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DEPARTMENT OF THE AIR FORCE
DIRECTORATE OF SPECIAL PROJECTS (OSAF)
AF UNIT POST OFFICE, LOS ANGELES, CALIFORNIA 90045

19 September 1968

REPLY TO ATTN OF: SP-1

Range Ship Support for Recovery Operations

Director, NRO (Dr Flax)

1. In response to your request during our last discussion of this subject, this letter summarizes the current recovery ship support problem and my recommendations for its resolution. I have included some background data in order to present this entire question in reasonable perspective. Basically the problem can be stated summarily as follows: In the beginning of the satellite reconnaissance program, two ships were specifically provided and configured to assist in the recovery operations. Over the years, these ships have been used to support other occasional users in addition to satellite recovery. In recent months this other use has begun to conflict with satellite recovery operations, making adequate coverage uncertain at times. In addition, the complete deactivation of these ships is apparently being considered for presumed cost savings, which would substantially reduce necessary satellite recovery support. I say "presumed" savings because, as I will discuss more fully in later paragraphs, the facts do not substantiate any reasonable expectation of savings when the pro-rata costs of probable lost capsules are considered.

2. The two ships in question are the Sunnyvale and the Longview, designated as "Surface Recovery Units" (SRU), but sometimes referred to simply as "recovery ships." These ships are equipped to carry helicopters, and have special telemetry communications, and hoisting and handling equipment for recovery of satellite capsules from the ocean. The pertinent history of these two ships may be summarized as follows:

a. Prior to 1959, the Sunnyvale and the Longview were Military Sea Transport Service (MSTS) cargo ships. Advanced Research Projects Agency (ARPA) Order No. 61-59, 20 Feb 1959, funded (approx $2.3 million) the modification of both ships to provide a helicopter operations capability; i.e., a flight deck and hangar. The ARPA Order contained the stipulation that the modified ships would be restricted to support of Program WS-117L only unless

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ARPA concurred otherwise. (Program WS-117L was the then current designator of the entire satellite reconnaissance program which at that time was under ARPA control.)

b. The ships were modified between Apr and Jul 1959 and were returned to MSTS for operation under Pacific Missile Range (PMR) control, with PMR helicopters aboard. Commencing about one year later, a telemetry capability was added piecemeal to each ship, between operations. The telemetry equipment was utilized in the recovery area for event reporting, etc. From time to time between 1961 and Feb 1965, when the two ships were turned over to the Air Force Western Test Range (AFWTR), PMR recommended using the ships to satisfy the telemetry requirements of other programs; however, such utilization never materialized, either because of USAF pressure or because USN wanted to keep its "foot in the door" of the recovery business, probably a little of both. Hence, the ships remained dedicated to surface recovery of satellite capsules throughout this period.

c. There is no evidence, other than the original ARPA Funding Order, available to indicate that the Ranges (PMR and AFWTR) have ever been instructed, or ever formally agreed, to consider the two surface recovery ships as program-dedicated resources. Shortly after AFWTR assumed the control of the Range ships in Feb 1965 (except for the Wheeling), three of them were modified and effectively dedicated to support specific programs: the Huntsville and the Watertown to Apollo, and the Richfield to an activity too remote geographically to be useful for any other purpose. Since that time, except for withdrawal of the Longview in the spring of 1967 for about 60 days for modifications (not AFSCF sponsored), AFWTR has been juggling the Sunnyvale and the Longview to support programs other than recovery. Initially this was strictly on a non-interference basis (with one notable exception: the deployment of the Sunnyvale to Henderson Island). However, by late spring 1967, AFWTR had adopted a "common user resources" philosophy, with the view that each conflict arising from simultaneous requirements for these two SRUs be settled by AFWTR comparing program priorities and precedence, and/or resolving each scheduling problem through negotiations between the program directors concerned on an individual conflict basis. In this philosophy, the non-interference basis of support to satellite recovery operations has been specifically rejected as being contradictory to the "common user resource" philosophy. In this connection, it has been pointed out by

AFWTR that one of the non-satellite programs supporting the spring 1967 modifications to the Longview modification (NIKE-RMP-B) enjoys equal priority with any other program. In addition to support of ballistic missile programs, the TAGBOARD program also has been supported by these ships, sometimes at the expense of requested support of orbiting satellite reconnaissance flights. For the first six months of 1968, actual SRU support of the satellite reconnaissance program has been approximately 10% less than requested.

