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750.047

URBAN DAMAGE PLOT MAP

Refer to Report U/DA - 1.3

Black = Old Damage

Hatched = Damage from raids
11 & 13 March, '45
18 & 19 March, '45

750.047

URBAN DAMAGE PILOT MAP

Refer to Report U/DA - 1.5

Black = Old Damage

Hatched = Damage from raids
11 & 13 March, 1945
18 & 19 March, 1945

NAGOYA

Twentieth Air Force
cc/S
opnl

SECRET

17 April 1945

JOINT TARGET GROUP
ASSISTANT CHIEF OF AIR STAFF, INTELLIGENCE

J.T.G. File

Preliminary Damage Assessment Report No. 22
Osaka Urban Area
Attack of 13 and 14 March 1945 (Mission No. 42)

ARTICULARS OF ATTACK

On 13 and 14 March, 275 planes dropped approximately 2172 tons of I.B. on the Osaka urban area of which 72 tons were M-47 and 2100 tons were M-69 in M-18 clusters. The attack took place during the night and continued for 3 hours and 28 minutes (2357 to 0325 Japanese time). Planes made individual attacks by radar and pathfinder at altitudes of 4500 to 9600 feet. Surface wind direction was 45 degrees with wind velocity of 8 miles per hour. Ground humidity was reported as low with no rain for 8 days preceding attack. Direction of attack is estimated at 70 degrees.

The attack was of high concentration within the commercial/residential area west and southwest of Osaka Castle, and extended into the fringe of the surrounding industrial districts.

PREVIOUS REPORTS

None.

SUMMARY

The total area of roof damage was 85,847,000 square feet, of which 93.3 percent was residential. Identified manufacturing roof area was 2.6 percent of total roof area damaged. It is tentatively estimated that some 5 percent of total manufacturing roof area in Osaka has been damaged or destroyed.

Direct industrial damage was largely confined to small manufacturing plants estimated to number some 2000 within the area of damage. Most of these plants were completely destroyed. Of about 800 identified factories some 675 or 85 percent were engaged in fabricating and manufacturing, and in producing machinery and electrical equipment items. The production of these plants was concentrated in the earlier stages of industrial processing.

The most important plants suffering significant damage were a machine tool plant with 1 percent of total Japanese capacity and one armament plant responsible for 1.2 percent of total production of 75 mm. shell cases.

Osaka's commercial and financial district was more than 75 percent destroyed and damage to urban transport, communications, and storage facilities was extensive.

Some 115,000 to 130,000 dwellings are estimated to have been destroyed with some 600,000 persons dehoused. It is believed that there is sufficient undamaged housing remaining which in combination with public buildings will provide housing for essential industrial workers.

Production loss resulting from the attack is still being appraised. No attempt will be made to compute an overall measure of the loss. The general economic consequences can be summarized as follows:

1. The industrial damage resulting from attack probably will not have appreciable immediate effect on output of military end-products. The impact of this loss

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can be cushioned by working inventories and pipe-line stocks of items produced by most of these plants. Damage to a few important plants contributing more directly to ground and air strength will not be important because of present under-utilization of capacity.

2. The major effect of the attack is the reduction of total Japanese industrial capacity. If this destruction of capacity is carried far enough the production of priority end-products will be affected.

3. Reorganization of production will create a serious problem for the Japanese but one which is not believed to be crucial as yet.

4. Some general production loss in Osaka to armament, shipbuilding and repair, machinery, and machine tool production has resulted from the attack because of absenteeism, loss of components, etc., but this effect is of short duration.

The heavily industrialized sections of Osaka lie outside the area burned out in the attack. Destruction of such areas would have considerably greater effect on the Japanese war potential than destruction of the center of the city.

DESCRIPTION AND SIGNIFICANCE

The attack of 13 and 14 March 1945 was directed to the area west and southwest of the Castle and south and southeast of the Aji River. Damage was well concentrated although there are many small scattered additional areas of damage on the periphery of the major area of damage particularly to the south. A few small areas of damage are northwest of the Aji River.

Although the area of major damage primarily contains housing and the central commercial district of the city, the location of numerous small factories on the western and southwestern fringe of the area and along waterways within the area gives this section of Osaka considerable significance industrially. Although Osaka has many large factories, much of its industrial importance is derived from the large number of small factories now engaged in war production. The relative importance of Osaka industrially is indicated below:

Table I

Concentration of Selected Industries in Osaka - Estimated Percent of Total In Japan Proper 1/

Industry	Percent Within Osaka Metropolitan Area
Combat aircraft parts*	11
Arms-Munitions *	5
Heavy A/A Guns *	15
Marine engines * *	12
Shipbuilding **	11
Ship repair **	12
Machine tools **	19
Anti-friction bearings**	27
Electrical equipment **	27

Table I (Cont'd.)

Industry	Percent Within Osaka Metropolitan Area
Pig Iron **	2
Steel ingots**	9
Intermediate steel products **	9

1/ See Table 2, Concentration of Selected Industries - Estimated percent of Total in Japan Proper for 13 Cities, Japanese Urban Areas, General Analysis, 26 February 1945, J.T.C., p. 3.

* Based on estimated production.
** Based on estimated capacity.

It is estimated that some 2000 small factories were within the area of damage. These plants were essentially of the small sub-contracting type engaging in metal plating, stamping, forging; in producing metal castings and rolled and drawn products, container tanks, engine blocks, machinery items, ship fittings, ordnance and aircraft parts, small general purpose machine tools, bearings, gears, navigation and optical instruments, small internal combustion engines, starters, generators, electric motors, electric relays and switches, consumer goods; in manufacturing rubber, cork, and leather products, lumber and building hardware; and in small boat construction and repair.

PHYSICAL DAMAGE

The damaged area as determined from post-attack photography is estimated at some 185 million square feet or 6.6 square miles. Damage was heavily concentrated against residential and commercial buildings which constituted 93.3 percent of total roof damage. Manufacturing roof damage is relatively small as the area of major fire damage included only the outlying fringe of the industrial area.

Table II

Physical Damage, Osaka Attack 13 and 14 March 1945

Type of Building	Ground Area of Damage (000 sq. ft.)	Average Building Density (Percent)	Roof Damage Area (000 sq. ft.)	Roof Damage Percent of Total
TOTAL	185,213	46.4	85,847	100
Residential 1/	170,256	47.0	80,103	93.3
Manufacturing	7,151	31.6	2,259	2.6
Storage	3,230	46.9	1,516	1.8
Mixed-Manufacturing Residential	4,576	43.0	1,969	2.3

1/ Includes commercial and government buildings and household industry.

It is estimated that some 115,000 to 130,000 homes were destroyed and some 600,000 people dehoused. This represents about 20 percent of the pre-attack housing. In addition, more than 75 percent of the central commercial and financial district was damaged and/or destroyed. This district contained the large department stores, banks, business offices, and the more important miscellaneous retail establishments in Osaka as well as several prefecture and city offices.

Most of the small factories, estimated to be some 2000 were destroyed. Appendix A contains a list of the more important factories and indicates the extent to which they incurred physical damage. Factory buildings escaping complete destruction within the area of damage were comparatively few and apparently were those better protected and of fire-resistant construction. Virtually all housing within the area of damage was destroyed.

CASUALTIES

For the purpose of this assessment adequate information is lacking for estimating casualties. Casualties are estimated at some 25,000 of which about half are believed to have been fatal. The comparatively large area of concentrated damage under circumstances of night attack and heavy weapon ground density were factors favorable to widespread public disorder and substantial casualties.

FUTURE TARGET VALUE

The major area of damage has no future target value because of the relative completeness of destruction. Osaka, however, contains areas of much greater industrial target value which have not been impaired. These areas should be attacked as soon as possible.

ECONOMIC ASSESSMENT

Of the comparatively few large identified manufacturing plants producing military end-products damage on the whole was very limited (see Appendix A). An important exception was the destruction of Osaka Metal Industry (90.25-686) engaged primarily in the forging and machining of 75 mm. shell cases. It is unlikely that plants incurring extensive damage will be restored. Apart from the cost and the time involved, the existence of unutilized capacities in armament and machine tools should permit rapid recovery of lost production.

Important industrial plants with moderate or less damage producing priority items probably will be repaired. Plants in this category are the Kurimoto Iron Works (90.25-685), Kubota Iron and Machinery Works (90.25-688, 701), Osaka Chain and Machinery Co., Kasugade Plant (Ref. No. 279), Showa Chemical Mfg. Co. plant (90.25-1356), etc.

A large number of small identified plants were extensively damaged. Of some 807 identified establishments, (of which not less than 75 percent were completely destroyed) 47 percent were iron works, 31 percent were producing machinery components and metal fabrications, and 7 percent were producing electric equipment components.

In proportion to the area of damage there appears to be as heavy a concentration of small plants as in the area of damage in Tokyo; there is, however, a higher proportion of plants engaged in general machining and metal working as against consumer goods. It is unlikely that there will be any appreciable restoration of these hundreds of small-scale plants. Production recuperability probably will emphasize the employment of excess capacities existing in large plants, some conversion of plant capacities producing less essential items, and readjustment of industrial priorities. The full production loss in components production for aircraft, ordnance, marine engines and ships, etc. can not be assessed adequately because of insufficient intelligence as to pipelines, working inventories, critical items in short supply, industrial flexibility, and the like.

Table III

Identified Manufacturing Plants Located in Burned-Out Area of Osaka

Ku	Consumer Durable Goods [1]	Construction [2]	Metal Fabricating [3]	Machining and Machinery [4]	Electrical Equipment [5]	Shipyards and Ship Repair [6]	Rubber, Cork & Leather Products [7]	Total
Nishi Yodogawa	1	--	3	2	2	--	--	8
Konohana	1	2	3	7	2	--	2	17
Minato	6	10	80	70	13	2	5	186
Nishi	--	1	32	14	2	--	10	59
Naniwa	1	2	79	38	12	2	14	148
Nishinari	1	4	59	24	--	3	3	94
Minami	2	1	14	1	1	--	2	21
Tennoji	--	3	19	1	5	--	1	29
Kita	--	2	9	6	7	--	3	27
Higashi	3	--	12	14	4	--	4	37
Taisho	8	9	55	62	9	12	7	162
Sumiyoshi	2	3	11	2	1	--	--	19
TOTAL	25	37	376	241	58	19	51	807

1/ Household articles.
2/ Lumber, building hardware, etc.
3/ Plating, stamping, forging, castings, rolled and drawn products, ship plate, container tanks, ventilating equipment, engine blocks, etc.
4/ Textile and automotive machinery, ship fittings, ordnance and aircraft parts including carburetors, hydraulic equipment, small general purpose machine tools, bearings, gears, navigation and optical instruments, small diesel and gas engines, construction machinery, etc.
5/ Switchboards, meters, relays and switches, starters, generators, electric motors, etc.
6/ Construction and repair of boats to 200 ft. in length.
7/ Rubber, cork, and leather products; rubber and leather belting, gaskets, hose, etc.

To the extent that consumer goods production has been affected, such production loss will be absorbed by reduction in consumer living standards.

Ordnance production loss from destruction of Osaka Metal Industry plant (90.25-686) is estimated at 1.2%of total Japanese production of 75 mm shell cases for 1 month with probable recovery of production in other plants within 3 months. Since it is estimated that Japanese arsenals are operating below capacity this loss of shell case production as well as other armament components should be restored without major difficulty.

Production loss of aircraft components, which is estimated to be of significant amount, is very largely duplicative of loss occurring to aero-engine and airframe plants from precision attack. In consequence the principal effect of production loss of component producing factories is to retard recuperability in aircraft production.

Only one significant machine tool plant was destroyed, Target 90.25-687 Osaka Wakayama Iron Works, producer of large lathes and general purpose tools. The production loss is estimated at not more than 1% of total Japanese output for 6 months and can be restored in other plants, assuming no further reduction in machine tool capacity.

The destruction of numerous small producers of light electrical equipment may have more serious industrial consequences as manufacturing capacity has been more fully utilized in this type of industrial production.

Damage to numerous small boatyards and associated machine shops probably will not have a significant effect on the Japanese shipping position because of the existence of numerous other small boatyards which should permit recovery of production.

The principal impact of production loss from damage to manufacturing facilities is confined to numerous small plants engaged in general engineering covering a wide variety of metal working and machining activities, and the production of miscellaneous machinery and electrical equipment items. Production loss as a result is widely diffused. The principal effect is to cause an appreciable reduction in total Japanese manufacturing capacity which in turn affects general industrial recuperability. The effect of this loss of general engineering capacity is to lessen significantly the ability of Japanese industry to absorb further damage and subsequently recover essential production. This damage, of itself, is not sufficient to prevent rapid recovery of priority production through utilization of excess capacities in the general engineering category. Some readjustment of industrial priorities and conversion of manufacturing capacities to higher priority production probably will be required.

For the larger manufacturing plants outside the area of damage loss of industrial production resulting from attack occurred primarily from short-run absenteeism and, to a minor extent, from component loss. Production loss from these causes is important only in terms of aggregate losses spread among a large number of plants. Recuperation of such production loss is rapid, necessitating somewhat better utilization of plant capacities by multiple labor shifts and a possible speed-up of production.

Completely destroyed within the area of damage, was a large part (some 75 percent) of the important central commercial section of Osaka. This included numerous large and small commercial establishments, warehouses containing principally consumer goods, and public buildings. While the loss of these facilities doubtless will create much public inconvenience and contribute somewhat to short-run industrial absenteeism, such production loss should be quickly recovered. Any extensive restoration of these facilities is unlikely.

Considerable damage occurred to urban transportation and communications facilities, but this should have no important effect on essential industrial production. Restoration of the essential minimum of these facilities will be an immediate post-attack task and should be speedily accomplished.

It is estimated that some 115,000 to 130,000 homes were destroyed and some 600,000 people dehoused. This represents about 20 percent of the pre-attack housing. Although the housing cushion in Osaka has been sharply reduced by this order of destruction, sufficient housing remains to permit comparatively rapid emergency rehousing of essential industrial workers. The post-attack evacuation of non-essential civilians will contribute to the housing re-adjustment.

The destruction of numerous small factories and commercial establishments will operate to ease the pre-attack supply of industrial labor. This factor will be favorable to the more rapid utilization of existing excess capacities of large industrial plants and facilitate the recuperation of current production loss of essential priority items.

It should be emphasized that the direct industrial loss noted above will not only be of relatively short duration but is of such character as to have little appreciable effect on end-product production of such high priority items as aircraft and armament. Such loss, however, will operate to lessen the aggregate of over-all industrial capacity, to occasion some industrial re-organization of pipe-lines, and to be a factor adversely affecting general industrial recuperability by reduction of total manufacturing floorspace with associated facilities.

Industrial repair and replacement can not be appraised quantitatively at this time because of uncertainties concerning specific excess capacities for high priority industries, industrial cross-conversion capacities, the program of industrial decentralization, available convertible floorspace, the readjustment of production schedules for high priority industry, etc. Industrial building repair and replacement may display erratic and unpredictable characteristics.

REMARKS

This assessment is based on incomplete photo cover and there may be additional small areas of damage. It is subject to further modification upon completion of detailed identification of industrial installations in the city.

Estimates of loss include only known damage resulting from this attack and are not adjusted for further reduction in Japanese industrial capacity resulting from other attacks.

APPENDIX A

Physical Damage to Selected Installations in Osaka Area
Attack of 13 and 14 March 1945

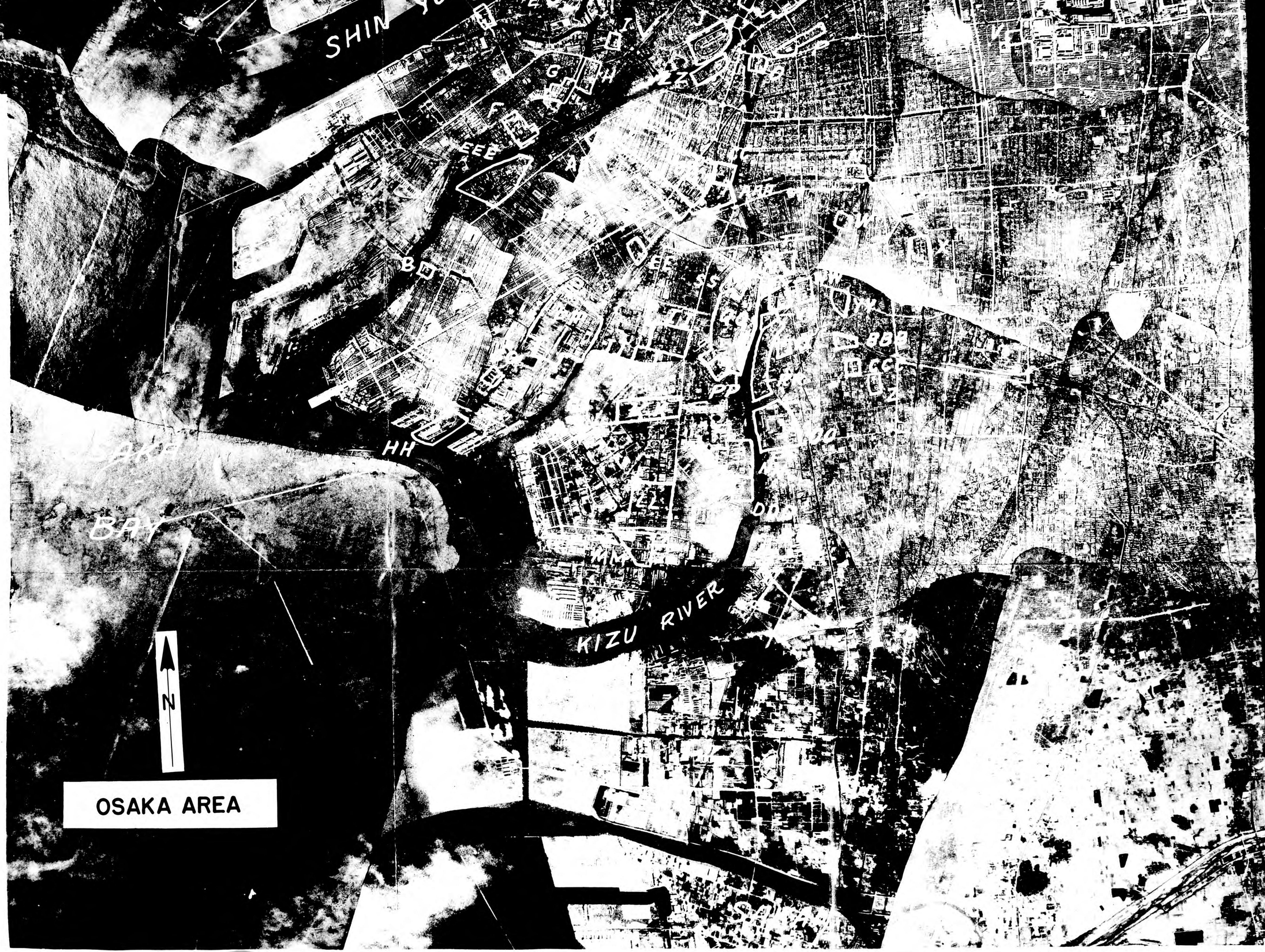
Extent of Physical Damage 1/				Mosaic Reference	Target Number	Name	Description and Product
Destroyed	Extensive	Moderate	Slight				
			X	A	18	**Aircraft** Kawanishi Aircraft	Assembly plant for flying boats and navy fighters.
						Ordnance	
		X		F		Osaka Chain and Machinery Co. (Kasugade Plant)	Machine tools and ordnance components.
			X	T	382	Osaka Arsenal	Japan's most important producer of heavy ordnance; also heavy AA guns.
	X			OO		Dai Nippon Spinning Co. (Tsumori Plant)	Reported converted to unspecified munitions production.
X				BBB	686	Osaka Metal Industry Co. (Nishinari Plant)	Munitions components for Osaka Arsenal.
			X	S		Osaka Arsenal Administrative H.Q. and Q.M. Depot	Administration and storage buildings.
						Electrical Equipment	
X				K		Kansai Electrical Equipment Co.	Auto starters and generators.
		X		R		Asahi Electrical Mfg. Co.	Small electric motors.
	X			B		Japan Submarine Cable Co.	Submarine cable.
						Machine Tools and Precision Instruments	
	X			Q		Dai Ichi Precision Instrument Co.	Subsidiary of Sekisan Kinzoku Kogyo, producing precision instruments.
X				CCC		Shirozuka Iron Works	Small precision tools.
X				U		Chiyoda Optical Instrument Co.	- - - -
X				Z	687	Osaka Wakayama Iron Works	Large lathes.
						Machinery	
X				L		Tetsuya Manufacturing Co.	Mining machinery and ventilating equipment.
			X	II		Industrial District	Group of small metal working and machinery plants.
X				EE		Tanaka Machinery Co.	Chemical plant machinery and equipment.
X				V		Ebisuya Iron Works	Precision gear works, related to Osaka Arsenal.
X				VV		Tanaka Machinery Co.	Chains.
						General Metal Machining	
	X			KK		Industrial District	Group of small metal working and machining plants.
			X	LL		Industrial District	Group of small metal working and machining plants.
	X			RR		Industrial District	Group of small machine shops and ship fitting plants.
			X	EEE		Minato Industrial District	Communications Ministry shops and group of small metal working, machining, and electrical equipment plants.
						Shipbuilding and Repair	
		X		Y	688	Kubota Iron and Machinery Works	One of 5 Osaka plants of company producing marine diesel engines and other machinery.
X				AA		Sakai Canal Industrial District	Group of small factories producing small marine engines, gears, machinery, castings and forgings, and light electrical equipment.
			X	MM	701	Kubota Iron and Machinery Works	One of 5 Osaka plants of company producing marine diesel engines and heavy machinery.
	X			GG		Nambajima Industrial District	Group of small shipyards, marine engine, and ship fitting plants.
						Iron/Steel and Fabricating	
	X			JJ		Toyo Steel Tube Plant	Subsidiary of Nippon Stainless K.K., producing alloy steel tubes.
		X		NN		Kubota Iron and Machinery Works (Okashima Plants)	Two plants: alloy steel and castings; heavy weighing equipment.
		X		DDD		Toho Steel Works	Alloy steel fabricating.
		X		PP	685	Kurimoto Iron Works	Steel tubes, castings and machinery.
X				XX		Yamato Steel Works	Ship plate.
	X			C		Nichi-A Steelworks, Osaka Branch	Galvanized sheet.
			X	I		Tokunaga Glass, Asahibashi Foundry	Converted to foundry work.
						Non-Ferrous Metals	
	X			W		Riken Alunite Mfg. Co.	Light metal castings and stampings.

