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ARMY CONCEPT TEAM IN VIETNAM
APO 143, San Francisco, California

①

① 24 June 1963,

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ACTIV-AM

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CATALOGED BY DDC

AS AD NO.

① Employment of CV-2B (Caribou) Aircraft

in Support of Counter-Insurgency Operations (U).

①

① Monthly Report, Number 3, 1963

1 April 1963 - 30 April 1963

343695

Additional
to
Contents
attached

DDC

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ARMY CONCEPT TEAM IN VIETNAM
APO 143, San Francisco, California

ACTIV-AM

24 June 1963

SUBJECT: Monthly Test Report Number 3 -- Employment of CV-28 Aircraft in Counter-Insurgency Operations, 1 through 30 April 1963 (U)

TO: See Annex O.

1. (C) General.

a. Purpose of the test.

(1) To evaluate, through field test in an active theater, the performance and effectiveness of the tactical CV-28 (Caribou) company and its component elements in counter-insurgency operations, with primary emphasis on sustained support of the Special Warfare effort, forward area helicopter refueling, and operational support of ARVN (Army of the Republic of Vietnam) combat elements.

(2) To determine modifications in organization, doctrine, tactics, procedures, techniques, and equipment of the company.

b. Test concept.

(1) Data responsive to test objectives are derived from observation of combat support operations of the 1st Aviation Company (1st AVCO). The company is assigned to the USASGV (US Army Support Group, Vietnam); it is under the operational control of COMUSMACV (Commander, US Military Assistance Command, Vietnam).

(2) Test data are collected during operational missions. The test unit is not required to engage in activities whose sole or primary purpose is production of test data.

c. Test program.

Present employment of CV-28 aircraft in the RVN precludes production of specific data required by several of the test objectives; g.g., objectives 3, 8, and 11. Special equipment to be evaluated, such as weather radar, has either not yet been made available or arrived too late for evaluation during this month's testing. The test is considered to be 50% complete.

2. (C) Description of the test unit.

a. Mission.

The mission of the Caribou company is to provide air transport to expedite tactical operations and logistical support in the combat zone. Tasks include tactical troop lift, forward area resupply, transportation of commanders and staffs, and medical evacuation.

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ARMY CONCEPT TEAM IN VIETNAM
APO 143, San Francisco, California

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24 June 1963

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c. Test progress.

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SUBJECT: Monthly Test Report Number 3 -- Employment of CV-28 Aircraft in Counter-Insurgency Operations, 1 through 30 April 1963 (U)

b. Deployment of 1st AVCO.

<u>Allocation of aircraft</u>	<u>Aircraft based at</u>	<u>Missions received from</u>	<u>USMACV operational control exercised through</u>
2 to I Corps	Da Nang	Corps TOC	J3, USMACV
2 to II Corps	1 at Pleiku	Corps aviation advisor	J3, USMACV
	1 at Nha Trang	MAAG Transportation Section	J3, USMACV
2 to III Corps	Vung Tau	Corps aviation advisor	J3, USMACV
2 to IV Corps	Vung Tau	Corps flight operations section	J3, USMACV
Balance of flyable air-planes to SEAAS (*)	Vung Tau	Combat Cargo Group, 2d Air Division	J4, USMACV

(*) Operations of the SEAAS (Southeast Asia Airlift System)

c. Statistical summary.

	<u>1-28 Feb</u>	<u>1-31 Mar</u>	<u>1-30 Apr</u>	<u>Southeast Asia totals to date</u>
Passengers	8914	9334	8821	62,876
Cargo (tons)	612	669	735	5,494
Sorties	1495	1790	1675	4,960
Flight hours:				
Service	932	1036	937	9,274
Training	40	23	26	251
Total	972	1059	963	9,525
Aircraft availability		10.9 of 16 (68%)	11.6 of 16 (72.5%)	10.9 of 16 (68%)

d. Operational summary of Corps and SEAAS for April.

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SUBJECT: Monthly Test Report Number 3 -- Employment of CV-2B Aircraft in Counter-Insurgency Operations, 1 through 30 April 1963 (U)

	Corps				Corps		Unit	
	I	II	III	IV	total	SEAS	misc flights	TOTAL
Passengers:								
Number.	1240	1606	2119	2649	7614	755	452	8821
Tons (*).	111.6	144.5	190.7	238.4	685.2	68.0	40.7	793.9
Cargo (Tons)	177.5	128.5	169.4	117.1	592.5	112.5	30.0	735.0
Sorties.	281	263	369	482	1395	178	102	1675
Weight per sortie (Tons).	1.03	1.04	.97	.74	---	1.01	---	---
Ton miles per sortie.	86.2	120.3	68.7	45.9	---	111.4	---	---

(*) Based on passenger weight of 180 pounds.

3. (C) Content and format of report.

a. Content.

Previous monthly reports give background and operational information on the 1st AVCO and outline command relationships under which it functions in the RVN. Most of this will not be repeated here or in later reports. Monthly reports are intended to indicate progress and to provide for an orderly collection of data to be included in the final test report. All monthly reports should be consulted for full background of test activities to date.

b. Format.

Tab A through M cover the 13 test objectives. Tab N illustrates damage to CV-2B by insurgent ground fire. Distribution of the report is shown at Tab O.

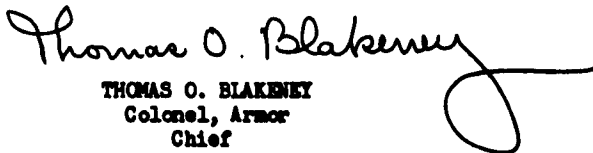
4. (U) References.

a. DA letter, AGAM-P(M) 381 (31 Oct 62) DCSOPS, subject "Army Troop Test Program in Vietnam (U)," 6 November 1962, as amended.

b. ACTIV letter, subject: "Test Plan for the Tactical Transport FW/LT AC-1 (Caribou) Company," 2 November 1962.

c. CINCPAC message, DTG 070506Z Jan 63, subject: "Test Plan for the Tactical Transport FW/LT CV-2B (Caribou)."

d. USACDC message, SDEG-DO S-138 DTG 131855Z March 1963.


 THOMAS O. BLAKENEY
 Colonel, Armor
 Chief

15 Incl
list on next page

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SUBJECT: Monthly Test Report Number -- Employment of CV-28 Aircraft in Counter-Insurgency Operations, 1 through 30 April 1963 (U)

LIST OF INCLOSURES

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2. (Tab B) ANNEX B -- Objective 2 (Short field operations).
3. (Tab C) ANNEX C -- Objective 3 (Detached platoon operations).
4. (Tab D) ANNEX D -- Objective 4 (Control of airspace).
5. (Tab E) ANNEX E -- Objective 5 (Command relationships).
6. (Tab F) ANNEX F -- Objective 6 (Navigational equipment).
7. (Tab G) ANNEX G -- Objective 7 (Cargo delivery by "Snatch-and-Go").
8. (Tab H) ANNEX H -- Objective 8 (Support of airborne operations).
9. (Tab I) ANNEX I -- Objective 9 (Helicopter refueling).
10. (Tab J) ANNEX J -- Objective 10 (Weather-avoidance radar).
11. (Tab K) ANNEX K -- Objective 11 (Airborne command post).
12. (Tab L) ANNEX L -- Objective 12 (Logistical support requirements).
13. (Tab M) ANNEX M -- Objective 13 (Medical evacuation)
14. (Tab N) ANNEX N -- Ground fire damage, CV-28 aircraft.
15. (Tab O) ANNEX O -- Distribution

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ACTIV-AM
Monthly Test Report Number 3 -- Caribou

ANNEX A -- Objective 1 (Support of the Special Warfare effort)

1. (C) Objective.

To determine the capability of the CV-2B Caribou company to air drop and support Special Warfare Teams requiring flights during daylight and darkness.

2. (C) Discussion.

a. Statistical data listed in Tab A-1 shows 16 tons transported by CV-2B for I Corps Special Forces Teams in April as compared to 29 tons for March. A lull in Special Forces construction appears to account for this decrease. Five camps (Da Nang, Khe Sanh, Hoa Cam, Phu Hoa, and Tra My) were completed during this period; construction has not yet begun at new locations. ARVN requirements for CV-2B support in April also were abnormally high -- particularly for shuttling ammunition to forward field locations -- and reduced the availability of I Corps direct support Caribous for support of Special Forces.

b. No Special Forces personnel air drop missions were conducted during this period.

3. (U) Findings.

None.

TAB A

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TAB A

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I. CV-28 Support to Special Forces

(a) By Southeast Asia Airlift System (II, III & IV Corps areas only)

- (1) Passengers - 755
- (2) Cargo (Tons)- 112.5
- (3) Sorties - 178

(b) Direct Support to Special Forces in I Corps only. (Exclusive of SEAAS)

- (1) Passengers - 113
- (2) Cargo (Tons)

Airlanded	9.5
Airdropped	<u>6.9</u>
Total	16.4
- (3) Sorties - 27

II. Total Special Forces Support by CV-28 (Paragraph A & B above)

- (1) Passengers - 868
- (2) Cargo (Tons) - 128.9
- (3) Sorties - 205

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Monthly Test Report Number 3 -- Caribou

ANNEX B -- Objective 2 (Short field operations)

1. (C) Objective.

To test the capability of the CV-2B Caribou company aircraft to operate from airfields and locations with reduced runways, unimproved surfaces and approaches, and under varying weather conditions, day or night.

2. (C) Discussion.

a. The graph at Tab B-1 is based on a comparison of airfield use by the CV-2B and the C-123 in support of Special Forces under the SEA Airlift System. Although this example is restricted in scope, it appears to illustrate best how aircraft mission assignments are made by Joint Air Operations Center JAOC based on the operational limitations or capabilities of the U.S. Army and USAF aircraft resources in the SEA Airlift System. (See para 2a Annex A, March Caribou Report for discussion of how these aircraft assignments are made). The graph represents approximately four C-123's and one CV-2B flying daily in support of Special Forces in February, March, and April.

b. Although the one CV-2B comprised approximately one-fourth the aircraft resources, it made more total landings than the four C-123's at airstrips less than 5000 feet in length. The four C-123's exceeded the one CV-2B in overall landings by thirty-two -- 184 C-123 total landings at airstrips under 10,000 feet compared to 152 for the CV-2B. This demonstrates the practice of using the CV-2B for multiple-sortie type missions, generally for delivery of light loads (less than 5000 lbs) to Special Forces field locations.

c. The graph shows little use by the C-123 of airstrips below 2000 feet (24 landings in this category compared to 52 for the CV-2B). Four C-123 landings were made at strips less than 1500 feet and none at strips less than 1300 feet compared to sixteen and eight in these respective categories for the CV-2B.

d. Above the 2000 foot length, frequency of landings of the two aircraft generally parallel each other, intersecting only beyond the 5000 foot length. This fact illustrates extensive use of the CV-2B in areas where its short take-off and landing (STOL) capabilities are not exploited.

e. The comparison will be expanded to the general case of C-123 and CV-2B use for all purposes in Vietnam as soon as complete data on C-123 landings become available.

3. (C) Findings.

a. Support of Special Forces under the SEA Airlift System demonstrates a more extensive use of all airfields under 4000 feet in length by the CV-2B than by the C-123.

b. Caribou's STOL characteristics permit it to use a portion of the spectrum of airfields at Special Forces field locations not served by the C-123. This generally includes those fields less than 2000 feet in length.

