

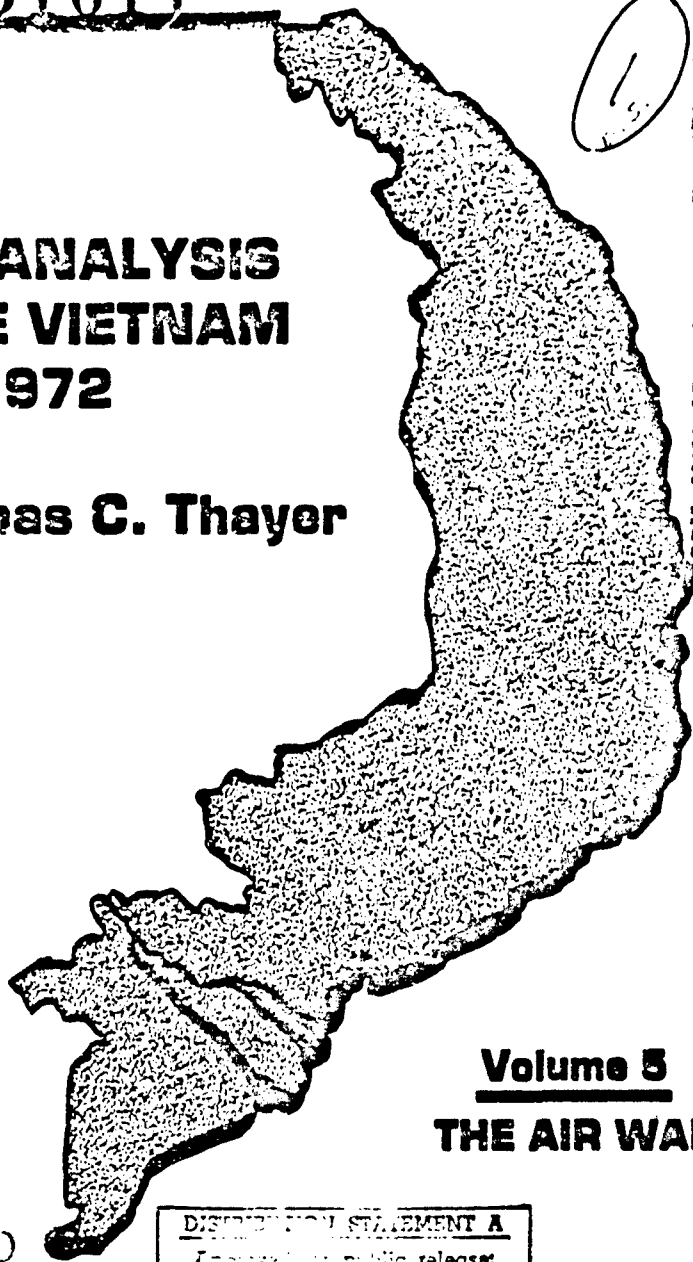
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A SYSTEMS ANALYSIS VIEW OF THE VIETNAM WAR 1965-1972

Editor: Thomas C. Thayer

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Volume 5
THE AIR WAR

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This twelve volume set includes every article printed in the fifty issue series of the <u>Southeast Asia Analysis Report</u> . The SEA Analysis Report represented a month-by-month analysis of Vietnam War activity including forces and manpower, VC/NV operations, Allied ground, naval and air operations, RVNAF, casualties and losses, population security, war costs and inflation and construction and port operations in South Vietnam.		

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A SYSTEMS ANALYSIS VIEW OF THE VIETNAM WAR: 1965-1972

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A SYSTEMS ANALYSIS VIEW OF THE VIETNAM WAR: 1965-1972

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A Systems Analysis View Of The Vietnam War: 1965-1972

Volume 5

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A Systems Analysis View Of The Vietnam War: 1965-1972

INTRODUCTION

This volume, plus the other eleven volumes in the series, contains every article ever printed in the Southeast Asia Analysis Report (a few additional papers not printed in the report are occasionally included, too.).

Fifty issues of the Southeast Asia Analysis Report were published from January 1967 through January 1972 by the Southeast Asia office under the Assistant Secretary of Defense (Systems Analysis). The Report had two purposes. First, it served as a vehicle to distribute the analyses produced by Systems Analysis on Southeast Asia. It thus provided other agencies an opportunity to tell us if we were wrong and to help prevent research duplications. We solicited and received frequent rebuttals or comments on our analyses which sharpened our studies and stimulated better analysis by other agencies. Second, it was a useful management tool for getting more good work from our staff -- they knew they must regularly produce studies which would be read critically throughout the Executive Branch.

The first page of the Report stated that it "is not an official publication of the Department of Defense, and does not necessarily reflect the views of the Secretary of Defense, Assistant Secretary of Defense (Systems Analysis), or comparable officials." The intent was solely to improve the quality of analysis on Southeast Asia problems -- and to stimulate further thought and discussion. The report was successful in doing precisely this.

We distributed about 350 copies of the Report each month to OSD (Office of the Secretary of Defense), the Military Departments, CINCPAC, and Saigon, and to other interested agencies such as the Paris Delegation, AID, State Department, CIA and the White House Staff. Most copies circulated outside OSD were in response to specific requests from the individual person or agency. Our readership included many of the key commanders, staff officers, and analysts in Washington and in the field. Their comments were almost always generous and complimentary, even when they disagreed with our conclusions. Some excerpts appear below:

"I believe the 'SEA Analysis Report' serves a useful purpose, and I would like to see its present distribution continued." (Deputy Secretary of Defense, 31 May 1968)

"We used a highly interesting item in your May Analysis Report as the basis for a note to the Secretary, which I've attached." (State Department, 28 June 1967)

"We were all most impressed with your first monthly Southeast Asia Analysis Report. Not only do we wish to continue to receive it, but we would appreciate it if we could receive 4 (four) copies from now on." (White House, 9 February 1967)

Best Available Copy

"Ambassador _____ has as a result to tell you that he has much appreciated and benefited from the statistics and analyses of this publication." (State Department/White House, 24 January 1969)

"Congratulations on your January issue. The 'Situation in South Vietnam' article was especially interesting and provoking." (State Department 24 January 1969)

"I let Ambassador _____ take a swing at the paper. He made several comments which may be of interest to you. Many thanks for putting us back on distribution for your report. Also, despite the return volley, I hope you will continue sending your products." (MACV-CORDS, 17 June 1968)

"As an avid reader (and user) of the SEA Analysis Report, I see a need for more rounded analyses in the pacification field and fewer simplistic constructs." (MACV-DEPCORDS, 17 April 1968)

"The SEA Programs Division is to be commended for its perceptive analysis of topics that hold the continuing concern of this headquarters... The approach was thoughtfully objective throughout and it was particularly pleasing to note a more incisive recognition of factors that defy quantified expression." (Commander, US Army Vietnam-USARV, 29 November 1967)

"In general, I think it is becoming the best analytical periodical I've seen yet on Vietnam (though there's not much competition)." (MACV-DEPCORDS, 21 April 1967)

"Statistical extrapolations of this type serve an extremely useful purpose in many facets of our daily work." (CIA, 6 February 1967)

"One of the most useful Systems Analysis products we have seen is the worthy Southeast Asia Progress Report.... Indeed it strikes many of us as perhaps the most searching and stimulating periodic analysis put out on Vietnam." (President of The Rand Corporation, 22 October 1969)

In November 1968, 55 addressees answered a questionnaire about the Report: 52 said the report was useful, 2 said it was not, and 1 said, "The report does not meet an essential need of this headquarters;" nonetheless, it desired "to remain on distribution" for 7 copies. From 48 questionnaires with complete responses, we found that an average 4.8 people read each copy -- a projected readership of 500-950, depending on whether we assumed 1 or 2.4 readers of copies for which no questionnaire was returned.

Readers responding to the questionnaire reported using the Report for the following purposes:

Information	42%
Analysis	31%
Policy Making	11%
Briefings	7%
Other	9%
	<hr/>
	100%

In addition, readers reported about equal interest in each of the seven subject areas normally covered in the Report.

VC/NVA	13%
Air Operations	20%
RVNAF	17%
Pacification	13%
Friendly Forces	12%
Deployments	12%
Logistics/Construction	8%
	<u>100%</u>

There was some negative reaction to the Report. Concern was expressed about "the distorted impressions" the Report left with the reader and its wide dissemination which "implies its acceptance by the Secretary of Defense, giving the document increased credibility."

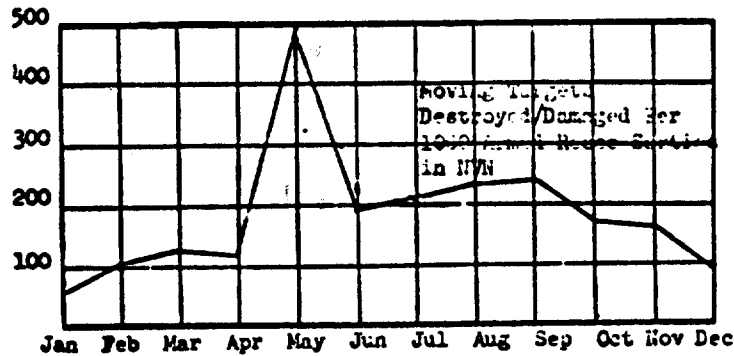
Given the way in which the Southeast Asia Analysis Report was used, the important responsibilities of many of its readers, and the controversial aspects of the report, I decided to include in these twelve volumes every article ever published in a Southeast Asia Analysis Report. This will allow the users of these volumes to arrive at their own conclusions.

Thomas C. Thayer
February 18, 1975

~~CONFIDENTIAL~~

Jan 67

**RESULTS OF ARMED RECONNAISSANCE SORTIES
VERSUS
MOVING TARGETS IN NORTH VIETNAM**



**ARMED RECONNAISSANCE SORTIES IN NVN
VERSUS
MOVING TARGETS DAMAGED OR DESTROYED ^{a/} _{b/}
(Jan 1 - Dec 26, 1966)**

CY 1966 Period Ending

	Feb 1	Feb 28	Mar 28	Apr 25	May 30	Jun 27	Aug 1	Aug 29	Sep 26	Oct 31	Nov 28	Dec 26	1966 Total
MOVING TARGETS DAM/DES													
Vessels	10	106	181	367	1851	647	1103	1432	1223	1257	700	397	9274
Vehicles	4	37	156	148	238	300	860	755	637	318	290	127	3870
RR Stock	-	21	73	7	377	366	455	291	738	92	6	26	2452
TOTAL	14	164	410	522	2466	1313	2413	2478	2598	1667	996	550	15596
ARMED RECCE SORTIES	231	1519	3313	4446	4924	6636	11991	10533	10710	9616	6098	5568	74793
DAM/DES PER 1000 SORTIES	61	108	124	117	501	198	216	235	243	173	163	99	208.5

^{a/} In addition to moving targets, other targets such as tunnels, bridges, and roads were also damaged or destroyed by these sorties.

_{b/} Source: Table 360, OSD SEA Statistical Summary.

The table summarizes by month the effectiveness of armed reconnaissance sorties against various types of moving targets in North Vietnam during CY 1966. During fourth quarter 1966 the average number of targets destroyed/damaged per 1000 armed reconnaissance sorties declined to 145 from levels of 272 during second quarter and 231 during third quarter. During December the rate of 99 was less than half the level sustained between May and September.

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AIR OPERATIONS, COST AND EFFECT

Armed reconnaissance aircraft loss rates in NVN have dropped since August 1966. The numbers of fleeting targets destroyed or damaged per month has also declined:

	<u>1966</u>				
	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>
<u>Cost/Effect ^{a/}-NVN</u>					
Targets destroyed or damaged ^{b/}	236	232	175	148	118
Fighter and attack aircraft loss rates	1.38	.95	1.62	.62	.34
Aircraft lost per 100 targets- damaged or destroyed	.58	.41	.93	.42	.29

Other measures of the cost and effect of air operations will be developed in future reports.

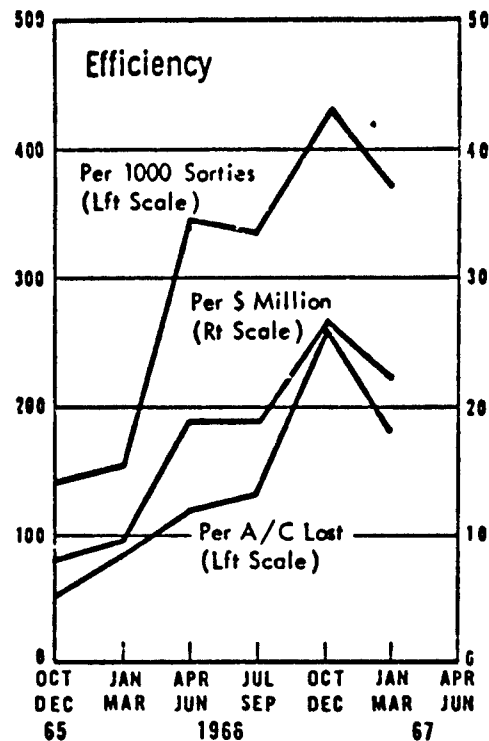
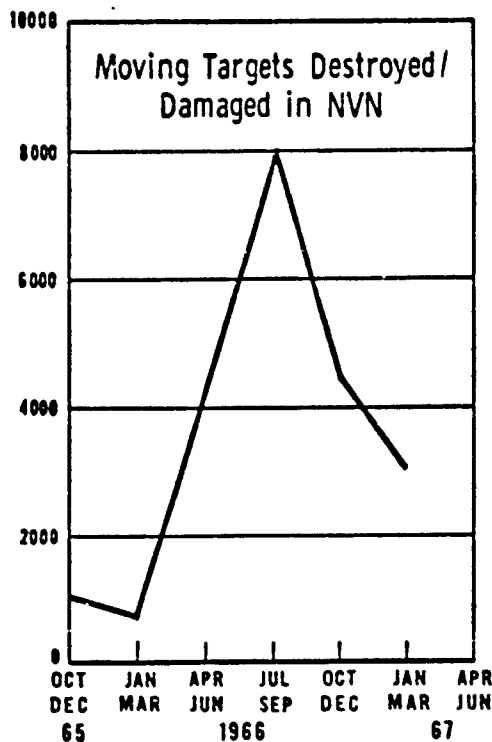
^{a/} Per 1000 sorties.

^{b/} Includes vessels, vehicles, and railroad stock.

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April 7

ARMED RECONNAISSANCE IN NVN



	1965	1966				1967	1966
	Oct Dec	Jan Mar	Apr Jun	Jul Sep	Oct Dec	Jan Mar	Total
Moving Targets Destroyed/Damaged							
Vessels	366	412	2898	4392	3233	2370	10935
Vehicles	398	251	941	2715	723	447	4630
RR Stock	233	29	486	872	488	217	1875
Total	997	692	4325	7979	4444	3034	17446
Armed Recce Sorties	6997	4445	12415	23750	10330	8181	50940
Targets D/D per 1000 AR sorties	142	156	348	336	430	371	342
A/C Lost on AR sorties	17	8	36	60	17	17	121
Targets D/D per a/c lost	59	86	120	133	261	178	144
Cost(\$ million) AR	121	72	227	417	163	136	879
Targets D/D per \$ million	8.3	9.6	19.2	19.2	27.0	22.3	20.0

Source: DIA for targets
NMCS OPREA for sorties,
losses.

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In the January Analysis Report (p23-24) we noted a decrease in moving targets destroyed per 1,000 armed reconnaissance sorties in NVN in the fourth quarter of 1966 versus the second and third quarters. This conclusion was based on Table 360 of the OSD SEA Statistical Summary, which provides cumulative results and cumulative "armed reconnaissance" sorties. These sorties include all attack sorties in NVN except for those flown against JCS numbered targets.

As can be seen from the graphs and table on the preceding page, a very different result can be obtained utilizing the OPREA file in the NMCS based on the OPREP-5 reporting system. This system divides the attack sorties into "strike" (attacks against all fixed and pre-planned targets of which the JCS targets are only a small proportion), "armed reconnaissance" (attacks against moving targets and targets of opportunity) "flak suppression," and three other categories inconsequential in NVN. There has been a very sharp decline in the armed reconnaissance sorties as compared to total attack sorties in NVN since August 1966 (98% in the first half of CY 66, 70% in 3Q, 46% in 4Q, and 40% in the first quarter of CY 67). When moving target results are compared to armed reconnaissance sorties, losses on these sorties, and the costs of these losses and sorties (at \$12,500 per sortie plus \$2 million per aircraft lost), efficiency or productivity can be seen to sharply rise throughout CY 66, but begin to decline in 1Q CY 67.

The decline in the proportion of effort devoted to armed reconnaissance appears not to be an artifact of any changes in the reporting system. Definitions have not changed and informal contact with the Air Staff and Joint Staff indicates that the key reason is the introduction and wide-spread use of radar bombing ("Sky Spot") against pre-planned targets. A review of the data by Services indicates that virtually all Marine NVN attack sorties since August (the beginning of any significant Marine attacks on NVN) have been "strike" as opposed to "armed reconnaissance," and about 37% of these have been "Sky Spot" in recent months. The number of Air Force and Navy "strike" sorties jumped last August and recently 65% of the Air Force sorties have been "Sky Spot."

Weather has also been a significant factor in the shift from armed reconnaissance. As moving targets become harder to find, the tactical commanders believe it more profitable to shift their effort from armed reconnaissance. Thus it is quite likely that there will be a partial shift back to armed reconnaissance as the weather improves. Indeed, March armed reconnaissance sorties were 43% of total NVN attack sorties, up from 37% in February and 39% in January.

Loss rates for "armed reconnaissance" sorties were 87% of those for "strike" sorties in CY 66 (2.7 vs 3.1 per 1,000 sorties). They were 140% in the first three months of CY 67 (2.1 vs 1.5 per 1,000 sorties). This suggests: (a) that armed reconnaissance sorties are more hazardous than radar bombing missions; (b) that NVN loss rates will increase as the weather improves and sorties are shifted back to armed reconnaissance; and (c) that over-all NVN attack loss rates will not revert to previous levels.

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July 1967

Armed Reconnaissance in NVN

Analysis of the NMCS OPREA file indicates a resuming of the improvement in the efficiency of U.S. armed reconnaissance operations over NVN. For instance, April-June 1967 armed recce sorties were up only 8% over April-June 1966, but moving targets destroyed/damaged were up 92%. A total of 8,316 vessels, vehicles, and railroad stock was destroyed/damaged during the quarter, the largest number since air operations over NVN began.

Targets destroyed/damaged per \$ million reached a new peak of 39.6 during the second quarter, more than double the previous quarter and more than triple April - June 1966. The ratio of targets destroyed/damaged to aircraft lost increased 2.2 times, from 178 in the first quarter to 396 in the second.

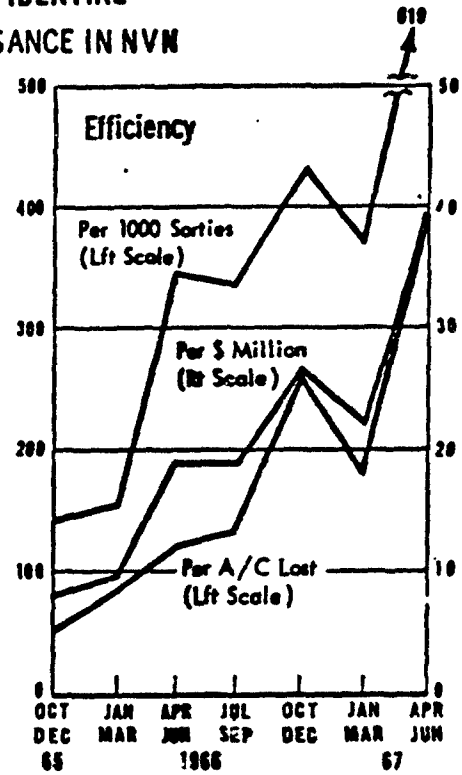
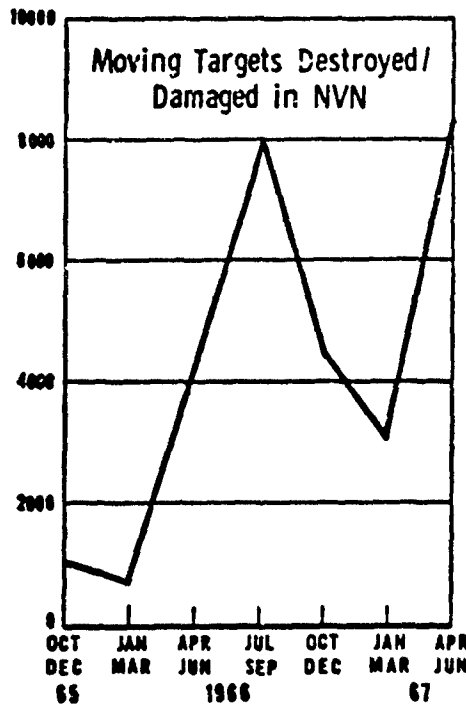
Armed recce sorties accounted for 42% of the total attack sorties during the 2nd quarter of CY 1967, an increase of 2% from the previous quarter. At the same time, armed recce losses as a percent of the total fell from 44% to 29%.

Armed reconnaissance loss rates fell from 2.0 per 1,000 sorties during the first quarter to an average of 1.6 during the second quarter. During the same period, the "strike" loss rate climbed from 1.5 to 2.7 per 1,000 sorties, reflecting increased clear weather attacks in Route Package VI.

Improving weather over NVN during the next few months, should lead to a shift from radar bombing to armed recce missions. If current armed recce efficiency continues into the summer months, enemy losses of "moving targets" may become very significant in reducing his logistic support capability.

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ARMED RECONNAISSANCE IN NVN



	1965		1966				1967	
	Oct Dec	Jan Mar	Apr Jun	Jul Sep	Oct Dec	Jan Mar	Apr Jun	
Moving Targets Destroyed/Damaged								
Vessels	366	412	2898	4392	3233	2370	5958	
Vehicles	398	251	941	2715	723	447	1724	
RR Stock	233	29	486	872	488	217	634	
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No. Armed Recce Sorties	6997	4445	12415	23750	10330	8181	13430	
Targets D/D per 1000 AR sorties	142	156	348	336	430	371	619	
A/C Lost on AR sorties	17	8	36	60	17	17	21	
Targets D/D per a/c lost	59	86	120	133	261	178	396	
Cost (\$ million) AR	121	72	227	417	163	136	210	
Targets D/D per \$ million	8.2	9.6	19.1	19.1	27.3	22.3	39.6	

Source: DIA for targets
DMCS for sorties,
losses.

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Aug 67

GROUND-RADAR CONTROLLED BOMBING

Air strikes in SVN, LAOS, and Route Packages 1-3 of NVN are being conducted by ground-based radar control even when bad weather obscures the targets. Two radar systems, the Marine Corps TPQ-10 and the Air Force MSQ-77 (nicknamed Combat Skyspot) are providing this all weather capability. From January thru June 1967, 44% of the Arc Light (B-52) sorties dropped their bombs on MSQ-77 command; as were 9% of all US attack sorties in LAOS. During that same period in SVN, the TPQ-10 and MSQ-77 systems have controlled 29% of the Air Force, Navy and Marine attack sorties; and in the NVN panhandle (RPs 1-3) the radars have handled 30%.

The following paragraphs from a PACAF intelligence summary describe the extent to which the MSQ-77 contributes to USAF and USMC bombing in Route Package 1:

"During the period 20 February to 19 March, Air Force and Marine aircraft attacked 427 targets in Route Package 1. The bulk of this effort was concentrated in the Tally Ho area in support of MACV to prevent further buildup in the adjacent I Corps. Bad weather seriously limited the numbers of visual strikes; nevertheless, the weight of effort was sustained under Combat Sky Spot control (MSQ 77, Ground radar)."

"Route 15 was attacked under Combat Sky Spot control on every day and night of the reporting period. On this route 55 trucks were either destroyed or damaged. Fourteen secondary explosions and ten secondary fires were reported. Also, the route was unserviceable at the Nuy Caay seeding segment for at least four separate days and nights during the period. Additionally, ten truck parks, the La Trang Staging/PCL Area, and the Thang Xa Storage Tunnel were heavily damaged." ^{a/}

System Description

When Marine tactical squadrons deployed to SVN in 1965, they were equipped with the TPQ-10. It is a fully automatic bombing control system, developed and tested in the early 1960s, with a design accuracy of 165 feet (CEA) at bomb release altitude of 10,000 ft. and aircraft speed of 300 kts. It will control to a range of 50 miles when operating with a radar beacon in the aircraft, and to half that distance without the beacon. TPQ-10 ground radars and control stations are located at Dong Ha, Phu Bai, Da Nang, Chu Lai and Quang Nga. This gives the Marines coverage of I CTZ and the lower portion of Route Package I.

a/ Effects of Air Operations in SEA (U), Hq-PACAF, March 1967

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The Air Force MSQ-77 is a modified radar bomb scoring system used extensively by SAC. After reversing the bomb impact prediction procedure to bomb release determination, and extending the effective radar range to 200 miles, the Air Force put the MSQ-77 into operation at Bien Hoa, SVN, in April 1966. There are now six sites, 4 more in SVN at Dalat, Pleiku, Dong Ha, and Binh Thuy, and one at Nakhon Phanom, Thailand. The 200 mile range (with beacon) capability from these six sites gives the AF coverage of all SVN, the pannandle of Laos, and NVN through RPs 1, 2 and most of 3.

Both Marine and Air Force systems control bombing by all Service's aircraft depending on their work loads and the tactical situation. The MSQ-77 systems also are used for B-52 Arc light missions. The MSQ site at Dong Ha was knocked out during an enemy mortar attack in May. To the extent they could, the Marine TPP-10 systems picked up the Air Force sorties until the MSQ was replaced.

System Use

Table 1 shows the number of bombing sorties in NVN, SVN, and Laos that were controlled by ground radars during the past 6 months. Of the 4814 total B-52 sorties, 2128 (44%) were MSQ-77 controlled.

For all U.S. fighter/attack aircraft attack sorties in SVN, the MSQ-77 and TPQ-10 controlled 29%. The Marines controlled 54% of their own attack sorties from January through June.

In Laos the small percentage (9) of total attack sorties is because a third of the fighter missions are armed reconnaissance, which are not radar controlled. If the AR missions are deleted from the sample, MSQ-77 still controls only 14% of the remaining strike missions in Laos.

Fighter/attack radar bombing is getting the greatest use in the NVN RP 1-3 area, where 38% of the sorties are either MSQ or TPQ controlled. With the improved weather in that area in the last few months, the all weather systems have played a lesser role than during the bad weather earlier in the year.

Most of the MSQ missions are flown within 150 miles of the radar sites in the beacon mode and within 50 miles without a beacon (skin track). The Air Force reports that the current overall average actual miss distance (CEA) for all MSQ operations is 270 ft. No specific accuracy data are being stated by the Marine Corps, but they report the TPQ-10 is performing within its design specifications (165 ft.)

Radar controlled bombing has other advantages besides its all-weather feature. When radar controlled, the pilot need not see the target visually or on a radar scope. He is directed to the release point either through radio signals to his autopilot, as with the TPQ-10, or by voice in the MSQ-77.

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Since the pilot need not acquire the target, bomb releases can be made at higher altitudes than with visual bombing. This helps keep the aircraft above the heavy gun defenses through which a low-level or dive bomber must pass. Since about 75% of our aircraft are lost to ground fire, the radar control systems should help reduce attrition. Another key advantage is that a fighter can be diverted to an alternate target without the lengthy pre-strike crew planning usually required.

Some other applications of the radar control systems are being tried in SEA. They include navigation assistance for aircraft, including helicopter and cargo aircraft; all weather control of leaflet and flare drops; up-dating and correction of the exact location of key interdiction points; and potentially an all-weather paradrop capability.

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TABLE 1

U.S. Sorties Controlled by Ground Radars ^{a/}

	1967						6 mo. TOTAL
	Jan	Feb	Mar	Apr	May	Jun	
<u>Fighter & Attack Aircraft</u>							
In <u>SVN</u>							
MSQ-77 Contl'd	2280	993	891	2329	1447	1021	8,961
TPQ-10 Contl'd	2248	1645	2444	3089	3197	2159	14,782
Total Contl'd	4528	2638	3335	5418	4644	3180	23,743
Total Attack Sorties	11983	11642	14276	13607	16226	14435	82,169
% Radar of Total Attk	38	23	23	40	29	22	29
In <u>LAOS</u>							
MSQ-77 Contl'd	365	372	728	642	75	83	2,265
Total Attack Sorties	5484	6684	5109	4866	2557	1441	26,141
% Radar of Total Attk	7	6	14	13	3	6	9
In <u>NVN</u>							
RP 1-3							
MSQ-77 Contl'd	1916	1737	2428	1044	357	396	7,878
TPQ-10 Contl'd	1382	1417	1604	1139	432	333	6,307
Total Contl'd	3298	3154	4032	2183	789	729	14,185
Total Attack Sorties	4238	4358	6830	6619	7979	7585	37,609
% Radar of Total Attk	78	72	59	33	10	10	38
<u>B-52 Aircraft</u>							
In <u>SVN</u>	342	377	269	199	338	265	1,790
In <u>LAOS</u>	24	9	161	135	9	-	338
Total Contl'd	366	386	430	334	347	265	2,128
Total Sorties ^{b/}	735	706	810	823	808	832	4,814
% Radar of Total Sorties	50	55	53	41	43	32	44

^{a/} Data Sources: MSQ-77, AFXOPA, HQ-USAF; TPQ-10, NMCS COMBA File;
Total Sorties, OASD(C) SEA Statistical Summary

^{b/} Includes 50 sorties in NVN, none controlled by MSQ-77 in this time period.

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Transportation Facilities in NVN

The bulk of the U.S. air strikes in NVN have been against the transportation system. From Jan 66 to June 67, U.S. planes flew 72,550 armed reconnaissance sorties against authorized LOC and LOC associated targets in North Vietnam. 159 U.S. aircraft were lost; the estimated cost is \$1.23 billion. ^{a/} The objective of this campaign has been to raise the cost of supplying the VC/NVA forces in SVN and to degrade the capability of NVN to transport men and equipment.

Despite heavy losses of moving vehicles, NVN has been able to replace them from external sources, thus shifting the cost of resupply to North Vietnam's Communist allies. The U.S. air operations have diverted an estimated 300,000 men to uneconomic construction and repair activities. The table on the following page shows the inventory of railroad equipment, trucks, and water craft in NVN from Jan 66 to June 67.

1. During this period the number of trucks in NVN increased from 11,696 to 11,744, despite losses of 6793 to U.S. aircraft. The U.S. armed reconnaissance campaign has forced the North Vietnamese to decentralize their operations over a wide geographical region, undoubtedly degrading their operating efficiency. However, the 6841 modern vehicles imported from the Soviet Union and Communist China have increased the overall carrying capacity.

2. 1029 pieces of rolling stock were destroyed. The estimated initial NVN inventory was 1740, and positively identified replacements total 109. However, comprehensive photographic survey of the NVN railroad facilities undertaken on 20 June 67 indicates that 2000-2300 freight cars are currently operating in North Vietnam. This is a three-fold increase over recent estimates. Despite heavy U.S. strikes against railroad facilities NVN may have been able to significantly increase its inventory of rolling stock.

Between Jan 66 and June 67, 21 locomotives were destroyed, 6 imports were identified, and the estimated inventory declined from 117 to 102. The photographic coverage in June 67 indicates the actual NVN locomotive inventory is approximately 120.

3. 7000 waterborn logistic craft have been destroyed by U.S. air strikes. The NVN inventory has declined from an estimated 42,000 in Jan 66 to 35,000-40,000 in June 67. The number of replacements has not been estimated, although large numbers of modern craft have been identified. These replacements have larger hulls and, while the absolute number of water craft may have declined slightly, the overall carrying capacity in NVN has not been degraded.

^{a/} \$2 million per aircraft lost and \$12,500 per sortie.

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TRANSPORTATION FACILITIES IN NVN

	1966					Total 1966	1967		1967 To Jun
	Jan Mar	Apr Jun	Jul Sep	Oct Dec	Jan Mar		Apr Jun		
<u>Trucks</u>									
Beginning Inventory	11696					4690	11890		
Losses ^{1/}	721	1510	1664	795	4884	888	1215	2103	
Replacements	1472	1689	865	753	11890	877	1080	1957	
Ending Inventory	12447	12626	11827	11890	11890	11879	11744	11744	
<u>RR Rolling Stock</u>									
Beginning Inventory	1740					687	1121		
Losses	7	206	282	192	68	74	286	342	
Replacements ^{2/}	30	0	38	0	1121	0	41	41	
Ending Inventory	1763	1557	1313	1121	1121	1047	802	802 ^{3/}	
<u>RR Locomotives</u>									
Beginning Inventory	117					9	114		
Losses	0	0	7	2	6	0	12	12	
Replacements	0	1	2	3	114	0	0	0 ^{3/}	
Ending Inventor.	117	118	113	114	114	114	102	102 ^{3/}	
<u>Water Craft</u>									
Beginning Inventory	42000								
Losses	124	1231	1899	1064	4318	822	1871	2693	
Ending Inventory ^{3/}								35000 40000	

1. Losses = (.75) (Reported Destroyed) + (.25) (Reported Damaged) + Retired at .005/month.
2. Imports of RR vehicles from Communist China are almost impossible to identify and only positive identifications have been included.
3. Additions to water craft inventory have not been estimated.
4. Comprehensive photographic coverage of NVN in June 67 indicates the inventory of rolling stock = 2300, locomotives=120. Discrepancy with prior estimates is due to lack of information pertaining to imports and incorrect initial evaluation.

SOURCE: DIA Target Analysts

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ARMED RECONNAISSANCE EFFICIENCY IN NORTH VIETNAM - A REAPPRAISAL

We previously said that the efficiency of armed reconnaissance sorties in NVN was rising fast. We now think that we were wrong. The May and July issues of the SEA Analysis Report contained articles which concluded that the number of moving targets destroyed or damaged per 1000 armed recce sorties had increased almost steadily from 142 in the last quarter of 1965 to 619 in the second quarter of 1967. We assumed that the total number of motor, water, and railroad vehicles destroyed in NVN, as reported by DIA, were the result only of armed reconnaissance sorties. Data now available from the NMCS COMBA File indicates that this assumption was incorrect. Large and increasing numbers of moving vehicles in NVN are destroyed by strike aircraft while attacking railroad yards, transshipment points, and dock facilities, as shown in the table below.

PILOT REPORTED
MOVING VEHICLES DESTROYED/DAMAGED IN NVN

	<u>1966</u>		<u>1967</u>	
	<u>Oct- Dec</u>	<u>Jan- Mar</u>	<u>Apr- Jun</u>	<u>Jul- Sept</u>
<u>By Type Sortie</u>				
Armed Recce	2933	2139	5437	3507
Strike & Other	684	881	1710	3453
Total	<u>3617</u>	<u>3020</u>	<u>7145</u>	<u>6960</u>
Tgts D/D on Strike and Other As % of Total	19	29	24	50

Source: COMBA File, NMCS

Data in the COMBA File are determined solely from pilot reports. It is difficult for a pilot operating a high-speed aircraft in a hostile environment to determine accurately the effects of his attack. Thus, the results reported by pilots tend to overstate the actual damage. However, if we assume the biases are constant, the information may be valid for analyzing efficiency trends. The table below shows pilot reports of the results of U.S. armed reconnaissance operations in North Vietnam.

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PILOT REPORTED
ARMED RECCE RESULTS - NVN

	1966		1967		12 mo. Total
	Oct- Dec	Jan- Mar	Apr- Jun	Jul- Sept	
<u>Targets D/D</u>					
Motor	559	389	1090	906	2944
Water	2281	1670	4117	2302	10370
Rail	93	80	230	299	702
Total	<u>2933</u>	<u>2139</u>	<u>5437</u>	<u>3507</u>	<u>14016</u>
Armed Recce Sorties	11257	7279	14779	11120	44435
Targets D/D Per 1000 AR Sorties	261	294	368	315	315

Consistent and dramatic increases in efficiency are not evident. The number of moving targets destroyed or damaged by armed recce sorties has fluctuated from one quarter to the next, but generally follows the weather cycle. Efficiency (in terms of the number of targets destroyed or damaged per 1000 sorties) also has varied considerably and has only a small secular trend at best. There were 293 targets destroyed/damaged per 1000 sorties in October 1966, 436 in April and 212 in July 1967. The number of moving targets destroyed/damaged per 1000 armed recce sorties declined from a peak of 368 in the second quarter to 315 in the third quarter of 1967.

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The Cost of Bombing North Vietnam

The bombing of North Vietnam appears to cost the US about 9% of the \$24 billion total cost of the war in SEA. The table below shows these costs in terms of the incremental savings estimated for CY 1968 if U.S. air operations against North Vietnam were to be stopped. This is not to say that the bombing should be stopped - it is only an essential assumption in order to make a cost estimate.

INCREMENTAL SAVINGS - CY 1968
IF U.S. AIR OPERATIONS IN SEA ARE STOPPED
(\$ Millions)

	<u>Operating Costs</u>	<u>Procurement Ammunition</u>	<u>Military Pay</u>	<u>Attrition</u>	<u>Pilot Costs</u>	<u>Total</u>
USAF Aircraft	148	253	126	417 ^{a/}	176 ^{b/}	1120
USN Aircraft	18	471	6	345 ^{a/}	18 ^{b/}	858
USN Carriers	11	c ^{c/}	12	0 ^{c/}	0	23
USA Personnel ^{d/}	28	5	33	0	0	66
USAF Personnel ^{d/}	43	0	49	0	0	92
	<u>248</u>	<u>729</u>	<u>226</u>	<u>762</u>	<u>194</u>	<u>2159</u>

a/ Includes \$26 million of USMC attrition.

b/ Includes \$1.4 million of USMC pilot costs.

c/ Included in cost of Navy aircraft.

d/ Base operating support and related support personnel.

If the air campaign against North Vietnam is stopped the U.S. would save approximately \$2.2 billion during CY 1968. Estimated savings in aircraft attrition (\$762 million) and ammunition (\$729 million) account for 69% of the total 2159 million. Pilot training costs would be reduced by approximately \$194 million because of lower training requirements and pilot losses. An additional \$248 million in operational expenses and \$226 million in military pay would be saved by reduced flying hours and munitions handling, closing of air bases and the phase out of the Intrepid.

These costs are based upon the SEAPRO Cost Analysis model which calculates the cost of alternative deployments in Southeast Asia. Cost factors in the model are based upon two states or conditions of military resources - deployed and not-deployed. These two states are roughly equivalent to wartime and peacetime conditions. This dual-state nature of the cost model makes it possible to calculate the incremental cost to deploy an infantry battalion (or a squadron of F4s) from a peacetime environment in the U.S. to a combat status and to operate it for a 12 month period in Southeast Asia. Wherever possible the cost factors have been based on the military cost handbooks and actual experience in Southeast Asia.

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Cost of U.S. Air Operations in NVN - Assumptions

The assumptions used to estimate the cost of U.S. air operations in North Vietnam during CY 1968 are shown below:

1. U.S. sorties planned for use in NVN were cancelled.
2. Planned sorties in Laos and South Vietnam were not charged.
3. Sufficient aircraft were left in South Vietnam to maintain air operations in SVN and Laos at their current level. All other aircraft were returned to the U.S. from Thailand and Navy aircraft carriers.
4. U.S. airbases in Thailand were closed whenever possible, and their base operating support personnel discharged from military service.
5. Two U.S. aircraft carriers were operated in a peacetime environment and the Intrepid was retired from the Navy.

Large numbers of Air Force and Navy aircraft could return to the U.S. if the U.S. air operations in North Vietnam are stopped. Without reducing the level of effort in South Vietnam and Laos, it would be possible to send all USAF fighter/attack, recce, and ECM currently stationed in Thailand to the U.S. The three Navy aircraft carriers at YANKEE STATION could be deployed to other areas of the world. Aircraft based in South Vietnam, no longer required to fly sorties in the North, would be used to offset the loss of these aircraft as shown below:

<u>Fighter/Attack Sorties in SVN/Laos Planned By</u>	<u>SVN/Laos Sorties</u>
USAF (Thailand-based)	12534
Navy	11401
Total	23935
<u>To Be Diverted From NVN</u>	
USAF (SVN-based)	20504
USMC (SVN-based)	7347
Total	27851
Difference	+3916
<u>Recce Sorties</u>	
Planned	4676
Diverted from NVN	4864
Difference	+188

It was assumed that two Navy aircraft carriers, currently operating in Southeast Asia, would be used for peaceful operations in other areas of the world. The Intrepid would retire from active service. The table below shows the Thailand-based aircraft which would return to the U.S. and operate in a peacetime environment. Propeller aircraft, B-52s, and F-102s were left in Thailand for use in other Southeast Asia military operations.

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<u>Type</u>	<u>Aircraft Returned to U.S.</u>
F-4	90
F-105	108
C-130	17
KC-135	40
RF-4	24
RF-101	16
EB-66	41
EC-121	6
Total	<u>342</u>

If these aircraft were returned to the CONUS it would be possible to close three U.S. airbases in Thailand (Udon, Udorn, and Korat). This action would make it possible to remove approximately 6000 base operating support personnel from active duty. In addition, 4350 Army troops, used primarily in support of USAF operations in Thailand, could be discharged from the service.

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TRUCK DESTRUCTION IN THE STEEL TIGER AREA

The STEEL TIGER area in Laos runs from the 20th parallel to the Cambodian border and includes the major infiltration routes of the Ho Chi Minh Trail. Most of the enemy men and supplies that infiltrate into South Vietnam pass through some part of this network of roads and trails.

Enemy activity along the Ho Chi Minh Trail increased significantly in 1967 despite heavy US interdiction. US pilots sighted 11,205 trucks in the STEEL TIGER area in Oct-Dec 1967, more than 13 times the number sighted during the same period in 1966. This increase in truck sightings is probably the result of three factors:

1. More US aircraft are operating in the area, hence more information. During the fourth quarter 1967, a total of 11,405 attack sorties were flown in the STEEL TIGER area, almost double the number during the same period in 1966. The number of FAC sorties also increased.

2. Wider use of night observation devices have increased significantly our night detection capability.

3. More trucks on the roads, in part due to an early end to the rainy season in Laos. In 1966 the monsoon continued through November. However, the roads were dry by October in 1967, and the North Vietnamese took advantage of the break in the weather to prepare for the Winter/Spring offensive.

The table below shows truck sightings, attack sorties and results in STEEL TIGER for the period Oct 66 - Dec 67.

	<u>1966</u> <u>Oct-</u> <u>Dec</u>	<u>1967</u>				<u>Total</u> <u>Oct 66-</u> <u>Dec 67</u>
		<u>Jan-</u> <u>Mar</u>	<u>Apr-</u> <u>Jun</u>	<u>Jul-</u> <u>Sep</u>	<u>Oct-</u> <u>Dec</u>	
Truck Sightings	848	2260	1673	743	11205	16729
Results (Pilot Reports)						
Trucks damaged	122	320	79	10	236	767
Trucks destroyed	204	456	173	52	1669	2554
Total	326	776	252	62	1905	3321
Evaluated Trucks Destroyed ^{a/}	184	422	150	42	1311	2109
Attack Sorties	6680	15238	7993	2673	11405	43989
Trucks Destroyed Per 1000 Sorties	28	28	19	16	115	48

^{a/} DIA estimate of trucks destroyed beyond repair.

SOURCE: DIA for sightings and results. COMBA file for sorties.

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DIA estimates that 300-400 trucks are permanently stationed in STEEL TIGER and approximately 300 more shuttle material into the area from North Vietnam. During the 15 month period, Oct 66 - Dec 67, US pilots reported they destroyed 2554 and damaged 767 trucks in the STEEL TIGER area. These results are based solely on pilot reports and probably overstate the actual damage. On the basis of past experience and collateral information, DIA estimates the actual truck losses are equal to approximately 75% of the trucks reported destroyed plus 25% of those reported damaged. On this basis, DIA estimates about 2100 trucks were destroyed in STEEL TIGER during the period Oct 66 - Dec 67. Thus, the North Vietnamese have been forced to replace their entire truck inventory in the Laotian Panhandle approximately three times since October 1966.

During the fourth quarter 1967 alone, the US interdiction effort appears to have destroyed about 1300 trucks. This represents approximately double the normal truck population in STEEL TIGER, but only 10-12% of the estimated total truck inventory of North Vietnam. The North Vietnamese (and their Soviet and East European supporters) appear able and willing to continue to sustain this magnitude of losses. Despite the heavy losses in late 1967, truck sightings in the STEEL TIGER area reached a new peak of 6200 in January 1968, almost five times the monthly average during 1967. During the first ten days of February, roadwatch teams reported 500 southbound trucks through the Mu Gia Pass, double the daily average in January.

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THE BOMBING - ITS ECONOMIC COSTS AND BENEFITS TO NORTH VIETNAM

I. Summary and Conclusion

One reason we bomb North Vietnam is to impose economic costs on the North Vietnamese for their continued support of the war in the South. These costs are imposed through destruction of North Vietnam's industry, transportation, communications, etc., and by forcing the government to divert productive labor from local production to bomb damage repair. (This paper does not consider other effects of the bombing on the North, such as adverse psychological effects on the population, creating fears of a wider war as an inducement to negotiate, and creating political divisions within the Government of North Vietnam that could lead to an early settlement).

Judged on this criterion, the air war on the North has not been very successful. The best statistical evidence available indicates that the results have been as follows:

- a. The total supply of goods in North Vietnam has been little affected by the bombing. Imports in the form of communist non-military aid have more than offset the loss of domestic production caused by the bombing. But, per capita consumption of consumer goods (food, clothing, etc.) is probably lower, because the composition of imports has been affected by military priorities.
- b. Much of North Vietnam's capital stock has been destroyed by the bombing. However, it could be replaced in a short period if the bombing stopped and if past or present levels of communist foreign aid continued. If the pre-bombing capital stock is replaced (but not increased), the "cost" of the bombing to North Vietnam would be the cumulative loss of output until full replacement occurs. Even if the pre-bombing capital stock were rebuilt but not increased, it would be more modern and productive than it otherwise would have been, thus offsetting part (if not all) of the bombing's cost.
- c. Manpower diverted from local production to bomb damage repair and military service (747,000) has been more than offset by the natural growth of the labor force, importation of foreign labor, labor released through bomb damage, etc., (841,000). North Vietnam has the ability to overcome future manpower shortages through a variety of methods such as diverting labor from low productivity employment (i.e., underemployment in agriculture), importing labor, and using more women in the labor force.

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- d. Some economic effects of the war on North and South Vietnam have been quite similar. In both countries, foreign aid has offset the loss of domestic production. The amount of aid to the two countries has been roughly proportional to the percentage of the labor force drawn into war activities.

II. Effects on North Vietnam's Gross National Product

Prior to 1965, the growth rate of the North Vietnamese economy averaged 6% per year. It is estimated that this rate continued (and even increased slightly) during 1965 and 1966, the first two years of the bombing (Table 1). In 1967, however, domestically-produced GNP declined sharply to only \$1,688 million - a level roughly comparable to the prewar years of 1963 and 1964. The cumulative loss in GNP caused by the bombing in the last three years is estimated to be \$294 million (Table 2).

To offset these losses, North Vietnam has had an increased flow of foreign economic aid. Prior to the bombing, economic aid to North Vietnam averaged \$95 million annually. Since the bombing began, the flow of economic aid has increased to \$340 million per year (Table 1). The cumulative increase in economic aid in the 1965-67 period over the 1953-64 averaged has been an estimated \$490 million.

Thus, over the entire period of the bombing, the value of economic resources gained through foreign aid has been greater than that lost because of the bombing (Table 3). The cumulative foreign aid increase has been \$490 million; losses have totaled \$294 million.

In addition to the loss of current production, North Vietnam has lost an estimated \$164 million in capital assets destroyed by the bombing. These capital assets include much of North Vietnam's industrial base - its manufacturing plants, power plants, and bridges.

It is not certain that Russia and China will replace North Vietnam's destroyed capital assets through aid programs, thus absorbing part of the bombing cost themselves. However, they could do so in a short period of time at relatively small cost; if economic aid remained at its wartime yearly rate of \$340 million and half were used to replace capital stock, North Vietnam's losses could be replaced in a year. If the capital stock is replaced, the economic cost to North Vietnam of the bombing will be the cumulative loss of output from the time the bombing began until the

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capital stock is fully replaced. Even this probably overstates the cost, however. Even if the pre-bombing capital stock were only replaced, it would be more modern and productive than it otherwise would have been.

While the aggregate supply of goods in North Vietnam has remained constant, standards of living may have declined. The composition of North Vietnam's total supply has shifted away from final consumer goods toward intermediate products related to the war effort, i.e., construction and transportation.

Food supplies, vital to the health and efficiency of North Vietnam, have been maintained with only a slight decline. As shown in Table 4, the estimated North Vietnamese daily intake of calories has fallen from 1,910 in 1963 to 1,880 in 1967. Even considering that imported wheat and potatoes are not traditional table fare in North Vietnam, the North Vietnamese are not badly off by past North Vietnamese standards or the standards of other Asian countries.

The output of industrial and handicraft output declined 35% in 1967 (Table 1). Economic aid has probably not replaced all of this decline. With lower war priority, the supply of non-food consumer goods such as textiles and durables has probably declined more than the food supply.

Despite lower standards of living, the ability of North Vietnamese government to sustain its population at a level high enough to prevent mass dissatisfaction is evident.

III. Effects on Total North Vietnamese Manpower Supply

In addition to the economic effects, the air war has drawn North Vietnamese labor into bomb damage repair, replacement of combat casualties, construction, transportation, and air defense. Over the last three years, these needs have absorbed almost 750,000 able-bodied North Vietnamese (Table 5).

But, again there are offsetting factors. First, over 90% of the increase in manpower has been provided by population growth (Table 5). Since the start of the bombing, 720,000 able-bodied people have been added to the North Vietnamese labor force.

Second, the bombing has increased not only the demand for labor but also the supply. The destruction of much of North Vietnam's modern industry has released an estimated 33,000 workers from their jobs. Similarly, the evacuation of the cities has made an estimated 48,000 women available for work on roads and bridges in the countryside. Both of these groups of people

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were available for work on war-related activity with little or no extra sacrifice of production; if they weren't repairing bomb damage, they wouldn't be doing anything productive.

Third, North Vietnam has been supplied with manpower as a form of foreign aid. An estimated 40,000 Chinese are thought to be employed in maintaining North Vietnam's road and rail network.

Finally, additional workers could be obtained in North Vietnam from low productivity employment. In less developed countries, agriculture typically employs more people than are really needed to work the land, even with relatively primitive production methods. Also, further mobilization may be possible through greater use of women in the labor force. The available statistics are not precise enough to identify the magnitude of this potential labor pool, but the estimates given in Table 6 show that even after two years of war the total North Vietnamese labor force is only 54% of its population - scarcely higher than it was in 1965.

In sum, the total incremental need for war-related manpower of roughly 750,000 people appears to have been offset (Table 5) with no particular strain on the population. Future manpower needs may outstrip North Vietnamese population growth, but the North Vietnamese government can import more manpower (though there may be limits to how many Chinese they want to bring into the country), use women and/or underemployed workers, and draw workers from productive employment, replacing their output with imports. Given these options, it appears that the North Vietnamese government is not likely to be hampered by aggregate manpower shortages.

IV. Comparison of War's Economic Impact on North and South

Some economic effects of the war upon North and South Vietnam are quite similar. In both countries, prosecution of the war requires increased manpower and economic resources in non-productive activities, i.e., war. Domestic production declines because of the resulting destruction and disruptions. However, in both countries, the loss in domestic production has been offset by foreign aid.

In 1964, the South Vietnamese war-related employment absorbed 5.9% of its controlled population, whereas, North Vietnam absorbed 2.4% of its controlled population (Table 7). Even by 1967, North Vietnamese war employment absorbed only 4.9% of its population - a smaller percentage than South Vietnam did in 1964. In comparison, by 1967 the South Vietnamese government absorbed 7.1% of its controlled population, and it is having trouble maintaining this level.

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The greater the proportion of its country's manpower used in non-productive activity, the more economic aid has been brought in to compensate for lost production (Table 8). In 1967, foreign economic aid per government employee was \$360 in the North - where 4.9% of the population was absorbed by war activities - and \$563 in the South - where 7.1% of the controlled population was absorbed. The implication is that economic aid has been roughly proportional to the percentage of the population drawn into war activities.

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TABLE 1
 NVN AGGREGATE OUTPUT + ECONOMIC AID ^{a/}
 (Current \$ Million)

	Industry & Handi- crafts ^{b/}	Agri- culture ^{c/}	Construction ^{d/}	Commerce & Trans- portation ^{e/}	Domestic ^{f/} Production	Foreign Economic Aid	Total NVN Supply
1963	\$599	\$600	\$193	\$240	\$1,632	\$95	\$1,728
1964	673	625	206	258	1,763	95	1,859
1965	731	654	265	290	1,941	150	2,091
1966	739	613	354	319	2,026	275	2,301
1967	480	572	354	281	1,688	340	2,028

^{a/} No NVN estimates of gross material product exist for 1966 or 1967. The figures shown represent estimates made using available information.

^{b/} 1963-1966 estimates are official NVN data. 1967 estimate was derived by estimating the functioning capacity of each industry and its related output. Source: NIS, Chapter 43, Section 6.

^{c/} The 1963-67 estimates are based on the total calories produced by NVN agriculture and a dollar per calorie estimate of their value. Source: Intelligence Note #868, Department of State.

^{d/} The 1963-66 estimates are official NVN data. It is assumed that the value of construction remained unchanged from 1966 to 1967. Source: NIS, Chapter 43, Section 6.

^{e/} The 1963-1964 estimates are official NVN data. The 1965-67 values were computed by assuming a constant ratio between total value of goods supplied and the value of their distribution and transportation. Source: NIS, Chapter 43, Section 6.

^{f/} The NVN term for domestic production is "gross material production". As this implies, it excludes non-material output such as services and does not net out depreciation of the capital stock.

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TABLE 2

**NVN ACTUAL AND POTENTIAL PRODUCTION
(\$ Million)**

<u>Year</u>	Actual Domestic Production <u>(1)</u>	Potential ^{a/} Domestic Production <u>(2)</u>	Production ^{b/} Gained (Foregone) <u>(3)</u>
1964	\$1,763		
1965	1,941	\$1,869	+72.0
1966	2,025	1,981	+45.0
1967	1,688	2,099	-411.0
Cumulative Production Foregone			-294.0

a/ Between 1958 and 1963, NVN's gross material product grew at 6% annually. It is assumed here that growth would have continued except for the bombing.

b/ It is assumed that all potential production foregone and actual production decline is attributable to the bombing. This assumption is not justified in regard to NVN's agricultural output, which was hurt by abnormally bad weather during 1967.

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TABLE 3
COST AND BENEFITS OF THE BOMBING
Cumulative 1965 - 1967

	<u>Benefits</u>		<u>Costs</u>
Incremental Foreign Aid	\$490 ^{a/}	Expected Growth and Current Production Foregone	\$294 ^{b/}
		Capital Losses	164 ^{c/}
Total	\$490		\$458

^{a/} Cumulative foreign aid, 1965-67, over and above the 1954-64 average of \$95.6 million per year.

^{b/} See Table 2.

^{c/} An Appraisal of the Bombing of NVN, CIA, October 1967. Capital losses include bridges and other transport facilities, transport equipment, electric power plants, manufacturing facilities, petroleum, and miscellaneous assets. The losses are valued at U. S. dollars replacement cost using Asian factor costs and proportions.

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TABLE 4
 NVN's FOOD SUPPLY ^{a/}

	Per Capital Daily Calories ^{b/}			Grams of Proteins Per Day ^{c/}
	1959	1963	1967	
North Vietnam				
Domestic	1,965	1,910	1,650	
Imported	-	-	230	
	<hr/>	<hr/>	<hr/>	
Total	1,965	1,910	1,880	42.7
Ceylon	2,030	1,920		42.0
Taiwan	2,330	2,380		60.0
India	1,900	1,940		50.0
Philippines	1,760	2,000		46.0

^{a/} NVN estimates from Intelligence Note #868, Department of State, November 1967.

^{b/} Source of estimates for countries other than NVN came from Statistical Yearbook - 1965, United Nations, N. Y. C.

^{c/} 1967 estimates for NVN, 1964 estimates for other countries.

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TABLE 5

SOURCES AND USES OF WAR-RELATED MANPOWER ^{a/}
 (People Aged 15-64 in 000)
 January 1965 - December 1967

<u>Sources</u>		<u>Uses</u>	
Natural Additions to Civilian Labor Force ^{b/}	720.0	Killed in NVN	25.0 ^{f/}
Foreign Workers ^{c/}	40.0	Killed in SVN	61.0 ^{g/}
Evacuated Employables ^{d/}	48.0	Increase in Armed Forces	275.0 ^{h/}
Bombing Released ^{e/} Industrial Workers	33.0	Total Bomb Damage Repair	200.0 ^{i/}
Industrial and Agri- cultural Workers Released by Imports	Unknown	Construction	65.0 ^{j/}
		Transportation	135.0 ^{j/}
		Increase in Transportation	146.0 ^{j/}
		Foreign Workers in Bomb Repair and Transportation	40.0
Total	841.0		947.0

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TABLE 5, Continued

SOURCES AND USES OF WAR-RELATED MANPOWER
(People Aged 15-64 in 000)
January 1965 - December 1967

Footnotes

- a/ Excludes part time workers (about 150,000 in bomb damage repair, 25,000-30,000 in air defense).
- b/ Civilian labor force is assumed to be 51.4% of the population. Population will increase from 17,950 million in January 1965 to 19,300 million in December 1967. Source: DIAAP 475-2-2-67-INT.
- c/ CIA staff estimate - December 1967.
- d/ Of 190,000 total evacuees from Hanoi and Haiphong, it is assumed that 50% are women of working age and half of those are employable on war activities. Source: DIA 4B-7335-14.
- e/ All of the decline in industrial employment (see Table 6) is attributed to the bombing.
- f/ These estimates by the CIA staff include civil and military casualties through December 1967. Between 19,000 and 23,000 NVN were killed from January 1965 through June 1967.
- g/ Includes killed, died of wounds, and defectors. Source: Southeast Asia Statistical Tables, OASD(SA).
- h/ Includes about 135,000 in air defense.
- i/ CIA staff estimate.
- j/ See Table 6. Total increase in manpower employed in transportation is 281,000 - the sum of men in repair activities (135,000) and transportation (146,000).

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TABLE 6
NVN EMPLOYMENT ^{a/}

	(Thousands)	
	January 1965	January 1967
<u>Production and Distribution</u>		
Agriculture	6,900	7,000 ^{b/}
Industries	850	817
Construction	185	250
Transportation & Communication	145	426
Trade & Other	350	366
	-----	-----
Subtotal	8,430	8,859
<u>Services</u>	770	841
Total Civilian Labor Force	9,200	9,700
Military	200	475
	-----	-----
<u>Total Labor Force</u> ^{c/}	9,400	10,175
Population	17,950	18,850

^{a/} DIA staff estimate.

^{b/} Includes some workers in war-related activities.

^{c/} Excludes unfit, students, unemployed, and members of the population younger than 15 and older than 64.

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**TABLE 7
WAR EMPLOYMENT - NVN AND SVN**

	Employment (000)		% of Population	
	January 1965	December 1967	January 1965	December 1967
NVN				
Military ^{a/}	200	475	1.1%	2.5%
Government ^{b/}	230	270	1.3	1.4
Bombing Repairs	0	200	0	1.0
	—	—	—	—
Total War Sector	430	945	2.4%	4.9%
Population	17,950	19,300		
SVN				
Military ^{a/}	612	724	4.8	4.9
Government ^{c/}	142	192	1.1	1.3
U.S. Employees	5	129	0	.9
	—	—	—	—
Total War Sector	759	1,045	5.9%	7.1%
Controlled Population ^{d/}	12,804	14,750		

^{a/} Estimates include all armed and uniformed soldiers. For SVN, this figure includes ARVN, RF, CIDG, and National Police. Source: Southeast Asia Statistical Bulletin, October 1967.

^{b/} Estimates include all employees in non-productive elements of socialist sector. It includes NVN government employees in industry, agriculture, construction and forestry. Source: DIA AP-475-2-2-67-LWT.

^{c/} Source: Annual Statistical Bulletin, USAID, Saigon 1967.

^{d/} Controlled population is assumed to consist of the sum of GVN-controlled and contested population. The VC-controlled population in SVN is excluded because the GVN will be unable to obtain employables from it in large numbers.

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TABLE 8
FOREIGN ECONOMIC AID - NVN AND SVN ^{a/}

	<u>1964</u>	<u>1967</u>
Foreign Aid (\$ Million)		
SVN	\$225	\$578
NVN	95	340
War Employment (000)		
SVN	759	1,045
NVN	430	745
War Employment as Percent of Population		
SVN	5.9%	7.1%
NVN	2.4	4.9
Foreign Aid Per War Employee (\$/Man)		
SVN	302	553
NVN	220	359

^{a/} Excludes all military aid. MIS, Chapter 43, Section 6 is source of NVN data. Annual Statistical Bulletin, USAID, Saigon 1967 is source of aid estimates for SVN.

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January 65

MUSCLE SHOALS-MUD RIVER

MUD RIVER is the sub-system of the MUSCLE SHOALS program which is designed to improve the effectiveness of our truck interdiction campaign in Laos. The system, which became operational on December 1, 1967, consists of electronic sensors which are monitored by orbiting EC-121 aircraft. Information received from the sensors is automatically relayed to an Infiltration Surveillance Center (ISC). The target is tracked as it passes through a sensor field, and estimates are made of its speed and direction of travel. When the ISC has identified a track the target information is passed to Task Force Alpha (TFA) for appropriate action. Strike recommendations are sent to the 7th Air Force Tactical Air Control Center (TACC) which directs FAC or strike aircraft to the designated area. The ISC continues to track targets which are not located or destroyed and periodically provides the TACC with updated target nominations.

The table on the next page shows results of the first 5 weeks of operation. A target track refers to one or more vehicles moving in a convoy, regardless of the number of times it is nominated as a target by Task Force Alpha. A target nomination refers to all targets identified by TFA and passed to the Tactical Air Control Center. For example, if a convoy of trucks is nominated as a target, located, and destroyed, it would be considered one track and one target nomination. However, if the convoy is not destroyed on the initial nomination, Task Force Alpha will continue to track its position and provide additional target nominations to the TACC. In this case, one track will generate multiple opportunities (nominations) to attack the target as it moves down the road. The table on the following page shows all TFA Target Nominations to the TACC. It also shows which nominations were generated by the initial target identification and which resulted from updated information relating to the same convoy. The total TFA Tracks include the total convoys identified by Task Force Alpha, regardless of the number of times they were nominated as a target.

During the first 5 weeks of operation, 262 seismic sensors were emplaced in the MUD RIVER area, 70 (27%) failed to operate after delivery. Of the 50 acoustic sensors dropped, approximately 22% failed to operate properly. MUSCLE SHOALS aircraft encountered AAA fire on 128 occasions, and 1 aircraft was damaged. The decline in AAA encountered during the last three weeks is apparently due to a failure in the reporting system, not a decrease in enemy defenses.

Truck Detection

Task Force Alpha recommended strikes on 1431 targets in the MUD RIVER area; approximately 50% (712) were investigated by FAC or strike aircraft which confirmed 127 as valid targets. FAC aircraft were unable to locate targets on the other 585 nominations which they investigated. It must be assumed that a portion of these were valid target tracks which escaped detection by the FAC, but we have no evidence at present to indicate the magnitude of this figure. Of the 719 not investigated, 240 were due to weather over the target area, 142 because FAC aircraft were not available, 151 because a strike was already in progress in the area (possibly indicating the presence of a valid target), and 186 due to other causes.

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Task Force Alpha identified 1118 tracks during the 5 week period. FAC or strike aircraft investigated 571 (51%) of the tracks and confirmed 118 as valid targets. The percentage of investigated tracks which are confirmed declined from 39% during the first two weeks of operation to 7% from December 29 to January 4.

Truck Destruction

MUD RIVER operations provided targets for 136 attack sorties which destroyed or damaged 112 trucks, 0.82 trucks per sortie. By comparison, during the first 9 months of 1967, U.S. pilots destroyed or damaged 1332 trucks on 30409 attack sorties in Laos, 0.04 per sortie. The rate for propeller aircraft, which operate primarily against moving vehicles in Laos, was 0.13 through September 1967, also well below the rate achieved by MUSCLE SHOALS aircraft. While it is recognized that other factors must be considered in a more comprehensive comparative analysis, the initial results of MUD RIVER indicate it may be a highly effective system for locating moving vehicles in Laos.

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MUSCLE SHOALS-MTD RIVER
(Dec 1967 - Jan 1968)

	Dec 4-14			Dec 15-21			In- Tr
	Initial Tracks	Updates	Total	Initial Tracks	Updates	Total	
<u>TFA TARGET NOMINATIONS^{a/}</u>							
Target Nominations Confirmed	45	12	57	19	13	32	
Target Nominations Not Confirmed							
Not located by FAC	84	32	116	127	45	172	
Strike in progress	0	0	0	0	1	1	
FAC not available	14	3	17	19	6	25	
Strike A/C not available	2	2	4	13	1	14	
Divert/other operations	14	6	20	26	7	33	
Weather	104	18	122	39	10	49	
Unknown	14	15	29	6	2	15	
Subtotal	232	76	308	230	79	309	
Total TFA Target Nominations	277	88	365	249	92	341	

TOTAL TFA TRACKS^{a/}

Total TFA Tracks	286	258
Total tracks investigated	138	155
Total tracks confirmed	54	28
Confirmed tracks/investigated tracks	.39	.18

RESULTS SUMMARY

Attack sorties	49	38
Trucks destroyed/damaged	43	19
Secondary fires/explosions	59	23
Trucks D/D per sortie	0.98	0.50

INCIDENTS

AAA encounters	20	99
SAM firings	0	0
Aircraft lost	0	0
Aircraft damaged	0	0

SENSOR DATA

Delivered/OPNL after delivery		
Seismic	166/129	63/47
Acoustic	23/18	9/8
Operational strings at end of period	36	50

^{a/} TFA - Task Force Alpha
Source: 7th Air Force

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Dec 15-21			Dec 22-28			Dec 29-Jan 4			Total to Date		
Initial			Initial			Initial			Initial		
Tracks	Updates	Total	Tracks	Updates	Total	Tracks	Updates	Total	Tracks	Updates	Total
19	13	32	22	6	28	8	2	10	94	33	127
127	45	172	97	26	123	145	29	174	453	132	585
0	1	1	55	30	85	53	12	65	108	43	151
19	6	25	33	17	50	47	3	50	113	29	142
13	1	14	0	0	0	2	1	3	17	4	21
26	7	33	6	3	9	22	8	30	68	24	92
39	10	49	16	3	19	43	7	50	202	38	240
6	9	15	8	1	9	11	9	20	39	34	73
230	79	309	215	80	295	323	69	392	1000	304	1304
249	92	341	237	86	323	331	71	402	1094	337	1431

258	241	333	1118
155	123	155	571
28	26	10	118
.18	.21	.07	.21

38	27	22	136
19	43	7	112
23	51	29	162
0.50	1.59	0.31	0.82

99	6	3	128
0	0	0	0
0	0	0	0
0	0	1	1

63/47	23/11	10/5	262/192
9/8	6/4	12/9	50/39
50	49	50	50

March 68

MUSCLE SHOALS/MUD RIVER - A CINCPAC REPORT

CINCPAC has provided comments on our January article summarizing the results of MUSCLE SHOALS/MUD RIVER operations for the period December 1967-January 1968. The CINCPAC analysis is presented below, followed by a SEAPRO comment.

"1. The OASD/SA Study shows approximately 0.82 trucks destroyed or damaged per attack sortie assigned by the Mud River ISC, and compares this with an overall rate for Laos, Jan-Sept 1967, of 0.04 trucks D/D per attack sortie. Unless amplified, this information could lead to erroneous conclusions. In concentrating on only one measure of effectiveness--truck destruction--the study ignores all other non-vehicular target objectives of the LOC interdiction campaign in Laos during this period--such as weapon sites and guns, storage and supply areas, choke point interdictions, troop concentrations and other fixed targets. It thus compares the truck killing effectiveness of a group of sorties directed exclusively against trucks (ISC directed) with that of another group directed against a wide variety of targets in all of Laos.

"2. The complete sortie data for South Laos in 1967 shows that approximately 38,000 attack sorties against all types of targets destroyed, among other things, 3,800 trucks. While this is only 0.1 trucks killed per sortie, when it is considered that only about 10 to 15 percent of these total sorties were ordnance delivering sorties against truck targets (as in the ISC case), the truck kill per sortie directed against trucks becomes approximately 0.8 trucks per sortie--essentially the same efficiency as for ISC directed sorties.

"3. An interim CINCPAC analysis of truck interdiction operations in South Laos for recent months has been made. The findings are summarized in the following paragraphs for 3 areas: Steel Tiger Area (excluding Mud River Area), Mud River Area (excluding Task Force Alpha requested sorties) and ISC/Task Force Alpha requested sorties.

"4. By limiting this comparison of sortie effectiveness to those attack sorties which delivered ordnance against vehicular targets, a smaller part of the total attack sortie effort is considered as seen in the table below. In December and January 1968 the majority of the vehicular targets in the Mud River Area were assigned through air observation alone without direction from Task Force Alpha. There was an apparent reversal of this trend in early February.

	Vehicle Attack Sorties		
	December	January	February 1-15 (Preliminary)
Steel Tiger Area (exclusive of Mud River)	420	370	100
Mud River Area (Not TFA Requested)	500	440	80
Mud River - ISC (TFA requested)	134	122	169

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"5. Vehicles either destroyed or damaged by each of the sortie categories of paragraph 4 above are tabulated here. The table shows a large majority of the kills in December and January resulted from sorties assigned through aerial observation only, while February distribution is about equal

	Vehicles Destroyed/Damaged		
	December	January	February 1-15 (Preliminary)
Steel Tiger Area (exclusive of Mud River)	180	240	132
Mud River Area (Not TFA Sorties)	620	690	133
Mud River - ISC (TFA Sorties)	100	71	114

"6. In this table, data from paragraphs 4 and 5 were used to find vehicles destroyed or damaged per sortie for each sortie category.

	D/D Per Sortie		
	December	January	February 1-15 (Preliminary)
Steel Tiger Area (exclusive of Mud River)	0.44	0.64	1.3
Mud River Area (Not TFA Sorties)	1.23	1.56	1.6
Mud River - ISC (TFA Sorties)	0.75	0.58	0.7
Steel Tiger/Mud River Areas (exclusive of TFA Sorties)	0.87	1.14	1.4

The apparent higher efficiency for air-observation assigned sorties may reflect a number of factors at work, e.g., (a) air-observation skins all the easy-to-attack cases leaving the ISC to detect the more difficult-to-fix targets; (b) difficulties associated with timely investigation and confirmation of the ISC generated targets; (c) truck hunting sorties expend against alternate fixed targets, failing to receive a vehicle target assignment through aerial observation.

"7. Because of the short time that the Mud River ISC has been operational and the limited data available for this analysis, it is premature to draw conclusions from these findings regarding its long-range capability. The results for December and January demonstrate it has achieved an average sortie interdiction capability approaching that provided by normal aerial observation and detection. The preliminary results from the first half of February, which are also shown above, indicate the system may show some improvement in coming months."

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SEAPRO Comment:

We agree that other factors besides truck kills per sortie must be considered in a complete comparison of MUSCLE SHOALS with other interdiction systems. However, the CINCPAC study then compares the results of all MUSCLE SHOALS sorties with results of attack sorties that actually delivered ordnance against vehicular targets. This is not a meaningful comparison because detection of moving vehicles in the mountainous Laotian Panhandle is the most difficult aspect of the interdiction campaign. CINCPAC excludes the large number of sorties which fail to find trucks and therefore attack alternative targets. A meaningful comparison of MUSCLE SHOALS with other interdiction systems in Laos must consider the cost of locating the target as well as the sorties required to destroy it once it is found.

We are continuing our analysis of MUSCLE SHOALS operations, and will present a more detailed evaluation in our next issue.

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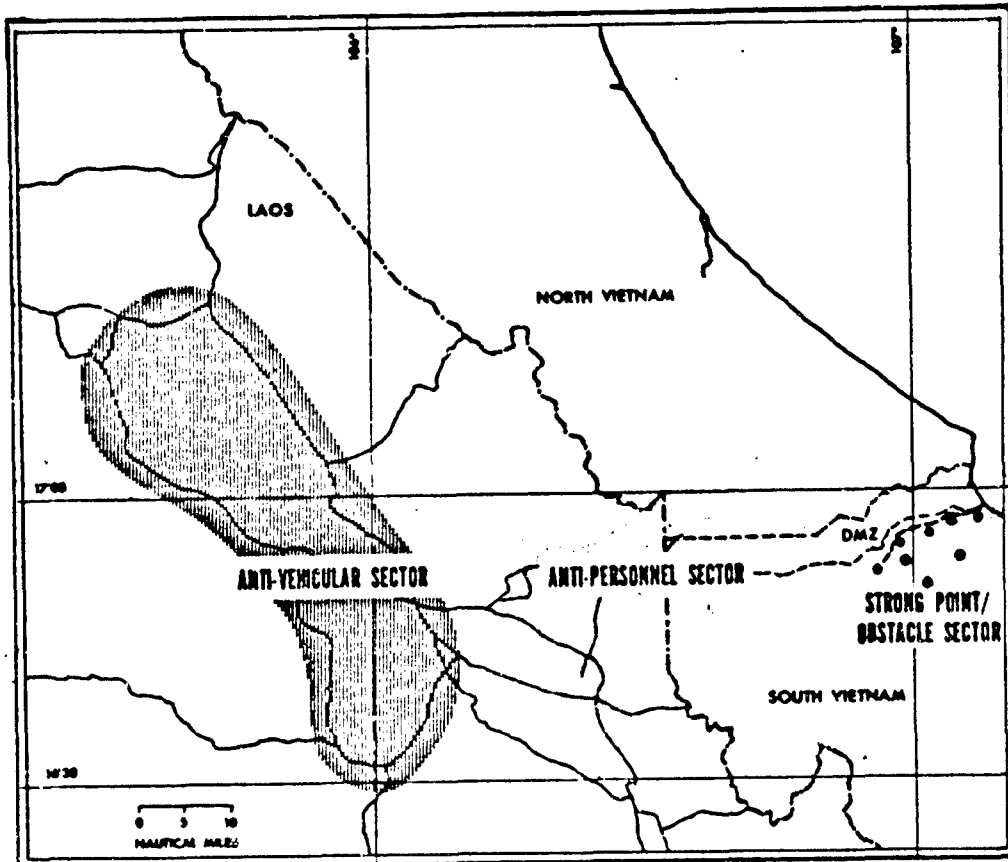
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April 68

MUSCLE SHOALS

MUSCLE SHOALS is a \$670 million per year air-supported surveillance system designed to help reduce the infiltration of men and material into South Vietnam. It has two major sub-systems: MUD RIVER, the anti-vehicular sub-system covering the major roads in Laos, and DUMP TRUCK, the anti-personnel sub-system in the western part of the Demilitarized Zone (DMZ) and eastern Laos (see map below). MUD RIVER has been in operation since December 1, 1967; DUMP TRUCK since February 1, 1968. Since we have virtually no effectiveness data on DUMP TRUCK, and since its resources have been diverted until recently to the Khe Sanh campaign, we will confine this analysis to MUD RIVER, the anti-truck sub-system.



ANTI-INFILTRATION SUBSYSTEMS

How Does MUD RIVER Work?

Strings of seismic and acoustic sensors are dropped along roads and trails by A-1 and F-4 aircraft. The sensors are monitored by orbiting EC-121 aircraft which automatically relay sensor activations to the Infiltration Surveillance Center (ISC) in Thailand. A target is tracked by the ISC as it passes through the sensor fields and estimates are made of its speed and direction of travel. When the ISC has identified a track it is passed to Task Force Alpha (the 7th Air Force control center) for appropriate action. Strike recommendations are sent to the Tactical Air Control Center (TACC) which directs aircraft to the target area. Task Force Alpha (TFA) continues to track targets which are not located or destroyed and periodically provides updated target information to the TACC.

What Has MUSCLE SHOALS Accomplished?

Results from the first four months of operation indicate that:

1. Forty-five percent (2557) of the 4665 target nominations^{1/} were never investigated. Other operations in the target area (not related to MUSCLE SHOALS) precluded investigation of 642 nominations, and 326 were not investigated because a strike was already in progress (probably indicating a valid track by TFA). FAC aircraft were not available to investigate 350 nominations and 312 were prevented by poor weather over the target area.

2. Twenty-one percent of the TFA nominations investigated are confirmed as valid targets.^{2/} This does not mean the system was wrong 79% of the time; it only shows that, for one reason or another, FAC aircraft were unable to locate targets on 2010 of the 2557 nominations they investigated during the period. Poor weather prevented confirmation of 266 nominations, and strikes were already in progress on 127 target nominations. FAC aircraft actually searched the target area on 1443 nominations and confirmed 547 targets, a confirmation rate of 38%. These results were probably due to one or more of the following factors: the system identified a "phantom target", the trucks were out of the area before a FAC arrived; or the FAC was unable to find a hidden target.

1. A target nomination is any suspected target identified by TFA and passed to the TACC.
2. FAC aircraft investigated 2443 of the 3984 target tracks during the period and confirmed 22% of those investigated as valid targets. A target track refers to one or more vehicles moving in a convoy regardless of the number of times it is nominated as a target by TFA.

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TVA TARGET NOMINATIONS

	Dec 1967	Jan 1968	Feb 1968	Mar 1968	Total Dec - Mar
<u>Nominations Investigated</u>					
Nominations Confirmed	114	95	187	151	547
Nominations Not Confirmed	491	373	190	389	1443
Not located by FAC	0	2	4	-	7
FAC abort	72	54	79	61	266
Weather in target area	9	97	9	12	127
Strike in progress	5	62	55	45	167
Other					
<u>Nominations Not Investigated</u>					
Strike in progress	98	225	3	-	326
Weather in target area	135	82	23	72	312
FAC not available	129	137	7	77	350
Other operations in area	52	52	90	448	642
Other	259	65	39	115	478
<u>Total Target Nominations</u>	<u>1364</u>	<u>1244</u>	<u>687</u>	<u>1370</u>	<u>4665</u>

3. Fifty-two percent of the confirmed targets were attacked. Of the 547 nominations confirmed as valid targets during the period, only 282 were attacked by strike aircraft. A total of 49 confirmed targets were lost in the foliage before attack aircraft arrived and an additional 107 were already under attack. Strike aircraft were not available on only 5% of the confirmed targets as shown below:

TASK FORCE ALPHA TARGET CONFIRMATIONS

Targets Confirmed and Struck	57	55	129	41	282
Targets Confirmed/Not Struck	57	40	58	110	265
Strike in progress	-	10	16	81	107
Other operations in area	31	1	22	3	57
Strike A/C not available	17	7	1	1	26
Abort	-	-	1	-	1
Lost in foliage	1	14	12	22	49
Lost in weather	7	4	5	-	16
Other	1	4	1	3	9
<u>Total targets Confirmed</u>	<u>114</u>	<u>95</u>	<u>187</u>	<u>151</u>	<u>547</u>

4. Five hundred sixty-nine attack sorties, flown in response to MUD RIVER target nominations, destroyed or damaged (D/D) 384 trucks, 0.67 trucks D/D per sortie. Trucks destroyed/damaged as a result of MUD RIVER nominations represent 13% of the 3000 trucks destroyed in the same area by all U.S. operations. Pilots reported 775 secondary fires and explosions during the four month period.

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	1967		1968		Total
	Dec	Jan	Feb	Mar	Dec - Mar
Attack sorties	191	89	213	76	569
Trucks destroyed	106	61	111	71	349
Trucks damaged	19	12	3	1	35
Secondary fires/explosions	200	176	341	58	775
Trucks D/D Per Sortie	0.65	0.82	0.54	0.95	0.67

5. A total of 955 seismic and acoustic sensors were emplaced in MUD RIVER during the first four months of operation; 692 (72% of the total) were operational after delivery. The spikebuoy had the highest operational rate (87%) while the seismic ADSID sensors had the lowest (65%). The percentage of ADSID and acoustic sensors operational after delivery has declined steadily since December 1967, as shown below. In addition, the end-of-life timers on many sensors failed to function properly, making it difficult to re-seed or move the sensor fields.