APPENDIX A (Cont'd.)

Extent of Physical Damage 1/ Destroyed	Extensive	Moderate	Slight	Mosaic Reference	Target Number	Name	Description and Product
						Leather Products (Industrial)	
X				UU	1761	Mitta Leather Belt Co.	Japan's largest producer of industrial belting.
	X			TT		Mitta Leather Belt Co., Branch Plant	Industrial leather products.
	X			YY		Osaka Leather Co.	Industrial leather products.
	X			X		Japan Leather Co., Osaka Branch	Industrial Leather products.
						Chemicals and Paints	
		X		D	1356	Showa Chemical Mfg. Co.	Secondary production of butanol and vinyl resin.
		X		E		Furukawa Electric, Yodogawa Plant	Enamel for insulating electrical equipment and cable.
X				H		Japan Paint Co.	Large paint works.
						Utilities	
			X	BB	1616	Kujo Steam Power Plant	Municipal standby plant.
			X	AAA	1712	Osaka Gas Works	Largest Osaka gas works.
						Textiles	
	X			CC		Toyo Textiles, Matsushima Plant and small Machine Shop	
X				SS		Toyo Spinning Co., Sangenya Mill	
						Miscellaneous (Principally Storage)	
	X			M		Municipal Electric Bureau Workshops and Sumitomo Warehouses	Workshops for city power distribution system and group transit sheds and warehouses.
X				N		Sumitomo Dotombori Warehouses	Large transit sheds and warehouses.
X				P		Sugimura Warehouses	- - - -
X				O		Enokojima City Offices	Group of city office buildings
			X	J		Osaka Central Market	Osaka's principal cold storage and food distribution center.
X				ZZ		Warehouses	- - - -
X				G		Shikanjima Warehouses	- - - -
	X			HH	53	Osaka Harbor	Quay #5 warehouses.
X				GG		Warehouses	- - - -
	X			FF		Sugimura-Taisho Warehouses	One of Osaka's principal storage and trans-shipment centers.
X				DD		Unidentified Industry	- - - -
	X			WW		Unidentified Industry	- - - -

1/ Definition of Classification:
Slight - less than 5% of roof damaged.
Moderate - 5 to 20% of roof damaged.
Extensive - 21 to 60% of roof damaged.
Destroyed - over 60% of roof damaged.

OSAKA AREA


SHIN
BAY
KIZU RIVER
N
OSAKA AREA

N

N
OSAKA AREA
URBAN DAMAGE PLOT
Refer to.Report No. -/D. -
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file damage took P X

CONFIDENTIAL

JOINT TARGET GROUP, WASHINGTON, D. C.
ECONOMIC DAMAGE ASSESSMENT

SHEET NO. 90.18-2011-DA
DATE
PAGE

TARGET NO. 90.18-2011
OBJ. AREA
OBJ. FOLDER NO.
~~XXXTARGETXSYSTEM~~ Category:
End Prdt Ind - Aircraft

LAT: 34°59' N.
LONG: 138°25' E.
ALT: 45 feet

ECONOMIC DAMAGE ASSESSMENT REPORT NO. 12

SHIZUOKA AIRCRAFT ENGINE WORKS

PARTICULARS OF ATTACK

This plant was attacked twice in the early part of April 1945. The first attack on 3 April (Mission #55) was made at night by 48 XXI Bomber Command B-29's which dropped 185 tons of 500-lb GP bombs and 5 tons of 500-lb IB bombs from 7000 to 8900 feet. Only 17 of these planes bombed visually.

The second strike (Mission #63) was made in daylight on 12 April. Eleven B-29's dropped 69 tons of 2000-lb HE bombs from 11,500 to 18,200 feet. All planes bombed visually.

PREVIOUS REPORTS

See Preliminary Damage Assessment Report No. 26 and Economic Damage Assessment Report No. 11 (Mitsubishi Aircraft Engine Plant, Nagoya - Target 90.20-193).

SUMMARY OF CONCLUSIONS

This plant has been severely damaged. About 29% of the total plant area received structural damage and 31% additional superficial damage. The primary objectives, the machine shops, suffered 40% structural and 38% superficial damage.

The loss of engines and airframes due to attacks on this plant alone cannot be computed accurately and losses as a result of all attacks on the two main Mitsubishi plants, this target and the Mitsubishi Engine Works at Nagoya, Target 90.20-193, are given here. It is estimated that attacks to date on both plants have resulted in loss of 9,000 engines and 3,000 planes at present production rates after deducting some 2,000 planes estimated to have been lost through attack on airframe plants.

In addition to losses at current production rates, it is believed that substantial expansion program has been retarded and that consequently the effect on enemy production in the future will be greater than that indicated above.

This plant now has no target value and is not likely to be repaired.

PHYSICAL DAMAGE

(Refer to damage plot attached.) As shown by the table below and the accompanying schedule, the damage to this plant was severe. Of the plant's 1,312,000 sq. ft. of plan area, 29% received structural damage and 31% of the remainder was superficially damaged. Since about 98% of this damage was done in the second attack, the estimates of loss given in the economic assessment below are based solely on the damage done at that time.

Shizuoka AC Eng. Works

PHYSICAL DAMAGE (Cont'd)

The machine shops which constitute the primary objectives were especially heavily hit. The plant is estimated to have about 575,000 sq. ft. of machine shop area, and of this, 40% received structural damage and an additional 38% superficial damage. This damage was concentrated in two areas of nearly equal size. The following table shows the damage to the principal plant sections.

Function & Building No.	Total Area (1000 sq ft)	Structural Damage		Superficial Damage	
		1000 sq ft	% total	1000 sq ft	% total
Forge & Foundry	0	-	-	-	-
Machine & Tool Shop & Heat Treat (16 [northern 24 bays], 42)	579.0	233.0	40	221.0	38
Engine Assembly (16 [southern 10 bays])	198.0	11.0	6	167.0	84
Test (31, 31A, 32)	40.0	-	-	-	-
Storage (9-11, 14, 15, 17-28, 38, 40, 41)	346.5	133.0	38	9.8	3
Others (1-8, 12, 13, 29, 30, 33-37, 39)	149.1	-	-	6.3	4
TOTAL	1,312.6	377.0	29	404.1	31

ECONOMIC ASSESSMENT

The large area of structural damage in the center of Building 16 will control the engine loss at this plant. It is believed that this area (20% of the machine shops) is nearly entirely devoted to machining and that at least one entire department was contained within this area. The size and shape of the damage suggests that parts of other departments were also damaged here and certainly other departments in the northern portion of the building were damaged. In the north section it is highly likely that a significant percentage of this damage was done to tool stores, receiving, and offices.

This loss is assessed at 4 months net output, which will be spread over 6 months following the attack.

This loss is less than that assessed at the newer section of the Mitsubishi Nagoya Engine Plant which, it is believed, makes similar engines. The loss and subsequent recovery of both plants must therefore be considered together. Averaged, it amounts to 5½ months' output spread over a 8-9 months period. This may not be reflected in a loss of as many airframes as was the case with the 14 cylinder engines produced by Mitsubishi since the expanding output of

ECONOMIC ASSESSMENT (Cont'd)

these newly developed engines would "lead" airframe output by a considerably greater margin than would a model in full scale output, i.e., the new engine would be brought into production before the airframe in which it is planned to be used.

Overall, the attacks on the Mitsubishi engine plants at Nagoya and Shizuoka between mid-December and mid-April have resulted in an estimated loss of some 9,000 engines for planes currently in production. These, in turn, would normally have caused a loss of some 5,000 airframes when applied to the average requirements for the period. Actually, the loss attributable to engines alone only amounts to some 3,000 airframes since the other 2,000 airframes suffered direct damage by bombing and thus made redundant a part of the effort against engine plants.

The heavy destruction at Nagoya and Shizuoka will create a loss in addition to the 9,000 engines above, which were to be used in airframes currently in production. This figure was based on an estimate of production for 1 March, the middle of the period during which the plants were subject to attack. Considerable expansion of output was anticipated for the remainder of 1945 and hence the widespread destruction of facilities at the two plants will decrease potential output as well as output already attained. No estimate of the loss of engines or planes from stoppage of expansion has been attempted, since there is little data on which to base such an estimate.

FUTURE TARGET VALUE

As is the case with the two sections at Nagoya, it is felt that this plant will not be rebuilt and that little target value remains.

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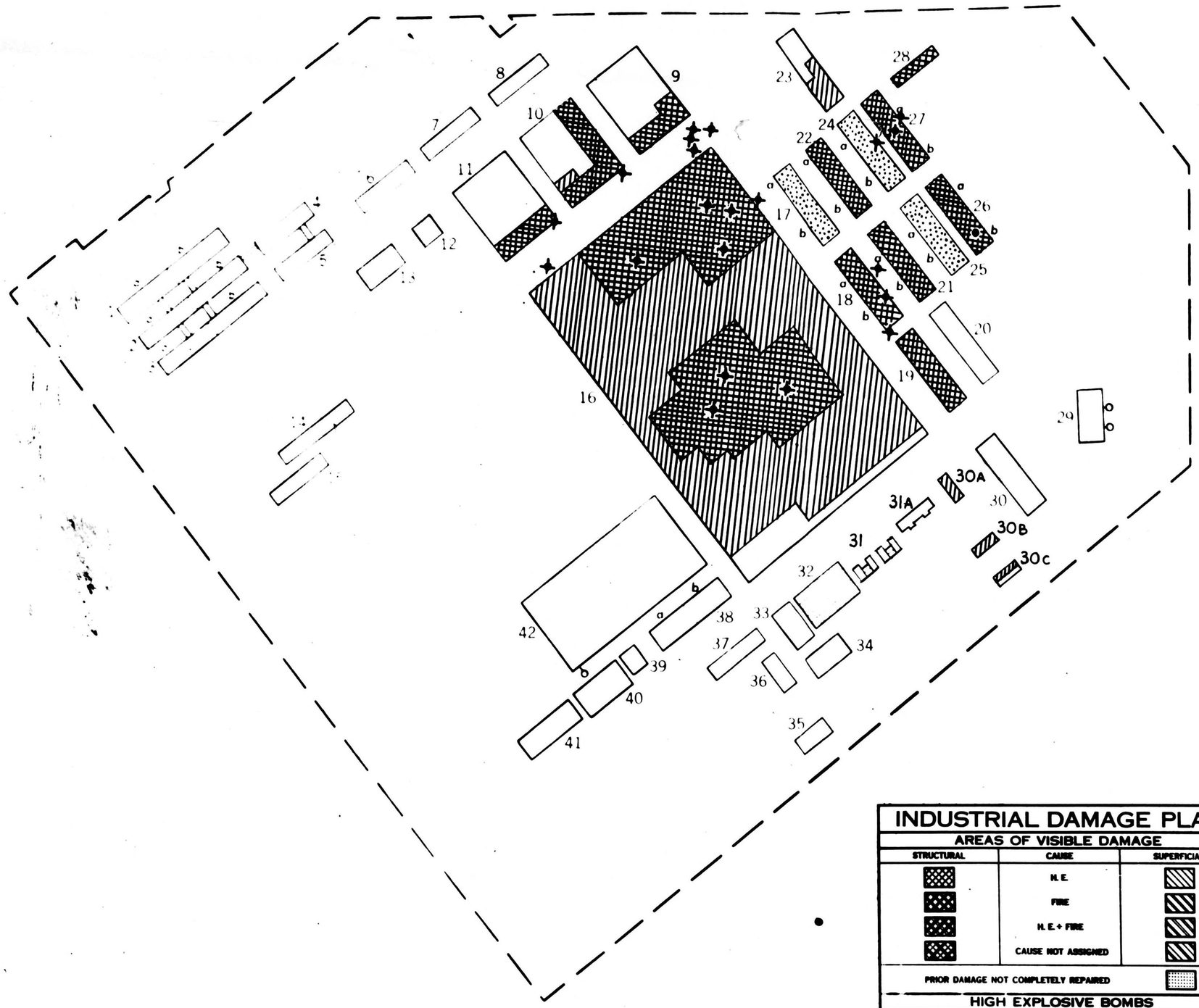

DAMAGE ASSESSMENT NO: 10

RAID DATES: APRIL 3, 45
APRIL 12, 45

COVER USED: 3PR5M 58; 3L, 5-7
3PR5M 140; 2V, 4-6

CONFIDENTIAL

SCALE IN FEET

INDUSTRIAL DAMAGE PLAN

AREAS OF VISIBLE DAMAGE

STRUCTURAL	CAUSE	SUPERFICIAL
	H. E.	
	FIRE	
	H. E. + FIRE	
	CAUSE NOT ASSIGNED	
PRIOR DAMAGE NOT COMPLETELY REPAIRED		

HIGH EXPLOSIVE BOMBS

- SINGLE BOMB CERTAIN WITH CRATER
- SINGLE BOMB CERTAIN WITHOUT CRATER
- SINGLE BOMB PROBABLE WITHOUT CRATER
- ONE OR MORE BOMBS CERTAIN IN GENERAL VICINITY OF ARROWHEAD
- ONE OR MORE BOMBS PROBABLE IN GENERAL VICINITY OF ARROWHEAD

AGAS INTELLIGENCE DIVISION
PHOTO INTELLIGENCE SECTION

SHIZUOKA AIRCRAFT ENGINE PLANT

SHIZUOKA, JAPAN

JAN [illegible]
90.18 2011

C.F.L. 744.026

AF HQ-12

HEADQUARTERS AAF

ROUTING SLIP

TO:

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COMMENT

This one attack took out about 20% of the Tokyo area. Subsequent attacks have raised this to over 50%. Your mail route damage to Tokyo, Osaka & Nagoya

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3-218, AF (REV 10 APR 45)

March 1945

SECRET

SPOT DAMAGE ASSESSMENT REPORT NO. 17

TOKYO URBAN AREA

Attacks of 25 February and 10 March 1945

PARTICULARS OF ATTACKS

On 25 February 167 aircraft dropped approximately 432 tons on Tokyo urban area, of which about 390 tons were M18 type IB clusters and the remainder consisted of 500-pound GP bombs. This attack was followed on 10 March by an attack on the central section of Tokyo north and northwest of the Palace and in the area between the Sumida and Naka Rivers by 285 planes carrying M47 and M69 IB bombs with an aggregate bomb weight of 1282 tons. The attack of 25 February was conducted during daylight from high altitude by radar with squadrons in column. The attack of 10 March was delivered from 5,000 to 9,000 feet with individual aiming by radar and visually. 1/

PREVIOUS REPORTS

None

CONCLUSIONS

Direct production loss resulting from attack is estimated as follows:

Direct Production Loss in Man-Months

	Destruction of Buildings and Equipment	Absenteeism	Total
Factories in Damaged Area			
Priority Factories			
Large	225,000	32,000	257,000
Small	371,000	37,000	408,000
Non-Priority Factories	247,000	--	247,000
Sub-total	843,000	69,000	912,000
Factories Outside Damaged Area	--	100,000	100,000
TOTAL	843,000	169,000	1,012,000

Direct Production Loss as a Proportion of Total Industrial Production in Tokyo and Japan Proper

(Based on man-months of industrial employment)

	3 Month Production	1 year's Production
Tokyo	24.5%	6.1%
Japan Proper	3.6%	.9%

It is probable that repair and replacement will be limited to the high priority industrial plants having only a moderate or slight amount of damage. Small factories and non-priority manufacturing establishments are not likely to be rebuilt. Recuperation of

1/ Excluded from consideration is the attack of 3 March, of 462 tons (mainly HE) directed by radar from altitudes of 25,000 ft. and above. This attack was generally ineffective.

CONCLUSIONS (Cont'd)

priority production probably will emphasise the employment of existing excess capacities and greater over-all efficiency in production. The loss of production of consumer goods and services probably will be largely absorbed. This will mean further reduction in the standard of living of the affected population.

Essential transport and communication facilities probably will be quickly restored. Such repair and replacement will represent only partial restoration of the pre-attack plant and will be held to a bare minimum.

Should the large priority factories with moderate damage and essential transport and communication plants be repaired and replaced, an additional 317,000 man-months will be required. In this event, total production loss is 1,329,000 man-months.

It is estimated that 1.2 million persons were dehoused. The housing cushion in Tokyo has been largely removed with the destruction of some 200,000-250,000 homes. Persons dehoused representing essential labor probably will be rehoused in the undamaged dwellings and public buildings. Attempts will be made to evacuate as many as possible of the dehoused non-essential population. The magnitude of the number of those dehoused will cause re-adjustment both within and without the community of serious proportions, necessitating immediate government action.

Casualties are estimated at 90,000 of which about half are fatal.

Production loss from absenteeism is comparatively small because of the relative completeness of industrial destruction. Factories outside the damaged area are estimated to incur large-scale absenteeism for some three days.

A significant order of direct production loss of short duration has been imposed on the Japanese economy. Large scale community re-adjustment is necessitated. The man-months cost of a minimum industrial repair and replacement program is of substantial proportions. The industrial loss to priority industry end-products is not of itself significant, as the concentration of loss is essentially in the primary and secondary stages of processing, spread among numerous small and medium-size establishments. This diffused and widespread production loss will have serious effects in the interruption of industrial pipelines and their reorganisation and in production stoppages of dependent plants where supply and inventories of components are in precarious balance. The large total of small segmentary damage even though deep in the economy will impose industrial strains and factors of unbalance which the Japanese probably can absorb in large part through further reduction in the standard of living.

The Japanese war economy has been characterised by rapid expansion of government controls of increasing rigidity. Tokyo is the nerve center of governmental war administration. The destruction and damage of a number of important government buildings contributes significantly to post-attack governmental disorganisation. To the extent this disorganisation exists some interference and confusion in war production may be expected. Although impossible to appraise in quantitative terms, this will be an added factor of production loss. It is questionable whether Japanese pre-attack planning facilities, and existing governmental controls are in any real measure adequate to meet the exigencies of such widespread devastation.