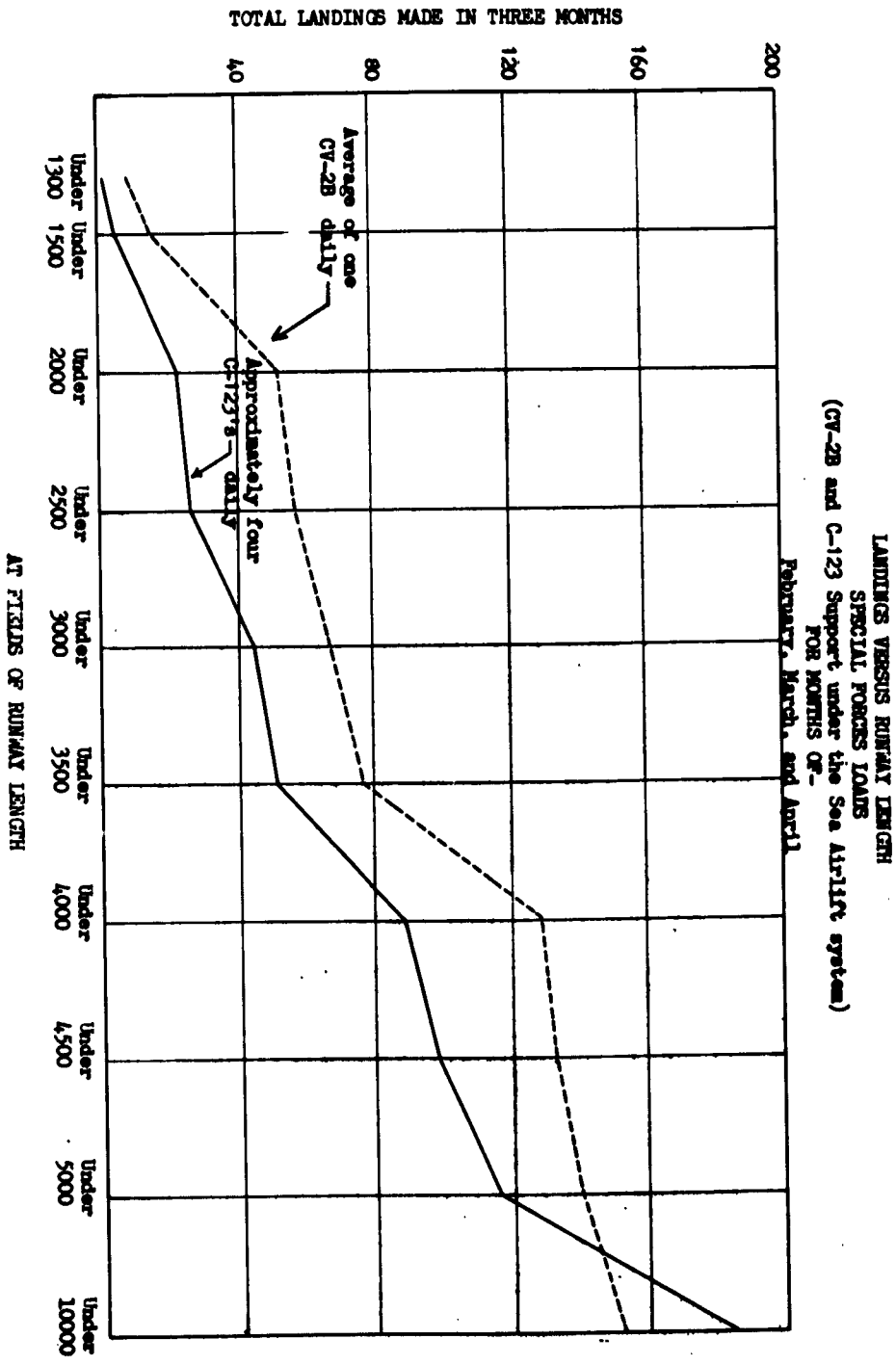
c. The airlift system makes extensive use of the CV-2B at fields greater than 2000 feet in length where its STOL characteristics are not required.

TAB B

TAB B

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Monthly Test Report Number 3 -- Caribou



TAB B-1

TAB B-1

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ACTIV-AM
Monthly Test Report Number 3 -- Caribou

ANNEX C -- Objective 3 (Detached platoon operations)

1. (C) Objective.

To determine the capability of the CV-2B Caribou Company to support tactical operations requiring platoons to operate away from base airfields to include security requirements, logistical support, communications, maintenance, and administration.

2. (C) Discussion.

There has been no change in CV-2B method of employment since the beginning of the test. Present method of employment is as discussed in Monthly Test Report Number 1.

3. (U) Findings.

None.

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ACTIV-AM

Monthly Test Report Number 3 -- Caribou

ANNEX D -- Objective 4 (Control of airspace)

1. (C) Objective.

To determine the most efficient method of controlling air space where the CV-28 Caribou Company must operate in support of tactical operations, considering allocation of altitude, arrival and departure from base fields, movement over the tactical forces, and landing or airdropping in the forward areas.

2. (U) Discussion.

No significant data were developed during this period.

3. (U) Findings.

None.

TAB D

TAB D

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ACTIV-AM
Monthly Test Report Number 3 -- Caribou

ANNEX E -- Objective 5 (Command relationships)

1. (C) Objective.

To determine the appropriate command relationships of the CV-2B Caribou company in support of tactical operations.

2. (C) Discussion.

The following summary of actions and events is intended to bring the reader abreast of developments which are expected to influence materially the command relationships of CV-2B units in the RVN.

a. MACV staff estimate of airlift requirements. Late in 1962, the MACV staff estimated that there would be a sharp increase in requirements for Caribou aircraft in the SEAAS to support a nearly four-fold step-up in intensity of RVNAF operations early in 1963. This estimate was accompanied by an assumption that stepped-up RVNAF operations would cause a reaction by the Viet Cong resulting in significant interruptions to the road and railroad network, thereby necessitating much greater dependence on airlift to provide logistical support to the National Campaign Plan. Based on this estimate and assumption, a request for additional airlift, including a second Caribou company was made to CINCPAC. CINCPAC approved the proposal for the additional company but expressed the view that it, and the 1st AVCO as well, should be placed under the SEAAS for operational control. The JCS approved the request without reference to how the Caribou would be controlled. The second Caribou company is scheduled for arrival in the RVN in June 1963.

b. Revision of the previous estimate. Recently, the MACV staff made a downward revision on the predicted acceleration of RVNAF activity. While the need for the second Caribou company was unaffected by this revision, it became apparent that the need, stated earlier, for higher than normal flying-hour rates, would not be necessary. If the assumption concerning severance of surface communication was borne out, a stepped-up rate could be implemented at that time.

c. Increased role of the direct support Caribou.

(1) Meanwhile, a new aspect of ARVN operations has begun to place an increased demand on Caribou lift. ARVN units have launched extensive "clear-and-hold" operations deep into Viet Cong territory. Typical of such operations is the establishment of an ARVN operational base at Rang Rang, a village nearly in the center of the notorious Zone "D" -- an area of approximately 1800 square miles -- occupied by hard-core Viet Cong units. In mid-April, ARVN engineers, accompanied by infantry and armor, forced their way into this former VC safe-haven and hastily prepared an airstrip where additional supplies and troops could be airlanded. Caribou supporting III Corps were landed at Rang Rang on 1 May -- 19 days after construction of the strip had begun. III Corps not only plans to stay at this location but to move to a second and then additional locations; in this manner expanding and consolidating its control over the entire area. The success of this type of operation is dependent in large measure on the assured availability of Caribou to resupply and reinforce these isolated, newly developed locations. If the ratio of engineers to clear-and-hold troops becomes greater than at present these Caribou strips can be improved to accommodate C 123's. If the ratio stays the same the engineers can either improve the Caribou strips or move on to new locations to develop new strips. In either event, the Caribou permits the maximum exploitation of the limited capabilities of engineers to

TAB E

TAB E

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Monthly Test Report Number 3 -- Caribou

ANNEX E -- Objective 5 (continued)

prepare new strips. There is a strong possibility that this pattern will be extended to the Do Xa area in II Corps following the current monsoon season.

(2) ARVN Corps commanders and their US advisors have recently become more aware of the possibility of solving forward area helicopter refueling problems by use of CV-2B's (as discussed in ANNEX H). There have been two instances within the past month where US advisors reported that the delivery of fuel to forward areas could have been used to good advantage. The first would have enhanced the capability of surprise by obviating the requirement for prior stockage of fuel in a forward area. The second would have made it possible to carry out an operation on schedule. Lengthy delays occurred as a result of the failure of a civilian contractor to deliver fuel to a forward base.

(3) A significant change in the character of logistic support has been taking place as a result of the implementation of the plan to place heavier reliance on sealift to support the National Campaign Plan. Five primary seaports have been designated "first" destination supply points. To these locations, Landing Ship Tanks (LST's), augmented as necessary by aircraft, are commencing to deliver, from Saigon, the bulk of the tonnage required in support of each ARVN Corps. From each of these "first" destination locations, ground and air means are to deliver supplies inland to "second" destination locations. At second destinations the tonnage will be broken into lighter loads for light aircraft and helicopters for delivery to units at "third" destinations. This movement of supplies is basically a north-south movement to and from first destinations and an east-west movement to second, third and final destinations. The object appears to be to have LST's carry the major loads moving in the north-south direction with airlift on this axis restricted to high priority, emergency, and perishable loads. Logically the C123 and C47 aircraft are ideally suited for this type of lift, the Caribou being used on this axis as necessary, to handle quick-response, smaller loads, or for direct delivery from Saigon to locations where short runways or soft landing field conditions make it infeasible to use other aircraft. In this event the Caribou could bypass the first destination, operating directly from Saigon to the second, third or fourth destination. Releasing all Caribou from this first-designation run would not only maximize the capabilities of this aircraft for logistical purposes, but at the same time would make it available for the purpose for which the Army bought the aircraft; i.e., to meet the increasingly larger demands for its use as a tactical vehicle. Direct control of the Caribous by the senior Corps advisors would appear to be the best method of employment to permit the maximum flexibility and effectiveness of the Caribous available.

3. (C) Finding.

The provision of sea and heavier air lift for first destination runs, and the increased demands for direct support Caribou to support Corps operations and provide second, third, and fourth destination runs, point to the use of CV-2B's in direct support of the several Corps.

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Monthly Test Report Number 3 — Caribou

ANNEX F — Objective 6 (Navigational equipment)

1. (C) Objective.

To determine the appropriate navigational equipment, both in the aircraft and on the ground, which will provide positive locations as needed.

2. (C) Discussion.

a. No data were collected during the period 1 - 30 April.

b. Installation of a Ryan RYANAV IV-4 V-P doppler navigational system in a YCV-2 aircraft assigned to the OSD/ARPA field unit was initiated on 24 April. It is estimated that installation of the doppler equipment will take four to six weeks. ACTIV will observe OSD/ARPA tests on this system. Any data considered pertinent to this objective will be discussed in later reports.

c. Fourteen sets of TAPS (Tactical Air Positioning System) DECCA Mark VIII navigational equipment are now being installed in 12 CH-21 and two UH-1 helicopters. Testing of this equipment is scheduled to start on 1 May. Results that can be correlated to CV-28 operations will be discussed in later reports.

d. (U) Findings.

None.

TAB F

TAB F

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ACTIV-AM
Monthly Test Report Number 3 -- Caribou

ANNEX G -- Objective 7 (Cargo delivery by "Snatch-and-Go")

1. (C) Objective.

To determine the capability of the CV-2B Caribou aircraft to deliver loads through use of the "snatch-and-go" delivery technique to areas which prohibit landing, to include determination of the proper altitude for contact with the ground mechanism, length of cleared area needed, and characteristics of minimum approach obstacles.

2. (U) Discussion.

Evaluation of this objective has been suspended pending modifications in the U.S. (to meet safety requirements) of the All American Model 24A Ground Based Air Delivery System.

3. (U) Findings.

None.

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Monthly Test Report Number 3 -- Caribou

ANNEX H -- Objective 8 (Support of Airborne Operations)

1. (C) Objective.

To determine the capability, coordination, logistical implications, communications, and maintenance required to support an airborne battalion operation, to include initial drop or air landing, resupply for 3 to 5 days, and pick-up and redeployment.

2. (U) Discussion.

3. (U) Findings.

None.

TAB H

TAB H

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Monthly Test Report No. 3 — Caribou

ANNEX I — Objective 9 (Helicopter refueling support)

1. (C) Objective.

To determine the capability of CV-2B Caribou aircraft to furnish a refueling capability for use by helicopters, to include determination of maximum fuel load, application of internal fuel container and pumping system, number of helicopters which can be refueled simultaneously, and extension of helicopter radius action.

2. (C) Discussion.

a. On 6 April 1963 ten sets of POL dispensing equipment, which are to be tested with the CV-2B, arrived in the RVN. With the receipt of this new equipment (e.g., 50 gallon-per-minute pump, Gorman-Rupp, electrically operated; Bendix "Go-No-Go" gage; 160 feet of 1½ inch discharge hose; 35 feet of 1½ inch suction hose and miscellaneous equipment), the preliminary ground tests of the substitute system were halted and tests initiated on the new equipment.

b. During this reporting period phase I of the helicopter refueling test concept has been completed (Tab I, Caribou Monthly Test Report Number 2). Results are outlined in subsequent paragraphs.

c. Phase I

(1) Two collapsible tanks, one 50 gpm pump, and two 160 foot sections of hose were set up on the ground for testing (See photos, Tab I-1). The tanks were connected in series so that they could be discharged either simultaneously or individually. The two discharge hoses were connected to separate discharge ports to simulate refueling two helicopters simultaneously. The following data were gathered:

(a) The collapsible tanks were filled directly from an M49C tank truck in nine minutes. Since weight calculations indicate that the CV-2B will only be able to carry a maximum of 550 gallons of AVGAS for helicopter refueling operations, only this amount was put into the tanks. (see Tab I-2). One 40 foot section of discharge hose was connected from the outside filter on the tank truck directly to the "Tee" on the suction side of the 50 gpm pump, thereby bypassing the pump during the fill operation.

(b) Pumping the product directly from an M49C (or an M131A3) tanker is particularly advantageous since the AVGAS is filtered and accurately metered before entering the collapsible tanks. Filtering reduces the chance for contamination prior to entering the helicopter.

(c) To further purify the fuel on the discharge side of the pump a newly developed filter called the Bendix "Go-No-Go Gage" is employed (See photos Tab I-1). This gage is a quality control device made up of an aluminum case, with removable end cover, which contains five filter elements. It may be used with AVGAS, JP-4, or MCGAS at the rate of 50 gpm. When dirt or water is present in the system, the flow is reduced. If contamination increases to an unacceptable level, the system will automatically cease to function and replacement of the contaminated elements is required. An additional filtering effect is provided by a wire mesh screen contained in the refueling discharge nozzle.

