metals, specialized petroleum products, and a variety of consumer goods were also imported by rail. Exports by rail consisted of apatite (until the line from the mines at Lao Cai was interdicted in July 1965), coal, and products of North Vietnam's food-processing and handicraft industries. Rail import traffic thus far in 1966 probably has continued at about the 1965 level.

B. Level of Traffic Compared with Route Capacity

1. Ports

Deep-draft international merchant ships normally call at only three North Vietnamese ports -- Haiphong, Cam Pha, and Hon Gai (see Figure F1). Only Haiphong is served by North Vietnam's rail network. Haiphong is the principal maritime port for virtually all seaborne imports and for all of the seaborne exports except coal. Prior to the bombing of the petroleum storage facilities which began in June 1966, Haiphong normally handled about 90 percent of all petroleum imports. Cam Pha and Hon Gai handle only one significant cargo, anthracite coal for export. About 90 percent of the seaborne coal exports originate at Cam Pha, which is the only coal port able to accommodate large ships at its dock. Both ports have limited wharf and storage facilities for general cargo, which consists almost exclusively of supplies for the mines and their small worker communities.

During 1965 the port of Haiphong received and dispatched an average of about 3,000 tons per day of general cargo (including relatively small quantities of packaged petroleum), of which 1,440 tons were imports and 1,540 were exports. During the first nine months of 1966 the corresponding total was about 2,500 tons per day of which 2,000 tons were imports and 500 tons were exports. Imports of petroleum by tankers through Haiphong averaged about 470 tons per day in 1965, increased to a rate of almost 730 tons per day in the first half of 1966, but averaged only about 590 tons per day for the first nine months of 1966. Although the quantity of general foreign trade cargo handled in 1965 and thus far in 1966 was well below the estimated capacity of the port (4,500 tons per day), irregular arrivals of ships have led at times to congestion in the port and delays to vessels. No tankers have attempted to deliver petroleum at the Haiphong petroleum terminal since June 1966, because its storage capacity and support facilities were reduced drastically by the air strikes.

Table B7

Airfields Attacked Under the Rolling Thunder Program
1965 and January-September 1966

JCS Target Number	Name	Target as a Percent of National Targeted Capacity	Percent of Target Utility Destroyed	Dates of Attack	Percent of National Targeted Capacity Destroyed or Inactive	Cost of Restoration (Thousand US $)
4.0	Dong Hoi	6	53 (inactive)	30 Mar 65 6 Jun 65 1 Jul 65 17, 22, 23 Sep 65	6	50
5.0	Vinh	6	10 (inactive)	8 May 65 30 Jun 65 1 Jul 65	6	43
1.0	Na San	4	45 (inactive)	25 Jun 65 23 Sep 65 24 Oct 65	4	144
2.0	Dien Bien Phu	3	94 (inactive)	2, 8 Jul 65	3	143
	Subtotal for 1965	19			19	380
2.0	Dien Bien Phu	3	94	6, 11 Feb 66	3	2
	Subtotal for 1966					2
	Total	19			19	382

the nonagricultural labor force probably would decline because of the transfer from normal work, the regime's probable demand for further amounts of uncompensated labor, and the separation from families as a result of new job assignments or the probable further evacuation of dependents from urban areas. But these effects would be felt directly by such a small segment of the population that they would neither control the reactions of the rest of the country nor be compelling enough to shape the attitude of the policymakers.

A further decrease in the normally tight supplies of food and other essential consumer goods as a result of the disruption of the transportation system and denial of imports might also have a harmful impact. Although North Vietnam imports some foodstuffs, it is basically self-sufficient in food. The distribution problems resulting from the disruption of transport, however, could lead to food shortages in some smaller urban areas and could intensify food shortages in the already food-deficit regions in the southern, northwestern, and northeastern parts of the country. Evacuation of urban residents, which is currently under way, would undoubtedly be stepped up to relieve food shortages. The proximity of North Vietnam's major urban areas -- Hanoi, Haiphong, and Nam Dinh -- to surplus rice-growing regions would ease the problem of distribution of food to these areas.

As certain sectors of the economy, such as the cement plant, coal mines, and the iron and steel plant, ceased to operate, transport capacity now used to serve them would be available for use in other ways. Ample transport capacity would remain to support the military establishment. Thus ability to continue the present level of aggression in South Vietnam and Laos would not be appreciably diminished by any or all of these proposed air attacks.

IV. Political Reactions

A. Free World

Free World reaction to the mining of North Vietnam's ports would probably be the same whether or not it was accompanied by intensified Rolling Thunder strikes. Virtually all countries would fear that one more step had been taken toward a wider war. Opposition could be expected from countries that trade with North Vietnam and from those that traditionally resent any interference with maritime trade. The United Kingdom, for example, might condemn the US action as a move against freedom of the seas. The chances

Table B5

Maritime Ports Attacked
Under the Rolling Thunder Program
1965 and January-September 1966

JCS Target Number	Name	Percent of National Maritime Cargo-Handling Capacity	Dates of Attack	Percent of Target Capacity Destroyed	Percent of National Cargo-Handling Capacity Destroyed	Cost of Restoration (Thousand US $)
71.0	Ben Thuy	4	5, 6, 8 Jun 65 9, 10, 11, 17, 19, 21 Jul 65	61	2.4	470
71.13	Ham Rong	1	14, 16, 18 Jul 65	15	0.2	190
	Subtotal for 1965					660
71.0	Ben Thuy	4	1 Feb 66 8 Mar 66	61	2.4	410
68.0	Cam Pha Port	16	24 Apr 66	21	3.4	160
	Subtotal for 1966					570
	Total					1,230

III. Major US Allies

Internal opposition to the US bombing of North Vietnam and to other US acts of escalation in Vietnam has made it difficult for several important US allies outside the Far East to fully support US policy on the war. Great Britain and Canada provide good examples of the problem.

Britain's Labor Government and the opposition Conservative Party both officially support American objectives in Vietnam. Underlying this support, however, is widespread uneasiness in government and private circles about the war. This uneasiness grows with each new step of escalation, and especially with the spread of bombing raids in the North. The Labor Government for the first time "disassociated" itself from US tactics in the war at the beginning of the bombing raids on the Hanoi-Haiphong area in June 1966. Its action, however, mainly constituted a sop to leftwing opinion within the party -- and was not an indication of change in the government's attitude. The pacifists and "neutralists" in Labor's leftwing continue to denounce US "aggression" and have sponsored various petitions and motions in Commons on the subject. These petitions have lately demanded withdrawal of all "foreign" forces and neutralization of Vietnam and have called on the Prime Minister to publicly repudiate his support of the United States.

More significant than leftwing opinion, however, is the deep misgiving felt by moderates in government, journalistic, and private circles. Even Britons who sympathize with US objectives in Vietnam doubt that the United States can "win" the war. They hope at best for a negotiated settlement leading to a neutral Vietnam. There is also some fear that the conflict could escalate to threaten British national interests and concern that it is causing the West to miss opportunities for detente with the Soviet Union. There is the great reluctance to see Britain involved with the United States in the conflict.

Almost all Britons oppose any escalation which increases the US stake in Vietnam and makes a face-saving settlement more difficult. Most were apprehensive about the US air attacks on the north in February 1965. Many, however, voiced support for the US action as an attempt to establish an acceptable basis for negotiations. Since then the conviction has grown that, whatever the United States may have intended by taking the war to the north, the dangers of escalation have grown while the prospects of negotiations have diminished. Many Britons believe, in fact, that the bombings are only increasing the

of Vinh, at least 32 were struck for the first time in 1966. The North Vietnamese have maintained through service on this line as far south as Nam Dinh during most of the time and have tried to maintain it as far as Thanh Hoa. South of Thanh Hoa, however, they have been forced to rely primarily on rail shuttle operations in conjunction with truck and water service. The Hanoi - Thai Nguyen line has been relatively uninterdicted throughout the Rolling Thunder campaign.

2. Highways

The most significant hindrance to highway traffic in North Vietnam has resulted from strikes against routes in the southern part of the country. The less intensive attack against routes in the central and northern parts of the country has resulted in only minor disruptions of truck service. Route 1A, running along the coast to the demilitarized zone (DMZ), has been subjected to the most intense bombing, but continues to be the most heavily used road in the south. Other north-south routes, such as Routes 15 and 101, have been used primarily as supplements or as alternates when portions of Route 1A were interdicted. These two roads and Route 137, the southernmost motorable road crossing into Laos -- which was completed in April 1966 -- also have been heavily bombed. Aerial photography has confirmed the destruction or damage of about 110 additional highway bridges in 1966, primarily in the south, for a total of 276 highway bridges struck since the start of the bombing. The significantly higher level of reported destruction and damage of trucks during 1966, most of which occurred in the south, also has added to the problem of moving supplies in that area (see Table E4).

In spite of the increased attacks against routes and equipment, there have been no indications of serious shortages of supplies resulting from either the loss of trucks or of lowered road capacities. Although the actual volume of truck traffic in southern North Vietnam is not known, some general indication of changes in the traffic level can be given by a comparison of truck sightings over time. The number of trucks sighted on Routes 1A, 15, and 101, the three major roads leading to southern Laos and the DMZ during the 1965-66 period, increased more than 300 percent during the first nine months of 1966, compared with the last 9 months of 1965. This increase undoubtedly overstates any actual increase in truck traffic because truck sightings are reported by pilots flying strike sorties, which also increased substantially. A more valid comparison, the number of trucks sighted per sortie flown, shows an increase of more than

APPENDIX D

THE ROLE OF EXTERNAL ECONOMIC AND MILITARY AID TO NORTH VIETNAM

I. Economic Aid

Communist economic aid extensions to North Vietnam since 1954 probably total at least $1 billion and, depending on the commitments made in 1965 and 1966, could be as much as $2 billion. Deliveries under these agreements probably are approaching $1 billion. Such expenditures are estimated to have averaged between $50 million and $75 million annually during 1955-64, to have jumped sharply to about $150 million in 1965, and to have continued rising in 1966. Economic aid outlays are estimated at $200 million for the period of January-September 1966. It appears that only a small share of Communist aid provided prior to 1966 was used to replace assets destroyed by US bombing. Information on deliveries in 1966 makes it seem likely that at least some of the transportation facilities and equipment destroyed by bombing are being rebuilt and replaced with Communist aid.

Most Communist deliveries, especially before 1966, were supplied under credits and grants extended prior to 1965. This aid,which totaled $950 million (see Table D1), was extended almost entirely for North Vietnam's economic development program. About 48 percent of these commitments were from Communist China and 39 percent from the Soviet Union. Most of the remainder represents extensions from the Communist countries of Eastern Europe. Additional Communist aid probably was extended in 1962-64 but the magnitude of such commitments is not known.

The cost to the individual Communist countries of aid to North Vietnam has been relatively small when compared with their overall economic capabilities. However, North Vietnam appears to be using the "wartime situation" to press for -- and to receive -- a substantial increase in economic assistance. North Vietnam, for example, has attempted to obtain a commitment to speed up deliveries.

Target	Number of Casualties
Ports	30
POL	180
Storage areas	800
Rail yards	100
Bridges	90
Total	1,200

3. Methodology

a. Civilian Casualties

Three factors were employed to estimate civilian casualties inflicted by the armed reconnaissance program in 1966. A daily casualty factor was derived for a representative Route Package.* This factor was then expanded to cover all of the six Route Packages in North Vietnam. Modifying indexes were calculated to reflect the varying population densities and sorties flown in the respective Route Packages in 1966. The adjusted daily casualty figures for each Route Package were then multiplied by the number of days of air operation in the specific Route Package.

* For an explanation of the term Route Package, see Figure A7.

B. Chinese Communist Economic Aid

Chinese Communist assistance extended for North Vietnam's development program prior to 1965 totaled about $460 million. Of this total, $225 million was specified as grant aid at the time of the extension. The largest share of Chinese aid was allocated for the development of agriculture and the construction of transportation, communications, electric power, and light industrial facilities. In addition, funds were obligated in 1959 for an iron and steel complex at Thai Nguyen and a fertilizer plant at Phu Lang Thuong. Information on recent Chinese assistance activities is scanty.

The Chinese also announced the extension of additional aid for agriculture in July and other economic aid in August.

C. Eastern European Economic Aid

All of the Communist countries of Eastern Europe also are providing economic assistance to North Vietnam, but on a much smaller scale. Prior to 1965 these countries extended at least $130 million in credits and grants to North Vietnam. Such assistance has been provided largely for light industrial, transportation, communications, and electric power facilities. A few credits also were extended to cover the import of some industrial raw materials, machinery, and consumer goods.

Construction activities under these credits and grants have continued during the past two years. Hungary still was providing assistance for some aid projects, including a hand tool and balance factory and the Thanh Hoa Electric Powerplant.

North Vietnamese will to resist. London's response to German bombing in World War II is frequently cited as a parallel case. Moderates in the Labor Party joined leftists at the October 1965 Party Conference in passing, over the party leadership's objection, a resolution calling for the unilateral cessation of US bombings of the North. The US Embassy estimated last summer that this position had the vocal support of about one-third of the Labor members of Parliament.

Any further increase in the intensity of the war is likely to increase British apprehension. Escalation of the bombings to new military-related targets might bring private remonstrances and even public protests from the British Government. An all-out conventional air assault against North Vietnam -- especially if it produced heavy civilian casualties -- would result in a strongly hostile response.

The Canadian Government also approves in general of the long-term objectives of US policy in Vietnam. It does not believe the conflict can be solved by military means, however, and favors opening of negotiations with few conditions and in any one of several forms. While Canadian authorities have sometimes publicly supported the bombing of North Vietnam, specifically the earlier retaliatory attacks, they have generally maintained that a letup in the air raids is a prerequisite to peace negotiations. Ottawa has never suggested, however, that the bombings be stopped permanently without some indication of Hanoi's willingness to negotiate. Criticism of US airstrikes against North Vietnam in the government, the press, and among the public has been least severe when the bombings followed a negative action by Hanoi -- that is, after the PT-boat attacks in the Gulf of Tonkin. The pauses in the air attacks have always been received with hope and relief -- and with some skepticism.

The Canadian Government's policy is in part a response to pressures from the press and public. It is also a reflection of Ottawa's fears that the conflict may escalate into a general war and that it may be damaging Canada's improving and profitable relations with the Communist world. Ottawa takes great pains to demonstrate that while it has a close community of interest with the United States, its foreign policy is developed independently. In the case of the Vietnamese war, Ottawa feels that it has easy access to both Hanoi and Washington, and that it can play an important role in negotiating a settlement.

In October 1966 the USIS in Ottawa estimated that 70 percent of the Canadian daily newspapers -- of which there are more than 100 -- tend to support the US commitment in Vietnam. Most hope for

Poland continued work on a silicate brick plant at Dong Trieu, the Cam Pha Coal-Washing Plant, and the Gia Lam Railroad Rolling Stock Repair Shops. Although the Cam Pha Coal-Washing Plant was mentioned before 1964, the technical documents for the project were not shipped until September 1966.

Among the other Eastern European countries, Rumania is equipping as many as five machine workshops; Bulgaria is constructing a number of cold storage warehouses, and East Germany delivered equipment for an electrode plant In July 1966, Czechoslovakia dispatched a number of technicians to complete the assembly of three packaged power stations begun in 1962.

II. Trade with the Communist Countries

The Communist countries generally account for 85 to 90 percent of North Vietnam's foreign trade. This trade reached its highest level in 1965 (about $260 million), an increase of about 30 percent over the previous year (see Table D3).

Although North Vietnam's exports have remained relatively steady in recent years, its imports from the Communist countries have generally followed an upward trend. The increase in trade with these countries in 1965 was the result of a 50-percent rise in imports. Preliminary trade data and a large increase in the volume of shipping indicate that North Vietnam's imports will rise even further in 1966.

North Vietnam maintains a chronic deficit in its trade balance with the Communist countries. During 1962-65 the deficit averaged nearly $60 million annually. In 1965 the deficit totaled about $100 million. In view of North Vietnam's growing inability to service this

will take retaliatory action in its bilateral relations with the United States or that any Free World country will change its policy to the point of offering significantly greater political or material support to the Vietnamese Communists.

100 such sites, with a total estimated capacity of between 25,000 and 30,000 tons, had been identified.

Additional storage capacity is represented by the "55-gallon" drums dispersed throughout the country. It is estimated that by mid-1966 about 130,000 drums, representing a capacity of 22,000 tons, had arrived in North Vietnam. There have been 1,200 strikes against 400 dispersed petroleum storage sites, including either or both small tanks and drums, between April and October 1966. These strikes may have resulted in the loss of as much as 5,000 tons of storage capacity. The monetary value of these dispersed sites is small, however, and no attempt has been made to estimate the cost of their replacement.

2. Powerplants

Attacks on North Vietnam's facilities for producing electric power started in April 1965, and a total of eight powerplants have been struck. Three of the six plants attacked in 1965 were restruck in 1966, and two additional plants were attacked for the first time this year. The total number of strikes against each installation has ranged from 10 against Thanh Hoa to one against Viet Tri. During 1966, air operations against electric powerplants in North Vietnam were fairly evenly distributed throughout the country. Seven out of 13 strikes occurred in the northern part of the country, whereas during 1965 17 out of 21 strikes against powerplants took place in the southern part of North Vietnam. Total power-generating capacity in North Vietnam has been reduced by 32 percent. The total cost of restoration is estimated at $11.9 million, of which $5.6 million was accumulated during 1966 (see Table B2).

Some 12,000 kilowatts (kw) of previously undamaged operating generating capacity were destroyed during 1966. An additional 24,000 kw of new generating capacity, which were being installed at the Uong Bi powerplant but which were not yet in operation, were denied. Moreover, 24,000 kw of capacity temporarily damaged at the Uong Bi plant in 1965 and restored to operation during 1966 were again put out of operation, this time for at least a year. In terms of the loss of output, the attacks on powerplants have been more effective in 1966 than in 1965. About 47,000 kw of capacity were put out of operation in 1965, but only about 23,000 kw remained out of operation at the end of the year; in 1966 some 36,000 kw of operating capacity and an additional 24,000 kw of new capacity have already been denied to North Vietnam.

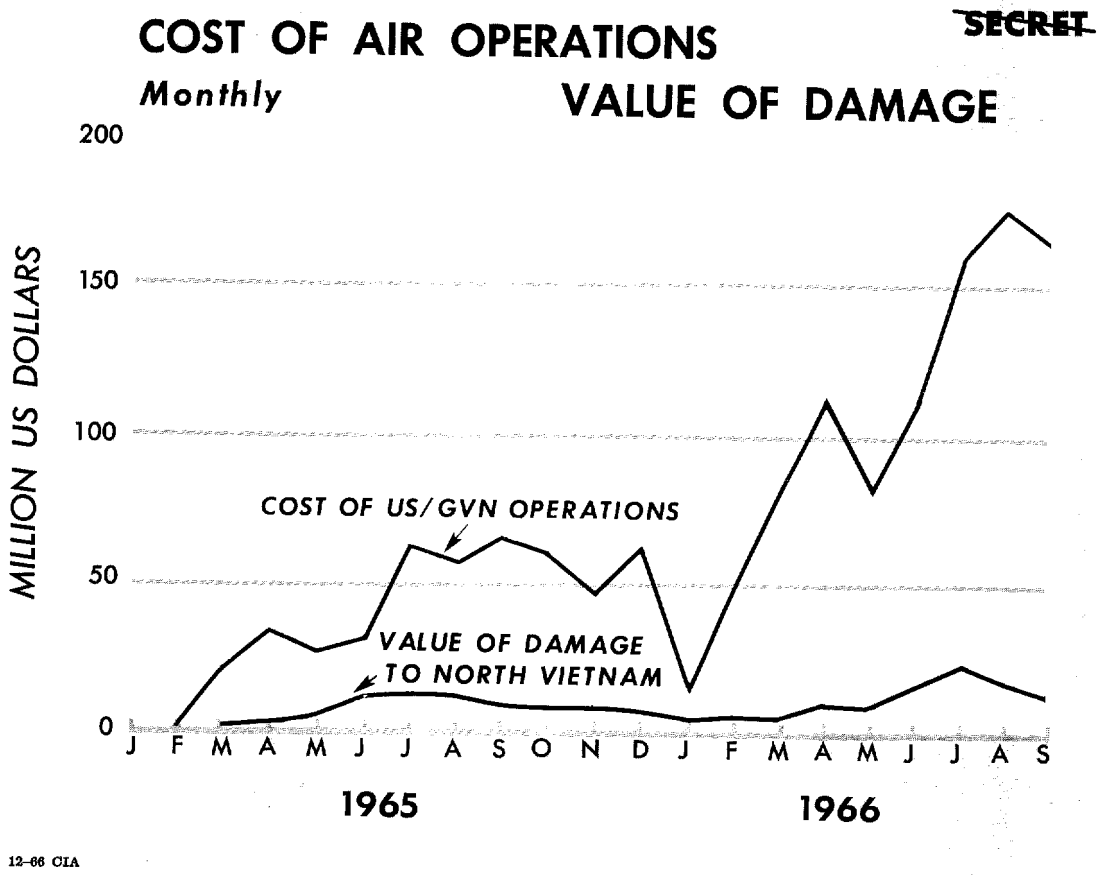

Figure A-10. Estimated Direct Operational Cost of US/GVN Air Operations in North Vietnam and Cost of Economic and Military Damage to North Vietnam, by Month, 1965 and January-September 1966

In implementing these countermeasures the North Vietnamese have received assistance from Communist China, which has provided an estimated 20,000 railway engineering troops. From 20,000 to 25,000 North Vietnamese and Pathet Lao are engaged in repair and construction activities in Laos.

In addition, the manpower input in 1965 into repair, maintenance, and construction activities in North Vietnam was probably as high as 100,000 men. With the completion of significant additions to the transport network and the experience acquired in bomb damage repair work, it is now estimated that this labor force could be reduced to between 60,000 and 70,000 men.

The efficacy of North Vietnam countermeasures is apparent in some indications of repair activity. Cratered road segments and rail beds are commonly repaired within a 24-hour period. The development of access roads to fords at the site of destroyed bridges has taken less than seven days. These rapid repair techniques coupled with the development of alternate routes provide the North Vietnamese with greater flexibility and more options in the choice of roads to be used to maintain through traffic.

3. The Prospects for Interdiction

The historical experience of interdiction campaigns, particularly against a logistics target system such as that in North Vietnam, shows that they can yield only limited returns. Although the present campaign has created burdens and added to the cost of supporting the Communist forces in South Vietnam, these strains have been within acceptable limits.

If interdiction cannot halt the flow of supplies, it at least maximizes the costs to the enemy when it is concentrated on the most vital links in the logistic supply system. In North Vietnam these links are the major port facilities and the initial rail connections from Hanoi to Haiphong, Dong Dang, and Lao Cai. The importance of these transport facilities is that they provide the primary means by which military and essential economic goods are brought into North Vietnam and redistributed internally. They are more lucrative targets than the low-traffic-density highways and waterways in the southern parts of North Vietnam which are extremely difficult to interdict. Over 82 percent of the armed reconnaissance effort in 1966 has been concentrated in the four Route Packages south of Hanoi. And although 80 percent of all the bridges struck to date are south of Hanoi, this concentrated attack has not stopped through traffic from being maintained.

is exported. The rest of the small manufacturing sector is devoted to production for the consumer and, except for the manufacture of military clothing and rations, has little military potential.

B. Machine Building

Before 1960, North Vietnam had a very limited capability to produce modern or even semimodern machinery. Most of its machine building output consisted of crude agricultural implements, simple water pumps, and spare parts for repair. Production then was typical of the machinery output of any less developed country -- simple in design, of low capacity, and of poor quality. The product mix of North Vietnam began to show an increase in complexity in the early 1960's. By 1963, North Vietnam was claiming production of replacement parts for "intricate" machinery, belt conveyors, and air compressors. By 1964 the Hanoi Engineering Plant, a Soviet aid project, was producing modern lathes, and other plants were producing DC motors and more complex pumps for the mining industry. References were also made in the press to precision-mold castings, 120-ton "pieces of machinery," and high-pressure hose, all examples of an improving technology. In 1965 North Vietnam claimed to have completed its second locomotive, a rail motor car, and "hundreds of tons of spare parts for tractors, diesel motors and mechanical pumps." The progress of the North Vietnamese machine building industry, as reflected in press reports, is shown in Table G2.

Perhaps the most important facet of North Vietnam's machine building industry, with respect to support of the war, has been its experience in the maintenance of the transportation system. This experience, together with extensive support from its Communist allies,has enabled North Vietnam to provide extensive maintenance for a hard pressed fleet of vehicles. The experience of the small motor vehicles installation in Nam Ha Province probably is at least partly representative of that at other such facilities. This shop was dispersed out of the city and 40 percent of the repair workers were reassigned to serve truck convoys. The workers have resorted to various means of improvisation, including cannibalization, to service the convoys. At the same time, the cadres and skilled workers reportedly trained over 100 students as lathe operators, fitters, and the like.

Claims that machine building plants have converted to production for agriculture are difficult to believe. There has always been a

There is no evidence that the manufacturing section of North Vietnam has converted to the direct production of military hardware. The manufacturing industries in North Vietnam most capable of providing significant assistance to the military effort are the machine building industry and, to a lesser extent, the chemical industry. The chemical industry manufactures small quantities of tires, pharmaceuticals, and some chemicals used in the production of munitions. A new nitrogen fertilizer plant is already or soon will be in operation. The explosives industry, however, provides only a fraction of the country's current military needs. The machine building industry makes an important contribution to maintenance of the transportation system. The production of spares and the general maintenance of locomotives and construction equipment is the present priority task of North Vietnam's machine building industry.

Imports of machinery and equipment have played an especially important role in the support of the transportation system of North Vietnam and in the improvement of the military communications capability. Along with transportation equipment, the Communist countries have increased deliveries of spare parts, machinery for the repair and maintenance of transport equipment, and construction equipment for the reconstruction and repair of lines of communication. Such imports have supplemented an already existing capability in the North Vietnamese machine building industry for the production of spare parts and simple machinery. The sharp increase in the import of telecommunications equipment almost certainly reflects an effort to upgrade military communications.

The increased program of aid associated with the military effort, however, has not been at the expense of economic aid in general. The number of Communist aid projects has actually increased significantly, and, although some of these projects such as machine building shops clearly have a potential military role, others -- mining, glass, and food products -- are just as clearly non-military in nature.

Neutralization of selected machine building plants in North Vietnam -- the Hanoi Engineering Plant, for example -- would delay recovery from the damage inflicted by the Rolling Thunder program. Destruction of North Vietnam's few major manufacturing facilities outside of the machine building sector and the Haiphong cement plant would be of little value, other than from the standpoint of reducing enemy morale, in the reduction of the North Vietnamese military capability. Even the destruction of the large machine building plants would not be crucial inasmuch as much of the repair capacity is already dispersed. Furthermore, the apparent scope of recent aid agreements

road washouts had occurred, but that porter trails in this area were in use. The Communists probably maintained some minimal level of supply in the Panhandle through a combination of portering and movement of trucks over the few serviceable road segments. The completion of 400 miles of new roads in the Panhandle during the 1965-66 dry season almost tripled the mileage of Communist roads in the area. In comparison with 1965, the infiltration network in Laos has improved considerably, and the Communists are now in a better position to maintain through traffic during the coming dry season because the new alternate routes make them less vulnerable to air attacks.

2. Comparison of 1965 Truck Traffic Moving into Laotian Panhandle from North Vietnam During Rainy Season with That of 1966

During the 1965 rainy season (June-October) no truck traffic was reported moving from North Vietnam into the Laotian Panhandle, according to ground observers. During the 1966 rainy season, however, light truck traffic continued to move into Laos in every month of the rainy season. The trucks moving into Laos during the 1966 season apparently did not move more than a few miles into the Panhandle.

In the 1966 rainy season, truck traffic into Laos through Mu Gia Pass continued over Route 12 and its bypasses throughout the season. The average number of trucks moving south per day increased from about 1 or 2 trucks in June and July to about 4 in August, 7 in September, and 13 in October. Apparently little, if any, of this traffic from Mu Gia Pass continued farther south over Route 23 than about 25 air miles from its junction with Route 12, nor did it continue west over Route 12 farther than 15 miles from the junction of Routes 12 and 23. Although Route 911 is believed to have been impassable to trucks north of Route 912 during most of the rainy season, a few trucks did move on Route 911 during June and July. There were no reports for the route during August and September, but in October trucks were again reported moving south, this time at an average of about one a day. Aerial photography during the 1966 rainy season of the junction of Routes 911 and 912 and of Route 911 south from this point showed evidence of foot traffic around interdictions that were not repaired. Foot traffic also was evident around interdictions on Routes 92, 96, and 110 during the same period.

In addition to the routes from Mu Gia Pass, Route 912 could have been used by trucks during the 1966 rainy season, and it

against JCS bridges in 1966 were conducted under armed reconnaissance. As in 1965, most of the bridges struck were located in the southern part of the country. The number of strikes against highway bridges on the JCS target list decreased during 1966, whereas strikes against JCS bridges on the rail lines increased. Seventy-seven strikes were made against 31 highway bridges in 1965, compared with only 37 strikes against 16 bridges during the first nine months of 1966. On the railroads, 67 strikes were made against 16 bridges in 1965, compared with 96 strikes against 16 bridges during January-September 1966.

b. Armed Reconnaissance Bridge Targets

Aerial photography has confirmed the destruction or damage of 359 bridges since the start of the bombing, including those bridges on the JCS target list. About 150 of these bridges were struck initially since 1 January 1966. A total of 83 railroad, combination railroad/highway, and railroad bypass bridges have been confirmed as destroyed or damaged on all rail lines in the country. About one-half of these bridges were initially struck during January-September 1966, as shown in the following tabulation:

Rail Line	Initially Struck During January-September 1966	Total Struck Throughout Bombing
Hanoi - Dong Dang	2	5
Hanoi - Haiphong	0	2
Hanoi - Lao Cai	5	17
Hanoi - South	23	49
Spur and bypass	10	10
Total	40	83

In addition, aerial photography has confirmed the destruction or damage of almost 280 highway bridges, about 110 of which were struck initially in 1966.

Pilots have reported destroying or damaging about 1,900 bridges during January-September 1966, for a total of about 2,560 bridges throughout the bombing. These figures undoubtedly contain considerable double counting and overstatement of the damage inflicted. Excluding JCS-targeted bridges, a total of only 306 bridges

Table E5

Incidents of Destruction and Damage to Targets
in Laos Reported by Pilots
January-September 1966

	Destroyed	Damaged	Cut/Cratered
Transportation facilities	1,627	4,526	2,449
Trucks	1,183 a/	1,344 a/	
Truck parks	45	1,200	122
Barges	71	72	
Junks	7	35	
Ferries	3	7	
Bulldozers	4	10	
Bridges	269 b/	348 b/	2
Road segments	13	1,168	1,833
Bridge approaches	5	160	269
Ferry approaches	1	15	4
Fords/ford approaches	26	165	218
Causeways		2	1
Military facilities	4,255	3,147	9
Structures/buildings	3,464	1,507	
Military areas/bivouacs	120	402	
Barracks	1		
Storage areas	34	721	6
POL storage areas	9	28	
Ammunition dumps	2	4	1
POL barrels	271	100	
Storage buildings	3		
AW sites	120	92	
AAA sites	11	46	2
Gun emplacements	71	132	
Bunkers	149	115	

a. These numbers have been deflated by 20 percent for computation of restoration cost.
b. Cost of restoring bridges, based on the destruction and damage to 64 bridges as verified by aerial photography.

2. Railroads

The Hanoi - Dong Dang and the Hanoi - Lao Cai railroad lines, the two rail connections with Communist China, each have an estimated uninterdicted capacity of 3,000 tons each way per day. In 1965 the Dong Dang line carried an average daily traffic of over 900 tons of imports and 420 tons of exports. The flow of traffic on the line was very uneven. During the first half of 1965 the line carried a considerable volume of Chinese transit traffic to Yunnan Province. This transit traffic was stopped in July when the Lao Cai line was interdicted. Rail traffic carrying imports for North Vietnam increased during the first half of 1965 and continued to rise during the third quarter until the Dong Dang line was interdicted temporarily. The flow of export traffic was also uneven. Apatite exports were stopped after July, and exports of other commodities by rail to China were reduced because of the interdiction of the railroads.

3. Roads

Only small amounts of cross-border, short-haul foreign trade move by truck between North Vietnam and Communist China. The estimated total capacity of the roads that cross the border and lead to the Hanoi-Haiphong area is 4,300/950* tons per day. Of this amount, about 2,700/650 tons could come over the eastern border of North Vietnam (from the Nanning, Canton, and Fort Bayard areas) and some 1,600/300 tons over the western border (the K'un-ming area).** The road capacity from Hanoi to Haiphong is estimated to be about 1,150/400 tons per day.

4. Inland Waterways

Very little, if any, foreign trade currently moves on inland waterway connections between Communist China and North Vietnam. With the completion of the new railroad connecting Yunnan Province with the rest of China, the Red River connecting Yunnan

* The figures separated by the slanting line show estimated minimum capacities between terminal points under the best and worst climatic conditions.

** Supplies from the Nanning, Canton, and Fort Bayard areas can now be shipped by rail through China to K'un-ming, China, and then to North Vietnam by rail, road, and inland waterway over the western border, if necessary.

TOP SECRET

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Table D2

Credits and Grants Extended by the Communist Countries to North Vietnam
January 1965 - October 1966
(Continued)

Country	Date	Amount (Million US $)	Description
East Germany	June 1965	N.A.	Economic aid.
	January 1966	N.A.	Economic aid.
	October 1966	N.A.	Credit for goods and technical services for 1967-70; vocational and advanced training included.
Hungary	June 1965	5.5	Long-term credit for economic aid.
	December 1965	N.A.	Long-term and interest-free credit; also postpones the repayment of earlier credits.
	August 1966	N.A.	Scientific cooperation.
	September 1966	N.A.	"Long-term, no interest loan" and an agreement on technical training.
Poland	June 1965	N.A.	Economic assistance.
	January 1966	N.A.	A credit.
	October 1966	N.A.	Economic assistance.
Rumania	May 1965	N.A.	Economic aid.
	January 1966	N.A.	A credit. Also deferred the repayment of certain credits extended earlier.
	September 1966	N.A.	Nonreimbursable aid and commercial exchanges.
Communist China	August 1966	N.A.	"Nonrefundable aid." Both economic and technical.
	October 1966	N.A.	Health cooperation agreement.
	October 1966	N.A.	Scientific and technical assistance.
Albania	April 1966	N.A.	Goods provided free of charge.
	October 1966	N.A.	"Nonrefundable economic aid."
North Korea	September 1966	N.A.	Nonrefund aid.
Mongolia	October 1966	N.A.	"Nonrefund material aid in 1966 and 1967."
Cuba	October 1966	N.A.	Economic aid.

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I. Introduction

The first nine months of 1966 saw impressive increases in the intensity of US/GVN air operations in Southeast Asia.* In terms of total sorties flown, the US/GVN air effort during January-September 1966 increased by 73 percent, compared with the entire year 1965, and was about evenly divided between targets in South Vietnam and out-of-country targets in Laos and North Vietnam. The greater part of the increase -- some 70 percent -- was accounted for by the air campaigns against Laos and North Vietnam, as shown in the following tabulation:

	Total Sorties Flown		
Area of Operation	1965	January-September 1966	Percent Increase 1966/1965
Laos	16,030	57,060	256
North Vietnam	55,210	105,970	92
South Vietnam	110,310	151,640	37
Total	181,550	314,670	73

The increases in Laos and North Vietnam reflect the growing concern with interdicting lines of communication and infiltration networks.

The air campaign in Southeast Asia has been almost exclusively a US operation. US forces accounted for 92 percent of the total sorties flown and 93 percent of the ordnance dropped in Southeast Asia in the first nine months of 1966.

II. Rolling Thunder Operations, January-September 1966

A. Scale of Attack

In terms of total sorties the Rolling Thunder program against targets in North Vietnam increased through September 1966 by 92 percent, compared with all of 1965. Rolling Thunder accounted for 34 percent of total sorties in Southeast Asia in 1966 compared with 30 percent in 1965. Although Rolling Thunder's share of the attack sorties flown

* See Appendix A.

V. Soviet Reaction to the Bombings

The bombing of North Vietnam in February 1965 coincided with the new Soviet leadership's first major effort to shift priorities to some extent in Soviet foreign policy. The new leaders had apparently been convinced that Khrushchev, over the preceding year or so, had drifted too far in the direction of rapprochement with the United States at the expense of the USSR's standing in the Communist world. Kosygin's visit to Hanoi at the time of the Pleiku incident and the US aerial retaliation against North Vietnam was part of an effort to restore a more even balance between Soviet policy toward the West and Soviet relations with foreign Communist regimes and parties.

The reaction of the new Moscow regime to the February bombing was in line with this new attitude and in considerable contrast with Khrushchev's response to the Tonkin Gulf incidents. During the latter affair, Soviet media were markedly restrained, as was Khrushchev himself. He waited several days before responding personally to the August 1964 incidents. He duly condemned US "aggression" but confined his remarks on the support of North Vietnam to a generalized assertion of the Soviet people's "sacred duty" to defend their homeland and "other socialist countries." In the eyes of the new Soviet leaders, the US bombings in February 1965 constituted a serious escalation and would probably have demanded a stiffer reply even from Khrushchev. It is doubtful, however, that he would have been prepared to respond as vigorously as were the new leaders.

The initial Soviet reaction to the US bombing attacks on North Vietnam was one of alarm and dismay. Moscow clearly hoped to bring a quick end to the intensified hostilities and almost immediately attempted to bend the North Vietnamese toward negotiations. Hanoi, however, would not be moved and left the Soviet leaders little alternative but to support its stand on the war.

In line with the new regime's apparent desire to increase the USSR's almost negligible influence in Hanoi, Kosygin had probably gone to North Vietnam with the intention of offering some, probably limited, military aid and economic assistance. The bombing probably made this a certainty. The 10 February communiqué ending Kosygin's visit was bland and noncommittal. On his return to Moscow, however, he reaffirmed Moscow's general pledge of "necessary assistance" to Hanoi and announced that a Soviet-North Vietnamese agreement on measures to "safeguard the security and strengthen the defense potential" of North Vietnam was being implemented.

Popular opposition continued to increase through at least the summer of 1966. There was mounting press criticism of US actions in Vietnam, including the bombing of the North. At the government level, the criticism was expressed indirectly, but nevertheless plainly, in ministerial statements which tended to place US actions in an unfavorable light.

During recent weeks, however, a number of Swedish political observers have stated that the heat is going out of the Vietnam issue in Sweden. Reaction to the POL bombings, for example, was relatively mild. A Communist-sponsored "Vietnam Week" in October was scarcely mentioned in the Stockholm press. The president of the Swedish Trade Union Federation recently cited Hanoi's continuing intransigence and the generally positive effect of President Johnson's Asian trip as reasons for the moderation in Swedish opposition. These factors apparently are persuading many Swedes for the first time that there are two sides to the Vietnam question.

While the temperature of the Vietnam issue has dropped in Sweden, any change in US policy which could be interpreted as unjustifiable escalation of the war would almost certainly cause the resurfacing of strong and unfavorable reactions. This would make it difficult, if not impossible, for the minority Socialist government to try to maintain a neutral line on the war.

III. The Prospects for Effective Interdiction

Air attacks against LOC's in the North Vietnamese and Laotian Panhandle areas have proved to be relatively ineffective because only a comparatively small volume of supplies need be moved over highways and waterways, which are extremely difficult to interdict. Emphasis on the destruction of bridges on those few major railroad lines with high traffic densities would maximize the costs to North Vietnam of sustaining their material support of the war in the South.

North Vietnam must rely on other countries for essential military supplies and economic assistance. Almost all of this assistance is moved on the Hanoi - Dong Dang and Hanoi-Haiphong rail lines. Continuous interdiction of the bridges on these two lines would hamper but not stop the normal flow of imports. Concentrated airstrikes against bridges on the Hanoi - Lao Cai line would also be essential, however, because this line can now be used as an alternate to the Dong Dang line. If the Rolling Thunder attack were to deny access to the port approaches and port facilities of North Vietnam, most of the normal seaborne traffic would have to move by land transport. * The North Vietnamese would then encounter more immediate and more serious transport problems in trying to maintain the normal flow of supplies under concentrated and continued interdiction of land transport targets. To the extent that other measures could be effected to overload the land transport connections between North Vietnam and China, many of the less essential economic supplies could not be moved and some industrial activities would probably be seriously curtailed.

A. The Hanoi - Dong Dang Rail Line (See Table E9)

More than one-fourth of total imports move on the Hanoi - Dong Dang rail line. Disruption of through rail traffic on this line, unlike that on the Hanoi - Lao Cai line, has resulted primarily from the destruction of JCS-targeted bridges and their bypass bridges. Strikes against non-targeted bridges, rail line segments, sidings, and yards have caused relatively little disruption to service. During 1965 a total of six strikes against three JCS-targeted bridges interdicted the line for through rail service for a total of about one month. A total of 14 strikes against three JCS-targeted bridges during

* For a further discussion of this problem, see Appendix F.

Tables

Appendix A

(4) A preliminary examination of North Vietnamese industry to determine the extent to which its evolution toward a war-supporting industry may influence future targeting programs.

These and other analyses are summarized in the body of the memorandum and are supported and documented in seven appendixes not previously provided. We have not reproduced from the preliminary report the analysis of the manpower situation in North Vietnam, the civil defense program in North Vietnam, and some of the details on North Vietnamese political reactions to the Rolling Thunder program. In all other respects, this memorandum supersedes the November report.

Table D4

Commodity Composition of North Vietnam's Trade with the USSR
1962-65

	1962	1963	1964	1965
Imports	54.7	56.7	47.7	74.9
Machinery and equipment	31.4	34.0	25.4	48.0
Complete plants	21.8	24.4	18.6	32.4
Motor vehicle and transportation and garage equipment	2.5	2.7	2.5	5.9
Petroleum products	4.2	4.1	4.6	5.3
Gasoline	1.7	1.2	1.4	1.5
Metal and metal products	7.8	7.6	5.4	7.1
Ferrous metal and products	6.3	6.0	3.9	5.3
Nonferrous metals and products	1.5	1.6	1.5	1.8
Cotton and silk textiles	2.1	2.4	2.8	3.4
Exports	30.2	35.3	34.8	30.6
Building material (frieze and parquet)	4.6	5.8	5.1	4.6
Clothing	4.6	5.8	5.1	4.5
Cloth products (towels and linen)	1.9	1.6	1.2	0.6
Leather footwear	1.1	1.4	1.4	1.4
Household machines and appliances	1.3	1.4	1.0	1.2

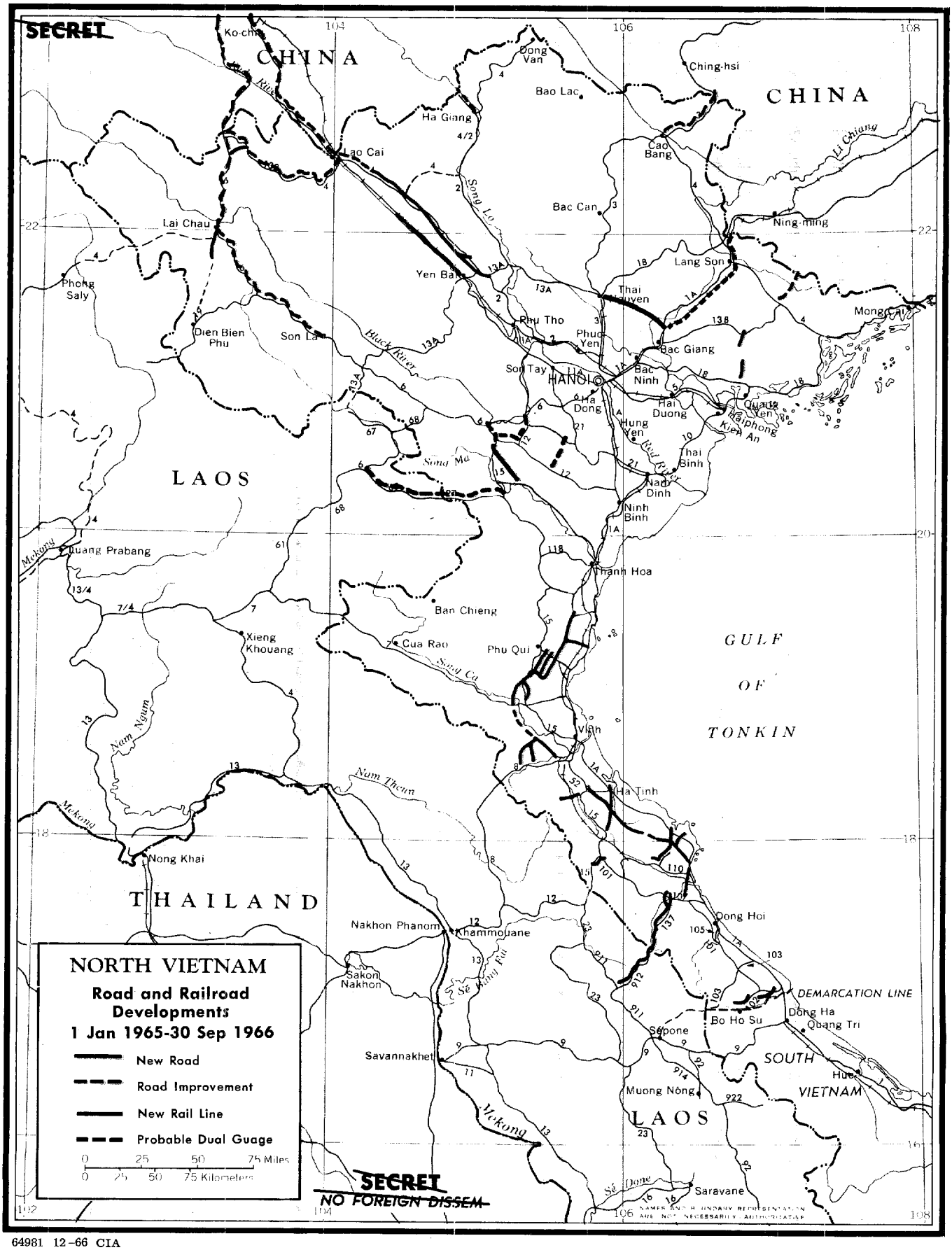
to about $225 million -- and has been maintained at a high level through 1966. By mid-1966, deliveries from the USSR had included a surface-to-air missile (SAM) system comprising 24 firing battalions, 88 assorted aircraft (including 60 MIG jet fighters), and several thousand antiaircraft guns. In addition, as many as 1,500 Soviet military technicians may have been engaged in training North Vietnamese military personnel in the use of SAM's and aircraft.

Soviet deliveries in 1966 (in terms of value) have been maintained at a high level, and during the first 10 months of the year apparently have been only slightly below the level achieved in 1965. This level

Table B3

Manufacturing Facilities Attacked
Under the Rolling Thunder Program
1965 and January-September 1966

JCS Target Number	Name	Target as a Percent of National Capacity	Dates of Attack	Percent of Target Capacity Destroyed	Percent of National Capacity Destroyed or Inactive	Cost of Restoration (Thousand US $)
47.2	Lang Chi Explosives Plant	100	24 Jul 65 7, 8 Aug 65	71	71	370
	Nam Dinh Textile Mill	Cotton spinning: 70 to 75 Cotton weaving: 50	28 Jul 65	5	Spinning inactive: 60 Weaving inactive: 40	800
	Subtotal for 1965					1,170
	Cam Pha Coal Treatment Plant		19, 24 Apr 66			75
	Viet Tri Paper Mill	80	Mid-Jul 66	100	80	600
	Subtotal for 1966					675
	Total					1,845



B. Casualties from Armed Reconnaissance Missions

1. General

During 1966 the armed reconnaissance program over North Vietnam accelerated sharply. Some 57,500 armed reconnaissance attack sorties were flown through September 1966, against non-fixed targets compared with 25,300 in 1965. The armed reconnaissance program has been gradually expanded to cover nearly all of North Vietnam. The program remains, however, one with the limited goals of minimizing civilian casualties and maximizing damage to the infiltration-transportation network.