Type	Total (Dec - Mar)		% Operational After Delivery			
	Delivered	% Opnl After Delivery	Dec	Jan	Feb	Mar
Acoubuoys	122	84%	95	80	77	na ^{a/}
ADSID	621	65%	71	68	62	57
Spikebuoy	212	87%	na ^{b/}	96	72	90

a/ No acoubuoys were delivered in March 1968.

b/ No spikebuoys were delivered in December 1968.

What Does MUSCLE SHOALS Cost?

The three-year (FY 67-69) program cost of MUSCLE SHOALS is approximately \$1.6 billion. As is shown in the table below we estimate the first year savings at \$428 million if both of the MUSCLE SHOALS sub-systems were discontinued (based on the level of operations planned during FY 69). Total savings realized by stopping either MUD RIVER or DUMP TRUCK alone are less than half the potential savings if both systems are abandoned because of joint costs required to operate the ISC and support aircraft.

FIRST YEAR SAVINGS
(\$ millions)

	Stop Only	Stop Only	Stop All
	MUD RIVER	DUMP TRUCK	MUSCLE SHOALS
Aircraft/ISC	30.0	30.0	91.2
Sensors	14.4	15.6	30.0
Munitions	147.6	159.6	307.2
Total	192.0	205.2	428.4

SOURCE: Defense Communications Planning Group (for sensors and munitions)
OASD/SA/SEAPRO (for aircraft and ISC)

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Only a portion of this first year savings of \$428 million would represent cash in hand. About \$337 million, 75% of the total, represent FY 68 or prior year funds which have already been obligated to produce sensors (\$30 million) and special munitions (\$307 million). It is impossible to realize significant cash savings on these items now. However, all of the sensors and munitions could be used in other areas of operation in Southeast Asia. For example, munitions and sensors could be seeded along lines of communications in North Vietnam or in suspected enemy bases in the South; both these uses are currently under consideration. In this sense, the sensors and munitions represent an opportunity cost of the MUSCLE SHOALS system. The remaining \$91 million are incremental operating costs of aircraft, equipment and personnel required to operate the ISC. If MUSCLE SHOALS were cancelled the savings in subsequent years would be greater. For example, the bulk of the funds in the FY 69 budget (\$673 million) could be used for other purposes.

Special MUSCLE SHOALS munitions (gravel, dragontooth, button bomblets, and WAAPM) cost approximately \$300 million per year. The contribution these munitions will make to the overall effectiveness of MUSCLE SHOALS is unknown; however, results during the first four months of operation indicate that the system can detect and track vehicular and personnel movement without them. The munitions could be used to impede or reduce enemy infiltration in other areas, and there is no evidence to indicate the optimum results are achieved by using them solely in the MUSCLE SHOALS area of operation. In fact, it may be easier for the enemy to sweep munitions from a limited area than if they are randomly seeded throughout the infiltration network.

Is MUSCLE SHOALS Worth Its Cost?

MUSCLE SHOALS is primarily an intelligence system and its value is dependent on the accuracy and timeliness of two types of intelligence.

1. Real-time intelligence on truck targets. Preliminary analysis by DCPG indicates that as many as 70-80% of the TFA nominations are valid targets. This conclusion is based on the high correlation between (1) truck sightings and MUD RIVER tracks and (2) sensor activations and vehicle sightings in specific sensor fields. While more comprehensive analysis is required to establish the reliability of the system, actual results from the first four months of operation suggest this estimate may be overly optimistic. During this period 127 nominations were not confirmed and 326 nominations were not investigated because other aircraft were already attacking the target area. To give the system the benefit of the doubt we have assumed these nominations were all valid target tracks. The following table shows that, under this assumption, approximately 35% of the total nominations investigated are considered "confirmed."

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Total nominations investigated	2557
Nominations not investigated (strike in progress)	326
Total "Investigations"	<u>2883</u>
Nominations confirmed	547
Nominations not confirmed (strike in progress)	127
Nominations not investigated (strike in progress)	<u>326</u>
Total "Confirmations"	<u>1000</u>
Total Confirmations/Total Investigations	0.35

It seems reasonable to assume that some percentage of the 1443 nominations actually investigated by FACs, but not confirmed, were also valid targets. However, to increase the confirmation rate to 70%, it is necessary to assume that approximately 100 (71%) of the nominations not located by FACs are valid targets. This is probably an unrealistic assumption. A recent MACV analysis of operations through February 1968 suggests that 60% of the sensor detections are reliable; this appears to be a more reasonable judgment.

The heavy overt movement of enemy trucks in Laos in recent months has reduced the value of real-time intelligence from MUSCLE SHOALS. However, the value of the system may increase during periods of light truck traffic when finding targets becomes more difficult. The interdiction campaign has been constrained recently, not by a lack of targets, but rather by an inability to destroy them. A total of four FAC aircraft normally operate in the MUD RIVER area at night and have identified a surplus of truck targets. Improved night sensors should continue to increase our detection capability. MUD RIVER sensors can identify truck traffic during bad weather; however, this type of real-time intelligence is of little value because of our inability to attack under poor conditions.

Strike aircraft responding to MUD RIVER target nominations flew 569 sorties during the first four months of operation and destroyed or damaged 385 trucks; 1.5 sorties per vehicle destroyed/damaged. The following table shows the efficiency and cost of MUD RIVER attack operations compared with other types of aircraft on armed reconnaissance missions (which are primarily against truck targets). (Data shown for MUD RIVER include only the cost of attack sorties, not the operational cost of the system itself.) Attack sorties using MUD RIVER intelligence were approximately four times more efficient in destroying trucks than the average armed recon sortie in Laos during 1967. However, both the A-26 and AC-130 GUNSHIP II were considerably more efficient than MUD RIVER attack sorties. In terms of cost per vehicle D/D, the MUD RIVER sorties were more efficient than jet aircraft but less efficient than the props.

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ESTIMATED COST TO DESTROY/DAMAGE A TRUCK IN LAOS

1967 Armed Reconnaissance	Sorties	Vehicles D/D	Sorties per Vehicle D/D	Cost per Vehicle D/D ^{a/}
All US Aircraft	13846	2160	6.4	\$ 55,700 ^{b/}
F-105	2836	262	10.8	\$118,000
A-26	1156	1281	0.9	\$ 5,900
GUNSHIP II ^{c/}	9	51	0.2	\$ 5,100
<u>MUSCLE SHOALS/MUD RIVER^{d/}</u> (Dec 67-Mar 68)	569	384	1.5	\$ 13,100 ^{b/}

^{a/} OASD/SA SEAPRO estimate (\$6500 per prop sortie; \$10,900 per jet sortie).

^{b/} Assumed 50% jet and 50% prop sorties.

^{c/} Based on test results in Laos, Oct-Nov 1967.

^{d/} Attack sorties only.

SOURCE: OPREA file (for sorties); COMBA file (for results); OASD/SA SEAPRO (for costs).

2. Basic intelligence. The second type of intelligence provided by MUD RIVER indicates the density, patterns, and areas of enemy infiltration. The value of this type of intelligence is extremely difficult to quantify, because it contributes to the effectiveness of all FAC and strike aircraft by pointing them into areas with the highest levels of enemy activity. It could also be of considerable value as a means to monitor North Vietnamese infiltration during a truce period. Nevertheless, we cannot say now whether this basic intelligence is worth the approximately \$300 million annual cost.

May 68

AIR OPERATIONS IN NORTH VIETNAM

On March 31, 1968, the President limited US air operations in North Vietnam to areas south of 20° (including Route Packages 1-3 and part of 4). In fact, US attack and reconnaissance sorties have been restricted almost entirely to areas south of 19° (Route Packages 1-2 and part of 3). Drones conduct limited reconnaissance in Route Packages 4-6.

Actual attack sorties in North Vietnam and Laos have been equal to the FY69 Budget Plan, despite the bombing restrictions. During the period April 1 - May 13, 15,275 attack sorties were flown south of 20°, 15% below the planned level for all of the North. However, sorties from North Vietnam were diverted into Laos, and as shown below, the total attack sorties in NVN/Laos did not decline.

<u>Attack Sorties</u>	<u>April 1 - May 26, 1968</u>		
	<u>North Vietnam</u>	<u>Laos</u>	<u>Total</u>
Actual	15,275	10,046	25,321
Planned ^{a/} (FY 69 Budget Plan)	18,062	7,767	25,829

^{a/} Based on 100% of April and 26/31 of May projections in FY69 Budget Plan.

The effect of the bombing restriction on North Vietnam's ability to support operations in the South is not yet clear, however, there are indications the current campaign is at least as effective as our previous efforts. First, while the geographical area of attack in North Vietnam was reduced, the intensity of strikes in Route Packages 1-3 and Laos has increased correspondingly. During the next five months we will concentrate 68,000 attack sorties in the target area in which we had planned to fly 40,000, a 70% increase. Second, the total weight of our attacks has increased as sorties previously devoted to MIG CAP and flak suppression have been switched to attack sorties. Third, strikes in RP 1-3 and Laos should be more effective because they concentrate on destroying trucks and water craft which have a more direct impact on enemy operations in South Vietnam than the destruction of a power plant or storage areas near Hanoi. Fourth, the current bombing campaign requires the North Vietnamese to shift repair forces south and reduce the effectiveness of their air defense system. Any southerly shift of AAA and SAM facilities will require a massive logistical effort to provide necessary ammunition and supplies. Finally, there is no evidence that previous attacks denied necessary supplies to enemy forces in South Vietnam, or even that they placed an effective ceiling on the level of infiltration. The current bombing campaign should be at least as effective as our previous strikes in disrupting North Vietnamese logistic operations.

May 68

TRUCK TRAFFIC IN NORTH VIETNAM AND LAOS

The table below shows enemy trucks sighted, damaged, and destroyed in North Vietnam (Route Packages 1-3) and southern Laos (STEEL TIGER). Truck sightings in both North Vietnam and Laos increased significantly during the last six months. Approximately 1800 motor vehicles were detected in North Vietnam during the first quarter 1967; sightings tripled in the first quarter 1968 when some 6050 trucks were reported. The increase in Laos was even greater. During the first four months of 1968 pilots sighted 27,000 trucks in the STEEL TIGER area, 1.6 times the number sighted during 1967. Destruction of trucks by U.S. air strikes has also increased in recent months. In Laos, 45% more trucks were destroyed or damaged in the first four months of 1968 (the good weather months) than during all of 1967.

TRUCK TRAFFIC IN NORTH VIETNAM AND LAOS

	North Vietnam (RP1-3)				Laos (STEEL TIGER)			
	1967		1968		1967		1968	
	Sighted	Dam/ Dest	Sighted	Dam/ Dest	Sighted	Dam/ Dest	Sighted	Dam/ Dest
Jan	383	72	2866	409	742	230	6733	1134
Feb	654	169	1039	310	1138	293	5092	786
Mar	770	180	2142	630	780	253	5933	941
Apr	1731	242	3036	765	840	138	9178	1424
May	2919	494			676	97		
Jun	3388	758			157	17		
Jul	4254	910			191	9		
Aug	5717	1297			272	26		
Sep	2510	404			280	27		
Oct	1037	166			992	75		
Nov	1090	100			4234	822		
Dec	1754	280			5979	1008		
Total	26207	5072	9083	2114	16281	2995	26936	4285
Average/ Month	2184	423	2271	529	1357	250	6734	1071

Source: Defense Intelligence Agency

This increase in truck sightings and destruction probably results from four primary factors. First, we are flying more sorties in these areas than previously and thus have more observers. Second, the enemy has resorted to overt movement in the last six months, making detection easier. Third, the recent introduction of night observation devices has improved our ability to locate targets during periods of darkness. Finally, there has probably been an increase in the number of enemy trucks operating in these areas.

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June 68

INTERDICTION OF ENEMY TRUCK TRAFFIC

Our calculations indicate that US airstrikes destroy less than 3% of the total truck traffic in North Vietnam and Laos. During the period Jan 67-May 68, US pilots sighted 96359 enemy trucks and destroyed 10466, about 11% of the total sighted; however, CIA estimates we sight only 25% of the actual truck traffic in these areas. Thus, only about 3% of the total truck movement is destroyed by the US interdiction campaign.

The following table shows that trucks sighted by aerial observers in North Vietnam and Laos have increased significantly since January 1967. Approximately 15,200 motor vehicles were detected in NVN during Jan-May 1968, about double the same period in 1967. Pilots sighted 33,251 trucks in Laos during the first five months of 1968, a seven-fold increase over 1967.

The increase in truck sightings probably results from two factors. First, we are seeing a higher percentage of the traffic because of (a) more sorties in areas with heavy truck traffic (RP 1-3 and STEEL TIGER), (b) more overt enemy movement, and (c) use of night observation devices. Second, the number of trucks operating in these areas has probably increased.

Evaluated enemy truck losses have increased significantly since the end of 1967 as shown in the following table. During the period Jan-May 68, a total of 5143 trucks were destroyed in North Vietnam and Laos, an average of 1029 per month compared to 444 per month in 1967. Approximately 68% of the trucks destroyed since January 1968 have been in Laos; however, this percentage will decline as poor weather covers the Laotian Panhandle during the summer.

TRUCK TRAFFIC IN NORTH VIETNAM AND LAOS
(Jan 67 - May 68)

	1967				1968		TOTAL Jan 67- May 68
	Jan- Mar	Apr- Jun	Jul- Sep	Oct Dec	Jan- Mar	Apr- May	
<u>Trucks Sighted</u>							
NVN	2424	9206	13313	5525	6731	8486	45685
Laos	3024	2104	917	11378	17973	15278	50674
Total	5448	11310	14230	16903	24704	23764	96359
<u>Trucks Destroyed^{a/}</u>							
NVN	257	884	1668	350	652	985	4796
Laos	456	215	55	1438	2038	1468	5670
Total	713	1099	1723	1788	2690	2453	10466
<u>Trucks destroyed/ Trucks sighted</u>	.13	.10	.12	.11	.11	.10	.11

a/ DIA evaluated losses.
Source: Defense Intelligence Agency

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The Defense Intelligence Agency estimates that heavy truck losses in recent months have reduced the North Vietnamese truck inventory from 10,500 in December 1967 to approximately 6500 in June 1968, as shown below:

NORTH VIETNAMESE TRUCK INVENTORY
(N.V. and Laos)

	1967				1968	
	Jan- Mar	Apr- Jun	Jul- Sep	Oct- Dec	Jan- Mar	Apr- May
Beginning Inventory	12000	12000	12000	10900	10500	8800
-Evaluated Losses	713	1099	1723	1788	2690	2453
+ Net Imports ^{a/}	713	1099	623	1388	990	153
Ending Inventory	12000	12000	10900	10500	8800	6500

a/ Net of an allowance for "retirements" due to normal wear.

This table significantly overstates the impact of US airstrikes on the North Vietnamese truck inventory for two reasons. First, DIA does not include truck imports unless confirmed by hard evidence, which is generally not available for several months. Thus, the DIA "imports" shown in recent months represent only a fraction of the actual imports. The Communist Bloc truck production is so large (the USSR alone produces 450,000 trucks per year) that it is unlikely the North Vietnamese logistic effort will be constrained by a shortage of trucks. Second, while the total number of trucks in North Vietnam may have decreased, the decline has been offset by the importation of bigger and better vehicles. The present inventory is largely composed of diesel trucks with greater capacity and lower maintenance requirements than was true two years ago.

JOINT STAFF COMMENTS ON JUNE ARTICLES

"1. The June 1968 SFA Analysis Report has been reviewed by the Joint Staff. In accordance with the request for suggestions to improve future reports, page 1, the following comments are provided.

"2. The articles in the report appear to represent three general types: those presenting data and information; those reporting on analysis with findings, conclusions, and sometimes recommendations; and those which commingle presentation of data and conclusions without the associated analyses. Examples from the June 1968 report are:

"a. Present data and information - 'The War in Vietnam - Post TET,' page 21; 'Aircraft Sorties and Losses,' page 58; and 'Wage and Real Income Changes in SVN,' page 65.

"b. Report on analysis - 'Enemy Initiated Activity Against RF/PF,' page 1; 'A Comparison of Allied and VC/HVA Offensive Manpower in SVN,' page 26; and 'GVN and VC Manpower Pools,' page 33.

"c. Commingle data and conclusions without analyses - 'VC/NVA Medical Material and Supplies,' page 10; 'Interdiction of Enemy Truck Traffic,' page 63.

"3. Articles presenting data and information can be very useful as a source of data for analyses by agencies which do not ordinarily have access to or the personnel to accumulate such data. This type of article should be continued as appropriate.

"4. Articles reporting the results of analyses can provide useful exchange of information, ideas, and methodology related to analysis of the war in Southeast Asia provided the following are included:

"a. Statement of the purpose, hypothesis, or proposition being addressed.

"b. Statement of the assumptions made or required.

"c. Definition of terms and measures.

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"d. Data, rationale, and methodology used.

"e. Identified findings, conclusions, and recommendations.

'These are required in order to establish a basis for any substantive exchange of ideas or comment on a specific article. The article, 'GVN and VC Manpower Pools,' page 33, is an outstanding example with an additional feature in the sensitivity analysis to show the effects of changes in 'estimated' values. Specific comments on another article, 'A Comparison of Allied and VC/NVA Offensive Manpower in SVN,' are set forth below. This type of article, if technically accurate and ably written, is the most valuable to decision-makers and analysts and should constitute the majority of the monthly report, however this particular article does not attain this standard.

"5. Articles which commingle data and conclusions without the associated analyses have no place in a report which has the purpose as that stated for the 'Southeast Asia Analysis Report.' Such articles assess the war by innuendo. They also disguise opinion as fact. Specific comment on two such articles are set forth below. These are: 'VC/NVA Medical Material and Supplies,' and 'Interdiction of Enemy Truck Traffic.'

Specific Joint Staff Comments on June Articles

"1. Article - 'A Comparison of Allied and VC/NVA Offensive Manpower in SVN,' page 26.'

Comments

'The purpose of the article is stated, 'This paper questions these assumptions,' i.e. '(a) that US/Free World Forces ground forces are clearly superior to VC/NVA forces, and (b) that the margin of superiority is great enough so that we can win a war of attrition and shift some of the military burden now borne by the U. S. to the RVNAF.'

"a. There is, by inference, a conclusion regarding the first assumption. That is, the assumption is false. This inference is based on the statements: 'Despite a 5.6 to 1 advantage in total military manpower in December 1967, the friendly forces were roughly at parity with enemy forces in rifle-carrying infantrymen on offensive operations.', page 26, and 'This analysis points up clearly that we do not now have a simple manpower advantage which would enable us to achieve a decisive military advantage, page 31.

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"b. The measure used to determine superiority of force appears to be 'rifle carrying infantrymen on offensive operations.' The number of infantrymen, per se, does not indicate the offensive power of ARVN, U.S., and Free World forces. It totally neglects firepower, combat support, and mobility (all of which are acknowledged in passing as US/FWF advantages). Furthermore, the technique used to quantify 'infantrymen on offensive operations' pits only the ARVN, U.S., and FW forces in designated offensive functions against all VC/NVA main force maneuver units.' This results in an inflated strength ratio in favor of the VC/NVA. The implicit assumption required to support this reasoning is that VC/NVA forces are engaged against only those ARVN, U. S., and FW forces on specifically designated offensive operations. This ignores the reality of combat in South Vietnam. In fact, the article, 'Enemy Initiated Activity Against RF/PF,' page 1, indicates that there were 5,210 enemy initiated incidents against RF/PF forces during 1967.

"c. If 'analysis of force dispositions by function' were applied to VC/NVA units, the 'availability' of VC/NVA manpower for offensive operations would be decreased by approximately 93 percent. Empirical evidence indicates that VC/NVA battalions engage in offensive operations about one day in 15. Thus, using the data for platoon strengths on page 28, the VC/NVA available manpower is $(1/15)(63.0) = 4.2$. The FWF strength would similarly be reduced because they were achieving a utilization rate of 7.5 battalion days of operation per battalion during December 1967. The FWF availability would be $(7.5/31)(9.9) = 2.4$. There would be no reduction in U. S. availability because they were employed at a rate of 31 battalion days of operation per battalion in December 1967. The resulting comparison is:

December 1967

	<u>Men in platoons</u>		<u>Men in platoons</u>
US	34.3	NVA	1.8
FWF	2.4	VC	2.4
Total	36.7		4.2

'The ratio of US/FWF to VC/NVA is 8.7 to 1. Applying the same method to both friendly and enemy forces to determine the number of forces 'available to engage in offensive operations' would give face validity to such comparisons. However, these comparisons would still be virtually pointless because they fail to

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consider many other factors of offensive power.

"d. The exclusion of the ARVN to provide comparisons between the VC/NVA and US/FWF presents an interesting comparison even though such comparison is meaningless in terms of analysis of the country-wide war. In essence, this eliminates the IV Corps Tactical Zone from consideration during the period covered in the analysis because US forces were there in limited numbers (18,232). Neither does it account for the fact that order of battle statistics indicate that 35,900 or 17.9 percent of the VC/NVA force was in the IV CTZ opposing, almost exclusively, ARVN forces.

"e. Based on the force ratios:

Total Military Manpower (pg 26)	5.6 to 1
Main Force Maneuver Units (pg 27)	
Battalions	1.7 to 1
Men in Battalions	2.0 to 1
Men in Platoons "available to engage in offensive operations" (recomputed above)	8.7 to 1

It is asserted that US/Free World Forces ground forces are clearly superior to VC/NVA forces. "Superior" meaning greater in quantity or number since quality has in no way been addressed. Manpower committed to offensive operations has not been considered for two reasons. First, the number of VC/NVA "committed" cannot be determined with accuracy and gross estimates would render the resulting force ratio nearly meaningless (despite the fact that estimates as high as 90 percent of the total VC/NVA force would give a ratio favorable to allied forces rather than the narrow superiority for the VC/NVA indicated in the article.) Second, the number of forces committed to offensive operations can be varied for both sides merely by accounting procedures. As noted on page 29, offensive forces are stationed in defensive positions around South Vietnam's cities and, similarly, defensive units participate in or support offensive actions.

"f. The second assumption - relating to war of attrition and shift of some of the military burden to the RVNAF - is not addressed in the article. An oblique conclusion about shifting

some of the burden to the RVNAF may have been intended by statements in the main conclusions on page 26. These are: 'Because the U. S. contributed most of the friendly offensive battalion and platoon manpower, a decrease in its forces would enable the enemy to gain an advantage in offensive manpower. Without any U. S. forces, the GVN/FWF combat forces on offensive operations might have been outnumbered by 2 to 1 by VC/NVA forces in battalion manpower.' and 'Since the Tet offensive, additional troop deployments and the reallocation of deployed forces have probably increased the Allies' relative offensive strength. However, projected increases in ARVN combat strength will not significantly add to this advantage.' There is no basis in fact for these statements, without extensive qualification, irrespective of the purpose for which they were made. Conjecture about offensive manpower ratios resulting from a change in one of five related variables without regard to the remaining four has no place in questioning assumptions. A forthright way to address a question is: state the hypothesis related to the question, select an appropriate statistical test, select a confidence level, calculate the critical value of the test statistic and the value of the selected statistic from empirical data, and then accept or reject the hypothesis. The report of the analysis and resulting conclusions need not be written in so simple a manner, but the report should at least reflect that a technically adequate analysis has been completed.

"g. Irrespective of the stated purpose of the article, one apparent purpose is to refute any future requirement for additional U. S. troops. This point is made on page 31 based on the fact that '...the ratio of friendly to enemy maneuver battalions had remained relatively constant since mid-1965.' Using this relatively constant ratio as basis for a conclusion that adding more U. S. troops is not the answer to achieving a 'decisive military advantage' (this term is not defined) is not logically consistent with the earlier developed premise that the key factors are men in maneuver battalions, and, more important, offensive rifle platoon manpower. Neither is it consistent with the change in platoon manpower before and after Tet as noted on page 29. 'Following the Tet offensive, the U. S. was able to both add 12 battalions to its force levels, reallocate 4 battalions to offensive activities from its reserves and pacification programs ... and increase the combat strength through the addition of a 4th rifle company to its standard battalion (ARCOV Program). Likewise, ARVN, without increasing its force size, has been able to shift 21 battalions to offensive operations.' This was accompanied by a total military force increase of 43,200 U. S., 96,500 RVNAF, and 600 3rd Nation which resulted in the following changes:

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	<u>Before Tet</u>	<u>After Tet</u>	<u>Percent Change</u>
Allied Battalion Manpower Advantage 1/	1.3 to 1	1.6 to 1	+23
Allied Platoon Man- power Advantage 1/2/	.7 to 1	1.3 to 1	+86
US Maneuver Battalions Combat Operations 1/	81	97	+20
GVN/FPF Maneuver Battalions (Combat Operations) 1/	75	96	+28
Military Forces (Thousands) 3/			
US	494.3	537.5	+9
RVNAP	494.3	537.5	+9
3rd Nation	636.9	743.4	+15
Total	60.6	61.2	+1
	1201.8	1342.1	+12

1/ Source: Southeast Asia Analysis Report, June 1968, pg 29.

2/ Enemy advantage of 1.4 to 1 converted to allied advantage of .7 to 1.

3/ Source: Southeast Asia Statistical Summary, OASD(C), Table 2, 1 August 1968. Before Tet - January 1968, After Tet - May 1968.

From these figures it is noted that a 7 percent increase in allied military personnel, achieved by increasing only U. S. personnel and other forces held constant, would result in a twofold increase in the percent change in allied advantage in both battalion and platoon manpower. Assuming that the U. S. increase would be met by a VC/NVA increase to maintain the 1.7 ratio of allied to VC/NVA battalions, there would be approximately a 5 percent increase in the ratio of both battalion and platoon manpower. Neither these force ratio changes nor any facts presented in the article are sufficient basis for decisions regarding increase or decrease of U. S. forces.

"2. Article - 'VC/NVA Medical Materiel and Supplies,' page 10.

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Comments

"a. There is no data or analysis in the article to support the statements 'The captured materiel probably did not affect significantly his medical needs.' and 'It is unlikely that the loss of these caches is the cause of reported enemy shortages of medical supplies.'

"b. Inclusion of such unfounded statements, apparently the opinion of the author, detracts from the overall value of the article and the 'Analysis Report' by raising the question, 'What is the purpose of the article - and the Report?'

"3. Article - 'Interdiction of Enemy Truck Traffic,' page 63.

Comments

"a. The major conclusion of the article is that 'US airstrikes destroy less than 3% of the total truck traffic in North Vietnam and Laos ... Thus, only about 3% of the total truck movement is destroyed by the US interdiction campaign. Apparently 'destruction of truck movement' is the measure used to evaluate the US interdiction campaign. This does not address the military objective of the air campaign which is to make it as difficult and costly as possible for North Vietnam to continue effective support of the Viet Cong and to cause North Vietnam to cease direction of the Viet Cong insurgency. Interdiction of enemy truck traffic is just one part of the air campaign.

"b. There is inconsistency in the logic used to arrive at the percent of truck movements destroyed. The analysis is based on a CIA estimate that we sight only 25 percent of the actual truck traffic while noting that an increase in truck sightings probably results from seeing a higher percentage of the traffic due to more sorties, more overt enemy movement, and use of night observation devices. This leads to the obvious questions as to when the CIA estimate was made, what is the current estimate of percent traffic sighted, and whether the change in observation rate was taken into account to arrive at the conclusion stated.

"c. The impact of truck attrition on the North Vietnamese truck inventory is discounted by stating that the Communist Bloc truck production is so large that it is unlikely the North Vietnamese logistic effort will be constrained by a shortage of trucks and while the number of trucks may have decreased, the decline has been offset by the importation of bigger and better vehicles. If such statements are intended to support a contention that the interdiction of truck traffic has no effect on the North Vietnamese logistic effort, they show a blatant

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disregard of factors essential to the analysis of a logistic system. Essential factors include: quantity of goods delivered, transportation time, resources required to maintain equipment and roads, transshipment and other support required, utilization of vehicles, etc.

"d. The data presented in the report indicates that 10,466 trucks have been destroyed from January 1967 through May 1968. This represents about a 100 percent turnover during that period and a substantial reduction in truck inventory. Despite the fact that some modernization has occurred, there is no data presented to indicate the capacity of the logistic system and whether the capacity has remained constant, decreased, or increased."

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Jul 68

THE U. S. BOMBING CAMPAIGN IN NORTH VIETNAM AND LAOS

This paper evaluates how well we have achieved the two principle objectives of the U. S. bombing campaign in North Vietnam and Laos.

1. To reduce or limit the flow of men and supplies from North Vietnam to South Vietnam below the level the enemy would like and thereby reduce its force or activity levels in South Vietnam.
2. To increase the cost to North Vietnam of supporting the war in South Vietnam, thereby providing an incentive for Hanoi to negotiate a settlement.

Summary

The following conclusions emerge:

1. The U. S. interdiction effort does not reduce or limit large increases in the flow of men and supplies from North Vietnam.
 - a. The bombing destroys 8% - 9% of the men and supplies in a given flow going to South Vietnam. However, the enemy can easily replace these losses and maintain its desired flow of men and supplies to South Vietnam, as it has demonstrated this year.
 - b. The bombing has not greatly reduced North Vietnam's road, truck, railway, watercraft, or manpower capabilities. While it has strained North Vietnam, the strain is not severe enough to prevent significant increases in the rate of infiltration, as has occurred in 1968.
2. The U. S. bombing in North Vietnam and Laos has no observable effect upon enemy force or activity levels in South Vietnam.
 - a. Since 1965, U. S. attack sorties against North Vietnam and Laos have increased about four-fold. Over the same period, the main force enemy has increased its strength levels by 75%, its attacks five-fold, and its overall activity nine-fold.
 - b. In I Corps, VC/NVA attacks have increased eight-fold since 1965. Over the same period, interdiction sorties in RP 1 have increased 14-fold; tactical sorties in I Corps itself have doubled.
3. Since 1965, foreign aid to North Vietnam of \$2,150 million has more than offset the \$991 million of material losses caused by the bombing; North Vietnam is better off than it was prior to the bombing in terms of total material resources.

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Almost all available evidence supports these conclusions. However, some factual uncertainties remain.

1. What factors explain why the North Vietnamese have not exploited their full supply and manpower capabilities to support the war in South Vietnam?
2. What are the maximum flows of men and supplies to South Vietnam that North Vietnam can or will support?

With these questions unanswered, there exists a very slight probability that the interdiction effort creates difficulties for the North Vietnamese we know nothing about or puts a limit on future increases in supply flows at some level many times greater than the 1957 level.

Analysis of Bombing Effectiveness

The overall purpose of the U. S. air effort, to reduce manpower and supplies available to the enemy in South Vietnam, can be achieved in two ways:

1. Destruction. For a given flow of men and supplies going to South Vietnam, the U. S. air effort may destroy so much that the amount arriving is reduced below the required level. However, if the enemy increases the flow going to South Vietnam to compensate for the amount destroyed enroute, destruction may not reduce the men and supplies arriving in South Vietnam.
2. Strain. The strain of maintaining any flow of men and supplies to South Vietnam may become so great that North Vietnam either will not be able to or will choose not to increase its support to the war in the South.

The destruction and strain imposed on North Vietnam are means to a single end - the reduction or limitation of the support available to the enemy in the South. The success or failure of the interdiction effort against this objective can be evaluated using both direct evidence on North Vietnam's support capabilities and indirect evidence on enemy activity in South Vietnam.

Direct Evidence on NVN Support Capabilities

Destruction Results. The destruction of enemy men and supplies for a given flow going South will decrease the amount arriving in the South by an equal amount, though the enemy may increase the flow to compensate for these losses. The U. S. bombing campaign attempts to achieve this objective by destroying vehicles, the supplies they contain, and support and storage points.

Supplies. As shown below, the total flow of enemy military supplies into Route Package 2 and 3 in North Vietnam was 539 short tons per day (ST/D) in 1957, excluding supplies for stockpiling or civilian usage. In

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1967, the U. S. bombing effort destroyed an estimated 33 ST/D of that flow, about 6% of the total.

**1967 MILITARY SUPPLY REQUIREMENTS^{a/}
(ST/D Averaged Over 1967)**

	Supplies Entering	Consumed	Destroyed ^{b/}	Unaccounted For	Sent On
RP 2 & 3	539	250	4	-	285
RP 1	285	130	14	-	141
South Laos 91}		40	15	19	17
NVA in RV 50}	141				
VC/NVA in SWV	17				
Total		420	33	19	—

a/ Military supplies include: military-related economic goods (i.e., machinery, trucks, and construction equipment); petroleum; military food supplies; weapons, ammunition, engineers, medical, etc.

b/ Tonnage destroyed includes: trucks - an average of 2.5 ST per truck destroyed was used for the 50% of the destroyed trucks that were loaded; secondary explosions - the 7th AF estimate of 1/8 ST per secondary explosion was used. Watercraft and the railroads are not important carriers of military supplies in RP 1-3.

If the material destroyed (33 ST/D) had all arrived in South Vietnam, it would have increased the VC/NVA's available supplies from 67 ST/D (17 ST/D through Laos and 50 ST/D across the KZ) to 100 ST/D (67 ST/D that arrived plus the 33 ST/D destroyed), about a 50% increase. However, this greatly overstates its effectiveness.

First, most of the material destroyed was not destined for South Vietnam. If the bombing destroys material going to South Vietnam and North Vietnam randomly, only 6 ST/D of the 33 ST/D destroyed was being sent to South Vietnam, as the following table shows. If all the destroyed material going to the South actually had arrived, it would have represented only 9% (6 ST/D) of the total supply requirements going South (67 ST/D) rather than 50%. While the bombing may reduce the amount of supplies arriving in the South for a given flow, it is at best a small reduction, fully replaceable out of a slightly larger flow.

Second, the amount of supplies destroyed that are actually going to the South is so small (less than three trucks per day) that it can be easily replaced out of existing internal flows of military goods. The North Vietnamese need only reduce their consumption of military supplies in RP 2 and 3 from 250 ST/D to 244 ST/D to replace the 6 ST/D of supplies

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SUPPLIES FOR SVN DESTROYED ENROUTE ^{2/}

	<u>Total ST/D Destroyed</u>	<u>Percent of Total ST/D Going to SVN</u>	<u>ST/D Going to SVN Destroyed Enroute</u>
RP 2 & 3	4	12.8%	.48
RP 1	14	17.5	2.38
South Laos	15	18.5	2.76
Total	33		5.62

^{2/} If the bombing destroys supplies going South and not going South without differentiation, then the percent of the supplies destroyed that would otherwise go South is the same as the percent of the total flow going South. For instance, in RP 2 and 3, 67 ST/D is going South out of a total flow of 539 ST/D. Of the 4 ST/D destroyed there, 12.8% (67 ST/D ÷ 539 ST/D) would have gone South if there were no bombing or .48 ST/D (4 ST/D destroyed x 12.8%).

destroyed in 1957. If a large amount of supplies is destroyed, this substitution might be difficult because the composition of supplies going South might be different from that consumed in North Vietnam or a reduction in consumption in North Vietnam might cut into vital military activities. However, at current levels of destruction (6 ST/D destined for SVN compared to consumption of 420 ST/D in North Vietnam and Laos), the North Vietnamese should be able to replace the supplies destroyed and keep the same amount of goods arriving in South Vietnam without increasing their military supply flows.

Hence, the interdiction effort in 1957 destroyed only 9% of the supplies going to the South and the material destroyed was easily replaceable within existing or slightly increased flows of supplies. The bombing campaign did not significantly reduce the amount of supplies that arrived in South Vietnam.

Manpower. The U. S. air strikes are estimated to kill directly 2% of the North Vietnamese manpower infiltrating into South Vietnam (CIA Intelligence Bulletin, "The Situation in South Vietnam", October 8, 1957). In addition, the interdiction effort may indirectly kill infiltrators by forcing them to march longer distances through rougher terrain before entering South Vietnam. The difficulty of the journey may increase the mortality rate due to illnesses contracted during infiltration. This mortality rate has been estimated to be 11% for 1957. If all deaths by illness among the infiltrators were assumed to be caused by the interdiction effort, it would for a given infiltration rate reduce the arrivals by 13%.

However, this assumption certainly overstates the effects of the bombing alone. First, North Vietnam would probably have used the same

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infiltration routes even if the bombing had not occurred - they used them prior to 1966. Second, the historical increases in infiltrators lost to illness (1% in 1966; 11% in 1967) are due not only to the increases in the bombing but also to the infiltration of less experienced and well-trained troops.

Available information is not adequate to identify that part of the North Vietnamese deaths due to illness attributable to the bombing. However, a reasonable guess might be that half of the deaths due to illness (6% out of 11%) would have occurred without the bombing. Using this assumption, the bombing during 1967 may have killed 8% of the infiltrators or about 7,500 men and reduced the level of NVA forces in South Vietnam by 9% below what it would have been without any bombing but the same rate of infiltration.

THE BOMBING AND THE NVA FORCES IN SVN ^{a/}

	1967
Infiltration (000 Men)	93.4
Manpower Losses Due to Bombing (000 Men)	7.5
NVA Year End Strength With Bombing (000 Men)	73.8
NVA Year End Strength Without Bombing (000 Men)	81.3
Percent Reduction Due to Bombing	9%

^{a/} Source: Adapted from "NVA Forces in South Vietnam," SEA Analysis Report, OASD(SA), May 1968.

The loss of 7,500 infiltrators that may have been caused by the bombing could be easily offset by the North Vietnamese without any increase in their present forces. Outside of their forces in South Vietnam, Laos, and air defense activities, the North Vietnamese have a regular army of 247,000 men and a full-time militia of 475,000 men. Thus, losses during infiltration, (if they actually occur), represent about 3% of the NVN regular army and 1% of the armed forces.

In summary, a best guess at North Vietnam's losses of infiltrators due to the bombing is 8% or 7,500 men in 1967. These losses can be easily replaced out of North Vietnam's existing armed forces of 722,000 men not committed to air defense or other vital war activities. Because the enemy could easily replace infiltration losses out of his armed forces reserves, we conclude that the bombing did not significantly reduce the infiltration of men and supplies from North Vietnam to South Vietnam.

Strain on North Vietnam

The strain on North Vietnam caused by U. S. interdiction efforts might limit increases in the flow of men and supplies by increasing the

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cost to the enemy of maintaining their current flow. Attacks on the enemy's lines of communication and repair activities might tie up such large amounts of material and manpower that the enemy would not or could not commit the resources needed to increase the flow. The strain on North Vietnam of maintaining the current flow of supplies and men to South Vietnam is analyzed below by looking at its highway, truck, railroad, watercraft, and manpower capacities.

Road Capacity. Since 1964, the highway network in North Vietnam has been expanded from about 10,000 kilometers to 13,000 kilometers. In 1964, there was only one all-weather road into Laos; today there are three. In addition, the North Vietnamese have constructed numerous bypasses that add flexibility as well as capacity to their highway system. As a result, the road capacities in North Vietnam are probably greater today than in 1964 and more than adequate for their required supply flows in 1967 and 1968.

As shown below, the 1967 supply flows in North Vietnam's panhandle (RP 1-3) are considerably below the road capacities. In RP 1, the total flow, including 50 ST/D for NVA forces in and around the DMZ, is only 194 ST/D or 20% of the perennial road capacity. The requirements for the DMZ area of South Vietnam are 50 ST/D, about 5% of the 943 ST/D capacity. The North Vietnamese can therefore increase their present DMZ area supply throughput of 50 ST/D many times without exceeding the currently available road capacity.

**UNINTERDICTED ROAD CAPACITY AND MILITARY REQUIREMENTS - NVN
(ST/D)**

Latitude	1967 Requirements			Perennial Daily Road Capacity ^{a/}
	NVN	Laos	Cumulative Total	
17°00' - 17°15'	194.0		194.0	943
17°15' - 17°30'	10.5	45.0	249.5	1,303
17°30' - 17°45'	40.7	45.0	335.3	1,250
17°45' - 18°00'	67.7		403.0	988
18°00' - 18°15'	64.7		467.7	786
18°15' - 18°30'	25.4	46.8	539.0	1,400

^{a/} Road capacities are calculated by DIA. They represent the one-way ideal capacity of a road as determined by its area and surface texture, adjusted downward by judgmental factors such as weather, maintenance, intersections, etc. It is important that these capacities do not reflect the effects of interdiction and no estimates exist that do. There is significant uncertainty about both the accuracy of the uninterdicted capacity estimates and the effects of interdiction upon the capability of these roads to allow traffic at their uninterdicted capacity.

Source: Requirements - OASD(SA)FEBA staff estimates; capacities - RAND/AFGOA Group, January 1, 1968.

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In the South Laos area, the 1967 required flows, as shown below, absorbed only 16% or 90 ST/D of the available capacity. Thus, the

ROAD CAPACITIES - SOUTH LAOS
(ST/D)

	<u>Dry</u>	<u>Wet</u>	<u>Monthly Average</u>	<u>1967 Requirements</u>
Ka Gia	600	150	420	
Ban Karai	200	50	140	
Total	800	200	360	90

Source: Requirements - OASD(SA)ESRA staff estimates; capacities - RAND/AFGOM Group, January 8, 1968.

throughput of North Vietnamese supplies to areas in South Vietnam below the DMZ could also be increased many-fold within current road capacities.

The limiting road capacity for the total flow of supplies to South Vietnam appears to lie between 18⁰⁰' and 18¹⁵' in the panhandle. In that area, current requirements are 467 ST/D; capacity is 785 ST/D. If the North Vietnamese strain their current road capacity to the maximum, 319 ST/D above their current requirements could enter either southern Laos or the DMZ area. This 319 ST/D supply flow (Laos POL, truck points, etc., needed to move it) could increase the total supplies entering South Vietnam from the 1967 level of 67 ST/D (DMZ area and South Vietnam) to about 390 ST/D, a six-fold increase.

The existing road capacities in North Vietnam, Laos, and the border areas of South Vietnam permit a many-fold increase in the flow of supplies to South Vietnam. These capacities can also be readily enlarged as they have been since 1955. We conclude that North Vietnam's supply flow to South Vietnam is not constrained by its road capacities.

Truck Capacity. Even with sufficient road capacities, the North Vietnamese might find their supply flow greatly limited if they were not able to obtain trucks to carry their supplies.

During the period 1965-67, U. S. pilots reported destroying 14,875 trucks. However, the North Vietnamese were able to maintain an inventory of 10,000-12,000 trucks through imports from China and the Soviet Union. Since December 1967, the North Vietnamese have lost 5,100 additional trucks through U. S. air attacks. As shown in the table below, the total North Vietnamese inventory of trucks is reported to have fallen from 10,500 in December 1967 to 6,500 in May 1968.

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NORTH VIETNAMESE TRUCK INVENTORY
(hVn and Loss)

	1967				1968	
	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-May
Beginning Inventory	12,000	12,000	12,000	10,900	10,500	8,800
Evastated Losses	713	1,099	1,723	1,788	2,690	2,453
Plus Net Imports ^{a/}	713	1,099	623	1,368	990	153
Ending Inventory	12,000	12,000	10,900	10,500	8,800	6,500

^{a/} Net of an allowance for "retirements" due to normal wear.

Source: "White House Charts", DIAAP-442, June 19, 1968.

This reported decline in the truck inventory greatly misrepresents the change in North Vietnam's throughput truck capacity. First, truck imports are not included in the inventory estimates until several months have passed and hard evidence has confirmed them. Thus, the "imports" shown in recent months represent only a small fraction of the actual imports. Second, the decline in the total number of trucks has probably been offset by the importation of bigger and better vehicles with greater load capacities. Third, the North Vietnamese may have had excess truck capacity in relation to their current supply requirements. Hence, a reduction in truck inventories might increase their truck utilization rate but need not decrease their throughput capability. For these reasons, the decline in truck inventories probably does not represent a real decline in North Vietnam's carrying capability.

Moreover, even if this capability did decline temporarily, the Soviet Union and China are able to replace the losses (the USSR alone produces 450,000 trucks per year) and will probably do so rather than see their ally constrained by a truck shortage.

Rail Capacity. Both the flexibility and capacity of the railroad network have increased since 1954. Alternate bridges, bypasses, and loading yards have been built at critical points. Since 1965, the North Vietnamese have maintained or increased their inventory of both rolling stock and locomotives.

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RAIL EQUIPMENT

	1955	End 1956	1957	June 1958
Locomotives	120	127	120	120
Rolling Stock	1,800	2,000	2,200	2,200

Source: DIAAP-406, June 10, 1958.

Repair times on critical railroad lines have actually decreased since 1955. As shown below, transit times have increased, but remain at a low level indicating that the supply flows are only temporarily delayed. Thus, North Vietnam's railways have the capability to at least maintain the current flow of supplies into North Vietnam's pan-handle.

TRANSIT TIME
(Hours)

	1956	April 1957	1958
Lao-Cai/Hanoi	15.0	18.0	18.0
Hanoi/Vinh	4.0	6.0	7.0

Source: DIAAP-406.

Watercraft Capacity. Approximately 21,000 watercraft and numerous repair facilities were destroyed in North Vietnam and Laos during the period 1956-67. The reported inventories of watercraft have fallen from 42,500 at the end of 1955 to 33,000 in June 1958. However, larger steel-hulled watercraft have been imported to compensate for these losses and, as a result, there may have been an increase of watercraft capability. In addition, construction of new storage points, trans-shipment facilities, and waterway capacity have increased the flexibility and redundancy of the waterway system.

Because most shipments of military supplies in North Vietnam's pan-handle and Laos are not made by watercraft, this capability will not limit increases in North Vietnam's supply flows. However, small craft movements along the Vietnamese coast are an alternative means for North Vietnam to increase its supply flows South.

Manpower Requirements. The air war has drawn North Vietnamese labor into bomb damage repair, replacement of combat casualties, construction, transportation, and air defense. Over the last three years, these needs have absorbed almost 750,000 able-bodied North Vietnamese, as shown below.

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CHANGES IN NORTH VIETNAM'S WAR-INDUCED MANPOWER
(People Aged 15-64 in Thousands)

<u>Manpower Gained From:</u>		<u>Manpower Diverted to:</u>	
Population Growth	720	Increase in Armed Forces	275
Foreign Workers	40	Bomb Damage Repair	200
Other ^{a/}	81	Transportation	146
		Other ^{b/}	126
Total	841		747

a/ The "Other" category includes evacuated employables (48,000) and industrial workers (33,000) released for war employment by the effects of the bombing. In addition, an unknown number of North Vietnamese have been diverted to war activities without loss of production because of the large imports of foreign aid including food.

b/ The "Other" category includes foreign workers in bomb repair (40,000) activities, and military manpower killed in both North and South Vietnam (85,000).

Source: SEA Analysis Report, OASD(SA), January 1968.

But, again there are offsetting factors. First, over 50% of the increase in manpower has been provided by population growth. Since the start of the bombing, 720,000 able-bodied people have been added to the North Vietnamese labor force.

Second, the bombing has increased not only the demand for labor but also the supply. The destruction of much of North Vietnam's modern industry has released an estimated 33,000 workers from their jobs. Similarly, the evacuation of the cities has made an estimated 48,000 women available for work on roads and bridges in the countryside. Both of these groups of people were available for work on war-related activity with little or no extra sacrifice of production; if they weren't repairing bomb damage, they wouldn't be doing anything productive.

Third, North Vietnam has been supplied with manpower as a form of foreign aid. An estimated 40,000 Chinese are thought to be employed in maintaining North Vietnam's road and rail network.

Finally, additional workers could be obtained in North Vietnam from low productivity employment. In less developed countries, agriculture typically employs more people than are really needed to work the land, even with relatively primitive production methods. Also, further mobilization may be possible through greater use of women in the labor force. The available statistics are not precise enough to identify the magnitude of this potential labor pool.

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In sum, the total incremental need for war-related manpower of roughly 750,000 people appears to have been offset with no particular strain on the population. Future manpower needs may outstrip North Vietnamese population growth, but the North Vietnamese government can import more manpower (though there may be limits to how many Chinese they want to bring into the country), use women and/or underemployed workers, and draw workers from productive employment, replacing their output with imports. Given these options, it appears that the North Vietnamese government is not likely to be hampered by aggregate manpower shortages.

The Meaning of Strain

There is no doubt that the bombing campaign strains the North Vietnamese. However, since 1955, North Vietnam has been able to increase its road and railway capacities and maintain its inventories of vehicles. Since its supply flows are well below current road capacities and vehicular capabilities can be increased through imports, North Vietnam is able to expand the flow of men and supplies to South Vietnam. However, it is possible that the interdiction has strained North Vietnam enough to limit future increases at some level more than 3 to 5 times greater than the 1957 one. The important point is that this potential limitation, if it should exist, plays no practical role in reducing enemy activity in South Vietnam at or several times above the 1957 level.

Evidence on Enemy Activity in South Vietnam

The ultimate purpose of the interdiction effort is to give the U. S. a tool for unilaterally reducing enemy force or activity levels in South Vietnam. If the enemy can maintain or increase his forces independently of the level of bombing, the interdiction has failed. The available evidence on enemy activity in South Vietnam supports the conclusion that the interdiction has no effect on enemy activity rates in South Vietnam.

First, the losses imposed by the past bombing have failed to prevent large increases in overall enemy activity, manpower, or supply flow levels. As shown below, while attack sorties have increased about four-fold, the main force enemy has increased his strength levels by 75%, his attacks five-fold, and his overall activity nine-fold.

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INDEX ACTIVITY IN SOUTH VIETNAM ^{a/}

	1965	1966	1967	1968
VC/NVA Combat Strength (000) ^{b/}	70	111	114	123
Attack Rate (Per 1000 Strength)	9.8	8.5	22.0	50.0
Index of VC/NVA Activity ^{c/} (1965 = 100)	100	135	363	900
U. S. Attack Sorties Against North Vietnam and Laos (000)	37	131	153	146

^{a/} Tables 1-B, 1-C, OASD(SM) SEA Statistical Tables, May 1968.

^{b/} Average annual confirmed combat strength for 1965-67. 1968 figure is the estimated March level.

^{c/} As defined by the numbers of VC/NVA battalion size or smaller attacks.

Secondly, the enemy has been able to increase his activity largely because of the men and material supplied from North Vietnam in spite of the bombing. North Vietnamese infiltration of men and supplies during

NVA ASSISTANCE TO VC/NVA FORCES IN SVN AND LAOS

	1st Qtr 1967	1st Qtr 1968
Infiltration (000)	23.6	53.0
Total ST/D Entering Laos	132.0	230.0

Source: President's Scientific Advisory Council (PSAC), "The Effect of Air Strikes in North Vietnam and Laos", May 27, 1968.

the first quarter 1968 was more than double the level during the same period in 1967. If U. S. bombing had been effective, an increase of this magnitude could not have occurred.

Thirdly, the bombing effort does not appear to have effectively limited enemy activities in such areas as I Corps where its impact is directly observable.

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ATTACK SORTIES AND VC/PAV ATTACKS IN I CORPS

	<u>1956</u>	<u>1st Ctr</u> <u>1957</u>	<u>1958</u>
Attack Sorties - RP 1	2,022	11,334	8,956
Attack Sorties - I Corps	9,575	13,451	24,349
Total Attack Sorties	11,597	24,785	33,305
VC/PAV Attacks	40	185	325

Source: OCSO(SA) SEA Statistical Tables, March 1958, for RP 1 in 1956 and I Corps. CSO SEA Statistical Summary for RP 1 in 1957 and 1958.

Since 1956, interdiction attack sorties in RP 1 directly above the I Corps area have increased four-fold and tactical attack sorties in the I Corps area itself have increased 2.5-fold, yet enemy activity in I Corps has increased eight-fold and is still increasing.

In sum, the historical evidence on both aggregate and localized enemy activity give no reason to believe that air operations have any effect on the level of enemy forces or activity rates in South Vietnam.

Increase the Cost to North Vietnam

Besides interdicting the flow of men and supplies to South Vietnam, the U. S. bombing campaign has sought to impose a cost on North Vietnam for its military operations in the South by destroying its industrial economy and increasing the economic resources required to support the war in South Vietnam. The three principle effects of the bombing are shown below:

1. Destruction of Capital Stock. During the period January 1955 - October 1957, the bombing campaign destroyed approximately \$170 million of North Vietnam's modern industrial, utility, and transportation facilities.
2. Loss of Economic Production. The destruction caused by U. S. air operations has caused a decline in North Vietnam's domestic output. Prior to 1955, the growth rate of the North Vietnamese economy averaged 6% per year. We estimate that the U. S. bombing program has reduced North Vietnam's total economic production by approximately \$300 million during the period 1955-67, compared to what it would have been with no bombing.
3. Destruction of Military Facilities. In addition to losses in the civilian economy, approximately \$121 million of military equipment and facilities have been destroyed since 1955.

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The North Vietnamese have relied partially on foreign aid to offset the effects of the bombing and maintain sufficient resources to support its military operations in the South. North Vietnam's communist allies have also been increasing their economic and military aid to the U. S. intensified the bombing campaign. Since 1955, the North Vietnamese have received foreign aid valued at approximately \$2.2 billion as shown in the table below.

FOREIGN AID TO NORTH VIETNAM

	(\$ Million)			Total
	1955	1956	1957	
Economic	\$150	\$275	\$310	\$735
Military	270	455	600	1,325
Total	\$420	\$730	\$910	\$2,150

This aid has more than offset the economic and military losses imposed on North Vietnam by the U. S. bombing campaign. The total economic aid provided to North Vietnam (\$735 million) has been almost twice as great as the \$470 million worth of capital stock and current production destroyed by U. S. air operations. Foreign military aid of \$1,325 million is more than ten times the value of military equipment destroyed in North Vietnam.

COST AND BENEFITS TO NORTH VIETNAM

Cost (\$ Million)		Benefits (\$ Million)	
Destroyed Capital Stock	\$170	Foreign Economic Aid	\$735
Lost Current Production	300	Foreign Military Aid	1,325
Destroyed Military Facilities	121		
Total Cost	\$591	Total Benefits	\$2,150

In terms of total economic and military resources, North Vietnam is substantially better off than it was prior to the bombing; their resource gains may also be understated because they do not include future foreign aid from the Communist bloc.

Although North Vietnam, as a nation, is better off because of the bombing, the civilian population has borne some hardships. While the aggregate supply of goods in North Vietnam has increased, standards of living have probably declined. The composition of North Vietnam's total supply has shifted away from final consumer goods toward intermediate products related to the war effort, i.e., construction and transportation.

Food supplies, vital to the health and efficiency of North Vietnam, have been maintained with only a slight decline. The estimated North Vietnamese daily intake of calories has fallen from 1,910 in 1953 to 1,800 in 1957. However, the North Vietnamese are not belly off by past

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North Vietnamese standards or the standards of other Asian countries.

Economic aid has probably not replaced all of the decline in consumer goods production. With lower war priority, the supply of non-food consumer goods such as textiles and durables has probably declined more than the food supply.

In both a lower standard of living and considerable loss of life, the civilian population of North Vietnam has borne a cost imposed by the bombing. However, these costs or hardships do not appear to have reduced their willingness to support military operations in South Vietnam.

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Data for the first three weeks of August indicates that attack sorties and truck sightings and destruction will be down this month. It appears that only about 14,500 sorties will be flown in Laos and NVN during August compared to over 17,500 in July, a reduction of about 20%. Truck sightings are down more sharply -- about 40% in NVN (e.g. 700 per week in August compared to 1200 per week during July).

Weather appears to be the primary factor although planned shipments may have been reduced following the enemy's heavy resupply effort in June and July in preparation for the August attacks. By the first of August monsoon rains in Laos had sharply reduced the throughput capacity of the road net. The tropical storms in NVN caused considerable flooding in the central and northern portion of the country which undoubtedly affected the flow of supplies into the Panhandle. This bad weather also reduced U.S. sorties which in turn affected truck sightings (and may have reduced the truck sightings on those sorties that were flown).

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INTERDICTION IN LAOS SINCE THE BOMBING HALT

Interdiction efforts in Laos increased dramatically with the cessation of US air strikes against North Vietnam on October 31. Large numbers of jet sorties previously used to attack targets in NVN have been shifted to interdiction missions in the Laotian Panhandle. Also, in early November, the Air Force began a new interdiction campaign in Laos (COMMANDO HUNT) designed to reduce or impede enemy truck traffic during the coming good weather months in Laos. Although it is still too early to tell, experience during the first 48 days of intensified operations in Laos indicates that the current interdiction campaign may be no more effective, at least in the terms of truck kills, than our previous efforts.

The table below shows attack sorties, enemy truck sightings, and results in Laos during Oct-Dec 1967 and 1968.

Truck Sightings

Total truck sightings during October and November 1968 were almost identical to sightings reported during the same months in 1967 (about 1000 in October and 4300 in November during both years). The large increase in sightings from October to November followed the normal seasonal pattern during both years as weather and road conditions improved in Laos. The 2665 sightings during the first 17 days of December appear slightly below this seasonal buildup, although the time period is too short to draw major conclusions.

Attack Sorties

US attack sorties in Laos increased significantly following the cessation of air strikes in North Vietnam. We flew 12,803 attack sorties in November 1968, more than twice the October total and three times the number flown last November. During Dec 1-17, we flew 8478 attack sorties, an average rate of about 15,400 per month. Most of the additional sorties were used to attack trucks and roads in southern Laos (STEEL TIGER).

Results

Despite a three-fold increase in attack sorties and about the same number of truck sightings this November, we destroyed only 37% as many trucks as in November 1967; truck kills declined from 680 in November 1967 to 249 in November 1968. Results in December appear to have almost returned to 1967 levels, although it is again too early to tell.

ATTACK SORTIES, TRUCK SIGHTINGS AND RESULTS (Laos Panhandle)

	1967			1968		
	Oct	Nov	Dec	Oct	Nov	Dec 1-17 ^{b/}
Trucks Sighted	992	4249	6046	1043	4395	2665
Trucks Destroyed ^{a/}	55	680	703	129	249	321
Attack Sorties	2939	4399	6722	5020	12803	8478

SOURCE: Defense Intelligence Agency

a/ DIA evaluated losses.

b/ Preliminary data for Dec 14-17.

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Enemy Truck Traffic in Laos

Truck sightings in Laos increased steadily during the first three weeks following the NVN bombing halt (to a peak of 1743 during Nov 15-21) and then declined (to 825 during Dec 5-11). Several factors suggest this increase represents a normal seasonal fluctuation more than an attempt to take advantage of the bombing halt. First, the large increase in sorties should result in more truck sightings; the number of sightings is a function of the number of eyes looking as well as the number of trucks operating. In fact, such a small increase in sightings despite the additional sorties may indicate there were fewer trucks operating in Laos this year than in November 1967. Second, the pattern of activity this year is almost identical to the 1967 buildup. Based on previous experience, truck sightings in Laos should continue to increase through March or April 1969. Finally, there has not been a significant increase in traffic entering Laos from North Vietnam, nor is there evidence of additional movement from Laos into South Vietnam. During November, road-watch teams reported normal traffic (about 15 trucks per day) through the Mu Gia and Ban Karai Passes into Laos, and only 25% of the total truck sightings were on roads in the southern Panhandle leading into South Vietnam. The bulk of the traffic appears to be shuttling pre-stocked material from depots south of the Mu Gia Pass to Base Area 610 in southern Laos.

Strike Efficiency in November

The limited results available since the bombing halt indicates that our truck killing efficiency per sortie in Laos declined significantly in November with the shift of large numbers of jet sorties from North Vietnam, although our strike efficiency appears to have returned to more normal levels in December. The table below shows that we destroyed only 6.5% of the trucks sighted in November 1968, compared to about 11% during the poor weather months this year and 16% in November 1967. Truck destruction per 100 attack sorties declined from 15.5 in November 1967 to 1.9 in November 1968. Results from Dec 1-17 indicate we destroyed about 12% of the trucks sighted, but truck destruction per 100 sorties remained at a relatively low level of 3.8.

MONTHLY TRUCK SIGHTINGS AND RESULTS
(Laos Panhandle)

	1967		1968		
	Nov	Dec	Jun-Oct ^{a/}	Nov	Dec 1-17
Trucks Destroyed/Trucks Sighted	16%	11.2%	11%	6.5%	12.1%
Trucks Destroyed/100 Sorties	15.5	10.5	6.2	1.9	3.8%

SOURCE: DIA for sightings and results; OSD Statistical Summary for attack sorties.

^{a/} Poor weather months in Laos.

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The decline in truck killing efficiency during November was probably the result of three primary factors. First, our basic interdiction strategy appears to have shifted from destroying trucks to creating chokepoints by attacking roads. Two principal chokepoints, Ban Laboy and Ban Pha Nop, have been selected just south of the Ma Gia and Ban Karai Passes leading to Laos. Large numbers of attack sorties (perhaps up to 35% of our 12,800 sorties in Laos) plus B-52 ARC LIGHT strikes have been used around the clock to keep these roads closed to traffic. In addition, we have been flying an unusually high percentage of our attack sorties against other fixed targets during the daylight, even though almost all of the truck movement is at night. In November 1968, only 29% of the USAF attack sorties were flown after dark, despite the fact that 96% of the truck sightings were at night. On the other hand, in November 1967 about 46% of the USAF attack sorties were at night.

Second, our ability to destroy a truck once it has been sighted by a FAC has declined with the introduction of large numbers of jet sorties from NVN that are relatively inefficient against moving vehicles. In spite of our recent concentration on cutting roads, we still flew about 3700 sorties at night in November (almost double the November 1967 level) and sighted about the same number of trucks as last year. But we destroyed only 6.5% of the trucks sighted this year, compared to 16% last year. In addition, munitions that are relatively efficient against moving vehicles (such as M-36 and OBU-54) are in short supply, and the additional jet sorties are forced to carry conventional iron bombs.

Finally, the November decline in truck destruction may have been the result of a similar decline in truck traffic; if fewer trucks were operating we had fewer potential targets to attack. Some observers believe our chokepoint operations successfully stopped the southbound traffic; alternatively, the North Vietnamese may have decided to use fewer trucks in southern Laos than last year. Unfortunately, it will probably be several months before we have sufficient intelligence to determine the actual number of enemy trucks currently operating in Laos. Nevertheless, the argument that our truck kills declined because enemy traffic decreased ignores the most critical issue -- we destroyed a relatively small fraction of the trucks we sighted, despite a large increase in the number of attack sorties at night. We are analyzing the causes for this decline in efficiency during November and will report our findings when more detailed data becomes available.

AIR STAFF COMMENTS 1/

Measurement of Effectiveness. The OSD report used truck/sortie statistics in isolation in making comparisons of truck kills since 1 November 1968 with a like period for 1967. There are other factors which must be considered in making judgments on effectiveness:

1/ These comments were provided by Director of Operations, USAF (AFJOP).

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1. COMMANDO HUNT, which started on 15 November 1968, was designed to impede the flow of traffic into and through the system by placing attack sortie emphasis on interdiction of selected LOC choke points and point target (truck parks, storage areas, etc.), rather than chasing individual trucks.

2. Sorties specifically flown against trucks cannot be broken out of the total attack sorties reported in the OPREP reporting system since the system is not designed to meet this request and operational variables make it impractical. The following chart, extracted from a COMMANDO HUNT report for the period 28 November - 10 December 1968, shows the distribution of COMMANDO HUNT sorties to the various target categories:

COMMANDO HUNT

Target/Sortie Distribution

28 Nov - 10 Dec 68

	<u>Percentage</u> ^{1/}
Traffic Control Points	47.6
Truck Parks and Storage Areas	29.7
Trucks	15.9
Defenses	2.4
Other (Structure, Troops, etc.)	4.4

^{1/} Excludes B-52 Sorties.

As indicated above, only 15.9% of the sorties for this period were flown against trucks. Since only a small percentage of the sorties were flown against trucks, the logic of comparing trucks destroyed with total attack sorties is not a valid measurement of truck kill effectiveness.

3. A complete quantification of effectiveness must include secondary explosions, number of trucks in the system, WBLC, and the degree of throughput reduction as the result of blocking key points on LOCs, etc. For example, raw data extracted from OPREP-4s reflect that only 11 percent of the trucks sighted during November 1968 were south of the COMMANDO HUNT area of operations.

Results.

The OSD report fails to correlate results with the interdiction objective of impeding the logistics flow into and through the system. In discussing results and effectiveness the report fails to recognize that during November 1968, of the two major choke points -- Ban La Boy south of Ban Karai Pass was closed by interdiction during most of the month, and Ban Pha Nop south of Mu Gia Pass was closed for more than half the time during the same period.

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It has been estimated by 7AF that as much as 75% of the logistics throughput in Laos has been impeded. For example, during November 1968, 7AF estimates that an average of 48 trucks per day entered Laos at Mu Gia Pass and that during the three day trip between Mu Gia Pass and Tchepone, there was an average loss rate of approximately 15 percent per day. Of the 48 trucks departing Mu Gia Pass, 30 arrived in Tchepone. Seventh Air Force further estimates that 21 of the 30 remaining trucks stayed in the Tchepone complex to shuttle stockpiles and daily subsistence requirements for the 52,000 NVA forces in Laos itself, and that of the nine truckloads moving south from Tchepone per day, an average of eight actually arrived in SVN. The arrival rate of eight trucks per day represented no more than 28 tons of supplies per day, or less than half of what it is estimated would be needed from NVN to sustain VC/NVA activities in the northern areas of SVN.

The "Summer Interdiction Campaign," which commenced on 14 July 1968, established beyond a doubt that by heavy concentration of effort against non-bypassable choke points, the enemy's traffic flow can be interdicted effectively.

Enemy Truck Traffic in Laos

The OSD report suggests that the steady increase in truck sightings in Laos during the first three weeks following the NVN bombing halt represents a normal seasonal fluctuation more than an attempt to take advantage of the bombing halt. During the first three weeks in November 1967, it is estimated that 1,665 short tons of materials were shipped out of NVN to Laos and SVN. During the period 4-23 November 1968, based on trucks photographed in Route Packages I, II, and III, an estimated 14,200 short tons of supplies were moved into the southern portions of NVN, the majority destined for eventual shipment to Laos and SVN. The preponderance of evidence gleaned from reconnaissance to date indicates that the enemy is exploiting the bombing halt to the fullest extent possible by increasing his efforts to deploy war supporting material southward via more efficient methods of transportation.

The OSD report states that there has not been a significant increase in traffic entering Laos from NVN, nor is there evidence of additional movement from Laos into SVN, but it fails to state why. Again, the report fails to correlate results and evidence with the objectives of the present interdiction campaign.

In summary, while OSD(SA) accurately presents statistical data relative to truck sightings, truck destruction, and attack sorties, they fail to correlate results with the interdiction objective of impeding the logistic flow into and through the system.

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SEAFRO Comment

We agree with the Air Force that one of the primary reasons we are destroying fewer trucks this year is that we are concentrating most of our air strikes against roads and other fixed area targets. This was one of the main points of our article. At the same time, we still believe the scarcity of effective munitions and the large numbers of additional jet sorties (which are relatively inefficient against trucks) also contributed to the recent decline in truck killing efficiency. We flew twice as many sorties at night (when the trucks move) this year as last, sighted about the same number of trucks, but only destroyed 6.5% of what we sighted (compared to 16% last year). It seems improbable that our aircraft were so busy attacking roads at night that we failed to attack lucrative truck convoys.

In addition, we have difficulty understanding some of the data in the Air Force comments. They state that during November an average of 48 trucks per day entered the Mu Gia Pass. DIA and CIA report that traffic entering Laos in November averaged 10 trucks per day through Mu Gia and 5 per day through Ban Karai, a total of only 15 per day. However, if the Air Force estimate is, in fact, correct our November interdiction campaign can hardly be considered to have stemmed the logistic flow into Laos as the Air Force claims; this truck flow is 23% above CIA's estimates of traffic through Mu Gia Pass during the first four months of 1968 (the highest ever recorded) which averaged only 39 trucks per day. If the only routes into Laos have been blocked where are these trucks going?

We also have reservations about the logic used to conclude that the November interdiction campaign impeded "as much as 75% of the logistics throughput in Laos." Assuming the Air Force numbers are correct, if 48 trucks enter Laos every day but only 8 reach South Vietnam, the net throughput is only 16.6%, not 25%. However, it is misleading to attribute the "loss" of 40 truckloads enroute solely to the US interdiction campaign. Much of the traffic entering Laos will be used to support the enemy logistic network and is not destined for SVN at all. For example, CIA analysis indicates that supply requirements in South Vietnam during the first six months in 1968 accounted for less than one quarter of the supplies actually entering Laos; the rest was either consumed (30% of the total), destroyed (15%), or stockpiled (55%). If this is true, the November throughput of 17% does not appear much below normal.

Finally, roadwatch team reports indicate that the anticipated seasonal traffic buildup in Laos began during the first two weeks in December, in spite of our reports of sustained interdiction. Roadwatch teams near Mu Gia Pass reported 35 trucks per day during December 8-14, more than three times the November average. A team on Route 912 reported only 2 trucks per day during Dec 1-12 compared to 5 per day in November; however, sensor data indicates the actual traffic may have been closer to 11 per day. These reports of an upsurge in truck traffic do not seem to be consistent with reports that during this period our interdiction points impeded 75% of the flow.

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SOUTHEAST ASIA TACTICAL AIRCRAFT OPERATIONS

Summary Findings. We analyzed tactical air resources, costs, missions and employment in Southeast Asia through May 1970 in order to examine their effectiveness and their impact on enemy activities and Vietnamization. Our main findings were:

1. Close Support in South Vietnam (SVN). - Only a very small percentage (about 4%) of the total air effort in Southeast Asia is in support of allied troops in contact with enemy units in South Vietnam. Most of the remaining sorties attack known or suspected enemy locations, roads, and supply storage areas.
2. South Vietnamese Air Support. - Of the total allied air effort in South Vietnam, about one-fourth of the attack sorties are reported as being flown for the Republic of Vietnam Armed Forces (RVNAF) units. In line with our Vietnamization objectives, the Vietnamese Air Force (VNAF) has increased the percentage of these missions it flies from 25% of total in early 1969 to over 50% currently. Increases in VNAF sortie capabilities will continue RVNAF's trend toward complete independence from US air support.
3. Interdiction in Southern Laos. - Air operations over the Laotian Pathet Lao strike at a flow of enemy supplies from North Vietnam equal to only about 15% of the total enemy supply requirements in South Vietnam. Even with the intensive bombing, the enemy still moves supplies adequate to continue, or substantially increase, his current operational levels.
4. Northern Laos. - About 75% of U.S. air support for the Royal Lao forces in Northern Laos strikes logistic targets, yet the flow of supplies into Northern Laos has consistently exceeded by a significant margin the requirements of Communist forces there. Vietnamese manpower requirements and casualties in this area are not a significant drain on the total manpower pool.
5. Communist Bloc Support to North Vietnam (NVN). - Air operations impose no meaningful material costs on North Vietnam since its allies pay for most of the resources. North Vietnam's foreign aid during the past three years has been two to three times as large as the costs of keeping her forces in South Vietnam, Cambodia, and Laos supplied and replacing the damage caused by the bombing of North Vietnam.
6. Priority Allocation of Sorties. - Our analysis shows that a schedule of high priority air strikes in SEA can be developed which uses only 35% of the current number of sorties being flown.

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Purpose

The purposes of our analysis were as follows:

1. To show total allied tactical aircraft deployments, levels of operation, and their annual costs in Southeast Asia (SEA).

2. To show the employment of allied tactical aircraft in different theaters and for different missions -- particularly support of allied troops in South Vietnam -- and to examine the effect of air interdiction on the enemy supply system in Southeast Asia.

Allied Air Resources

This section examines air resources available to allied forces (US, South Vietnamese and Laotians) in SEA, their cost to the US, and the impact of diversions to Cambodia.

Deployed Tactical Air Forces: Table 1 shows US, Vietnamese Air Force (VNAF) and Royal Laotian Air Force (RLAF) tactical aircraft by base locations. Our analysis of this data shows that:

- Force drawdowns already executed, or now planned through June 1970, will reduce US forces based in SVN and naval carriers offshore by one-third from peak 1968-1969 levels.

- VNAF and RLAF capability has increased about one third since 1967.

- Overall the number of allied tactical aircraft deployed in SEA has declined about 13% from 1968-1969 peak levels.

- Offsetting these reduced force levels, allied tactical air forces in Southeast Asia have been steadily improved by the addition of slow-moving fighter/attack aircraft (A-1s, A-37s, B-57s) and aircraft gunships, both of which are much more effective providing close ground support and attacking moving vehicles than high-performance jets. Improved ordnance, delivery techniques, and intelligence collection and targeting have further improved air capability.

1/ See Table 12, which shows the relative effectiveness of gunships and other aircraft against moving trucks and Table 13, which shows the change in the mix of allied aircraft.

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TABLE 1
TACTICAL AIRCRAFT IN SOUTHEAST ASIA
(Possessed Aircraft)

	<u>Dec 67</u>	<u>Dec 68</u>	<u>Dec 69</u>	<u>June 70</u> (Projected)
<u>USAF</u>				
SVN	363	414	369	332
Thailand	255	291	297	306
Total	<u>618</u>	<u>705</u>	<u>666</u>	<u>638</u>
<u>USMC (SVN)</u>	157	192	148	101
<u>USN (Offshore)</u>	<u>167</u>	<u>202</u>	<u>119</u>	<u>122</u>
U.S. Total	<u>924</u>	<u>1099</u>	<u>933</u>	<u>861</u>
<u>VNAF (SVN)</u>	90	44 ^{a/}	120	114
<u>RLAF (Laos)</u>	53	61	70	70
Total Tactical Aircraft	<u>1067</u>	<u>1204</u>	<u>1123</u>	<u>1045</u>

^{a/} Reduced VNAF force caused by A-1 aircraft attrition which depleted aircraft inventories.

Tactical Air Sorties Levels: Table 2 shows the average monthly number of attack sorties (the basic measure of tactical air utilization) by theater for the last 4 years.

- SEA tactical air attack sorties levels are currently about 20% below peak FY 68-69 levels.

- Many of the past sortie reductions have been in South Vietnam sortie levels; this has largely been due to reduced levels of combat in SVN.

- Following the November 1968 bombing halt over NVN, the US air effort shifted first to Southern Laos and then in mid-1969 to Northern Laos.

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TABLE 2

US/VNAF/RIAF ATTACK SORTIES BY TARGET AREA
(Monthly Average Rates)

	<u>FY 67</u>	<u>FY 68</u>	<u>FY 69</u>	<u>FY 70</u> (Jul-Mar)
South Vietnam	14,648	17,877	17,385	12,464
North Vietnam	9,065	7,955	4,196	10
Laos: South	2,981	3,698	8,489	7,890
North	<u>1,099</u>	<u>1,372</u>	<u>2,475</u>	<u>5,732</u>
Total	27,793	30,902	32,545	26,096

B-52 Sorties: Table 3 shows B-52 sorties flown in Southeast Asia since FY 67. Our analysis found that:

- Overall B-52 sorties levels tripled from FY 67 to FY 69 (from 600 sorties monthly to 1200 to 1800) in response first to the siege of Khe Sanh and then the February 1968 Tet offensive.

- Commensurate with overall reductions in combat activity in South Vietnam, FY 70 sortie levels are about 1,400 sorties monthly, 20% lower than in FY 69.

- The B-52 strike emphasis shifted to Southern Laos from South Vietnam in FY 69 and FY 70 to support interdiction efforts against the Ho Chi Minh Trail.

TABLE 3

B-52 OPERATIONS IN SOUTHEAST ASIA
(Average Sorties Per Month)

	<u>FY 67</u>	<u>FY 68</u>	<u>FY 69</u>	<u>FY 70</u> (Jul 69-Mar 70)
South Vietnam	483	864	1,328	981
South Laos	193	197	424	465
North Vietnam (and DMZ)	<u>20</u>	<u>163</u>	<u>47</u>	<u>-</u>
Total	636	1,214	1,799	1,446

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Cost Impact: Table 4 shows FY 70 estimated costs of allied air operations in SEA, broken down by theater.

- The estimated incremental costs of allied air operations in Southeast Asia currently are about \$3.5 billion per year.
- The costs of air operations in South Vietnam represent \$1.9 billion (55%) of the total.
- U.S. air operations account for \$3.2 billion (91%) of the total.
- B-52 operations account for \$700 million (20%) of the total.

TABLE 4

FY 70 INCREMENTAL COSTS OF ALLIED
AIR OPERATIONS IN SOUTHEAST ASIA ^{a/}

	(\$ Millions)	\$ Total
<u>South Vietnam:</u>		
U.S.	1,640	47
VNAF ^{b/}	260	8
Total	<u>1,900</u>	<u>55</u>
<u>Northern Laos:</u>		
U.S.	390	11
RLAF ^{b/}	40	1
Total	<u>430</u>	<u>12</u>
Southern Laos	1,150	33
Total Costs	<u>3,490</u>	<u>100</u>

^{a/} Projected from sortie rates during July 1969-March 1970. Includes tactical fighter sorties (attack and non-attack), sorties flown by supporting aircraft, and B-52 sorties. Excludes peacetime operating costs of aircraft in the post-Vietnam force structure.

^{b/} Air Force estimate of amounts included in the FY 70 military functions appropriations for support of the RLAF and VNAF.

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Air Support in Cambodia: Table 5 shows recent US and VNAF air strikes in Cambodia and the required diversions of sorties from SVN and Laos. Our analysis found that :

- Allied air operations in Cambodia now constitute about one-fourth of total SEA tactical air and B-52 sorties. This has necessitated substantial reallocations of air effort from SVN and Laos.

- The tactical air sorties (6,600 per month) were reallocated almost equally from SVN and Laos, thereby lowering both the SVN and Laos sortie levels by 20-25%.

- B-52 sorties were reallocated in large part from Laos.

- It is doubtful that the diversions from Laos have had much impact since the monsoon rains have begun which hamper air operations.

TABLE 5
IMPACT OF CAMBODIAN OPERATIONS
(US, VNAF)

	Monthly Average			
	SVN	Cambodia	Laos	Total
<u>May 1970</u> ^{a/}				
Tactical Aircraft Sorties	9,733	6,655	8,974	25,372
Percent	39%	26%	36%	100%
B-52 Sorties	847	325	219	1,391
Percentage of Total	63%	24%	16%	100%
Air Ordnance (000 Tons)	47.5	25.2	27.8	100.5
Percent	47%	25%	28%	100%
<u>Jul 69 - Mar 70</u>				
Tactical Aircraft Sorties	12,454	-	11,792	24,256
Percent	51%	-	49%	100%
B-52 Sorties	981	-	465	1,446
Percentage of Total	68%	-	32%	100%
Air Ordnance (000 tons)	57.9	-	41.6	99.5
Percent	58%	-	42%	100%

^{a/} Based on 19 days data.

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Primary Uses of Allied Air Resources

This section discusses relevant objectives for air operations, identifies sorties devoted to different targets and missions, and finally, where data permits, assesses the effectiveness of the fulfillment of the mission objectives. We considered three primary objectives, each of which is defined and analyzed in turn:

- Close air support in SVN.
- Interdicting supply movements.
- Supporting Royal Lao operations.

(1) Close Air Support in SVN

Objective: To supplement the fire support requirements of the ground commander with adequate capability made available to the ground commander on a timely basis.

Analysis:

(a) Uses of Sorties in SVN: Table 6 gives a breakout of SVN air strikes showing support for troops in contact, immediate sorties delivered, and preplanned strikes. Our analysis found that:

- Less than 10% of all air strikes in SVN (4% of total in SEA) are flown to support allied forces in contact with enemy forces.
- Another 25% of SVN sorties fulfill a request from a ground commander or forward air controller for an "immediate" strike on a target that is time sensitive (e.g., enemy troops, an occupied base camp, an anti-aircraft site, etc.)
- Most of the remaining sorties are preplanned 24 hours or more in advance to strike known or suspected enemy locations.

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Table 6
SOUTH VIETNAM - TYPES OF AIR STRIKE MISSIONS

	<u>Attack</u> <u>Monthly Sorties</u> <u>(Jul 69 - Mar 70)</u>	<u>Percentage</u> <u>of Total ^{a/}</u>
<u>Support of Allied Troops in Contact (TIC)</u>		
From Strip Alert Aircraft	722	6
From Preplanned Strikes	329	3
From Armed Reconnaissance Missions	21	-
Total	<u>1,072</u>	<u>9</u>
<u>Immediate Strikes (Other than TIC)</u>		
Known Enemy Locations	1,851	15
Suspected Enemy Locations	778	6
Preparation of Allied Positions	203	2
Anti-Aircraft Sites	222	2
Total	<u>3,054</u>	<u>25</u>
<u>Preplanned Strikes (Not-Diverted)</u>		
Known Enemy Locations	3,470	28
Suspected Enemy Locations	3,955	32
Preparation of Allied Positions	708	5
Anti-Aircraft Sites	164	1
Total	<u>8,338</u>	<u>66</u>
Total Sorties	12,464	100

^{a/} Calculated from an analysis of U.S. tactical aircraft sorties flown in August 1969. SOURCE: USAF DASCLOG Computer File.