3. We use these SRUs and associated helicopters to provide a means of surface recovery of any reconnaissance capsule which is not caught by aircraft. While their use does not guarantee that we will succeed, operation without such support definitely increases the probability of loss of any capsule in the water. In addition, the absence of adequate surface recovery support definitely increases the risk that the floating capsule may be picked up by unfriendly nations, with attendant international complications. Actual loss of any capsule in the water, even by its safely sinking, involves two distinct losses: the loss of the intelligence information on the film in the lost capsule, and the loss of the costs represented by the lost capsule.

4. We need two of these SRUs to provide a reasonable basis of surface recovery, while making full use of available land bases for helicopter coverage. Our normal procedure is to station one SRU at or near the predicted impact point, with a CH-3B helicopter on board. However, often this is not possible, and we must compromise with a location which at least puts this point within helicopter range from the ship. We have accepted coverage by land-based helicopters instead of ship coverage when the predicted impact point is within range (240 n.m.) of Johnson, Tern, or the Hawaiian Islands. However, we must have coverage on each orbit that a recovery could be made, to insure a chance at recovery even under conditions of sudden failure on orbit. This means that such coverage is needed for 15 consecutive days for a CORONA mission (alone) or 10 consecutive days for a GAMBIT mission alone. Neither of these can be met separately by land-based helicopters alone. During the not infrequent case when both CORONA and GAMBIT missions are in progress, the need is increased, as the possible recovery revs for these two programs step across the entire east-west dimension of the recovery "ball park" in different directions. As a result, adequate coverage can be approached only by using two ships plus taking full advantage of land bases for helicopter coverage.

Operation of nth day synchronous orbits with n less than the planned duration of the mission also requires two ships for adequate coverage, since the recovery revs reverse from one end of the "ball park" to the other on the nth day. One ship can keep up with the recovery revs for each day through n-1 days, but obviously cannot make the 12-1300 mile trip on the nth day. In the first six months of 1968, we have used two ships on six occasions (only one of which was an SRU in each instance, since both SRUs were not available). However, even when one deployed ship is adequate two ships in general must be assigned to insure that one is always available, since they cannot stay out indefinitely, and must periodically undergo maintenance. The extent of the need for ships in addition to land-based helicopters is partially reflected by the fact that we have had 32 air recoveries outside of the helicopters 240 n.m. range from land since 1962. Eleven of these have occurred within the last two years.

5. Various suggestions have been made with the objective of either eliminating our need for the SRUs, reducing this need, or substituting other means for the ships. These are listed below. None of them seems adequate for a reasonable program, for reasons stated below.

a. Reduction of the east-west dimensions of the recovery "ball park," so that all surface recovery can be provided by land-based helicopters. This reduction is not at all reasonable, as the present east-west dimensions are necessary in order to provide a reasonable chance of acceptable weather in one area when unacceptable weather exists in other areas. It is not unusual to have to move the planned recovery point from one end of the "ball park" to the other in the course of a 10 to 15 day mission. An essential part of this area lies both west and east of the land-based helicopter range.

b. Use of the other Navy vessels on an "ad hoc" basis, to eliminate either the need for SRUs, or to substitute for them whenever conflicts arise. We occasionally are forced to use such vessels, sometimes a destroyer but most often an ocean-going tug. In the first six months of 1968, we have used such other vessels on 10 occasions. While such coverage is better than nothing, it is not an acceptable substitute. We need the SRU specifically configured for its intended use, including on-board recovery helicopter, capsule handling equipment, and necessary communications and beacon equipment.