It is estimated that some 10,000 civilian and 3,400 military casualties were inflicted on North Vietnam as a consequence of the armed reconnaissance program in 1966. This represents a considerable increase over the estimated 4,000 civilian and 2,900 military casualties in 1965. The rate of casualties per sortie has remained stable, however. In 1966 casualties were inflicted at the rate of 0.23 per sortie, compared with 0.27 in 1965. The stability of this ratio undoubtedly reflects improved North Vietnamese air warning and civilian defense measures and the continued efforts by the USAF and USN to minimize casualties as the tempo of the airwar increases.

2. Armed Reconnaissance on Pre-briefed Non-JCS Targets

In the past year it is estimated that some 1,200 additional casualties were inflicted on the North Vietnamese civilian population as a consequence of the armed reconnaissance attacks against small pre-briefed non-JCS targets. These facilities were for the most part targets of secondary importance but were attacked as fixed targets. Casualty estimates were made on the same basis as that used for attacks on JCS fixed targets. Because no estimate of this type exists for 1965, it is impossible to put the current casualty estimate in perspective. A tabulation of the targets and the respective casualties is presented in the following tabulation:

Table D6

Soviet Military Aid to North Vietnam
1953 - October 1966

	1953 - October 1966		1965		January-October 1966	
	Quantity (Units)	Value (Million US $)	Quantity (Units)	Value (Million US $)	Quantity (Units)	Value (Million US $)
Total value		455.0		225.0		160.0
Surface-to-air missile firing battalions	24	127.0	20	106.0	4	21.2
Aircraft	163	55.4	48	15.1	40	31.3
Il-28 light jet bomber	8	2.8	8	2.8		
MIG-21 jet fighter	25	20.0	11	8.8	14	11.2
MIG-15/17 jet fighter	35	4.5	25	3.2	10	1.3
Mi-6 helicopter	6	12.0			6	12.0
Other aircraft	89	16.1	4	0.3	10	6.8
Naval craft	20	8.2	0	0	0	0
Armor (tanks, armored vehicles, self-propelled guns)	150	5.4	20	0.5	20	0.5
Artillery	3,550	71.6	1,184	30.6	1,225	18.0
100-mm AAA	64	3.0	64	3.0		
85-mm AAA	630	26.1	250	10.0	125	5.0
57-mm AAA	930	25.6	350	12.4	100	3.6
37-mm AAA	1,570	14.1	500	5.0	900	8.4
Other artillery	356	2.8	20	0.2	100	1.0
Radar	69	12.4	41	7.8	20	4.0
Trucks and vehicles	1,500	10.0	1,000	5.0	1,000	5.0
Small arms and infantry weapons		40.0		10.0		25.0
Ammunition		125.0		50.0		55.0

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campaign is seen in the allocation of damage to military and economic target systems. Damage to military targets in 1966 accounted for less than 30 percent of the total, compared with almost 48 percent in 1965.

Although damage to the North Vietnamese economy is accounting for an increasing share of total bomb damage, the cost has been broadly distributed throughout the economy. The major changes in 1966 have been the sharp increases in estimated damage to transport equipment and petroleum storage facilities, and in indirect losses of exports and agricultural crops. Losses of transport equipment in 1966 were four times their 1965 value; damage to petroleum facilities was three times the 1965 level; and indirect losses of agricultural crops and exports jumped from over $9 million in 1965 to over $24 million in 1966.* In all of these cases the damage sustained has had no significant impact on North Vietnam's ability to continue with the war. Although the attack on petroleum storage facilities eliminated over 76 percent of the targeted national storage capacity, the North Vietnamese had already implemented a system of dispersed storage and have been able to maintain petroleum imports at almost normal levels. Losses of transport equipment have been offset by increased imports. The substantial indirect losses attributed to the bombings have little impact on the course of the war and are more than compensated for by economic assistance from other Communist countries.

The damage sustained by other economic sectors has not yet reached unacceptably high levels. Some 32 percent of total electric power-generating capacity in North Vietnam has been eliminated by air attack. This loss has had only a minor effect on economic activity and on North Vietnam's ability to conduct military operations. The main powerplants in the power system, those most vital to the Hanoi-Haiphong area, have still not been subjected to air attack. The attacks on other economic target systems, including the intensive interdiction program against lines of communication, have yielded relatively low returns. This is essentially because most of these targets are parts of low-value systems or make only a limited contribution to the war. None has been attacked in sufficient depth and concentration. Moreover, the North Vietnamese have acquired increasing skill and flexibility in responding to the disruptions caused by the bombings.

* It should be noted that losses of agricultural crops are arbitrarily attributed entirely to the indirect effects of the bombing. An unknown part of these losses is in fact due to weather and other natural causes.

Packages (see Figure A7). During the first nine months of 1966, more than 70 percent of the US sorties flown over North Vietnam were concentrated in attacks on transportation and port facilities located in Route Packages I, II, and III, covering the panhandle south of Thanh Hoa (see Table A12). About 39 percent of all US sorties attacked targets in Route Package I, which extends from the 18th Parallel to the DMZ. Approximately 20 percent of all US sorties were flown over Route Packages IV through VI, including 7 percent over Route Package VI in the key northeast area. Most of the more publicized strikes in 1966 were in the area of Route Package VI, including the strikes on bulk petroleum storage facilities at Hanoi and Haiphong, on the Uong Bi thermal powerplant, and on the coal-processing facilities at Cam Pha. The vital Hanoi - Dong Dang and Hanoi - Haiphong rail lines are also in Route Package VI.

B. Ordnance

During the first nine months of 1966, sorties flown over North Vietnam delivered a total of 91,770 tons of ordnance, or nearly 2.7 times the tonnage delivered during 1965. The amounts delivered during the early months of the year were much smaller than in the later months. The total for January-March was only about 12,790 tons, whereas 17,760 tons were delivered in September alone -- an amount equal to about 52 percent of the total ordnance delivered on North Vietnam during all of 1965. The US Air Force delivered 59 percent of all ordnance expended on North Vietnam during January-September 1966, the US Navy 37 percent, the US Marine Corps 3 percent, and the South Vietnamese Air Force 1 percent. The shares in total ordnance delivered on North Vietnam in 1966, compared with similar shares for 1965, are shown in the following tabulation:

	Percent			
	USAF	USN	USMC	VNAF
1965	62	35	N.A.	3
January-September 1966	59	37	3	1

Ordnance delivered on fixed targets from the JCS target list represented only 3 percent of total ordnance delivered on North Vietnam during the first nine months of 1966, compared with 37 percent during 1965. Conversely, ordnance delivered by armed reconnaissance

unharmed over the minefields and travel close to the shore, thereby minimizing opportunities for detection by US aircraft. The number of small craft available in the area could, if properly organized, handle a volume of general cargo corresponding to that estimated to have moved through the port of Haiphong in 1965 and 1966.

Excluding bulk petroleum, North Vietnam imports through Haiphong amount to about 2,000 tons a day. A combination of about 2,800 motor-powered and sailing junks would be required to handle this volume of imports if they were to be delivered via Fort Bayard in China.

Cargoes to be handled by small craft would, however, be limited to items that could be loaded and unloaded by ships' gear and floating cranes and carried in small native craft, lighters, and barges. Among such items would be bagged fertilizer, grain and other foods, packaged petroleum, and vehicles. Loose bulk products such as fertilizer, grain, apatite, and coal probably would be difficult to handle. Clamshell buckets, ordinary buckets, wicker baskets, slings, and other such devices could also be used to offload bulk cargoes into lighters, but any of these alternatives would be time consuming.

The river port of Nam Dinh would be a significant loophole in current mining programs. Nam Dinh is the third largest city in North Vietnam and is served by the main railroad and highway network as well as the extensive inland water network in the delta area. The port area of Nam Dinh, including piers and riverbank suitable for handling cargo, has a cargo-discharge capacity of about 3,625 tons a day -- more than three-quarters as great as the general cargo-handling capacity at Haiphong. Only small ships with a draft of up to 9 feet could use this port as an alternative to the mined ports, however, and some of the cargo would have to be discharged along the banks of the Red River rather than at piers and quays.

The ports of Cam Pha and Hon Gai are especially equipped to export coal and have very limited facilities for handling other types of cargo. Aerial photography reveals that coal occasionally is loaded from lighters onto ships while the ships are anchored outside the port area. Presumably this is done only for topping off or when the berths at the docks are filled. The time and expense of lightering coal make it unlikely that more than 10 percent of normal exports would be loaded in this manner. The small amount of imports normally needed in the

VI. Chinese Communist Reaction to the Bombing

Peking's reaction to US bombing of North Vietnam is an integral part of its overall response to US involvement in the Vietnam war. This has been noisy, violently hostile and, over the past twelve months, increasingly cautious. Peking is anxious to have the fighting continue, but the Chinese want to keep it a proxy war and have carefully hedged their promises of direct military assistance.

As part of their effort to keep the Vietnamese Communists steadfast and in the field, the Chinese have provided a steady and substantial flow of aid goods and military materiel. They also maintain a military presence in North Vietnam of between 25,000 and 45,000 men -- mostly engineering units and antiaircraft troops.

This assistance has been provided to an accompaniment of virulent propaganda attacks against the United States intended to bolster morale in Hanoi and when possible to generate political pressure against US military escalation. Propaganda blasts, however, have dropped off in both harshness and volume since the fall of 1965. This probably reflects a combination of factors -- steadily increasing preoccupation with domestic political turmoil, a clearer appreciation of US determination, and perhaps also a realization that threatening talk coupled with cautious action becomes ridiculous after a time.

Peking was quick to react to the first US air attacks on North Vietnam following the Tonkin Gulf incidents in August 1964, warning that the Chinese people would "not sit idly by" and that "aggression by the US against North Vietnam means aggression against China." Peking backed up these statements of support by prompt delivery of 36 Chinese jet fighters to North Vietnam during the first week in August -- just two days after the retaliatory US airstrikes. The Chinese, however, avoided any specific threat of retaliation and underscored the role of "Vietnamese" forces in defending North Vietnam.

After the Tonkin Gulf incidents the Chinese began intensive efforts to bolster their air defense system. This activity appears to have been more a part of long-range contingency planning than a clearcut response to specific US military moves. The Chinese stepped up air defense cooperation with North Vietnam. They also constructed three new airfields near the North Vietnamese border.

Table E3

Comparison of Railroad Bridges Destroyed or Damaged
by Railroad Line
1965 and January-September 1966

Railroad Line	Total Bridges on Line	Destroyed/Damaged 1965	Total Destroyed/Damaged 1965
Hanoi - Dong Dang	53	3	5
Hanoi - Haiphong	10	2	2
Hanoi - Lao Cai	139	12	17
Hanoi - South	85	26	58
Hanoi - Thai Nguyen	7	0	1
Total	294	43	83

most important lines for the movement of both imports and domestic goods, have been interdicted for a total of only about two months and one month, respectively, during 1966. The average volume of traffic moved on these two lines could easily have been equal to that moved in 1965. The lines are normally used below maximum capacity, and traffic backlogged during periods of interdiction could have been moved when the lines were open.

The Hanoi - Lao Cai line was interdicted for through rail service for almost 60 percent of the time during January-September 1966, compared with about 40 percent of 1965. The interdiction of this line brought an end to the shipment of apatite, a major bulk commodity export. As a result, the average volume of total rail traffic in North Vietnam is estimated to have decreased in 1966. The location of the Lao Cai line in a narrow valley has made it difficult for the North Vietnamese to build bypass bridges, thus requiring temporary spans to be built at the original site. These repairs have been of a makeshift nature, so that the restored bridges have much lower capacity. Unlike the Dong Dang and Haiphong lines, most bridges destroyed on the Lao Cai line were not JCS targets. The Hanoi-Vinh line has been disrupted for through rail service almost continually since it was first struck in April 1965, except during the cessation of bombing in January 1966. Of the total of almost 60 railroad and combination bridges struck on this line and on the makeshift line south

APPENDIX E

INTERDICTION OF THE LOGISTICS TARGET SYSTEM

I. The Interdiction Program

A. North Vietnam

The rail lines, highways, and waterways of North Vietnam were under continued attack from January through September 1966, with emphasis primarily on the same areas which were struck in 1965. Aerial photography confirms that at least 359 bridges have been destroyed or damaged since the start of bombing. About 150 of these bridges were struck for the first time in 1966. All lines of communication (LOC's) were struck with greater intensity during 1966, but the only new LOC's struck were the roads developed as alternates to routes bombed in 1965.

Airstrikes against JCS-targeted bridges, like strikes against all bridges in North Vietnam, have been concentrated in the southern part of the country. The number of strikes against highway bridges on the JCS target list decreased during 1966, whereas strikes against JCS bridges on the rail lines increased as shown in Table E1. This situation has resulted in part from North Vietnamese emphasis on the construction of highway bypasses, rather than the repair of the original highway bridges. Although alternate rail bridges have been constructed at the more strategic river crossings, the North Vietnamese have emphasized the repair of the original rail bridges, which then have been restruck.

1. Railroads

In spite of the accelerated interdiction program in 1966, there has been no significant increase in the total length of time the rail lines have been interdicted for through rail service during the year, as shown in Table E2. Aerial photography confirms that a total of 83 railroad and combination railroad/highway and rail bypass bridges were damaged or destroyed on all rail lines in North Vietnam since the start of the bombing. About half of these were destroyed or damaged in 1966. A comparison of these data, by individual line, is shown in Table E3. The Hanoi - Dong Dang and Hanoi-Haiphong lines, the two

in the Haiphong port area and has not been attacked. The other targeted base not yet struck is Port Wallet, located about halfway between Hon Gai and the Chinese border. In addition to these five targeted bases, North Vietnam has naval support facilities in ten other ports. Restoration of the damaged bases can be accomplished quickly and with local materials, with the exception of replacing or repairing machinery that may have been destroyed or damaged.

5. Radar

North Vietnam has 50 known radar sites, of which five coastal sites were targeted because of their strategic location. During 1965-66, these five targeted sites were attacked. Two sites (Hon Matt and Hon Nieu) were totally destroyed and two (Vinh Son and Bach Long) were damaged. The extent of damage to the remaining site (My Duc) is unknown. Damage or destruction of targeted sites amounted to an estimated $1.7 million during 1965 and to slightly over $900,000 in 1966 for a total of $2.6 million. Details of the types of radar damaged or destroyed and their estimated value are shown in the following tabulation:

Site	Radar Model	Total Value (Thousand US $)	Destroyed or Damaged (Thousand US $)
1965			
Vinh Son	1 Track Dish - fire control	245	245
	2 SCR-270 - early warning	270	270
	3 Firecan - fire control	1,000	
	1 Cross Slot - early warning	135	645
	1 Spoonrest A - early warning	135	
Bach Long	1 Cross Slot - early warning	135	135
Hon Matt	2 Cross Slot - early warning	270	270
Hon Nieu	1 Cross Slot - early warning	135	135
My Duc	1 Cross Slot - early warning	135	N.A.
	1 Rus-2 - early warning	135	N.A.
	1 SCR-270 - early warning	135	N.A.
	Subtotal for 1965		1,700
1966			
Vinh Son	1 Spoonrest A - early warning	135	135
	1 Firecan - fire control	335	335
	2 Firecan - fire control	670	
	1 SCR-270 - early warning	135	374
	1 Cross Slot - early warning	135	
Bach Long	1 Cross Slot - early warning	135	80
Hon Matt	None		
Hon Nieu	None		
	Subtotal for 1966		924
	Total 1965 and 1966		2,624

Table A3

Sorties Over South Vietnam by Mission and Nationality [a]
1965 and January-September 1966

Year and Month	By US Services			By the South Vietnamese Air Force			Total		
	Attack Sorties [b]	Support Sorties	Total Sorties	Attack Sorties [b]	Support Sorties	Total Sorties	Attack Sorties [b] [c]	Support Sorties [c]	Total Sorties
1965									
January	740	270	1,010	N.A.	N.A.	1,630			2,640
February	1,200	260	1,460	N.A.	N.A.	1,330			2,790
March	1,860	300	2,160	N.A.	N.A.	1,310			3,470
April	2,290	310	2,600	N.A.	N.A.	1,490			4,090
May	4,940	500	5,440	N.A.	N.A.	1,320			6,760
June	5,800	330	6,130	N.A.	N.A.	1,440			7,570
July	8,270	1,880	10,150	N.A.	N.A.	2,100			12,250
August	8,910	1,430	10,340	N.A.	N.A.	2,430			12,770
September	9,120	1,210	10,330	N.A.	N.A.	2,570			12,900
October	9,510	1,870	11,380	N.A.	N.A.	2,990			14,370
November	10,380	1,960	12,340	N.A.	N.A.	2,700			15,040
December	10,520	2,540	13,060	N.A.	N.A.	2,600			15,660
Total 1965	73,540	12,860	86,400	N.A.	N.A.	23,910			110,310
1966									
January	9,680	2,990	12,670	2,470	50	2,520	12,150	3,040	15,190
February	10,570	2,760	13,330	2,800	40	2,840	13,370	2,800	16,170
March	12,760	3,200	15,960	2,870	50	2,920	15,630	3,250	18,880
April	9,340	3,010	12,350	2,400	100	2,500	11,740	3,110	14,850
May	9,620	2,890	12,510	2,460	110	2,570	12,080	3,000	15,080
June	10,400	3,080	13,480	2,710	80	2,790	13,110	3,160	16,270
July	12,540	4,510	17,050	2,890	110	3,000	15,430	4,620	20,050
August	11,670	3,340	15,010	2,960	140	3,100	14,630	3,480	18,110
September	10,730	3,560	14,290	2,520	230	2,750	13,250	3,790	17,040
Total first nine months 1966	97,310	29,340	126,650	24,080	910	24,990	121,390	30,250	151,640
Total January 1965 - September 1966	170,850	42,200	213,050			48,900			261,950

a. Rounded to nearest 10 sorties.
b. Attack sorties include strike and flak-suppression sorties.
c. The distribution of South Vietnamese sorties by attack and support categories is not available for 1965.

III. Impact of Mining Under an Intensified Rolling Thunder Program

The effectiveness of the mining of the three major ports would be greatly enhanced by an expanded bombing program, including intensive interdiction of road and rail connections with China, attacks on the remaining principal and dispersed petroleum storage sites and the Haiphong cement plant, and 24-hour armed reconnaissance against all forms of transport -- particularly in the northern part of North Vietnam. An attack on the Haiphong cement plant would deprive North Vietnam of domestic production of 650,000 tons of cement annually, almost 90 percent of which is consumed within the country. More than 90,000 tons of this commodity is consumed in military construction. If North Vietnam attempted to maintain all normal construction activity, particularly the Communist aid projects, an additional 450,000 tons of cement would have to be imported overland.

If only one-half of the traffic through Haiphong at the rate experienced in 1966 could be handled by lighters and other craft once they are subject to 24-hour armed reconnaissance, the other half would probably be transferred to rail transport. In this case, 1,000 tons per day of general cargo imports and up to 300 or 365 tons per day of petroleum imports would be transferred to rail transport. The main rail connection to Communist China, the Hanoi - Dong Dang line, which is currently operating at only about one-third of capacity, would then be forced to attempt to operate at levels approaching normal capacity while it was being interdicted. If production in the cement plant were also halted at the same time, an additional import requirement for cement, probably as high as 1,500 tons a day, would be generated. This additional tonnage would raise traffic to a level considerably in excess of the uninterdicted capacity of the Dong Dang line. The North Vietnamese would then be forced to try to use the new Chinese railroad through Yunnan Province and thence the Hanoi - Lao Cai line as well as the highways and inland waterway. The rail distance to Hanoi from Fort Bayard via Lao Cai is over 2,000 kilometers, nearly three times the distance via Dong Dang, thus adding to the cost and effort. Nevertheless, the alternate railroad connection, in addition to the highways and inland waterway, would represent considerable additional transport capacity.

The extent to which the Communists would try to avail themselves of this additional capacity would depend on the degree to which imports through Haiphong by means of improvised lighterage operations are disrupted and the effectiveness of the interdiction of the Hanoi - Dong

A final alternative would be the use of the new railroad within Communist China to Yunnan Province and thence the Red River to Hanoi. The capacity of the river for movements from Lao Cai to Hanoi is estimated at 900 to 2,700 tons per day depending on the season of the year.

C. Measures to Reduce the Volume of Traffic

North Vietnam could reduce the volume of traffic that would be required to move through the mined ports by eliminating all non-essential seaborne foreign trade (see Table F1). Export of coal from Hon Gai and Cam Pha normally represents about 70 percent of the volume of North Vietnam's total seaborne exports and accounts for about 25 percent of its foreign exchange earnings. The coal export trade might therefore be considered essential by the North Vietnamese, but the time and expense involved in its transportation by means other than water would probably make it unprofitable to continue to export this commodity if the ports were mined. A similar situation would apply to the export of cement and apatite. In fact, the export of apatite had been reduced drastically by August 1965. A decision to forgo the export of these bulk commodities would reduce seaborne exports from about 4,700 tons per day, including coal, to less than 460 tons a day. at the 1965 rate, and from about 3,000 tons per day to 180 tons a day at the rate for 1966.

North Vietnam would be more reluctant to cut back on its imports. Fertilizers, grains, and other bulk foodstuffs are important to the economy. They represent only a small percentage of the total food supply, however, and if necessary could be eliminated by strict rationing programs. Coal for the coking plant at Thai Nguyen, which represents a significant portion of rail imports, could be cut out with only the production of pig iron being affected. A reduction in the use of petroleum would be more difficult to achieve, and it is estimated that North Vietnam would try to maintain petroleum imports at or near 16,000 tons per month. The reduction of imports of miscellaneous cargoes, some of which are essential to the continued operation of modern industry and transportation, would be more difficult. Imports of military supplies would certainly be maintained as would imports of rails and that portion of timber imports which is used in transport repairs. It is estimated that less than one-half of the 1965 level of imports could be eliminated without materially affecting the economy or military capability in the short run. In the long run, the modern sector of the economy would be greatly slowed down by such a reduction.

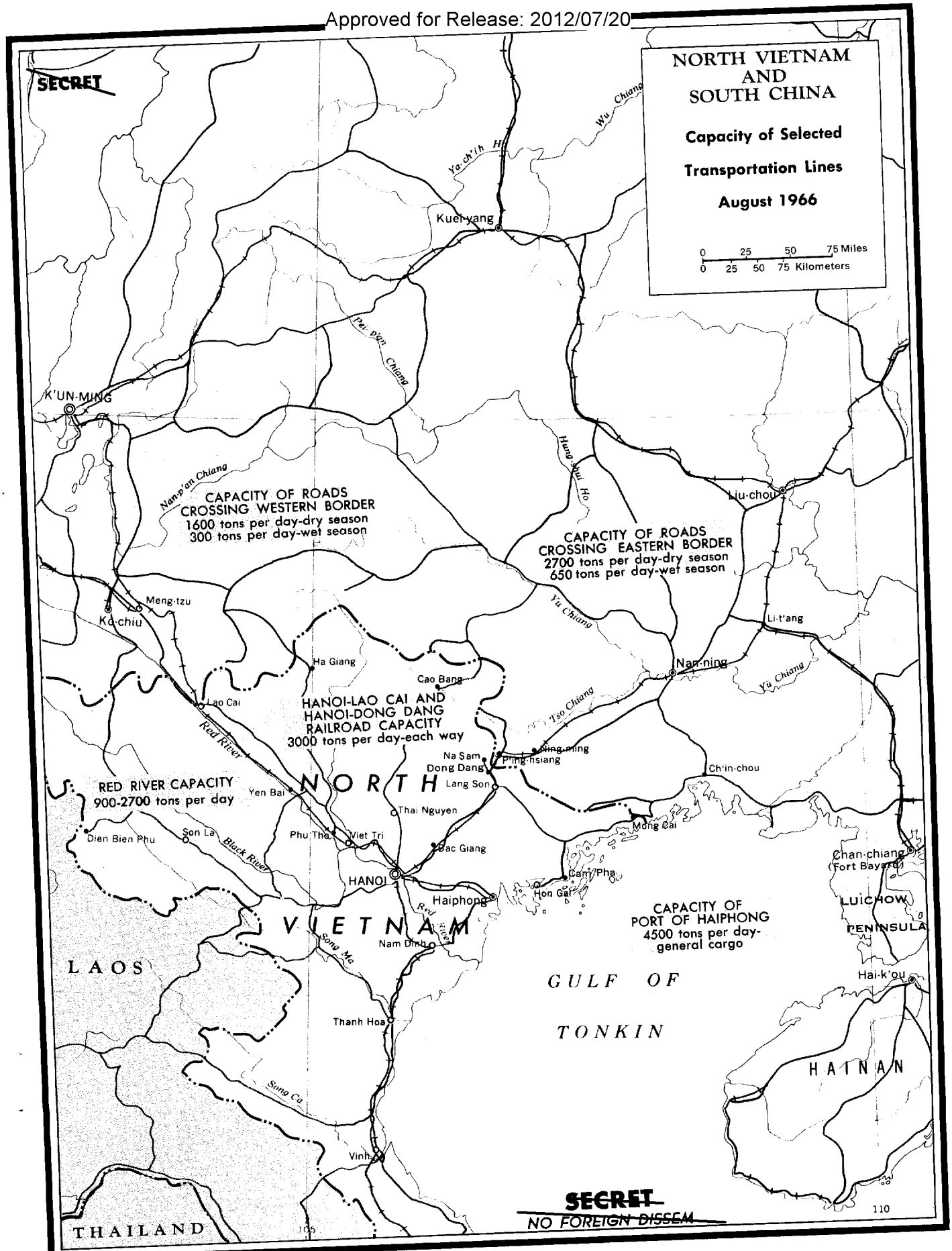

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Figure F-1

Table A9

Sorties Over North Vietnam, by Mission and Nationality a/
1965 and January-September 1966

Year and Month	By US Services			By South Vietnamese Air Force			Total		
	Attack Sorties b/	Support Sorties	Total Sorties	Attack Sorties b/	Support Sorties	Total Sorties	Attack Sorties b/	Support Sorties	Total Sorties
1965									
January	0	0	0	0	0	0	0	0	0
February	130	70	200	60	0	60	190	70	260
March	530	240	770	120	Negl.	120	650	240	890
April	1,500	1,360	2,860	100	10	110	1,600	1,370	2,970
May	1,510	2,710	4,220	100	20	120	1,610	2,730	4,340
June	2,310	1,530	3,840	90	10	100	2,400	1,540	3,940
July	3,160	2,960	6,120	70	10	80	3,230	2,970	6,200
August	3,420	3,790	7,210	30	10	40	3,450	3,800	7,250
September	3,990	4,230	8,220	20	Negl.	20	4,010	4,230	8,240
October	3,460	4,550	8,010	10	Negl.	10	3,470	4,550	8,020
November	3,120	4,180	7,300	10	Negl.	10	3,130	4,180	7,310
December	2,170	3,570	5,740	30	20	50	2,200	3,590	5,790
Total 1965	25,300	29,190	54,490	640	80	720	25,940	29,270	55,210
1966									
January	130	2,890	3,020	0	0	0	130	2,890	3,020
February	2,810	3,710	6,520	0	0	0	2,810	3,710	6,520
March	4,480	4,940	9,420	10	10	20	4,490	4,950	9,440
April	5,310	5,090	10,400	140	0	140	5,450	5,090	10,540
May	4,360	4,250	8,610	110	0	110	4,470	4,250	8,720
June	7,520	5,430	12,950	270	0	270	7,790	5,430	13,220
July	9,960	6,240	16,200	240	0	240	10,200	6,240	16,440
August	11,790	7,030	18,820	20	0	20	11,810	7,030	18,840
September	12,340	6,880	19,220	10	0	10	12,350	6,880	19,230
Total first nine months 1966	58,700	46,460	105,160	800	10	810	59,500	46,470	105,970
Total January 1965 - September 1966	84,000	75,650	159,650	1,440	90	1,530	85,440	75,740	161,180

a. Rounded to nearest ten sorties. Negl. includes less than five sorties.
b. Attack sorties include strike and flak-suppression sorties.

1. Transport Equipment

Destruction and damage of all types of transport equipment by airstrikes increased considerably during the first nine months of 1966 compared with 1965. The following tabulation, which is based primarily on pilot reports and includes some duplication and exaggeration,* provides a general indication of the increase in damage inflicted, by type of equipment.

	1965		January-September 1966	
Type of Equipment	Destroyed	Damaged	Destroyed	Damaged
Locomotives	6	6	10	13
Railroad freight cars	227	592	1,061	850
Trucks	318	487	1,617	1,479
Ferries	53	56	64	118
Barges	263	487	1,813	2,977
Other water craft	144	210	816	1,255
Total	1,011	1,838	5,381	6,692

The estimated cost to the North Vietnamese of destroyed and damaged transport equipment increased from $5.9 million in 1965 to $24.5 million in 1966.

In spite of the significantly higher level of damage inflicted during 1966, there has been no evidence of serious transport problems resulting from shortages of equipment. Imports of locomotives and trucks have been sufficient to maintain inventories at the 1965 level. Reported losses of freight cars have included a significant number of small, makeshift cars used on the rail lines south of Hanoi which have not been included in the inventory of mainline freight cars. Although this mainline inventory has decreased by about 35 percent during 1966, there has been no indications of serious shortages of freight cars. If a high rate of utilization is assumed for the remaining freight cars, the September 1966 inventory is sufficient to handle the decreased volume of rail freight carried. Furthermore, Communist China probably has loaned or given North Vietnam all the freight cars needed to compensate for any shortages. Although some watercraft and motors for water craft have been imported, most of the watercraft needed to compensate for losses apparently have been constructed domestically. Sightings of watercraft indicate that there has

* The data have been adjusted downward to eliminate duplication whenever possible.

Table G2

Reported Machinery Produced in North Vietnam
1957-66

Year	Type of Machinery	
1957-60	Brick presses Farm implements Mechanical pumps Ventilators	Motor launches Locomotive repair Truck and engine repairs
1961	Cement mixers Farm implements Equipment for: Brick factories Rice mills Tug and river boats	Railroad cars Internal combustion engines Air compressors Transformers Diesel engines Welding machines
1963	Belt conveyors Farm implements Began production of springs, jacks, measuring devices, replacement parts for intricate machinery	Development of electric hammer Transformers
1964	T-620, T-630, 1K62 (Soviet-type) lathes Milling machines DC motors for trolley cars Pumps for agriculture and mining	"120-ton piece of machinery" Filter presses Valves Fans Crushing machines High pressure hose Precision-mold castings
1965	Hundreds of tons of spare parts for tractors, diesel motors, mechanical pumps Transformers for pumping stations	Water pipe, 62,000 meters Rail motor car North Vietnam's second locomotive
1966	Electric generators, 15 KW Electric motors Switchboards Diesel engines	Auto accessories T613 lathes M120 universal milling machines Circuit breakers Water pumps

many of which have never been struck. A sufficient number of these bridges would have to be kept interdicted so that the line is broken into segments of 10 to 15 miles in length. The Red River has sufficient capacity to serve as a partial alternate to the Lao Cai line, but its use for the movement of a large volume of goods would be cumbersome and time consuming and would necessitate the use of a large number of watercraft which could be used elsewhere more effectively.

C. The Hanoi-Haiphong Rail Line and Haiphong Port

Nearly three-fourths of North Vietnam's imports arrive by sea. Much of this traffic then moves on the Hanoi-Haiphong rail line. Furthermore, most of the traffic now moved by land on the Dong Dang line could be shifted to sea if service on this line were severely curtailed. There are five bridges on the Haiphong line with a length of at least 50 feet, two of which are JCS targets. Five strikes against one targeted bridge during January-September 1966 resulted in the line being interdicted for through rail service for a total of only about one month. The completed construction of new rail bypass bridges will make interdiction of this line more difficult in the future. Even if all five bridges on the line and their bypass bridges were continually interdicted, however, the capacity of the inland water network between Haiphong and Hanoi is sufficient to handle all traffic moving through the port. Therefore, neutralization of Hanoi-Haiphong transport would seem to require the denial of the use of the port of Haiphong to ocean-going traffic.

D. Effectiveness of the Interdiction of the Northern Railroads

Some rail shuttle service probably would be moved on portions of the northern rail lines in spite of a much more intensive and continuous interdiction program. Such a program, however, would be far more effective in hindering the movement of supplies and maximizing the cost to North Vietnam than the present emphasis on interdicting highways and the relatively minor railroads in the south. Effective interdiction of the northern railroads would force a large volume of supplies moving into North Vietnam onto highways and inland and coastal waterways, as the North Vietnamese are doing south of Thanh Hoa under the present system of interdiction.

The use of these alternate transport means for the movement of large volumes of traffic would provide far greater opportunities for air attacks against trucks and watercraft. Additional requirements of

JCS TARGET NO — NAME

Struck in 1965 / Struck in 1966 / Not Struck

Airfields

1 Na San
•2 Dien Bien Phu
3 Hanoi/Gia Lam
4 Dong Hoi
5 Vinh
6 Phuc Yen
7 Hanoi/Bac Mai
8 Haiphong/Cat Bi
9 Haiphong/Kien An
9.1 Kep
9.11 Kep Ha

Railroad, Railroad and Highway, and Highway Bridges and Highway Ferries

•10 Ninh Binh RR & Hwy Br ov Song Day
•11 Hai Duong RR & Hwy Br ov Song Thai Binh
12 Hanoi RR & Hwy Br ov Red River
13 Hanoi RR & Hwy Br ov Canal des Rapides
•14 Thanh Hoa RR & Hwy Br ov Song Ma
•15 Viet Tri RR & Hwy B ov Riviere Claire
•16 Dap Cau RR & Hwy Br ov Song Cau
•17 Haiphong Hwy Br ov Song Da Bach
18 Lang Son RR & Hwy Br ov Song Ky Cung
•18.1 Dong Hoi Hwy Br ov Rao Le Ky
•18.11 My Duc Hwy Br ov Khe Cam Ly
18.12 Xom Phuong Hwy Brs ov Song Dinh
•18.13 Kim Cuong Hwy Br SW ov Nam Chot
18.14 Khe Kien Hwy Br W ov Nam Kien
•18.15 Bai Duc Thon Hwy Br NW ov Ngan Sau
18.17 Vinh Hwy Ferry
18.19 Kim Cuong Hwy Br W
18.2 Thanh Yen Hwy Br ov Rao Da
•18.21 Phu Ly RR Br ov Song Lap
•18.22 Co Trai RR & Hwy Brs ov Canal
•18.23 Bac Giang RR & Hwy Br ov Song Thuong
•18.24 Cao Nung RR Br ov Song Hoa
18.25 Hai Duong RR & Hwy Br E ov Song Rang
18.26 Lang Con RR Br NW ov Ngoi Niai
•18.27 Lang Bun RR Br ov Ngoi Bon
18.31 Kep Hwy Br ov Song Thuong
18.32 Tri Dong Hwy Br ov Song Day
•18.33 Thai Nguyen Hwy Br ov Song Cau
18.35 Cho Moi Hwy Br ov Song Cho
•18.36 Ha Gia Hwy Br ov Song Cong
18.38 Dan Phuong Hwy Causeway ov Song Day
18.4 Huu Hung Ferry
18.41 Ban Pom Lot Hwy Br S
18.42 Xuan Mai Hwy Br ov Song Con
18.44 Phuc Thiem Hwy Br
18.46 Xom Thai Xa Hwy Br
•18.47 Ly Nhan Hwy Br ov Song Bang
•18.49 San Dinh Hwy Br ov Song Kiem
•18.5 Dien Chau RR Br ov Song Bang
18.51 Trai Noi Hwy Br
18.52 Xom Gia Hwy Br ov Song Gia
•18.53 Tho Son Hwy Br ov Song Nghen
•18.54 Ha Tinh Hwy Br ov Song Nai
18.55 Ron Hwy Ferry
18.57 Mi Le Hwy Ferry
18.58 Lang Dang RR Br ov Song Thuong
18.59 Long Khap Hwy Br ov Song Chay
•18.6 Tam Da RR & Hwy Br ov Song Cua Lo
18.61 Bac Can Hwy Br ov Song Cau
•18.62 Lang Luong Hwy Br ov Song Mo Ga
•18.63 Vinh Tuy Hwy Br ov Song Con
18.64 Ban Pa Huone Hwy Br ov Nam Meuk
18.65 On Hwy Br ov Song Ta
18.66 Me Xa Hwy Br ov Song Ky
18.67 Chieng Chang Hwy Br ov Song Luc Nam
18.68 La Khe Thon RR Br ov Ngan Sau
•18.7 Qui Vinh RR Br No. 1 ov Song Hoang Mai
18.71 Loc Binh Hwy Br ov Song Ky Cung
18.72 Xuan Mai Hwy Br SW ov Song Day
•18.73 Phong Dinh RR Br
18.74 Vu Chua RR Br S ov Suoi Ngang
•18.75 Lang Met Hwy Br ov Song Thuong
18.76 Ha Chanh Hwy Br
•18.77 Ha Chanh Hwy Br N
18.78 Lam Hwy Br NE ov Song Luo Nam Trib
•18.8 Dong Phong Thuong RR & Hwy Br ov Song Len
•18.9 Xom Ca Trang Hwy Br ov Rao Cai

Railroad Facilities

19 Yen Vien RR Clf Yard
20 Hanoi RR Car Repair Shops Gia Lam
21 Hanoi RR Stn Clf Yd & Shops
•21.1 Vinh RR Class Yd NW
•21.11 Thai Nguyen RR Sta Yds & Shops

Barracks

22 Xuan Mai Army Bks SSW
23 Xuan Mai Army Bks NNW Hoa Muc
24 Chanh Hoa Army Bks SE
•25 Son La Army Bks, Hq Mil Reg NW & Sup Dep
•26 Dien Bien Phu Army Bks
•28 Ban Xom Lom Army Bks
29 Quang Suoi Army Bks NE
30 Hanoi Mil Hq N Vietnam ADD
31 Ha Dong Army Bks and Sup Dep
32 Vu Con Army Bks and Supply Area
•33 Dong Hoi Army Bks WNW
34 Vinh Yen Army Bks and Tng Area N
35 Son Tay Army Bks SW Tung
36 Vit Thu Lu Army Bks/Storage Area
37 Moc Chau Army Bks
38 Vinh Army Bks Central NE
•39 Chap Le Army Bks NW
•39.1 Ben Quang Army Bks SW
39.11 Hoan Lao Army Bks S
•39.12 Dong Hoi Army Bks Citadel
39.13 Phu Le Army Bks & Sup Dep
•39.14 Ba Don Army Bks
39.15 Hoa Luat Nam Army Bks
39.17 Don Bai Dinh Mil Camp
39.18 Muong Sen Mil Instl
•39.2 Vinh Linh Army Bks Central NE
•39.21 Yen Phu Army Bks NE
39.22 Thanh Hoa Army Bks S
39.23 Thanh Hoa Bks SSE
•39.24 Sam Son Army Bks W
•39.25 Vinh Son Army Bks S
39.26 Dong Cao Thon Army Bks
•39.27 Vinh Army Bks NNE
39.28 Bai Thuong Army Bks NE
39.29 Kep Ha Army Bks NE
•39.3 Mu Gia Pass Army Sup & Staging Point
39.31 Xom Trung Hoa Bks & Ammo Dep NNW
39.32 Xom Bang Army Bks E
39.33 Trai Thon Army Bks
•39.34 Ha Tinh Army Bks & Sup Dep
•39.35 Co Dinh Army Bks NW
39.36 Vinh Army Bks NW
39.37 Vinh Yen Army Bks NNE
39.38 Phu Tho Army Bks NW
39.39 Phu Van Army Bks SSE
39.4 Quan Lan Army Bks
39.41 Ngoc Thi Army Bks & Sup Dep
39.42 Son Dong Army Bks and School
39.43 Kep Army Bks S
39.44 Chi Ne Army Bks
•39.46 Bien Son Army Bks NNE
•39.47 Giap Rong Army Bks
39.49 Quang Khe Army Bks
39.5 Xom Trung Hoa Army Bks & Sup Dep
39.51 Nam Son Barracks
39.6 Vinh Linh Army Bks SW
39.7 Vinh Linh Army Bks E Lien Cong
39.8 Vinh Linh Army Bks NW Xom Cho
39.9 Xom Y Lanh Army Bks

Ammunition Depots

40 Phu Qui Ammo Dep SW
41 Phu Van Ammo Dep
43 Qui Hau Ammo Dep W
•44 Yen Bai Ord Dep
45 Haiphong Ammo Dep Kien An SW PUG
46 Ban Phieng Hay Ammo Dep
47 Yen Son Ord & Ammo Dep
48 Yen Khoai Army Bks
47.2 Lang Het Ammo Dep
47.3 Tai Xouan Ammo Dep SE
47.4 Vinh Yen Ammo Dep
47.16 Hon Gai Explo Stor
47.17 Cam Ly Ammo Dep
•47.18 Xom Rung Ammo Dep
47.19 Ban Nuoc Chieu Ammo Dep
47.21 Bac Giang Ammo Dep
47.22 Bac Can Ammo Dep
•47.9 Xom Bang Ammo Dep

Petroleum Storage Facilities

42 Phu Van POL Stor
•48 Haiphong Pet Prod Stor
•49 Hanoi Pet Prod Stor Thanh Am
•50 Vinh Pet Prod Stor
•51 Nguyen Khe Pet Prod Stor
51.1 Phuc Yen Pet Prod Stor NNE UG
•51.11 Bac Giang Pet Prod Stor
•51.12 Nam Dinh Pet Prod Stor
•51.13 Do Son POL Stor
•51.14 Viet Tri Pet Prod Stor
•51.16 Phu Qui Pet Prod Stor
•51.17 Duong Nham Pet Prod Stor UG
51.18 Kep Pet Prod Stor

Military Supply Areas

•52 Vinh Hq MR IV, Army Bks & Sup Dep E
53 Phu Van Army Sup Dep SE Du Luen
•54 Thien Linh Dong Army Sup Dep S
55 Vinh Son Army Sup Dep SW Do Luong
56 Phu Qui Army Bks & Sup Dep
57 Hanoi MND Army & MZ Hq
58 Hanoi Army Sup Dep S Quinh Loi
59 Hanoi Army Sup Dep N Tay Ho
60 Thai Nguyen Army Sup Dep N
61 Xom Chang Army Bks S
62 Van Dien Army Sup Dep
63 Thuan Chau Bks & Dep
•63.1 Vinh Loc Storage Area S
63.11 Van Dien Vehicle Dep Complex
63.12 Phu Duc Warehouse Area
63.13 Chuc A Army Bks & Sup Area
63.14 Son Tay Army Sup Dep
63.2 Dong Thanh Warehouse Area S
63.21 Dong Thanh Warehouse Area W

SAM Sites

•50.59 Haiphong SAM Site
65.14 Hanoi SAM Site
65.15 Hanoi SAM Site
65.8 Hanoi SAM Sup Fac

Radar and Communications Sites

39.16 Hon Gio Mil Bks/Radar Stn Tiger Island
39.19 Muong Sen Rdo Comm Stn
66 Hanoi Intel Radio Trans Sta Dai Mo
66.1 Hanoi HF Telecom Site Phu Coc
67 Hanoi Int Radio Rec Sta Son Dong
67.1 Cap Mui Ron Radar Site
67.11 Ha Tinh Radar Site
•67.12 Hon Matt Island Site
•67.19 Bac Long Vi Island Radar Site
•67.2 Vinh Son Radar Site
67.3 Chanh Hoa Military Radio Comm Sta
Dong Hoi Radar Site
Vinh Linh Radar Site
Cua Lo Radar Stn
•67.8 My Duc Radar Site
67.9 Hon Nieu Island Radar Site

Port Facilities

•68 Cam Pha Port Facilities
68.1 Cam Pha Approaches/Mineable Area
•69 Hon Gai/Bai Chay Port and Naval Complex
69.1 Hon Gai Approaches/Mineable Area
70 Haiphong Port Complex
70.1 Haiphong Mineable Area Gulf of Tonkin
•71 Ben Thuy Port Facilities
71.09 Phuc Loi Approaches/Song Ca/Cua Hoi Mineable Areas
71.13 Ham Rong Port Facilities E and W on Song Ma
72.1 Port Wallut Approaches/Mineable Area
73 Hanoi Port Facilities, Red River
74 Quang Khe Approaches/Song Giang Mineable Area

Locks

71.11 Thanh Hoa Lock Song Chu Canal
71.12 Ben Thuy Lock and Dam on Song
71.17 Nguyet Quang Lock No. 1 Song Chu Canal
•71.18 Qua Nhue Ha Lock No. 2 Song Chu Canal
71.19 Bich Phuong Lock No. 3 Song Chu Canal
71.2 Ben Thon Lock No. 1 Song Thuong Canal
71.21 Van Cau Lock No. 5 Song Thuong Canal
71.22 Ln Yen Lock No. 7 Song Thuong Canal

Naval Bases

•71.1 Phuc Loi Naval Base
72 Port Wallut Naval Base
•74.1 Quang Khe Naval Base, Cuu Dinh

Industrial Complexes

47.2 Lang Chi Explosives Plant
75 Viet Tri Chemical Plant
76 Thai Nguyen Iron & Steel Combine
77 Hanoi Machine Tool & Engr Equip Plant
77.1 Haiphong Cement Plant
78 Haiphong Phosphatic Fertilizer Plant
78.1 Phu Tho Chemical Fertilizer Plant Lam Thao
79 Bac Giang Chemical Fertilizer Plant

Powerplants

80 Haiphong Thermal Powerplant West
81 Hanoi Thermal Powerplant
•82 Uong Bi Thermal Powerplant
•82.1 Thanh Hoa Thermal Powerplant
•82.11 Ben Thuy Thermal Powerplant
82.12 Haiphong Thermal Powerplant East
82.13 Hon Gai Thermal Powerplant
82.14 Lao Cai Thermal Powerplant
82.15 Nam Dinh Thermal Powerplant
•82.16 Thai Nguyen Thermal Powerplant
•82.17 Viet Tri Thermal Powerplant
82.18 Co Dinh Thermal Powerplant
82.19 Phu Ly Thermal Powerplant
82.21 Ban Thach Hydroelectric Powerplant
82.22 Ta Sa Hydroelectric Powerplant
82.23 Ta Sa Hydroelectric Powerplant Na Ngan
82.24 Hanoi Transformer Sta Dong Anh
82.25 Lang Chi Hydroelectric Powerplant Thac Ba
82.26 Bac Giang Thermal Powerplant

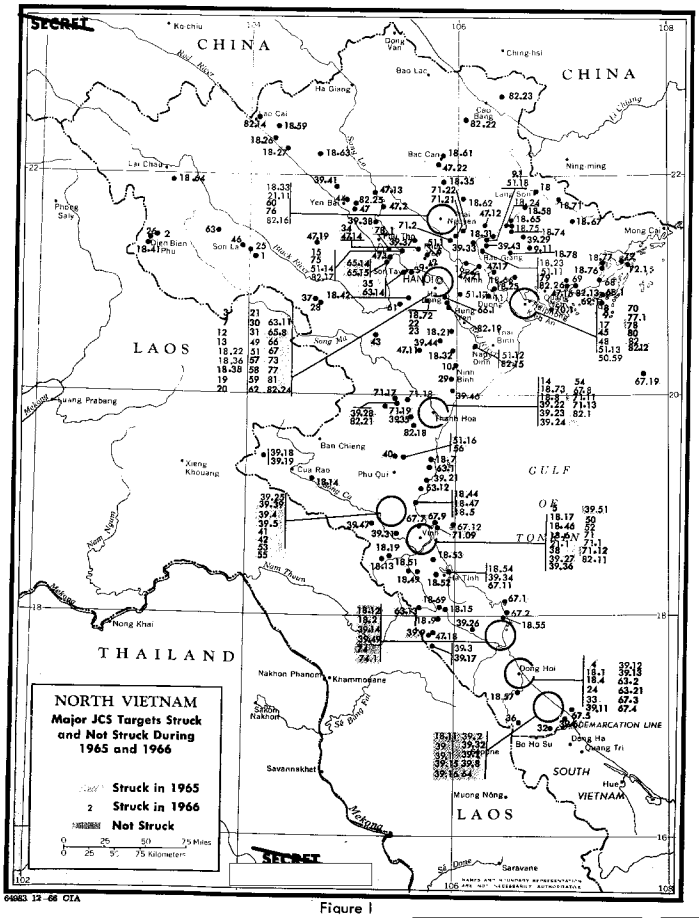

Figure 1

The shortfall in the 1966 spring rice crop was at least 200,000 tons below the 1961-65 average of about 1.7 million tons for spring rice.* Since this crop was planted in late 1965, $3.5 million of the loss was somewhat arbitrarily judged to have occurred in 1965 and $13.5 million during the first six months of 1966.