(b) RVNAF Air Support: Table 7 identifies air strikes for RVNAF, showing magnitude of sorties flown, number of sorties supporting RVNAF troops in contact with enemy forces, and the percent of support flown by VNAF. Our analysis shows:

- RVNAF receives about 4-5,000 tac air sorties per month, about 20% of total allied SEA capability.

- Consistent with our Vietnamization efforts, an increasing percentage of RVNAF air support -- low 52%, as compared to 25% in early 1969 -- is flown by the VNAF. As VNAF attack sortie capability increases above current levels, VNAF should continue to provide an increasing proportion of total RVNAF support.

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- Overall RVNAF air support levels have declined since early 1969, consistent with the reduced total SVN sortie effort; however, the essential air support sorties for RVNAF troops in contact have increased.

TABLE 7

TACTICAL AIR SUPPORT FOR RVNAF
(Attack Sorties Per Month)

	1969		1970
	Jan-Jun	Jul-Dec	Jan-Apr
Air Strikes for RVNAF Troops in Contact	645	496	690
Total RVNAF Strikes	5173	4585	3638
% of Total Strikes Flown by VNAF	24%	44%	52%

(c) Comparison of RVNAF and US Air Support: Table 8 relates SVN air strikes for RVNAF and US forces to numbers of battalions and numbers of friendly casualties. Our analysis found:

- RVNAF units in South Vietnam apparently receive less air support than U.S. units -- only about 60% as many sorties per battalion and 2% as many per man killed in action.

- For both RVNAF and US units, support for troops in contact requires only about 10% of total sorties received.

- RVNAF's share of SVN air support (US and RVNAF) has risen from 33% in early 1969 to 43% in early 1970.

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TABLE 8
COMPARISON OF RVNAF AND US AIR SUPPORT LEVELS
 (Jan 69 - Feb 70)

	<u>Support For Troops in Contact with Enemy</u>	<u>Total Air Support Received</u>
<u>Total Attack Sorties Received Per Month</u>		
RVNAF	514	4,639
US	939	8,130
RVNAF as % of US	57%	57%
<u>Total Attack Sorties Per Person Killed in Action</u>		
RVNAF	0.3	3.0
US	1.3	11.3
RVNAF as % of US	24%	27%
<u>Total Attack Sorties Per Battalion a/</u>		
RVNAF	5	46
US	9	81
RVNAF as % of US	56%	57%

a/ For calculations assume one ARVN battalion equates to 0.6 US battalions.

(2) Interdicting Supply Movements: Results of these missions, which occur in all theaters, are illustrated by US operations in Southern Laos.

Objectives:

- To impose a ceiling on enemy combat activity in South Vietnam by reducing the flow of supplies below amounts required to support high activity levels, the primary concern being the enemy's ability to launch an offensive of sufficient intensity to upset Vietnamization.

- To impose a meaningful cost on the North Vietnamese in terms of their materiel and human resources (to be meaningful, the costs must be at or near maximum levels which the North Vietnamese are willing to sustain).

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Analysis:

(a) North Vietnamese Logistics: Chart 1 is a flow diagram of supply movements showing all supply flows into SVN and consumption by VC/NVA forces there, consumption and destruction in transit through Laos, etc. While almost all the supply flows it shows are uncertain, and while the most uncertain are probably the amounts destroyed by air strikes, the chart does give a reasonably complete picture within the limits of current intelligence. Our analysis indicates the following tentative conclusions.

- The enemy receives about 70% of his supplies for SVN operations from sources inside SVN, 10% from Cambodia, and about 3% from across the DMZ. He receives about 15% from NVN over his supply routes through Laos, the supply route against which our primary air interdiction effort is directed.

- About one-third of all supplies shipped into Southern Laos transit the system into SVN. The rest are destroyed by air strikes, consumed in-transit, or stockpiled in Laos.

- Seaborne imports into NVN are over 20 times greater than estimated supply shipments from NVN into Northern and Southern Laos.

(b) Laotian Supply Movements: Table 9 compares supplies moved from NVN via Laos into SVN during the last dry season to estimated VC/NVA supply requirements in SVN. Our analysis shows:

- Even in the face of intensive air interdiction efforts, the Communists successfully moved large amounts of supplies through Laos into SVN.

- During the last dry season, sensor data indicated the magnitude of the Laotian supply system's excess or surge capability. February 1970 supply flows, for instance, were two to four times average SVN resupply levels.

- Assuming the Communists suffer permanent loss of seaborne shipments of arms and ammunition (up to 15 tons per day) into and through the Port of Sihanoukville (now Kompong Som) in Cambodia, and assuming they can continue last season's dry season shipment rate through Laos next dry season, they will meet their average daily supply requirements in SVN if they can ship 25 tons of supplies through Southern Laos during the wet season. All intelligence indicates the enemy intends to do this. They will, however, remain dependent on Cambodian rice sources.

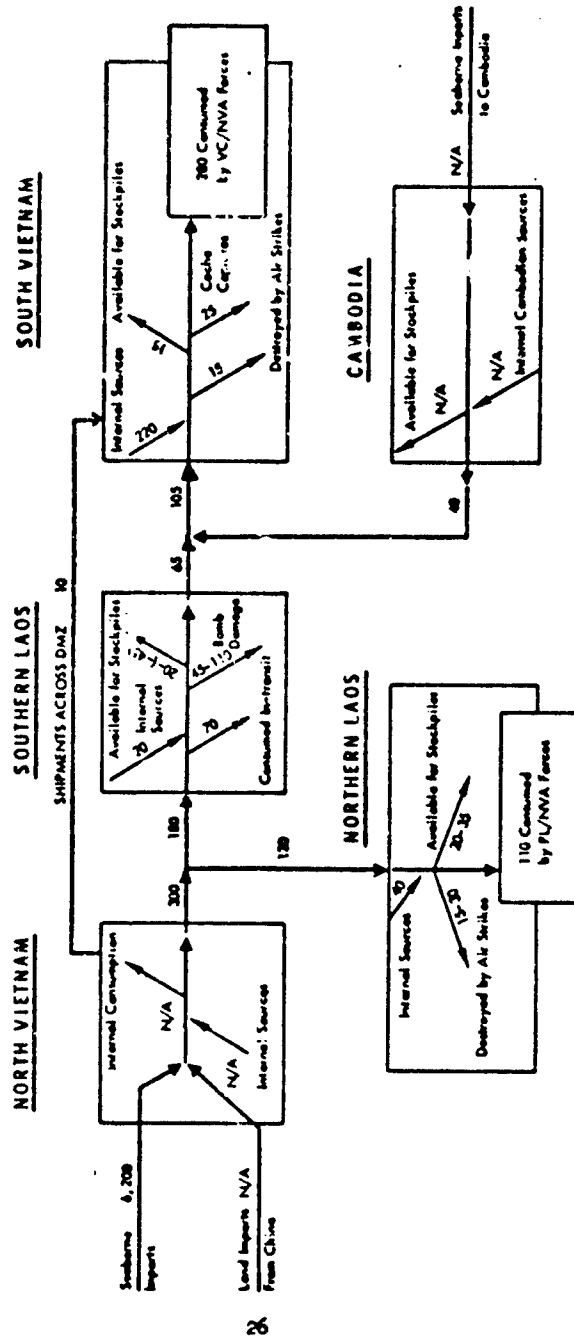
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CHAPT. 1

THE NORTH VIETNAMESE LOGISTICS SYSTEM

(Estimates of Supply Movements in Short Tons Per Day - Average Over a 12 Month Cycle)



N/A = Not Available

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Table 9
INTERDICTION - LAOTIAN SUPPLY FLOWS COMPARED
TO SVN SUPPLY REQUIREMENTS

	Short Tons Per Day
<u>VC/NVA Supply Requirements in SVN</u>	
Total Supply Requirements	320
<u>External Supply Requirements</u>	
Total From Laos and Cambodia b/	90
Total from Laos Assuming Cambodian Rice, but not Cambodian Arms and Ammunition, Available c/	65
Total from Laos Assuming Cambodian Rice, Arms, and Ammunition Available d/	50
<u>Supply Flows From Southern Laos into South Vietnam</u>	
<u>Dry Season a/</u>	
November 1969	12
December 1969	52
January 1970	130
February 1970	215
March 1970	149
April 1970	79
May 1970 (est.)	49
<u>Wet Season Projection (Jun-Oct)</u>	<u>25-50</u>
<u>Full-year Average</u>	<u>68-78</u>

a/ 7th Air Force estimates based on sensors placed along roads leading into SVN from Southern Laos.

b/ Excludes 10 tons of rice per day which NVN ships across the DMZ.

c/ Cambodian sources supply about 25 tons of rice per day to II and III Corps.

d/ In the past up to 15 tons per day of arms, ammunition, and other equipment were moved to III and IV Corps. The closure of Sihanoukville will most likely curtail these shipments.

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(c) Enemy Materiel Costs: Table 10 compares NVN's costs of replacing trucks, supplies shipped into Laos, and selected other war costs, to NVN foreign aid. It shows:

- Foreign aid to North Vietnam has substantially exceeded the costs of supplying Communist forces in Laos, South Vietnam, and Cambodia in the years 1967-1969.

- The costs of supplying Communist forces in Southeast Asia declined by about one-half between 1967 and 1969 primarily because of the bombing halt over North Vietnam.

- Military aid to North Vietnam declined even more sharply than costs between 1967 and 1969.

- A 25% increase in economic aid partially offset the sharp decrease in military aid between 1967 and 1969, but total aid was lower by nearly one-third.

- The estimated incremental costs to the U.S. (about \$1.5 billion in 1969) of interdicting Communist supplies in Northern and Southern Laos were nearly ten times the costs of all enemy supplies shipped into Laos and the replacement value of trucks destroyed by air strikes.

(d) Targeting and Aircraft Effectiveness: Table 11 shows the relative emphasis of Southern Laos strikes against trucks, roads and supply storage areas and the resulting effectiveness in destroying supplies. We found that:

- During the 1969-1970 dry season interdiction program, 7th Air Force significantly shifted the target emphasis to moving vehicles, increasing these strikes from 15% of total in the 1968-1969 dry season to 27% of total this dry season, while at the same time reducing strikes against roads and supply storage areas.

- This shift increased estimated total destruction of enemy supplies by about 20% over dry season 1968-1969; the shift increased destruction per sorties about 60%, since 1969-1970 sortie levels were reduced about 25%.

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Table 10

INTERDICTION - SELECTED ENEMY COSTS
(\$ Millions)

	Calendar Year		
	1967	1968	1969
<u>Costs of Supplies Shipped To:</u> ^{a/}			
Northern Laos	53	61	58
Southern Laos	45	63	60
Total	<u>98</u>	<u>124</u>	<u>118</u>
<u>Costs of Trucks Destroyed:</u> ^{b/}			
Northern Laos	1	1	3
Southern Laos	6	44	38
Total	<u>7</u>	<u>45</u>	<u>41</u>
<u>Costs of Supplies, Equipment, and</u> <u>Industry Destroyed in North Vietnam</u> ^{c/}	139	85	-
<u>Costs of Air Defense in North Vietnam</u> ^{d/}	235	122	83
<u>Total Costs</u>	479	376	242
<u>Total Foreign Aid To North Vietnam:</u> ^{d/}			
Economic	380	480	470
Military	650	395	220
Total	<u>1,030</u>	<u>875</u>	<u>690</u>
<u>Total Costs as % of Foreign Aid</u>	46%	43%	35%
<u>Total Costs as % of Military Aid</u>	74%	95%	110%

^{a/} Computed from CIA estimates of supply shipments and estimated costs per ton of supplies of \$1,300 for Northern Laos and \$1,100 for Southern Laos.

^{b/} Computed from DIA estimates of truck attrition and estimated cost of \$6,000 per vehicle.

^{c/} OASD/SA estimates, based on several earlier studies.

^{d/} CIA/DIA estimates.

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- The increased supply destruction resulted largely from greater reported truck destruction, which in turn resulted from the large increase in truck-kill sorties and the addition of highly effective gunship aircraft (AC-119s and AC-130s) to our interdiction force. (See Table 12 which shows relative aircraft effectiveness against trucks and supply targets, and Table 13 which shows the mix of deployed aircraft.)

- By continuing to emphasize truck targets with the most suitable truck-killing aircraft and reducing the numbers of sorties flown during the wet season (Jan-Sep) when visibility degrades effectiveness (and enemy truck traffic normally is substantially reduced), we can achieve about the current levels of destruction with substantially fewer sorties. (Table 20 illustrates an example of such a program, and is discussed more fully in a later section. It requires only about 40% as many sorties as currently being used.)

TABLE 11

U.S. INTERDICTION EFFORTS IN SOUTHERN LAOS

	<u>Dry Season</u> <u>Nov 68-April 69</u>	<u>Wet Season</u> <u>May 69-Oct 69</u>	<u>Dry Season</u> <u>Nov 69-Apr 70</u>
<u>Targets Struck (average monthly sorties)</u>			
Moving Vehicles	1,826	751	2,471
Storage Areas and Truck Parks	4,261	3,377	2,562
Roads ^{a/}	4,747	2,101	2,105
Anti-Aircraft	730	300	1,006
Other	<u>609</u>	<u>976</u>	<u>1,009</u>
Total Sorties	12,173	7,505	9,153
<u>Estimated Supply Destruction ^{b/}</u>			
Tons Destroyed (000's)	26.8	8.4	31.9
Tons per Sortie	0.37	0.19	0.58

^{a/} LOC's, Traffic Control Points.

^{b/} USAF estimate

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TABLE 12

INTERDICTION - RELATIVE AIRCRAFT EFFECTIVENESS

<u>Results From Truck Attacks</u>	<u>Reported Bomb Damage Per Sortie</u> <u>Trucks Destroyed/Damaged</u>	<u>Estimated Supplies Destroyed Per Sortie</u> <u>Tons</u>
High-Performance Jets <u>a/ b/</u>	0.27	0.67
Slow-Moving Attack Aircraft <u>a/ c/</u>	0.37	0.92
Aircraft Gunships <u>a/ d/</u>	2.40	5.99
Total From Truck Attacks <u>e/</u>	0.35	0.86
<u>Results From Storage Area/ Truck Park Attacks</u>	<u>Secondary Fires/ Explosions</u>	<u>Tons</u>
All Aircraft <u>f/</u>	1.64	0.61

a/ Results during randomly selected time periods of 1969-70 dry season.

b/ F-4, F-100, F-105, A-4, A-6, A-7.

c/ A-1.

d/ AC-119, AC-123, AC-130.

e/ Calculated first by assuming 55% of trucks are loaded and carry 3.8 tons of supplies and second by adding 0.187 tons per truck-related secondary fire or explosion (under the assumption that 50% of truck-related secondaries result from roadside caches not cargo in trucks).

f/ Results achieved by all tactical aircraft from November 1969 to April 1970. Calculated by assuming each secondary fire or explosion associated with an air strike against a storage area target means 0.375 tons of supply destruction.

g/ November 1969-April 1970.

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TABLE 13
AIR RESOURCES - THE MIX OF DEPLOYED AIRCRAFT
(US, VNAF, RLAF)

	<u>Dec 67</u>	<u>Dec 68</u>	<u>Dec 69</u>	<u>Projected June 30</u>
<u>Tactical Aircraft</u>				
High Performance Jets	868	1006	877	731
Slow-moving Attack Aircraft ^{a/}	146	137	176	244
F-26s (RLAF)	53	61	70	70
Total	<u>1067</u>	<u>1204</u>	<u>1123</u>	<u>1045</u>
<u>Aircraft Gunships</u>				
With sensor equipment ^{b/}	-	4	11	23
Without sensor equipment ^{c/}	<u>40</u>	<u>46</u>	<u>45</u>	<u>40</u>
Total	<u>1107</u>	<u>1254</u>	<u>1179</u>	<u>1108</u>

a/ A-1, A-27, A-37, B-57.

b/ AC-119K, AC-123, AC-130.

c/ AC-47, AC-119G.

(e) Enemy Casualty Considerations: Table 14 shows the relationship between combat levels in SVN, resultant enemy casualties, and North Vietnamese manpower reserves. From it we conclude:

- Continuance of the high first half 1968 combat levels would result in about 360,000 losses per year (300,000 of which would come from NVN). These replacement rates in three years would reduce available NVN manpower reserves by almost one-half.

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- Manpower and casualty considerations rather than supply availabilities appear to impose the effective ceiling on North Vietnamese activity levels in SVN. The enemy's shift to a protracted war strategy using economy of force tactics suggests that the enemy now views manpower as a constraint.

TABLE 14

INTERDICTION - NVN MANPOWER RESERVES VERSUS SVN COMBAT LEVELS

SVN Combat Rate ^{a/}	NVN Manpower Reserves (Dec 69) ^{b/}	Annual Replacement Required for SVN Losses ^{c/} ^{e/}	Annual Additions to NVN Manpower Pool ^{d/}	Projected NVN Manpower Reserves		
				Dec 1970	Dec 1971	Dec 1972
<u>Peak Rate</u>						
(Jan-May 68)	1,500,000	300,000	74,000	1,274,000	1,048,000	822,000
<u>Average Rate</u>						
(Jul 68- Jun 69)	1,500,000	172,000	74,000	1,402,000	1,304,000	1,206,000
<u>Lull Rate</u>						
(Jul-Oct 69)	1,500,000	140,000	74,000	1,434,000	1,368,000	1,302,000

- ^{a/} Activity indicators for these periods are not perfectly symmetric. The average rate is closer to the lull rate than the peak rate.
- ^{b/} U.S. Census Bureau Study. Includes 560,000 in the Armed Forces.
- ^{c/} Assumes first, that VC continue present recruiting rates in SVN and that all VC/NVA losses above 5,000 per month are replaced by NVN and second, that losses from all causes (KIA, died of wounds, captured, deserted, etc.) continue constant through the forecast period at rates actually experienced during each given sample time period.
- ^{d/} 137,000 physically fit males will reach the age of 15 years; but 63,000 males, not in the North Vietnam military, leave the manpower pool by reaching the age of 35 years or through natural death as civilians. Males in the military of all ages are assumed to remain in the manpower pool indefinitely.
- ^{e/} An additional 10,000-15,000 North Vietnamese casualties per year occur in Laos.

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(3) Air Support for Royal Lao Operations:

Objectives:

- To help limit the capability of the enemy to advance during the dry season.

- To impose meaningful costs on enemy efforts.

Analysis:

(a) Close Support Versus Interdiction: Table 15 gives a breakdown of US and RLAF sorties in Northern Laos showing strikes providing close support versus interdiction missions. Our analysis shows that:

- During the last year US aircraft flew an average of about two-thirds of the total 5,700 monthly attack sorties over Northern Laos; RLAF T-28s flew the remainder.

- About 70% of the US and 10% of the RLAF sorties performed interdiction missions along the enemy supply routes from North Vietnam; the others were directed mainly at enemy troops, fortifications, and weapons positions.

TABLE 15

AIR SUPPORT FOR ROYAL LAO FORCES a/

<u>US Tactical Aircraft</u>	<u>No. Avg Attack Sorties</u>	<u>Percent</u>
Strikes Against Enemy Troops, Fortifications, and Weapons Positions	976	17
Interdiction	2,770	48
Anti-Aircraft Suppression	156	3
Total	<u>3,902</u>	<u>68</u>
 <u>RLAF</u>		
Strikes Against Enemy Troops, Fortifications, and Weapons Positions	1,647	29
Interdiction	183	3
Total	<u>1,830</u>	<u>32</u>
Total	5,732	100

a/ Average for the July 1969-March 1970 period. Breakdown by mission estimated from data in the USAF L&M card file for May-December 1969.

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(b) Measures of Effectiveness: Table 16 compares North Vietnamese supply losses and KIA in Northern Laos with losses in other theaters, and available NVN resources. From it we conclude that allied operations in Northern Laos have little impact on available North Vietnamese manpower or supply flows. Losses are small relative to other theaters and to available replacement manpower and supplies.

TABLE 16

IMPACT OF ALLIED OPERATIONS IN NORTHERN LAOS

<u>Enemy Personnel Losses</u>	<u>Monthly Average Rates a/</u>
Total NVA casualties in North Laos	10-12,000
As percentage of NVA casualties in SVN	8-10%
Number Years of Available Manpower Reserves in NVN at Above Loss Rate	14 years
<u>Enemy Supply Losses</u>	
Total supply losses in North Laos (tons)	450-900
As percentage of supply losses in South Laos	20-40%
As percentage of supply inputs to North Laos	12-25%

a/ Time period - an average of recent supply and loss experience during last 12 months.

Priority Allocation of Sorties

This section examines the allocation of sorties in Southeast Asia to high priority targets versus those of lesser priority. We also develop a proposed program for high priority strikes in both dry and wet seasons which could be incorporated into future SEA tactical air programs.

Essential Strikes: We analyzed tactical air strikes in each theater (SVN, Southern Laos, Northern Laos) to see what percentage hit targets considered essential or of proven value. Tables 6, 11, 12 and 15 provided the basic data for our analysis.

- In South Vietnam less than 10% of all strikes support troops in contact with the enemy (over 60% of all strikes are pre-planned 24 hours in advance or longer to hit suspected or known enemy locations). (See Table 6.)

- In Southern Laos a small percentage of total strikes (15-25% depending on season) hit moving vehicles which are the most lucrative targets (see Table 11). Of these strikes, a small number of gunships accomplish most of the reported destruction (see Table 12).

- In Northern Laos nearly 75% of all US strikes hit supply-related interdiction targets, with limited effectiveness in denying the enemy his

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supply requirements (See Table 15).

Conclusions Pertinent to Priority Sortie Allocations: Substantial reductions in tactical aircraft sorties can be achieved with little adverse impact on essential missions. In each area we identify high priority missions considered essential, and discuss possible reductions in lesser priority missions:

(1) South Vietnam: High priority strikes include air strikes for allied troops in contact with enemy forces, and other strikes called for by the ground commander or forward air controller on an immediate basis (i.e., time-sensitive targets). Preplanned strikes in SVN can be reduced with little degradation in quality of close air support. Table 17 shows the number of high priority strikes flown in the past (July 1969- March 1970).

TABLE 17

HIGH PRIORITY AIR STRIKES IN SOUTH VIETNAM a/

	<u>Monthly Attack Sorties</u>	<u>% Total</u>
<u>High Priority Strikes</u>		
Troops in Contact	1,072	9
Other Immediate Strikes	<u>3,054</u>	<u>25</u>
Total	4,126	34
<u>Lower-Priority Strikes</u>		
Pre-planned Strikes	8,338	66
Total	12,464	100

a/ See Table 6 for further detail.

(2) Southern Laos: High priority strikes include attacks against moving trucks emphasizing slow-moving, truck-killing aircraft, and strikes against enemy air defenses to protect the slow-moving aircraft. They could also include limited numbers of strikes against identified lucrative supply storage targets. By shifting more sorties to trucks, and relying on aircraft that are effective in truck-killing, current rates of destruction can be continued with fewer total sorties. Most of the reduction would be in high-speed jet aircraft sorties that are relatively ineffective for this particular mission

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in Southern Laos. Note that our earlier analysis showed that even with the intensive air interdiction effort in Southern Laos, traffic flow estimates show the enemy infiltrates supplies adequate for his current levels of operations in South Vietnam or substantially higher ones. Table 18 shows a proposed program of high priority strikes for Southern Laos.

(3) Northern Laos: High priority strikes include close air support for Royal Lao forces, probably emphasizing strikes against enemy troops, but not excluding other close support battlefield targets. By reducing interdiction strikes but continuing direct support missions, it would be possible to continue to maintain significant pressure on the PL/NVA with 50% fewer sorties. Table 19 shows the number of high priority strikes in the past (July 1969-November 1970).

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TABLE 10

HIGH PRIORITY AIR STRIKES IN SOUTHERN LAOS

	By Season		Past Period		By Season		Past Period	
	(Nov 68-Apr 69)	(May 69-Sep 69)	(Oct 68-Mar 69)	(Apr 69-Jul 69)	(Nov 68-Apr 70)	(May 70-Sep 70)	(Oct 69-Jan 70)	(Apr 70-Jul 70)
High Priority Strikes								
Attachment Trucks								
Gunships	63	60	350	180	350	180	350	180
Other Truck Sorties	1,761	691	2,121	159	2,121	159	2,121	159
Total	1,824	751	2,471	349	2,471	349	2,471	349
Protecting U.S. Aircraft								
AAA Strikes	667	240	666	60	666	60	666	60
Gunship Escort (Striking AAA)	130	40	130	20	130	20	130	20
Total AAA Strikes	797	280	796	80	796	80	796	80
Total High-Priority	2,621	1,031	3,267	420	3,267	420	3,267	420
Lower-Priority Strikes								
Striking Road System	4,747	8,101	4,747	8,101	4,747	8,101	4,747	8,101
Striking Storage Areas and Truck Parks	4,261	3,377	4,261	3,377	4,261	3,377	4,261	3,377
Other	669	876	669	876	669	876	669	876
Total Lower-Priority	9,677	12,354	9,677	12,354	9,677	12,354	9,677	12,354
Total Sorties	12,173	7,505	12,173	7,505	12,173	7,505	12,173	7,505

1/ Present AC-119G, AC-119K, and AC-119J gunship capability.
 2/ December 1969 experience, which can reasonably be considered about a
 peak requirement; only about 1,500 truck sorties monthly were used
 during 1968-1969 dry season.
 3/ Calculated by using two tactical air sorties per gunship, but with
 only one of the two sorties actually striking an AAA site. The
 other 726 monthly sorties, being non-attach, are excluded from this
 table.
 4/ Estimated.

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TABLE 19
HIGH PRIORITY U.S. STRIKES IN NORTHERN LAOS^{a/}
 (Jul 69-Nov 70)

	<u>Monthly</u> <u>Attack Sorties</u>	<u>% Total</u>
<u>High Priority Strikes</u>		
<u>U.S.</u>		
Enemy Troops	631	11
Anti-Aircraft Sites	<u>176</u>	<u>3</u>
Total	787	14
<u>MAF</u>	1,830	32
Total High Priority	2,617	46
<u>Lower Priority Strikes</u>		
<u>U.S.</u>		
Trucks	208	4
Logistic Storage Areas/ Truck Parks/LOCS	2,456	43
Enemy Fortifications/ Weapons Positions	345	6
Other ^{b/}	<u>106</u>	<u>2</u>
Total Lower Priority Strikes	3,115	54
Total	5,732 ^{c/}	100

a/ SOURCE: L&N Card File.

b/ Airfields, dams, free strike zones, heavy construction equipment, construction areas, tactical vehicles, watercraft, other (unspecified).

c/ Sortie rate (May-Dec 69).

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Priority Sortie Programs: Table 20 summarizes an illustrative sortie plan which provides only high priority support for missions in South Vietnam, Southern Laos, and Northern Laos. In comparison to July 1969-March 1970 experience, this proposed program represents only 38% of the monthly average of attack sorties currently flown. Note that any proposed tactical air program for SEA must include additional resources for a substantial number of lower priority strikes plus a high surge capability to deal with contingencies; all plans currently being considered include these additional resources.

TABLE 20
A PLAN FOR REDUCED TACTICAL AIRCRAFT SORTIE LEVELS

	<u>Attack Sorties</u> <u>Per Month</u>
<u>Current Operations (July 1969-March 1970)</u>	
USAF	14,285
USN	3,350
USMC	3,636
VNAF	2,995
RIAF ^{a/}	1,830
Total	<u>26,096</u>
<u>An Illustrative Priority Sortie Plan</u> <u>(US, VNAF, RIAF)</u>	
South Vietnam - Support of Troops in Contact and Other Immediate Strikes	4,100
Southern Laos - Truck Attacks and AAA Suppression.	3,200
Northern Laos - RIAF Sorties and Arbitrary U.S. Sortie Rate	<u>2,600</u>
Total	9,900

a/ January 1969-October 1969.

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AN APPRAISAL OF ARC LIGHT (B-52) OPERATIONS

The ARC LIGHT program, B-52 strikes in SEA, started on June 18, 1965 with 27 sorties against targets in SVN. An average of 220 sorties per month were flown during the rest of 1965. In October COMUSMACV stated a requirement for 450 total sorties per month by March 1966. This level was approved, and subsequent approvals raised it to 600 and then 800 sorties per month by February 1967, the present approved program. CINCPAC has recently requested that the monthly sortie level be raised to 1200.

In December 1965 targets were struck in Laos for the first time; NVN targets near the DMZ were added in April 1966; and the DMZ itself was first hit in July 1966. The table below shows ARC LIGHT sorties and ordnance expended by target country from June 1965 thru August 1967. During that period over 13,000 sorties have dropped 301,000 tons of bombs, 80% of them in SVN, 15% in Laos, and 5% in NVN. Consumption the first 8 months of this year has averaged 20,000 tons per month, equalling the monthly ordnance expenditures by all types of aircraft during the peak year of the Korean War.

B-52 ARC LIGHT Sorties

	<u>1965</u>	<u>1966</u>		<u>1967</u>	<u>Total Sorties</u>
	Monthly Avg Jun - Dec	Monthly Avg. Jan-Jun Jul-Dec		Monthly Avg. Jan - Aug	Jun 65 - Aug 67
SVN	220	309	376	572	10,227
LAOS	3	68	40	167	2,005
NVN	0	7	22	10	253
DMZ	0	0	47	49	676
Total	223	384	435	798	13,161

Munitions Dropped (Tons)

SVN	4515	6165	8186	15,294	240,062
LAOS	63	1362	671	4,172	46,018
NVN	0	168	731	1,210	15,076
Total	4578	7695	9588	20,676	301,156

The B-52s were all based at Anderson Air Base, Guam, until Apr. 11, 67 when strikes were launched from U-Tapao, Thailand. Thru August 1967, 1343 sorties had been flown from Thailand. The planned level of 15 aircraft at U-Tapao was reached on 10 July, and that base will support 450 sorties per month in December 1967 when ammunition facilities are completed.

ARC LIGHT Costs

The 13,161 sorties flown through August 1967 have cost about \$210 million in direct operating costs and have expended munitions valued at \$600 million, for a total cost of \$810 million. The average cost per sortie

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was slightly over \$61,000. (Attrition has been ignored since no aircraft are purchased to replace losses).

The average cost per sortie at present is closer to \$65,000 because the aircraft are carrying considerably heavier loads. The annual costs should be approximately \$620 million ^{a/} at the present 800 sortie per month level, even considering the lower costs of basing 15 aircraft at U-Tapao, Thailand. (The direct operating costs of a flight from Guam are about \$17,000 compared to \$4600 from Thailand.) At present 450 sorties are flown from Thailand and 350 from Guam. About 1 January the mix will shift to 260 from Guam and 540 from Thailand. This will reduce monthly operating costs by about \$1.1 million.

What Has ARC LIGHT Accomplished?

Despite continuing attempts, no objective means to measure ARC LIGHT results have been found. Valid post-strike information is skimpy as most of the bombing is deep in enemy territory, and in areas of thick jungle cover. As a result, bomb damage assessment (BDA) by visual and photo reconnaissance is virtually useless.

Nevertheless, BDA reports are made by forward air controllers, aerial observers, B-52 strike crews, and ground follow-up units and MACV submits weekly reports of results. These data are inconclusive, which the following example of a COMUSMACV summary report shows. This one-week sample (July 9-15 1967) covers 24 missions involving 157 sorties. Eight missions were scheduled in direct support of ground operations, the other 16 against suspected troop and supply areas. Visual or ground follow-up BDA was reported on 18 missions; on the other 6 reconnaissance was delayed due to other operational commitments. The BDA on 12 missions showed no results of military significance, and on the remaining 6, the following effects were noted:

Trench destroyed	100 meters
Trench uncovered	1030-1130 meters
Damaged trenches	12
Road cuts	9
Base camps uncovered	2
New bunkers uncovered	48
Bunkers destroyed	40
Bunkers damaged	3
New structures destroyed	1
Tunnels collapsed	3
Foxholes uncovered/damaged	30
VC sited in target area	1
AA/Automatic weapons positions damaged	6
AA/Automatic weapons positions destroyed	32
Houses destroyed/damaged	12
Artillery positions destroyed	1
Artillery positions damaged	12
Bridges destroyed	1

(Data Source: Msg from COMUSMACV, 250435Z Jul 67, "Summary of ARC LIGHT Strikes, 9-15 Jul 67.")

^{a/} Virtually all of these costs are incremented. The normal annual training cost of the aircraft and tankers would only be about \$25 million.

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For these same 24 missions, SAC crews reported 68 secondary explosions and fires in the target areas.

Another source of bombing effects information is interrogation reports of prisoners and ralliers. Five of these reports taken during April - June 1967 show that 117 enemy were killed and 84 wounded. ARC LIGHT may kill and wound many more enemy than is indicated by this small sample. For example, the DIA recently published this interrogation report:

"A VC guerrilla captured in Hau Nghia Province has revealed that he was assigned to a burial detail following a B-52 strike in the vicinity of Khanh Hamlet, Duc Hoa District, in mid-March. He stated that 500 to 600 men were bivouaced in the area at the time of the strike and that most of them were sleeping in one and two man "trenches". He stated that approximately 70% of the trenches collapsed. The source could not make accurate estimate of the number of survivors but believed the total was less than 300, many of whom appeared to be seriously wounded." a/

Another instance of possible heavy NVA fatalities from a B-52 raid was reported by an Air Force intelligence source: He said that on July 26 an ARC LIGHT raid near the DMZ nearly destroyed an NVA regiment.

The RAND Corporation started studies of VC morale and motivation in 1965. Their field team has interviewed over a thousand VC and NVA prisoners, defectors and Chieu Hoi returnees. Specific questions have been asked about B-52 operations against the interviewees, their prior warning of the raids, and effects of the bombings. A quotation from the October 1966 quarterly report summarizes the findings of the RAND studies:

"Respondents tended to regard the B-52's as an especially dangerous U.S. aircraft and some made the statement that the B-52's are an indication of great U.S. - G.V.N. strength. In fact, some of interviewees who had not actually experienced a B-52 attack seemed to express more fear of this weapon system than did some of the soldiers who had actually been attacked." b/

Does the Enemy Get Warning of B-52 Raids?

Prisoners of war and returnees generally reported that they were told about impending attacks. Most also reported that they had been given specific instructions on how to protect themselves. The practice of scheduling ARVN troops for ARC LIGHT follow-up was discontinued when it was felt this could be the source of the leaks. Although the ARVN nominates targets and is briefed during the approval phase by MACV, they are not given the time dates that targets will be struck.

a/ DIA Intelligence Bulletin 147-67, 31, July 1967.

b/ "VC Motivation & Morale Project," Quarterly Report, 28 Oct, 1966, RAND Corp.

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There is some evidence in the prisoner reports that country-wide alerts are issued when B-52's are known to have departed their bases or passed look-out posts both at sea and in country. (Note: The B-52's operate in radio silence, so no evidence of their presence or plans can be obtained by radio monitoring). However, recent intelligence shows good correlation between warnings and raids, which indicates that broad area alerts have been replaced with more specific and more reliable notices. This being the case, the surprise element and the overall effectiveness of ARC LIGHT is being particularly compromised.

One likely source of VC intelligence on ARC LIGHT strikes is "heavy artillery" warnings broadcast to friendly troops to clear target areas. These broadcasts identify the approximate strike times and provide the target coordinates in an elementary code. The codes are used by US and ARVN combat units and could fall into enemy hands. Since the VC/NVA have established an extensive communications monitoring network (primarily using captured US radios), this could be the means by which they get warnings of the attacks.

Are ARC LIGHT Sorties Worth Their Cost?

In view of the \$600 million annual cost of the ARC LIGHT Program the question should be asked, is the program paying its way? As was indicated previously, it appears impossible to find valid quantifiable measures of the true effectiveness of this program. MACV reports based on bomb damage assessment indicate that limited damage to Viet Cong bases and personnel is achieved by the bombing. On the other hand prisoner and rallier interrogation reports seemingly prove that the impact on the enemy may be greater than the BDA indicates.

With these considerations in mind it would appear that it would be a mistake to stop the raids entirely. It not only would relieve the pressure on the enemy in his redoubts, but it might be viewed by the Viet Cong and North Vietnamese as a weakening of our determination to continue the conflict.

There is no statistical basis to justify an increase in the sortie rate to 1,200 sorties per month. We estimate that the incremental cost would be about \$366 million per year, including the cost to retain some B-52s now scheduled to be retired.

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ARC LIGHT (B-52) OPERATIONS

The September issue (pg. 25) of the SEA Analysis Report contained an article on B-52 Operations in Southeast Asia. The following comments were received from the Army Staff (ODCSOPS). SEAPRO comments are also included.

ODCSOPS Comments

The referenced report contains an appraisal (pp 25-28) of ARC LIGHT (B-52) operations. The history of these operations since their initiation is covered in some depth and costs and accomplishments of the program are also addressed. The apparent thrust of the article is to question the CINCPAC request for an increase in the B-52 sortie rate to 1200 sorties per month. The article summation is quoted below:

"In view of the \$600 million annual cost of the ARC LIGHT Program the question should be asked, is the program paying its way? As was indicated previously, it appears impossible to find valid quantifiable measures of the true effectiveness of this program. MACV reports based on bomb damage assessment indicate that limited damage to Viet Cong bases and personnel is achieved by the bombing. On the other hand prisoner and rallier interrogation reports seemingly prove that the impact on the enemy may be greater than the BDA indicates.

"With these considerations in mind it would appear that it would be a mistake to stop the raids entirely. It not only would relieve the pressure on the enemy in his redoubts, but it might be viewed by the Viet Cong and North Vietnamese as a weakening of our determination to continue the conflict.

"There is no statistical basis to justify an increase in the sortie rate to 1,200 sorties per month. We estimate that the incremental cost would be about \$366 million per year, including the cost to retain some B-52s now scheduled to be retired."

The lack of "a statistical basis" for justification of the 1200 sortie per month request is offered as the prime reason for the O'SD/SA position cited above. In this connection, it is probably true that no quantifiable objective means are now in being to measure total ARC LIGHT results or to justify the requested increase to 1200 sorties. There are certain considerations, however, that override pure statistical analyses. These are described below.

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a. One advantage the enemy has enjoyed in SVN has been his ability to engage or disengage almost at will and to withdraw to base camps or other sanctuaries in order to refit, rest and train for future operations. In order to offset this advantage, US/FW/IAF are engaged in a comprehensive program including the employment of airborne and ground detection devices and airmobile and ground reconnaissance agencies to locate his position. This, we are finding, is the nature of the area war in which we are involved. It follows then that the first phase of any operation in SVN must be reconnaissance, which is followed by a generation and subsequent concentration of combat power on a confirmed position or in an area where there is strong evidence that the enemy is present. This reconnaissance usually results in the identification of enemy locations often beyond supporting artillery range. The B-52 aircraft is well suited to follow up by engaging in deep interdiction missions. There is no other conventional weapon available today that can provide a comparable degree of the area saturation.

b. Operations along the DMZ are cases in point. During the month of September, approximately 89 percent of all ARC LIGHT sorties were flown there. However, this has been at the expense of other areas. For example, in September, no sorties were flown in Laos, yet during the period April through August, 22 percent of all ARC LIGHT sorties were in the Laos area. Also, during September only 11 percent of all ARC LIGHT sorties flown in SVN were in areas south of Quang Tri Province, as compared to 55 percent during April-August. This necessary reduction in sorties occurred in spite of continuing valid requirements to the contrary. After repeated B-52 attacks in the DMZ, the enemy withdrew. It may never be known whether or not this was a direct result of B-52 strikes, but one may presume that these strikes contributed to the decision to withdraw.

c. Another ARC LIGHT effect which is not quantifiable is the reluctance of the VC/NVA to concentrate on the battlefield and force a favorable decision, because these forces fear massive firepower concentrations. To permit the enemy to do this by reducing our ability to concentrate B-52 firepower would place our isolated intelligence and special force posts in jeopardy and, as a consequence, our intelligence effort would suffer.

In summary, it is true that no statistical basis exists to justify an increase in ARC LIGHT strikes, but it is also true that no overriding statistical rationale exists by which their disapproval could be justified. In this circumstance, then, the judgment and specific recommendations of the commander who bears the responsibility for the accomplishment of his mission and the safety and welfare of the troops in his command should prevail. Absentee decision-making is rarely wise.

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SEAPRO COMMENTS ON ARMY REBUTTAL

The Army Staff comments on the ARC LIGHT sortie analysis include 3 major points, one of which unquestionably has merit. The Army Staff points out that the DMZ action in September consumed a very large proportion of the B-52 sorties. During the one month 740 B-52 sorties were flown in the DMZ area (Quang Tri Province, the DMZ and the southern part of North Vietnam), about 89% of all B-52 sorties for the period. This concentration of B-52 firepower reduced the number of sorties available in other areas to less than 100. As a result, targets which would normally have been struck by B-52s had to be deferred, at least temporarily. While it is difficult to prove what impact this diversion had on operations in South Vietnam or Laos, we can assume that some targets for which reasonably good intelligence was available, were not struck. This point does not, however, necessarily argue for an increase in the over-all sortie level. Perhaps it points to the need to provide a surge capability for our ARC LIGHT operations in Southeast Asia. Such a surge capability would permit us to increase B-52 sorties for short periods of time should another emergency such as the DMZ situation occur. Using this surge capability, and with careful targeting by MACV of priority targets, we could concentrate tremendous firepower on a particular area and still strike other worthwhile targets in South Vietnam and Laos.

The other two points made in the Army comments, however, appear to have less validity. The first one is that a higher B-52 sortie rate is justified by the ability of the B-52s to strike the enemy deep in his base camp areas. Certainly the B-52 has this ability. However, the analysis in this September SEA Analysis Report did not recommend that the entire ARC LIGHT effort be stopped. Rather it stated that there was inadequate evidence to support a further expansion of the program. The present 800 sorties per month, most of which are normally flown in South Vietnam, other than the DMZ area, provides a very significant capability to strike base camps. In addition, we have been flying about 17,000 tactical fighter and attack sorties per month in South Vietnam. These tactical aircraft sorties coupled with our B-52 sorties provide a substantial capability to strike enemy base camps. In view of the difficult problem of getting good intelligence as to the location and occupancy of base camps, we may already have enough capability to hit bases and sanctuaries when we have reasonable intelligence to support a strike.

The Army Staff's other point was that the B-52s help to make the VC/NVA reluctant to concentrate their forces on the battlefield. Again, the current 800 sorties per month level combined with our tactical aircraft assets, our long range artillery, naval gunfire, etc., provide massive firepower which should inhibit the enemy from concentrating his forces. There is no evidence that a further expansion of our firepower in Southeast Asia would increase his risks significantly.

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Our article attempted in part to deal with the marginal return from an increase in military firepower. B-52 operations may be at the point where the funds for additional sorties could be better spent on other aspects of the war - helicopters, or Revolutionary Development, for example. Most B-52 targets are planned in advance and are against areas known or suspected to be enemy base camps, headquarters, etc. They are seldom used against fleeting targets or in close support of troops in contact. Therefore, unless random luck is depended on, an effective B-52 strike requires hard intelligence as to the location of the enemy and his base facilities. In any period of time there will be several good intelligence leads on which B-52 raids can be based. There will be other, slightly less promising intelligence leads and so forth. After those targets for which we have good intelligence are struck, each additional sortie is less likely to provide a worthwhile return, as the quality of the intelligence declines. It is impossible to draw a curve that accurately depicts this declining return from our B-52 program. But few people would argue that we are not encountering this situation of declining marginal utility; many people would argue that we are well out on the flat of the curve. This fact must be considered when assessing the requirement for additional B-52 sorties, more tactical aircraft, or more artillery.

Nevertheless, none of the above (nor the article) makes a recommendation one way or the other as to more B-52 sorties. It is a matter for judgment by those who have the responsibility to judge. All we can do, and the ODCSOPS rebuttal helps, is to assist those judgments by sharpening the questions and arraying the facts that should be considered in making the decision. No analysis can substitute for judgment.

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TACTICAL AIR OPERATIONS IN SOUTH VIETNAM

US tactical aircraft operating in South Vietnam perform two major functions. First, they provide close air support to allied troops in contact with enemy units; this function is naturally given top priority. Second, they attempt to harass enemy operations and destroy his base camps by attacking fixed targets known or suspected to be areas of activity. Typically, about 90% of US aircraft sorties are directed against the fixed targets.

The magnitude of the allied air support effort in South Vietnam has increased steadily in recent years. The table below shows the number of aircraft and sorties actually operating in South Vietnam during the period of July 1966 to June 1969. Total attack sorties in SVN increased each year until 1969. However, in recent months the average sortie rate per aircraft has declined approximately 7% below previous rates. In addition to tactical aircraft, B-52 ARC LIGHT strikes have increased threefold since 1966. Ordnance tonnage has increased much faster than total sorties because of the large increase in B-52 sorties which carry about 10-15 times the tonnage of a tactical aircraft. Finally, we have doubled the US force of armed helicopters and fixed-wing gunship aircraft since 1966. The ratio of armed aircraft and attack sorties to US infantry battalions has remained relatively constant since July 1966. However, mainly due to the B-52 sortie increases and increased munitions tonnage per sortie, the ordnance per US battalion has increased about 50% since 1966.

AIR EFFORT IN SVN
(Average Per Month)

	<u>July 66- June 67</u>	<u>July 67- June 68</u>	<u>July 68- June 69</u>
Attack Sorties	14,648	17,876	17,384
B-52 Sorties	506	922	1,327
Tons Air Ordnance	34,000	59,000	68,000
Fighter/Attack Aircraft ^{a/}	670	740	770
Armed Helicopters	350	641	693
Gunship Aircraft	21	35	48
Total Armed Aircraft	<u>1041</u>	<u>1416</u>	<u>1511</u>
Armed Aircraft Per US Infantry Battalion	13.0	14.4	14.1
Attack Sorties Per US Infantry Battalion	183	182	162
Air Ordnance Expended per US Infantry Battalion (tons)	425	602	635

^{a/} Aircraft actually operating in South Vietnam. Aircraft based in SVN, but operating in Laos not included. Estimated using average sortie rates per aircraft.

SOURCE: OSD Statistical Summary

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Detailed and accurate information related to many aspects of tactical air operations in South Vietnam is not available through the normal reporting channels. For example, it is not possible to determine response times, ordnance delivery accuracy, and the allocation of effort among different targets. However, during the summer of 1968, the Air Force sent a team of analysts to Vietnam to analyze forward air controller (FAC) operations in detail. For a period of 30 days the team collected data on every phase of tactical air operations supporting the 25th Infantry Division in III Corps in South Vietnam. In addition to data on FAC operations, the team collected unusually detailed information on air support to friendly troops in contact, immediate and preplanned strikes, communications, delivery accuracy, and the allocation of strike effort among different types of targets. The sample covers a relatively short period of time, but the Air Force believes the 201 ground contacts recorded are representative of overall US combat operations in Vietnam.

Based on data in the final Air Force report^{1/} it is now possible to describe in detail the nature of US tactical air operations in South Vietnam. The principal findings are:

1. Ground commanders request tactical air support in less than 8% of their engagements with the enemy; these engagements typically involve large numbers of enemy troops. The bulk of the ground contacts request either artillery or armed helicopter support.
2. Primarily as a result of the small number of air support requests, less than 10% of the total attack sorties in South Vietnam support troops in contact; the remainder attack interdiction targets or areas of suspected enemy activity.
3. The response time (from time of enemy contact to bomb delivery) is not appreciably longer for sorties flown from strip alert than from airborne aircraft diverted to the contact (about 130 minutes for strip alert compared to 120 minutes for diverts).
4. Over 50% of the air strikes hit targets preplanned over 24 hours in advance, where intelligence is many times not current.

Requests for External Fire Support - Tactical air support is requested in only 8% of the total ground contacts as shown below. On the other hand, artillery or armed helicopters are requested to provide fire support for almost 40% of the ground contacts. More than half (53%) of the fire fights are either over so quickly or so small that they do not generate requests for any type of fire support.

^{1/} Forward Air Controller Operation; USAF AFGOA memorandum 68-4; Dec 68.

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	<u>Contacts</u>		<u>Duration(Hrs)^{a/}</u>		<u>Average^{a/}</u>
	<u>Number</u>	<u>%</u>	<u>Ave</u>	<u>Median</u>	<u>Enemy Strength</u>
<u>Fire Support Requested</u>					
Artillery/Armed Helo Only	78	39	1.5	.7	34
Tactical Air ^{b/}	16	8	6.4	3.0	143
<u>Fire Support Not Requested</u>					
	107	53	.4	.2	6
Total	201	100			

a/ Data on duration and enemy strength not reported for all missions. Only contacts with complete data are included.

b/ Artillery and/or armed helicopter support may also have been requested.

SOURCE: USAF AFGOA Study.

Tactical air support is typically requested for contacts with large numbers of enemy troops (about 150) and which last for long periods of time (three to six hours). This could be a result of slow air response times for tactical aircraft (up to one hour) and an unwillingness of ground commanders to call for air support in relatively small engagements with the enemy. Contacts with small enemy forces (about 35 personnel) and shorter durations (45 to 90 minutes) usually led to a request for only artillery and armed helicopter support.

Response Time - The tactical air response time is the period between the time the initial request for air support is received and the arrival of the first aircraft in the target area. The table below shows the average and median tactical air response times for alert and diverted airborne aircraft supporting troops in contact. Diverted aircraft have only slightly faster response times, almost entirely as a result of the shorter flying time required to reach the target area.

TACTICAL AIR RESPONSE TIME

	<u>Average (min)</u>	<u>Median (min)</u>
Strip Alert Aircraft	55	45
Air Diverted Aircraft	40	38

In addition to the tactical air response time, two other factors influence the time required to deliver air ordnance on any enemy position; ground response time and holding time in the target area. Ground time (elapsed time between the initial contact and the ground commander's request for air support) usually averages approximately one hour; holding time (that time required to complete the mission once over the target)

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averages about 15 minutes both for strip alert and diverted aircraft. Thus, the total air support reaction time, from the initial contact until the first bombs fall, averages about two hours.^{1/}

One reason given as justification for having large numbers of pre-planned strikes against fixed targets is that having these sorties airborne makes them available for close air support when needed at a considerable saving in time. Our findings do not substantiate this reasoning. First, the majority (65%) of close air support for ground contact is supplied by aircraft on strip alert; the preplanned sorties are not being diverted for ground support missions. Second, the average air response times for airborne diverted air support is only slightly (10-15 minutes) less than for strip-alerted aircraft.^{2/} As shown in the following table, this amount of time lag becomes insignificant when compared to the total time responses required from the initial ground contact to the time when ordnance begins to fall on the target.

AIR SUPPORT RESPONSE TIME

<u>Function</u>	<u>Time</u>
Contact Made: Air Request Made	60 minutes
Aircraft Requested: Arrives over Target	45-55 minutes
Aircraft Locates Target: Delivers Ordnance	15 minutes
	<u>120-130 minutes</u>

Type Targets Attacked by Tactical Aircraft - Only about 10% of the total attack sorties in South Vietnam are used to support troops in contact with enemy units. The other 90% are directed, primarily on a pre-planned basis, against fixed targets of opportunity and areas of suspected enemy activity. Half the total air strikes attack suspected VC/NVA base camps and an additional 27% strike potential assembly areas and base complexes. The effectiveness of many of these strikes is largely unknown because they usually attack targets in dense jungle or enemy-held areas, but it is likely that many have a relatively small impact unless they are based on hard current intelligence. Some strikes are undoubtedly based

^{1/} The relatively long response time for tactical air support is probably a major reason why only 8% of the ground contacts request air support. Only if a large enemy force is discovered and fixed in position is it realistic to request air support; small contacts are usually finished before aircraft could arrive in the target area. Artillery and gunships support is typically available faster than the tac air and can be used closer to friendly positions (which, in part, could explain the long ground response time for tac air).

^{2/} It is interesting to note that the Israelis claim they can deliver air ordnance within three to ten minutes of the time of enemy contact, anywhere in Israel or along its borders. The Israelis use no preplanned sorties, only strip alert; pilots are continuously (24 hours per day) in their cockpits with jet engines ignited, waiting to receive the field request for air support.

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on good intelligence and are probably highly effective, but we should be able to substantially reduce the large numbers of preplanned sorties without an appreciable impact on the course of the war. The allocation of attack sorties by type target is shown below.

<u>Type Target Struck</u>	<u>Missions^{a/}</u>	<u>% Total</u>
Troops in Contact	63	10
Enemy Troops in Open	16	2
Suspected Base Camps	329	50
Bunkers and Assembly Areas	179	27
Lines of Communication	18	3
Other	56	8
	<u>661</u>	<u>100</u>

^{a/} Each mission typically included two aircraft.
SOURCE: USAF AFGOA Study.

Immediate and Preplanned Sorties - There are two principal types of attack sorties in SVN, immediate and preplanned. Immediate strikes, which primarily support troops in contact or attack fleeting targets are provided as rapidly as possible by using aircraft on strip alert or diverting aircraft already airborne. Preplanned strikes primarily attack interdiction targets and suspected areas of enemy activity, and they are normally scheduled at least 24 hours in advance.

It is not possible to determine the exact allocation of sorties between preplanned and immediate strikes. It is clear, however, that at least half (50%) of the attack sorties actually hit targets that are preplanned several days in advance; an additional unknown number of sorties (perhaps as much as 28% of the total) are preplanned and then diverted to more lucrative immediate targets.

About 11% of total strikes are flown by aircraft on strip alert. These sorties attack targets designated for immediate strikes, and as would be expected, the bulk (61%) of them support US troops in contact with the enemy. The following table indicates that almost two-thirds (65%) of the total tactical air support for troops in contact is provided by aircraft on strip alert. The remainder of the sorties is provided by diverting aircraft already en route to attack lower priority targets.

TACTICAL AIR SUPPORT FOR US TROOPS IN CONTACT

<u>Source of Attack Sorties</u>	<u>Number Sorties</u>	<u>% Total</u>
Strip Alert	46	65
Preplanned Divert	22	31
Other Divert	3	4
Total	<u>71</u>	<u>100</u>

SOURCE: USAF AFGOA Study.

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TACTICAL AIR OPERATIONS IN SOUTH VIETNAM: A REBUTTAL

We must apologize for the unintentional delay in printing the Air Force comments on our August 1969 article dealing with tactical aircraft operations in South Vietnam. The Air Force points are well taken, in general. On one main point, however, subsequent research has validated the fact that less than 10% of tactical air strikes support troops in contact, on a countrywide basis. That analysis, which also addresses the "immediates" mentioned by the Air Force, was presented in the November-December 1969 SEA Analysis Report. We appreciate receiving the Air Force comments and present them in their entirety below:

"Reference is made to your 'Southeast Asia Analysis Report' dated 29 August 1969. The section on Tactical Air Operations in SVN draws heavily from AFGOA Memorandum 68-4, dated December 1968, 'Forward Air Controller Operations.' However, in so doing, a significant portion of the data was misinterpreted resulting in a series of erroneous findings.

To place the AFGOA FAC OPS study in perspective, your attention is drawn to the fact, stated in the abstract of 68-4, that '... the emphasis in this effort was placed on constructing a comprehensive data file on USAF Air Liaison Officer/Forward Air Controller (ALO/FAC) operations and TAC air support of U.S. Army field forces ... Centering on the FAC/ALO operations of a single U.S. Army division over a 30-day period starting 22 July 1968, data were collected that would quantitatively record combat operations.' In the face of this qualification and constraint, the comment by your office that 'the team collected data on every phase of tactical air operations supporting the 25th Infantry Division in III Corps,' suggests an initial misunderstanding of the scope of this data collection effort. From this resulted a series of misinterpretations of the data, as for example, your statement that "the Air Force considers the 201 recorded ground contacts as representative of overall U.S. combat operations in SVN." Clearly, this is not consistent with our beliefs nor can it be supported. In the interest of clarifying the several areas where these misinterpretations occurred, we quote from your findings the major points of disagreement, noting our rebuttal in each instance.

a. 'Ground commanders request tactical air support in less than 8% of their engagements with the enemy; these engagements typically involve large numbers of enemy troops. The bulk of the ground contacts request either artillery or armed helicopter support.'

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The 8% of ground contacts receiving tactical air support is derived from a fairly small data base (the contacts of one division for 30 days) which was never claimed to be representative of operations in SVN. Nevertheless, in the FAC OPS data base, the bulk of ground contacts (53%) received no external fire support; 39% received artillery or helicopter gunship support.

b. 'Primarily as a result of the small number of air support requests, less than 10% of the total attack sorties in South Vietnam support troops in contact (TIC); the remainder attack interdiction targets or areas of suspected enemy activity.' While it is acceptable to say, as you have, that 10% of the attack sorties in SVN are used to support TIC, it is not correct to say that the other 90% are directed on a pre-planned basis against fixed targets and suspected enemy targets. The FAC OPS sample clearly indicates that nearly 90 of 661, or about an additional 15% of the missions fill immediate requests to strike fleeting and lucrative immediate targets and, as shown below, the remaining 75% (the preplanned sorties) are used to support the current needs of the ground forces.

c. 'The response time (from time of enemy contact to bomb delivery) is not appreciably longer for sorties flown from strip alert than from airborne aircraft diverted to the contact (about 130 minutes for strip alert compared to 120 minutes for divers). In the FAC OPS study, the time interval from the start of a ground contact until first ordnance delivery is defined as fire support reaction time rather than response time. It averaged 129 minutes for a sample of four ground alert missions and 118 minutes for a sample of five division divers of preplanned missions. However, the definitions and corresponding data in your report that make reference to Tactical Air Response Times are quoted erroneously. Our definition is that segment of Fire Support Reaction Time beginning when the DASC (or Division TACP in the case of Division divers) receives a request for air support and ending with the first TOT. Similarly, we emphasized in 68-4 that these data were available only for ground alert missions and not available for division divert aircraft. A further qualification of the results made explicit in our report is that the 40.2 minute average increment for divert aircraft is not TAC Air Response Time. Apparently this went unheeded, if not unnoticed. Hence, in your report the response time data for air divers, as shown in tabular form, is in error. Also, it is noted in our 68-4 that FAC OPS data includes the holding time within TAC Air Response time; it is not separated as shown in your table titled, 'Air Support Response Time.' Although not broken out in our report, the time from Air Force receipt of a divert request until the fighter rendezvous with the FAC averages in the neighborhood of 10 minutes.

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d. 'Over 50% of the air strikes hit targets preplanned over 24 hours in advance; where intelligence is many times not current.' The section of your report covering preplanned sorties is erroneous in toto, being based on procedures that were operative prior to 30 May 1968. Since that date, the method of allocating them is, in essence, that 70% of the preplanned sorties are allocated by area on a weekly basis, to the major ground commanders to meet operational requirements within their areas of operations. These strikes are used for small unit operations, long range reconnaissance patrols, cordon and search, column cover, landing zone preparation and cover and to counter enemy-initiated attacks. Thus, these sorties are allocated by area and not by specific targets. The remaining 30% of preplanned sorties are allocated daily, but again by area - not target, to support higher levels of conflicts or to add firepower on newly acquired enemy targets. Thus, preplanned sorties are allocated to the ground unit well in advance but the actual targets are assigned by the ground commander just prior to the actual employment. Hence, the latest intelligence information is used in target selection.

In conclusion, the complexity of the air and ground operations in Vietnam have brought forth a variety of innovations including gunships and armed FAC aircraft. Policy decisions, impacting on both near and mid-term operations, typically have been made, and will continue to be made, on the basis of foreseeable operational trends as well as thorough and well-documented analyses. Cognizant of this process, we offer these comments in the interest of improving the quality and scope of the existing dialogue and thereby affording the decision-maker at every echelon a more precise basis for his judgments."

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AIR SUPPORT FOR TROOPS IN CONTACT

Summary. About 10% of the total attack sorties flown in SVII support troops in contact, according to countryside sortie data for 5 months of 1969. This confirms a 1968 analysis which was based on a small data sample from an Air Force FAC study. About one-third of all gunship sorties support troops in contact.

In the summer of 1968 the Air Force sent a team of analysts to Vietnam to study forward air controller operations. The team collected detailed information on air support to friendly troops in contact, immediate and pre-planned strikes, communications, delivery accuracy and the allocation of strike effort among different types of targets. Although this was a short-term effort and only covered tactical air operations supporting the 25th Infantry Division in III Corps, the team was confident that the sample was representative of overall U.S. air operations in South Vietnam.

Findings we derived from the data in the study^{1/} were set forth in the August 1969 SEA Analysis Report^{2/} and are repeated below:

"1. Ground commanders request tactical air support in less than 8% of their engagements with the enemy; these engagements typically involve large numbers of enemy troops. The bulk of the ground contacts request either artillery or armed helicopter support.

"2. Primarily as a result of the small number of air support requests, less than 10% of the total attack sorties in South Vietnam support troops in contact; the remainder attack interdiction targets or areas of suspected enemy activity.

"3. The response time (from time of enemy contact to bomb delivery) is not appreciably longer for sorties flown from strip alert than from airborne aircraft diverted to the contact (about 130 minutes for strip alert compared to 120 minutes for diverts).

"4. Over 50% of the air strikes hit targets preplanned over 24 hours in advance, where intelligence is many times not current."

The proportion of air sorties devoted to support of troops in contact was surprisingly small, less than 10%. Since the sample only included 201 ground contacts, we searched for additional data on the subject and found it in the MACV Evening Telecons which arrive daily. These reports include a count of the countryside total of US-VNAF attack sorties flown every day divided into those devoted to "immediates," and within that category, those devoted to direct support of troops in contact. The statistics for five months of 1969 are shown in Table 1. The degree of combat activity for each month is indicated by the level of US combat deaths.

^{1/} Forward Air Controller Operation; USAF AFGOA memorandum 68-4, December 1968.

^{2/} "Tactical Air Operations in South Vietnam." SEA Analysis Report, Aug 1969, pp. 31-36.

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TABLE 1

ATTACK SORTIES IN SVN^{a/}
(Daily Average)

	1969				
	May	Aug	Sep	Oct	Nov
Total Attack Sorties	609	573	539	377	394
Immediate Sorties	204	151	98	96	125
Sorties in Support of Troops in Contact	92	46	35	27	43
% Immediate	33	26	22	25	32
% Troop Support	15	8	8	7	11
% Immediate in Support of Troops in Contact	46	30	36	28	34
US KIA	39	26	16	12	15

^{a/} Source: MACV Evening Telecon.

Table 1 indicates that:

1. The Air Force figure of 10% is a good approximation of the average percentage of total attack sorties flown in support of allied troops in contact.
2. The number of total attack sorties, immediate sorties and sorties in support of troops all vary directly with U.S. KIA, indicating a relatively consistent response to the changing tempo of combat.
3. The percentage of total sorties used in support of troops varies approximately in the same direction as U.S. KIA.
4. From 67% to 78% of all attack sorties in SVN are preplanned, depending on the intensity of combat activity; only 28% to 46% of all immediate sorties are used to support troops in contact.

In short, the data support at least one segment of the Air Force study and lend support to the arguments set forth in the August Analysis Report article on air support.

In addition to the data on attack sorties, countrywide data on gunship sorties have also become available, as shown in Table 2. The data indicate that about one-third of all gunship sorties support troops in contact with the enemy.

^{1/} For total attack sorties, this is true for 11 of the past 12 months (ending 30 November 1969).

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TABLE 2

GUNSHIP SORTIES^{a/}
(Daily Average)

	1969			
	Aug	Sept	Oct	Nov
Gunship Sorties	22	19	17	19
Sorties in Support of Troops	8	6	4	6
% in Support of Troops ^{b/}	34%	31%	26%	31%

^{a/} Source: MACV Evening Telecons, Daily. May data not available.

^{b/} Calculated from unrounded data.

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AIR STRIKES NEAR RVN POPULATION

Summary

According to pilot reports and HES data from two sample months, tactical air strikes are farther away from populated hamlets and affecting less population in 1971 than in 1969. In January 1969, 23% of the population had air strikes within three kilometers of their hamlet (2 miles); in January 1971 the figure was less than 6%. The population directly affected by the strikes-- i.e. within one kilometer (.6 mile)--fell from 5% in 1969 to .9% in 1971.

There are at least two reasons for the improvement. First, pacification has tended to separate the main force war from the population, so the distance of sorties from hamlet centers has increased. In 1969, 32% of attack missions were flown within 3 kilometers of hamlets; by 1971 the figure was down to 16%.

Second, the number of tactical air strikes flown in South Vietnam in FY 71 (8,700 per month) is only 30% of what it was two years ago (19,000 per month).

Population living in D-E (contested) and VC hamlets are about 2 1/2 times more likely to have air strikes nearby than A-B-C hamlets (relatively secure). In 1971, 15% of D-E-VC population had air strikes within 3 kilometers, compared to only 5% for A-B-C.

Methodology. The distance air strikes occur from hamlets is one measure of how close the main force war is to the population. As pacification proceeds, and as friendly forces gain superiority over enemy main forces, the distance should increase. As a result, the likelihood of civilian casualties and disruption of civilian life should decrease.

To measure the distance of tactical air sorties from population centers in South Vietnam, we used the following data:

-- Air strike locations - computerized pilot reports from the JCS-J3 COACT (1969) and 7th Air Force OPREP-4/SEADAB (1971) systems. One set of coordinates is available for each fighter attack mission (consisting of an average of two sorties) which dropped ordnance. Similar data on B-52's and helicopter gunships is not available.

-- Population locations - MACV/CORDS Hamlet Evaluation System (HES) data, contained in computer tapes sent to Washington. US district advisors provide coordinates for the centers of all 12,000 reported hamlets in RVN, containing about 16 million people. We excluded Saigon's two million people from our analysis, since air strikes rarely occur there, and detailed coordinates are not reported for each precinct.

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Clearances for air strikes in populated areas are always required in advance from either the province chief or Vietnamese military commanders responsible for the area. Friendly civilian population is supposed to have advance warning that their area is in a target zone. The HES is not sensitive enough to reflect temporary population movements, so we do not know exactly how many people were physically located in their hamlets on the day and hour of the reported air strikes. However, if an air strike did occur within 1-3 kilometers of the center of a hamlet, it is likely that some disruption of normal life occurred, from the air strike itself, from the fighting in the area before and after the strike, or from the enemy forces which were targeted by the strike.

We selected two sample months for our analysis--January 1969 and January 1971--which span a two-year period and should give an indication of significant trends.

Population Results. Air strikes are affecting less population in 1971 than in 1969. Table 1 shows that in January 1969, 23% of the population had one or more air strikes within 3 kilometers (2 miles) of their hamlet; in January 1971 the figure dropped to less than 6%. The population directly affected by the strikes--i.e., within 1 kilometer (.6 mile)--fell from 5% in 1969 to .9% in 1971.

TABLE 1

POPULATION LOCATED NEAR AIR STRIKES

	<u>January 1969</u>	<u>January 1971</u>
<u>Population (Millions)</u>		
Within 1 km of air strikes	.70	.15
From 1-2 km	1.24	.33
From 2-3 km	1.33	.42
Outside 3 km	10.9	15.1
No UTM's reported	2.6 a/	1.9 a/
<u>RVN Total</u>	<u>16.8</u>	<u>17.9</u>
<u>Percent of Population with Reported UTM's</u>		
Within 1 km of air strikes	5.0	0.9
Within 2 km	13.7	3.0
Within 3 km	23.0	5.6

a/ Includes Saigon's 1.7 million population.

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Population living in D-E (contested) and VC hamlets are about 2½ times more likely to have air strikes nearby than A-B-C hamlets (relatively secure) In 1971, 13% of D-E-VC population had air strikes within 3 kilometers, compared to only 5% for A-B-C. In 1969, the figures were 42% for D-E-VC and 18% for A-B-C (Table 2).

TABLE 2
POPULATION WITHIN 3 KILOMETERS OF AIR STRIKES

	<u>January 1969</u>	<u>January 1971</u>
<u>A-B Hamlets</u>		
Pop. Near Air Strikes (Millions)	.9	.5
Pop. Not Near (Millions)	4.5	10.9
% Near	16	5
<u>A-B-C Hamlets</u>		
Pop. Near Air Strikes (Millions)	1.9	.8
Pop. Not Near (Millions)	8.8	14.3
% Near	18	5
<u>D-E-VC Hamlets</u>		
Pop. Near Air Strikes (Millions)	1.4	.1
Pop. Not Near (Millions)	2.0	.8
% Near	42	13
<u>All Hamlets</u>		
Pop. Near Air Strikes (Millions)	3.3	.9
Pop. Not Near (Millions)	10.8	15.1
% Near	23	6

Air Sortie Location. The main reason fewer people are being affected by air strikes is that air missions are occurring farther from the centers of hamlets. Table 3 shows that in 1969, 32% of attack missions were within 3 kilometers of hamlet centers; in 1971 the figure dropped to 16%.

Missions within 1 kilometer showed an even more dramatic drop from 15% in 1969 to 4% in 1971.

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TABLE 3

ATTACK MISSIONS NEAR POPULATION a/
(South Vietnam)

	Jan 1969	Jan 1971	% Change 1969-1971	
<u>Attack Missions</u>				
Within 1 km of populated hamlets	1,252	99	- 93	} - 87
From 1-2 km	838	142	- 83	
From 2-3 km	570	112	- 80	
Outside 3 km	5,575	1,803	- 68	
Total	8,235	2,146	- 74	
<u>Percent of Missions</u>				
Within 1 km of populated hamlets	15.2	4.1		
Within 2 km	25.4	10.8		
Within 3 km of populated hamlets	32.3	16.0		

a/ Includes only missions which actually dropped ordnance. Note that each mission consists of about two sorties on the average.

Another reason fewer people are being affected by air strikes is that US and VNAF are flying fewer attack sorties in South Vietnam. Table 4 shows that the average number of attack sorties per month so far in FY 71 (5,700) is only 30% of what it was in FY 69 (19,000). Our two sample months followed the same pattern--4,108 in January 1971 compared to 17,557 in January 1969.

TABLE 4

OVERALL ATTACK SORTIE LEVELS a/

	FY 68	FY 69	FY 70	FY 71 ^{b/}	% Change FY 69 - 71
<u>Average Monthly Attack Sorties</u>					
SVN	19,298	19,120	13,302	5,738	- 70
Laos/Cambodia	12,642	14,408	12,712	11,471	- 49
Total SEA	31,940	33,528	26,014	17,209	
<u>Sample Months</u>		Jan 69		Jan 71	
SVN		17,557		4,108	- 77
Laos/Cambodia		14,803		14,583	- 62
Total SEA		32,360		18,691	

a/ Source: OSD(C) SEA Statistical Summary, Table 2. Includes US and VNAF attack sorties.

b/ Data through April 30, 1971.

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In January 1971 only 89 attack missions dropped ordnance within one kilometer of hamlets, compared to 12,252 in 1969, reflecting the impact of greater distance from hamlets and reduced sortie levels.

Map Plots. Geographic plots of the data help to show the improved nature of the air war. We plotted air mission locations as small black squares on a map showing population locations as gray areas.

In 1969 there were many areas of dense sortie concentrations, two of which (Quang Nam province in MR I and the US 9th Division TAOR in MR IV) seem to be located very close to population centers. These two areas were among the most heavily contested in 1969, and large main force units were involved on the ground for both sides.

In January 1971 there were very few dense concentrations, except for a few in the sparsely-populated A Chau Valley (MR I), Cambodian border (MR III), and U Minh Forest (MR IV) area.