c. Development of longer range helicopters, so that all required coverage can be provided by land-based helicopters. While this is a possible course of action, certainly it is not the most economical one, even if such helicopters are developed elsewhere and the only applicable costs are the unit price of each plus its operating expense. The present ships and helicopters exist, are paid for, and are adequate. The only costs are the on-going operating costs. A long range helicopter could not completely substitute for a ship with a present type helicopter on-board, which can remain in a search mode for the entire 48 hours that the capsule will float before the sink-plug is activated, regardless of daylight or local weather ceiling and visibility.

d. Restriction of coverage to the planned recovery revs only (one recovery rev per capsule per mission) instead of each possible recovery rev (one rev per mission each day any capsule is in orbit). This would reduce coverage but would not significantly reduce the overall SRU requirements, since the ships must spend a great deal of the time steaming in order to be in the correct position on the planned recovery days. The possible recovery rev crossings progress across the recovery "ball park" on the order of 100 to 350 miles per day, depending upon the period of the orbit. Since the ships can travel a maximum distance of about 360 miles per day, and since the east-west dimension of the "ball park" is 12-1300 miles, they must be committed even to a single mission for more than just the planned recovery day. Any reduction of coverage on any possible recovery rev definitely increases the risk of loss, since these revs are the only reasonable times when a recovery could be attempted each day, regardless of when a critical malfunction should occur in the orbiting system. Recovery of all exposed film becomes more important as programs mature, and the number of flights per unit time decreases, as is the case with the present CORONA and GAMBIT programs. Loss of any coverage represents a significant part of the planned annual coverage.

e. Elimination of the surface recovery support on the basis of "acceptable" risk. Such proposals are based upon some calculation that the probability of losing a capsule is very low and extrapolation of this result to future operations. For example, on the basis of the last 147 opportunities to recover (through the first eight recoveries of 1968), the overall probability of aerial recovery may be calculated to be 97.3%, and the probability of a capsule going into the water (and its loss if there were no surface recovery capability) to be 2.7%. These and similar calculations have been cited as evidence that the risk of operating without the SRUs is small. However, such reasoning is fallacious, regardless of whether one considers this an "acceptable" probability of loss, for several reasons:

(1) The actual water recoveries which have occurred represented different overall recovery systems, with differences in equipment, in significant operational factors (weight, sink rates, parachutes), and personnel. The overall configurations are not the same as being flown now or programmed for next year, and none of the experience was obtained in statistically significant samples. The occasions of their water recovery being lumped together is correct only in that it represents one aspect of what did happen, namely that these capsules were actually recovered from the water. It does not represent the expectation of the occurrence at the time, and it is not a valid basis for predicting future expectation.

(2) Changes in equipment, operational characteristics, and personnel continue to be made. Equipment changes include weight and sink rate changes in present type capsules, the introduction of much larger and heavier capsules with new parachute systems, and major changes in key personnel which are a vital part of the aerial recovery system. (Even if my recent request for tour extensions is approved, we will undergo a 41% loss of recovery pilots and a 59% loss of recovery navigators in the next 14 months. If it is not approved, these losses will be 65% and 64%, respectively). Even minor changes in experience level of pilots and navigators have a significant effect on the probability of successful aerial recovery.

(3) The problem of establishing and maintaining the competence of aerial recovery crews is further complicated by the introduction of substantially different operational characteristics for capsule/parachute systems which will be operational during the same period. Crews not only must be competent in each system, they must be competent in arbitrarily mixing the different types, that is, from recovering a light or heavy Mark V type and a large HEXAGON type, with different sink rates and parachutes, in an arbitrary order. This increasing variation in such vital operational characteristics obviously will increase the probability of missed aerial recovery opportunities, and the consequent need for SRU support.