While poor weather in the last half of 1965 and in the first half of 1966 undoubtedly contributed to the poor performance of agriculture, the disruptive effects of the bombing attacks were considerable. Even before the bombing attacks, agriculture in North Vietnam had experienced difficulties -- partly because of the undependable weather and partly because of management problems on agricultural cooperatives associated with the socialization of agriculture. The war has brought such additional problems as manpower shortages -- particularly skilled manpower -- the disruption of normal farming schedules, and the interruption of electrically powered irrigation systems and of the production and distribution of fertilizers. The efforts of the North Vietnamese to counter the disruptive effects of the bombing attacks -- including the importing of diesel generators to power the irrigation systems and of increased amounts of chemical fertilizers -- have not been completely successful.

The bombing attacks have resulted in serious interruption of fishing activities -- particularly offshore fishing -- in the three southern provinces of North Vietnam: Quang Binh, Ha Tinh, and Nghe An. It is estimated that this has been responsible for a loss in the salt water fish catch valued at $4 million,** with approximately $1.7 million worth of this shortfall occurring in 1965 and $2.3 million in 1966. The intensive fishing season in North Vietnam -- when most of the offshore fishing takes place -- is in the three-month period of September to

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* There was no shortfall in rice production in 1965. Although the 1965 spring rice crop was above-normal, the poor 1965 fall rice crop canceled out this surplus, giving about an average harvest. The spring rice crop normally makes up about one-third of the annual harvest and the fall crop most of the remainder.

** Information on salt water fish catch in North Vietnam is limited. It is estimated that the three southern provinces are responsible for about one-third of the annual catch and that about one-third of this is caught offshore where most of the loss occurred. This suggests that the total salt water fish catch was down by about 10 percent. If the fish were valued at 1.50 dong per kilo -- a price that is between the wholesale and retail price of the various kinds of fish -- this loss would amount to $4 million.

Table B4

Railroad Yards Attacked Under the Rolling Thunder Program
1965 and January-September 1966

JCS Target Number	Name	Dates of Attack	Damage	Cost of Restoration (Thousand US $)
21.1	Vinh Classification Yard N.W.	26, 27 May 65 1 Jun 65	Main line interdicted in four places; four sidings interdicted	
	Nam Dinh Yard	2, 4 Aug 65	Damage to switching wye, rail sidings, tracks, and buildings	70
	Yen Bai Yard	11, 13, 14 Jul 65	Damage to rolling stock; lines interdicted in numerous places	
	Subtotal for 1965			70
21.1	Vinh Classification Yard N.W.	18 Feb 66 4, 24 Apr 66 1, 22 May 66 9 Jul 66	75 percent of capacity destroyed as of September 1966	
21.11	Thai Nguyen	29 Apr 66 5, 8, 22 May 66 10 Jun 66 2 Aug 66	20 percent of capacity destroyed as of September 1966	400
	Yen Bai Yard	23 Apr 66	Cratered	
	Thanh Hoa Yard	12, 19 May 66 1, 23 Jun 66 22 Jul 66 18 Aug 66	Cratered	
	Subtotal for 1966			400
	Total			470

The air campaign over Laos shows similar emphasis on the attempted interdiction of the infiltration network into South Vietnam. Attack sorties flown under the Barrel Roll and Steel Tiger programs increased from 11,000 sorties in 1965 to about 38,000 during the first nine months of 1966. Ninety-five percent of the attack sorties flown in Laos in 1966 were on armed reconnaissance missions.

The major measurable effects on North Vietnam of Rolling Thunder attacks are:

(1) About 20 percent, or 70,000, of the total military forces are engaged directly in defensive programs and countermeasures against the Rolling Thunder program. About 220,000 full-time and 100,000 part-time workers have been diverted to repair, reconstruction, and dispersal programs in North Vietnam and Laos. In 1965 and 1966, from 25,000 to 30,000 persons are tentatively estimated to have been casualties of air attacks in the North.

(2) Physical damage to economic and military targets has also increased. This damage amounted to $69 million in 1965 and an additional $100 million in the first nine months of 1966. Of the latter total, more than 70 percent represented damage to economic targets.

Despite the increased weight of air attack, North Vietnam continues to increase its support to the insurgency in South Vietnam. The Rolling Thunder program has not been able to prevent about a threefold increase in the level of personnel infiltration in 1966. The external logistic support needed to maintain the expanded Viet Cong/North Vietnamese force in South Vietnam has been adequate. In particular, despite the neutralization of the major petroleum storage facilities in the North, petroleum supplies have continued to be imported in needed amounts.

The interdiction campaign against the logistics target system has created burdens and added to the cost of supporting the Communist forces in South Vietnam, but these strains have been within acceptable limits. If the interdiction campaign is to maximize the costs to the enemy and reduce his capability to recuperate, it must

Table E8

Total Bridges Damaged or Destroyed and Types of Countermeasures
Used on Transportation Routes in North Vietnam
1965 - 30 September 1966

	Road	Rail
Total bridges damaged or destroyed (confirmed by aerial photography)	276	83
Total of all types of alternate crossings	391	121
Original bridge repaired	104	79
Alternate temporary bridge	49	23
Culverts	36	0
Fords	125	7
Ferries	21	4
Pontoon bridges	13	4
Cable bridges	38	4
Decoy bridges	5	0

2. Costs of Bridge Destruction

An analysis of the relative costs to the North Vietnamese of various means of replacing destroyed bridges helps to explain why they have resorted to temporary bridges and bypasses rather than attempt more permanent repairs. The estimated cost for permanent replacement of all damaged or destroyed bridges totals $17.3 million, up to $6.8 million since 1 January 1966 (see Figure E1). It is estimated that it has cost the North Vietnamese $2.5 million to date to temporarily repair about 180 bridges and to provide bypasses for the remainder. This is only 14 percent of the cost of permanently replacing all the destroyed bridges. It would cost an additional $1.1 million to temporarily restore the remaining unrepaired bridges. The total labor input required to complete temporary repairs to all bridges is estimated to be 153,000 man-days (see Figure E2). It is estimated that the North Vietnamese have actually expended 62,000 man-days on bridge repairs to date, or 40 percent of requirements for temporary repairs of all damaged bridges.

45 of the targeted barracks have been attacked, with a loss of capacity for about 100,000 men. Other nontargeted barracks in outlying areas have been attacked by armed reconnaissance, but it is believed that the total capacity destroyed to date represents for the most part only excess or unused capacity. Most of the important barracks are located in the Hanoi-Haiphong complex and have not been attacked. The military strength in this area far exceeds that in outlying areas already struck. The order of battle strength of the North Vietnamese army is currently estimated at slightly over 300,000. Thus North Vietnam has sufficient capacity remaining to house the military forces.

The lack of barracks capacity in the areas where the destruction took place is, however, undoubtedly causing much inconvenience. Most of the barracks attacked are located in the southern part of the country, along the border of Laos, and in the northwestern provinces. These areas are particularly significant for infiltration of South Vietnam and military operations in Laos. Barracks in these areas have not been repaired. Apparently, troops are being quartered with civilians in nearby towns, in tents, and in other makeshift shelters in surrounding areas.

2. Airfields

Very little change has occurred in North Vietnam's airfield capability as a result of attacks on airfields during 1966 (see Table B7). North Vietnam has 23 airfields, of which 11 are targeted and considered to have economic and military significance. Four of the targeted fields were attacked in 1965, resulting in the destruction of about 20 percent of the total targeted airfield capacity. Although each of the bombed airfields had facilities left standing, the runways were heavily cratered and the fields were unable to receive air traffic. During the first nine months of 1966, there were only two strikes against Dien Bien Phu Airfield, one of the four attacked in 1965. The attacks took place in February with only slight additional damage to the runway, which had not been repaired. It is estimated that restoration of this additional damage would cost only about $2,000, compared with a total of $380,000 in restoration costs estimated for attacks on airfields during 1965. Recent observation of the Dien Bien Phu Airfield revealed that a portion of the runway is serviceable for light aircraft.

The damage inflicted on airfields thus has continued to have only limited secondary military and economic effects. Air transport and passenger service is virtually nonexistent in North Vietnam.

Table G1

Photographic Analysis of Major Manufacturing Plants in North Vietnam

Installation	Photography Compared	Remarks
Hanoi Machine Tool and Engineering Plant	18 Apr-23 Sep 1966	Plant has remained relatively unchanged. No apparent change in level of output.
Hanoi Rubber Products Plant	18 Apr-23 Sep 1966	No noticeable change in activity or facilities, but no positive indicators such as products, steam, smoke or vehicular traffic.
Hanoi Vehicle Repair and Assembly Plant	18 Apr-23 Sep 1966	Seventy vehicles noted in April compared with 20 in September, also less track activity in September. Apparent drop in plant activity.
Haiphong Phosphate Fertilizer Plant	15 Aug-18 Sep 1966	No new construction, no smoke, vehicular or watercraft activity associated with plant was evident. Slight decrease in amount of materials in open storage. Apparent continuing low level of activity.
Haiphong Cement Plant	Sep 1965 - Sep 1966	No new construction during period. Smoke evident from kiln. Approximately same number of barges at mooring areas. No change in level of production.
Thai Nguyen Iron and Steel Combine	3 Mar-1 Aug 1966	Stores of coal, iron ore and limestone at the same level. Eighty-two pieces of rolling stock, including 2 locomotives, counted in August. Railroad yard and 2 warehouses sustained bomb damage. Two blast furnaces in open operation in August compared to 3 in March.

US air attacks proved that Washington was not at all interested in a peaceful settlement.

During a speech on 1 July before the graduates of Soviet military academies, Soviet Party Chief Brezhnev said, "Our assistance to Vietnam will keep growing."

Brezhnev could hardly have responded with less forcefulness, and his comment was in conformity with the restrained and essentially pro forma, overall Soviet response. At the same time, the USSR was indicating its intention to continue its own contacts with the West on several other important issues. Moscow's cancellation of Soviet participation in the dual track meet in California was only a nominal gesture of protest. The USSR has turned to such well-advertised areas of US-Soviet relations as cultural exchanges in order to register its disapproval of US policy. Moscow, however, has avoided some provocative moves it might have made, and has demonstrated a determination to keep lines open to the West and to keep Soviet-US relations from falling into a state of complete disrepair.

No major changes in the main lines of Soviet policy in Vietnam, as it has evolved over the past two years, are expected in the near future. Even in the event the war is further escalated, the USSR, while providing military and economic aid to Hanoi, will almost certainly continue to avoid steps which could lead to a direct military confrontation with the United States, unless and until it considers its own security or national interest directly and seriously threatened.

strikes not on JCS fixed targets accounted for 97 percent of total ordnance delivered in 1966, compared with 63 percent in 1965. This change was a continuation of a trend already under way in late 1965, when, in comparison with previous levels, the attack on fixed targets represented a rapidly declining share of the total attack on North Vietnam. The decline undoubtedly reflects the diminishing number of potentially fruitful new fixed targets for which strikes were authorized, broadened authorization for armed reconnaissance, and, at least in part, a change in definitions used in bookkeeping.

The average ordnance load per attack sortie against North Vietnam during the first nine months of 1966 was a little more than 1.5 tons per sortie, a slight increase over the 1.3 tons per sortie averaged in 1965. *

C. Losses

A total of 249 aircraft and 208 men were lost in the air attack on North Vietnam during January-September 1966. An additional 131 men were lost but recovered. Losses by service are compared for 1966 and 1965 in Table A15. In both 1965 and 1966, the service that flew the largest number of sorties lost the largest number of planes. In 1965, this was the US Navy, and in 1966, the US Air Force. Total losses are related to attack sorties in the following tabulation. The average number of aircraft lost per 1,000 attack sorties dropped from about 6.6 in 1965 to a little less than 4.2 in 1966, ** as shown in the following tabulation:

Year	Total Attack Sorties	Total Losses	Losses as a Percent of Total Attack Sorties
1965	25,940	171	0.66
1966	59,500	249	0.42

* For details on ordnance delivered on North Vietnam in 1966, by month, program, and delivering service, see Tables A13 and A14 and Figure A8.

** Calculated on the basis of total losses -- combat and operational. The rate for combat losses only is 3.7 aircraft per 1,000 attack sorties.

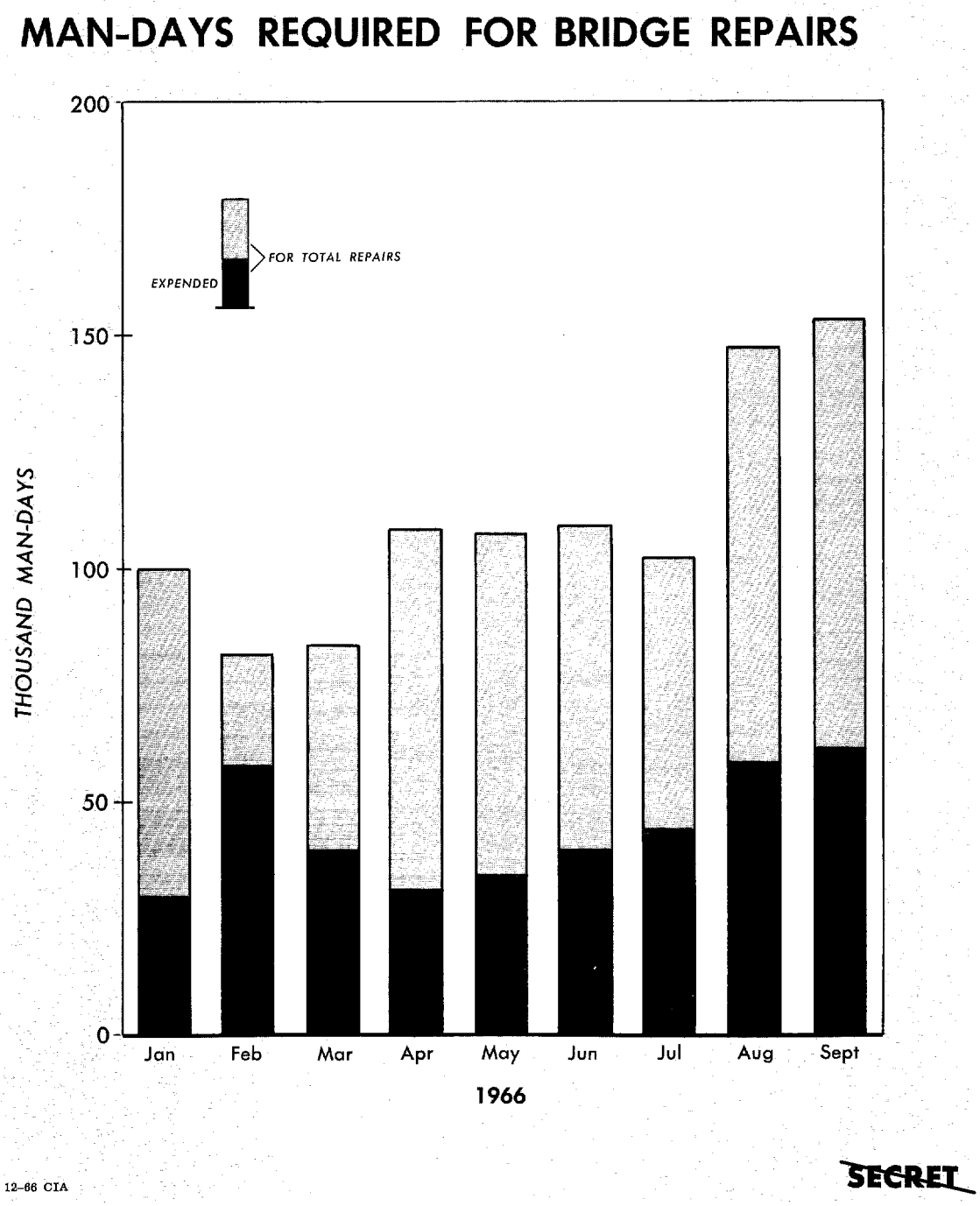


Figure E-1. North Vietnam: Man-Days Required for Total Bridge Repairs and Man-Days Actually Expended, by Month, January-September 1966

current account debt, the deficits probably are being refinanced as long-term credits or are written off as grant aid. This decision probably is reflected in the spate of Communist agreements to provide "nonrefundable" aid -- that is, aid to cover past and future trade deficits. An agreement with the USSR in December 1965 provides for a credit to cover the 1965 trade deficit.

Not all of North Vietnam's trade deficit reflects current account indebtedness. Imports under long-term economic aid credits also are included in the trade statistics but usually cannot be specifically identified. Soviet foreign trade data does provide a minimum estimate in the complete plant category (see Table D4). These Soviet exports usually move under long-term credits. This category has accounted for about 40 percent of North Vietnam's imports from the USSR since 1962. Grant aid, however, is not included in Soviet statistics, implying that the level of North Vietnam's imports from the Communist countries is higher than that reflected in published trade data.

III. Military Assistance

Although Communist deliveries of military equipment to North Vietnam cannot be quantified precisely, it is estimated that between 1952 and October 1966 these deliveries totaled more than $610 million (see Table D5*). Approximately three-fourths of the total provided has come from the Soviet Union and the balance from Communist China. The contribution of other Communist countries has been negligible. More than three-fourths of Communist military assistance to North Vietnam has been delivered since the end of 1964.

A. Soviet Military Aid

Nearly 85 percent (about $385 million) of Soviet aid has been delivered to North Vietnam since the end of 1964. Between 1953 and 1964 Soviet assistance consisted largely of artillery, small arms, ammunition, about 75 aircraft (largely trainer and transport aircraft), and 20 small naval craft (see Table D6). Such aid totaled about $25 million in 1964.

In 1965 the character of Soviet aid changed drastically as the emphasis shifted to the rapid development of an air defense network. The magnitude of Soviet assistance jumped sharply-- rising

* Additional extensions of military aid used in military infrastructure projects were made during the period.

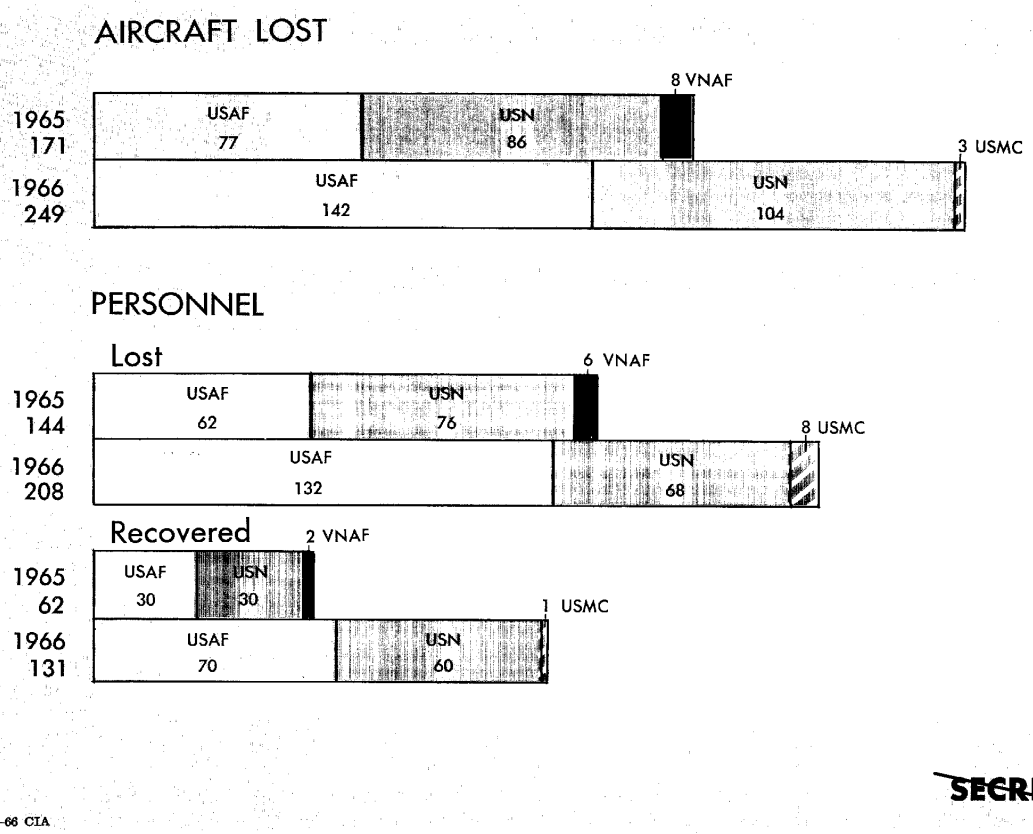


Figure A-5. Statistical Summary of Aircraft Lost and Personnel Lost and Recovered in North Vietnam, 1965 and January-September 1966

APPENDIX A

AIR OPERATIONS IN SOUTHEAST ASIA
1 JANUARY 1965 - 30 SEPTEMBER 1966

I. All Areas of Operation in Southeast Asia

During the first nine months of 1966, US/GVN forces flew nearly 315,000 sorties and delivered about 350,000 tons of ordnance on all areas of operation in Southeast Asia. US aircraft flew 92 percent of the sorties and carried 93 percent of the ordnance.* About 70 percent of the sorties were attack sorties** and 30 percent were support sorties, approximately the same proportion that prevailed during 1965.*** The ratio of attack sorties to support sorties did not, however, remain constant for the various individual areas of attack. In North Vietnam, attack sorties rose from 47 percent of total sorties in 1965 to 56 percent in 1966, whereas in South Vietnam attack sorties represented a smaller percentage of total sorties in 1966 than in 1965. The percentages of attack and support sorties in each area are shown in the following tabulation:

	North Vietnam		South Vietnam		Laos		All Areas of Operation in Southeast Asia	
Year	Attack Sorties	Support Sorties	Attack Sorties	Support Sorties	Attack Sorties	Support Sorties	Attack Sorties	Support Sorties
1965	47	53	85 a/	15 a/	68	32	70 a/	30 a/
1966	56	44	77 a/	23 a/	67	33	70	30
1966			80 b/	20 b/				

a. US sorties only. Distribution of sorties by South Vietnamese Air Force in 1965 is not available.
b. All US/GVN sorties.

* For a summary of sorties and ordnance delivered on all areas of operation in Southeast Asia, by delivering service, see Table A1.

** Including strike and flak suppression sorties, and sorties in close air support of ground operations, plus the major carriers of ordnance.

*** A monthly distribution of sorties over all areas of operation in Southeast Asia, by mission and nationality, during 1965 and the first nine months of 1966 is presented in Table A2.

A. Economic

1. Petroleum Storage

On 1 January 1965 there were 13 fixed (JCS) petroleum storage targets with a combined storage capacity of almost 128,000 tons.* During 1965, nine airstrikes were made against four of these fixed targets -- three were completely destroyed and the facility at Vinh, which was damaged during the limited retaliation following the Gulf of Tonkin incidents in 1964,** suffered further damage. About 26,000 tons of capacity -- about 20 percent of the total capacity on 1 January 1965 -- was destroyed in these attacks. The value of the tankage and contents and the related support facilities destroyed is estimated at $1.6 million.

During the first nine months of 1966, 57 airstrikes were mounted against eight of the fixed petroleum storage targets. About 73,000 tons of capacity -- 56 percent of the total existing on 1 January 1965 (72 percent of the total on 1 January 1966) -- were destroyed. The value of the tankage and contents and the related support facilities destroyed is estimated at between $4.4 million and $5 million (see Table B1).***

The total residual capacity at the nine fixed petroleum storage targets remaining on 30 September 1966 was about 29,000 tons, no single site having sufficient capacity to accept the cargo of a fully loaded 10,000-ton tanker. There was no indication that any of the attacked sites was being restored or reconstructed as of 30 September 1966. Recent photography revealed that cannibalization of moderately damaged tanks at Haiphong was under way.

In addition to the capacity of the JCS targeted facilities, the North Vietnamese since 1 January 1965 have developed additional capacity in dispersed tank sites. By 30 September 1966, more than

* There was additional tankage of about 5,400 tons which existed on 1 January 1965 but which was subsequently removed, but the present whereabouts of this tankage is unknown. This tankage was not affected by bombings, is not now carried as usable capacity, and therefore is excluded from all calculations.

** The capacity of the tankage destroyed at Vinh in 1964 -- about 4,000 tons -- is not included in the total capacity shown for 1 January 1965.

*** The range in value is necessary to reflect the possible range in the amount of petroleum in the tankage that was damaged (or destroyed).

Page

coal mining areas could, however, be imported by lightering. Truck transport from the port area to the main transport network probably would not be used for either coal exports or the movement of imports away from the port. Both ports are connected by route 18 with the main road network and thereby to Hanoi and Haiphong but have no connections to the main rail network. The capacity of route 18 is limited to 90 tons a day during the rainy season because it traverses low-lying terrain that is subject to inundation, and even during the dry season it can handle only 550 tons a day. Furthermore, if route 18 were used for truck traffic carrying supplies from Communist China to Hanoi or Haiphong, traffic from Cam Pha and Hon Gai would have to share route 18 with this traffic.

2. Maintaining the Flow of Petroleum

Whether or not mining is employed, maintenance of the flow of petroleum into and within North Vietnam is difficult and, in the long run, will be costly in terms of money, material, and labor as a result of the recent bombings. There is now no single petroleum storage terminal in North Vietnam, at tidewater or elsewhere, with sufficient capacity to accept the entire cargo of a fully loaded ocean-going tanker. As of 1 November 1966, the petroleum terminal at Haiphong had capacity remaining to store only an estimated 4,330 tons of petroleum out of a prestrike capacity of 40,620 tons. Even this small remaining capacity probably is not now usable, because of the damage to or destruction of such related essential fixtures as pumps, piping, and loading facilities for tank cars and tank trucks. In any event, no tankers have attempted to use the petroleum terminal. Tankers have been offloaded into barges or have been diverted to China from where North Vietnam has received petroleum by rail.

When pumps, piping, and minimum essential fixtures within the Haiphong terminal are replaced or restored, the facility probably could accept bulk deliveries of petroleum from tankers on a limited scale into the few remaining storage tanks for further movement through the tanks into rail tank cars or tank trucks. Using such expedients would result in long delays in the discharge of tankers.

If tankers were continued to be denied direct access to the Haiphong terminal, there are several possible alternatives that could be used or developed to continue imports of petroleum in bulk by sea.

were already more than 40 percent higher than those of 1965. The primary Chinese contribution since 1964 has been that of providing small arms, trucks and vehicles, military technical assistance, and technicians and laborers for military-related construction activities. Between 25,000 and 45,000 Chinese support troops are believed to be in North Vietnam working on the construction, repair, and defense of transportation facilities. An unknown number of Chinese military personnel also are employed in the training of North Vietnamese troops.

against the ports and transshipment points. Dredging of waterways, an annual project for the North Vietnamese, apparently increased during 1966 in the south. There may have been as many as 14,000 laborers manually dredging canals between Thanh Hoa and Vinh from December 1965 to February 1966.

Airstrikes against watercraft apparently have been more important in hindering water shipments than strikes against cargo-handling facilities. The number of watercraft reported by pilots to be destroyed or damaged through September 1966 increased nearly five-fold over 1965 (see Table E4). The number of watercraft used in the southern area apparently has not decreased, however. Although sightings of watercraft are even less accurate as a measure of supplies moved than are truck sightings, they can provide some general measure of craft in use. The number of watercraft sighted during June-September 1966 increased about 130 percent over February-May 1966. When compared with the number of strike sorties flown, * the number of watercraft sighted per sortie has remained fairly constant during the last eight months. These data indicate that the number of watercraft in use in the southern area probably has not decreased significantly during 1966 in spite of the intensive attacks against them.

4. Enemy Activity in the Demilitarized Zone

Some indication of the activity of the enemy in the DMZ and the adjacent area in South Vietnam is given by the number of enemy battalions estimated by MACV to be in the South Vietnamese First Corps area. MACV estimated that in December 1965 there were 35 enemy battalions in the First Corps area, while in October 1966 this number had risen to 50, of which 35 were North Vietnamese Army. MACV further estimated that as of October 1966 the enemy's 324B Division and one regiment were located in or close to the DMZ.

* A ratio of sightings per sortie is less valid for watercraft than for trucks because trucks theoretically could be seen during almost all sorties, but many sorties, such as those originating in Thailand, could be accomplished without flying over significant lengths of navigable waterways.

Table A12

Distribution of Sorties over North Vietnam,
by Route Package a/
January-September 1966

Percent

Month	Route Package I	II	III	IV	V	VI	Unknown	Total
January	17	18	30	4	3		28	100
February	31	24	15	3	5		22	100
March	34	31	13	5	11		6	100
April	37	29	17	3	6	3	5	100
May	30	19	26	10	6	4	5	100
June	49	19	14	8	1	4	5	100
July	47	18	12	5	4	8	6	100
August	35	16	11	9	1	12	16	100
September	39	16	12	17	5	8	3	100
Nine-month average	39	19	15	9	4	7	7	100

a. North Vietnam is divided, for operations, into six geographic areas, known as Route Packages. For the location of Route Package areas, see Figure A7.

Table A25

Statistical Summary of Attacks on Petroleum Storage
in North Vietnam
1965 and January-September 1966

	1965	1966	Total
Number of JCS fixed targets	13	13	
JCS fixed targets struck	4	10	
Percent of national capacity destroyed	17	60	
Sorties			
Attack	130	340	470
Support	120	180	300
Total	250	520	770
Ordnance delivered (tons)	120	500	620
Aircraft lost	1	5	6
Personnel lost	0	2	2
Personnel recovered	1	1	1
Unknown	0	2	2
Cost to the United States (million $)			
Aircraft lost	1.3	8.20	9.50
Operational cost of sorties flown	0.3	0.85	1.15
Ordnance delivered	0.2	0.99	1.19
Total	1.8	10.04	11.84

Table G4

Major North Vietnamese Imports of Machinery
from the USSR, by Type
1964-65

	1964		1965	
	Value Thousand US$	Rank	Value Thousand US$	Rank
Total imports	25,352		48,031	
Complete enterprises	18,605	1	32,415	1
Spare parts for motor vehicles	1,913	2	2,926	2
Trucks	219	9	2,261	3
Power equipment, including marine diesels, and diesel-electric power plants	389	5	1,329	4
Excavators, road building equipment	294	8	861	5
Spare parts for tractors	363	6	851	6
Ships and marine equipment	542	4	788	7
Bearings	611	3	749	8
Hoisting and conveyor equipment	192	11	554	9
Electrical engineering equipment	202	10	513	10
Passenger cars	114	13	476	11
Metalcutting machine tools	301	7	460	12
Mining equipment	78	16	411	13
Oil well drilling equipment	91	15	374	14
Pumps and compressors	33	19	341	15
Cranes	129	12	336	16
Truck cranes	67		261	
Medical equipment and instruments	60	17	254	17
Instruments	101	14	249	18
Winches			147	19
Hoisting equipment	49	18	68	20

is believed to have been passable most of the time. However, there were no reports for this route in the rainy season until 5 September, and a total of only 13 trucks were reported moving south in that month. In October, reports for 14 days gave an average of seven trucks a day moving south over Route 912.

II. Communist Countermeasures to the Interdiction Campaign

A. Countermeasures in North Vietnam

The principal logistical goals of the Communists since the start of the Rolling Thunder program have been to maintain and even to increase support to the Communist forces in South Vietnam and Laos. The Communists have successfully countered the effects of bomb damage to transportation routes and simultaneously have expanded their capability to move supplies by means of a comprehensive program of rapid repair, construction of alternate river crossings, and new routes. Their intense efforts and willingness to use relatively primitive means for repairs and movement of supplies have provided them with not only a greater choice of route options during 1966 but also a capability to continue supply operations during the monsoons.

North Vietnamese ability to repair railroad bridges on important lines has been significantly enhanced by the introduction of Chinese Communist railroad construction troops. The development of extensive alternate crossings to destroyed highway bridges and the construction of significant additional mileage to the road system have increased the capability to provide uninterrupted movement of supplies over the transportation system. New road and railroad mileage completed since the start of the bombing to 30 September 1966 amounts to 680 miles (see Table E7).

More than half of the new road construction in North Vietnam has taken place south of Hanoi where the military supply activity is greatest and the bombing has been most intensive. Inland road construction designed to bypass up to 200 miles of coastal Route 1A, which in many places is vulnerable to naval shelling, will be completed in December 1966. Route 137, completed in April 1966, provides an additional motorable border crossing in Laos 35 miles south of Mu Gia Pass. Its importance as a route to the south was further emphasized by the continued maintenance of this route during the Laotian rainy season. Improvements to Routes 15 and 101 also have been completed since the start of the bombings. Other road construction in North Vietnam has been part of a long-range improvement program in transportation, with emphasis on border crossings to China and roads northwest of Hanoi.

I. The Far East

There is considerable popular and official support in the Far East for US policy in Vietnam. The majority of government leaders are fearful of Chinese Communist aggression and are convinced that US defense of South Vietnam is essential to preserve freedom in the area. In general, support for US policy extends to approval or acquiescence in the US bombing of North Vietnam. Since the inception of the raids, there have been only minor changes in official and popular attitudes in the Far East toward the air attacks. Those that disapproved, remain opposed; those who approved, still do, although in some cases more reluctantly than before. Among the countries that generally support the United States on the air attacks are Australia, Malaya, New Zealand, Japan, Thailand, South Korea, and Taiwan.

In some of the countries which officially oppose the attacks, there is an underlying ambivalence in attitudes on the war that has tended to dampen active opposition to the raids. This can be seen, for example, in Indonesia where there is a deep distrust of policies identified with imperialism, but also a strong anti-Communist and anti-Chinese sentiment. Some Indonesian military officers and some key civilian leaders have quietly let the United States know that Djakarta understands and supports the US position but is likely to hedge its public statements because of strong popular opposition. There is widespread sympathy for Hanoi in its fight to gain "independence" of the West.

Significant opposition in the Far East to the US air attacks has also come from Cambodia and, to a lesser extent, from Burma, where there is official understanding of the US position, but considerable popular disapproval.

It is clear that the persistent indications of US willingness to end the air raids if the Vietnamese Communists take reciprocal action have helped maintain popular and official support for the United States throughout much of the Far East. Overall support in the Far East has, in fact, increased in the wake of the US peace efforts made since late 1965. This change can be readily seen in Japan, where the development of popular and official attitudes on the air raids has been fairly typical of independent Asian opinion.

The Japanese Government has approved of American efforts to hold the line in Southeast Asia since the initial US involvement in the Vietnam war. However, negative attitudes on the war among the

6. Maritime Ports

Six North Vietnamese ports representing 88 percent of the country's total maritime cargo-handling capacity have been selected as JCS targets. Under the Rolling Thunder program for the first nine months of 1966, the port of Ben Thuy was restruck twice and Cam Pha port was attacked for the first time. Approximately 60 percent of the cargo-handling capacity at Ben Thuy was destroyed as a result of the attacks in 1965 and 1966 and approximately 20 percent at Cam Pha. In 1965 the only other JCS-targeted port attacked was Ham Rong, a minor port near Thanh Hoa. Damage to port facilities from 1966 strikes will cost about $570,000 to restore, compared with about $660,000 from 1965 strikes (see Table B5).

The impact of this damage in itself on North Vietnam's economy is not significant, but significant export losses have resulted. Ben Thuy represents only 4 percent of the nation's maritime cargo-handling capacity and Ham Rong only 1 percent. Both serve the southern provinces, which are largely rural. While Cam Pha is a major North Vietnamese port, representing 16 percent of the country's maritime cargo capacity, the $160,000 damage against it is nominal. During the attack against it, however, the coal-washing machinery and the rail facilities were also hit. The damage to these facilities has already resulted in a coal export loss of about $3.7 million.

Haiphong and Hon Gai, the two other most important ports, have not been subjected to attack. The Haiphong port complex represents 50 percent of the country's maritime port capacity and handles most of the import and export trade. Hon Gai, representing 16 percent of national cargo-handling capacity, handles primarily coal exports. These ports, representing 66 percent of the nation's cargo-handling capacity, are the only other significant deepwater ports in addition to Cam Pha in North Vietnam.

The cost of restoring the petroleum terminal at Haiphong -- damaged during the airstrikes against petroleum bulk storage -- is included in the cost of replacing the support facilities to the Haiphong petroleum installation (see 1, above).

all-weather capability to move supplies. During 1966, light truck traffic continued to move into Laos in every month of the rainy season, whereas no truck traffic was reported moving into the Laotian Panhandle during the 1965 rainy season. Although through truck traffic to the South Vietnamese border was not possible during the 1966 rainy season, the North Vietnamese apparently retained a capability of moving some supplies to South Vietnam through a combination of trucking and porterage.

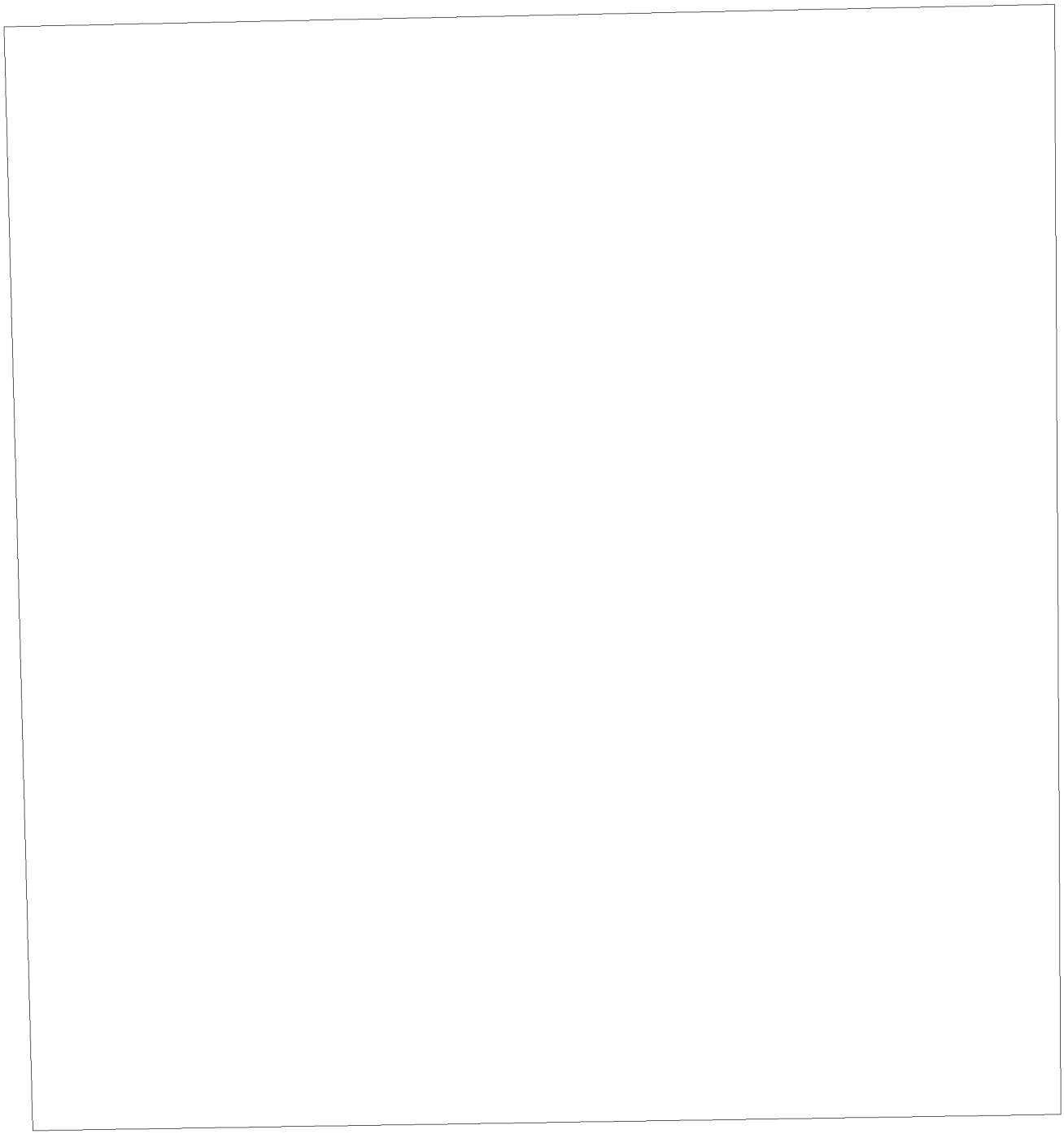
2. Countermeasures

The success of the Communists in countering the intensive interdiction program is explained by two factors. The first is that although the transport system on which the attack is concentrated is rudimentary, it is also highly diversified and required to carry only small volumes of traffic. It, therefore, offers few lucrative targets for the interdicting force to attack. The second reason is the success the Communists have had in implementing countermeasures.

The Communists have successfully countered the effects of bomb damage to their transportation network and, by improvisations and intensive construction activity, have been able to increase the capacity of the transport system. By December 1966 over 200 miles of bypasses will have been constructed around the heavily interdicted Route 1A in southern North Vietnam. Construction and improvement of the road network since the start of the Rolling Thunder Program has totaled almost 1,200 miles. Over 200 miles of rail construction and improvement has also been completed. The conversion of the rail line from Kep - Dong Dang to dual gauge probably has been completed, and the dual line should be operational by December 1966. During the past dry season the Communist-held road network in the Laos Panhandle has been tripled.

Improvisation techniques are best illustrated by the use of new bridging techniques. Although 359 bridges have been damaged or destroyed in North Vietnam, the North Vietnamese have been able to put in place more than 500 alternate crossings, ranging from culverts and ferries to cable bridges.

Only 183 of the damaged bridges have been permanently repaired at a cost of $2.5 million, compared with an estimated cost of $17.3 million if all damaged or destroyed bridges had been permanently repaired.



Following Page

Illustrations

APPENDIX C

SELECTED THIRD COUNTRY ATTITUDES TOWARD THE BOMBING OF NORTH VIETNAM

There has been a wide variety of popular and official reactions in the Free World to the bombing of North Vietnam. A study of selected Free World countries indicates, on the one hand, that there is considerable support for the US action. Most important in producing this support has been the fear of further Communist aggression should the United States fail in its defense of South Vietnam. There also appears to be more popular and official backing in countries which are partially or wholly dependent on the United States for economic and/or military assistance.

There is very strong popular opposition to US policy on Vietnam, including the bombing of the north, in some of the major neutral nations and countries allied with the United States. This opposition, which stems primarily from fear that the war will escalate into a worldwide conflict, or from the view that the United States is guilty of "aggression" against a weaker, Asian state, has definitely limited official support for US policy in some countries. In a few instances, there has been a definite growth in popular opposition as the US air war escalated. In most cases, however, popular and official attitudes have remained relatively static since the start of the sustained air attacks, or else the opposition to the raids has tended to moderate.

The moderation has resulted from several factors. For one thing, the populace in some countries has tended to become inured to the war and has lost interest in the actions of both sides. There has also been a demonstrable return from the indications of US willingness to end the bombing if the other side will take reciprocal de-escalatory action. The intransigence of the Vietnamese Communists in the face of US bombing pauses has definitely cost them some Free World support.

A major escalation of the air war in the future, especially if accompanied by substantial civilian casualties, is likely to produce a significant intensification of opposition to the bombing in some countries. Stronger denunciations of the United States, independent action in the United Nations, and other political protest activities might be forthcoming. It is unlikely, however, that any Free World country

export coal from North Vietnamese mines to the rail system might mean that this movement would be forgone. If US air strikes against the rail network continue at the level achieved thus far in 1966, North Vietnam should have no difficulty in maintaining both the current volume of imports and exports by land as well as the imports normally received by sea. Although the volume of foreign trade traffic on the Dong Dang rail line increased by about 30 percent in 1965, it is estimated that this line, even when carrying transit traffic, was used at less than 50 percent of its normal capacity of 3,000 tons each way per day. In spite of the air strikes the North Vietnamese with Chinese help have been able to maintain the line at its normal capacity.

The Hanoi-Lao Cai rail line was effectively disrupted for through service during the second half of 1965 and for most of 1966. Interdiction of this line disrupted the export of apatite by rail to China and through the port of Haiphong to other countries, and ended the movement of Chinese transit traffic to and from Yunnan Province. There are indications, however, that the North Vietnamese may have begun to ship apatite from Lao Cai through Yunnan to the rest of China over the new K'un-ming - Kuei-yang railroad, which was opened to traffic during the first part of 1966. Thus North Vietnam now has a second rail line to China which can be used for imports and exports. Chinese goods to and from Yunnan now move over the Chinese rail line rather than through North Vietnam, so that some railroad cars formerly used for this traffic are now available for other purposes.

As of 1 October 1966, North Vietnam had about 1,100 freight cars, including an estimated 200 tank cars. Some meter-gauge freight cars, including about 150 tank cars, can also be obtained from Communist China, since Yunnan Province has some railroads of the same gauge as Vietnam. Although the estimates of capacities and of the actual traffic carried on the North Vietnamese rail lines may be subject to large margins of error, ample excess capacity is estimated to be available on the railroad lines to carry any tonnage that might be diverted to them by mining of the approaches to the port of Haiphong.

Although road transport has not been used for a significant quantity of North Vietnamese foreign trade, it is available as an alternative to sea transport. The North Vietnamese have shown considerable ability to maintain motor transport operations in spite of the air strikes delivered thus far. The approximately 11,500 trucks in the North Vietnamese civilian and military truck parks would probably be sufficient to move over the roads that import and export tonnage which for various reasons might not be handled by rail movement.

Table A10

Sorties Against North Vietnam, by Program and by Service
1965 and January-September 1966

Year and Month	On Fixed Targets (1) Total on Fixed Targets (Col. 2 & 3)	On Fixed Targets (2) By Fixed Target Strikes	On Armed Reconnaissance (3) By Armed Reconnaissance Strikes	On Armed Reconnaissance (4) Armed Reconnaissance Not on Fixed Targets	On Armed Reconnaissance (5) Total on Armed Reconnaissance (Col. 3 & 4)	(6) Total (Col. 1 & 4)	Services (7) United States Air Force	Services (8) United States Navy	Services (9) United States Marine	Services (10) South Vietnamese Air Force
1965										
January	0	0	0	0	0	0	0	0	0	0
February	0	0	0	260	260	260	80	120	N.A.	60
March	850	850	0	40	40	890	360	410	N.A.	120
April	1,800	1,460	340	1,170	1,510	2,970	1,200	1,660	N.A.	110
May	1,790	1,300	490	2,550	3,040	4,340	2,280	1,940	N.A.	120
June	1,410	1,360	50	2,530	2,580	3,940	1,840	2,000	N.A.	100
July	1,910	1,590	320	4,290	4,610	6,200	2,380	3,600	140	80
August	1,900	1,390	510	5,350	5,860	7,250	3,030	4,030	150	40
September	1,600	1,440	160	6,640	6,800	8,240	3,890	4,160	170	20
October	770	570	200	7,250	7,450	8,020	3,480	4,370	160	10
November	1,040	570	470	6,270	6,740	7,310	3,330	3,830	140	10
December	820	530	290	4,970	5,260	5,790	2,630	2,980	130	50
Total	13,890	11,060	2,830	41,320 a/	44,150 a/	55,210 a/	24,500	29,100	890	720
1966										
January	0	0	0	3,020	3,020	3,020	1,570	1,220	230	0
February	170	0	170	6,350	6,520	6,520	3,190	3,160	170	0
March	180	0	180	9,260	9,440	9,440	4,600	4,630	190	20
April	390	50	340	10,150	10,490	10,540	4,850	5,410	140	140
May	160	0	160	8,560	8,720	8,720	4,060	4,420	130	110
June	320	240	80	12,900	12,980	13,220	7,340	5,420	190	270
July	360	50	310	16,080	16,390	16,440	9,520	6,100	580	240
August	280	20	260	18,560	18,820	18,840	9,660	8,120	1,040	20
September	150	0	150	19,080	19,230	19,230	10,110	8,090	1,020	10
Total	2,010	360	1,650	103,960	105,610	105,970	54,900	46,570	3,690	810

a. Also including 645 miscellaneous sorties such as leaflet drops, gift drops, and photoreconnaissance sorties not accompanying a strike mission.