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DESCRIPTION AND SIGNIFICANCE

Attacks 25 February and 10 March 1945 were delivered to the central part of Tokyo comprising the area between the Naka and Sumida Rivers and an irregular area west of the Sumida river extending north and northeast from the general vicinity of the Imperial Palace. Additional and isolated damage occurred in and around the Palace grounds and in areas as far west as Kakuno Ku. The largest areas of destruction were the central business section and the industrial/commercial/residential area east of the Sumida River. These sections include two of the most populous wards in Tokyo. The location here of some 3,000 plants and shops (predominantly small) gave the area considerable industrial significance. Available data indicate that plants in the area were engaged in producing building materials, such as cement, glass, lumber and hardware; in metal working such as drawing, rolling, galvanizing, casting, forging, stamping and plating; in the production of chemical, textile and mining machinery, locks, gears, bearings, simple machine tools, small gas engines, optical and precision instruments; small electric motors, wire and cable, switches, switch boards, tube bases and filaments; and consumer goods such as processed foods, clothing, drugs, soap; furniture and household articles. There are extensive wholesale food and other markets, storage facilities and some marine engine and boat building capacity in the area. Most of these establishments are located in the area between the Naka and Sumida Rivers. East of the Sumida River there is a greater preponderance of commercial and governmental administrative buildings and comparatively few of the production facilities described above.

PHYSICAL DAMAGE

Estimates of the damaged area as revealed in post strike photography aggregates some 369 million square feet or 13.2 square miles for both attacks of which an estimated 350 million square feet or 12.6 square miles related to the attack of 10 March.1/ Between 200,000 and 250,000 dwellings were destroyed dehousing an estimated 1,200,000 persons. Most of the small factories in the area were destroyed. (See Appendix A for a list of the more important factories and the extent of the physical damage to them.) Only a few of the larger, better constructed, and protected factories escaped total destruction. Housing in the area of the conflagration was destroyed.

CASUALTIES

It is estimated that some 50,000 persons may have been injured during and immediately succeeding the attack of which about half were fatal. If entrapment occurred because of the rapidity of fire spread and blocking of means of exit, casualties may be greater. (See Appendix B for comparison with Tokyo fire of 1923). Carefully guarded statement of the Japanese press and radio have voiced criticism of air raid defenses, have urged more extensive evacuation and have admitted to a "considerable" number of victims.

FUTURE TARGET VALUE

The devastated area has no future target value except for a few important plants at the north and south extremities.

Two other target areas in Tokyo of approximately the same size, with equal or greater industrial importance and comparable vulnerability, should be attacked as soon as possible.

1/ - Reports of small, scattered damage in the west and northwest parts of the city cannot be verified because of incomplete photo cover.

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Table 1. Estimated Physical Damage to a Selected List of More Significant Installations

(Damaged Installations are Listed in Appendix A)

Type of Facility	Number of Factories				
	Total	Destroyed 1/	Extensively damaged 1/	Moderately damaged 1/	Slightly damaged 1/
Total	**107**	**45**	**26**	**20**	**16**
Aircraft	4	2	2	--	--
Armament	3	2	--	1	--
Chemicals	9	6	2	1	--
Electrical Equip.	5	3	1	--	1
Iron and Steel	10	3	2	3	2
Machine tools & precision instruments	6	1	3	--	1
Machined Metal Products	4	2	1	1	--
Machinery	4	1	1	--	2
Petroleum	3	2	--	1	--
Shipbldg. and repair	3	1	--	--	2
Textiles	5	4	--	--	1
Miscellaneous industrial	17	12	3	2	--
Storage	8	--	3	3	2
Transportation	8	3	3	1	1
Utilities	9	2	1	4	2
Public buildings	10	1	4	3	2

1/ Definition of damage categories:
"Destroyed" - more than 60%
"Extensively" - 21% to 60%
"Moderately" - 5% to 20%
"Slightly" - less than 5%
Percentages are based on visible damage to building area. They exclude invisible damage to interiors and contents.

ECONOMIC ASSESSMENT

Damage and destruction to manufacturing plants was extensive with the principal impact on small and medium-size establishments.

Large plants are estimated to account for some 30 percent of manufacturing employment in the damaged area. Among the large plants suffering substantial damage are the Fujikura Electric Cable Works (90.17-826) a major producer of all types of insulated wire and cable (estimated 10 percent of Japanese capacity); the Rolling Stock Manufacturing Co. plant (90.17-366) producing locomotives and ordnance; the Nisso Steel Manufacturing Co. plant (90.17-324) producing special steel products; the Kakurado Engineering Works (90.17-904) manufacturing aircraft engine parts including carburetors; the Japan Machine Industry plant (90.17-1342) producing ordnance and aircraft components; the Tokyo Kozai Co. plant (90.17-1350) producing alloy and bearing steel, rolled products, and springs; Japan Bakelite Co. plant (90.17-1365) producing bakelite products - important metal substitute items (Japan's largest plant); the Nippon Electric Wire and Cable Co. plant (90.17-1430) a large-scale producer of wire and cable for power and communications systems; the Hirabin Spinning Mill (90.17-912) possibly converted to aircraft or ordnance components; and the Japan Military Goods Co. plant (Ref. No. 122) a converted textile mill producing small naval ordnance components.

Among the less important and smaller-size manufacturing plants heavily damaged or destroyed are the Japan Fat and Soap Co. (Ref. No. 134) a large glycerine manufacturing plant, the Osaka Engineering Works (Ref. No. 85) producing aircraft electrical equipment; the Japan Machinery Co. plant (Ref. No. 123) manufacturing aircraft parts, including landing gear; the Nitto Veneer Manufacturing Co. plant (Ref. No. 210) producing plywood for trainer aircraft; the Asahi Steel Works, Sumamachi Plant (Ref. No. 254) producing ordnance components; the Japan Bonite Co., Hikawajima plant (Ref. No. 74) producing plastics; the Tokyo Chemical Works plant (Ref. No. 126) producing industrial chemicals; the Nissan Chemical Mfg. Co. plant (Ref. No. 132) producing sulphuric acid; the Tokyo Heavy Industry (Ref. No. 249) manufacturing electrical equipment; the Japan Wire Co. plant (Ref. No. 260) producing wire and cable; the Ishihara Steel Works, Mukojima plant (Refer. No. 140) producing rolled steel products; the Taido Steel Co., Tsukaten plant (Ref. No. 141) producing steel ingots, springs, and forgings for ordnance; the Takasago Iron Works (Ref. No. 159) producing boilers and stripsteel; the Hasegawa Steel Works (Ref. No. 244) manufacturing castings; the Yokoyama Mfg. Co. (Ref. No. 257) producing structural steel products; the Japan Cast Steel Co., Oshima Tool plant (Ref. No. 154) producing machine tools and second grade bearings; the Nomada Printing Machinery Co., Plants Nos. 1 and 2 (Ref. No. 160 & 162) reported producing grinding machines and machine tools (general purpose machine tools); the Chinchara Machinery Co., Monjo plant (Ref. No. 161) a small producer of high quality specialized tools; the Japan Ford Products Co. plant (Ref. No. 166) manufacturing auto parts; the Kicho Copper Works (Ref. No. 209) producing metal products; the Engineering Works (Ref. No. 228) producing metal products for shipyards and auto plants; the Japan Mfg. Co. plant (Ref. No. 248) producing machinery and automotive parts; the Jote Boatyard (Ref. No. 235) building standardized cargo vessels; the Fukui Machinery Co. plant (Ref. No. 158) producing machinery; and the Tokuchima Machinery Co. plant (Ref. No. 300) manufacturing gas engines.

Numerous lumber and woodworking plants, textile plants, rubber works, leather plants, and consumer goods manufacturing were extensively damaged or destroyed.

The medium and small-size manufacturing plants are responsible for approximately 70 percent of manufacturing employment.

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ECONOMIC ASSESSMENT (Cont'd)

Total manufacturing employment in this industrialized area is estimated at some 300,000 workers spread among some 3000 plants.

The highest relative concentration of production loss apparently is in electrical equipment manufacturing, general metal machining, and in a broad category of consumer durable goods. The numerous small plants in these industrial activities were very largely destroyed.

Identified Small Plants Located in Completely Burned-Out Areas

	East of Sumida River	West of Sumida River
Consumer Goods food, clothing, drugs, soap, furniture and household articles	245	160
Building Materials cement, glass, lumber, building hardware	85	10
Metal Working drawing, rolling, galvanizing, casting, forging, stamping and plating; boilers, tanks, structural steel	545	70
Machinery machining, threading, grinding, polishing; automotive and aircraft parts; chemical, textile, mining machinery; tools, locks, gears, bearings; simple machine tools, small gas engines; optical and precision instruments	370	50
Electrical small motors, wire and cable switchboards, switches, tube bases and filaments, meters	90	16
Miscellaneous small chemical plants; plastics; warehouses	80	15
TOTAL	1415	321

In addition to the extensive destruction of manufacturing facilities a substantial number of important storages were severely damaged or destroyed. The more important storages seriously affected are the Mitsubishi Warehouses (Ref. No. 208), the Tsukiji Market and Warehouses (90.17-1448) one of Tokyo's three principal food storage and distribution centers; the Toshin Warehouses (Ref. No. 266) having extensive storage capacity; the Military Storage and Trans-shipment area (Ref. No. 72) a naval storage depot; the Koto Market (90.17-1450) also one of Tokyo's three principal food storage and distribution centers; and the Army Provisions Depot (90.17-355) comprising military storage.

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ECONOMIC ASSESSMENT (Cont'd)

Important transportation facilities incurred major damage or destruction. Among these facilities were the Shiodome Freight Yards (90.17-365) a key trans-shipment point for central Tokyo with extensive storage capacity; the Minowa Car Barns (Ref. No. 87) a tramway barn; a Bus Terminal (Ref. No. 88) an urban bus terminal and garage; the Morikawa Station and Yards (Ref. No. 119) a local freight and shunting yards with freight sheds; the Kinshi-cho Freight Yards (Ref. No. 179) a local freight yard and storage depot; and the Ryogoku Station and Yard (90.17-1372) a local freight yard and storage depot.

Heavy damage was inflicted upon a number of important utility systems among which were the Railroad Transformer Stations (Ref. No. 19) transformer substations serving electric railways; the Tokyo Gas Co., Senju Works (Ref. No. 82) a large gas works with a minor by-products plant; a telephone exchange (Ref. No. 20) a local telephone exchange; the Tersjima Transformer Station (Ref. No. 102) a secondary power transformer station; the Tokyo Gas Co., Sai Works (Ref. No. 155) producing coke and by-products; the Tokyo Gas Co., (Ref. No. 175) a gas storage plant; and the Tokyo Gas Co., Sumesachi Plant (90.17-908) producing gas and coke.

Among the important government buildings subject to substantial damage or destruction were the Imperial University (Ref. No. 13) Japan's largest university; the Tokyo Tax Office, the municipal tax bureau; the National Treasury, the Government Printing Office, the Communications Office, the Agriculture and Forestry Office and the Court and Justice Office (all Ref. No. 42).

No estimate of direct production loss was made for damage and destruction of transportation and communications facilities, storages, and utility systems.

Direct production loss of large priority factories is estimated at 257,000 man-months; for small priority factories 408,000 man-months; total loss for priority industry (within damaged area) is 665,000 man-months.

Non-priority factories (within damaged area) are estimated to incur production loss of 247,000 man-months.

Because of the relative completeness of destruction there is only a relatively small proportion of additive absenteeism - 7.5 percent of total direct loss (plants within area of damage).

Factories outside the damaged area in Tokyo will be effected by the attack and resulting conflagrations. It is estimated that 100,000 man-months of absenteeism will result from firefighting, fatigue, aid to the injured, searching for relatives and friends, etc.

Total direct production loss therefore is 1,012,000 man-months.

Repair and replacement probably will be limited to the high priority industrial plants having no more than a moderate amount of building damage. The extensiveness of the industrial damage, the relative tightness of the Japanese economy, and the existence of some excess capacities in particular industries support this conclusion. Small priority factories and non-priority manufacturing plants are not likely to be replaced. Recuperation of priority production probably will be largely confined to the employment of excess industrial capacities, upgrading of industrial facilities to higher priority uses, and emphasis on greater overall efficiency in production.

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ECONOMIC ASSESSMENT (Cont'd)

Production loss of consumer durables and consumer services probably will be largely absorbed. This will cause further reduction in the standard of living of the affected population.

Transport and communication facilities of the most essential character probably will be quickly restored. Such repair and replacement will represent no more than a partial restoration of the pre-attack plant.

Should the large priority factories with no more than moderate damage and the minimum transport and communications plant replacements occur an additional 317,000 man-months will be required. Productions loss, with inclusion of the minimum replacement requirements, is in the amount of 1,329,000 man-months.

It is estimated that 1.2 million persons were dehoused. The destruction of some 200,000-250,000 homes has largely removed the pre-attack housing cushion in Tokyo. The undamaged housing remaining is estimated to be adequate to absorb the essential workers among those dehoused. Undamaged dwellings and public buildings will be used to provide quarters probably under rigid government direction. Re-adjustment of those dehoused through evacuation of the non-essential population to other areas and the essential persons to undamaged housing facilities in Tokyo will be a major task.

It is improbable that there will be any significant replacement of destroyed housing. The impact of the destroyed housing, therefore, will express itself in further reduction of civilian living standards for the population affected.

Casualties are estimated at 50,000 of which 30,000 are fatal. This represents probably a minimum. Any large-scale entrapments would cause casualties to reach a large total. Present information available does not permit a more adequate estimate of casualties.

REMARKS

1. This report is based on incomplete cover and it is possible that there are additional small areas of damage in other parts of the city.

2. This is the first instance of a conflagration in a highly congested industrial district. It is highly probable that comparable industrial damage can be accomplished in areas of similar character, both in Tokyo and other cities. It demonstrates the importance of avoiding unnecessary firebreaking of important target areas by light, random attacks.

3. It is of urgent importance that two other target areas in south and north Tokyo of approximately the same size, with equal or greater industrial importance and comparable vulnerabilities, be attacked as soon as possible as (a) the undamaged industrial plants will be more fully utilized, (b) a heavier concentration of essential industrial workers will be found in the undamaged housing, (c) first-aid transport, and other facilities essential to post-attack relief are in a critical situation, and (d) general industrial and social disorganization will rapidly pyramid.

4. It should be noted that, while the magnitude of industrial loss from this attack was relatively large, the direct effect on military end-product production - particularly with reference to ground strength - is not of appreciable significance on a short term basis. There are several target areas which offer greater opportunity to inflict direct loss on military end-products.

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APPENDIX A

SELECTED LIST OF MORE SIGNIFICANT INSTALLATIONS DAMAGED

Physical Damage 1/				Reference No.	Target No.	Name	Product Description
Destroyed	Extensive	Moderate	Slight				
						AIRCRAFT	
	X			85	- -	Oana Engineering Works	Generators and other aircraft electrical equipment.
X				123	- -	Japan Machinery Co.	Aircraft parts, including landing gear.
	X			250	904	Sakurada Engineering Works	Aircraft engine parts (including carburetors).
X				210	- -	Nitta Veneer Manufacturing Co.	Plywood for trainer aircraft.
						ARMAMENT	
X				122	- -	Japan Military Goods Co.	Converted textile mill, producing small naval ordnance components.
X				176	1342	Japan Machine Industry	Ordnance and aircraft components.
		X		254	- -	Asahi Steel Works, Sunamachi Plant	Ordnance components.
						CHEMICALS	
X				74	- -	Japan Ebonite, Mikawajima Plant	Plastics.
	X			98	1365	Japan Bakelite Co.	Japan's largest Bakelite Plant (important metal-substitute items).
X				109	- -	Lion Soap Co.	Fats and glycerine.
	X			118	- -	Komiai Alcohol Co.	Alcohol distillery.
		X		120	- -	Ito Dyeworks	Dyestuffs.
X				124	- -	Japan Fat and Soap Co.	Large glycerine plant.
X				126	- -	Tokyo Chemical Works	Industrial chemicals.
X				127	- -	Miyoshi Chemical Co.	Unidentified chemicals.
X				132	- -	Nissan Chemical Mfg. Co.	Sulphuric acid.
						ELECTRICAL EQUIPMENT	
X				110	1430	Nippon Electric Wire and Cable Co.	Large-scale producer of wire and cable for power and communications.
			X	142	916	Hitachi Engineering, Kameido Plant	Major producer of heavy electrical equipment and industrial machinery.
X				216	826	Fujikura Electric Cable Works	Major producer of all types of insulated wire and cable (10% Jap capacity).
	X			249	- -	Tokyo Heavy Industry	Electrical Equipment.
X				260	- -	Japan Wire Co.	Wire and cable.
						IRON AND STEEL	
X				140	- -	Ishihara Steel Works, Mukojima Plant	Rolled steel products.
X				141	- -	Daido Steel Co., Teihatsu Plant	Alloy steel ingots, springs, forgings for ordnance.
	X			156& 157	1350	Tokyo Kosai Co.	Alloy and bearing steel, rolled products & springs.
X				159	- -	Takasago Iron Works	Boilers and strip steel.

1/ Definition of damage categories:
"Destroyed" - more than 60%
"Extensive" - 21% to 60%
"Moderate" - 5% to 20%
"Slight" - less than 5%
Percentages are based on visible damage to building area. They exclude invisible damage to interiors and contents.

Physical Damage 1/				Reference No.	Target No.	Name	Product Description
Destroyed	Extensive	Moderate	Slight				
						IRON AND STEEL (Cont'd.)	
		X		222	- -	Hitachi Engineering Works, Fukagawa Plant	Alloy steel ingots and castings
			X	237	1349	Japan Special Steel Works	Alloy steel and rolled products.
	X			244	- -	Hasegawa Steel Works	Castings.
			X	245	- -	Azuma Steel Works	Castings and rolled products.
		X		252	- -	Yokoyama Manufacturing Co.	Structural steel.
		X		261	334	Nisso Steel Manufacturing Co.	Special steel products.
						MACHINE TOOLS AND PRECISION INSTRUMENTS	
	X			154	- -	Japan Cast Steel Co., Oshima Tool Plant	Machine tools and second grade bearings.
	X			160	- -	Hamada Printing Machinery Co., Plant #1	Reported producing grinding machines and machine tools.
	X			162	- -	Hamada Printing Machinery Co., Plant #2	General purpose machine tools.
			X	168	913	Hattori Company	Large plant; precision instruments and fuses.
	X			181	- -	Shinohara Machinery Co., Honjo Plant	Small producer of high quality, specialised tools
						MACHINED METAL PRODUCTS	
	X			166	- -	Japan Ford Products Co.	Auto parts.
	X			209	- -	Kicho Copper Works	Metal products.
			X	228	- -	Engineering Works	Metal products for shipyards and auto plants.
		X		248	- -	Japan Manufacturing Co.	Machinery and automotive parts.
						MACHINERY	
			X	43	- -	Tsugishima Machinery Co.	Chemical plant equipment.
			X	152	- -	Yoshizawa Machinery Co.	Chemical plant equipment.
	X			158	- -	Fukui Machinery Co.	Machinery.
	X			200	- -	Tokushima Machinery Co.	Gas engines.
						PETROLEUM	
		X		80	1366	Nippon Oil Co.	Local storage and distribution.
	X			163	910	Rising Sun Petroleum Terminal	Small tank farm
	X			199	911	Ogura Oil Co.	Minor refining capacity; storage.
						SHIPBUILDING AND REPAIR	
			X	229	1459	Susaki Dockyard of Ishikawajima Co.	Shipbuilding and repair yard for medium size naval & merchant ships.
	X			235	- -	Joto Boatyard	Builds standardized cargo vessels.
			X	265	330	Ishikawajima Shipbuilding Co., Marine Engine Works	Major producer of all types of marine engines.

1/ Definition of damage categories:
"Destroyed" - more than 60%
"Extensive" - 21% to 60%
"Moderate" - 5% to 20%
"Slight" - less than 5%
Percentages are based on visible damage to building area. They exclude invisible damage to interiors and contents.

SECRET

APPENDIX A (Cont'd.)

