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No. 2

AIR TARGET SYSTEM FOLDER

JAPANESE AIRCRAFT

JOINT TARGET GROUP
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AIR TARGET SYSTEM FOLDERS are designed for the use of operating air units in the field and are published in a quantity to permit distribution to level of Air Force Groups (American) and Naval Aircraft Carriers.

The material in this folder is divided into three parts as follows:

GENERAL ANALYSIS

This gives an over-all appreciation of the target system so that the importance of individual targets within the system can be readily evaluated. It also lists the essential details of the main targets in the system.

LOCATION MAP

This shows the location of the principal targets.

DATA ON INDIVIDUAL TARGETS

This is to contain Target Information Sheets and Illustrations and Economic Damage Assessment Reports as issued for individual targets in the system.

Addenda consisting of revised sheets and additional sheets will be issued from time to time. The folder is designed to permit ready substitution or addition of such material.

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Joint Target Group
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JAPANESE AIRCRAFT INDUSTRY

GENERAL ANALYSIS

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By Authority of
The Commanding General
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15 Jan '45 WJFRB
Date Initials

SUMMARY

PRODUCTION

Enemy Aircraft position as of 1 December 1944 is estimated to be:

2100 combat aircraft per month consisting of 60 percent fighters, 27 percent bombers and 13 percent reconnaissance aircraft.

PRESENT STRENGTH

First line unit strength 2300 fighters, 660 bombers, 650 other aircraft. Total strength in operational units 2470 fighters, 1070 bombers, 990 other aircraft. The unit strength includes aircraft in identified units only. Photography indicates that there are many combat type aircraft at air arsenals, training fields and large airfields not included in the unit strength. The total may be one or one and one half months production - between 2,000 and 3,000 aircraft.

EXPENDITURE

Rate of expenditure from all causes varies with military operations. In 1944, prior to 1 October it averaged around 900 aircraft per month. In November and December expenditure exceeded production.

VULNERABILITY TO AIR ATTACK

At present both aero-engine and airframe production is highly concentrated as shown by the table below. New plants, not yet in full operation, will decentralize the industry even in the absence of air attack. Dispersion of both engine and airframe manufacture is to be expected following air attack. Airframe production is likely to be more widely dispersed than aero-engine production.

PRINCIPAL TARGETS

The important targets in the industry include the plants listed below. At present they account for about 90 percent of combat engine production and 80 percent of completed aircraft.

Aero-Engine Plants

Target No.	Plant	Area	% of JAF Engines
90.20-193	Mitsubishi Engine Plant	Nagoya	40%
90.20-2010	Aichi Engine Plant	Nagoya	4%
90.17-357	Nakajima Engine Plant	Tokyo	40%
90.25-1547	Kawasaki Engine Plant	Kobe	8%

Airframe Plants

Target No.	Plant	Area	% of JAF Airframes
90.20-194	Mitsubishi Airframe Plant	Nagoya	20%
90.20-1729	Aichi Airframe Plant	Nagoya	6%
90.20-240	Kawasaki Airframe Plant	Nagoya	14%
90.17-1544	Nakajima Ota Airframe Plant	Tokyo	16%
90.17-1545	Nakajima Koizumi Airframe Plant	Tokyo	21%
90.25-18	Kawanishi Airframe Plant	Kobe	6%

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TARGET SYSTEMS

There are three main target systems in the aircraft industry of any nation. These are (1) airframe manufacture and assembly plants (airframe plants), (2) aero-engine parts manufacture and assembly plants (aero-engine plants) and (3) component plants making either parts of airframes or engines or accessories such as starters, carburetors, magnetos, generators, etc. With some exceptions, notably the air arsenals which manufacture a few airframes and. engines, they are quite distinct. The large engine plants in Japan make no airframes and, conversely, the large airframe plants make no engines. While both airframe and engine plants manufacture many components going into their finished products, there are very large plants devoted solely to the manufacture of either engine or airframe components. The accessories, such as hydraulic landing gears, instruments, carburetors, magnetos, starters, generators, etc. are almost certainly made outside the assembly plants.

European experience and study of the Japanese economy show that maximum results can only be obtained when a single target system is selected and is then subjected to concentrated attack. Dissipation of effort among two or three systems usually leads only to duplication of effort, with little net gain in results.

Successful attack on airframe plants will have more immediate effect on front line strength than attack on any of the other systems since the planes come from this plant ready, or nearly ready for combat. Damage to airframe plants can, however, be rapidly repaired. There is little critical equipment in the plants since the machine shop areas are small and require no specialized equipment, and the specialized jigs used in sub-assembly take up a relatively small area.

Three or four months are required to replace sub-assembly jigs and machine tools, if totally destroyed, but is is likely that partial production can be started in a damaged plant as soon as physical repairs to buildings housing them is made.

British and German experience show that dispersion of airframe plants can be expected to be extremely widespread and that, once a plant is dispersed, effective reattack is difficult. The Germans, in general, moved damaged portions (i.e., did little rebuilding) of their plants and maintained production in the undamaged portions of the plants.

Successful attack on engine plants takes longer to affect front line strength, since there are always spare engines which can be used and some engines in the pipe-line between engine and plane assembly. Attack on engine plants, however, take much longer to repair than do airframe plants. Machine shops are the primary objectives of attack and the specialization of production lines -- i.e., one department for crankcases, another for cylinder heads, etc. -- makes widespread destruction of any one shop of extreme importance. An engine plant that has been successfully attacked may lose 6 months or more output.

Dispersion of engine plants following attack is highly likely but the need for a linear production line to maintain large scale output usually demands a concentration of process in each dispersed locality.

Attack on component plants will reduce aircraft production only when many factors have been overcome. Components, such as anti-friction bearings, piston rings, etc., have a relatively large civilian and non-aircraft "cushion" which has to be absorbed before the aircraft industry is affected. There are substitutes available for

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other components, and in many cases the component can be made in small factories of which there are many in Japan. Magneto and starter production, even though concentrated, is often located within large industrial complexes or in built-up urban areas and thus makes a difficult target.

Loss of production of completed aircraft from successful attack on a particular component might, however, be serious. There is evidence that one seriously damaged German propeller plant was out of production for four months following an RAF attack, with some result on aircraft strength.

Since, as indicated above, simultaneous attack on all three systems in the aircraft industry will tend to duplicate effort without corresponding additional loss in completed aircraft, the engine, airframe and component systems are treated separately below.

TABLES

Principal manufacturers of Aircraft and Engines are set out in the tables attached to this analysis as follows:

ATSF/AC/T1.....Table 1 - Principal Japanese Aircraft, their producers and their engines - 15 December 1944.

ATSF/AC/T2.....Table 2 - Principal Japanese Engines, their producers and the planes using them.

DIAGRAM AND MAPS

This analysis is supported by the following diagrams and maps:

ATSF/AC/D.....Diagram showing principal Japanese Engines and Airframe Producers as of November 1944.

ATSF/AC/M1.....Map showing location of main targets.

ATSF/AC/M2.....Map inset of Tokyo area showing location of targets.

ATSF/AC/M3.....Map inset of Nagoya area showing location of targets.

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ENGINE PLANTS

Engine manufacture is highly concentrated. Four companies are currently estimated to manufacture over 90 percent of all combat aircraft engines in four plants. These are shown in the table below.

Target No.	Plant	Area	% of JAF Engines
90.20-193	Mitsubishi Engine Plant	Nagoya	40%
90.20-2010	Aichi Engine Plant	Nagoya	4%
90.17-357	Nakajima Engine Plant	Tokyo	40%
90.25-1547	Kawasaki Engine Plant	Kobe	8%

As shown below this very heavy concentration will undoubtedly be somewhat less when new plants not yet in full production are completed.

Those engine plants thus far covered by aerial photography are compactly built concentrations of large buildings. They have apparently been designed and built primarily for production efficiency with no dispersal because of fear of bombing.

PRESENT PRODUCTION

Estimates of engine production are based on Japanese requirements for installation in the airframes believed to be manufactured (see section on Airframes) plus a 40% spare allowance.

As shown above two plants dominate the production of aero-engines - the Nakajima Tama-Musashino plant near Tokyo (Target 90.17-357) and the Mitsubishi plant in northern Nagoya (Target 90.20-193).

The Tama-Musashino plant (Target 90.13-357) was built in at least two stages, the Army half (Musashino) preceding the Navy section (Tama) by several years. The 1500 per month engines believed to be currently produced by this plant (about 40 percent of the total combat engine production) is probably close to its maximum capacity. The coming year should see a substantial increase in the number of Homare engines (1800 and up HP) produced at this plant, replacing lower performance engine output. Its 2.5 million square feet of floorspace are compactly laid out.

The Mitsubishi engine plant in northern Nagoya (Target 90.20-193) was also built in two phases. At present there are two separate plants within the same target area which total slightly over 4 million square feet. Current output is only slightly greater than that of the Nakajima plant, which suggests that capacity at this plant has not yet been reached. Output of high powered engines such as the Ha 104, etc. will undoubtedly increase and it is possible that the newer portion of this factory (the eastern section) is now producing this engine.

Third in importance as an engine producer at present is the Kawasaki plant at Akashi (Target 90.25-1547). Almost all of the output of this plant is believed retained by the parent company for planes produced by it. The Type 2, 1050 engine produced by this plant is also produced by Nakajima.

Among the other producers, Aichi Aero-Engine Plant (Target 90.20-2010) manufactures the Atsuta in-line engine for its own use. The Hitachi engine plant near Tachikawa, (Target 90.17-2009), the 11th Air Arsenal at Hiro (Target 90.30-660), and others are believed producing increasing numbers of the lower powered operational models as well as being engaged in large scale production of trainer engines.

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JAPANESE AIRCRAFT INDUSTRY - GENERAL ANALYSIS (Cont'd)

EXPANSION

There are numerous indications of large scale expansion of engine production. As noted above, it is believed that Mitsubishi's output has not yet reached capacity. It is probable that 300 - 500 more engines per month may be produced by this plant by the end of 1945. The large scale expansion at Omura, now halted by bombing, was presumably to be devoted largely to engine output and the 36 new test cells there, if used for new production, suggest a capacity of about 700 engines per month. A new engine plant east of Shizuoka (probably Mitsubishi) (Target 90.18-2011) will undoubtedly come into large scale production during 1945. Capacity of this plant may amount to 600 engines per month although it is apparently somewhat short of test cells at present. Another new plant (Target 90.21-2012) under construction at Hamamatsu, is thought to be a Nakajima plant. The presence of six test cells indicates that it may be devoted to engine production.

Some of these plants may manufacture other than combat types of engines. It seems highly likely, however, that unless Japanese production is reduced by air attack the end of 1945 will see at least 1000 more combat engines produced per month, and probably 1500. This one-third increase should, of course, be reflected in increased airframe production.

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AIRFRAME PLANTS

Five companies operating six plants dominate airframe production. These are:

Target No.	Plant	Area	% of JAF Airframes
90.20-194	Mitsubishi Airframe Plant	Nagoya	20%
90.20-1729	Aichi Airframe Plant	Nagoya	6%
90.20-240	Kawasaki Airframe Plant	Nagoya	14%
90.17-1544	Nakajima Ota Airframe Plant	Tokyo	16%
90.17-1545	Nakajima Koizumi Airframe Plant	Tokyo	21%
90.25-18	Kawanishi Airframe Plant	Kobe	6%

A number of new plants are probably now in operation on a limited scale. A substantial reduction in the degree of concentration can be expected when they begin to operate at full capacity.

PRESENT PRODUCTION

Production estimates are made by Military Intelligence Division, WDGS. Estimates of total production of completed aircraft (airframe assembly and installation of engines manufactured elsewhere) are believed to be based on rather firm intelligence and production estimates of the older types of combat aircraft are also believed to be reasonably accurate. Current production figures, however, are the result of studying the rates for earlier periods of the year and trends observed in Japanese airframe production. The estimates therefore are strictly tentative. In a few cases, mainly where new planes or plants are now coming into production, current MID figures could be raised in advance of solid evidence to support the increase shown. This is believed justified by American and British experience in bringing new types into production. Floorspace utilization analysis indicates that some plants such as Tachikawa, Mitsubishi-Nagoya, and Mitsubishi-Mishima could handle a larger production than is currently assigned.

Output of Japanese combat aircraft is estimated to have been nearly 2100 per month in December 1944. Fighter aircraft constitute 60 percent of this total; bombers, 27 percent and the remaining 13 percent are reconnaissance aircraft.

It will be noted that the Nakajima Company's, Ota and Koizumi airframe plants, (as well as its Musashino-Tama engine plants) are located relatively close to Tokyo. These plants are believed working at near capacity figures and produce approximately 37 percent of all combat types. The relative importance of this company is especially striking for fighter aircraft as it produces 51 percent of the single and twin engined fighters. Output of new types of fighters (Frank and Ki 80) is relatively low at present, but a sharp increase must be expected. Nakajima's bomber output amounts to 28 percent of the total. Both the Ota and Koizumi plants are modern and well laid out. Each has about 2.5 million square feet of total floor area and the site areas of each are highly built-up.

Mitsubishi is currently estimated to produce approximately 20 percent of total combat aircraft at its Nagoya plant (Target 90.20-194). It produces 15 percent of all fighter types but is relatively more important in bomber output, accounting for 31 percent of the total. Its new and potentially important planes are the fighters Sam, Jack and Luke, and the bombers Taizan and Ki 83. This plant is exceptionally large. Total floorspace is well over 5 million square feet, and the older portions are quite highly built-up.