(4) Any calculation of aerial recovery probability or expectation that is based only on whether or not successful recovery occurred incorrectly omits some significant factors of these occurrences, as well as incorrectly inferring that future recovery opportunities will be handled with the same degree of success in spite of many major differences between these past and future systems. Beginning with

the first water recovery on 11 Aug 1960, there have been eight water recoveries of reconnaissance capsules (one in 1960, three in 1961, two in 1963, one in 1964, one in 1967). However, these totals do not reflect how marginal was the success of other aerial recoveries, some of which were practically wet when recovered at the last possible instant. Some of the relatively large gaps when no water recoveries occurred reflect the influence of reasonably stable recovery system configurations and high experience level of key personnel. However, some of the successful aerial recoveries even in these periods had very little margin between success and failure. Consequently, the need for SRU support was greater than indicated by the actual water impacts alone. I do not know how to quantify the factors involved in such a way as to obtain a really meaningful prediction of future water recovery probability. It is not the same for all programs, or even for the same program at different times. It is not the same in a given program throughout each month of the year, and it is not the same throughout, or for sometime following, periods of substantial change in key personnel. It is certainly not the result that can be computed by using the simple statistics pertaining to actual recovery history.

6. One of the recurring suggestions to discontinue use of the SRUs in the satellite recovery operation is based on the idea that such action would result in substantial cost savings. As recently as last May, for example, we learned informally from AFWTR that SAFRD had requested AFWTR to conduct a cost savings study on putting the Longview and Sunnyvale into storage. In the year of withdrawal, ostensibly the savings would be the annual programmed operating costs, less the cost of mothballing (estimated at $436,000 per ship) and the operating costs to the point of withdrawal. For subsequent years, the savings would be the programmed annual operating costs. These represent the order of alleged savings if the costs of operating these ships are considered as the only cost criterion. However, this is not the total cost involved, and is not a valid basis for any decision based on saving money. Against these ship costs, the costs of probable lost capsules must be considered. Since these costs vary greatly with different programs, and within the same program in different time periods, it is necessary to analyze this question in some detail. We have made such an analysis, the results of which are attached herewith (Atch 1). The cost of the recovery capsules for each program is shown as cost per FY per recovery vehicle, along with the number of recovery vehicles (and recovery opportunities) involved per FY in each program. For comparison, the estimated total FY cost for the two SRUs is shown at the bottom in round numbers.

Also shown for additional perspective is the incremental cost per RV of these SRUs, which represents the amount each recovery vehicle would have to pay if the total cost of the two SRUs were evenly allocated to the scheduled recovery vehicles during each fiscal year. In effect, this would be the insurance premium to provide for water recovery if each capsule were charged the same premium. On the basis of these data, I make the following observations:

a. As reflected in the FY 1964 and subsequent year costs shown in Atch 1, the cost per recovery vehicle generally decreases with each year, fluctuating upward when major new program changes are introduced, but maintaining a steady trend otherwise. The costs of six vehicles recovered from the water between Aug 1960 and the beginning of FY 1964 are not shown in the analysis. The cost of the seventh water recovery vehicle (CORONA) in FY 1964 was $7.8 million, and the cost of the eighth was $8.1 million. If the costs of the first six are considered as approximately $4 million each, then the cost of these eight water recovery capsules is seen to be approximately $40 million. Obviously, $4 million is a low estimate for the six water recoveries prior to FY 1964, hence the actual value of these eight recovered capsules exceeds $40 million. Therefore, the dollar value of these eight water recoveries alone has paid for the exclusive use of both SRUs by the satellite reconnaissance program from 1960 to sometime beyond 1972, even if no more capsules are recovered from the water.

b. In FY 1969, of 22 programmed recovery opportunities, there will be 14 which represent $3.5 million each, and eight which represent $22 million each. Thus, recovery of a single capsule of the cheapest type would essentially pay for the entire year's operating cost of both SRUs. If a single one of the eight more expensive types were recovered by SRUs, it would pay for both SRUs for FY 1969 plus five more years.

c. The cost of both ships for an entire year represents exceptionally inexpensive insurance against the loss of even the cheapest capsule. For example, in FY 1969, eight GAMBIT (110) capsules at $22 million each plus 14 CORONA capsules at $3.5 million each are programmed, for a total of 22 recovery vehicles. If the total FY 1969 cost of both

ships ($3.7 million) is divided equally between these 22 capsules, then the incremental cost of the ships is $0.168K per capsule. As an annual insurance premium for each of the $3.5 million CORONA capsules, this is only 4.8% of the cost of each capsule. As a premium for the $22 million GAMBIT capsules, this is only 0.76%. If the costs of operating the SRUs were divided in some proportion to the cost of the capsules involved, the CORONA premium would be less and the GAMBIT premium would be more than the 4.8% and 0.76%, respectively, shown above. However, the point is clear: no matter how such annual costs are allocated between the capsules programmed to be recovered in that year, the cost of the SRUs is extremely cheap insurance in comparison to the cost of the capsules involved.