Physical Damage 1/ Destroyed	Extensive	Moderate	Slight	Reference No.	Target No.	Name	Product Description
						TEXTILES	
X				73	--	Japan Woolen Cloth Co.	Textiles.
			X	101	--	Choseki Cord Manufacturing Co.	Cord.
X				153	1914 1915	Oriental Weaving Co.	Textiles.
X				121	--	Toyo Textile Co, Mukojima Plant	Textiles.
X				167	912	Nisshin Spinning Mill	Large plant; possible conversion to aircraft or ordnance components.
						MISCELLANEOUS INDUSTRIAL	
X				18	--	Toppan Printing Co., Shitayo Plant	Large engraving and printing plant.
X				105	--	Marumiya Rubber Works	Rubber products.
X				106	--	Kyowa Leather Co.	Industrial leather products.
	X			107	--	Rubber Works	Rubber products.
X				108	--	Haneda Belt Co.	Industrial belting.
		X		117	--	Japan Brewing Co.	Large brewery.
X				125	--	Glass works	Glass products.
X				130	--	Meiji Leather Co.	Industrial leather products.
X				139	--	Daido Weaving Co., Kameido Mill	Textiles.
	X			183	--	Toppan Printing Type Co., Honjo Plant	Type metal and type.
		X		203	--	Asano Cement Co.	Cement.
X				207	--	Kiyosumi Lumber Mill	Woodworking.
X				212	--	Toyo Lumber Co.	Woodworking.
X				213	--	Lumber mill	Woodworking.
X				223	--	Teikoku Lumber Co.	Large woodworking plant.
	X			264	--	Japan Flour Co., Tokyo Plant	Large flour mill.
						STORAGE	
			X	17	1449	Kanda Market and RR Station	Tokyo's principal food storage and distribution center.
X				208	--	Mitsubishi Warehouses	Storage.
	X			44	1448	Tsukiji Market and Warehouses	One of Tokyo's 3 principal food storage and distribution centers.
	X			266	--	Toshin Warehouses	Extensive storage.
			X	71	--	New Warehouse Area	Unidentified storage.
X				72	--	Military Storage and Trans-shipment Area	Naval storage depot.
	X			186	1450	Koto Market	One of Tokyo's 3 principal food storage and distribution centers.
X				214	355	Army Provisions Depot	Military storage

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"Extensive" - 21% to 60%
"Moderate" - 5% to 20%
"Slight" - less than 5%
Percentages are based on visible damage to building area. They exclude invisible damage to interiors and contents.

Physical Damage 1/				Reference No.	Target No.	Name	Product Description
Destroyed	Extensive	Moderate	Slight				
						TRANSPORTATION FACILITIES	
			X	14	369	Ueno Station	One of Tokyo's 3 principal passenger stations.
	X			45	365	Shidome Freight Yards	Key trans-shipment point for central Tokyo; extensive storage facilities.
X				87	- -	Minawa Car Barns	Tramway barn.
	X			88	- -	Bus Terminal	Urban bus terminal and garage.
X				119	- -	Narihira Station & Yards	Local freight and shunting yards; freight sheds.
X				179	- -	Kinshi-cho Freight Yards	Local freight yard and storage depot.
	X			182	1372	Ryogoku Station and Yard	Local freight yard and storage depot.
		X		239	366	Rolling Stock Mfg. Co.	Locomotives and ordnance.
						UTILITIES	
		X		19	- -	RR Transformer Stations	Transformer sub-stations serving electric railways.
		X		82	- -	Tokyo Gas Co., Senju Works	Large gas works; minor by-products plant.
		X		20	- -	Telephone Exchange	Local telephone exchange.
			X	100	- -	Telephone Exchange	Local telephone exchange.
		X		102	- -	Terajima Transformer Station	Secondary power transformer station.
X				155	- -	Tokyo Gas Co., Sei Works	Coke and by-products.
			X	42	1418	Marunouchi Telephone Exchange	Tokyo's central telephone exchange.
X				175	- -	Tokyo Gas Co.	Gas storage.
	X			257 258	907	Tokyo Gas Co, Sunamachi plant	Gas and coke.
						PUBLIC BUILDINGS	
			X	12	352	Army Engineering School	H.Q. Army Engineering School.
		X		13	- -	Imperial University	Japan's largest university.
	X			28	- -	Schools and Public Bldgs.	Group of public buildings and schools.
			X	29	- -	Meteorological Center	National meteorological bureau.
	X			42	- -	Tokyo Tax Office	Municipal tax bureau.
	X			42	- -	National Treasury	National treasury bureau.
X				42	- -	Government Printing Office	National printing office.
		X		42	- -	Communications Office	National communications bureau.
	X			42	- -	Agriculture and Forestry Office	National bureau of agriculture and forestry.
		X		42	- -	Court and Justice Office	National court offices.

1/ Definition of damage categories:
"Destroyed" - more than 60%
"Extensive" - 21% to 60%
"Moderate" - 5% to 20%
"Slight" - less than 5%
Percentages are based on visible damage to building area. They exclude invisible damage to interiors and contents.

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APPENDIX B

Tokyo Earthquake and Fire of 1923

Fire damage in the earthquake and fire disaster of September 1923 occurred in a section of Tokyo almost identical to the area of damage resulting from the two attacks assessed here. Because information on the extent of damage caused by these two attacks is not available from Japanese sources the following data are presented for the disaster of 1923 for comparative purposes: Area devastated 17 sq. miles; houses completely burned 300,926; houses damaged 10,797; persons dehoused 1,500,000; total casualties 94,926, of which 88,104 were fatal.

It is not possible to estimate the bomb damage to city railway systems and rolling stock from currently available information and photo cover. Data relating to the 1923 earthquake and fire reveal destruction from fire of 900 street cars and all overhead wiring in the burned area.

In making any comparison the following differences between the 1923 disaster and the bombing of 1945 should be noted: (1) The fire began at noon while the bombing attack of 10 March began shortly after midnight, (2) reconstruction of the area after 1923 provided wider straight streets; (3) concrete bridges replaced wooden bridges burned out in the 1923 disaster - loss of life on wooden bridges was considerable in 1923; and (4) the primary entrapment in 1923, occurred at the Military Clothing Depot, while it may be expected that loss of life from the bombing attacks occurred principally from enforced firefighting and the location of small shelters along-side homes.

4 June 1945

SECRET

JOINT TARGET GROUP
WASHINGTON, D.C.

SECRET
By Authority of
The Commanding General
Army Air Forces
12 June 45 [illegible]
Date Initials

Preliminary Damage Assessment Report No. 29
Tokyo Urban Industrial Concentration No. 1 - 3600
Target 90.17-3600

PARTICULARS OF ATTACK

On the 13/14 April, 332 planes attacked the north Tokyo Arsenal complex dropping 2,238.4 tons of bombs from altitudes varying from 5,500 ft. to 25,000 ft. Three aiming points viz Targets 202, 206 and 204 were selected. Bombing was conducted through individual attack by radar and visually over a period of 3 hours and 22 minutes from 2257 on the 13th to 0229 on the 14th. Humidity is believed to have been high for two or three days preceding the attack with rain occurring for two days before the attack. Details as to weapons are given in the following table.

Bombs Reported Dropped

Type	Number	Actual Weight (tons)
AN-M64	320	87.8
M-47	6,447	225.6
E-46	9,054	1924.0
M-65	4	1.0
	Total	2238.4

PREVIOUS REPORTS

There was no previous attack on this area. Spot Damage Assessment Report No. 17 covered the urban area attacks of 25 February, 3 and 10 March, 1945 against other sections of Tokyo.

SUMMARY

Physical damage in this attack on Tokyo UIC/1 - 3600 amounted to 97,776,000 sq. ft. of building area. Of this total 90.1 percent represented dwellings, 8.6 percent industrial establishments both manufacturing and non-manufacturing and 1.3 percent was mixed industrial-residential. From 160,000 to 180,000 dwellings were destroyed dehousing from 575,000 to 625,000 persons. No estimate of casualties has been made.

Industrial damage expressed as a percentage of pre-attack building area within the industrial concentration ranged from 9.9 for finished metal products and electric power to 95.1 for abrasives. Important industries in the area sustained physical damage to building area of 21.3 percent for ordnance, 23.2 percent for machinery, 15.6 percent for chemicals, 59.9 percent for paper and allied products, 44.9 percent for textiles, 95.1 percent for abrasives, and 58.6 percent for transportation facilities.

Future target value depends upon the extent to which important ordnance plants in the northern part of the target area were damaged. For these, absence of adequate post-attack photography has prevented assessment of damage.

DESCRIPTION AND SIGNIFICANCE

Tokyo Urban Industrial Concentration No. 1 - 3600, consisting of 10.6 square miles, contains the Tokyo Arsenal complex which centers about Target 90.17-206 specializing in the production of light automatic weapons and fire-control apparatus and 90.17-205 specializing in the manufacture of explosives. Facilities for the manufacture of ammonium nitrate, army field radio and communications

equipment and shell loading and storage facilities for munitions, clothing and other military supplies are located in this industrial concentration. The Tokyo Optical Co., an important producer of lenses and precision equipment used in automatic weapon fire control is located here. The concentration includes installations with small capacity for the production of aircraft components and speciality steels. Prior to the attack the area contained 21,094,000 sq. ft. of annotated building area (roof area) identified as to company or plant name and/or product. (See Tables 2 and 3).

PHYSICAL DAMAGE

A total of 97,776,000 sq. ft. of building area was damaged or destroyed of which 8,420,000 sq. ft., or 8.6 percent was separately identifiable as industrial, 1,286,000 sq. ft., or 1.3 percent was mixed industrial-residential, and 88,070,000 sq. ft. or 90.1 percent was residential. These figures probably understate the damage to industrial structures because (1) while the aiming points selected and the damage pattern suggests damage to arsenal buildings in the northwestern part of the target area, the quality of available post-attack cover is too poor to make any assessment and (2) the figures include no estimates for household industry or other small industrial plants not identifiable as such from pre-attack photography.

ECONOMIC ASSESSMENT

Of the 15,179,000 sq. ft. of identified industrial building area contained in Urban Industrial Concentration No. 3600 and for which post-attack cover is available, a total of 6,299,000 sq. ft. or 41.5 percent was destroyed or damaged. Heaviest hit were abrasives plants which suffered a loss of 95.1 percent of pre-attack building area. Approximately 85 percent of the small amount of lumber and woodworking facilities in the area was damaged. Two small aircraft parts plants sustained approximately 70 percent damage, iron and steel capacity about 60 percent, non-ferrous metals 67 percent, transportation repair and storage facilities approximately 59 percent and paper and allied products about 60 percent. Ordnance and chemicals facilities which are most heavily represented in the area sustained losses of 21.3 percent and 15.6 percent respectively of the pre-attack building area. Table 3 discloses the damage to building area by industry for all identified plants for which post-attack photography is available.

Table 1. Building Area Damaged by Area Attack of 13/14 April 1945 on Tokyo UIC/1-3600

Type of Building	Buildingarea Damaged (000 sq. ft.)	Percent of total bldg. area damaged
Total, all buildings	97,776	100.0
Total industrial	8,420	8.6
Annotated	6,890	- - -
Unannotated manufacturing	1,380	- - -
Unannotated storage	150	- - -
Total mixed industrial/residential	1,286	1.3
Total residential	88,070	90.1

Table 2. Building Damage to Annotated Industrial Installations Caused by Area Attack of 13/14 April 1945 on Tokyo UIC/1-3600 1/

Item	Total area of damage (000 sq. ft.)	Within Tokyo UIC/1 - 3600			Damaged building area outside Tokyo UIC/1-3600 (000 sq. ft.)
		Pre-attack building area (000 sq ft)	Damaged Bldg. Area		
			Thousands of sq. ft.	Percent of pre-attack area	
Installations covered by post-attack photography, total	6,890	15,179	6,299	41.5	591
Industry identified and classified	4,358	11,548	4,051	35.1	307
Miscellaneous and unidentified industry	2,532	3,631	2,248	61.9	284
Installations not covered by post-attack photogtaphy	2/	5,915	2/	2/	2/

1/ see accompanying mosaic for annotations.

2/ not applicable.

Table 3. Building Damage to Annotated Industrial Installations Caused by Area Attack of 13/14 April 1945 on Tokyo UIC/1-3600, by Industry 1/

Industry	Total bldg. area damaged (000 sq ft)	Within Tokyo UIC/1-3600			Area of bldg. damage outside Tokyo UIC/1 - 3600 (000 sq. ft.)
		Pre-attack bldg. area (000 sq. ft)	Building area damaged (000 sq ft)	Percent of pre-attack area damaged	
Total, all industrial	6,890	15,179	6,299	41.5	591
Aircraft	50	72	50	69.4	- -
Ordnance	680	3,190	680	21.3	- -
Finished metal products	113	593	59	9.9	54
Machinery (except electrical)	303	276	64	23.2	239
Iron and Steel	555	907	552	60.9	3
Non-ferrous Metals	200	298	200	67.1	- -
Chemicals	323	2,070	323	15.6	- -
Abrasives	350	369	350	95.1	- -
Transportation Facilities	487	812	476	58.6	11
Electric Power	35	329	35	10.7	- -
Textiles	648	1,444	648	44.9	- -
[illegible]ber-Woodworking	87	102	87	85.3	-
Paper and Allied Products	645	1,076	645	59.9	- -
Gas Works and Storage	- -	10	- -	0.0	- -
Misc. and Unidentified	2,532	3,631	2,248	62.0	284

1/ See Table 2 for distribution of total damage. Table 3 excludes 5,915,000 sq. ft. of building area in Tokyo UIC/1 -3600 for which post-attack photography is not available. Distribution by industry (in 000 sq. ft.) is as follows:

Ordnance	1,570
Machinery (except electrical)	199
Non-ferrous Metals	73
Chemicals	170
Military Storage	2,464
Miscellaneous and unidentified	1,439

Aiming points and the damage pattern for this attack suggests that these installations in the northwestern and western part of UIC/1-3600 received bomb hits and that the total area of building damage is therefore greater than that presented here.

Some notion of the effectiveness of this attack can be gained from a review of the damage sustained by the principal industries and plants within the Tokyo UIC/1 - 3600.

ORDNANCE AND MILITARY STORES

Six important armament or military storage installations were completely obscured by cloud in post-attack photography and one-half of a seventh was likewise obscured. For the remaining 8 plants damage amounted to 21.3 percent of the pre-attack building area. Among the damaged plants was the Army Arsenal (90.17-206) which sustained destruction of 5 shop-type buildings and 3 storage structures, and damage to 5 other buildings. It is questionable whether these structures will be rebuilt but if they are several months will be required for their replacement. Production loss is believed to have been small. Stock losses can not be assessed. The Army Arsenal and Military Gunpowder Works (90.17-205) sustained secondary damage to that half of the installation visible on post-attack cover. The greatest relative damage occurred to the Army Branch Powder Factory (90.17-208) which suffered a 30 percent loss of pre-attack building area, and the Military Works (90.17-209) which sustained a 35 percent loss. For Target 208 production and stock losses are expected to be significant but too little is known about Target 209 to estimate the economic effect of damage.

It is believed that Target 202, Army Central Clothing Depot was damaged, though photography cover of this establishment is hazy.

Destruction of the Toshima plant of the Hattori Co., manufacturers of precision ordnance equipment will not in itself seriously affect production. Destruction of this plant, coupled with previous serious damage to the other two company plants will have long run and cumulative effects on naval and a/c instruments.

The Army Chemical Research Laboratory located about 1200 feet north of the Shinjuku Station and RR junction was damaged. Experimental work with explosives and other ordnance materials is carried on here.

ABRASIVES

Known capacity for the manufacture of abrasive products was destroyed, the three identified plants having sustained a loss of approximately 95 percent of building area. It must be remembered, however, that considerable abrasive capacity remains, particularly at Hiroshima and Okegawa.

TEXTILES

Almost half of the pre-attack textile capacity was damaged. Included is the important Japan Felt Company, chief Japanese producer of paper making felts, which sustained slight damage.

CHEMICALS

About 15 percent of pre-attack building area devoted to chemicals products was damaged in the attack. Among damaged plants was the Japan Fertilizer Co., and the Oji Plant of the Hodogaya Chemical Co.

TRANSPORTATION

Although 80 percent of the buildings within the Tobata-Nippori RR Yards were damaged through-traffic and classification facilities were not affected.

HOUSING

It is estimated that 160,000 to 180,000 houses were destroyed, resulting in the dehousing of 575,000 to 625,000 persons. No estimate has been made for casualties.

FUTURE TARGET VALUE

Absence of post-attack cover for the northern part of this industrial concentration makes it impossible to include judgment as to the future target value of the Tokyo Arsenal Complex. Heavy industrial damage in other sections of the target area would eliminate these portions from high bombing priority. Determination of whether important arsenal buildings should be considered for future attack must await receipt of adequate photo cover.

REMARKS

Additional damage not included in the statistical data accompanying this report is probable both for arsenal buildings and in areas not included in accompanying mosaics.

Table 4. Physical Damage to Selected Industrial Installations Caused by Area Attack of 13/14 April on Tokyo Urban Industrial Concentration No. 3600 1/

Name	Mosaic Reference 2/	Area of Building Damage (000 sq ft)	Percent of pre-attack Building Area	Description and Product
AIRCRAFT				
Nagata Precision Co.	Y	22	60	Precision light metal components for aircraft.
Pilot Fountain Pen Co.	Z	28	80	Unspecified aircraft parts.
ORDNANCE				
Army Arsenal	206	209	15	Assembly and inspection of light automatic weapons, optical fire control instruments and field radio equipment.
Military Gunpowder Works	207	70	14	Probably storage and light manufacturing related to 90.17-206.
Army Branch Powder Factory	208	110	30	Probably light manufacturing related to 90.17-206.
Military Works	209	181	35	Ordnance manufacturing related to 90.17-206.
Unidentified - believed related to "X"	W	7	13	- - - - -
Hattori Co. - Toshima Plant	X	40	100	One of three company plants making fire control and other precision, ordnance equipment.
Nippon Cellophane Co.	AR	62	60	Nitro-cellulose.
FINISHED METAL PRODUCTS				
Rangi Spring Works	AH	51	15	Spring steel.
Riken Springs Mfg. Co., Adachi Plant	AN	8	6	Special springs.
MACHINERY (Except Electrical)				
Riken Heavy Industry	1358	7	3	Piston rings, precision machinery.
Physico-Chemical Industries, Ltd.	1364*	239	60	Specialized machinery, abrasives.
Toyoda Iron Works	BL	57	100	Concrete mixers.
IRON AND STEEL				
Oriental Steel Co.	AV	37	10	Open hearth and electric steel, steel bars, rods, sheets, castings and forgings.
Steel Fabricating Works	BV	448	95	- - - - -
NON-FERROUS METALS				
Tokushu Light Metals Co.	AW	19	16	Special alloy castings and forgings.
Riken Manufacturing Co.	BF	63	35	Vanadium oxide.
CHEMICALS				
Japan Artificial Fertilizer Co.	204	124	10	Phosphate fertilizers, sulphuric acid and nitric acid and ammonium nitrate.
Hodogaya Chemical Co., Oji Plant	AL	41	18	Chemicals and chemical equipment.
Glycerine Works	AY	53	30	Chemicals.
Japan Oil and Fat Co.	BD	105	25	Glycerine and special lubricants.
Japan Soda Co.	CK*	3	2	Chemicals.
ABRASIVES				
Riken Corundum Co., Adachi Plant	AQ	59	75	Abrasives.
Kyoyo Abrasives Co.	BG	98	100	Abrasives, industrial chemicals.
Riken Corundum, Oji Plant	CJ	193	100	Abrasives, and carbon electrodes.
TRANSPORTATION				
Tabata-Nippori RR Yards	224	358	80	Large marshalling yards serving main N. Japan routes. Shop facilities and several factories located within the yard area.
Car Barns	T	6	15	- - - - -
RR Car Shops	BA	12	20	Inter-urban car service.
Car Barns	CF	77	100	- - - - -
Car barns	CG	23	60	- - - - -
Car Barns	CQ*	11	18	- - - - -
ELECTRIC POWER				
Oji Transformer Station	BW	2	2	Transformer.
Takinogawa Transformer Station	BY	32	80	Transformer.
Government Steam Power Plant	228	2	1	Secondary standby generating station.
TEXTILES				
Imperial Hemp Co., Oji Mill	AA	278	65	Rope and burlap.
Japan Wool Spinning Co. (formerly E. Asia Fibre Co.), Oji Plant	AS	125	85	Textiles.
Japan Wool Spinning Co., Oji Plant	AT	52	100	Textiles.
Japan Felt Co.	AX	19	8	Chief producer of paper-making felts.
Toyo Spinning Mill	AZ	8	5	Textiles.
Toyo Spinning Mill	BP	93	80	- - - - -
Toyo Spinning Co., (related to "BP")	BQ	73	100	- - - - -

(Table cont'd on page 2)

TABLE 4 (Cont'd.)