The Kawasaki plant at Kagamigahara (N of Nagoya) is the third most important airframe producer, making 14 percent of total combat aircraft. It fabricates 18 percent of the total fighters produced and 14 percent

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of the bombers. This plant may soon produce larger numbers of Rob, a new fighter. Typical of modern Japanese plants, it is large with a plant site compactly built-up.

Aichi Airframe Plant in Nagoya is only important at present because of its output of the Navy single engined bomber, Judy. The Kawanishi plant will undoubtedly become increasingly important when it goes into large scale production of the new fighters George, Rex and Tenrai.

EXPANSION

Little is known about the present output of the Mitsubishi plant at Mishima (Target 90.27-1681) which was, prior to recent photo cover, believed to be producing 25 Betty's per month. The large size of the plant and the large number of planes seen here, however, suggests that the output may very shortly be 75 twin engine bombers per month. Eventual capacity of this plant may well be 200 bombers per month. Similarly, nothing is as yet known as to planned airframe output at the bombed Omura plant (Target 90.36-1627).

The expansion in engine production facilities suggests that future photo cover will reveal either several new airframe plants or expansion of existing facilities.

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COMPONENTS

Component and accessory plants tend to be fairly widely scattered and lie somewhat deeper in the production process of aircraft than do airframe or engine plants. A few of the component systems which at present seem to offer some possiblities as targets are discussed below.

Oleo struts for Aichi, Kawasaki, Nakajima and Mitsubishi are made by Kayaba Seisakusho although Mitsubishi is known to produce some of its own requirements. The only known plant of this company is in Shiba-ku. Next in importance is Okamoto Kogyo which has four plants.

Almost all starters recovered have been made by Tokyo Keiki Seisakusho - possibly in one plant of this company. Offsetting this apparent vulnerability is the estimated large supply of starters available and the known ability of Japanese industry to turn out light electrical equipment in great volume.

Three companies dominate the manufacture of magnetos and one of these - Kokusan Denki - produces about 75 percent of the output. Output for this company, however, is scattered among at least four separate plants and the stock situation is apparently growing progressively more comfortable.

Propeller manufacture for combat use is thought to be concentrated in two companies and five or six plants. Sumitomo with three plants in the Osaka area is thought to make almost all the propellers used in Navy planes as well as some for the Army. Nippon Gakki with possibly two plants in Hamamatsu and one in the Tokyo area are thought to make all propellers used in combat aircraft not made by Sumitomo.

Anti-friction bearings do not appear to make an attractive target system in the aircraft industry because of the number of plants engaged in their manufacture and the distinct possibility that the Japanese can eliminate a sizeable proportion of the anti-friction type of bearing used in aircraft if this course becomes necessary.

Many of these component factories have not yet been assigned target numbers, but they can be located if it should develop that attack upon them is desirable.

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PRODUCTION PROCESSES - ENGINES

There are three main processes in engine fabrication. These are machining, assembly and testing. Each process is discussed below.

MACHINING - PARTS FABRICATION

This process involves a linear movement of the part being machined so that the raw forging or castings (which are usually not made at the engine plant) entering at one end, emerge at the other end as finished engine parts (components). This necessitates that (i) several types of operations be done in sequence and (ii) that, to insure maximum production, only one part be made on any production "line". Thus a production line for crankshafts or connecting rods, etc., will each have its own turning, milling and grinding operations. The finished parts are assembled on the main assembly line. In the most modern plants highly complicated machines capable of performing many operations may be used in these lines. In any case, even the more simple (and hence more flexible) machine tools will have special jigs and fixtures to permit the most rapid alignment of the work.

GENERAL MACHINING

Almost all engine plants have a few general machining departments where miscellaneous grinding, drilling, etc., are done. These departments thus have a concentration of similar type tools - there will be a grinding department, a lathe shop, etc.

The steel parts - crankshaft, connecting rods, gears, etc., - are generally isolated from the aluminum/magnesium alloy departments where cylinder heads, pistons, etc., are machined.

An important part of the machine shop is the tool room where the cutting tools are resharpened, jigs and fixtures made, gauges adjusted, etc.

ASSEMBLY

Some parts, such as radial engine cylinders and cylinder heads are usually made into subassemblies before reaching this production stage. Most sub and final assembly occurs at one point however. For an aero-engine this is relatively simple and can be done in a matter of a few hours.

TESTING

Engines are tested for performance characteristics in special houses. These tests usually last four to eight hours and afterwards most plants tear down their engines, inspect them, reassemble them and test them once more. This tear down and inspection stage may be done near the assembly process or it may be some distance away.

PLANT LAYOUT

Engine plants are typical machine shops. Unlike the airframe assembly plants they need not be tall. They often consist of two or more story buildings. A well laid out integrated plant will have several sub-assembly lines feeding into a main assembly line. The layout of buildings often suggests this system. The most easily recognized out buildings are likely to be the test cells. These are of two basic types - the "hangar type" in which the engine turns a heavy wooden propeller and the "dynamometer type" where the engine is geared to an electric generator. The former type can usually be recognized from the air by one or two stacks (air inlet or exhausts) for each individual cell. Storehouses, warehouses and other out buildings are often recognizable.

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PRODUCTION PROCESSES - AIRFRAMES

METAL FABRICATION

Briefly stated there are four principal stages in airframe fabrication. These are: Metal Fabrication, Bench or Detail Work, Subassembly, and Final Assembly.

After reception of raw sheets, forgings and extrusions, metal is cut, then *machined* or *pressed* or *hammered* or *stretched* into its required shape. Besides machining and press shop facilities, heat treating equipment is utilized.

BENCH OR DETAIL WORK

In this stage the parts made in stage #1 are finished, holes are drilled in metal, and small parts are put together. These processes also include welding and polishing.

SUBASSEMBLY

In this stage the parts from stages one and two are assembled into the major parts (components) of the airframe. In this stage the relatively vulnerable jigs (frames in which parts are held in their proper relative position during machining and assembly) are used to make certain every part will be interchangeable with similar parts made before and after it. Unlike the two preceding stages, this stage of fabrication is divided among the major airframe components, and there is a wing section or shop, a fuselage shop, etc. As was mentioned above, the final fabrication process in this stage is the *assembly* of the finished parts into the completed component.

FINAL ASSEMBLY

In this stage the completed components are assembled to make the aircraft; motors, tires, armament are added and the finished airplane is ready for flight testing.

PLANT LAYOUT

Airframe assembly plants require considerable floorspace. If the plant is highly integrated - makes many of its sub-assemblies - the floorspace requirements are, of course, higher than if there is considerable sub-contracting - purchase of sub-assemblies from outside sources. The final assembly portions of the plant consist of high ceiling hangar type buildings with wide spans. Sub-assembly portions are typical machine shops, often with saw-tooth roofs. The heat treating, annodizing - treatment to prevent corrosion - and other special departments may be in the same buildings as other processes and are often difficult to locate. Special buildings such as foundries, warehouses, etc., may often be identified from aerial photographs.

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GENERAL ANALYSIS

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ANNEX I. WEAPON RECOMMENDATIONS

A. INTRODUCTION

This is one of a series of technical papers on the attack of target systems, each of which is issued as an Annex to the General Analysis of the system. It is written for technically qualified persons in AAF or Naval Air Commands engaged in selecting weapons and estimating force requirements, and is designed to assist planners in the formulation of operational orders for attacks on targets in the system.

Each Annex attempts to answer the following questions:

1. What buildings or installations constitute the primary objective; i. e., what is the vital part of the system and of each target against which the attack should be directed?

2. What is the best size, type, and fuzing of HE? If the system is atypical, in what circumstances should different types be used?

3. Should IB be used, either independently or in conjunction with HE? If so, what is the best IB, and what is the optimum quantity of IB?

4. What is the weight of attack necessary to destroy targets in the system?

B. TARGET CHARACTERISTICS, PRIMARY OBJECTIVES

The system is divided into four sub-systems, namely, Airframes, Aero Engines, Components, and Repair, Overhaul and Modification Centers.

1. Airframe Plants.

Japanese airframe plants are now fairly typical, that is similar to each other in layout, built-up density, and construction, but are not likely to remain so after dispersal. The primary objectives are the sub-assembly and metal fabrication and drop hammer shops. Final assembly is only a secondary objective. Primary objective buildings are one-story steel-framed structures, usually of multi-bay layout and with spans ranging from short to long. Roofs are predominantly of saw-tooth section and heights to eaves are from 20 to 40 feet. Roofing is lightweight corrugated asbestos or steel. Building density averages 45%. A significant proportion of the final assembly buildings are hangar-type buildings.

2. Aero Engine Plants.

Japanese aero engine plants are also fairly typical prior to dispersal, that is similar to each other in layout, built-up density and construction. The primary objectives are the machine shops. Primary objective buildings are usually one-story steel framed structures, with multi-bay layouts and short to medium spans. Roofs are predominantly of saw-tooth section and heights to eaves are rarely more than 25 feet. Roofing is lightweight corrugated asbestos or steel. Building density averages 40%.

3. Component Plants.

These are less typical because of the variety of processes. Principal buildings contain machine shops and are very much like the buildings in aero engine plants. A considerable proportion of the processes may be carried out in multi-story buildings.

4. Repair, Overhaul and Modification Centers.

These contain a larger proportion of assembly type buildings and hangars than do aircraft plants. Frequently none of the buildings can be singled out as primary objectives.

A characteristic of the system as a whole is that on average buildings are large in area and built-up density of targets is high (35–40%).

C. PHYSICAL VULNERABILITY AND DATA ON WEAPON EFFECTIVENESS

1. Vulnerability to HE.

The vulnerability of the primary objectives to HE is expressed as per classification defined in JTG/M/3/1 and explained in detail in JTG/M/8.

a. *Airframe plants.*—50% of the primary objectives are V4 structures, the remainder being V4A and V5. In view of their differences in vulnerability, each target needs accurate analysis from air cover. These types are similarly susceptible to inside blast attack and fuzing should be 0.01 nose (or 0.1 nose if not available) and non-delay tail.

b. *Aero engine plants.*—Primary objectives are usually V4 structures against which best fuzing is 0.01 nose (or 0.1 nose if not available) and non-delay tail.

c. *Component plants.*—Primary objectives are predominantly V4 structures with same fuzing as above.

d. *Repair, Overhaul and Modification centers.*—Important buildings are either hangars (V5) or assembly types (V4A). These two types are frequently difficult to differentiate on photo cover. Best fuzing is 0.01 nose (or 0.1 nose if not available) and non-delay tail.

The Mean Areas of Effectiveness (M) of the above classes are in square feet of structural damage per ton of bombs as follows:

Building classes	500 GP	1,000 GP	2,000 GP	4,000 LC
	Sq. ft.	*Sq. ft.*	*Sq. ft.*	*Sq. ft.*
V4	16,400	16,000	15,000	24,000
V4A	10,000	14,000	15,000	24,000
V5	29,000	33,400	38,500	52,000

The above average values hold only if best fuzing is used. Since the 3 classes of buildings under consideration are primarily vulnerable to blast, the 4,000 LC is the most effective weapon with the 500 a second choice against V4. V4A, because of the great strength of its trusses, requires a greater initial release of energy than the 500 GP can produce in order to start extensive collapse.

2. Vulnerability to IB.

On an average, the proportion of combustible buildings differs considerably between primary objectives and whole targets. It is low for the primary objectives, approximately 5%, but varies considerably from target to target; for the whole target, on the other hand, it is less variable from target to target and averages 25 to 30%. This is true of both airframe and aero engine plants. In repair, overhaul and modification centers and component plants the proportion of combustible buildings for the whole target is likely to be equal if not higher than for the other sub-systems, with some component plants having a high percent of combustible buildings.

The combustibility of the various industrial processes in the system is low and is defined as only slightly combustible. The average "beta" value (see section D.2 for definition) for these processes is 0.20 for aero engines and 0.25 for the other three sub-systems.

Provided the combustible portion of any target is greater than 25% (i. e. the "alpha" value is higher than 25%, see section D.2 for discussion), the use of IB's in combination with HE's will be definitely profitable. Most targets in this system fall within this category. In view of average size of buildings, roof resistance to penetration and layout of contents, the AN–M50AZ and the AN–M69 are the best available IB's with the AN–M47 a secondary choice.

D. RANGE OF GROUND DENSITIES

Two types of attacks must be considered.

1. HE Attacks.

The following table shows the ground densities (D) in tons per million square feet with a *50% probability* of achieving various levels (F) of structural damage against the three classes of buildings, V4, V4A, and V5, described in section 6.

Required densities for pure HE attacks

[Tons per million square feet of Target Area]

Building classes	Bombs	F=0.30	F=0.50	F=0.70
V4	500 GP	22	43	74
	1,000 GP	22	44	76
	2,000 GP	24	46	81
	4,000 LC	15	29	50
V4A	500 GP	33	70	120
	1,000 GP	26	50	87
	2,000 GP	24	46	81
	4,000 LC	15	29	50
V5	500 GP	12	24	42
	1,000 GP	11	21	36
	2,000 GP	9	18	31
	4,000 LC	7	13	23

The above values were computed from formula

$$F=1-e^{-MD}\left(\text{or } D=\frac{1}{M}\log_e\frac{1}{1-F}\right)$$

In pure HE attacks a bonus may be gained through fire caused by explosion. This bonus is a very variable quantity and depends primarily on the combustibility of buildings. No fire bonus is included in the above table.

The machinery used in the various targets of this system is relatively light and difficult to damage. Although blast effects and debris appear to be most effective against light machinery, one should not expect the area of machinery damage to be equivalent to structural damage. Thus a fairly high (0.50–0.70) level of structural damage should be aimed for if the purpose of the attack is to destroy a high proportion of the machinery. A lower level (0.30) can be expected to stop production in the damaged target for one to three months.