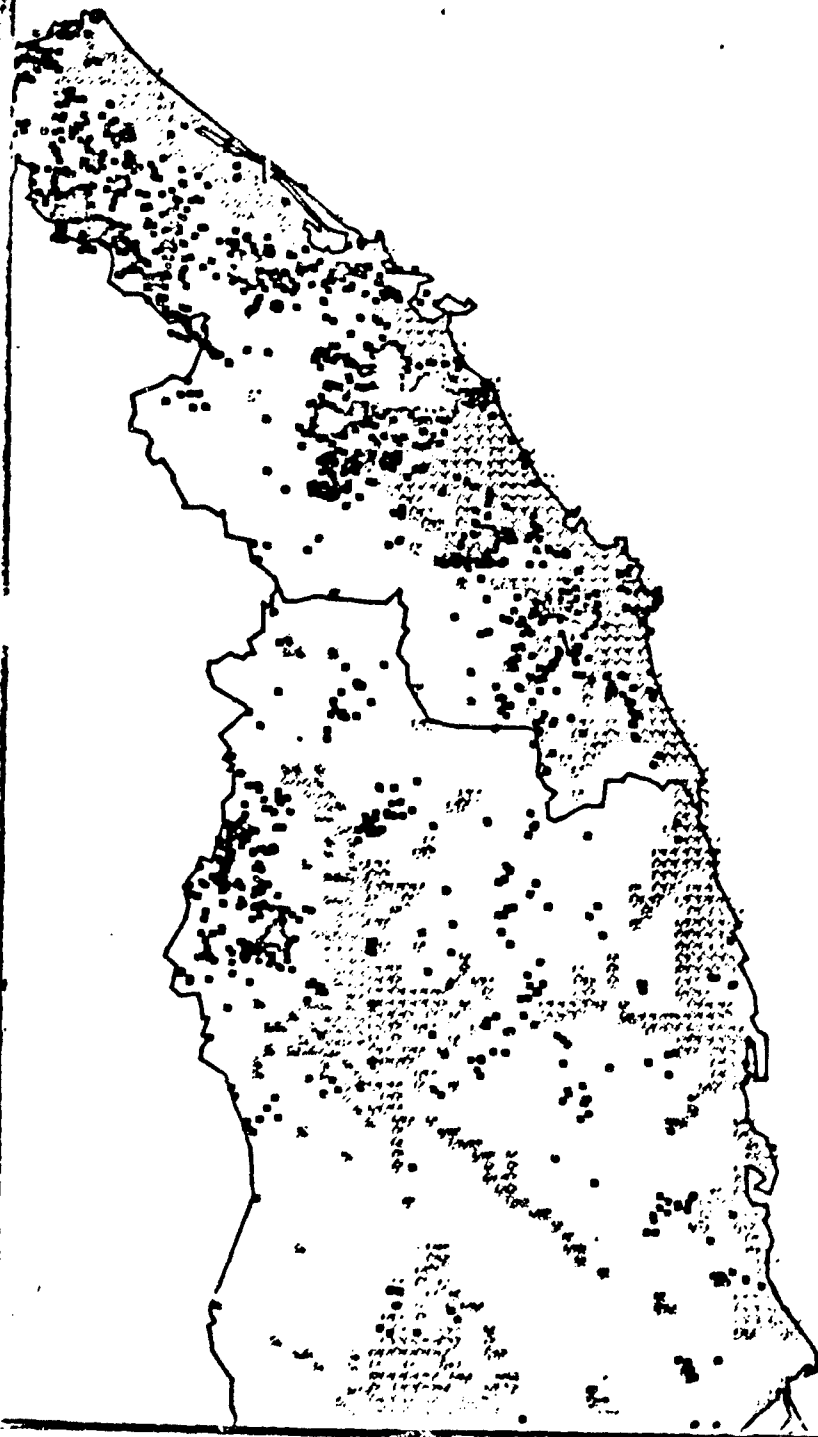
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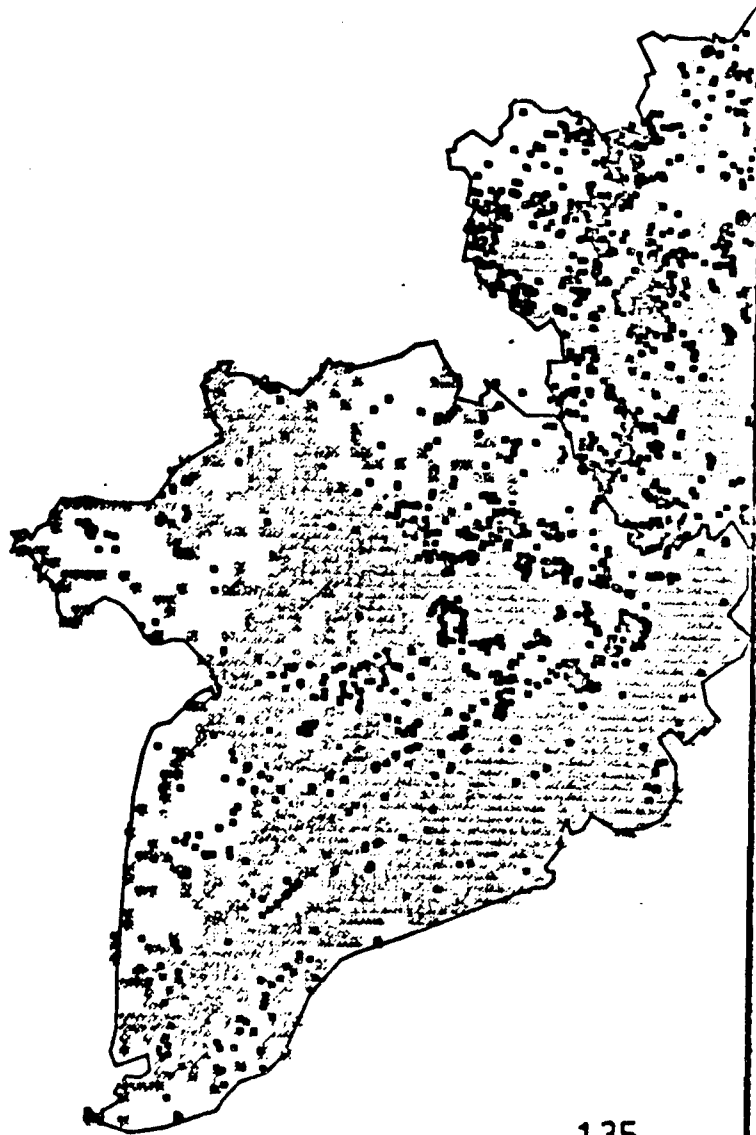
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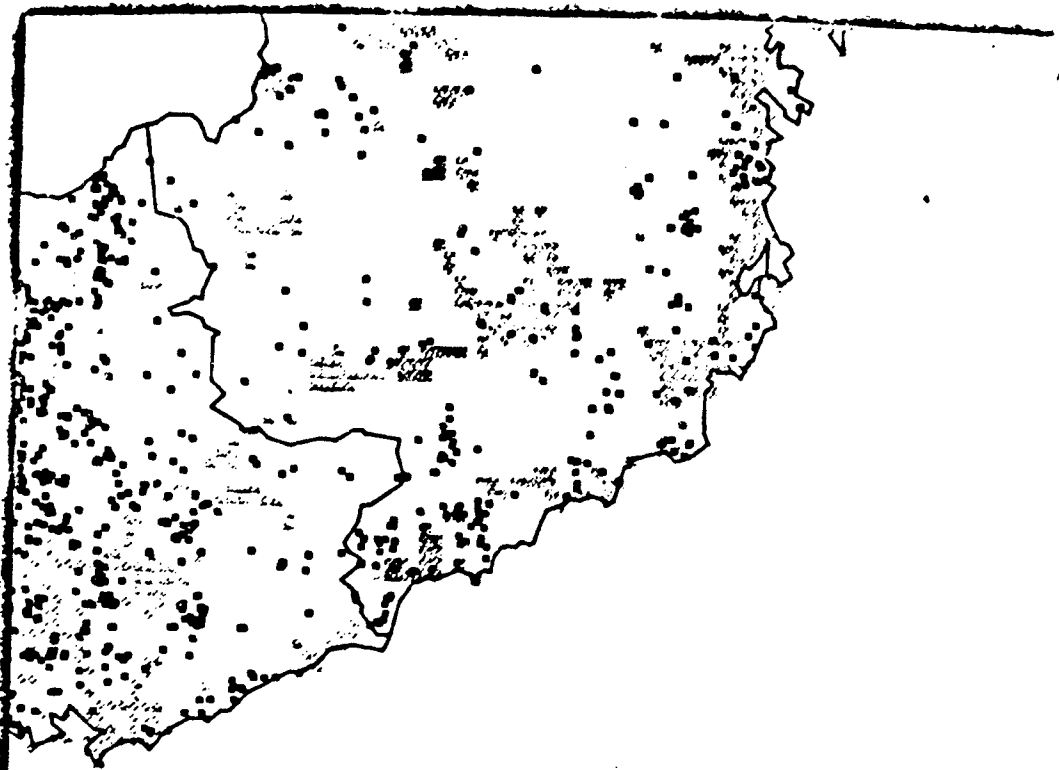
**SOUTH VIETNAM
AIR STRIKE LOCATIONS
JANUARY 1969**

- Location of tactical air attack sortie
- ▨ Populated area





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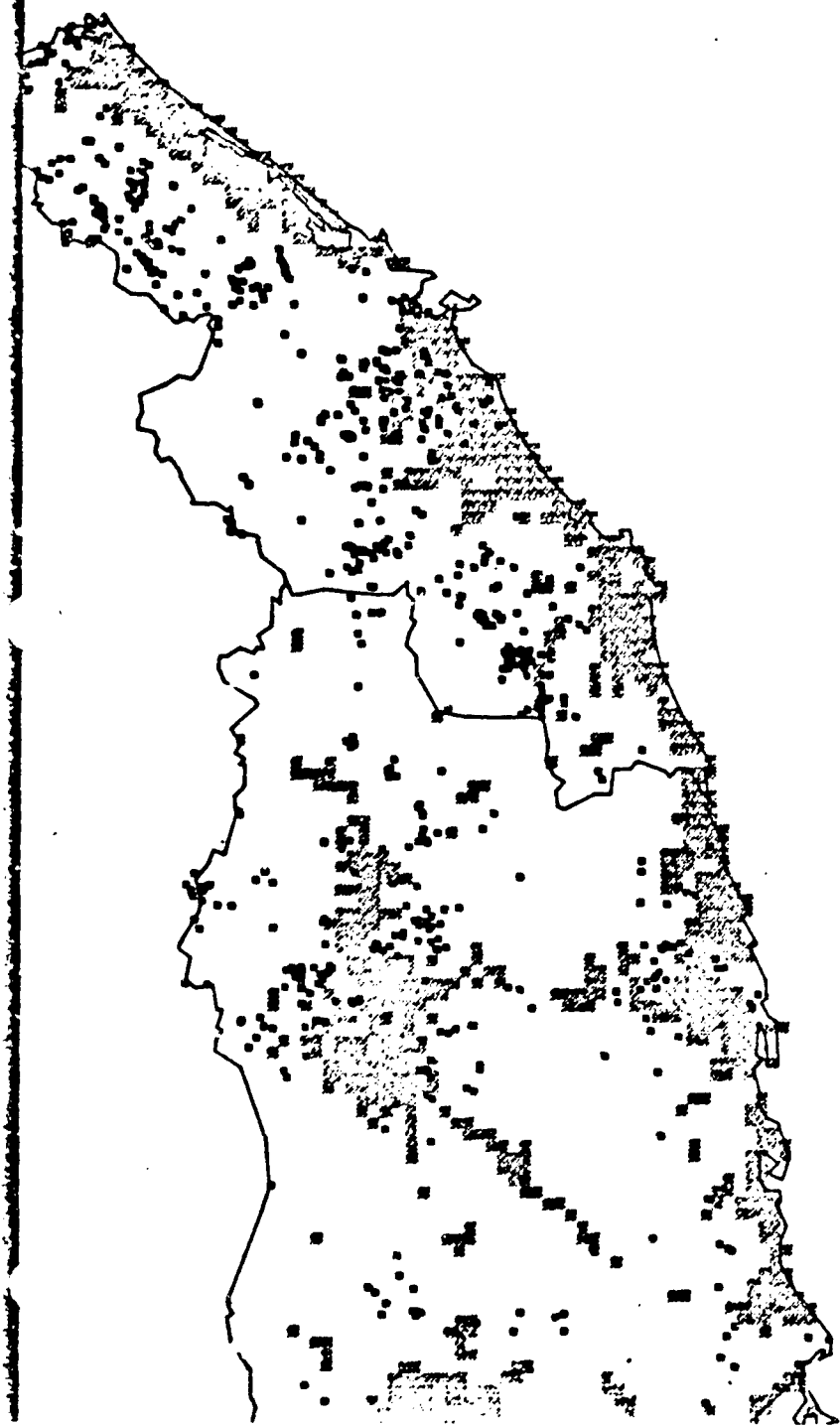


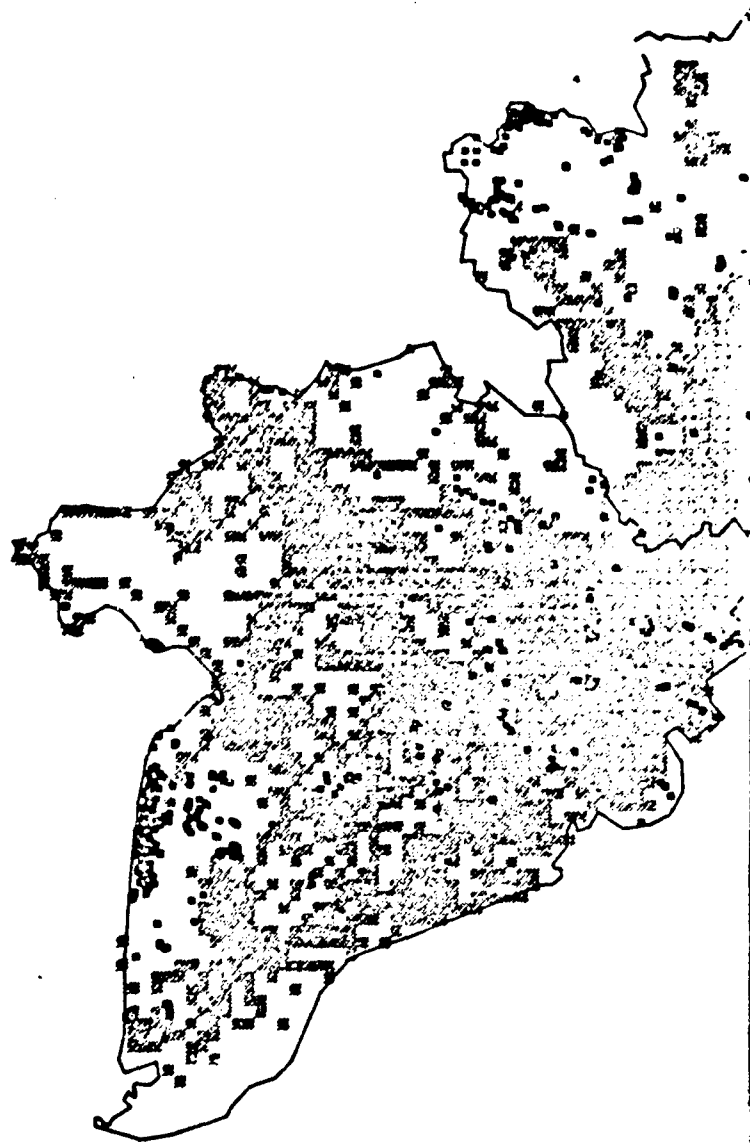
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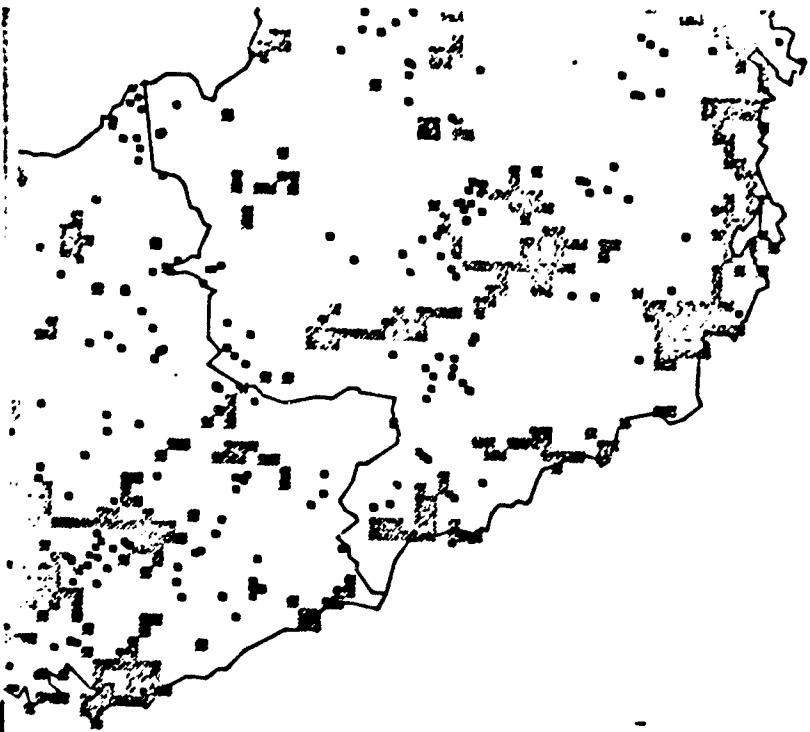
SOUTH VIETNAM
AIR STRIKE LOCATIONS
JANUARY 1971

- Location of tactical air attack sortie
- ▨ Populated area





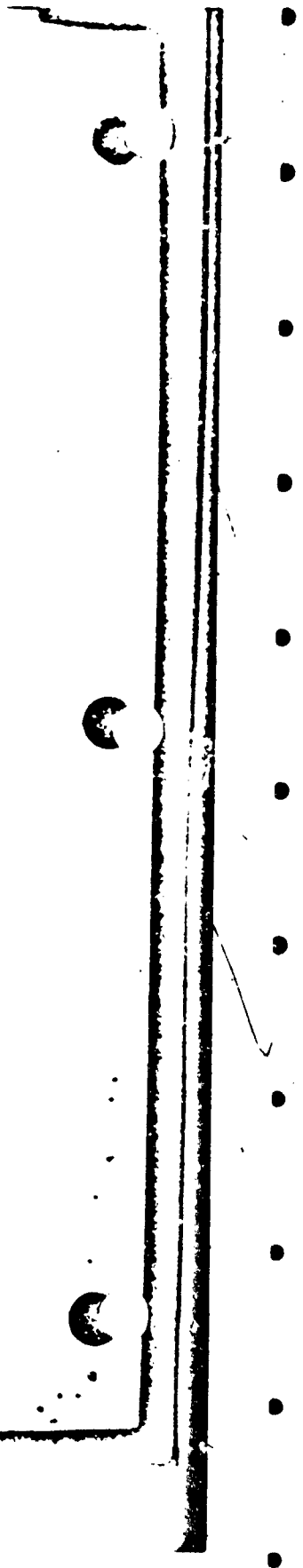
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Air Crew Recovery

From January 1962 through July 2, 1967 over 40% of 1680 Air Force, Navy, and Marine Corps air crewmen whose aircraft were shot down, have been recovered. Of those not recovered, 392 (23%) were reported killed; therefore of those who survived the aerial combat and/or crashes, 54% were rescued. Table 1, which is based on the NMCC's Combat Air Summary File (OPREA), provides detail on USAF, USN, and USMC losses and crew status by area for hostile losses since January 1962. 1/

As would be expected there are significant differences between recovery averages in different areas. In SVN and Laos about 50% of the downed crewmen were recovered; of those who survived 84% and 61%, respectively, were rescued. Recovery rates over NVN, however, were much lower. Only 32% of the crewmen shot down were recovered, and 36% of those not known to have been killed were rescued. Over 40% of the crewmen downed over NVN are listed as missing. It is not known whether they were killed or captured.

There are no startling differences between the Services in recovery rates. Over NVN the Services lose (killed, missing, or captured) slightly over two-thirds of their downed crewmen; 42% of the Navy survivors are recovered against 33% for the Air Force. The higher Navy recovery is because most of their missions are in Route Packages 2, 3, 4 and 6B, all of which border on the Gulf of Tonkin. Aircraft hit over those areas have a good chance of reaching the open sea, where recovery is much more likely than over the inland areas of RP's 5 and 6A, which are assigned to the Air Force. The USMC sample over NVN is too small to be statistically significant.

In SVN the Air Force and Marines fly most of the missions. (Army losses were not considered in this analysis due to the lack of data with an equivalent level of confidence). SVN recovery rates for surviving crewmen of all aircraft types were virtually identical for two services, 83% for the Air Force and 84% for the Marines. However, a much larger proportion (62% vs 33%) of the Air Force crewmen, whose aircraft are downed over SVN, are killed or missing. The reason is that virtually all (98%) of the Air Force hostile losses over SVN were fixed-wing type aircraft compared to only 29% for the Marines. Both Services had identical (64%) crew loss rates for fixed-wing aircraft. The proportion of crews lost in helicopters, however, is much lower, about 28%. Since only 2% of the Air Force aircraft losses were helicopters, while they accounted for 71% for the Marines, overall Marine crew losses are much lower. The Table 2 below shows the differing losses in SVN by aircraft type:

1/ This study only addressed recoveries of crews downed by hostile fire. In addition there were 304 operational losses involving 647 crewmen, of whom 174 (27%) were killed and 444 (69%) rescued or recovered. The 66 aircraft destroyed by enemy ground attacks did not involve aircrews.

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TABLE 1

Hostile Aircraft Losses and Aircrewmembers Status

	Hostile Losses ^{a/}	Aircrewmembers Involved	Aircrewmembers Status			Recovered	Loss
			Killed,	Lost Missing,	Captured		
<u>SVN</u>							
USAF	206	354	199	27	1	137	6.7
USN	13	15	5	0	0	10	6.7
USMC	118	293	59	37	0	197	6.7
TOTAL	337	672	263	64	1	344	6.7
<u>BVN</u>							
USAF	336	477	21	234	70	152	6.7
USN	260	330	71	110	40	109	6.7
USMC	11	20	0	14	0	6	6.7
TOTAL	607	827	92	358	110	167	6.7
<u>LAOS</u>							
USAF	85	139	33	48	2	56	6.7
USN	17	22 ^{b/}	4	0	0	18	12.2
USMC	6	10	0	2	0	8	6.7
TOTAL	108	171	37	50	2	82	6.7
<u>At Sea</u>							
USAF	1	2	-	-	-	2	6.7
USN	2	8	-	8	-	-	10.0
TOTAL	3	10	-	8	-	2	6.7
<u>All Areas</u>							
USAF	628	982	253	309	73	547	6.7
USN	291	375 ^{b/}	80	118	40	137	6.7
USMC	135	323	59	53	0	211	6.7
TOTAL	1055	1680	392	480	113	695	6.7

Data Source: Combat Air Force
2 July 67.

- ^{a/} Includes all fixed wing & helicopters.
Does not include a/c destroyed on ground by hostile actions
- ^{b/} One crewman has also escaped.
- ^{c/} Sum of crewmen killed, missing and captured divided by crewmen involved.
- ^{d/} Crewmen recovered divided by "crewmen involved less crewmen killed".

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Aircrewmen Status

Personnel Status	Recovered	% Crewmen Lost c/	% living crewmen Recovered d/
1	137	62.4	83.0
0	10	33.3	100.0
0	197	32.8	84.2
1	344	48.8	84.1
0	152	68.1	33.3
0	109	67.0	42.1
0	6	70.0	30.0
0	167	67.7	36.3
2	56	59.7	52.8
0	18	18.2	100.0
0	8	20.0	80.0
2	82	52.0	61.2
-	2	0	100.0
-	-	100.0	0
-	2	80.0	20.0
13	347	64.7	47.6
10	137	63.5	46.3
0	211	34.7	79.9
13	695	58.6	53.9

Data Source: Combat Air Summary File (OPREA), 1 Jan 62 thru 2 July 67.

men involved.

killed".

OASD/SA/SEA Programs Div.
July 15, 1967

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TABLE 2

Aircraft Hostile Losses	TOTAL SVN HOSTILE LOSSES & CREW STATUS				
	Aircraft Status			% Crewmen Lost	
	Lost	Recovered	Total		
<u>Fixed-Wing Aircraft</u>					
USAF	201	218	125	343	64
USN	13	5	10	15	33
USMC	34	30	17	47	64
TOTAL	248	253	152	405	63
<u>Helicopters</u>					
USAF	5	9	12	21	43
USN	0	-	-	-	-
USMC	84	66	180	246	27
TOTAL	89	75	192	267	28
Total	337	328	344	672	49

In summary, the 5½ years of data show that Search and Rescue (SAR) operations in SEA have saved 54% of the hostile-downed crewmen who are known to have survived their aerial combat and/or crashes. There are no significant differences between the recovery possibilities for USAF, USN, and USMC crews. Crewmen, who are not killed, have the following expectations for being rescued: in SVN, 84%; in NVN, 36%; and in Laos, 61%

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AIRCREW RECOVERY OPERATIONS IN SEA

Over the last four years (January 1965-December 1968) over 63% of 5,884 US aircrewmembers whose aircraft were shot down in Southeast Asia have been recovered. Of the 2,169 lost, 898 (41%) were reported killed. An accepted measure of rescue performance is the ratio of crewmen rescued over the total involved minus those killed. This statistic for the last four years shows that 75% of those who survived the aerial combat and/or crashes were rescued. Table 1, which is based on the FMCC Combat Air Summary File (OPREA), shows the status of downed aircrewmembers by country for 1965-68.

South Vietnam. In South Vietnam the number of crewmen shot down has shown a steady increase (from 269 in 1965 to 2,183 in 1968), which reflects the buildup of US forces and the increasing intensity of the war. However, rescue operations in SVN show no appreciable change through the years, since about 90% of surviving crewmen have been rescued each year. The percentage of crewmen lost in SVN has had a slight downward trend due to a parallel decrease in the percentage of crewmen reported killed. This change can no doubt be attributed to more efficient recovery operations that have located and quickly returned injured crewmen to medical facilities.

North Vietnam. Rescues in North Vietnam must be considered in light of the restrictions that affected the areas of bombing, reconnaissance, and recovery operations. Prior to April 1, 1968, attack and reconnaissance missions were flown throughout the country; and about 70% of the crews shot down were lost (killed, missing and captured). About 36% of the living crewmen were rescued. These factors did not vary much over the 39 month period, January 1965-March 1968. The "poor" results in NVN can be attributed to the hostile environment throughout the country and the great difficulty, and many times impossibility, in making rescues deep inland and near populated and defended areas. The northern regions of NVN contributed heavily to the low rescue rates. In the NVN panhandle (Route Packages I-III) the recovery rate was almost twice that of the northern region. (See Table 2.)

TABLE 2
NVN AIR RESCUE OPERATIONS

	Jan-Mar 1968		Apr-Dec 1968	Jan-Dec 1968
	Above 19°N	Below 19°N	Below 19°N	All NVN
Recovered	10	15	66	91
Lost - Killed	-	3	9	12
Missing	29	16	83	128
Captured	5	5	4	14
Total Lost	34	24	96	154
Total Involved	44	39	162	243
% Lost ^{a/}	77.3	61.5	59.3	62.9
% Rescued ^{b/}	22.7	41.7	43.1	39.1

^{a/} ^{b/} See notes Table 1.

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A big factor contributing to the difference between northern and southern NVN is the proximity of the ocean to the lower regions. We have experienced high rescue rates for crewmen who bail out over water. ^{1/} Those who were hit further inland, especially in the Hanoi and Red River Valley regions, could not reach the ocean areas before bailing out.

Since April 1, 1968, when bombing and reconnaissance were confined to below 19 N latitude, there were 162 crewmen downed over NVN. Sixty-six were recovered, 59% were lost, and 43% of the survivors were rescued. These performance factors agree very well with the below 19 degree operations for January-March 1968 (See Table 2.) The apparent small improvement in rescue rate in NVN since April 1968 (43% vs 32% in 1967 and 31% from January-March 1968) was because rescues were being made in the southern panhandle and off the coast, rather than in the heavily defended northern regions.

Laos. In Laos the four years experience shows that a little over half (54%) of the crewmen shot down were lost. The percentage of survivors rescued has also varied slightly around 54%.

Conclusions. Four years of performance data on rescue of aircrewmen downed by enemy action in SEA shows no real trends in any geographical area. The apparent rise in rescue rate in NVN during 1968 was due to the bombing restrictions that confined combat missions to the southern panhandle. Based on the four years of experience, aircrews have the following expectations of being rescued if they survive their crashes: in SVN, 90%; in NVN below 19°N, 43%, and in Laos, 54%. If operations are resumed throughout NVN, experience shows that only 36% of the surviving crewmen will be rescued there.

^{1/} CINCPAC Analysis Staff Study 9-67, "Recovery of Downed Carrier-Based Aircrews", Sept 1967, reports that 85% of surviving crewmen downed at sea were recovered from April 65-March 67.

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TABLE 1
U.S. Aircrewmembers Status by Area of Operations in SEA ^{e/}
(CY 1965 - CY 1968)

	CY 1965	CY 1966	CY 1967	CY 1968	
Laos					
Recovered	13	51	34	69	
Lost - Killed	4	18	19	9	
Missing	9	33	26	71	
Captured	3	1	-	1	
Total Lost	16	52	45	81	
Total Involved	29	103	79	150	
% Lost ^{a/}	55.2	50.5	56.9	54.0	
% Rescued ^{b/}	52.0	60.0	56.7	48.9	
South Vietnam					
Recovered	168	380	927	1,621	
Lost - Killed	86	113	156	378	
Missing	11	58	86	184	
Captured	4	-	-	-	
Total Lost	101	171	242	562	
Total Involved	269	551	1,169	2,183	
% Lost ^{a/}	37.5	31.0	20.7	25.7	
% Rescued ^{b/}	91.8	86.8	91.5	89.8	
CY 1968					
				Jan-Mar ^{c/}	Mar-Dec ^{d/}
North Vietnam					
Recovered	60	147	154	25	66
Lost - Killed	49	35	19	3	9
Missing	42	154	290	45	83
Captured	56	58	42	10	4
Total Lost	147	247	351	58	96
Total Involved	207	394	505	83	162
% Lost ^{a/}	71.0	62.7	69.5	69.9	59.3
% Rescued ^{b/}	38.0	40.9	31.7	31.3	43.1

^{a/} % lost = total crewmen lost divided by total crewmen involved.

^{b/} % rescued = crewmen recovered divided by "crewmen involved minus crewmen killed"

^{c/} Bombing throughout NVN, as in CY65-67.

^{d/} Bombing restricted to below 19°N latitude.

^{e/} Losses due to hostile enemy action. Since these data are based on operational reports, they may not reflect the final status of aircrews, as continued in the "PW and Missing in Action Statistics."

Data Source: OASD(Comp) and Combat Air Summary File (OPREA).

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ANALYSIS OF THE USE OF PROPELLER VS JET AIRCRAFT IN LAOS

AIRCRAFT EFFECTIVENESS

Data relating to the use of propeller ^{a/} and jet ^{b/} aircraft in Laos during Jan-Aug '67 is shown in the table below. Analysis shows that:

1. Propeller aircraft are approximately 10 times as effective as jet aircraft per sortie in destroying trucks and water craft in Laos. Prop aircraft flew 7187 attack sorties in Laos during the 8 month period, 25% of the total 28,732 attack sorties. Jet aircraft accounted for the remaining 21,545 (75%). During this period, propeller aircraft destroyed or damaged (D/D) a total of 932 moving vehicles, an average of 13.0 targets D/D per 100 sorties. Jets destroyed or damaged 311 moving vehicles, 1.4 per 100 sorties.

2. The loss rates per sortie for propeller aircraft operating in Laos are 4 times greater than the loss rates for jet aircraft. Prop aircraft sustained a total of 9 losses on attack sorties from Jan-Aug 1967. Jet aircraft suffered 8 attack losses. The attack loss rate (losses per 1,000 sorties) for propeller aircraft was 1.252, about 3.5 times higher than the jet loss rate of 0.371.

ATTACK SORTIES, LOSSES AND RESULTS

	LAOS - CY 1967								
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
<u>Propeller Aircraft</u> ^{a/}									
Attack Sorties	966	1103	983	1053	942	814	696	630	7187
Non-Attack Sorties	169	82	135	118	117	114	134	144	1013
Total	1135	1185	1118	1171	1059	928	830	774	8200
Attack Losses	0	1	1	0	2	2	1	2	9
Attack Loss Rate	0	.907	1.017	0	2.123	2.457	1.437	3.175	1.252
<u>Vehicles Dest/Dam</u> ^{d/}									
Vehicles D/D/Att Sorties	115	241	142	158	101	76	99	NA	932
	.119	.218	.145	.150	.107	.093	.142	NA	.130
<u>Jet Aircraft</u> ^{b/}									
Attack Sorties	4518	5620	4126	3813	1615	627	593	633	21545
Non-Attack Sorties	114	222	182	151	119	211	286	252	1537
Total	4632	5842	4308	3964	1734	838	879	885	23082
Attack Losses	3	3	2	0	0	0	0	0	8
Attack Loss Rate ^{c/}	.664	.534	.485	0	0	0	0	0	.371
<u>Vehicles Dest/Dam</u> ^{d/}									
Vehicles D/D/Att Sorties	58	104	71	56	17	2	3	NA	311
	.013	.019	.017	.017	.011	.003	.005	NA	.014

^{a/} A-26, A-1, T-28

^{b/} F-100, F-102, F-105, F4, F8, A4, B57

^{c/} Losses per 1000 sorties

^{d/} Includes motor and water vehicles

Source: KMCC COACT File (for BDA)
OASD/Comptroller (for sorties and losses)

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THE USE OF PROPELLER AND JET AIRCRAFT IN LAOS - JOINT STAFF COMMENTS

An article in the November SEA analysis Report (Pg 46) stated that propeller aircraft were approximately 10 times more effective than jets against moving vehicles in Laos. Comments received from the Joint Staff indicate that several additional factors should have been considered in the analysis. Joint Staff feels the relative effectiveness of propeller aircraft has been overstated but props are still more effective than jets in a permissive environment. A follow-on study is needed to determine whether they are sufficiently more effective to justify reducing the flexibility of the field commander in shifting his effort from area to area. The principle comments are summarized below.

1. Type Mission Scheduled. Approximately 75% of the prop sorties in Laos are armed reconnaissance against moving vehicles. By contrast, 67% of the jet sorties were against fixed targets (truck parks, bridges, assembly areas, etc), which rarely produced confirmed truck kills. Therefore, one should expect the props to produce better results against trucks.

2. Weather Diverts. Many of the jet sorties in Laos are weather diverts from North Vietnam and only have a short time in which to locate a suitable target in Laos. By contrast the prop aircraft are used almost entirely in Laos and can use their loiter time to find and destroy trucks.

3. Bomb Damage Assessment. Approximately 10% of the jet sorties in Laos are under COMBAT SKYSPOT control (radar bombing) for which no BDA is available. This tends to understate the effectiveness of jet aircraft.

4. Day versus Night Effectiveness. Most of the truck traffic in Laos is believed to occur at night. During the first eight months of 1967 about 40% of the propeller aircraft sorties were flown at night compared to 15% of the jet attack sorties. Since propeller aircraft operate more frequently during these periods of higher truck activity, they should destroy more vehicles per sortie than jets.

5. AAA Defenses. The AAA firings per 1000 sorties in Laos increased from 19 in 1966 to 74 during the first 10 months of 1967. If this trend continues the loss rate for propeller aircraft could force greater reliance on jet aircraft in Laos.

SEAPRO COMMENT

SEAPRO agrees with the Joint Staff that these factors tend to narrow the difference in effectiveness of prop and jet aircraft against moving vehicles. However, our analyses indicate that propeller aircraft are still many times more effective than jets in destroying trucks in the mountainous Laotian Panhandle. We will continue to evaluate the significance of these factors and the results will be reported in a future article. Some of our specific comments are shown below:

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1. Type Mission. It is not clear from available data that attacks on truck parks and assembly areas rarely produce confirmed truck kills. In addition, preliminary analysis indicates that propeller aircraft are considerably more effective than jets against fixed targets as well as moving vehicles.

2. Day versus Night Effectiveness. Evidence from MUSCLE SHOALS operations indicates that considerable truck traffic exists during the day. But if it is true that trucks move mostly at night, the need for such large numbers of jet sorties in Laos during daylight hours needs to be examined further.

KILLING TRUCKS IN LAOS

An article in the November 1967 Analysis Report stated that propeller aircraft are about ten times as efficient as jets per sortie in destroying moving vehicles in a "permissive environment" such as Laos. Comments received from the Joint Staff (January 1968) indicated our analysis overstated the relative effectiveness of propeller aircraft and suggested several additional factors that should be considered. We now have evaluated the significance of these factors and find that:

1. Operational characteristics (slow speed, high maneuverability, high payload with appropriate munitions and long loiter time) rather than the means of propulsion determine an aircraft's ability to destroy large numbers of moving targets. Propeller aircraft are more likely to have these characteristics than jets, and thus tend to destroy more trucks.
2. The primary assigned mission of the aircraft is at least as important as its operational characteristics in determining its effectiveness against moving vehicles. Aircraft whose basic mission is to destroy trucks have been highly successful.

Operational Characteristics

Focusing on the relative effectiveness of propeller and jet aircraft is misleading. All other factors being equal the most efficient truck killing aircraft fly low and slow, carry a heavy payload, and loiter in the target area for long periods of time. Propeller aircraft, such as the T-28 and A-26, have these operational characteristics and have been relatively effective against moving targets. However, the B-57 (a jet aircraft) also has these operational characteristics and is second only to the A-26 as the most efficient truck killer per sortie.

Table 1 shows attack sorties and results for USAF aircraft in Laos during Jan-Mar 1968. During this period, two aircraft (the A-26 and B-57) accounted for 88% of the total truck destruction but only 22% of the attack sorties. The A-26 reportedly destroyed or damaged (D/D) 1233 trucks on 1229 attack sorties (about one truck per attack sortie) while B-57 aircraft D/D 1679 trucks on 2716 sorties (0.62 per sortie). The A-1, which has operational characteristics similar to the A-26, should also be an effective truck-killer; however, it performed poorly (.06 targets D/D per sortie). The A-1 results were not appreciably better than those of the F-4 and the F-105, both high-speed, high-performance jets. Some possible explanations for these poor results are discussed in the next section.

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TABLE 1

USAF ATTACK SORTIES AND RESULTS IN LAOS
(Jan-May 1968)

<u>Type Aircraft</u>	<u>Attack Sorties</u>	<u>% Sorties at Night</u>	<u>Trucks D/D</u>	<u>Trucks D/D Per Sortie</u>
A-26	1229	99%	1233	1.00
B-57	2716	78%	1679	.62
A-1	1741	3%	96	.06
F-4	7213	37%	272	.04
F-105	5002	1%	23	-
Total	17901	34%	3303	.18

SOURCE: NMCS COMEA File

Table 2 shows attacks, passes and results in the STEEL TIGER area of Laos during Sep 66-Dec 67 (1968 data are not available). An attack is defined as one aircraft that delivers ordnance against a truck target. During an attack, the aircraft can make one or more passes against the target. For example, if an aircraft finds two separate truck convoys and makes three passes against each it would be recorded as two attacks and six passes. The number of trucks destroyed and damaged per attack (or per pass) provides one measure of the aircraft's ability to destroy a truck once the target has been located. Attacks and passes should not be used to measure the aircraft's overall effectiveness because they ignore the difficult task of finding moving vehicles in the mountainous Laotian Panhandle. These data indicate that the B-57 was the most efficient truck killer, destroying or damaging 176 per 100 attacks. The A-1, A-26 and T-28 aircraft were less efficient and destroyed 52-83 trucks per 100 attacks. The F-4 and F-105 had the poorest record destroying 19-27 trucks per 100 attacks.

TABLE 2

ATTACKS, PASSES AND RESULTS IN STEEL TIGER
(Sep 66 - Dec 67)

<u>Type</u>	<u>Attacks</u>	<u>Passes</u>	<u>Trucks D/D</u>	<u>D/D Per 100 Attacks</u>	<u>D/D Per 100 Passes</u>	<u>Passes Per Attack</u>
A-1	316	1253	164	52	13	4.0
T-28	753	3772	622	83	16	5.0
A-26	888	4072	521	59	13	4.6
B-57	194	879	342	176	38	4.5
F-4	1034	1623	198	19	12	1.6
F-105	368	573	100	27	17	1.6

One major conclusion emerges from this data; the ability of an aircraft to destroy a truck is heavily dependent on the number of passes it can make during an attack. Both high- and low-performance aircraft destroy or damage roughly the same number of trucks per 100 passes (the B-57 being

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an exception). However, low-performance aircraft average 4-5 passes per attack and thus destroy three times more trucks per attack than high-performance jet aircraft that average only 1.6 passes per attack.

Speed, operational attitude, payload, and loiter time all affect the number of passes an aircraft can make per attack.^{1/} Aircraft that fly low and slow can deliver ordnance with greater accuracy than high-speed aircraft; they can also turn fast enough to make several passes before the truck disappears in the jungle. The more payload and loiter time that is available, the more passes the aircraft can make before running out of fuel or bombs. Low-performance aircraft such as the A-26, T-28 and B-57 are efficient truck killers primarily because they have sufficient ordnance, maneuverability, and loiter time to thoroughly "work" a convoy. High-speed jets often run out of bombs and fuel or lose the target in the jungle after one pass.

Type Mission

The type of mission an aircraft flies appears to be at least as important as its operational characteristics in determining truck kills. Our analysis indicates that the few aircraft which concentrate on killing trucks are highly successful. As shown on Table 1, the A-26 and the B-57 fly almost entirely at night, which is also when 70-80% of the enemy truck traffic reportedly occurs in Laos. During Jan-May 1968, about 99% of the A-26 and 78% of the B-57 attack sorties in Laos were at night. On the other hand, the F-4 flew only 37% of its missions at night, and less than 1% of the F-105 sorties were after dark. The A-1, which has the operational characteristics to be an efficient truck killer, seldom attacks moving vehicles. The A-1s are generally used to deliver IGLCO WHITE sensors and munitions, support Laotian Army operations, and provide cover on search and rescue operations; only 3% of their attack sorties are at night.

About 80% of the USAF attack sorties in Laos concentrate on destroying storage areas, LOCs, and other fixed targets, not trucks. Only about one-third of the sorties are flown at night when the trucks are moving. Prior to the current bombing restrictions, North Vietnam (particularly the Hanoi-Haiphong area) was the primary focus of our bombing campaign and Laos got only what was left over. Because of the emphasis on NVN, attack sorties in Laos were often flown at the wrong time, with the wrong ordnance, against wrong targets. For example, last winter up to 3000 attack sorties

^{1/} Passes per attack should also affect loss rates, particularly against heavily defended targets, but there is conflicting evidence on this point. The A-26 makes three times more passes per attack than the F-4 but its attack loss rate is only twice as high in Laos (1.5 per 1000 sorties for the A-26 compared to 0.7 for the F-4 during FY 68). Similarly, the B-57 loss rate (0.4) during FY 68 was about half the F-4 rate, despite the high passes per attack for B-57 aircraft.

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per month were routinely scheduled against high-priority fixed targets in North Vietnam and then diverted into Laos because of poor weather. Aircraft diverted from strikes in NVN reached Laos in two waves, one about 9 AM and the other at 4 PM, times when few enemy trucks were on the roads. These aircraft, armed with general purpose bombs and with short loiter times, were generally unable to find truck targets; most dropped their loads on a road or against a suspected base area in the jungle.

Conclusions

Our analysis suggests that we could significantly increase (perhaps double or triple) the number of trucks destroyed in Laos just by systematically using existing aircraft to attack moving vehicles. Only a small percentage of our total effort has been devoted to killing trucks, and a handful of aircraft account for most of the destruction.

We could significantly increase enemy truck destruction by shifting sorties from day to night, staggering our attacks to provide better coverage, and using aircraft which are efficient truck killers to attack moving vehicles. While some daylight sorties are undoubtedly required, it is unlikely we need to use 70-80% of our sorties to create interdiction chokepoints and keep the trucks off the road during the day.

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JET AND PROPELLER AIRCRAFT OPERATIONS IN SOUTHEAST ASIA

For some time now, the relative efficiency and appropriate role of propeller-driven tactical aircraft in Southeast Asia has been the subject of almost continuous controversy. We have entered the discussion at various points, usually to indicate the efficiency of "slow moving" aircraft (principally A-1s, A-26s, and B-57s) as truck-killers in Laos. We have now looked further into the problem, and this paper summarizes our recent analysis of the effectiveness, attrition, and costs of the propeller and jet aircraft against a variety of different targets in Southeast Asia.

Major Conclusions

Our findings are:

1. Propeller-driven aircraft are about 150% more efficient (targets destroyed per sortie) than jet aircraft against interdiction targets (vehicles, roads and storage areas) and 180% more efficient against offensive targets (troops fortifications, and buildings).
2. Propeller aircraft perform as well at night as during the day, but jet aircraft are only half as efficient after dark.
3. The weather changes in Laos appear to have no significant effect on aircraft efficiency; total sorties declined during the Jul-Sep 1968 wet season but destruction per sortie did not fall (the difficulty of operating in poor weather may have been offset by the larger target population available per sortie).
4. Destruction per sortie, for both propeller and jet aircraft, is lower in Laos than in South Vietnam.
5. The addition of large numbers of high-performance jet aircraft in Laos, previously used in North Vietnam, reduced the destruction per sortie. At the current level of operations, the marginal benefit from additional sorties against roads and chokepoints appears to be very small.
6. The incremental cost (including attrition) to destroy various types of targets is about 80% lower for propeller than for jet aircraft.
7. Aircraft attrition for props per target destroyed is about the same as or lower than for jet aircraft.

Methodology

In this study we used pilot reports maintained in the BOMBA Computer File. The reporting was sometimes incomplete (some missions were not completely reported); however, the data base was useful for relative comparisons and for discerning trends over time with large samples. For

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example, although we could not accurately determine the total number of trucks destroyed in January 1969, we could compare F-4 and A-1 truck kill rates during calendar year 1968 because a large enough sample existed to make a statistically meaningful comparison of relative effectiveness. (To illustrate, the BCMBA file showed 725 trucks destroyed/damaged in Laos during January 1969, DIA showed 1276 in the comparable period.)

Some terms need definition. First, the study divided all air targets into six classes. "LOC Facilities" included roads, bridges, waterways, and railroads; "Logistics Storage Areas" included area depots and truck parks. "Enemy Fortifications and Buildings", "Troops", and "Air Defense Targets" were self-explanatory. "Moving Vehicles" included trucks, other motor vehicles and watercraft; 91% of these targets in Laos are trucks while in SVN 96% are watercraft. Airfields, aircraft, radar sites, and unknown targets were classed as "Other" (about 2% of the total attacks fell into this category). The computer file strike data was presented by attacks and passes against different target types. The file reported about 1.2 attacks per attack sortie and between four and seven passes at each target per attack. An attack occurred each time an aircraft released ordnance against a target. However, the aircraft could make a number of passes in a single attack against one target. An aircraft sortie finding no targets would report no attacks; conversely, more than one attack could occur per sortie. Aircraft were classed as propeller and jets. The propeller aircraft included A-1s, and A-26s, while jets included the F-4, RF-4, F-8, F-100, F-105, A-4, A-6, A-7, and A-37.

Targets Struck

In South Vietnam, about three-fourths of total jet sorties strike either suspected enemy logistic areas (30%) or enemy fortifications and buildings (45%); two-thirds of the propeller sorties attack enemy fortifications and buildings. In Laos, the majority (77%) of the sorties strike interdiction targets (roads, bridges, chokepoints, storage areas, and trucks). For example, about 40% of both jet and propeller sorties in Laos during 1968 attacked logistics storage areas. During the same period, jets concentrated 33% of their strikes on lines of communications (LOCs) while propeller aircraft attacked trucks (20% of total sorties). The table below shows the percentage of total attacks flown against each type of target in South Vietnam and Laos.

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AIR OPERATIONS IN SOUTH VIETNAM AND LAOS
(CY 1968)

	Percentage of Total Attacks Flown			
	South Vietnam		Laos	
	Jets	Propellers	Jets	Propellers
<u>Air Defense Targets</u>	4	1	7	6
<u>Interdiction Targets^{a/}</u>				
LOC Facilities	3	2	33	10
Logistics Storage	30	14	41	40
Motor Vehicles	3	6	7	21
Total	<u>36</u>	<u>22</u>	<u>81</u>	<u>71</u>
<u>Offensive Targets^{a/}</u>				
Enemy Fortifications and Buildings	45	66	6	7
Troops	15	11	6	16
Total	<u>60</u>	<u>77</u>	<u>12</u>	<u>23</u>
<u>Total Attacks Flown^{b/}</u>	100	100	100	100

^{a/} Categorization as interdiction or offensive based on target type.
^{b/} Does not include targets classed as "other" which were about 2% of total attacks.

SOURCE: BOMBA Computer File - OASD(SA).

The efficiency of an aircraft (targets destroyed per attack) varies with such factors as: type target, type aircraft, visibility (day, night, weather), and the tactical nature of the target area (AAA, terrain). These variables are discussed briefly below.

1. Target Type - Propeller aircraft appear to be about 2.5 times as effective as jets against interdiction targets. For example, they are 2.6 times as effective as jets against logistics storage areas and truck parks, 1.9 times as effective against roads, bridges, and other LOC targets,

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and 1.4 times as effective against trucks and other moving vehicles.^{1/} Moreover, neither jets nor propellers destroy or damage a road or bridge on each attack; over three jet attacks and 1.6 propeller attacks are required to damage a road or bridge. The results are much worse for attacks against storage area targets and truck parks; over 13.5 jet attacks or five propeller attacks are required to damage this type of target. Both types of aircraft appear to be more effective against moving vehicles than other type targets.

We classified enemy troops and enemy fortifications (including buildings and assembly areas) as offensive targets primarily because attacks against these types of targets are designed to destroy men and offensive positions rather than materiel and supplies. Propeller aircraft are two to three times as effective as jets against these targets (2.3 times against troops and 2.8 times against buildings and fortifications). In Laos and SVN in 1968, jet and prop aircraft reportedly destroyed and damaged about 141,000 enemy fortifications and buildings and killed approximately 23,000 enemy troops. This destruction required 175,000 attacks, the equivalent of 146,000 sorties.

The following table summarizes the bomb damage inflicted per attack from air operations over Laos and SVN. It shows (1) the relative differences in effectiveness between jets and props against the same target and (2) the relative effectiveness of attacks against targets of different types.

^{1/} In SVN, over 96% of moving vehicle targets were motor boats and other watercraft while in Laos over 91% were trucks. Jets were relatively efficient (compared to props) against watercraft in SVN but much less so against trucks in Laos. Our analysis indicates jets should not be used to attack vehicles in Laos, while they might efficiently destroy watercraft in South Vietnam. The following table points out the differences in SVN and Laos effectiveness.

MOVING VEHICLES DESTROYED/DAMAGED
PER 100 ATTACKS

	<u>Jet</u>	<u>Propeller</u>	<u>Prop/Jet</u>
SVN	99.3	118.7	1.2
Laos	<u>23.1</u>	<u>72.1</u>	<u>3.1</u>
Total	66.2	91.6	1.4

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RELATIVE EFFECTIVENESS OF JET AND PROPELLER
AIRCRAFT IN SOUTHEAST ASIA^{a/}

	Targets Destroyed or Damaged Per 100 Attacks			
	Jet		Propeller	
	Number	Index	Number	Index
<u>Interdiction Targets</u>				
LOC Facilities	32.8	100	61.7	188
Logistic Targets	7.4	100	19.3	260
Moving Vehicles	66.2	100	91.6	138
All Interdiction Targets	17.5	100	44.5	253
<u>Offensive Targets</u>				
Buildings and Fortifications	76.9	100	213.0	277
Troops	42.6	100	97.9	230
All Offensive Targets	67.7	100	189.9	280
<u>Air Defense Targets</u>	13.4	100	19.9	148
<u>Other Targets</u>	2.7	100	2.9	107
Total Targets Struck	40.2	100	123.3	306

a/ Includes operations in SVN and Laos Jan-Dec 1968.

2. Day Versus Night Operations - For operations in Laos, jet aircraft suffer a larger relative degradation in their target-killing capability at night than do propeller aircraft. Jets are only about 43% as efficient at night as during daylight; props are 22% better at night. One aircraft, the B-57, performs 63% better at night than during the day. The propeller aircraft's good nighttime performance against trucks is probably because of its lack of dependence on a FAC, higher delivery accuracy, and increased target availability and convoy size at nighttime. Jets are more efficient at night than during the day against air defense targets (this may be because the lower aircraft vulnerability to AAA and small arms fire at night increase the pilot's ability to get close to the target and thus improves bombing accuracy). The following table, which indicates the impact of night operations on effectiveness, shows the ratio of night to day destruction per sortie. A ratio greater than one indicates the aircraft is more efficient at night against that target than during daylight; a number less than one indicates the opposite.

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NIGHT VERSUS DAY AIR OPERATIONS
LAOS - 1968

	Ratio of Night to Day Aircraft Effectiveness ^{a/}		
	<u>Jet</u>	<u>Propeller</u>	<u>B-57</u>
<u>Interdiction Targets</u>			
LOC Facilities	.36	.83	1.39
Logistics Facilities	.27	.24	n.a.
Moving Vehicles	.79	1.21	1.25
All Interdiction Targets	.57	2.08 ^{b/}	1.8.
<u>Offensive Targets</u>			
Buildings and Fortifications	.14	.37	.59
Troops	.16	.43	n.a.
All Offensive Targets	.13	.36	.59
<u>Air Defense Targets</u>	1.03	.88	1.00
Total Targets Struck	.43	1.22	1.63
<u>Percentage of Attacks at Night</u>	18.4%	38.4%	77.9%

a/ Targets destroyed or damaged per 100 attacks at night divided by the same measure during the daylight.

b/ The ratio for the "All Interdiction Targets" (2.08) exceeds the comparable ratios for the three interdiction target categories (.83, .24, .121) because the sample sizes for the three target types differ. Specifically, most of the day attacks hit logistics facilities with poor target destruction results per attack (.107 targets D/D per attack) while most night attacks hit trucks and show higher destruction (.737 targets D/D per attack). The total interdiction target ratio, therefore, is heavily weighted by two different target types (day logistics targets and night truck strikes) which causes it to be higher than the ratio for the individual targets.

3. Weather - The monsoon season in Laos supplies a reasonably valid test of the effects of bad weather and poor visibility on aircraft performance. Actual experience in Laos during 1968 indicates that weather does not have a significant impact on aircraft efficiency (targets D/D per attack) as shown below. The various measures of effectiveness per sortie tend generally downward, showing no large degradation during the Southeast monsoon (Jul-Sep 1968). One explanation may be the substantial reduction of attack sorties flown in Laos during the Jul-Oct period. The bulk of the US interdiction effort was shifted to the NVN panhandle to support the "7th Air Force Summer Interdiction Campaign"; the relatively few sorties in Laos were probably directed against

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lucrative targets based on hard intelligence. Just the opposite effect appears to have been produced by the massive increase in the US effort to support COMANDO HUNT, the US interdiction program in Laos (Nov 68 - Apr 69). Aircraft effectiveness per sortie has fallen substantially since the beginning of COMANDO HUNT, in spite of the good weather and visibility.

THE WEATHER CYCLE AND AIRCRAFT EFFECTIVENESS IN LAOS

	<u>Jan-Mar 1968</u>	<u>Apr-Jun 1968</u>	<u>Jul-Sep 1968</u>	<u>Nov 68 Jan 69^{a/}</u>
<u>Motor Vehicles</u>				
Total Attacks	3,205	2,551	1,041	4,654
<u>Targets Destroyed/Damaged</u>				
Per 100 Jet Attacks	22.9	24.0	25.5	18.5
Per 100 Prop Attacks	62.0	102.5	41.9	30.3
Per 100 Attacks	58.4	81.7	35.0	25.4
<u>LOC Facilities</u>				
Total attacks	4,734	11,793	1,662	16,418
<u>Targets Destroyed/Damaged</u>				
Per 100 Jet Attacks	34.7	25.2	20.9	19.1
Per 100 Prop Attacks	52.7	43.2	64.1	32.7
Per 100 Attacks	36.5	26.5	29.8	19.2
<u>Logistics Targets</u>				
Total Attacks	8,191	4,576	3,506	19,377
Per 100 Jet Attacks	3.9	6.3	8.4	4.1
Per 100 Prop Attacks	3.9	13.8	9.0	3.5
Per 100 Attacks	3.9	8.6	8.6	4.1

^{a/} Subsequent data unavailable at this time.

4. Tactical Environment - SVN Versus Laos - We compared destruction per sortie in SVN and Laos to show the degradation of efficiency in Laos. This ratio indicates the advantage of destroying a target in SVN (if it is available) rather than in Laos. The largest degradations for jets occur in attacks against interdiction targets; they destroy two to four times as much per sortie in South Vietnam as in Laos. For props, attacks against offensive targets (such as troops and buildings) seem to be the most affected by Laos operations. However, almost all aircraft operating in Laos are much less efficient against all types of targets than they are in South Vietnam. This probably results from the heavier enemy AAA defenses (which cause higher bomb release altitudes) and the more mountainous terrain in Laos.

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COMPARISON OF AIRCRAFT EFFICIENCY IN SVN AND LAOS

	<u>Ratio of Efficiency in SVN to Laos^{a/}</u>	
	<u>Jet</u>	<u>Prop</u>
<u>Interdiction Targets</u>		
LOC Facilities	2.5	1.8
Logistics Targets	2.0	3.8
Moving Vehicles	4.3	1.6
All Interdiction Targets	1.4	1.7
<u>Offensive Targets</u>		
Enemy Buildings and Fortifications	1.1	2.6
Troops	1.2	3.0
All Offensive Targets	1.3	3.7
<u>Air Defense Targets</u>	1.8	2.6
<u>Other Targets</u>	0.7	0.7
All Targets Struck	2.7	4.1

^{a/} Targets destroyed or damaged per 100 attacks.

Air Operations - Loss Rates and Costs

The relative effectiveness per sortie of jet and propeller aircraft is only half of the issue. We should also consider the difference in cost per sortie, including aircraft loss rates, air crew casualties, and direct operating costs.

1. Aircraft Loss Rates - Because of their slower speed, propeller aircraft are substantially more vulnerable to ground fire than jets. Prop loss rates per sortie are 220% as high as jets in Laos (1.203 vs. 0.555 per 1000 attack sorties) and 260% as high in South Vietnam (1.188 vs. 0.452). The anti-aircraft fire in Laos inflicts much higher loss rates on all aircraft than suffered in SVN. The differences between prop and jet loss rates by country are summarized below.

AIRCRAFT LOSS RATES^{a/}
(Per 1000 Attack Sorties)

	<u>SVN</u>	<u>Laos</u>
Jets	0.452	0.555
Props	1.188	1.203

^{a/} Actual experience in SEA during July 1967 - June 1969 includes A-1, A-4, A-6, A-7, A-26, F-100, F-4 and F-105 (USAF, USN, USMC).

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2. Crew Loss Rates - Three factors must be combined to calculate expected aircrew losses: (1) the aircraft loss rate, (2) the crew's chances of being rescued per aircraft loss, and (3) number of members in the crew. Aircrew size and survivability are discussed below.

In South Vietnam propeller aircraft crews have only about one-half the chance for rescue and recovery that jet crews have. This could result from the lower bomb delivery altitudes and longer loiter times for props. In Laos, prop and jet crews both have about the same survivability. We cannot explain, however, why crew loss rates are higher (fewer crews are recovered alive) for props in SVN than in Laos. In fact, because of the AAA and the hostile ground environment in Laos, we would expect the opposite. Many jets (F-4s, A-6s, part of the F-100s and F-105s) have two crewmen. The A-1, the most heavily used propeller aircraft, has one crew member. The combination of these two factors, shown below indicates that jets lose more crew members per downing in Laos than do props (.75 vs. .44), but they lose fewer in SVN (.64 vs. .73).

	<u>AIR CREW SURVIVABILITY</u>		<u>LAOS</u>	
	<u>SVN</u>			
	<u>Crew Loss Rate</u> <u>Per Downing^{a/}</u>	<u>Crew Members</u> <u>Lost</u> <u>Per Downing</u>	<u>Crew Loss Rate</u> <u>Per Downing^{a/}</u>	<u>Crew Members</u> <u>Lost</u> <u>Per Downing</u>
Jet Aircraft	37%	.64 ^{b/}	45% ^{b/}	.75 ^{b/}
Propeller Aircraft	73%	.73 ^{c/}	44%	.44 ^{c/}

a/ Actual rescue experience Feb 68 - May 69.

b/ 1.75 crew members per aircraft.

c/ 1.0 crew members per aircraft.

3. Direct Costs - Jet aircraft cost about 50% more to operate per sortie than props. As shown below the typical jet sortie (F-4, F-105, etc.) costs approximately \$9,000 while the prop sortie (A-1) costs \$6,000. The cost comparison considered on the basis of destruction achieved rather than per sortie flown shows an even more favorable cost advantage for props (almost four to one).

DIRECT COSTS - JET AND PROP AIRCRAFT
IN SOUTHEAST ASIA
(Per Attack Sortie)

	<u>Jets</u>	<u>Props</u>
Operating and Maintenance Costs	\$2,300	\$1,100
Military Pay	800	400
Ordnance Procurement	4,200	3,800
Attrition Procurement	1,700	600
	<u>\$9,000</u>	<u>\$5,900</u>

SOURCE: CASD(5A) Estimates.

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Summary

Overall, propeller aircraft are almost three times as efficient per target destroyed as jets and cost only 20% as much to destroy a target. However, to destroy a target at night with a jet costs about 13 times more than with a propeller aircraft. Furthermore, prop aircraft suffer about the same or fewer aircraft and crew losses as jet aircraft per target destroyed. Yet even in face of the cost effectiveness of propeller aircraft relative to jets, over 90% of the sorties in Southeast Asia are flown by high-performance jet aircraft. The ready availability of jets that were used over NVN and the lack of props in the US air forces causes this seemingly inefficient use of aircraft.

COSTS AND LOSSES PER TARGET DESTROYED

	Cost Per Target		Aircraft Lost Per		Airmen Lost Per	
	Destroyed/Damaged ^{a/}		1000 Targets		1000 Targets	
	Jet	Prop	Jet	Prop	Jet	Prop
<u>Interdiction Target</u>						
LOC Facilities	\$ 23,000	\$ 8,000	1.0	0.7	0.8	0.9
Logistic Targets	104,000	26,000	4.8	4.8	3.6	2.8
Moving Vehicles	12,000	6,000	0.6	1.0	0.4	0.6
All Interdiction Targets	44,000	11,000	2.0	2.1	1.6	1.2
<u>Offensive Targets</u>						
Buildings and Fortifications	10,000	2,000	0.5	0.4	0.4	0.3
Troops	18,000	5,000	0.8	1.0	0.6	0.6
All Offensive Targets	11,000	3,000	0.6	0.5	0.4	0.3
<u>Air Defense Targets</u>	57,000	26,000	2.7	4.7	2.0	2.8
<u>Other Targets</u>	285,000	176,000	13.2	32.4	10.0	19.0
Total Targets Struck	19,000	4,000	0.9	0.8	0.7	0.4

a/ \$7700 per jet attack and \$5100 for prop attack (Approximately 1.2 attacks occur per sortie.)

b/ 0.38 aircraft losses per 1000 jet attacks and 0.94 aircraft losses per 1000 prop attacks.

c/ 0.27 airmen lost per 1000 jet attacks and 0.55 airmen lost per 1000 prop attacks.

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Based on the costs per target destroyed, we offer three tentative conclusions on tactical aircraft operations.

1. Prop aircraft should be used to replace large numbers of jet aircraft operating in Southeast Asia, especially at night. The Air Force has already taken steps to increase the number of gunships modified and deployed to SEA, but more prop (or slower jets such as B-57s) are needed.

2. Attacks against moving vehicles, especially trucks in Laos seem cost effective. The cost to the US of destroying a moving truck in Laos is \$6-12,000; it costs the enemy more than \$6000 to replace the truck, supplies and train the driver. Unfortunately, less than 4% of total attacks hit moving vehicles.

3. We should consider reducing attacks against LOCs and logistics targets in light of the relative value and the cost of destroying each target. There probably is significant damage inflicted in some attacks against logistic targets, but (1) the returns from these strikes are undoubtedly less than 3-5 times higher than attacking moving vehicles (or other targets) and (2) these targets do not appear to justify eight times as many attacks (present allocation of attacks) as do moving vehicles.

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WINDING DOWN THE AIR WAR

Air munitions expended and sorties flown in Southeast Asia since 1965 (table attached) show the following patterns:

-- Intensity levels. Monthly sortie rates for both tactical aircraft and B-52's peaked in 1968 and have steadily declined since then. Monthly munition tonnages show a similar pattern.

- In the three year period 1966 through 1968 tactical air sorties were 50% higher than the monthly rates for the ensuing 3 year period (Jan 1969-Oct 1971).

- Monthly B-52 sorties increased by nearly 300% from 1966 to 1968 and have declined almost 40% since then.

--Monthly munition expenditures tend to follow the B-52 pattern, because of their heavy loads. They increased by 180% from 1966 to 1968 and have declined about 40% since then.

-- Distribution by country. Total B-52 and tactical air sortie levels have been reduced in those areas likely to have high population densities. Munition expenditures again seem to follow the B-52 sortie distribution in each country.

- In 1971 we are flying fewer tactical air sorties in all of SEA than we flew in South Vietnam alone in 1968.

- Although B-52 sorties against the enemy logistic network in lightly populated areas of Laos and Cambodia have doubled since 1968, in South Vietnam they are only one-eighth (1/8) the 1968 levels.

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US TAC AIR SORTIES

	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>(thru Oct)</u> <u>1971</u>
South Vietnam	124,686	169,828	205,250	155,091	76,105	15,903
North Vietnam	81,131	105,575	92,231	285	113	284
Laos	48,469	44,450	75,274	144,323	100,576	75,647
Cambodia	--	--	--	20	14,689	14,186
TOTAL	254,286	319,853	372,755	299,719	191,483	106,020
(Monthly Avg)	(21,190)	(26,654)	(31,063)	(24,976)	(15,957)	(10,602)

US B-52 SORTIES

	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>(thru Oct)</u> <u>1971</u>
South Vietnam	4,364	6,609	16,505	13,931	5,293	2,136
North Vietnam	223	1,364	686	--	--	--
Laos	647	1,713	3,377	5,567	8,518	7,579
Cambodia	--	--	--	--	1,292	304
TOTAL	5,234	9,686	20,568	19,498	15,103	10,609
(Monthly Avg)	(436)	(807)	(1,714)	(1,625)	(1,259)	(1,061)

US MUNITIONS TONNAGE

	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>(thru Sep)</u> <u>1971</u>
South Vietnam	259,891	487,867	830,489	735,147		
North Vietnam	127,659	247,205	227,039	662		
Laos	73,679	128,025	239,617	516,006		
Cambodia	--	--	--	--		
TOTAL	461,229	863,097	1,297,145	1,251,815	976,000	603,000
(Monthly Avg)	(38,436)	(71,925)	(108,095)	(104,318)	(81,333)	(67,000)

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Effects of Crop Spraying in South Vietnam

Two recent RAND Studies* indicate the use of herbicides in crop destruction in Vietnam does not have a significant effect on the enemy's food supply. The program may be counter-productive in view of its alienation from the GVN of the non-VC population subjected to crop spraying.

The findings are based on 206 interviews with ex-VC and non-VC civilians, USAID statistical abstracts, and crop destruction operations data supplied by CINCPAC. These studies are summarized below, with some OASD/SA comments appended.

Summary

The herbicide program can be broken down into two parts: 1) defoliation of forested areas to reduce the cover available to the VC, and 2) destruction of crops to reduce the amount of food available to the VC. During 1965 some 751,000 acres were defoliated and 113,000 acres of crops were destroyed. The RAND report focuses primarily on the crop destruction program.

The report concludes that the crop destruction program has not in any major sense denied food to the VC. MACV estimates the VC forces constitute about 1.5 percent of the population. Allowing for losses in the system, they need no more than 3 percent of all the food consumed in the country. Because of the coercive access the VC have to rice at the consumer level, they are able to transfer most of the burden of deprivation to the local peasant. It would be difficult to destroy enough food, except in localized instances, to prevent the VC from eating. Those interviewed indicated that: (1) their normal food ration was adequate, (2) there was no consistent deterioration in rations in the time period studied (1965 through end 1966) and (3) higher ranking subjects believed the system could adapt to even more intense crop destruction. However, as a result of US/GVN herbicide operations some VC units in the central highlands had serious food problems.

Statistical analysis indicates the intensity of crop destruction operations did not have a significant impact on the amount of rice or rations per VC in a given area. Production, population and access to foreign sanctuary were the significant predictors of the ration. The VC grow little of their own food (an estimated 10 percent), some is imported, but the principal VC source of supply is the indigenous population. Thus, the major portion of the crops destroyed through aerial spraying has inevitably been civilian-owned and

* Russell Betts and Frank Denton, An Evaluation of Chemical Crop Destruction in Vietnam, RM-5446-ISA/ARPA, September 1967, and Anthony J. Russo, A Statistical Analysis of the U.S. Crop Spraying Program in South Vietnam, RM-5450-ISA/ARPA, September 1967.

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cultivated. RAID estimates that over 500 civilians experience crop loss for every ton of rice denied the VC.

The reaction to spraying operations which destroy civilian crops is almost unanimously hostile. Eighty-eight percent of those interviewed indicated the people blame the US/GVN for the destruction. Crop destruction not only causes food shortages and economic hardships, but it also threatens to disrupt the peasant's total pattern of existence. The civilian population generally lacks knowledge and understanding about the nature and the purpose of these operations. They feel that the spraying shows a lack of SVN concern for their welfare. Many peasants also believe the chemicals used are toxic and can cause illness or death.

The sources suggest also that herbicide operations do not appear to have caused significant refugee movements as may have been anticipated. The civilian who had lost his crops apparently believed he would not be appreciably better off as a refugee in GVN areas, and might not be as well off.

There was some limited evidence from the interviews that the people might be more willing to accept crop spraying as a legitimate (though still highly undesirable) weapon of war, provided the US/GVN could at the same time successfully demonstrate its sincere concern for their welfare. The report notes that "The incidence of SVN aid to people affected by crop spraying was very low. Surprisingly enough, aid from the Viet Cong was more commonly attested to." In addition to aid, better psychological war techniques also appear needed. The crop destruction operations were rarely accompanied by GVN or US warnings and explanation. In the absence of such information, the VC stepped in with their own propaganda. They claim the chemicals are toxic, the GVN lacks concern for them while the VC have a real concern; and the US and GVN are not able to win a guerrilla war since they have to blindly destroy the people to get at the VC.

SEA PRO Comment

These studies have some questionable aspects. The sample is small. Furthermore, the studies do not address the effectiveness of spraying VC controlled areas and base camps versus contested areas. One implication of the studies is, however, that the crop destruction program should be limited to local actions in which it is part of a concerted effort to disrupt supply lines or to force the VC to move from selected base areas.

The results of more warning of the peasants of impending spraying are not entirely foreseeable. On the one hand, alienation may be reduced. On the other hand, refugees may be produced on a wholesale basis - something the US has generally avoided. The study cites at least one example where the people concerned were warned of impending herbicide operations and urged to flee to SVN controlled areas; most of them did. This is one way to separate the VC from the peasants. It might be a desirable way, but only if we have prepared adequate refugee centers, determined how to make the refugees economically productive, and managed to separate out the VC who have fled with the refugees.

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We agree with RAND that the evidence indicates that the present wholesale crop spraying program is counter-productive because it neither denies food to the VC nor prevents the alienation of the affected population. Limiting crop spraying to selected areas may still be worth the risks, but even then the program should be accompanied by a public information program.

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EFFECTS OF CROP SPRAYING IN SVN: A RECONSIDERATION

In November we reviewed two RAND studies on herbicide crop destruction. The RAND studies concluded that the present deliberate crop destruction program does not deny food to VC main forces, that large numbers of civilians are affected, and that present crop destruction programs alienate rural people. However, new data shows that MACV crop destruction programs are highly selective as to target, and local results are generally restricted to enemy areas. We conclude that the RAND studies do not evaluate the MACV deliberate crop destruction program as it is carried out, that MACV has established that effects of its crop destruction program are highly concentrated in VC controlled areas, and that further checking is needed of new CINCPAC data which suggests that the number of civilians affected is small. Also, we conclude that answers are still needed to the questions about the adequacy of the allied explanation of all herbicide programs and indemnification for accidental crop destruction. Finally, we conclude that further study is needed of the questions RAND raises about the relation of these programs to pacification.

In November 1967 we reviewed two RAND studies ^{1/} (henceforth referred to as the evaluation study and the statistical study) of the chemical crop destruction program in South Vietnam. The studies are based on interviews of 206 and 207 returnees respectively. After summarizing the studies, we commented along the following lines: a) the samples of interviewees are small, b) the results of mere warning to peasants of impending spraying may result in an undesired generation of refugees, and c) "we agree with RAND that the present wholesale crop spraying program is counterproductive because it neither denies food to the VC nor prevents alienation of the affected population."

Since November, JCS, CINCPAC and MACV have provided evidence that have caused us to reexamine our November evaluation of the RAND reports. In our comments below on the RAND, and the military positions, we modify our November views on the effects of crop destruction programs on the peasant and the question of VC food denial.

1. Can and does the MACV herbicide crop destruction program deny the VC food?

RAND concludes that "because of the wide access the VC have to resources throughout most areas of Vietnam...it would be difficult to destroy enough food to prevent the VC from eating." "Significant or crippling effects on VC rice consumption would result only if a major proportion (perhaps 50 percent or more) of the rural economy were destroyed." "The data consistently suggest that the crop destruction program has not in any sense denied the VC food." "Further, no significant relationship was noted between VC rice rations (main force) and the percentage of regional rice lands sprayed."

^{1/} Russell Bettis and Frank Denton, An Evaluation of Chemical Crop Destruction in Vietnam, Room 5446 - ISA/ARPA, September 1967, & Anthony J. Russo, A Statistical Analysis of the VC Crop Spraying Program in South Vietnam, Room 5450 - ISA/ARPA, September 1967.

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JCS, CINCPAC and MACV state that crop destruction targets are located in VC controlled, sparsely populated, rice deficit areas. MACV seeks to deny a ready rice supply to VC units operating in remote areas, to divert VC manpower to crop production and to weaken VC strength in these areas. Spray aircraft during 1967 received 297 hits from ground fire in 622 crop destruction sorties, thus indicating the hostile terrain over which they fly. JCS reports that MACV destroyed 82,000 tons of rice in 1967. JCS asserts that captured documents (which report local food shortages, diversion of VC/NVA forces to food gathering forays, and diversion of troop labor to grow food) support the effectiveness of the MACV crop destruction program.

SEAPRO Comment. The RAND statistical study uses a methodology which leads to a logically valid conclusion: food cannot be denied to a main VC force unit which has multiple avenues of access to the rural economy. The key points are access and a VC logistical system which can transfer food to herbicide affected areas. Local crop destruction cannot deny the VC main forces food if there is no effective control of food moving between VC controlled and secure areas. We agree with CINCPAC that the MACV program aggravates VC/NVA supply problems and forces them to divert combat troops to obtain food. The amount of impact remains to be determined. We note that MACV has no systematic, quantitative evaluation of its crop destruction program. We believe that the RAND statistical study model might be useful in evaluating the effects on a local area targeted by MACV when MACV secures the relevant data on its herbicide operations.

2. How many civilians are affected by crop destruction?

RAND analysis "indicates that the civilian population seems to carry very nearly the full burden of the results of the crop destruction program; it is estimated that over 500 civilians experience crop loss for every ton of rice denied the VC." The RAND statistical study estimates that 325,000 persons had their crops sprayed in 1966.

CINCPAC reports that 63% of all missions were flown against areas where population data indicates there are less than 50 inhabitants per square mile (87% where population density is under 250/sq mile). Therefore, CINCPAC uses average civilian population density in areas of deliberate crop destruction to estimate that a maximum total of 62,000 persons are directly affected.

SEAPRO Comment. MACV destroyed enough food in 1967 to feed approximately 779,000 people, using a CINCPAC estimating technique. RAND points out that much labor is required to grow rice. Therefore, the population density in the areas around rice paddies is high enough so that the MACV estimate of 62,000 persons affected understates herbicide effects. The RAND suggested order of magnitude of hundreds of thousands is probably correct. Enemy control of areas selected for crop destruction prevents collection of precise civilian loss data.

3. What effect does crop destruction have on the Vietnamese population?

RAID's evaluation study considers the effects of all (both defoliation and crop destruction) programs on crops. Chemical sprays used for defoliation sometimes spill over and destroy friendly crops. The evaluation study concludes that, "it would appear that the crop destruction effort may well be counterproductive....to any long range US/GVN pacification objectives." RAID interviews uncovered deep seated peasant hostility to herbicide operations which result in crop destruction. Psychological operations messages concerning the purpose of US/GVN crop destruction programs had reached only five of 205 interviewees. Further, RAID interviews indicate that MACV indemnification for accidental destruction of crops is ineffective. RAID states that the resulting alienation of people in the countryside is responsive to the GVN, and results in hatred towards the US.

JCS and MACV do not address this RAID claim directly. JCS reports that 98% of crop destruction sorties are targeted on VC controlled (75%) and uninhabited areas (22%). The GVN has an ongoing program to tell the people in these areas that crop destruction will cease if they drive the VC out. MACV has no program to indemnify Vietnamese whose crops it has deliberately destroyed because they are enemy. The GVN considers all persons in VC controlled areas to be VC. Consequently, there is no indemnification for crop destruction of civilians except that which occurs accidentally as the result of defoliation operations in areas classified by the GVN as secure. Here, the GVN Province Chief investigates losses and provides indemnification under MILCAP procedures.

SEAPRO Comment: RAID raises important questions about the amount of accidental crop destruction and also allied policies towards the civilians in areas under VC control. The JCS response that 98% of deliberate crop destruction sorties are targeted on VC and uninhabited areas makes it clear that this program is not counterproductive to short range pacification efforts which generally avoid VC controlled areas. In the long run, however, we have doubts about any program that treats all civilians in VC controlled areas as permanent enemies.

As to accidental damage and indemnification, RAID does not provide proof that the present indemnification program is inadequate. Its study makes plain that failure promptly to compensate peasants who suffer crop loss through the defoliation program alienates the peasantry, but the length and pervasiveness of delays in indemnification need documentation. A US investigation must establish the status of compensation and, if appropriate, generate US/GVN follow-up action to cut delays in indemnification. We also suspect that a better job needs to be done in explaining defoliation operations to those affected.

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THE HERBICIDE ISSUE

Summary. A review of articles and letters in Science magazine, a publication of the American Association for the Advancement of Science (AAAS), reveals that a prolonged and thoughtful dialogue on the use of herbicides in RVN has taken place. Most contributors oppose the use of these agents, primarily because of ecological, sociological or economic considerations. In many cases the opposition is based on views extrapolated from limited data.

Four findings appear to be indisputable:

- Areas north and west of Saigon (War zones C & D), the Rung Sat Special Zone, the DMZ, and portions of the coastal area of Southern MR IV have been sprayed heavily and repeatedly.

- Mangrove forests (such as the Rung Sat Special Zone) are very vulnerable to defoliants. A single application kills most trees.

- Repeated spraying kills most trees, mangrove or not. This is the situation in War Zones C and D.

- Regrowth of heavily defoliated areas is inhibited by invasion of bamboo.

All other claims are not well supported by documentary evidence and have been subject to much dispute. The claims include toxicity to man or animals, increased birth defects, climate changes, hardening of soil, psychological impact, and social changes. Most researchers feel they can be substantiated with further studies. They undoubtedly hope the Defense sponsored study by the National Academy of Sciences will provide definitive support for the claims.

The articles in Science are well written, academic works. The authors are generally careful to identify opinion, conjecture or weak arguments. Research is well documented and up to date. The letters about herbicides published in Science are less objective, tending to reflect the bias of the authors.

The people involved in the dialogue should not be dismissed as wild-eyed young radicals. They are, for the most part, respected members of the academic and scientific establishment. The dialogue has served to sharpen their arguments, focus attention on the important and high impact issues, and will almost certainly influence the direction of congressional inquiry and interest.

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THE HERBICIDE ISSUE

A review of the herbicide articles in Science Magazine (the publication of the American Association for the Advance of Science) indicates that:

- The scientific dialogue on the use of herbicides in Vietnam has been long and thoughtful.
- Most contributors are opposed to the use of herbicides primarily on ecological, sociological and economic grounds.
- Their opposition is based mostly on views extrapolated from limited data.
- The three articles (in the last two years) are well written and thoughtful. The various authors are careful to identify opinion, conjecture, and weak arguments. Research is well documented and up to date.
- The letters contributed to Science on herbicides do not show the same balanced and reasoned approach. The preconceptions of the authors (usually negative) definitely come through.

Review of Articles

In the past few years, there have been ten major articles on herbicides. The three articles reviewed below, appeared in the last two years. They concentrate on the use of herbicides in Vietnam.

There seems to be clear agreement that:

- mangrove forests are very susceptible to herbicides,
- tree mortality in other types of forests increases greatly with repeated spraying,
- bamboo invasion of areas which experience high tree loss is a serious problem which could retard (or possibly prevent) a site returning to its natural state.

There also seems to be agreement that there is insufficient evidence concerning:

- toxicity of agents to man or animals,
- long range effects,
- herbicides causing birth defects in humans,
- contamination of food chains,

- hardening and contamination of soils,
- irreversibility of damage,
- social and psychological effects,
- economic impact.

This may indicate why members of the AAAS are in favor of, and may have encouraged, Congressional support for the NAS study.

Defoliation in Vietnam, Fred H. Tschirley, February 2, 1969:

Mr. Tschirley, a member of the US Department of Agriculture, presents a balanced picture of the program (his efforts were the basis of the US Embassy's 1968 Policy Review). He identifies the apparent sensitivity of mangroves to herbicides, bamboo invasion of defoliated forests, and the killing of trees by repeated spraying as the most severe problems.

Tschirley addresses, and largely dismisses, climatic effects, laterization (hardening) of soil, inability of the forests to regenerate (except for mangroves and sites invaded by bamboo), and toxicity to man or animals. He concludes there have been ecological effects, but they are not irreversible.

Ecological Effects of the War in Vietnam, G. H. Orians and E. W. Pfeiffer, May 1, 1970.

Drs. Orians and Pfeiffer, zoologists from the Universities of Washington and Montana, respectively, have authored a comprehensive article which deals mainly with herbicides (although its title would lead the reader to expect a more balanced treatment of the war's total impact). They confirm the susceptibility of mangrove to herbicides, and the repeated spraying and bamboo invasion problems noted by Tschirley. They specifically note there is little evidence of direct toxic effects on animals. They discuss the impact of herbicides on rubber plantations in great detail, but conclude that (1) the problems of the rubber plantations are the result of multiple factors and (2) they cannot assess the relative importance of each factor.

The remainder of the paper is subtly negative - much conjecture based on limited observation. In at least two cases (stating that the tiger population has probably increased by feeding on battle casualties and stating that people are forcibly transported to Saigon) they are clearly trying to provoke a negative response.

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Herbicides in Vietnam: AAAS Study Finds Widespread Devastation (News & Comment), P. M. Boffey, January 15, 1971.

This is the magazine's coverage of the preliminary report of Dr. Meselson, Harvard University biologist, and his AAAS sponsored group, to the annual convention of the AAAS in Chicago. The article, identifying Meselson's conclusions as "assertions," weaves his report into a summary of recent White House actions, a review of the herbicide program, reactions of others at the convention, and criticism of other studies, notably those by the Army. The final study is to be presented "perhaps in a few months time."

Four main "assertions" were attributed to Meselson's group:

- there has been extensive killing of mangrove forest
- half the trees in mature hardwood forests north and west of Saigon (Note: War Zones C & D) are dead and massive bamboo invasion has taken place.
- crop destruction is nearly a total failure because the food would have been consumed by civilians (particularly Montagnards)
- no definite evidence of adverse health effects as a result of herbicide spray was found (Note: this conclusion was qualified and left open to future study).

Review of Letters

- Meyer Chessin, botanist, Univ. of Montana, responding to an article (not reviewed above) on benefits of herbicides in the control of woody plants, raises questions of animal toxicity and long range effects.

- Edwin D. Willis, biologist, Oberlin College, responding to the same article, disputes the point that grass developing on defoliated areas is useful, especially in tropical climates.

- K.C. Barrons, Dow Chemical Company, discusses the relatively low toxicity of herbicides to cattle and fish, especially with proper range management, in domestic applications.

- G.H. Orians, University of Washington, and E.W. Pfeiffer, University of Montana state that agent White (picloram & 2, 4-D) is being used in place of Orange (2, 4-D and 2, 4, 5-T) especially in MR III, because Orange tends to drift. They claim they saw much damage from drifting herbicides around Saigon. They then note the persistence of agent White in soil.

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- Clarence Leuba, psychologist, Antioch College, criticizes biologists for overlooking the reason herbicides are used--to save lives--and for taking outraged stands without viewing the whole picture.

- J.A. Duke and J.T. McGinnis, Battelle Memorial Institute, note the continuing dialogue on herbicides and suggest a ten point research program with the aim of leaving Vietnam better off thru environmental engineering.

- Roy M. Sachs, University of California, criticized Arthur Westing's (see next item) negative attitude, obvious bias, and lack of objectivity during the AAAS investigating team's visit to Ft. Detrick (and Boffey's account of Westing's visit in Science magazine). He accuses them of ignoring the military realities (especially in Cambodia) and reminds them that they must meet certain standards before they can expect to have access to classified information. The status derived from their appointment to an AAAS committee is not sufficient. Finally, he criticizes the AAAS study for not publishing the full report of dozens of experts at a conference last June.

- A.H. Westing, biologist, Windham College, responding to Sach's letter, agreed that his mandate from the AAAS was limited to an assessment of the biological effects of herbicides in RVN. He denies that he was preoccupied with only adverse effects. He passes off Sach's criticism of his remarks at Ft. Detrick as "inept attempts at humor" intended to break the ice. He concludes by stating that his "personal political and moral views are separate from and irrelevant to the AAAS study."

- William Haseltine, William R. Carter, and Ngo Vinh Long, Harvard University, commenting on the Orians and Pfeiffer article, claim that less attention should be paid to the corrosion of the ecology and more to the effects on Vietnamese society. They claim that defoliation is used to force people into cities. They conclude by calling for an extension of the AAAS resolution to banning the use of all herbicides in war.

- G. H. Orians and E. W. Pfeiffer, replied to Haseltine, Carter and Long's letter, expressing complete agreement and stating their regret that time, circumstances, and evidence did not permit a fuller treatment of the social issue. They state that the 1969 goal of the pacification program was to get 90% of the population under US control and then tied this to an alleged US policy of "moving people from the countryside, which we cannot control, to the cities which we can control."

- Ambassador R. W. Komer, commenting on the Orians and Pfeiffer letter above, categorically denied the accusations they made and correctly stated the pacification goal. He also emphatically pointed out that he "had nothing to do with the (herbicide) program," and objected to "assertions that the pacification program was in any way associated with destroying Vietnam's ecological balance or society." He did not attempt to defend the herbicide program.

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A PRELIMINARY RESPONSE TO
CRITICISM OF THE USE OF HERBICIDES IN RVN

Criticism

Critics contend that herbicides have devastated Vietnam. Specifically they have charged that:

- herbicides are responsible for increased birth defects and infant mortality.
- severe - possibly irreversible - damage has been done to Vietnam's ecology.

The American Association for the Advancement of Science (AAAS) is at the center of the controversy. The scientific and academic community is heavily represented in the association's membership.

Probably the most vocal and widely-quoted critic within AAAS, is Dr. Matthew Meselson, Harvard University biologist. Dr. Meselson recently chaired the AAAS Herbicide Assessment Commission and visited Vietnam in December. In a statement to the AAAS convention in January 1971, Dr. Meselson was reported to have stated:

- "One-fifth to one-half of South Vietnam's mangrove forests, some 1400 square kilometers in all have been 'utterly destroyed,' and even now, years after spraying, there is almost no sign of new life coming back."
- "Perhaps half the trees in the mature hardwood forests north and west of Saigon are dead, and a massive invasion of apparently worthless bamboo threatens to take over the area for decades to come."
- "The Army's crop destruction program, which seeks to deny food to enemy soldiers, has been a near total 'failure,' because nearly all the food destroyed would have been consumed by civilian populations, particularly the montagnard tribes of the Central Highlands."
- "There is no definite evidence of adverse health effects, but further study is needed to determine the reason for a high rate of still-births in one heavily sprayed province and for an increase in two particular kinds of birth defects which were reported at a large Saigon hospital and which were coincident with large scale spraying.^{1/}

^{1/} Herbicides in Vietnam: AAAS Study Finds Widespread Devastation (News & Comment) P. M. Boffey, Science, January 15, 1971.

A Preliminary Response

- Pictures taken on January 25, 1971 show that in the Rung Sac Special Zone, the most frequently sprayed mangrove swamp, the effect of defoliants is quite evident, but the forest is far from "utterly destroyed." Moreover, there is ample evidence of regrowth.

- Pictures taken on January 26, 1971 of the hardwood forested area north and west of Saigon show a dense canopy. Some dead trees are evident (perhaps 10%--far fewer than 50% as charged by Meselson).