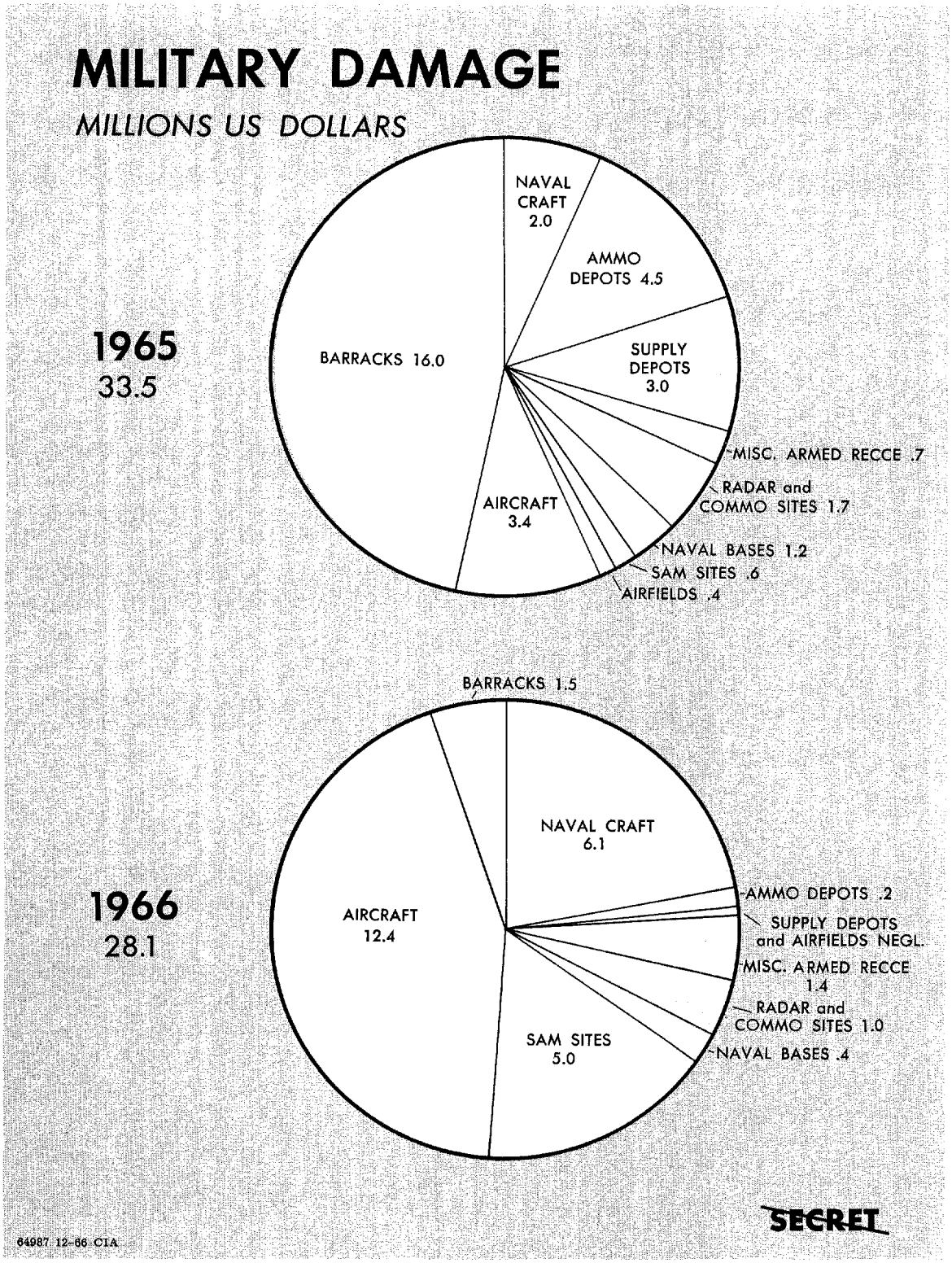


Figure B-3. Value of Military Damage in North Vietnam, by Type, 1965 and January-September 1966

January-September 1966 resulted in interdiction for a total of about two months. Some supplies undoubtedly moved over this line during the periods of interdiction by means of shuttle service around destroyed bridges. The movement of such bulk items as coke and coking coal, which are difficult to offload onto trucks and back to freight cars, apparently was seriously curtailed. The movement of manufactured goods, including military supplies, however, probably was not.

Effective interdiction of the Dong Dang line requires that it be broken into such small segments that the cost and time involved in shuttling around interdictions becomes prohibitive. Furthermore, the number of airstrikes must be sufficient to keep the bridges continually interdicted. Otherwise, the unused capacity of the line is sufficient to allow increases in traffic when the line is open to compensate for the loss of traffic when the line is closed.

Strikes against the Kep - Thai Nguyen and Thai Nguyen - Hanoi lines also would be necessary to prevent their use as an alternate to the Dong Dang line between Kep and the Hanoi area. Strikes against the railroad yards at Hanoi and Yen Vien and the railroad repair shops at Gia Lam would complicate transport problems on the Dong Dang line as well as on the Hanoi - Lao Cai and Hanoi-Haiphong lines. In case of serious disruption to service on the Dong Dang line, traffic could be shifted through Yunnan Province in China to the Lao Cai line or through Haiphong Port to the Haiphong line.

B. The Hanoi - Lao Cai Rail Line

The Chinese can now move supplies by rail through Yunnan to North Vietnam by using the Lao Cai line. Extensive airstrikes against this line interdicted through rail service for a total of about five months in 1965 and a like amount in 1966. These strikes effectively curtailed the movement of almost all apatite for export through the port of Haiphong but did not halt the movement of manufactured goods by shuttle service over the southern portion of the line. Therefore, under current levels of interdiction, shuttle service probably could be used over most of the line for manufactured goods, including military supplies, if use of the Lao Cai line were required as an alternate for the Dong Dang line. To disrupt this shuttle service, the line would have to be struck more often and more extensively, especially north of Lang Bun and south of Viet Tri. There are a total of 76 bridges on the Lao Cai line with a length of at least 50 feet,

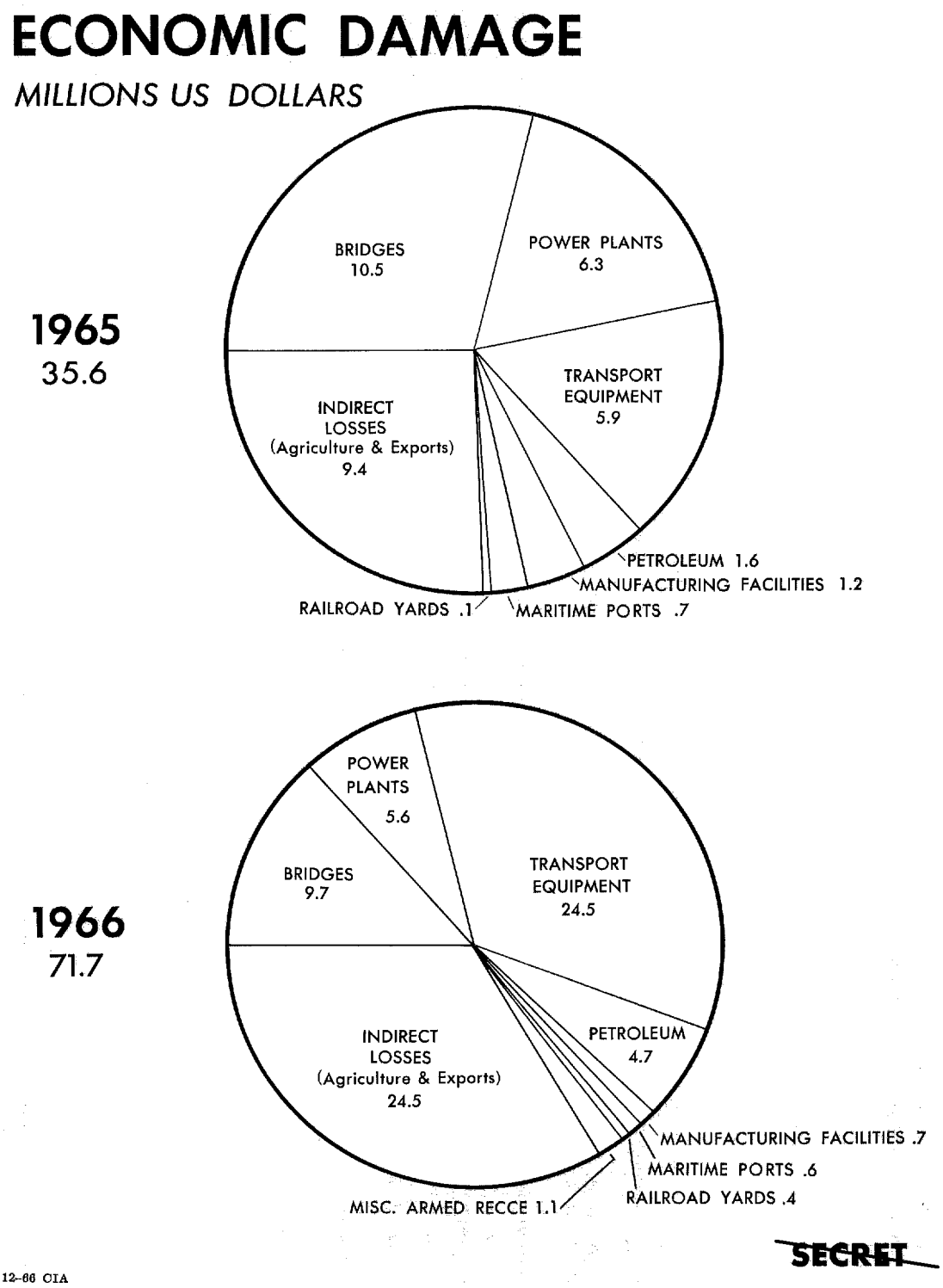


Figure B-2. Value of Economic Damage in North Vietnam, by Sector, 1965 and January-September 1966

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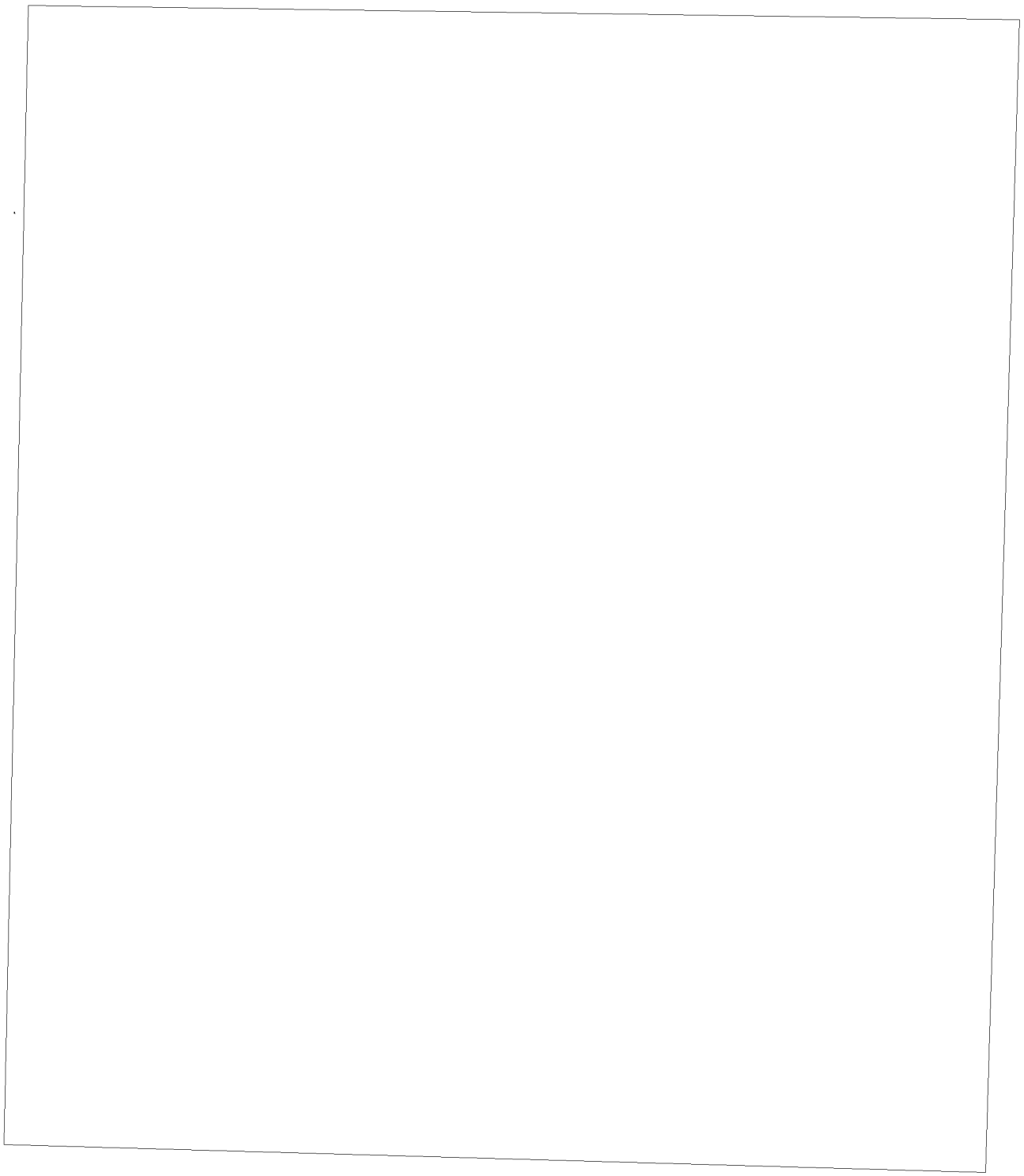
been no significant decrease in the number of watercraft in use during 1966 in spite of the considerable increase in the level of destruction.

2. Miscellaneous Targets of Armed Reconnaissance

During 1966 the number of sorties flown under the armed reconnaissance phase of the Rolling Thunder program increased to about three times the number flown in 1965. Armed reconnaissance sorties accounted for more than 99 percent of the total attack sorties flown in 1966, compared with about 75 percent of those flown in 1965. Most of the damage resulting from this program has been discussed under the major categories of targets. Pilot and bomb-damage assessment reports, however, have revealed a variety of miscellaneous targets which have been destroyed or damaged and which were not included in the major categories. These miscellaneous targets consist mainly of transport and military facilities. The inventory of these facilities as reported by pilots is given in Table B9. The number of such targets reported as destroyed or damaged in 1966 increased significantly over the 1965 level, especially in the case of transport facilities.

Because of the nature of air operations, it is difficult for pilots to provide a definitive evaluation of destruction or damage to targets. There is also some double counting in reporting. There is a tendency to overstate the amount of destruction or damage, but there is no rational basis currently available for deflating reports properly. In providing estimates of replacement cost, there is the further problem that the description of each target or target category is not precise. Costs can be based only on the destruction or an assumed level of damage to a typical target in each category. With these limitations in mind, the restoration costs of these miscellaneous targets have been computed. The cost of restoring or repairing the miscellaneous transport facilities attacked in 1966 is roughly estimated at about $1.1 million and the military facilities at about $1.4 million. Damage to all such miscellaneous targets in 1965 was estimated at about $700,000.



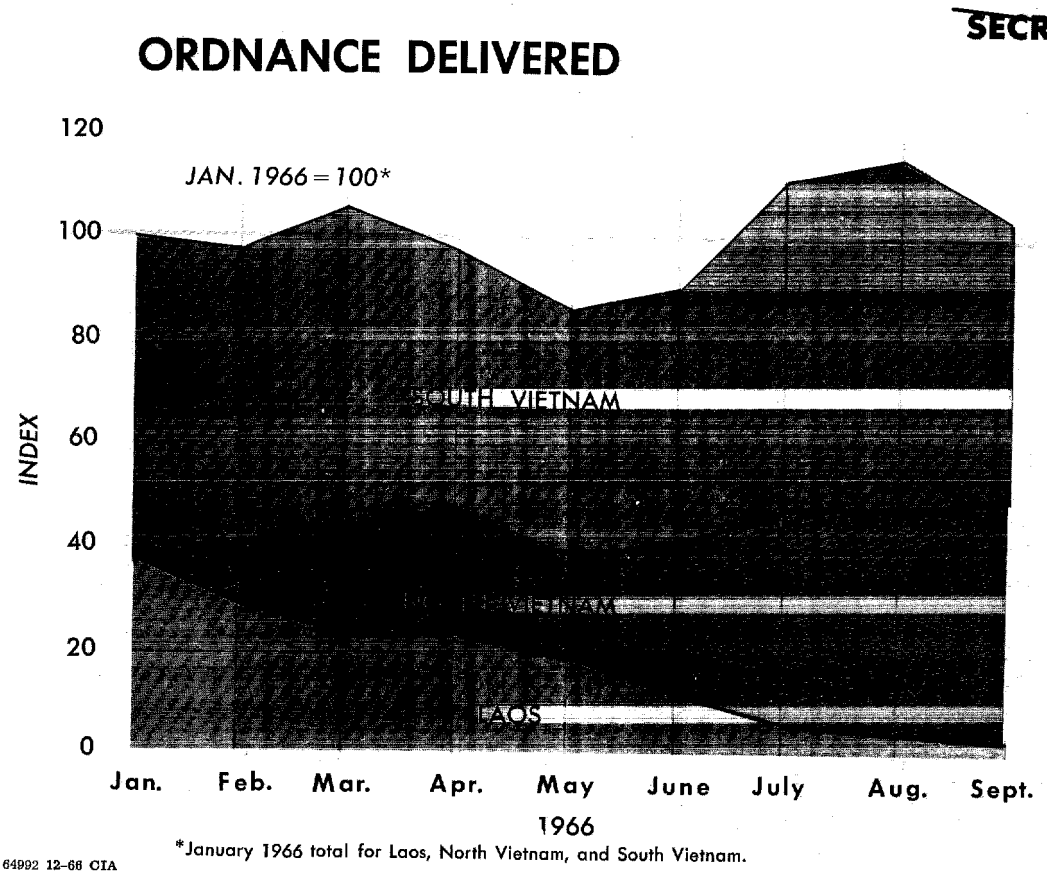


Figure A-2. Index of Ordnance Delivered in Southeast Asia and Relative Amounts in Each Area, January- September 1966

	Million US $	
	1965	January-September 1966
Aircraft lost	305.8	486.8
Operating cost	98.0	233.9
Ordnance	56.2	231.1
Total	460.0	951.8

The cost of air operations over North Vietnam was almost half of the total operating costs of more than $2 billion for all air operations in Southeast Asia during the nine-month period.

The measurable costs to North Vietnam for the reconstruction or repair of bomb-damaged facilities and other indirect losses attributable to the bombings from January-September was just under $100 million. Thus the cost of inflicting one dollar's worth of damage during 1966 may be estimated at more than $9.50, compared with about $6.70 in 1965. The cost of inflicting damage on North Vietnam in 1966 has increased by about 42 percent. The increase in cost per unit of damage is attributable essentially to the increasing costs of a greatly accelerated air interdiction program concentrated on low-yield target systems.

III. Effects of the Rolling Thunder Program

A. Physical Effects*

In spite of the significant increase -- 130 percent -- in the number of attack sorties in the air campaign during 1966, the yield, in terms of measurable damage to military and economic target systems, has not increased proportionately. A comparison of the total measurable damage for 1965 and the first nine months of 1966 is shown in the following tabulation:

	Million US $	
	1965	January-September 1966
Economic targets	35.6	71.7
Military targets	33.5	28.1
Total	69.1	99.8

* See Appendix B.

Table D7

Chinese Communist Military Aid to North Vietnam
1953 - October 1966

	1953 - October 1966		1965		January-October 1966	
	Quantity (Units)	Value (Million US $)	Quantity (Units)	Value (Million US $)	Quantity (Units)	Value (Million US $)
Total value		155.0		35.0		50.0
Aircraft	44	5.7	8	1.0	0	0
MIG-15/17 jet fighter	44	5.7	8	1.0	0	0
Naval craft	38	25.2	0	0	8	7.2
Swatow-class PGM	30	18.0	0	0	0	0
Shanghai-class PTF	8	7.2	0	0	8	7.2
Artillery	285	5.3	0	0	0	0
57-mm AAA	100	3.5	0	0	0	0
37-mm AAA	85	0.8	0	0	0	0
Other artillery	100	1.0	0	0	0	0
Radar	126	7.5	40	4.0	0	0
Trucks and vehicles	2,250	11.3	1,000	5.0	750	2.8
Small arms and infantry weapons		55.0		10.0		20.0
Ammunition		45.0		15.0		20.0

IV. The Six-Nation Survey

There have been very few comprehensive or comparable samplings of popular opinion abroad toward US policy on Vietnam. Specific samplings of opinion on the bombing of North Vietnam are nonexistent. However, a recent poll by affiliates of the Gallup organization abroad provided some interesting overall statistical data. Responses were as follows in Canada, Australia, France, West Germany, and Great Britain on whether the United States should:

	Percent				
	Canada	Australia	France	West Germany	Great Britain
Begin to withdraw troops	31	21	68	51	42
Carry on the war at present levels	18	43	8	19	17
Increase the attacks on North Vietnam	27	24	5	15	16
No opinion	24	12	19	15	25

Table E9

JCS-Targeted Bridges on the Hanoi - Dong Dang Railroad Line
June 1966

JCS Number	Name	Location	Length (Feet)	Number of Spans	Number of Times Struck	
					1965	Jan-Sep 1966
12	Hanoi Railroad/Highway Bridge over Red River	21 03 N 105 52 E	5,520	19		
13	Hanoi Railroad/Highway Bridge over Canal des Rapids	21 05 N 105 55 E	730	5		
16	Dap Cau Railroad/Highway Bridge over Song Cau	21 12 N 106 06 E	600	5		3
18	Lang Son Railroad/Highway Bridge over Song Ky Cung	21 51 N 106 46 E	330	3		
18.23	Bac Giang Railroad/Highway Bridge over Song Thuong	21 16 N 106 11 E	460	4		6
18.24	Cao Nung Railroad Bridge over Song Hoa	21 33 N 106 30 E	180	3	3	5
18.58	Lang Dang Railroad Bridge over Song Thuong	21 39 N 106 35 E	110	2	1	
18.74	Vu Chua Railroad Bridge over Suoi Ngang	21 27 N 106 21 E	60	2	2	

months of 1966 and probably an additional 1,000 trucks were effectively destroyed in Laos.* In addition, the lines of communication in both countries were subjected to intensive attack on the inland waterways and highways, thus compounding the task of maintaining the supply routes to South Vietnam.

The limited effectiveness of the interdiction campaign is apparent in the short time that the key railroads have been interdicted for through rail service. The Hanoi - Dong Dang line has been interdicted for a total of only two months in 1966 and the Hanoi-Haiphong line has been interdicted for only one month. The Hanoi - Thai Nguyen line has been open to through traffic almost continuously in both 1965 and 1966. On the other hand, two rail lines subjected to more intensive attack (Hanoi - Lao Cai and Hanoi-Vinh) have been interdicted for 5 and 8 months respectively in the first nine months of 1966.

The cost of this interdiction campaign to the Communists has not been excessive. A rough approximation of bomb damage inflicted in Laos during 1966 totals about $11 million of which some $5.7 million represents damage to transportation facilities and equipment. In North Vietnam the estimated bomb damage during the first nine months of 1966 is $24.5 million for transport equipment and slightly under $10 million for bridges destroyed or damaged. A large part of this latter cost has been avoided through the expedient of using temporary repairs or bypasses rather than attempting permanent repairs.

In spite of these losses, it is estimated that the Hanoi regime has been able to infiltrate men and supplies into South Vietnam at the levels necessary to maintain its forces. Sightings of truck and inland water traffic in North Vietnam throughout 1966 indicate that the level of traffic has not decreased in 1966 and in all probability is at higher levels than it was in 1965. In Laos, for example, the Communists were able during the 1965-66 dry season to construct 400 miles of road in the Panhandle and to make substantial improvements in their

* Effective losses in North Vietnam would be less if account was taken of exaggerations in pilot reports and of measures to repair or rebuild damaged trucks. Truck losses in 1965 were at a considerably lower level and more than compensated for by substantial imports. In 1966 a minimum of 4,300 trucks will be imported, so that the net inventory of trucks will be larger at the end of 1966 than it was when the air campaign started.

By late November a change had occurred. The press and radio began playing reports from Vietnam straight and in low key. Several Indian officials told US Embassy personnel that, in view of the hostilities with Pakistan and the continuing threat from Peking, the cabinet took a more understanding view of the US role in Vietnam.

The Indian press reacted favorably to suspension of the bombing of North Vietnam in late 1965. In South India, the press was nearly unanimous in accepting that the US sincerely wanted peace. Following the resumption of bombings, the government issued a statement expressing its "grave concern" over the danger of escalation. There was no official call, however, for another suspension. The press greeted the resumption with mixed feelings, but only the newspapers of the far left questioned the basic US desire for peace. Many editorials in early February expressed concern at the latest development, but pointed out that the US decision was taken only after the failure of efforts to gain a start toward a negotiated settlement.

However, the Indian Government's reaction to the bombings of the POL installations in mid-1966 was completely negative. The top Indian officials publicly deplored the action and called for an end to all bombings of North Vietnam. Mrs. Ghandi, the Prime Minister, may have found the timing particularly disconcerting as she was slated to visit the UAR, Yugoslavia, and the USSR in early July. On the evening of her departure, she again called for an immediate cessation to the bombing of North Vietnam, to be followed by a cessation of hostilities and the convocation of the Geneva Conference. In Moscow, Mrs. Ghandi agreed to a joint Soviet-Indian communiqué which called for a unilateral cessation of the air attacks.

Mrs. Ghandi repeated her call for a cessation on her return to India. It appears that the Indian Government, concerned over the July 1966 escalation of the attacks, had become convinced -- probably as a result of talks with Bloc members -- that there was no chance for peace negotiations until the bombing of North Vietnam was unconditionally ended. In the Indian Parliament on 25 July, Mrs. Ghandi stated that it would be "unrealistic to expect a conference until the bombing of North Vietnam has stopped."

Table A23

Statistical Summary of Attacks on Railroad Yards and Shops in North Vietnam 1965 and January-September 1966

	1965	1966	Total
Number of JCS fixed targets	5	5	
JCS fixed targets struck	1	2	
Percent of national capacity destroyed	5.2	10.3	
Sorties			
Attack	80	100	180
Support	40	Negl.	40
Total	120	100	220
Ordnance delivered (tons)	70	140	210
Aircraft lost	2	1	3
Personnel lost	1	1	2
Personnel recovered	1	0	1
Cost to US (million dollars)			
Aircraft lost	2.40	3.00	5.40
Operational cost of sorties flown	0.13	0.16	0.29
Ordnance delivered	0.04	0.17	0.21
Total	2.57	3.33	5.90

three PT boats were sunk while at sea, and two SO-1 subchasers and one Swatow-class gunboat were destroyed while moored near Cac Ba Island.

According to the North Vietnamese Naval Order of Battle as of 15 September 1966, the loss of the five Swatow-class gunboats has deprived North Vietnam of almost one-third of the operational gunboat fleet, the loss of the three PT boats leaves North Vietnam with only nine operational craft of this type, and there are now only two subchasers operational.

The estimated restoration cost of these naval craft totals $8.1 million. The loss incurred during 1966 accounts for $6.1 million.

10. Aircraft

North Vietnamese aircraft losses increased significantly during the first nine months of 1966 as a consequence of air engagements with US aircraft. Three supersonic MIG-21's and 14 MIG-17's were destroyed, compared with only five MIG-17's in 1965. These cumulative losses represent nearly 20 percent of the MIG-21 inventory (16) and more than 40 percent of the in-country MIG-15/17 inventory (45) in the Air Order of Battle of North Vietnam as of 3 November 1966. An additional 50 MIG-15/17's of the North Vietnamese are known to be held in China.

Almost all of the MIG's were destroyed during strikes against fixed targets. The destruction in 1965 occurred in June and July. In 1966, MIG losses were greatest in April, with five, June, with four, and July and September, with three each. The estimated cost of this loss is $3.4 million in 1965 and $12.4 million in 1966.

C. Armed Reconnaissance

During 1966, Rolling Thunder became almost exclusively an armed reconnaissance program directed primarily against the North Vietnamese lines of communication and transport targets. The effect of the attack on lines of communication and other fixed targets was discussed in an earlier section of this appendix. The armed reconnaissance attack on the logistics target system is discussed in detail in Appendix E.

That production is in fact to continue at the larger plants is further suggested by the provisions made for the protection of workers and equipment. Most large industrial facilities have many foxholes nearby and trenches radiating from the plant area for the protection of personnel. Extensive shelter systems of this type are evident in photography of the Hanoi Chemical Fertilizer Plant, the Hanoi Vehicle Repair and Assembly Plant, the Nam Dinh Textile Plant, the Thai Nguyen Iron and Steel Combine, and the phosphate fertilizer and cement plants in Haiphong. A number of factories have reportedly resettled their employees and families in housing away from the plant. Sandbags or brick walls have been installed in the main interior of some plants to minimize damage of equipment in case of a direct hit.

Most of the dispersal that has occurred in industry is believed to consist of the resettlement of light and handicraft-type industry. The relocation of this type of industry would serve both to meet the demands of evacuees for goods, services and employment opportunities, and to provide for protection of such production.

In addition to the resettlement of small, light, and handicraft shops away from urban areas and the aforementioned consolidation of many of the smallest machine and repair shops the Vietnamese are probably also building small new industrial shops away from urban areas as a means of developing a degree of regional self-sufficiency. A network of small machine building shops, for example, is being established based in part on the indigenous manufacture of simple production machinery and in part on the import of simple production machinery. Such small shops are probably being installed in existing buildings in many instances.

II. Capability of North Vietnamese Manufacturing Industries to Support the War

A. Introduction

The only manufacturing industry in North Vietnam which is capable of providing significant assistance to the military effort is machine building. The chemical industry manufactures only small quantities of tires, pharmaceuticals, and some chemicals used in the production of munitions. The explosives industry itself provides only a fraction of the country's current military needs. The Thai Nguyen Iron and Steel Plant currently is producing only pig iron, most of which

Japanese popular attitudes toward US policy in Vietnam remained greatly improved, compared with early 1965. Fears that the war might expand into a major US-China conflict seemed to have subsided somewhat as confidence in US restraint and moderation increased.

Japanese officials publicly minimized the prospect that the US bombing of the petroleum installations near Haiphong and Hanoi would result in a general expansion of US military action in Vietnam. Prime Minister Sato stated his belief that the raids had been limited to military targets and that the United States would not deviate from this policy. Popular protests over the POL attacks came almost entirely from leftist groups. The modest impact of the Hanoi-Haiphong strikes on the general public was apparently attributable to popular boredom with the war. Press comment was more regretful than condemnatory in tone and reiterated hopes for a negotiated settlement.

The reaction in Japan and the situation in other Far Eastern countries suggest that a continued gradual escalation of the air war in North Vietnam, so long as it involves primarily military or related economic targets and does not result in demonstrably high civilian casualties, will probably not cause a significant change in current official and popular attitudes in the Far East.

A representative selection of popular opinion on US policy in Vietnam in major cities of the Far East in July 1965 is given in the following tabulation:

	Percent		
City	Approve	Disapprove	No Opinion or Unaware
Manila	49	3	48
Seoul	47	4	49
Bangkok	45	8	47
Kuala Lumpur	19	12	69
Singapore	10	6	84
Tokyo	6	38	56

This sampling probably represents the high point of the opposition to the raids since, as indicated above, there has been some moderation in opinion during 1966.* These questions were asked: "Do you approve

* No representative sampling of popular opinion specifically on the raids against North Vietnam is available. The sampling above was obtained by USIA and is taken from its publication US Standing in Worldwide Public Opinion, 1965. A similar sampling for 1966 is not available.

Table A26

Statistical Summary of Attacks on Ports and Naval Bases in North Vietnam
1965 and January-September 1966

	1965	1966	Total
Number of JCS fixed targets	12	15	
JCS fixed targets struck	4	5	
Percent of national capacity destroyed	N.A.	N.A.	
Sorties:			
Attack	320	100	420
Support	110	20	130
Total	430	120	550
Ordnance Delivered (tons)	390	190	580
Aircraft lost	3	0	3
Personnel lost	3	0	3
Personnel recovered	0	0	0
Cost to US (million dollars)			
Aircraft lost	5.30	0.00	5.30
Operational cost of sorties flown	0.60	0.14	0.74
Ordnance delivered	0.40	0.23	0.63
Total	6.30	0.37	6.67

Table B2

Electric Powerplants Attacked Under the Rolling Thunder Program
1965 and January-September 1966

JCS Target Number	Name	Pre-Strike Target Capacity (Kilowatts)	Target Capacity as a Percent of National Capacity [a]	Dates of Attack	Percent of Target Capacity out of Operation [b]	Percent of National Capacity out of Operation	Cost of Restoration Attributed to Each Strike (Million US $) [c]	Remarks
82.1	Thanh Hoa	5,000	3	4 Apr 65			0.2	
				27 Jul 65				
				29 Jul 65				
				30 Jul 65				
				31 Jul 65				
				4 Aug 65	100	3	0.9	Further damage in September 1966.
82.11	Ben Thuy	8,000	5	4 Jun 65			0.3	Additional strikes in 1966.
				4 Jun 65	100	5	0.7	
82.18	Co Dinh	1,500	1	8 Jun 65			0.2	No attempt to restore plant.
				10 Jun 65	100	1	0.2	
82.15	Nam Dinh	7,500	4	28 Jun 65			0.2	Progress of restoration during 1966 indicates possible partial operation around end 1966.
				29 Jun 65			0.3	
				2 Aug 65			0.3	
				3 Aug 65	100	4	1.2	
82.21	Ban Thach	1,000	0.5	21 Aug 65				No attempt to restore plant.
				22 Aug 65			0.1	
				23 Aug 65	100	0.5	0.2	
82	Uong Bi	24,000	14	15 Dec 65				Out of operation until March 1966.
				20 Dec 65				
				22 Dec 65				
				22 Dec 65	100	14	1.5	
	Subtotal for 1965						6.3	
82	Uong Bi	24,000	13	18 Apr 66			0.1	Smokestack destroyed. Out of operation until July 1966.
				28 Apr 66				No additional damage.
				11 Aug 66	100	13	4.3	Severe damage to 24,000 kw operating plus an additional 24,000 kw being installed.
				14 Aug 66				No additional damage.
				17 Aug 66				No additional damage.
82.16	Thai Nguyen	24,000	13	6, 8 Jul 66	50	6	0.8	First strike. 12,000 kw of capacity out of operation.
82.17	Viet Tri	16,000	9	Prior to 19 Jul 66	0	0		First strike. Damage negligible.
82.11	Ben Thuy	8,000	4	13 Mar 66	100	4		Plant already out of operation. No additional damage.
				15 Mar 66				
82.1	Thanh Hoa	5,000	3	22 Sep 66				Restoration in progress but plant believed not operating. Probable minimum of 6 months for partial operation.
				23 Sep 66				
				23 Sep 66				
				23 Sep 66	100	3	0.4	
	Subtotal for 1966						5.6	
	Total					32	11.9	

a. Based on national installed capacity of 175,000 kw in 1965 and on 187,000 kw in 1966.
b. Information was not available on which to make a judgment until the final strike.
c. Lack of an entry indicates either no damage or no information available on which to base an estimate.

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Table A22

Statistical Summary of Attacks on Bridges
in North Vietnam
1965 and January-September 1966

	1965	1966	Total
Number of JCS fixed targets	61	61	
JCS fixed targets struck	47	32	
Percent of national capacity destroyed	49	51	
Sorties			
Attack	2,420	610	3,030
Support	1,710	250	1,960
Total	4,130	860	4,990
Ordnance delivered (tons)	3,200	1,120	4,320
Aircraft lost	37	5	42
Personnel lost	35	3	38
Personnel recovered	9	1	10
Unknown		1	1
Cost to the United States (million $)			
Aircraft lost	82.2	11.4	93.6
Operational cost of sorties flown	0.2	1.4	1.6
Ordnance delivered	4.1	1.3	5.4
Total	86.5	14.1	100.6

Province with Hanoi takes on new importance. The capacity of the Red River from Lao Cai to Hanoi is estimated to be 900 to 2,700 tons per day. Some imports for North Vietnam could now move over this circuitous and costly rail-water route via Yunnan Province.

II. Impact of Mining Under the Present Rolling Thunder Program

A. Immediate Effects

If mining of the ports was carried out without warning, a number of foreign-flag ships might be caught in the ports.* The average daily number of ships at Haiphong during January-September 1966 included 11 freighters (6 Soviet and Eastern European, 3 Free World, and 2 Chinese Communist) and 1 Soviet tanker. The actual number on any one day during this period ranged from 3 to 12 ships. Since the end of April, however, the average daily number of Free World ships at Haiphong has declined to one. In addition, one or two ships (of the flags listed above) are loading at either Cam Pha or Hon Gai on any given day.

An immediate short-term effect of mining the ports would be an intensive disruption of normal transport activity. This would arise from the need to adopt alternative distribution procedures; to reroute import traffic; to reallocate small craft, rolling stock, and trucks; and to reassign personnel. The maximum impact from mining the ports under the present Rolling Thunder program would be one of delay but not of denial in the delivery of imports. Moreover, at least in the immediate future, it is unlikely that the mining operations would have any significant additional effects on the imports of petroleum because the normal delivery procedure has already been disrupted by the extensive damage to the Haiphong petroleum terminal. Almost all current exports could be continued, except that the added costs of handling coal exports might be so great that they would be forgone.

The amount of delay in rearranging the routes and methods of import and export would depend on the extent of North Vietnam's contingency planning. The organization of transport to cope with the

* It would be possible for mines to be equipped with delayed action fuses to provide sufficient time for foreign-flag ships to clear the port or for shipping en route to the port to be diverted.

Table A20

Comparison of Sorties and Ordnance
on Major JCS Fixed Target Systems in North Vietnam
1965 and January-September 1966

JCS Fixed Target System	1965	January-September 1966	Total
Barracks/supply depots/ammunition depots			
Attack sorties	4,290	260	4,550
Ordnance (tons)	7,300	390	7,690
POL storage			
Attack sorties	130	340	470
Ordnance (tons)	120	500	620
Powerplants			
Attack sorties	230	40	270
Ordnance (tons)	370	140	510
Manufacturing and explosives plants			
Attack sorties	20	N.A.	20
Ordnance (tons)	90	N.A.	90
Airfields			
Attack sorties	420	40	460
Ordnance (tons)	330	100	430
Bridges			
Attack sorties	2,420	610	3,030
Ordnance (tons)	3,200	1,120	4,320

effects of bombing has improved substantially in the past year. There are several indications that the regime has prepared itself to cope with a denial of the port of Haiphong. Over 100 small dispersed bulk petroleum storage sites are located throughout the country. There may be other sites as yet unidentified; alternative petroleum distribution procedures have been adopted; and by-pass bridges, roads, and rail routes have been constructed. The extensive publicity given to possible US courses of action against the port of Haiphong makes it highly probable that Communist plans to deal specifically with a mining of the port are well developed.

The North Vietnamese capability for various courses of action of this type is discussed below. These alternatives include the shifting of seaborne trade to South China ports and using transport routes through China for the movement of cargoes to and from North Vietnam, the use of small watercraft to load and unload oceangoing ships while they are anchored outside North Vietnamese ports, the use of other minor ports in North Vietnam, and the construction of pipelines and new storage tanks for petroleum.

B. Means of Maintaining Foreign Trade

1. Small Watercraft Through Haiphong and Other Ports

Only in recent years have the areas near the docks at Haiphong been dredged to permit dockside loading and unloading of ships with full loads. Before the dredging, goods were lightered between ships anchored downstream and the docks to lighten or top off the load. Thus the North Vietnamese have had considerable experience with these operations.

If the mining operation affects only the movement of oceangoing ships, shallow-draft watercraft could be used to transport supplies to and from the mined ports. There are probably more than 900 motor-powered junks and about 4,800 sailing junks operating in the waters off southern China (Hong Kong - Canton - Hainan area) and the northern coasts of North Vietnam that might be used for improvised lighterage in addition to those craft normally used for this purpose. Because of their shallow drafts, these craft might move

Table E4

Reported Losses of Transport Equipment
as a Result of Bombing in North Vietnam a/
1965 and January-September 1966

	1965		January-September 1966	
	Destroyed	Damaged	Destroyed	Damaged
Watercraft	460	750	2,690	4,350
Trucks b/	320	490	1,620	1,480
Railroad freight cars c/	230	590	1,060	850
Locomotives	6	6	10	13

a. These data are based primarily on pilot reports but are adjusted downward to eliminate some duplication. Data probably include some exaggeration. All data, except those for locomotives, are rounded to the nearest 10.
b. Additional trucks were destroyed and damaged in Laos, resulting in effective losses of about 1,000 trucks from the North Vietnamese inventory.
c. Including small, makeshift railroad cars used on the lines south of Hanoi. This type of car is not included in the inventory of mainline freight cars.

50 percent in January-September 1966 over April-December 1965. Although these data should be used with caution, they indicate that truck traffic in the southern area probably has increased, in spite of the interdiction campaign. Furthermore, the North Vietnamese are in a better position to cope with transport problems resulting from the current rainy season in the south than they were during the 1965-66 rainy season because of more effective countermeasures to the bombing.

3. Waterways

The most significant change in the movement of supplies to the south in 1966 compared with 1965 has been the increased emphasis on the use of inland and coastal waterways. Airstrikes against the waterways followed the same pattern during 1966 as in 1965, with attacks primarily against watercraft, port areas, and other cargo-handling facilities in the southern part of the country. No significant restrictions to water traffic have resulted from the numerous strikes

(in Hanoi and Haiphong) in addition to restrikes against those facilities hit in 1965.

It is estimated that at a minimum some 700 civilian and 400 military casualties resulted from attacks on fixed targets in 1966. In an absolute sense, this compares favorably with the 2,000 civilian and 4,300 military casualties estimated to be inflicted by the 1965 JCS target campaign. The 1966 casualties, however, are at a rate of 0.6 per attack sortie, compared with a rate of 0.7 per attack sortie in 1965. The decrease in the sortie-casualty ratio undoubtedly reflects the considerable care given to the selection and direction of attacks against the new target system put under attack in 1966.

This estimate of casualties resulting from attacks on fixed targets is based essentially on methodologies formulated by DIA. The DIA estimate has been weighted, however, to take into account the data on casualties reported in prisoner-of-war reports, [redacted] The investigation of these [redacted] sources showed that initial attacks on JCS fixed targets have inflicted casualties that are nearly four times greater than the minimum DIA post-strike estimates of casualties. Consequently, the minimum DIA casualty estimates for attacks against previously unstruck JCS targets hit in 1966 were weighted by a factor of four. Facilities hit in both years were credited with the minimal estimate for purposes of estimating the 1966 casualty figure. This was done to take account of the probability that inhabitants residing in areas previously attacked would either move out or construct adequate shelter. The number of casualties derived by this method are shown in the following tabulation:

	Number of Casualties		
JCS Fixed Target System	Military	Civilian	Total
Barracks/supply depots/ ammunition depots	300	50	350
POL storage	50	100	150
Powerplants		80	80
Airfields	20		20
Bridges		180	180
Rail yards		200	200
Ports	30	90	120
Total	400	700	1,100

would see this as a step toward a wider war. Those few Free World countries still trading with North Vietnam would object vigorously. But the alignment of Free World nations toward the Vietnam war would probably not change significantly.

Aside from vigorous protests, Hanoi's reaction probably would be largely determined by its success in countering the interdiction programs. Peking would react noisily to the new US attacks and almost certainly would increase its level of logistic support, but would probably continue to avoid any action which it believed would increase the chance of US military moves against China. The USSR would be faced with the greatest dilemma because the mining would force Moscow to choose between a confrontation with the United States, the risk of running the minefields, increased reliance on rail transit through China, or possibly supplying Hanoi with less aid. Soviet-US relations would probably deteriorate further.

The mining action would be interpreted by most countries as a strong indication of US determination to escalate the war in pursuit of its minimum objectives.

I. The Dimensions of North Vietnam's Foreign Trade

A. Volume of Foreign Trade

In spite of the bombing of North Vietnam and the interdiction of lines of communication, the volume of foreign trade in 1965, both by sea and railroad, exceeded the level of 1964. Foreign trade in 1966 is continuing at almost the 1965 level but there has been a sharp increase in imports and a significant decline in exports. There have been changes also in the composition and direction of the trade. The total foreign trade of North Vietnam in 1965 amounted to at least 2.9 million tons.* About 2.4 million tons, or 85 percent of the total, was seaborne trade moving through the ports of Haiphong, Cam Pha, and Hon Gai. The remainder, about 470,000 tons, moved overland by rail across the North Vietnamese-Chinese border at Dong Dang. In addition, a small amount of trade moved by highway.

The volume and commodity composition of the seaborne trade in 1964, 1965, and the first nine months of 1966 are shown in Table F1. About 70 percent of the trade during 1964 and 1965 consisted of exports,

* All tonnages are given in metric tons.

eventual negotiations and favor at least a measured pause in the bombings to bring them about, but few favor the withdrawal of US forces before an agreement. The influence of the newspapers which have consistently criticized the US position in Vietnam is large because they include three of Canada's largest and most influential dailies.

Public opinion in Canada supports US actions in Vietnam, including the air attacks on North Vietnam, by a small margin. The minority that is opposed to US policy is a vocal one and includes prominent journalists and many academicians and other intellectuals. Overall public pressure on the government to oppose US policies in Vietnam is substantial, but not as great as it is in Britain. A Gallup Poll in September 1966 reported that, while 31 percent of the Canadian people thought the United States should withdraw its troops from Vietnam, 27 percent thought the United States should escalate the war, 18 percent said the United States should carry on at the present level of fighting, and 24 percent had no opinion.

The basic Canadian views about US Vietnam policy have not been drastically changed by the US bombing of North Vietnam. There has been some shifts of opinion against the United States in all quarters, and particularly a hardening of the opposition that was already there. The air attacks have not been the only cause of the hardening of Canadian attitudes on Vietnam that has taken place during the past two years, however. Political instability in South Vietnam, bombings of villages in the south, and the like have also played a part.

Further escalation of the bombing against military-related targets would sharpen Canadian opposition but would probably not result in any drastic change in Canadian policy or in Ottawa's relations with the United States. A major US bombing effort against North Vietnam which resulted in heavy civilian casualties would be condemned by most Canadians. There is a segment -- probably less than a quarter of the population and a like number of newspapers -- that would support such escalation, but their influence is small overall. Nothing so drastic as a break in relations would result, although something like a United Nations resolution hostile to the United States might gain Ottawa's backing.

In West Germany, popular opposition to the bombing has not created any particularly heavy pressure on the regime. Government and top-level political opinion in the Federal German Republic overtly supports US policy. Bonn has issued a statement backing the

7. Locks

Only one attack was carried out against locks and dams in North Vietnam during 1966, and it was unsuccessful. Only two of the eight targeted locks on the inland waterways have been attacked. The Bich Phuong Lock No. 3, located in Thanh Hoa Province on the Song Chu Canal, was attacked in August 1965 and was heavily damaged. By 30 October 1965, temporary repairs had been made and the site of the lock had been coffer dammed. Water-level control was restored, and navigation continued, although it is interrupted at the site of the lock. Qua Nhue Ha Lock No. 2 on the same canal was attacked in 1966, but the lock continued to function after the attack.

Three of the targeted locks that have not been struck are located on the Song Thuong Canal, part of the inland water network that links Thai Nguyen with Hanoi and the seaport at Haiphong. Disruption of traffic on this waterway would create some transportation problems because a significant portion of the freight moved in the Delta region is transported by inland water. This waterway serves as an alternative to rail and road transport in the area, and thus the locks must be destroyed if disruption of transport routes in the Delta is to be achieved. The destruction of the four targeted locks that are still functioning in Thanh Hoa and Nghe An Provinces would present problems to canal traffic operating in the area. These canals have become significant routes for the transportation of supplies within Military Region IV.

8. Agriculture

Although agricultural production in North Vietnam has not been a direct target of the US/GVN airstrikes against that country, these attacks have had a significant indirect effect on the agricultural segment of the economy. It is impossible, however, to isolate the indirect effect of the bombings on agricultural production from other influences -- such as weather.

The bombing attacks have been associated with a decrease in agricultural production during the period 1965 through September 1966 which is valued at an estimated $21 million. Of this amount, $17 million is attributed to a shortfall of rice harvested during the spring of 1966. This shortfall was caused by poor weather and by the bombing attacks. A decrease in the salt water fish catch -- caused by the bombing attacks -- is responsible for the remaining estimated decrease in production. This decrease is valued at $4 million.