TAB I

TAB I

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Monthly Test Report No. 3 — Caribou

ANNEX I — Objective 9 (continued)

(d) For easier M49C adaptation to filling collapsible tanks, the discharge port of the tanker's external filter was modified with a brass Tee connection and a female quick coupling device, (See photos Tab I-1). This allows the tanker's organic discharge hose to be permanently connected and the discharge hose of the portable POL system to be quick-coupled into the filter whenever the collapsible tanks are to be filled.

(e) The discharge side of the pump was modified with the Tee included in the pump kit so that two discharge hoses could be attached at the same time to allow simultaneous refueling of two helicopters. The Tee connection supplied with the system is not designed for this purpose.

(f) During ground tests, 550 gallons of fuel were discharged from the collapsible tanks in 14 minutes. The rate of discharge was comparable whether the tanks were emptied one at a time or simultaneously.

(g) As indicated in the March report, a design deficiency in the 500 gallon collapsible tank prevents dispensing the last 25 gallons of fuel. Greater efficiency could be attained by addition of an internal suction device to force all fuel from the tank.

(2) There are three features of the electrical system which should be considered for modification by the Quartermaster Research and Engineering Command, Natick, Massachusetts. These are described in detail in TAB I-3.

(3) Equipment weight and attendant problems:

(a) On page 2, TAB I-2 is a list of the POL dispensing and allied equipment required to operate the CV-2B as a refueling vehicle. The weight of this equipment is 1609 lbs.

(b) 1st AVCO is now installing cockpit protective armor and self-sealing fuel tanks in its CV-2B aircraft. Armor protection for the air crew seats weighs 254 pounds. The self-sealing wing fuel tanks add another 280 pounds to the weight of the aircraft.

(c) Combined weight of POL dispensing and allied equipment, armor protected seats and self-sealing tanks reduce the net allowable weight for the CV-2B to 5,087 lbs (See page 1, TAB I-2). This weight must be apportioned between fuel required for range and the amount of fuel required for a helicopter refueling mission. Page 1, TAB I-2 lists weight considerations for the CV-2B when used for the helicopter refueling mission. Page 3, TAB I-2 lists the CV-2B range - payload considerations for the same mission.

(d) The average helicopter fuel requirement during tactical operations has been found to be approximately 100 - 150 gallons per helicopter. With a maximum of 548 gallons of fuel to be carried in the POL refueling system by one CV-2B, only four or five helicopters could be refueled per Caribou. Unless dispensing equipment, armor, and accessories can be made lighter, considerations of cost/effectiveness in Caribou POL delivery may require reappraisal of this concept.

(e) The 500 gallon collapsible tanks present the greatest weight problem (520 lbs). These should be replaced with a lightweight tank,

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Monthly Test Report No. 3 -- Caribou

ANNEX I -- Objective 9 (continued)

weighing no more than 100-150 pounds, with internal baffles to resist surge. Payload and range penalty resulting from weight of the present POL system is shown in Page 3, Tab I-2.

(f) Discharge hose furnished with the new dispensing system weigh approximately one pound per foot (41 lbs per 40 ft. section). This weight could be reduced by substituting a collapsible hose which would be substantially lighter and much easier to handle.

(g) The Army Tactical Mobility Requirements Board (Howse Board) tested a POL system in which the fuel was dispensed from 500 gallon collapsible fuel cells, under pressure furnished by a lightweight nitrogen pressure tank. This system weighs considerably less than the present system and should be considered when a study is made for lighter systems.

(4) A special equipment test was conducted in April to determine the vulnerability of the 500 gallon collapsible tank against small arms fire. One collapsible tank was placed inside the hull of a salvaged H-21 helicopter and filled with AVGAS. The tank within the helicopter hull was subjected to M1 and M14 rifle ball and tracer ammunition to determine the possibilities of fire or explosion if a tank were hit by insurgent fire during flight or ground refueling operations. No fires or explosions occurred. Detailed results of this test are listed at Tab I-4.

d. Phase 2

A CV-2B has not been made available for conduct of tests in this phase.

3. (C) Findings.

a. The most efficient way to fill the 500 gallon collapsible fuel cells mounted in CV-2B aircraft is to fill them directly (bypassing their 50 gpm pump) from the M49C (or M131A3) tank truck.

b. The M49C tank truck pump can deliver 550 gallons of AVGAS to the 500 gallon collapsible fuel cells in nine minutes. Approximately 550 gallons of fuel can be discharged from the tanks in 14 minutes using the 50 gpm electric pump.

c. The 50 gpm pump can be adapted to connect two discharge hoses for simultaneous refueling of two helicopters. The present adaptor is not satisfactory and should be replaced.

d. The 500 gallon collapsible fuel cell should be modified to include an internal suction device so that all of the fuel can be discharged.

e. The 50 gpm pump has as its power source the 28V DC external receptacle on the CV-2B. Modification of the pump's electric circuitry would allow it to be operated from the Caribou's internal 24V AC power system.

f. The overall weight of the POL dispensing system is excessive. Weight of the major components (fuel tanks, the pump, the electric power cable, and the discharge hose) must be reduced before the system can be considered satisfactory.

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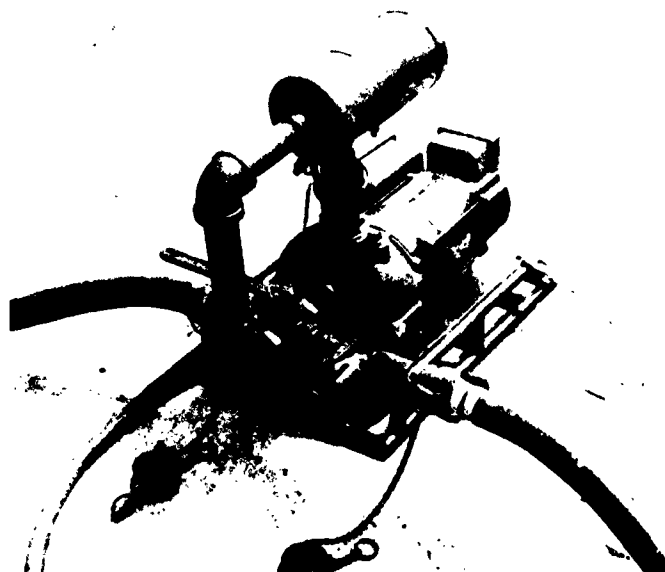
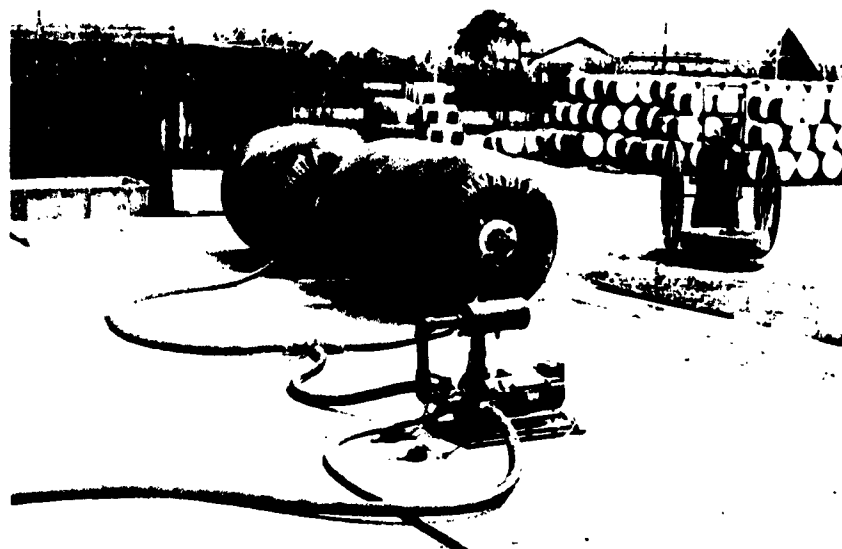
ANNEX I -- Objective 9 (continued)

g. Installation of air crew protective armor and self-sealing fuel tanks add 534 pounds to the empty weight of the CV-2B.

h. Additional weight of the aircrew protective armor and PUL dispensing equipment reduces the AVGAS refueling payload to 548 gallons. This amount of AVGAS can refuel only four to five helicopters.

i. A 500 gallon collapsible fuel cell sustained 24 hits from both M1 and M14 ball and tracer ammunition without fire or explosion.

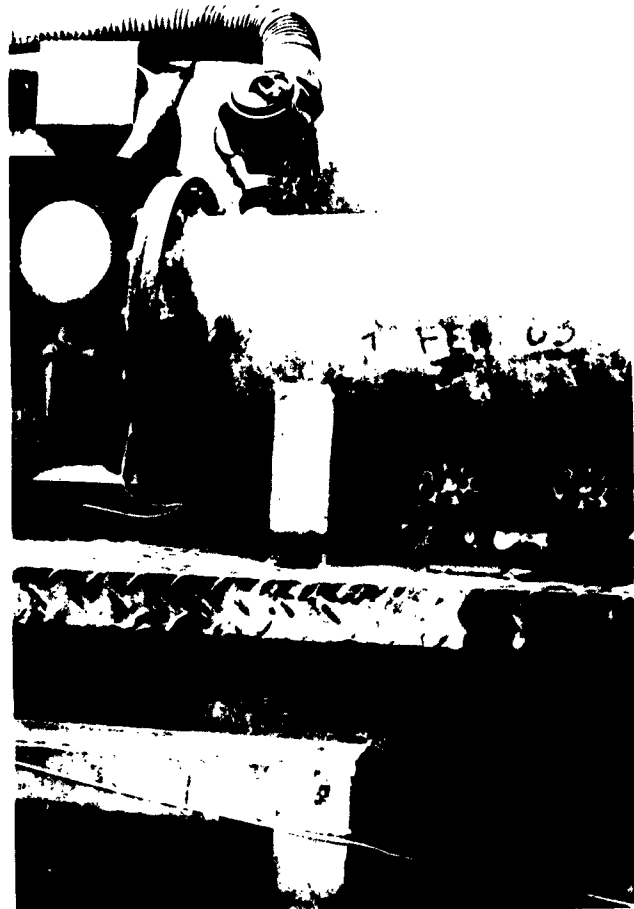
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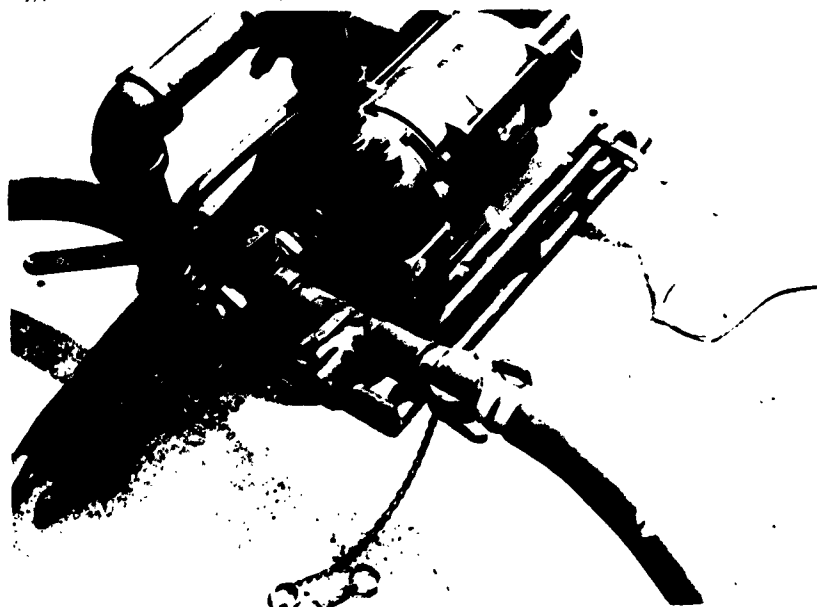
Monthly Test Report

Appendix 1 to the



1470 tank test. The test was conducted with a male and female quick coupling device to allow for a quick change of one 4 foot section of 1 1/2 inch discharge hose, when filling the tank with water.

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 10/10/41
 10/10/41



10/10/41
 10/10/41



10/10/41
 10/10/41

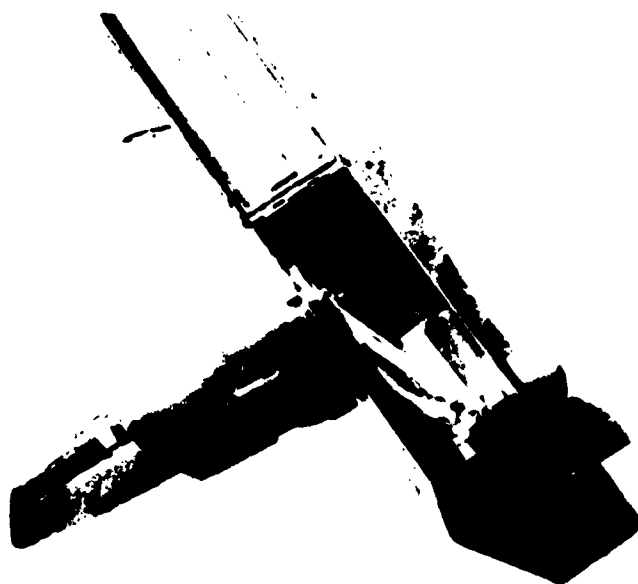




Fig. 1.2. While drawing from
the power source.