- The "failure" of the crop destruction program appears to be a generalization made by Dr. Meselson from an aerial reconnaissance of a single area in Quang Ngai province which was a recent crop destruction target. The conclusion was "substantiated" by reference to "several classified studies conducted under military auspices since 1967 which have come to a similar conclusion." The studies referenced undoubtedly include two RAND studies.^{2/} We feel these studies are not adequate to demonstrate the failure of the crop destruction program. On the other hand, we are not yet able to make a case for the military effectiveness of crop destruction--this question will be addressed by an ODDR&E sponsored contract study (which will complement the National Academy of Science Study looking into the effects of herbicides on the ecology and people of RVN). Interrogation of prisoners and Hoi Chanh indicates that VC/NVA forces in the northern regions suffer from serious food shortages and much of their effort is devoted to subsistence rather than military activity. Crop destruction's role, if any, in creating this situation should emerge from the ODDR&E study.

- We agree that there is no definite evidence of adverse health effects, while the jury is still out on the question, DCD has forgone the use of the most effective defoliant, agent Orange, as a precautionary measure. It is conceivable that the higher instances of birth defects and infant mortality noted by Meselson could be the result of defoliation. But they could also be the result of more people receiving medical care, which in turn would tend to generate more complete reporting of such statistics.^{3/}

- The possibility that agent Orange may be linked to birth defects has resulted in intensive study. Several efforts are now in progress. Since the chemicals in "Orange" are widely used by farmers in this country, the toxicity problem has to be resolved regardless of what happens to the herbicide program in Vietnam.

- 2/ a. A Statistical Analysis of the US Crop Spraying Program in RVN, RM-5450-ISA/ARPA, A. J. Russo, The RAND Corp., October 1967.
- b. An Evaluation of Chemical Crop Destruction in Vietnam, RM-5446-ISA/ARPA, R. Betts and F. Denton, the RAND Corp., October 1967.
- 3/ Although recent figures are not available, the number of beds in hospitals giving consultation and maternity services showed a steady increase from 1961-1968. In 1968 there was a 30% increase in beds available (16,342 vs 12,582 in 1967). The number of government physicians increased 65% in two years (397 in 1968 vs 240 in 1966). Self employed physicians increased 22% (1252 in 1968 vs 1028 in 1967). (Vietnam Statistical Yearbook - 1968).

Character of the Issue

The entire herbicide issue is emotionally loaded. The effect on the objectivity of those studying the problems associated with herbicide use is illustrated by the following example.

In December 1967, the AAAS established a formal committee entitled "the Committee on Environmental Alteration." Although this committee had not been set up specifically to study the Vietnam problem, the pressures to do so and to pre-judge the findings were so great that its Chairman, Dr. David R. Goddard, resigned. He explained his action in the following statement:

"One might think that professional scientists would not expect the committee to reach conclusions before it has received scientific evidence, but this is clearly not the case. The correspondence reaching my desk, and the telephone calls--many of them from very distinguished scientists--indicate that many people have prejudged the issue before any committee can be formed. Outsiders are trying to determine the composition of the committee, and the conclusions that it will reach."

In July 1968, the AAAS Board of Directors issued a policy statement recommending essentially that a field study be conducted under the direction of the United Nations to assess the ecological impact in Vietnam.

Later, after receiving a DOD sponsored study of the ecological effects of repeated use of herbicides, in March 1969, the Board decided it should review the report because of the difficulties of getting an unbiased committee together.

^{4/} House, W. B., et al. Assessment of Ecological Effects of Extensive or Repeated Use of Herbicides. Kansas City Missouri Midwest Research Institute; November 1967. (DDC AD 724-314).

THE IMPACT OF HERBICIDES: AN OVERVIEW

An analysis of data on herbicide operations in Vietnam shows that:

- Herbicides have not caused widespread devastation. From 1962-1970, herbicide has been sprayed on less than 10% of the land area of RVN.

- In 1967, the year of greatest herbicide use, less than 3% of the country was defoliated; about 2.4% of the land under cultivation was subject to crop destruction.

- HES shows that only about 3% of the population live in defoliated areas; less than 1% live where crops were destroyed.

We also determined that:

- Herbicide operations were conducted under rigid controls involving both US and GVN authorities at all levels.

- Crop destruction was confined to the lightly populated rice deficit highlands of MR's 1 and 2; at no time were crops destroyed in the country's food producing centers (MR 4). Since 1967, the primary targets have been plots of mountain rice and vegetables in hostile areas.

- Most (about 90%) crop destruction was confined to areas in and around known enemy base areas.

Recent pictures taken of heavily defoliated areas show:

- There is considerable regrowth of foliage in the hardwood forests.

- Mangrove swamps (which are very sensitive to herbicides) still show considerable effects. However, there is definite evidence of regrowth along waterways.

- Clearing vegetation with herbicides appears to be much less destructive and certainly less permanent compared to the alternative methods commonly used in areas where military operations are conducted or where military installations are located (eg. Rome plows, "daisy cutters," blasting, petroleum sprays, burning, etc.).

The four plots attached show where herbicide missions were flown in relation to populated areas in RVN.

As can be seen, large scale defoliation (Maps 1 and 2) has been used to help counter VC/NVA forces in:

- The DMZ and mountains of MR 1

- Western Kontum and Pleiku

- War zones C and D

- Mangrove swamps in the Rung Sat Special Zone, the U Minh Forest, the Ca Mau Peninsula and the coast of Vinh Binh and Kien Hoa provinces.

Maps 3 and 4 show the areas where crop destruction missions have been flown from 1965-1970 (map 3) and during 1967 (map 4).

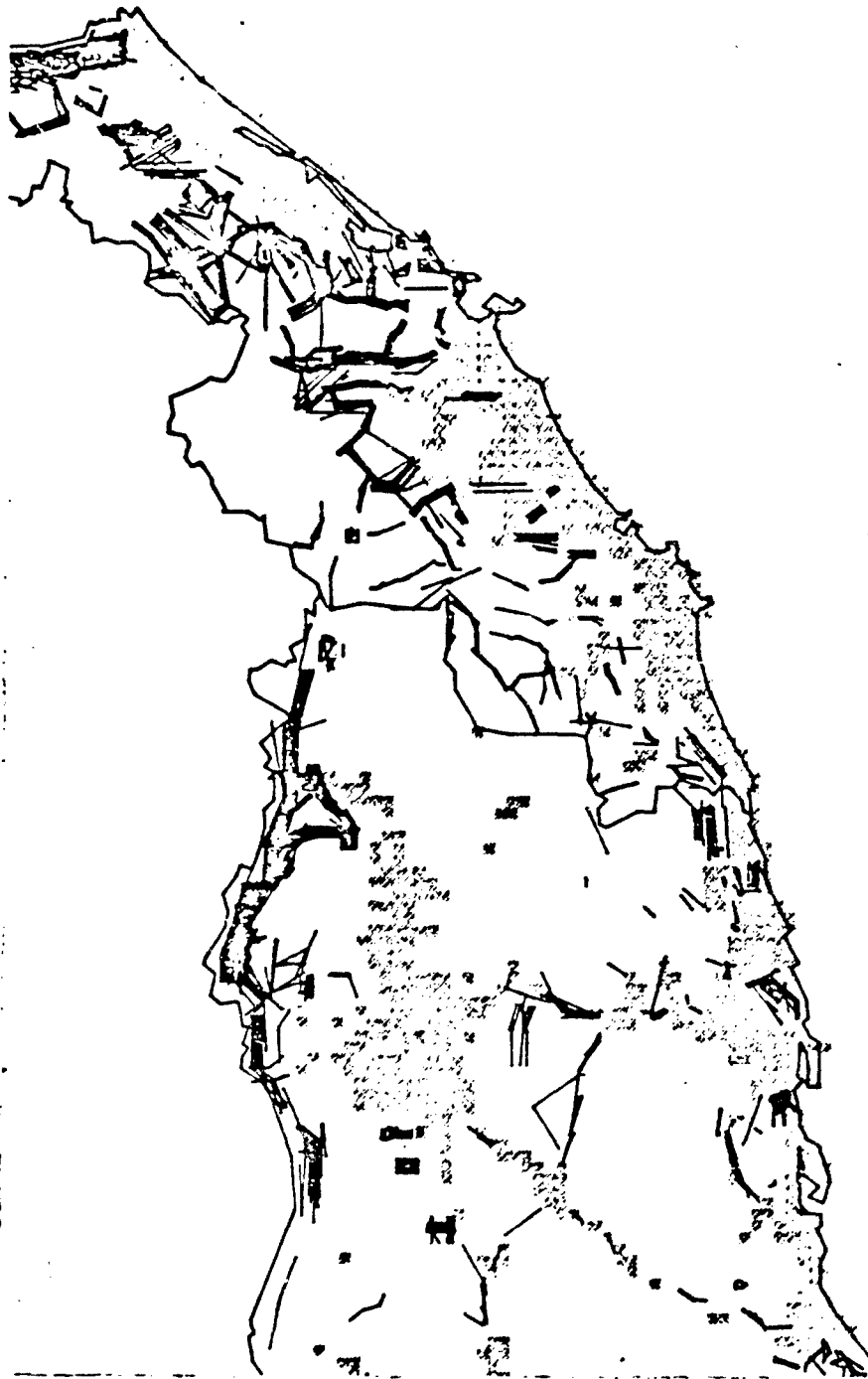
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**SOUTH VIETNAM
DEFOLIATION MISSIONS**

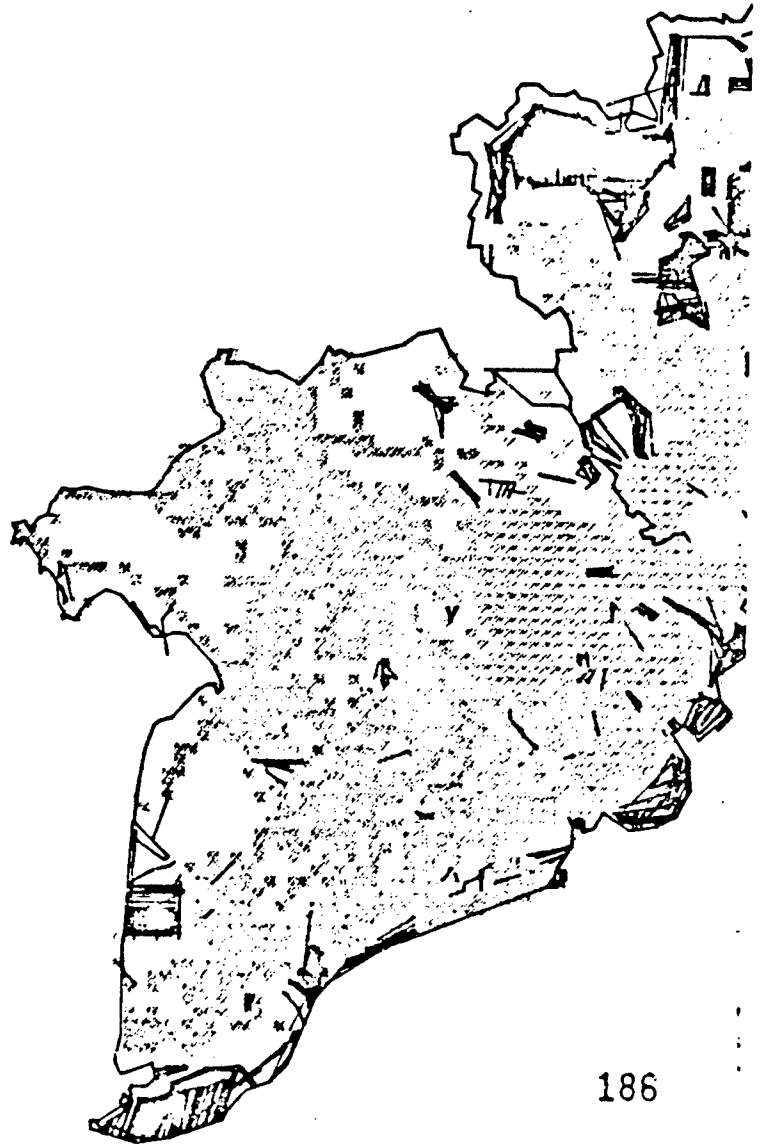
JANUARY 1965 - FEBRUARY 1971

— Mission track

▣ Populated area

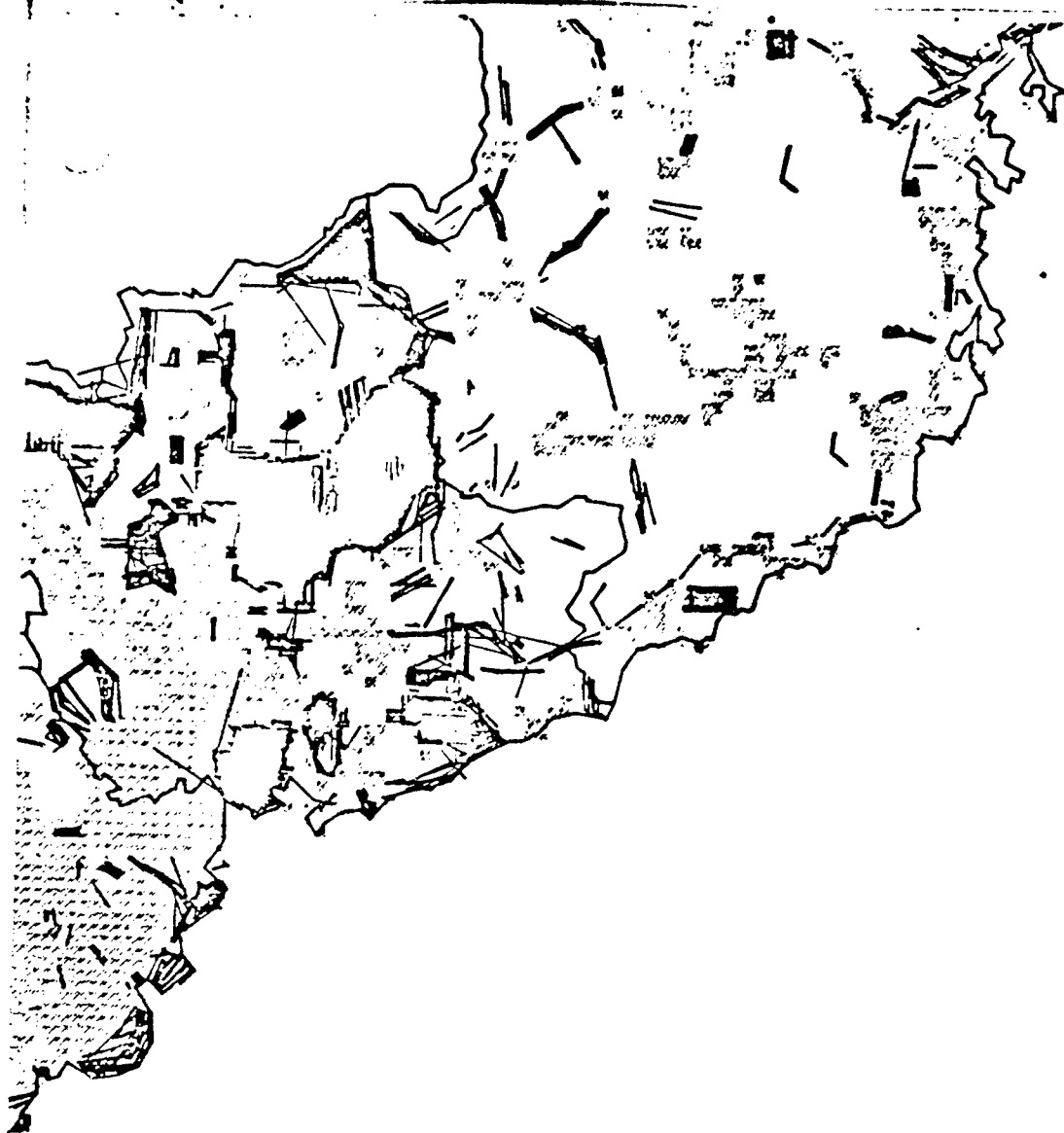


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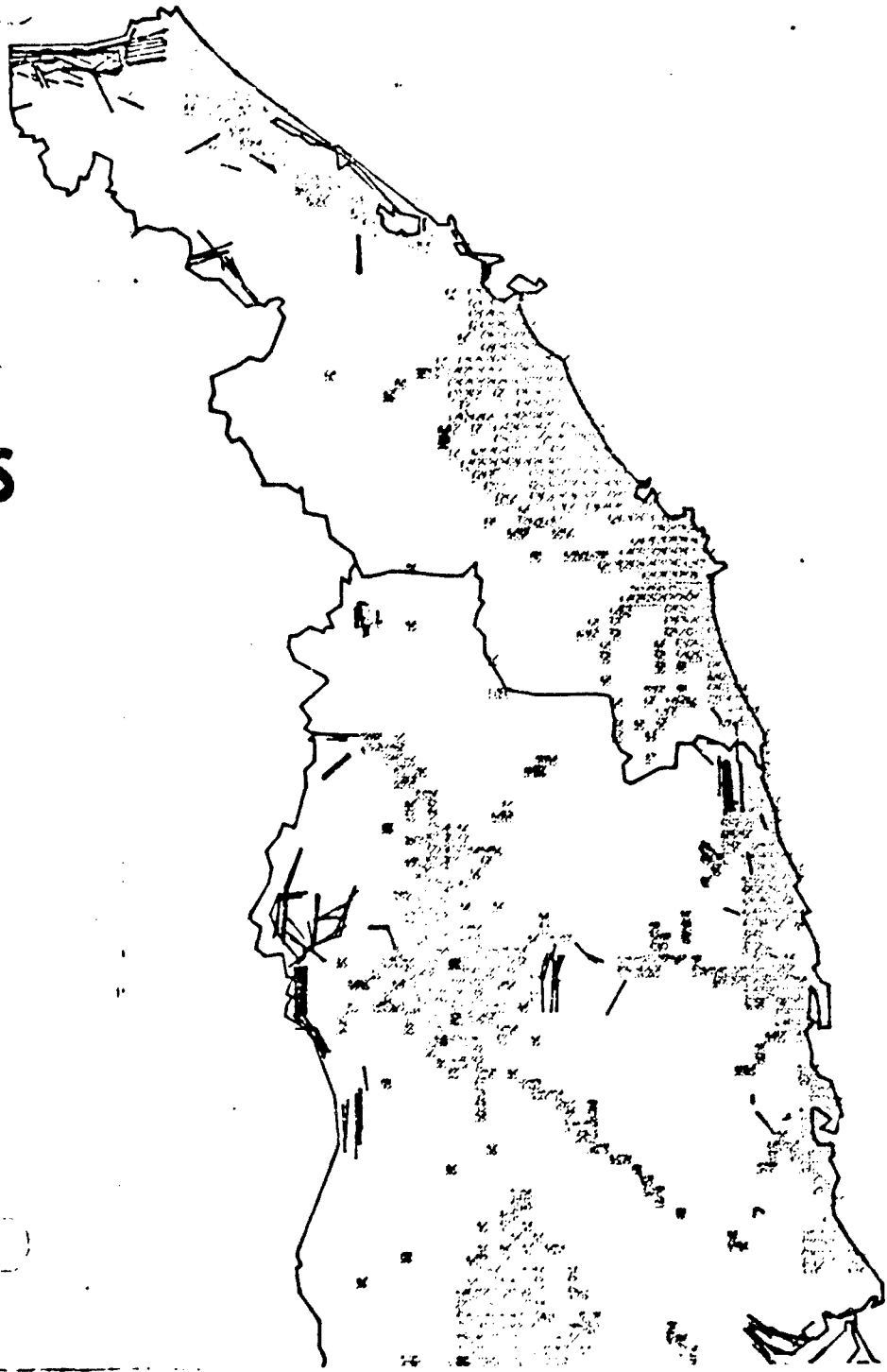


**SOUTH VIETNAM
DEFOLIATION MISSIONS
JANUARY - DECEMBER 1967**

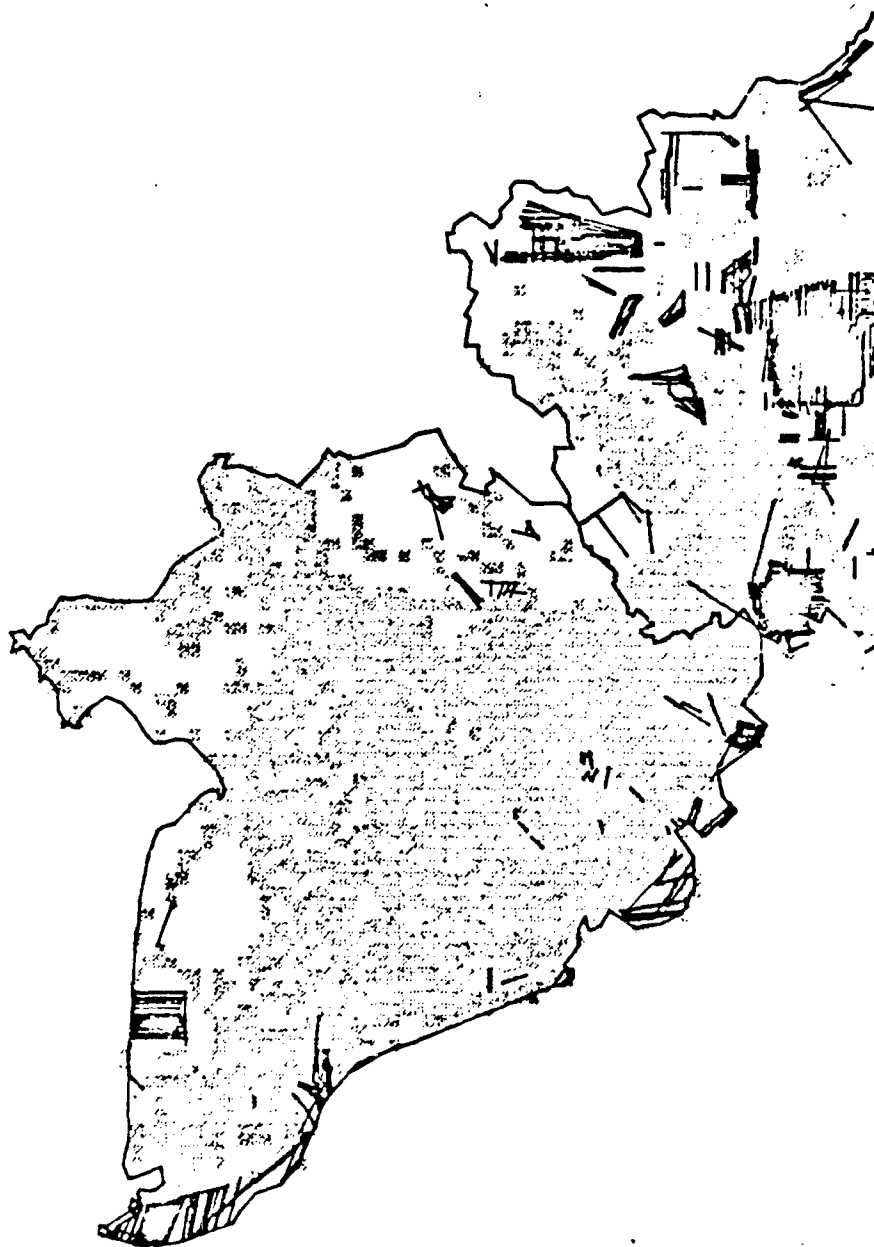
- Mission track
- Populated area

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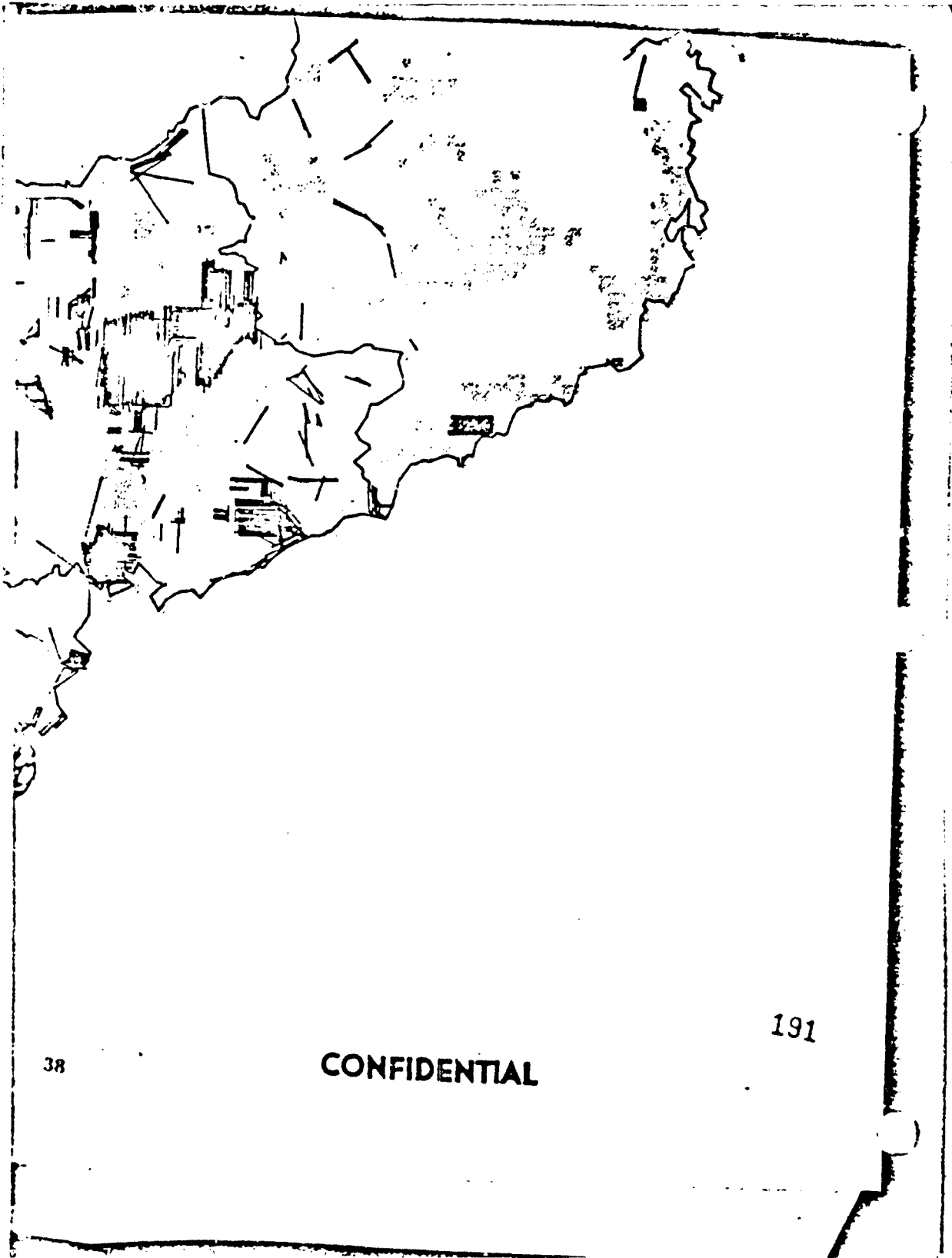
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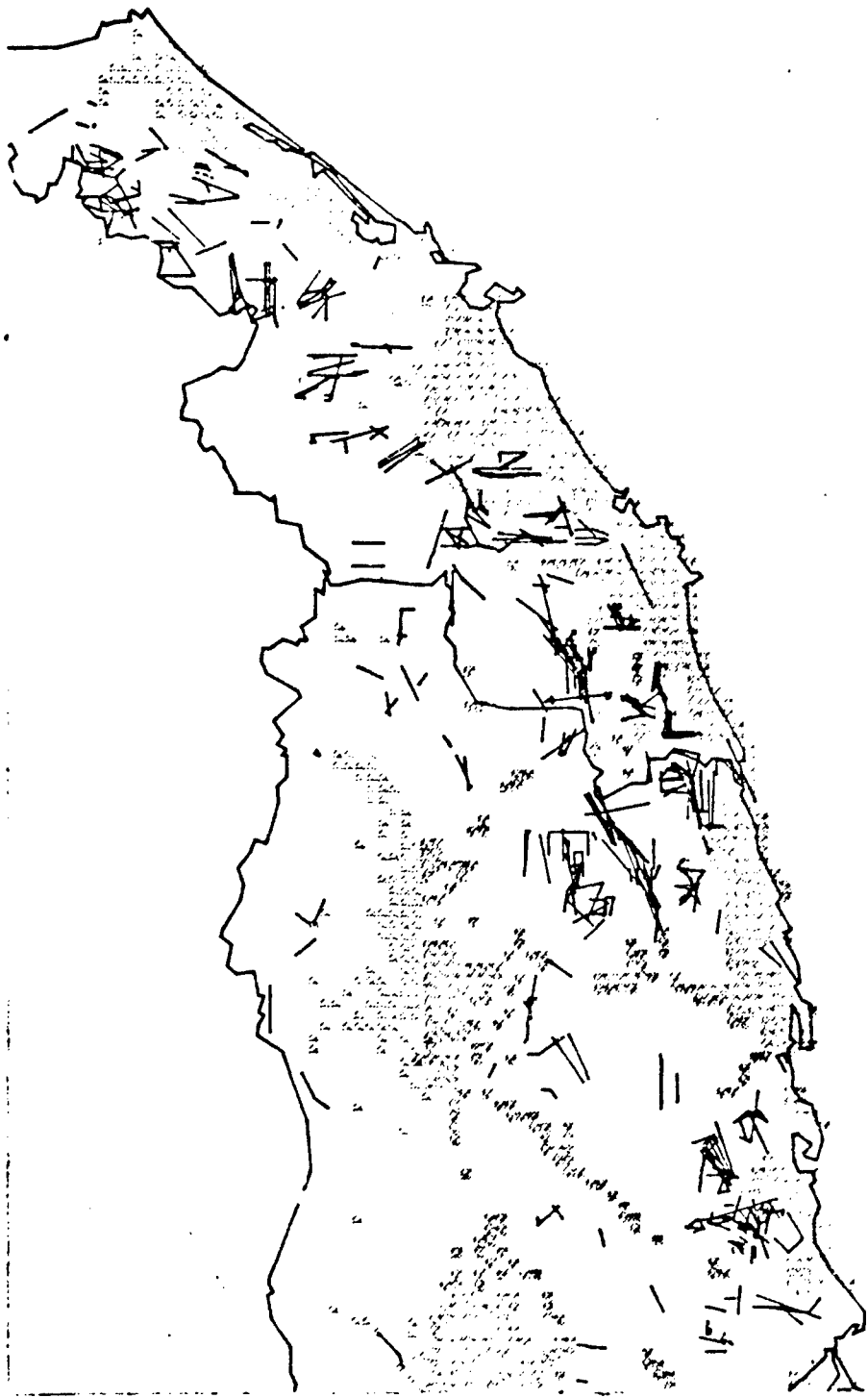
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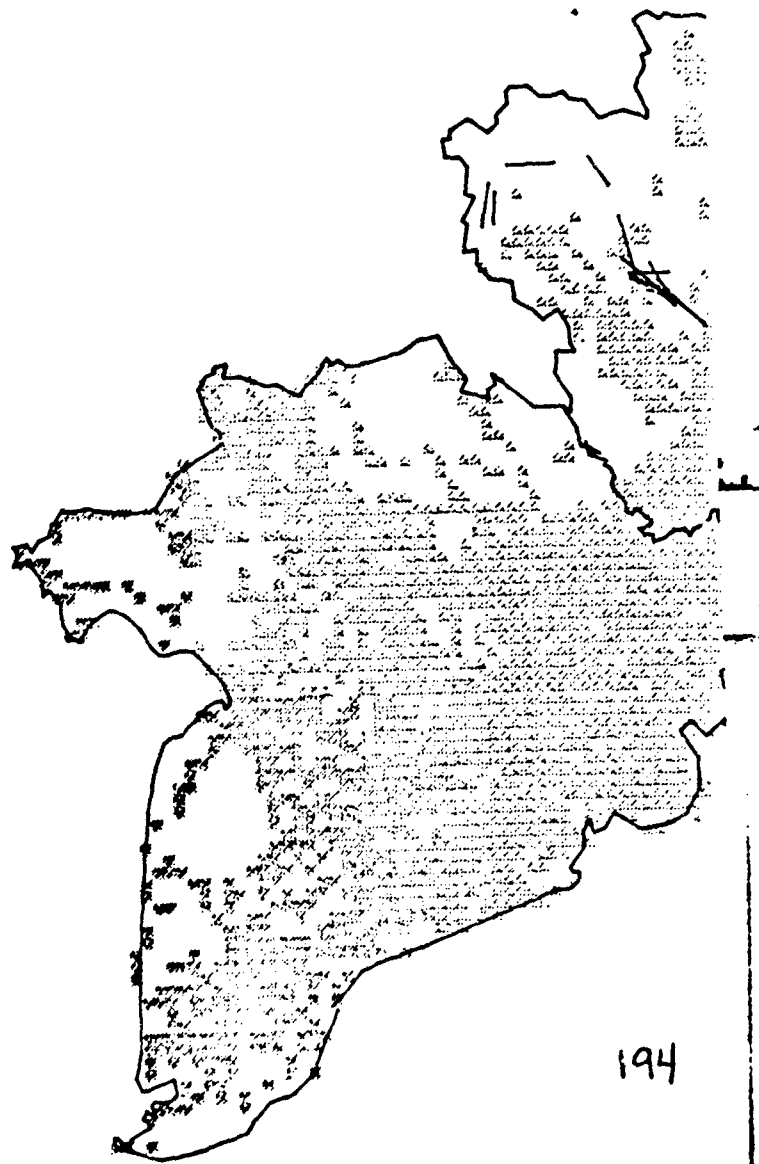
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SOUTH VIETNAM
CROP DESTRUCTION MISSIONS
JANUARY 1965 - FEBRUARY 1971

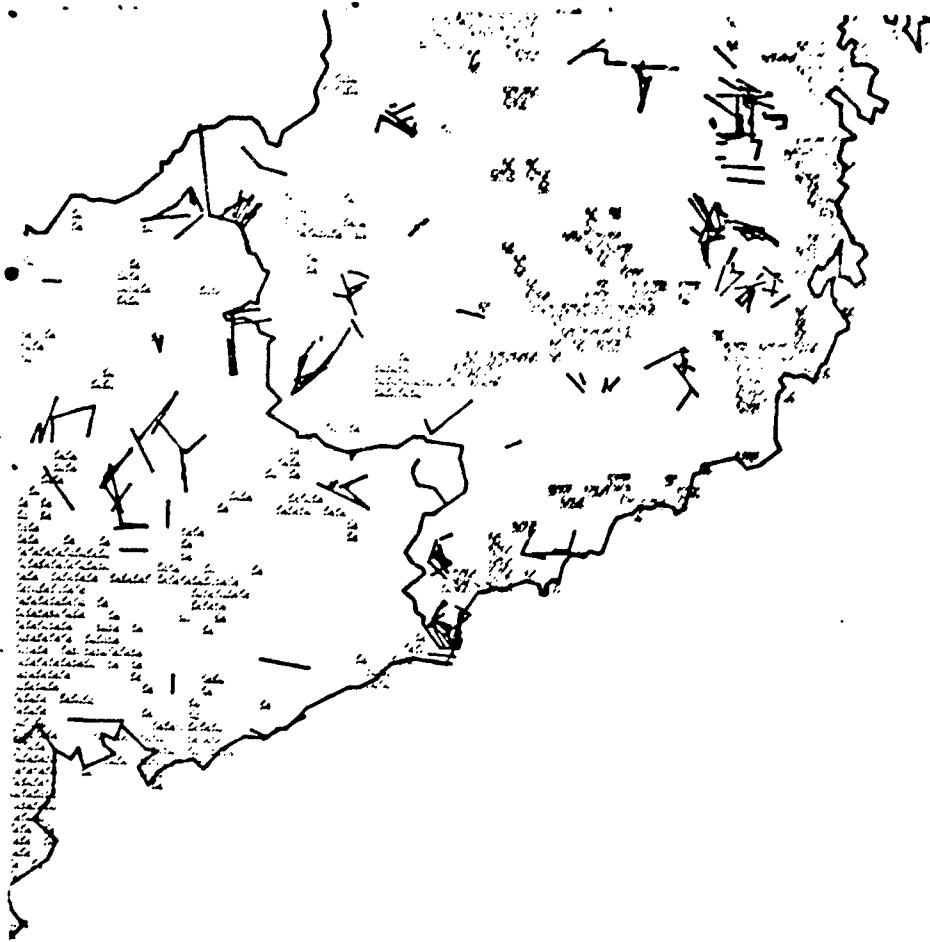
— Mission track
■ Populated area



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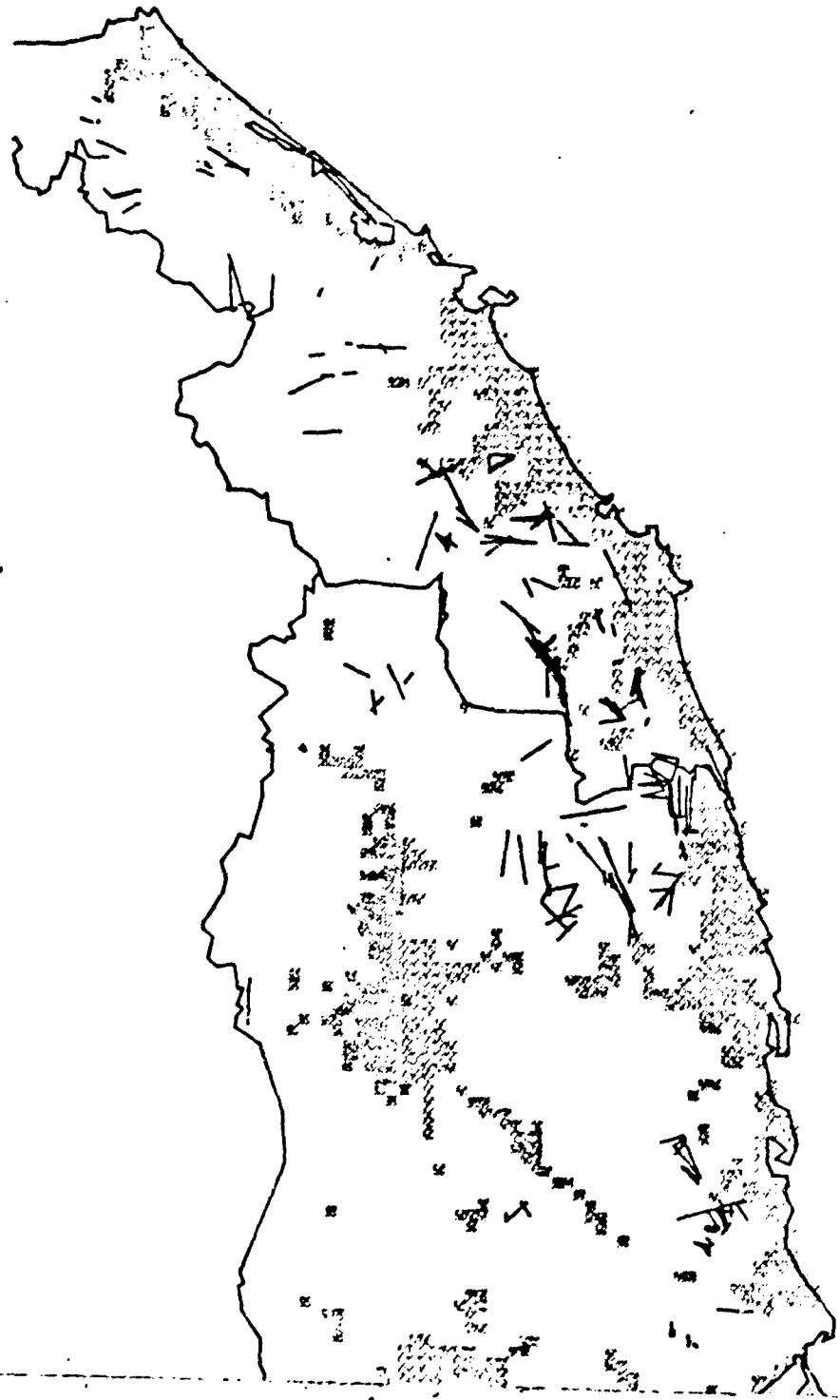


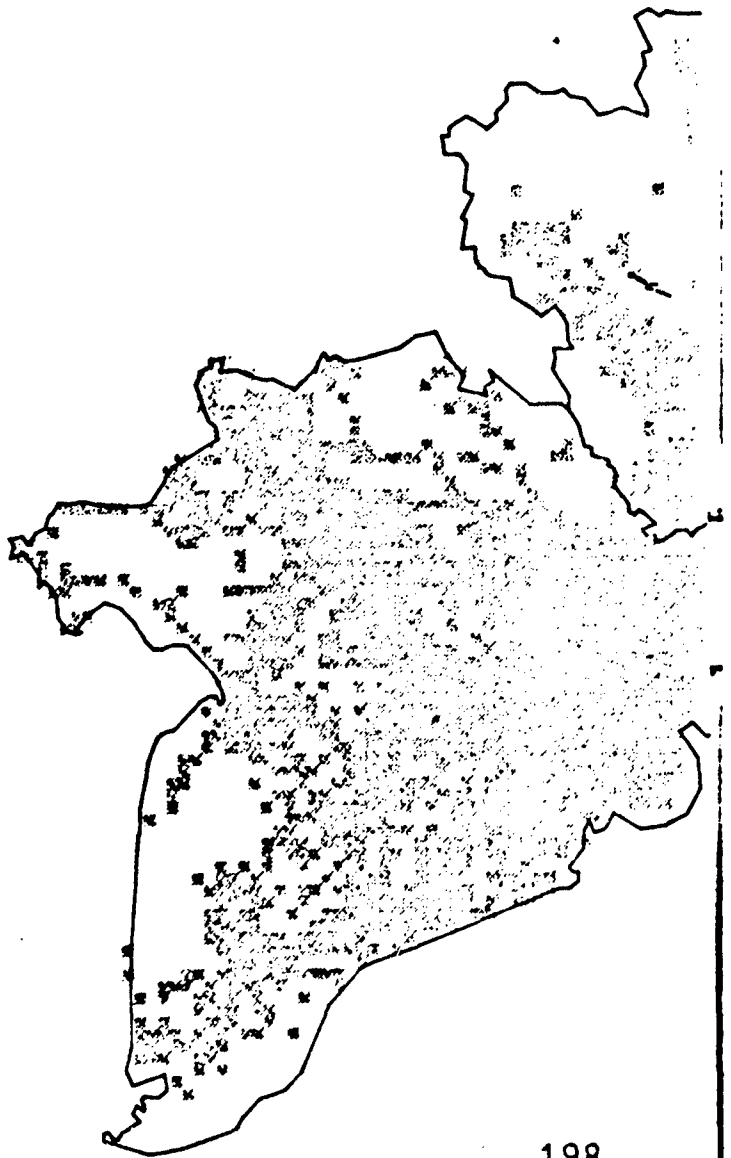
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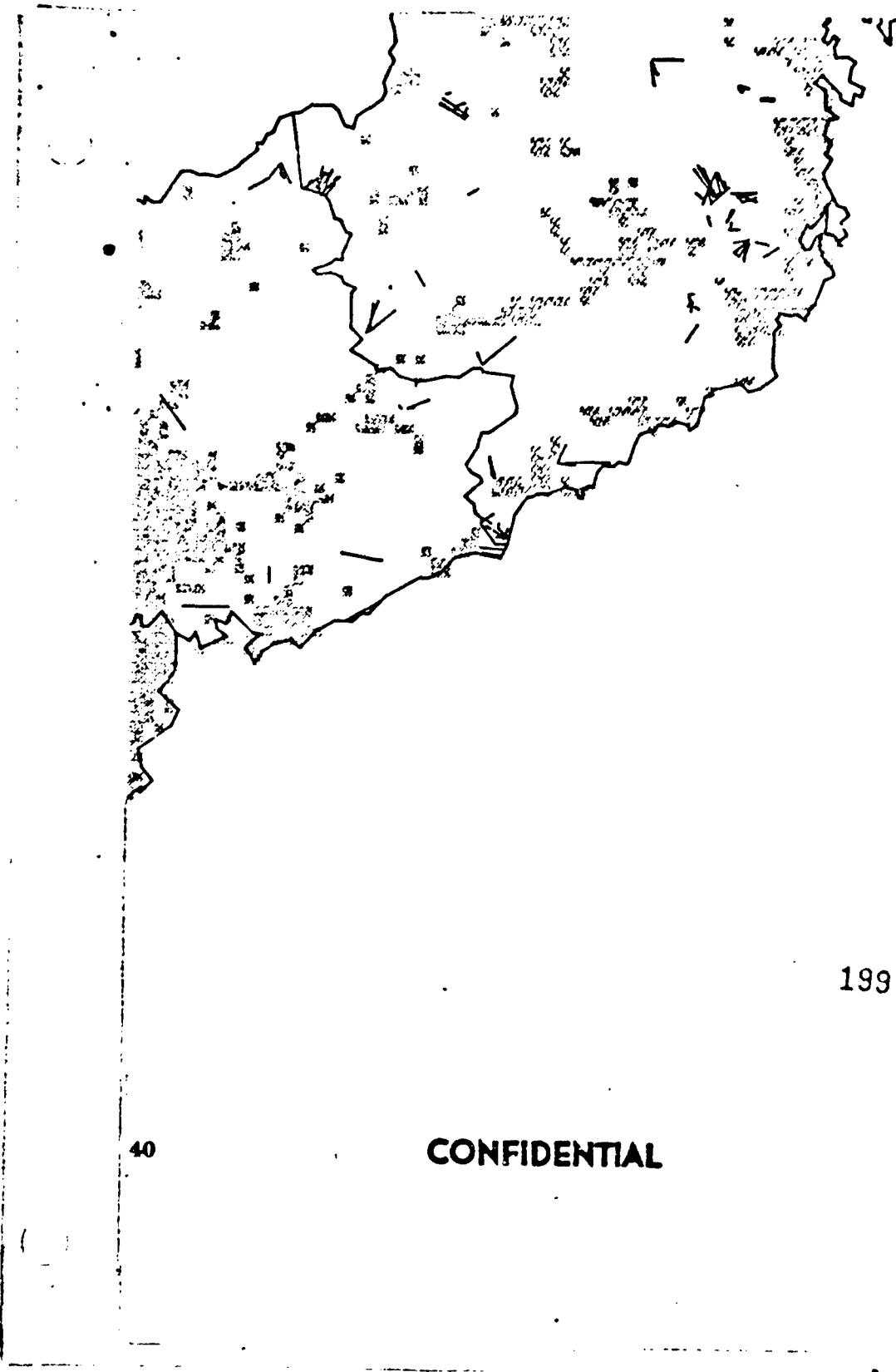
SOUTH VIETNAM
CROP DESTRUCTION MISSIONS
JANUARY - DECEMBER 1967

— Mission track
■ Populated area

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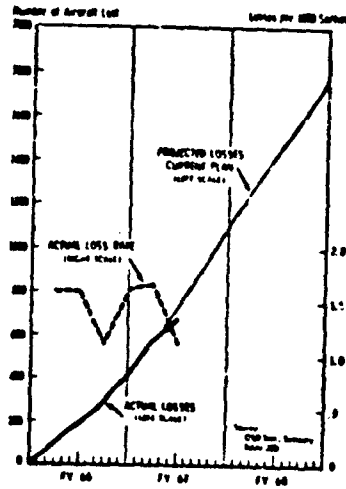
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SOUTHEAST ASIA LOSSES-US AND VNAF

TOTAL LOSSES AND OVERALL LOSS RATE



**TABLE 1
TOTAL LOSSES**

	Actual			Current Plan		
	Dec 1966	Nov 1966	FY 1967 Thru Dec 66	FY 1966	Jul 65 - Dec 66	Jul 65 - Dec 66
Fighter and Attack A/C						
On Attack Sorties						
SVN	8	4	38	73	111	113
NVN	14	15	144	177	321	354
Laos	1	3	10	39	49	55
On Other Sorties	4	2	20	24	44	47
All Other Losses	5	9	48	98	146	152
Total	32	33	260	411	671	721
Air Force	23	20	170	209	379	402
Navy	8	9	70	152	222	243
Marines	0	3	11	29	40	44
VNAF	1	1	9	21	30	32
Total	32	33	260	411	671	721
Ground Fire	17	21	174	258	432	
SAM	8	1	19	16	35	
MIG	2	0	7	2	9	
Other	5	11	60	135	195	
Total	32	33	260	411	671	

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TABLE 1 (Cont.)

TOTAL LOSSES

	Actual					Current Plan
	Dec 1966	Nov 1966	FY 1967 Thru Dec 66	FY 1966	Jul 65 - Dec 66	Jul 65 - Dec 66
<u>Rece/ECM</u>						
Hostile - SVN	0	1	2	3	5	5
NVN	3	1	15	28	43	50
Laos	0	0	0	0	0	0
Subtotal	3	2	17	31	48	55
All Other Losses	0	0	4	7	11	13
Total	3	2	21	38	59	68
Air Force	3	2	15	17	32	36
Navy	0	0	6	18	24	29
Marines	0	0	0	3	3	3
Total	3	2	21	38	59	68
<u>Other Fixed Wing</u>						
Air Force	1	7	66	22	88	97
Army	2	7	31	34	65	66
Marines	2	0	3	1	4	3
VNAF	0	0	12	4	16	20
Total	5	14	112	61	173	186
<u>Helicopters</u>						
Army	22	29	247	214	361	361
Marines	3	4	27	64	91	91
Total	25	33	174	278	452	452

Aircraft and Helicopter Attrition

Total aircraft losses in December were 65, compared to 82 in November. (See Table 1) Losses of fighter and attack aircraft were 32, the lowest since the 24 losses in February 1966. Of the 32 fighter and attack aircraft lost, 27 were downed by enemy action. Hostile ground fire again accounted for the preponderance of the losses, 17; losses to SAMs increased to 8; losses to MIGs were up to 2; and 5 aircraft were lost in operational accidents.

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**SOUTHEAST ASIA SORTIES
US AND VNAF
FIGHTER AND ATTACK AIRCRAFT
TOTAL SORTIES AND OVERALL SORTIE RATES**

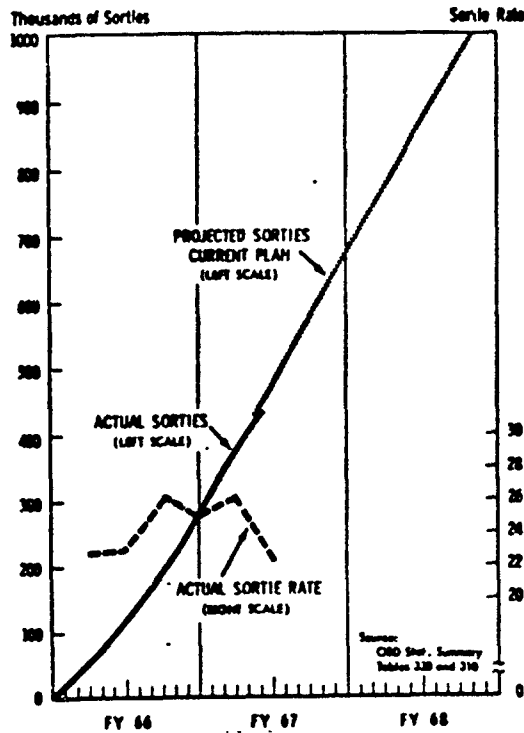


TABLE 2

	Total Sorties Actual			Current Plan	
	Dec 1966	Nov 1966	FY 1967 Thru Dec 66	FY 1966	July 65 - Dec 66
Attack					
SVN	13,246	13,005	79,814	144,876	224,690
VN	6,672	7,261	56,847	44,538	101,385
Laos	4,841	3,027	14,393	41,206	55,899
Subtotal	24,759	23,293	151,054	230,920	381,974
Other	4,832	4,412	28,941	47,090	76,031
Total Combat	29,591	27,705	179,995	278,010	458,005

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Sortie Rates

Monthly sortie rates (also, see Graph 2) dropped from 26.7 during the first quarter of FY 1967 to 22.3 in the second quarter, or about 16.5 per cent.

<u>Sortie Rates</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>
Air Force	28.7	27.5	27.0	25.4	24.8	25.6
Navy ^{a/}	25.0	22.5	21.9	15.6	15.8	17.1
Marines	38.9	37.9	37.0	27.3	28.2	29.4
Overall per quarter			26.7			22.3

The sharp decline in the Navy's sortie rate from September to October was caused by the fire in ORISKANY on October 26 and by the worsening weather conditions in NVN and its coastal waters resulting from the northeast monsoon. (This monsoon is dominant from October through January.) The sortie rates of all services, however, increased slightly in December.

Attack Sorties by Area

Attack sorties into NVN (Table 2) dropped to 6672, the lowest total since May, when 4457 sorties were reported. Attack sorties into Laos rose to 4841, highest since the 6044 in April, 1966. This shift of sorties from NVN to Laos will probably continue through the middle of February, if the expected weather cycle holds. Losses will probably remain near current levels in the next two months and begin to increase in the late winter and spring as more sorties are sent into NVN.

NVN attack sorties were overestimated by the Current Plan in November and December:

<u>Attack Sorties - NVN</u>	<u>Nov</u>	<u>Dec</u>
Current Plan	10,002	9,579
Actual	<u>7,261</u>	<u>6,672</u>
Difference	+ 2,741	+ 2,907

The shallow NVN/Laos weather cycle applied in the Current Plan will be recalculated in March/April 1967, based upon two full years of sortie experience in Southeast Asia. This should result in more accurate monthly sortie and loss predictions.

^{a/} Sorties are divided by the aircraft assigned to 5 SEVENTH FLEET CVAs.

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Actual losses since July 1965 continue to be less than planned losses for all aircraft types, except helicopters:

	<u>Fighter & Attack</u>	<u>Recce & ECM</u>	<u>Other Fixed Wing</u>	<u>Helicopter</u>	<u>Total</u>
Actual Losses	671	59	173	452	1355
Planned Losses	<u>721</u>	<u>68</u>	<u>185</u>	<u>452</u>	<u>1426</u>
Excess Predicted Losses	50	9	12	-	71

The reduced trend in aircraft losses is explained by three primary factors: lower loss rates, lower sortie rates, and fewer attack sorties in NVN. The following discussion focuses on fighter and attack aircraft.

Loss Rates

US and VNAF fighter and attack aircraft loss rates have been declining since October.

<u>Losses per 1000 Sorties</u>	1966					Jul 65- Dec 66
	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	
Overall	1.67	1.70	1.31	1.19	1.08	1.47
SVN	.21	.63	.68	.31	.60	.49
NVN	2.54	2.69	1.96	2.07	2.10	3.17
Laos	1.22	.79	1.73	.99	.21	.88

The overall loss rate in December, 1.08, is the lowest since February's rate, 0.97. Loss rates in NVN (the highest attrition area) have stabilized at about 2.0 for the past three months. (The high in CY 1966 was 4.25 in April). The Air Force and the Navy, which fly 90% of the attack sorties in NVN, have each experienced significant improvement in loss rates in recent months:

<u>Loss per 1000 Sorties NVN</u>	1966						Jul 65- Dec 66
	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	
Air Force	3.89	3.64	3.76	1.42	2.72	1.94	3.44
Navy	2.93	1.50	1.79	3.16	1.36	2.96	3.08

The factors contributing to the lowered loss rates are being examined by the Joint Staff and the Military Services and will be analyzed in future issues of this report.

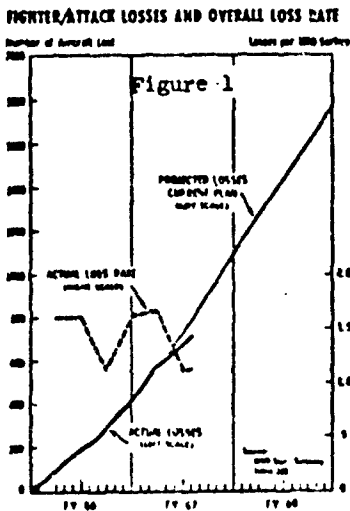
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SOUTHEAST ASIA AIRCRAFT LOSSES -US AND VNAF

TABLE 1
AIRCRAFT LOSSES

	Actual					Current Plan
	Jan 1967	Dec 1966	FY 1967 Thru Jan 67	FY 1966	Jul 65 - Jan 67	Jul 65 - Jan 67
Fighter And Attack						
On Attack Sorties						
SVN	6	7	44	73	117	120
MVN	12	14	156	117	333	385
Laos	3	1	13	40	53	61
On Other Sorties	4	5	24	24	48	52
All Other Sorties	9	6	57	97	154	162
Total	34	33	294	411	705	780
Air Force						
Air Force	18	23	188	209	397	437
Navy	12	8	82	152	234	262
Marines	3	0	14	29	43	47
VNAF	1	2	10	21	31	34
Total	34	33	294	411	705	780
Ground Fire						
Ground Fire	21	16	198	260	458	
SAM ^{a/}	2	9	22	16	38	
MIG ^{a/}	0	2	7	2	9	
Other	11	6	67	133	210	
Total	34	33	294	411	705	

^{a/} Probable and confirmed.



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TABLE I

AIRCRAFT LOSSES (Continued)

	Actual					Current Plan
	Jan 1967	Dec 1966	FY 1967 Thru Jan 67	FY 1966	Jul 65 - Jan 67	Jul 65 - Jan-67
<u>Recce/ECM</u>						
Hostile - SVN	0	0	2	3	5	5
NVN	4	3	19	28	47	55
Laos	0	0	0	0	0	0
Sub-total	4	3	21	31	52	60
All Other Losses	0	0	4	7	11	14
Total		3	25	38	63	74
Air Force	4	3	19	17	36	40
Navy	0	0	6	18	24	31
Marines	0	0	0	3	3	3
Total	4	3	25	38	63	74
<u>Other Fixed Wing</u>						
Air Force	8	1	74	22	96	106
Army	4	2	35	34	69	71
Marines	0	2	3	1	4	3
VNAF	0	0	12	4	16	22
Total	12	5	124	61	185	202
<u>Helicopters</u>						
Army	33	22	180	214	394	389
Marines	14	3	41	64	105	95
Total	47	25	221	278	499	484
Total US and VNAF	97	65	664	788	1452	1540

Fixed Wing Aircraft and Helicopter Attrition (Table I and Figures 1 and 2)

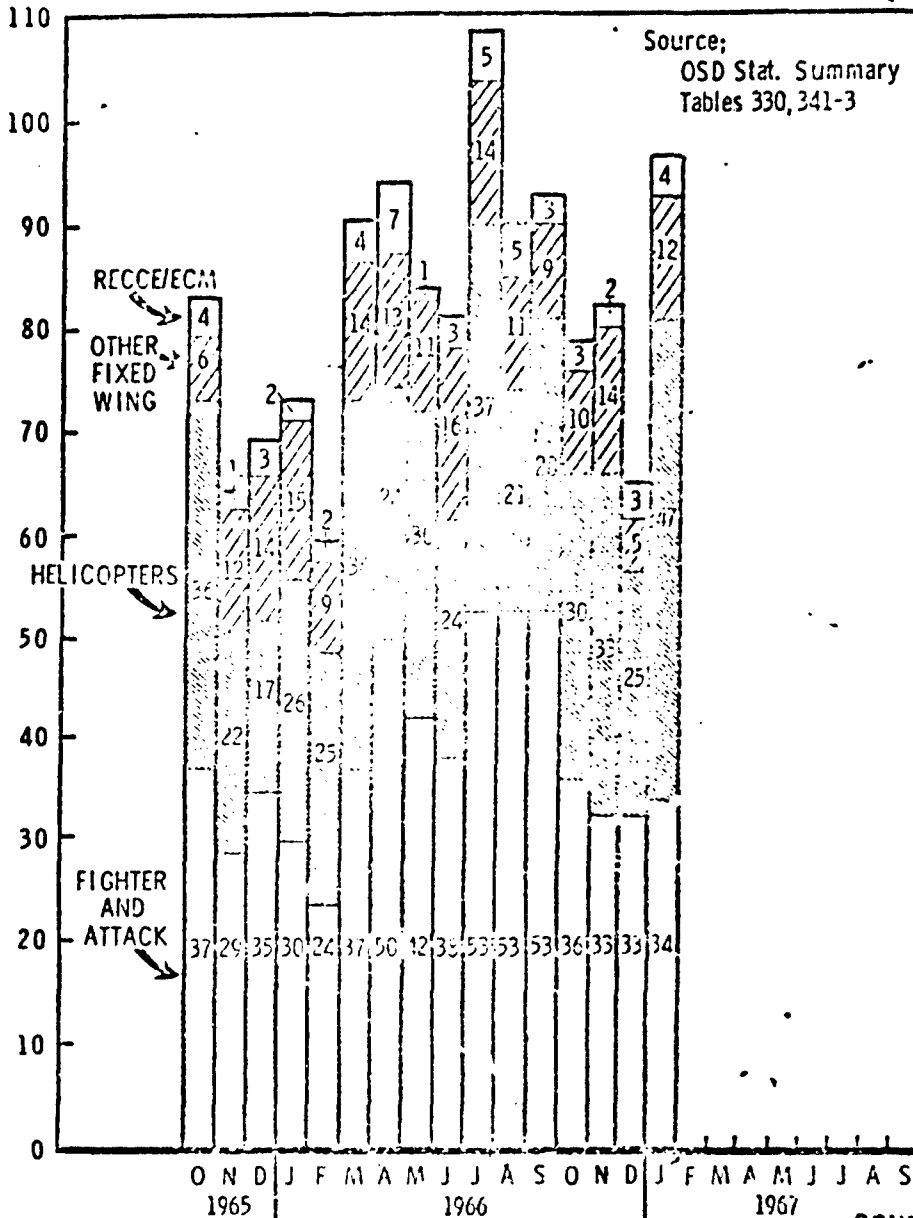
Total aircraft losses in January were 97, compared to 65 in December. Of the total, losses of fighter and attack aircraft were 34, which is about the same monthly level as October-December 1966. Of the 34 fighter and attack aircraft lost, 25 were destroyed by enemy action. Hostile ground fire again accounted for the preponderance of the losses, 21; losses to SAMs decreased to 2; losses to MIGs were down to 0; and 9 aircraft were lost in operational accidents. Losses of other fixed wing aircraft increased to 12; of this, Air Force losses were up to 8 and included 4 O-1s, 2 AC-47s, and 2 C-123s. Helicopter losses were up sharply to 47; the highest in the period July 1965-January 1967. Actual losses continue to be lower than those predicted by the current plan, except for helicopters. Although the Army reports 394 helicopters lost in the period, this total may be as much as 14 percent high (55 aircraft) because no correction has

MONTHLY AIRCRAFT LOSSES IN SEA US AND VNAF

Figure 2

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Number of Aircraft Lost



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been made to stated losses for aircraft repaired and returned to an operable condition. The table below shows the excess of planned losses to actual losses: (Also, see Figure 1 above)

	<u>Fighter & Attack</u>	<u>Recce & ECM</u>	<u>Other Fixed Wing</u>	<u>Helicopter</u>	<u>Total</u>
Actual Losses	705	63	185	499	1452
Planned Losses	<u>780</u>	<u>74</u>	<u>202</u>	<u>484</u>	<u>1540</u>
Excess Predicted Losses	75	11	17	(15)	88

The reduced trend in aircraft losses is explained by three primary factors: lower loss rates, lower sortie rates, and fewer attack sorties in NVN. The following discussion focuses on fighter and attack aircraft.

Loss Rates

US and USAF fighter and attack aircraft loss rates began declining in October.

Losses per 1000 Attack Sorties	1966					Jul 65- Jan 67
	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Jan</u>	
Overall	1.70	1.31	1.19	1.08	1.07	1.47
SVN	.63	.68	.38	.53	.41	.49
NVN	2.69	1.96	2.07	2.10	1.83	3.09
Laos	.79	1.73	.99	.21	.56	.87

The overall loss rate in January, 1.07, is the lowest since last February's rate, 0.97. Loss rates in NVN (the highest attrition area) have stabilized at about 2.0 for the past three months. The high in CY 1966 was 4.25 in April). The Air Force and the Navy, which fly 90% of the attack sorties in NVN, have each experienced significant improvement in loss rates in recent months:

Losses per 1000 Sorties NVN	1966					Jul 65- Jan 67
	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Jan</u>	
Air Force	3.76	1.42	2.72	1.94	1.16	3.30
Navy	1.79	3.16	1.36	2.96	2.81	3.06

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The table below compares recent cumulative NVN loss rates of various reconnaissance aircraft with fighter and attack aircraft in response to a recent question concerning their relative loss rates:

Losses per 1000 Sorties NVN	Jul 66- Nov 66		Jul 66- Jan 67	
		Mean		Mean
RF-8	6.02		4.56	
RF-4B	0		0	
RF-4C	1.58		2.69	
RF-101	2.36		2.05	
RA-5	4.23	Recon: <u>2.60</u>	2.95	Recon: <u>2.62</u>
F-4B	.98		1.00	
F-4C	1.54		1.62	
F-8	3.51		3.15	
F-105	4.67		4.04	
A-4	2.09	Ftr/Atk: <u>2.50</u>	2.27	Ftr/Atk: <u>2.39</u>

The periods July-Nov. and July-Jan. were chosen to show the trends. But the RF-8 data sample is rather small (3 losses in 658 sorties) and may indicate an unreliable loss rate. The same applies to the RA-5 (2 losses in 677 sorties). The RF-4C and RF-101, which are the major reconnaissance aircraft, show loss rates somewhat higher than F-4B and F-4C, bracket the A-4 loss rate, and less than the F-105. The mean recon aircraft attrition rates in NVN are higher than fighter/attack rates.

Sortie Rates

Monthly sortie rates (see Figure 3 below) rose from 22.3 during the second quarter of FY 1967 to 24.9 in January:

Sortie Rates	Aug	Sep	Oct	Nov	Dec	Jan
Air Force	27.5	27.0	25.4	24.8	25.6	27.4
Navy ^{a/}	22.5	21.9	15.6	15.8	17.1	18.2
Marines	37.9	37.0	27.3	28.2	29.4	29.2
Overall Per Quarter		26.7		22.3		24.9

^{a/} Sorties are divided by the aircraft assigned to 5 SEVENTH FLEET CVAs.

The upward trend in sortie rates is expected to continue as the northeast monsoon loses dominance and weather conditions improve in NVN.

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Attack Sorties by Area (Figure 3 and Table II)

Attack sorties reported into NVN dropped to 6572, the lowest total since May, when 4457 sorties were reported. Attack sorties into Laos rose to 5329, highest since the 6044 in April. This shift of sorties from NVN to Laos will probably continue through the middle of February, if the current weather cycle holds. Losses of attack aircraft should remain near current levels during February and begin to rise in the late winter and early spring as NVN sorties increase.

NVN attack sorties were overestimated in the Current Plan in November, December and January:

<u>Attack Sorties - NVN</u>	<u>Nov</u>	<u>Dec</u>	<u>Jan</u>
Current Plan	10,002	9,579	9,725
Actual	<u>7,261</u>	<u>6,672</u>	<u>6,572</u>
Difference	+2,741	+2,907	+3,153

The shallow NVN/Laos weather cycle applied in the Current Plan will be recalculated in the OSD Best Estimate in April 1967, based upon two full years of sortie experience in Southeast Asia. This should result in more accurate monthly sortie and loss predictions.

FIGHTER/ATTACK SORTIES AND OVERALL SORTIE RATES

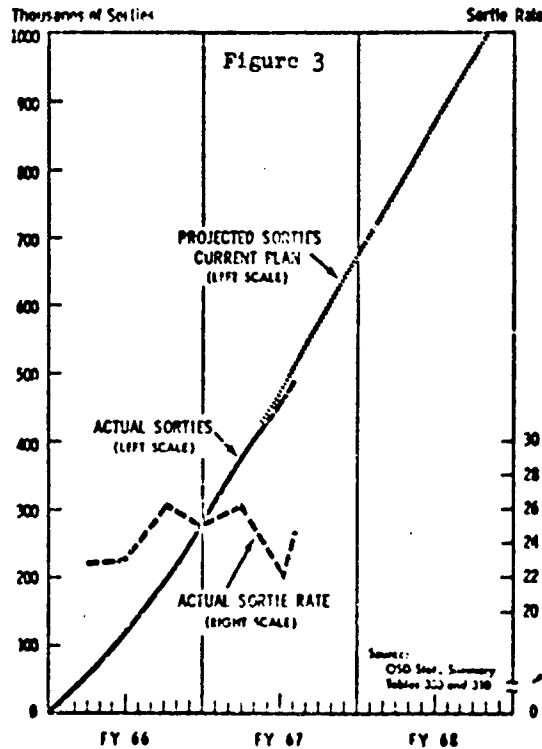


TABLE 2

CONFIDENTIALTOTAL SORTIES

	Actual			Current Plan		
	Jan 1967	Dec 1966	FY 1967 Thru Jan 67	FY 1966	Jul 65- Jan 67	Jul 65- Jan 67
Attack						
SWN	14,502	13,246	94,316	144,876	239,192	241,424
NVN	6,572	6,672	63,410	44,538	107,957	116,758
Laos	5,329	4,841	19,722	41,506	61,229	61,464
Sub-total	26,403	24,759	177,437	230,920	408,377	419,646
Other	4,514	4,832	33,455	47,090	80,545	83,315
Total Combat	30,917	29,591	210,912	278,010	488,922	502,961

Aircraft Recoveries

The CH-47 (Chinook) and CH-54 (Flying Crane) have recovered 40 fixed wing aircraft and 828 helicopters since July 1965, according to Army and Boeing-Vertol sources. These numbers are impressive and show that heavy-lift helicopter recovery operations have an important effect on aircraft loss rates. In addition to recovering downed aircraft from areas inaccessible to land vehicles, helicopter recovery has also decreased aircraft time in transit to repair activities and, therefore, increased flying hours in the theater.

Approximately 95 per cent of the recovered aircraft were helicopters. The following table compares helicopter loss rates with recovered helicopters and those reported damaged or lost from hostile action:

<u>Helicopters</u>	CY 1966 (Quarterly)			
	<u>First</u>	<u>Second</u>	<u>Third</u>	<u>Fourth</u>
Recovered	169	112	112	313
Lost/Damaged	1085	1042	879	911
Per cent ^{a/}	15.6	10.7	12.7	34.4
Loss Rate ^{b/}	3.54	2.93	2.72	2.85

^{a/} Per cent lost and damaged helicopters recovered.

^{b/} Per 10,000 flying hours, excluding helicopters destroyed on the ground.

Helicopter loss rates have decreased from 3.54 per 10,000 flying hours in the first quarter, CY 1966, to the present relatively constant level of about 2.85. The quantitative effect of aircraft recoveries on the loss rates cannot be identified from available statistics.

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TABLE 2
TOTAL SORTIES

	Actual			Current Plan	
	Jan 1967	Dec 1966	FY 1967 Thru Jan 67	FY 1966 Jul 65- Jan 67	Jul 65- Jan 67
Attack					
SVN	14,502	13,246	94,316	144,876	241,424
NVA	6,572	6,672	63,410	44,538	116,758
Laos	5,329	4,841	19,722	41,506	61,454
Sub-total	26,403	24,759	177,457	230,920	419,636
Other	4,514	4,832	33,455	47,000	83,315
Total Combat	30,917	29,591	210,912	278,010	502,951

Aircraft Recoveries

The CH-47 (Chinook) and CH-54 (Flying Crane) have recovered 40 fixed wing aircraft and 828 helicopters since July 1965, according to Army and Boeing-Vertol sources. These numbers are impressive and show that heavy-lift helicopter recovery operations have an important effect on aircraft loss rates. In addition to recovering downed aircraft from areas inaccessible to land vehicles, helicopter recovery has also decreased aircraft time in transit to repair activities and, therefore, increased flying hours in the theater.

Approximately 95 per cent of the recovered aircraft were helicopters. The following table compares helicopter loss rates with recovered helicopters and those reported damaged or lost from hostile action:

<u>Helicopters</u>	CY 1966 (Quarterly)			
	<u>First</u>	<u>Second</u>	<u>Third</u>	<u>Fourth</u>
Recovered	169	112	112	313
Lost/Damaged	1085	1042	879	911
Per cent ^{a/}	15.6	10.7	12.7	34.4
Loss Rate ^{b/}	3.54	2.93	2.72	2.85

^{a/} Per cent lost and damaged helicopters recovered.

^{b/} Per 10,000 flying hours, excluding helicopters destroyed on the ground.

Helicopter loss rates have decreased from 3.54 per 10,000 flying hours in the first quarter, CY 1966, to the present relatively constant level of about 2.85. The quantitative effect of aircraft recoveries on the loss rates cannot be identified from available statistics.

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AIRCRAFT LOSSES AND PRODUCTION - KOREA AND SOUTHEAST ASIA

Both the absolute numbers of losses and rates for fixed wing aircraft losses in Southeast Asia have been well below those in Korea. Table 1 compares losses during the Korean War (30 June 1950 to 27 July 1953) with the actual and projected losses for the period of FY 1966 - 1968. Losses outside of the conflict area (e.g., training accidents) are not included because comparable data for the Korean War period are not available.

Table 1

	Losses ^{c/}		Production	
	Korea ^{a/}	Southeast ^{b/} Asia	Korea ^{d/}	Southeast ^{b/} Asia
Fighter & Attack	2476	1717	7945	2833
Recon.	88	179	311	444
Heavy & Medium Bombers	69	-	749	2
Transport	86	89	1003	351
Trainers	81	-	3094	839
Other Fixed Wing	<u>124</u>	<u>409</u>	<u>1474</u>	<u>786</u>
Total Fixed Wing	2924	1393	14,576	5255

a/ Excludes Army losses which were very small in number as valid data are not available. Data for 30 June 1950 - 27 July 1953.

b/ Data for FY 1966 - 68.

c/ Hostile and non-hostile losses in the combat zone -- Excludes operational losses in other areas.

d/ Excludes Army aircraft acceptances which totaled 3574 during the 3 years.

Production of new fixed wing aircraft during the Korean War exceeded losses in the combat theater by a wide margin, and the same is true for Southeast Asia. During the 3-year Korean War period over 14,000 aircraft were produced, over half of them fighter/attack aircraft. Large numbers of trainers were produced and the build-up of the SAC bomber forces accounted for about 750 new aircraft (B-36's and B-47's). During the FY 1966-1968 period, about 5200 aircraft will be produced, over one-half of which will be fighter/attack aircraft. Although the total numbers produced during the Korean War are higher than at present, in virtually all categories, the numbers of reconnaissance aircraft to be produced during FY 1966-68 are about 50 percent higher than during the Korean War.

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Helicopters were not widely used in Korea and the numbers lost were small, totaling only 77 compared to 2224 in Southeast Asia projected for the FY 1966-68 period. In both conflicts, the bulk of helicopter losses were from operational (non-hostile) causes. Helicopter production is also much greater now than during the Korean War period -- 7002 for FY 1966-68 compared to only 1902 for Korea.

Aircraft Loss Rates

Available data indicates that the loss rates during the Korean War were significantly higher than has been true in Southeast Asia. For example, on all combat sorties by fighter/attack aircraft the hostile loss rate during the Korean War was about 2.0 per thousand compared to only 1.27 per thousand in Southeast Asia during CY 1964-66. Table 2 provides more detailed data on loss rates by Service for the two time periods.

Air Force loss rates on attack sorties also were lower in SEA than in Korea (valid Korean War data for other Services is not available). During calendar years 1964 through 1966 the rate was 1.65 per thousand compared to 2.37 per thousand during Korea. Table 3 provides additional detail on the Air Force attack sortie loss rates.

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Table 2
**FIGHTER AND ATTACK AIRCRAFT COMBAT SORTIES,
 HOSTILE LOSSES, AND LOSS RATES**

Calendar Year	KORREA			Calendar Year	SEA		
	Total Sorties ^{1/}	Losses	Loss ^{3/} Rate		Total Sorties ^{2/}	Losses	Loss ^{3/} Rate
<u>1950</u>				<u>1964</u>			
Air Force	54,322	140	2.58	Air Force	8,959	25	2.79
Navy	22,159	42	1.90	Navy	118	4	33.90
Marines	6,598	10	1.52	Marines	-	-	-
Total	83,079	192	2.31	Total	9,077	29	3.19
<u>1951</u>				<u>1965</u>			
Air Force	155,432	373	2.40	Air Force	79,918	136	1.70
Navy	46,311	125	2.70	Navy	58,178	101	1.74
Marines	36,790	97	2.64	Marines	18,295	5	.27
Total	238,533	595	2.49	Total	156,391	242	1.55
<u>1952</u>				<u>1966</u>			
Air Force	153,089	284	1.86	Air Force	214,239	265	1.24
Navy	53,011	128	2.41	Navy	95,631	122	1.23
Marines	40,948	60	1.47	Marines	60,454	21	.35
Total	247,048	472	1.91	Total	370,324	408	1.10
<u>1953</u>							
Air Force	94,304	106	1.12				
Navy	35,555	64	1.80				
Marines	23,603	16	.68				
Total	153,472	186	1.21				
<u>Total 1950-53</u>				<u>Total 1964-66</u>			
Air Force	457,147	903	1.98	Air Force	303,116	426	1.41
Navy	157,046	359	2.29	Navy	153,927	227	1.47
Marines	107,939	183	1.70	Marines	78,749	26	.33
Total	722,132	1445	2.00	Total	535,792	679	1.27

1/ Includes Attack, Air Defense, Recce, and Search and Rescue sorties.
 2/ Includes Attack, Air Defense, Recce, and all other combat support sorties.
 3/ Per thousand sorties.

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Table 3
USAF TACTICAL AIRCRAFT ATTACK SORTIES AND LOSSES

<u>Calendar Year</u>	<u>Total Attack Sorties</u>	<u>Losses on Attack Sorties</u>	<u>Attack Sortie Loss^{1/} Rate</u>	<u>Calendar Year</u>	<u>Total Attack Sorties</u>	<u>Losses on Attack Sorties</u>	<u>Attack Sortie Loss Rate^{1/}</u>
<u>1950</u>	47,004	131	2.79	<u>1954</u>	4,644	11	2.37
<u>1951</u>	110,588	299	2.70	<u>1955</u>	54,282	111	2.04
<u>1952</u>	84,313	193	2.29	<u>1956</u>	145,145	214	1.47
<u>1953</u>	52,272	73	1.40				
<u>Total</u>	294,177	696	2.37	<u>Total</u>	204,071	336	1.65

^{1/} Per thousand sorties.

NOTE: Data are not available for Korea War Attack sorties for USN and USMC.

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AIR OPERATIONS

This section of the Southeast Asia Analysis Report will examine U.S. tactical aircraft losses, loss rates, sorties, and sortie rates. The discussion includes an analysis of recent loss rate and sortie rate trends. It closes with a brief of a recent study of data pertaining to lost and damaged combat aircraft.

Southeast Asia Aircraft Losses - US and VNAF

TABLE 1
AIRCRAFT LOSSES

	Actual				Current Plan
	Feb 1967	Jan 1967	FY 1967 Thru Feb 67	FY 1966	Jul 65-Feb 67
<u>Fighter & Attack</u>					
On Attack Sorties					
SVN	5	6	49	73	122
NVN	4	12	160	177	418
Laos	5	3	18	40	67
On Other Sorties	0	4	24	24	48
All Other Sorties	9	9	67	97	164
Total	23	34	318	411	841
Air Force	12	18	200	209	472
Navy	7	12	89	152	283
Marines	2	3	16	29	50
VNAF	2	1	13	21	36
Total	23	34	318	411	841
Ground Fire	13	21	205	260	465
SAM ^{a/}	1	2	23	16	39
MIG ^{a/}	0	0	7	2	9
Other	9	11	93	133	216
Total	23	34	318	411	729

^{a/} Probable and confirmed.

