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INTELLIGENCE MEMORANDUM

Effects of the Rolling Thunder Program:
Bomb Damage, Civilian Casualties,
And Morale in North Vietnam

Summary

Attacks against major industrial plants in North Vietnam have given a new dimension to the air war in 1967. Damage to electric power facilities has been particularly severe and has affected other industries. Modern industry, however, does not play a vital part in North Vietnam's ability to meet the needs of the people or to continue the war. Despite the widening air war the Rolling Thunder program remains predominantly an interdiction campaign against men and supplies. Movement has become more difficult, but ingenious countermeasures and determination, backed up with material support from other Communist countries, have enabled Hanoi to meet its own needs and to support the insurgency in South Vietnam. Attacks against military targets have been disruptive, but North Vietnam's over-all military capabilities have not been reduced.

While North Vietnam has diverted substantial numbers of personnel to reconstruction and repair of bomb damage, these diversions have not significantly limited Hanoi's ability to infiltrate troops into South Vietnam and will not cripple the economy.

Civilian casualties in North Vietnam are rising as the scope and intensity of the air war increase. The estimated total number of civilian casualties--

Note: This memorandum was produced solely by CIA. It was prepared jointly by the Office of Economic Research and the Office of Current Intelligence.

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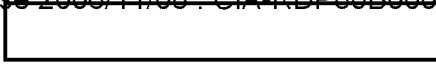
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43,000 killed and wounded--remains small, however, in relation to the population of 19 million and to the 172,000 attack sorties against targets in the north.

Public morale in North Vietnam appears to be holding up fairly well, despite growing hardships. Although some signs of war-weariness are becoming evident, the people in general appear willing to put up with their many difficulties and to respond to the Hanoi regime's direction. There have been no reports of open opposition. It is too early to gauge the effects of the recent bombing of targets in the Hanoi area previously regarded as "safe." As the bomb damage, casualties, and hardships mount, the regime may be hard pressed to keep morale at a satisfactory level. The evidence to date suggests, however, that morale is not likely to pose a major problem in the near future.


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I. Damage to Economic, Military, and Logistic Targets

Effects of Physical Damage

1. Almost 64,000 attack sorties were flown in the first seven months of 1967, compared to 82,000 in 1966. Attacks against major industrial plants and important military targets have given new dimensions to the air war in 1967. In terms of sorties, however, the Rolling Thunder Program remains preponderantly an interdiction effort against transportation routes and other logistic targets primarily in the southern part of the country.

2. The cumulative effects of the bombing program have caused numerous management and logistic problems for the North Vietnamese and have raised the cost of Hanoi's support of the insurgency in South Vietnam. The movement of men and supplies has become more difficult and time consuming and a substantial volume of war and war-supporting material has been destroyed in transit. As shown in the following tabulation, the estimated direct cost of damage inflicted was greater for the first seven months of 1967 than for the year 1966; damage to military targets so far in 1967 has been more than double the amount inflicted in 1966.*

<u>Type of Target</u>	<u>Million US \$</u>		
	<u>1965</u>	<u>1966</u>	<u>Jan-Jul 1967</u>
Economic	36.2	93.3	95.3
Military	32.5	19.1	44.8
Total	<u>68.7</u>	<u>112.4</u>	<u>140.1</u>

*See Table 1 for details.



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3. The North Vietnamese, however, have shown great ingenuity and determination in developing countermeasures against the air attacks. These countermeasures offset, in large part, the effects of damage inflicted by the bombing. Heavy attacks on lines of transportation thus have not succeeded in cutting route capacities to the point where the small flow of supplies needed to support the insurgency in South Vietnam has been significantly impeded. In addition, the North Vietnamese have been able to maintain essential economic activities and thus supply the basic needs of the population while continuing the war effort.

4. North Vietnam has been able to absorb the punishment of the air war largely because of the aid it has received from other Communist countries. The flow of aid has been increasing and far exceeds the cost of damage inflicted from the air.

	<u>Measurable Damage</u>	<u>Economic and Military Aid From Communist Countries</u>
1965	69	395
1966	112	720
1967 (1st seven months)	140	525

Industry

5. The extension of the Rolling Thunder Program during 1967 to include attacks against important industrial facilities has significantly damaged North Vietnam's small modern industry. Large-scale industrial production has virtually ceased. About 80 percent of the central electric generating capacity is currently out of operation. All of the central generating plants in the main Hanoi-Haiphong network, with the exception of the Hanoi plant itself, have been out of service since early June.