2. Combined IB and HE Attack.

In order to determine the combined ground density of HE and IB required for a given level of damage and to determine the best break down of this density into HE and IB, it is necessary to know the proportion of the target which is combustible. This proportion depends on the fraction of the building area which consists of combustible structures and on the combustibility of the contents of non-combustible structures. The exact expression is as follows:

where

$\alpha=c+(1-c)1.5\ \beta$

α=proportion of target which is combustible.

c=fraction of building area which consists of combustible buildings.

β=average fraction of contents of non-combustible buildings which is combustible.

For this target system values of c and β are given in section C above. Only if α for the whole target

is greater than 25% is it worthwhile to carry incendiaries. When incendiaries are carried, a density of 8 tons of any one of the recommended IB types available per million square feet may be expected to destroy 80% of the combustible portion (a) of the target; the remainder of the target must be destroyed by HE, and the HE density required thus depends on a and on the desired total fraction of damage.

The following table shows what density of 500 GP against V4 buildings is required in addition to an IB density of 8 tons per million square feet to achieve the indicated levels of damage.

Densities of 500 GP in addition to 8 tons IB's per million square feet in mixed load attacks against V4 buildings

[Tons per million square feet of Target Area]

Fraction of damage	α=0.30	α=0.40	α=0.50	α=0.60	α=0.70
0.30	5	None	None	None	None
0.50	26	17	11	3	None
0.70	56	48	42	33	24

The above values were computed from the approximation

$$F-0.8a=(1-0.8a)(1-e^{-MD})*$$

where

M=16,400 sq. ft/ton and D is ground density (in tons per million sq. ft)

By the same method and substituting proper values of M, other tables can be readily computed for mixed load densities of various sizes of HE bombs used in addition to the 8 tons of IB's per million square feet against various classes of building vulnerability (for instance 4,000 LC against V5 buildings). Where a variety of building types is found, an average M (weighted by plan area) should be used.

*The explanation of this formula is discussed in JTG/M/8.

E. FORCE REQUIREMENT ESTIMATES

1. High Level Bombing.

To obtain force requirements necessary to achieve ground densities indicated in the above paragraphs, usual methods of computation based on operational factors and accuracy of the air force must be followed.[1]

2. Dive Bombing.

The primary objectives in this system are sufficiently large and identifiable to be suitable aiming point for dive bombers. Furthermore the high concentration of bombs to be expected from dive bombing gives a rather high probability of destroying completely one process and thus of paralyzing production.

To obtain the number of hits required to achieve any level of damage (F), the ground density shown in section D should be multiplied by

1. the area of the objectives expressed as a fraction of 1 million square feet.
2. the number of bombs per ton.

Total force requirements will then be computed by usual methods based on accuracy of bombing.[1]

HE attacks by dive bombers will be the rule unless the selected primary objective is of combustible construction (or α of that objective=1.0), when incendiary attack on that objective will be more profitable. If the area of the objective expressed as a fraction of 1 million square feet is multiplied by 10 tons, the product will be the tonnage of IB's required to fall on the objective to give an 80% probability of its destruction. The best IB for dive attacks against single objectives is the AN–M76, but should the size of the single objective be more than 100,000 square feet or should relatively small single objectives be grouped very closely, the use of clustered AN–M50 A2 or AN–M69 is recommended. As indicated in section C above, few primary objectives in this target system are in combustible buildings.

[1] A discussion of these methods is given in JTG/M/8.

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JAPANESE AIRCRAFT INDUSTRY

PRODUCTION

SUMMARY OF CURRENT INTELLIGENCE

The latest MIS production estimate available at the time this Summary goes to press (Production Report No. 6 - 15 March 1945) shows the *rate* of production as of 1 March 1945. This estimate takes into consideration the attacks on aircraft plants through 28 February. In the case of plants which have been damaged, loss in production is based on JTG estimates of the percentage of pre-attack output which the plant was capable of turning out on 1 March, to which the MIS estimates of pre-attack production rates have been applied. The MIS estimates do not take into account the following factors.

a. Possible dispersion of the Japanese aircraft industry prior to attacks to undiscovered new branch or "shadow" plants, leaving the old factories producing either at reduced rates or not at all.

b. Combat aircraft production by new manufacturers at new plants in Japan, Manchuria or Korea.

c. Conversion of facilities producing trainers to the manufacture of combat airplanes.

d. Special priorities given to the production of selected aircraft in factories not affected by bomb damage, by increasing output of those types through extra working shifts or increased efforts.

On the basis of intelligence now available it is impossible to measure the importance of any of these factors in terms of airplanes per month.

Due to the uncertainties indicated above a fixed production rate can not be given. The accepted estimate of production rate on 1 March is between 1305 and 1750 combat aircraft per month which figure does not include transport, liaison or training planes. A breakdown between Army and Navy planes and specific types is also uncertain but a rough estimate, accurate enough for practical use, as of 1 March indicates that 70% of Japanese aircraft production was in Navy types and 30% Army planes. The disparity in the production estimate for the two services results largely from the complete destruction of the Nakajima New Ota Plant, Target 90.13-1544, which was the principal Nakajima plant making Army aircraft, and the heavy damage in January to the Kawasaki Akashi plant, Target 90.25-1547, which turned out the Army TEF Nick and engines for the Army SEF Tony and TEB Lily.

Using minimum production figures as a basis for computation, it appears that Navy SEF production had been reduced only about 3% by 1 March. On the other hand indications are that Army SEF production was reduced about 80% from peak production at that date. Here again the destruction of the Nakajima New Ota Plant with an estimated 1 January production of 240 Franks and 80 Tojos per month and the sharp reduction in engines for Tony account for this phenomenal reduction. The reduction in Army SEF production is even more pronounced as a result of the effects being felt from the January attack on the Kawasaki Akashi plant and the February attack on the Nakajima Musashino-Tama Plant, Target 90.17-357, together believed to be making all engines for Oscar. (See Progress in Counter Air Program, Report No. 3 dated 27 March included in the General Analysis).

PRESENT STRENGTH

The number of aircraft in identified tactical units as of 1 April is estimated to be 3838, of which 1783 are Army and 2055 Navy planes. This is an increase of 8 Army and a

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decrease of 235 Navy planes as compared with 1 March. The identified strength in Japan Proper is 2261 planes including 614 Army fighters, 679 Navy fighters, 187 Army bombers and 456 Navy bombers. There was a loss of only 21 aircraft in Japan Proper during March as compared with an overall reduction of 227 planes. Photography and combat crew observations continue to show large numbers of aircraft on factory airfields, depot airfields, etc. These aircraft probably have not yet been assigned to tactical units.

EXPENDITURE

Aircraft losses of the JAF continue to fall and there is lessened resistance to the continually rising scale of Allied effort, both naval and air. This may result from shortage of aircraft in tactical units, shortage of pilots or gasoline or a policy of conservation of aircraft on the part of the JAF as a result of past and anticipated attacks on their production facilities. Accepted estimates of losses during March are 1024 aircraft destroyed, 235 probably destroyed and 215 damaged. Adding 12% of average strength for non-combat losses to the 1024 aircraft destroyed gives 1506 as total loss for the month. These estimates are made in advance of complete claims or final evaluation of each reporting command and accordingly are tentative and possibly incomplete. They are, however, considered accurate within usable limits. Comparative figures for the past five months are:

November	2072
December	2008
January	2149
February	1571
March	1506

PRINCIPAL TARGETS

The principal targets in the aircraft industry and their relative importance prior to attack are shown in the General Analysis following (see ATSF/AC/1 pages 5 and 7). Some of these targets have been destroyed and others more or less seriously damaged with a resultant change in their relative importance. Any estimate of the current relative importance of targets must consider the fact that some of the engine plants attacked supply airframe plants not attacked and vice-versa. For example, although the Kawasaki Airframe Plant at Kagamigahara, Target 90.20-240 has not been attacked, it is thought that production of completed aircraft there will be severely curtailed until the production of engines affected by the damage to the Kawasaki Engine plant at Akashi, Target 90.25-1547 is restored. The possibility of stockpiling either airframes, engines, or important components such as propellers must also be considered.

Uncertainty as to the extent of damage to date, differing rates of recovery for different plants, the possibility of plant dispersal, and the possibility of undiscovered engine plants precludes any practical estimate of the percentage of engine production accounted for by individual plants. In the following table the plants are listed in the order of expected importance during April.

Aero-Engine Plants

Target No.	Plant	Location
90.20-193	Mitsubishi Aircraft Engine Works	Nagoya
90.17-357*	Nakajima Aircraft, Musashino-Tama Plant	Tokyo
90.20-2010	Aichi Aircraft Engine Works, Nagoya Plant	Nagoya
90.18-2011	Shizuoka Aircraft Engine Works	Shizuoka

*Assumes this plant was not severely damaged by the night attack on 2 April 1945.

The Hiro Naval Aircraft Factory (Target 90.30-660) is known to manufacture some engines and it may be more important than some of the plants listed above. The lack of good quality photography and meager ground intelligence prohibits assessment of its importance as a target at this time.

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Since production at a number of undamaged airframe plants may be curtailed by lack of engines as a result of attack on engine plants and further attack on engine plants will limit production at all of them in varying degrees, it is difficult to estimate their current relative importance.

The following plants are generally believed to be the principal airframe producers although major facilities may have been dispersed to unknown locations. There is little evidence one way or another on dispersal of undamaged plants.

Airframe Plants

Target No.	Plant	Location
90.13-1545	Nakajima Aircraft, Koizumi Plant	Koizumi
90.20-194	Mitsubishi Aircraft Works	Nagoya
90.17-792	Tachikawa Aircraft	Tachikawa
90.20-240	Kawasaki Aircraft, Kagamigahara	Gifu
90.27-1681	Mitsubishi Aircraft, Mishima Plant	Tamashima

A newly discovered plant in a converted textile mill near Himeji is believed to be assembling the new Navy SEF George. This plant has been assigned a target name and number - Kawanishi Aircraft, Himeji Plant, Target 90.27-2047. On the basis of floor space analysis, it is estimated that this plant has a capacity of at least 75 SEF per month which will be reached in the near future. Other sources indicate this plant as currently producing 35 Georges per month.

Information on the production of propellers is believed to be more exact than that regarding any other major aircraft component. Since publication of this Summary for March fair quality photography of the Sumitomo Metal Industry plant, Target 263B, has been examined and no indication of propeller manufacture found. On the basis of this and re-examination of ground intelligence this plant has been dropped from the list of propeller manufacturers. The revised list follows:

Target No.	Plant	Area	% Production of Combat Propellers
90.25-2041	Sumitomo Kanzaki Propeller Plant	Osaka)	60-70
Part of Target 90.25-263A	Sumitomo Osaka Propeller Plant #1	Osaka)	
90.21-1219	Japan Musical Instrument Propeller Plant	Hamamatsu	20-30
90.17-2015	Japan International Aircraft, Hiratsuka Plant	Tokyo	Less than 20

Attack on these propeller plants immediately following neutralization of the major engine plants would delay recovery of engine manufacture by setting up competing demands on the machine tool industry as well as causing shortages of some critical types of propellers. For maximum effectiveness, however, such attack should follow engine plant attack closely in order to eliminate the stockpiling of propellers.

DISPERSAL AND REPAIR

Dispersal of the aircraft industry to mid-March is covered by a special report dated 19 March included as Annex No. II to the General Analysis. Since that report was written additional photography shows that repair of the Kawasaki Aircraft, Akashi Plant, Target

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90.25-1547, has continued. Recent photography also shows that some buildings at the Kawanishi Naruo Plant, Target 90.25-18, have been removed. This is probably another example of the Japanese practice of removing combustible buildings or buildings containing combustible contents in order to lessen the fire hazard.

Since publication of Annex II, photography of Omura Aircraft Factory, Target 90.36-1627 has been received. Photographs show no evidence of repair to this plant, but there is indication of new construction. Building 125, a large assembly building, sustained some structural and substantial superficial damage in previous attacks. New building activity is going on within the framework of this structure but there is no re-roofing of the original framework.

A basement has been excavated along the side of building 124 and roofed over. There is no indication of the purpose of this Construction.

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ANNEX NO. II

to

JAPANESE AIRCRAFT INDUSTRY - GENERAL ANALYSIS

PRELIMINARY ASSESSMENT OF JAPANESE PATTERN OF REPAIR AND DISPERSAL OF AIRFRAME AND AERO-ENGINE PLANTS

SUMMARY

Dispersal to and repair of the Japanese airframe industry noted thus far presents a pattern which is far from clear but which permits a few generalizations. It appears that to date greater effort has been made to repair moderately damaged aero-engine plants than airframe plants. Also, pre-raid dispersal of both types of plants largely has been one of removal of storage, the most combustible facilities. Finally, in the one clear-cut case of dispersal of an entire plant, the most probable explanation is that the plant had not yet been tooled up for engine production and hence its removal did not involve any loss of current production.

AERO-ENGINE PLANTS

Pre-Attack Dispersal

Of the three instances noted, two are quite similar in the pattern they present.

The Hitachi Engine Plant at Tachikawa (Target 90.17-2009) and the new Shizuoka Engine Works, probably Mitsubishi, (Target 90.18-2011) have had storage sheds removed prior to any attack. Alternate sheds were removed which strongly suggests that a reduction in fire hazard is the prime reason for dispersal. These sheds may have been of wooden construction and their combustible contents in addition to their compact grouping would make them highly vulnerable to fire damage.