Name	Mosaic Reference 2/	Area of Building Damage (000 sq ft)	Percent of pre-attack Building Area	Description and Product
LUMBER - WOODWORKING				
Japan Plywood Co.	U	87	85	Woodworking and wood products
PAPER AND ALLIED PRODUCTS				
Oji Paper Co., Jujo Plant	BC	62	20	Bond paper.
Oji Paper Co., Oji Mill	BM	460	90	Special papers for government securities and paper money.
Government Printing Works	CB	123	48	Printing.
MISCELLANEOUS				
Sato Engineering Works	AB	38	50	Light engineering.
Oji Plating Works	AF	64	50	Alloy plating.
Toho Engineering	AG	3	2	- - - - -
Japan Artificial Leather Co.	BB	131	80	- - - - -
Mitsui Asbestos Cement Co.	BJ	60	65	Asbestos Cement.
Watanabe Engineering Works	CO	31	40	- - - - -

1/ "Selected" installations are those for which name and/or product has been identified. Installations marked with an asterisk are outside Tokyo UIC/1 -3600; all others are within Tokyo UIC/1 -3600.

2/ Numerical references are AAF target numbers; letter symbols relate only to accompanying mosaic.

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Ec-5556

ADDRESS REPLY TO
COMMANDING GENERAL, ARMY AIR FORCES
WASHINGTON 25, D. C.

ATTENTION:

HEADQUARTERS, ARMY AIR FORCES
WASHINGTON

FOR VICTORY BUY UNITED STATES WAR BONDS AND STAMPS

Bomb Damage

SUBJECT: J.T.G. Report on Bomb Damage to Japanese Aircraft Plants in April, 1945.

TO: Assistant Chief of Staff, G-2
Attention: Dr. Richard O. Lang

Thru: Director of Intelligence, M.I.S.

1. The attached tables show the current J.T.G. assessments of damage thus far inflicted in the Japanese aircraft industry.

2. These figures are given separately for airframe and engine plants and no effort is made to convert the damage inflicted on engine plants to airframe loss. Dates of February and March attacks are shown in the tables.

3. Since data for December 1944 have received neither changes nor additions, this month has been omitted from the tables which run from 1 January to 1 May 1945.

4. Two points concerning these tables need clarification

A. It will be noted that a slight production loss has been shown for the Aichi Eitoku plant in the middle of April. This is caused by loss of the stocks suffered by this plant in the attack of 11/12 March and is not believed to affect output before one months time has elapsed. Severe damage was also inflicted on a portion of this plant believed producing a new type plane -- i.e. not in production of Judy and Paul.

B. On Table 2 it will be noted that a differential note has been applied to the recovery of the two engine types normally known to be in production at Kawasaki's Akashi plant. This is caused by the damage to the Nakajima Musashi plant on 17 February which also made the Type 2 1150 engine. It has been assumed that Nakajima will not be able to supply Kawasaki with components and hence maximum loss has been assumed for this engine. Conversely it is still assumed that components can be supplied by Aichi for the Type 2 1100.

5. It will be obvious that the heavy damage to Ota in conjunction with the loss of Tony and Oscar engines because of damage to Akashi and Musashi has brought production of Army s.e.f. close to the vanishing point

DAMAGE BOMB

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as of the first of April. It seems highly probable however that at least 100 planes in this category will be produced by a judicious use of engines obtained from the spare pool. AIR IND is, of course, keenly aware of this problem and it is hoped that the study now being undertaken will permit a resolution of this problem.

FOR THE COMMANDING GENERAL, ARMY AIR FORCES:

Mr Sheen

for

JOHN MITCHELL
Commander, USNR
Deputy Director, Joint Target Group
Office of AC/AS, Intelligence, USAAF

1 Incl
Airframe Plants
Table 1

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TABLE 1. AIRFRAME PLANTS: ESTIMATED PERCENTAGE OUTPUT BY WEEKS

Month	Week	Mitsubishi Betty & Zeke	Jack	Nagoya Army Bombers & Recce.	New Types	Nakajima Frank & Tojo	Ota Helen & K:80/82*	Nakajima Irving & Frances*	Koizumi Zeke, Sam & Renzan*	Kawasaki Akashi Nick	Aichi Eitoku All Types	New types only ?
Jan. 45	1	15	40	75	0	100	100	100	100	100		
	2	50	70	100	0	100	100	100	100	100		
	3	75	90	100	0	100	100	100	100	60	100	100
	4	90	100	100	0	100	100	100	100	0	100	100
Feb. 45	1	100	100	100	0	100	100	100	100	0	100	100
	2	100	100	100	10	50	50(Attacked10 Feb	100	100	0	100	100
	3	100	100	100	25	0	0(" 17 Feb.	100	100	0	100	100
	4	100	100	100	50	0	0	50	50(attacked 25 Feb.	0	100	100
March 45	1	100	100	100	60	0	0	0	0	5	100	100
	2	100	100	100	70	0	0	0	5	10	100)attacked	
	3	100	100	100	80	0	0	0	15	20	100 11/12 Mar.	50
	4	100	100	100	90	0	0	0	45	30	100	0
April 45	1	100	100	100	95	0	0	0	85	40	100	0
	2	100	100	100	100	0	0	5	95	50	75	0
	3	100	100	100	100	0	0	10	100	60	75	0
	4	100	100	100	100	0	0	20	100	70	100	5
May 45	1	100	100	100	100	0	0	35	100	80	100	15

* Data changed from previous reports

TABLE 2. ENGINE PLANTS: ESTIMATED PERCENTAGE OUTPUT BY WEEKS

Month	Week	Mitsubishi Nagoya 14 cyl. Engine	Kawasaki Akashi Type 2 1150	Type 2 1100*	Nakajima Army	Musashi Navy (Tentative)
Jan. 45	1	50	100	100	100	
	2	50	100	100	100	
	3	50	60	60	100	
	4	50	0	0	100	
Feb. 45	1	75	0	0	100	
	2	75	0	0	100	
	3	25	0	0	100	
	4	50	0	0	50	(attacked 17 Feb.
March 45	1	100	0	0	0	
	2	100	0	5	0	
	3	100?(attacked 27 Mar.	0	10	0	
	4	100?	0	17.5	10	
April 45	1	100?	0	27.5	25	
	2	100?	5	40	35	
	3	100?	12.5	60	60	
	4	100?	20	72.5	85	
May 45	1	100?	35	82.5	95	

* Data changed from previous reports.

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	Total Area Destroyed 1/	Population Dehoused	Total Houses Destroyed	Estimated 2/ Total Factories Destroyed	Significant Factories and Other Installations	
					Seriously Damaged	Moderately Damaged
Tokyo						
March Attacks	13.2	1,200,000	225,000	3,000	72	36
April Attacks						
Kawasaki (April)						
Osaka	6.6	600,000	125,000	2,000	38	18
Kobe	3.0	250,000	50,000	300	33	14
Nagoya	4.4	400,000	80,000	600	46	42

1/ Total destroyed area, with open land and water areas and unburned districts eliminated.
2/ Including very small factories and larger household shops.

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From: CINCPAC Adv Headquarters

Action: CINCPAC Adv Headquarters sends action to CTF 73,93 94 CINCBPF DEPCOM 20th AF all TF and TG CMDRS 5th Flt COMMARGILSAREA COMPHIBSPAC ACONEBPF PHOTOGRP 2 all Carriers 5th Flt 21st BOMCOM COMAAFSWPA CINCSWPA info CINCPAC Pearl COM 7th Flt COMAIRPAC COMSUBPAC AIRPACSUBCOMFORD CNO.

Info: CNO

DTG: 090535 NCR 3425 9 May 1945

OPINTEL 69.

Review of Empire industrial targets is subject of

(A) Aircraft plants. Following are damaged and have no present strategic target value.
Mitsubishi Engine, Nagoya target 90.20-193
Shizuoka, target 90.18-2011
Naka Jima, Hamamatsu target 90.21-2012
Hiro Naval Aircraft Factory, target 90.3-660
Omura, target 90.3-1627
Naka Jima, Iota target 90.13-1544

Following damaged but still have target value.
Naka Jima, Musashinotama target 90.17-357 with west half of plant continuing production.
Naka Jima, Koizumi target 90.17-1545
Tachikawa Aircraft, target 90.17-792
Mitsubishi Airframe, Nagoya target 90.20-194 with 35% damage.

CM-IN-9264 (10 May 45)

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From: CINCPAC Adv Headquarters

DTG: 090535 NCR 3425 9 May 1945

Following are damaged but target value uncertain pending further photos.
Kawasaki Akashi, target 90.25-1547
Hitachi Tachikawa, target 90.17-2009
Oita Airframe, target 90.33-2081

Following are new plants.
Kawanishi Aircraft Himeji Plant, target 90.27-2047 (formerly 21 BOMCOM 6090 at 34-50 north 134-42 east reported producing GEORGE)
Na Jima Seaplane Works, Fukuoka target 90.35-2079 at 33-39 north 130-26 east is medium sized assembly plant.
Mitsubishi Kumamoto, target P531 (formerly P524) At 32-48 north 130-46 east is large engine and airframe plant.
Kyushu Aircraft (formerly Watanabe) target 90.35-662 at 33-32 north 130-27 east is large assembly plant.

Target 21 BOMCOM 6181 previously unidentified is Kyuto Engine Plant of Kawanishi.

Hitachi Aircraft at Chiba, target P539 is large assembly with small engine section.

Summary of aircraft industry attacks.
The original known four big engine producers have suffered 62% physical damage with probably greater cuts in production. However recent intelligence has uncovered small dispersed plants indicating additional production facilities.

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From: CINCPAC Adv Headquarters

DTG: 090535 NCR 3425 9 May 1945

(B) Baka plants. Following believed making Bakas.

Japan Aircraft near Hiratsuka, target 90.17-2015
Fumi Ofuna, target 90.17-2033
Janan Aircraft, Okubo target 90.23-1167

(C) Electronics plants. Following are damaged but still have target value.

Tokyo Shibaura Electric Company number 1 target 90.17-496 is lightly damaged.
Tokyo Shibaura Electric Company number 2 target 90.17-488 is lightly damaged.
Tokyo Shibaura Electric Company number 3 target 90.17-4011 is 70% burned but main building still good.

Following are not damaged.
Nippon Electric Company number 1 target 90.17-497
Nippon Electric Company number 2 target 90.17-326
Kawanishi Machine Shop target 90.25-1745

(D) Armament plants. No shown damage to important plants except following.
Chigusa Factory of Nagoya Arsenal target 90.20-196 with 18% damage.
Torimatsu Factory of Nagoya Arsenal target 90.20-200 lightly damaged.

CM-IN-9264 (10 May 45)

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From: CINCPAC Adv Headquarters

DTG: 090535 NCR 3425 9 May 1945

(E) Chemical Plants.

Hodogaya Soda Company target 90.10-2025 at Koriyama 80% damaged, no longer good target.

16...COG COMINCH..OPO3...33..BUAER...CNO

ACTION: OPD

INFO : ASF, G-2, 20th Air Force

CM-IN-9264 (10 May 45) DTG 090535 da

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27/12/44
#18
9/1/45
#22
26/1/45

HEADQUARTERS
ATSE/AC/1
27 February 1945
Chief of Staff
Deputy C. of S. P & A
Deputy C. of S. Opr.
Deputy C. of S. T.M.S.E.

ADDENDUM NO. 2 - TABLE
PROGRESS IN COUNTER-AIR PROGRAM

Target	Mission & Date	Force Attacking	Tons Dropped	Results	Comments
Omura A/C Plt. Kyushu (Target 90.36-1627)	#13 25/10/44	XX B.C.	156	Photo cover is available for assessing results of first three attacks but not last two. In view of blind bombing and relatively low tonnage of last two attacks, it is probable that no substantial additional damage was done. Prior to attack, plant was assembling some aircraft (no engines); was about to commence airframe & engine production; and was fairly important repair center. First 3 attacks set back planned large-scale prod. of airframes & engines by several months. Estimated 125 completed a/c plus 60 engines destroyed. Loss to future output believed not large because new portion of plant where main damage was done would have come into production slowly; old assembly plant & repair sections were damaged but enough intact space remains to carry on former output without great reduction.	Most of damage done by first attack; all others largely through heavy undercast.
	#16 11/11/44	XX B.C.	85		
	#17 21/11/44	XX B.C.	204		
	#22 19/12/44	XX B.C.	51		
	#25 6/1/45	XX B.C.	89		
Nakajima A/C Engine Plant Musashino-Tama (Target 90.17-357)	#7 24/11/44	XXI B.C.	58	Physical Damage: A few scattered hits throughout plant prior to Navy attack on 17 Feb; engine test cells, and machine shops damaged slightly. Economic-Military Effect: Most of the damage inflicted prior to Navy attack had been repaired. The loss in finished engines was negligible up to that time.	No estimate of damage by Navy attack on 17 Feb 45 available. Communique reports substantial damage. — about 10%
	#10 3/12/44	XXI B.C.	142		
	#16 27/12/44	XXI B.C.	103		
	#18 9/1/45	XXI B.C.	50		
	#22 26/1/45	XXI B.C.	61		
	17/2/45	Navy			
Mitsubishi A/C Engine Plant, Nagoya (Target 90.20-193)	#12 13/12/44	XXI B.C.	181	Physical Damage: 25% of older section of plant damaged, three-quarters superficial and one-quarter structural in attack prior to 1 February. Attack on 4 Feb did moderate damage to 14 cylinder engine section. Economic-Military Effect: Loss of output will depend on the extent of internal damage the range being between 1800 and 3300 engines.	Substantial repair in two large buildings since December 1944 attacks. Production of 14 cylinder engines believed low in last half of February, but quick recovery expected. Production of 18 cylinder engines not seriously affected.
	#14 22/12/44	XXI B.C.	130		
	#21 23/1/45	XXI B.C.	117		
	#34 15/2/45	XXI B.C.	104		
Kawasaki Engine & A/C Assembly Plant, Akashi (Target 90.25-1547)	#20 19/1/45	XXI B.C.	160	Physical Damage: Both engine plant and assembly plant were severely damaged. Scattered hits were registered on metal fabrication and component erection shops of airframe section largest buildings - fuselage sub and final assembly received 8-9 direct hits. Economic-Military Effect: Loss of 1500 or more engines which will be reflected at a later time in the loss of 250-600 aircraft assembled by the Kawasaki airframe plant in Kagamigahara (Target 90.20-240). Loss of 200-250 aircraft manufactured at this plant.	Post attack photography shows more serious damage than was indicated in strike photography on which the January report of this series was based.

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ADDENDUM NO. 2 (Cont'd.)

Target	Mission & Date	Force Attacking	Tons Dropped	Results	Comments
Mitsubishi A/C Assembly Plant, Nagoya (Target 90.20-194)	#13 18/12/44	XXI B.C.	154	Moderate damage inflicted. A loss of 90-140 airframes is indicated. This duplicates at least some of the loss already caused by attacks against Mitsubishi A/C Engine Plant. In addition, planned expansion has probably been interrupted by severe damage to a new part of the plant.	Based on good post-attack photography.
	#19 14/1/45	XXI B.C.	128		
Nakajima Aircraft, New Ota Plant (Target 90.13-1544)	#29 10/2/45	XXI B.C.	118	Heavy damage from XXI Bomber Command attack resulted in loss of at least 900 aircraft.	Carrier borne attacks on 17 Feb and 25 Feb almost certainly greatly increased this damage. Plant is probably out of operation for 4 months with a loss of well over 1000 planes. (total 75-85%)
	17/2/45	Navy			
	25/2/45	Navy			
Tachikawa Aircraft (Target 90.17-792)	17/2/45	Navy			No photographs - Communiques report damage.
Hitachi Aircraft, Tachikawa Plant (Target 90.17-2009)	17/2/45	Navy			No photographs - Communiques report damage.
Nakajima Aircraft, Koizumi Plant (Target 90.13-1545)	25/2/45	Navy			No photographs - Communiques report damage. (11%)

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JOINT TARGET GROUP, WASHINGTON, D.C.

Sheet No. ATSF/AC
Date 28 Feb 45
Page No. 1 (2 pages)

no

PROGRESS IN COUNTER AIR PROGRAM

REPORT NO. 2

TWENTIETH AIR FORCE ATTACKS

During February the XXI Bomber Command mounted only three missions against specific aircraft targets. Severe damage was done to the Nakajima Aircraft, New Ota Plant, Target 90.13-1544 and some damage to the Mitsubishi Nagoya Engine Plant, Target 90.20-193. The third attack intended for the Nakajima Musashino-Tama Plant, Target 90.17-357 enountered instrument weather and no aircraft bombed the primary target. The successful attacks were:

a. Attack on Nakajima, New Ota Assembly Plant, Target 90.13-1544 on 10 February. The attack severely damaged the plant. Preliminary estimates of production loss is three months output of completed aircraft or about 900 planes.

b. Attack on Mitsubishi Engine Plant at Nagoya, Target 90.20-193. The preliminary estimate is that additional damage will cause a loss of about one week's production of 14 cylinder engines or about 400 engines.

No attacks on aircraft production were made by the XX Bomber Command. While operational airfields were attacked on two occasions, no accurate assessments of results is possible.

CARRIER BORNE ATTACKS

Carrier borne naval aircraft also attacked targets in the Tokyo and Nagoya areas on 17 Feb and 25 Feb. As yet, however, no satisfactory reports of damage done to aircraft factories by these attacked is available in Washington. Communiques indicate considerable damage to the Tachikawa Aircraft, Target 90.17-792 and Hitachi Engine Works, Target 90.17-2009. Additional damage was done to Nakajima, New Ota Plant, Target 90.13-1544 and "severe" damage to the Nakajima Koizumi Plant, Target 90.13-1545.

DESTRUCTION OF COMPLETED AIRCRAFT

It is too early to assess accurately the result of February operations against completed aircraft. On the basis of fragmentary reports, however, it is estimated that the JAF suffered heavy losses from carrier attacks on the Japanese main islands. Since the enemy refused to commit his air arm in the Philippines his losses there are believed to be rather light.

DISPERSAL

In February the first clear evidence of building removal, possibly indicating dispersal of Japanese aircraft production prior to attack appeared. Reconnaissance of the Nakajima Ota and Koizumi assembly plants on the day before the 10 February strike showed that about 450,000 square feet of buildings at Koizumi and 173,000 square feet at Ota had been removed. These buildings are believed to have housed only storage or relatively unimportant processes. The indicated pattern is that the plants were being cleaned up to reduce fire hazard, rather than that processes were being dispersed.

A pretty clear pattern of repair following attack has also developed. The airframe plants, as a rule are not being repaired,

and indications are that damaged production is being dispersed. To the contrary, substantial repair of damaged engine plants has been undertaken. Thus, damaged structures at the Mitsubishi Airframe Plant at Nagoya, Target 90.20-194 have been cleared away but there has been no large scale reconstruction. At the Kawasaki Akashi Plant, Target 90.25-1547, substantial repair of the engine section is underway but there is little or no repair in the airframe section. Two large buildings in the Mitsubishi Nagoya Engine Plant, Target 90.20-193, however, have been re-roofed, and all damage at the Nakajima Musashino-Tama Plant, Target 90.17-357 has been repaired. There is considerable evidence that some processes at Musashino-Tama are being moved underground.

PRESENT TARGET VALUE OF AIR-CRAFT PLANTS

On the basis of photography received in Washington prior to 28 February 1945, no aircraft targets can definately be considered to have been so extensively damaged as not to be ready for immediate re-attack. Two targets, the Kawasaki Akashi Plant, Target 90.25-1547, and the Nakajima Ota Airframe Plant, Target 90.13-1544, are estimated to be completely out of production as of 28 February 1945, but considerable undamaged or repairable equipment is still believed to be in the buildings and unless they are re-attacked, recovery can be expected in a relatively short time. It is likely that the Navy attacks on the Nakajima Ota Plant on 17 and 25 February have so damaged this plant as to eliminate it as a possible target until substantial rebuilding has taken place, but no photography is available to confirm this possibility.

The other plants so far attacked still have substantial target value. Some production of 14 cylinder engines at the Mitsubishi Engine Plant at Nagoya, Target 90.20-193, can still be carried on and the eastern section making the newer type 18 cylinder engines has not been hit. The Nakajima Musashino-Tama Engine Plant, Target 90.17-357, had not been seriously damaged prior to the carrier borne attack on 17 February and no photography on which to base assessment of the damage resulting from this mission is available in Washington. Much of the productive capacity of the Mitsubishi Airframe Plant at Nagoya, Target 90.20-194, is still undamaged.

Conclusions as to the necessity of re-attack on the airframe and aero-engine plants in the Tachikawa district and the Nakajima Assembly Plant at Koizumi, all of which were attacked by Navy aircraft on 17 and 25 February, can not be reached until strike or post attack photography is available.