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FRONTIER/ATTACK LOSSES AND OVERALL LOSS RATE

Number of Aircraft Losses Losses per 1000 sorties

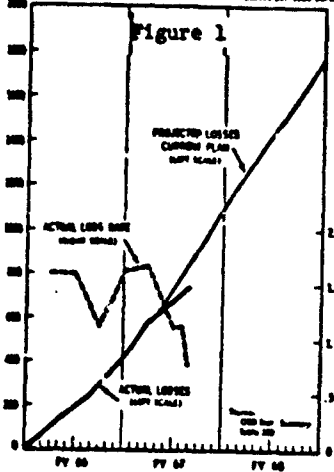


TABLE 1 AIRCRAFT LOSSES
(Continued)

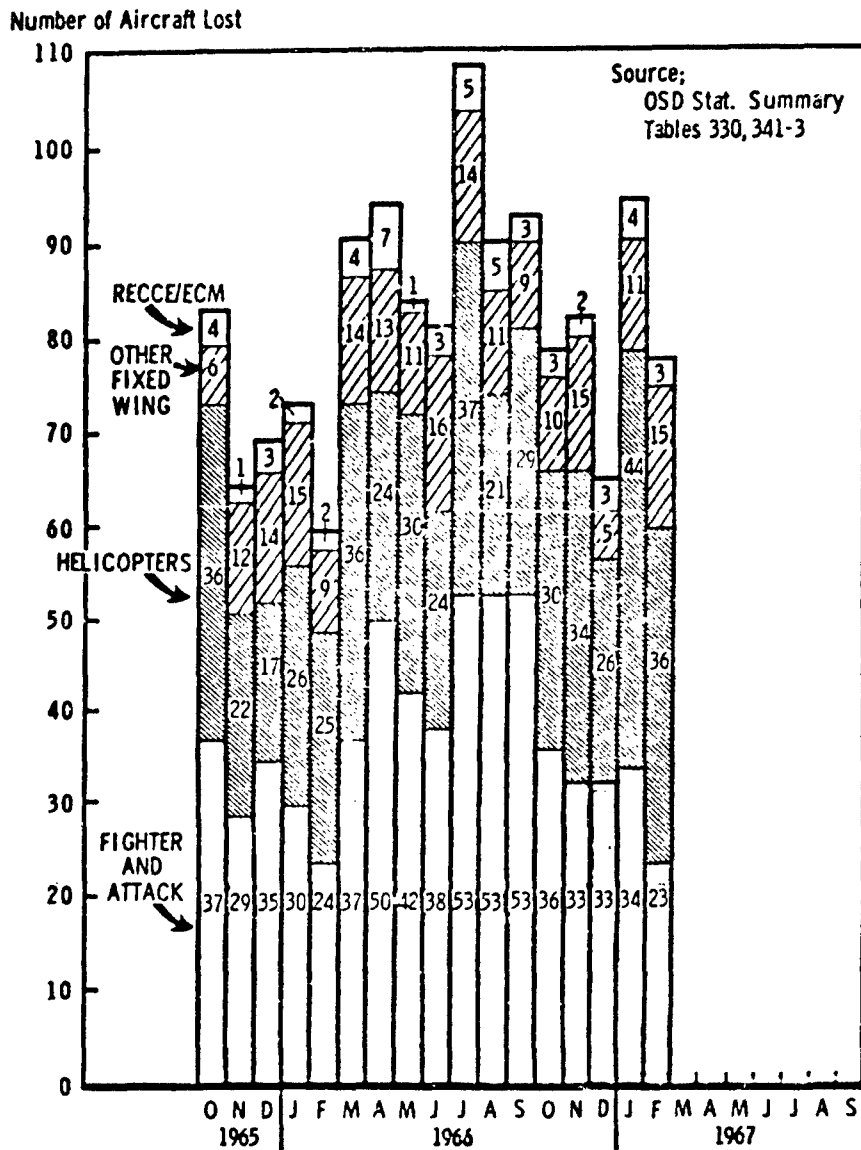
	Actual					Current Plan
	Feb 1967	Jan 1967	FY 1967 Thru Feb 67	FY 1966	Jul 65-Feb 67	Jul 65-Feb 67
<u>Receiv/ECM</u>						
Hostile - SVN	0	0	2	3	5	6
NVN	3	4	22	28	50	60
Laos	0	0	0	0	0	0
Sub-Total	3	4	24	31	55	66
All Other Losses	0	0	4	7	11	15
Total	3	4	28	38	66	81
Air Force	2	4	21	17	38	43
Navy	1	0	7	18	25	34
Marines	0	0	0	3	3	4
Total	3	4	28	38	66	81
<u>Other Fixed Wing</u> ^{a/}						
Air Force	6	7	80	22	102	115
Army	8	4	43	34	77	76
Marines	0	0	2	1	3	3
VNAF	1	0	7	12	19	23
Total	15	12	132	69	201	217
<u>Helicopters</u>						
Army	34	33	214	214	428	417
Marines	2	11	43	64	107	99
Total	36	44	257	278	535	516
Total US & VNAF	77	94	735	796	1531	1655

^{a/} Beginning October 1965.

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MONTHLY AIRCRAFT LOSSES IN SEA US AND VNAF

Figure 2



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Fixed Wing Aircraft and Helicopter Attrition (Table I & Figures 1 & 2)

Total aircraft losses in February were 77, compared to 94 in January. Of the total, losses of fighter and attack aircraft were 23, which is about a third of the monthly level from October 1966-January 1967. Of the 23 fighter and attack aircraft lost, 14 were destroyed by enemy action. Hostile ground fire again accounted for the preponderance of the losses, 13; loss to SAMs was only 1; losses to MIGs were 0; and 9 aircraft were lost in operational accidents. Losses of other fixed wing aircraft increased to 15; of this, Air Force losses were 6 and the 8 Army losses included 5 O-1s, 2 U-6s and 1 OV-1. Helicopter losses were 36, which is about the average in the period October 1966-February 1967. Actual losses continue to be lower than those predicted by the Current Plan, except for helicopters. The table below shows the excess of planned losses to actual losses: (Also, see Figure 1 above).

	<u>Fighter & Attack</u>	<u>Recce & ECM</u>	<u>Other Fixed Wing</u>	<u>Helicopter</u>	<u>Total</u>
Actual Losses	729	66	201	535	1531
Planned Losses	<u>841</u>	<u>81</u>	<u>217</u>	<u>516</u>	<u>1655</u>
Excess Predicted Losses	112	15	16	(19)	124

The continued reduced trend in fixed wing aircraft losses results from lower loss rates and fewer attack sorties in NVN. The following discussion highlights fighter and attack aircraft.

Loss Rates

US and VNAF fighter and attack aircraft loss rates began declining in October.

<u>Losses per 1000 Sorties</u>	<u>1966 Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Jan</u>	<u>Feb</u>	<u>Jul 65- Feb 67</u>
<u>Attack</u>							
SVN	.63	.63	.38	.53	.41	.37	.48
NVN	2.69	1.96	2.07	2.10	1.83	.73	2.97
Laos	.79	1.73	.99	.21	.56	.78	.86
<u>Overall Attack & Non-attack</u>	1.70	1.31	1.19	1.08	1.07	.77	1.36

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The overall attack and non-attack loss rate in February, 0.77, is the lowest since last February's rate, 0.97. The loss rate in NVN (the highest attrition area) declined to 0.73 from the recent levels of about 2.0. The Air Force and the Navy, which fly 90 percent of the attack sorties in NVN, have each experienced significant improvements in loss rates in recent months:

Losses Per 1000 Attack Sorties NVN	1966						Jul 65-
	Sep	Oct	Nov	Dec	Jan	Feb	Feb 67
Air Force	3.76	1.42	2.72	1.94	1.16	.69	3.18
Navy	1.79	3.16	1.36	2.96	2.81	.93	2.96

Although many interrelated factors affect aircraft attrition rates, the principal ones are: enemy defenses, defense suppression, type of target, weather, tactics, aircraft design and engineering changes, weapons, ECM, and damages to own aircraft.

The Navy has found that its drop in NVN attack loss rates is partially explained by the following factors:

- The assignment of permanent route packages has provided planners and pilots with increased familiarity of the best routes to targets and of the nature of target defenses.
- A careful control over tactics will result in greater survivability of specific aircraft types. The A-1, for example, is stringently restricted in flying attack missions and is generally limited to striking targets which have been "tested" by the A-4. Most current A-1 missions are for offshore armed reconnaissance, RESCAF, and providing spotting services for SEA DRAGON naval gunfire operations. The F-8, with its high NVN attack loss rate (13.18 per 1000 sorties, February - October 1966), was diverted to CAP and ESCORT missions in order to reduce its exposure to enemy ground fire. Its ratio of attack to non-attack sorties was 0.16 from February - August 1966 and .07 from September-December. F-8 average monthly attack losses were 0.9 and .3 aircraft respectively, during these periods.
- The increasing reliance on defensive ECM systems allows higher penetration and bomb release altitudes, and thus, decreased vulnerability to ground fire. (The Navy found during CY 1966 that 90 percent of its aircraft losses occurred at 5000 feet or below and 47 percent at 2500 feet or below).
- Excessive cloud cover and weather restrictions in February limited many of the Navy's armed reconnaissance sorties to the lightly defended coastal areas of NVN. Similarly, more sorties were flown in Route Package 1.

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In summary, the winter months have produced a sharp decline in fixed wing aircraft loss rates in SEA. The lower loss rates, reinforced by the decline in NVN sorties, reduced the actual numbers of attrited aircraft to about 55 percent of the Current Plan predictions from November 1966 to date. The next month or two should produce a reversal of this trend.

Sorties (Figure 3 and Table II)

Attack sorties reported in NVN dropped to 5472, the lowest total since May, 1966, when 4457 sorties were recorded. Attack sorties into Laos rose to 6442, highest since the 6247 last March. The highest month ever in Laos was January 1966, with 8000 attack sorties. This shift of sorties from NVN to Laos will probably begin to reverse in March, 1967, if the typical weather cycle holds. Losses of attack aircraft should also begin to rise again in March as NVN sorties increase.

NVN attack sorties (and, therefore, losses) were overestimated in the Current Plan, beginning in November:

<u>Attack Sorties-NVN</u>	<u>1966</u>		<u>1967</u>	
	<u>Nov</u>	<u>Dec</u>	<u>Jan</u>	<u>Feb</u>
Current Plan	10,002	9,579	9,725	9,698
Actual	<u>7,261</u>	<u>6,672</u>	<u>6,572</u>	<u>5,472</u>
Difference	+2,741	+2,907	+3,153	+4,226
Cumulative	+2,741	+5,648	+8,801	+13,027

TABLE II

TOTAL SORTIES

	<u>Actual</u>				<u>Current Plan</u>	
	<u>FY 1967</u>			<u>FY 1966</u>	<u>Jul 65-</u>	<u>Jul 65-</u>
	<u>Feb 1967</u>	<u>Jan 1967</u>	<u>Thru Feb 67</u>	<u>1966</u>	<u>Feb 67</u>	<u>Feb 67</u>
<u>Attack</u>						
SVN	13,543	14,502	107,859	144,876	252,735	256,144
NVN	5,472	6,572	68,891	44,538	113,429	126,456
Laos	<u>6,442</u>	<u>5,329</u>	<u>26,164</u>	<u>41,506</u>	<u>67,670</u>	<u>66,298</u>
Sub-total	<u>25,457</u>	<u>26,403</u>	<u>202,914</u>	<u>230,920</u>	<u>433,834</u>	<u>448,898</u>
Other	<u>4,262</u>	<u>4,522</u>	<u>37,725</u>	<u>47,090</u>	<u>84,815</u>	<u>88,846</u>
Total Combat	<u>29,719</u>	<u>30,925</u>	<u>240,639</u>	<u>278,010</u>	<u>518,649</u>	<u>537,744</u>

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Sortie Rates

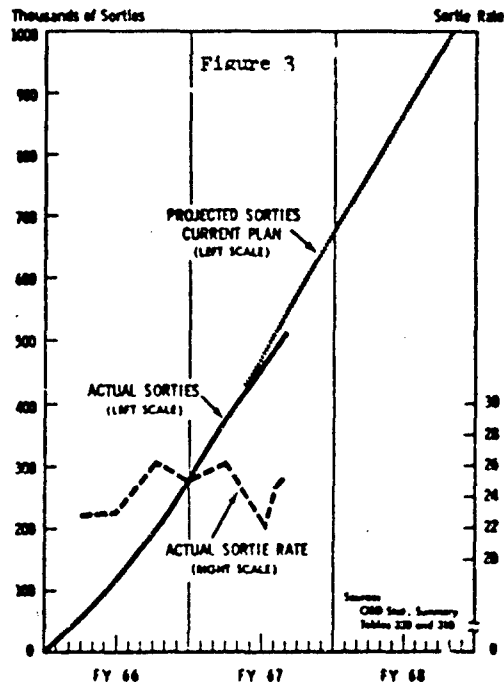
Monthly sortie rates (see Figure 3 below) rose from 22.3 during the second quarter of FY 1967 to 25.3 for January and February:

<u>Sortie Rates</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Jan</u>	<u>Feb</u>
Air Force	27.0	25.4	24.8	25.6	27.4	28.7
Navy ^{a/}	21.9	15.6	15.8	17.1	18.2	18.8
Marines	37.0	27.3	28.2	29.4	29.2	31.9
Overall Per Quarter	26.7			22.3		25.3

^{a/} Sorties are divided by the aircraft assigned to 5 SEVENTH FLEET CVAs.

The upward trend in sortie rates is expected to continue as the northeast monsoon loses dominance and weather conditions improve in NVN. The sortie rates achieved in February were somewhat less than expected, probably because the weather in NVN has been more severe than last year. Also, no adjustment was made to the table above for the TET slowdown or to convert February to the standard 30-day month.

FIGHTER/ATTACK SORTIES AND OVERALL SORTIE RATES



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Special Report

The Analysis of Data on Combat Lost and Damaged Aircraft in Southeast Asia (U), Weapons Systems Evaluation Group (WSEG) Staff Study 133 of February 1967, examined those data elements relative to combat lost and damaged aircraft required for R&D attrition analysis to improve equipment and hardware. The study analyzed aircraft lost and damaged during the period February 1, 1965-January 31, 1966. Although somewhat dated, the major conclusions are:

- The attack phase of the mission accounted for 76 percent of Air Force and 70 percent of Navy combat losses.
- Bridges, barracks, and military facilities accounted for about 46 percent of Air Force and Navy aircraft lost. This is higher than for any other generic targets.
- 75 percent of the losses were to automatic weapons (12.7mm or 14.5mm) or light anti-aircraft (37mm or 57mm).
- The pullout is the most dangerous phase of the attack: 28 percent of Air Force and 32 percent of Navy losses occurred during pullout.
- 90 percent of the aircraft losses were at altitudes below 7000 feet and 28 percent were at 1000 feet or below.
- Flight control system failures accounted for 33 percent of Air Force and 15 percent of Navy losses. The A-4 and A-1, which have manual backup and straight manual systems, respectively, were significantly more survivable than aircraft which rely solely on hydraulic flight control systems.
- Fire occurred in 50 percent of Navy losses and 75 percent of Air Force losses and was the primary final cause of loss.
- Vulnerability design lessons learned from our present combat employment should be incorporated in general specifications for aircraft weapons systems design, and this should be weighted heavily in design competitions.

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Aircraft Losses

Total aircraft losses in March were 117, compared to the Current Plan of 119 and 79 actual in February. Of the total, losses to fighter and attack aircraft were 45, compared to the plan of 61 and last month's 23. Reconnaissance losses were 3 below plan. Losses of other fixed-wing aircraft were 5 below planned and helicopter losses were 23 above. The table below shows the excess of planned losses to actual losses from July 1965 through March 1967.

	<u>Fighter/ Attack</u>	<u>Recce/ ECM</u>	<u>Other Fixed- Wing</u>	<u>Helicopters</u>	<u>Total</u>
Actual Losses	775	70	212	592	1649
Planned Losses	<u>903</u>	<u>89</u>	<u>234</u>	<u>550</u>	<u>1776</u>
Excess Predicted Losses	128	19	22	(42)	127

Source: OSD SEA Statistical Summary, Tables 340-343.

Loss Rates

The fighter and attack losses predicted in the Current Plan were calculated on the basis of a nine month "moving average" loss rate which used actual data from February-October 1966 for each aircraft type. North Vietnam and Laos attack sorties were predicted to vary in counter cycles, which reflected weather, targeting decisions, and force employment. This prediction methodology estimated monthly losses which ranged from a low of 54 in the winter to a high of 63 in June. Experience since last November shows that the cycle was too shallow; actual losses have varied from 23 in February 1967 to 53 last summer.

We also note a definite long term downward trend in over-all attack loss rates in NVN. Chart 1 shows typically wide variations in monthly loss rates. The high is 5.9 losses per 1,000 sorties in December 1965 and the low 0.73 in February 1967. The cumulative trend peaked in January 1966 and has declined in every subsequent month to its present value of about 2.94. We believe the downward trend to result from: (1) the actions taken by the Navy to control hostile losses (particularly the F-8 and A-1), so that 3 CVAs at Yankee Station have lost no more aircraft in NVN than 2 CVAs did; and (2) the long term trend downward in Air Force loss rates in NVN resulting primarily from improved ECM and flak suppression weapons.

Table 1 and Charts 1-2 present five loss rates by month and by Fiscal Year; NVN over-all, Laos over-all, SVN over-all, non-attack over-all, and operational over-all. We are unable to determine any weather cycles in loss rates by country or any definite trends except in the NVN attack loss rates, where the cumulative trend is down as explained above. The NVN attack loss rates, however, are approximately six times as great as SVN

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loss rates and three times those in Laos. SEA aircraft loss predictions, therefore, are extremely sensitive to the NVN rates.

Our next attrition estimate, to be promulgated prior to Budget Apportionment in late Spring, will give fairly heavy weight to FY 1967 loss experience in NVN. Loss projections, therefore, will probably be lower than those shown in the Current Plan.

TABLE 1

**SEA OVERALL LOSS RATES
FIGHTER & ATTACK AIRCRAFT (US & VNAF)
(Per 1000 Sorties)**

	North Vietnam		South Vietnam		Laos		Non-Attack		Operational	
	Mo.	Cum	Mo.	Cum	Mo.	Cum	Mo.	Cum	Mo.	Cum
FY-1966										
Jul	2.83	-	0.51	-	2.99	-	0.61	-	0.46	-
Aug	5.20	4.06	.18	.34	0	1.73	.60	.60	.11	.28
Sep	5.25	4.51	.63	.44	.96	1.44	.57	.59	.36	.31
Oct	4.90	4.60	.58	.48	1.04	1.34	.78	.64	.44	.34
Nov	5.12	4.70	.32	.44	0	.96	.87	.69	.29	.33
Dec	5.91	4.83	.71	.49	.33	.73	.58	.67	.47	.36
Jan	a/	4.90	.85	.54	.75	.74	0	.55	.50	.38
Feb	1.78	4.51	.23	.50	1.90	1.02	.52	.55	.16	.38
Mar	3.78	4.39	.73	.53	.32	.87	.20	.50	.20	.32
Apr	4.26	4.37	.35	.51	.99	.89	1.08	.57	.44	.34
May	4.03	4.33	.43	.51	1.63	.97	.25	.54	.45	.35
Jun	2.31	3.97	.47	.50	.87	.96	.22	.51	.35	.35
FY-1967										
Jul	3.43	3.87	.47	.50	0	.92	.97	.55	.19	.33
Aug	2.54	3.64	.21	.48	1.22	.92	.60	.56	.51	.35
Sep	2.69	3.49	.63	.49	.79	.92	.61	.56	.26	.34
Oct	1.96	3.34	.68	.49	1.73	.96	.64	.57	.15	.33
Nov	2.07	3.24	.38	.49	.99	.96	.45	.56	.29	.32
Dec	2.10	3.17	.53	.49	.21	.89	1.04	.59	.17	.32
Jan	1.83	3.08	.41	.48	.56	.87	.66	.60	.32	.32
Feb	0.73	2.97	.37	.48	.78	.86	0	.57	.30	.32
Mar	2.47	2.94	.48	.48	.41	.83	.21	.55	.37	.32
Program #4 Projections ^{b/}		3.25		.48		1.08		.76		.31

a/ 2 losses in 132 sorties = 15.15

b/ Rate used in projections for Program #4 (Feb-Oct 1966)

Source: OSD Stat Summary, Table 330

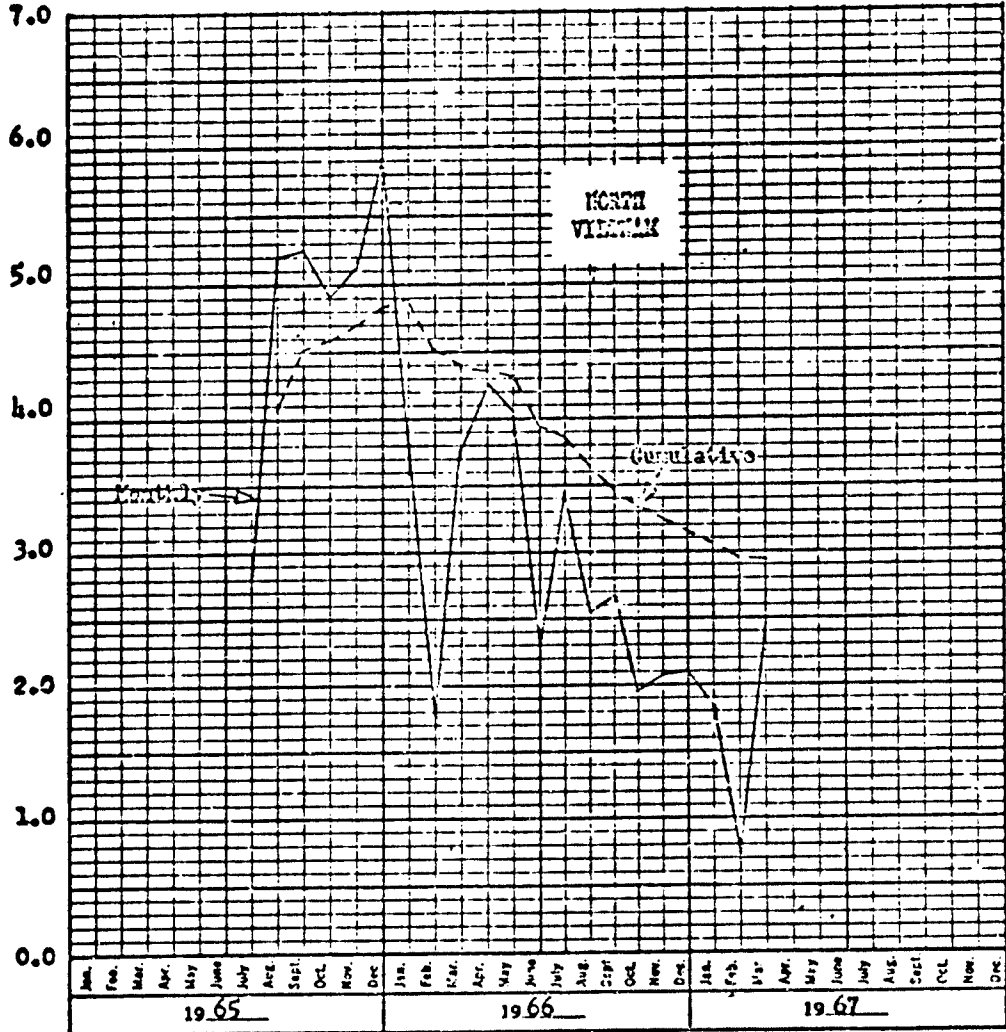
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CHART 1

ATTACK LOSS RATES

FIGHTER AND ATTACK AIRCRAFT - U.S. AND VNAF

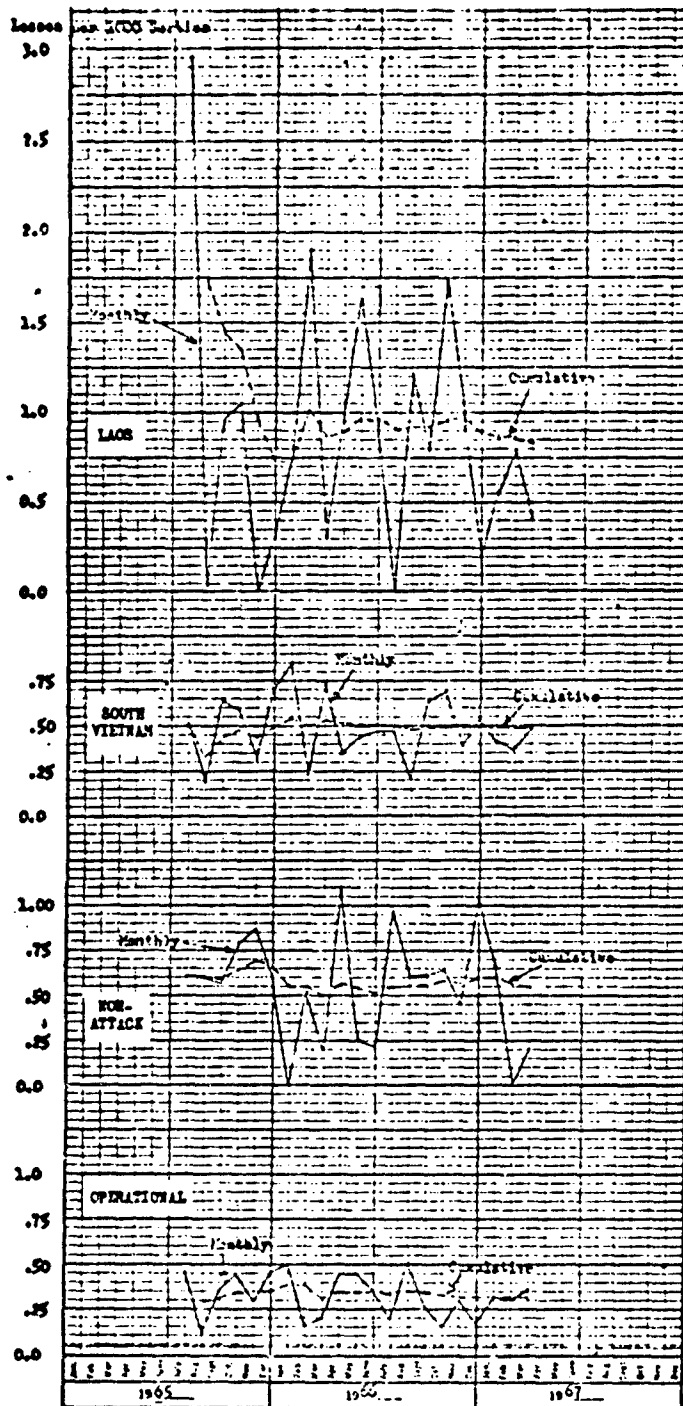
Losses per 1000 Sorties



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CHART 2
ATTACK LOSS RATES
FIGHTER AND ATTACK AIRCRAFT - U.S. AND USAF



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AIRCRAFT LOSSES

Aircraft losses in April totaled 92, compared to the 118 in March and the Budget Plan projection of 122. We lost 40 fighter and attack aircraft, compared to 45 in March and the Budget Plan estimate of 62. Losses of one reconnaissance aircraft and 11 other fixed wing aircraft were both 6 below the plan; the 40 helicopter losses exceeded the plan by 4. The table below shows the excess of planned losses to actual losses from July 1965 through April 1967:

	<u>Fighter/ Attack</u>	<u>Recce/ ECM</u>	<u>Other Fixed Wing</u>	<u>Helicopters</u>	<u>Total</u>
Actual Losses	818	71	217	643	1749
Planned Losses	<u>965</u>	<u>96</u>	<u>270</u>	<u>586</u>	<u>1897</u>
Excess Predicted Losses	147	25	33	(57)	148

SEA Fighter and Attack Aircraft Losses - OSD April 1967 Estimate

As the table above indicates, losses of fighter and attack aircraft have been well below the December 1966 Plan in recent months. For this reason a new OSD April "Best Estimate" has been prepared for financial and production planning. The old estimate will be redesignated as the Budget Plan and will appear as such in the OSD SEA Statistical Summary.

Based on the new "Best Estimate", the US and VNAF will lose 437 fewer fighter-attack aircraft in the July 1965-December 1969 period (2333 versus 2770) than we thought last December (See Table 1). This 437 aircraft reduction consists of the 127 fewer aircraft actually lost than planned through March 1967 and 310 fewer projected losses during the period April 1967 through December 1969 based on our new loss rate projections. Assuming that the attrition rates now projected are correct, the 95% statistical confidence limits around the new estimate are + 79 aircraft. The basis for the April "Best Estimate" is outlined below.

a. Methodology - We use 7 loss rates for each aircraft model (e.g., F-4, A-4) to predict aircraft losses: loss rates for attack and non-attack sorties for each of three areas (Laos, NVN, SVN), and a rate for all other losses (operational losses and losses on the ground).

We use 6 sortie rates for each aircraft model; an attack and non-attack sortie rate for each of three areas.

Finally, we have developed a "weather cycle" to apportion attack sorties between NVN, Laos and SVN in accordance with our observations of the shifts in sortie patterns between areas. The total sorties and losses per year are not influenced by the weather cycle. But, since month-by-month losses change sharply, the weather cycle aids in following seasonal changes.

	F Y 1 9 5 8										FY 1969	FY 1970	JUL 65-	JUL 65-
	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL	TOTAL	JUL-DEC	DEC 69	MAR 67	
202	17282	17282	17282	17282	17282	17282	17282	17282	277386	287386	163092	856552	286246	
100	3988	3988	3988	3988	3988	3988	3988	3988	47856	47856	23928	213433	81889	
122	4522	4522	4522	4522	4522	4522	4522	4522	54222	54222	27111	224322	75802	
170	25778	25778	25778	25778	25778	25778	25778	25778	379242	389242	194621	1294347	443937	
200	4268	4268	4268	4268	4268	4268	4268	4268	48728	48728	24364	216373	82353	
410	29838	29838	29838	29838	29838	29838	29838	29838	357968	357968	178984	1518728	526330	
410	13942	13118	13218	12725	12725	12725	13097	12861	159752	169752	82126	712753	270245	
150	10283	9876	9745	9557	9563	10223	12853	11943	125278	124278	58462	475483	136254	
232	3533	4349	4196	4244	4251	4326	3847	2824	44225	42225	21183	183247	71029	
232	27158	27335	27157	27246	27239	27599	27599	27628	328763	328763	157777	1178183	477528	
117	5111	5453	5476	5454	5439	5453	5453	5327	63728	63728	30512	268198	94368	
167	32269	32788	32631	32728	32678	32852	32852	32955	392671	392671	196289	1646381	571896	
251	14995	14848	14161	13670	14385	13146	12849	12227	163780	160624	78004	710095	269643	
328	9062	7540	7852	7266	7733	9175	10738	12129	120585	122060	67800	463620	121931	
197	4033	5062	4915	6024	4921	4610	3744	2601	42916	44521	18215	190846	73169	
308	28087	27848	26929	26967	26961	26932	26932	26957	320204	327201	164015	1364555	464743	
398	4609	4647	4721	4678	4659	4719	4719	4639	55733	55437	28742	245142	90528	
365	32697	32496	31651	31646	31621	31651	31651	31997	384018	382639	192757	1609697	555272	

	April 1967										Estimate (4-1/2 yrs)	Prog Plan (4-1/2 yrs)	Current Plan (4-1/2 yrs)	Actual
											.508	.821	.466	0.482
											2.627	4.614	3.223	2.936
											.905	1.091	1.094	0.820
											.521	.481	.771	0.641
											.279	.309	.298	0.308

Source - Plan Sys Anal
Actual JCS

10 May 1967

F Y I O & T															
SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL	JUL	AUG	SEP	OCT	NOV
13600	15505	17202	17202	17202	17202	17202	17202	17202	17202	194244	17202	17202	17202	17202	17202
3900	3900	3900	3900	3900	3900	3900	3900	3900	3900	47856	3900	3900	3900	3900	3900
4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	54000	4500	4500	4500	4500	4500
22177	23400	25772	25772	25772	25772	25772	25772	25772	25772	296140	25772	25772	25772	25772	25772
2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	24000	2000	2000	2000	2000	2000
26400	28500	29900	29900	29900	29900	29900	29900	29900	29900	344000	29900	29900	29900	29900	29900
		13800	14507	14800	14722	14101	13701	14400	14340	167804	13900	13900	13900	13433	13502
		10202	9579	9725	9600	9700	10236	10111	10740	122809	10019	10791	10791	10904	10301
		4212	4522	4990	4714	4731	4327	3500	3185	48501	2792	2826	2826	2833	3531
		27023	28500	29333	29252	28010	28244	28143	28279	331274	27000	27500	27500	27200	27100
		5454	5400	5500	5511	5522	5470	5416	5111	63201	5125	5151	5151	5117	5110
		33277	34050	34910	34700	34102	33720	33550	33300	394550	32725	32737	32737	32347	32200
12790	11740	13000	13200	14500	13600	16700	13200	12400	12200	160000	12900	13500	13400	14200	14000
12240	8650	7200	6670	6570	5470	8500	8000	10470	11000	108000	12900	12900	12700	10300	9000
1200	2310	3000	4000	5400	6670	5100	4570	3800	2600	40000	1700	1300	1500	3300	4000
26300	22710	23310	24770	26500	25700	30200	26700	26700	26000	310000	26000	27000	27000	27000	26000
4000	4790	4550	5010	4660	4430	4990	4950	4950	4790	50000	4500	4500	4600	4500	4600
31100	27510	27000	29770	31200	30100	35300	31700	31700	31600	372000	31000	32000	32000	32500	32600
10.4	12.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	102.2	15.0	15.0	15.0	15.0	15.0
10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	220.0	10.4	10.4	10.4	10.4	10.4
4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	50.0	4.9	4.9	4.9	4.9	4.9
35.9	30.3	30.3	30.3	30.3	30.3	30.3	30.3	30.3	30.3	441.0	30.3	30.3	30.3	30.3	30.3
1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	22.0	1.9	1.9	1.9	1.9	1.9
0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	100.0	0.6	0.6	0.6	0.6	0.6
43.0	40.4	40.4	40.4	40.4	40.4	40.4	40.4	40.4	40.4	570.0	40.4	40.4	40.4	40.4	40.4
		6.0	7.1	7.2	7.3	6.0	6.4	6.0	6.9	0.1	6.5	6.5	6.5	6.4	6.4
		32.3	30.1	30.0	32.9	33.0	35.0	34.0	35.3	300.3	30.2	33.5	33.5	33.9	31.5
		4.7	5.2	5.7	5.0	5.4	5.2	5.5	5.1	40.2	5.0	5.7	5.7	5.5	5.2
		43.0	42.4	43.7	45.8	45.4	46.4	46.1	46.0	507.0	40.3	43.7	43.7	43.0	42.1
		4.7	4.5	4.8	5.3	5.5	5.5	5.4	5.3	55.0	5.3	4.5	4.5	4.1	4.1
		10.0	9.0	10.0	10.4	10.4	10.4	10.3	10.3	115.0	10.0	9.5	9.5	9.2	9.3
		50.5	50.7	50.5	01.5	01.5	02.3	01.0	02.4	000.0	01.0	01.7	01.7	01.1	01.5
8.0	8.0	5.0	7.0	6.0	5.0	8.0	6.9	6.3	6.4	70.0	6.7	7.2	7.2	7.0	7.1
13.0	17.0	15.0	14.0	12.0	5.0	21.0	23.0	27.0	31.0	263.5	32.7	33.2	32.4	22.5	26.0
1.0	0.0	1.0	1.0	3.0	5.0	2.0	4.0	4.0	3.2	32.0	2.2	1.7	2.4	1.0	0.0
12.0	20.0	23.0	22.0	21.0	14.0	31.0	35.3	38.3	40.5	372.1	31.5	42.1	42.0	37.0	37.0
3.0	3.0	2.0	3.0	4.0	0.0	1.0	2.2	2.4	2.4	33.0	2.0	2.4	2.4	1.0	0.0
0.0	5.0	0.0	6.0	11.0	9.0	13.0	9.5	9.5	9.5	110.0	0.0	0.0	0.0	0.0	0.0
53.0	37.0	33.0	33.0	36.0	23.0	45.0	47.0	50.1	52.4	515.5	53.0	53.4	53.2	40.5	47.1
605	601	300	300	413	360	477									
2.000	1.900	2.000	2.000	1.800	1.800	2.400									
700	1.700	900	200	500	775	810									
0.010	0.025	0.035	1.035	0.857	0.0	0.207									
0.257	0.102	0.009	0.169	0.352	0.303	0.372									

For comparative purposes only.

See 1966 actual data.
Losses are against total combat sorties.

whi (0 calculated from Apr. 1966 - March 1967 actual data). Cumulative totals include July 1965 - March 1967 actual data.

F Y 1 9 6 6									F Y 1 9 6 7						
	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL	JUL	AUG	SEP	OCT	NOV	DEC	JAN
1	11270	11566	12452	12735	12785	12785	12785	143848	13297	13257	13889	19585	17282	17282	17282
4	3988	3988	3988	3988	3988	3988	3988	45997	3988	3988	3988	3988	3988	3988	3988
9	3570	4580	4520	4520	4520	4520	4520	35392	4520	4520	4520	4520	4520	4520	4520
1	18758	28854	22948	21193	21193	21193	21193	225147	21785	21785	22377	23993	25772	25772	25772
8	3898	3898	3981	4868	4868	4868	4868	45853	4868	4868	4868	4868	4768	4868	4868
9	22648	23944	24921	35253	25253	25253	25253	271888	25845	25845	26437	28853	29838	29838	29839
													13889	14567	14689
													18282	9579	9725
													4712	4522	4922
													27823	28568	29333
													9454	5488	5588
													33277	34856	34919
10	12763	11751	12958	15153	11291	11611	12672	144876	14929	14081	12798	11748	13024	13264	14526
5	2178	132	2839	4497	5485	4467	7788	44538	10198	11811	12249	8656	7261	6672	6572
2	3223	2222	2282	6247	6244	4308	3442	41528	2134	820	1261	2310	3027	4841	5484
13	17944	19883	21221	25897	22748	22378	23432	234923	27274	26712	26308	22714	23312	24777	25282
3	3471	4324	3852	4939	4628	3988	4477	47898	5167	4963	4860	4797	4554	5001	4666
6	21435	24289	24873	38836	27368	24358	28379	278818	32438	31675	31168	27511	27666	29778	31248
4	2.2	7.9	9.8	9.8	9.8	9.8	9.8	98.7	9.6	9.6	10.4	12.6	15.8	15.8	15.8
6	18.4	18.4	18.4	18.4	18.4	18.4	18.4	212.2	18.4	18.4	18.4	18.4	18.4	18.4	18.4
7	3.8	4.9	4.9	4.9	4.9	4.9	4.9	38.7	4.9	4.9	4.9	4.9	4.9	4.9	4.9
7	29.4	31.2	32.3	32.3	32.3	32.3	32.3	341.8	32.9	32.9	33.7	35.9	38.3	38.3	38.3
7	1.9	1.9	1.9	1.9	1.9	1.9	1.9	24.2	1.9	1.9	1.9	1.9	1.9	1.9	1.9
8	6.8	7.2	7.6	7.7	7.7	7.7	7.7	85.2	7.9	7.9	8.2	8.6	9.2	9.2	9.2
4	38.1	48.3	41.8	41.9	41.9	41.9	41.9	451.2	42.7	42.7	43.8	46.4	49.4	49.4	49.4
													6.8	7.1	7.2
													32.3	38.1	38.8
													4.7	5.2	5.7
													43.8	42.4	43.7
													4.7	4.5	4.8
													18.8	9.8	18.8
													58.5	58.7	58.5
8	9.8	18.8	3.8	11.8	4.8	5.8	6.8	73.8	7.0	3.8	8.0	8.0	5.0	7.0	6.0
8	13.8	2.8	5.8	17.8	23.8	18.8	18.8	177.8	35.2	38.8	33.8	17.0	15.8	14.8	12.0
	1.8	6.2	18.8	2.0	8.2	7.8	3.8	40.0	8.0	1.8	1.8	4.0	1.2	1.0	3.0
2	23.8	18.8	18.8	30.0	33.8	38.8	27.8	290.0	42.0	34.8	42.0	29.0	23.0	22.0	21.0
2	2.8	8.0	2.8	1.8	5.8	1.8	1.8	24.8	5.2	3.8	3.2	3.0	2.2	3.0	4.0
8	18.8	12.8	4.8	6.0	12.8	11.8	18.8	97.0	6.0	16.8	8.8	5.0	8.0	6.0	11.0
3	35.8	38.8	24.8	37.8	58.8	42.8	38.8	411.8	53.2	53.8	53.0	37.0	33.2	33.0	36.0
17	.785	.851	.232	.726	.354	.431	.473	.584	.469	.213	.485	.681	.388	.528	.413
28	5.914	15.152	1.788	3.788	4.255	4.838	2.311	3.974	3.432	2.548	2.694	1.964	2.566	2.098	1.286
	.333	.758	1.888	.320	.993	1.628	.223	.963	8.0	1.228	.793	1.732	.991	.287	.541
71	.576	8.0	.519	.282	1.888	.251	.272	.318	.948	.824	.419	.625	.453	1.035	.857
91	.467	.496	.161	.195	.438	.452	.352	.349	.185	.585	.257	.182	.389	.159	.352

a. Action through CY 1969 is based upon June 1967. Extrapolated through December 1969 for comparative purposes only.
 b. Data include Jul 65-Oct 66 actual data.
 c. Loss rates from November 1965 through October 1966. Cum. totals include July 1965-October 1966 actual data.
 d. The appropriate total of sorties, and shown as per thousand sorties. Rates for "All Other Losses" are against total combat sorties.
 e. Loss and recover NVH sortie performance by USAF Thailand based attack aircraft.
 f. Total sorties and loss rates from July 1965 through March 1967 (except NVH loss rates, which were calculated from Apr. 1966 - 1967)

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TABLE 1

**Sorties and Losses - Planned vs. Actual - Total U.S. and VNAF
Fighter and Attack Aircraft Only**

***** F Y 1 9 6 6 *****										
	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	
PLANNED SORTIES - DECEMBER PLAN										
ATTACK - SVN					13661	11279	11566	12452	12725	
- NVN					3964	3980	3980	3980	3980	
- LAOS					1260	3320	4500	4500	4527	
SUB-TOTAL					18691	18750	20054	20948	21173	
OTHER					3478	3890	3890	3981	4068	
TOTAL COMBAT					22560	22640	23944	24921	25253	
PLANNED SORTIES - CURRENT PLAN										
ATTACK - SVN										
- NVN										
- LAOS										
SUB-TOTAL										
OTHER										
TOTAL COMBAT										
ACTUAL SORTIES/April 1967 Estimate										
ATTACK - SVN	9997	10908	11894	12098	12686	12763	11751	12958	15153	
- NVN	3182	3465	4882	3468	3125	2178	132	2839	4497	
- LAOS	1895	724	1851	968	1472	3823	8282	5262	6247	
SUB-TOTAL	14994	15177	16137	16524	17283	17964	19881	21221	25697	
OTHER	3287	3331	3497	3859	3443	3471	4326	3852	4939	
TOTAL COMBAT	17381	18508	19634	20333	20646	21435	24209	24673	30636	

PLANNED LOSSES - DECEMBER PLAN										
ON ATTACK SORTIES - SVN					9.6	7.2	7.9	9.8	9.8	
- NVN					18.7	18.4	18.4	18.4	18.4	
- LAOS					2.7	3.8	4.9	4.9	4.9	
SUB-TOTAL					24.7	29.4	31.2	32.3	32.3	
ON OTHER SORTIES					1.9	1.9	1.9	1.9	1.9	
ALL OTHER LOSSES					6.8	6.8	7.2	7.4	7.7	
TOTAL LOSSES					37.4	38.1	40.3	41.8	41.9	
PLANNED LOSSES - CURRENT PLAN										
ON ATTACK SORTIES - SVN										
- NVN										
- LAOS										
SUB-TOTAL										
ON OTHER SORTIES										
ALL OTHER LOSSES										
TOTAL LOSSES										
ACTUAL LOSSES/April 1967 Estimate										
ON ATTACK SORTIES - SVN	5.3	2.8	7.8	7.8	4.8	9.8	18.8	3.8	11.8	
- NVN	9.3	18.8	21.8	17.8	16.8	13.8	2.8	5.8	17.8	
- LAOS	3.3	8.	1.8	1.8	3.	1.8	6.2	12.2	2.8	
SUB-TOTAL	17.3	28.3	29.3	25.8	23.2	23.2	18.8	16.2	30.2	
ON OTHER SORTIES	2.2	2.8	2.8	3.8	3.8	2.8	8.	2.8	1.8	
ALL OTHER LOSSES	8.2	2.8	7.8	9.8	6.8	18.8	12.8	4.8	6.8	
TOTAL LOSSES	27.3	24.8	38.8	37.8	29.3	35.8	38.8	24.8	37.8	

LOSSES PER THOUSAND SORTIES										
ON ATTACK SORTIES - SVN	.585	.122	.631	.579	.317	.785	.851	.232	.776	
- NVN	2.828	5.195	5.247	4.982	3.128	5.914	15.152	1.782	3.728	
- LAOS	2.985	8.	.961	1.835	8.	.333	.752	1.982	.528	
ON OTHER SORTIES	.688	.688	.572	.777	.871	.576	8.	.519	.222	
ALL OTHER LOSSES	.463	.188	.357	.442	.291	.467	.496	.161	.375	

1/ Plan is as of 11 December 1965. Cum. totals include Jul-Oct 1965 actual data. Projection through CY 1969 is a
 2/ Plan is as of 18 November 1966, and force deployments planned in Program 4. Cum. totals include Jul 65-Oct 66
 3/ Beginning in November 1966, loss projections are based upon actual sortie and loss rates from November 1965 thru
 4/ Rates have been computed by dividing the aircraft lost in each category by the appropriate total of sorties, as
 5/ Beginning in November 1966 projections are based upon 3 CVA at DaNang Station and recent SVN sortie performance
 6/ Beginning in April 1967, sortie and loss projections are based upon actual sortie and loss rates from 3
 Totals may not add due to rounding.

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b. Forces and Sorties - Sorties are a product of forces and sortie rates. We have used Program 4 forces through Change 25, plus an F-4 squadron for PRACTICE NINE. However, the forces were slightly changed when initial runs of this attrition estimate showed that we could retain certain aircraft longer than anticipated in Program 4. For instance, 1 F-105 squadron is not replaced by an F-4 squadron because of the lower F-105 loss rate.

Sortie rates are based on the 21 month period of July 1965-March 1967 instead of a 9-month moving average used in previous estimates. The reasons for the change are that variations have been random and the longer period gives a statistically better sample. We now predict 1.61 million sorties in the 1 July 1965-31 December 1969 period instead of 1.64 million, about 2% less.

c. Loss Rates - Past estimates have used a 9-month period for loss rate projections. The new estimate uses 21 months (July 1965-March 1967) for all loss rates except in NVN. While loss rates have fluctuated sharply from month to month, they show no trends except in NVN. Since we are predicting losses for 26 aircraft models using 7 loss rates, the need for a large sample size dictates the use of the longest stable period possible.

The NVN attack loss rate has not stabilized, as is shown for the Air Force and the Navy on Charts 1 and 2. This rate is critical since it determines about half of all losses. The table below compares projected losses using several reasonable NVN attack loss rates:

<u>Base Period</u>	<u>Loss Rate per 1000 Sorties</u>	<u>Projected Losses Apr 67 - Dec 69 a/</u>
Jul 65 - Mar 67	2.94	1005
Apr 66 - Mar 67	2.53	864
Jul 66 - Mar 67	2.31	790
Oct 66 - Mar 67	1.92	656

a/Based on 342,000 sorties in 33-month period.

The choice of an NVN attack loss rate is a matter of judgement. We improve our equipment and tactics and so do the North Vietnamese. So far, we are improving faster than they are but this could change. Furthermore, if we increase the proportion of sorties in northern North Vietnam (Route Packages 5 and 6) our loss rates on these sorties would increase by a factor of 3 to 5, as the table below indicates.

	<u>Month Average</u>		
	<u>Apr-Sep 66</u>	<u>Oct 66-Mar 67</u>	<u>Apr 66-Mar 67</u>
<u>Sorties</u>			
Rt. Pack. I-IV	7636	6221	6953
Rt. Pack V-VI	967	968	968
Total	8653	7189	7921
<u>Loss Rates</u>			
Rt. Pack. I-IV	1.84	1.47	1.68
Rt. Pack. V-VI	12.41	4.81	8.60
Total	3.02	1.92	2.53

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If we used a 9 month moving average to estimate NVN loss rates, the loss rate would be 2.31 and losses in the Apr 67-Dec 69 period would total 790. This rate would permit about 25% of the NVN sorties to be flown in Route Packages V and VI if the loss rates of the last 6 months continue, or it would allow a loss rate of about 9.8 in Routes V and VI, if we continue to fly about 11% of the NVN attack sorties in them and if the rate in Route Packages I - IV does not exceed 1.5.

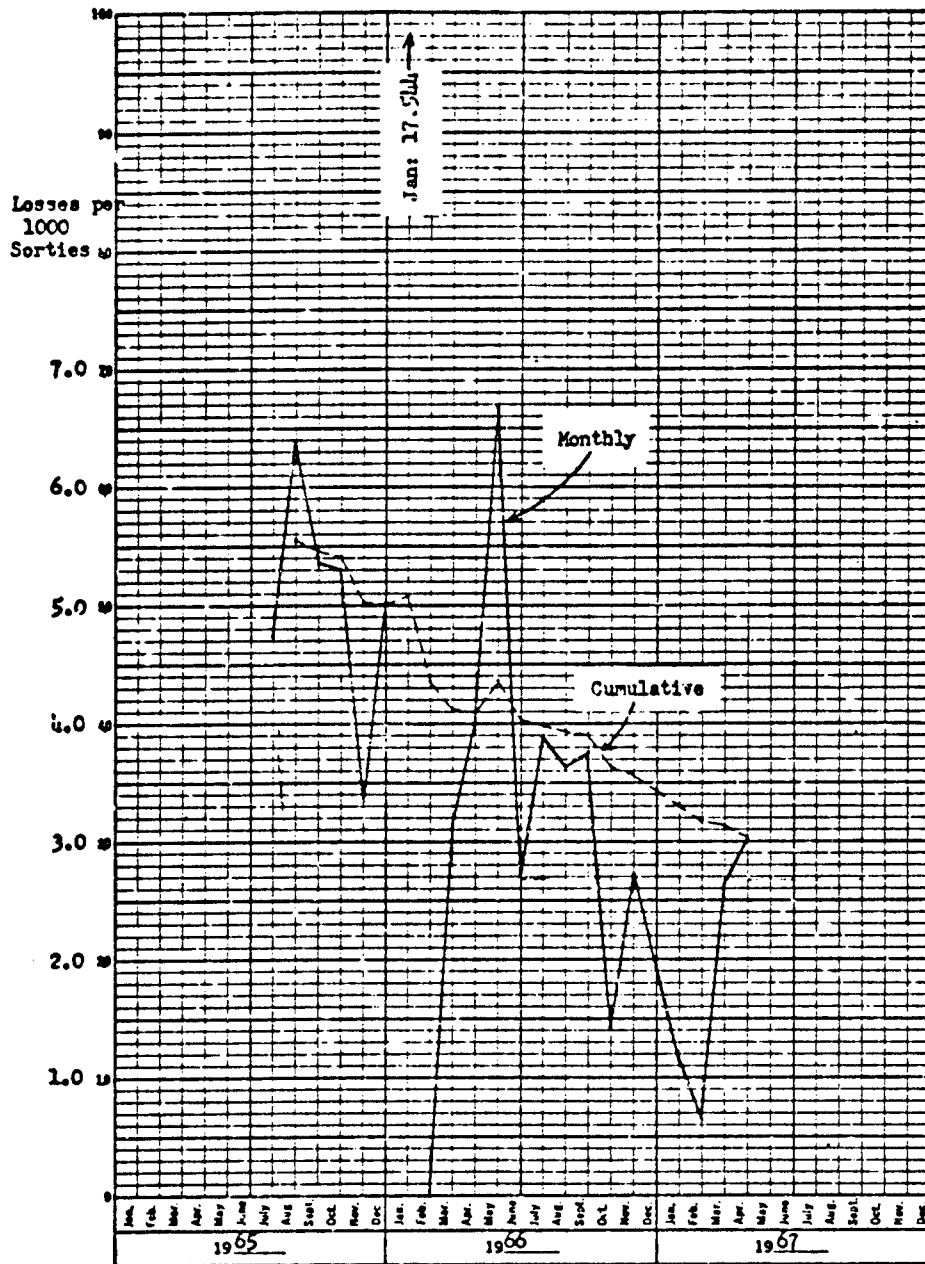
The 9 month attack rate, however, might prove too low if we fly an extended campaign against highly defended targets in the Hanoi - Haiphong areas. Loss rates of 10 to 20 aircraft per 1,000 sorties are likely in such strikes. It would also prove too low if the North Vietnamese receive SA-3 missile systems, REDEYE/CHAPEREL type infrared missile system, or if they rapidly learn how to use better the equipment they now have.

Therefore, to be on the safe side, we used the 2.53 rate of the last 12 months (Apr 66-Mar 67). Thus we project 864 attack losses in NVN from April 1967 through December 1969. The use of this loss rate provides a hedge against increased losses due to deployment of 3-4 more squadrons or a possible extensive campaign against heavily defended targets in the Hanoi-Haiphong area.

In brief, the NVN attack loss rate is the key factor, has a large range of variability, and is highly subject to targeting decisions which we do not know. The loss rate of 2.53 used in the April estimate is unlikely to result in either a large over-estimate or under-estimate of losses, but some uncertainty is unavoidable.

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CHART 1
ATTACK LOSS RATES - NVN
FIGHTER AND ATTACK AIRCRAFT - U.S. AIR FORCE

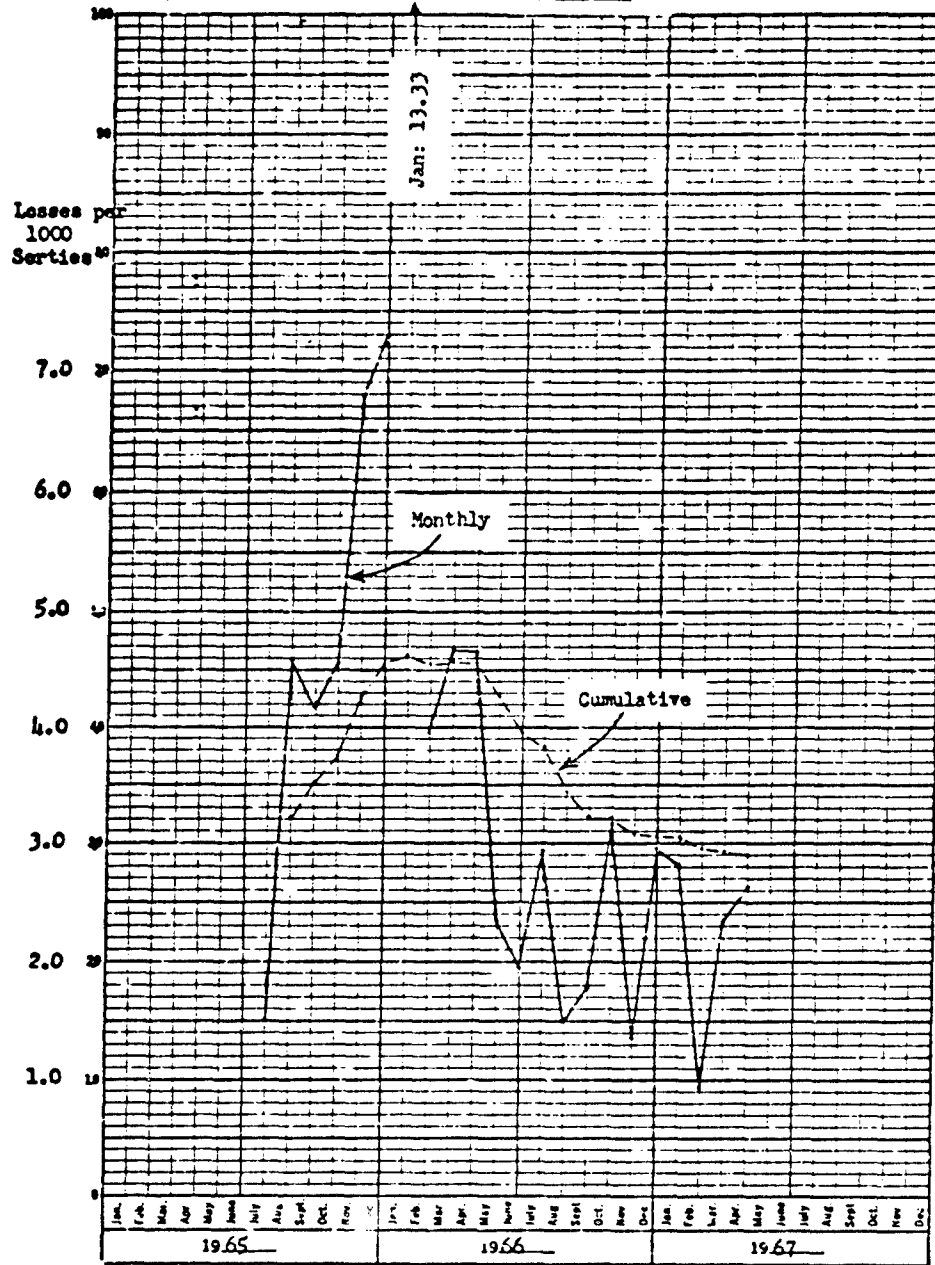


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CHART 2
ATTACK LOSS RATES * NVN
FIGHTER AND ATTACK AIRCRAFT - U. S. NAVY



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AIRCRAFT DESTROYED ON THE GROUND BY HOSTILE ACTION

Of 1599 U.S. aircraft lost to all causes in SEA from July 1965 through March 1967, 51 or 3% were destroyed on the ground by enemy action. Thirty-five of the 51 lost were helicopters; of these, 23 were OH-1s.

Thirty-one of the losses occurred during the first three quarters of FY 1966; only 11 occurred during the same period in FY 1967. While only one aircraft was destroyed in April 1967, 4 have been lost already in May in the attack on Bien Hoa.

Losses on the ground are difficult to predict since they are due to isolated, sporadic, and random enemy thrusts. Nevertheless, the OSD loss predictions include losses on the ground (and operational or non-combat losses) in the "All Other Losses" category in the Table 330 Series, OSD Statistical Summary.

AIRCRAFT DESTROYED BY HOSTILE ACTION
ON THE GROUND

	FY 1966				FY 1967			TOTAL
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	
<u>Fighter/Attack</u>								
F-102-AF	3	-	-	-	-	-	-	3
A-1-AF	-	-	-	2	-	-	-	2
A-1-USMC	-	2	-	-	-	-	-	2
SUB TOTAL	3	2	-	2	-	-	-	7
<u>Other Fixed Wing</u>								
C-119-AF	-	-	-	1	-	-	-	1
C-47-130-AF	3	-	-	-	-	-	-	3
O-1-A	-	-	-	3	-	-	-	3
CV-2-A	-	-	-	-	1	-	-	1
U-8-A	-	-	-	-	-	-	1	1
SUB TOTAL	3	-	-	4	1	-	1	9
<u>Helicopters</u>								
HH-43-AF	-	-	-	-	1	-	0	1
UH-1-MC	-	13	-	-	-	-	-	13
UH-34-MC	-	6	-	-	-	-	-	6
UH-1-A	-	-	-	3	4	1	2	10
OH-13-A	-	-	1	-	1	-	-	2
CH-37-A	-	-	1	-	-	-	-	1
CH-47-A	-	-	2	-	-	-	-	2
SUB TOTAL	-	19	4	3	6	1	2	35
TOTAL U.S.	6	21	4	9	7	1	3	51

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AIRCRAFT SORTIES & LOSSES

May Aircraft Losses

United States and VNAF aircraft losses reached a new high of 152 in May compared to a Current Plan projection 108. Twenty-one aircraft were destroyed on the ground, also a new high. (Losses in June have been much lighter. Only 33 aircraft have been lost during the first 13 days; if this pace continues we would lose 76 for the month.

Aircraft losses during the January-May period are summarized below:

Aircraft Losses in SEA - CY 1967 (All types)

	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>
Fighter/Attack	36	25	45	40	69
Recce/ECM	4	3	4	1	2
Other Fixed Wing	12	16	13	12	2
Helicopters	37	40	77	36	79
Total Losses	89	82	139	89	152

In May we lost 69 fighter and attack aircraft, compared to the Current Plan estimate of 50 (The Budget Plan estimated 62). Included were 10 F-105's, 15 F-4's, 16 A-4's and 13 A-1's. There were three main reasons for the large numbers of losses. Attack sorties in NVN were 8% over the Current Plan and losses were 12% higher (31 vs 27.6). We lost 27 fighter/attack aircraft on attack sorties in IP VI alone. Second, losses in SVN on attack sorties were more than double the plan (14 vs 6.4), primarily due to very high Marine losses (7 in May vs 23 in the previous 22 months). Third, the "all other losses" totaled 15 vs 9 predicted, due to 7 unexpected VNAF losses including 5 on the ground.

The 79 helicopter losses, of which 13 were on the ground, were 42 over the plan. Nine of these ground losses were Army helicopters destroyed during the May 18 attacks on Camp Carroll, Gio Linh, Dong Ha, and Cam Lo. We lost 53 Army UH-1s. 28 to hostile action (including 12 on the ground) and 25 operational. However, 20% of Army helicopters reported as destroyed are usually later found to be repairable.

The table below shows the excess of predicted losses from July 1965 through May 1967:

	<u>Fighter/ Attack</u>	<u>Recce/ ECM</u>	<u>Other Fixed Wing</u>	<u>Helicopters</u>	<u>TOTAL</u>
Actual Losses	887	73	227	699	1886
Budget Plan	1028	102	268	590	1988
Current Plan	875 a/	81 a/	268 b/	590 b/	1814
Excess of Predicted Losses over Actuals					
Budget Plan	141	29	41	(109)	102
Current Plan	(12)	8	41	(109)	(72)

a/ Includes actuals through March 1967 and April and May projections.

b/ Current Plan same as Budget Plan.

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May Sorties

Fighter and attack sorties in May reached a new high of 37,573. In SVN 18,319 were flown, 47% over the current plan of 12,500 primarily due to the USMC doubling its planned 3000 SVN attack sorties. The 11,292 sorties in RVN were up 26% from April, but only 18% over the planned 10,472. Marine fighter and attack aircraft had an especially busy month. They flew 6850 attack sorties, exceeding the plan of 4197 by over 60% and the previous peak month by 45%. Marine aircraft averaged about 49 total sorties each during the month compared to the historical average of about 31.

Marine helicopters logged 17,253 flying hours, a new high, up 51% over April. The Army also set a new helicopter flying hour record with 135,216 hours flown, up 2% from April. The Army increase reflects an increase in the numbers of deployed helicopters.

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AIRCRAFT SORTIES & LOSSES

June Aircraft Losses

United States and VNAF aircraft losses totaled 108 in June down 44% from the peak month of May and 19 below the Current Plan. June losses included eighteen Army UH-1 helicopters destroyed on the ground.

Aircraft losses during the first six months of 1967 are summarized below:

US & VNAF AIRCRAFT LOSSES IN SEA - CY 1967 - ALL TYPES

	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>
Fighter/Attack	36	23	45	40	69	37
Recce/ECM	4	3	4	1	2	4
Other Fixed-Wing	11	17	11	11	5	7
Helicopters	<u>38</u>	<u>41</u>	<u>61</u>	<u>38</u>	<u>76</u>	<u>60</u>
Total Losses	89	84	121	90	152	108

In June we lost 37 fighter and attack aircraft, compared to the Current Plan estimate of 52 (the Budget Plan estimated 62). June losses dropped sharply (46%) from the record high of 69 in May, although the total sorties flown were only down 9%. The lower losses and relatively large number of sorties had some interesting effects on loss rates for June. The NVN attack rate dipped to 1.48 (losses per 1,000 sorties) from rates of 2.79 and 2.75 in April and May. The only month on record with a lower NVN loss rate is February 1967 (0.73). The significant reduction in SAM activity in June compared to May (61 vs 119 engagements, 223 vs 596 missiles fired) resulted in 8 fewer (2 vs 10) fighter/attack losses.

The distribution of NVN attack sorties by route package showed some change between May and June. RP 1 & 2 sorties went down 6% to 5882, while those in the "tough" RPs 5 and 6 went up by 27% to 2646. The attack loss rate in RPs 5 & 6 dropped abruptly from 13.50 in May to 5.11 in June. This was due primarily to a shift from the heavily defended targets close to Hanoi and Haiphong to rail lines and outlying targets. The table below summarizes loss rates for various time periods.

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FIGHTER AND ATTACK AIRCRAFT LOSS RATES ^{a/}

	<u>1967</u>			<u>FY-67</u> Average	<u>OSD ESTIMATES</u>	
	<u>Apr</u>	<u>May</u>	<u>Jun</u>		<u>Current Plan</u>	<u>Bdgt Plan</u>
On Attk Sorties - SVN	.31	.76	.24	.47	.60	.46
- NVN	2.79	2.74	1.48	2.31	2.64	3.24
- Laos	.21	.78	1.39	.64	1.10	1.10
On Non-Attk Sorties (All Areas)	.63	1.29	1.46	.75	.47	.77
Operational (All Areas)	.17	.40	.20	.28	.26	.29
Total Losses	40	69	37	513 ^{b/}	516 ^{b/}	679 ^{b/}

^{a/} US & VNAF losses per 1,000 sorties.

^{b/} FY 1967 total.

Loss Predictions vs Actuals

The table below shows the excess (shortfall) of predicted losses by aircraft types from July 1965 through June 1967:

	<u>Fighter Attack</u>	<u>Recce/ ECM</u>	<u>Other Fixed Wing</u>	<u>Heli- copters</u>	<u>TOTAL</u>
Actual Losses	924	77	243	728	1972
Budget Plan	1090	109	286 ^{b/}	637	2122
Current Plan	927 ^{a/}	86 ^{a/}	286 ^{b/}	719 ^{c/}	2018
Excess of Predicted Losses over Actuals					
Budget Plan	166	32	43	(91)	150
Current Plan	3	9	43	(9)	46

^{a/} Includes actual data through March 1967 and projections in April through June.

^{b/} Current Plan same as Budget Plan.

^{c/} Includes actual data through May 1967 and June projection.

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Sortie Rates

Monthly sortie rates showed a steady increase during FY 1967. During April - June 1967 available aircraft flew an average of 33 sorties per month, up 25% over the last quarter of CY 1966. The increases were largely in Marine and Navy aircraft utilization. In part this reflects improved flying weather over NVN and the step-up in ground activities in I CTZ requiring many Marine close support missions. The table below summarizes the actual rates flown by Service for fighter/attack aircraft.

Fighter Attack Sortie Rates

Sortie Rates	1966			1967					
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Air Force	25.9	25.3	25.7	26.5	25.5	29.4	28.5	29.2	28.8
Navy (Based on 3CVA)	25.9	27.0	27.7	30.5	31.1	37.8	38.4	42.4	38.8
Marine	27.4	28.7	28.3	30.5	33.9	37.1	38.3	49.4	40.0
All Service Ave. Per Quarter	26.3			29.4			33.2		

(NOTE: No adjustments made for varying days per month or for standdown periods).

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AIRCRAFT SORTIES AND LOSSES

July Aircraft Losses

United States and VNAF aircraft losses in SEA totaled 146 ^{a/} in July, up 32 from June, but 12 below the peak month of May 1967. Current Plan estimate was 119, low by 27. July losses included 21 during the USS FORRESTAL fire and 10 at the Danang Air Base mortar attack.

July was the most costly month of the war in fighter/attack aircraft, when 77 were lost (the Budget Plan estimate was 62 and Current Plan, 53). The USS FORRESTAL fire and the attack on DaNang Air Base accounted for 18 and 8, respectively. There were 7 operational. The remaining 44 (22 AF, 19 Navy, and 3 Marine) combat losses rank July next to May 1967, when 52 fighter/attack types were downed. SAMs hit 6 fighter/attack aircraft, again ranking July next to May, when the missiles accounted for a high of 10. SAM launchings increased 21% over June (271 vs 213), but were still less than half of the 556 fired in May. All 6 losses to SA-2s were Navy and Marine aircraft, 4 A-4s and 2 F-8s. A point of special interest is that 222 (82%) of the SAMs were fired against Navy/Marine aircraft. Usually the missiles are split nearly equally between Air Force and Navy/Marine targets.

Total fighter/attack sorties in July were 35,588, 13% above the current plan which was based on average sortie rates in the 21 month period July 65 - Mar 67. Air Force and Navy total sorties were about 5% over plan but the Marines were up 34%, flying 6840 sorties. Marine aircraft each averaged 43 sorties and 53 flying hours in July, compared to 29 sorties and 55 flying hours per average possessed Air Force fighter/attack aircraft. The VNAF set a new record, when they flew 3327 A-1 and F-5 sorties in July, equating to 31 sorties and 50 flying hours for each aircraft. The Navy averaged 41 sorties and 70 flying hours, based on 3 CVAs.

In NVN attack sorties were about the same as for May and June, 11,274, but sortie distribution by route package showed an abrupt change due to choice targets and clearing weather. Sorties in RP 6 rose to a record high of 3,724 up 68% from June. Losses were also up from June in RP 6, 19 vs 9, and the loss rate rose from 4.07 to 5.10. Even as RP 6 loss rates were still well below the 15.0 average rate in October 66 - May 67.

A summary of July losses and the monthly average losses for the preceeding 3,6 and 12 months by aircraft category is shown in this table:

^{a/} In addition, the Air Force lost 3 B-52s.

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US & VNAF Aircraft Losses in SEA - All Types

	July 1967	Apr - Jun 1967 Monthly Avg.	Jan - Jun 1967 Monthly Avg.	FY 1967 Monthly Avg.
Fighter/Attack	77	49	42	43
Recce/ECM	6	2	3	3
Other Fixed Wing	11	9	11	11
Helicopters	52	61	54	42
Total Losses	146 a/	121	110	99

a/ Plus 3 B-52s

From the July and monthly average losses it appears that our aircraft losses are "skyrocketing." A closer look leads to some reasonable explanations. Three of the 6 Recce/ECM losses in July were in the USS FORRESTAL fire. For the fighter/attack aircraft, 26 were lost in the fire and in the Danang rocket attack. Subtracting these from the 77 total gives 51, not too different from the previous 3-month average, and accountable by the seasonal increase in NVN attack sorties. For helicopters the force in SVN has shown a steady increase, (19% over the FY 67 average) hence more aircraft have been exposed to attrition.

Loss Predictions vs Actuals

Our aircraft loss estimates include a forecast of operational losses and losses on the ground, but they cannot predict the occurrence of a unique disaster such as the USS FORRESTAL fire. Primarily because of the fire, total Navy and Marine Corps losses in fighter/attack and recce/ECM aircraft in July were 28 more than planned, raising the cumulative losses 26 over plan:

	Apr-Jun 1967		Current Plan	July 1967			Cum. Jul 65-67	
	Current Plan	Actual		Hostile & Opn'l	USS		Cur- rent Plan	Actual
					FORRESTAL Fire	Total Losses		
<u>Navy/Marines</u>								
Fighter/Attack	62	62	21	30	18	48	368	416
Recce/ECM	5	2	2	0	3	3	37	35
Total	67	64	23	30	21	51	425	451

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Since last month's report the Current Plan estimate of Other Fixed Wing aircraft attrition (including Program 5 forces) was approved. This completes the up-dating of Budget Plan estimates of aircraft losses. The table below shows the excess (shortfall) of predicted losses by aircraft categories from July 1965 through July 1967:

(US & VNAF)	Fighter/ Attack	Recce/ ECM	Other Fixed Wing	Helicopters	Total Aircraft
Actual Losses ^{d/}	1002	83	257	785	2127
Budget Plan	1152	116	312	675	2255
Current Plan	981 ^{a/}	92 ^{a/}	260 ^{b/}	769 ^{c/}	2102
Planned Less Actual					
for Budget Plan	150	33	55	(110)	128
for Current Plan	(21)	9	3	(16)	(25)

a/ Includes actual data through March 1967.

b/ Includes actual data through June 1967.

c/ Includes actual data through May 1967.

d/ Does not include AF: 5 B-52s, 5 helicopters; Navy: 2 helicopters; VNAF: 10 helicopters. Losses for these a/c are not forecasted.

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AIRCRAFT SORTIES AND LOSSES

July Aircraft Losses

During August US and VNAF aircraft losses in SEA totaled 139, down from July, but 16 greater than the Current Plan for those aircraft types included in the plan.

A summary of August losses and the monthly average losses for the preceding 3 and 12 months by aircraft categories is shown in this table:

US & VNAF AIRCRAFT LOSSES IN SEA

	<u>August 1967</u>		<u>Actual</u>	<u>Actual</u>
	<u>Planned</u>	<u>Actual</u>	<u>May-July 1967 Monthly Average</u>	<u>Aug 66-Jul 67 Monthly Average</u>
Fighter/Attk	53	59	61	45
Recco/ECM	6	9	4	3
Other Fixed-Wing	15	19	10	11
Helicopters	46	49	59	41
Subtotal	<u>120</u>	<u>136</u>	<u>134</u>	<u>100</u>
Total of Types Not Forecasted		3	5	2
Total Actual Losses	<u>120</u>	<u>139</u>	<u>139</u>	<u>102</u>

Fighter/Attack sorties in August were 4.7% greater than planned. The greatest difference was in SVN where the Air Force and Marines flew 13,900 sorties, 24% more than projected. Total fighter/attack hostile losses were 43, one greater than projected. There were 14 operational losses, 5 greater than planned, due to 5 VNAF A-1 operational losses compared to its planned rate of one every two months.

In the Reconnaissance/ECM category, we lost 9 aircraft, 3 more than planned, although total sorties flown were within 1% of plan. The sortie distribution, however, differed from the plan. The NVN loss rate in August was 2.09 per 1,000 sorties compared with an April-July rate of 0.59. Thus we were over plan in NVN in August versus almost 10 under plan there in the previous 4 months. Compounding the problem were 3 accidental losses, double the plan and to be compared with 6 in all of FY 67.

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Other Fixed Wing losses were 19, 4 over plan. The losses included 5 Air Force O-1/O-2 PAC aircraft destroyed in a POL fire on the ground at DaNang. The 49 helicopter losses, including 4 Marine aircraft destroyed during rocket attacks, were 3 over plan.

Loss Predictions vs Actuals

This table shows the excess (shortfall) of predicted losses by aircraft categories for the 26 month period through August 1967:

	<u>Fighter/ Attack</u>	<u>Recco/ ECM</u>	<u>Other Fixed Wing</u>	<u>Helicopter</u>	<u>Total Aircraft</u>
Actual Losses					
Total	1062	91	286	852	2291
Less Types Not Forecasted	None	None	5 ^{a/}	27 ^{b/}	32
Total of Types Forecasted	1062	91	281	825	2259
Budget Plan	1211	121	332	713	2377
Current Plan	1036	96	277	808	2217
Plan Less Actual					
Budget Plan	149	30	51	(112)	118
Current Plan	(26)	5	(4)	(17)	(42)

^{a/} USAF B-52's.

^{b/} USAF, USN and VNAF helicopters.

AIRCRAFT SORTIES AND LOSSES

September Aircraft Losses

Total US and VNAF aircraft losses in SEA dipped to 89 in September, 66% of the average for the last 3 months and 73% of the expected. Actual losses were 34 below the Current Plan for those aircraft types included in the Plan, with most of the shortfall in the fighter/attack category. September losses were the lowest since last December.

A summary of September losses and the average losses for the preceding 3 and 12 months by aircraft categories is shown in this table:

US & VNAF AIRCRAFT LOSSES IN SEA

	<u>September 1967</u>		<u>Actual</u>	<u>Actual</u>
	<u>Planned</u>	<u>Actual</u>	<u>Jun-Aug 1967</u> <u>Monthly Average</u>	<u>Sep 66-Aug 67</u> <u>Monthly Average</u>
Fighter/Attack	53	26	58	45
Recce/ECM	6	8	6	4
Other Fixed-Wing	15	8	14	12
Helicopters	48	46	53	43
Subtotal	<u>122</u>	<u>88</u>	<u>131</u>	<u>104</u>
Total of Types Not Forecasted ^{a/}		1	4	2
Total Actual Losses		<u>89</u>	<u>135</u>	<u>106</u>

^{a/} Aircraft for which losses are not forecasted are USAF B-52's and USAF, USN and VNAF helicopters.

Total fighter/attack sorties in September were only 5% below the plan (30,871 vs 32,485), but poor flying weather over North Vietnam restricted operations more than anticipated, particularly in high loss areas. Only 8492 attack sorties were flown in NVN, almost 4300 fewer than planned. By comparison during September of last year, over 12,000 attack sorties were flown over NVN. In addition a large portion of the September sorties were in the southern portion of NVN; over 58% of the sorties were in Route Package I, compared to the 6 month (March - August) average of 44%. This may be attributed largely to increased support for ground forces operations near the DMZ. In RP's V and VI, where the weather was particularly bad, there were only 1704 attack sorties, 20% of the NVN total. The net result was a

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favorable month from the view point of losses and loss rates. Only 9 fighter/attack aircraft were lost to hostile causes, the lowest over NVN since February.

During the last three months we have lost 23 reconnaissance and ECM aircraft, equal to the number lost during the previous 8 months. (The Current Plan estimate for July through September was 17.) The primary factor was losses over NVN, 11 during the period. They include an RF 101 shot down by a MIG in September and 4 aircraft (3 RF-4C's and 1 RF-101) downed by SA-2 missiles during the past 2 months. Recce/ECM aircraft may be more vulnerable to MIGs and SAMs since they fly in smaller formations. This offers better odds to MIG attackers and reduces the effectiveness of our ECM equipment. Recce/ECM sorties in September were down to 3273, 14% below plan. Again, bad weather restricted photo missions severely. With these low sorties, loss rates (losses per 1000 sorties) were high when compared to the average rates for the last 12 months (e.g., in NVN, 3.09 for September vs 1.01 for the past year).

September was the first month on record during which no aircraft were destroyed on the ground, either from hostile or operational causes.

Loss Predictions vs Actuals

The table below shows the excess (shortfall) of predicted losses over actual losses by aircraft categories for the 27 month period through September 1967:

AIRCRAFT LOSSES-PLAN VS ACTUAL
July 1965 - Sept 1967

	Fighter/ Attack	Recce/ ECM	Other Fixed- Wing	Helicopter	Total aircraft
Actual Losses	1088	100	294	903	2385
Less Losses for A/C Types Not forecasted	None	None	5 ^{a/}	28 ^{b/}	33
Total Losses of A/C Types Forecasted	1088	100	289	875	2352
Budget Plan (Dec 1966)	1268	128	351	753	2500
Current Plan	1089	103	292	856	2340
Plan less Actual					
Budget Plan	180	28	62	(122) ^{c/}	148
Current Plan	1	3	3	(19)	(12)

^{a/} USAF B-52's
^{b/} USAF, USN & VNAF Helicopters
^{c/} () means Actual losses exceed the plan.

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The Current Plans for Fighter/Attack and Recce/ECM aircraft have been in effect for 6 months, Other Fixed-Wing for 3 months, and for Helicopters, 4 months. The table below shows how the actual losses during these periods compared with the projections.

CURRENT PLAN VS. ACTUAL PLAN

	Forecast Period	Planned	Actual	% Error in Forecast
Ftr/Atk	6 mos, Apr-Sep	308.5	308	0.2
Recce/ECM	6 mos, Apr-Sep	33.0	30	10.0
Other Fixed-Wing	3 mos, Jul-Sep	44.1	41	7.6
Helicopter	4 mos, Jun-Sep	187.0	206	(9.2) ^{a/}

^{a/} Forecasted Low.

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OCTOBER AIRCRAFT LOSSES

A total of 133 US and VNAF aircraft were lost to hostile and operational causes during October, 6.6% (8 aircraft) over the Current Plan for those aircraft types for which we forecast losses. A summary of October losses and the average losses for the preceding 3 and 12 months by aircraft category is shown in this table:

US & VNAF AIRCRAFT LOSSES IN SEA

	<u>October 1967</u>		<u>Actual</u>	<u>Actual</u>
	<u>Planned</u>	<u>Actual</u>	<u>Jul-Sep 67</u> <u>Monthly Average</u>	<u>Oct 66-Sep 67</u> <u>Monthly Average</u>
Fighter/Attack	49	59	54	43
Recce/ECM	5	4	8	4
Other Fixed-Wing	16	20	14	13
Helicopters	52	47	53	45
Subtotal	122	130	129	105
Total of Types Not Forecasted ^{a/}	—	3	3	1
Total Actual Losses	122	133	132	106

^{a/} Aircraft for which losses are not forecasted are USAF B-52's and USAF, USN and VNAF helicopters.

Seven fighter/attack aircraft were downed by SAMs over NVN (2 F-4, 1 F-8, 2 F-105, and 2 A-4) and 3 were lost to MIGs (1 F-4 and 2 F-105). Groundfire, however, continued to be the greatest threat over the North, accounting for 22 aircraft. The large number of sorties against newly approved and heavily defended targets in the Hanoi/Haiphong area resulted in a heavy toll of F-105s -- 25 were lost, 16 to hostile action and 9 operational. The sixteen losses were on 2146 sorties for a hostile loss rate of 7.5 (per 1,000 sorties), the highest F-105 NVN rate since May 1966. The operational loss rate of 3.4 was the worst ever experienced for the F-105.