Fig. 1.3. While drawing from
the power source.

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Appendix 2 to ANNEX I -- Objective 9

SUBJECT: Total weight of CV-2B and Aviation Fuel which may be carried.

Aircraft weight (includes parachutes & survival gear)	20,200 lbs.
Crew (@200 lbs)	800 lbs.
Armored crew seats (2 ea)	254 lbs.
Self-sealing fuel tanks*	280 lbs.
POL dispensing and allied equipment (see page 2)	1,609 lbs.
Aircraft engine oil	<u>270</u> lbs.
Total	23,413 lbs
CV-2B maximum allowable gross weight	28,500 lbs.
Total weight of A/C, crew, POL equipment, etc.	<u>23,413</u> lbs.
Total weight of A/C, fuel, and fuel payload which can be carried	5,087 lbs. (848 gals)

EXAMPLE.

Fuel load required to maintain A/C for 2 hrs. plus 30 minutes reserve	1,800 lbs. (300 gals)
Fuel than can be carried for helicopter refueling	3,287 lbs. (548 gals)

*Addition of self-sealing fuel tanks reduces CV-2B fuel capacity by 660 lbs. (110 gals) and endurance by approximately one hour.

TAB I-2

TAB I-2

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Appendix 2 to ANNEX I -- Objective 9

SUBJECT: Total weight of POL dispensing and allied equipment required for helicopter refueling operations.

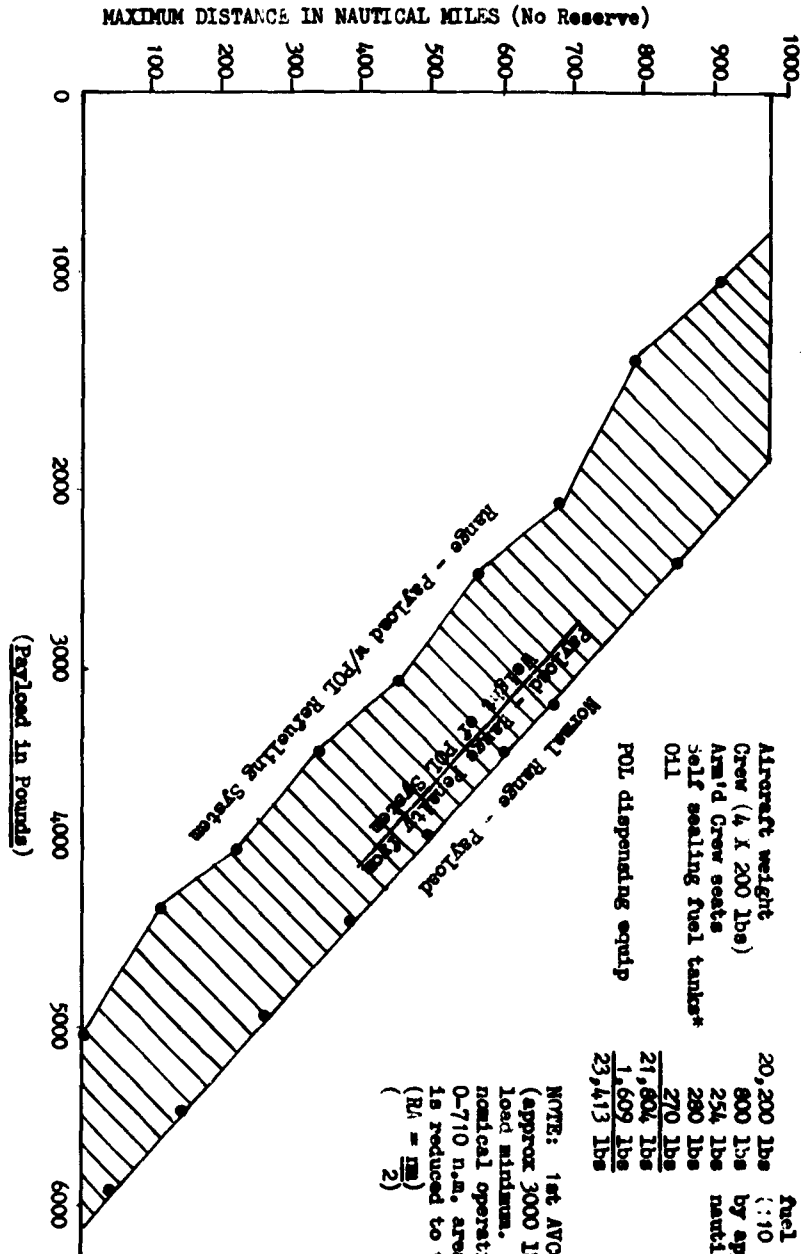
2 ea. Drum, collapsible, 500 gal. @ 260 lbs.	520 lbs.
2 ea. Pallets, plywood* @ 60 lbs.	120 lbs.
1 ea. Pump, Gormann-Rupp, 50 gpm	120 lbs.
Cable, electric, 28V DC	56 lbs.
8 ea. Hose, discharge, 1½ in. @ 41 lbs.	328 lbs.
Hose, suction, 1½ in.	34 lbs.
2 ea. Nozzle, 1 in. @ 5 lbs.	10 lbs.
Ground	11 lbs.
6 ea. Roller conveyor* @ 50 lbs.	300 lbs.
Tie-downs, webbing, straps, etc.	20 lbs.
2 ea. Fire extinguishers @ 45 lbs.	90 lbs.
Total weight of POL dispensing and allied equipment -	1,609 lbs.

*Pallets and roller conveyors are required as indicated in a test report of the Airborne, Electronics, and Special Warfare Board, Project number 1363, subject "Operational Evaluation of Air Transport of Gasoline in Drum, Fabric, Collapsible, Liquid Fuel, 500 gallon Capacity (Non-vented), in CV-2 (Caribou) Aircraft," dated 5 April 1963.

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(Normal cruise - 2000 rpm, 32.5" manifold pressure, 5000 ft altitude, 669 lbs fuel per hr)

DISTANCE VS PAYLOAD - CV-2B

Max gross wt: 28,500-
23,413 are table for self
fuel & payload 5,087 lbs

*Addition of self-sealing
fuel tanks reduces CV-2's
fuel capacity by 660 lbs
(110 gals) and endurance
by approx 1 hour or 150
nautical miles

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Monthly Test Report No. 3 -- Caribou

Appendix 3 to ANNEX 1 -- Objective 9

SUBJECT: Modifications to Electrical System

The three modifications to the electrical system which should be considered by the Quartermaster Research and Engineering Command, Natick, Massachusetts, are:

1. An adaptor to provide simultaneous refueling of two helicopters. Power to operate the dispensing system must be provided by an auxiliary power unit (APU) whenever a CV-2B is not available. The 50 gpm pump's electrical cable has a female plug suitable for connection to the 28 volt direct current external receptacle on the CV-2B. But the APU has the same type of female plug as the 50 gpm pump's electrical cable. Therefore, in order to supply power from the APU it is necessary to devise two male plugs to complete a connection between the two female plugs. An expedient, but temporary solution was found by mounting two male receptacles back to back on opposite sides of a 30 calibre ammunition box (see photos Tab I-1).

2. A modification to the 50 gpm pump allowing it to be operated from the Caribou's 24V AC internal power source. The 50 gpm pump was designed for the CV-2B 28V DC power source. The cable must be connected to the APU power receptacle located on the outside of the aircraft. This method of operation is considered potentially dangerous when the system is operated during rainy periods or when water is standing on the runway.

3. Electrical cable and junction boxes should be made lighter. The present weight of electrical cable and battery-control box for the 50 gpm pump is 56 pounds. The cable is 50 feet long. Twenty-five feet of cable is adequate for refueling operations. Cable and battery-control box weight should be reduced by one-half. The heavy cast aluminum electric junction box on the side of the pump also should be reduced in weight.

TAB I-3

TAB I-2

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Appendix 4 to ANNEX I -- Objective 9

Equipment Test: Effect of small arms fire against the 500 gal. collapsible fuel tank placed inside the hull of a salvaged aircraft, and the results derived: Photographs follow.

1. M14 rifle at 250 yds. distance:
 - a. Test - Two rounds of 7.62mm tracer ammunition fired slow-fire.
 - b. Results - One hit in tank; penetration of one side only; very small leak.
2. M1 rifle at 250 yds. distance:
 - a. Test - Four rounds of .30 cal ball ammunition fired slow-fire.
 - b. Results - Three hits; one complete penetration of tank; one ricochet which tore hole one inch long; other holes almost sealed.
3. M14 rifle at 250 yds. distance:
 - a. Test - Four rounds of 7.62mm ball ammunition fired slow-fire.
 - b. Results - Three hits; one ricochet; 1½ inch hole near bottom of tank; fuel discharged at approximate rate of 2 - 3 gallons per minute.
4. M14 rifle at 250 yds. distance:
 - a. Test - Four rounds of 7.62mm tracer ammunition fired slow-fire.
 - b. Results - Three hits; one large hole; approximately 2 gallons fuel per minute discharged.
5. M14 rifle at 150 yds. distance:
 - a. Test - Twenty rounds of 7.62mm tracer ammunition fired in 4-6 round bursts.
 - b. Results - Several hits (not counted); most holes leaked slightly; larger holes continued to discharge fuel rapidly.
6. M14 rifle at 100 yds. distance:
 - a. Test - Twenty rounds of 7.62mm tracer ammunition fired in 4 - 6 round bursts.
 - b. Results - Same as for test #5.
7. Overall results:
 - a. A total of 24 rounds penetrated the fuel tank (21 remained inside) during this test. No fire or explosion occurred.

TAB I-4

TAB I-4

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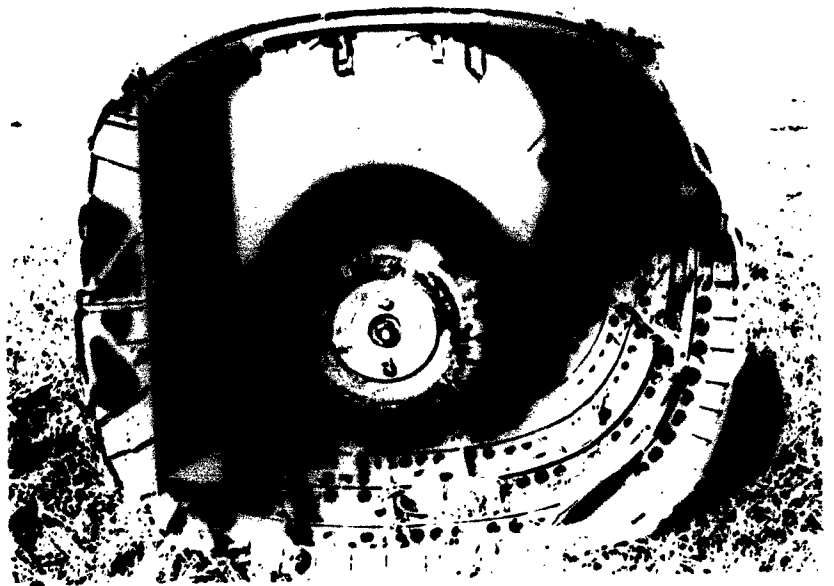
Monthly Test Report No. 3 -- Caribou

Appendix 4 to ANNEX I -- Objective 9 (continued)

b. The fuel tank could not be repaired due to the extensive damage sustained during this test.

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Monte Carlo Report No. 2



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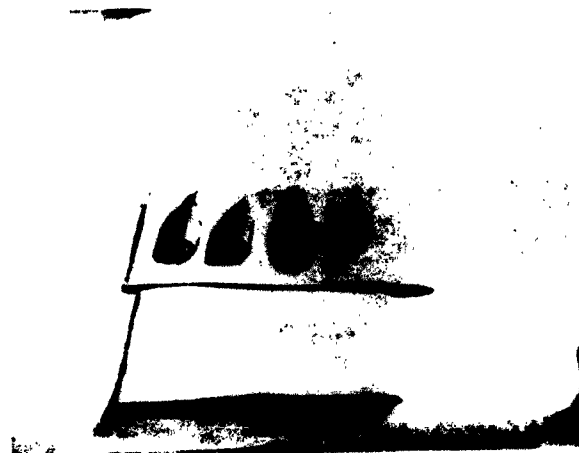


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Report No. 2 -- Caribou
to Air Force I -- Objective 9 (continued)



from the inside of the 500 gal. collapsible tank.
and the two in the center are tracer.



All (21) of the tanks which remained inside the 500 gal. collapsible tank.

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Monthly Test Report Number 3 -- Caribou

ANNEX J -- Objective 10 (Weather-avoidance radar)

1. (C) Objective.

To determine the capability of the CV-2B (Caribou) aircraft to operate under adverse weather conditions utilizing weather radar.

2. (U) Discussion.

Five sets of the Collins WP-103 airborne weather avoidance radar will be available for testing in Caribou aircraft in July. Results will be reported as obtained.

3. (U) Findings.

None.

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Monthly Test Report Number 3 -- Caribou

ANNEX K -- Objective 11 (Airborne command post)

1. (C) Objective.

To determine the feasibility of installing an airborne CP for control of combined air-ground operations.