On the other hand the nearly new Nakajima plant at Hamamatsu, (Target 90.20-2012) was almost completely removed. It appears highly unlikely that the razing of this site was caused by the 7 Dec 44 earthquake, the center of which was about 150 miles off the coast, but most probably is the result of complete dispersal of this plant. It is significant that this was a newly constructed plant which was probably not in production - in fact may well not have been tooled up. Thus, its removal probably did not cost the Japanese any immediate engine production, but may have set forward the future production of engines.

Post Attack Dispersal and Repair

There is no clear cut pattern observed following bombing of engine plants. In general while light to moderate damage to productive buildings has been repaired Kawasaki has repaired severe damage at its Akashi plant while Mitsubishi has not repaired some damage at its Nagoya plant.

The light damage to the Nakajima Musashino-Tama Plant (Target 90.17-357) was quickly repaired and flak was greatly strengthened and there is some evidence that some processes were moved underground. Similar repairs were made to part of this company's Ogikubo plant (Target 90.17-356). However, no effort was made to restore damaged storage facilities at Ogikubo.

Repairs were started to the more lightly damaged portions of the Hitachi Tachikawa Engine Plant (Target 90.17-2009). Additional post attack cover is needed before it can be determined whether or not the buildings more seriously damaged in the Navy strike are being repaired. As noted above, dispersal of storage sheds had been underway prior to this attack.

Repairs were quickly undertaken to the less severely damaged buildings at the Mitsubishi Engine Works in Nagoya (Target 90.20-193), but the moderately damaged machine and assembly shop was not repaired. In this instance it appears that the

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Japanese were following classic German practice of not making major repairs and abandoning those facilities severely damaged.

Heavy damage was done to the main machine shop at the Kawasaki Engine Plant at Akashi (Target 90.25-1547) and it was predicted in the damage assessment report that this building would be abandoned. The immediate post raid cover showed great truck activity which was interpreted as being dispersal of undamaged contents. Repairs were started in the less severely damaged facilities in the first month after the attack. The most recent cover available, taken some six weeks after the attacks, shows that repairs have been instigated in the heavily damaged machine shop, but it is still too soon to predict whether the entire building will be rebuilt.

AIRFRAME PLANTS
Pre-Attack Dispersal

At both the Nakajima New Ota (Target 90.13-1544) and Koizumi (Target 90.13-1545) plants extensive efforts were apparently made to clean up the site areas. Storage buildings in the roads at Ota and the long sheds besides each production shop at Koizumi were torn down in an effort, apparently, to create as large a series of fire breaks as possible. In addition, some buildings tentatively identified as machine shops at Koizumi and parts and post assembly shops at Ota were also removed prior to the attacks on these plants. It is quite possible that these buildings were improperly identified and were storage buildings rather than machine shops. Since many of these buildings lie peripheral to the plant sites, it seems unlikely that their removal represents further effort to clean up these plants. Another possibility is that the process identifications of these buildings is substantially correct and that their removal represents the beginning of true dispersal of processes lying relatively deep in the production cycle. In either case the number of true storage type buildings removed is larger than those which may house fabrication processes.

Buildings seen under construction in the first cover of the Mitsubishi Mishima Plant (Target 90.27-1681) were still being erected at the date of the latest cover. Apparently, however, they are not to be as large as was originally planned. Presumably even this partially dispersed site is not considered too safe.

A part of the subassembly section of the Manchuria Aircraft Plant No. I at Mukden (Target 93.3-177) was removed prior to the attacks on this plant and in the same time interval, a shed like building was given north light roofing. It is not believed that this represents dispersal but might have been a result of a civil fire which necessitated the changes noted.

Post Attack Repair and Dispersal

In general the Japanese have shown a greater reluctance to rebuild bombed airframe plants than they have engine plants.

Mitsubishi has made no effort to repair any part of its Nagoya airframe plant (Target 90.20-194) regardless of the severity of the damage.

A similar reluctance to rebuild in situ was noted at the new plant at Omura (Target 90.36-1627), part of which may be producing engines. Several buildings were razed after the attack but the time lag between strike and post raid cover makes it impossible to determine how much of this destruction was due directly to bombing and how much to cleaning up following damage by bombing.

As pointed out above, the heavily damaged engine section of the Kawasaki plant at Akashi is being repaired. While there are very slight indications that the airframe section may be under repair, cover to date is not sufficient to reach even a tentative conclusion on this point.

The most recent cover of the Nakajima plants at Ota and Koizumi was taken only two days after the carrier borne attacks on 25 Feb. It is still too early to determine whether they will be rebuilt. However, the pattern of Japanese dispersal to date suggests that major repair will not be undertaken.

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PROGRESS IN COUNTER AIR PROGRAM

REPORT NO. 3

TWENTIETH AIR FORCE ATTACKS

Area attacks against the large industrial cities in central Honshu consumed most of the effort of the XXI Bomber Command during March. Attacks on Tokyo, Nagoya, Osaka and Kobe resulted in heavy damage to a few large plants in these cities and destruction of many small industries. While data on the results is far from complete no serious damage to major units in the aircraft industry is known to have resulted. However, many small factories making components for aircraft and aero-engines are known to have been destroyed. It is likely that aircraft production will suffer as a result of these attacks and that recuperation of aircraft plants already damaged and those which will be damaged in the future will be delayed. To date, however, there is insufficient knowledge both as to the extent of damage and the importance of the factories affected to permit any quantitative assessment of the results.

On 4 March the Mitsubishi Aircraft Engine Works at Nagoya was the primary target for a large force of XXI Bomber Command B-29s but weather conditions forced the attack to be diverted to a secondary target. On 24 March about 220 planes made a night attack on the same target with results reported good to excellent.

In addition, both the XXI Bomber Command and naval aircraft attacked major overhaul/ repair/ modification centers and important operational airfields in Kyushu and navy planes attacked airfields in the Inland Sea area. The attacks by the XXI Bomber Command were made on 27 March. The Naval Air Depots at Omura, Kanoya and Oita and the Army Air Depot at Tacharai were the targets. All are known to be 4th echelon repair centers, storage areas for aircraft supplies and probable modification centers. In addition there is known to be some aircraft manufactured at Omura, and there are large buildings at the other three Depots which are probably now engaged in repair or modification, but which can be used for manufacture under a program for dispersed production. While these attacks are not believed to have greatly reduced current aircraft production, they could, if serious damage to the installations and equipment resulted, substantially dislocate the repair and overhaul system of the enemy and reduce to a measurable degree serviceability of the JAF in southern Japan. This dislocation, however, is not likely to have a very long range effect.

In the table attached the damage to those targets known to have a substantial built-up area devoted either to manufacture or major repair is summarized.

CARRIFR BORNE ATTACKS

Since the publication of Report No. 2 in this series, both strike and post attack photography covering the 16-17 and 25 February missions by the Navy have reached Washington. This permits more accurate assessment of the results of these missions than was possible at the time Report No. 2 was written.

It now appears that the Nakajima Aircraft, New Ota Plant, Target 90.13-1544, which was heavily damaged by XXI Bomber Command attack on 10 February, was for all practical purposes completely destroyed by Navy bombers on 16-17 February. Loss in completed aircraft will amount to at least 4 months output at this plant over a period of 6 months -- a total of over 1400 aircraft. The 25 February Navy attack on the Nakajima Airframe Plant at Koizumi, Target 90.13-1545, inflicted moderate damage and should result in loss of about 650 aircraft. The 25 February missions against the Hitachi Aircraft Engine Plant at Tachikawa, Target 90.17-2009, and the Tachikawa Aircraft Company, Target 90.17-792, resulted in comparatively little damage.

Preliminary assessment of damage by Navy bombers to the Nakajima Aircraft Musashino-Tama Plant, Target 90.17-357, on 17 February indicates that production of about 1100 Army

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and 1100 Navy engines will be lost. This plant is still, however, an important engine plant unless the equipment has since been dispersed.

Navy attacks during March included missions between 17th and 21st against the Omura, Kanoya and Oita Naval Air Depots also attacked by XXI Bomber Command. In addition attacks were made on operational airfields in both Kyushu and the Inland Sea area. While assessment of damage is not possible at this time the results to be expected are indicated above.

In the table attached to this report the results of attack on airframe, aero-engine and overhaul/repair/modification centers with large buildings have been included. Operational airfields with only relatively small hangars have not been included.

PRODUCTION LOSS

On the basis of more complete information concerning the Navy strikes in February, production losses of combat aircraft to 1 March 1945 have been revised as follows:

Production Loss from Attacks on Airframe Plants

Nakajima, Ota	90.13-1544	1400 a/c
Nakajima, Koizumi	90.13-1545	650 a/c
Kawasaki, Akashi	90.25-1547	200 a/c
Omura	90.36-1627	125 a/c
Mitsubishi, Nagoya	90.20-194	125 a/c
		2500

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
Nakajima, Musashino	90.17-337	2,200 engines	300-1000 a/c*
			1825-2525
		Total Loss	4325-5025

* - Because of attacks on Nakajima Airframe plants using engines produced by Nakajima Musashino aircraft loss may be duplicated by attack on this plant. Present information is not sufficient to make a complete separation of the losses but they are estimated to be within the limits stated of 300 to 1000 aircraft.

The 27 March attack on the Mitsubishi engine works in Nagoya, Target 90.20-193 is not included in this computation, no direct loss is attributed to the area attacks, and no consideration is given to delay caused by bombing in putting new plants into production. The figures are, therefore probably conservative. The production rate as of 1 April is estimated to be between 60 and 70% of planned production.

DESTRUCTION OF AIRCRAFT

Aerial opposition to the night attacks during March on Honshu by the XXI Bomber Command have met much less opposition than most of the previous daylight attacks and enemy losses were correspondingly lighter. No claims as a result of the 27 March mission against Kyushu have been received.

The Navy missions on 17-21 March met aerial opposition and a large number of aircraft were destroyed on the ground. More than 700 enemy planes were claimed as destroyed or damaged.

NOT TO BE TAKEN INTO THE AIR

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REPORT NO. 3 - 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.	The foregoing assessment of damage does not include XXI B.C. and Navy attacks in March since preliminary reports do not make clear whether the aircraft plant or the adjoining Naval Air Depot were attacked. See note of attacks on Omura Naval Air Depot. Target 90.36-849 following.
	#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 See comments	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 on 17 Feb. had been repaired. The loss in finished engines was negligible up to that time. The Navy strike inflicted moderate damage estimated to result in loss of about 1100 army and 1100 navy engines.	Assessment based on rather poor photography.
	#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 15 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. Note: Assessment does not include damage by attack on 24 March since photos have not reached Washington. Field reports indicate considerable damage to new section making 18 cylinder 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. Some indication that 14 cylinder production is dispersed. Certainly the eastern section making 18 cylinder engines is most important unless heavily damaged on 24 February.
	#14 22/12/44	XXI B. C.	130		
	#21 23/1/45	XXI B. C.	117		
	#34 15/2/45	XXI B. C.	104		
	24/3/45	XXI B. C.			
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.	Substantial repair to the engine section and some little repair to the airframe section appears to be underway. This plant may attain target value by the middle of April.

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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 #19 14/1/45	XXI B. C. XXI B. C.	154 128	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.	Recent photography shows little repair and much clearing. It is probable that considerable dispersal has taken place.
Nakajima Aircraft, New Ota Plant (Target 90. 13- 1544)	#29 10/2/45 17/2/45	XXI B. C. Navy	118	Heavy damage from XXI Bomber Command attack resulted in loss of at least 900 aircraft. The following Navy attack completed destruction and raised the loss of at least 1400 aircraft.	Complete returns from the Navy show that this plant was not attacked on 27 Feb. as stated in report No. 2.
Tachikawa Aircraft (Target 90. 17-792)	17/2/45	Navy		Moderate damage to new section not believed to be in production; little damage to section in mass production of combat type.	Based on rather poor photography.
Hitachi Aircraft, Tachikawa Plant (Target 90. 17- 2009)	17/2/45	Navy		Moderate damage resulting in loss of 1½ months output. Little information as to type of engine produced.	Probably not high priority engine target.
Nakajima Aircraft, Koizumi Plant (Target 90. 13- 1545)	25/2/45	Navy		Moderate damage resulting in loss of about 650 aircraft.	Plant will be in substantial production six weeks after attack unless equipment is moved.
Oita Naval Air Station (Target 90. 33 - 1308)	17 to 21 March	Navy XXI B. C.			No photographs - Communiques report damage.
Omura Naval Air Depot (Target 90. 36 - 849)	17 to 21 March 27/3/4	Navy XXI B. C.			No photographs - Communique from Navy and preliminary report from XXI B. C. indicate good to excellent results.
Kanoya Naval Air Sta. (Target 90. 38 - 1378)	17 to 21 March 27/3/45	Navy XXI B. C.			No photographs - Communique from Navy and preliminary report from XXI B. C. indicate good to excellent results.
Tacharai Army Air Depot (Target 90. 35 - 1236)	27/3/45	XXI B. C.			No photographs - Preliminary report indicates good to excellent results.

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JOINT TARGET GROUP-WASHINGTON, D. C.