The rate at which ordnance has been delivered on North Vietnam has increased sharply during the year. Whereas the total ordnance delivered in the first three months of 1966 was less than 13,000 tons, over 17,000 tons were delivered in both August and September. The amount delivered in these two months exceeds that delivered in all of 1965. In the past few months the Rolling Thunder program has accounted for about 40 percent of all the ordnance being delivered by all air operations in Southeast Asia.

Ordnance delivered on JCS-designated fixed targets in North Vietnam through September 1966 was only 3 percent of the total, compared to 37 percent in 1965, reflecting the rapidly diminishing share of fixed targets in the total attack on North Vietnam.

C. Losses

A total of 249 aircraft were lost during the Rolling Thunder campaign from January through September 1966. These losses amount to 61 percent of total losses in air operations in Southeast Asia during the period. Total losses over North Vietnam include 222 losses resulting from enemy action and 27 from operational losses. The losses sustained in 1966 were at a rate of 4.2 aircraft per 1,000 attack sorties. This is a decided improvement over 1965 when the loss rate was 6.6 aircraft per 1,000 attack sorties.

In addition to aircraft, a total of 339 men were lost during January-September 1966, of whom 131 were later recovered. The recovery rate in 1966 -- 39 percent -- was an improvement over that in 1965 when it was 30 percent. The improvement is particularly notable in view of the fact that many of the losses resulted during attacks on targets located in heavily defended areas.

D. Cost of Operations

The US/GVN direct operating costs of the Rolling Thunder campaign (excluding manpower losses) from January through September 1966 were some $950 million, more than double the direct operating costs in 1965, as shown in the following tabulation:

Table D2

Credits and Grants Extended by the Communist Countries to North Vietnam
January 1965 - October 1966

Country	Date	Amount (Million US $)	Description
USSR	February 1965	N.A.	Grant of six fishing boats and an unspecified amount of hospital and medical equipment. The agreement also consolidated credits extended in 1960-62, extended the repayment period, and eliminated interest on these credits.
	July 1965	N.A.	For developing the country's economy and strengthening its defensive potential. Of the economic credits 30 percent will go to power stations and transmission lines and 15 percent for the creation of state farms, irrigation, and other agricultural needs.
	December 1965	N.A.	Provides grant and technical aid for 1966, extends a credit to cover balance of 1965 clearing account, and postpones payments during 1966 on credits extended earlier.
	January 1966	N.A.	Aid for the development of the economy and the strengthening of defense.
	May 1966	N.A.	Technical assistance.
	July 1966	N.A.	Scientific cooperation.
	September 1966	2.0	"Free charge commodities" (possibly consumer goods and medicines).
	October 1966	N.A.	Grant aid for economic development and to increase military aid potential. (Signed agreement for additional credits and commercial trade at same time.)
Bulgaria	June 1965	N.A.	For the rendering of material aid.
	January 1966	N.A.	Equipment and technical assistance for economic development.
	September 1966	N.A.	"Nonrefundable economic and technical assistance."
Czechoslovakia	January 1966	N.A.	A credit for economic aid.
	July 1966	N.A.	Scientific cooperation.
	September 1966	N.A.	Economic, technical, and military aid.

Table B1

Petroleum Storage Facilities Attacked Under the Rolling Thunder Program
1965 and January-September 1966

JCS Target Number	Name	Target As a Percent of JCS Targeted Capacity	Dates of Attack	Percent of Facility Destroyed	Percent of JCS Targeted Total Capacity	Cost of Restoration (Thousand US $)	Value of Petroleum Destroyed (Thousand US $)
42.00	Phu Van	Negl.	6 May 65	100	Negl.	40	20
50.00	Vinh a/	6	24, 26 May 65	34	2	120	70
			11, 15 Sep 65	34	2	120	70
			6 Oct 65	17	1	60	30
50.12	Nam Dinh	9	2, 4 Jul 65	100	9	500	270
50.16	Phu Qui	6	18 May 65	100	6	340	0
	Subtotal for 1965				20	1,180	460
48.00	Haiphong	32	29 Jun 66	46	14	840	300 to 460
			7 Jul 66	32	10	600	190 to 310
			2 Aug 66	11	4	200	44 to 81
49.00	Hanoi	24	29 Jun 66	100	24	1,380	490 to 760
50.00	Vinh b/		30 Jul 66				
			7, 8 Aug 66				
			6 Sep 66				
51.00	Nguyen Khe	6	30 Jun 66	10	Negl.	36	13 to 20
			19 Jul 66	0	0	0	0
			17, 18, 22 Aug 66	0	0	0	0
			4 Sep 66	0	0	0	0
51.11	Bac Giang	2	30 Jun 66	31	Negl.	32	11 to 17
			31 Jul 66				
			11 Aug 66				
			14 Sep 66				
51.13	Do Son	2	29 Jun 66				
			3 Jul 66				
			5, 8, 10, 14, 15, 17, 22 Aug 66	50	1	64	16 to 35
51.14	Viet Tri	1	30 Jun 66	0	0	0	0
			19 Jul 66	3	Negl.	2	1 to 2
			14 Aug 66	0	Negl.	0	0
			5 Sep 66	0	Negl.	0	0
51.17	Duong Nham	3	1, 12, 23 Jul 66	25	1	46	16 to 25
			17, 22 Aug 66	50	2	94	24 to 50
	Subtotal for 1966				56	3,294	1,105 to 1,760
	Total				76 +	4,474	1,565 to 2,220

a. The facility at Vinh was attacked in August 1964, prior to the Rolling Thunder program.
b. See the estimate for 1965.

During the course of the US air war, third country attitudes throughout most of the Free World have remained essentially static. Some countries have tended to be more moderate in their opposition to US policy. The major reason for this moderating trend has been the frequent indications of US willingness to end the bombings, in contrast to the intransigence of the Hanoi regime. It is estimated that the opposition of third countries to the bombings would not significantly intensify if there were a major escalation of the air war, unless the escalation were accompanied by substantial civilian casualties. Although propagandistic and political opposition might become stronger in the event of further escalation, it seems unlikely that Free World third countries would take retaliatory actions in their bilateral relations with the United States or take measures to provide increased political or material support to the Vietnamese Communists.

Among Communist third countries, attitudes toward the bombing have remained essentially unchanged. The Soviet attitude is in large measure dictated by the need to maintain a certain balance in Soviet relations with the West and with Communist countries, while at the same time supporting a sister Communist country. The USSR reacted to the initial air attacks by attempting to influence Hanoi to begin negotiations. Hanoi's refusal and the Soviet desire to maintain its influence in Hanoi left the USSR with little recourse but to support Hanoi's stand on the war. The USSR has met each escalation of the air war with a reaffirmation of its solidarity with Hanoi and with promises of further economic and military assistance. At the same time, the USSR has been relatively restrained in its condemnations of the United States, unwilling apparently to take any steps which could seriously upset US-Soviet relations or which might lead to a direct military confrontation with the United States. Against a background of a deepening Sino-Soviet rift and a contest for leadership of the Communist world, the Soviet attitude towards the US bombings will remain essentially as it has over the past two years.

The initial Chinese reaction to the US bombings was one of violent and vociferous hostility. The Chinese have provided a steady flow of economic and military aid, including large numbers of support troops. They seem intent on keeping the war going but with definite limitations on the extent of direct Chinese involvement. Chinese rejection of any US exploration of possibilities for a negotiated settlement of the war has been complete and unrelenting. During the past year, however, the domestic turmoil within China has made China more cautious about direct involvement in the Vietnamese war. China's

It is estimated that of the total of 15,700 casualties inflicted from January through September 1966, about 40 percent were killed and 60 percent wounded. This would indicate that a total of less than 5,000 civilian deaths have resulted from military action against North Vietnam mostly among persons directly engaged in maintaining and operating the logistic pipeline to South Vietnam. The impact of this loss is not large in a country where over 350,000 persons die annually of other causes and where the number of accidental deaths is at least two to three times the number resulting from the Rolling Thunder program.

C. Political Reactions

In the previous memorandum, it was estimated that after enduring 18 months of air attack, the North Vietnamese leaders were as determined as ever to continue the war. The regime is apparently united in agreeing that the economic and military sacrifices it has made are not yet an unacceptable burden. Some economic programs have been postponed but support of the war continues to have top priority in Hanoi. Insofar as can be determined, the people of North Vietnam still firmly support the policies of the Hanoi government. The net effect of the bombings seems to have been a reinforcement of this popular support although there are some signs that support for the government is not expressed as actively as when the bombings began. There is no indication, however, that the Rolling Thunder program has resulted in any anti-regime or anti-war sentiments significant enough to generate sufficient political pressure to compel the Hanoi leadership to alter its present attitudes toward the war.

The attitudes of selected third countries toward the bombing of North Vietnam are examined in more detail in this memorandum.* Popular and official reactions in Free World countries to the bombing of North Vietnam vary widely. The US program receives considerable support, motivated principally by the fear of further Communist aggression if South Vietnam should fall. There is strong opposition to the US program in some of the major neutral nations and allied countries. This opposition reflects generally a fear that the war will escalate into a worldwide conflict or a conviction that the United States is an "aggressor" in the present conflict.

* See Appendix C.

Table A24

Statistical Summary of Attacks on Barracks, Supply Depots, Ammunition Depots, and Military Complexes in North Vietnam 1965 and January-September 1966

	1965	1966	Total
Number of JCS fixed targets	92	91	
JCS fixed targets struck	70	26	
Percent of national capacity destroyed	N.A.	N.A.	
Sorties			
Attack	4,290	260	4,550
Support	1,730	20	1,750
Total	6,020	280	6,300
Ordnance delivered (tons)	7,300	390	7,690
Aircraft lost	15	1	16
Personnel lost	8	status unknown	
Personnel recovered	7	status unknown	
Cost to the United States (million $)			
Aircraft lost	23.1	3.9	27.0
Operational cost of sorties flown	11.2	0.5	11.7
Ordnance delivered	9.1	0.5	9.6
Total	43.4	4.9	48.3

Dec 1966 IM, The Effectiveness of the Air Campaign Against North Vietnam, 1 January - 30 September 1966, SC No. 12898/66, December 1966, Copy 75 (the comprehensive version of SC No. 09646/66)

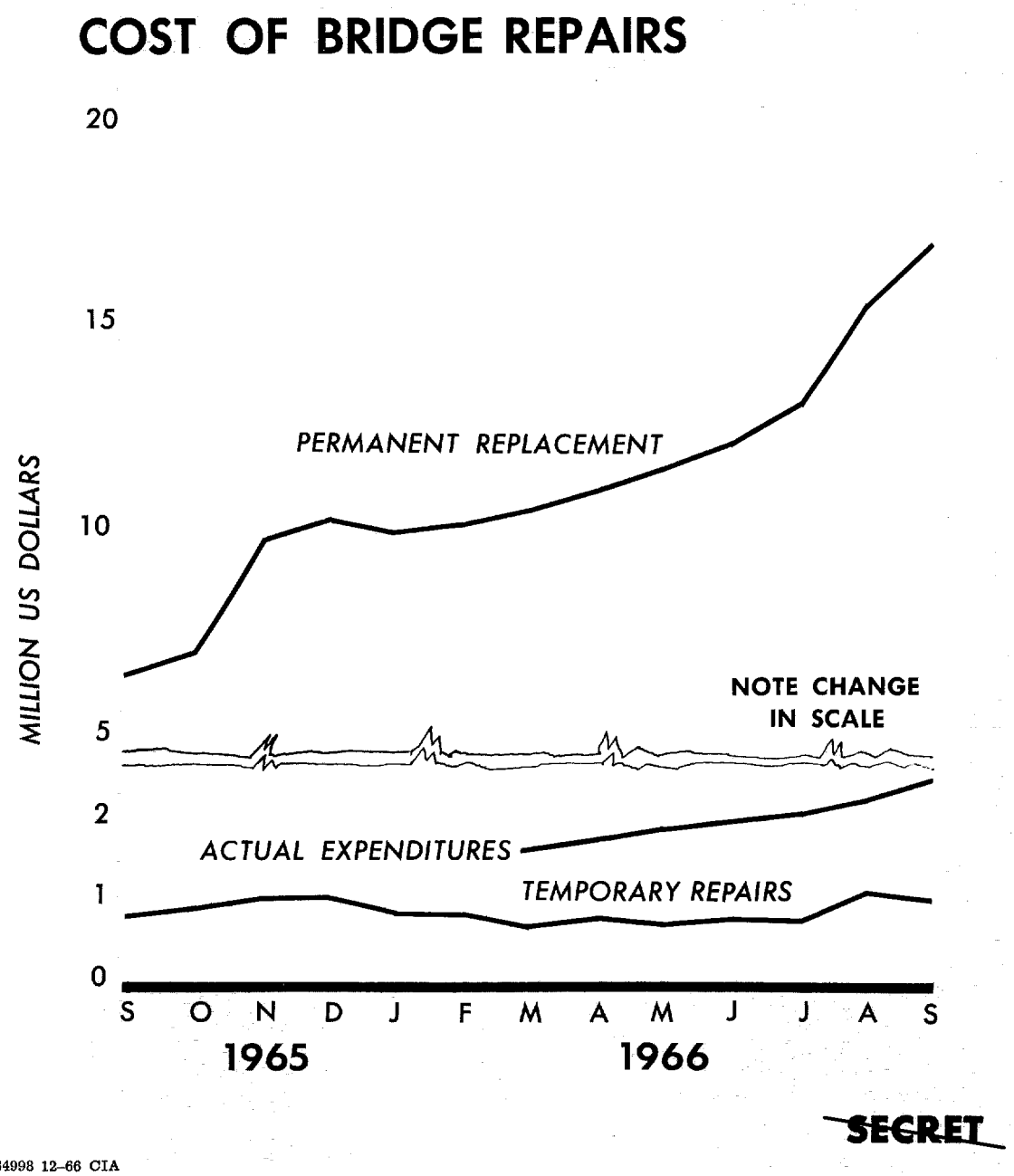

Figure E-2. North Vietnam: Cost of Permanent and Temporary Repairs of Bridges and Actual Expenditures, by Month, September 1965-September 1966

3. Deception Techniques

A more intensive and widespread use of camouflage has been noted in North Vietnam and Laos during 1966. Aerial photography indicates the use of trelliswork and natural cover on roads in Laos and on rail spurs in North Vietnam. Workcamps involved in repair work have been ordered to camouflage more bridges and to erect dummy bridges in southern North Vietnam; aerial photography has confirmed this.

4. Resources Used in Countermeasures

The North Vietnamese have demonstrated that they have the capability to maintain and repair those lines of communications vital to their war effort while at the same time building new roads to act as alternates. The labor force involved directly in repair, maintenance, and construction activities is believed to have reached a peak of 70,000 to 100,000 in late 1965 and to have declined slightly in 1966. Through a program of pre-planning, airstrikes have been anticipated on lines of communications by pre-positioning labor and materials for quick repairs to damaged bridges, cratered roads, and railbeds. Speed and simplicity of repair have been the main features of the North Vietnamese maintenance program, based primarily on large amounts of highly mobile labor and the use of local building materials. North Vietnamese planners have considered possible reductions in the labor force working on bomb damage during 1966 if an expected increase in labor productivity was realized. Indeed, the completion of significant additions to the transport network, together with the experience acquired in bomb damage repair may have allowed the North Vietnamese to reduce the permanent labor force to between 60,000 and 70,000.

The movement of an estimated 20,000 railroad engineering troops from Communist China into northern North Vietnam has, among other things, relieved the North Vietnamese from the task of maintaining the rail lines from China. Although it is not known whether the Chinese have engaged in other repair work, their presence has given the North Vietnamese greater flexibility in assigning their own construction workers for duty in southern North Vietnam, Laos, and South Vietnam.

North Vietnamese ability to maintain a high rate of repair has further enabled them to keep the transport system operable. They repaired cratered road segments and rail beds within a 24-hour

Table A16

Losses by Model of Aircraft in Operations Against North Vietnam
1965 and January-September 1966

Aircraft Model	1965 Number of Aircraft Lost	1965 Total Sorties Flown by this Model Aircraft	1965 Losses as a Percent of Total Sorties Flown by this Model Aircraft	January-September 1966 Number of Aircraft Lost	January-September 1966 Total Sorties Flown by this Model Aircraft	January-September 1966 Losses as a Percent of Total Sorties Flown by this Model Aircraft
F105	54	9,217	0.6	86	12,537	0.7
F4	19	6,203	0.3	33	8,437	0.4
A1	26	3,546	0.7	24	4,845	0.5
A4	29	8,951	0.3	47	12,175	0.4
F8	15	3,600	0.4	15	4,897	0.3
A6	3	506	0.6	8	687	1.2
RF101	6	299	2.0	11	406	2.7
RF8	6	364	1.6	6	495	1.2
EA1	1	726	0.1	2	987	0.2
F104	0	696	0	3	946	0.3
RA3	0	26	0	1	36	2.8
KA4	0	701	0	1	953	0.1
RA5	3	141	2.1	2	191	1.0
A3	0	109	0	1	147	0.7
B57	1	149	0.7	1	203	0.5
C130	0	51	0	1	69	1.4
F100	5	418	1.2	1	610	0.2
HU16	0	0	0	1	N.A.	
RB66	0	288	0	2	391	0.5
RC47	0	0	0	1	N.A.	
EF10	0	455	0	1	618	0.2
KC130	0	4	0	1	5	20.0
SH3A	3	6	50.0	0	0	0
Total	171	36,456 a/	0.5	249 b/	49,635 a/	0.5

a. Including only sorties by aircraft models for which losses occurred in either 1965 or 1966.
b. Including 222 combat losses and 27 operational losses.

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would be less severe. The attacks would have little or no immediate effect on military capabilities, although they might have a minor effect in the long run.

North Vietnam has made some slow progress in restoring damaged power facilities. Repair work at Nam Dinh had progressed to a stage in August that indicates possible partial operation of this plant by the end of 1966. Restoration under way at the Thanh Hoa and Ben Thuy plants was either set back or nullified by airstrikes during September and October. There has been no attempt to repair the damaged powerplants at Co Dinh or at Ban Thach since mid-1965. The Uong Bi powerplant was put back into service after the strikes of December 1965 and April 1966, and work toward restoration apparently has been started again since the heavy destruction inflicted in August 1966.

The persistence of efforts to restore damaged power facilities underlines the importance of these plants to North Vietnam and strongly suggests that no suitable alternative to central generating plants has been found. Mobile generating units imported by the hundreds during the past 18 months apparently have failed to offset the loss of central generating facilities. From the sizes and total capacity of mobile units imported thus far, however, significant reliance on such units for industrial power supply is highly unlikely.

The history of the attack on powerplants during 1965 and 1966 indicates that they can be put out of operation for long periods of time only if the main buildings sustain direct hits; near-misses have produced a negligible effect. It is also clear that a number of restrikes were carried out against plants that already were out of operation. Finally, it seems probable that airstrikes against large powerplants in the main power system, such as Thai Nguyen, Viet Tri, Hon Gai, and Bac Giang -- had they been carried out -- would have produced far greater effect than the strikes actually made on the four small isolated powerplants in the area of Thanh Hoa and Ben Thuy.

3. Manufacturing

Only four manufacturing facilities of any significance have been attacked under the Rolling Thunder program, two in 1965 and two in 1966 (see Table B3). Although restoration costs are estimated to be comparatively small for damage to these plants in either year ($1.2

FOREWORD

This memorandum presents a detailed analysis of the Rolling Thunder program during the period 1 January-30 September 1966. It follows a preliminary report, The Effectiveness of the Rolling Thunder Program in North Vietnam, published in November 1966. The summary in this memorandum is essentially that presented in the earlier paper, except for two major changes, resulting from additional analysis, and some changes in detail. We now find that the costs of the program in 1966 have been much higher, as compared with the dollar value of the destruction achieved, than we had estimated in the preliminary report.* In addition, our assessment of the interdiction campaign indicates that its reorientation to the high-yield target systems in the northern part of North Vietnam would make Rolling Thunder a more effective program both in terms of maximizing the costs to the enemy and of reducing his capability to recuperate.

The present memorandum presents comprehensive analyses of some subjects not covered in the preliminary report. Among these are:

(1) Third country attitudes toward the Rolling Thunder program;

(2) A study of the consequences of mining the port of Haiphong;

(3) A detailed re-assessment of the interdiction aspects of the bombing programs in North Vietnam and Laos, including an estimate of the potential of a revised interdiction program; and

* US and allied costs include only direct operating costs -- aircraft losses and sortie overhead and ordnance costs. The damage to North Vietnamese installations is valued by estimating the cost to North Vietnam of restoring attacked installations; these costs are then converted to dollars. The ratio of the two is a statistical measure of the direct cost of inflicting a dollar's worth of damage in North Vietnam through Rolling Thunder attacks. It should not be interpreted as a monetary expression of the total effectiveness of Rolling Thunder.

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suggests that the Communist countries will continue to provide North Vietnam both with replacements for essential damaged equipment and with equipment enabling North Vietnam to continue its own repair and maintenance.

makes it evident that the relative cost and value of the air war in Southeast Asia must be measured in military, political, and psychological terms, rather than economic.

II. North Vietnam

A. Sorties

During the first nine months of 1966, a total of 105,970 sorties was flown against North Vietnam, nearly twice the total of 55,210 flown during 1965.* In 1966, as in 1965, US aircraft flew 99 percent of the sorties, and aircraft of the South Vietnamese Air Force flew the remaining 1 percent. The share of attack sorties in the total increased from 47 percent in 1965 to 56 percent in 1966, while the share of support sorties declined from 53 percent to 44 percent. Thus the number of ordnance-carrying sorties increased, relative to the total.** Sorties flown over North Vietnam in 1966 represented 34 percent of total sorties flown in Southeast Asia, compared with 30 percent in 1965. Sorties flown against fixed targets from the JCS target list, which in 1965 accounted for 25 percent of total sorties, represented only about 2 percent of total sorties in 1966. Armed reconnaissance sorties not carried out as restrikes of JCS fixed targets increased from 75 percent of total sorties in 1965 to 98 percent in 1966. The US Air Force, which flew 44 percent of all sorties against North Vietnam in 1965, increased its share to 52 percent in 1966, while the share of the US Navy declined from 53 percent to 44 percent. The US Marine Corps increased its share from 2 percent in 1965 to 3 percent in 1966, and the share of the South Vietnamese Air Force remained constant at 1 percent.***

Of the total sorties against North Vietnam, 44 percent originated from the Navy aircraft carriers, 36 percent from US Air Force bases in Thailand, and 20 percent from bases in South Vietnam (see Table A11). To facilitate the assignment of armed reconnaissance sorties, North Vietnam is divided into six areas known as Route

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* Data pertaining to the air attack on North Vietnam in 1965 and 1966 are summarized in Figures A4, A5, and A9.

** For a presentation of monthly sorties over North Vietnam in 1965 and 1966, by mission and nationality, see Table A9.

*** For a presentation of monthly sorties against North Vietnam during 1965 and 1966, by program and by service, see Table A10 and Figure A6.

Although US airstrikes have put out of operation about one-third of the generating capacity in North Vietnam's electric power industry, the losses of power-generating capacity probably have had only a minor effect on the economy and on the ability of North Vietnam to conduct military operations. Remaining capacity has been adequate to supply most industrial consumers and probably even to supply minimal nonindustrial demands. There have been reports of occasional power shortages in Hanoi and Haiphong involving nonindustrial consumers, but no reports concerning restrictions on power supplied to industry. The major part of modern industry in North Vietnam is concentrated in and around these two cities. Shortages in the Hanoi-Haiphong area probably have made it necessary to discontinue service only to nonessential users during peak-load periods. The most severe shortages of power to industry are estimated to have occurred at Nam Dinh, Thanh Hoa, and Ben Thuy. Power supply to Nam Dinh probably has fluctuated during the past year, depending on whether the Uong Bi powerplant was in or out of service. Damage to powerplants in the vicinity of Thanh Hoa and Ben Thuy has virtually eliminated the supply in these areas for more than one year, but the effect on the national economy must have been slight in view of the small contribution to national product made by those localities.

The margin of reserve generating capacity available prior to the beginning of airstrikes apparently has been eliminated. Industrial demands probably could be generally fulfilled even if an additional 10 percent of generating capacity were lost. However, staggering work shifts and eliminating nonessential consumption by residential-commercial users, public lighting, and transportation probably would become necessary. Any additional losses of generating capacity would almost certainly reduce the power supply for industry.

The most important powerplants still operating in the Hanoi-Haiphong Power System are located at Thai Nguyen, Viet Tri, Hon Gai, and Bac Giang. Destruction of these plants would deny over one-half of remaining power-generating capacity. Hanoi would be forced to rely on a local powerplant which, in view of its age and generally poor condition, probably could supply no more than 40 to 50 percent of demand, and even this level of supply probably could not be sustained for long periods. Roughly the same deficit would occur in Haiphong which also would have to rely on two small, old powerplants that are in poor condition. Successful attack on the four important powerplants remaining would greatly reduce the power supply for heavy industry. The effects on light industry and agriculture

APPENDIX G

THE WAR-SUPPORTING ROLE OF NORTH VIETNAM'S INDUSTRY

I. Current Activity in North Vietnamese Manufacturing Facilities

A. Photographic Evidence

A detailed study of representative major modern industrial installations in North Vietnam shows no appreciable change in the level of production activity at these installations during the period of the Rolling Thunder program. In only one plant, the Hanoi Vehicle Repair and Assembly Plant, was it possible to discern a significant decrease in productive activity in recent months, and this apparent reduction could reflect the dispersal of part of the plant's facilities to other areas. Photography gave no firm evidence of the dismantling and moving away of significant amounts of production equipment from large plants. Not even the Nam Dinh Textile Mill, which has repeatedly been reported to have been dismantled, showed signs of such dismantlement. On the other hand no new construction was evident in the photography of the plants studied. A summary of the photographic analysis is given in Table G1.

B. Dispersal of Industry

Despite the heavy emphasis given in the North Vietnamese press to the claim that industry has been dispersed, it is extremely doubtful that any serious attempt has been made to dismantle major industrial plants and set up the equipment again in scattered areas. Technical constraints would probably prohibit any effective dispersal of such facilities as the fertilizer or rubber plants. Such plants cannot be economically subdivided, and even a plant with homogeneous equipment such as in a spinning mill cannot be subdivided without the installation of necessary ancillary equipment at each of the new locations. Furthermore, it is even likely that many of the large number of small machine shops and repair installations already scattered throughout North Vietnam are being consolidated and strengthened by additional equipment. The Hanoi Machine Tool Plant, the prime candidate for dispersal in the machine building industry, reportedly has expanded its facilities in 1966 and has opened a shop in another location as well.

million in 1965 and $700,000 in 1966), losses in production from these plants appear to be considerably more significant.

The two plants attacked in 1965 were the Lang Chi Explosives Plant (JCS No. 47.2) and the Nam Dinh Textile Plant, which is not targeted. Neither plant has been restored, and presumably greater imports are compensating for the loss in production from these plants. The Lang Chi plant is the only known explosives plant in North Vietnam. The Nam Dinh Textile Plant, although only slightly damaged unintentionally by a strike in late July 1965, is operating with only a small percent of its capacity, if at all. As a result, about 60 percent of the national spinning capacity and 40 percent of the weaving capacity have remained inactive for over a year. Inadequate or fluctuating electric power supply may be the major reason for this plant being inactive, rather than damage to the plant itself.

In 1966 the Cam Pha Coal Treatment Plant was attacked twice in April (as part of the attacks on the Cam Pha Port complex, JCS No. 68.0) and the Viet Tri Paper Mill (not targeted) was attacked in July. Damage at Cam Pha, although slight, resulted in a considerable reduction in coal exports, amounting to about $3.7 million through September 1966. It is estimated that the major machinery at the Viet Tri Paper Mill was destroyed, and, if so, the plant will be inoperable for a long time. Work has begun to repair the roof of the plant. This plant represents 80 percent of the national capacity for paper production.

4. Bridges

The total number of bridges confirmed by photography to have been damaged and destroyed by the Rolling Thunder attack in 1966 (January through September) was about equal to that obtained in 1965. The estimated cost of complete restoration and temporary repairs to the bridges also was about equal in the two years -- $10.5 million in 1965 and $9.7 million in 1966.

a. JCS-Targeted Bridges

Although the total number of bridges attacked in January through September 1966 was about equal to the number in 1965, attacks against JCS-targeted bridges decreased. In 1966, at least 133 strikes were carried out against 32 bridges, some of which had been attacked in 1965, compared with 144 strikes and restrikes against 47 JCS-targeted bridges in 1965. Almost all of the strikes

Table A5

Ordnance Delivered by Air in Southeast Asia
by Month
March-December 1965 and
January-September 1966

Tons

Year and Month	Country			
	North Vietnam	South Vietnam	Laos	Total
1965				
March	1,130	N.A.	N.A.	1,130
April	2,260	N.A.	N.A.	2,260
May	1,800	N.A.	N.A.	1,800
June	3,330	N.A.	N.A.	3,330
July	3,470	N.A.	N.A.	3,470
August	4,670	N.A.	N.A.	4,670
September	5,520	N.A.	N.A.	5,520
October	5,090	N.A.	N.A.	5,090
November	4,520	N.A.	N.A.	4,520
December	2,510	N.A.	N.A.	2,510
Total	34,300	N.A.	N.A.	34,300
1966				
January	270	23,870	13,920	38,060
February	4,780	21,810	10,880	37,470
March	7,740	24,090	8,980	40,810
April	9,040	18,920	9,290	37,250
May	7,550	18,080	7,130	32,760
June	10,960	19,030	4,520	34,510
July	16,340	23,880	2,360	42,580
August	17,330	25,590	1,440	44,360
September	17,760	20,430	1,230	39,420
Total	91,770	195,700 a/	59,750	347,220

a. Including 5,630 tons of ordnance expended by an unknown number of US Army sorties in South Vietnam.

Table A21

Statistical Summary of Attacks on Airfields
in North Vietnam
1965 and January-September 1966

	1965	1966	Total
Number of JCS fixed targets	11	11	
JCS fixed targets struck	4	1	
Percent of national capacity destroyed	19	19	
Sorties			
Attack	420	40	460
Support	130	10	140
Total	550	50	600
Ordnance delivered (tons)	330	100	430
Cost to the United States (million $)			
Aircraft lost	0	0	0
Operational cost of sorties flown	0.48	0.11	0.59
Ordnance delivered	0.40	0.13	0.53
Total	0.88	0.24	1.12

II. Civilian and Military Casualties

The cumulative civilian and military casualties attributable to the Rolling Thunder program through September 1966 total 28,900, of which an estimated 17,900 are civilian personnel. Some 13,200 of the total casualties occurred in 1965. On the basis of sample data through the first nine months of 1966, North Vietnamese civilian and military casualties are estimated to have been about 40 percent killed and 60 percent wounded.

During 1966 the emphasis on armed reconnaissance rather than attacks on fixed targets resulted in armed reconnaissance accounting for 93 percent of total casualties, compared with 52 percent in 1965. The swing away from attacks on JCS-designated fixed targets had several notable results in terms of human casualties in North Vietnam. In 1965 a greater emphasis in attacks on fixed targets, which are predominantly military, resulted in military personnel accounting for almost 55 percent of total casualties. In 1966, however, military personnel accounted for only about 24 percent of total casualties.

The preponderance of civilian casualties resulting from the acceleration of armed reconnaissance has in large measure involved those civilians who are most directly engaged in the maintenance and operation of the logistics system moving supplies and personnel into Laos and South Vietnam. The total impact of some 11,900 civilian casualties, including possibly as many as 5,000 deaths, is not an inordinately high result from military action against North Vietnam. The impact of this loss is even smaller when compared with the annual total in North Vietnam of some 350,000 natural deaths, and the annual number of accidental deaths which is from two to three times the deaths resulting from the Rolling Thunder program.

A. Casualties from Attacks on Fixed Targets

In the past year the Rolling Thunder attack against JCS fixed targets has changed considerably in both size and scope. Some 2,000 attack sorties were directed against JCS targets in 1966, compared with 8,700 sorties flown in 1965. The JCS strikes in 1965, generally were directed against facilities in areas with relatively low population densities. During 1966 the growing scarcity of unstruck JCS targets has resulted in a restrained bombing program against more lucrative targets in areas having much higher population densities

The decline is attributable in part, at least, to increased internal consumption of cement as a consequence of the bombing. The quarterly totals of these losses are presented in the tabulation below:

	Thousand US $			
	Apatite	Cement	Coal	Total
1965				
2nd quarter	665	192		858
3rd quarter	1,043	324		1,367
4th quarter	1,554	395		1,949
Subtotal	3,262	911		4,174
1966				
1st quarter	1,554	205		1,759
2nd quarter	1,554	40	1,476	3,071
3rd quarter	1,457	244	2,192	3,893
Subtotal	4,565	489	3,668	8,723
Total	7,827	1,400	3,668	12,897

B. Military

1. Barracks

Although about 35 strikes were made against at least 15 JCS-targeted barracks during January-September 1966, no significant additional loss resulted. All but one of the barracks had been struck in 1965, and more than half of them appeared to have been inactive at the end of 1965. The attacks in 1966 increased the percent of barracks capacity destroyed to about 23 percent of the total national capacity, compared with a little more than 18 percent destroyed at the end of 1965. The cost of restoration of the damage done in 1966 is estimated at about $1.5 million, compared with about $16 million in 1965 (see Table B6).

Before the beginning of the Rolling Thunder program, North Vietnam had barrackscapacity for about 443,000 men. The 63 targeted barracks accounted for about 180,000 men. Thus far, about

Table F1

North Vietnam: Identified Seaborne Foreign Trade a/
1964, 1965, and January-September 1966

Thousand Metric Tons

	1964	1965 b/	January-September 1966
Total c/	2,200	2,410	1,530
Imports	638	697	704
Petroleum	142	170	160
Fertilizers	140	162	172
Grain and bulk food	162	119	39
Timber	32	15	13
Miscellaneous	162	231	320
Exports	1,565	1,713	823
Coal	950	1,150	694
Apatite	338	318	10
Cement	140	78	69
Miscellaneous	137	167	50

a. An additional unknown quantity of imports was carried from Communist China by Chinese Communist ships. Because of rounding, components may not add to the totals shown.
b. In 1965 an additional 56,200 metric tons of cargo was identified as carried by North Vietnamese ships involved in trade between Haiphong and South China ports.
c. Rounded to the nearest 10,000.

much of which was coal. Apatite and cement were the other major export items. Exports of coal and apatite by sea decreased substantially in the first nine months of 1966. The major seaborne imports were petroleum and fertilizers. In 1966 there has been a marked increase in the imports of machinery, vehicles, manufactured and processed goods, and other economic aid items -- all vital to the small modern sector of the economy and to the country's ability to absorb the impact of the air war.

The foreign trade carried by railroad in 1965 consisted of about 320,000 tons of imports and 150,000 tons of exports. Coal made up about one-half of the imports by rail, while military supplies made up a significant portion of the remainder. Machinery,

Table A28

Statistical Summary of Attacks on Powerplants
in North Vietnam
1965 and January-September 1966

	1965	1966	Total
Number of JCS fixed targets	18	19	
JCS fixed targets struck	6	5	
Percent of national capacity destroyed	27	32	
Sorties			
Attack	230	40	270
Support	260	0	260
Total	490	40	530
Ordnance delivered (tons)	370	140	510
Aircraft lost	4	0	4
Personnel lost	3	0	3
Personnel recovered	1	0	1
Cost to the United States (million $)			
Aircraft lost	4.4	0	4.4
Operational cost of sorties flown	0.9	0.075	0.975
Ordnance delivered	0.7	0.070	0.770
Total	6.0	0.145	6.145

Table A13

Ordnance Delivered by Air on North Vietnam, by Month and by Program
March-December 1965 and January-September 1966

Tons

Year and Month	On JCS Fixed Targets (1) Total on JCS Fixed Targets (Col. 2 & 3)	On JCS Fixed Targets (2) By Fixed Target Strikes	On JCS Fixed Targets (3) By Armed Reconnaissance Strike	On Armed Reconnaissance (4) Armed Reconnaissance Not on Fixed Targets	On Armed Reconnaissance (5) Total on Armed Reconnaissance (Col. 3 & 4)	Total (6) Total (Col. 1 & 4)
1965						
March	1,130	1,130	0	0	0	1,130
April	1,830	1,620	210	430	640	2,260
May	1,420	1,420	0	380	380	1,800
June	1,900	1,900	0	1,430	1,430	3,330
July	1,490	1,410	80	1,980	2,060	3,470
August	1,470	1,280	190	3,200	3,390	4,670
September	1,790	1,780	10	3,730	3,740	5,520
October	700	590	110	4,390	4,500	5,090
November	620	480	140	3,900	4,040	4,520
December	450	350	100	2,060	2,160	2,510
Total	12,800	11,960	840	21,500	22,340	34,300
1966						
January	0	0	0	270	270	270
February	270	0	270	4,510	4,780	4,780
March	220	0	220	7,520	7,740	7,740
April	460	80	380	8,580	8,960	9,040
May	220	0	220	7,330	7,550	7,550
June	280	190	90	10,680	10,770	10,960
July	440	60	380	15,900	16,280	16,340
August	460	40	420	16,870	17,290	17,330
September	260	0	260	17,500	17,760	17,760
Total	2,610	370	2,240	89,160	91,400	91,770

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provinces and along the Laotian border. Except for the Vinh Supply Depot (serving Military Region IV) and the Yen Bai Ordnance Depot (serving the area northwest of Hanoi), the depots struck are of relatively minor importance to the North Vietnamese army. The largest supply depots, located in the Hanoi area and at Thai Nguyen, have not been attacked.

8. Ammunition Depots

Information available indicates that airstrikes have been carried out against only two JCS-targeted ammunition depots so far in 1966 -- the Xom Bang (JCS No. 64.00) and Xom Rung (JCS No. 47.18) depots, both of which had been attacked in 1965 and were inactive at the end of the year. The attacks in 1966 resulted in slight additional damage, the restoration of which will cost only about $200,000. Attacks in 1965 against 13 depots resulted in damage amounting to about $4.5 million.

North Vietnam had storage capacity for about 112,600 tons of ammunition at the beginning of 1965, exclusive of storage in barracks and headquarters complexes. It is believed that attacks carried out through September 1966 have destroyed about one-fourth of this capacity. There is no indication that the depots resumed activity after being attacked.

The destruction of the depots probably has caused temporary delays in distribution and inconvenience but has not caused shortages of ammunition in the areas where they are located. Four of the depots destroyed are located north or northwest of Hanoi and could have been used for the receipt of ammunition from Yunnan Province in China. The other depots are important for regional support of the North Vietnamese troops and for supplying the Communist forces in Laos and South Vietnam. Other depots not yet attacked, located in the Hanoi-Haiphong area, are much more significant in the system for importing ammunition from China, distributing it internally, and arranging for its infiltration into neighboring countries.

9. Naval Craft

A total of 10 North Vietnamese naval craft have been destroyed by US aircraft through September 1966. In 1965, three Swatow-class gunboats were sunk while in waters near Haiphong and Hon Gai, and a fourth was destroyed while in tow at sea. In 1966,

Table A6

Distribution of US Sorties from Each Launch Base
to Target Areas in Southeast Asia
January-September 1966

Percent

	From South Vietnam			From Thailand	From Naval Carriers
	By USAF	By USMC	All from South Vietnam	By USAF	By USN
To North Vietnam	15	10	10	65	55
To South Vietnam	65	75	70	0	25
To Laos	20	15	20	35	20
Total	100	100	100	100	100

The transport network and its supporting facilities -- such as rail yards and railroad repair shops -- in the northern part of North Vietnam, on the other hand, services a much higher volume of traffic. As traffic on these connections is increased, an interdiction campaign offers greater opportunities for more meaningful results. Denial of the use of port facilities in North Vietnam and other related measures could increase the traffic burden on the major rail connections to Communist China to the extent that all normal traffic could probably not be satisfied.* The utilization of surface transport connections at capacity or near-capacity levels would also offer the prospect of more successful armed reconnaissance missions against trucks and watercraft.

Finally, an intensive attack on these vital transport links coupled with 24-hour reconnaissance would create significant problems in repair and recuperability. The success of North Vietnamese countermeasures has been singularly less striking when they have had to cope with destroyed or damaged rail bridges. These are for the most part less adaptable to temporary expedients to keep traffic moving and generally require permanent and more expensive repair work.

D. North Vietnam's Industry**

The manufacturing industries of North Vietnam have suffered relatively little damage from airstrikes in 1966. Although attacks against the coal-treatment plant at Cam Pha, the Viet Tri Paper Mill, and the Nam Dinh Textile Plant have had an important impact on coal exports and the production of paper and textiles, the remainder of the manufacturing sector has emerged almost unscathed.

A detailed study of modern industrial installations in North Vietnam shows no appreciable change in the level of production activity at these installations during the period of Rolling Thunder. In only one plant -- the Hanoi Vehicle Repair and Assembly Plant -- has a significant decrease in production activity been noted in recent months. This apparent reduction may reflect the dispersal of a part of this plant's facilities to other areas because the plant plays a significant role in its support of war-related activities. There is no evidence that the Rolling Thunder program has forced any other large-scale industry either to disperse facilities or to curtail production. In fact, the manufacturing capability of North Vietnam has been augmented by a stepped-up rate of imports of machinery and equipment from the Communist countries.

* See Appendix F.
** See Appendix G.

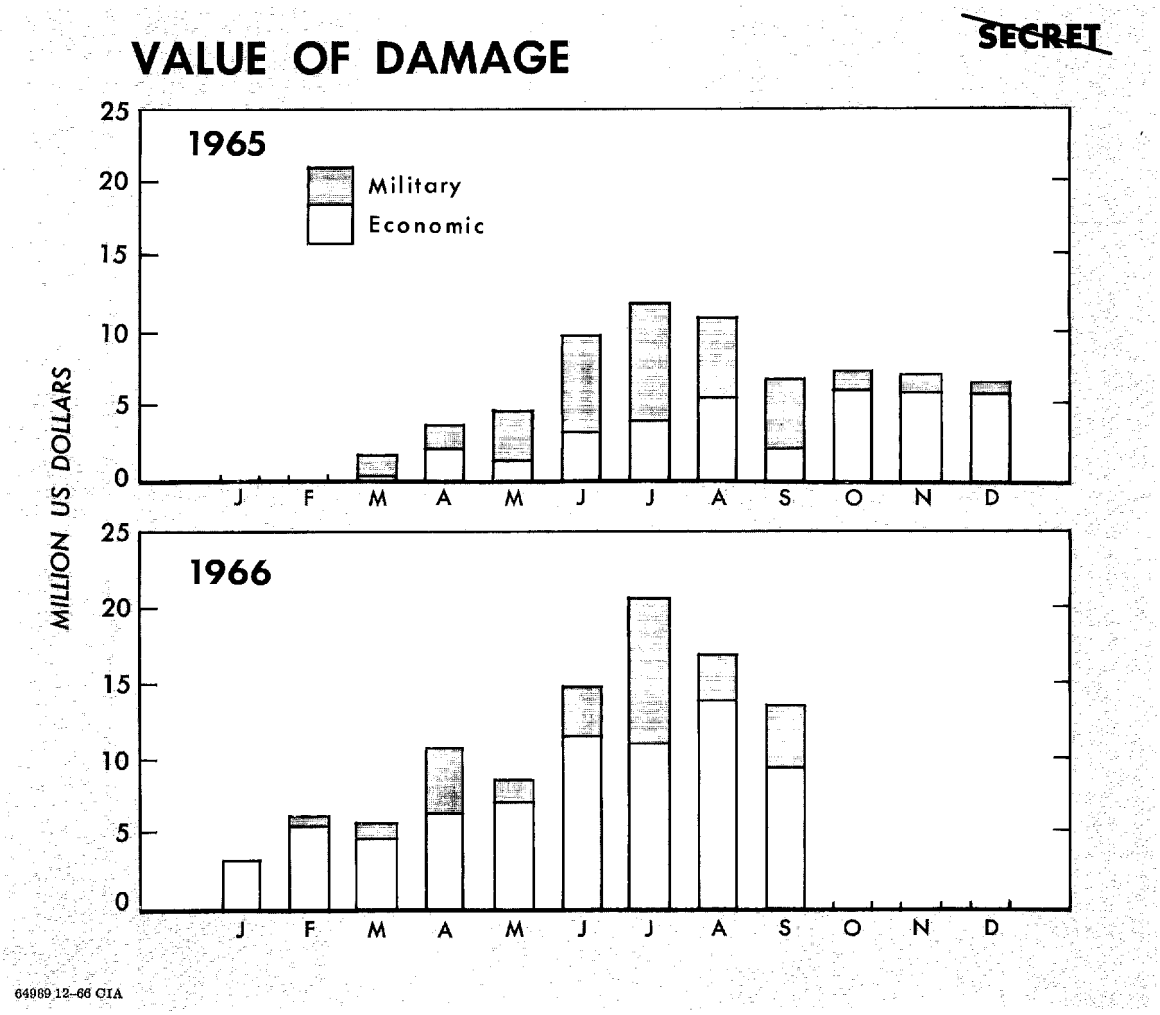


Figure B-4. Value of Economic and Military Damage in North Vietnam, by Month, 1965 and January-September 1966

Table A7

Aircraft Losses in Southeast Asia
by Area of Operation, Nationality, and Type of Loss
January-September 1966

	AREA OF OPERATION															
	North Vietnam			South Vietnam							Laos			Total Southeast Asia		
	NATIONALITY OF AIRCRAFT LOST															
	United States			United States [a]			South Vietnam				United States			United States and South Vietnam		
	TYPE OF LOSS [b]															
Month	Combat	Operational	Total US	Combat	Operational	Total US	Combat	Operational	Total GVN	Total US and GVN	Combat	Operational	Total	Combat	Operational	Total
January	3	0	3	8	7	15	2	1	3	18	5	2	7	18	10	28
February	9	0	9	3	0	3	0	1	1	4	11	1	12	23	2	25
March	24	1	25	11	1	12	1	1	2	14	3	4	7	39	7	46
April	29	5	34	4	3	7	3	1	4	11	8	0	8	44	9	53
May	20	2	22	3	5	8	2	1	3	11	11	1	12	36	9	45
June	21	6	27	4	3	7	2	0	2	9	6	0	6	33	9	42
July	43	1	44	4	2	6	2	2	4	10	1	0	1	50	5	55
August	37	9	46	3	6	9	0	1	1	10	1	0	1	41	16	57
September	36	3	39	8	4	12	0	0	0	12	2	1	3	46	8	54
Total	222	27	249	48	31	79	12	8	20	99	48	9	57	330	75	405

a. Excluding US Army aircraft losses.
b. Combat loss means the destruction of an aircraft on an attack or support mission by enemy fire. Operational loss means the destruction of an aircraft on an attack or support mission through aircraft malfunction or pilot error.

In Europe, one of the most significant of the neutral states is Sweden, whose position on the Vietnam war is generally representative of other North European and neutral West European countries. Several shifts in attitude over the last two years can be noted in Sweden's reaction to the air attacks. The initial response to the strikes during the Tonkin Gulf crisis, for example, was generally one of understanding for the United States coupled with apprehension over the potential for enlargement of the war.

Press criticism of the airstrikes during early 1965 was relatively subdued. This period, however, saw the beginning of picketing of the US Embassy and the receipt of protest letters from Communist and front groups. In March the government's first public statement on Vietnam stressed the urgent need for negotiations and the danger of extending the conflict. It aroused little public interest, however.

A heavy flow of press comment critical of the United States began in April with scare headlines and extensive television coverage. The basic themes were fear of escalation and consequent involvement of Soviet and Chinese Communist forces. During this period the US Embassy was flooded with protest letters. Public media were largely silent on the first pause in the bombing from 12 to 18 May.

There was a marked increase in the volume and violence of protests in Stockholm during the summer as the bombings continued. Some elements of the press began to call on the Swedish Government to take action in the United Nations or some other international forum to counteract US policy. The government, however, did not go beyond a generalized statement on the need for negotiations. The US Embassy noted that left-wing demonstrations and protests had thus far had no effect on government policy or attitude toward US involvement in Vietnam, but that more influential elements now seemed to be entering the picture and that this might make it difficult for the government to maintain its officially neutral stance.

A public opinion poll released on 30 September 1965 showed that 94 percent of those queried were aware that the United States had sent troops to Vietnam; of this percentage 45 percent disapproved of US policy, 25 percent both "approved and disapproved," 13 percent approved, and 17 percent were undecided. The US Embassy concluded that the ambivalent 25 percent did not oppose general US policy, but rather specific acts such as the bombing of North Vietnam. The poll seemed to indicate that the Swedish public was considerably less hostile to US Vietnam policy than the Swedish press.