2. (C) Discussion.

a. There were no operations in April involving the aerial command post mounted in the CV-2B aircraft.

b. Design and fabrication of the communications system described in Monthly Test Report No. 2 continues. This system should be operational in May.

3. (U) Findings.

None.

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Monthly Test Report Number 3 -- Caribou

ANNEX L -- Objective 12 (Logistics support requirements)

1. (C) Objective.

To determine the logistic support requirements of the CV-2B Caribou Company to include air base facilities, supply levels, personnel and equipment, POL personnel and equipment, and other support requirements

2. (C) Discussion.

a. Personnel.

(1) Fourteen replacement aviators have been assigned to the 1st AVCO. A program for area and operational familiarization of replacement personnel is under way, conducted by experienced instructor pilots. This training is conducted concurrently with operational missions and includes flights in both mountainous and delta terrain. Twelve aviators including the company commander have returned to the United States. The new commanding officer was assigned on 20 April 1963.

(2) Enlisted aircraft mechanic replacements, although MOS-qualified through service schooling, have not had sufficient practical experience in maintaining the CV-2B aircraft. It is estimated that 60 days will be required to train these mechanics.

(3) Unless experienced CV-2B crew chiefs (MOS 672.30) are assigned as replacements for those departing, a major problem will develop in both the maintenance and operational areas. Employment of the CV-2B aircraft in direct support of ARVN Corps away from the base airfield, requires the crew chief to work without direct maintenance supervision. Approximately three months are required to train an inexperienced mechanic as a crew chief.

(4) The 70th Transportation Detachment arrived on 7 April. Members of the detachment are MOS-qualified but lack practical experience in maintaining the CV-2B aircraft. In the opinion of the detachment commander, his maintenance personnel are approximately 65% effective. He estimates that an additional 30 days of on-the-job training will be required to gain the experience necessary to assume the detachment mission. There will be sufficient time for such training while the detachment awaits the arrival of its TOE equipment which is scheduled for 14 May 1963. Mechanics are trained by reinforcing the 1st AVCO service platoon under supervision of experienced maintenance personnel.

(5) Data compiled to date regarding the adequacy of the number of aviators authorized by the TOE is shown on appendix 1 (Tab L-1). Collection of data will continue and findings will be published in the final report.

b. Aircraft maintenance and supply

(1) Two CV-2B aircraft were damaged on landings in April:

(a) On 1 April 1963 at Ben Tre a strut (lower strut, machined leg, Part No. 5768-5) failed on the left main landing gear of a CV-2B. As a result of the strut failure the left main gear folded, causing major damage to the engine, propeller, wing, nose wheel, and fuselage (see Tab L-2). An accident board determined the primary cause for the accident to be the

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REF ID: A6

Monthly Test Report Number 3 -- Caribou

ANNEX L -- Objective L2 (continued)

failure of the drag strut. Contributing factors were: a cross-wind; rutted runway; and touchdown short of the runway. There were no injuries to the crew or the 13 passengers. The aircraft was evacuated on 28 April to Saigon where it will be repaired under civilian contract (Air Vietnam).

(b) On 9 April 1963, a CV-2B struck the rotor blades of two parked CH-21 helicopters with its left wing while landing at the Bac Lieu airstrip. After minor repair of the two outboard flap hinges, the Caribou was cleared by the 1st AVCO maintenance officer for a one-time flight to the base airfield. There were no injuries. No photographs were taken of this accident.

(2) All 1st AVCO CV-2B aircraft were temporarily grounded on 1 April 1963, as a result of the landing gear strut failure discussed above. After thorough inspection of the landing gear struts on the company's remaining CV-2B aircraft the restriction was lifted. Since this was the second accident caused by material failure of this part, a decision was made to exchange 30 struts out of the 1st AVCO stock for an improved product available at the DeHavilland factory in Toronto, Canada. In order to expedite the receipt of the new struts in the RVN, the DeHavilland technical representative personally delivered 30 of the old type struts to Toronto and exchanged them for 38 (part No. 5750-17) of the improved version. The exchange was accomplished within one week. All 1st AVCO CV-2B aircraft are now equipped with the improved strut. An EIR (Equipment Improvement Report) DA Form 2407 has been submitted.

(3) Personnel armor kits are being installed on the CV-2B aircraft to provide protection for the pilot and co-pilot. Primary armor material is Doron (laminated fiberglass) with perforated steel used in the more vital areas of either side of the cockpit to increase the effectiveness of the armor. Sections of Doron are mounted in such a manner that protection is furnished for the aircrew from the bottom, sides, and backs of the seats. Weight of the armor kit is 254 pounds. Initial comments from 1st AVCO indicate that the kit hampers pilot operations:

(a) Trim - Obscures view of the trim scale and causes an unnatural movement of the right hand to reach the trim control.

(b) Steering - Interferes with left arm of pilot when operating the nose wheel steering wheel.

(c) Pitch control - The side plates limit pilot arm movement when rotating the aircraft during take-off and landing.

(d) Control column clearance - The close tolerance (3/4") between the control column and armor material appears to be insufficient. If the armor plate is displaced outward inadvertently by weight of the pilot's legs, the aft movement of the control column could be blocked.

(e) Access doors - The hydraulic access door and emergency fuel pump door are partially blocked by the side panels of the armor kit.

(4) Engines of 1st AVCO CV-2B's are scheduled for change at 1500 hours of flying time (15th periodic inspection). Since, many of the engines have shown an abnormal increase in oil consumption and decrease in compression, they may have to be changed prior to 1500 hours. On 30 April, the average engine time was 711 hours. Under the present supply system engines are issued

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ANNEX L -- Objective 12 (continued)

stripped of accessories. Accessories from the old engine are used for build up of the new engines. Four days are required for change and replacement of both engines; the majority of this time being necessary to exchange accessories from the old to the new engines. The overall time for engine change could be reduced by at least 50% if two engines, complete with accessories, were authorized and available in 1st AVCO stock.

(5) Certain aircraft repair parts continue to be in critical short supply (see Tab L-3). Inadequate supplies continues to be the main limiting factor in 1st AVCO maintenance. Cannibalisation of tachometers, magnetos, carburetor temperature bulbs, manifold pressure transmitters, control surfaces and nose wheel assemblies have been necessary to complete required aircraft maintenance. Although cannibalisation prevents EDP (equipment deadlined for parts) status, and thereby increases the availability rate, it increases maintenance manhours and aircraft down time. An estimated 700 maintenance manhours were used in April for cannibalization.

(6) The average aircraft availability for the period 1-30 April 1963, was 10.9 or 68.1% of the 16 authorized aircraft (see Tab L-4). A total of 963.5 hours were flown. Tab L-5 depicts comparison of aircraft availability and hours flown for Jan - Apr 63.

(7) Maintenance manhours per flying hour for April 1963 is shown on Tab L-6.

3. (C) Findings.

- a. Replacement officers and enlisted men are being assigned as projected. No critical personnel shortages exist in the 1st AVCO.
- b. Replacement aircraft mechanics and repairmen lack practical experience in maintaining the CV-2B aircraft.
- c. Design of the personnel armor kit causes interference with pilot movements in flight.
- d. Aircraft down time for engine change could be reduced by at least 50% if two QCA (quick change assemblies) were authorized CV-2B companies.
- e. Certain aircraft repair parts are short supply and cannibalisation has been necessary to complete aircraft maintenance.

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Monthly Test Report Number 3 -- Caribou

Appendix 1 to Annex L

Data compiled to date regarding the adequacy of the number of aviators authorized by the TOR.

1. The number of aviators with duties that preclude their performing regularly scheduled flight missions are as follows:

a. Company commander and executive officer	- 2
b. Operations and assistant operations officer	- 2
c. Maintenance and assistant maintenance officer	- 2
d. Two flight platoon leaders	- 2
e. Airfield officer of the day	- 1
Total	9

2. The average number of hours flown by the aviators during January, February and March are as follows:

- a. Overall average - 52.3 hours
- b. Command, operations, maintenance personnel average - 26.6 hours
- c. Aviators without additional duties average - 59.9 hours

Note: TUI tours in direct support of Corps prevent balancing flying time of individual aviators. For example, during January one aviator flew 93 hours; in February an aviator logged 108 hours; and in March two aviators exceeded 100 hours (103 and 108 hours).

3. Fatigue caused by landings and take-offs is considerable and impossible to measure. The following computations show a landing and take-off occurred every 36 minutes of flying time in January, February and March.

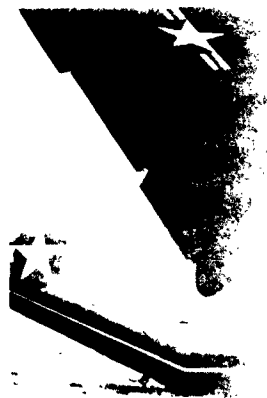
<u>Month</u>	<u>Hours flown</u>	<u>Take-offs</u> <u>Landings</u>	<u>-</u>	<u>Frequency of take-</u> <u>offs and landings</u>
Jan	919.5	1515		36 minutes
Feb	931.9	1543		36 minutes
Mar	1058.7	1781		35 minutes

TAB L-1

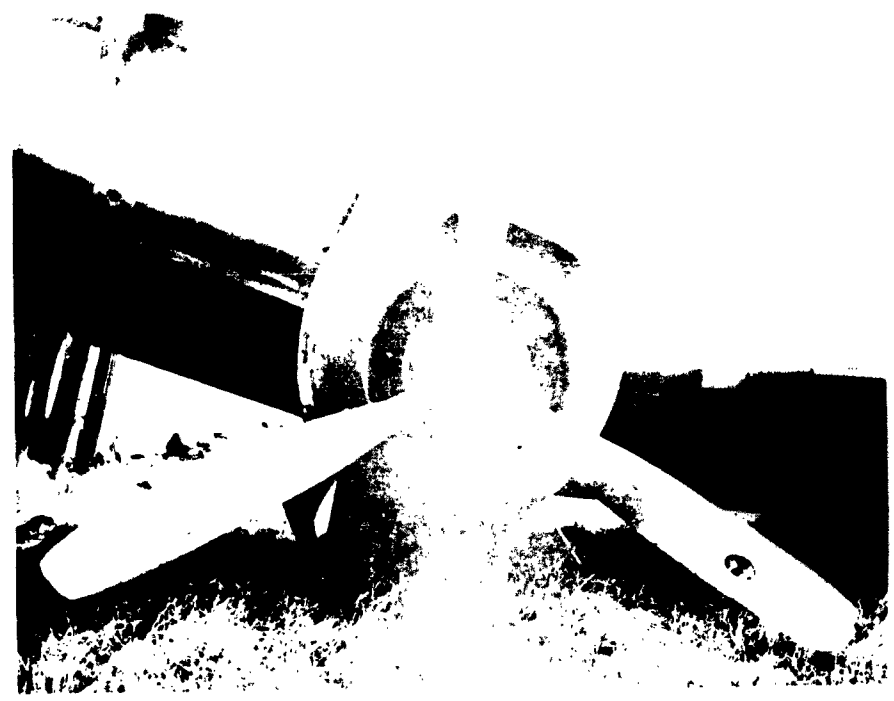
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Appendix 3 to Annex L
Aircraft parts on requisition