7. My conclusions are:

a. There is absolutely no valid basis for removing these SRUs on the expectation of saving money when the cost of probable lost capsules is considered.

b. The prediction of future water recoveries on basis of past occurrences is not valid due to significant changes in equipment, operating characteristics, and experience of assigned recovery personnel. Prediction of water recoveries is not subject to meaningful quantization due to the several significant factors which must be determined subjectively, and to the absence of relevant experience in statistically significant sample sizes. However, it is obvious that the probability of such an occurrence is increasing, rather than decreasing or remaining unchanged.

c. The exclusive use of both the Sunnyvale and the Longview by the satellite reconnaissance program has been paid beyond 1972 on the basis of the cost alone of the eight capsules that have been recovered from the water so far.

d. Even if the value of previous water recoveries is not considered, the annual cost of operation of both SRUs represents an extremely inexpensive insurance program against the loss of any future capsule.

e. In addition to dollar costs, any loss of a reconnaissance capsule involves a loss of intelligence data on the film which is not recovered. This loss is much greater now than in earlier years, due to more austere programming. It will be greater in FY 1970 than in FY 1969, as a single capsule represents a larger proportion of the programmed intelligence coverage.

f. In addition to dollar and intelligence coverage losses, any water impact without adequate surface recovery capability involves risk of recovery by unfriendly hands. While difficult to quantify, it is obvious that operation without surface ship support involves greater risk than regular use of the SRUs.

g. While the satellite reconnaissance program can be operated on a basis which will permit the occasional use of one of the two SRUs in support of some other effort, and in special circumstances involving particular operations and inclinations, conceivably even permit limited periods when neither SRU is committed to support of the satellite reconnaissance program, the adjudication of actual or potential conflicts for the use of these units on the basis of standard priority and precedence is unreasonable. There is no rational basis upon which any support agency, such as a range, can reasonably adjudicate conflicts for support between the operational satellite reconnaissance program and any other programs carrying equal priority and precedence. There is, however, a substantial difference between the satellite reconnaissance program and other competing activities in the flexibility of scheduling the actual events which require such support. Both of these SRUs were procured for, and have been maintained over the years primarily to support the satellite reconnaissance program. These SRUs are essential to the satellite reconnaissance program, and the changing character of this program makes their availability for other users more difficult to predict very much in advance of specific satellite missions as well as more restricted in terms of total available time. In view of these considerations, and the increased lifetimes, multiple recoveries per program, and overlapping orbital missions of different satellite reconnaissance projects, it seems obvious that both SRUs should be assigned specifically to support the satellite reconnaissance program on a dedicated basis, and that allocation of any support by these two units to any other program, as well as adjudication of any conflict for such use be assigned specifically to the senior responsible official of the satellite reconnaissance program in the field, namely the Director of Special Projects. As the field representative of the Secretary of the Air Force, this is a reasonable assignment even where support of other services is involved. As Deputy Commander for Satellite Programs, SAMSO, it is properly placed in respect to other related Air Force resources, and the best, and most convenient, way to resolve any conflicts involving SAMSO projects, the AFSCF, and the AFWTR with the satellite reconnaissance program. From a practical point of view, it is a workable arrangement.