When sustained US air attacks on North Vietnam began in February 1965, the Chinese reacted with a bitter propaganda barrage similar to that which they had mounted the previous August. Peking repeated earlier threats that the Chinese people would not "stand idly by" but did not send additional aircraft to Hanoi. In June of 1965, however, the Chinese began sending support troops to North Vietnam to help maintain the supply lines between Hanoi and the Chinese border.

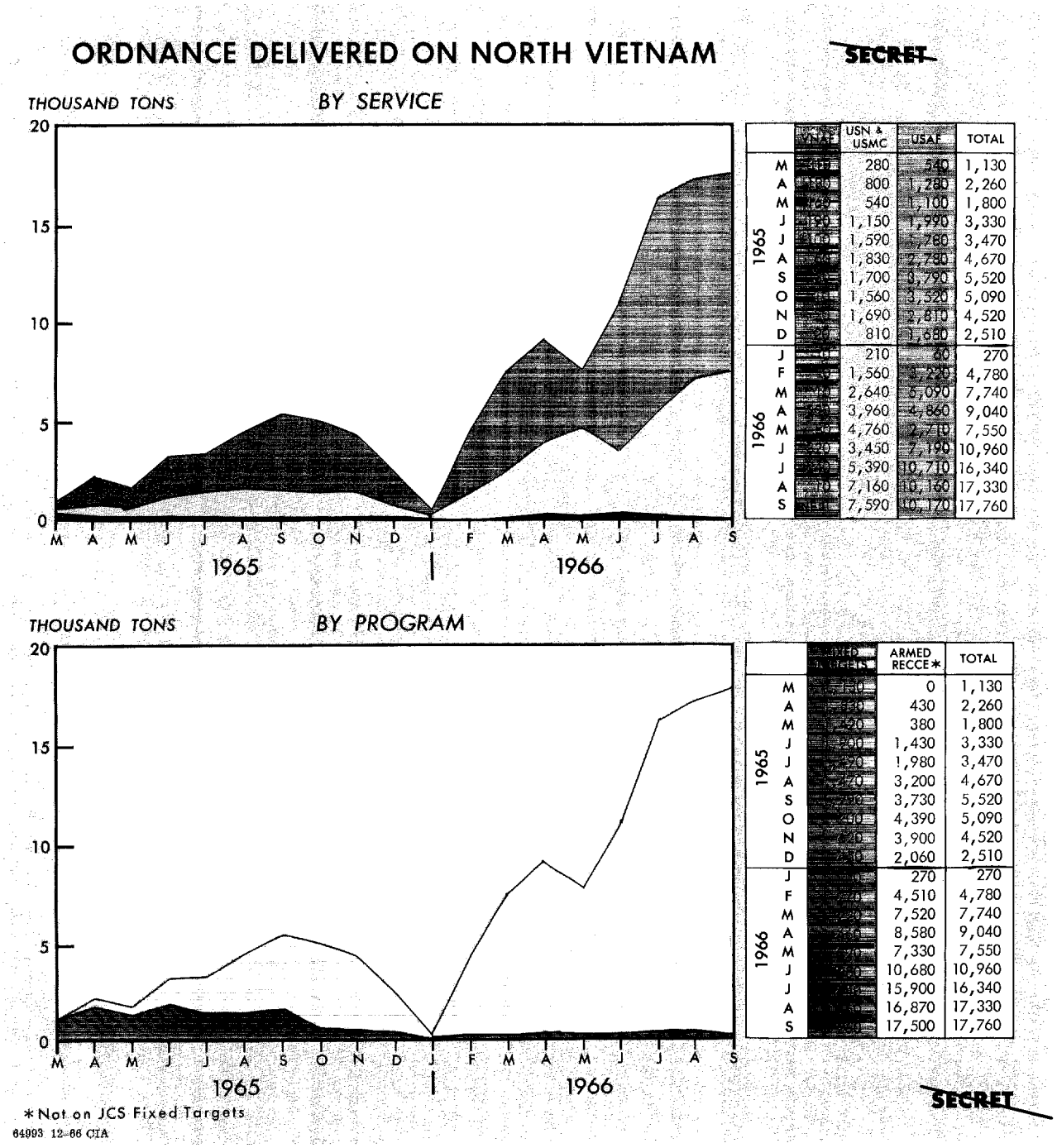
The Chinese have reacted to US peace campaigns and the two suspensions of bombing raids over North Vietnam by declaring them a "peace hoax" designed to prepare for further escalation of the war. During the first pause in the bombing, in May 1965, Peking charged that all US peace efforts were meant to allow continuation of aggression in Vietnam. When the raids resumed, a Chinese Foreign Ministry statement claimed the suspension had been a mere "trick" to sell the US "swindle of unconditional discussions."

During the second bombing pause, in December-January 1965-66, the Chinese again launched a bitter propaganda attack which repeated the familiar "peace hoax" theme and urged Hanoi to reject any negotiated settlement except on Communist terms.

During 1966 the Chinese have become increasingly preoccupied with the Cultural Revolution and the associated power struggle in China. Because of this, they have devoted less attention to foreign policy matters and have become more cautious with regard to Vietnam in both their statements and their actions. Since early spring, Chinese propaganda broadcasts on Vietnam have dropped off sharply -- recently to as low as 3 percent of the total, whereas they had been about 30 percent early in the year.

The Chinese not only have been saying less about Vietnam, but also what they have said recently indicates a gradual pulling back by Peking to a safer, less exposed position on assistance to Vietnam. The Chinese still talk of giving "support" to Vietnam, but less frequently and in more general terms -- giving the impression of not wanting to provoke US retaliation. Chinese propaganda has continued to stress Vietnamese self-reliance.

Another indication of increasing Chinese caution has been the virtual cessation of references to the possibility of "volunteers" being sent to Vietnam since the fall of 1965. The issue, which Peking had raised for the first time in the spring of 1965, reappeared briefly



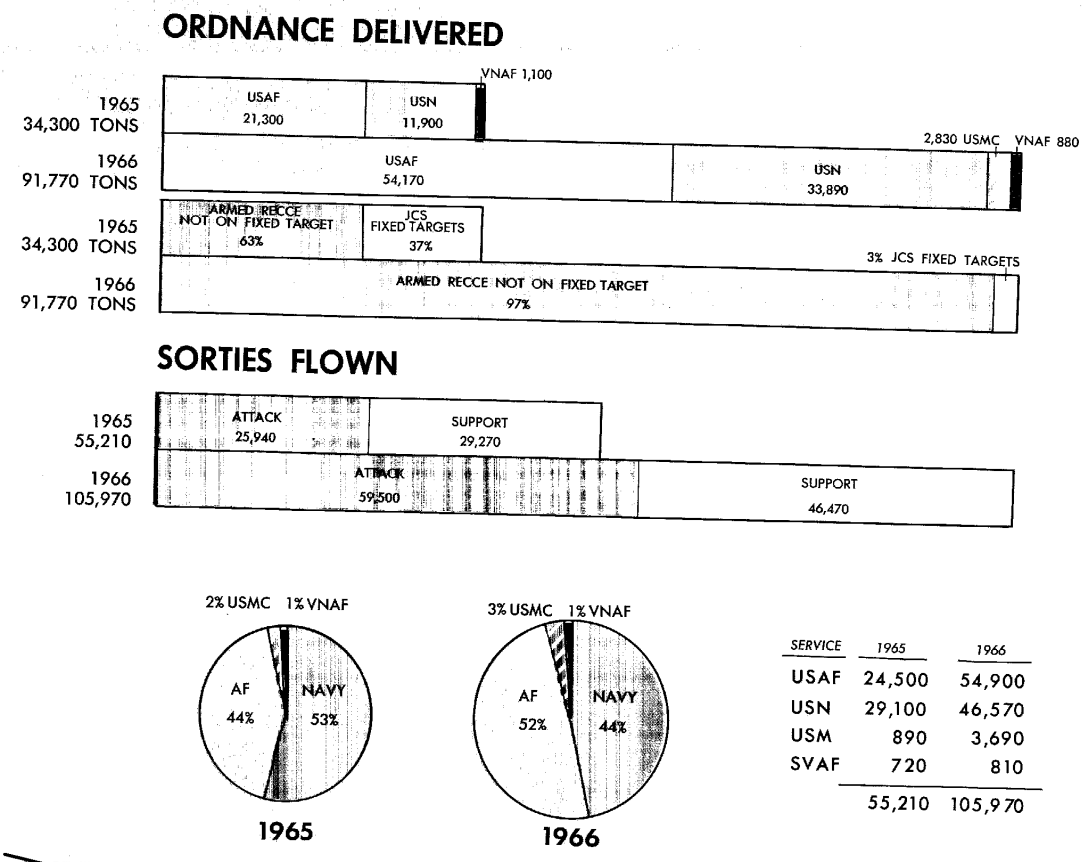
		USN & USMC	USAF	TOTAL
1965	M	280	540	1,130
	A	800	1,280	2,260
	M	540	1,100	1,800
	J	1,150	1,990	3,330
	J	1,590	1,780	3,470
	A	1,830	2,780	4,670
	S	1,700	3,790	5,520
	O	1,560	3,520	5,090
	N	1,690	2,810	4,520
	D	810	1,680	2,510
1966	J	210	60	270
	F	1,560	3,220	4,780
	M	2,640	5,090	7,740
	A	3,960	4,860	9,040
	M	4,760	2,710	7,550
	J	3,450	7,190	10,960
	J	5,390	10,710	16,340
	A	7,160	10,160	17,330
	S	7,590	10,170	17,760

		ARMED RECCE *	TOTAL
1965	M	0	1,130
	A	430	2,260
	M	380	1,800
	J	1,430	3,330
	J	1,980	3,470
	A	3,200	4,670
	S	3,730	5,520
	O	4,390	5,090
	N	3,900	4,520
	D	2,060	2,510
1966	J	270	270
	F	4,510	4,780
	M	7,520	7,740
	A	8,580	9,040
	M	7,330	7,550
	J	10,680	10,960
	J	15,900	16,340
	A	16,870	17,330
	S	17,500	17,760

Figure A-8. Monthly Summary of Ordnance Delivered on North Vietnam, by Service and by Program, March 1965-September 1966

Hanoi's ability to support the war in the south, and in this way may exert a certain worrisome pressure on Hanoi. On the other hand, if Rolling Thunder were to be terminated at this point without concessions, the United States would be deprived of one form of leverage against Hanoi which it now has.

Figure A-4. Statistical Summary of Ordnance Delivered and Sorties Flown in North Vietnam, 1965 and January–September 1966



SERVICE	1965	1966
USAF	24,500	54,900
USN	29,100	46,570
USM	890	3,690
SVAF	720	810
	55,210	105,970

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in Chinese propaganda in July 1966 after the US airstrikes at POL facilities in the Hanoi-Haiphong area. However, Peking has been silent on the subject since then. Also in July 1966 the Chinese began to describe their country as the "reliable rear area" in the Vietnam conflict -- a formulation which suggests that Peking is more reluctant than ever to become directly involved in the war.

Peking's caution is further demonstrated by the fact that neither the number nor the mission of Chinese troops in North Vietnam has changed substantially in the past nine months. It is now estimated that there are between 25,000 and 45,000 Chinese troops in North Vietnam concentrated in the northern part of the country. Their presence in North Vietnam has never been publicly acknowledged by either Hanoi or Peking.

Although US aircraft have crossed into Chinese airspace a number of times during 1966, Peking has avoided specific threats of counteraction and has continued to move with considerable caution, attempting to minimize the prospect of a major clash. For example, Chinese fighters crossed the North Vietnamese border in early September to attack US aircraft which had made a shallow penetration of Chinese airspace, but a relatively deep penetration by a US plane later that month drew a milder response.

Although the continuing internal crisis in China is a complicating factor in judging China's future course of action in Vietnam, the disarray in China's leadership militates against the likelihood of direct intervention at the present. A further intensification of US bombing raids, bringing sizable North Vietnamese civilian casualties, would probably produce a shrill propaganda outcry and cause the Chinese to increase the level of their aid to Hanoi. It is unlikely, however, that it would result in any direct Chinese intervention in the war. Indeed, Peking is unlikely to become directly involved unless the United States launches a ground invasion of the north or the Hanoi regime seems in imminent danger of collapse.

Another US suspension of the bombing of North Vietnam would probably produce a Chinese reaction similar to that which followed the two previous suspensions. Peking would denounce it as a US "hoax" and would press the Vietnamese to reject any negotiated settlement of the war short of a complete Communist victory.

WARNING

This document contains classified information affecting the national security of the United States within the meaning of the espionage laws, US Code Title 18, Sections 793, 794, and 798.

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been carried out against bridges, fords, ferries, and chokepoints. Some 38,000 attack sorties, primarily armed reconnaissance, were flown in Laos during the first nine months of 1966. Air attacks were heaviest during the dry season, when an average of about 1,200 sorties were flown per week. The level of sorties dropped to an average of about 275 per week during the rainy season, which started in June. Pilots reported the following damage to LOC's in Laos for the period 1 April to 30 September 1966:

Region	Bridges	Road Cuts	Fords and Ferries
North Central (Barrel Roll)	13	99	2
Panhandle (Steel Tiger/Tiger Hound)	173	1,071	114

However, aerial photography since January 1966 confirms the destruction or heavy damage of only seven bridges in the north-central region and 57 bridges in the Panhandle, most of which are on fordable streams. In addition, it is estimated that about 1,000 trucks have been destroyed on roads in the Panhandle since the start of bombing in southern Laos.

There were about 16,000 incidents of damage or destruction to targets in Laos reported by pilots during the first nine months of 1966. Ninety percent of these were reported in the Steel Tiger area in the south and the remaining 10 percent in the Barrel Roll area to the north. Destruction was claimed for 37 percent of the targets, 48 percent of them were said to be damaged and 15 percent cut or cratered. The remaining targets were found among the transportation facilities used to supply Communist troops and construction workers in Laos from North Vietnam and Cambodia and to move supplies from North Vietnam through Laos to the border of South Vietnam for the Viet Cong and North Vietnamese forces (see Table E5).

Any estimate of the restoration cost of targets destroyed or damaged in Laos contains a large margin of error because of a lack of adequate post-strike photography for use in cost analysis and an almost total reliance on pilot reports. Because of the nature of the air operations, it is difficult for pilots to provide definitive evaluations of the extent to which targets have been damaged or destroyed, or indeed always to give meaningful descriptions of the targets.

More than 405 planes were lost in the air war over Southeast Asia during the first nine months of 1966.* Of the 405 aircraft, 330, or approximately 81 percent, were reported as combat losses, due to hostile action, and 75, or about 19 percent, were reported as operational losses. Sixty-two percent of total losses were in operations against targets in North Vietnam, 24 percent against targets in South Vietnam, and 14 percent against targets in Laos. The number of planes lost per month, and more significantly, per 1,000 sorties, remained relatively constant for all areas of operation in Southeast Asia.** The average number of combat losses per 1,000 attack sorties during the first nine months of 1966 was 1.5 for all of Southeast Asia, compared with 3.7 for North Vietnam, 0.5 for South Vietnam, and 1.3 for Laos.

The direct operational cost of the air operations in Southeast Asia during the first nine months of 1966 is estimated to be more than $2 billion -- approximately $950 million in operations over North Vietnam, $820 million over South Vietnam, and $310 million over Laos. These costs include only the production cost of aircraft lost, sortie overhead expenses, which vary directly according to the number of hours flown, and the cost of ordnance expended. They make no allowance for such indirect overhead as the cost of maintaining air bases or keeping aircraft carriers on line, or logistic support.*** The value of damage done to the economy of North Vietnam by air operations during 1966 has been estimated at about $100 million. The restoration cost of targets reported as destroyed or damaged by pilots over Laos is estimated to be about $11 million. It is impossible to estimate the economic cost to the North Vietnamese and Viet Cong of airstrikes within South Vietnam. The cost of inflicting a dollar's worth of damage in North Vietnam was about $9.50, up about 42 percent from an estimated cost of approximately $6.70 in 1965. The cost of inflicting a dollar's worth of damage by sorties carried out over Laos in 1966 has been about $28.80. The disparity between the unit cost to the United States of doing damage in North Vietnam compared with damage in Laos reflects the more capital intensive nature of targets in North Vietnam. The figure for both areas, however,

* This figure does not include losses by the US Army.

** Monthly aircraft losses in Southeast Asia are presented by area of operation, nationality, and type of loss in Table A7.

*** The estimated direct operational costs of air operations in Southeast Asia are summarized in Table A8 and Figure A3.

been attacked with the depth and concentration of effort required to obtain maximum results. The air campaign has, in fact, become essentially an interdiction program designed to slow down or to make the movement of men and supplies into South Vietnam more costly. Even this campaign has not obtained maximum results, because a substantial part of the most critical lines of communication have not been subjected to intensive interdiction on a sustained basis. A reorientation of the Rolling Thunder program could produce more meaningful results from the interdiction program and attacks on economic/military target systems. The results to be obtained are, however, limited, not only because North Vietnam's principal contributions to the war do not generally constitute attractive targets, but also because of the military and economic assistance provided by other Communist countries.

B. The Role of External Military and Economic Aid*

Hanoi's ability to provide continued logistic support to Communist forces in South Vietnam, to withstand the effects of the bombing of North Vietnam, as well as to undertake some economic development activity, is largely dependent on the continued receipt of materiel from Communist China and the USSR.

All countries of the Communist camp responded to the intensified US/GVN air offensive in 1965 by extending military and economic assistance as proof of their support. The major aid programs have been undertaken by the USSR and Communist China. The Eastern European Communist countries have extended only limited amounts of assistance.

Since 1953, North Vietnam has received at least $1.5 billion in deliveries of economic aid and military equipment from Communist countries. It is estimated that about one-third of the economic aid and over three-fourths of the military aid have been delivered since 1964. During 1965 and in the first nine months of 1966, at least $350 million in economic aid and $470 million in military equipment deliveries were provided to North Vietnam. The total deliveries of at least $820 million amount to almost five times the value of total damage attributable to the Rolling Thunder program. In addition, North Vietnam's trade deficit, which averaged about $60 million annually in recent years and reached $100 million in 1965, probably is being written off as grant aid or refinanced under long-term credits.

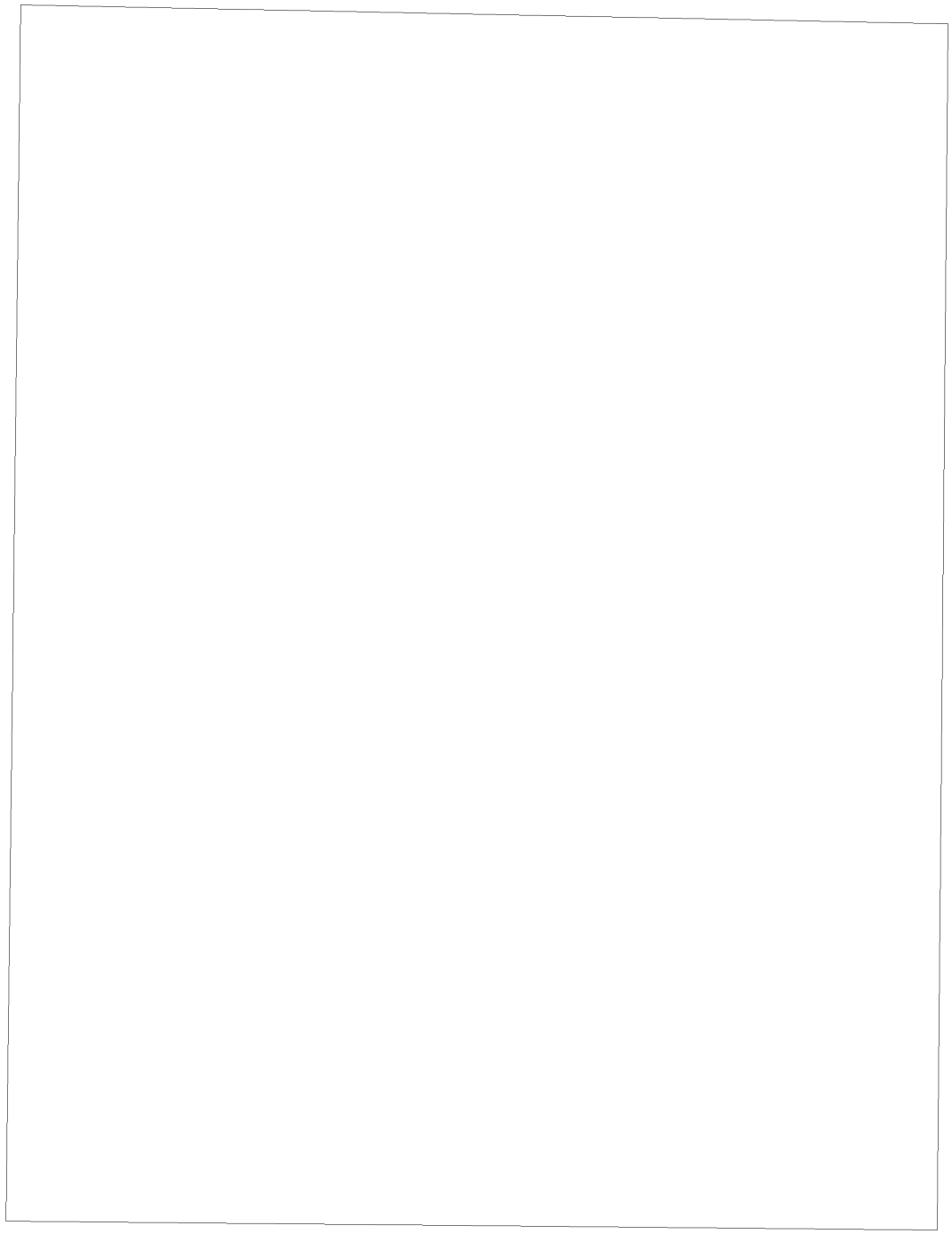
* See Appendix D.

Table B9

Inventory of Miscellaneous Damage
by Armed Reconnaissance Sorties a/
1965 and January-September 1966

	Destroyed		Damaged	
	1965	1966	1965	1966
Transport facilities a/	0	149	75	5,887
Piers		12		25
Road segments				2,670
Ferry facilities		15	75	262
Bridge approaches		7		1,558
Fords/ford approaches		29		308
Bridge bypasses		13		190
Causeways		17		182
Railroad yards		9		19
Railroad segments		2		660
Road construction equipment		28		8
Bulldozers		13		5
Cranes		2		
Road graders		2		
Military facilities	1,911	3,582	2,625	2,303
Barracks	93	48	137	32
Supply warehouses	71	73	105	65
Structures/buildings	1,673	2,920	2,024	1,720
Antiaircraft sites	62	316	88	252
Automatic weapons sites		164		75
Radar and communications sites	9	29	133	49
POL storage areas		12		17
POL tanks		15		6
Truck parks	3	5	138	87

a. Some of the differences in numbers of transport items reported in the two years reflect changes in reporting methods.



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be reoriented to concentrate on the high-yield transport and logistics target systems in the northern part of the country.

Taking a broader view, during the course of the Rolling Thunder program the North Vietnamese capability to support the war effort has improved.

(1) The capacity of the transportation system, at least as it affects the ability to handle the flow of men and military supplies to South Vietnam, has been increased.

(2) The sizable manpower drain has peaked, unless there is a sharp increase in estimated VC/NVA manpower losses in South Vietnam or a radical change in the nature of the air campaign against North Vietnam. In 1965 and 1966, North Vietnam had to mobilize 80 percent of its physically fit males as they reached draft age. Subject to the assumptions just delineated, this levy could be as low as 50 percent of the 1967 class.

(3) Aid from the USSR and Communist China received in 1965 and 1966 has amounted, in estimated value, to about five times the total damage caused by Rolling Thunder attacks.

The fact that a large share of the imports now flowing into North Vietnam is not military aid but machinery and equipment seems particularly significant. On the one hand, it reflects a willingness of the major Communist powers to provide additional equipment for war-related industrial facilities, probably encouraged by the fact that the modern industrial sector of the North Vietnamese economy has been largely off limits to air attack. On the other hand, it suggests that adequate reserves of skilled manpower, electric generating capacity, and other essential inputs are available on a significant scale for conversion to a war-supporting role. While this new emphasis accelerates the ability to support military operations in the short run, it does postpone Hanoi's long-run plans for the development of heavy industry.

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December 1966
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INTELLIGENCE MEMORANDUM

The Effectiveness of the Air Campaign Against North Vietnam

1 January — 30 September 1966

DIRECTORATE OF INTELLIGENCE

~~TOP SECRET~~

GROUP 1
Excluded from automatic downgrading and declassification

A detailed analysis of the damage inflicted on each major target system is presented in Appendix B. The cumulative damage to economic and military facilities through September 1966 amounted to slightly less than $170 million. Economic targets accounted for almost two-thirds of the total damage.

A comparison of 1965 and 1966 shows significant variations in the physical effects of the air attack. During 1966 the air campaign became almost exclusively an armed reconnaissance program. Attack sorties flown against JCS fixed targets in 1966 (including restrikes on armed reconnaissance missions) were less than 3 percent of the total number of attack sorties compared with nearly 35 percent in 1965.

From its inception through September 1966, 175 JCS fixed targets had been attacked. A total of 153 JCS targets were struck in 1965 of which 65 were restruck in 1966. During 1966, 87 JCS targets were struck but only 22 targets were being attacked for the first time. The JCS target list of 30 September 1966 includes 242 targets of which 83 targets have not been attacked.* For the geographic locations of JCS targets and a list of these targets, see Figure 1.

Excluding airfields, over 65 percent of the JCS target program against the military establishment has been implemented. The greatest shortfall has occurred in the implementation of the economic target program. A large number of JCS targets remain among powerplants and other industrial installations, and among critical transportation targets such as locks on the inland waterways, bridges on key rail lines, and the port facilities and mineable areas in the approaches to the principal ports. These unstruck targets would have provided a much greater payoff than many of the JCS targets actually struck during 1965 and 1966, compounding Hanoi's logistic problems and reducing the ease with which it implements effective countermeasures against Rolling Thunder. The airstrikes against JCS fixed targets in 1966 accounted for only 25 percent of total damage, compared with about 70 percent in 1965. The damage yield for each sortie against fixed targets more than tripled, however, rising from $3,400 per sortie in 1965 to over $12,000 per sortie in 1966. This rise is explained principally by the concentration of a limited number of attack sorties against high-cost target systems, particularly the petroleum storage and electric power facilities in North Vietnam. Another significant change in the 1966 air

* The total number of JCS targets struck includes 15 targets struck in 1965 and 1 target struck in 1966 which have been deleted from the current JCS target list.

the United States. Peking could, therefore, be expected to move with great caution, avoiding any action which the Chinese believed might increase the likelihood of US military moves against China.

The initial reaction would probably be a violent propaganda barrage labeling the new developments as a step toward general war in Asia and implying that Chinese involvement was more likely as a result of the US escalation. The objective of all this would be to generate deterrent pressure from US allies and neutrals against any further enlargement of the war. The Chinese campaign would also be targeted against the general public in the United States in the hope of developing effective domestic opposition to administration policies.

Peking might, if the Vietnamese press for it, publicly acknowledge some part of the Chinese logistic support presence in North Vietnam and might make some thinly veiled military moves inside China designed to demonstrate growing Chinese concern. Peking would, however, be very reluctant to do this. Since the fall of 1965, the Chinese have sharply reduced public statements suggesting that they might take a direct role in the hostilities and have implied that war with the United States would come only if the United States attacked China.

The Chinese, however, almost certainly would attempt to increase the level of logistic support in an effort to make up for restrictions imposed on sea supply by the mining of the ports. The Chinese have already started to improve overland supply routes to North Vietnam, probably in the expectation that the ports might sometime be damaged or put out of action. These efforts would be increased. Communist China might also furnish additional antiaircraft weapons and possibly more Chinese antiaircraft artillery units to bolster North Vietnamese air defenses. It seems unlikely, however, that the Chinese would commit their outmatched air force to defend North Vietnam.

3. The USSR

The USSR would protest vigorously and would be quick to mount an intense propaganda campaign condemning US actions. Moscow would probably also reiterate for the record its pledge to provide North Vietnam with the necessary defensive assistance. The USSR has displayed an overriding concern to avoid an open Soviet-US military confrontation, however, and its response will almost certainly be moderated and limited by this continuing concern.

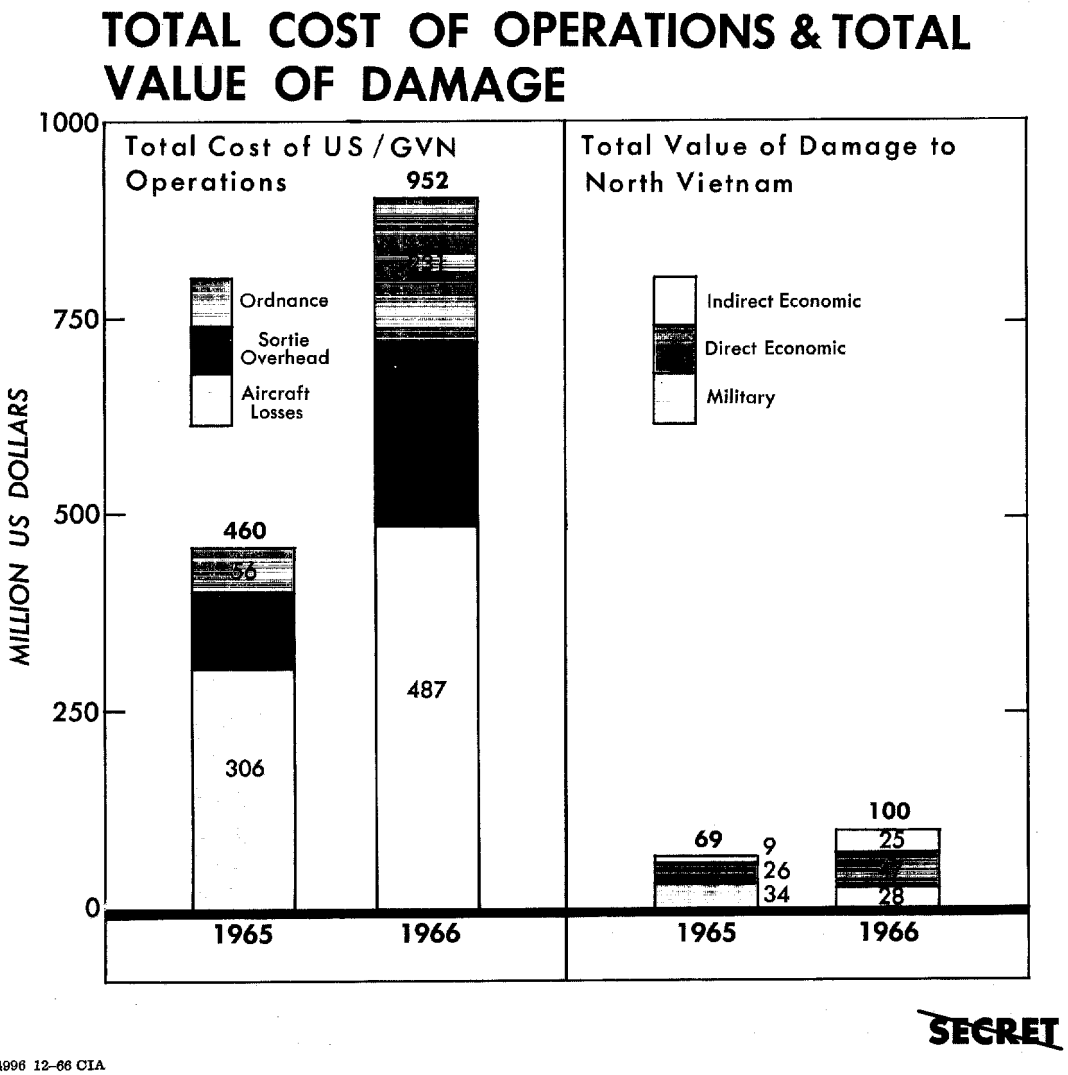

Figure A-9. Estimated Direct Operational Cost of US/GVN Air Operations in North Vietnam and Cost of Economic and Military Damage to North Vietnam, 1965 and January-September 1966

Although it is not possible to quantify the total amount of supplies moved by the Communists in or through the DMZ, they apparently have been able to meet the needs of the increased number of troops. Aerial reconnaissance in September 1966 provided evidence of heavy foot traffic along the trail leading from the DMZ to Route 92 in Laos. The area in northwest Quang Tri Province has new trails varying from two to three feet wide to the width of a motorable country road. Aerial photography shows that the trail at the end of North Vietnamese Route 102 in the DMZ has been improved and that a telecommunications line has been installed through the DMZ into Laos toward Route 9. A recent road-watch report indicated that Route 92 from the DMZ to Route 9 is motorable, but this cannot be confirmed by NPIC from aerial photography. A prisoner-of-war report from Khe Sanh reporting on the same area stated that 70 to 100 bicycles were used to move supplies over trails in the area during the rainy season. It has been estimated that more than five tons of supplies daily could have been moved by these bicycles. Bicycle traffic had been reported in the previous dry season in Laos, but this is the first report of such a sizable number being used there in the rainy season. A recent rallier reported that his battalion crossed the Ben Hai River in the DMZ and that three companies were transporting rice from south of the river to the area of Tan Lam in South Vietnam. Other information indicates that units are continuing to move through or toward the DMZ.

B. Laos

1. Results of Bombing the Logistics System

Air operations against LOC's have been concentrated in the north-central and Panhandle areas of Communist-held Laos. The roads and river crossings in the Panhandle were hardest hit in 1966, with about 70 percent of the sorties flown in this region. Strikes have

Moscow depends on the sea lanes for the delivery of most of its economic aid to North Vietnam, and if the United States were in effect to interdict Soviet shipping to North Vietnam, Soviet leaders would probably conclude that the United States had decided to enter a new phase in the war despite the consequences for bilateral US-Soviet relations. From a practical point of view, the USSR would take steps to offload cargo outside the harbors or in Chinese ports, in spite of the risks involved in allowing Peking to exercise control over the transit of Soviet materiel. It is not believed that the USSR would risk open confrontation with the United States by bringing in submarines or minesweepers in a show of the flag.

Beyond this, however, the USSR might consider mining of the seaports so provocative a step as to warrant even sharper diplomatic retaliation. Moscow could, for example, break off all bilateral negotiations with the United States in such matters as outer space and nonproliferation discussions. The USSR might recall its ambassador from Washington in an ostentatious display of anger. It would certainly launch a massive propaganda campaign designed to embarrass the President by contrasting this provocative and dangerous step with his "hypocritical" appeals for a reduction in East-West tensions. This possibility would be greatly strengthened if the United States carried out the mining operation without warning or with some serious damage to Soviet shipping.

Table A17

Direct Operational Costs Related to Costs of Damage
to the Economy of North Vietnam
January 1965-September 1966

Million US$

Year and Month	US/GVN Operational Costs: Aircraft Losses	Sortie Overhead	Ordnance	Total	Cost to North Vietnam
1965					
January	0	0	0	0	0
February	0	0.4	N.A.	0.4	0
March	18.8	1.4	1.7	21.9	1.7
April	23.3	5.1	3.6	32.0	3.6
May	14.6	7.6	3.9	26.1	4.4
June	18.8	6.9	5.7	31.4	9.7
July	45.0	11.0	5.1	61.1	11.6
August	34.5	13.0	8.6	56.1	10.9
September	39.0	14.8	10.6	64.4	6.7
October	39.4	14.4	5.8	59.6	7.1
November	27.2	13.1	7.4	47.7	7.0
December	45.2	10.3	3.8	59.3	6.4
Total	305.8	98.0	56.2	460.0	69.1
1966					
January	4.8	9.2	1.6	15.6	3.1
February	23.2	16.4	10.9	50.5	6.1
March	37.6	22.7	19.8	80.1	5.7
April	67.2	23.9	25.3	116.4	10.4
May	48.1	16.5	18.3	82.9	8.5
June	49.4	29.0	30.4	108.8	14.9
July	81.7	35.3	41.7	158.7	20.8
August	99.0	37.7	38.4	175.1	17.0
September	75.8	43.2	44.7	163.7	13.3
Total	486.8	233.9	231.1	951.8	99.8

Table A14

Ordnance Delivered on North Vietnam,
by Month and by Service
March 1965-September 1966

Tons

Year and Month	USAF	USN	USMC	VNAF	Total
1965					
March	540	280		310	1,130
April	1,280	800		180	2,260
May	1,100	540		160	1,800
June	1,990	1,150		190	3,330
July	1,780	1,590		100	3,470
August	2,780	1,830		60	4,670
September	3,790	1,700		30	5,520
October	3,520	1,560		10	5,090
November	2,810	1,690		20	4,520
December	1,680	810		20	2,510
Total	21,270	11,950		1,080	34,300
1966					
January	60	210	0	0	270
February	3,220	1,550	10	0	4,780
March	5,090	2,610	30	10	7,740
April	4,860	3,960	Negl.	220	9,040
May	2,710	4,760	0	80	7,550
June	7,190	3,450	0	320	10,960
July	10,710	4,860	530	240	16,340
August	10,160	6,090	1,070	10	17,330
September	10,170	6,400	1,190	Negl.	17,760
Total	54,170	33,890	2,830	880	91,770

Table G1

Photographic Analysis of Major Manufacturing Plants in North Vietnam
(Continued)

Installation	Photography Compared	Remarks
Viet Tri Chemical Plant	19 Jan 1965 - 4 Mar 1966	No change in plant facilities. Reduced numbers of watercraft at plant's dock.
Viet Tri Paper Plant	4 Mar-28 Sep 1966	Repairs were under way on some bomb damage to one of production buildings.
Viet Tri Sugar Refinery and Alcohol Plant	Mar-Jul 1966	No change in status.
Nam Dinh Textile Mill	1 Mar 1963 - 19 Aug 1966	No indications of level of activity; no attempt to repair old bomb damage although work is under way to repair adjacent powerplant.
Ha Bac Nitrogen Fertilizer Plant	13 Oct 1964 - 8 Jun 1966	Construction continued, and plant's first stage may now be completed. Output will include 100,000 tons per year of ammonium nitrate fertilizer, which also can be used as an explosive compound. The second stage of construction probably will provide output of 100,000 tons per year of ammonium chloride fertilizer.

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The following tabulation shows that nearly half of the sorties, and somewhat over half of the ordnance delivered, was on South Vietnam with the larger share of the remaining half of the effort being directed against North Vietnam:

	January-September 1966			
	Sorties		Ordnance	
Area of Operation	Number	Percent	Tons	Percent
Laos	57,060	18	59,750	17
North Vietnam	105,970	34	91,770	27
Laos and North Vietnam combined	163,030	52	151,520	44
South Vietnam	151,640	48	195,700	56
Total Southeast Asia	314,670	100	347,220	100

Since mid-1965 the increase in sorties flown over South Vietnam has been approximately parallel to the increase in sorties flown over North Vietnam and Laos combined, and since the beginning of 1966 the increase in sorties flown over North Vietnam* has been roughly proportional to the decrease in sorties flown over Laos (see Figure A1).

The amount of ordnance delivered monthly by air on Southeast Asia remained fairly constant during 1966. It was a little over 38,000 tons in January, increased to over 44,000 tons by August, and was a little over 39,000 tons in September. Similarly, the amount of ordnance delivered monthly on South Vietnam also remained fairly constant, fluctuating within the range of 18,000 to 26,000 tons. The amount of ordnance delivered monthly on North Vietnam, however, increased substantially, while the ordnance delivered on Laos declined sharply (see Table A5 and Figure A2). The amount of ordnance delivered on North Vietnam in September 1966 was nearly four times

* For a presentation of sorties flown monthly over South Vietnam and Laos in 1965 and the first nine months of 1966, see Tables A3 and A4. The comparable data pertaining to North Vietnam are presented in Table A9.

Except for the radar destroyed at the Hon Matt and Hon Nieu sites in 1965, radar at the three remaining targeted sites have been repaired or replaced as necessary, thus permitting the sites to continue operations. Air defense coverage for the Hon Matt and Hon Nieu area is provided by radar located at Vinh Lin and Hong Doi.

The overall air warning capability of North Vietnam has not been affected by bombing of targeted radar sites during 1965-66. During the period of the Rolling Thunder program, the number of radar deployed at sites throughout North Vietnam has increased.

6. Communications

North Vietnam has at least 35 major high-frequency (HF) radio centers and several hundred small HF radio stations. Five of the centers are JCS targets, only two of which have been struck, both in 1965. These two facilities, the Chanh Hoa and Muong Sen radio centers (JCS Nos. 67.3 and 39.19), represent 20 percent of the targeted capacity and have continued to be inoperable. In addition, a nontargeted center at Quang Khe was destroyed in 1965, and the center at Dien Bien Phu, although not bombed, was dismantled. The other JCS targets are located in the Hanoi area, and a fair number of the nontargeted centers are also located in that area. Those centers attacked or dismantled in 1965 were all located some distance south or west of Hanoi. Restoration of the damage inflicted on HF radio centers in 1965 is estimated at about $75,000.

The full extent of physical damage to the wireline system of North Vietnam cannot be estimated. The wireline system has not been specifically targeted for destruction and the damage sustained has been a collateral effect of the bombing of rail and road facilities, which are generally paralleled by open wirelines. There is a strong possibility that wireline damage has been extensive but it is not being picked up by intelligence collection media. Cumulative monetary damage to the open wireline system since the beginning of Rolling Thunder is estimated very roughly at $100,000, of which $80,000 probably occurred during 1966.

Although the cost of the damage inflicted on communications is nominal, indirect costs in this field resulting from the Rolling

Table B8

Naval Bases Attacked Under the Rolling Thunder Program
1965 and January-September 1966

Target Number	Name	Target as a Percent of National Naval Base Support Capacity	Dates of Attack a/	Percent of Base Utility Destroyed	Percent of National Naval Base Support Capacity Destroyed	Cost of Restoration (Thousand US $)
74.1	Quang Khe Naval Base	15	2 Mar 65 28 May 65 21, 24, 27, 28 Sep	47	7	400
71.1	Phuc Loi	10	20 May 65 12 Sep 65	78	8	815
	Subtotal for 1965				15	1,215
74.1	Quang Khe Naval Base	15	26 Apr 66	47	7	100
71.1	Phuc Loi	10	4, 5 Apr 66	78 (inactive)	10	230
69.0	Bai Chay	17	6 Aug 66	14	2	28
	Subtotal for 1966				19	358
	Total				19	1,573

a. Dates of attack indicate only assigned strikes; in certain instances more attacks have been launched against a specific target than is indicated above.

Table A8

Cost of Air Operations in Southeast Asia
January-September 1966

Million US $

	North Vietnam				South Vietnam				Laos				Total Southeast Asia			
1966	Losses	Sorties Overhead	Ordnance	Total	Losses	Sorties Overhead	Ordnance	Total	Losses	Sorties Overhead	Ordnance	Total	Losses	Sorties Overhead	Ordnance	Total
January	4.8	9.2	1.6	15.6	24.9	24.6	56.3	105.8	10.1	16.9	35.4	62.4	39.8	50.7	93.3	183.8
February	23.2	16.4	10.9	50.5	5.1	23.6	43.4	72.1	16.4	11.4	40.7	68.5	44.7	51.4	95.0	191.1
March	37.6	22.7	19.8	80.1	12.0	30.6	57.9	100.5	7.9	12.8	19.5	40.2	57.5	66.1	97.2	220.8
April	67.2	23.9	25.3	116.4	7.0	26.8	42.6	76.4	7.5	11.6	21.6	40.7	81.7	62.3	89.5	233.5
May	48.1	16.5	18.3	82.9	12.4	25.8	57.4	95.6	13.1	8.8	19.6	41.5	73.6	51.1	95.3	220.0
June	49.4	29.0	30.4	108.8	8.1	26.9	54.9	89.9	0.6	7.3	19.8	27.7	58.1	63.2	105.1	226.4
July	81.7	35.3	41.7	158.7	9.0	31.4	52.6	93.0	0.4	4.9	6.3	11.6	91.1	71.6	100.6	263.3
August	99.0	37.7	38.4	175.1	14.1	30.3	44.2	88.6	0.4	2.3	5.2	7.9	113.5	70.3	87.8	271.6
September	75.8	43.2	44.7	163.7	16.2	27.8	49.1	93.1	0.9	2.8	3.5	7.2	92.9	73.8	97.3	264.0
Total	486.8	233.9	231.1	951.8	108.8	247.8	458.4	815.0	57.3	78.8	171.6	307.7	652.9	560.5	861.1	2,074.5

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propaganda statements in the last six months have been more restrained and reflect a more cautious approach. The Chinese are also now less prone to take steps which could lead to retaliatory measures by the United States.

China's internal crisis and the disarray in its leadership militate against direct intervention in the war at this time. Even an escalated air war with sizable North Vietnamese civilian casualties would not be likely to bring about direct Chinese intervention. Broadly speaking, such intervention is unlikely unless the United States launches a ground invasion of the North or the Hanoi regime seems in danger of collapse. A suspension or reduction of the bombing, on the other hand, would almost certainly have no effect in reducing Chinese insistence that the Vietnamese reject any move toward a negotiated settlement.

IV. Assessment of North Vietnam as a Target System

A. General Characteristics

North Vietnam has only limited attractiveness as a target system, particularly within the restraints applied to the Rolling Thunder program. The military significance of North Vietnam rests essentially in its three basic contributions to the war in the south: its use as a logistic base for the accumulation and movement of supplies into South Vietnam; its manpower contribution; and its function as a control center for the direction of insurgency. The country is notable because it is waging a protracted war with an inadequate economic base which is not heavily committed to the support of military operations.

The North Vietnamese economy is basically one of subsistence agriculture, with only a small modern industrial sector in a few urban centers, including Hanoi, Haiphong, Nam Dinh, Viet Tri, and Thai Nguyen. The country imports little food and depends largely on domestic production to feed its population of about 18 million persons. More than 80 percent of the population is engaged in agriculture. North Vietnam produces only small amounts of military equipment and must import all of its heavy military equipment and most of its small arms, ammunition, and medical supplies from Communist countries.

The attacks to date on military and economic facilities have not affected significantly the capabilities of North Vietnam's armed forces. Most of the military and economic target systems have not

Table D1

Economic Credits and Grants Extended by Communist Countries to North Vietnam a/
1955-64

Million US $

	1955-64	1955	1956	1957	1958	1959	1960	1961	1962	1963-64
Total	956	350	16	19	21	127	200	223	N.A.	b/
Communist China	457	200	b/	b/	b/	100	b/	157	b/	b/
USSR	369	100	8	12	21	25	200	4	N.A.	b/
Eastern Europe	130	50	8	7	b/	2	Negl.	62	b/	b/

a. This is the minimum of economic aid extended by the Soviet Bloc and Communist China. In addition, insignificant amounts of aid have been extended by Albania, Mongolia, and North Korea. Because of rounding, components may not add to the totals shown.
b. No extensions are known to exist, although some may have taken place.

Table A4

United States Sorties Over Laos, by Mission a/
1965 and January-September 1966

Year and Month	Attack Sorties b/	Support Sorties	Total Sorties
1965			
January	60	160	220
February	80	280	360
March	300	370	670
April	830	900	1,730
May	790	460	1,250
June	510	330	840
July	1,010	380	1,390
August	730	280	1,010
September	1,020	320	1,340
October	970	430	1,400
November	1,480	390	1,870
December	3,050	900	3,950
Total 1965	10,830	5,200	16,030
1966			
January	8,080	2,340	10,420
February	5,350	1,380	6,730
March	6,390	1,650	8,040
April	6,210	2,460	8,670
May	4,420	2,160	6,580
June	3,560	2,440	6,000
July	2,210	2,270	4,480
August	820	1,750	2,570
September	1,260	2,310	3,570
Total first nine months 1966	38,300	18,760	57,060
Total January 1965 - September 1966	49,130	23,960	73,090

a. Rounded to nearest 10 sorties.
b. Attack sorties include strike and flak-suppression sorties.

the amount delivered in February, the first complete month of bombing during the year, and was more than three times the amount delivered in September a year ago, the peak month of 1965. The amount delivered on Laos in September 1966, on the other hand, was less than 9 percent of the amount delivered in January.