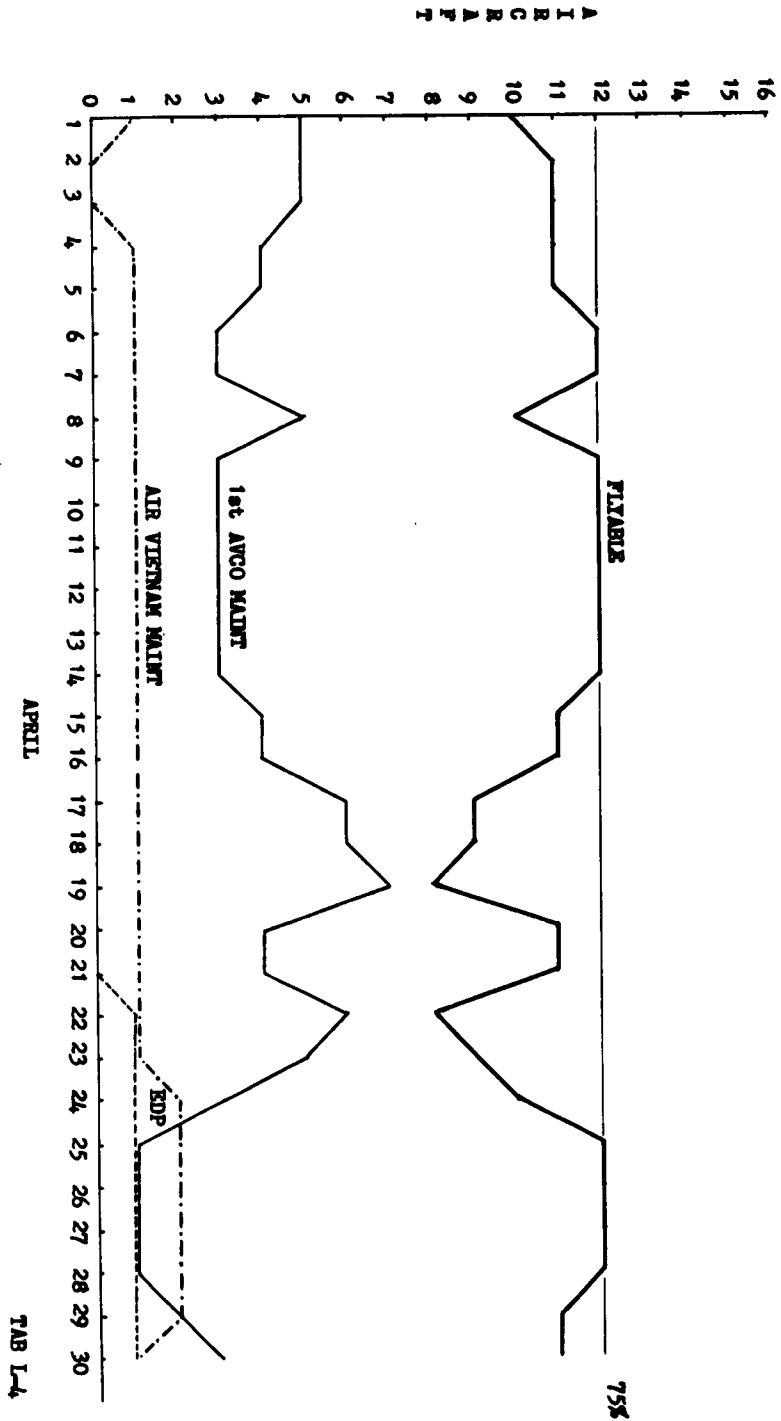
<u>Date</u>	<u>P/N P/N</u>	<u>Nomenclature</u>	<u>Quantity</u>
4 Jan	P/N FLST	Limiter Assy.	1
11 Jan	1630-474-8231	Wheel Assy.	5*
11 Jan	P/N C4W 1655-4	Mech inst.	1
12 Jan	P/N C4E302-5	Cable Assy.	1
12 Jan	C4E 1303-5	" "	1
14 Jan	P/N DAGE 5192-1	Connector	1
16 Jan	1630-474-8231	Wheel Assy.	1*
16 Jan	P/N 10-26198	Washer	8
16 Jan	4720-090-4620	Tube, Inst.	8
16 Jan	P/N 10-3383	Screw	8
16 Jan	5970-031-7431	Sleeve	8
16 Jan	2925-182-8932	Collar spring	8
28 Jan	C4R 1516-1	ADF, Sens. Antenna	100 Ft.
28 Jan	P/N KSBY 5-123	Bearing	32
29 Jan	P/N L12-41	Actuator, linear	1
4 Feb	6685-522-7354	Bulb, temp, oil	2*
13 Feb	6680-712-1424	Indic, Tac.	2*
5 Mar	6620-840-8605	Indic, fuel & oil press.	1
11 Mar	6680-712-1424	Indic, Tac.	1*
14 Mar	" " "	" "	2*
14 Mar	P/N C4MM 1118-1	Bolt	2
14 Mar	1560-605-5071	Tube Assy.	1
14 Mar	1560-707-6948	Actuator Assy.	1
14 Mar	2810-118-9904	Pipe Assy.	1
16 Mar	6685-522-7354	Bulb, temp, oil.	1*
28 Mar	6680-712-1424	Indic, Tac.	2*
29 Mar	6685-522-7354	Bulb, temp, oil.	1*

TAB L-3

TAB L-3

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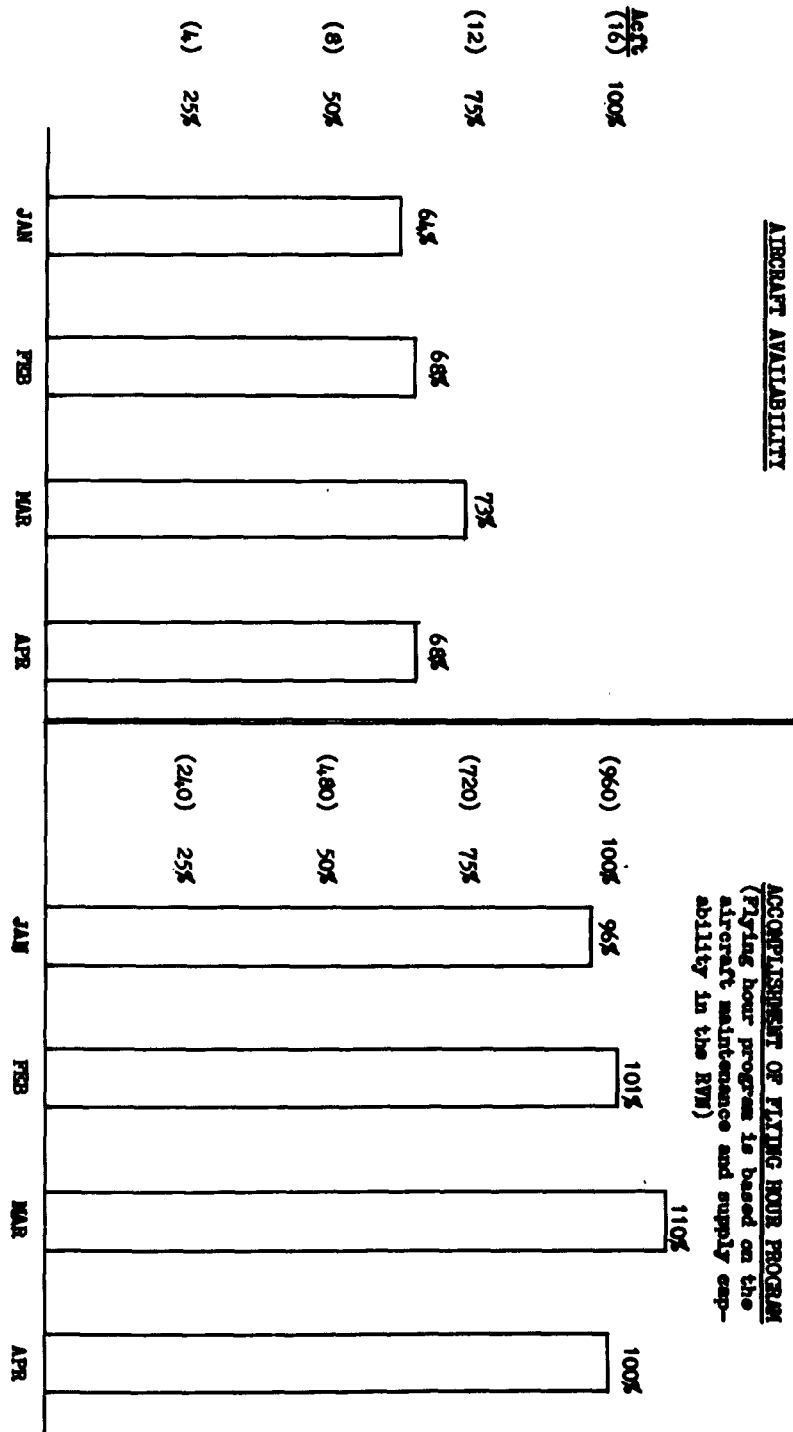
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Appendix 5 to Annex 1.
Comparative aircraft availability and hours flown during the period Jan - Apr 63



TAB L-5

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Appendix 6 to Annex L

Maintenance manhours per flying hour, 1 - 30 Apr 63					
Type Maint.	No.		Maint. man- hours each		Maint. manhours
Daily inspections	288	X	3	=	864
Intermediate inspection	29	X	5	=	145
Periodic inspection	10	X	350	=	3500
Demand (includes 2344 main- tenance manhours by Air Vietnam)					<u>2344</u>
Total					9353

9353 Maintenance manhours = 9.7 Maintenance manhours per flying hour.
963.5 Flying hours

Average maintenance manhour for Mar 63 - 6.1

" " " for Apr 63 - 9.7

" " " for Mar & Apr 63 - 7.9

NOTE: Daily inspections are required after the last flight of the day or prior to the next flight.

Intermediate inspections are required at 25 flight hour intervals.

Periodic inspections are required at 100 flight hour intervals.

Demand maintenance includes all maintenance not done during one of the inspections.

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Monthly Test Report Number 3 — Caribou

ANNEX M — Objective 13 (Medical evacuation)

1. (C) Objective.

To evaluate the capability of the CV-2B Caribou aircraft when employed in the Medical Evacuation role, to include requirements for aid-men, medical equipment and supplies, and suitability of present interior configuration for this role.

2. (C) Discussion.

a. General.

(1) Aeromedical evacuation is a primary mission of TOE Medical Service Corps air ambulance units that are normally employed under the operational control of the command surgeon. Supplemental aeromedical evacuation is a mission function of all Army aviation units that have a passenger carrying capability. This mission function may be discharged on an opportune basis by aircraft that are nearest and most responsive to the emergency evacuation requirement; or it may be preplanned — that is, aviation elements may be placed in direct support of the surgeon for a particular operation and included, with the air ambulance units, in the medical support plan. The type of employment, opportune or direct support, determines the degree to which aircraft load configuration can be tailored to the medical evacuation requirement:

(a) Opportune Missions. Aircraft can carry medical supplies and equipment (litter kits, blankets, bandages, splints, and medicines) only to an extent that does not restrict the aircraft's normal mission performance. Medical personnel are not normally aboard and the aircraft does not operate under medical control. Therefore, certain sensitive items, or items requiring special handling (narcotics, plasma, serums, etc.) will not be carried. Items that impose a weight or bulk penalty (litters, blankets, pillows, splints, etc.) if available at all will be in limited quantities. The normal CV-2B configuration for opportune aeromedical evacuation is described in paragraph b., "Present CV-2B configurations."

(b) Direct Support Missions. Aircraft can carry supplies and equipment, within weight and balance limitations, as determined by the medical officer in charge. The total weight and bulk is subject to the limitations imposed by the total weight of the patients to be carried per load, range required (fuel load), and ratio of medical attendants to patients. The types of supplies to be carried are based on such considerations as the degree of medical attention required, and the nature of the injuries or illnesses expected in a particular operation (e.g. extra leg splints for parachute drops, ice for heat casualties). It appears desirable to design a basic medical support kit for the CV-2B which can be expanded to meet any contingency. Investigation of this aspect will continue. Typical load planning factors that the medical officer can apply to a given set of circumstances are at Tab M-1.

(2) Established Army doctrine defines the air ambulance as being "—not special purpose in design—but—special purpose in utilization" (Para 141d, FM 1-100). Adherence to this concept is necessary to allow the shifting of aircraft within a command without extensive aircraft retrofit. Any permanent modifications in aircraft configuration should enhance the all-purpose capability of the aircraft. Special purpose installations

TAB M

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ANNEX M -- Objective 13 (Medical evacuation)

which would interfere with other mission functions must be portably mounted and be so designed that they will have minimum effect on range and payload.

b. Present CV-2B configuration.

(1) In the CV-2B, provision has been made for carrying fourteen standard military (Type AD 205) litters at the aft end of the cabin leaving room for 12 seats at 20 inch pitch (maximum seating configuration). The litters are arranged in a center group of six litters in two tiers of three, and a rear group of eight litters in two tiers of four (Illustration - Tab M-2). The litter kits, consisting of floor supports, strap assemblies, and litter clamp supports, hook into studs and socket plates which are built into the airplane. When not in use, the litter kits, weighing 55 pounds, are packed into canvas bags and stowed in the flight compartment. A full complement of litters are not normally provided as aircraft equipment. In the absence of litters, up to eight patients can lie comfortably on the passenger seats after the extra seat belts are removed and the backrests lowered.

(2) The aircraft is equipped with four standard aircraft emergency medical kits. These kits are for first-aid treatment of wounds and burns resulting from aircraft accidents.

(3) Heating and Ventilation. The US Army Aviation Board service test of the CV-2A (CV-2B prototype) found the aircraft heating and ventilation systems inadequate for the medical evacuation. The current series CV-2B aircraft, in use in the RVN, have been provided with additional cabin fresh air intakes and the heater system has been modified to allow ground operation. Sufficient data have not yet been accumulated to determine if these modifications are satisfactory in Vietnam.

(4) Weight and Balance. During Service tests of the CV-2A, the US Army Aviation Board noted that the center of gravity was beyond aft limits when fourteen litter patients were loaded into the aircraft (utilizing the litter kits). This necessitates balancing the load with additional personnel, equipment, or ballast in the forward cabin area. The Aviation Board recommended that, as a corrective measure, additional litter points be provided in the forward cabin area. However, it has been found that while provision of forward litter points may provide increased flexibility of loading, it is not a prerequisite for solution of the problem. The only time the present litter points are required is when the total load combination of litters, ambulatory personnel, and equipment makes it necessary to stack litters in order to conserve space. In such cases the load can be balanced. The feasibility of tying litters to the floor versus placing them in the litter kits will be examined from the patient comfort and medical convenience standpoint and will be discussed in future reports.