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18 April 1945 JOINT TARGET GROUP

JAPANESE AIRCRAFT PRODUCTION AS OF 15 APRIL 1945

1. This estimate is based on the assumption that if there had been no air attack on the Japanese aircraft industry production as of 1 April 1945 would have been about 2300 aircraft per month. It is impossible to estimate accurately such factors tending to increase production as new plants, increased production in old plants, etc., or other factors tending to decrease production, such as effects of area attacks, cumulative effect of bombing many plants, etc. These will tend to cancel each other out, but the extent to which this will occur can not be gauged. In making this very tentative estimate these factors have not been considered and the results reached are, accordingly, only very rough approximations.

2. Excluding the results of attacks during April, it is estimated that overall production of Japanese aircraft as of 15 April 1945 is slightly over 50% of peak production. These estimates do not consider the effect of attacks during April since no post attack photography is available and, with the exception of the Nakajima Koizumi plant, all were on engine plants. The effect of engine plant attacks will not be felt for some weeks after the damage.

3. April attacks severely damaged three large engine plants, the Mitsubishi Nagoya Plant, Target 90.20-193; the Nakajima Musashino-Tama Plant, Target 90.17-357; and the Mitsubishi Shizuoka Engine Plant, Target 90.18-2011. The effects will not be felt until about 1 May, but will likely be severe after that time. After allowing for recovery of other plants during April, a rough approximate estimate is that by 15 May production of aircraft will be down to about 40% of peak production, even without further attack.

4. Two tables are attached. Table I shows status of the chief known Japanese aero-engine plants as of the month of April 1945. Table II shows the estimated production of the large airframe plants broken down by months from December 1944 through April 1945.

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18 April 1945 - JOINT TARGET GROUP

file - Special Reports

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By Authority of
The Commanding General
Army Air Forces
18 Apr 45 [illegible]
Date Initials

JAPANESE AIRCRAFT PRODUCTION AS OF 15 APRIL 1945

1. This estimate is based on the assumption that if there had been no air attack on the Japanese aircraft industry the monthly production as of 1 April 1945 would have been about 2275 aircraft per month. It is impossible to estimate accurately such factors tending to increase production as new plants, increased production in old plants, etc., or other factors tending to decrease production, such as effects of area attacks, cumulative effect of bombing many plants, etc. These will tend to cancel each other out, but the extent to which this will occur cannot be gauged. In making this very tentative estimate these considerations have not been considered and the results reached are, accordingly, only very rough approximations.

2. Excluding the results of attacks during April, it is estimated that overall production of Japanese aircraft as of 15 April 1945 is slightly over 50% of the output which would have been attained if the industry had not been attacked. These estimates do not consider the effect of attacks during April since no post attack photography is available and, with the exception of the Nakajima Koizumi plant, all were on engine plants. The effect of engine plant attacks will not be felt for some weeks after the damage.

3. April attacks severely damaged three large engine plants, the Mitsubishi Nagoya Plant, Target 90.20-193; the Nakajima Musashino-Tama Plant, Target 90.17-357; and the Mitsubishi Shizuoka Engine Plant, Target 90.18-2011. The effects will not be felt until about 1 May, but will likely be severe after that time. After allowing for recovery of other plants during April, a rough approximate estimate is that by 15 May production of aircraft will be down to about 40% of expected production, even without further attack.

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Table I

Status of Principal Japanese Aero-Engine Plants as of April 1945

Plant	Target No.	Status As of April, 1945 Output	Status As of April, 1945 % Normal	Present Target Value of Site	Remarks
Mitsubishi Nagoya	90.20-193	550	30	nil	Remaining output coming from dispersed locations.
Mitsubishi Shizuoka	90.18-2011	0	0	nil	Future target value depends on degree of repair and extent of structural damage.
Nakajima Musashino-Tama	90.17-357	400	25	Musashino - nil Tama - prob. full	Tama should be in full production in May unless dispersed.
Kawasaki Akashi	90.25-1547	200	30	about half	Maximum target value should be attained by mid-May.
Aichi Nagoya	90.20-2010	200	100	Full	- - - -
Hitachi Tachikawa	90.17-2009	75	50	About half	Large scale trainer output might be converted to combat types.
Ishikawajima "	90.17-1391	100	100	Full	- - - -
Hiro Naval Aircraft	90.30-660	100	100	Full	- - - -
Nakajima Omiya	90.17-2037	75	100	Full	A Nakajima "shadow" plant with eventual capacity of 250/mo.
TOTAL		1700	40		

TABLE II

Output of Japanese Aircraft Plants by Months
December 1944 - April 1945
(Paranthetical figures are results of attacks on Engine Plants)

	Nakajima Ota		Nakajima Koizumi		Mitsubishi Nagoya		Kawasaki Gifu		Kawasaki Akashi		Aichi Nagoya		Kawanishi Naruo		Kawanishi Himeji		Kawanishi Fukae		Tachikawa		Nakajima Handa		Mitsubishi Mishima	
	%	Output	%	Output	%	Output	%	Output	%	Output	%	Output	%	Output	%	Output	%	Output	%	Output	%	Output	%	Output
December 1944	100	360	100	385	70	300	100	240	100	75	100	165	100	120	100	35	100	10	100	215	100	65	100	25
January 1945	100	360	(95)	(365)	75	330	100	240	50	35	(95)	(155)	100	120	100	35	(50)	(5)	100	215	(60)	(40)	(50)	10
February 1945	40	145	90	350	(95) (in part)	(420)	(65)	(150)	0	0	(95)	(155)	100	120	100	35	(50)	(5)	(85)	(180)	(60)	(40)	(50)	10
March 1945	0	0	15	50	(80)	(350)	(5)	(10)	20	15	(90) (mostly)	(150)	(75)	(90)	(60)	20	(55)	(5)	(65)	(140)	(70)	(45)	(55)	15
April 1945	0	0	65	250	(90)	(400)	(25)	(60)	65	50	85	140	(70)	(85)	(55)	20	100	10	(15)	(35)	(75)	(50)	100	25

TABLE II

Output of Japanese Aircraft Plants by Months
December 1944 - April 1945
(Paranthetical figures are results of attacks on Engine Plants)

	Kawasaki Akashi		Aichi Nagoya		Kawanishi Naruo		Kawanishi Himeji		Kawanishi Fukae		Tachikawa		Nakajima Handa		Mitsubishi Mishima		Others		Total	
	%	Output	%	Output	%	Output	%	Output	%	Output	%	Output	%	Output	%	Output	%	Output	%	Output
	100	75	100	165	100	120	100	35	100	10	100	215	100	65	100	25	100	160	95	2150
	50	35	(95)	(155)	100	120	100	35	(50)	(5)	100	215	(60)	(40)	(50)	10	(65)	(105)	90	2015
)	0	0	(95)	(155)	100	120	100	35	(50)	(5)	(85)	(180)	(60)	(40)	(50)	10	(65)	(105)	75	1715
)	20	15	(90) (mostly)	(150)	(75)	(90)	(60)	20	(55)	(5)	(65)	(140)	(70)	(45)	(55)	15	100	160	45	1050
)	65	50	85	140	(70)	(85)	(55)	20	100	10	(15)	(35)	(75)	(50)	100	25	100	160	55	1285

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18 May 1945 JOINT TARGET GROUP EC-5-73

Preliminary Estimate of Progress in Counter Air Program to 15 May 1945

To 15 May 1945, Army Air Forces and Naval air attacks have caused substantial damage to 5 airframe and 7 aero-engine plants. The plants attacked and their present condition are:

Aero-Engine Plants

Plant	Pre-Attack Importance	Present Status
Mitsubishi, Nagoya	Perhaps 35% Jap combat engines.	Destroyed. Not likely to be repaired.
Nakajima, Musashino	Perhaps 35% Jap combat engines.	All Army production stopped. Some Navy engines may be made.
Kawasaki, Akashi	Perhaps 10% Jap combat engines.	Out of production for three months. Substantial repair.
Mitsubishi, Shizuoka	New plant in expansion program. Probably in very limited production.	Destroyed. Not likely to be repaired.
Omura Naval Aircraft Factory	New plant in expansion program. Probably in limited production.	Destroyed. Not likely to be repaired.
Hiro Arsenal, Kure	Small production of important engines.	Reported destroyed.
Hitachi, Tachikawa	Trainer engines, perhaps some combat.	Attacked but substantial repair.

Airframe Plants

Plant	Pre-Attack Importance	Present Status
Nakajima, Ota	Perhaps 15% Jap planes.	Destroyed. Little repair.
Nakajima, Koizumi	Perhaps 20% Jap planes.	Severely damaged. Little or no production.
Mitsubishi, Nagoya	Perhaps 18% Jap Planes.	Moderately damaged. Probably moved.
Tachikawa, Tachikawa	Perhaps 2% Jap planes.	Moderately damaged. Some production, but expansion stopped.

Airframe Plants - Cont'd.

Plant	Pre-Attack Importance	Present Status
Kumumoto Aircraft Co.	Production unknown	Reported severely damaged.

In addition, very important repair and overhaul stations at Okayama in Formosa, and Kanoya, Tachiarai, Omura and Oita in Kyushu have been so severely damaged as to be of little use to the Japanese Air Force.

It is estimated that if these attacks had not been made the rate of production in Japan by 15 May would have been close to 2,400 planes per month. The estimated rate on this date is less than 1,200 per month. It is believed that by 1 December 1944 the enemy was actually producing about 2,000 planes per month. The air attack has, therefore, reduced production 40% from the estimated rate actually attained and 50% from the expected rate in the absence of attack.

It is further believed that attack on aircraft industry has resulted in a loss of between 8,000 and 9,000 airplanes spread over a period of 6 months, some of this loss will occur in the future while production destroyed in plants which have been attacked is being restored.

There is increasing evidence that the enemy has been building both engine and airframe plants. Most of these were intended to increase the production formerly attained, but they will be the chief source of aircraft since damage to the older factories. These will have to be attacked if production is to be further lowered. To date, 18 significant airframe plants and 9 significant engine plants (including those listed above as damaged) have been identified. There are others which may have small production.

This estimate has not considered results of area attacks for two reasons; first, the aircraft plants so far severely damaged are believed to make only smaller parts for which substitute manufacturing facilities can be found; and second, the parts

affected are of the general type of which there is likely to be a sizeable stockpile. As stockpiles are reduced and further plants are destroyed in area attacks, an increasing strain will be put on aircraft production and the recovery program will be strained and delayed. As yet, however, the results of these attacks can not be measured.

Loss in Aircraft Caused by Attacks on Nakajima Aircraft, Musashino - Tama Plant

	Engine Loss		Airplane Loss	
	Army	Navy	Army	Navy
Prior to 7 April 1945	1050	1275	450	500
7 April 1945 Attack	1750	850	700	350
	2800	2125	1150	850
Total Engine	4925		Total Airframe	2000

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By Authority of
The Commanding General
Army Air Forces
1 Feb 45 afl
Date Initials

(12)

REVIEW OF TARGET INTELLIGENCE

for

JANUARY 1945

This is the second in a series of monthly reviews covering important new items of intelligence received and conclusions arrived at during the month by the Joint Target Group. It is designed to achieve rapid and informal dissemination of such information to a few major users in advance of formal issuance of new or revised JTG materials. Many of the economic estimates and conclusions presented here are in preliminary form and should be treated as such pending their inclusion in regular JTG publications.

J.T.G. REV. OF TARGET

Prepared by

Economic Vulnerability Section
Joint Target Group
AC/AS, Intelligence

1 February 1945

SECRET

1 February 1945

REVIEW OF TARGET INTELLIGENCE FOR JANUARY 1945

A. Shipping - Decline in Traffic from South

1. It has been apparent for sometime that, as shipping lanes from the Southern Area (N.E.I., Indo China, etc.) become more vulnerable to Allied attack, the enemy would probably divert shipping from this run to carrying economic traffic between the Mainland (Yangtze River and above) and Japan Proper. There is reason to believe that this reallocation between shipping routes is now taking place, at least to the extent of a very substantial decline in tonnage over the Southern route, though the extent to which shipping thus released has already been put to work hauling traffic from the Mainland is unknown. One factor which would delay the re-employment of ships on the latter route is the fact that a considerable portion of the available merchant fleet is made up of tankers, and the task of converting these in large numbers for other types of cargo would require considerable time.

2. A sharp decline in shipping from the Southern Area entails a large tonnage reduction in imports of oil products, bauxite, and rice, and on a smaller scale such items as tin and rubber. Any additional shipping allocated to the Mainland route would presumably be absorbed, in part, in carrying iron ore, coal, food, and aluminous materials (of a lower grade, but substituting for previous imports from N.E.I.).

A. Shipping (Cont'd)

3. Oil is the chief item for which the decline in imports from the Southern Area might bring about a considerable change in the overall Japanese economic position. In view of uncertainty as to stored reserves of oil products in Japan Proper, but the presumption that these are equivalent to roughly one year's requirements, it must be concluded that the effects on the enemy economy and military position will not be critical during the next 12 months. These conditions, however, do raise the economic vulnerability of oil storage and production facilities in Japan Proper.

B. Rail Transportation - Completion of Double-line under Shimonoseki Strait

1. Various intelligence has led to the conclusion that a second single-track railroad tunnel under Shimonoseki Strait, adjacent to the first tunnel opened in 1942, was completed and operating by the end of 1944. With two electrified tracks instead of one linking Kyushu and Honshu, it is estimated that approximately 72 trains each way can be handled per day, or an annual tonnage of 15.8 million tons of bulk freight. This will facilitate particularly the shipment of coal from Kyushu mines to industrial areas of Honshu. It has the important strategic effect of reducing enemy dependence on coast-wise shipping between Kyushu and other home islands. This may help to explain, for example, the surprisingly low shipping activity on recent cover of Omuta Port, which would normally be expected to show high activity in view of its former importance as a coal shipping center for Kyushu.

C. Arsenals - First Photo Cover Received on Several Important Arsenals

1. Last month's review presented comments based on photographic cover of 5 large Japanese arsenals. Since then, initial cover of three additional arsenals has been examined.

a. Cover is now available on all 4 of the main plants which comprise the highly important Nagoya Arsenal complex. There is a possible fifth plant not revealed by available cover, but it is believed to be less important if it does exist. The two most recently covered arsenals, built since 1939-40 and located in the Torimatsu and Takaki districts of Nagoya, have a combined building area which exceeds that of the two older Nagoya Arsenal plants.

(1) Torimatsu Arsenal (90.20-200) is a major repair center for heavy equipment (mainly artillery) and produces the same items. The photographs reveal large yard areas covered over with tarpaulin, presumably to protect equipment awaiting repair or shipment.

(2) Takaki Arsenal (90.20-1691) is an important ammunition center, apparently fairly integrated. Beyond the immediate arsenal compound is a separate detonator or fuse plant. Within the arsenal are facilities for shell loading and storage, and apparently for production of shell cases.

C. Arsenals (Cont'd)

b. Hiratsuka Naval Arsenal (90.17-1336) is a branch of Yokosuka Naval Arsenal and is one of four or five secondary naval arsenals in Japan. It produces small amounts of double base powder, black powder, and possibly some HE; and it probably loads HE into bombs and mines. It also has a small machine shop and forge shop and may repair and construct small marine engines.

c. Further examination of Toyokawa Naval Arsenal (90.21-1653), mentioned in the December review, reveals that it contains

(1) A large machine and assembly shop section probably fabricating light automatic weapons.

(2) A large initiator manufacture and propellant loading section.

(3) Substantial storage facilities.

Of particular interest are the apparent underground storage facilities located in the hill about one mile north. These are in addition to the storage area within the arsenal compound.

2. Chief remaining areas not yet adequately covered which contain important arsenals are Kure, Maizuru, Sasebo, Osaka, Muroran, Tokyo, Sagami and Keijo-Kinsen (Korea).

D. Oil - New Estimates of Tankage & Japanese Aircraft Fuel Consumption

1. Tankage Capacity: Re-examination of previous evidence in conjunction with photographic intelligence has led to the conclusion that total Inner Zone oil tankage capacity is between 60 and 70 million barrels. This includes all types of storage, distribution and processing tankage. Between a third and a fourth of the total figure

D. Oil - 1 Tankage Capacity (Cont'd)

is accounted for by direct photographic evidence, and as more cover becomes available a further check will be made.

a. About 3/4 of the total tankage is located in the area between Sasebo and Tokyo, mainly in the following areas: Sasebo, Kure, Tokuyama, Yokkaichi, Maizuru, and Tokyo Bay Area. A large portion of total tankage is associated either with naval bases (for fuel oil storage) or refineries. (Upwards of 4/5 of Inner Zone refining capacity is located in the area between Sasebo and Tokyo.) Tankage at synthetic oil plants is relatively small.

b. A significant omission from the above estimate is the storage capacity at many airfields, particularly in the form of drums. Although total aviation fuel stored at airfields may be increasing with the increase in number of airfields, it is believed that a considerable portion of total aviation fuel stocks are probably still held in large central depots included in the tankage estimate.

c. A significant item revealed by photo reconnaissance is confirmation of earlier reports that the Japanese are attempting to reduce vulnerability of oil storage to air attacks, particularly at naval bases, by constructing underground tanks. Determination of the extent to which this trend has already gone, and the physical vulnerability of these underground facilities must await further evidence and analysis.

d. The new estimates of tankage capacity conform in general with previous estimates based on less evidence, though they are slightly lower than some former estimates. They are purely

D. Oil - Tankage Capacity (Cont'd)

estimates of capacity rather than actual stocks on hand. They do, however, serve as a gauge of the upper limit of possible stocks. To date, in absence of firm evidence, it has been presumed that the Japanese have sufficient stocks of oil and oil products on hand to cover one year's requirements. The new estimates suggest that available tankage is more than sufficient to accommodate currently estimated oil stocks equivalent to one year's consumption.

2. Japanese Aircraft Gasoline Consumption: JTG has just completed new estimates of aviation gasoline consumption by the Japanese Air Force for 1944 which shows a total of 7 million barrels. This includes only aircraft uses and excludes fuel consumed by air force ground vehicles. The following table shows the breakdown by categories of aircraft and by areas. A distinction is made between "Active Combat Areas" (including China, the Pacific islands other than Formosa, and the area south of China) and "Rear Areas" in which active combat did not occur for any substantial part of 1944.

	Active Combat Areas	Rear Areas	Totals
	(in millions of barrels)		
Training a/c	0.6	2.1	2.7
Transport a/c	0.9	0.9	1.8
Operational a/c	1.0	1.5	2.5
Totals	2.5	4.5	7.0

Of the total of 7 million barrels consumed, an estimated 5.7 barrels were high octane (above 77) and 1.3 low octane (used mainly for training in rear areas).

E. Steel -

1. New Blast Furnaces in Korea; New Output Estimates Made by JTG.

Recent photo cover has revealed 28 small blast furnaces, ranging from 20 to 50 tons estimated daily capacity, at Heijo and Kenjiho in Korea. These small installations, similar to those appearing in earlier cover of the Yangtze Valley, are of very simple and antiquated design but are believed to have been constructed relatively recently.

a. Pending further information, it is presumed that these small scale facilities have been constructed in accordance with a policy of locating pig iron capacity near coal and ore sources on the Mainland as a means of conserving transportation and shipping, and making use of more abundant labor in such areas. Such an explanation is consistent with the fact that this type of blast furnace can be built quickly from less essential materials and brought into operation in a minimum of time.

b. It is assumed that examination of photo cover of other ore and coal producing areas on the Mainland may reveal recent construction of similar pig iron facilities. While individually these furnaces are small, their collective contribution to an easing of the Japanese steel and shipping position might be considerable. For example, the 28 furnaces at Heijo and Kenjiho may be turning out as much as 150,000 tons per annum of pig iron, which would represent a saving of 2 to 3 times that amount in shipments of ore and coal to Japan Proper to produce an equivalent amount of pig iron there.

E. Steel (Cont'd)

2. Japanese Steel Position Believed Tighter Than Previously Estimated.

Joint Target Group has arrived at new estimates of Japanese steel output based upon examination of photographic and other evidence. In contrast to earlier estimates by various intelligence agencies ranging between 7 and 10 million tons annually, it is now believed that 1944 production of rolled, forged, and cast steel products was in the neighborhood of 5 million tons. This represents less than a 50% utilization of available capacity. It is presumed that the limiting factor is shipping capacity for transporting ore and coal from the Mainland to Japan Proper.

a. There is strong reason to believe that production of steel in 1944 was insufficient to meet all Japanese military requirements, thus forcing a cutback in output of certain important military end products. This means that any further curtailment of steel production would have a definite impact on important front line items, though with a significant time lag.

b. The plants on the Mainland represent by far the most vulnerable segment of the enemy iron and steel industry since they are operating at virtually full capacity, whereas the bulk of unused capacity is located in Japan Proper. This is explained primarily by the enemy's need to conserve shipping. Imports of coal and iron ore (40 to 50% iron content) to Japan Proper weigh 2½ to 3 times the weight of the equivalent in pig iron from plants in Manchuria and Korea. The following estimates of the geographical distribution of pig iron production in 1944 assume full use of Mainland capacity,

E. Steel (Cont'd)

95% capacity operation of plants at Yawata-Tobata, and operation at 10 to 50% of capacity for plants in Honshu and Hokkaido.