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6. The country's only cement plant--at Haiphong--has ceased production because of bomb damage and the loss of its electric power supply. The country's only metallurgical plant--at Thai Nguyen--which produced pig iron for export and fabricated metal products from imported steel has ceased production for the same reasons. The only explosives plant has been out of operation for two years and the production of apatite and coal, both previously exported in quantity, have been drastically reduced. One of the country's two textile plants has been heavily damaged; production in the small fertilizer and chemical industry has been curtailed; and paper production has been reduced by 80 percent.

7. Modern industry, however, does not play a vital part in North Vietnam's ability to continue the war. PEPCO's plant in Alexandria generates five times the power that all of North Vietnam's power plants produced before the bombing. The economy is essentially agrarian and most of the demand for consumer goods is met by local and handicraft industries which have been expanded since the start of the bombing.

Transportation

8. Attacks against transportation have been heavy throughout the Rolling Thunder program. Nearly \$100 million in damage has been inflicted on the transportation system and transport equipment.

9. Over 660 instances of serious damage have been recorded against highway and railroad bridges and various types of bypasses. At least 50 major railroad yards on all of the railroad lines have been attacked, as well as numerous sidings, spurs, and stations. Highway facilities such as truck parks, transshipment areas, fords, and supply areas have also been heavily damaged. Transportation equipment has been attacked extensively. Pilots reported destroying nearly 4,000 trucks and nearly 2,000 cars through July 1967.

10. Air strikes against transportation during the first months of 1967 followed the same general pattern as in 1965 and 1966, with strikes directed mainly south of Hanoi but with some attacks against railroad yards farther north and against bridges on the more important railroad lines, especially the two leading to China. The road system was not appreciably damaged although traffic was slowed at times by frequent interdictions.

11. Since late June, concentrated, simultaneous attacks have been carried out against targets on all northern railroad lines. Attacks against the road system in the south have also increased. Destruction and damage to transportation equipment of all types have reached new highs. More recently, in August, key targets in the former restricted areas around Hanoi and in the 25-mile buffer zone along the Chinese border have been struck, including the important Doumer Bridge over the Red River, the Canal des Rapides Bridge, and several yards and bridges at Lang Son, near the Chinese border. This recent damage will present the North Vietnamese with formidable repair problems. In view of the demonstrated ability of the North Vietnamese to restore damage, these attacks will not, however, create a serious decline in essential transportation service.

Military Targets

12. The damage inflicted on military targets has had little significant impact on North Vietnam's over-all military capabilities. Attacks against these targets have, however, disrupted normal military activities, caused the abandonment of many facilities such as barracks and supply depots, and forced widespread dispersal of equipment. Ammunition depots are the only military targets that have been damaged significantly. Nonetheless, the loss of about 80 percent of ammunition storage capacity has had no measurable impact on the availability of ammunition, largely because new supplies can be readily imported.

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13. The North Vietnamese have been able to strengthen and improve the capability of many military systems, despite the air attacks. During the past three years, Hanoi has developed its air defense from a rudimentary state to a complex, sophisticated system.

14. The cumulative damage to military targets through July 1967 is estimated at \$96.4 million. Losses of aircraft and damage to barracks complexes comprised most of this damage.

Restoration and Countermeasures

15. Three principal factors have accounted for North Vietnam's success in restoring traffic in the face of destruction and damage to the transportation system. First, North Vietnam's transport system, although rudimentary, is highly diversified, and is required to carry only a small volume of traffic compared to its capacity. The second factor is the rapidity with which repairs have been completed, along with the success of countermeasures. Third, other Communist countries have provided sufficient railroad rolling stock, motor vehicles and watercraft to compensate for losses. The ability of the North Vietnamese to use all types of primitive transport has also contributed to the success of their countermeasures.

16. The effects of bomb damage to the transportation system have not only been successfully countered, the capacity of the system also has been increased at the same time. Repairs to important bridges, damaged extensively and sometimes repeatedly, have been completed in a matter of days. For example, the Bac Giang Railroad and Highway Bridge, heavily damaged on 30 April 1967, was restored to traffic by 1 May.

