEX B.

3.2. Annual Cost. The annual cost to the government for total manpower and materials, and one-time cost of special training and equipment, are estimated to be $185,000 if nine missions are processed in a three-year period. An equipment utilization plan is given in ANNEX C.

3.3. Personnel. While thirty-three (33) persons will be engaged in each production run, only eight (8) additional manpower spaces are required. Three (3) employees are needed for administrative services and five (5) photographic laboratory employees are required to assure satisfaction of the existing workload during the "special project" peak-production periods. A timely DA authorization and hiring authority for the additional personnel is critical to the success of the proposed operations. A minimum lead-time of 12 to 18 months is usually required to recruit and hire, provide on-the-job training, obtain special security

clearances, and replace the project cadre who will attend advanced training courses. (See ANNEX B, page 2)

3.4. Work Area. The 2070 square feet of floor space needed for this project is or will become available within presently available physical space.

4.0. Discussion of Advantages and Disadvantages.

4.1. Advantages.

4.1.1. The physical facilities (including clean rooms), the major items of equipments, and a nucleus of qualified technical and administrative personnel are available at TOPOCOM. Therefore, government dependence on contract services can be reduced.

4.1.2. The USATOPOCOM is a primary user of satellite photography. This provides a special incentive for maintaining metric quality.

4.1.3. The proposed function is a technical support service that is directly related and harmonious to the TOPOCOM mission of providing a variety of topographic products to a broad array of users. A similar mission was assigned to the Army for the KH-5 material and resulted in experience which will be beneficial in the conduct of this mission.

4.1.4. The DOD and the Army will benefit because the operation will provide pragmatic technical knowledge that can assist in formulating future photographic technology development plans.

4.1.5. Functions of this kind are judged important for the future mapping operations concept and they were considered when the Chief of Engineers topographic resources were reorganized and the Army Topographic Command was formed. This project will be a critical first-phase of the continual evolution toward a family of topographic materials and products.

4.1.6. Since the project is directly related to the master topographic data base concept of operations, it will serve as an excellent pilot test project, and it will help to further refine the data bank concept by testing the theory of timely response in a non-crisis situation.

4.1.7. Furthermore, the project will help to improve organizational effectiveness in a major topographic technology by affording Army the means to develop and exploit an unused but latent capability to produce a high quality interim topographic product at the level of the state-of-the-art. Photographic technology is primary to the techniques used in

raw data reduction and source materials transformation because the quality of the topographic end-product depends, in no small measure, on the quality of the photographic image. The processing operation is, therefore, an integral and vital part of the total data reduction effort.

4.1.8. Finally, it affords the opportunity to obtain unbiased, but critical, user reactions from a heterogeneous cross-section of customers regarding the service rendered and maintained.

4.2. Disadvantages -- With Counter-arguments.

4.2.1. Army's assumption of responsibility for the project requires programming of additional funds to acquire the minimal additional resources necessary to fulfill the objective.

The mission must be accomplished and no organization can organize and conduct the job without impact on their facilities, their resources, or their present obligations. Funds must be allocated to whoever performs the job.

4.2.2. The project may occasionally compete with the timely completion of scheduled support for priority operations.

Safeguards, such as the early recruitment and training of eight (8) additional employees to replace or assist the experienced persons who will conduct the project must be accomplished. Advance notices of forthcoming peak-periods will be issued to operating elements to submit servicing requirements in advance.

4.2.2. It is very possible that requests for "extra" customer services on KH-9 material will further increase the projected workload.

Reimbursable servicing agreements will cover extra expenses incurred for the benefit of outside elements.

4.2.4. Because of the more advanced technology to be employed, it is mandatory that a minimum of six (6) cadre employees receive specialized training prior to the initiation of the project.

A timely conversion to advanced technology was a primary reorganization objective of the Chief of Engineers.

4.2.5. Technical review and evaluation must be instituted to avoid costly mistakes in the beginning.

Outside consultant systems analysis will be provided to the unit supervisors during the operational planning and initial conduct of the project and cost auditing will identify expended resources.

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5.0. Summary.

5.1. Location of Facility. The decision to locate the proposed processing facility in the Capitol area will be in the best interest of the government because the majority of users are located nearby and the reliance on the contractor will be reduced. It is assumed the contractor would also encounter an impact similar to the one Army will have for this project. Similarly, the Air Force facility, which has been processing duplicate materials and is geared to the present mission, will be burdened with a substantial workload for the panoramic, or prime camera, products from KH-9.