TABLE 1
PRINCIPAL JAPANESE OPERATIONAL AIRCRAFT, THEIR PRODUCERS AND ENGINES
15 DECEMBER, 1944

Type	Model	Est. Production 12/44	Produced by		Engine Used	Engine Manufacturer	
			Name	Target No.		Name	Target No.
S.E. Fighters	Zeke 52	265	Nakajima Koizumi	90.13-1545	Sakae 21	Nakajima-Musashi	90.17-357
		50	Mitsubishi Nagoya	90.20-194	Sakae 31	Ishikawajima	90.17-1391
	Oscar	270	Nakajima Ota	90.13-1544	Type 2, 1150	Nakajima-Musashi	90.17-357
			Tachikawa A/C Co.	90.17-792		(and Kawasaki Akashi)	90.25-1547
	Tony	150	Kawasaki-Gifu	90.20-240	Type 2, 1100	Kawasaki Akashi	90.25-1547
	Frank	100	Nakajima Ota	90.13-1544	Ha 45	Nakajima-Musashi	90.17-357
	Sam	60	Mitsubishi-Nagoya	90.20-194	Homare	Nakajima-Musashi	90.17-357
	George	55	Kawanishi Naruo	90.20-240	Homare	Nakajima-Musashi	90.17-357
	Jack	50	Mitsubishi Nagoya	90.20-194	Kasei 23	Mitsubishi Nagoya	90.20-193
	Tojo	50	Nakajima Ota	90.13-1544	Type 2, 1450	Nakajima-Musashi	90.17-357
	Rex	25	Kawanishi-Naruo	90.25-18	Kasei 13/24	Mitsubishi Nagoya	90.20-193
	Luke	3	Mitsubishi Nagoya	90.20-194	Kasei 24	Mitsubishi Nagoya	90.20-193
	Steve	3	?	?	Ha 104	Mitsubishi Nagoya	90.20-193
	Rufe	15	Nakajima Handa	90.20-1635	Sakae 21	Nakajima Musashi	90.17-357
						Ishikawajima Tomioka	90.17-1391
	Pat	3	Tachikawa A/C Co.	90.17-792	?	?	?
T.E. Fighters	Nick	75	Kawasaki Gifu	90.20-240	Type 1, 1050	Ishikawajima	90.17-1391
	Irving	45	Nakajima-Koizumi	90.13-1545	Sakae 21	Nakajima-Musashi	90.17-357
	Denko	5	Aichi Nagoya	90.20-1729	Homare	Nakajima-Musashi	90.17-357
	Tenrai	2	Kawanishi Naruo	90.25-18	Homare	Nakajima-Musashi	90.17-357
	Ki 80	2	Nakajima-Ota	90.13-1544	?	?	?
T.E. Bombers	Lily	80	Kawasaki Gifu	90.20-240	Type 2, 1150	Kawasaki Akashi	90.25-1547
						(Nakajima Mishima)	(and 90.17-357)
	Betty	75	Mitsubishi Nagoya	90.20-194	Kasei 21	Mitsubishi Nagoya	90.20-193
			Mitsubishi Mishima	90.27-1681			
	Frances	75	Nakajima Koizumi	90.13-1545	Kasei 25	Mitsubishi Nagoya	90.20-193
					Homare	Nakajima Musashi	90.17-357
	Peggy	50	Mitsubishi Nagoya	90.20-194	Ha 104	Mitsubishi Nagoya	90.20-193
	Helen	40	Nakajima-Ota	90.13-1544	Type 2, 1450	Nakajima-Musashi	90.17-357
	Taizan	15	Mitsubishi Nagoya	90.20-194	Ha 104 ?	Mitsubishi Nagoya	90.20-193 ?
	Ki 82	2	Nakajima Ota	90.13-1544	Homare ?	Nakajima Musashi	90.17-357
	Ki 83	2	Mitsubishi Nagoya	90.20-194	Ha 104 ?	Mitsubishi Nagoya	90.20-193 ?
S.E. Bombers	Kate	20	11th Naval Air-Hiro	90.30-660	Sakae 11	Nakajima Mishima	90.17-357
	Judy	130	Aichi Nagoya	90.20-1729	Atsuta	Aichi Nagoya	90.20-2010
	Jill	50	Nakajima Koizumi	90.13-1545	Kasei 25	Mitsubishi Nagoya	90.20-193
	Grace	15	21st Naval Air Omura	90.36-1627	Homare	Nakajima Musashi	90.20-193
			Aichi Nagoya	90.20-1729			
T.E. Recce	Dinah) Clara) Edna)	60	Mitsubishi Nagoya	90.20-194	Type 1, 1050	Mitsubishi Nagoya	90.20-193
			Tachikawa A/C Co.	90.17-792	Ha 104 ?	Mitsubishi Nagoya ?	90.20-193 ?
			Mitsubishi Nagoya	90.20-194			
S.E. Recce	Sonia) Ki 65)	70	(Mitsubishi Nagoya	90.20-194	Type 99, 950	Mitsubishi Nagoya	90.20-193
			(Rikugun Arsenal	90.17-2008			
			Mitsubishi Nagoya	90.20-194	?	?	?
	Jake	40	Watanabe Aircraft Plant (Kyushu Hikoki)	90.35-662	Kinsei 43/44	(Mitsubishi Nagoya	90.20-193
						(11th Naval Air Hiro	90.30-660
	Pete	30	21st Naval Air Omura	90.36-1627	Zuisei 13	Mitsubishi Nagoya	90.20-193
	Paul	20	Aichi Nagoya	90.20-1729	Kinsei 54	Mitsubishi Nagoya	90.20-193
	Norm	10	Kawanishi Naruo	90.25-18	Kasei 24	Mitsubishi Nagoya	90.20-193
	Myrt	15	Nakajima Koizumi	90.13-1545	Homare	Nakajima Musashi	90.17-357

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JOINT TARGET GROUP-WASHINGTON, D. C.

Sheet No. ATSF/AC/T2
Date 10 JANUARY 1945
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TABLE 2
PRINCIPAL JAPANESE ENGINES, THEIR PRODUCERS AND PLANES USING THEM
NOVEMBER 1944

Engine	Made by		Est. Production 11/44	Used in	Airframe Made by	
	Plant	Target No.			Plant	Target No.
Sakae 21/31	Nakajima Musashi	90.17-357	530	Zeke 52	Mitsubishi Nagoya	90.20-194
					Nakajima Koizumi	90.13-1545
				Irving	Nakajima Koizumi	90.13-1545
				Rufe	Nakajima Handa	90.20-1635
Homare	Nakajima Musashi	90.17-357	355	Frances, Myrt	Nakajima Koizumi	90.20-1635
				Ki 82	Nakajima Ota	90.13-1544
				Sam	Mitsubishi Nagoya	90.20-194
				Tenrai, George	Kawanishi Naruo	90.25-18
				Grace	21st Naval Air Omura	90.36-1627
					Aichi Nagoya	90.20-1729
				Denko	Aichi Nagoya	90.20-1729
Sakae 11	Nakajima Musashi	90.17-357	30	Kate	11th Naval Air Hiro	90.30-660
Type 2, 1150	Nakajima Musashi	90.17-357	475	Oscar	Nakajima Ota	90.13-1544
					Tachikawa A/C Co.	90.17-792
Ha 45	Nakajima Musashi	90.17-357	140	Frank	Nakajima Ota	90.13-1544
Type 2, 1450	Nakajima Musashi	90.17-357	180	Helen, Tojo	Nakajima Ota	90.13-1544
	Total Nakajima		1710			
Kasei 13/24	Mitsubishi Nagoya	90.20-193	100	Norm, Rex	Kawanishi Naruo	90.25-18
				Luke	Mitsubishi Nagoya	90.20-194
21	Mitsubishi Nagoya	90.20-193	350	Betty	Mitsubishi Nagoya	90.20-194
					Mitsubishi Mishima	90.27-1681
22	Mitsubishi Nagoya	90.20-193	65	Emily	Kawanishi Naruo	90.25-18
23	Mitsubishi Nagoya	90.20-193	70	Jack	Mitsubishi Nagoya	90.20-194
25	Mitsubishi Nagoya	90.20-193	170	Jill, Frances	Nakajima Koizumi	90.13-1545
Kinsei 43/44	Mitsubishi Nagoya	90.20-193	70	Jake	Aichi Nagoya	90.20-1729
				Kate	11th Naval Air Hiro	90.30-660
53	Mitsubishi Nagoya	90.20-193	170	Tabby	Showa Aircraft	
54	Mitsubishi Nagoya	90.20-193	100	Paul, Val	Aichi Nagoya	90.20-1729
Zuisei 13	Mitsubishi Nagoya	90.20-193	40	Pete	21st Naval Air Omura	90.36-1627
Type 1, 1050	Mitsubishi Nagoya	90.20-193	300	Nick	Kawasaki Gifu	90.20-240
				Dinah	Mitsubishi Nagoya	90.20-194
Type 99, 900	Mitsubishi Nagoya	90.20-193	100	Thelma	Tachikawa A/C Co.	90.17-792
				Sonia	Mitsubishi Nagoya	90.20-194
Ha 104	Mitsubishi Nagoya	90.20-193	250	Peggy	Mitsubishi Nagoya	90.20-194
				Edna	Rikugun Arsenal?	
				Clara	Tachikawa A/C Co.	90.17-792
	Total Mitsubishi		1785			
Type 2, 1150	Kawasaki Akashi	90.25-1547	225	Lily	Kawasaki Gifu	90.20-240
Type 2, 1100	Kawasaki Akashi	90.25-1547	210	Tony	Kawasaki Gifu	90.20-240
	Total Kawasaki		435			
Atsuta	Aichi Nagoya	90.20-2010	180	Judy	Aichi Nagoya	90.20-1729
Sakae 21	Ishikawajima Tomioka	90.17-1391	60±	Zeke	Mitsubishi Nagoya	90.20-194
					Nakajima Koizumi	90.13-1545
Kinsei 43/44	11th Naval Air Hiro	90.30-660	60±	Jake	Aichi Nagoya	90.20-1729

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REPORT 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.
	#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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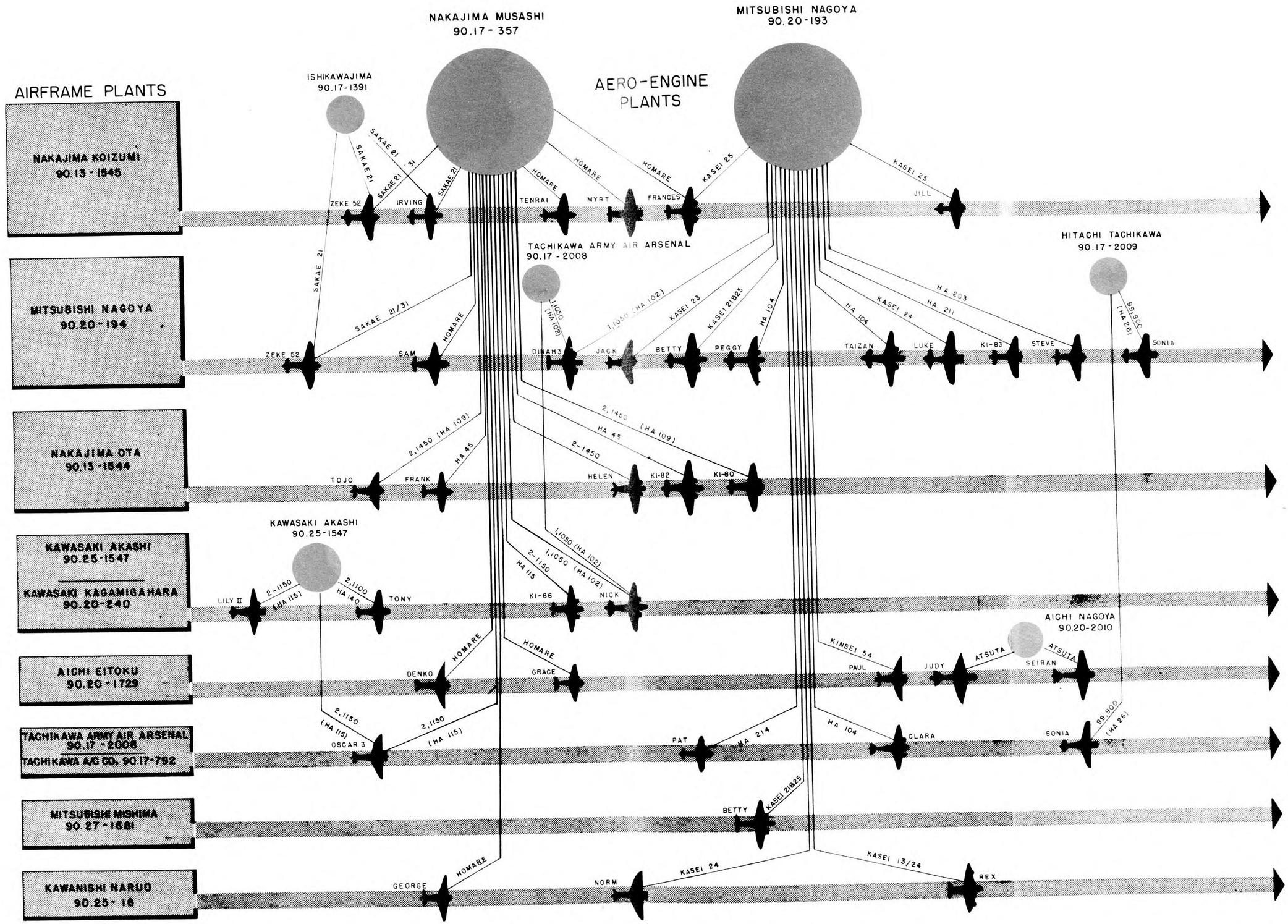
JOINT TARGET GROUP-WASHINGTON, D. C.