17. Countermeasures employed to maintain the flow of traffic at vulnerable stream crossings include construction of fords, causeways, ferries, light and heavy pontoon bridges, and as many as two to three alternate bridge structures. Craters in roads, railroad lines and yards are filled quickly and quantities of railroad rail and ties are stocked at advantageous locations.

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Electric Power

18. Hanoi is finding it hard to repair the damaged power plants. Most of the rebuilding requires foreign technical and material assistance and long periods of construction. Persistent efforts to restore damaged power plants to partial operation during 1965 and 1966 were largely thwarted by restrikes. The severe damage inflicted by strikes in the first half of 1967 appears to have resulted in general abandonment of reconstruction efforts. For the past four months, there has been no observed reconstruction effort at seven of the main facilities in the Hanoi-Haiphong network.

19. North Vietnam has countered the loss of central generating plants by importing some 2,000 diesel-driven generating sets during the past two years. Most of the diesels are small, however, and cannot be readily operated in parallel within a power transmission network, nor can they cover the demands of heavy, continuous-process industry. A few of the larger diesel units reported are located in underground facilities in Hanoi to supplement the limited power supply in that city. The imported diesel units cannot replace more than about ten percent of the capacity of central power plants out of operation, but they probably produce sufficient electricity for war-related activities and for essential services.

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20. Attacks against petroleum bulk storage facilities have destroyed more than 85 percent of the JCS-targeted national capacity. This loss has been effectively countered, however, by an extensive system of dispersed storage, much of which was installed before the major damage occurred. More than 100 well concealed or protected storage sites, with a total estimated capacity of between 30,000 and 40,000 tons, are now dispersed throughout North Vietnam. The widespread use of 55-gallon drums also provides additional storage capacity and increased flexibility. The remaining bulk storage, dispersed tanks and drums, gives North Vietnam a storage capacity equal to about two-thirds of prestrike bulk capacity.

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21. Imports of petroleum have not only been maintained but have increased during the first five months of 1967. Although imports decreased during June-July, stocks at the end of July were estimated to be equivalent to nearly 120 days of supply. There is no evidence that the bombing of petroleum targets has seriously weakened the economy, produced significant shortages of petroleum, or diminished North Vietnam's ability to support military activities and the infiltration of men and supplies into Laos and South Vietnam.

Manpower

22. Hanoi has been forced to divert an estimated 300,000 full-time and 300,000 to 400,000 part-time workers for reconstruction and repair. Although the total number of personnel diverted may have limited somewhat North Vietnam's capability for sustained large-scale operations in South Vietnam, the diversions do not significantly limit its ability to infiltrate troops into South Vietnam or to continue to counter the Rolling Thunder program. Most workers perform only manual labor requiring no special skills, and can easily be recruited from groups of city evacuees, farms, and fishing villages with a minimum of dislocation to the economy. As long as the population continues to support the regime and imports of necessary equipment continue, North Vietnam will not be faced with a crippling shortage of labor, unless losses and/or infiltration in the South increase sharply.

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TABLE

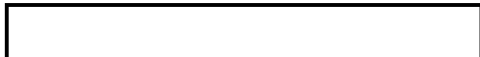
**Value of Damage Inflicted by the Rolling Thunder Program^{a/}
1965 Through July 1967**

<u>Economic Facilities and Equipment</u>		<u>Military Facilities and Equipment</u>	
<u>Direct Losses</u>	<u>Million US\$</u>	<u>Direct Losses</u>	<u>Million US\$</u>
Railroad/Highway Bridges	28.3	Barracks	28.2
Other Transport Facilities	7.1	Ammunition, Motor Vehicle and Supply Depots	12.5
Transport Equipment	59.1	Radar and Communications Sites	2.8
Electric Powerplants	27.3	SAM Sites	5.0
Manufacturing Facilities	17.5	Airfields and Naval Bases	2.5
Petroleum	7.4	Aircraft	30.8
Miscellaneous	1.9	Naval Craft	4.6
SUBTOTAL	148.6	Miscellaneous	10.0
<u>Indirect Losses</u>		TOTAL MILITARY	96.4
Exports ^{b/}	25.4		
Agriculture ^{c/}	42.5		
Fishing	8.3		
SUBTOTAL	76.2		
TOTAL ECONOMIC	224.8		

a. Some estimates are incomplete because of inadequate poststrike photography.

b. Including imports of cement necessitated by the loss of production at the Haiphong Cement Plant.

c. Although decreases in agricultural production are arbitrarily attributed entirely to the indirect effects of the bombing, an unknown part is the result of weather and other natural causes.