8. I recommend direction of the following action:

a. That both the Sunnyvale and the Longview be continued in active service as SRUs.

b. That both SRUs be designated specifically as essential units of the operational satellite reconniassance program, with their use in support of any other program contingent upon specific release from support of the satellite reconnaissance program. The full responsibility for making any such release and adjudicating any conflict should be delegated to the Director of Special Projects. Since the rationale for this action can only be explained by BYEMAN documents, it obviously cannot be explained to the various programs and non-satellite-reconnaissance personnel involved or potentially involved. Hence, it must be simple directed, as a policy matter, i.e., both the Sunnyvale and the Longview designated as exclusively in support of projects under the management of the Director of Special Projects, OSAF, unless and until he specifically releases them for support of other effort on a case-by-case basis.

c. That all maintenance and other withdrawal schedules for these ships must be coordinated with the Director of Special Projects and all modifications must have his concurrence.

d. That, consistent with the above actions, these ships be funded as part of the AFSCF. Evidently this has been considered but is presently in doubt, as evidenced by the following quote from an AFSC message of 29 Aug:

"Previous direction from DDR&E specified that beginning in FY70 the AFSCF would assume complete funding responsibility for the Longview and Sunnyvale and the budgets of the AFWTR and AFSCF for FY70 and thereafter have been structured and briefed to the Air Staff and DDR&E accordingly. * * This headquarters is in receipt of informal information that the former position of DDR&E has been reversed. This development places the future status of these ships in doubt with the possibility that either or both may be subject to deactivation in the foreseeable future. * * At the present time the entire subject is under review at the SAFRD/AF Special Projects level. You will be informed immediately upon receipt of further information. * *."

JOHN L. MARTIN, JR
Major General, USAF
Director

1 Atch
Est Avg Cost per RV

1 cy to SAFSS (Gen Berg)
w/Atch

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EXPLANATION	SAFSP ESTIMATED AVERAGE COST PER RV
GAMBIT (206) and CORONA (846)	1. [redacted] historical financial data goes back to FY 1964 only. No accumulated FY 1963 and Prior years are available. 2. Costs per RV are based on a single launch resulting in one RV for P-110 and 2 RV's for P-846.
GAMBIT (110)	1. Development costs funded for P-110 in FY 1966 and Prior and for P-467 in FY 1970 and Prior were amortized over the latest launch life of each respective program, which is FY 1974 for financial purpose. 2. Prelaunch recurring costs funded for P-110 and P-467 were amortized over the latest launch life of each respective program. 3. Prelaunch recurring Agency-Black funds for P-467 were amortized over the launch life of the program. 4. Agency - Black funds for P-467 were estimated for FY 1971-1974 at a decreasing rate since financial requirements of the Agency for these years is unknown at this time.
SHIPS:	Incremental cost to support one RV ranges from .077 to .142 from FY 1964 to FY 1974.

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IMATED AVERAGE COST PER RV ($ in Millions)

YEAR COSTS						11 Yr Total	Average Cost
FY 1969	FY 1970	FY 1971	FY 1972	FY 1973	FY 1974	Prog. Cost	per RV
0	0	0	0	0	0	$ 407.5	0
-	-	-	-	-	-	38/38	-
0	0	0	0	0	0	0	-
-	-	-	-	-	-	-	$ 10.7
175.7	206.5	192.0	177.7	177.3	177.3	$1,475.7	0
8/8	7/14	7/14	7/14	7/14	7/14	57/92	-
22.0	14.8	13.7	12.7	12.7	12.7	0	0
-	-	-	-	-	-	-	$ 23.4
-	-	-	-	-	-	-	$ 13.3
-	-	-	-	-	-	-	$ 16.0
49.3	36.2	15.4	0	0	0	$ 687.6	0
7/14	6/12	4/8	-	-	-	69/138	-
3.5	3.0	1.9	0	0	0	0	0
-	-	-	-	-	-	-	$ 4.9
0	0	380.2	374.9	356.6	353.6	$1,465.8	0
-	-	5/20	5/20	5/20	5/20	20/80	-
0	0	19.0	18.8	17.9	17.6	0	0
-	-	-	-	-	-	-	$ 18.4
22	26	42	34	34	34		
3.7	3.7	3.7	3.7	3.7	3.7		
.168K	.142K	.088K	.108K	.108K	.108K		

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