5.2. Resources. The physical environment for high quality processing is available now. The assignment of this mission to Army will only require a minor augmentation in personnel.

5.3. Primary Producer. DIAMC letter of 3 Dec 68 (TCS-657905/68), subject: "Exploitation of TALENT-KEYHOLE Materials," designated Army the primary producer of large scale cartographic products from KH-9 materials. To guarantee maximum exploitation of source materials during aerotriangulation and stereo-photogrammetric compilation, all pertinent photo products must be made directly from the original negative.

6.0. Conclusions.

6.1. The APPL facility is ideal for processing satellite photography from KH-9 missions.

6.2. Significant technological benefits will be attained with a minor expenditure of resources.

7.0. Recommendation.

It is recommended that higher headquarters authorize assignment of the project to the Army Topographic Command.

8.0. Addendum.

After this study was prepared, the DIA requested information on the capability to process the original negative (reference para 2.3.2.). Because of the short time allowed, a brief impact assessment is appended as ANNEX D. As the APPL facility was purposely constructed to provide a total precision photographic and photogrammetric capability, ANNEX D is submitted as a second alternative for decision. Naturally, more resources are required for original than duplicate processing. The eight persons become twenty and more training and technical advice will be needed.

Alternative 1 - Process duplicate materials.

Alternative 2 - Process original and duplicate materials.

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KH-9 (NEW SEARCH) PHOTOGRAPHIC PROCESSING

PROBABLE CUSTOMERS

SETS (positive & negative)

ORGN	FRAME	STELLAR
1. TOPOCOM	2	1
2. ACIC	2	1
3. NPIC	1	1
4. DIA	1	-
5. NSA	1	-
6. SAC	1	-
	8 Sets	3 Sets

PARTIAL SETS (frame)

ORGN
7. NAVOCEANO
8. USGS
9. Canada
10. SOCOM
11. MEAFSA
12. EUCOM
13. U.K. (possible stellar)
14. PACOM
1 Set

Stellar users have generally required loan of original negative (white background with black dots). Recent ACIC reports indicate improved measuring accuracy and more visible stars using a positive copy.

Note: The omission of organizations from this preliminary list does not imply a denial of access to the material; but, rather it suggests additional customers.

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ANNEX A

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KH-9 (NEW SEARCH) PHOTOGRAPHIC PROCESSING
OF DUPLICATE MATERIALS

PRELIMINARY COST SUMMARY

			Funded By Army	Funded By NRO(S)
1.	COST PER MISSION	$37,100		
	Personnel - Direct Labor		$12,800	
	Materials - Photographic & Packaging			$24,300*
2.	ONE-TIME EXPENSES	$58,600		
	Consultant Services			$ 3,000*
	Special Training			$ 7,200*
	Salaries During Training (430 Man-days)		$18,150	
	Processing & Support Equipment			$29,000*
	Office Equipment		$1,250	

*TOPOCOM estimates

3. ADDITIONAL MANPOWER	Persons	
Photo Lab	5	(8 @ $11,540)
Service & Support	3	
Total	8	$92,320 pa

Minimum lead-time of 12-18 months required to recruit and hire, provide OJT, obtain security clearances, and replace cadre for special training.

Assignment of mission should be accompanied by authority to program and budget for appropriate resources and any sets or servicing required beyond this should be on a reimbursable basis.

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ANNEX B

KH-9 (NEW SEARCH) PHOTOGRAPHIC PROCESSING OF DUPLICATE MATERIALS

PRELIMINARY RESOURCE REQUIREMENTS

1. PERSONNEL - Direct Labor

	Required	Available	Need	Estimated Cost per Mission
Service & Support (1)	5	2	3	$ 4,800 (0.625 MY)
Photo Lab (2)	28	23	5	8,000 (0.688 MY)
Total	33	25	8	$12,800 1.3 MY

Estimated FY72 Salary Base: (1) $7,700, (2) $11,620.

2. PHYSICAL SPACE (square feet)

Secure vault space for storage and work areas.

	REQD	AVAIL	NEED
Administrative	1150	325[b]	825[a]
Laboratory	50	0	50[a]
Other[c]	870	0	870[c]
	2070	325	1745

[a]Space available in APPL Building. Administrative activity could coexist with technical.