The US air effort in Southeast Asia was carried out by aircraft stationed in South Vietnam and Thailand as well as by aircraft from US Navy carriers in the Gulf of Tonkin and in the South China Sea. The US Air Order of Battle in the area as of 26 October 1966 was as follows:

		Aircraft				
Launch Base	Air Bases	USAF	USN	USMC	USA a/	Total a/
South Vietnam	30	723	9	438	1,985	3,155
Thailand	7	422	0	0	0	422
Naval carriers	2 to 3	0	151	41	0	192
Total aircraft		1,145	160	479	1,985	3,769

a. US Army aircraft, mostly helicopters and light observation aircraft, have not been considered in this report.

Approximately 55 percent of all US sorties flown in Southeast Asia originated from bases in South Vietnam, 30 percent from aircraft carriers, and 15 percent from bases in Thailand.* During the first nine months of 1966, about 70 percent of all US sorties flown from South Vietnam struck targets in South Vietnam, 20 percent were flown over Laos, and 10 percent over North Vietnam. Approximately 65 percent of the sorties from Thailand were flown over North Vietnam and 35 percent over Laos. To avoid violation of Cambodian air space, no sorties were flown from Thailand over South Vietnam. About 55 percent of the sorties from the Navy aircraft carriers during the first nine months of 1966 were flown over North Vietnam, 25 percent over South Vietnam, and 20 percent over Laos.

* The distribution of sorties from each of these launch bases to the three target areas in Southeast Asia is shown in Table A6.

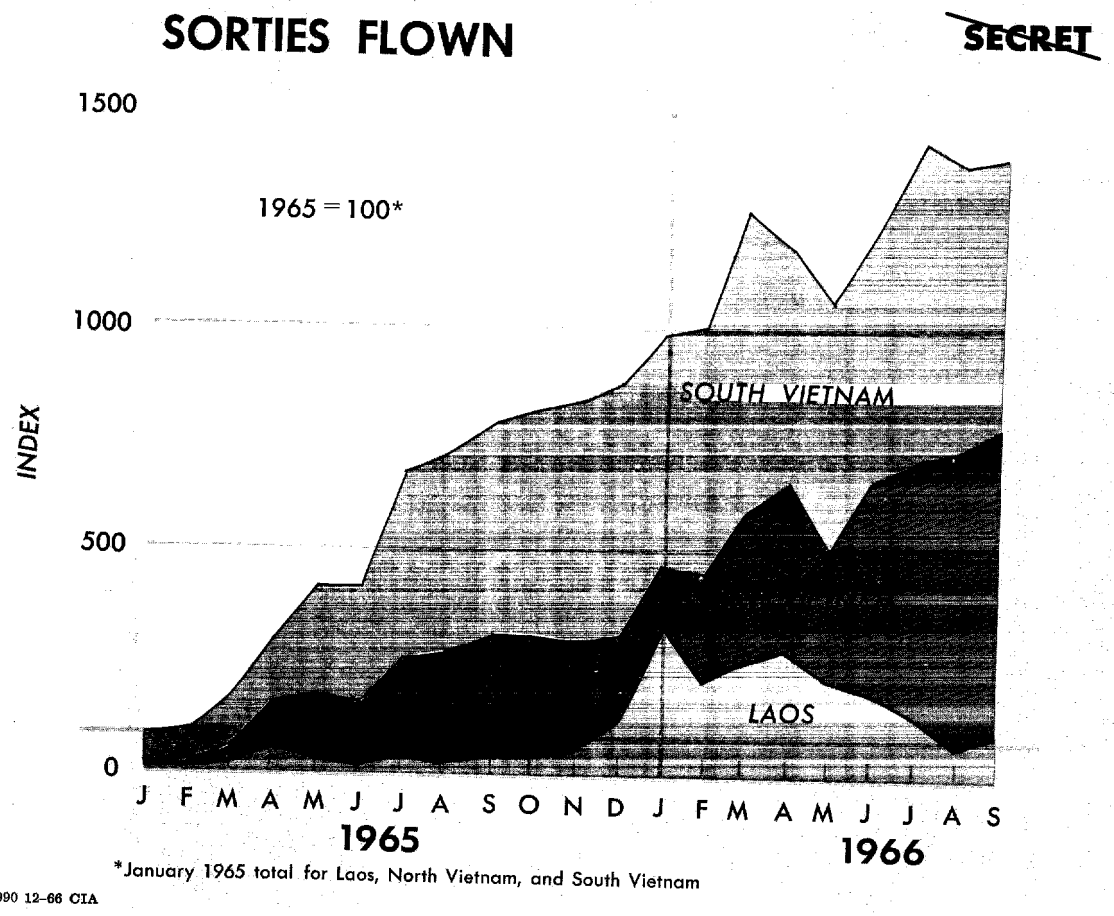

Figure A-1. Index of Sorties Flown in Southeast Asia and Relative Amounts in Each Area, 1965 and January-September 1966

North Vietnam apparently is receiving aid commitments to a degree which it was unable to obtain from the Communist countries prior to the escalation of the war in Vietnam. Recent agreements with most Communist countries refer to "nonrefundable" assistance, which probably means grant aid (see Table D2). It is clear that the Communist Bloc countries have implicitly guaranteed to finance the economic losses incurred by North Vietnam as a result of its war effort. An unconfirmed report from Poland after the recent Warsaw Pact meeting stated that the Pact countries had pledged $1 billion in aid to support Hanoi's war effort and is an indication of the magnitude of the effort the Communist countries seem willing to undertake. All recent announcements of new aid have stressed support for the war effort, perhaps indicating a growing shift in aid to materials and services needed to continue the war.

A. Soviet Economic Aid

Soviet economic aid extensions between mid-1955 and the end of 1964 totaled at least $370 million and were allocated largely for industrial development. Sizable sums have been channeled into the construction of mining, electric power, and light and heavy industrial facilities. Among the largest mining projects contracted for prior to 1964 are the Mong Duong Mine and the Vang Danh Coal Mine. Construction of both projects got under way in 1966. A credit of $87.5 million extended in 1960 was obligated for the development of 46 state farms.

The USSR also is assisting in the construction of a number of powerplants in North Vietnam. The plant at Uong Bi still is receiving Soviet equipment, probably to replace the machinery destroyed by bombing early in 1966. Construction of the Thac Ba Hydroelectric Powerplant, which was at least two years away from completion and for which large quantities of goods had been received, was suddenly postponed in September 1966 when most of the 35 Soviet technicians at the project were recalled. Another power project which North Vietnam is anxious to complete but with which it is encountering difficulties is the Red River Project. Although initial contracts were signed in April 1964, North Vietnam still was reporting problems throughout 1966 and requested the assistance of additional Soviet technicians to eliminate these difficulties. Other powerplants under construction with Soviet assistance are located at Coc Thanh, Co Dam, Nha Trang, and Nhu Trac.

The Soviet Union has numerous other projects under way, stemming largely from agreements concluded prior to 1964. At least 17 new contracts were observed in 1966, but only a few have been identified. In February 1966 the two countries discussed the completion of plans for a $12 million soda factory. A sulfuric acid shop, possibly at the Phu Tho Superphosphate Plant, may have been completed

US build-up in South Vietnam. Brezhnev, speaking at Ulan Bator on 15 January, claimed that the United States was expanding "aggression" while professing a desire for peace talks and expressed doubt about Washington's sincerity.

Privately, Soviet leaders were generally noncommittal. They were apparently not optimistic over US chances of success, as indicated by pessimistic statements President Podgorny made to the French Ambassador in Moscow. Kosygin, however, reportedly gave a somewhat different thrust to his remarks made to Indian Prime Minister Shastri during their talks in Tashkent. Kosygin made a point of commenting favorably on Ambassador Harriman's visit with the Poles, who were in contact with Hanoi during the pause.

A Soviet hope that something good might come of the pause appears to have been behind the mission to Hanoi made by Party Secretary Shelepin in January. Shelepin may well have tried to encourage the North Vietnamese to give serious consideration to US moves toward a political solution. However, there was no sign that he persuaded Hanoi to budge from its tough line, and the visit ended with only a terse communiqué, restating Soviet support for Hanoi.

The resumption of the bombings brought a predictable response from Moscow. A government statement on 31 January claimed that the resumption showed that Washington's "so-called peaceful initiative was a diplomatic move aimed at misleading world opinion and preparing the ground for further escalation." The statement reiterated Soviet support for Hanoi's stand on a settlement of the war.

On 30 June the USSR released a very restrained government statement concerning the US air raids on "parts" of Hanoi and Haiphong. The statement was quite bland and essentially a restatement of past Soviet expressions of support for North Vietnam and criticism of the "shameful crime" committed by the United States in bombing North Vietnam. While characterizing the raids as of a "particularly dangerous nature," the USSR went no further than in past statements that the USSR "has been and will be rendering North Vietnam every assistance, economic and political as well as by means of defense, in its struggle against imperialist attacks."

Also on 30 June, Kosygin received President De Gaulle. At a reception in his honor, the Soviet premier's publicized remarks on the bombing were only tepid. He merely reiterated the theme that

November. Air attacks on fishing installations in these southern provinces appear to have been extensive, and some damage has been inflicted on these installations. The value of this damage, however, is believed to be minor.*

The agricultural shortfall, the disruptive effects of the bombing attacks on agriculture and fishing activities, together with the increased requirements for the war, have contributed to food shortages -- particularly in rural areas. Food supplies in the larger cities such as Hanoi have been maintained at adequate levels, however, and there have been no indications of critical food shortages or cases of malnutrition. The continuation of the bombing attacks will further aggravate the tight food situation in North Vietnam. The self-sufficient nature of the agricultural economy and the availability of food imports -- particularly from Communist China -- suggest, however, that food supplies are not likely to become critical.

9. Export Losses

From 1 April 1965 to 30 September 1966, measurable export losses attributed to direct and secondary effects of the Rolling Thunder program totaled $12.9 million, of which $4.2 million occurred in 1965 and $8.7 million in 1966. Reduction in exports of apatite and coal accounted, respectively, for 61 percent and 28 percent of the total. Losses in seaborne exports of apatite resulted from repeated interdictions of the rail line connecting the apatite mines at Lao Cai with the port of Haiphong. Coal shipments were retarded by airstrikes against coal-processing facilities at Cam Pha in April 1966. Although production of cement is believed to have been unhindered, the remainder of the losses is accounted for by an apparent reduction** in seaborne exports of cement since the initiation of the Rolling Thunder program.

* Out of seven sea product agencies -- local fish storage and processing units -- which allegedly have been bombed, only one has been identified in photographic intelligence. It is estimated that the replacement cost for damage inflicted on the sea product agency in Thach-kim village, Ha Tinh Province, is about $60,000. Even if all of the other six sea product agencies had received similar damage -- available information indicates that this is not the case -- total damage would be less than one-half million dollars.

** It is possible that undetected increases in exports of cement to China have been made on Chinese Communist ships.

Table G3

North Vietnam: Imports of Machinery from the USSR
1959-65

	1959	1960	1961	1962	1963	1964	1965
Total imports (million US$)	19.9	24.4	41.3	54.7	56.7	47.7	74.9
Imports of machinery (million US$)	5.8	11.9	19.6	31.4	34.0	25.4	48.0
Imports of machinery as percent of total	29	48	47	57	60	53	64

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Japanese people have compelled Tokyo to refrain from professing unqualified support for Washington. In public, Japanese leaders have tended to explain their support in terms of the US-Japan security relationship rather than in terms of Japan's own national interest. The Japanese press, the socialists, and labor have been highly critical of US policy and have attempted to marshal public opinion against the air attacks. There was some fear among the Japanese public, even prior to the beginning of the sustained bombings in late February 1965, that the escalation of hostilities might involve Japan.

The Japanese Foreign Minister told the Diet on 10 August 1964 that the government believed the Tonkin Gulf crisis had been initiated by the North Vietnamese. However, a large segment of the public apparently felt that the United States had over-reacted against its tiny adversary and was uneasy about the possibility of a larger conflict.

The Japanese Government supported the program of sustained US airstrikes in North Vietnam which began early in 1965, but its leaders were clearly uncomfortable over their policy. During Diet interpellations on 8 February, Prime Minister Sato stated that he considered the airstrikes limited in scope and hoped the war would not be expanded. Japanese press and radio reactions were generally negative.

Sato continued to cautiously support US policies in Vietnam following the renewal of the airstrikes after the May 1965 pauses. However, many of his party members privately expressed strong reservations about the effectiveness of the strikes. By early summer, criticism of US Vietnam policies was very widespread and acerbic. The B-52 strike by Okinawa-based planes on 28 July sharpened fears that Japan would become involved in the war as a result of its defense ties with the United States.

The situation began to change somewhat during the last few months of 1965. There was a slow but steady improvement of Japanese public attitudes toward the US involvement in Vietnam during the autumn, partly as a result of US efforts to publicize its objectives in Vietnam. The December-January pause in the bombing produced an even sharper shift of popular opinion in favor of the United States. Japanese officials were sympathetic to the resumption of the airstrikes, which they felt had been prompted by the Communists' failure to respond to US peace initiatives. The restrained manner in which the bombing was resumed together with the continued American diplomatic offensive for negotiations tended to counter adverse reactions. During 1966,

Table A19

Comparison of Strikes on Major JCS Fixed Target Systems in North Vietnam
1965 and January-September 1966

JCS Fixed Target System	Number Targeted As of 30 September 1966	Number of Targets Struck: Struck 1965	Restruck January-September 1966	New Strike January-September 1966
Airfields (11)	11	4	1	0
Lines of communication (74)				
Bridges	61	47 a/	26	6
Railroad yards and shops	5	1	1	1
Locks	8	1	0	1
Military installations (130)				
Barracks/supply depots/ammunition depots/military complexes	91	70 b/	25	1
Petroleum storage	13	4	3	7
Ports and naval bases	15	4	3	2
Communication facilities	5	2	0	0
Radar sites	5	10 c/	3	1
SAM support facilities	1	1	0	0
SAM sites d/	0	2	0	1
Industrial installations (27)				
Electric power facilities	19	6	3	2
Manufacturing and explosives plants	8	1	0	0
Total	242	153 e/	65	22 f/

a. Includes 2 bridges dropped from JCS Fixed Target List.
b. Includes 4 barracks and 1 barracks/supply area dropped from JCS Fixed Target List.
c. Includes 6 radar sites dropped from JCS Fixed Target List.
d. Includes 2 SAM sites struck in 1965 and 1 in 1966 that have been dropped from the JCS Fixed Target List.
e. Includes 15 targets dropped from the JCS Fixed Target List.
f. Includes 1 target dropped from the JCS Fixed Target List.

Table D5

Soviet and Chinese Communist Deliveries of Military Equipment to North Vietnam
1953 - October 1966

Million US $

Year	Total	USSR	Communist China
Total	610	455	155
1953-63	100	45	55
1964	40	25	15
1965	260	225	35
1966 a/	210	160	50

a. January-October.

was maintained in spite of the fact that deliveries in 1965 included the arrival of most of the SAM equipment necessary to fulfill North Vietnam's immediate defensive requirements. Non-SAM-related deliveries during the period of January-October 1966 (an estimated $140 million) already were nearly 20 percent higher than similar deliveries for all of 1965. During July-October 1966, Communist deliveries consisted almost entirely of artillery, small arms and ammunition, trucks and other vehicles, and radar equipment. There is no information to indicate that any of the major categories of equipment (such as SAM facilities, aircraft, and naval craft) were delivered during this period.

B. Chinese Communist Military Assistance

About 45 percent of the estimated $155 million in military assistance provided to North Vietnam by Communist China was delivered prior to 1965. The largest share of these pre-1965 deliveries consisted of 30 Swatow-class motor gunboats and a variety of artillery, small arms and ammunition, and radar equipment. In 1964, Communist China delivered 36 MIG-15/17 jet fighters (see Table D7).

Chinese military assistance in 1965 more than doubled over the previous year, and deliveries during the first ten months of 1966

CONTENTS

Appendixes

a. Use of Bulk Storage in Mainland China

Tankers could be consigned to ports in Communist China where bulk cargoes could be accepted and the petroleum transshipped by rail, barge, or coastal tanker to North Vietnam.

b. Shallow-Draft Lighters

Shallow-draft lighters would have to be suitable for receiving bulk petroleum over the side of a tanker. They would have to be of sufficiently shallow draft to permit movement either through mined areas or through any of the various shallow river channels that link bulk storage facilities with the Gulf of Tonkin. It is estimated that North Vietnam probably has sufficient lighters that meet these criteria.

c. Pipeline to Haiphong Terminal

Complex offshore mooring and discharge pipelines could be installed. Such facilities, requiring Soviet technical assistance and materials, would include suitable buoys, either a floating or submarine pipeline to the shore, and a pipeline from the shore to the terminal. Unless adequate new tankage is constructed at the Haiphong terminal, development of such elaborate facilities would be unlikely.

d. New Tankage and Discharge Lines

In the long term, North Vietnam, again with technical assistance and materials supplied by the USSR, would have to develop a new marine petroleum terminal along the coast. This facility would involve the construction of new tankage and, if docking facilities could not be provided, mooring facilities and either a floating or submarine pipeline for discharge offshore.

3. The Use of Chinese Transport Connections

Land transport from the Chinese port of Fort Bayard or other Chinese ports via the Chinese rail network to the border at Dong Dang provides the North Vietnamese with a significant alternative route for their foreign trade if the ports are mined. This route probably could provide sufficient capacity for all of the normal imports of North Vietnam. Not all of the exports would necessarily be moved by rail, however. The problem of added costs of moving

On 23 March, Brezhnev gave the first hint of a promise of volunteers to assist the Vietnamese. In a public speech he ambiguously stated that Soviet citizens were expressing their readiness "to take part" in the North Vietnamese struggle. Interestingly, he also reaffirmed the USSR's interest in good relations with the United States, although warning of the dangers of US actions in Vietnam.

A high-level North Vietnamese party-government delegation visited Moscow in April and got more public pledges from Soviet leaders of "further assistance." The communiqué on 17 April made a cautious pledge to send Soviet volunteers, if requested. On 8 May 1965, Brezhnev asserted that there was a "full unanimity of views" between Moscow and Hanoi on broad policy strategy and that Soviet "assistance will increase if necessary."

This show of solidarity with Hanoi was accompanied by a series of Soviet moves apparently intended to persuade, cajole, and even frighten the United States into changing course. Typical were the remarks of Soviet Ambassador Dobrynin made to Ambassador Thompson in Washington on 15 February. Dobrynin clearly indicated that the Soviet leaders were relating US actions in bombing North Vietnam to Kosygin's visit to Hanoi. The Soviet Ambassador's remarks underscored the concern with which Moscow viewed the situation and emphasized that bilateral relations could be seriously affected if the United States continued its course.

When the brief pause in US bombings came in May 1965, the USSR appeared to be looking the other way. Just prior to the pause, Soviet leaders were publicly reiterating Moscow's pledges of support for Hanoi, and evidence was accumulating suggesting the imminent arrival of Soviet military equipment. In the midst of the pause, on 15 May, Kosygin spoke at a Soviet-Indian rally honoring visiting Premier Shastri. Kosygin said that the United States had launched a "veritable crusade" against the world "national liberation movement" and that it was the duty of all the newly independent and the nonaligned states to join the USSR in resisting the resurgence of imperialism. He reiterated Soviet determination to strengthen the defensive potential of North Vietnam.

The USSR adopted a relatively cautious attitude toward the US "peace offensive" during the bombing pause from December 1965 through January 1966. Moscow kept up its standard propaganda line that the "so-called peace initiative" was accompanied by a continued

The air attack against military targets has not substantially reduced the capacity of North Vietnam's fixed military establishment. Most of the major military facilities are in sanctuary areas or have not been attacked. The major effort has been against military barracks. All but one of the barracks attacked in 1966 had been struck in 1965 and over half of them appeared to have been deactivated at the end of 1965. In terms of national capacity, no major military target system -- barracks, airfields, SAM sites, naval bases, radar, and supply and ammunition depots -- has suffered as much as 25 percent damage. The attacks have, of course, disrupted normal military practices, caused the abandonment of many facilities, forced Hanoi to engage in widespread dispersal of equipment and facilities, and resulted in losses of equipment.

The major change in the 1966 air campaign against military targets has been the increase in losses of equipment, particularly in certain categories such as aircraft and naval craft. Thus almost 20 percent of the MIG-21 inventory and over 40 percent of the in-country MIG-15/17 inventory had been lost as a result of air engagements through September 1966. An additional 50 MIG-15/17s of the DRV are known to be held in China. Losses of naval craft have also been substantial -- one-third of the operational gunboat fleet, one-fourth of the inventory of PT boats, and one-half of the small number (4) of subchasers. Military equipment losses in 1966, including estimated damage to SAM sites, amounted to $23.5 million, or over 80 percent of the total damage inflicted on military targets.

B. Civilian and Military Casualties

The number of casualties which have resulted from the bombing of North Vietnam cannot be estimated with any precision. Analysis of [redacted] and DIA casualty studies does, however, provide sufficient evidence to permit an estimate, which may be subject to a large margin of error.

Although the United States continues to place restrictions on the air offensive against North Vietnam in order to minimize civilian casualties, North Vietnam still maintains that the Rolling Thunder program is a vicious and unrestrained assault on hospitals, schools, and the general civilian population. The only specific statement from Hanoi in 1965 indicated casualties by September 1965 in the order of 40,000 killed and 35,000 wounded. Analysis at that time could support casualty estimates of only 15 - 20 percent of that number. During 1966, Hanoi has issued only two specific claims on casualties, both

C. Analysis of North Vietnam Imports of Machinery

imports of machinery by North Vietnam increased markedly in 1965 and suggests that imports have increased even more in 1966.

As shown in Table G4 a large share of the increase in North Vietnam's imports of machinery can be related to maintaining and improving the transportation sector of the economy.

The significance of imports, by commodity, is discussed below.

1. Machine Tools

In 1965 and 1966, substantial quantities of machine tools were imported by North Vietnam. The largest share of these imports can be identified as machine tools appropriate for the repair of all kinds of motor vehicles, construction equipment, and other industrial equipment. Diamond boring machines, honing machines, and camshaft grinders can be definitely associated with motor vehicle repair. The considerable number of slotters and honing machines in evidence strongly suggests a dispersion of repair facilities

Gear hobbing machines for bevel gears suggest spare parts production for road building equipment, hoists, and cranes.

of which showed relatively insignificant numbers. A letter in May 1966 to the International Red Cross cited only 239 civilian casualties since 31 January 1966, although implying many more. The second statement was an admission by the Education Ministry in October 1966 that only 300 students and 30 teachers had been killed since the bombings began.

Current estimates indicate that despite the great acceleration of Rolling Thunder during 1966, the number of human casualties attributable to air attack has been light.

The estimates for 1965 and 1966 shown in the following tabulation are discussed in greater detail in Appendix B:

	1965	January-September 1966	Total
Civilians	6,000	11,900	17,900
Attacks on fixed targets	2,000	700	2,700
Attacks on armed reconnaissance missions	4,000	11,200	15,200
Military	7,200	3,800	11,000
Attacks on fixed targets	4,300	400	4,700
Attacks on armed reconnaissance missions	2,900	3,400	6,300
Total	13,200	15,700	28,900

The increase in casualties during 1966 is a function of both the growing scale of the Rolling Thunder program and the greater emphasis on armed reconnaissance and targets located in more heavily populated areas. In spite of the increase in casualties, however, the number per sortie has remained stable for both armed reconnaissance and fixed target missions.

The composition of the casualties resulting from the 1966 air campaign differs notably from that in 1965. Over 75 percent of the casualties in 1966 were civilians, compared with 45 percent in 1965. Armed reconnaissance, which accounted for 52 percent of the casualties in 1965, accounted for 93 percent of total casualties in 1966.

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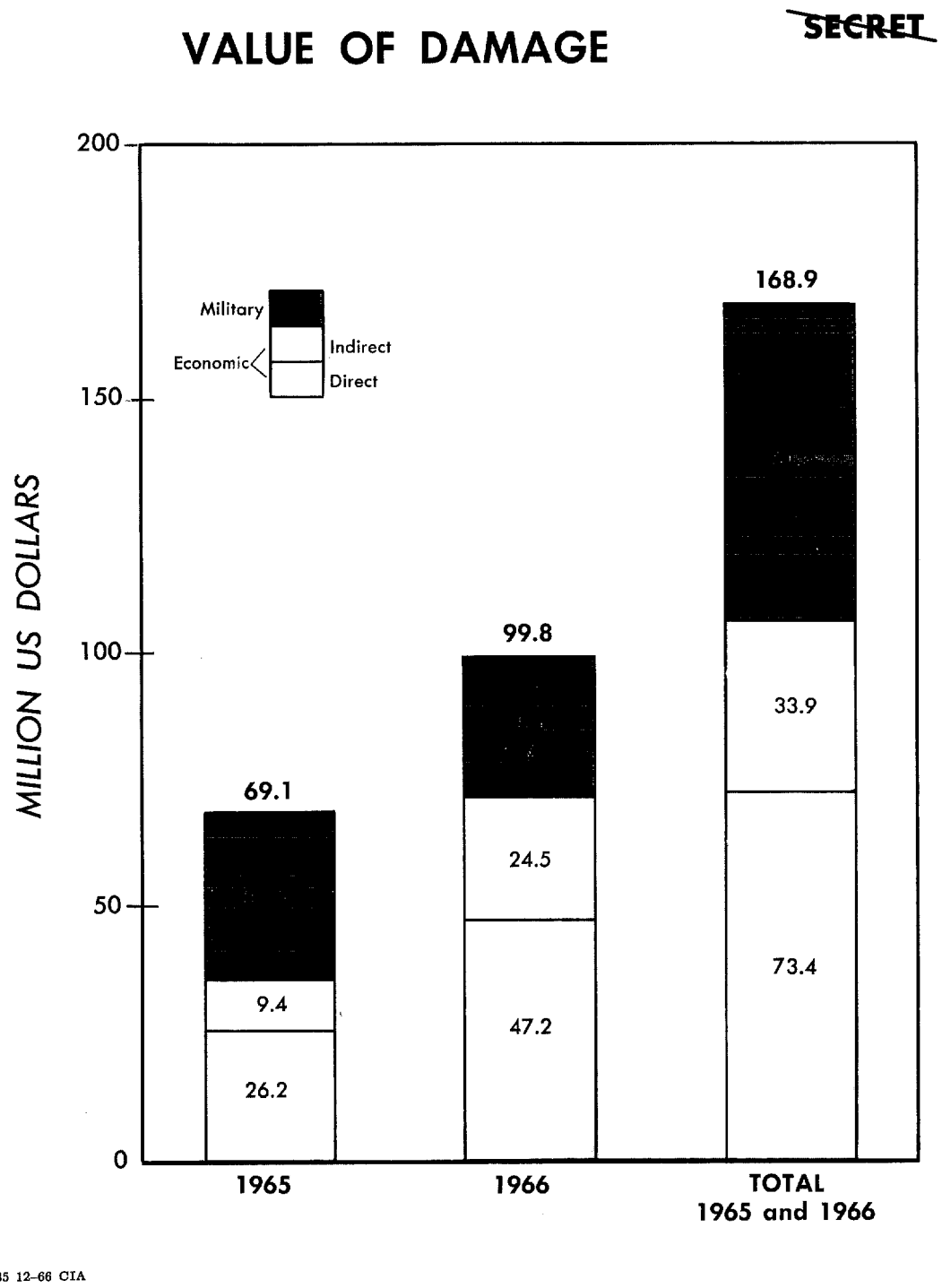

Figure B-1. Value of Economic and Military Damage in North Vietnam, 1965 and January-September 1966

Table A11

Distribution of Sorties to Each Target Country,
by Launch Base in Southeast Asia
January-September 1966

	Percent		
	To North Vietnam	To South Vietnam	To Laos
From South Vietnam			
By USAF	16	46	30
By USMC	3	21	10
By VNAF	1	16	
Total	20	83	40
From Thailand			
By USAF	36	0	30
From naval carriers			
By USN	44	17	30
Total	100	100	100

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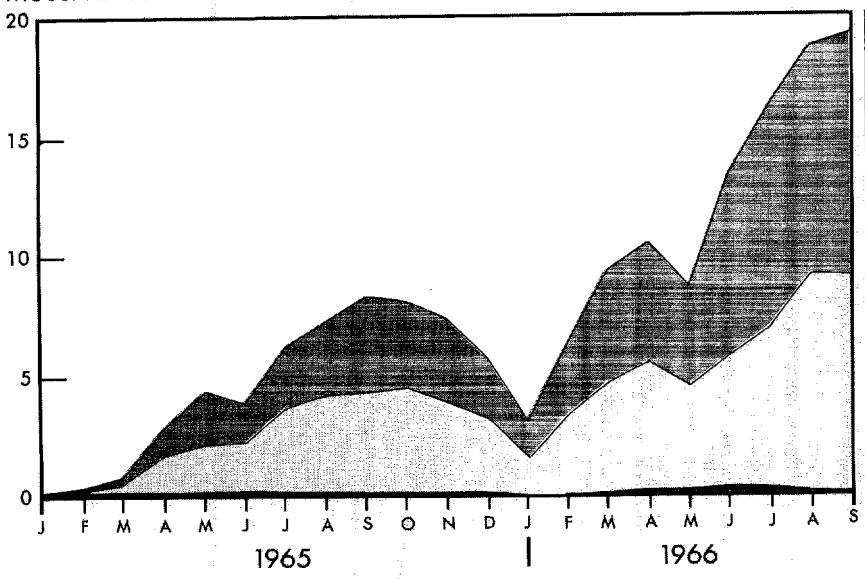
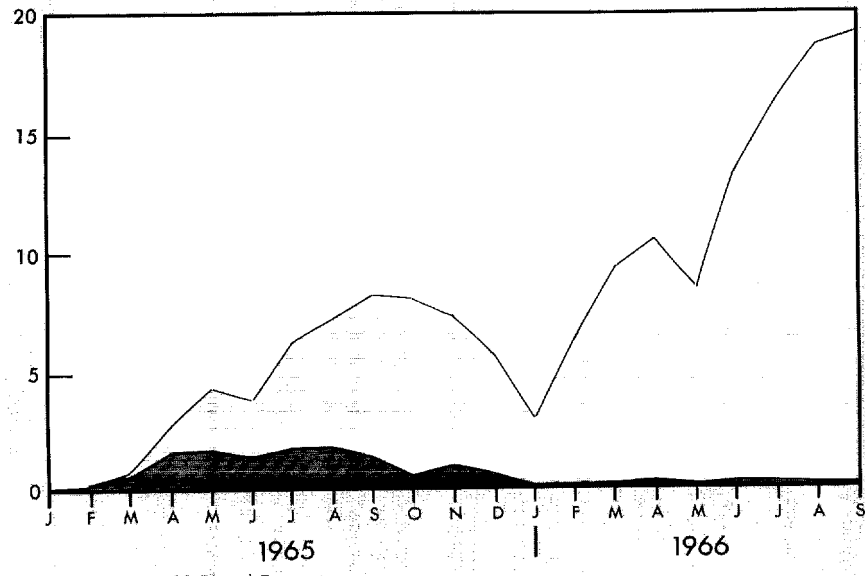
SORTIES FLOWN

BY SERVICE



		USN & USMC	USAF	TOTAL
1965	J	0	0	0
	F	120	140	260
	M	410	480	890
	A	1,660	1,310	2,970
	M	1,940	2,400	4,340
	J	2,000	1,940	3,940
	J	3,740	2,460	6,200
	A	4,180	3,070	7,250
	S	4,330	3,910	8,240
	O	4,530	3,490	8,020
	N	3,970	3,340	7,310
	D	3,110	2,680	5,790
1966	J	1,450	1,570	3,020
	F	3,330	3,190	6,520
	M	4,820	4,620	9,440
	A	5,550	4,990	10,540
	M	4,550	4,170	8,720
	J	5,610	7,610	13,220
	J	6,680	9,760	16,440
	A	9,160	9,680	18,840
	S	9,110	10,120	19,230

BY PROGRAM



		FIXED TARGETS	ARMED RECCE *	TOTAL
1965	J	0	0	0
	F	0	260	260
	M	850	40	890
	A	1,800	1,170	2,970
	M	1,790	2,550	4,340
	J	1,410	2,530	3,940
	J	1,910	4,290	6,200
	A	1,900	5,350	7,250
	S	1,600	6,640	8,240
	O	770	7,250	8,020
	N	1,040	6,270	7,310
	D	820	4,970	5,790
1966	J	0	3,020	3,020
	F	170	6,350	6,520
	M	180	9,260	9,440
	A	390	10,150	10,540
	M	160	8,560	8,720
	J	320	12,900	13,220
	J	360	16,080	16,440
	A	280	18,560	18,840
	S	150	19,080	19,230

* Not on JCS Fixed Targets

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Figure A-6. Monthly Summary of Sorties Flown in North Vietnam, by Service and by Program, 1965 and January-September 1966

period. Development of access roads to fords at the site of destroyed bridges has been accomplished within seven days. Rapid repair together with the development of alternate routes has provided the North Vietnamese with greater flexibility in the choice of roads to be used for through traffic.

5. Problems in Countermeasures

The North Vietnamese are not able to use temporary expedients such as ferries to bypass damaged railroad bridges. In order to maintain uninterrupted through rail service, the North Vietnamese must completely repair the original bridge or build a bypass bridge of equal capacity. Repair of original bridges or construction of bypass bridges account for a large percentage of all countermeasures on rail lines. Closer tolerances in design and construction and the high load capacities required make countermeasures on railroads more costly in terms of time and resources.

B. Countermeasures in Laos

The maintenance and repair of roads in the Laos Panhandle by the Communists during the 1965-66 dry season has countered the effects of bombings. A combined workforce of an estimated 20,000 to 25,000 North Vietnamese and Pathet Lao have made quick repairs to cratered roadbeds, fords, and ferry crossings. The share of North Vietnamese in the workforce in Laos may be as high as 80 percent because local conscription of labor is difficult in the sparsely settled Panhandle. There have been few repairs to highway bridges in Laos because most of them are on fordable streams. Aerial photography has confirmed destruction or damage on 57 highway bridges in the Panhandle during 1966. It is estimated that restoration of these bridges to pre-strike condition would cost about $1 million. A comparison of rates of repair in Laos and North Vietnam reveals that the Communists have repaired bomb damage just as quickly on routes in Laos as they have to roads in North Vietnam. Although much of the road system in the Panhandle was not repaired during the 1966 rainy season, it is believed that construction laborers were used as porters during this period. Repairs and maintenance will probably be intensified in November and December to allow through movement of trucks in the 1966-67 dry season. The addition of about 400 miles of roads in the Panhandle by means of a crash construction effort in 1965-66 indicates that when repairs are completed, the Communists will be better able to move goods through the Panhandle despite the bombing efforts.

Table A20

Comparison of Sorties and Ordnance
on Major JCS Fixed Target Systems in North Vietnam
1966 and January-September 1966
(Continued)

JCS Fixed Target System	1965	January-September 1966	Total
Radar			
Attack Sorties	620	30	650
Ordnance (tons)	680	30	710
Naval bases, railroad yards, and ports			
Attack sorties	400	200	600
Ordnance (tons)	460	330	790
Total Attack sorties	8,530 a/	1,520	10,050
Total Ordnance	12,550 a/	2,610	15,160

a. Excluding 180 attack sorties and 250 tons of ordnance on railroad shops, locks, ferries, communications facilities, and surface-to-air missile support facilities.

APPENDIX B

THE EFFECTS OF THE ROLLING THUNDER PROGRAM

I. Physical Damage

The cost of reconstruction or repair of the economic and military facilities in North Vietnam which have been attacked under the Rolling Thunder program from January 1965 through September 1966 is estimated at $170 million (see Figure B1). About 65 percent of the damage was inflicted on economic targets and 35 percent on military targets. The damage inflicted during the first three quarters of 1966 represents $100 million of the total.

Damage to the economy accounts for more than 70 percent of the total in 1966, whereas in 1965 economic loss represented only about 50 percent. Destruction and damage to transport equipment accounted for slightly more than a third of the total economic damage in 1966 (see Figure B2). An equal amount was accounted for by indirect losses caused by shortfalls in agriculture, fishing, and exports. Bridges, powerplants, and petroleum storage sites were the principal categories of targets responsible for the remainder.

More than 80 percent of all military damage in 1966 resulted from attacks on aircraft, naval craft, and SAM sites, but in 1965 the damage from such attacks amounted to less than 20 percent of the total. Damage to barracks made up almost one-half of the total damage to military targets in 1965 but only a small portion of the total during 1966 (see Figure B3).

The greatest amount of damage inflicted in 1966 occurred in the months of June through September, with the peak month being July (see Figure B4). During these months the attacks on bulk petroleum storage began, and major losses in naval craft, aircraft, and transport equipment occurred. Damage to bridges also reached a peak in July. Indirect losses were at their highest point in June. During 1965 the monthly trend in physical damage was similar to that in 1966.

Table B6

Barracks Attacked Under the Rolling Thunder Program a/
January-September 1966

JCS Target Number	Name	Percent of Targeted National Capacity	Dates of Attack	Percent of Targeted Capacity Destroyed		Cost of Restoration for Damage Inflicted During 1966 (Thousand US $)
				During 65	As of 30 Sep 66	
28.00	Ban Xom Lom Barracks	2.3	18 Feb	57 (inactive)	57 (inactive)	0
26.00	Dien Bien Phu Barracks and Storage Area	2.3	19, 20, 21 Feb	52	87 (inactive)	800
39.3	Mu Gia Pass Barracks	0.1	1, 9, 10, 17 Feb	74 (inactive)	74 (inactive)	0
39.2	Vinh Linh Barracks Cent. NE	0.3	22 Mar 27 Apr	39 (inactive)	52 (inactive)	10
25.0	Son La Barracks Hq., MR North West	2.0	7, 8 Apr	52	61	190
39.34	Ha Tinh Barracks, Sup Dep.	0.2	9, 15 Mar 26 Apr 9, 10, 22 May 6 Jun	31 (inactive)	31 (inactive)	0
39.25	Vinh Son Barracks S	0.8	13, 14, 17 Apr	52 (inactive)	52 (inactive)	0
39.12	Dong Hoi Barracks Cit.	0.6	4 Apr	77 (inactive)	77 (inactive)	0
39.27	Vinh Barracks NNE	0.6	4 Apr	43	51 (inactive)	40
39.24	Sam Son Barracks W	0.3	12 May	22	56 (inactive)	100
39.46	Bien Son Barracks NNE	1.9	23 Jun 1, 5, 12 Jul	0	18	300
33.00	Dong Hoi Barracks WNW	1.1	N.A.	82	82 (inactive)	0
39.21	Yen Phu Barracks NE	1.0	20, 21 Aug	51 (inactive)	51 (inactive)	0
39.14	Badon Barracks	0.2	28 Aug 3, 12 Sep	30 (inactive)	99 (inactive)	100
39.18	Muong Sen Camp	0.1	31 Jan	100 (inactive)	100 (inactive)	0
	Total					1,540

a. A few additional barracks have been attacked for which information is not available to estimate damage.

Average daily casualties for the 30-day period were 2.2 killed by air and 6.7 wounded by air. Because prisoner-of-war reports, and Thai letters, reflected sporadic references to the bombing of schools and hospitals, a factor for these inadvertent attacks was also included in the daily casualty figures. The final daily casualty rates for civilians as a consequence of the armed reconnaissance were estimated to be 3.5 killed and 8.0 wounded in Route Package II.

b. Military Casualties

The problems encountered in deriving a credible estimate of military casualties inflicted by armed reconnaissance were insoluble.

Prisoner-of-war reports and Thai letters were also of marginal value. A methodology employing the results of the armed reconnaissance program weighted the number of trucks or other facilities destroyed and damaged with DIA estimates of casualties per truck and per other facility in the following tabulation:

	Number Destroyed or Damaged	Weight	Military Casualties
Barracks	80	0.1	10
Supply warehouses	138	0.1	10
Misc. buildings	4,640	0.1	460
Radar Com.	78	0.1	10
Truck parks	92	0.1	10
AAA sites	568	0.1	60
Trucks	3,096	0.5	1,550
Watercraft	2,071	0.5	1,040
RR cars	2,234	0.1	220
Total			3,400 a/

a. Because of rounding, components may not add to the total shown.

In two specific categories, trucks and watercraft, the casualty weights were decreased to reflect the information gained from prisoner-of-war reports It should be pointed out, however, that at best this method represents a very crude approximation of military casualties.

During 1966, North Vietnamese fighter aircraft have become more active outside of the sanctuary area surrounding Hanoi. The four airfields attacked during 1965 and 1966 do not have runways long enough to support jet fighters fully, and their vulnerable locations limit their usefulness as operating bases.

The three most important airfields in North Vietnam (Hanoi/Gia Lam, Haiphong/Cat Bi, and Phuc Yen) are located in the Hanoi-Haiphong area. These fields have full jet-handling capability and account for about 60 percent of the targeted capacity. The Kep airfield also has full jet-handling capability and accounts for an additional 10 percent of the capacity. At least three new airfields are under construction. These fields are located at Yen Bai, at Hoa Lac near Hanoi, and at Bai Thuong near Thanh Hoa. They will represent a significant addition to total airfield capability.

3. SAM Sites

From January through September 1966, 75 airstrikes were carried out against 60 SAM sites. The North Vietnamese are believed to be limited to about 25 SAM firing units (battalions), most of which have exhibited a high degree of mobility. Therefore, although 144 SAM sites had been identified as of 30 September, not more than 20 to 25 of them are believed to have been occupied at any one time.

Considerable damage was reported for the SAM facilities attacked, as indicated in the following tabulation:

	Destroyed	Damaged
Sites	25	25
Fan Song radars	19	
Missile transporters		3

Insufficient post-strike photography prevents making an accurate assessment of the amount of damage actually sustained by these SAM facilities in 1966. Damage reported by pilots could have totaled at

Table D3

North Vietnam's Trade with Communist Countries a/
1962-65

Million US $

	1962	1963	1964	1965
Imports	122.3	134.1	118.7	179.8
Eastern Europe	21.9	21.2	14.8	29.7
Bulgaria	2.0	1.6	1.3	2.4
Czechoslovakia	4.7	5.7	4.4	9.7
East Germany	5.4	3.6	2.9	4.9
Hungary	3.0	2.4	2.7	5.3
Poland	1.9	1.3	2.1	4.0
Rumania	4.9	6.6	1.4	3.4
USSR	54.7	56.7	47.7	74.9
Communist China b/	45.0	55.0	55.0	70.0
Other Communist countries c/	0.8	1.2	1.2	5.2
Albania	0.2	0.2	0.2	0.2
Cuba	0.6	1.0	1.0	5.0
Exports d/	78.6	76.1	84.5	80.4
Eastern Europe	22.3	19.5	22.4	26.6
Bulgaria	1.6	2.2	2.4	2.4
Czechoslovakia	7.4	4.9	5.0	7.2
East Germany	5.2	2.8	2.7	6.1
Hungary	2.6	2.3	4.9	3.7
Poland	2.9	2.9	5.2	5.1
Rumania	2.6	4.4	2.2	2.1
USSR	30.2	35.3	34.8	30.6
Communist China b/	25.0	20.0	25.0	20.0
Other Communist countries	1.1	1.3	2.3	3.2
Albania	0.2	0.2	0.2	0.2
Cuba	0.9	1.1	2.1	3.0 c/

a. All figures are taken from statistics published by North Vietnam's trading partners.
b. Estimated.
c. There is no information on trade with North Korea and Mongolia; Yugoslavia did not conduct any trade with North Vietnam during these years.
d. Exports include cost of freight and insurance (c.i.f.).

are confirmed by photography to be destroyed or damaged. This figure probably understates somewhat the number of smaller bridges damaged or destroyed, however, because photography may not be available for some of these bridges. A comparison of the two sets of data is given in the following tabulation:

	Destroyed or Damaged	
	Photographic Evidence	Pilot Reports
Railroad and combinations	63	92
Highway	243	2,467
Total	306	2,559

5. Railroad Yards

Many small railroad yards and sidings have been attacked by armed reconnaissance, and at least five comparatively important yards have been struck during the Rolling Thunder program. But the principal yards in the country, particularly those on the Hanoi-Haiphong and Hanoi-Dong Dang lines, have not been attacked. The yard at Thai Nguyen is the only relatively important yard attacked for the first time during 1966 (see Table B4). In addition, the yards at Vinh and Yen Bai were restruck in 1966. The Vinh Classification Yard NW has been hardest hit by air attacks, with 75 percent of its capacity destroyed as of September 1966. This yard was struck at least three times in 1965 and six times in 1966. The Hanoi-Vinh rail line has been interdicted for through service during most of the time since the bombing began, however, and the yard generally has been used only in support of shuttle service.

The cost of restoration of the damaged rail yards amounted to $400,000 in 1966, compared with only $70,000 in 1965. Most of these costs stem from the need to repair railroad stations and other buildings, rather than yard track. The strikes have resulted in only temporary disruption to rail service during both years, and rail service at these yards has usually been restored within a few days.

There has been no change in recent weeks in the Indian Government's opposition to the bombing of North Vietnam. On 5 October, Foreign Minister Singh told Secretary Rusk that he saw no chance of bringing North Vietnam to the conference table so long as the bombing continued. Similarly, on 7 November, the Minister of State for External Affairs told Parliament that India continued to be of the firm opinion that the US bombing of North Vietnam should stop "without any conditions."

It is probable that official Indian opinion will continue along these lines in the foreseeable future and that New Delhi's opposition will be considerably intensified if any significant escalation of the air attacks takes place. Short of an all-out US attack on civilian population centers, however, it is unlikely that Indian opposition will be manifested in channels other than those already utilized. Bilateral Indian-US relations are unlikely to be drastically affected.

The development of opinion in Yugoslavia has been somewhat similar to that in India. The official government position is that a solution to the war must begin with a unilateral cessation of the bombing. The government is, however, less hostile to the United States on Vietnam than any other Communist regime. The Yugoslavs, for example, have acknowledged in their press that the refusal of the Vietnamese Communists to make any concessions on the war is a key factor in the continuation of the air attacks. The position of the Yugoslav Government is attributable in part to its reliance on the West, particularly the United States, for the achievement of its economic goals. It is unlikely that further escalation of the air attacks against military-related targets will bring any significant new initiative on the conflict from Belgrade.

Another of the leading non-aligned states, the UAR, has officially taken a relatively neutral stance on the bombings. Recent statements by Nasser, however, have characterized the bombing as aggression and are consistent with his privately stated view that no progress in mediation is possible while the bombing continues. The press in the UAR has generally been critical of US policy. However, the great bulk of the UAR public is apathetic about the Vietnamese war and is not a source of pressure on the regime. Continued bombing of North Vietnam and further escalation of the attacks would probably result in an intensification of criticism from the UAR, but would probably not provoke any new line of overt action of a significant deterioration of the UAR's bilateral relations with the United States.

Thunder program appear to be substantial. Damage inflicted on other sectors of the economy in North Vietnam has produced a considerable increase in domestic communications requirements. The establishment and expansion of new communications networks have become an especially urgent need for units assigned to the repair, maintenance, and augmentation of transportation and logistics facilities. In order to service these new requirements, North Vietnam has been forced to seek sizable quantities of communications equipment from foreign suppliers and to construct new telecommunications transmission media. In the spring of 1966, North Vietnam imported one hundred 15-watt radiotransceivers and ten 1-kilowatt transmitters at an estimated cost of $270,000. Currently, Hanoi is attempting to procure 30,000 kilometers of military field wire at a cost that could exceed $1 million if purchased in the West. Additional telecommunications equipment in smaller quantities -- including tele-typewriters, radiobroadcast receivers, and multiplexing gear for the open wireline system -- also has been imported. Since at least February 1966, photography has identified construction activity on at least six new open wireline routes in North Vietnam. Although it is impossible to distinguish precisely between communications requirements induced as a direct result of bomb damage and those generated by the expansion of North Vietnam's military establishment, it is clear that the Rolling Thunder program has been an important, if not the prime, force in increasing the complexity of Hanoi's communications problems. On balance, however, it appears that the operational efficiency of the telecommunications system of North Vietnam has not been seriously impaired, and if the present trend continues, North Vietnam will have significantly increased telecommunications capacity.

7. Supply and Ordnance Depots

Ten of the 17 targeted supply depots have been attacked under the Rolling Thunder program. Restrikes on a few depots in 1966 resulted in insignificant damage and only slight additional loss of national capacity. Restoration of damage inflicted in 1966 will cost about $130,000, and that in 1965 will cost at least $3 million.