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II. Civilian Casualties

1. The number of civilian casualties caused by the Rolling Thunder Program continues to mount as the scope and intensity of the air war in North Vietnam increase. The estimated total number of civilian casualties--43,000 killed and wounded--remains small, however, in relation to the population of 19 million and to the 172,000 attack sorties against targets in the North. North Vietnamese Brigadier General Tran Quy Hai recently observed in an authoritative party journal that "Thanks to our good preparatory work in taking precautionary measures, our losses are insignificant compared with the intensity of the enemy strikes."

2. Civilian casualties occur primarily as a result of civilian involvement in war-support activities, such as the repair of bomb damage, civil defense, and the operation and maintenance of logistic supply lines. Relatively few civilian casualties have resulted from accidental bombing of residential areas. Detailed photographic studies of Hanoi and Nam Dinh show that air strikes in and near these urban areas have been carried out with a minimum number of civilian casualties. Even in its propaganda Hanoi concedes that most attacks are carried out with a surprisingly low number of civilian casualties. In the relatively few instances where heavy civilian casualties have occurred, they usually have resulted from the bombing of heavily defended and difficult targets bordering on densely populated civilian neighborhoods.

3. Estimated civilian casualties for the period February 1965 - June 1967 are shown in the following tabulation. Thirty to forty percent of the total casualties are estimated to have been killed.

Estimated Civilian Casualties, North Vietnam

<u>1965</u>	<u>1966</u>	<u>1967</u> <u>Jan-June</u>	<u>Total</u>
6,000	19,000	17,800	42,800

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4. Estimates of civilian casualties in North Vietnam are subject to unknown margins of error.

An April 1967 statement by a responsible official



tends to support the method used in calculating these estimates. The official said that 20,000 North Vietnamese had been killed in US air raids from August 1964 to date. This closely corresponds to our estimate of 19,000 to 26,000 civilians and military personnel killed through June 1967. The number of civilian personnel alone killed during this period ranged from 13,000 to 17,000.

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III. Morale in North Vietnam

1. Morale in North Vietnam appears to be holding up fairly well, despite the heavy burdens placed on the population by US air strikes. Available information indicates that the people in general remain willing to endure considerable hardship and that they continue to respond to the Hanoi regime's direction, although some signs of war-weariness are evident. There have been no reports of open opposition to the regime. It is too early to gauge the effects of the recent bombing of targets in the Hanoi area previously regarded as "safe."

2. [REDACTED]

[REDACTED] the people in and around the city are adequately fed and clothed and that their general attitude toward the war effort ranges from enthusiasm to resignation. Although our evidence on the rural areas is less detailed and direct, it does not appear that morale in the countryside is significantly lower than in the Hanoi area, even though some areas suffer more severe hardships.

3. The regime's effort to keep up the level of morale has been facilitated in Hanoi by the evacuation of non-essential people. For the most part, those left in the city are young men and women, the element of North Vietnamese society most enthusiastic about the war and most responsive to regime propaganda. The evacuation of old people and children to the countryside has, however, caused difficulties for the younger people, who now must commute as best they can from Hanoi to the relocation areas in order to see their families. The main burden of organizing the evacuated people in relocation centers and of housing and feeding them appears to have fallen on the evacuees themselves. The regime reportedly has done little to help them.

4. The few reports we have giving details of life in the relocation centers indicate that the evacuees are finding it difficult to find food, educational facilities for their children, or a means to earn money to buy highly priced essential commodities.

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5. [Redacted]

[Redacted]

Complaints [Redacted]

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about food shortages, separation from family, casualties among relatives, and excessively heavy work loads have gradually increased in intensity over the past two years.

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[Redacted] difficulties are still well within the endurance levels of the populace.

[Redacted]

7. It appears from the evidence available that the regime still has the confidence of most of the people, and that it still is able to exploit their anger at the US for the air attacks to maintain support for Hanoi's war policy.

8. As the difficulties caused by intensified bombings mount, the regime may be unable to keep morale at a satisfactory level. The evidence to date, however, suggests that this is not likely to happen soon.

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