[b]Space will become available as out-of-date materials are phased out.

[c]An additional 870 square feet are required for housing personnel who will be displaced when 1st floor of APPL is operated as a Clean Room. The 870 square feet is not work space.

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ANNEX B

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KH-9 (NEW SEARCH) PHOTOGRAPHIC PROCESSING OF DUPLICATE MATERIALS

tentative equipment utilization plan

Operation	Units of Equip	Persons	Work Units Per Job	Rate (capacity / estimate)	Man-machine Hrs (Per Job)
1. Film Cleaning* *(not always needed)	(1)	(1)	1650 ft (½ of original)	1200 / 400 fph	4.0*
2. Inspection and Splicing	1	1	111,760 ft (original & processed)	2000 fph	56.
3. Densitometric** Inspection and	3	3	59,180 ft (original & 50% processed)	(300) fph	200/3
Quality Control	-	1			32.
4. Continuous Film Printing	2	2	105,160 ft	6000 fph	17.5/2
5. Continuous Spray Processing	2	6	105,160 ft	3600 / 1800 fph	58.4/2
Optional Techniques		14 per shift			
4.a. Step and Repeat Contact Printing	2	2	26,400 ft (4 copies)	360 / 90 fph	293/2
5.a. Continuous Viscous Processing	1	1	105,160 ft		
7. Security Control Records (input & output)		0.125 MY	681 cans, 637 labels		225 MH
8. Inspection Contents		0.25 MY	111,760 ft, 681 cans		450 MH
9. Storage and Distribution Administration		0.25 MY	637 cans, 102 boxes		450 MH

**Operation 3: Work effort preparatory to production of the first unit provides technical process criteria that permit faster production of subsequent units. Time will be less if measurement data is made available with the ON.

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ANNEX C

KH-9 (NEW SEARCH) PHOTOGRAPHIC PROCESSING

OF ORIGINAL NEGATIVE

1.0. As noted in the Addendum (p 5), a statement on TOPOCOM capability to process the original negative (reference para 2.3.2) has been requested. The impact on manpower, training and space allocation is outlined in the following pages.

USATOPOCOM would not object to the assignment of the mission of processing the ON material if such assignment is considered in the national interest. However, in consideration of the relative advantages and disadvantages, including the greater impact on facilities and resources of processing the ON's, it is believed that it would be advantageous to process the ON materials at other facilities. In any event, full qualification for processing the duplicate materials should be attained prior to embarking on the critical ON processing.

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KH-9 (NEW SEARCH) PHOTOGRAPHIC PROCESSING
ADDITIONAL REQUIREMENTS - PROCESSING ORIGINAL NEGATIVE

PRELIMINARY COST SUMMARY

			Funded By Army	Funded By NRO(S)
1.	COST PER MISSION	$18,625		
	Personnel - Direct Labor		$ 15,380	
	Materials			$ 3,245*
2.	ONE-TIME EXPENSES	$2,113,150		
	Consultant Services			$ 6,000*
	Special Training			$ 4,850*
	Salaries During Training (290 Man-days)		$14,300	
	Processing & Support Equipment			$2,088,000*

*TOPOCOM estimates

3. ADDITIONAL MANPOWER	Persons	
Photo Lab	6	
Engineering Maintenance	4	(12 @ $11,540 pa)
Custodial	2	
Total	12	$138,480 pa

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ANNEX D

KH-9 (NEW SEARCH) PHOTOGRAPHIC PROCESSING
ADDITIONAL REQUIREMENTS - PROCESSING ORIGINAL NEGATIVE

PRELIMINARY RESOURCE REQUIREMENTS

1. PERSONNEL

	Required	Cost Per Mission	
Technical			
Photographic	6	$ 14,480*	($12,800 pa)
Engineering Maintenance	4	560**	($14,000 pa)
Custodial	2	340	($ 6,300 pa)
	Total	$ 15,380	

*Based on FY72 salary GS-10-5 working a 24-hour day (2 12-hour shifts) and including overtime and rehearsal.
**Based on FY72 salary GS-11-5 working 8-hour day 2½ days per mission

2. PHYSICAL SPACE

Outside the Clean Area 2,800 square feet of space must be made available to compensate for equipment and personnel displaced by:

2.1. Placement of the CD Processor

2.2. Separation of paper and film processing operations

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ANNEX D