Bad weather in NVN continued to hold sorties in that area below the planned output, 8987 vs 10,327. Total sorties in all areas, however, were within 1% of the plan. Sorties that could not be flown in the North were shifted to SVN, where 16,316 were flown, 14.5% over plan.

Loss Predictions vs Actuals

The table below shows the excess (shortfall) of predicted losses over actual losses by aircraft categories for the 28 month period through October 1967:

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AIRCRAFT LOSSES-PLAN VS ACTUAL
July 1965 - Oct 1967

	Fighter/ Attack	Recce/ ECM	Other Fixed- Wing	Helicopters	Total Aircraft
Actual Losses	1146	104	315	952 ^{a/}	2517
Less Losses for A/C Types Not forecasted	None	None	5	31 ^{b/}	36
Total Losses of A/C Types Forecasted	1146	104	310	921	2481
Budget Plan (Dec 1966)	1325	135	371	797	2628
Current Plan	1137	108	309	908	2462
Plan less Actual ^{c/}					
Budget Plan	179	31	61	(124)	147
Current Plan	(9)	4	(1)	(13)	(19)

^{a/} USAF B-52's.

^{b/} USAF, USN & VNAF Helicopters.

^{c/} () means Actual losses exceed the plan.

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AIRCRAFT SORTIES AND LOSSES

November Aircraft Losses

A total of 127 U.S. and VNAF fixed and rotary-wing aircraft were lost to all causes in SEA during November. This total was 9 less than the FY 1968 Budget Plan for those aircraft types included in the Plan, and 3 less than the recently approved FY 1969 Budget Plan. (The new loss projection is discussed later.)

A summary of November losses and the average losses for the preceding 3 and 12 months by aircraft categories is shown in this table:

	<u>November 1967</u>		<u>Aug-Oct 1967</u>	<u>Nov 66-Oct 67</u>
	<u>Planned^{a/}</u>	<u>Actual</u>	<u>Monthly Average</u>	<u>Monthly Average</u>
Fighter/Attack	43	44	48	45
Recco/ECM	5	5	7	4
Other Fixed Wing	16	20	17	13
Helicopters	<u>61</u>	<u>53</u>	<u>52</u>	<u>48</u>
Subtotal	125	122	127	110
Total of types not forecasted b/		5	2	1
Total Reported Losses	125	127	129	111

a/ FY 1969 Budget Plans

b/ Aircraft for which losses are not forecasted are USAF B-52's and USN and VNAF Helicopters.

Total combat sorties by Fighter/Attack aircraft in November were 30,463, 4.8% below the new FY 1969 Budget Plan. Attack sorties were 4.3% below the plan (26,831 vs. 28,029), with the continuing bad flying weather in NVN being the major factor. Only 7,192 attack sorties were flown in NVN compared to 8,939 planned: a portion but not all of these sorties were shifted to Laos; 4,392 sorties were flown compared to only 3,105 planned. The number of NVN attack sorties was the lowest total since last February, but 25 aircraft were downed, giving a loss rate of 3.5 per thousand sorties. Fourteen of these were F-105's, as the Thunderbird continued to sustain higher than expected losses. In the past two months 30 F-105's were lost on 3,650 attack sorties, for a loss rate of 8.2. MIG's accounted for 5, SAM's downed 9, and the rest (16) were lost to AAA.

MIG resistance to our operations in NVN continued to increase. During November MIGs shot down three F-105's, an Air Force F-4 and a Navy F-4, the largest total since last April. Tactics being used by the NVN pilots indicate that they are getting good GCI control.

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Loss Predictions vs Actuals

The table below shows the excess (shortfall) of predicted losses over actual losses by aircraft categories for the 29 month period through November 1967.

AIRCRAFT LOSSES-PLAN VS ACTUAL
July 1965 - Nov 1967

	Fighter/ Attack	Recce/ ECM	Other Fixed- Wing	Helicopters	Total Aircraft
Actual Losses	1190	109	340	1012	2651
Less Losses for A/C Types Not forecasted	none	none	5 ^{a/}	23 ^{b/}	28
Total Losses of A/C Types Forecasted	1190	109	335	989	2623
FY68 Budget Plan (Dec 1966)	1381	141	391	859 ^{d/}	2772
FY69 Budget Plan (Dec 1967)	1189	109	331	997	2626
Plan less Actual					
FY68 Budget Plan	191	32	56	(130)	149
FY69 Budget Plan	(1)	0	(4)	8	3

a/ USAF E-52s.

b/ USN & VNAF Helicopters.

c/ () means Actual losses exceed the plan.

d/ Adjusted to include USAF losses that were not forecasted.

New Attrition Estimates

The official projections of aircraft losses in SEA through December 1970 were revised during November and subsequently approved by the Secretary of Defense for programming and budgetary purposes. The new estimates, called the FY 1969 Budget Plans, cover Fighter/Attack, Recce/ECM, Helicopters and Other Fixed-Wing Aircraft. The forces used in all estimates were Program 5, through Change #6, including the latest Navy carrier deployment and aircraft loading plans. The methodology used for each estimate is outlined below.

A. Fighter and Attack. We estimate that the US and VNAF will lose 19 more fighter-attack aircraft in the July 1965-December 1970 period that we predicted in April of 1967, but 532 fewer than we estimated a year ago for the FY 1968 Budget Plan.

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The methodology is similar to that used for the FY 1968 Budget Plan of November 1966 and for the April 1967 "Best Estimate." This method last April predicted fighter aircraft within 2.5% in the Apr-Oct 1967 period (357 predicted, 366 actual). We used 7 loss rates for each aircraft model to predict losses: loss rates for attack and non-attack combat sorties for three areas (SVN, NVN, Laos), and a rate for all other losses (operational and destroyed on the ground). We use 6 sortie rates for each aircraft type: an attack and non-attack combat sortie rate for each of the three areas. Finally, we have a "weather cycle" that apportions sorties between NVN, Laos, and SVN according to our observations of the shifts in sortie patterns between areas from month to month.

This new estimate used the 28 month (July 1965 - October 1967) average for all loss rates except the NVN attack rate. All rates vary widely from month to month, but none show a trend except in NVN (See Chart 1). It appears that the NVN attack loss rate has nearly stabilized. For the 5 months (June-October) the "last 12 month moving average" has been about 2.3 (losses per 1,000 sorties). Therefore, we used individual aircraft rates that aggregate to 2.3 for this estimate, compared to a composite rate of 2.5 for the estimate of April 1967 and of 2.9 for the FY 1968 Budget Plan prepared a year ago. Our loss projections are particularly sensitive to the NVN rate, as it determines about half of the total losses.

Sortie rates were based on the July 1965 - October 1967 period, except for the Marine Corps. Since their sortie output had increased significantly since last January, we used the last twelve months data for our projection. Over-all, we now predict 2,652,000 total sorties in the July 1965 - December 1970 period, up 1.3% from the April estimate and last year's Budget Plan.

B. Reconnaissance/ECM. We project the loss of 29 fewer reconnaissance and ECM aircraft in the July 1965 - December 1970 period than the plan of last April and 103 less than the FY 1968 Budget Plan.

The prediction method used in this estimate was the same as that used in the past; loss and sortie rates were computed for each type aircraft from historical data. A 28 month data base (July 1965 - October 1967) was used for all rates except NVN loss rates. As in the case of fighter/attack aircraft, loss rates for the recce/ECM type aircraft vary widely from month to month. In NVN, however, there was a definite downward trend, so we used the last 12 months moving average for each aircraft type, rather than an average based on all historical data as we had done in the past. Thus, the composite NVN loss rate used was 1.2 (losses per 1,000 sorties), compared to 1.7 last April and 1.8 in November 1966. This methodology predicted last April that we would lose 38 aircraft in the Apr-Oct 1967 period; we actually lost 34.

C. Other Fixed-Wing Aircraft. Our new estimate did not vary significantly from the one made in July. We now project 4 more losses in the October 1965 - December 1967 period. The total of 952 losses for the FY 69 Budget Plan is 167 fewer than those estimated in the FY 1968 Budget Plan.

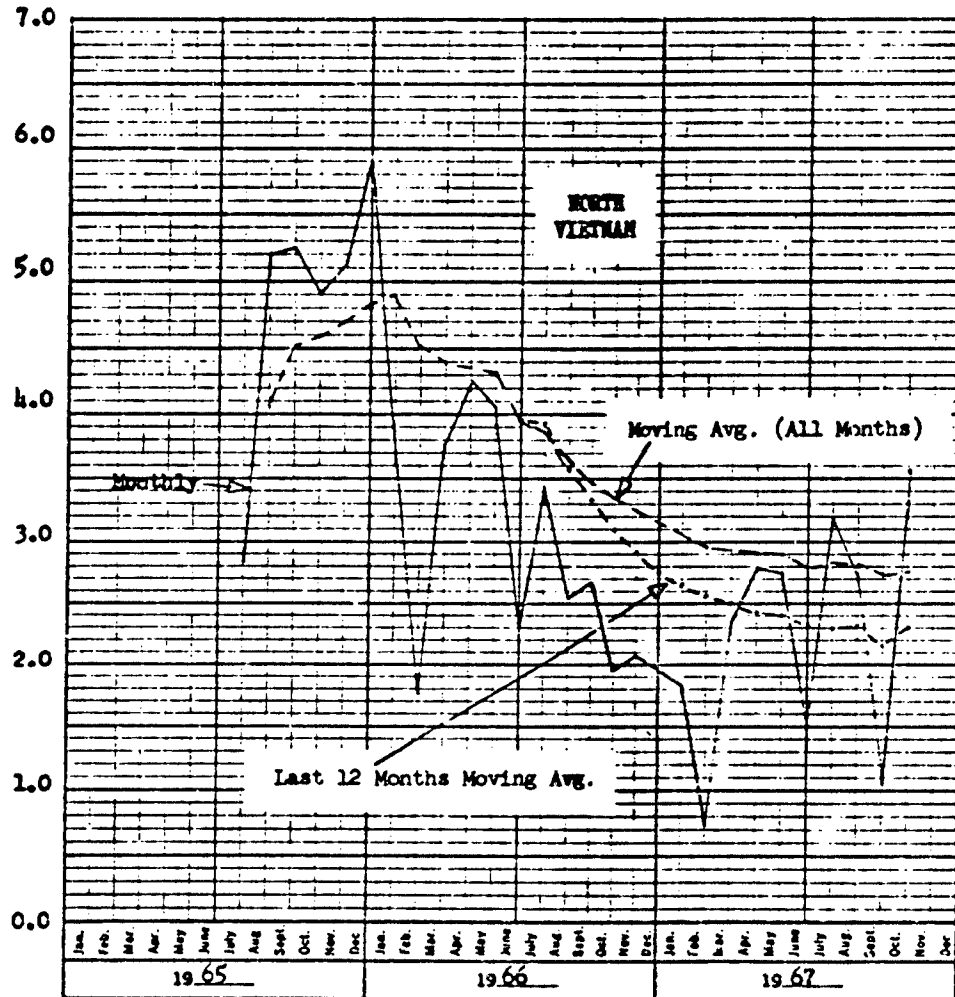
We used a loss rate per possessed aircraft in this estimate, not losses per sortie. The loss rates were computed by dividing total losses (included

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CHART 1.
ATTACK LOSS RATES
FIGHTER AND ATTACK AIRCRAFT - U.S. AND VNAF

Losses per 1000 Sorties



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aircraft destroyed on the ground by enemy actions) by total possessed aircraft over a 12 or 25 month period. The 12 month base was used when the loss rate showed a definite trend (either up or down) and 25 month data when no trend was apparent or total losses were small. In general, loss rates and approved deployments have not changed much since July, hence the small change in projected losses.

D. Helicopters. For the Army and Marine Corps we now expect to lose 349 more helicopters in the July 1965 - December 1970 period (3370 vs 3021) than we estimated last June (based on Program 4). Increased deployments will account for 44 (13%) of the increase, and higher loss rates the rest. To these losses we have added actual and predicted Air Force losses, not previously forecasted. We estimate that the Air Force will lose 65 from November 1967 through December 1970. Adding these losses to the 15 already lost since July 1965, the new cumulative losses through December 1970 for Army, Marine Corps and Air Force are projected to be 3450.

In general, we followed the same approach as with "Other Fixed-Wing Aircraft," projecting losses on the basis of the number of possessed aircraft. Loss rates were computed using the experience of the last 12 months for which reliable data are available (November 1966 - October 1967). Where total losses are small, however, the experience of the last 25 months was used.

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AIRCRAFT SORTIES AND LOSSESDecember Aircraft Losses

A total of 113 U.S. and VNAF fixed and rotary-wing aircraft were lost in SEA during December, down from 132 in October and 134 in November. The December total was 12 less than the FY 1969 Budget Plan for those aircraft types included in the Plan. A summary of December planned versus actual losses and average losses per month for 2 preceding periods are shown below:

	<u>Last Month</u>		<u>Last 3 Months</u>	<u>Last Year</u>
	<u>December 1967</u>	<u>Planned^{a/} Actual</u>	<u>Sep-Nov 1967</u> Monthly Average	<u>CY 1967</u> Monthly Average
Fighter/Attack	40	33	43	46
Recce/ECM	5	2	6	4
Other Fixed Wing	17	12	18	14
Helicopters	62	65	51	52
Subtotal	124	112	118	116
Total of Types not forecasted b/	-	1	2	2
Total Reported Losses	124	113	120	118

a/ FY 1969 Budget Plans

b/ Aircraft for which losses are not forecasted are USAF B-52's and USN and VNAF helicopters.

Seventy of the 113 December losses were due to hostile causes; of these 65 were from ground fire, 2 to SAMs and 3 to MIGs. Hostile losses were distributed as follows: 17 in NVN, 9 in Laos, and 44 in SVN. Of 269 crewmembers involved in all aircraft losses, 56 (21%) were reported killed, 2 captured, 42 (16%) missing, and 168 (62%) were recovered. SAR in NVN recovered 11 (37%) of the crewmembers they tried to rescue. No attempts could be made for 3 crewmen because of the hostile environment in which they landed.

Fighter/Attack Aircraft

Sixteen fighter/attack aircraft were lost over NVN while on attack missions, the number forecast in the FY 1969 Budget Plan. Attack sorties in NVN were less than planned, however, 5718 vs. 7112 as the Northeast monsoon continued to hamper missions, particularly in the northern Route Packages. For example, in RP VI from 1-28 December, the Air Force scheduled (fragged) 2,864 primary day strike sorties; only 375 (13%) of these were flown, virtually all of them during the week of 15-21 December when conditions cleared appreciably.

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The sorties cancelled because of weather were diverted to other areas of NVN or to targets in Laos. As a result, attack sorties in Laos numbered 6722, the highest on record, and 30% more than the 5157 projected. Attack losses in Laos reached an all time high of 8, but targets destroyed and damaged also rose as increased truck convoy activity through the Laotian panhandle offered more lucrative targets than could be struck. The high losses resulted from added sorties as well as increased enemy AAA and small arms opposition to attacks. The JCS has reported that AAA firings in Laos increased from 19 per 1000 sorties in 1966 to 74 per 1000 during the first 10 months of 1967.

MIGS shot down 3 USAF aircraft in December, one F-105 and two F-4's. This was the fifth consecutive month with at least one fighter/attack aircraft loss to MIGS (16 losses from August through December). In addition, the Air Force reported that 98 attack sorties over NVN jettisoned ordnance because of MIG interference. MIG tactics changed; attacks by 2 aircraft in formation (made earlier last year), were replaced in December by 4 plane intercepts (both MIG-17's and MIG-21's used these tactics). These changes in enemy tactics underscore the continued improvements in the NVN GCI network and their ability to maintain, and in fact increase the MIG threat despite our strikes against Phuoc Yen and various other key airfields.

Attack sorties in SVN, NVN, and Laos were 27,651, 1% below forecasted. Total fighter/attack sorties numbered 32,023, less than 1% fewer than projected.

Recce/ECM Aircraft

No reconnaissance/ECM aircraft were lost to hostile causes during December. This was the first month on record with no hostile losses; 26 were lost in the previous 6 months. Operational causes, however, lead to crashes of a USAF EB-66, the second in two months, and a USMC RF-4. Reconnaissance/ECM sorties continued at a lower level than planned. 3159 were flown, 20% fewer than projected.

Ground Losses

No U.S. aircraft were destroyed on the ground by enemy attacks in December, but VC mortar, rocket and infiltrator attacks accounted for 40 aircraft losses in CY 1967. The replacement cost of these aircraft is about \$50 million. This table shows these losses by aircraft types:

US Losses on the Ground from
Hostile Causes - CY 1967

<u>FIGHTER/ATTACK</u>	<u>HELICOPTER</u>	<u>OTHERS</u>
1 F-102	12 UH-1	5 C-130
1 F-100	2 UH-34	8 O-1
6 F-4	1 UH-23	1 U-8
2 F-8	1 CH-46	14
<u>10</u>	<u>16</u>	

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Loss Predictions vs Actuals

The table below shows the excess (deficit) of OSD predicted losses over actual losses by aircraft categories for the 2½ year period, July 1965 through December 1967.

AIRCRAFT LOSSES - PLAN VS ACTUAL
July 1965 - December 1967

	Fighter/ Attack	Recce/ ECM	Other Fixed- Wing	Helicopters	Total Aircraft
Actual Losses	1223	111	354	1086	2774
Less Losses for A/C Types Not forecasted	none	none	a/	24 ^{b/}	29
Total Losses of A/C Types Forecasted	1223	111	349	1062	2745
FY69 Budget Plan (Dec 1967)	1229	114	348	1062	2753
Plan less Actual	6	3	(1) ^{c/}	0	8

- a/ USAF B-52's.
- b/ USN & VNAF Helicopters.
- c/ () means Actual losses exceed the plan.

AIRCRAFT SORTIES AND LOSSES

US and VNAF fixed and rotary-wing aircraft losses in SEA during January and February 1968 totaled 157 and 176 respectively. Included were 80 aircraft destroyed on the ground by enemy attacks on bases in SVN (44 fixed wing and 36 rotary). The 176 losses in February make it the most costly month on record, surpassing the previous high of 162 in July 1967. A summary of January and February planned versus actual aircraft losses and the average losses per month for the preceding six months are shown on Table 1.

TABLE 1

US & VNAF PLANNED VS ACTUAL AIRCRAFT LOSSES

	January 1968			February 1968			Monthly Average Previous 6 months July-December 1967		
	FY69 Budget Plan	Act- ual	on Ground ^{a/}	FY69 Budget Plan	Act- ual	on Ground ^{a/}	FY68/69 Budget Plans ^{e/}	Act- ual	on Ground ^{a/}
Fighter/ Attack	42	53	(10)	40	33	(3)	53	50	(1)
Reconnais- sance ECM	5	5	(0)	5	4	(2)	9	6	(0)
Other Fixed Wing	17	8	(4)	17	33	(25)	18	17	(2)
Helicopter	62	87	(14)	65	102	(22)	48	61	(2)
Totals for A/C that are pro- jected	126	153	(28)	127	172	(52)	128	134	(5)
Losses for A/C not projected		^{b/}			^{c/}			^{d/}	
Total Reported Losses		157	(28)		176	(52)		136	(5)

- a/ Included in total Actual.
- b/ VNAF: 2 CH-34, USN: 1 OP-2E and 1 C-1.
- c/ USN: 2 OP-2E, 1 P-3, 1 UH-2.
- d/ VNAF & USN losses which are not projected.
- e/ FY 68 Budget Plan for Jul-Oct and FY 69 Budget Plan for Nov-Dec 1967.

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Aircraft Destroyed on the Ground

The 80 aircraft that were destroyed on the ground have a replacement cost of \$50 million. In addition, moderate and heavy damage was inflicted on 124 fixed-wing and 296 helicopters. During the previous six months an average of only 5 fixed and rotary-wing aircraft were destroyed and 24 damaged by enemy attacks each month.

Fighter/Attack Aircraft

During January and February, 86 fighter/attack aircraft were lost to all causes, 4 more than the FY 69 Budget Plan forecast. Forty-six of the losses were on attack missions (21 in NVN, 17 in SVN, and 8 in Laos). Attack sorties for the two months totaled 58,703, within 2% of the forecast, but distribution differed significantly from the plan. Unusually bad flying weather reduced the number of sorties in NVN (9638 actual vs 14,347 planned), and the increased tempo of ground operations in SVN resulted in heavier than expected in-country air support (34,891 actual vs 29,899 planned). Attack sorties in Laos during the two months totaled 14,174, 5% more than planned; over 8,000 of these were flown during January, the highest number on record. This is in part a reflection of the greater emphasis on interdiction in Laos, in part a response to lots of targets being spotted and in part the result of large numbers of weather divers from targets in NVN. Despite the large number of sorties, losses were about as expected; 3 in January and 5 in February, well below the record high of 8 losses in Laos in December.

The 21 hostile losses over NVN in January and February were as follows: 6 to ground fire, 7 to SAMs, and 8 to MIGs. February marked the seventh straight month in which at least one aircraft has been downed by a MIG. During the last six months of CY 67, we lost an average of 2.7 aircraft per month to MIGs. The 4 losses to SAMs in January and the 3 in February were below the July thru December 1967 average of 6.2 per month. SAM firings dropped sharply; only 124 SAMs were fired in January, and 110 in February, compared to a monthly average of 392 during October-December 1967. But there was a marked increase in "relative" efficiency of North Vietnam's SAMs during January and February. The ratio of SAMs fired to aircraft losses was 33:1 in January/February, compared with ratios of 72:1 and 56:1 during the first and second halves of CY 1967.

Recce/ECM Aircraft

Nine reconnaissance/ECM aircraft were lost in January and February, one less than our forecast. All were to hostile causes, 7 while on missions (including one EB-66 probably to a MIG) and 2 to rocket/mortar attacks at Tan Son Nhut Air Base. Recce/ECM sorties continued at a lower than projected level, 6430 in January and February vs 8312 forecasted.

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Other Fixed-Wing Aircraft

Forty-one other fixed-wing aircraft were destroyed during the last two months, against a forecast of 34. The bulk of the losses, 29, were aircraft destroyed on the ground, including 15 O-1 and 6 O-2 FAC aircraft.

Helicopters

Helicopter losses in January and February were extremely heavy totaling 87 and 102, respectively (plus 2 VNAF CH-34s and 1 Navy UH-2, aircraft types for which losses are not projected). The FY 69 Budget Plan estimates for those months were 62 and 65. Again, aircraft destroyed on the ground contributed heavily to the losses, 14 in January and 22 in February. However, even if only losses in the air were considered, our projections appear low. The reason for the heavier losses in the air is the increased pace of ground operations in SVN and the resulting increase in helicopter operations coupled with more intense and effective anti-aircraft fire. Total US flying hours averaged 195,679 hours during January and February, a 30% increase over the average for the last three months of 1967. The helicopter force only increased 10% during this period.

The losses in January and February were primarily to hostile causes. During the last three months of 1967 the Army and Marine Corps lost an average of 28 helicopters per month to ground fire while on missions and 36 to operational causes. However, during January and February the losses to ground fire rose significantly to 46 and 55, while the operational losses dipped to 26 and 24. During CY 67 hostile losses consistently accounted for about 45% of the flying losses. They increased to 70% in January and February. Whether this reflects a general improvement in VC/NVA anti-air capability or merely unusual operational considerations during the TET offensive is not known.

TABLE 2

US HELICOPTER LOSSES IN SVN
HOSTILE & OPERATIONAL

	1967						Monthly Average		1968			
	October		November		December		Oct-Dec 67		January		February	
	H	O	H	O	H	O	H	O	H	O	H	O
US Army	5	33	27	34	42	32	25	33	41	25	48	23
USMC	2	3	3	3	4	2	3	3	5	1	7	1
Total A/C Losses	7	36	30	37	46	34	28	36	46	26	55	24
Destroyed on Ground	4	-	2	1	-	1	2	-	14	-	22	-
Total Losses	47		70		81		66		86		101	

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Loss Predictions vs Actuals

We normally make two loss projections each year, in the fall when the Budget is prepared and in the spring before the funds are apportioned. Our current approved loss estimate (the FY 69 Budget Plan) was made in November, 1967, based on experience through October. Our planned versus actual experience during the four months since the projections were made is shown below:

TABLE 3

AIRCRAFT LOSSES-PLAN VS ACTUAL

November 1967-February 1968

	Fighter/ Attack	Recce/ ECM	Other Fixed- Wing	Heli- copters	Total Aircraft
Actual Losses	162	16	81	351	610
Less Losses for A/C Types Not Forecasted	-	-	5 ^{a/}	9 ^{b/}	14
Total Losses of A/C Types Forecasted	162	16	76	342	596
FY 1969 Budget Plan	164	20	66	250	500
Plan less Actual ^{c/}	2	4	(10)	(92)	(96)

^{a/} USN: 3 OP-2E, 1 C41, 1 P-3.

^{b/} USN: 2 UH-2; VNAF: 7 CH-34

^{c/} () means Actual losses exceed the Plan.

Although in gross our projections of fixed-wing aircraft have been quite accurate, losses of individual aircraft types vary more widely from the projections. For instance, for the four months of the FY 69 Budget Plan, USAF F-4 losses were 9 more than the forecast (37 actual versus 28 planned), while A-1 losses are 8 under the estimate (5 versus 13). The USN and USMC F-4s are 4 over (20 vs 16), and the A-4s 12 under (15 vs 27). These variances are not great enough to require any action at this time. They will be accounted for in our next regular update of attrition projections in May. Any corrective actions in deployments and production scheduling that may be needed can be taken at that time.

The heavier than expected helicopter losses led us to make a new projection which forecasts 4,183 losses for the period ending December 1970, 730 more than the FY 69 Budget Plan. This new estimate served as the basis for additional helicopter procurement which is under consideration and will be used as the "Current Plan" in future OSD publications.

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AIRCRAFT SORTIES AND LOSSES

March Aircraft Losses

US and VNAF aircraft losses in SEA totaled 155 in March, down from the record high of 177 in February. Nevertheless, actual losses exceeded the plan by 7 (151 vs 144) for those aircraft types included in OASD(SA) projections. A summary of March losses and the average monthly losses for the preceding 3 and 12 months by aircraft categories is shown in this table:

	<u>Last Month</u> <u>March 1968</u>		<u>Previous 3 Months</u> <u>Dec 1967-Feb 1968</u>	<u>Previous 12 Months</u> <u>Mar 1967-Feb 1968</u>
	<u>Planned^{a/}</u>	<u>Actual</u>	<u>Monthly Average</u>	<u>Monthly Average</u>
Fighter/Attack	45	36	40	48
Recce/ECM	5	3	4	4
Other Fixed Wing	17	26	18	15
Helicopters	<u>77</u>	<u>86</u>	<u>90</u>	<u>64</u>
Subtotal	144	151	152	131
Total of types not forecasted ^{b/}		4	3	3
Total reported losses		155	155	134

a/ FY 1969 Budget Plan for Recce/ECM and other fixed wing aircraft and the Current Plan (March 1968) for Fighter/Attack and helicopters.

b/ Aircraft for which losses are not forecasted are USAF B-52's, VNAF helicopters, and some USN aircraft.

108 of the 155 March losses were due to hostile causes; of these 95 were from ground fire and 13 were destroyed on the ground. No aircraft were lost to MIGs or SAMs, although 218 SAMs were fired at U.S. aircraft during March. At least one US aircraft had been shot down by MIGs each month since last August. Fighter/attack hostile losses were distributed as follows: 8 in North Vietnam, 8 in South Vietnam, and 9 in Laos. The 9 hostile losses in Laos were the highest of the war. The abrupt drop to 13 aircraft destroyed on the ground from 28 in January and 52 in February reflects the slackening of enemy action directed at our SVN bases.

March Sorties and Loss Rates

A total of 37,029 combat sorties, a new record, were flown by fighter and attack aircraft in March. (The FY 1969 Budget Plan projected only 33,647 sorties.) More than half (19,300) were attack missions in SVN,

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also a new high; only 14,900 were projected. The loss rate of 0.415 (losses per 1000 sorties) in South Vietnam is less than the overall rate of 0.448 realized in SVN since July 1965 and the FY 1969 Budget Plan forecast of 0.460. The heavier losses in SVN anticipated in the December forecast have not yet materialized.

Attack sorties in North Vietnam totaled 5039, 44% fewer than the 8900 forecast in FY 1969 Budget Plan. This was the result of continued adverse weather. The 8 losses in NVN gave a loss rate of 1.59, the lowest since last September. As in previous months of the Northeast monsoon season, attack sorties were diverted to Laos, where over 7100 were flown, 35% more than the 5260 forecasted. The attack loss rate in Laos jumped to 1.267, higher than any month since last August, and above the overall rate (0.968) used in the FY 1969 Budget Plan estimates. The higher than expected Laos rate may reflect greater efforts by the enemy to buildup his AAA defenses there to offset our increased attacks on supply and infiltration routes. A recent USAF intelligence report,^{a/} for example, states that lower than expected burst altitudes in the 37 mm threat areas of Laos indicate that fuzing changes may have been made to make the AAA more effective.

Reconnaissance and ECM sorties rose slightly from February to a total of 3164, still well below the 4156 forecasted. Fewer than expected missions in NVN accounted for most of the reduction.

The pace of helicopter operations in SVN continued to increase during March reflecting the continued buildup of helicopters. Over 200,000 flying hours were logged by US and VNAF crews on nearly 580,000 sorties. The 90 helicopter losses consisted of 62 to hostile causes (including 8 on the ground) and 28 to operational causes. As we noted in the March report during the past three months, a significant shift in losses has occurred in the ratio of hostile to operational losses. Prior to January the majority of helicopter losses were due to operational causes. This year the percentage dropped to 34%. There appear to be two countervailing trends; losses to ground fire are increasing while operational losses have declined significantly, as shown below.

ARMY/MARINE HELICOPTER LOSSES IN SVN
HOSTILE AND OPERATIONAL FLYING LOSSES

	4th Quarter 1967		1st Quarter 1968	
	Hostile	Operational	Hostile	Operational
Army	74	99	124	74
Marine	9	8	27	4
Total	83	107	151	78

The reasons for the sharp increase in losses to ground fire appear to be two-fold: (1) more helicopters and as a result more sorties and (2) the heavy combat pace in recent months coupled with improved VC/NVA air defenses.

^{a/} WAIS, 7AF DIA-0233.

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Stringent USARV efforts to reduce the heavy toll of losses to operational causes appear to be paying off; operational losses were down 25% despite increased sortie and flying hours. The most probable reason for the drop in Marine operational losses is the CH-46 modification program.

April Attack Sorties and Losses

The restrictions on bombing in North Vietnam have resulted in a concentration of attack sorties in the southern Route Packages and some sortie diversions to Laos. Total sorties in the two countries will be quite close to our projections. Based on data through April 22, about 7000 attack sorties will be flown in NVN during the month against a forecast of 9000. In Laos, about 7000 will be flown vs a projection of 5350. Losses appear to be well below the projection: 8 in NVN (21 planned) and 2 in Laos (5 planned). The table below shows planned and actual fighter/attack sorties and losses in NVN and Laos during the first 3 months of 1968 and a linear extrapolation for April based on 22 days operation.

FIGHTER/ATTACK SORTIES AND LOSSES

	1968			
<u>North Vietnam</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr^{b/}</u>
Fighter/Attack Sorties				
Actual	6357	3281	5039	7055
Plan ^{a/}	7737	6610	8921	9001
Fighter/Attack Hostile Losses				
Actual	14	7	8	8
Plan ^{a/}	18	15	21	21
Actual Loss Rate	2.20	2.13	1.59	1.13
<u>Laos</u>				
Fighter/Attack Sorties				
Actual	8070	6104	7103	7043
Plan ^{a/}	5869	7596	5262	5349
Fighter/Attack Hostile Losses				
Actual	3	5	9	2
Plan ^{a/}	5	6	5	5
Actual Loss Rate	.37	.82	1.27	.28

a/ FY 69 Budget Plan.

b/ Linear extrapolation of 22 days data.

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June 68

AIRCRAFT SORTIES AND LOSSES

US and VNAF fixed and rotary-wing aircraft losses in SEA during April and May 1968 were 143 and 171 respectively. These totals are down from the 190 per month average for the first three months of 1968 but well above the average of 120 losses per month during CY 1967. A summary of April and May planned versus actual aircraft losses and the average losses per month for the preceding three months are shown in Table 1.

TABLE 1

US & VNAF PLANNED & ACTUAL AIRCRAFT LOSSES

	<u>April 1968</u>		<u>May 1968</u>		<u>Monthly Average</u>	
	<u>FY 69</u>		<u>FY 69</u>		<u>Prev 3 months</u>	
	<u>Budget Plan</u>	<u>Actual</u>	<u>Budget Plan</u>	<u>Actual</u>	<u>FY 69</u>	<u>Jan-Mar 1968</u>
					<u>Budget Plan</u>	<u>Actual</u>
Fighter/ Attack	46	32	49	45	42	41
Reconnaissance/ ECM	5	3	5	4	5	5
Other Fixed- Wing	17	21	17	28	17	26
Helicopters	78	81	80	91	68	114
Totals for Aircraft that are Estimated	146	137	151	168	132	186
Losses for Air- craft not Esti- mated		6 ^{a/}		3 ^{b/}		4 ^{c/}
Total Reported Losses		143		171		190

a/ VNAF: 4 CH-34; USN: 1 UH-2, 1 P-3.

b/ VNAF: 3 CH-34.

c/ VNAF and USN aircraft that are not estimated.

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Fighter/Attack Aircraft

During April and May, 77 fighter/attack aircraft were lost to all causes, 18 fewer than the FY 69 Budget Plan forecast. The primary reason for the reduced losses was the restriction on bombing in NVN. This accounted for 27 fewer losses (a saving of roughly \$75 million) than estimated last December. The December plan estimated 50 fighter/attack losses over NVN during the two months; we only lost 23. During the same two months last year, we lost 65 aircraft. The 7,259 and 9,739 attack sorties below 19° in NVN for April and May were only 2,790 sorties (14%) below the December 1967 planned sorties for all of NVN. Most of these sorties were shifted to Laos or SVN. Table 2 compares sorties, losses, and loss rates before and after bombing in NVN was restricted to targets below 19° N latitude.

TABLE 2

NORTH VIETNAM FIGHTER/ATTACK OPERATIONS

	<u>Bombing Restricted to</u> <u>19°N Latitude</u> <u>April, May 1968</u>	<u>Bombing All NVN</u>	
		<u>Apr, May 1967</u> <u>Actual</u>	<u>Apr, May 1968</u> <u>Dec 67 Plan</u>
<u>Sorties</u>			
Attack	16,998	20,242	19,788
Non-attack	4,939	6,760	3,999
Total	21,937	27,002	23,787
<u>Losses</u>			
Attack	21.0	55.0	47.0
Non-attack	2.0	10.0	3.0
Total	23.0	65.0	50.0
<u>Loss Rates</u>			
Attack	1.24	2.72	2.38
Non-attack	.41	1.48	.75
Total	1.05	2.41	2.10

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A Navy F-4 was shot down by a MIG near VINH (RP III) on May 7, the first loss to a MIG since last February.

In Laos operations slowed as weather restricted flying. Only 3,598 attack sorties were flown in May, 25% more than planned and 40% more than in May 1967, but about half of the 6,887 in April. The 10,485 sorties for the 2 months were about 2,200 more than planned, reflecting the shift of sorties from NVN to Laos. (Thus, for the two areas, NVN and Laos, about 27,500 sorties were flown, within 1% of the December Plan for the two areas.) In addition to these fighter/attack aircraft sorties, the USAF AC-130 flew 29 attack sorties in April and May. We lost a total of four aircraft during the two months; the average attack loss rate was .572, down from the previous six months average of .668. The loss rate in March had jumped to almost 1.3, leading to fears that improved enemy air defenses would take a much heavier toll in the future. This does not appear to be so.

Fighter/attack operations in SVN increased in May as 21,836 attack sorties were flown. This was 3500 more sorties than in April and almost 6,500 (42%) more than planned, reflecting in part, shifts of sorties from NVN. Attack losses over SVN reached a new high of 14 in May and the attack loss rate rose to .641 (losses per 1000 sorties). For the six months prior to May that average loss rate was .426. More concentrated and more accurate enemy ground fire coupled with more sorties are causing these increased losses. The gunships (USAF AC-47, AC-130 and VNAF AC-47) also flew 944 attack sorties in April and May. Two AF AC-47s were downed by ground fire in May.

Recce/ECM Aircraft

Seven reconnaissance/ECM aircraft were lost in April and May, three less than our estimate. All were lost to enemy ground fire, five over NVN, and one each over SVN and Laos. A total of 3,921 sorties were flown in May, continuing the recovery from the low point reached in February. Nevertheless, 6% fewer sorties were flown than we had projected. Sorties over NVN, even though restricted to below 19°, rose to 1,736 in May from less than 1,400 in April, but were still 23% less than our December projection. Table 3 compares sorties, losses and loss rates before and after the bombing restrictions in NVN.

TABLE 3

NORTH VIETNAM RECCE/ECM OPERATIONS

	<u>Bombing Restricted to 19° Latitude April, May 1968</u>	<u>Bombing All NVN</u>	
		<u>Apr, May 1967</u>	<u>Dec 67 Plan Apr, May 1968</u>
Sorties	3,121	4,936	4,500
Losses	5	3	7
Loss Rate	1.60	.61	1.55

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Other Fixed-Wing Aircraft

Forty-nine other fixed wing aircraft were destroyed during the last two months, 15 more than were forecasted. FAC aircraft continue as heavy losers. During April and May, the Air Force lost 9 O-1s and 11 O-2s, and the Army lost 9 O-1s. Of those 29 aircraft, 12 were operational losses, 1 was destroyed on the ground, and 16 were downed by hostile ground fire. The Air Force's C-130 losses have also been heavy in recent months; 7 were destroyed in April and May, and 12 during the previous six months. All of these increased fixed-wing losses in recent months attest to the intensified ground combat operations.

Helicopters

Helicopter losses in SVN continue to mount as refined data on previous months losses are received. On June 15, 65 more Army helicopter losses during January-April 1968 were reported officially to OSD. A 10-15% updating has been experienced in the past as heavily damaged aircraft are fully assessed for possible repairs, but this recent correction amounted to a 21% increase.

May losses reported to date total 94 helicopters (73 Army, 17 Marine, 1 Air Force, and 3 VNAF). If the Army total increases by 15%, May losses will go up to 105, raising the total losses for the five months of 1968 to 539 (108 per month). Army UH-1s account for most of the losses, 322, during the five months. An average of 2,019 UH-1 aircraft were deployed during that period (not including maintenance fleet), giving a loss rate of 3.19 (losses per 100 possessed per month) during 1968.

Loss Predictions vs Actuals

We are preparing new loss estimates for all aircraft categories. Fighter/attack and reconnaissance/ECM forecasts are being made considering the changes in bombing policy over NVN and with the possibility that the bombing area there may again be extended. For other fixed-wing aircraft and helicopters, the new estimates will use loss rates that reflect the increased activity and losses expected in SVN.

Our currently approved loss estimate (the FY 69 Budget Plan) was made in November, 1967, based on experience through October. The one exception is for helicopters; our projection was updated in March, based on uncorrected data through February 1968. As is shown in Table 4, during the period since our estimates were prepared, we lost 195 more aircraft than we projected, almost all Helicopters.

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TABLE 4

AIRCRAFT LOSSES - PLANNED VS ACTUAL
(November 1967 - Nov 1968)

	<u>Fighter/</u> <u>Attack</u>	<u>Recce/</u> <u>ECM</u>	<u>Other</u> <u>Fixed-</u> <u>Wing</u>	<u>Helicopters</u>	<u>Total</u> <u>Aircraft</u>
Actual Losses	275	29	166	691	1161
Less Losses for A/C types not fore- casted.	-	-	6 ^{a/}	21 ^{b/}	27
Total Losses of A/C Types forecasted	275	29	160	670	1134
FY 1969 Budget Plan	303	35	117	484	939
Plan less Actual ^{c/}	28	6	(43)	(186)	(195)

^{a/} USN: 3 OP-2E, 1 C-1, 2 P-3.

^{b/} USN: 3 UH-2; VNAF: 18 CH-34.

^{c/} () mean actual losses exceed the plan.

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July 68

AIRCRAFT SORTIES AND LOSSES

A total of 129 US and VNAF fixed and rotary-wing aircraft were lost in SEA during June, down from 171 in May. June losses were also less than the 164 monthly average during the last three months, but still above the average of 120 losses per month in CY 67. The June total was 44 less than the Current Plan and 26 less than FY 69 Budget Plan for those aircraft types included in the plan. A summary of June planned versus actual losses and the average losses per month for the preceding three months is shown below:

	June 1968			Monthly Average Previous 3 months March-May 1968
	FY 69 Budget Plan	Current Plan	Actual	
Fighter/Attack	51	45	32	38
Reconnaissance/ECM	5	4	1	3
Other Fixed-Wing	17	22	17	26
Helicopters	79	99	76	93
Totals for aircraft that are estimated	152	170	126	160
Losses for aircraft not estimated	—	—	3 ^{a/}	4 ^{b/}
Total Reported Losses	152	170	129	164

a/ Two VNAF CH-34 Helicopter and one USAF U-3.

b/ USN UH-2 and P-3 and two VNAF CH-34s.

Seventy-two of the 129 June losses were due to hostile causes; of these 67 were from ground fire, one to a SAM, one to a MIG, and three were destroyed on the ground. Hostile losses were distributed as follows: 12 in NVN, 56 in SVN, and four in Laos.

Fighter/Attack Aircraft

Nine fighter/attack aircraft were destroyed over NVN in June while on attack missions, compared to 21 predicted in the Current Plan (which assumes strikes only in RP I-III). Attack sorties in NVN were also less than planned, 10,375 vs 12,363. Sorties in Laos, however, were greater than planned as the weather was not as bad as expected. In Laos 2346 attack sorties were flown, down from 6900 in April and 3600 in May, but 860 above (58%) our projection. We lost two aircraft in Laos on attack sorties, the number forecasted. Attack sorties in SVN continued to exceed our projections: 21,389 sorties were flown in June, almost equal to May, and 2200 more than forecasted. Attack losses over SVN were also greater than projected by about the same ratio as sorties, ten actual vs eight projected.

Table 1 summarizes planned and actual sorties and losses for the three months since the bombing restrictions in NVN (April-June 1968). Total combat sorties during that period were 115,077, about 7% more than predicted. Over

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61,000 sorties were flown in SVN, 14% more than projected. Sorties in NVN and Laos totaled 40,300, about 4% fewer than projected. Actual composite loss rates for the last three month's experience and the rates used in the Current Plan projections (which assume strikes are restricted to RP I-III) are shown below. Loss rates in NVN have been significantly lower than we anticipated when the current plan was developed.

FIGHTER/ATTACK LOSS RATES^{a/}

	Attack			Non-Attack	Operational
	SVN	NVN	Laos		
Current Plan (June 1968)	.409	1.753	.886	.812	.287
Actual Apr-Jun 68	.511	1.059	.701	.678	.252

^{a/} Losses per 1000 sorties

TABLE 1

FIGHTER/ATTACK SORTIES & LOSSES

	1968						Total	
	April		May		Jun		Apr - Jun	
	Plan ^{a/}	Actual	Plan ^{b/}	Actual	Plan ^{b/}	Actual	Plan	Actual
Sorties								
Attack-SVN	16,206	18,367	18,451	21,366	19,138	21,389	53,795	61,592
NVN	8,776	7,259	11,623	9,739	12,363	10,376	32,762	27,373
Laos	5,303	6,887	2,399	3,598	1,487	2,346	9,189	12,831
Total Attack	30,285	32,513	32,473	35,173	32,988	34,110	95,746	101,796
Total Non-attack	4,615	3,971	3,515	4,852	3,484	4,458	11,614	13,281
Total Combat	34,900	36,484	35,988	40,025	36,472	38,568	107,360	115,077
Losses								
Attack-SVN	7.6	8	7.9	15	8.2	10	23.7	33
NVN	21.0	8	19.2	12	20.8	9	61.0	29
Laos	4.9	4	2.6	3	2.0	2	9.5	9
Total Attack	33.5	20	29.7	30	31.0	21	94.2	71
Total Non-attack	2.1	2	3.9	3	3.9	3	9.9	8
Total Combat	35.6	22	33.6	33	34.9	24	104.1	79
Operational	10.5	10	10.1	12	10.0	8	30.6	30
Total Losses	46.1	32	43.7	45	44.9	32	134.7	109

^{a/} FY 69 Budget Plan of November 1967.

^{b/} Current Plan

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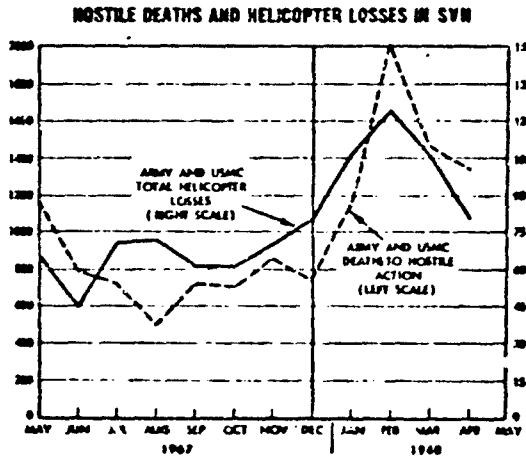
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Helicopters

Helicopter losses in SVN for June totaled 78 (as reported by July 18), down significantly from the 94 in May and the monthly average of 106 from January through May 1968. The June total however, will probably increase by 10-15% as the reparability of heavily damaged aircraft is fully assessed. Nevertheless, June appears to have been the lightest month this year. Assuming a 10% increase in total losses, the composite loss rate for June was 2.30 (losses per 100 possessed aircraft). This rate compares to 2.89 for May, and 4.06 in February 1968, which was the most costly month on record for helicopters (129 reported lost to all causes).

We have experienced considerable difficulty during the past year in forecasting helicopter losses. The FY 69 Budget Plan of November 1967 estimated we would lose 508 helicopters to all causes from November 1967 through June 1968. We actually lost 744. Two reasons account for the large underestimate. First, our prediction method could not forecast the great number of losses from enemy ground and rocket/mortar attacks on our SVN bases. During the 30-day period following Tet, 40 helicopters were destroyed on the ground; while the average for the preceding six months had been only two per month. Second, our methodology did not anticipate the sharp increase in ground combat activity which has taken place in SVN during this year. The new estimate of helicopter losses discussed later in this article uses loss rates based on a time period including the heavy activity and losses of the last few months. Since we anticipate that this tempo of the ground war will continue in SVN, the new, higher rates should lead to better loss estimates.

Since ground operations in SVN are supported so heavily by helicopters, we investigated the correlation between total helicopter losses and measures of ground combat activity. One such measure is US deaths resulting from hostile action. This graph plots Army and Marine Corps deaths and total (hostile and operational) helicopter losses during the period May 1967 - April 1968.



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The coefficient of linear correlation between deaths and helicopter losses is 0.86 (a perfect correlation would be 1.0). This indicates, as expected, that Army and Marine Corps combat deaths are closely related to the total helicopter losses of those Services.

New Estimates of Aircraft Losses

The Deputy Secretary of Defense has approved for programming and budgetary purposes new attrition estimates (Current Plan), that replace the FY 69 Budget Plan estimates of November 1967. These new estimates extended the planning period by one year to December 1971. The forces considered were Program #6, through Change #7, with some slight changes due to pending Deployment Adjustment Requests. In general, the sortie and loss rates used were based on 12 months experience, May 1967 - April 1968. For fighter/attack aircraft the Current Plan assumes that bombing in NVN will continue to be restricted to Route Packages I-III. This table compares the total losses projected in the FY 69 Budget Plan and the Current Plan from July 1967 - December 1971.

TOTAL US & VNAF AIRCRAFT LOSSES OF
FY 69 BUDGET PLAN AND CURRENT PLAN
(July 1967 - December 1971)

	<u>Fighter/ Attack</u>	<u>Recce/ ECM</u>	<u>Fixed-Wing</u>	<u>Helicopters</u>	<u>Total All Aircraft</u>
FY 69 Budget Plan	2510	245	921	4718	8394
Current Plan (June 1968)	2373	198	1305	6005	9881

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AIRCRAFT SORTIES AND LOSSES

Aircraft losses in SEA continued to decline in July; the 110 US and VNAF fixed and rotary-wing aircraft destroyed was the lowest total since September 1967 and slightly below the average of the first seven months of 1967. The table below shows the downward trend in aircraft losses from the record high month of the war, February. The monthly average for 1968, however, is over 46% greater than that average for the first seven months of 1967.

US & VNAF AIRCRAFT LOSSES

	1968							Monthly Average Jan-Jul	1967 Monthly Average Jan-Jul
	Jan	Feb	Mar	Apr	May	Jun	Jul		
	Losses to Hostile Causes While on Missions	101	106	106	85	107	71		
Destroyed on the Ground	40	48	14	6	13	3	3	18	4
Total Hostile Losses	141	154	120	91	120	74	67	110	63
Operational Losses	44	51	69	69	63	60	43	57	51
Total Acft Destroyed	185	205	189	160	183	134	110	167	114

July's 110 losses were 67 below the Current Plan and 32 below the FY 69 Budget Plan for those aircraft types included in the Plan. A summary of July planned versus actual losses is shown below:

	July 1968		
	FY 69 Budget Plan	Current Plan	Actual
Fighter/Attack		49	45
Reconnaissance/ECM		5	4
Other Fixed-Wing		17	23
Helicopters		69	103
Totals-Aircraft Estimated	140	175	108
Losses-			
Losses-Aircraft Not Estimated	-	-	2 ^{a/}
Total Reported Losses	140	175	110

^{a/} VNAF CH-34 helicopters.

Three of the 67 hostile losses in July were destroyed on the ground and the rest were from ground fire. There were no losses to SAMs or MIGs. Hostile losses were distributed by country as follows: 16 in RVN, 48 in SVN, and 3 in Laos. Of the 266 crewmembers involved in all aircraft losses, 58 (22%) were reported killed, 30 (11%) missing or captured, and 178 (67%) recovered. SAR returned 16 (53%) of the crewmembers who survived crashes

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over NVN and the adjacent areas of the Tonkin Gulf. All four airmen downed in Laos were rescued, as were 153 (91%) of the survivors in SVN. The five crewmembers involved in operational accidents in Thailand all survived.

Effects of NVN Bombing Restrictions on Aircraft and Crew Losses

The restriction on bombing NVN above 19° has led to a sharp reduction in aircraft losses. Total sorties in NVN have not changed appreciably but loss rates are down to less than half those of a year ago. During the four months since the President's bombing restriction went into effect, we have lost only 51 fighter and attack aircraft over NVN to hostile causes. This is 75 fewer than were lost during the same four months last year and 57 fewer than we forecast in December when the Budget was prepared.

FIGHTER/ATTACK AIRCRAFT LOSSES OVER NVN
DUE TO HOSTILE CAUSES ^{a/}

	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>% No. Total</u>
CY 1967 Actual	27	38	24	37	126
December 1967 Budget Plan	23	27	29	29	108
CY 1968 Actual	9	14	11	17	51

^{a/} Total combat (attack and non-attack) losses.

As would be expected, loss rates in southern NVN are considerably lower than those experienced in the northern portions of the country, especially the Hanoi/Haiphong areas. But, the loss rates experienced since April have been somewhat lower than we expected; and despite some evidence of redeployment of AAA and SAMs, loss rates are not rising.

FIGHTER/ATTACK HOSTILE LOSS RATES OVER NVN ^{a/}

	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>% No. Composite</u>
CY 1967	2.25	2.53	1.66	2.69	2.28
CY 1968	.98	1.10	.81	.95	.95

^{a/} Losses per 1000 combat (attack and non-attack) sorties.

Other aircraft losses over NVN have also dropped since the bombing restriction, but not as sharply as fighter/attack aircraft losses. During the period Apr-Jul 1967 we lost nine other aircraft (reconnaissance/ECH, forward air control aircraft and rescue helicopters) compared to six this year.

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The concentration of our bombing below 19° in NVN has led to a sharp increase in the crew recovery rates. Historically, we have been able to rescue only about 35% of the crews not known to have died when shot down over NVN. Over the past four months we have recovered 60% of the crews. Last year, from April through July, 124 airmen were killed or missing. This year, half as many, 63, were so lost. This table compares rescue statistics during the four months, April-July, of 1967 and 1968

	CREW STATUS OVER NVN ^{a/}				4 Mo. Composite
	Apr	May	Jun	Jul	
<u>1967</u>					
No. Involved	43	63	38	51	195
Known Killed	-	1	-	2	3
Known Rescued	16	18	16	21	71
Recovery Rate ^{b/}	37%	29%	42%	43%	37%
<u>1968</u>					
No. Involved	31	55	29	31	146
Known Killed	1	3	3	1	8
Known Rescued	20	29	18	16	83
Recovery Rate ^{b/}	67%	56%	69%	53%	60%

a/ Downed from hostile and operational causes over NVN.

b/ Crewmen rescued as percent of those who survived.

Fighter/Attack Sorties & Losses

Fighter/attack sorties continued at a higher than planned rate during July; 40,929 total combat sorties were flown compared to our projection of 35,166. Nearly half the combat sorties (19,116) flown were attack sorties in SVN. Against NVN targets, over 14,339 attack sorties were flown, 14% more than planned; and 2,728 attack sorties were flown in Laos, more than double our projection(1,330). Thus a total of over 17,000 sorties were flown against the infiltration routes of NVN and Laos, 23% more than forecasted.

Thirteen fighter/attack aircraft were lost over NVN while on attack missions, compared to 23 forecast in the Current Plan (which assumes no bombing above 20°). These losses led to an NVN attack loss rate of 0.91 (losses per 1000 sorties). Over SVN 15 fighter/attack types were lost for an attack loss rate of 0.78, and in Laos the two losses yielded a 0.73 loss rate.

Reconnaissance/ECM Aircraft

Three reconnaissance/ECM aircraft were destroyed in July, an Air Force RF-4 and a USMC EF-10 to ground fire over SVN, and a USAF EB-66 operational loss in Thailand. The Current Plan forecast four losses. About 18% more

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sorties were flown than planned, 4293 versus 3636, as Recce/ECM missions continued at a high rate despite restrictions of NVN flights to below 19°. The table below summarizes planned and actual sorties and losses for the four months since the bombing restrictions in NVN (Apr-Jul 1968). Total sorties during the period were 15,399, within 3% of the forecast.

RECONNAISSANCE/ECM SORTIES & LOSSES

1968	April		May		June		July		Total April-July	
	Plan ^a	Actual	Plan ^b	Actual	Plan ^b	Actual	Plan ^b	Actual	Plan	Actual
Sorties-SVN	1395	1280	1240	1562	1240	1663	1240	1628	5115	6133
NVN	2250	1385	1944	1736	1820	1883	1913	2333	7927	7337
Laos	511	680	484	623	483	289	483	337	1661	1929
Total Sorties	4156	3345	3668	3921	3543	3835	3536	4298	15003	15399
Losses-SVN	.5	1	.6	0	.6	0	.5	2	2.2	3
NVN	3.5	1	1.6	4	1.6	0	1.6	0	8.3	5
Laos	.3	1	.5	0	.5	1	.5	0	1.8	2
Total Combat	4.3	3	2.7	4	2.7	1	2.5	2	12.3	10
Operational	1.0	0	1.3	0	1.3	0	1.3	1	4.9	1
Total Losses	5.3	3	4.0	4	4.0	1	3.9	3	17.2	11

a/ FY 69 Budget Plan of November 1967

b/ Current Plan of May 1968.

Actual composite loss rates for the last four month's experience and the rates used in the Current Plan projections (which assumes NVN operations are restricted to RPs I-III) are shown below. Although the sample size of actual performance for this comparison is small, it appears that the loss rates used in the Current Plan are quite reasonable.

RECONNAISSANCE/ECM LOSS RATES^a

	<u>SVN</u>	<u>NVN</u>	<u>Laos</u>	<u>Operational</u>
Current Plan (May 1968)	.438	.906	1.035	.401
Actual (Apr-Jul 1968)	.489	.681	1.037	.069

a/ Losses per 1000 sorties.

Helicopters

Helicopter losses for July in SVN totaled 52 (all Services, as reported by August 28). This total continues the downward trend in losses that started in June when 21 were destroyed. For the previous five months of 1968 (Jan-May) US and VNAF forces lost an average of 112 aircraft per month to all causes. One factor that has contributed to the sharp drop in losses is the near absence of losses on the ground from enemy attacks during the last two

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months. Only one (an Army UH-1) was destroyed on the ground during June and July, while an average of 13 per month had been lost to enemy attacks during Jan-May 1968.

The "Current Plan" helicopter loss estimate began in May, and used loss rates based on experience during the 12-month period May 67 - Apr 68. This data base included the high loss months of January (107), February (129), March (114) and April (66). As a result the rates were in general considerably higher than those used in FY 69 Budget Plan prepared last fall. The table below compares Army and Marine planned and actual losses and loss rates during the last three months.

	<u>ARMY & MARINE CORPS HELICOPTER LOSSES^{a/}</u>						<u>3 Month Composite May-Jul 1968</u>			
	<u>May</u>		<u>June</u>		<u>July</u>		<u>Losses</u>		<u>Loss Rates^{b/}</u>	
	<u>Plan</u>	<u>Actual</u>	<u>Plan</u>	<u>Actual</u>	<u>Plan</u>	<u>Actual</u>	<u>Plan</u>	<u>Actual</u>	<u>Plan</u>	<u>Actual</u>
Army										
UH-1	54.9	46	52.7	45	52.0	24	159.6	115	2.80	1.96
AH-1G	3.5	5	4.1	1	4.7	3	12.3	9	2.50	2.10
OH-6	15.1	20	17.6	14	21.6	10	54.3	44	6.00	6.79
OH-13	6.0	4	5.1	6	4.8	-	15.9	10	4.84	3.69
OH-23	3.5	5	2.9	2	2.8	2	9.2	9	2.79	2.06
CH-47	2.3	3	2.3	1	2.3	3	6.9	7	.90	.91
CH-54	.4	-	.4	-	.5	-	1.3	-	1.68	-
Total Army	85.7	83	85.1	69	88.7	42	259.5	194	3.02	2.29
USMC										
UH-1	2.5	1	2.5	2	2.5	2	7.5	5	3.45	2.24
UH-34	1.9	3	1.9	2	1.9	3	5.7	8	2.58	2.95
CH-46	5.9	11	5.9	5	5.9	2	17.7	18	4.09	5.54
CH-53	.9	2	.9	-	.9	1	2.7	3	2.73	3.53
Total USMC	11.2	17	11.2	9	11.2	8	33.6	34	3.48	3.76

a/ Losses to all causes. Plan is Current Plan of May 1968.

b/ Losses per 1000 possessed aircraft.

Army losses reported through August 28 have been considerably lower than expected, 194 actual versus 260 planned. The gap will probably be closed some when final evaluation of damaged aircraft shows that they cannot be repaired. Historically, this has caused losses to increase about 10-15%. However, the data as now reported indicate that the loss rates we used are about right for the OH-6 and CH-47 and high for all other types. Needless to say, a sharp increase in combat tempo could change this picture considerably.

There is an apparent discrepancy in the OH-6 losses and rates. That is, we projected high (54 vs 44 actual) but the loss rate we used is lower than the actual experience (6.00 vs 6.79). This can be explained by the number of deployed aircraft we expected and the number that were actually in SVN. The

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approved deployment for OH-6s from May-Jul was 905 aircraft months, but the actual sum of averaged possessed was only 648. For the other Army helicopters the difference between planned and actual forces was not so pronounced.

For Marine helicopters, the forecast has been quite good. For the CH-46 the actual and planned loss rates appear to contradict the losses. That is, while the planned and actual losses are identical (10), the actual loss rate is considerably higher than the one used in our estimate (5.54 vs 4.09). This can be explained by slower than expected deployments of the CH-46, which is replacing UH-34s. This same difference between actual deployments and the approved forces (used in forecasting losses) accounts for the difference between the Marine actual composite loss rate of 3.76 and the composite planning factor of 3.48. For the three month period actual deployments (sum of average possessed aircraft) lagged approved forces by 75 (904 actual vs 966 approved). As long as a lag exists, our forecasts will be on the high side, assuming that our loss rates are roughly right.

Loss Predictions vs Actuals

The Current Plan for programming and budgetary purposes has been in effect for three months. The table below shows the excess (deficit) of OSD predicted losses over actual losses by aircraft categories for May-Jun 1968.

AIRCRAFT LOSSES - PLAN VS. ACTUAL
(May-Jul 1968)

	<u>Fighter/</u> <u>Attack</u>	<u>Recce/</u> <u>ECM</u>	<u>Other</u> <u>Fixed</u> <u>Wing</u>	<u>Heli-</u> <u>copters</u>	<u>Total</u> <u>Aircraft</u>
Actual Losses	120	8	62	237	427
Less Losses for A/C types not forecasted	-	-	<u>1</u> ^{a/}	<u>7</u> ^{b/}	<u>8</u>
Total losses for A/C types forecasted	120	8	61	230	419
 FY 69 Budget Plan (November 1967)	 147	 15	 51	 198	 411
 Current Plan (May 1968)	 <u>135</u>	 <u>12</u>	 <u>62</u>	 <u>301</u>	 <u>510</u>
 Plan less Actuals FY 69 Budget Plan	 27	 7	 (10) ^{c/}	 (32) ^{c/}	 (8)
 Current Plan	 15	 4	 1	 71	 91

a/ USAF U-3
b/ VIIAF CH-34s.
c/ () means actual losses exceed the plan.

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AIRCRAFT SORTIES AND LOSSES

US and VNAF aircraft losses totaled 121 during August reflecting the lull in the general intensity of ground and air operations. The total losses were up 10% from July (110), but still significantly lower (32% than the monthly average of 176 for January thru June 1968. August losses were 57 below the Current Plan and 21 below the FY 69 Budget Plan for those aircraft types included in our projections. A summary of August planned versus actual losses is shown below:

	August 1968		
	FY 69 Budget Plan	Current Plan	Actual
Fighter/Attack	50	46	33
Reconnaissance/ECM	5	4	4
Other Fixed-Wing	17	23	9
Helicopters	67	102	72
Total - Aircraft Estimated	139	175	118
Losses - Aircraft not estimated	-	-	3 ^{a/}
Total Reported Losses	139	175	121

a/ VNAF CH-34 helicopters.

Nearly 36,000 attack sorties were flown in August, 14% below July, but 9% more than planned. Sorties flown in Laos and South Vietnam exceeded our projections. Attack sorties in NVN were almost exactly as we projected (12,940 actual vs 12,913), but more would probably have been flown in the North if the weather had been better. Reconnaissance/ECM sorties were down from the record month of July, with a total of 4017 being flown. This was 14% more than planned, with most of the extra flights over South Vietnam.

VNAF Sortie and Loss Rates. Considerable planning is underway aimed at modernizing the Vietnamese Armed Forces. The following analysis of VNAF aircraft sortie and loss rates in SVN was prepared to assist in planning for the modernization of the VNAF.

Fighter/Attack Aircraft. All aircraft now or soon to be in the VNAF inventory (the A-1, A-37 and F-5) have been or are being flown by the USAF in South Vietnam. Table 1 shows sorties, losses, loss rates and sortie rates for these aircraft during the past twelve months (September 1967 - August 1968). The USAF F-100 is also included because it is the "workhorse" in South Vietnam, and it provides a reasonable "standard" for other tactical aircraft.

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Table 1

AIR OPERATIONS IN SVN, SEP 67 - AUG 68

	Attack Sorties	Hostile Losses	Hostile Loss Rate ^{a/}	Opn'l Losses	Opn'l Loss Rate	Total Sortie Rate ^{c/}
<u>USAF</u>						
A-1	3,055	7	2.291	5	0.379	19.0
A-37	14,276	3	0.210	2	0.131	51.0 ^{d/}
F-100	86,162	31	0.360	10	0.111	32.4
F-5 ^{b/}	6,360	6	0.943	2	0.314	39.8 ^{d/}
<u>VNAF</u>						
A-1	18,925	17	0.898	8	0.352	2 ^a 1
F-5	4,872	1	0.205	1	0.202	1.0

a/ Losses per 1000 attack sorties.

b/ Last 12 mos. of USAF operations, May 66-April 67.

c/ Sorties per aircraft per month, all areas of SEA.

d/ Sortie rates exceptionally high due to more intensive and higher quality maintenance during special tests.

On attack missions the VNAF A-1s appear to be roughly 2.5 times as survivable as the USAF, while the VNAF operational loss rate is about the same as the USAF. VNAF A-1 sortie output is good (28.1 sorties per aircraft per month). The reason the VNAF appears to be significantly better than the USAF (19.0 sorties) is because only 26% of the total USAF A-1 sorties are flown in SVN. Most of them (71%) are in Laos, where added flight time to and from the targets results in a smaller total sortie output. If all USAF A-1s were based in SVN and flown against SVN targets; the sortie rate would probably be about 40-45 per month.

The Air Force flew the F-5 jet Freedom Fighter in SVN for 18 months (Oct 65 - April 67) and at that point they were turned over to the VNAF. A comparison of these periods of operation may indicate what to expect from the VNAF A-37 since it is a jet attack aircraft roughly similar in size to the F-5 (the A-37 is, however, subsonic). For the last 12 months of USAF F-5 operations, the attack loss rate was a high 0.94, while for the past year the VNAF flew three-fourths as many F-5 attack sorties with only one loss (loss rate of 0.21). The VNAF operational loss rate is also significantly lower (0.20 vs 0.31).

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The most significant statistic regarding USAF experience with the A-37 is the high sortie rate, 51, or 1.7 sorties per day per aircraft. This can be attributed to short flight times to targets and quick turn around time (refueling, rearming, etc.) at Bien Hoa. Both the A-37 combat and operational loss rates are low.

VNAF transition into the A-37 should be no more difficult than it was to the F-5. With this assumption and considering both Services' experience in the F-5, we estimate that the VNAF A-37 attack loss rate will be about 0.20, and the operational rate about 0.15. These are very "respectable" loss rates. Of course, the unpredictable factor, that is more significant than losses, is the effectiveness, or degree of tactical support, that the VNAF will be able to deliver with the more modern weapon systems.

Helicopters. The five VNAF helicopter squadrons had been equipped with CH-34s until June 1968, when they started getting UH-1s. The UH-1 force will increase as CH-34s are attrited out of the inventory. By the end of FY 69 one squadron was to have converted to UH-1s (20 aircraft); but Phase I of the VNAF modernization program would raise this to two squadrons (40 aircraft). Further substitution of UH-1s for CH-34s would lead to one CH-34 squadron (25 a/c) and eight UH-1 squadrons (248 a/c) by mid FY 71.

Loss data for the CH-34 show that during the past year (August 1967 - July 1968) there have been 23 losses, 15 to hostile causes and 8 operational. The total loss rate is 2.54 aircraft per 100 possessed per month. The Marines are the only US Service flying the UH-34 in SEA; and their loss rate during the last year was 2.63, slightly higher than the VNAF's.

Both the US Army and USMC fly UH-1s, and their respective loss rates for the past year are 2.71 and 3.28. Using UH-34 experience as a guide, we should expect the VNAF UH-1 loss rate to be about 3.00.

AIRCRAFT SORTIES AND LOSSES

US and VNAF forces lost a total of 111 fixed and rotary-wing aircraft during September, reflecting the continued relative lull in ground and air operations. September losses were 74 below the Current Plan and 28 below the FY 69 Budget Plan for those aircraft types included in our projections. The monthly average of 114 losses for the last three months is well below the average of 135 losses during the same period of CY 67.

The causes of the September losses were as follows: one lost to a SAM (a Navy A-6), 69 to enemy ground fire, 2 destroyed on the ground (VNAF helicopters), and 39 to operational causes. Of the 72 hostile losses, 15 were over NVN, 4 over Laos, and 53 in South Vietnam.

Losses over North Vietnam

Eighty-five US aircraft have been destroyed by enemy missiles and ground fire over North Vietnam in the six months following restrictions on air activity to below 19°N Latitude. During the same period in 1967 we lost 168 aircraft. We anticipated that loss rates would drop, but they have been even lower than our estimates. Table 1 compares attack loss rates for fighter/attack aircraft during the April-Sept period with the 12 months prior to the bombing restrictions.

TABLE 1
NVN ATTACK LOSS RATES

		12 mo. Before Bombing Restrictions Apr 67-Mar 68	6 mo. Apr-Sep 68 Actual
<u>USN</u>	A-4	2.381	.655
	A-6	3.242	1.267
	A-7	2.278	.985
	F-8	3.115	0
	F-4	<u>2.913</u>	<u>2.285</u>
Composite	2.556	.925	
<u>USMC</u>	A-4	1.375	0
	A-6	1.872	.734
	F-4	<u>.685</u>	<u>.552</u>
Composite	1.153	.442	
<u>USAF</u>	F-4	1.917	.866
	F-105	<u>3.624</u>	<u>1.515</u>
Composite	2.751	1.108	
All Service Composite	2.515	.954	

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Loss rates have fluctuated from month to month, but do not appear to be increasing despite evidence that the North Vietnamese have strengthened their air defenses south of 19°. Table 2 shows the loss rates for fighter/attack aircraft on all combat sorties (strike, CAP, armed recon, flak suppression, etc.) for the six months since the bombing restriction, compared with the same period last year.

TABLE 2
FIGHTER/ATTACK COMBAT LOSS RATES OVER NVN ^{a/}

	Apr	May	Jun	Jul	Aug	Sep	6 mo. Composite
CY 1967	2.25	2.53	1.66	2.69	2.46	0.98	2.14
CY 1968	.98	1.10	.81	.89	.70	1.13	0.92

^{a/} Losses per 1000 combat (attack and non-attack) sorties.

Sorties

There were 32,000 attack sorties flown in September in all areas, down from the 36,000 in July and August, and 3% fewer than planned. Non-attack sorties continue at higher than planned levels, with the Navy generating the extra sorties. Less than 900 Navy non-attack sorties were forecast for September; they actually flew nearly 2300. Since the Navy flies primarily in RPII and RPIII, the added sorties indicate the emphasis on escort and MIGCAP in order to protect their strike forces from the MIG threat near 19°. The Air Force and Marines are operating primarily in RPI, where there is little threat of a MIG attack. As a result both these services are devoting fewer sorties to the non-attack missions than we had projected, and a larger share to the attack role.

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AIRCRAFT SORTIES AND LOSSES

Ninety-five US and VNAF aircraft were destroyed in November, the lowest total in over a year (92 were lost in September 1967). Average monthly aircraft losses had been 134 aircraft in the Apr-Oct period after the limitation of bombing in NVN. A breakout of November losses by Service and type aircraft is shown below:

NOVEMBER 1968 AIRCRAFT LOSSES IN SEA

	<u>USAF</u>	<u>USN</u>	<u>USMC</u>	<u>USA</u>	<u>VNAF</u>	<u>Total</u>	<u>Monthly</u>
							<u>Average</u>
							<u>Apr - Oct 68</u>
Fighter/Attack	12	2	6	-	1	21	35
Reconnaissance/ECM	2	1	-	-	-	3	3
Helicopter	2	-	5	52	2	61	78
Other Fixed Wing	7	-	-	2	1	10	18
	<u>23</u>	<u>3</u>	<u>11</u>	<u>54</u>	<u>4</u>	<u>95</u>	<u>134</u>

The November losses included 40 to operational causes (42%) while the remaining 55 were shot down by enemy ground fire. Virtually all (49 of 55) of the combat losses were in SVN, four were lost over NVN and two in Laos. No aircraft were lost to MIGs, SAMs or enemy attacks on our bases in SVN. Of the 16 crewmen involved in losses in Laos and NVN, 8 were rescued, 1 killed, and 7 reported missing.

Air Operations Since the NVN Bombing Halt

With the restrictions on bombing of NVN that went into effect November 1, tactical air operations have been redirected against targets in Laos and South Vietnam. The total attack (strike, armed recon, flak suppression, interdiction, and close and direct air support) sortie output for November was 29,448, down 8% from October, and down 10% from the monthly average of 32,816 for the Jan-Oct 1968 period. Only 330 of November's attack sorties were flown against NVN targets before the halt took effect; the remaining 29,118 were divided 16,322 in SVN, and 12,796 into Laos. SVN sorties were up slightly (5%) from October, but were 14% below the monthly average there for the previous ten months. The big shift was to Laos, where almost 13,000 attack sorties were flown, compared to 4729 in October, and a monthly average of 4721 during all of 1968. Thus, the air effort in November against supply and infiltration routes, interdiction points, and troop/supply concentrations in Laos almost tripled (2.7 times) the October and the previous ten month average. (For an analysis of the effectiveness of the effort, see the article "Interdiction in Laos Since the Bombing Halt.")

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The pattern of operations for ARC LIGHT (B-52) strikes also changed markedly. Of the 1,786 sorties in November, about two-thirds (1,125) were in SVN, and one-third (661) in Laos. This effort in Laos was 2.4 times the monthly average from Jan-Oct 1968; during that ten month period, a total of almost 17,000 ARC LIGHT sorties dropped 466,000 tons of ordnance, 84% of it in SVN, 4% in NVN, and 12% in Laos.

Fighter/Attack Aircraft Losses

Eleven fighter/attack aircraft were lost to enemy action in November, 3 fewer than October and 15 fewer than the monthly average for the preceding ten months. The 11 losses (USAF: 7, USN: 0, USMC: 3, and VNAF: 1) were divided 8 in SVN, 2 over NVN, and 1 in Laos. The attack loss rate in SVN for November was 0.43 aircraft per 1000 attack sorties, roughly equal to the 0.45 rate of the last two years (Nov 66 - Oct 68). In Laos, however, the loss rate was 0.07 per 1000 sorties, well below the levels in the past. Loss rates in Laos, contrary to the expectation of many observers, have not increased in recent months, despite some evidence of more enemy AAA weapons. The table below shows fighter/attack aircraft sorties, losses and loss rates over Laos for the past 17 months.

TACTICAL AIR OPERATIONS OVER LAOS

	FY 68 Monthly Averages					FY 69			
	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Year	Mo. Ave. 1st Qtr	Oct	Nov	Total Jul-Nov
<u>Attack</u>									
Sorties	1417	4684	7093	4277	4368	2784	4749	12,796	25,900
Losses	1.33	3.67	6.00	3.00	3.50	1.33	1	-	5
Loss Rate	.94	.78	.85	.70	.80	.48	.21	-	.19
<u>Non-Attack</u>									
Sorties	360	497	702	348	477	335	447	1,390	2,841
Losses	-	.33	.33	1.00	.42	.67	-	1	3
Loss Rate	-	.67	.48	2.87	.87	1.97	-	.72	1.06
<u>Total Combat</u>									
Sorties	1777	5181	7795	4625	4845	3120	5196	14,187	28,741
Losses	1.33	4.00	6.33	4.00	3.92	2.00	1	1	8
Loss Rate	.75	.77	.81	.87	.81	.64	.19	.07	.28

The monsoonal pattern of sorties in Laos is readily apparent during FY 68 and the first five months of FY 69. Attack and non-attack loss rates fluctuated indecisively in FY 68, and the only apparent change is a slight increase throughout the year in the total combat rate (from 0.75 in the 1st Quarter to 0.87 in the 4th, with an average rate of 0.81 for the year). However, a change may have begun in FY 69. While the non-attack loss rate

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was up during Jul-Sep, the attack rate dropped significantly to 0.48, and the total combat rate was down to 0.64. The downward trend continued in October. In November when sorties skyrocketed, the attack loss rate dropped to zero, non-attack rose to about its FY 68 level, and total combat became almost negligible at 0.07.

An important factor to note when considering Laos loss rates is that the large influx of sorties during November was almost entirely by jet aircraft. They have had a considerably lower loss rate than the propeller types in the less sophisticated (than NVN) air defense environment in Laos. For the 12-month period Nov 67 - Oct 68, the combat loss rate for jets over Laos was 0.60, while it was 1.29 for prop types (the A-1, A-26, and T-28). On the other hand, the prop aircraft have proven to be much better truck killers than the jets (except the B-57) due to their longer loiter time, slower speeds, and greater maneuverability.

One, or even two months (Oct and Nov) data on sorties and losses are insufficient for developing loss rates that could be used in forecasting future losses with much confidence. However, the experience of the last 17 months, and particularly the last 5 months, indicates that tactical air operations in Laos may cost us fewer aircraft to hostile causes in the future than would be expected based on long term loss rates. This conclusion, of course, assumes there will be no sizeable increase in numbers and effectiveness of AAA defenses, and particularly the introduction in Laos of SAMs and MIGs. The North Vietnamese may have to choose between supplies for SVN and vast amounts of AAA ammunition, missiles and control equipment in Laos for a sophisticated defense. Even a decision to increase air defenses in Laos may only offset the decreased vulnerability of the jets, leading to a maintenance of the historical loss rate of about 9 aircraft per 10,000 attack sorties.

Tactical Reconnaissance of NVN

USAF and USN photo reconnaissance missions over North Vietnam (below 19° N latitude) were flown at a rate of 7.6 per day (227 total sorties) in November. While on these missions, the photo aircraft were assisted by nearly 1500 USAF, USN, and USMC tactical aircraft escort sorties and by 532 ECM aircraft sorties. About one-third of the photo flights reportedly received fire from enemy AAA and SAMs, and a USAF RF-4 and a USN RA-5 were shot down. A USAF F-4 was also lost to ground fire while escorting a recon flight.

FY 70 Budget Plan Estimates of Aircraft Losses

Projections of SEA aircraft losses for the FY 70 Budget have been approved by the Deputy Secretary of Defense for helicopter, other fixed-wing, and reconnaissance/ECM types of aircraft. This table compares the cumulative losses estimated last May with the new November estimates during the period Jul 1967 - Dec 1971.

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ESTIMATED AIRCRAFT LOSSES IN SEA
(July 1967 - December 1971)

	<u>USA</u>	<u>USMC</u>	<u>USAP</u>	<u>USN</u>	<u>VNAF</u>	<u>Total US & VNAF</u>
<u>Helicopters</u>						
May 1968 Plan	5383	554	91	51 <u>a/</u>	<u>b/</u>	6079
FY 70 Budget Plan (November 1968)	4263	500	78	33 <u>a/</u>	250	5124
Change	-1120	-54	-13	-18	+250	-955
<u>Other Fixed-Wing</u>						
June 1968 Plan	448	22	685	18 <u>a/</u>	133	1306
FY 70 Budget Plan (November 1968)	376	28	610	17 <u>a/</u>	164	1195
Change	-72	+ 6	-75	-1	+31	-111
<u>Reconnaissance/ECM</u>						
May 1968 Plan	-	23	176	26	-	225
FY 70 Budget Plan (November 1968)	-	16	124	25	-	165
Change	-	-7	-52	-1	-	-60

a/ GAME WARDEN only.

b/ VNAF helicopter losses not estimated in May 68 Plan.

The forces used in the new estimates are Program #6, through Change 33. In general, loss rates for helicopters and other fixed-wing aircraft were computed from the last six months experience (May - Oct 1968). For the reconnaissance/ECM types, loss rates were based on 12 months experience in NVN and 24 months in SVN and Laos. Photo reconnaissance over NVN (below 19° N) was forecasted to be about half (5200 sorties per year) what it had been during the past year.

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AIRCRAFT SORTIES AND LOSSES

One hundred twenty-five (125) US and VNAF aircraft were destroyed in January, the highest total since last June. Nevertheless, the January losses were 17 below the FY70 Budget Plan. The table below shows the planned and actual losses by aircraft categories for January and the three months (Nov 68-Jan 69) the FY70 Budget plan has been in effect.

	January 1969		Nov 68-Jan 69	
	FY70 Budget Plan	Actual	FY70 Budget Plan	Actual
Fighter/Attack	29	37	83	79
Reconnaissance/ECM	3	1	9	7
Other Fixed-Wing	20	15	59	37
Helicopters	90	72	265	208
Total Losses	142	125	416	331

The January losses included 66 shot down by enemy ground fire, 53 lost to operational causes, and six destroyed on the ground by attacks on our airbases. These ground losses were the most in that category since last May, when 13 were destroyed; but were well below the 42 lost in January 1968 during the Tet attacks. There were no losses in January to either MIGs or SAMs. In fact, the last aircraft shot down by a MIG was in June 1968 before the NVN bombing halt, and the last loss to a SAM was a Navy A-7 in October, also before the halt.