	Pig Iron Output (metric tons)	% of Japanese Total
Manchuria	2,386	43%
Korea	573	11%
Kyushu	1,760	32%
Honshu	487	9%
Hokkaido	293	5%
Total	5,499	100%

Adjusting for pig iron used in iron castings, additions of scrap, and deduction for conversion losses, this pig iron output would support approximately 5 million tons production of rolled steel products, steel castings and forgings.

c. Although the above estimates are still regarded as tentative and subject to revision in light of additional evidence, it is believed that the following conclusions are well founded:

(1) That Japanese steel output is far below capacity.

(2) That any further curtailment of output would have its main impact on relatively high priority military end products (allowing for a time lag in production).

(3) That attacks on plants in Manchuria and Korea, which are operating at full capacity, would most quickly bring about such a curtailment of output.

E. Steel (Cont'd)

d. It is tentatively estimated that a 60% level of destruction of 6 Mainland plants, assuming the amount of available shipping remains the same, would result in a loss of 1,050,000 tons of steel products annually, a reduction of 20% of the 1944 level. This takes no account of the effects on steel production which further shipping attrition or a blockade of traffic from the Mainland would have. It may be noted, however, that the latter types of attacks would add to rather than duplicate the economic effects of attacks on Mainland iron and steel plants, since the incidence of a decline in ore and coal shipments would be upon iron and steel production in Japan Proper.

F. Area Attack - Preliminary Assessment of Nagoya Attacks

1. Preliminary examination by Joint Target Group of photo cover taken after the incendiary attack of 3 January 1945 on Nagoya shows a very small area of visible damage - between 3 to 3½ million square feet, of which the bulk is residential. Later cover of a 6 to 9 square mile area of the city, N and NE of the designated target area, which is cloud obscured in the available cover, may show some additional damage.

a. The economic effects of the observed damage are insignificant. It is estimated that 5 to 8,000 persons were de-housed, resulting in a small amount of industrial absenteeism. Direct industrial damage appears to have been confined to a few small textile mills, plywood factories, and unidentified plants.

F. Area Attacks (Cont'd)

b. It seems likely that only a small portion of the bomb tonnage reportedly dropped over the target area actually landed in this zone, and that the concentrations of hits were so low that resulting fires were fairly quickly brought under control by available fire fighting personnel and equipment.

c. The evidence now available re-emphasizes earlier conclusions that, despite the relatively high combustability of Japanese cities, extensive conflagrations can be expected only where a high density of hits and a large number of separate fires are achieved, resulting in saturating of fire-fighting capacity. The evidence further confirms that fire damage in Japanese residential districts tends to be virtually complete when it does occur, and that small Japanese factories are vulnerable to incendiary attack.

G. Aircraft

1. Damage to Kawasaki Aircraft Company: Strike photos of the 20 January 1945 attack on Kawasaki Aircraft Company (Akashi Plant, 90.17-1547) provided Joint Target Group with its first photographic cover of this target. As anticipated, it was confirmed to be a fairly large aero-engine plant with probable eventual capacity for 6-800 engines per month. At the time of attack it was estimated to be turning out about 435 engines per month, including 225 Type 2 - 1150 H.P. radial engines for the Lily Bomber and 210 Type 2 - 1100 H.P. engines for Tony Fighters.

The photos also revealed what was only previously suspected as a possibility, namely, that this same plant also produces either Nick Fighter-Bombers or its successor. Judged from floorspace available, eventual

G. Aircraft (Cont'd)

capacity is estimated as 125 to 150 T/E aircraft per month; with probable output of 75 to 80 per month at the time of attack.

b. Only a rough, preliminary assessment of economic damage imposed by the 20 January attack can be made, since part of the factory is smoke covered. Moreover, complete uncertainty exists as to how the damage is divided between the two different engines produced here. Considerable physical damage was achieved, including heavy damage to at least 20% of the machine shops of the engine plant, and extensive damage to airframe shops.

c. As a first approximation, probably on the conservative side, it is estimated that this attack will result in a loss of output of 800 to 1100 engines and 350 to 750 combat aircraft. The loss of engines and finished aircraft from this particular attack does not represent a duplication of economic loss to the enemy, since it is believed all of the engines go to the Kawasaki plant at Gifu for Lily and Tony production, rather than being used in the Akashi Plant in the assembly of Nicks. The above estimate of loss of output of finished aircraft thus includes those lost at the Akashi Plant because of damage to airframe shops plus that resulting at the Gifu assembly plant because of the curtailment of engine supply from Akashi. The effect on output will be felt immediately and, if the maximum estimates apply, will extend over a period of 6 to 7 months.

G. Aircraft (Cont'd)

2. Twentieth Air Force Progress in Counter-Air Program to Date. Counter-air targets, including production and repair centers and airfields, have absorbed a large portion of XX and XXI Bomber Commands' effort up to the end of January 1945. An appreciable dent has already been made in the Japanese aircraft production program and in air strength as a result of these attacks, but the total achievements thus far must be regarded as merely an encouraging start toward the much larger job which lies ahead.

a. The XX Bomber Command, in its first 31 missions, launched 11 primary attacks against 3 aircraft production and repair plants and 3 airfields (see Table I for details). The total impact of XX Bomber Command operations on the enemy air position has been seriously limited by the fact that none of the most important Japanese aircraft production centers were within range; hence targets of secondary importance had to be selected. The highly successful XX Bomber Command and Navy attacks on the Okayama production and modification plant at Formosa, and on Formosa airfields, resulted in an estimated production loss of 600 training aircraft, destruction of the main repair base in the area, and destruction of numerous completed combat aircraft. These attacks contributed heavily to the weakening of enemy air strength in the Philippines area. Attacks on Omura Aircraft Plant, though resulting in much less physical damage, are estimated to have destroyed 125 completed combat aircraft and 60 engines, and a small loss of current production. More important perhaps, damage imposed on the new section of the Omura plant will delay by at least six months the attainment of very substantial engine production from these new facilities, originally scheduled

G. Aircraft (Cont'd)

to reach full output by mid-1946. Attacks by XX Bomber Command against the Manchuria Aircraft Plant at Mukden resulted in an estimated loss of two weeks output, equivalent to 120 training aircraft.

b. The XXI Bomber Command, in its first 24 missions, directed 17 attacks against 6 counter-air targets. These included 9 attacks on the 3 largest Japanese aero-engine plants accounting for an estimated 88% of total operational type engine output; 3 attacks on 2 airframe and assembly plants which account for an estimated 24% of total enemy combat aircraft production (one of these plants is also included as an engine plant); and 6 attacks against airfields on Iwo Jima and Northern Luzon. (See Table II for details).

c. In contrast to XX Bomber Command, XXI Bomber Command has within its range the most important targets in the Japanese aircraft industry; thus its attacks have had a considerably greater effect on enemy aircraft output to date.

d. On the basis of evidence available in Washington, it is estimated that the 5 attacks directed to date against the Nakajima Engine Plant near Tokyo (producing 40% of total operational engines) have done so little physical damage that no significant production loss has resulted. The 3 attacks on Mitsubishi Engine Plant in Nagoya, on the other hand, have done moderate damage which will result in loss of output equivalent to an estimated 1400 to 3300 engines, depending upon the severity of internal damage.

G. Aircraft (Cont'd)

e. Two attacks on Mitsubishi Airframe Assembly Plant at Nagoya have resulted in moderate damage and an estimated loss of output equivalent to 100 to 200 combat-aircraft. A portion of this loss may possibly duplicate some of the economic loss resulting from earlier attacks on the Mitsubishi Engine Plant.

f. On the basis of preliminary evidence and assessment, it appears that the most successful mission to date by XXI Bomber Command was that of 20 January 1945 against the Kawasaki Airframe and Engine Plant at Akashi. Preliminary estimates indicate a resulting production loss of 800 to 1000 engines and 350 to 750 combat aircraft.

g. In no case where substantial damage has been achieved has large scale repair been undertaken by the enemy. This probably indicates dispersal of production previously carried on in the damaged buildings and underscores the necessity for quick follow-up of earlier attacks against major plants. European experience has demonstrated that unless a high proportion of tools and equipment in aircraft factories are destroyed, the remaining equipment can be salvaged and put back into production at a new location in a relatively short time. Only by heavy damage to this equipment before it is dispersed can a long term reduction of output be obtained.

TABLE I

XX BOMBER COMMAND COUNTER-AIR ATTACKS

TARGET	Mission & Date	Tons Dropped	RESULTS	COMMENTS
Okayama, Formosa A/C Plant	#10 14/10/44	651	Physical Damage: Approx. 90% of plant building space destroyed or seriously damaged. Out of 80 large & small buildings in "assembly plant," only 6 small ones and engine test blocks remain intact. Also very heavy damage to A/D buildings, 69 A/C (many of them trainers) destroyed in plant area plus unknown number in buildings. Additional 47 A/C destroyed or damaged at A/D plus other in buildings. Economic-Military Effect: Substantial reduction of enemy air capabilities in Philippines by destruction of repair and supply facilities and finished A/C. Also loss of 5 mos. output of training A/C estimated at 600.	Carried out in conjunction with Navy air strikes pursuant to policy set down in JCS directive. Main intention to produce prompt effect on front line enemy air strength as support for Philippines campaign. Majority of damage done by XX B.C. although Navy did considerable.
Heito A/D, Formosa	#11 16/10/44	159	No full assessment available. Indications are moderate damage to facilities but probably not large no. of A/C destroyed.	In conjunction with 2nd attack on Okayama
Einansho (Tainan) Air Base, Formosa	#12 17/10/44	64	No assessment available	
Kagi Air Base Formosa	#28 15/1/45	413	No assessment available	Visual bombing

Table I - XX B.C. Counter-Air Attacks (Cont'd)

TARGETS	Mission and Date	Tons Dropped	RESULTS	COMMENTS
Omura A/C Plt. Kyushu	#13 25/10/44	156	Photo cover is available for assessing results of first three attacks but not last two. In view of blind bombing and relatively low tonnage of last two attacks, it is probable that no substantial additional damage was done. Prior to attack, plant was assembling some aircraft (no engines); was about to commence airframe & engine production; and was fairly important repair center. First 3 attacks set back planned large-scale prod. of airframes & engines by several months. Estimated 125 completed a/c plus 60 engines destroyed. Loss to future output believed not large because new portion of plant where main damage was done would have come into production slowly; old assembly plant & repair sections were damaged but enough intact space remains to carry on former output without great reduction.	Most of damage done by first attack; all others largely through heavy undercast.
	#16 11/11/44	85		
	#17 21/11/44	204		
	#22 19/12/44	51		
	#25 6/1/45	89		
Mukden Manchuria A/C Plt.	#19 7/12/44	263	Photo cover following 1st attack shows considerable damage resulting in estimated destruction of 100 trainer a/c under plant roof & further loss of 20 a/c from output during recovery period. Scattered bombing resulted in more damage to Mukden Arsenal than to a/c plant.	Second attack, though mainly visual, encountered highly effective smoke screen.
	#23 21/12/44	88	No photo cover for assessing 2nd attack. Crews reported "unobserved to good."	

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TABLE II

XXI BOMBER COMMAND COUNTER-AIR ATTACKS

TARGET	Mission & Date	Tons Dropped	RESULTS	COMMENTS
Nakajima A/C Engine Plant	#7 24/11/44	58	Physical Damage: A few scattered hits throughout plant; engine test cells, and machine shops damaged slightly. Economic-Military Effect: Most of the damage inflicted had been repaired by 16 January. The loss in finished engines is negligible.	Latest photo cover taken on 16 Jan. - Mission #22 was by radar & probably did very little damage.
	#10 3/12/44	142		
	#16 27/12/44	103		
	#18 9/1/45	50		
	#22 26/1/45			
Mitsubishi A/C Engine Plant	#12 13/12/44	181	Physical Damage: 25% of older section of plant damaged, three-quarters superficial and one-quarter structural. Machine shops received 3% structural and 28% superficial damage. Economic Military Effect: Loss of output will depend on the extent of internal damage the range being between 1400 and 3300 engines.	No assessment available after last two strikes against this plant. Damage inflicted on these two attacks is thought to be negligible due to poor bombing conditions.
	#14 22/12/44	130		
	#21 23/1/45			

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TABLE II

XXI Bomber Command Counter-air Attacks

TARGET	Mission & Date	Tons Dropped	RESULTS	COMMENT
Kawasaki Engine & A/C Assembly Plant	#20 20/1/45	160	Physical Damage: Both engine plant and assembly plant were severely damaged. 20% of machine shops in engine plant heavily damaged. One large section received 13-15 direct hits. Scattered hits were registered on metal fabrication and component erection shops of airframe section largest building - fuselage sub and final assembly received 8-9 direct hits. Economic-Military Effect: 3-5 months output of engine loss - 800-1080 engines. Airframe loss - 350-750 combat a/c. These losses will be felt over the next 3 to 6 months.	Based on strike photos and field damage assessment report. Only partial cover available due to smoke. Damage assessment is minimum.
Mitsubishi A/C Assembly Plant	#13 18/12/44 #19 14/1/45	154 128	Moderate damage inflicted by first attack. No assessment available for second. A loss of 90-140 airframes is indicated. This duplicates at least some of the loss already caused by attacks against Mitsubishi A/C Engine Plant.	Photo cover on 14 Jan. prior to 2nd attack.

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Army Air Forces
10 Mar 45 ajc
Date Initials

JOINT TARGET GROUP
Washington, 25, D. C.

REVIEW OF TARGET INTELLIGENCE

for

FEBRUARY 1945

This is the third in a series of monthly reviews covering important new items of intelligence received and conclusions arrived at during the month by the Joint Target Group. It is designed to achieve rapid and informal dissemination of such information to a few major users in advance of formal issuance of new or revised JTG materials. This month's review is comprised mainly of summaries of major Industry Studies completed during February. The studies themselves may be consulted for further details and methods employed in reaching conclusions.

Prepared by

Economic Vulnerability Section
Joint Target Group
AC/AS, Intelligence

10 March 1945

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MONTHLY TARGET INTELLIGENCE REVIEW

FEBRUARY 1945

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MONTHLY TARGET INTELLIGENCE REVIEW

FEBRUARY 1945

A. Aircraft - Progress of Counter-air Program to 1 March 1945.

1. Summary of Production Loss: Preliminary estimates by JTG indicate that air attacks to date have forced down the rate of output of Japanese operational type aircraft by at least 20 to 25% as of 1 March 1945 from the peak level reached in 1944. This measure probably understates somewhat the reduction in output achieved, first, because it takes no account of Navy aircraft attacks in the Tokyo area during February, and, second, because it measures the reduction from a level of output actually achieved during 1944, whereas production probably would have expanded by March 1945 over the peak level of 1944 in the absence of air attacks.

The approximate cut in output estimated for specific models is as follows:

75 to 100% reduction	(Nick (Frank (Tojo (Helen
40%	- New types (Nakajima, Cta)
25% reduction	(Jill (Betty (Jack (Dinah (Paul (Val (Emily (Tabby (Pete
15%	- Frances
20 to 25%	- Total Operational Types

On the same basis as above, it is estimated that attacks up to 1 March 1945 (excluding Navy strikes) on airframe and aero-engine plants will cause a minimum total production loss of approximately 3000 operational aircraft over the several months between date of attack and date of full recovery for each plant. Only a portion of this loss has taken place already. The breakdown by individual targets is as follows:

A. Aircraft (Cont'd)

1. Summary of Production Loss (Cont'd)

Production Loss from Attacks on Airframe Plants

Nakajima, Ota	90.13-1544	1000 a/c	
Mitsubishi, Nagoya	90.20-194	125	
Kawasaki, Akashi	90.25-1547	200	
Omura	90.36-1627	125	
Total			1450

Production Loss from Attacks on Aero-Engine Plants

Mitsubishi, Nagoya	90.20-193	2,000 engines	800 a/c	
Kawasaki, Akashi	90.25-1547	1,500 engines	700 a/c	
Omura	90.36-1627	60 engines	25 a/c	
Total		3,560		1525

Total 2975 a/c

Past attacks on 3 engine plants will result in an estimated production loss of at least 3560 engines which in turn will force a loss of 1525 finished aircraft. Attacks on 4 assembly plants (two of them also included under engines) will cause an additional loss of 1450 aircraft. No specific allowance has been made for some probable duplication of effect from attacks on both airframe and engine plants. However, the estimates used in all cases are on the low side of minimum-maximum estimates and the normal margin of error is considered to cover this factor. With higher levels of damage in future attacks, however, the factor of duplication would bulk larger and require separate consideration. The accompanying table summarizes attacks through February 1945 on engine and airframe plants. Assessments of cumulative effect on production are given where evidence is available to JTG, taking into account repair and recovery of plants damaged in earlier months.

2. February Attacks:

During February the XXI Bomber Command mounted only three missions against specific aircraft targets. Severe damage was done to the Nakajima Aircraft, New Ota Plant, Target 90.13-1544 and some damage to the Mitsubishi Nagoya Engine Plant, Target 90.20-193. The third attack intended for the Nakajima Musashino-Tama Plant, Target 90.17-357 encountered instrument weather and no aircraft bombed the primary target. The successful attacks were:

a. Attack on Nakajima, New Ota Assembly Plant, Target 90.13-1544 on 10 February. The attack severely damaged the plant. Preliminary estimates of production loss is three months output of completed aircraft or about 1000 planes.

b. Attack on Mitsubishi Engine Plant at Nagoya, Target 90.20-193. The preliminary estimate is that additional damage will cause a loss of about one week's production of 14 cylinder engines or about 400 engines.

No attacks on aircraft production were made by the XX Bomber Command. While operational airfields were attacked on two occasions, no accurate assessment of results is possible.

Carrier borne naval aircraft also attacked targets in the Tokyo and Nagoya areas on 17 February and 25 February. As yet, however, no satisfactory reports of damage done to aircraft factories by those attacks is available in Washington. Communiques indicate considerable damage to the Tachikawa Aircraft, Target 90.17-792 and Hitachi Engine Works, Target 90.17-2009. Additional damage was done to Nakajima, New Ota Plant, Target 90.13-1544 and "severe" damage to the Nakajima Koizumi Plant, Target 90.13-1545, and to Musashino-Tama Plant, Target 90.17-357.

It is too early to assess accurately the result of February operations against completed aircraft. On the basis of fragmentary reports, however, it is estimated that the JAF suffered heavy losses from carrier attacks on the Japanese main islands. Since the enemy refused to commit his air arm in the Philippines his losses there are believed to be rather light. .

3. Repair and Dispersal Activity: Photographic evidence received in February provides the first clear indication of enemy intentions regarding dispersal and repair of the aircraft industry. Though further evidence may alter the picture, the conclusion at present is that in general the Japanese are endeavoring to repair engine plants but dispersing airframe plants rather than repairing them. There is probably a limited transfer of vital equipment to underground workshops.

Reconnaissance of the Nakajima Ota and Koizumi assembly plants on the day before the 10 February strike showed that about 450,000 square feet of buildings at Koizumi and 173,000 square feet at Ota had been removed. These buildings are believed to have housed only storage or relatively unimportant processes. The indicated pattern is that the plants were being cleaned up to reduce fire hazard, rather than that processes were being dispersed.

Damaged structures at the Mitsubishi Airframe Plant at Nagoya, Target 90.20-194 have been cleared away but there has been no large scale reconstruction. At the Kawasaki Akashi Plant, Target 90.27-1547, substantial repair of the engine section is underway but there is little or no repair in the airframe section. Two large buildings in the Mitsubishi Nagoya Engine Plant, Target 90.20-193, however, have been re-roofed, and all damage at the Nakajima Musashino-Tama Plant, Target 90.17-357 has been repaired. There is considerable evidence that some processes at Musashino-Tama are being moved underground.