Sheet No. ATSF/AC/D/1
Date 2 March 1945

AIR TARGET SYSTEM FOLDER-JAPANESE AIRCRAFT
MAIN AIRFRAME AND AERO-ENGINE PLANTS JANUARY 1945



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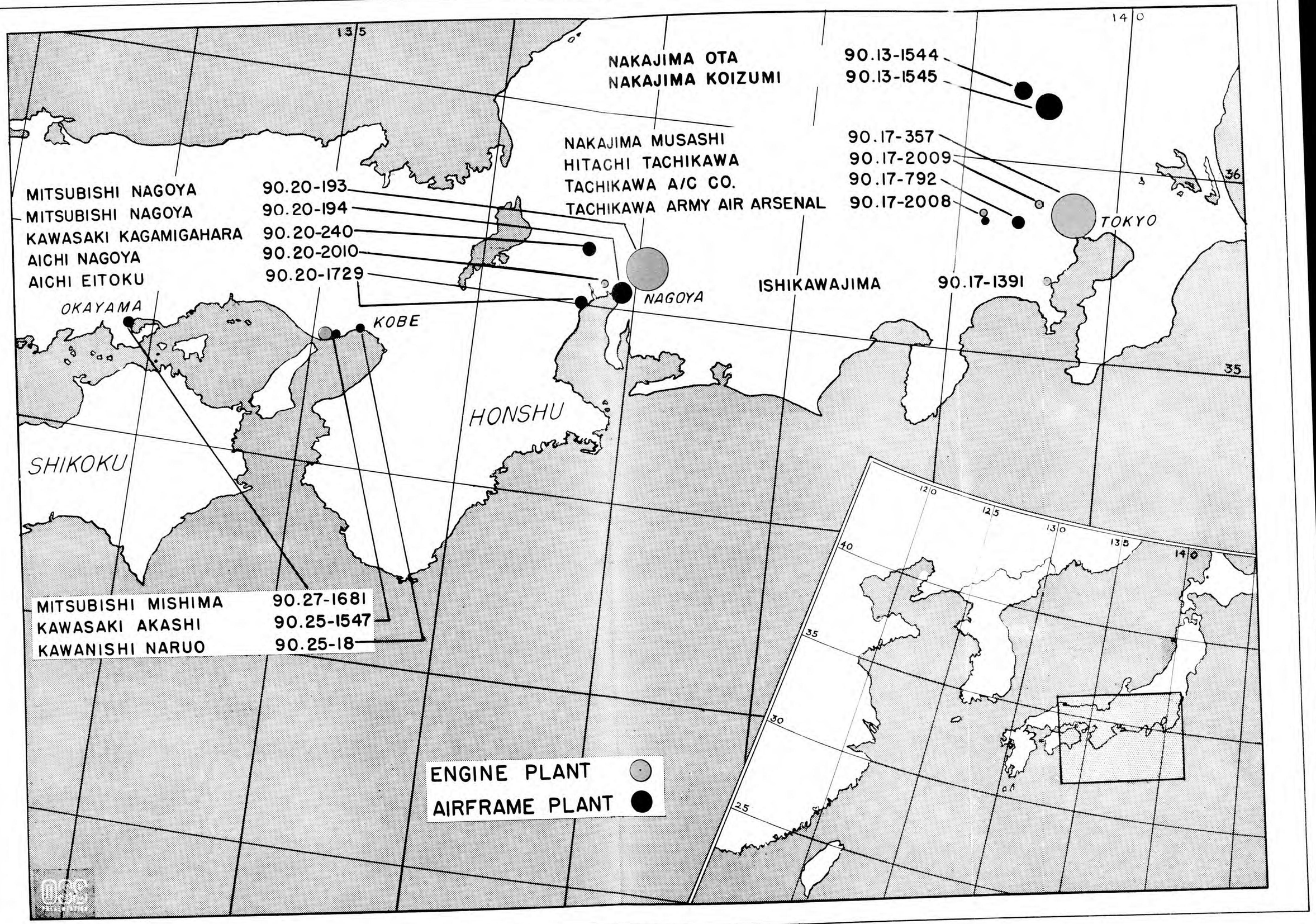
JOINT TARGET GROUP-WASHINGTON, D. C.

Sheet No. ATSF/AC/D2
Date 2 March 1945

AIR TARGET SYSTEM FOLDER—JAPANESE AIRCRAFT

LOCATION AND CONCENTRATION OF MAIN AIRFRAME & AERO-ENGINE PLANTS



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JOINT TARGET GROUP-WASHINGTON, D. C.

Sheet No. ATSF/AC/MI
Date 9 JAN. 1945
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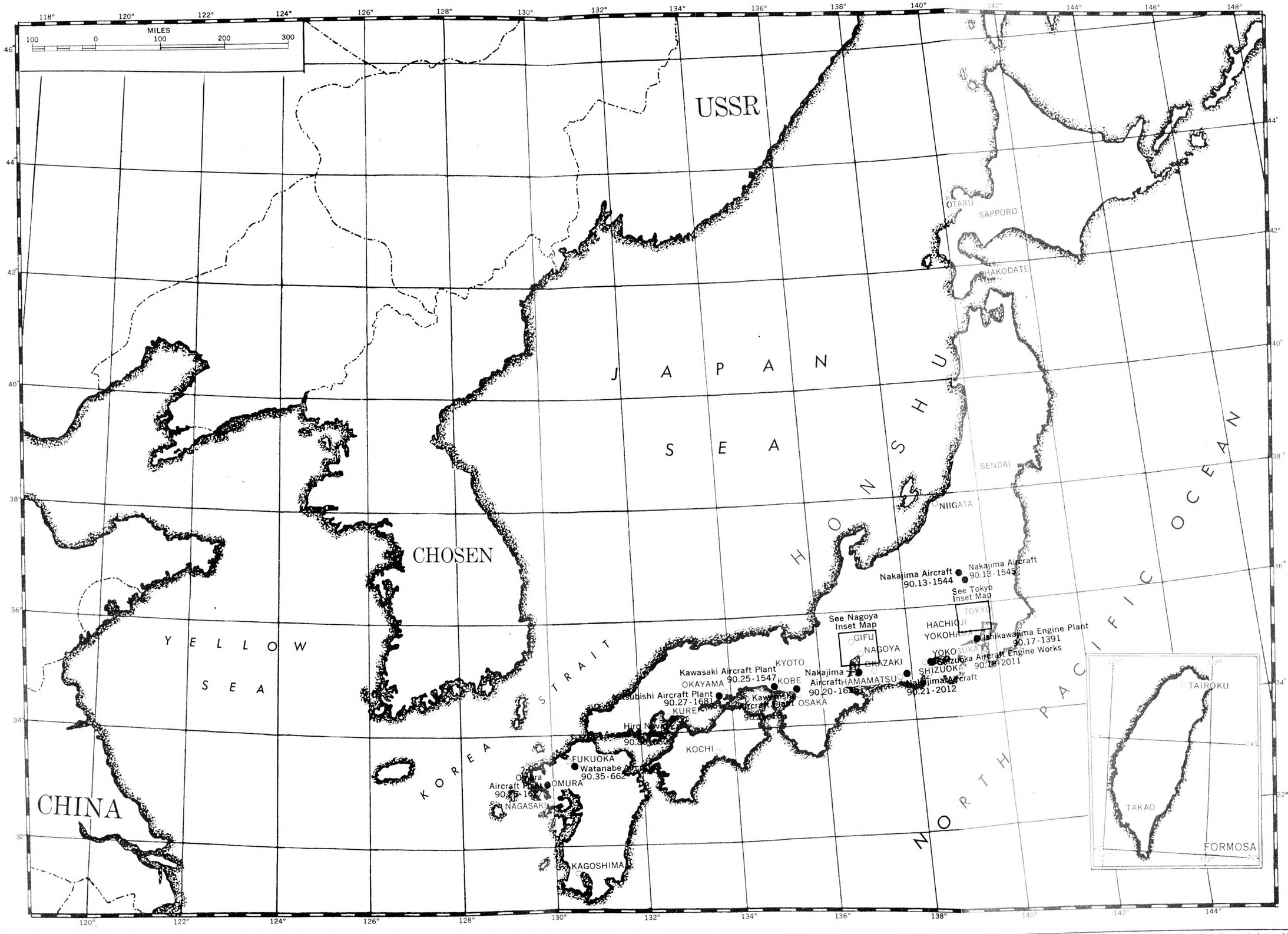
AIR TARGET SYSTEM FOLDER—JAPANESE AIRCRAFT—GENERAL LOCATION MAP



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Prepared at the direction of the Commanding General, Army Air Forces,
Aeronautical Chart Service, by the U. S. Coast and Geodetic Survey,
Washington, D. C. for AC AS Intelligence.
January, 1945

Location Map

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JOINT TARGET GROUP-WASHINGTON, D. C.

Sheet No. ATSF/AC/M2
Date 9 JAN. 1945
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AIR TARGET SYSTEM FOLDER—JAPANESE AIRCRAFT—TOKYO INSET

SECRET

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JOINT TARGET GROUP-WASHINGTON, D. C.

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AIR TARGET SYSTEM FOLDER—JAPANESE AIRCRAFT—NAGOYA INSET

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January, 1945

Target Material

Joint Target Group, Washington, D. C.

AIR TARGET INDEX — JAPANESE WAR
PART I — SYSTEM INDEX

AIRCRAFT

Target Name	Place Name	Target Number
Aichi Aircraft Eng. Wks., Atsuta Plant	Nagoya (Japan)	90.20–2010
Aichi Aircraft Works, Tsukiji Plant	Nagoya (Japan)	90.20–1828
Hiro Naval Aircraft Factory	Hiro (Japan)	90.30–660
Hitachi Aircraft, Tachikawa	Tachikawa (Japan)	90.17–2009
Hitachi–Solex Aircraft Co., Totsuka	Totsuka (Japan)	90.17–1390
Ishikawajima Engine Plant, Tomioka	Tomioka (Japan)	90.17–1391
Ito Aircraft Plant, Tsudanuma	Chiba (Japan)	90.14–1519
Japan Mus Inst Propeller Plant	Hamamatsu (Japan)	90.21–1219
Kanegafuchi Aircraft Plant	Tokyo (Japan)	90.17–1394
Kawanishi Aircraft Co., Fukae	Fukae (Japan)	90.25–1702
Kawanishi Airplane Co., Naruo	Naruo (Japan)	90.25–18
Kawasaki Aircraft Co., Akashi	Akashi (Japan)	90.25–1547
Kawasaki Aircraft Works, Kagamigahara	Gifu (Japan)	90.20–240
Manchuria Airplane Mfg. Co., Plant No. 1	Mukden (Manchuria)	93.3–177
Manchuria Airplane Mfg. Co., Plant No. 2	Mukden (Manchuria)	93.3–45
Mitsubishi Aircraft Co., Shibaura Plant	Tokyo (Japan)	90.17–327
Mitsubishi Aircraft Co., Oimachi	Tokyo (Japan)	90.17–799
Mitsubishi Aircraft Co., Kagamigahara	Gifu (Japan)	90.20–1838
Mitsubishi Aircraft Co., Mishima	Mishima (Japan)	90.27–1681
Mitsubishi Aircraft Engine Wks.	Nagoya (Japan)	90.20–193
Mitsubishi Aircraft Works	Nagoya (Japan)	90.20–194
Nakajima Aircraft, Ogikubo Plant	Tokyo (Japan)	90.17–356
Nakajima Aircraft, Musashino Plant	Tokyo (Japan)	90.17–357
Nakajima Aircraft, Tanashi Foundry	Tokyo (Japan)	90.17–539
Nakajima Aircraft, Hamamatsu Plant	Hamamatsu (Japan)	90.21–2012
Nakajima Aircraft Co., Koizumi	Koizumi (Japan)	90.13–1545
Nakajima Aircraft Co., Ota Pts. Plt.	Ota (Japan)	90.13–789
Nakajima Aircraft Plant, Koromo	Koromo (Japan)	90.20–1834
Nakajima Aircraft Plant, New Ota Plant	Ota (Japan)	90.13–1544
Nakajima Aircraft Works, Handa	Handa (Japan)	90.20–1635
Nakajima Seaplane Works	Tokyo (Japan)	90.17–332
Okamoto Aircraft Works, Tarui	Tarui (Japan)	90.20–1736
Okayama Aircraft Plant	Okayama (Formosa)	91.6–166
Omura Aircraft Plant	Omura (Japan)	90.36–1627
Shizuoka Aircraft Engine Plant	Shizuoka (Japan)	90.18–2011
Shoda Aircraft Co.	Tokyo (Japan)	90.17–1395
Showa Aircraft	Tokyo (Japan)	90.17–791
Showa Aircraft Factory, Mirin	Heijo (Korea)	84.3–65
Tachikawa Aircraft	Tachikawa (Japan)	90.17–792
Tachikawa Army Air Arsenal	Tachikawa (Japan)	90.17–2008
Tokyo Gas & Electric Engineering Co.	Tokyo (Japan)	90.17–331

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Sheet No. 90.13-1544-TI/2
Date 8 Feb. 1945
Page No. 1 (7 pages)

JOINT TARGET GROUP, WASHINGTON, D.C.
TARGET INFORMATION SHEET

Obj. Folder 90.12, 13
Obj. Area 90.13
AAF Target No. 90.13-1544
NAME OF TARGET NAKAJIMA AIRCRAFT, NEW OTA PLANT

Place Ota (Japan)
Air Target System Aircraft

Lat.: 36° 18'N
Long: 139° 23' E
Alt.: 175 feet

ALL PREVIOUS SHEETS CANCELLED

SIGNIFICANCE

Roughly 14 per cent of the known Japanese combat planes are assembled in this plant, which also manufactures major aircraft components but no engines. Engines are supplied by the company's Musashino-Tama (Musashi) (TARGET 90.17-357) engine plant in the W outskirts of Tokyo. All production at Ota is for the Army with concentration of fighter types, but also with some assembly of bombers. Approximately 20 per cent of all Japanese fighters and 40 per cent of Army fighters, are finished here. This is the older of Nakajima's two key assembly plants. The newer nearby Koizumi plant (TARGET 90.13-1545) concentrates on Navy types.