Fighter/Attack Aircraft. Fighter/attack losses totaled 37 in January, eight more than planned, and well above the 21 losses recorded in November and December. Twelve USAF F-100s were destroyed, two on the ground at Phan Rang, two to operational causes and eight on combat sorties. Five of these eight combat losses occurred in SVN during 5903 attack sorties. The resultant attack loss rate of 0.85 (losses per 1000 sorties) is almost double the rate (0.44) for the 12 months of CY1968, and more than twice the 0.38 rate used in the FY70 Budget Plan estimates of November 1968. There are no apparent reasons for this jump in F-100 losses, just a "bad" month like last July when nine were shot down in SVN and the attack loss rate reached an all-time high of 1.02. We see no reason to believe these high F-100 losses will continue (only one has been lost in 1-23 February).

There were 34,400 combat sorties flown by US and VNAF pilots, 6% fewer than forecasted by OSD/SA. Likewise, the attack sorties were down by 7%, at 30,180. As in the preceding two months, the distribution of attack sorties between SVN and Laos was significantly different than expected, as more attacks were made in Laos. Good flying weather and the COMNAVDO HUNT interdiction campaign account for the intense Laotian operations. In addition, the slow pace of ground operations in SVN permitted the shift in sorties from there into Laos. The next table shows the OSD/SA projected and actual combat sorties for US and VNAF aircraft during Nov 68-Jan 69.

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US & VNAF FIGHTER/ATTACK SORTIES
(Nov 68-Jan 69)

	FY70	
	<u>Budget Plan</u>	<u>Actual</u>
Attack-SVN	66,317	50,271
Laos	30,744	41,540
NVN	-	431
Total Attack	<u>97,061</u>	<u>92,242</u>
Non-Attack	<u>11,813</u>	<u>12,034</u>
Total Combat	108,874	104,276

Reconnaissance/ECM Aircraft. One recon/ECM aircraft was lost in January, a USAF RF-4 over SVN. We had estimated that three of all types would be destroyed. Total recon/ECM sorties continued at a higher than predicted rate, 3754 in January, 12% more than the estimate of 3353. Nearly half of the flights were over Laos in support of the heavy interdiction campaign. This concentration in Laos at the expense of NVN has persisted for the last three months since the NVN bombing halt. Bad weather has also restricted photo missions over the NVN panhandle. The table below shows planned and actual sorties by country for the three months of the FY70 Budget Plan.

US RECONNAISSANCE/ECM SORTIES
(Nov 68-Jan 69)

	FY70	
	<u>Budget Plan</u>	<u>Actual</u>
SVN	4,119	4,565
Laos	2,544	4,838
NVN	<u>3,436</u>	<u>1,752</u>
Total Sorties	10,099	11,155

Helicopters. In January there were 72 US and VNAF helicopters destroyed, 18 fewer than predicted. Exactly half (36) were to hostile causes (including 3 Army CH-47s on the ground).

This table compares the estimated and actual losses by Service during the three months of the FY70 Budget Plan.

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US & VNAF HELICOPTER LOSSES
(Nov 68-Jan 69)

	FY70	
	<u>Budget Plan</u>	<u>Actual</u>
Army	216	178
Marine Corps	30	19
Air Force	6	8
Navy (Game Warden)	2	-
VNAF	<u>11</u>	<u>3</u>
Total	265	208

From a production/funding viewpoint, the UH-1 and OH-6 are the most critical helicopters. This table compares the OSD/SA estimates and actual losses for these aircraft during the past three months.

	<u>USA</u>	<u>USMC</u>	<u>USAF, USN & VNAF</u>	<u>Total</u>
UH-1 Planned	105	5	4	114
UH-1 Actual	103	7	3	113
OH-6 Planned	69	-	-	69
OH-6 Actual	50	-	-	50

While actual UH-1 losses are very close to our estimate, the OH-6 has had considerably fewer than planned. Possible explanations for this are more experience with the aircraft and a refinement in tactics during recent months that has reduced exposure to enemy fire. The OH-6 loss rate for Nov 68-Jan 69 is 3.78 (losses per 100 possessed aircraft). For the FY70 Budget we used a rate of 5.20, based on 6 months experience from May-October 1968. The number of OH-6s in SVN has steadily increased from less than 200 in May 1968 to 472 in January.

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AIRCRAFT SORTIES AND LOSSES

Total US and VNAP aircraft losses in February were 116, down from 126 in January and slightly below the monthly average of 120 during the seven previous months of FY 69. February losses declined despite 21 aircraft destroyed on the ground by enemy attacks during the recent VC/NVA Tet offensive. However, enemy attacks this year have been much less effective than those in 1968, when 42 aircraft were destroyed on the ground in January, 51 in February, 16 in March, and seven in April.

February losses of aircraft types that are estimated by OASD(SA) were below the FY 70 Budget Plan (115 actual vs 145 planned). The table below compares planned (FY 70 Budget Plan) and actual losses by aircraft categories in February and during the period November 68 - February 69.

US AND VNAP AIRCRAFT LOSSES IN SEA

	February 1969		Nov 68 - Feb 69	
	FY 70 Budget Plan	Actual	FY 70 Budget Plan	Actual
Fighter/Attack	29	20	111	99
Reconnaissance/ECM	3	-	11	7
Other Fixed wing	21	15	80	54
Helicopters	92	80	356	288
Total -Aircraft Estimated	145	115	558	448
Losses-Aircraft Not Estimated	-	1 ^{a/}	-	1 ^{a/}
Total Reported Losses	145	116	558	449

^{a/} USN UH-2 helicopter.

In addition to the 21 aircraft destroyed on the ground in February, 57 were shot down by enemy ground fire and 38 were lost to operational causes.

Tactical air operations declined in February to 30,862 combat sorties, 10% fewer than in January and 16% below the monthly average for the previous seven months (Jul 68 - Jan 69). The February sortie output was also 16% (nearly 6000 combat sorties) below the OASD(SA) FY 70 Budget Plan. Fighter/attack sorties were below forecasted levels for all Services except the Navy, which flew over 5200 combat sorties, about what they flew in January and 5% more than forecasted. The 12,500 attack sorties last month in Laos (46% of the total attack sorties in SEA) were considerably below the 15,100 and 13,600 sorties in December and January, but still 10% above the projected level.

There were 3622 reconnaissance/ECM sorties in February, about equal to the monthly average since the NVN bombing halt. No recon/ECM aircraft were destroyed, however, for the first month on record. One principal reason; there were virtually no enemy AAA reactions to the 376 sorties over North Vietnam.

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Destroyed on the ground. Nine of the 21 aircraft destroyed on the ground were Army CH-47 Chinooks during an enemy attack on the Cu Chi Base Camp, 16 miles northwest of Saigon, on February 26. After a rocket/mortar attack, enemy sappers penetrated the defenses, destroyed nine, and heavily damaged two CH-47s with grenades and satchel charges. The Army also lost four UH-1s, one OH-6, and two O-1s to other VC/NVA rocket/mortar attacks on bases at Kontum, Cu Chi, and Camp Holloway. The USAF lost a CH-3, that had made an emergency landing in Laos due to mechanical problems, when it was burned by the enemy before a security guard could be posted. Sappers also penetrated the airfield at Dau Tieng, destroying a USAF O-1 and damaging two OV-10s. During a rocket/mortar attack on Bien Hoa Air Base on February 23, an F-100 was destroyed in a steel shelter that was not yet completely concrete covered. Besides this loss, three aircraft parked in Armco revetments were struck by shrapnel; a U-10 was destroyed and an F-100 and a C-47 damaged. The VNAF lost one CH-34 to a rocket/mortar attack.

One factor that has undoubtedly kept the 1969 Tet offensive losses of USAF fighter/attack aircraft well below the high losses last year is the covered shelters now at most bases. At Da Nang an enemy 122 mm rocket round made a direct hit on a shelter housing a fully armed F-4. There was no damage to the aircraft, and only minor surface damage to the shelter. In all, 573 concrete covered shelters will be constructed in South Vietnam; 408 at USAF/VNAF bases, and 165 for Marine/Navy aircraft. At about \$26,000 per shelter, the one known aircraft save at Da Nang has already paid for 20% of the shelter program. (On March 20 an undetermined number of 122 mm rocket rounds hit the Marine Air Base at Chu Lai. Six A-4's were destroyed and nine damaged. These aircraft were not parked in revetments, nor were any of the planned covered shelters completed for them.)

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AIRCRAFT SORTIES AND LOSSES

One hundred thirty-nine US and VNAF aircraft were destroyed in April, ten fewer than in March and four more than the monthly average of 135 during the first three months of 1968. The FY 70 Budget Plan forecast of 151 losses for April was 3% high. Only two aircraft, an Army UH-1 and a USAF O-1 were destroyed on the ground by enemy attacks on our bases. (This compares to six in January, 22 in February, and 1 in March destroyed on the ground.) In addition to the two aircraft destroyed on the ground in April, 76 were shot down by enemy ground fire and 61 were lost to operational causes. The table below shows the planned and actual losses by aircraft categories for April and the six months (Nov 68 - Apr 69) the FY 70 Budget Plan for aircraft attrition has been in effect.

	April 1969		Nov 68 - Apr 69	
	FY 70		FY 70	
	Budget	Plan Actual	Budget	Plan Actual
Fighter/Attack	29	24	169	162
Reconnaissance/ECM	3	4	17	12
Other Fixed-Wing	22	12	124	85
Helicopters	97	99	550	490
Total Aircraft Estimated	151	139	860	749
Losses-Aircraft not estimated	-	-	-	1 ^{a/}
Total Reported Losses	151	139	860	750

^{a/} USN UH-2 helicopter

Tactical air operations in April consisted of 33,645 combat sorties, less than 1% below the monthly average of 33,833 flown during the previous five months (Nov 68-Mar 69) since the NVN bombing halt. April attack sorties were distributed 57% in SVN and 43% in Laos. This closely approximates the 55-45% split between SVN and Laos that were flown during the previous five months (Nov 68-Mar 69). The November-March period was one of good flying weather in Laos. Despite the onset of the rainy/overcast period of the southwest monsoons which began in April, the level of attack effort in the COMMANDO HUNT interdiction campaign has not yet declined. The primary reason is the wide use of radar controlled strikes.

Fighter/Attack Aircraft Loss Rates

Since the NVN bombing halt, loss rates in SVN have not changed significantly. The table below shows the SVN overall combat loss rate for the year before the halt was 0.480 (losses per 1000 combat sorties); and for the six months following it had dropped by 4% to 0.462. In Laos a similar comparison shows the overall combat loss rate also dropping slightly from 0.764 to 0.753. However, November 1968, which had only one combat loss biased the last 6-month average. Each month since November has had a loss rate higher than the 12-month average before then; and the 5-month average

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rate for Dec 68-Apr 69 is 0.879. Thus the data shows that the combat loss rate over Laos has increased since the NVN bombing halt. How far up it will go depends on how much anti-aircraft effort the enemy will devote to protecting his supply lines through Laos.

COMBAT^{a/} SORTIES, LOSSES AND LOSS RATES
OVER SVN AND LAOS

	Before NVN Bombing Halt			After NVN Bombing Halt						
	12 Months			1968				1969		6 Months
	Nov 67-Oct 68	Total	Mo Ave	Nov	Dec	Jan	Feb	Mar	Apr	Nov 68-Apr 69
SVN										
Losses	111	9.25		8	5	13	4	11	6	47
Sorties (000)	231.2	19.3		16.7	17.9	16.9	15.2	17.7	17.4	101.8
Loss Rate	.480	.480		.478	.280	.768	.263	.622	.344	.462
LAOS										
Losses	49	4.08		1	14	14	11	15	13	68
Sorties (000)	64.2	5.3		14.2	16.9	15.9	14.3	14.6	41.6	90.5
Loss Rate	.764	.764		.070	.830	.881	.772	1.027	.893	.753
										(rate from Dec 68- Apr 69) .879

^{a/} Sum of attack and non-attack missions.

Helicopter Losses

Total helicopter losses were 99 during April, the highest since last May, as the cyclic pattern of heavy losses during the enemy spring offensive repeats itself. In 1968 US and VNAF helicopter losses averaged 100 per month during January-April. Of the 99 losses in April, 48% were to operational causes, the remainder to hostile fire; and over half (52) were Army UH-1 Hueys.

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AIRCRAFT ATTRITION IN SOUTHEAST ASIA

There were a total of 124 US and USAF fixed and rotary-wing aircraft destroyed in Southeast Asia in June 1969. These losses were within 5% of the projections in the Current Budget Plan and about the same as the loss experience in the last 12 months. However, as the table below shows, while total aircraft losses continued at projected levels, (1) fighter and attack aircraft losses in June were much lower than projected (and lower than the last 12 month's experience) and (2) helicopter losses were substantially above both the Budget Plan projection and recent loss experience. These two trends have been present since February 1969, but were accelerated in May and June.

TOTAL AIRCRAFT LOSSES IN SOUTHEAST ASIA
(Monthly Averages)

	<u>Actual</u> <u>June 69</u>	<u>Actual</u> <u>FY 69</u>	<u>Current Budget</u> <u>Plan - FY 69</u>
Helicopters	96	84.1	81.3
Fighter/Attack Aircraft	11	27.7	30.8
Recce/ECM Aircraft	1	2.3	2.5
Other Fixed-Wing Aircraft	16	14.8	15.4
Total	124	128.9	130.0

Fighter and Attack Aircraft Losses and Loss Rates

Fighter and attack aircraft losses have declined substantially in recent months. The table below compares the loss experience during three time periods (1) calendar year 1968 (to indicate a full year of the seasonal weather cycle), (2) the Nov 1968-Jun 1969 period since the bombing halt over NVN, and (3) the most recent 3-month period.

FIGHTER AND ATTACK AIRCRAFT LOSSES IN SOUTHEAST ASIA
(Monthly Averages)

	<u>Jan-Dec</u> <u>1968</u>	<u>Nov 68-</u> <u>Jun 69</u>	<u>Apr-Jun</u> <u>1969</u>
<u>Attack Losses</u>			
SVN	9.0	6.7	5.0
NVN	8.5	0.1	0.0
Laos	3.7	8.2	7.0
Total	21.2	15.0	12.0
<u>Non-Attack Losses</u>	2.8	2.2	1.3
<u>Operational Losses</u>	10.3	6.7	4.7
Total	34.3	23.9	18.0

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Three factors are contributing to the lower fighter/attack losses. First, there have been changes in the distribution of sorties to the different combat areas in Southeast Asia; second, there have been changes in the attack loss rates per sortie experienced in the different combat areas; and third, operational and non-attack loss rates have declined.

1. Distribution of Sorties - The November 1968 cessation of bombing over NVN halted attack sorties in the high AAA and SAM threat areas in NVN. At the same time, the US dramatically increased attacks against interdiction targets in Laos to support the COMMANDO HUNT interdiction campaign. The following table, which shows the sortie distribution by country during selected months, illustrates the shift in emphasis from NVN to Laos which occurred in 1968. For example, in June 69 over five times as many attack sorties were flown in Laos as in June 68 (11,500 versus 2,300). We have maintained this high level of attack sorties, even though the monsoon rains have reduced enemy truck traffic in Laos to a trickle. This reallocation of attack sorties reduced total aircraft losses because loss rates per sortie were over 50% lower in Laos (about 0.6 per 1000 attack sorties in 1968) than in NVN (1.1 per 1000 sorties).

ATTACK SORTIE DISTRIBUTION BY COUNTRY
(Percentages of Total)

	Mar 1968 ^{a/}	Apr 1968	Jul 1968 ^{b/}	Oct 1968 ^{c/}	Nov 1968 ^{d/}	Jan 1969	Apr 1969	Jun 1969
SVN	62%	57%	52%	48%	56%	55%	57%	61%
NVN	16	22	40	37	1	-	-	-
Laos	22	21	8	15	43	45	43	39

- a/ Bombing in NVN was halted above the 19th parallel on Mar 31.
b/ Beginning of "Summer Interdiction Campaign" in NVN Panhandle.
c/ Bombing halt over NVN on Oct 31.
d/ COMMANDO HUNT began on Nov 15.

2. Attack Loss Rates - Loss rates are down 40% for sorties in South Vietnam. The Apr-Jun 1969 loss rates in SVN were the lowest in two years, with the exception of Sep 67, Oct 67, and Oct 68. Attack loss rates over NVN have fallen to zero primarily because of the small number of attack sorties in NVN (less than 200 during Apr-Jun 1969), or errors to attack only when a recce mission is attacked (thus it is a defensive rather than an attack sortie), and finally, because of the relatively light AAA defenses in the southern Route Packages of North Vietnam. The attack loss rate over Laos has remained the same since 1967, even though the AAA threat increased significantly in 1969.

3. Operational and Non-Attack Loss Rates - Operational and non-attack loss rates have declined significantly; the Apr-Jun loss rates are less than half the 1968 experience. In recent months US aircraft have been flying lower sortie rates per aircraft per month (5-10% lower than in 1968), and these lower rates of operation could account for part of the improvement in per sortie operational loss rates. The non-attack loss rate (recce, escort,

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flak suppression, etc.) has also fallen largely as a result of the bombing halt over NVN and the cessation of sorties in the high threat areas around Hanoi and Haiphong.

The table below summarizes changes in fighter and attack loss rates since 1967.

FIGHTER AND ATTACK AIRCRAFT LOSS RATES
IN SOUTHEAST ASIA
(Losses Per '000 Sorties)

	<u>Jan-Dec 67</u>	<u>Jan-Dec 68</u>	<u>Nov 68-Jun 69</u>	<u>Apr-Jun 69</u>
<u>On Attack Sorties</u>				
SVN	0.390	0.484	0.399	0.283
NVN	2.403	1.106	1.560	0.000
Laos	0.697	0.599	0.641	0.587
Total	3.490	2.189	2.600	.870
<u>On Other Combat Sorties</u>	0.910	0.667	0.359	0.336
<u>Operational Loss Rate</u>	0.343	0.281	0.200	0.139

Helicopter Losses

Helicopter losses are generally related to the pace and intensity of ground combat in South Vietnam; losses should vary with the intensity of ground combat. Our analysis has shown that enemy-initiated attacks are the best indicator of combat intensity. The table below shows the relationship between enemy attacks and helicopter losses from hostile action; enemy attacks and helicopter losses increase and decrease together, although the relationship is not necessarily linear. (Operational losses and aircraft destroyed on the ground also appear closely related to enemy attacks.)

HELICOPTER LOSSES IN SOUTHEAST ASIA
(US Army and Marines)

	<u>CY 68</u>				<u>CY 69</u>	
	<u>1st Qtr</u>	<u>2nd Qtr</u>	<u>3rd Qtr</u>	<u>4th Qtr</u>	<u>1st Qtr</u>	<u>2nd Qtr</u>
<u>Losses to Hostile Action</u>						
In Flight	178	134	98	37	108	147
Destroyed on Ground	54	15	-	5	18	23
Total	232	149	98	93	126	170
<u>Losses to Operational Causes</u>	115	125	80	99	118	132
<u>Total</u>	347	274	178	192	244	302
<u>Total Enemy Initiated Attacks</u>	1537	1267	594	523	985	1162

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Enemy tactics in 1969 have primarily emphasized standoff attacks and harassment by fire rather than large-scale military engagements. As a result, helicopters have been destroyed on the ground by enemy rocket and sapper attacks (15 in May and 7 in June); nonetheless, ground losses in 1969 have been less than half as high as occurred during the first half of 1968. Enemy actions against helicopters on the ground have destroyed an average of 7.5% of total helicopter losses since 1968. The largest numbers of helicopter ground losses have tended to occur during the months of high levels of enemy ground activity. For instance, each of the three months since the beginning of the war when the enemy successfully destroyed large numbers of US helicopters on the ground (Jan 68, Feb 68 and Feb 69) was also characterized by high levels of ground combat. During these three months over 20% of total helicopter losses resulted from hostile action on the ground.

US helicopter losses apparently have begun a downward trend from the May 1969 high of 112 losses. The table below shows that the relationship between enemy attacks and hostile losses is being borne out in July; however, it is difficult to project a trend from a one or two month loss experience due to the high month-to-month variability in aircraft losses.

HELICOPTER LOSSES - US ARMY

	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u> ^{a/}
Hostile	45	66	45	29
Operational	46	38	39	36
Total	<u>91</u>	<u>104</u>	<u>84</u>	<u>65</u>
Total Enemy-Initiated Attacks	316	459	454	251

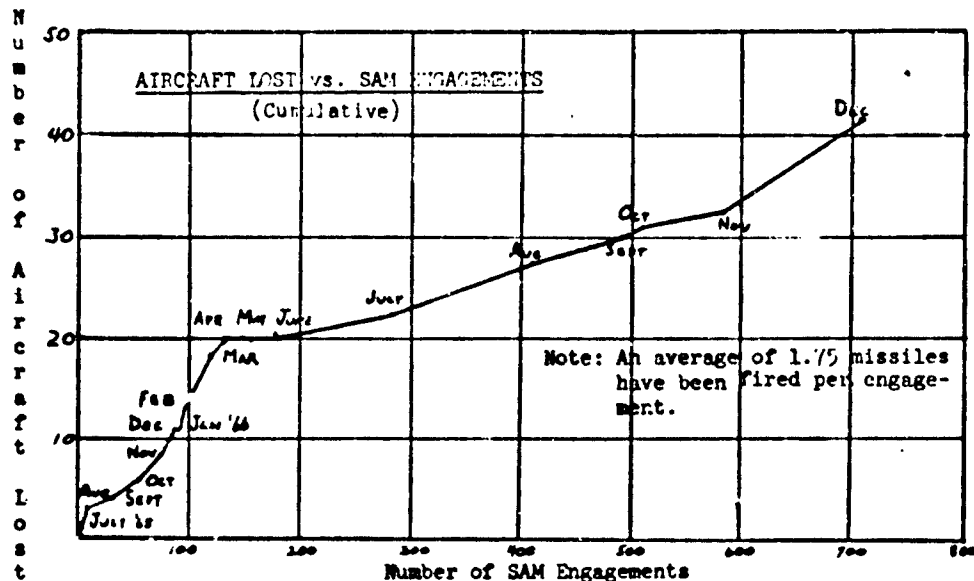
a/ Estimated from data through Jul 23rd.

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Jan 67?

SA-2 EFFECTIVENESS AGAINST U.S. AIRCRAFT

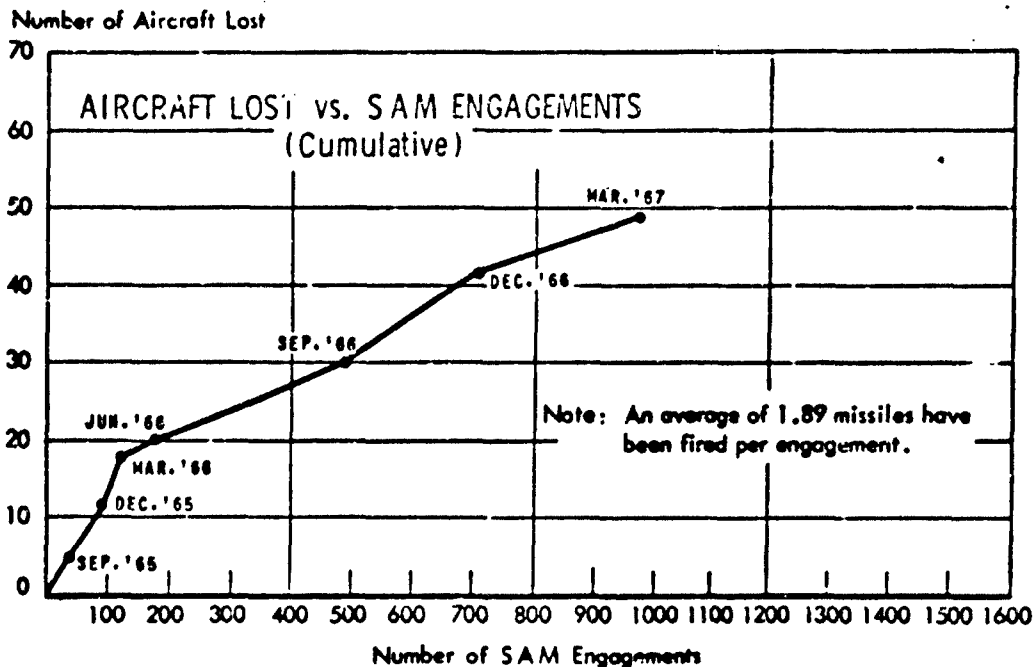


The above graph displays the relationship between aircraft lost and SAM engagements. Engagements appear to provide a better base against which to measure SAM effectiveness than do missile expenditures. In a single engagement a SA-2 battery can launch one, two or three missiles. The average number of missiles expended per engagement, and the attrition rates per engagement are shown in the following table:

	Jul- Sep 1965	Oct- Dec 1965	Jan- Mar 1966	Apr- Jun 1966	Jul- Sep 1966	Oct- Dec 1966	Cumulative Jul 65 - Dec 66
No. Engagements	30	60	30	60	310	217	707
No. Missiles Fired	55	125	43	97	504	413	1237
No. A/C Lost	4	7	6	2	10	12	42
Missiles Fired/ Engaged	1.83	2.08	1.43	1.62	1.63	1.90	1.75
A/C Lost/Missile Fired (%)	7.3	5.6	14.0	2.1	2.0	2.9	3.4
A/C Lost/ Engaged (%)	13.3	11.7	20.0	3.3	3.2	5.5	5.9

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SA-2 EFFECTIVENESS AGAINST U.S. AIRCRAFT



The above graph displays the relationship between aircraft lost and SAM engagements. Missiles per engagement steadily increased in the past 15 months, reached a new peak in January-March 1967. If the 1.9 missiles/engagement ratio of Oct-Dec 1966 had applied in Jan-Mar only 505 missiles would have been fired instead of 597. Even so, the kill rate per engagement dropped to a new low of 2.6%, less than half of Jul-65-Dec 66 (5.9%). The extremely low loss rate is probably due to the QRC-160. The average number of missiles expended per engagement are shown in the following table.

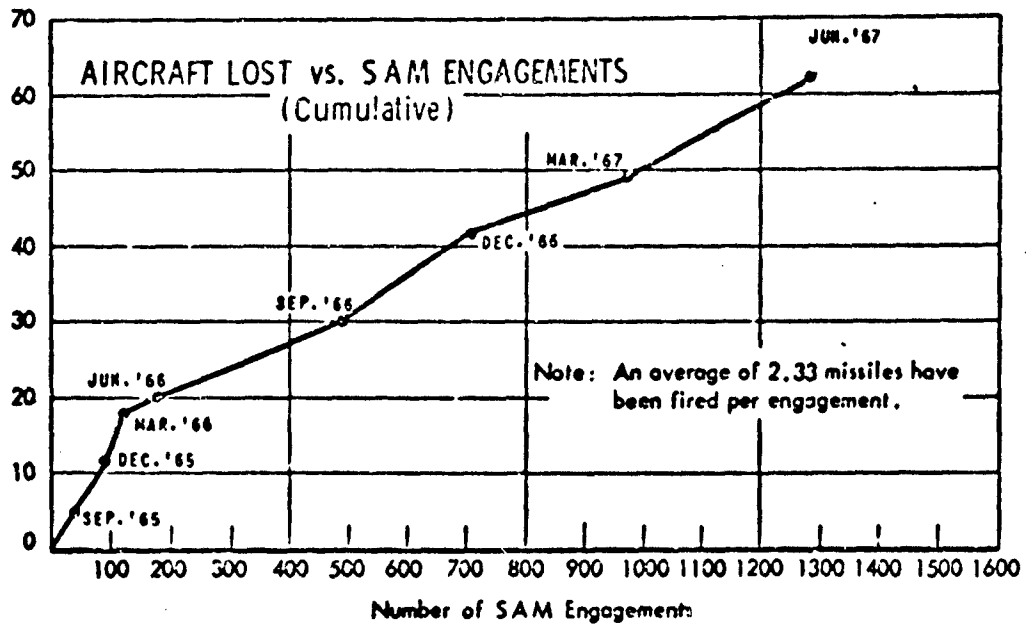
	1965		1966				1967	Cumulative	
	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Jul 65	Mar 67
No. Engagements	30	60	30	60	310	217	266	973	
No. Msls Fired	56	125	43	97	504	413	597	1835	
No. A/C Lost	4	7	7	2	10	12	7	49	
Msls Fired/Engagement	1.9	2.1	1.4	1.6	1.6	1.9	2.2	1.9	
A/C Lost/Missile Fired (%)	7.1	5.6	16.3	2.0	2.0	2.9	1.2	2.7	
A/C Lost/Engagement (%)	13.3	11.7	23.3	3.3	3.2	5.5	2.6	5.0	

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SA-2 EFFECTIVENESS AGAINST U.S. AIRCRAFT

Number of Aircraft Lost



The above graph shows aircraft lost versus SAM engagements through June 1967. The following table shows that missiles fired doubled in Apr-June 1967 (1144); 556 firings were reported in May alone. U.S. aircraft losses per missile fired continued at 1.1, well below CY 1966. The missiles per engagement ratio, however, which had gradually increased during the past 21 months, rose sharply to 3.8 missiles fired per engagement. The number of A/C lost per engagement rose accordingly to 4.3%. The enemy appears to be compensating for the low kill rate per missile fired by increasing the number of missiles per engagement. The total number of U.S. aircraft destroyed by SA-2 missiles during the quarter reached a new peak of 13 and raised our cumulative losses to SAM to 62.

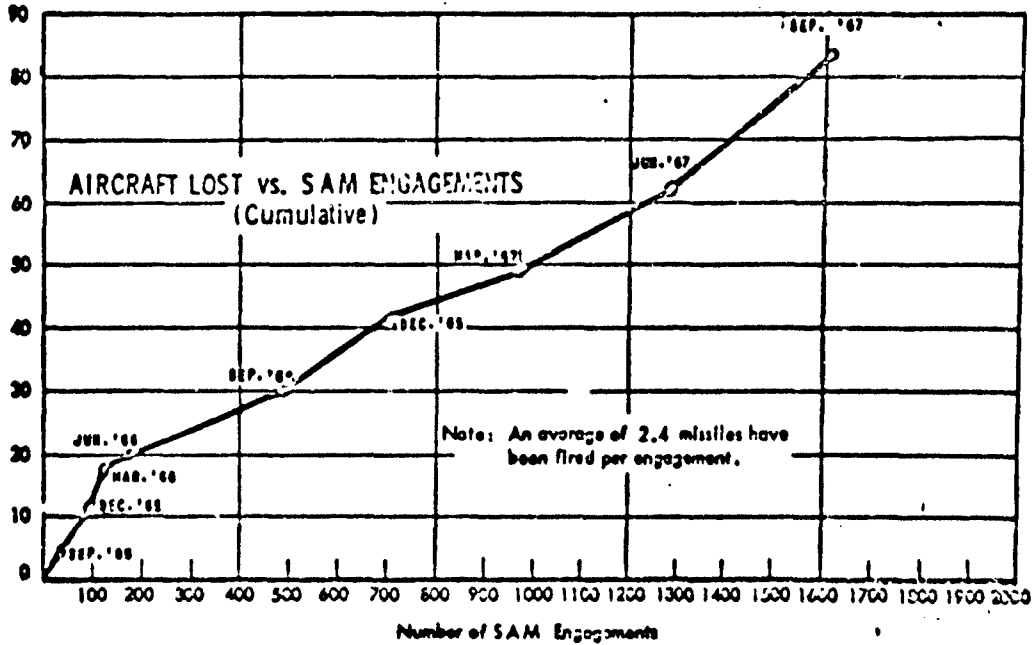
	1965		1966				1967	
	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr
	Sep	Dec	Mar	Jun	Sep	Dec	Mar	Jun
Number of Engagements	30	60	30	60	310	217	266	304
Number Missiles Fired	56	125	43	97	504	413	597	1144
Number A/C Lost	4	7	7	2	10	12	7	13
Missiles Fired/Engagement	1.9	2.1	1.4	1.6	1.6	1.9	2.2	3.8
A/C Lost/Missile Fired (%)	7.1	5.6	16.3	2.0	2.0	2.9	1.2	1.1
A/C Lost/Engagement (%)	13.3	11.7	23.3	3.3	3.2	5.5	2.6	4.3

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SA-2 EFFECTIVENESS AGAINST U.S. AIRCRAFT

Number of Aircraft Lost



The above graph shows aircraft lost versus SAM engagements through September 1967. The following table shows that the number of SAM engagements increased steadily during 1967, reaching a peak of 333 during the third quarter. The number of missiles fired declined to 908, 21% below the 1144 fired during the previous quarter. The ratio of missiles per engagement, which had risen every quarter for a year, dropped sharply.

A total of 17 U.S. aircraft were destroyed by SAM missiles during the period, raising our cumulative losses to 84. The number of U.S. aircraft lost per missile fired during 1967 has increased steadily from 1.2% during the first quarter 1967 to 1.9% during the Jul-Sep period, which may indicate that the North Vietnamese are using random volley-fire less than previously. Our losses per missile fired, however, are still below those of previous years.

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	<u>1965</u>		<u>1966</u>				<u>1967</u>		
	Jul Sep	Aug Oct	Jan Mar	Apr Jun	Jul Sep	Oct Dec	Jan Mar	Apr Jun	Jul Sep
Number of Engagements	30	60	30	60	310	217	266	304	333
Number Missiles Fired	56	125	43	97	504	413	597	1144	908
Number A/C Lost	4	7	7	2	10	12	7	18	17
Missiles Fired/Engagement	1.9	2.1	1.4	1.6	1.6	1.9	2.2	3.8	2.7
A/C Lost/Missile Fired (%)	7.1	5.6	16.3	2.0	2.0	2.9	1.2	1.6	1.9
A/C Lost/Engagement (%)	13.3	11.7	23.3	3.3	3.2	5.5	2.6	5.9	5.1

The table below shows losses to SAM missiles by aircraft type and service. The Air Force has lost a total of 39 aircraft, including 10 F-4s and 15 F-105s. The Navy has lost 32 aircraft, including 26 A-4s. The only Marine losses have been 2 A-4 aircraft. The Navy so far this year has lost 24 of the US total of 35 fighter/attack aircraft (69%) while flying only 26% of the total sorties in NVN this year.

	<u>1965</u>	<u>1966</u>	<u>1967</u> ^{b/}	<u>Total</u>
<u>Air Force</u>				
F-4	2	6	2	10
F-105	3	5	7	15
F-104		2		2
O-1			1	1
RF-4			3	3
RF-101		3	2	5
RB/EB-66		2	1	3
Total AF	<u>5</u>	<u>18</u>	<u>16</u>	<u>39</u>
<u>Navy</u>				
A-4	1	9	16	26
A-6	1		2	3
F-4	1		3	4
F-8	2	2	3	7
A-1		2		2
RA-5	<u>1</u>			<u>1</u>
Total Navy	<u>6</u>	<u>13</u>	<u>24</u>	<u>43</u>
<u>Marines</u>				
A-4			2	2
Total Marines	<u>0</u>	<u>0</u>	<u>2</u>	<u>2</u>
<u>U.S. Total</u>	<u>11</u>	<u>31</u>	<u>42</u>	<u>84</u>

a/ Includes confirmed and probable.

b/ Jan-Sep 1967.

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January

SA-2 EFFECTIVENESS AGAINST U.S. AIRCRAFT

The table below shows that SAM engagements, which have increased steadily since October 1966, almost doubled during the fourth quarter of 1967. The number of missiles fired reached a new peak of 1176 in the Oct-Dec period, more than were fired during all of 1966. A total of 21 U.S. aircraft were lost to SAM missiles, raising our cumulative losses to 104.

	1965		1966				1967			
	Jul Sep	Oct Dec	Jan Mar	Apr Jun	Jul Sep	Oct Dec	Jan Mar	Apr Jun	Jul Sep	Oct Dec
Number of Engagements	30	60	30	60	310	217	266	304	333	563
Number Missiles Fired	56	125	43	97	504	413	597	1144	908	1176
Number A/C Lost	4	7	7	2	10	12	7	18	16	21
Missiles Fired/Engagement	1.9	2.1	1.4	1.6	1.6	1.9	2.2	3.8	2.7	2.1
A/C Lost/Missile Fired (%)	7.1	5.6	16.3	2.0	2.0	2.9	1.2	1.6	1.8	1.8
A/C Lost/Engagement (%)	13.3	11.7	23.3	3.3	3.2	5.5	2.6	5.9	4.8	3.7

Enemy effectiveness (U.S. losses per SAM missile fired) continued at the same level as the third quarter of this year (1.8%), higher than in the first half, but still below last year. A total of 31 aircraft were lost to 1057 missiles in 1966, 2.9 per 100 missiles fired. Despite the fact that this ratio declined to 1.6 in 1967, the North Vietnamese fired far more missiles (3825) and thus destroyed 62 U.S. aircraft. The North Vietnamese (and their Soviet supporters) appear willing to continue firing this relatively large number of SAM missiles for each aircraft lost.

An average of only 2.1 missiles were fired per engagement during the fourth quarter, down from an average of 2.9 during the first nine months of 1967. The number of aircraft lost per engagement declined to 3.7%, well below the averages during the second and third quarter of 1967.

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ACTUAL/ ESTIMATED AIRCRAFT ORDNANCE CONSUMPTION

	CY 1966			CY 1967				
	Oct. 5/	Nov. 5/	Dec. 5/	Jan	Feb	Mar	Apr	May
Attack Sorties								
USN/USMC	6840	7132	7517	10093	10013	10010	9906	9804
USAF-TAC	13695	13690	14942	16627	16626	16007	16007	16008
B-52	410	531	699	650	800	800	800	800
Tons Per Sortie								
USN/USMC	1.59	1.58	1.78	1.75	1.75	1.75	1.75	1.75
USAF-TAC	1.38	1.52	1.59	1.65	1.70	1.75	1.80	1.85
B-52	20.7	20.0	20.8	22.0	24.0	26.0	26.0	26.0
Tons								
USN/USMC	10.9	11.3	13.3	17.7	17.5	17.5	17.3	17.2
USAF-TAC	18.9	20.8	23.7	27.4	28.3	28.0	28.8	29.6
B-52	8.5	10.6	13.7	14.3	19.2	20.8	20.8	20.8
MAP	4.0	5.0	5.1	5.5	5.5	5.5	5.5	5.5
Army	1.1	1.0	1.2	1.3	1.3	1.3	1.3	1.3
Total	42.7	47.7	56.9	66.2	71.8	73.1	73.7	74.4
Worldwide Inventory (Thous. of Tons)								
Start Month	425.5	459.7	493.9	522.1	549.3	574.0	599.4	625.3
-Cons	42.7	47.7	56.9	66.2	71.8	73.1	73.7	74.4
+Prod	76.9	81.9	85.1	93.4	96.5	98.5	99.6	95.0
End Month	459.7	493.9	522.1	549.3	574.0	599.4	625.3	645.9
a/Actual data thru 15 Dec.								

The above table contains an estimate of air ordnance expenditures in SEA through CY 1967. It is approximately equal to the 1.77 level experienced during the last six weeks of CY 1966. The Air Force level experienced during CY 1965 and during January 1966. Analysis of general purpose bomb stock following table shows the relationship between stock levels and 30-day consumption rates.

	500/750 #GP Bomb Stocks vs. Consumption Rates in SEA							
	October			November			December	
	1-10	11-20	21-31	1-10	11-20	21-30	1-15	16-20
USN/USMC								
Stocks (tons)	6.4	9.1	13.0	11.9	14.9	13.8	20.6	
30-day Cons Rate (tons)	5.7	4.3	6.2	6.9	6.0	6.3	6.8	
Ratio (Days)	34	63	63	52	74	66	91	
USAF-Tac								
Stocks (tons)	10.3	12.8	11.4	10.1	13.3	13.0	15.2	
30-day Cons Rate (tons)	7.4	9.4	9.6	11.7	9.0	13.6	14.0	
Ratio (Days)	42	41	36	26	44	29	33	

The above table shows that Navy stocks have increased rapidly since mid-November and that expected. The Air Force, on the other hand, has barely maintained 30-day levels while its consumption probably continue to increase. A 1.68 ton per sortie level was reached in the second half of Dec.

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Feb 67

ANALYSIS OF AIRCRAFT ORDNANCE CONSUMPTION

Tactical aircraft sorties in January were 11 percent below the estimate with the larger percentage drop (19%) in USN/USMC sorties. Both USN/USMC and USAF-TAC exceeded the projected loads per sortie. The B-52 loads per sortie were lower than anticipated but this was balanced by exceeding the projected sorties. Ordnance delivered totaled 63,000 tons the highest total of the war and 2½ times the tons delivered during the peak month of the Korean War. The January total was, however, slightly below (about 5%) the estimate.

	<u>Jan Estimate</u>	<u>Jan Actual</u>
<u>Sorties</u>		
USN/USMC	10093	8223
USAF-TAC	16627	15616
B-52	650	735
<u>Tons/Sortie</u>		
USN/USMC	1.75	1.99
USAF-TAC	1.65	1.71
B-52	22.0	20.7
<u>Tons (in Thousands)</u>		
USN/USMC	17.7	16.4
USAF-TAC	27.4	26.7
B-52	14.3	15.2
MAP	5.5	3.5
Army	<u>1.3</u>	<u>1.2</u>
Total Tons	66.2	63.0

The enclosed table projects aircraft ordnance consumption throughout the remainder of CY 1957. As you will note, the February projection is below the January actuals. The reasons are the jet stand down and the fact that it is a short month. In March, however, tonnage should be above the January levels.

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ACTUAL/ ESTIMATED AIRCRAFT ORDNANCE CONSUMPTION

	CY 1966				ACTUAL	PROJECTED			
	Oct	Nov	Dec	Jan	Jan	Feb	Mar	Apr	May
Attack Sorties									
USN/USMC	6840	7132	7517	8223	8010	10010	9906	9801	9801
USAF-TAC	13695	13590	14942	15616	13301	16007	16007	16003	16003
B-52	410	531	659	739	745	800	800	800	800
Tons Per Sortie									
USN/USMC	1.59	1.58	1.78	1.99	1.75	1.75	1.75	1.75	1.75
USAF-TAC	1.38	1.52	1.59	1.71	1.70	1.75	1.80	1.80	1.80
B-52	20.7	20.0	20.8	20.7	20.7	26.0	26.0	26.0	26.0
Tons									
USN/USMC	10.9	11.3	13.3	16.4	14.0	17.5	17.3	17.3	17.3
USAF-TAC	18.9	20.8	23.7	26.7	22.6	28.0	28.8	28.8	28.8
B-52	8.5	10.6	13.7	15.2	15.4	20.8	20.8	20.8	20.8
MAP	4.0	4.0	5.1	3.5	4.4	5.5	5.5	5.5	5.5
Army	1.1	1.0	1.2	1.2	1.0	1.3	1.3	1.3	1.3
Total	42.7	47.7	56.9	63.0	57.4	73.1	73.7	73.7	73.7
Worldwide Inventory (Thous. of Tons)									
Start Month	429.5	459.7	493.9	522.1	552.3	589.1	613.8	638.5	663.2
-Cons	42.7	47.7	56.9	63.0	57.4	73.1	73.7	74.0	74.0
+Prod	76.9	81.9	85.1	92.2	94.2	97.8	98.2	98.2	98.2
End Month	459.7	493.9	522.1	552.3	589.1	613.8	638.5	663.2	689.4

a/Actual data thru 31 January.
 b/Assumes 2nd attack days.

The above table contains an estimate of air ordnance expenditures in SEA through CY 1967 and the length of the month). Tons per sortie for USN/USMC aircraft are approximately equal to tactical aircraft tons per sortie assume a gradual return to the two ton level experienced during available in SEA for tactical aircraft supports the above average loads. The following table

500/750 #GP Bomb Stocks vs. Consumption Rates in SEA

	October			November			December		Jan
	1-10	11-20	21-31	1-10	11-20	21-30	1-15	16-31	
USN/USMC									
Stocks (tons)	6.4	9.1	13.0	11.9	14.9	13.8	20.6	21.4	20.6
30-day Cons Rate (tons)	5.7	4.3	6.2	6.9	6.0	6.3	6.8	8.6	10.0
Ratio (Days)	34	63	63	52	74	66	91	75	62
USAF-Tac									
Stocks (tons)	10.3	12.8	11.4	10.1	13.3	12.0	15.2	20.0	24.7
30-day Cons Rate (tons)	7.4	9.4	9.6	11.7	9.0	13.6	14.0	16.1	15.0
Ratio (Days)	42	41	36	26	44	29	33	37	47

The above table shows that Navy stocks have increased rapidly since mid-November and that projected. The Air Force, on the other hand, has barely maintained 30-day levels while its consumption probably continue to increase. A 1.71 ton per sortie level was reached in January by the Air

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NAFT ORDNANCE CONSUMPTION

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	ACTUAL		PROJECTED							
	1965	Jan 66	CY 1967							
	Jan 66	Feb 66	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
1	7517	8223	8010	10010	9906	9804	9940	9864	9850	
2	14942	15516	13301	16007	16007	16008	16008	15928	15928	15928
3	659	735	745	800	800	800	800	800	800	800
1.55	1.76	1.99	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75
1.72	1.59	1.74	1.70	1.75	1.80	1.85	1.90	1.95	2.00	2.00
20.0	20.8	20.7	20.7	26.0	26.0	26.0	26.0	26.0	26.0	26.0
1.3	13.3	16.4	14.0	17.5	17.3	17.2	17.4	17.3	17.3	17.3
2.3	23.7	26.7	22.6	28.0	28.8	29.6	30.4	31.1	31.9	31.9
3.6	13.7	15.2	15.4	20.8	20.8	20.8	20.8	20.8	20.8	20.8
4.0	5.1	3.5	4.4	5.5	5.5	5.5	5.5	5.5	5.5	5.5
1.0	1.2	1.2	1.0	1.3	1.3	1.3	1.3	1.3	1.3	1.3
7.7	56.9	63.0	57.4	73.1	73.7	74.4	75.4	76.0	76.8	76.8
693.9	522.1	552.3	589.1	613.8	638.3	660.8	677.1	682.6	682.6	682.6
56.9	63.0	57.4	73.1	73.7	74.4	75.4	76.0	76.8	76.8	76.8
85.1	53.2	98.2	97.8	98.2	95.9	91.7	81.5	75.7	75.7	75.7
522.1	522.3	522.1	613.8	638.3	660.8	677.1	682.6	682.6	682.6	682.6

an estimate of air ordnance expenditures in SEA through CY 1967. Sorties are those of Program #4 (except... Tons per sortie for USN/USMC aircraft are approximately equal to the 1.77 level experienced during the... sorties assume a gradual return to the two ton level experienced during CY 1965 and during January 1966. Additional aircraft support the above average loads. The following table shows the relationship between stock levels...

500/750 #GP Lamb Stocks vs. Consumption Rates in SEA

October			November			December		January	
1-10	11-20	21-31	1-10	11-20	21-30	1-15	16-31	1-15	16-31
6.4	9.1	13.0	11.9	14.9	13.8	20.6	21.4	20.8	19.2
5.7	4.3	6.2	6.9	6.0	6.3	6.8	8.6	10.0	5.9
34	63	63	52	74	66	91	75	62	98
10.3	12.8	11.4	10.1	13.3	13.0	15.2	20.0	24.7	24.5
7.4	9.4	9.6	11.7	9.0	13.6	14.0	16.1	15.6	20.1
42	41	36	26	44	29	33	37	47	37

at Navy stocks have increased rapidly since mid-November and that expenditures have leveled off. This... other hand, has barely maintained 30-day levels while its consumption has been growing rapidly. This... A 1.71 ton per sortie level was reached in January by the Air Force, the highest level since last...

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	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	9206 16007 800	9204 16008 800	9310 16008 800	9264 15978 800	9850 15928 800	9850 15928 800	9850 15933 800	9779 15933 800	9955 15953 800
.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75
.75	1.80	1.85	1.90	1.95	2.00	2.00	2.00	2.00	2.00
.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0
.5	17.3	17.2	17.4	17.3	17.3	17.3	17.3	17.1	17.4
.6	28.8	29.6	30.4	31.1	31.9	31.9	31.9	31.9	31.9
.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8
.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
.1	73.7	74.4	75.4	76.0	76.8	76.8	76.8	76.6	76.9
.2	613.8	638.3	660.8	677.1	682.6	681.5	676.4	667.5	656.0
.1	73.7	74.4	75.4	76.0	76.8	76.8	76.8	76.6	76.9
.8	98.2	96.9	91.7	81.5	75.7	71.7	67.9	65.1	65.9
.5	35.3	30.5	27.1	22.8	20.5	17.4	15.5	15.0	15.0

through CY 1967. Sorties are those of Program #1 (except for an adjustment in February for TET approximately equal to the 1.77 level experienced during the last six weeks of CY 1966. The Air Force consumption experienced during CY 1965 and during January 1966. Analysis of general purpose bomb stocks. The following table shows the relationship between stock levels and 30-day consumption rates.

Rates in SEA

December		January	
1-15	16-31	1-15	16-31
20.6	21.4	20.8	19.2
6.8	8.6	10.0	5.9
91	75	62	98
15.2	20.0	24.7	24.5
14.0	16.1	15.6	20.1
33	37	47	37

mid-November and that expenditures have leveled off. Thus no increase in Navy total rates is projected while its consumption has been growing rapidly. Thus it is clear that the Air Force will in January by the Air Force, the highest level since last February.

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OASD/SA/SEA Programs Div.
February 17, 1967

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ANALYSIS OF AIRCRAFT ORDNANCE CONSUMPTION

Tactical aircraft sorties in February were 7% above the estimate published last month, which adjusted Program 4 sorties for the 24 attack days in February. They were 15% below Program 4, which assumed a 30-day month. Both USN/USMC and USAF-TAC exceeded the projected load factor per sorties for the second successive month. B-52 loads were substantially above those projected or previously realized. Ordnance expended totaled 68.2 thousand tons - the highest total of the war. We now estimate bomb consumption will level at about 80,000 tons per month for combat, plus about 3,000 tons per month for training, 6000 tons per month higher than previously projected.

	<u>Feb Estimate</u>	<u>Feb Actual</u>
<u>Sorties</u>		
USN/USMC	8010	8854
USAF-TAC	13301	14478
B-52	745	706
<u>Tons/Sortie</u>		
USN/USMC	1.75	1.97
USAF-TAC	1.70	1.80
B-52	20.70	28.05
<u>Thousands of Tons</u>		
USN/USMC	14.6	17.4
USAF-TAC	22.6	26.0
B-52	15.4	19.8
MAP	4.4	3.8
Army	<u>1.0</u>	<u>1.2</u>
Total Tons	57.4	68.2

The current estimate for consumption for the CY 1967 is shown on the table that follows.

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ACTUAL/ESTIMATED AIRCRAFT ORDNANCE CONSUMPTION a/

	ACTUAL					PROJECTED			
	CY 1966					CY 1967			
	Oct b/	Nov b/	Dec b/	Jan b/	Feb b/	Mar	Apr	May	Jun
Attack Sorties									
USN/USMC	6840	7132	7517	8223	8854	10010	9906	9804	9940
USAF-TAC	13695	13690	14942	15616	14478	16007	16907	16008	16008
B-52	410	531	659	735	706	800	800	800	800
Tons Per Sortie									
USN/USMC	1.59	1.58	1.78	1.99	1.97	1.95	1.95	1.95	1.95
USAF-TAC	1.38	1.52	1.59	1.71	1.80	1.85	1.90	1.95	2.00
B-52	20.7	20.0	20.8	20.7	28.05	28.0	28.0	28.0	28.0
Tons									
USN/USMC	10.9	11.3	13.3	16.4	17.4	19.5	19.3	19.1	19.4
USAF-TAC	18.9	20.8	23.7	26.7	26.0	29.6	30.4	31.2	32.0
B-52	8.5	10.6	13.6	15.2	19.8	22.4	22.4	22.4	22.4
MAP	4.0	4.0	4.0	3.6	3.8	4.8	4.8	4.8	4.8
Army	1.1	1.0	1.2	1.2	1.2	1.3	1.3	1.3	1.3
Total	43.4	47.7	55.8	63.1	68.2	77.6	78.2	78.8	79.9
Worldwide Inventory (Thous. of Tons)									
Start Month	401.7	432.2	463.4	489.7	516.8	539.8	557.0	574.0	589.1
-Cons*	46.4	50.7	58.8	66.1	71.2	80.6	81.2	81.8	82.9
+Prod	76.9	81.9	85.1	93.2	94.2	97.8	98.2	96.9	91.7
End Month	432.2	463.4	489.7	516.8	539.8	557.0	574.0	589.1	597.9

500/750 BCP Bomb Stocks vs. Consumption Rates

	October	November	December
USN/USMC			
Stocks (tons)			21.4
Monthly Cons Rate (tons)			7.7
Ratio (Days) c/			83.6
USAF-Tac			
Stocks (tons)			20.0
Monthly Cons Rate (tons)			15.0
Ratio (Days) c/			40

2.75 in Motors vs. Consumption Rates in SEA

	October	November	December
Army			
Stocks (Items 000)			318.8
Monthly Cons Rate (Items 000)			100.7
Ratio (Days) c/			95

a/ Sorties are those of Program #4. Tons per sortie for USN/USMC aircraft are approximately last three months. The Air Force tactical aircraft tons per sortie assume a gradual rate CY 1965 and during January 1966. Analysis of general purpose bomb stocks available in S loads.

b/ Actual data thru 28 February.

c/ Based on 30 day month.

* Includes 3000 tons per month training expenditures.

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Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
9906	9804	9940	9864	9850	9850	9850	9779	9955
16007	16008	16008	15928	15928	15928	15933	15933	15933
800	800	800	800	800	800	800	800	800
1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95
1.90	1.95	2.00	2.00	2.00	2.00	2.00	2.00	2.00
28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0
19.3	19.1	19.4	19.2	19.2	19.2	19.2	19.1	19.4
30.4	31.2	32.0	31.9	31.9	31.9	31.9	31.9	31.9
22.4	22.4	22.4	22.4	22.4	22.4	22.4	22.4	22.4
4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8
1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
	78.8	79.9	79.6	79.6	79.6	79.6	79.5	79.8
557.0	574.0	589.1	597.9	596.8	589.9	579.0	564.3	546.9
81.2	81.8	82.9	82.6	82.6	82.6	82.6	82.5	82.8
98.2	96.9	91.7	81.5	75.7	71.7	67.9	65.1	65.9
574.0	589.1	597.0	596.8	539.9	579.0	564.3	546.9	530.0

Stocks vs. Consumption Rates in SEA

November	December	January	February
	21.4	19.2	15.6
	7.7	10.8	11.6
	83.6	53	48
	20.0	24.5	36.7
	15.0	17.9	17.6
	40	41	63

Consumption Rates in SEA

November	December	January	February
	318.8	284.2	416.6
	100.7	101.4	103.5
	95	84	121

Tactical aircraft are approximately equal to the 1.92 level experienced during the sortie assume a gradual return to the two ton level experienced during bomb stocks available in SEA for tactical aircraft supports the above average

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OASD/CA
March 15, 1967

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Apr 67

ANALYSIS OF AIRCRAFT ORDNANCE CONSUMPTION

Ordnance delivered totaled 77,400 tons vs 77,600 estimated for March - an error of $\frac{1}{4}$ of 1%. USAF-TAC aircraft sorties in March were nearly 10% over the February estimate and there was a slight dip from the projected USAF-TAC load factor - .04 tons. USN/USMC sorties were estimated within $\frac{1}{2}$ of 1% but a 9% dip occurred in the load factor.

Future consumption is now estimated to level at 84,000 tons, including 3,000 for training. A higher load factor for B-52s is projected (30.0 vs 28.0) due to SAC's increase in the numbers of sorties to be optimally loaded.

	<u>March Estimate</u>	<u>March Actual</u>
<u>Sorties</u>		
USN/USMC	10010	10070
USAF - TAC	16007	17528
B-52	800	816
<u>Tons/Sortie</u>		
USN/USMC	1.95	1.77
USAF - TAC	1.85	1.81
B-52	28.00	27.08
<u>Thousands of Tons</u>		
USN/USMC	19.5	17.8
USAF - TAC	29.6	31.8
B-52	22.4	22.1
MAP	4.8	4.0
Army	<u>1.3</u>	<u>1.7</u>
Total Tons	77.6	77.4

The current estimate for CY 1967 consumption is on the table that follows.

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ACTUAL/ESTIMATED AIRCRAFT ORDNANCE CONSUMPTION

	ACTUAL						PREDICTED			
	CY 1966						CY 1967			
	Oct. h/	Nov. h/	Dec. h/	Jan. h/	Feb. h/	Mar. h/	Apr.	May	Jun	Jul
Attack Sorties										
USN/USMC	6440	7132	7347	8247	8912	10070	9976	9974	9940	9864
USAF-TAC	13594	13562	14769	15616	14713	17528	16007	15008	16008	15928
B-52	408	531	659	735	776	864	800	800	800	800
Tons Per Sortie										
USN/USMC	1.59	1.58	1.81	1.99	1.95	1.77	1.95	1.95	1.95	1.95
USAF-TAC	1.40	1.54	1.60	1.71	1.77	1.81	1.90	1.95	2.00	2.00
B-52	20.8	20.0	20.6	20.7	28.0	27.1	30.0	30.0	30.0	30.0
Tons										
USN/USMC	10.9	11.3	13.3	16.4	17.4	17.8	19.3	19.1	19.4	19.2
USAF-TAC	19.0	20.9	23.7	26.7	26.0	31.8	30.4	31.2	32.0	31.9
B-52	8.5	10.6	13.6	15.2	19.8	22.1	24.0	24.0	24.0	24.0
MAP	3.0	4.1	4.0	3.6	3.8	4.0	4.5	4.5	4.5	4.5
Army	1.1	1.0	1.2	1.2	1.2	1.7	1.6	1.6	1.6	1.6
Total	42.5	47.9	55.8	63.1	68.2	77.4	79.8	80.4	81.5	81.2
Worldwide Inventory (Thous. of Tons)										
Start Month	408.7	440.1	471.1	497.4	524.5	547.5	564.9	580.3	593.8	601.0
-Cons*	45.5	50.9	58.8	66.1	71.2	80.4	82.8	83.4	84.5	84.2
+Prod	76.9	81.9	85.1	93.2	94.2	97.8	98.2	96.9	91.7	81.5
End Month	440.1	471.1	497.4	524.5	547.5	564.9	580.3	593.8	601.0	598.3

500/750 BCP Bomb Stocks vs. Consumption Rates in SPA

	October	November	December	January
USN/USMC				
Stocks (tons)	13.0	13.8	21.4	19.2
Monthly Cons Rate (tons)	5.4	6.4	7.7	10.8
Ratio (Days) c/	72.2	64.7	83.4	53.3
USAF-Tac				
Stocks (tons)	11.4	13.0	20.0	24.5
Monthly Cons Rate (tons)	8.8	11.4	15.0	17.9
Ratio (Da2ys) c/	38.9	34.2	40.0	41.1

2.75 in Motors vs. Consumption Rates in SPA

	October	November	December	January
Army				
Stocks (items 000)	251.6	342.8	318.9	284.2
Monthly Cons Rate (items 000)	84.1	84.5	100.7	101.4
Ratio (Days) c/	89.8	121.7	95.0	84.1

a/ Sorties are those of Program #4. Tons per sortie for USN/USMC aircraft are slightly higher than the last three months. The Air Force tactical aircraft tons per sortie assume a gradual return to the CY 1965 and during January 1966. Analysis of general purpose bomb stocks available in SPA for tactical loads.

b/ Actual data thru 31 March.

c/ Based on 30 day month.

* Includes 1000 tons per month training expenditures.

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Nov	Jun	Jul	Aug	Sep	Oct	Nov	Dec
9804	9940	9864	9850	9850	9750	9779	9955
16704	16704	15928	15978	15928	15935	15933	15933
800	800	800	800	800	800	800	800
1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95
1.95	2.00	2.00	2.00	2.00	2.00	2.00	2.00
30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
19.1	19.4	19.2	19.2	19.2	19.2	19.1	19.4
31.2	32.0	31.9	31.9	31.9	31.9	31.9	31.9
24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
80.4	81.5	81.2	81.2	81.2	81.2	81.1	81.4
.3	597.8	601.0	598.3	589.8	577.3	561.0	542.0
83.4	84.5	84.2	84.2	84.2	84.2	84.1	84.4
96.9	91.7	81.5	75.7	71.7	67.9	65.1	65.9
593.8	601.0	598.3	589.8	577.3	561.0	542.0	523.5

Consumption Rates in SPA

cr	December	January	February	March
9	21.4	19.2	18.6	23.2
4	7.7	10.8	11.6	11.0
7	83.4	53.3	48.1	63.3
0	20.0	24.5	36.7	35.1
4	15.0	17.9	17.6	22.1
2	40.0	41.1	62.6	47.6

ion Rates in SPA

cr	December	January	February	March
8	318.8	284.2	416.6	575.3
5	100.7	101.4	107.5	126.1
7	95.0	84.1	120.8	136.9

ft are slightly higher than the 1.90 level experienced during the
 some a gradual return to the two ton level experienced during
 nake available in SPA for tactical aircraft supports the above average

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ANALYSIS OF AIRCRAFT ORDNANCE CONSUMPTION

Tactical aircraft sorties in February were 9% above the estimate published last month, which adjusted Program 4 sorties for the 24 attack days in February. They were 15% below Program 4, which assumed a 30-day month. Both USN/USMC and USAF-TAC exceeded the projected load factor per sorties for the second successive month. B-52 loads were substantially above those projected or previously realized. Ordnance expended totaled 68.2 thousand tons - the highest total of the war. We now estimate bomb consumption will level at about 80,000 tons per month for combat, plus about 3,000 tons per month for training, 6000 tons per month higher than previously projected.

	<u>Feb Estimate</u>	<u>Feb Actual</u>
<u>Sorties</u>		
USN/USMC	8010	8854
USAF-TAC	13301	14478
B-52	745	706
<u>Tons/Sortie</u>		
USN/USMC	1.75	1.97
USAF-TAC	1.70	1.80
B-52	20.70	28.05
<u>Thousands of Tons</u>		
USN/USMC	14.0	17.4
USAF-TAC	22.6	26.0
B-52	15.4	19.8
MAP	4.4	3.8
Army	<u>1.0</u>	<u>1.2</u>
Total Tons	57.4	68.2

The current estimate for consumption for the CY 1967 is shown on the table that follows.

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ACTUAL/ESTIMATED AIRCRAFT ORDNANCE CONSUMPTION a/

	ACTUAL					PROJECTED			
	CY 1966					CY 1967			
	Oct b/	Nov b/	Dec b/	Jan b/	Feb b/	Mar	Apr	May	Jun
Attack Sorties									
USN/USMC	6840	7132	7517	8223	8854	10910	9906	9804	9940
USAF-TAC	13693	13690	14942	15616	14478	16007	16007	16008	16003
B-52	410	531	659	735	706	800	800	800	800
Tons Per Sortie									
USN/USMC	1.59	1.58	1.78	1.99	1.97	1.95	1.95	1.95	1.95
USAF-TAC	1.38	1.32	1.59	1.71	1.80	1.85	1.90	1.95	2.00
B-52	20.7	20.0	20.8	20.7	28.05	29.0	28.0	28.0	28.0
Tons									
USN/USMC	10.9	11.3	13.3	16.4	17.4	19.5	19.3	19.1	19.4
USAF-TAC	18.9	20.8	23.7	26.7	26.0	29.6	30.4	31.2	32.0
B-52	8.5	10.6	13.6	15.2	19.8	22.4	22.4	22.4	22.4
MAP	4.0	4.0	4.0	3.6	3.8	4.8	4.8	4.8	4.8
Army	1.1	1.0	1.2	1.2	1.2	1.3	1.3	1.3	1.3
Total	43.4	47.7	55.8	63.1	68.2	77.6	78.2	78.8	79.9
Worldwide Inventory (Thous. of Tons)									
Start Month	401.7	432.2	463.4	489.7	516.8	539.8	557.0	574.0	589.1
-Cons*	46.4	50.7	58.8	66.1	71.2	80.6	81.2	81.8	82.9
+Prod	76.9	81.9	85.1	92.2	94.2	97.8	98.2	96.9	91.7
End Month	432.2	463.4	489.7	516.8	539.8	557.0	574.0	589.1	597.9

500/750 FCP Bomb Stocks vs. Consumption Rates i:

	October	November	December
USN/USMC			
Stocks (tons)			21.4
Monthly Cons Rate (tons)			7.7
Ratio (Days) c/			83.6
USAF-Tac			
Stocks (tons)			20.0
Monthly Cons Rate (tons)			15.0
Ratio (Days) c/			40

2.75 in Motors vs. Consumption Rates in SEA

	October	November	December
Army			
Stocks (items 000)			318.8
Monthly Cons Rate (items 000)			100.7
Ratio (Days) c/			95

a/ Sorties are those of Program 24. Tons per sortie for USN/USMC aircraft are approximately last three months. The Air Force tactical aircraft tons per sortie assume a gradual rate CY 1965 and during January 1966. Analysis of general purpose bomb stocks available in SEA loads.

b/ Actual data thru 28 February.

c/ Based on 30 day month.

* Includes 3000 tons per month training expenditures.

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Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
9706	9804	9940	9864	9850	9850	9850	9779	9955
6007	16003	16008	1728	15928	15928	15933	15933	15933
800	800	800	500	800	800	800	800	800
1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95
1.90	1.95	2.00	2.00	2.00	2.00	2.00	2.00	2.00
28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0
19.3	19.1	19.4	19.2	19.2	19.2	19.2	19.1	19.4
30.4	31.2	32.0	31.9	31.9	31.9	31.9	31.9	31.9
22.4	22.4	22.4	22.4	22.4	22.4	22.4	22.4	22.4
4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8
1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
	78.8	79.9	79.6	79.6	79.6	79.6	79.5	79.8
557.0	574.0	589.1	597.9	596.8	589.9	579.0	564.3	546.9
81.2	81.8	82.9	82.6	82.6	82.6	82.6	82.5	82.8
98.2	96.9	91.7	81.5	75.7	71.7	67.9	65.1	65.9
574.0	589.1	597.9	596.8	589.9	579.0	564.3	546.9	530.0

cks vs. Consumption Rates in SEA

November	December	January	February
	21.4	19.2	18.6
	7.7	10.8	11.6
	83.6	53	48
	20.0	24.5	34.7
	15.0	17.9	17.6
	40	41	63

Consumption Rates in SEA

November	December	January	February
	318.8	284.2	416.6
	100.7	101.4	103.5
	95	84	121

aircraft are approximately equal to the 1.92 level experienced during the sortie assume a gradual return to the two ton level experienced during bomb stocks available in SEA for tactical aircraft supports the above average

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OASD/SA
March 15, 1967

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ANALYSIS OF AIRCRAFT ORDNANCE CONSUMPTION

May SEA air munitions consumption exceeded the estimate by 4%-- reaching 80,600 tons. The major reason was a 38% increase in USN/USMC sorties. The tons per sortie were not as high as expected for all services. The supply of USAF-IAC and USN/USMC 500/750# GP bombs appeared to be the constraint. Stocks of these weapons dropped from 54,300 tons in April to 48,900 tons in May.

USN/USMC--500/750# bomb stocks dropped from 63.5 days at the then current consumption rate to 43.4 days in May. Army 2.75" Rockets remained in long supply (four months) at present consumption rates.

	<u>May Estimate</u>	<u>May Actual</u>
<u>Attack Sorties</u>		
USN/USMC	9151	12642
USAF - TAC	15306	16792
B-52	800	812
<u>Tons/Attack Sorties</u>		
USN/USMC	1.95	1.86
USAF - TAC	1.90	1.77
B-52	28.0	25.9
<u>Thousands of Tons</u>		
USN/USMC	17.8	23.5
USAF - TAC	31.2	29.8
B-52	22.4	21.0
MAP	4.2	4.5
Army	1.9	1.8
Total Tons	<u>77.5</u>	<u>80.6</u>

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ACTUAL/ESTIMATED AIRCRAFT ORDNANCE CONSUMPTION ^{g/}

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	CY 1966							CY 1967			ACTUAL		PROJECTED	
	Oct b/	Nov b/	Dec b/	Jan b/	Feb b/	Mar b/	Apr b/	May b/	Jun	Jul	Aug			
	Attack Sorties													
USM/USMC	6840	7132	7347	8247	8928	10070	10315	12642	9220	9190	9181			
USAP-TAC	13594	13562	14769	15616	14713	17528	16896	16792	15306	15459	16401			
B-52	408	531	659	735	706	816	823	812	800	800	800			
Tons Per Sortie														
USM/USMC	1.59	1.58	1.81	1.99	1.95	1.77	1.83	1.86	1.95	1.95				
USAP-TAC	1.40	1.54	1.60	1.71	1.77	1.81	1.83	1.77	1.95	2.00				
B-52	20.8	20.0	20.6	20.7	28.0	27.1	25.5	25.9	30.0	30.0	30.0			
Tons														
USM/USMC	10.9	11.3	13.3	16.4	17.4	17.8	18.9	23.5	18.0	17.9	17.9			
USAP-TAC	19.0	20.9	23.7	26.7	26.0	31.8	30.9	29.8	29.8	30.9	30.9			
B-52	8.5	10.6	13.6	15.2	19.8	22.1	21.0	21.0	24.0	24.0	24.0			
MAP	3.0	4.1	4.0	3.6	3.8	4.0	4.0	4.5	4.2	4.2				
Army	1.1	1.0	1.2	1.2	1.2	1.7	1.9	1.8	1.9	1.9				
Total	42.5	47.9	55.8	63.1	68.2	77.4	76.7	80.6	78.9	80.9	80.9			
Worldwide Inventory (Thous. of Tons)														
Start Month	422.2	453.9	481.9	509.0	536.1	556.5	574.0	589.3	604.8	617.8	630.1	630.1	630.1	
-Consum	45.5	50.9	58.8	66.1	71.2	80.4	79.7	83.6	81.9	83.9	83.9	83.9	83.9	
+Prod	77.2	78.9	85.9	93.2	91.6	97.9	95.0	99.1	94.9	96.2	96.2	96.2	96.2	
End Month	453.9	481.9	509.0	536.1	556.5	574.0	589.3	604.8	617.8	630.1	630.1	630.1	630.1	

500/750 ACP Bomb Stocks vs. Consumption Rates in SEA

	October	November	December	January	February	March
USM/USMC						
Stocks (tons)	13.0	13.8	21.4	19.2	18.6	24.6
Monthly Cons Rate (tons)	5.4	6.4	7.7	10.8	11.5	11.0
Ratio (Days) ^{g/}	72.2	64.7	83.4	53.3	48.1	64.4
USAP-Tac						
Stocks (tons)	11.4	13.0	20.0	24.5	36.7	35.1
Monthly Cons Rate (tons)	8.8	11.4	15.0	17.9	17.6	22.1
Ratio (Days) ^{g/}	38.9	34.2	40.0	41.1	63.6	47.6

2.75 in Motors vs. Consumption Rates in SEA

	October	November	December	January	February	March
Army						
Stocks (items 000)	251.6	324.8	318.8	284.2	416.6	575.3
Monthly Cons Rate (items 000)	84.1	84.5	100.7	101.4	103.5	126.1
Ratio (Days) ^{g/}	89.8	121.7	95.0	84.1	120.8	136.9

^{g/} Sorties are those of Program #4. Tons per sortie for USM/USMC aircraft are slightly higher than the last three months. The Air Force tactical aircraft tons per sortie assume a gradual return to the two CY 1965 and during January 1966. Analysis of general purpose bomb stocks available in SEA for tactical loads.

^{h/} Actual data thru 31 May.

^{i/} Based on 30 day month.

^a Includes 3000 tons per month training expenditures projected for April and subsequent months. Actual

DOWNGRADED AT 3 YEAR INTERVALS:
DECLASSIFIED AFTER 12 YEARS
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ACTUAL	PROJECTED							
	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
642	9220	9190	9185	9190	9281	9402	9163	
792	15306	15459	16402	16402	16394	16394	16394	
812	800	800	800	800	800	800	800	
1.86	1.95	1.95	1.95	1.95	1.95	1.95	1.95	
1.77	1.95	2.00	2.00	2.00	2.00	2.00	2.00	
25.9	30.0	30.0	30.0	30.0	30.0	30.0	30.0	
23.5	18.0	17.9	17.9	17.9	18.1	18.3	17.9	
29.8	29.8	30.9	32.8	32.8	32.8	32.8	32.8	
21.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	
4.5	4.2	4.2	4.2	4.2	4.2	4.2	4.2	
1.6	1.9	1.9	1.9	1.9	1.9	1.9	1.9	
80.6	78.9	80.9	80.8	80.8	81.0	81.2	80.8	
50	604.8	617.8	630.1	640.3	649.7	658.3	666.9	
8	81.9	83.9	83.8	83.8	84.0	84.2	83.8	
99.1	94.9	96.2	94.0	93.2	92.6	92.8	93.1	
604.8	617.8	630.1	640.3	649.7	658.3	666.9	676.2	

Consumption Rates in SEA

	January	February	March	April	May
	19.2	18.6	23.6	26.9	21.0
	10.8	11.6	11.0	12.7	14.5
	53.3	48.1	64.4	63.5	43.4
	24.5	36.7	35.1	27.4	27.9
	17.9	17.6	22.1	21.3	20.5
	41.1	63.6	47.6	38.6	40.8

SEA Rates in SEA

	January	February	March	April	May
	284.2	416.6	575.3	680.9	634.6
	101.4	103.5	126.1	158.8	150.9
	84.1	120.8	136.9	128.6	126.2

are slightly higher than the 1.82 level experienced during the
 time a gradual return to the two ton level experienced during
 is available in SEA for tactical aircraft supports the above average

and subsequent months. Actual figures are Worldwide consumption.

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June 15, 1967

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ANALYSIS OF AIRCRAFT ORDNANCE CONSUMPTION

June ordnance expenditures were within 1% of the estimate. The sorties for both USN/USMC and USAF - TAC were 14% and 10%, respectively, higher than the estimate but average loads were below that planned. As in the previous month the constraint appeared to be in USAF - TAC 500/750 # GP bomb stocks. These stocks dropped about 20% from May to a level of one months consumption at the June expenditure rate. Meanwhile, USN/USMC 500/750 # bomb stocks rose from 43 days of the contemporary consumption in May to 65 days in June.

Army 2.75" rocket stocks remained unusually high -- four months of stocks at the present consumption rate. Consumption is well below the CINCPAC allocation and requirement.

	<u>June Estimate</u>	<u>June Actual</u>
<u>Attack Sorties</u>		
USN/USMC	9220	10515
USAF - TAC	15306	16818
B-52	800	832
<u>Tons/Attack Sorties</u>		
USN/USMC	1.95	1.88
USAF - TAC	1.95	1.83
B-52	30.0	25.5
<u>Thousands of Tons</u>		
USN/USMC	18.0	19.7
USAF - TAC	29.8	30.8
B-52	24.0	21.2
MAP	4.2	4.5
Army	1.9	1.8
Total	78.9	78.0

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ACTUAL/ESTIMATED AIRCRAFT ORDNANCE CONSUMPTION ^{g/}

	CY 1966			CY 1967						PROJECTED	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Attack Sorties											
USN/USMC	6840	7132	7347	8247	8928	10070	10315	12642	10515	9190	9100
USAF-TAC	13594	13562	14749	13416	14713	17528	16894	16792	16818	15439	16400
B-52	408	531	659	755	706	816	823	812	832	800	800
Tonnage Per Sortie											
USN/USMC	1.59	1.58	1.81	1.99	1.95	1.77	1.83	1.86	1.88	1.95	1.95
USAF-TAC	1.40	1.54	1.60	1.71	1.77	1.81	1.83	1.77	1.81	2.00	2.00
B-52	20.8	20.0	20.6	20.7	20.0	27.1	25.5	25.9	25.5	30.0	30.0
Tonnage											
USN/USMC	10.9	11.3	13.3	16.4	17.4	17.8	18.9	23.5	19.7	17.9	17.9
USAF-TAC	19.0	20.9	23.7	26.7	26.0	31.8	30.9	29.0	30.8	30.9	30.9
B-52	8.5	10.6	13.6	15.2	19.8	22.1	21.0	21.0	21.2	24.0	24.0
MAP	3.0	4.1	4.0	3.6	3.8	4.0	4.0	4.5	4.5	4.2	4.2
Army	1.1	1.0	1.2	1.2	1.2	1.7	1.9	1.8	1.8	1.9	1.9
Total	42.5	47.9	55.8	63.1	68.2	77.4	76.7	80.6	78.0	80.1	80.1
Worldwide Inventory (Thous. of Tons)											
Start Month	404.8	436.7	466.5	494.9	523.7	545.4	564.4	582.8	599.1	614.1	625.1
-Consum ^a	45.3	49.1	57.5	64.4	69.9	78.9	78.4	82.6	81.0	83.9	83.9
+Prod	77.2	78.9	85.9	93.2	91.6	97.9	96.8	98.9	96.0	94.9	94.9
End Month	436.7	466.5	494.9	523.7	545.4	564.4	582.8	599.1	614.1	625.1	625.1

300/730 GCP Bomb Stocks vs. Consumption Rates in SEA

	October	November	December	January	February	March
USN/USMC						
Stocks (tons)	13.0	13.8	21.4	19.2	18.6	23.6
Monthly Cons Rate (tons)	5.4	6.4	7.7	10.8	11.6	11.0
Ratio (Days) ^{g/}	72.2	64.7	83.4	53.3	48.1	64.4
USAF-Tac						
Stocks (tons)	11.4	13.0	20.0	24.5	36.7	35.1
Monthly Cons Rate (tons)	8.8	11.4	15.0	17.9	17.6	22.1
Ratio (Days) ^{g/}	30.9	34.2	48.0	41.1	63.6	47.6

2.75 in Motors vs. Consumption Rates in SEA

	October	November	December	January	February	March
Army						
Stocks (Items 000)	251.6	324.8	318.8	284.2	416.6	575.3
Monthly Cons Rate (Items 000)	84.1	84.5	100.7	101.4	103.5	126.1
Ratio (Days) ^{g/}	89.8	121.7	95.0	84.1	120.8	136.9

^{g/} Sorties are those of Program #4. Tonnage per sortie for USN/USMC aircraft are slightly higher than the 1. last three months. The Air Force tactical aircraft tonnage per sortie assumes a gradual return to the two CY 1965 and during January 1966. Analysis of general purpose bomb stocks available in SEA for tactical loads.

^{h/} Actual data thru 30 June.

^{i/} Based on 30 day month.

^{j/} Includes 3000 tons per month training expenditures projected for June and subsequent months. Actual ()

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ACTUAL		PROJECTED					
May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
12642	10515	9190	9185	9190	9281	9402	9163
16792	14818	15459	16402	16402	1,394	16394	1639
812	832	800	800	800	800	800	800
1.86	1.88	1.95	1.95	1.95	1.95	1.95	1.95
1.77	1.83	2.00	2.00	2.00	2.00	2.00	2.00
25.9	23.5	30.0	30.0	30.0	30.0	30.0	30.0
23.5	19.7	17.9	17.9	17.9	18.1	18.3	17.9
29.8	30.8	30.9	32.8	32.8	32.8	32.8	32.8
21.0	21.2	24.0	24.0	24.0	24.0	24.0	24.0
4.5	4.5	4.2	4.2	4.2	4.2	4.2	4.2
1.8	1.8	1.9	1.9	1.9	1.9	1.9	1.9
80.6	78.0	80.9	80.8	80.8	81.0	81.2	80.8
	599.1	614.1	625.1	636.8	651.1	664.9	681.2
	81.0	83.9	83.8	83.8	84.0	84.2	83.8
94.9	96.0	94.9	95.5	96.1	97.8	100.5	100.9
599.1	614.1	625.1	636.8	651.1	664.9	681.2	698.3

Consumption Rates in SEA

per	January	February	March	April	May	June
	19.2	18.6	23.6	26.9	21.0	28.8
	10.8	11.4	11.0	12.7	14.5	13.3
	53.3	48.1	64.4	63.5	43.4	64.8
	24.5	36.7	35.1	27.4	27.9	22.5
	17.9	17.4	22.1	21.3	20.5	23.1
	41.1	63.6	47.6	38.6	40.8	30.9

ion Rates in SEA

per	January	February	March	April	May	June
	284.2	416.6	575.3	680.9	634.6	621.6
	101.4	103.5	126.1	158.8	150.9	150.7
	84.1	120.8	138.9	128.6	176.2	123.7

ft are slightly higher than the 1.86 level experienced during the
 assume a gradual return to the two ton level experienced during
 locks available in SEA for tactical aircraft supports the above average

and subsequent months. Actual figures are Worldwide consumption.

OASD/SA/SEA Programs Division
 July 15, 1967

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