PROGRESS IN COUNTER-AIR PROGRAM

Target	Mission & Date	Force Attacking	Tons Dropped	Results	Comments
Omura A/C Plt. Kyushu (Target 90.36-1627)	#13 25/10/44	XX B.C.	156	Photo cover is available for assessing results of first three attacks but not last two. In view of blind bombing and relatively low tonnage of last two attacks, it is probable that no substantial additional damage was done. Prior to attack, plant was assembling some aircraft (no engines); was about to commence airframe & engine production; and was fairly important repair center. First 3 attacks set back planned large-scale prod. of airframes & engines by several months. Estimated 125 completed a/c plus 60 engines destroyed. Loss to future output believed not large because new portion of plant where main damage was done would have come into production slowly; old assembly plant & repair sections were damaged but enough intact space remains to carry on former output without great reduction.	Most of damage done by first attack; all others largely through heavy undercast.
	#16 11/11/44	XX B.C.	85		
	#17 21/11/44	XX B.C.	204		
	#22 19/12/44	XX B.C.	51		
	#25 6/1/45	XX B.C.	89		
Nakajima A/C Engine Plant Musashino-Tama (Target 90.17-357)	#7 24/11/44	XXI B.C.	58	Physical Damage: A few scattered hits throughout plant prior to Navy attack on 17 Feb; engine test cells, and machine shops damaged slightly. Economic-Military Effect: Most of the damage inflicted prior to Navy attack had been repaired. The loss in finished engines was negligible up to that time.	No estimate of damage by Navy attack on 17 Feb 45 available. Communique reports substantial damage.
	#10 3/12/44	XXI B.C.	142		
	#16 27/12/44	XXI B.C.	103		
	#18 9/1/45	XXI B.C.	50		
	#22 26/1/45	XXI B.C.	61		
	17/2/45	Navy			
Mitsubishi A/C Engine Plant, Nagoya (Target 90.20-193)	#12 13/12/44	XXI B.C.	181	Physical Damage: 25% of older section of plant damaged, three-quarters superficial and one-quarter structural in attack prior to 1 February. Attack on Feb did moderate damage to 14 cylinder engine section. Economic-Military Effect: Loss of output will depend on the extent of internal damage the range being between 1800 and 3300 engines.	Substantial repair in two large buildings since December 1944 attacks. Production of 14 cylinder engines believed low in last half of February, but quick recovery expected. Production of 18 cylinder engines not seriously affected.
	#14 22/12/44	XXI B.C.	130		
	#21 23/1/45	XXI B.C.	117		
	#34 15/2/45	XXI B.C.	104		
Kawasaki Engine & A/C Assembly Plant, Akashi (Target 90.25-1547)	#20 19/1/45	XXI B.C.	160	Physical Damage: Both engine plant and assembly plant were severely damaged. Scattered hits were registered on metal fabrication and component erection shops of airframe section largest buildings - fuselage sub and final assembly received 8-9 direct hits. Economic-Military Effect: Loss of 1500 or more engines which will be reflected at a later time in the loss of 250-600 aircraft assembled by the Kawasaki airframe plant in Kagamigahara (Target 90.20-240). Loss of 200-250 aircraft manufactured at this plant.	Post attack photography shows more serious damage than was indicated in strike photography on which the January report of this series was based.

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Target	Mission & Date	Force Attacking	Tons Dropped	Results	Comments
Mitsubishi A/C Assembly Plant, Nagoya (Target 90.20-194)	#13 18/12/44	XXI B.C.	154	Moderate damage inflicted. A loss of 90-140 airframes is indicated. This duplicates at least some of the loss already caused by attacks against Mitsubishi A/C Engine Plant. In addition, planned expansion has probably been interrupted by severe damage to a new part of the plant.	Based on good post-attack photography.
	#19 14/1/45	XXI B.C.	128		
Nakajima Aircraft, New Ota Plant (Target 90.13-1544)	#29 10/2/45	XXI B.C.	118	Heavy damage from XXI Bomber Command attack resulted in loss of at least 900 aircraft.	Carrier borne attacks on 17 Feb and 25 Feb almost certainly greatly increased this damage. Plant is probably out of operation for 4 months with a loss of well over 1000 planes.
	17/2/45	Navy			
	25/2/45	Navy			
Tachikawa Aircraft (Target 90.17-792)	17/2/45	Navy			No photographs - Communiques report damage.
Hitachi Aircraft, Tachikawa Plant (Target 90.17-2009)	17/2/45	Navy			No photographs - Communiques report damage.
Nakajima Aircraft, Koizumi Plant (Target 90.13-1545)	25/2/45	Navy			No photographs - Communiques report damage.

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FOR THE USE OF ALLIED FORCES

B. Aluminum - New JTG Estimates of Enemy Position

1. A recently completed JTG study of the Japanese Aluminum Industry concludes that capacity and production are adequate to meet current military requirements. The industry at each stage is fairly concentrated and moderately vulnerable to air attack. A sharp decline in aircraft production, which currently consumes over 80% of primary aluminum, would give Japan a sizeable cushion of excess aluminum capacity.

2. The industry consists of three stages: alumina production, aluminum reduction, and fabrication. The first two stages are examined in the recent JTG study, but the fabrication stage is still being studied.

a. Alumina Production:

As noted in an earlier monthly review, Japan's alumina industry has been undergoing a transition from the Bayer process (which requires NEI bauxite as raw material) to alternative processes which can use types of raw materials available within the Inner Zone. Shipping stringency has already reduced operation of Bayer plants to less than 30% of capacity. Non-Bayer plants, operating at full capacity, now account for 80% of total alumina production. Further expansion of non-Bayer plants should soon release Japan's aluminum industry altogether from dependence upon NEI bauxite supplies. Japan's alumina position is summarized as follows:

	Bayer Plants	Non-Bayer Plants	Total
Capacity	232,000	339,000	571,000
Production	89,600	335,000	424,000
Requirements			424,000
Stocks			35,000

The largest 10 plants include about 75% of total alumina capacity; the largest 14 plants 90%; but much of this represents unused capacity in Bayer plants. The 5 largest non-Bayer plants are believed to account for about 65% of total current output.

b. Aluminum Reduction:

Total capacity is estimated at 232,000 metric tons and output at 208,000 tons. Production is equivalent to requirements and

B. Aluminum (Cont'd)

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stocks are at a minimum. Japan possesses a total of 20 aluminum reduction plants. Fourteen of these contain 92% of capacity; the largest 10 plants include slightly over 75% of capacity.

C. Electric Power - Conclusions of Recent JTG Study

1. A new JTG study of the Japanese Electric Power Industry concludes that destruction of a large portion of this industry's capacity would severely cripple Japan's war production, but such a scale of destruction by air attack would be difficult to achieve and smaller scale destruction of capacity would not have important effects.

2. In Japan, to an even greater degree than in other countries, electric power is of extreme importance to virtually all forms of industrial and other economic activity. Total energy consumption, however, is spread over a wide range of industries, with no one of them accounting for a large fraction of the total. Thus, a severe cut in power output would have to be achieved to assure substantial inroads into production of highest priority industries. The basic industries as a group are the heaviest power users and would probably absorb the main impact of large scale attacks on power. Metals, chemicals, and coal mining together represent about half of all energy consumed, with aluminum the largest single user. The attached table presents very rough estimates of the electric power consumption pattern of the Japanese Inner Zone. A considerable part of the 16 billion KWH of energy "unaccounted for" in this table probably represents an overestimate of output rather than a cushion of miscellaneous low priority uses.

-Electric power consumption pattern Japanese Inner Zone—1944

Consumption category	Energy consumption (in million kilowatt-hours)	Percentage of total energy consumption accounted for (percent)
Metals	12,000	25.5
Aluminum	6,300	13.4
Open-hearth steel	1,370	2.9
Alumina	1,300	2.8
Electric steel	1,260	2.6
Magnesium	660	1.4
Copper	530	1.1
Pig iron	360	.8
Zinc	120	.3
Lead	100	.2
Chemicals	9,000	19.2
Chemical nitrogen	3,230	6.9
Calcium carbide	1,800	3.8
Rayon	1,220	2.6
Chlorine	910	2.0
Other chemicals	1,840	3.9
Machining industries	8,800	18.7
Ordnance	3,000	6.4
Other munitions and supplies	2,100	4.5
Machinery and machine tools	1,000	2.1
Naval and merchant shipbuilding	970	2.0
Aircraft	930	2.0
Other machined products	800	1.7
Consumer and miscellaneous industries	6,300	13.4
Small light and power (residential, municipal, commercial, small workshops)	4,500	9.6
Coal mining	3,800	8.1
Transportation (electric railways, tramcars, city and intercity)	2,600	5.5
Total energy accounted for	47,000	100.0
Total energy unaccounted for	16,000	
Total energy consumed	63,000	

NOTE.—Calculations based on estimated 1944 gross energy output of 72.6 billion kilowatt hours, reduced to 63 billion kilowatt hours net energy output.

For details by power supply areas see Consumption Tables in Supply Area Sections of this study.

3. The Japanese electric power industry must be considered for target purposes largely in terms of individual power supply areas, each representing a more or less separate target system. Within each area there is a high degree of flexibility in sending power from any individual generating plant to any power consumer within the same area, but the interchange of power between areas is severely limited by cycle differences and the relatively small capacity of inter-area transmission lines. The new JTG study deals primarily with the following 7 power supply areas which together account for over 3/4 of total Inner Zone power capacity.

Power Supply Area	Percent of Total Inner Zone Installed Power Capacity
Osaka-Nagoya	26
Tokyo	20
Manchuria	13
North Korea	9
West Kyushu	6
North Kyushu	3
Formosa	2

4. In each power area Japan has a considerable margin of unused power capacity during much of the year which could be drawn upon in emergencies. In most areas, Japan has a large capacity of steam electric plants which are normally used only a fraction of the time to supplement hydro plants during the dry season when stream flow is lower. This steam capacity could be used more intensively if it were deemed sufficiently important to warrant the diversion of coal from other uses for this purpose.

5. If the bulk of total electric power supply were suddenly cut off, Japanese industrial production would be quickly halted and the flow of military supplies abruptly reduced. Relatively small scale destruction of total installed power capacity in any area (e.g. 20 to 25%), however, would probably have no significant effect on high priority production or military strength, though it would force a decline in the general level of industrial activity. The existing cushion of unused capacity and low-priority consumption, coupled with the high degree of flexibility which the enemy would have in adjusting to the emergency situation, would permit continued output of higher priority military goods at virtually unreduced levels. It must be anticipated that a very substantial portion of total installed capacity in any area - at least 40 to 50% - must be destroyed before serious inroads into important war production can be assured.

6. Concentration of attacks within a single power area sufficient to reduce capacity there by at least 40 to 50% would impose much greater economic and military injury upon the enemy than equivalent physical destruction spread over more than one power area. In most areas, destruction of power capacity will have its major economic impact during the 3 to 4 driest months of the year.

7. The low concentration of capacity, the small size of the targets, and the poor accessibility of many of them place serious obstacles in the path of air power. In the 7 primary power areas, a total of 54 steam and hydro plants with capacity of 50,000 KW or more represent less than half of total installed capacity; and 137 plants of 20,000 KW or larger account for two-thirds of total capacity. The degree of concentration varies widely between separate power areas.

D. Steel - New JTG Estimates of Steel Consumption Pattern.

1. Last month's REVIEW OF TARGET INTELLIGENCE discussed recent JTG conclusions regarding Japanese steel production. Against available capacity of at least 10 million tons, the new estimates indicate an annual output rate of 5 million metric tons of intermediate products as compared with older estimates ranging between 7 and 10 million.

2. Estimates of the Japanese steel consumption pattern for 1944, prepared by Joint Target Group, are shown in the accompanying table. There is evidence that, in order to trim consumption down to production, the Japanese were obliged in 1944 to curtail output of certain military end products, including tanks, heavy artillery, and ammunition.

3. The following conclusions may be drawn from present JTG estimates of Japanese Steel Production and Consumption:

a. In 1944, Japanese steel allocations for naval and merchant marine uses were considerably greater than - and partly at the expense of - allocations to ground force equipment and supplies.

b. Any further cut in steel output will have an impact on production of end products for direct Army, Navy, or Air Force use. There is no cushion of non-essential or very low priority steel uses.

c. Since the proportion of total steel going to ground force uses in 1944 was comparatively small, it would be possible for the enemy to achieve a considerable increase in arms and ammunition production in 1945 even in the face of further cuts in steel supply. The fabrication capacity is available for increased output of most ground force items. Such increases could be achieved mainly by reducing allocations of steel to naval and merchant marine building.

D. Steel (Cont'd)

3. d. A further cut in steel production by as much as 2 to 3 million tons would prevent Japan from fighting a long war of heavy attrition. It would probably not, however, preclude Japan from fighting a fairly drawn-out last ditch defensive if ground force uses are strongly favored in the allocation of remaining steel supply.

JAPANESE STEEL ALLOCATIONS 1944
(Thousands of Metric Tons)

TOTAL		4,825
DIRECT MILITARY USES		2,960
Navy, Total 1/		1,170
Naval shipbuilding	420	
Guns, mounts and armor	90	
Repairs, maintenance, battle damage conversions	100	
Naval ammunition (incl. AA, torpedoes)	300	
Mines, depth charges, underwater gear	160	
Miscellaneous (station maintenance, issues to ships, etc.)	100	
Army, Total 2/		810
Ground forces combat equipment (incl. AA guns, vehicles)	140	
Ground forces ammunition	600	
Miscellaneous field equipment	70	
Air Forces, Total 3/		450
Airplane engines, propellers and frames	240	
Bombs, guns, ammunition	140	
Air forces construction	70	
Other Military, Total		530
Fuel drums, storage of military products (mostly fuel)	330	
Fortifications	200	
INDIRECT MILITARY USE		1,865
Merchant vessel construction and maintenance	600	
Railroads	350	
Other	915	

(c) *Transportation* - Rolling stock has suffered from the lack of repair materials and replacements. There have been several instances of dismantling rail lines in China and Southeast Asia for use elsewhere in order to save new rails.

(d) *Ordnance Manufacture* - Many steel consuming industries are operating well below capacity due primarily to the shortage of steel. Photo reconnaissance of two units of the Nagoya Arsenal shows very little, if any, activity.

1/ Based on reliable intelligence showing Japanese 1944 naval shipbuilding program; types and number of guns carried on Jap naval ships; total number of barrels, by size, mounted on Jap fleet; total ship repair facilities - the limiting factor in estimating steel used for battle damage and repairs; rates of ammunition expenditure with adjustments for type of tactical employment. Production programs were estimated and then translated into steel.

2/ See Target System Folder on Armament.

3/ Based on estimated Japanese plane production and U.S. A.A.F. ammunition experience in Pacific.

E. Chemicals - JTG Review of Enemy Position

1. A review by JTG of earlier evidence and estimates on the Japanese chemical industry confirms previous conclusions that this industry has relatively low economic vulnerability to air attack.

2. Japan's chemical industry developed rapidly during the 1930's in order to support the synthetic fiber, textile, and paper industries. This has provided Japan with a war-time excess chemical capacity. It is estimated that established capacity for various basic chemicals is presently utilized at approximately the following rates:

Product	Utilization of Capacity
Sulphuric Acid	75%
Soda Ash	33-1/3%
Electrolytic Chlorine	75%
Caustic Soda	75%
Calcium Carbide	75%
Nitrogen	80%

3. In the case of nitrogen, requirements for fertilizer are virtually unlimited, but capacity is not completely utilized chiefly because of competing uses for raw materials. Capacity is more than 5 times nitrogen requirements for explosives (based on 1944 production).

4. Japan's chemical industry is depressed somewhat by the shortage of raw materials resulting from shipping stringency, though not to the same degree as steel. The chemical industry is particularly dependent upon imports of salt and coking coal from the Mainland. A very sizeable reduction in imports would probably be required before chemical production for important military uses was affected, and even then considerable time would have to lapse before the impact was felt on front line strength.

5. There is a fairly high degree of concentration of capacity in the larger chemical plants, though the remaining capacity is widely dispersed in a large number of small plants. With the industry operating well below full capacity today, the larger plants are probably operating at a higher than average rate and hence account for a somewhat higher share of output than their capacity would suggest. The following table indicates the degree of capacity concentration for the main chemicals.

Product	No. of Large Plants	Capacity in Large Plants (%)
Nitrogen	6	56
Explosives	3	20
Dye Intermediates	4	57
Calcium Carbide	6	52
Sulphuric Acid	8	33
Soda Ash	3	73
Electrolytic Chlorine	5	33

F. Oil - New JTG Estimate of Japanese Oil Position

1. The following comments are based on the recently completed JTG Japanese Oil Industry Study which will be published soon. Despite intensive analysis of Japan's oil position over three years, the basic data are still in process of study and revision. Stock estimates, which are particularly vital in appraising the oil industry, are subject to considerable error since they must be built upon the basis of production and consumption estimates for a number of years. Later intelligence, particularly as to stocks, may change considerably the present estimates.

2. Reduced availability of Outer Zone sources has greatly weakened the enemy's oil position, but the shortage is not likely to reach serious proportions until at least 1946. Almost one-half of estimated 1945 requirements can be met by Inner Zone production. Thus during 1945 and 1946 Japan must rely heavily upon reserve stocks. It is estimated that Inner Zone stocks on 1 January 1945 approximated 14 months requirements at the consumption rates anticipated for 1945.

3. Reduction of imports from the Outer Zone will reduce total output available for Inner Zone use from an estimated 57 million barrels in 1943 and 52 million in 1944 to 21¼ million in 1945. Inner Zone production for 1945 represents 16¼ million barrels of the indicated 21¼ million available. This 16¼ million is made up of 9-3/4 million barrels from synthetic and shale plants, 3 million from crude oil refineries, and 3.5 million from other sources (e.g. tar oils, alcohol, reclaimed lubricants, and vegetable oils). Synthetic and shale plants are believed operating at full capacity, whereas refining capacity is believed to be in the order of 14 times the amount necessary to process the crude available from Inner Zone sources.

4. Stocks of all oil products in the Inner Zone are estimated between 30 and 45 million barrels. Total requirements for 1945 are estimated at 33 million barrels against 54 million consumption in 1944, reflecting particularly the decline in fuel oil requirements for the Navy and merchant fleet.

5. The position with regard to individual oil products indicates a much tighter situation in aviation gasoline and lubricants than in fuel oil and motor gasoline. These estimates, shown below, necessarily contain an even greater degree of possible error than the overall estimates.

6. The decline in oil supplies available has been cushioned somewnat by a decline in requirements as the Japanese have been forced to contract supply lines and as a result of attrition in merchant shipping, naval vessels and aircraft. If shipping and naval strength or activity are forced drastically downward during this year, and if the Allied counter-air program meets with substantial success, total oil requirements will probably be lower than shown above for 1945 (based on only moderate reductions). Thus, Japan's oil situation may tend to become relatively

F. Oil (Cont'd)

less tight as her air and sea strength diminishes. It is noteworthy that her motor gasoline position for ground force use is relatively comfortable, first because stocks and production are high in relation to requirements, and second, because the Japanese army depends much less on mechanized equipment than the U.S. and German armies.

7. Japan's production of petroleum products from crude oil is not vulnerable to air attack because of the considerable number of refineries and the tremendous amount of excess capacity. Synthetic and shale oil production is contained in some 20 known plants, with 3/5 of total output concentrated in 4 plants, three of which are in Manchuria, the other in Northern Korea. Inner Zone storage capacity is approximately 65 million barrels, located mainly in the area from Tokyo to Sasebo. About 75% of total capacity is concentrated in 38 facilities, each having over 500,000 barrels in one location. An estimated 25% or more of all storage capacity is under ground. Sufficiently heavy air attacks might deprive Japan of as much as one-third of total oil stocks.

Estimates of

Japan's Oil Position in 1945 /1

(Thousands of barrels)

Median Estimates of /3	Fuel Oil	Aviation Gasoline	Motor Gasoline	Total /2
Stocks as of 1 Jan. 1945	17,745	4,881	13,564	40,021
Imports from Outer Zone	3,250	800	500	5,000
Inner Zone Production	6,205	2,500	5,685	16,250
Total Available in 1945	27,200	8,181	19,749	61,271
Requirements in 1945	15,000	8,011	7,160	33,431
Stocks as of 1 Jan. 1946	12,200	170	12,589	27,840

/1 **This is essentially a picture of the Japanese Inner Zone position. It excludes Outer Zone production consumed in the Outer Zone. The bulk of the stocks are located in the Inner Zone and the bulk of the requirements are satisfied from Inner Zone oil supplies.**

/2 **Including lubricating oils and kerosene.**

/3 These estimates are subject to a considerable degree of possible error. Additional intelligence may alter substantially the estimate of the enemy's position indicated in this table. See JTG Oil Industry Study for estimating methods and full qualifications.