(5) Oxygen. Availability of oxygen for patients is highly desirable in view of the CV-2B's potential altitude and range capabilities. Aircraft on medical evacuation missions in RVN often fly at altitudes in excess of 10,000 feet because of weather and high terrain (see Tab M-3, inclosure 2). Army Regulations 95-1 limit flights, without oxygen, to one hour at altitudes of 10,000 to 14,000 feet. Above 14,000 the use of oxygen is mandatory. In addition to this requirement therapeutic oxygen may be necessary at any time. There are no provisions in the CV-2B for patient (or passenger) oxygen. Installation of additional outlets to the crew oxygen

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ANNEX M -- (Medical evacuation)

system will provide a useful but limited capability. (See Tab M-3) The overall capabilities of the aircraft would be enhanced if a great oxygen capacity were provided.

c. Employment.

(1) The CV-2B has been employed in the medical evacuation role in the RVN on an opportune basis. Tab M-4 describes a typical mission. The 1st AVCO SOP provides for the abandonment of routine missions to meet emergency medical evacuation requests without recourse to formal channels. There is no command SOP which outlines procedures or establishes responsibilities for opportune aeromedical evacuation. To date, no CV-2B aircraft have been assigned to a medical installation or in support of an operation, as a result of operations planning, with the primary mission of medical evacuation. On several occasions the company has been alerted for possible evacuation of wounded after an operation was underway. (Phuoc Vinh - September 1962 when two aircraft were pre-positioned in response to an alert for possible evacuation of casualties). To obtain a CV-2B for medical evacuation with minimum delay, US advisors have habitually relied on "on mission" aircraft notified through air traffic control (ATC) channels or the company's FM operations net. Coordination at the destination airfield is limited to that affected by the pilot through air traffic control (ATC) radio channels. This type of procedure is subject to error; ATC personnel, in the press of their primary duties may be unable to provide adequate follow-up on a message relay. Also, language difficulties present direct dealing with indigenous control personnel. Establishment of an FM air evacuation radio net, monitored by medical installations, with call signs and frequencies posted in all aircraft cockpits, would improve coordination and control of these missions.

(2) There is a tendency in the RVN to call for air evacuation of sick or wounded regardless of whether such evacuation is justified. It is known that aircraft will respond to such calls and that it is easier to put a sick or injured man on an aircraft than it is to take him to the nearest doctor. In many cases air evacuation of the patient is not justified by the symptoms of the injury or disease. Calls for medical air evacuation are frequently made by individuals without medical knowledge or medical advice. This procedure has on occasion burdened the pilot with the responsibility for determining the destination of wounded personnel. Aircrews are not qualified to make such decisions and should not be required to do so. But arbitrary restrictions on use of aircraft for medical evacuation may preclude opportune airlift when it may be the only life saving means available. A possible solution may be a command indoctrination and orientation program covering medical symptoms a layman might recognize in order to comfort or aid a patient or to make a reasonably valid decision on evacuation. Aviation units should be advised of medical facilities available in the command to include the recommended destination of patients by categories of wounds or illnesses. Medical coverage is broad in the RVN. Some individuals may be unaware of the many facilities available. (See Tab M-5)

(3) Suitable fixed-wing landing areas are limited in the

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ANNEX M — Objective 13 (Medical evacuation)

RVN. Meanwhile, helicopter operations are wide-ranging. These two facts indicate that the most common utilization of the CV-2B for medical evacuation will be as a second stage carrier. Casualties may be transported by helicopter, or ground transportation to the nearest medical facility. After preliminary diagnosis and treatment those casualties requiring treatment beyond the scope or resources of the medical facility can be evacuated by CV-2B to the 6220th USAF Dispensary at Tan Son Nhut or to the 8th Field Hospital at Nha Trang. In instances where the first stage ambulance, not being in near proximity to a medical installation, proceeds to the nearest CV-2B landing site, it is entirely possible that the CV-2B crews will be called upon to attend to the patients enroute. Implications involving the medical training of the crew and the suitability of the aircraft medical kits for this purpose will be further explored as data develops.

(4) Medical evacuation mission performance of the CV-2B in the RVN has been as follows:

- (a) Prior to 1 January 1963: No records available.
- (b) 1-31 January 1963: Three missions flown. Numbers and types of patients unknown.
- (c) 1-28 February 1963: Twelve missions flown in transporting ten litter and seven ambulatory patients.
- (d) 1-31 March 1963: Nine missions flown. Eight litter and ten ambulatory patients.
- (3) 1-30 April 1963: Eleven flown. Fifteen litter and thirteen ambulatory patients.

3. (C) Findings.

- a. The CV-2B has demonstrated a capability for evacuating ambulatory and litter patients on an opportune basis.
- b. A command wide SOP governing opportune medical evacuation does not exist. Such an SOP is needed to establish procedures and responsibilities and to educate the command in the proper utilization of the aeromedical evacuation capability and the scope of medical coverage existing in RVN.
- c. A radio communications net linking the field hospital with the U.S. Medical Dispensaries and evacuation aircraft would improve coordination and control of opportune evacuation missions.
- d. The CV-2B lacks the oxygen capability to transport patients over mountainous terrain at high altitudes.
- e. The addition of outlets to the crew oxygen system will provide a limited capability for up to 24 people.
- f. An expanded oxygen system would increase the general effectiveness of the aircraft.

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Appendix 1 to ANNEX M

Load Planning

CV-2B Medical Evacuation

1. Load factors: *

a. Maximum load (including fuel)	7,500 lbs.
b. Fuel capacity	4,968 lbs.
c. Average fuel consumption per hour	700 lbs.
d. Range per hour of fuel (0 wind)	150 NM
e. Planning weight per litter patient (American)	250 lbs.
Planning weight per litter patient (ARVN)	220 lbs.
f. Planning weight per other passengers (American)	200 lbs.
Planning weight per other passengers (RVN)	180 lbs.

2. Limiting factors:

- a. Load in excess of 6,000 lbs. must be fuel (1,500 lbs. limiting fuel).
- b. Allow 700 lbs. of fuel for taxi, runup, climb and reserve.
- c. See TM-55-1510-206-10 for space limitations.

3. Sample problem:

a. It is required to transport 14 American litter patients, 8 ambulatory, and 800 lbs. of medical equipment a distance of 150 nautical miles. All patients have priority over equipment.

b. Computation.

- (1) Fuel required: 700 (reserve) + 700
(1 Hr flight + 100 (limiting fuel) = 1,500 lbs.
- (2) Allowable load: 7500 - 1500 = 6,000 lbs.
- (3) Litters (14 X 250) = 3,500 lbs.
- (4) Ambulatory (8 X 200) = 1,600 lbs.
- (5) Equipment (6,000 - 5100) = 900 lbs.

c. 100 pounds additional equipment may be carried.

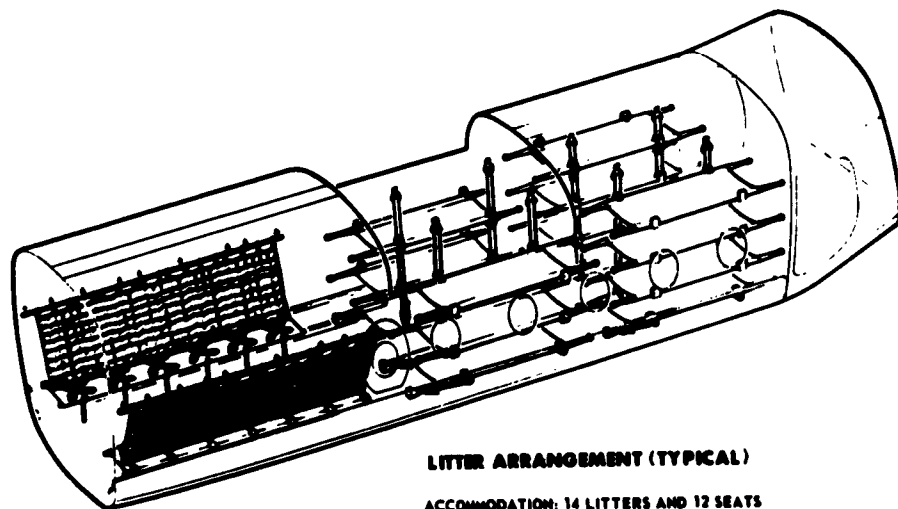
* Computed weights do not include self sealing fuel tanks or armored crew seats to be installed in CV-2B aircraft.

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Appendix 2 to ANNEX M



LITTER ARRANGEMENT (TYPICAL)

ACCOMMODATION: 14 LITTERS AND 12 SEATS

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CV-2B Oxygen System

1. A constant flow, crew oxygen supply is installed in the CV-2B. One outlet is located in the forward cabin area. Two outlets, for pilot and co-pilot, are in the flight compartment. There are three masks. This system, when fully charged to 1800 pounds pressure, will provide eight hours of oxygen for three persons, at minimum flow; or two hours and ten minutes supply for three persons at maximum flow. The flow-rate control is on the oxygen console at the co-pilot's station. Adjustment of the flow-rate affects all three outlets when masks are connected - there is no provision for selective flow-rate to one or more outlets.

2. The following table, extracted from TM 55-1510-206-10, "Operator's Manual AC-1 aircraft" dated June 1962, shows the oxygen duration in hours for three crew members at various flow settings (Gage altitude):

<u>Gage Altitude</u> <u>(Feet)</u>	<u>Duration</u> <u>(Hours)</u>
8,000	8.1
10,000	6.7
12,000	5.6
14,000	4.6
15,000	4.3
20,000	3.2

3. By adding additional outlets to the present system the following oxygen capability can be approximated. (Note: Figures are based on the preceding table and do not take into account system losses which may occur through the additional connections.)

<u>Gage Altitude</u> <u>(Feet)</u>	<u>24</u>	<u>20</u>	<u>16</u>	<u>12</u>	<u>8</u>
	<u>(Number of persons)</u>				
8,000	1:00	1:13	1:31	2:02	3:02
10,000	:50	1:00	1:15	1:40	2:31
12,000	:42	:50	1:03	1:24	2:06
14,000	:34	:41	:52	1:09	1:43
15,000	:32	:39	:49	1:05	1:37
20,000	:24	:29	:36	:48	1:12

4. Inclosure 1 (Duration Chart - Oxygen Vx. Fuel) compares the present oxygen capability (with additional outlets installed) with the

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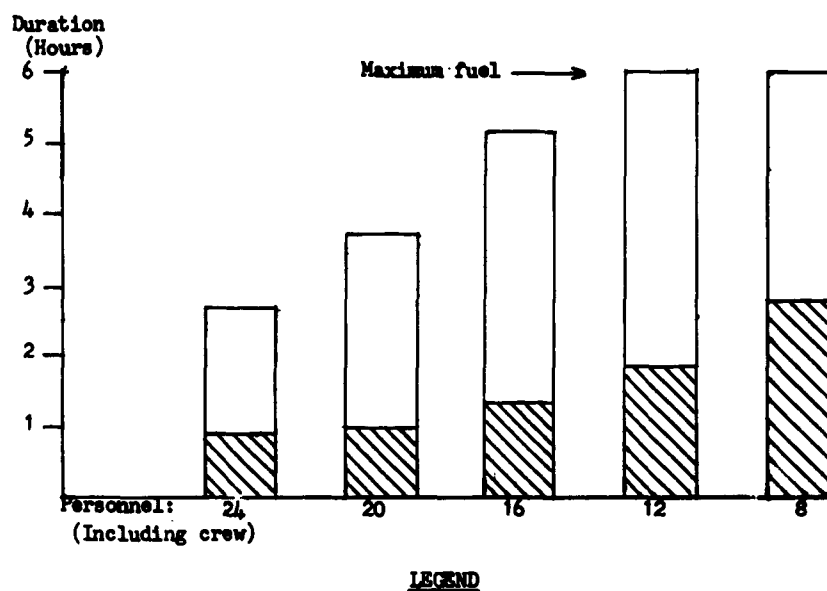
Appendix 3 to ANNEX M

range capability of the aircraft. The present installation was designed to take care of a crew of three during extended ferry flights. It is obvious, from the chart, that this oxygen will meet the needs of additional personnel for comparatively brief periods. However, the most remote U.S. Medical facility is not more than two hours flying time from the 8th Field Hospital at Nha Trang. (See Map, Inclosure 2) Within a mission profile of two hours at 10,000 feet there is ample oxygen for eight persons 100% of the time, 12 persons 87% of the time, 16 persons 67% of the time, and 20-24 persons 45% of the time.

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DURATION CHART - OXYGEN VS FUEL



Oxygen= 

Fuel= 

One hour fuel reserve allowed.

Data based on standard load factors (See appendix 1). Weights are calculated for 14 litters out of the 20 and 24 personnel load, 11 litters out of 16, 7 litters out of 12, and 3 litters out of 8.

Oxygen flow is calculated at 10,000 feet pressure altitude.