North Vietnam had a total storage capacity at all known installations of about 10.6 million square feet before the beginning of the Rolling Thunder program. The total storage capacity of the 17 targeted installations is about 3.4 million square feet. Destruction of targeted installations represents about 15 percent of the national capacity. Most of the destroyed installations are located in the southern

Table A27

Statistical Summary of Attacks on Radar Sites
in North Vietnam
1965 and January-September 1966

	1965	1966	Total
Number of JCS fixed targets	5	5	
JCS fixed targets struck	10	4	
Percent of national capacity destroyed	58	80	
Sorties			
Attack	620	30	650
Support	350	Negl.	350
Total	970	30	1,000
Ordnance delivered (tons)	680	30	710
Aircraft lost	11	0	11
Personnel lost	3	0	3
Personnel recovered	9	0	9
Cost to the United States (million $)			
Aircraft lost	N.A.	0	
Operational cost of sorties flown	N.A.	0.04	
Ordnance delivered	N.A.	0.06	
Total	N.A.	0.10	

not be further aggravated." Privately, however, several Indian officials expressed their approval of the retaliatory action and were almost apologetic in explaining that India's policy of non-alignment and its position in the ICC strictly limited what could be said officially. Editorial reaction to the Tonkin incident ranged from mild to strong approval of the US action, except in the Communist and extreme leftist press.

Reaction by the Indian Government to the beginning of sustained attacks on North Vietnam in early 1965 was less sympathetic and resulted in several Indian diplomatic initiatives designed to ease the tension. On 8 February an official statement called for all peace-loving countries to "bend their efforts to insure that there is no escalation of the conflict," and asked for an immediate suspension of "all provocative action" in South and North Vietnam "by all sides involved."

Indian Foreign Secretary C. S. Jha, in a meeting with Ambassadors Bowles and Lodge on 30 April 1965, said the Indians looked "sympathetically" on the US position in Vietnam but would like to see more emphasis on a political solution. Jha claimed there was evidence of a cleavage between the Soviet Union and North Vietnam on one side and Communist China on the other. He felt that there was a possibility of exploiting this cleavage if the bombings of North Vietnam were to stop.

During the period June to December 1965, a more sympathetic popular and official attitude developed in India toward US efforts in Vietnam. This change was due in part to India's war with Pakistan and its confrontation with China during the autumn. Although Prime Minister Shastri continued to demand that the United States cease bombing North Vietnam and was also critical of increasing US troop commitments to South Vietnam, there is some evidence that other cabinet ministers were chiding Shastri for "harping" on Vietnam in his public speeches.

A USIS report in August found that the leading Indian newspapers, in contrast to the May-June period, were carrying editorials more in agreement with US objectives in Vietnam. Most of the editorials, however, still contained reservations regarding bombing raids against North Vietnam. A report on the results of a questionaire devoted to attitudes toward Vietnam in a June-July 1965 survey of public opinion among 2,000 literate adults in the major Indian cities revealed virtually an even split between those opposing and favoring US policy. Among those who opposed the United States, 50 percent listed the bombing of North Vietnam as the primary cause of their opposition.

Losses by model of aircraft are compared for 1966 and 1965 in Table A16. Losses as a percent of total sorties flown by models of aircraft most used either remained about the same or increased slightly.

D. Cost Effectiveness of Operations Against North Vietnam in 1966

The direct operational cost of the air attack on North Vietnam during the first nine months of 1966 is estimated at something more than $950 million, or more than double the cost of the attack during 1965. This figure includes the production cost of the aircraft lost, valued at $487 million; direct sortie overhead costs, estimated at about $234 million (not including any allowance for maintenance of air bases and the aircraft carriers or for logistic support); and ordnance costs of $231 million. The value of the damage inflicted on North Vietnam by the air attack has been estimated at about $100 million, consisting of $28 million in military costs, $47 million in direct economic costs, and $25 million in indirect economic costs. Thus the cost of inflicting one dollar's worth of damage on North Vietnam during 1966 may be estimated at more than $9.50. The comparable figure in 1965 was about $6.70. Details of these cost estimates are presented in Table A17 and in Figure A 9. The cost of the air attack and of the damage to the economy of North Vietnam are compared on a monthly basis in Figure A10. The costs of the US/GVN air operations and the value of damage to the economy of North Vietnam, in general, fluctuate together. On the average, however, the cost of the air operations per unit of damage to the North Vietnamese economy was about 42 percent higher during the first nine months of 1966 than it was during 1965.

E. The Attack on Fixed Target Systems

As indicated previously, the attack on JCS fixed targets has represented a much smaller effort in 1966 than it did in 1965. Only 2,010 sorties were flown against such targets in 1966, compared with 13,890 sorties in 1965, and only 2,610 tons of ordnance were delivered, compared with 12,800 last year (see Table A18). As of 30 September 1966, there were 242 targets on the JCS list. A total of 153 targets from the list were struck in 1965, including some no longer carried on the current list. During the first nine months of 1966, 22 new targets were struck, and 65 that had been struck previously were restruck (see Table A19). The effort against the individual target systems is summarized in Table A20, and is presented in greater detail in Tables A21 through A28.

Table A18

Attack on JCS Fixed Targets in North Vietnam
1965 and January-September 1966

Year and Program	Sorties Flown				Ordnance Delivered	
	Strike and Flak Suppression	Support	Total Number	Total Percent	Tons	Percent
1965						
Fixed target	6,930	4,130	11,060	80	11,960	93
Armed reconnaissance	1,780	1,050	2,830	20	840	7
Total	8,710	5,180	13,890	100	12,800	100
January-September 1966						
Fixed target	210	150	360	18	370	14
Armed reconnaissance	1,310	340	1,650	82	2,240	86
Total	1,520	490	2,010	100	2,610	100

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least $14 million*; however, photography indicated only that equipment valued at some $900,000 was destroyed.** The actual amount of damage in 1966 probably lies closer to $5 million.*** Damage to SAM facilities in 1965 was estimated at about $630,000.

During this period, approximately 660 missiles (valued at about $20 million†) were fired against Allied targets, resulting in the destruction of 22 planes and 14 drones.

4. Naval Bases

By the end of September 1966, airstrikes against naval bases had destroyed almost one-fifth of the naval support facilities. The damage is estimated to have amounted to about $1.2 million during 1965 and about $400,000 during January-September 1966 (see Table B8).

Most of the increased destruction during 1966 resulted from restrikes on naval facilities at Quang Khe and Phuc Loi, two bases that had been hit during 1965. The only additional base attacked in 1966 was the Bai Chay Naval Complex located in the Hon Gai port area. One strike on this base in August resulted in the destruction of about 14 percent of its capability but represented only a relatively small cost of reconstruction. Possibly as another result of the strike, however, some of the command responsibilities for naval operations in the area have been shifted from the Bai Chay headquarters to the newly constructed command post at Binh Dong in the Haiphong area.

It is doubtful that the damage to the bases has seriously affected the operations of the small North Vietnamese navy. The major base accounting for 40 percent of the targeted capacity is located

* It is assumed that all of the sites reported destroyed were occupied when struck and that most of the major equipment was destroyed: specifically, the Fan Song radar, cabling, and an average of five launchers and three missiles. No attempt has been made to assign a value to the "damaged" category.

** Two missiles on launchers, six launchers without missiles, and two sets of guidance and control equipment.

*** Cost computations are based on estimated production costs of replacement equipment; inasmuch as at least some of the equipment is believed to be older models not now in active service in the USSR, these computations probably overstate their true present value.

† This cost is not included in the estimated costs of physical damage resulting from the Rolling Thunder program.

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in Southeast Asia was only 27 percent in 1966,* this was also an increase above 1965.

More than 56 percent -- 59,500 -- of the sorties flown in North Vietnam were attack sorties. This compares favorably with 1965 when only 47 percent were attack sorties. As in other areas of Southeast Asia the air campaign against North Vietnam was overwhelmingly a US effort. The South Vietnamese air force has accounted for less than one percent of the total sorties flown over North Vietnam.

Of the total sorties flown against North Vietnam, 44 percent originated from Navy aircraft carriers, 36 percent from US Air Force bases in Thailand, and 20 percent from bases in South Vietnam. Among the US services, the Air Force predominated, accounting for 52 percent of total sorties. This is a reversal of the situation in 1965 when the US Navy dominated the program and accounted for 53 percent of total sorties flown.

The 1966 Rolling Thunder program varied radically from the 1965 campaign in the increasing emphasis on armed reconnaissance rather than attacks on fixed targets. In 1966, only 2,010 sorties were flown against JCS-designated fixed targets, compared with 13,890 sorties in 1965. Armed reconnaissance (excluding restrikes on JCS fixed targets) accounted for over 98 percent of all sorties flown against North Vietnam.

The increasing emphasis on Rolling Thunder as an interdiction program is seen in the geographic distribution of the air effort. More than 70 percent of the total sorties over North Vietnam in the first nine months of 1966 were concentrated in the three southernmost armed reconnaissance Route Package areas (Routes I-III). These three Route Package areas cover the North Vietnamese Panhandle area south from Thanh Hoa to the Demilitarized Zone. On the other hand, only 7 percent of the sorties flown were over Route Package VI, the key northeast area which contains most of the lucrative fixed targets and the two most important rail lines in North Vietnam.

B. Ordnance

From January to September 1966, almost 92,000 tons of ordnance were delivered on North Vietnam, nearly 2.7 times the tonnage delivered in 1965. This ordnance amounted to 26 percent of the total ordnance delivered in all air operations in Southeast Asia.

* Unless otherwise specified, 1966 refers to the first nine months of the year.

Table E7

Construction and Improvement on Road and Railroads
in North Vietnam
1965 - 30 September 1966

	Miles	
Type of Construction	Road	Railroad
Newly developed routes	650	30
Improvements to existing routes	350	~~125~~ 90
Short bypasses to existing routes	150	~~80~~ 60

New rail construction in North Vietnam has centered on the development of a 28-mile standard gauge line west from Kep to Thai Nguyen. This line and the conversion to dual gauge (meter and standard) of the Dong Dang line from Kep to the China border apparently will be fully operational in December 1966.

Other rail construction has included the southward extension for 10 miles of the uncompleted Vinh to Dong Hoi rail line.

Continued through movement of supplies around destroyed or damaged bridges has been insured by the rapid repair of bridges or the construction of alternate forms of bypass. Aerial photography has confirmed damage to 359 rail and highway bridges in North Vietnam, and almost every one has some alternate means of crossing (see Table E8).

1. Bridging Techniques

More than 70 highway bridges have not been repaired during 1966, apparently because of the effective use of one or more alternate crossings. The most common type of bypass on the rail lines which have been kept open to through traffic is the alternate temporary bridge. A novel bridging technique using parallel steel cables strung across a stream on which removable deck sections are placed was discovered in June 1966. Aerial photography has confirmed more than 40 cable bridges in North Vietnam, located principally on routes leading to areas of Communist insurgency.

II. Neutral States Outside the Far East

There have been a number of "neutral" or "non-aligned" nations which have been active in attempts to arrange a peaceful settlement in Vietnam. Several of these countries have taken an active role in the United Nations and other important international organizations and thus have considerable influence throughout the Free World. Some of the neutrals are actively opposed to the bombings, whereas others are more passive, in part because of local factors which tend to limit opposition.

The official Indian attitude all along has been to oppose the bombings. However, there are some influential people both within and outside the government who have privately expressed sympathy with the US program.

The Indians have been basically against any escalation of hostilities in Vietnam since they assumed the chairman's role in the International Control Commission (ICC) for Vietnam in 1954. Their concern was founded not only on a fear that hostilities in Vietnam might spread to involve all of Asia but also on increasing fear of Communist China. The government in New Delhi and a majority of the non-Communist press believe that India's only defense against a growing Chinese menace resides in cooperation between the United States and the USSR. Any action which tends to drive Washington and Moscow apart, and conversely Moscow and Peking together, is regarded with dismay. In general, the Indians have viewed the bombing of North Vietnam as forcing the United States and USSR apart and, consequently, as detrimental to New Delhi's interests.

Other factors influencing Indian attitudes toward the struggle in Vietnam include India's role as a leader of the non-aligned world and its position as a leading neutral among the Afro-Asian states. There also is a definite desire on the part of the government in New Delhi to achieve an objective position on Vietnamese matters because of representation on the ICC. India's long struggle against colonialism also tends to generate emotional support for the Vietnamese Communists in their fight against the power and sophisticated weapons of the United States.

The US air attacks on North Vietnam during the Tonkin Gulf crisis evoked a wide reaction in India. The government issued an official statement on 5 August 1964 expressing "grave concern" and the hope that "the explosive situation created by these incidents will

B. Deliveries from the USSR

North Vietnamese imports of machinery from the USSR increased from $25.4 million in 1964 to $48.0 million in 1965. Imports in 1965 were 32 percent higher than the previous peak of Soviet imports which occurred in 1963. Although total machinery imports from the USSR by North Vietnam are still small when compared with machinery imports of an industrial nation, North Vietnam's imports are impressive in view of the country's small industrial base. The value of Soviet machinery imported by North Vietnam in 1965 was 65 percent greater than that of North Korea, although the latter country has many times the industrial capacity of North Vietnam.

An analysis of Soviet exports of machinery to North Vietnam in 1965 shows that a large share of the imports can be related to a war-supporting role. As shown in Table G4, spare parts for motor vehicles, trucks, power equipment, and excavators and road building equipment comprised an important share of imports of machinery into North Vietnam other than [redacted] Truck cranes, winches, and hoisting equipment were also imported in significant quantities. Exclusive of complete enterprises, more than one-third of North Vietnam's imports from the USSR in 1965 can be related to the maintenance, repair, and expansion of the transportation and power sectors of the economy, the two sectors of the economy under heavy attack by the Rolling Thunder Program. [redacted] some small [redacted] -- by far the most important category of North Vietnamese imports -- consist of repair shops and manufacturing facilities that probably also have war-supporting capabilities, such as vehicle repair.

At the same time, however, there were substantial increases in the import of other commodities not directly related to the support of transportation and power. The import of mining equipment in 1965 increased by more than 400 percent compared with 1964, pumps and compressors by more than 900 percent, and oilwell drilling equipment by more than 300 percent. Furthermore, much of the machinery being imported under the category "complete enterprises " is [redacted] going to major Soviet aid projects in mining, electric power, and civilian manufacturing.

relatively heavy emphasis on the production of farm implements -- in 1964 such equipment accounted for 40 percent of machine building output. Today, during a period when its stock of railroad rolling equipment, trucks, power grid, and POL storage facilities is under strong air attack, it is almost inconceivable that the machine building facilities of North Vietnam would be converting to farm machinery production or even that business as usual is being carried on.

It would seem equally unlikely, however, that machine building has converted any significant capacity to the production of military hardware. Markings analysis indicates that small quantities of carbines, grenades, bangalore torpedoes, and other simple hardware have been produced in North Vietnam. However, the ease of importing weapons should discourage any serious desire on the part of the regime to produce modern weapons in sizable quantities.

The production of spares and the general maintenance of locomotives, trucks, construction equipment, and industry in general is the present priority task of North Vietnam's machine building industry. Its total machine building capability is still rudimentary, but many of today's priority tasks resulting from the Rolling Thunder program are similar to many of the tasks performed by machine building, under less pressing circumstances, during the past six or more years.

III. Communist Aid to North Vietnam in Machinery and Equipment

A. Introduction

Communist aid to North Vietnam in machinery and equipment has been vital to the support of the war effort. Along with transport equipment, the Communist countries have provided substantial quantities of equipment for construction, communication, and maintenance -- all of which are valuable to the military effort and to the maintenance of the civilian economy. Furthermore, increased quantities of machinery and equipment have apparently been made available for both new and continuing aid projects which are not military-associated. Table G3 describes the trend in 1959-65 in North Vietnamese imports of machinery and equipment from the USSR.

Table A15

Aircraft and Personnel Losses in Attacks on
North Vietnam, by Service
1965 and January-September 1966

	Service	Aircraft	Personnel	
			Lost	Recovered
1965				
	USAF	77	62	30
	USN	86	76	30
	USMC	0	0	0
	VNAF	8	6	2
Total		171	144	62
1966				
	USAF	142	132	70
	USN	104	68	60
	USMC	3	8	1
	VNAF	0	0	0
Total		249 a/	208	131

a. Including 222 combat and 27 operational losses.

Communist aid is likely to continue to increase in the near future. All Communist countries have pledged substantial amounts of economic and military aid. Imports continue to rise sharply without a compensating increase in exports and there is almost no prospect that North Vietnam will be able to repay the trade indebtedness thus incurred.

The material assistance provided by the USSR and Communist China is a highly significant factor in the North Vietnamese attitude toward continuing the war. The importance of this assistance has been attested to in Vietnamese public statements. The North Vietnamese consider Communist support as valuable in sustaining, if not increasing, the military pressure that can be brought to bear in South Vietnam. They also see it as a protective umbrella which partly inhibits direct allied military pressure on North Vietnam and helps to negate the effects of the bombing. Finally, this aid serves to affirm the ideological unity of the Communist camp in supporting the "war of liberation" in South Vietnam.

Material assistance to North Vietnam is also significant as an apparent commitment of other Communist countries to underwrite the material costs of the war and to assist in the reconstruction of North Vietnam's economy. These assurances undoubtedly underlie North Vietnam's apparent willingness to lose its economic facilities to air attack and to persist in its pursuit of the war in South Vietnam. This attitude is strengthened by the knowledge that even more assistance will be forthcoming.

C. The Logistics Target System*

1. The Interdiction Campaign

An assessment of the interdiction campaign against the logistics target system requires an examination of the air campaigns in both North Vietnam and Laos. Over 98 percent -- 104,000 -- of all sorties flown over North Vietnam and the greater part of the sorties flown in Laos -- 57,000 -- were in effect allocated to the interdiction program in the first nine months of 1966. Through the use of aerial photography, it has been possible to confirm the destruction or damage of 359 bridges in North Vietnam and 64 bridges in Laos since the air campaigns started. Pilot reports indicate that probably over 3,000 trucks were destroyed or damaged in North Vietnam in the first nine

* See Appendix E.

Sorties and Ordnance in Southeast Asia, by Service
1965 and January-September 1966

	North Vietnam								South Vietnam				Laos				All Areas of Operation in Southeast Asia			
	Sorties		Percent of Total Sorties		Ordnance (Tons)		Percent of Total Ordnance		Sorties	Percent of Total Sorties	Ordnance (Tons)	Percent of Total Ordnance	Sorties	Percent of Total Sorties	Ordnance (Tons)	Percent of Total Ordnance	Sorties	Percent of Total Sorties	Ordnance (Tons)	Percent of Total Ordnance
	1965	1966	1965	1966	1965	1966	1965	1966	1966	1966	1966	1966	1966	1966	1966	1966	1966	1966	1966	1966
US																				
Air Force	24,500	54,900	44.4	51.8	21,300	54,170	62.1	59.0	67,770	44.7	117,240	59.9	41,240	72.3	42,350	70.9	163,910	52.1	213,760	61.6
Navy	29,100	46,570	52.7	43.9	11,900	33,890	34.7	36.9	23,530	15.5	21,750	11.1	8,470	14.8	9,140	15.3	78,570	25.0	64,780	18.7
Marine Corps	890	3,690	1.6	3.5	N.A.	2,830		3.1	35,350	23.3	28,480	14.6	7,350	12.9	8,260	13.8	46,390	14.7	39,570	11.4
Army									N.A.	N.A.	5,630	11.5						N.A.	5,630	1.6
Total US	54,490	105,160	98.7	99.2	33,200	90,890	96.8	99.0	126,650	83.5	173,100	97.1	57,060	100.0	59,750	100.0	288,870	91.8	323,740	93.3
VNAF	720	810	1.3	0.8	1,100	880	3.2	1.0	24,990	16.5	22,600	2.9					25,800	8.2	23,480	6.7
Total	55,210	105,970	100.0	100.0	34,300	91,770	100.0	100.0	151,640	100.0	195,700	100.0	57,060	100.0	59,750	100.0	314,670	100.0	347,220	100.0

Dang line. If almost all of the normal seaborne imports through Haiphong are halted, both of the connecting railroad lines in North Vietnam would be forced to attempt to operate under interdicted conditions at a level approaching capacity. Sustained interdiction of the lines would force the Communists to allocate considerable amounts of manpower and materials to maintain the railroad lines and alternative highway routes. The repair of major bridge structures would be measurably more complex and expensive than the relatively simple expedients which keep traffic moving in the southern provinces and in Laos. Sustained 24-hour interdiction and destruction of locomotives and rolling stock by armed reconnaissance would stop all daylight traffic and disrupt nighttime traffic, thus slowing down movements and making the flow of traffic uneven. The North Vietnamese would probably be forced to make greater use of highway and inland water traffic. Although it is extremely difficult to interdict these systems, their greater use would increase the opportunities for harassment of actual traffic movement.

On balance, it is estimated that the North Vietnamese, with Chinese engineering help and the possible loan of transport equipment, could continue to move at least the essential import and export traffic by using all modes of transport. The essential traffic, however, would not include supplies for all sectors of modern industry, some of which would then cease to operate as supplies of raw materials and imported machinery were depleted. The resulting economic impact would be significant because modern industry accounts for about one-half of gross industrial output. Industrial construction would come to an almost complete halt under the assumed attack. There would be a sharp setback to North Vietnam's economic development program. The repercussions of the slowdown of modern industry, however, would be limited by the primarily self-sufficient nature of the subsistence agricultural sector, which supports about 80 percent of North Vietnam's 18 million people. The impact of even a complete loss of its modern industrial base would be a matter of direct concern to only a small element of the North Vietnam society.

Most of the population of North Vietnam leads a fairly primitive life, with simple wants and needs. Only a small segment of the society would find its daily routine or standard of living measurably impaired if the industrial base ceased to operate. More than one-half million nonagricultural workers would be released from their jobs, but most of these workers would undoubtedly be reemployed in reconstruction and transportation. The morale and productivity of

APPENDIX F

CONSEQUENCES OF MINING THE SEAPORTS OF NORTH VIETNAM*

The immediate impact of mining the seaports of North Vietnam would be a severe disruption to normal transport activity. Over the longer term, alternative means of supply from abroad could be developed, and the impact would be a delay rather than a denial of essential war-supporting imports.

The North Vietnamese eventually could probably move by alternative means of transport almost all normal foreign trade and could certainly maintain the import of essential military and economic goods. A mining program alone could not stop the regime from continuing its logistic support of the war in South Vietnam. The movement of goods, however, would be more costly, and the alternative means of transport -- by rail and road -- would become more vulnerable to air attack.

If the mining of the ports were carried on in conjunction with an intensified program of air attack against significant military/economic targets, the impact would be more severe. North Vietnam would probably be unable to maintain the normal flow of import and export traffic, and some civil requirements would have to go unsatisfied. The ability of the regime to continue the present level of aggression in South Vietnam and Laos, however, would not be appreciably diminished.

Political reaction to a mining program, with or without an intensified air campaign, would probably approximate past reactions to US escalation of the conflict. The intensity of political reactions in this instance would probably depend on the timing of the program in relation to current peace initiatives. Virtually all Free World countries

* This appendix examines the effects of a conventional mining program designed to prevent the use of deep-draft oceangoing ships. It does not consider the effects which would occur if mines with a capability against shallow-draft vessels were used. This study also excludes consideration of the impact of a complete break in Sino-Soviet relations.

Table E1

North Vietnam: Air Strikes Against JCS-Targeted Bridges
1965 and January-September 1966

Type and Location of Bridge	Number of JCS-Targeted Bridges Struck		Number of Strikes a/	
	1965	January-September 1966 b/	1965	January-September 1966
Railroad and railroad/highway	16	16	67	96
Hanoi - Dong Dang line	3	3	6	14
Hanoi - Lao Cai line	1	2	7	9
Hanoi-Haiphong line	2	1	5	5
Hanoi-South c/	10	10	49	68
Highway	31	16	77	37
21 N - 23 N	12	7	28	12
19 N - 21 N	3	1	5	1
17 N - 19 N	16	8	44	24
Total	47	32	144	133

a. Including restrikes against JCS bridges.
b. Including JCS bridges initially struck in 1965.
c. Including the Hanoi-Vinh line and the makeshift line south of Vinh.

Table E2

North Vietnam: Estimated Total Length of Time
Railroad Lines Were Interdicted for Through Rail Service
1965 and January-September 1966

Railroad Line	1965	January-September 1966
Hanoi - Dong Dang	1 month	2 months
Hanoi - Haiphong	1 week	1 month
Hanoi - Lao Cai	5 months	5 months
Hanoi - Vinh	9 months	8 months
Hanoi - Thai Nguyen	Negl.	Negl.

Rolling Thunder has not visibly reduced the determination of Hanoi to continue the war and there is no evidence that the air attack alone has shaken the confidence of the regime. With increased Soviet and Chinese aid to bolster its capabilities, North Vietnam in the short term at least will not be influenced by the air attack to take positive steps toward a negotiated settlement. In any event, it is estimated that Hanoi will continue to be insistent on a cessation of the bombings as a prerequisite for negotiations. Analysis of popular attitudes in North Vietnam indicates a continued firmness in support of the regime's policies. Although the long-term effects of the war may have some wearying effect on the population, there is no evidence that it has yet reached a point sufficient to deter Hanoi's leaders from their present policies.

Finally, the course of the air campaign in 1966 has had no significant effect on the attitudes of third countries. From the resumption of the bombings in January 1966 to the escalation represented by the bombing of the petroleum storage facilities, attitudes in most Free World countries have remained essentially static. Some countries have tended to be more moderate in their opposition to US policy. The unyielding attitude of the North Vietnamese, particularly during the January bombing pause, has had a somewhat sobering impact on some third countries. Indeed, the escalation against POL storage facilities produced a reaction more restrained and less critical than had been anticipated. Among Communist third countries, the USSR and the Eastern European countries would prefer a negotiated settlement because they regard a continuation of the war as potentially dangerous to themselves and in any case as posing an awkward dilemma for them within the Communist world. The Chinese Communists, however, remain adamant in their attitudes toward the war and oppose any steps leading toward a negotiated settlement.

Over and above the measurable effects discussed in the foregoing, the Rolling Thunder program has certain intangible aspects such as enemy morale and determination which are much more difficult to assess. The Rolling Thunder program has been the object of much neutralist criticism and the target of a concerted Communist diplomatic and propaganda campaign. In one sense, this must serve to stiffen Hanoi's back; at the same time, the program has become one way Hanoi probably measures US determination -- although the extent of US commitment on the ground conveys this determination far more persuasively. Moreover, the Rolling Thunder operation carries some threat of further escalation which could more effectively strain

or disapprove of the policies and actions of the United States regarding Vietnam, or haven't you heard much about them?"

The sampling indicates that opinion varies widely from country to country and is more opposed in those countries where there is little overall US military or political involvement.

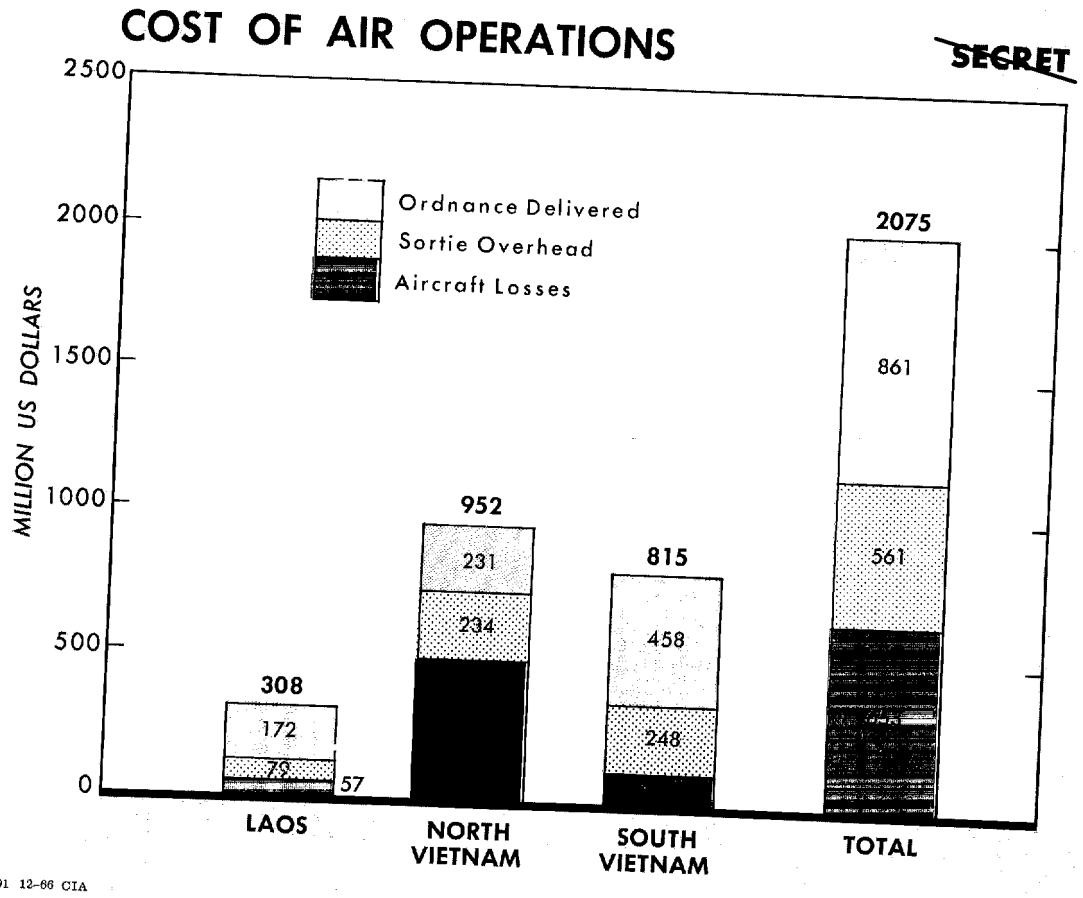
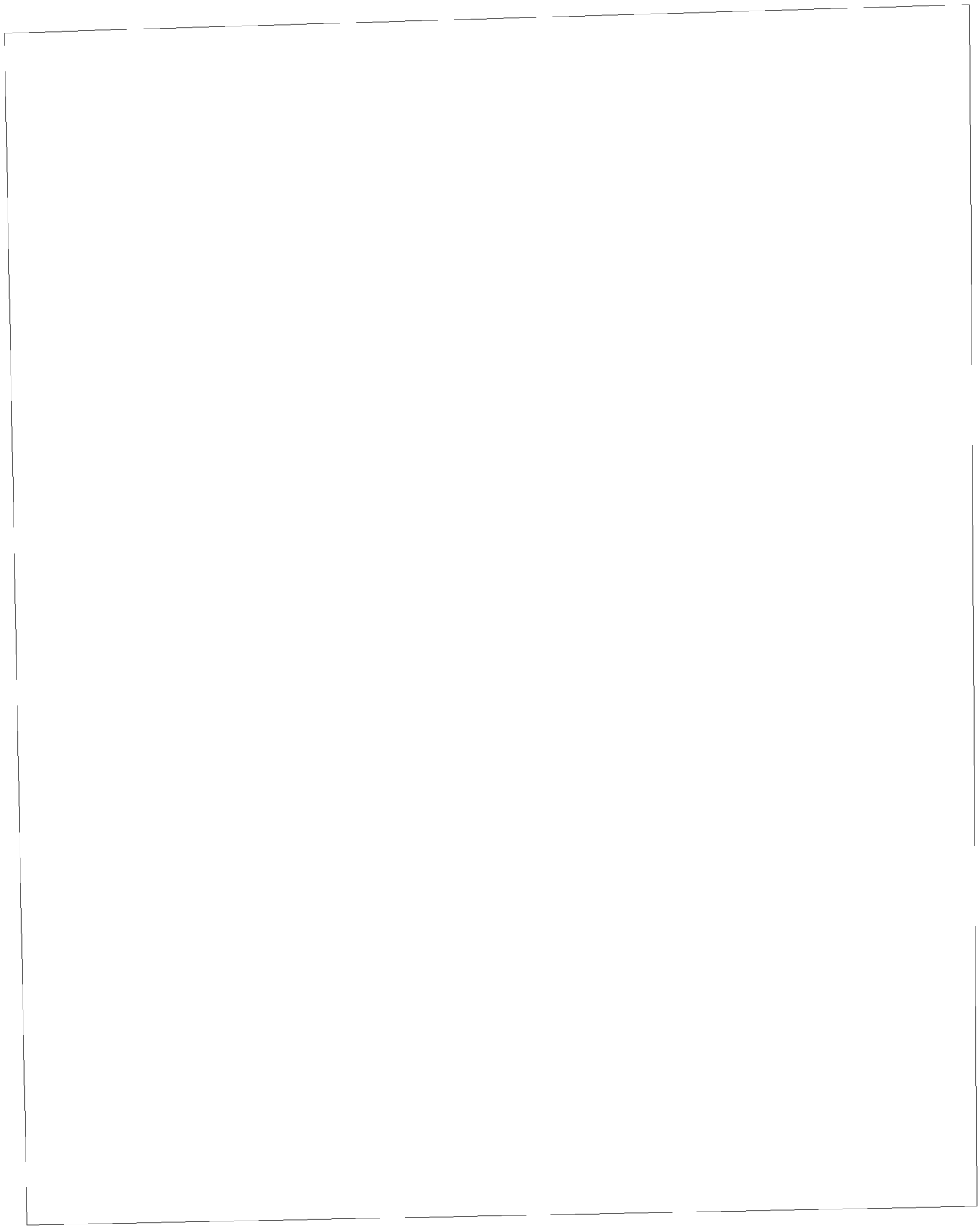


Figure A-3. Estimated Direct Operational Cost of US/GVN Operations in Southeast Asia, January-September 1966



On the basis of these reservations, the order of magnitude of the total restoration cost for targets destroyed or damaged in Laos during the first nine months of 1966 is estimated to be $10.7 million. Of this amount, $5.7 million represents the restoration cost of transport facilities and $5.1 million that of military facilities. The comparable total figure for 1965 is roughly estimated at $2.7 million. (For an estimate of the cost of restoration in 1966, by months and major target categories, see Table E6.)

Table E6

Estimated Restoration Cost, by Month, of Targets Reported Destroyed or Damaged by Pilots in Laos January-September 1966

Thousand US $

Month	Transportation Facilities	Military Facilities	Total
January	344	157	501
February	511	324	835
March	740	461	1,201
April	1,569	757	2,326
May	1,242	485	1,727
June	614	577	1,191
July	213	619	832
August	202	456	658
September	225	1,251	1,476
Total	5,660	5,087	10,747

The airstrikes against LOC's in the Laos Panhandle, however, have not significantly reduced the capacity of these routes, and the amounts of supplies moved have been adequate to support Communist military efforts in South Vietnam. Escalation of the rate of North Vietnamese personnel infiltration into South Vietnam has been facilitated by the Communists' ability to move correspondingly larger amounts of supplies. Although through truck traffic was halted during the rainy season in 1966, routes from North Vietnam into Laos were kept open, and there was some movement of trucks in the area south of Attopeu and in the tri-border area. Aerial photography of routes between these points revealed that the roads were not repaired, that landslides and

destruction of the Hanoi-Haiphong POL sites -- the only European government to do so. There is, however, widespread uneasiness that the military situation may escalate to a point where the USSR or the Communist Chinese will be directly involved, with repercussions in Europe. There is also concern that the United States will become so committed in the Vietnam war that its military position in Europe will be weakened. A noisy left-wing minority opposes every US action, particularly the bombing of the north. There is also, however, a minority group which wholeheartedly supports the United States. In the middle is a vast majority which is generally sympathetic to US actions. It is probable that an escalation of conventional bombing by the United States would not incite a significant change in West German popular or official attitudes.

The French have consistently maintained a policy of unalterable opposition to US involvement in the war in Vietnam. Since July 1964, when France delineated its proposals for a settlement, it has continued to press the view that the neutralization of Vietnam is the only alternative to an escalation of the present conflict or to a humiliating Western withdrawal.

Claiming that the conflict is a civil war which cannot be resolved by the application of external military force, the French have been opposed to the US bombing raids from their inception. The general French thesis is that up to January 1965, negotiations were possible but that the sustained bombing raids on North Vietnam have changed the whole picture. According to Paris, continuation of the raids can only further impair the already slim chances for a negotiated settlement; cessation of the bombardment is therefore a prerequisite to peace talks. Paris believes that the bombing raids have presented North Vietnam with pressures to which it cannot succumb without losing face. According to Quai d'Orsay, Moscow and Peking are unlikely to permit Hanoi to "capitulate" to US pressure.

Public opinion polls taken in 1965 after the bombing began and in 1966 after the bombardment of the oil depots show that official French policy reflects the attitude of the populace. Four out of five Frenchmen with an opinion on the subject indicated disapproval of US policy toward Vietnam. At least 43 percent believe the United States is principally responsible for the war (as against 24 percent who blame other countries and 32 percent who express no opinion). In response to another question, while only 8 percent wish to see

might be increased somewhat for a move by some African and Asian nations, supported by France, to condemn the United States in the United Nations. Nevertheless, the reasons for the mining would be understood and there is little likelihood that it would alter significantly the current attitude of any Free World nation toward the Vietnam war.

B. The Communist World

1. North Vietnam

The mining of its major seaports would cause serious concern to North Vietnam's leaders, particularly if that action were accompanied by a step-up in the Rolling Thunder program. The key to Hanoi's reaction would be the effectiveness of the interdiction and the adequacy of alternate means of bringing in supplies. The North Vietnamese probably would wait until they were able to evaluate the effectiveness of their contingency plans for insuring the importing of supplies before considering any basic change in their policy toward the war.

Hanoi's propaganda machine could be expected to mount an outcry alleging a serious new escalation of the war. This outcry would probably include a Foreign Ministry statement, a protest to the International Control Commission, and possibly a note to the 1954 Geneva Conference Cochairmen urging all "peace-loving people" to take action to stay the hand of the "US imperialists." The propaganda probably would also include vague references to retaliation against US forces and a reiteration of Hanoi's determination to continue the fight at any cost.

2. Communist China

Peking would react noisily to the new US attacks, but, even if mining of the ports were accompanied by increased bombing of North Vietnam, it is unlikely that the Chinese response would go beyond propaganda blasts and stepped-up logistic support for Hanoi. The current domestic political upheaval in Peking has added a new element of uncertainty with regard to Chinese foreign policy decisions, but the net effect thus far has been to focus the attention of Chinese leaders on problems close to home. This preoccupation with internal matters has probably increased Chinese caution and has made the Chinese leaders even more reluctant than before to risk a war with

maintenance of the present US military commitment and 5 percent desire increased attacks on North Vietnam, 68 percent of the French public thinks the United States should begin to withdraw its troops.

The deterioration of French-US relations has probably been accelerated by frictions over the Vietnamese conflict, but would have occurred in any event, since French aspirations to great-power status have been blocked or impeded by the overall military, economic, and political preponderance of the United States. Moreover, the real point of disagreement between Paris and Washington is not the bombing program but the whole policy of seeking a military solution to what the French see as an essentially political problem in Vietnam and of intervening in an area which the French believe is not properly a US "sphere of influence."

Seen in this context, the present limited bombing program has been only a minor factor in the deterioration of US-French relations, and Paris' reaction even to greatly accelerated bombing is likely to be only an increased propaganda effort. De Gaulle is willing to use the Vietnam conflict to emphasize his independence from the United States. He does not, however, consider it important enough to risk a full-scale showdown with the United States and wants in addition to ensure that France is in a strong position to play a mediating role in the conflict.

equipment, spare parts, fuel, and manpower would cause serious transport problems and bottlenecks. The transport system would be forced to function at near capacity levels, undoubtedly complicated by confusion and distribution difficulties. Transport requirements for the movement of military supplies, however, could be met. The more essential economic supplies, such as food, also could be moved, but economic development and some current activities in the small industrial sector would be seriously curtailed because of inadequate transportation. Intensive interdiction of the lines of communication in North Vietnam could not prevent the movement of essential military and economic supplies, but it would result in significant increases in the burden and costs being inflicted on the enemy.

Table A2

Sorties Over All Areas of Operation in Southeast Asia, by Mission and Nationality a/
1965 and January-September 1966

Year and Month	By US Services			By the South Vietnamese Air Force			Total		
	Attack Sorties b/	Support Sorties	Total Sorties	Attack Sorties b/	Support Sorties	Total Sorties	Attack Sorties b/ c/	Support Sorties c/	Total Sorties
1965									
January	800	430	1,230	N.A.	N.A.	1,630			2,860
February	1,410	610	2,020	N.A.	N.A.	1,390			3,410
March	2,690	910	3,600	N.A.	N.A.	1,430			5,030
April	4,620	2,570	7,190	N.A.	N.A.	1,600			8,790
May	7,240	3,670	10,910	N.A.	N.A.	1,440			12,350
June	8,620	2,190	10,810	N.A.	N.A.	1,540			12,350
July	12,440	5,220	17,660	N.A.	N.A.	2,180			19,840
August	13,060	5,500	18,560	N.A.	N.A.	2,470			21,030
September	14,130	5,760	19,890	N.A.	N.A.	2,590			22,480
October	13,940	6,850	20,790	N.A.	N.A.	3,000			23,790
November	14,980	6,530	21,510	N.A.	N.A.	2,710			24,220
December	15,740	7,010	22,750	N.A.	N.A.	2,650			25,400
Total 1965	109,670	47,250	156,920	N.A.	N.A.	24,630			181,550
1966									
January	17,890	8,220	26,110	2,470	50	2,520	20,360	8,270	28,630
February	18,730	7,850	26,580	2,800	40	2,840	21,530	7,890	29,420
March	23,630	9,790	33,420	2,880	60	2,940	26,510	9,850	36,360
April	20,860	10,560	31,420	2,540	100	2,640	23,400	10,660	34,060
May	18,400	9,300	27,700	2,570	110	2,680	20,970	9,410	30,380
June	21,480	10,950	32,430	2,980	80	3,060	24,460	11,030	35,490
July	24,710	13,020	37,730	3,130	110	3,240	27,840	13,130	40,970
August	24,280	12,120	36,400	2,980	140	3,120	27,260	12,260	39,520
September	24,330	12,750	37,080	2,530	230	2,760	26,860	12,980	39,840
Total first nine months 1966	194,310	94,560	288,870	24,880	920	25,800	219,190	95,480	314,670
Total January 1965 - September 1966	303,980	141,810	445,790			50,430			496,220

a. Rounded to nearest 10 sorties.
b. Attack sorties include strike and flak-suppression sorties and close air support of ground operations.
c. The distribution of South Vietnamese sorties by attack and support categories is not available for 1965.

TOP SECRET

Approved for Release: 2012/07/20

THE EFFECTIVENESS OF THE AIR CAMPAIGN AGAINST NORTH VIETNAM* 1 JANUARY-30 SEPTEMBER 1966

Summary

The Rolling Thunder air offensive against North Vietnam has been accelerated sharply in 1966, compared with operations in 1965. The 59,500 attack sorties flown in the first nine months of 1966 against targets in North Vietnam were about 2.3 times the 1965 effort; the 92,000 tons of ordnance dropped was 2.7 times the ordnance delivered on targets in 1965. The 1966 air operations have also been carried out more efficiently than the 1965 campaign. The average bomb load per attack sortie has increased, and the rate of aircraft losses per 1,000 aircraft sorties has been only about 64 percent of the 1965 rate.

By the end of 1965 a growing scarcity of fruitful fixed targets outside of sanctuary areas, as well as other operational restrictions, virtually forced a continually increasing emphasis on armed reconnaissance. This trend was temporarily interrupted by the strikes against major petroleum storage installations, which began late in June 1966. Sorties against JCS fixed-target systems dropped from more than 25 percent of the total sorties flown in 1965 to less than 2 percent in 1966. Armed reconnaissance sorties increased by almost 140 percent, from 55,150 sorties in 1965 to more than 105,600 in 1966. Over 70 percent of total sorties were directed at the southernmost areas of North Vietnam, the Panhandle section south of Thanh Hoa. This shift in the types of targets under attack in large part accounts for an increase of some 40 percent in the cost of inflicting a dollar's worth of damage in North Vietnam -- from an estimated $6.70 in 1965 to about $9.50 in 1966.

* This memorandum was produced by CIA. Aside from the normal substantive exchange with other agencies at the working level, this memorandum has not been coordinated outside CIA. It was prepared by the Office of Research and Reports with a contribution from the Office of Current Intelligence. It was coordinated with the Office of Current Intelligence and the Special Assistant for Vietnamese Affairs; the estimates and conclusions represent the best judgment of this Office as of 7 December 1966.

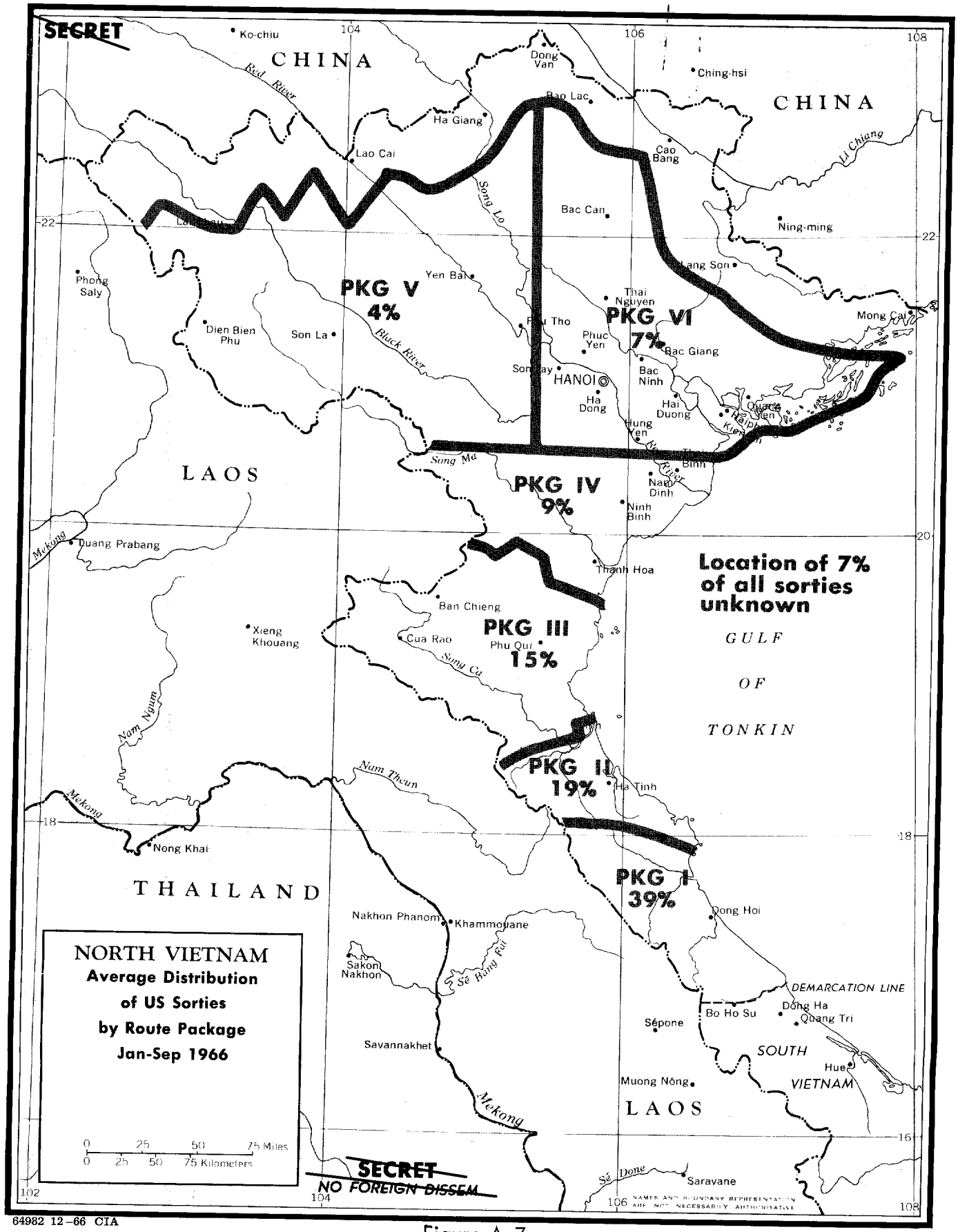


Figure A-7