Nakajima is the oldest privately owned aircraft company in Japan and with Mitsubishi is one of the two leading producers of aircraft and engines for both the Army and Navy.

LOCATION

Approximately 40 miles NW of Tokyo on the N edge of a plain drained by the Tone River, which flows generally SSE with its nearest point less than 4 miles S. A wooded 10 mile ridge points to the plant from the NW and the major Kumagaya Air Base (TARGET 90.13-1644) is situated about 10 miles SSW. Three miles to the SE is the Nakajima Koizumi Plant (TARGET 90.13-1545). The landing field which serves both plants is located between the two.

The target is located directly E of Ota village and is bounded on the W by a road leading 4 miles NE to Ashikaga and on the S by one leading to Koizumi 3 miles SE. Just to the S of the plant the electrified RR which runs through Ota forks NE to Ashikaga and SE to Koizumi.

DESCRIPTION AND LAYOUT

(Refer to Illustrations No. 90.13-1544 P3, P5, and P6). The total target area is about 2500 by 2000 feet, roughly rectangular in shape with the major axis lying in a N-S direction. The built-up area is about 2,800,000 square feet or 55 per cent of the target area; the floor area (including multi-story buildings) is approximately 3,300,000 square feet. Raw materials for both fighters and bombers are probably received in the southern part of the plant and are initially processed in the buildings along the western part. Fighter plane parts then, it is believed, move to the large parts processing and fabrication buildings in the central portion of the plant (buildings 20 and 21) and from there to sub-assembly, and post assembly operations in buildings 9, 10, 18, 19, and 39. After initial processing bomber parts move for fabrication to buildings 28 and 29. Sub-assembly and final assembly is performed in buildings 30 and 31 and post assembly in building 34. Administration buildings are along the S edge of the compound. Electric power is supplied by the outside network.

PRIMARY OBJECTIVES

(Refer to Illustrations No. 90.13-1544 P3, P5, and P6). The primary objectives are buildings 11, 12, 18, 19, 20, 21, 29, 30 and 39. These buildings contain sub and major parts assembly processes, as well as machine shops housing vital jigs and fabrication equipment.

The buildings are fairly well dispersed throughout the plant, but all of them lie within a 1200-foot circle centering on the NW corner of building 18, the recommended aiming point for high level attack.

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Sheet No. 90.13-1544-TI/2
Date 8 Feb. 1945
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TARGET INFORMATION SHEET *(Contd.)*

CONSTRUCTION & VULNERABILITY

(Refer to Illustrations No. 90.13-1544 P3, P5, and P6).

Roofs: Approximately 60 per cent of the important buildings have sawtooth roofs and 40 per cent have double-pitched, shed-type roofs. Sawtooth roofed buildings generally have exposed chords, and are long-span (bays 90 x 50 feet) aircraft assembly-type structures varying from 25 to 40 feet high at the eaves. Double-pitched roofs are largely medium-span (55 to 70 feet) and average about 20 feet high to the eaves. Roofs are corrugated asbestos or iron over exposed steel trusses.

Walls: Buildings are fully framed in steel and walls are covered with lightweight non-combustible sheeting.

Floors: Floors are predominantly concrete. Multi-story units have floors of reinforced concrete.

Stories: 93 per cent of the entire target (plan area) is composed of single-story buildings.

Fire Divisions: 64 in 59 buildings.

The Fire Susceptibility Plan indicates the vulnerability to fire of each building and its contents. Contents are of slight combustibility, with the exception of administration and maintenance units. It is estimated that 24 per cent of the productive capacity can be destroyed by fire.

WEAPON RECOMMENDATIONS

The most effective weapons for high level attack are a combination of:

AN-M66 2000-lb G.P., fuzed 0.01 sec. nose/0.01 sec. tail (if M139 nose fuzes are unavailable, 0.1 sec delay nose fuzes should be used.)

AN-M50 4-lb incendiary (in M17 aimable clusters)

The aircraft assembly-type buildings (long span and high) are best demolished by blast. The 2000-lb G.P. provides the necessary charge weight to cause initial structural collapse either by direct hit or near miss. Bombs fuzed to explode 6 to 10 feet beneath the roof will produce maximum damage to the contents as well as the structure. The 1000-lb G.P., weight for weight, is 90 per cent as effective against this target as the 2000-lb G.P; the 500-lb bomb is 85 per cent as effective.

The fire divisions are large but that part of the contents which is readily combustible is so dispersed as to require multiple hits for maximum fire damage. The majority of the buildings are non-combustible (exposed steel trusses and columns, non-combustible lightweight roofing). The AN-M50 4-lb incendiary (in M17 clusters) is only slightly better than the AN-M47 70-lb or AN-M69 6-lb (in M18 clusters). The AN-M69 is an acceptable alternate against this target as the roofs of the principal buildings are light and therefore penetrable.

The following Loading Table shows the per cent of serious damage to the target which can be expected for different weights of attack and different accuracies of bombing. Accuracy is measured by the per cent of bombs dispatched expected to fall within 1000 feet of the aiming point. Allowance has been made in the table for the fact that this target lies within a 1200-foot circle. (Reference should be made to Joint Target Group Memorandum No. 3, "Explanation of Weapon Recommendations and Loading Tables Given in Target Information Sheets", dated 27 December 1944.)

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Table I

LOADING TABLE - MOST EFFECTIVE WEAPONS

HE: AN-M66 2000-lb G.P., fuzed 0.01 sec. nose/0.01 sec. tail. (1)
IB: AN-M50 4-lb (in M17 clusters)

NAKAJIMA AIRCRAFT CO., NEW OTA PLANT

Total Load in Tons (4)	Per cent of bombs dispatched expected to fall within 1000 feet of each aiming point (2)			
	10% HE IB F(3) Tons (4)	15% HE IB F(3) Tons (4)	20% HE IB F(3) Tons (4)	30% HE IB F(3) Tons (4)
50				15 35 14%
75			20 55 14%	15 60 18
100		25 75 16%	20 80 18	35 65 22
150	35 115 14%	30 120 20	60 90 22	85 65 30
200	35 165 18	80 120 24	110 90 28	135 65 37
300	125 175 23	180 120 30	210 90 38	235 65 48
400	225 175 28	280 120 37	310 90 45	335 65 57
500	325 175 34	380 120 44	410 90 52	435 65 65
600	425 175 38	480 120 50	510 90 58	535 65 70
700	425 175 42	580 120 54	610 90 63	635 65 75

NOTES: (1) Because of the difference in effectiveness of the various G.P. bombs against this target, this table should not be used for bombs other than the 2000 G.P. (The 1000-lb G.P. is 90 per cent as effective; the 500-lb, 85 per cent.) Because of the slight difference in the effectiveness of the various incendiaries, however, this table can be used for the AN-M47 or the AN-M69 (in M18 clusters) as well as the AN-M50.

(2) In the examples following this table, this quantity is called the "Index of Mission Efficiency." It is a measure of bombing accuracy, and bears no relation to the size of the target.

(3) Expected fraction (per cent) of serious damage to target. (Allowance has been made for the fact that this target lies within a 1200 foot circle.)

(4) Load is given in tons of actual (not nominal) weight of bombs.

Method of Use:

1. Determine Index of Mission Efficiency:
   (a) Estimate per cent of dispatched planes bombing primary target.
   (b) Estimate per cent of bombs over target expected to fall within 1000 feet of aiming point.
   (c) Multiply (a) by (b) and round off to nearest percentage figure in table.
2. Read under computed Index of Mission Efficiency and opposite the total load dispatched the recommended high explosive-incendiary loading and the expected per cent of damage.

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Examples Illustrating Use of Loading Table:

1. To find the best HE-IB combination and resulting per cent of damage for a given force:

Given: Planes expected to bomb primary target, 70 per cent of mission. Per cent of bombs over target, expected to fall within 1000 feet of aiming point, 30 per cent. Mission of 50 planes with total load of 150 tons.

Solution: 70 per cent x 30 per cent equals 21 per cent; i.e., 20 per cent is Index of Mission Efficiency. Opposite 150 tons in 20 per cent column find loading:

HE 60 tons equals 20 plane loads at 3 tons per plane.
IB 90 tons equals 30 plane loads at 3 tons per plane.

Fraction of damage: 22 per cent.
Hence, for optimum loading 20 planes will carry HE and 30 planes IB, but if groups of 12 are to carry only one kind of bomb per group, this may be revised to 2 groups of HE and 2 groups of IB.

2. To find force required to achieve recommended level of damage:

Given: Recommended level of damage, 50 per cent. Same Index of Mission Efficiency as in Example 1. Individual A/C bomb load 3 tons.

Solution: In 20 per cent Mission Efficiency column take:
F equals 52 per cent and find loading:
HE 410 tons
IB 90 tons
Total 500 tons
requiring a total force of 166 A/C or 14 groups of 12 A/C.

The Loading Table has been prepared from an analysis of the target before attack. If the important buildings of the target have suffered only slight damage in an early attack, it will still be suitable for determining the best loading, but after substantial damage to the important buildings has resulted, a new analysis of the target should be made and a new Loading Table prepared.

If the target has suffered substantial damage in earlier attacks, and no new Loading Table is available, the following general rules can be applied:

a. If previous attacks have destroyed most of the important combustible buildings (or buildings with highly combustible contents) on the site, as shown in the Fire Susceptibility Plan (Illustration No. 90.13-1544P5), loads carried on subsequent attacks should consist wholly of the recommended high explosive weapon.

b. If the proportion of combustible buildings remaining is about the same as before attack (e.g., because the bomb pattern has covered only part of the site), the original Loading Table may again be used to calculate the best mixture of HE and IB for a subsequent attack.

c. If it has not been possible to assess damage in the earlier attack, the Loading Table should be used to determine the cumulative load. For example, if 150 tons have previously been dispatched, and 150 tons are to be dispatched in a second attack on this target (Index of Mission Efficiency, 20 per cent), the Loading Table shows that the cumulative load (300 tons) should be divided 210 tons HE and 90 tons IB. If 60 tons HE and 90 tons IB were sent in the first attack (as per Loading Table), no IB and 150 tons HE should be dispatched in the second attack.

LEVEL OF DAMAGE

Serious damage (structural damage plus severe fire damage) of the following approximate levels will result in the net production loss shown below:

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Fraction of Serious Damage	Months of Net Loss
20 per cent	1 month
30 - 40 per cent	2 to 4 months
50 per cent	5 to 6 months

The 50 per cent level is desirable, particularly in the subassembly sections, as it will destroy or warp a considerable proportion of the highly specialized assembly jigs. This level also will destroy a high percentage of the total material in production as well as heavily damaging vital machinery in sections other than sub-assembly.

At lesser levels, the net production loss will vary depending upon whether or not bombs strike important processes. Also, there is greater probability of increased use of duplicate undamaged equipment at the plant or of dispersion of equipment to nearby plants in the area. Damage of 20 per cent or less usually can be repaired rather quickly and will not seriously affect production.

The total tonnage which must be dispatched to cause these levels of damage may be estimated from the Loading Table.

CAMOUFLAGE, DECOYS AND SMOKE SCREENS

Photography of 7 November 1944 shows all important buildings camouflaged with disruptive painting. No decoys or smoke screens were evident.

ADDITIONAL INFORMATION

There is evidence of the assembly at this location of the following plane types:

1. Two engined medium bomber HELEN Mk 3
   a. With Type 2, 1450 HP engines supplied by Nakajima, Musashino-Tama (TARGET 90.17-357).
   b. With tail sub-assemblies supplied by the Nakajima plant at Tatebayashi.
2. Single engined fighter TOJO Mk 2.
   a. With Type 2, 1450 HP engine supplied by Nakajima Musashino-Tama (TARGET 90.17-357).
3. Single engined fighter OSCAR Mk 3, probably replaced by Frank.
   a. With Type 2, 1150 HP engine supplied by Nakajima, Musashino-Tama (TARGET 90.17-357).
4. Single engined fighter FRANK.
   a. With Ha 45,2000 HP engine supplied by Nakajima, Musashino-Tama (TARGET 90.17-357).
5. Two engined medium bomber Ki 82 (no code name) believed to be designed for replacing HELEN.
   a. With Ha 45, 2000 HP engine supplied by Nakajima, Musashino-Tama (TARGET 90.17-357).

(Refer to Illustration No. 90.13-1544 P XI). A sketch of the floor plans of the Ota plant drawn by a PW is included for the purpose of providing greater detail of the internal arrangement of the plant. While the PW appears to be reliable it should be noted that his information is based upon conditions prevailing in 1942, and furthermore, that his apparently extensive knowledge of the plant must be evaluated in light of the strict security restrictions which are generally imposed upon most employees in Japanese aircraft plants. The PW worked on final assembly in building 19. His aircraft nomenclature Ki 43, Ki 44 and Ki 49 refer, respectively, to Oscar, Tojo and Helen. Although in several instances his memory of the buildings in their relation to the target area is faulty, this should not detract from the almost photographic sketch which he presents.