Inclosure 1
TAB M-3

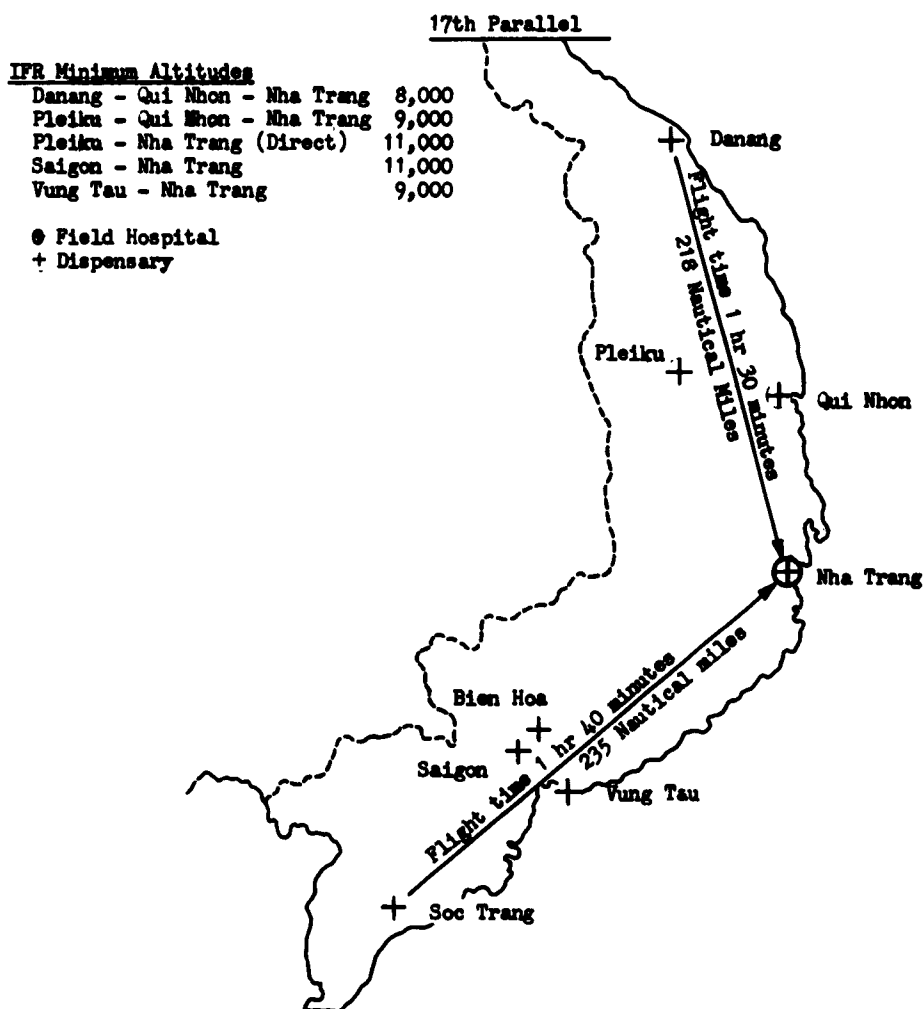
Inclosure 1
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U. S. Medical Installations - RVN

(Mileages reflect airway routes. Direct routes are slightly shorter.)



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Inclosure 2

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Inclosure 2

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Appendix 4 to ANNEX M

Typical CV-2B Opportune Medical Evacuation Mission

On 27 February 1963 at about 1700 hours CV-2B Sn# 439 landed at Soc Trang on a cargo mission. After unloading, the crew was advised that a helicopter had crashed and that another helicopter was bringing in the occupants. It was known that there were some injured but the number and extent was undetermined. The CV-2B crew was asked to stand by for a possible evacuation mission to Nha Trang.

Loading operations were discontinued and the aircraft was prepared for the evacuation mission. Litter kits to accommodate seven (7) litters were installed at the left rear station. It took three men about twenty minutes to accomplish the installation. Passenger seats were rigged forward of the litters and along the entire right side of the cargo compartment.

The rescue helicopter arrived at 1745 hours. The flight surgeon made a preliminary examination, then had the patients removed to the dispensary where it was determined that five Americans and three Vietnamese were to be evacuated. Six of these, including one of the Vietnamese, were litter cases.

Five litters were placed in the litter kit and the sixth (who was to debark at Can Tho) was tied down on the cargo floor just aft of the flight compartment. Eleven other passengers boarded and the flight departed for Can Tho at 1830 hours. The three Vietnamese debarked at Can Tho and the flight proceeded to Nha Trang via Saigon arriving at Nha Trang at 2100 hours.

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Appendix 5 to ANNEX M

Medical Units Republic of Vietnam

1. US Army Medical Units:

Unit	Location	Auth Off	Strength EM
4th Med Det (Vet)	Saigon	1	4
8th Fld Hosp (100 bed)	Nha Trang	22	63
7th Med Det (Lab)	Saigon/Nha Trang	3	10
20th Med Det (Prev Med)	Saigon/Nha Trang	3	33
36th Med Det (Dental)	Nha Trang	6	13
(unit has mobile teams)			
44th Med Det (Orthopedic)	Nha Trang	3	3
(will be deactivated o/a 1 May 63)			
66th Med Det (Thoracic)	Saigon	3	3
(will be deactivated o/a 1 May 63)			
91st Med Det (OA)	Vung Tau	1	7
45th TC Bn Med Sec	Tan Son Nhut	1	13
130th Med Det (OA)	Qui Nhon	1	8
93rd Med Det (OA)	Bien Hoa	1	8
129th Med Det (OA)	Tan Son Nhut	1	8
94th Med Det (OA)	Pleiku	1	8
52nd TC Med Sec	Pleiku	1	13
134th Med Det (OA)	Soc Trang	1	8
57th Med Det (Helicopter Ambulance)	Tan Son Nhut/Pleiku	7	22
US Army Special Forces (2 officers 90 EM)			
Civil Affair Mobile Training Team	Darang		
Civil Affair Mobile Training Team	Qui Nhon		
Civil Affair Mobile Training Team	Bien Hoa		
Civil Affair Mobile Training Team	Can Tho		
(Each team has 1 MC, 1 VC, 1 MSC, 1 EM AMED)			

2. US Air Force Medical Units:

Unit	Location	Auth Off	Strength EM
6220th USAF Disp (10 bed)	Tan Son Nhut	3	18
6221st AB Squad Disp	Bien Hoa	1	4
6222nd AB Squad Disp	Da Nang	1	4

3. US Navy Medical Units:

Unit	Location	Auth Off	Strength EM
HEDSUPPACT Disp (20 beds)	Saigon	8	18
TE 79.3.3.6 Disp	Da Nang	3	?
HEDSUPPACT Dental Clinic	Saigon	3	6

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Appendix 5 to ANNEX M

4. USOM Surgical Teams, RVN

Da Nang
Nha Trang
Pleiku
Can Tho

Each Team has 2 MD, 1 Lab - x-ray Tech, and 3 Nurses.

5. Medical Civic Action Teams (MEDCAT)

a. Division Teams

Location	Auth Off	Strength EM
(1) Quang Tri	1	3
(2) Da Nang	1	3
(3) Kontum	1	3
(4) Qui Nhon	1	3
(5) Quang Ngai	1	3
(6) Ban Me Thout	1	3
(7) Bien Hoa	1	3
(8) My Tho	1	3
(9) Bac Lieu	1	3

b. Corps Teams

Location	Auth Off	Strength EM
(1) Hue	1	8
(2) Da Nang	1	8
(3) Tuy Hoa	1	8
(4) Song Be	1	8
(5) Tay Ninh	1	8
(6) Can Tho	1	8

c. Civil Guard/Self Defense Corps Teams:

Location	Auth Off	Strength EM
(1) Hue		3
(2) Da Nang		3
(3) Kontum		3
(4) Pleiku		3
(5) Tay Ninh		3
(6) Ban Me Thout		3
(7) Bien Hoa		3
(8) Can Tho		3
(9) Can Tho		3

d. Separate Teams

Unit	Location	Auth Off	Strength EM
46th Inf Regt	Da Nang		1

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Unit	Location	Auth Off	Strength EM
47th Inf Regt	Suei Doi (west of Tay Hoa)		1
48th Inf Regt	Ca Mau		1
Airborne Brigade	Saigon		1
Marine Brigade	Saigon		1

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ANNEX N -- Ground fire damage to CV-2B aircraft

1. In April two Caribou aircraft were hit by Viet Cong small arms ground fire.
2. Locations of hits on the two aircraft are shown on succeeding pages. A summary of hits follows:

<u>a. Aircraft Nr.</u>	<u>Date Hit</u>	<u>Nr. of Hits</u>	<u>Days for Repair</u>	<u>See pages</u>
60-5439	23 Apr	1	None#	2 & 3
61-2389	Unknown	1	None*	2 & 3

#Repaired during intermediate inspection. No time lost for repair.

*Repaired during PE. No time lost for repair.

- b. Point of bullet entry:

Bottom of aircraft	2
Right side	0
Left side	0

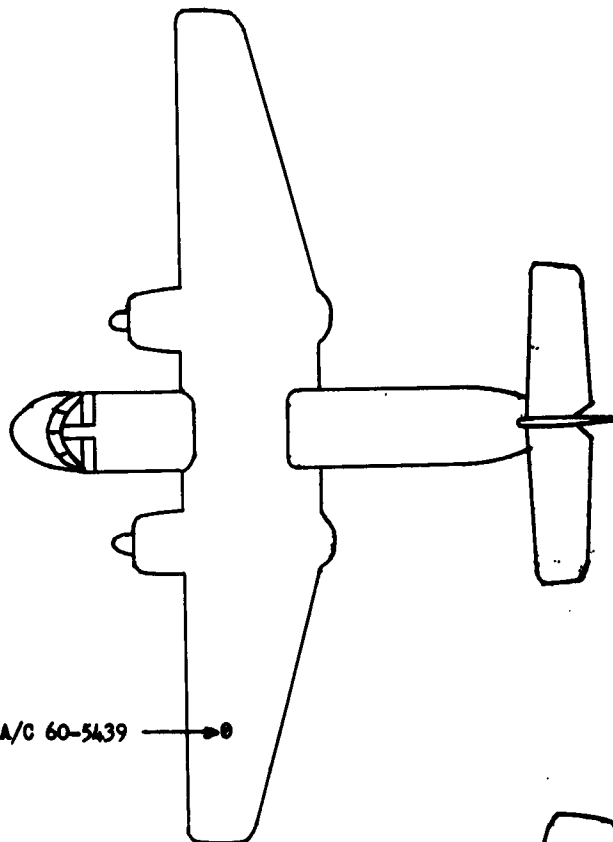
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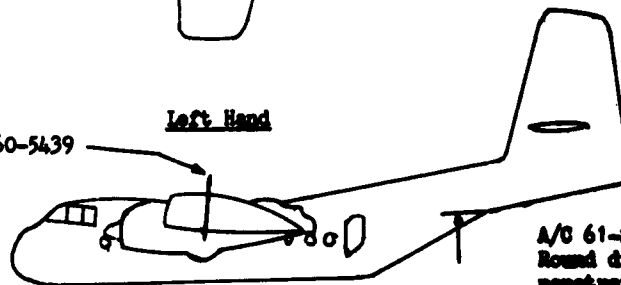
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Top



Left Hand

A/C 60-5439



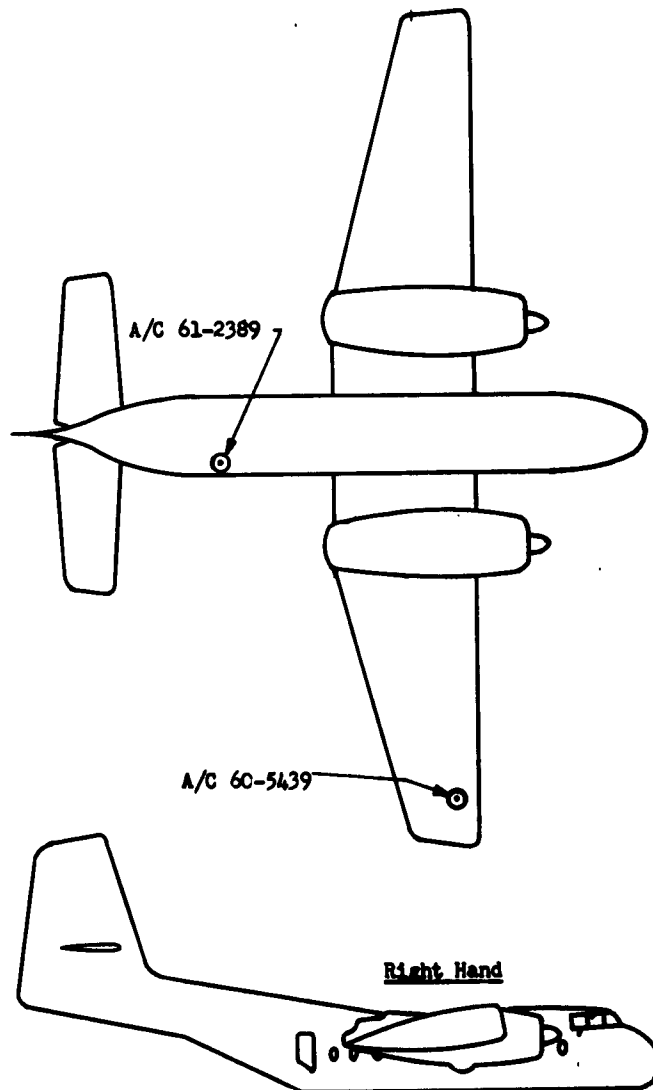
A/C 61-2389
Round did not
penetrate cargo
door of A/C

LEGEND: ● Circled dot indicates hit on aircraft
— Indicates path of projectile

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Bottom



Right Hand

LEGEND: ⊙ Circled dot indicates hit on aircraft
⊙— Indicates path of projectile

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