There are several major points of difference between the PW's identification of buildings and those shown in Illustrations No. 90.13-1544 P5, and P6. These are shown below:

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Date 8 Feb. 1945
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TARGET INFORMATION SHEET *(Contd.)*

Building No: In Target Illus. P5 & P6.	Building No: By PW	Identified as: In Target Illus. P5 and P6.	Identified as: By PW
28	34	Probable machining and parts	Final Assembly
11	11	Machine shop- probable jig shop and storage	Final Assembly
12	1	Machine shop- storage and fabrication presses	Final Assembly
31	38-40	Final assembly	Wing and tail surface assembly
33	41	Storage and probable press shop	Engine test cells
18	17, 18a, 19	Final assembly and fuselage erection	Wing assembly
19	18, 20 21	Final assembly and fuselage erection	Final assembly
9	24	Final assembly- finishing- painting- delivery	Trial bomber construction
10	24	Final assembly- finishing- painting- delivery	Trial fighter construction
34	60a	Post assembly- finishing- painting- delivery	Final assembly
30a	36,37	Sub-assembly	Final assembly and fuselage erection.

In the following comments on the PW identifications, numbers given without parentheses are those shown on Illustration No. 90.13-1544 P5 and P6, and those in parentheses are given on the PW sketch Illustration No. 90.13-1544 PXI. Buildings 11 and 12 (11,1) may actually be engaged in final assembly operations, rather than in machining as shown on P5 and P6; several other PW's who worked in the Ota plant some time ago have offered this identification. However, it is believed that with the plant expansion fighter production has been rationalized so that raw materials start from the SW part of the plant, are routed N and NE and then come down the SE portion as finished parts and aircraft.

While buildings 9 and 10 (24) may be devoted in part to experimental production, the present arrangement of the plant makes it necessary for the aircraft finished in buildings 18 and 19 to move through these buildings and it is quite likely that some post-assembly operations would be performed as they pass through. The presence of experimental work in a final assembly or post assembly building is not uncommon since the type of building needed is usually large and high with no obstructions.

Building 19 (18) is identified as engaged in both final assembly and fuselage erection in Illustrations P5 and P6, while only the former of these is listed as an assembly building by the PW. This is quite possible, but it should be noted that the PW identifies only one area, relatively small, as manufacturing fuselages for both Oscar and Tojo so that additional fuselage erection area seems to be necessary.

Building 18 (17, 18a, 19) may in fact be performing wing assembly as reported by PW rather than fuselage erection and final assembly. The latter again supposes that production has been rationalized since 1942 as previously described. Moreover its relative height, as well as the fact that it is as high as building 19, would also indicate final assembly for this building.

The PW identification of building 33 (41) as engine test cells appears unlikely for at least two reasons: first, the Ota plant does not manufacture engines, and did not even in 1942, so that there would be little reason for it to have engine test cells; second, the building does not look like engine test cells, most of which are easily identifiable in aerial photographs.

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The major differences in building identification between the PW and Illustrations P5 and P6 are concerned with the buildings in the N part of the plant. It has been assumed in Illustrations P5 and P6 that the flow of production in this part of the plant is from W to E with the planes leaving the plant through the eastern gate. The PW's identification, on the other hand, would establish the production flow in just the opposite direction, that is from E to W with final operations taking place in building 28 (34). While building 28 could certainly be engaged in final assembly, its relatively great height (it is the highest building in the plant) suggests that it may be two-storied. In addition, photographs show no obvious point of egress in this part of the plant for the completed aircraft. Moreover, the PW states that building 30 (36 and 37) was engaged in fuselage erection and in the joining of tail assemblies and wings to the fuselage as well as in engine installation. This being the case, there would be few, if any, final assembly operations remaining to be done in building 28.

Bomb Damage: On 10 February 1945, B29's of the XXIst Bomber Command attacked the Ota plant. Strike photographs, obscured somewhat by clouds and heavy smoke, indicate that the results were good and that heavy damage was done to the eastern half of the plant believed to be manufacturing the fighters FRANK and TOJO. The extent of the production loss, however, cannot be determined from the strike photography. (Refer to Illustrations No. 90.13-1544 P3, P5, and P6.) Buildings which appear to have sustained damage are: 9, 10, 11, 18, 19, 20, 30, 31, 34, 35, 37, 38, 39.

Dispersal: Reconnaissance photography of 9 Feb. 1945 shows that dispersal of the Ota plant had begun even prior to the bombing attack of a day later. It is reported that a total of almost 175,000 square feet of roof and/or building had been removed by that date. (Refer to Illustrations No. 90.13-1544 P3, P5, and P6.) The buildings affected are 21 (partially), 8 (partially), 52, 53, 54a, and 47. Considerably greater dispersal can probably be expected in the early future.

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TARGET No. 90.13-1544

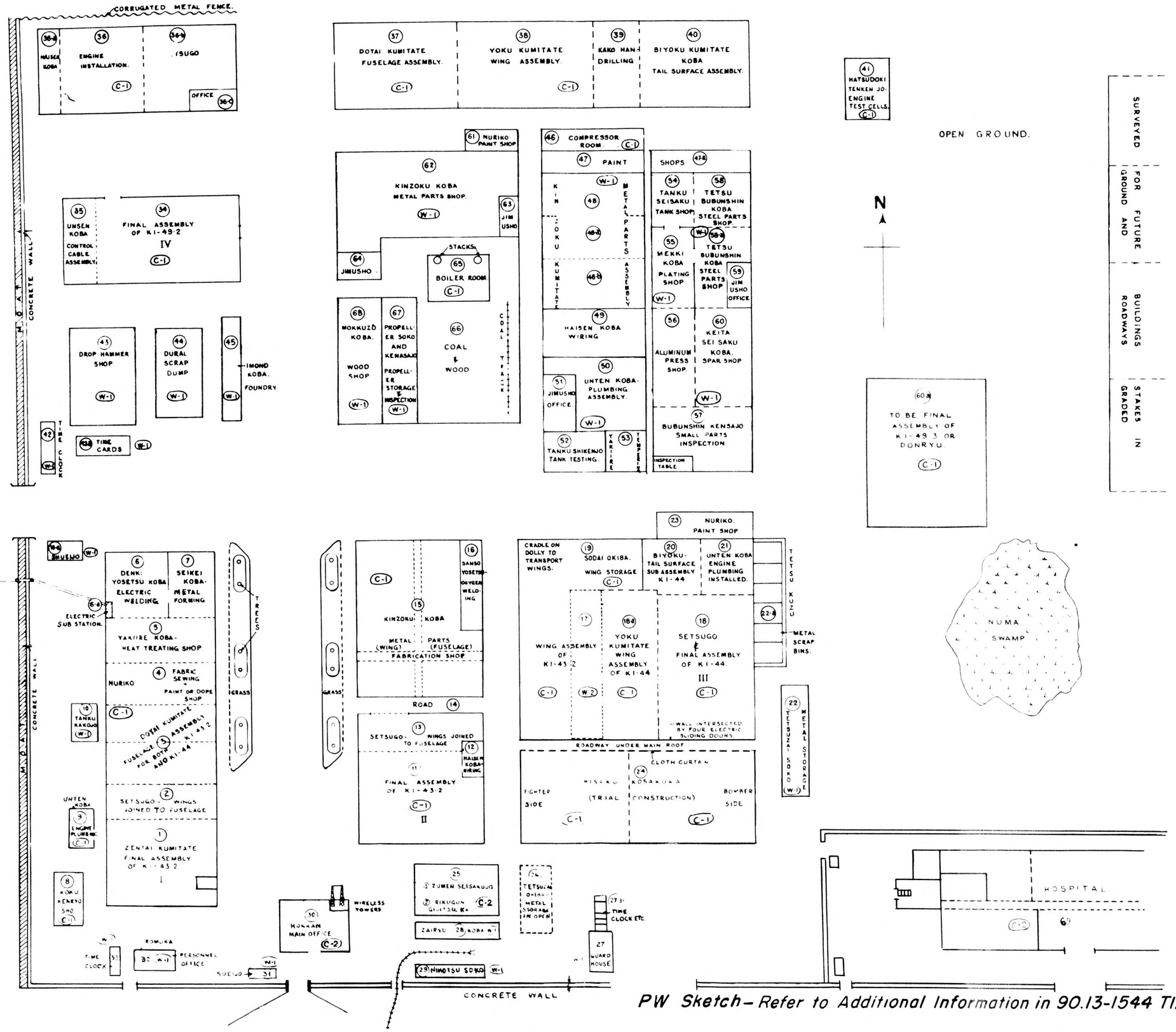
COORDINATES 36°18'N. 139°23'E.

JOINT TARGET GROUP-WASHINGTON, D. C.

NAKAJIMA AIRCRAFT, NEW OTA PLANT
OTA, JAPAN

ILLUSTRATION No. 90.13-1544 PX1

ISSUED 1 March 1945



PW Sketch – Refer to Additional Information in 90.13-1544 TI/2

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TARGET NO. 90.13-1544

APPROX. COORDINATES 36° 18'N 139° 23'E

PHOTOGRAPHED 7 NOVEMBER 1944

NAKAJIMA AIRCRAFT — NEW OTA PLANT

TAKASAKI AREA, JAPAN

0 2000 4000 6000 FEET

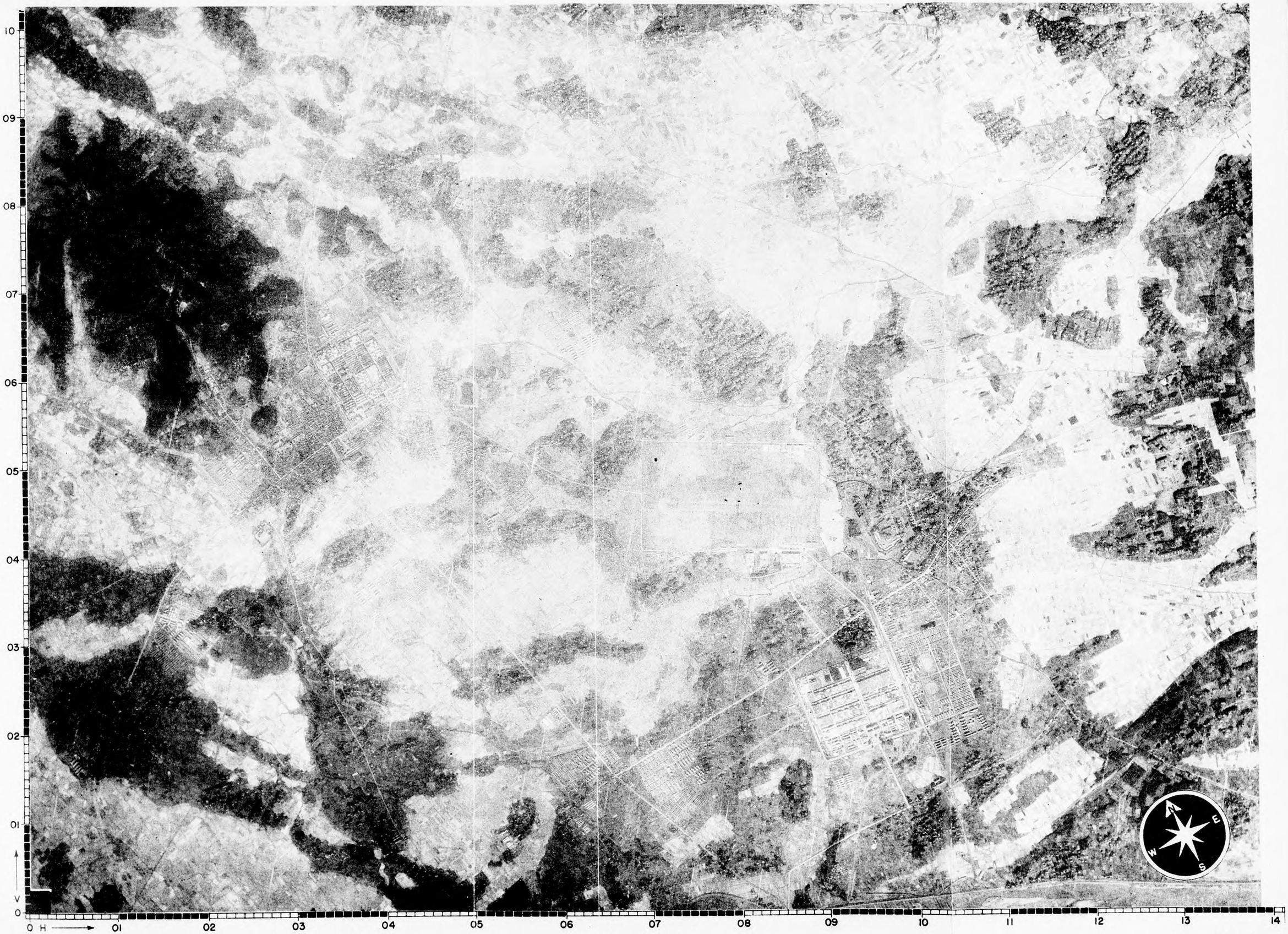
0 ½ 1 MILE

1:32 000 APPROX.

ILLUSTRATION NO. 90.13-1544 PI

ISSUED NOVEMBER 1944

CONFIDENTIAL



JOINT TARGET GROUP
WASHINGTON, D. C.

NAKAJIMA AIRCRAFT, NEW OTA PLANT
OTA JAPAN

0 2000 4000 6000 FEET
0 ½ 1 MILE
1:32 000 APPROX.

ILLUSTRATION No. . 90.13-1544 P2/1
DATE . . . . . 29 April 1945
TARGET No. 90.13-1544
COORDINATES . . . 36°18'N 139°23'E
PHOTOGRAPHED . 7 November 1944

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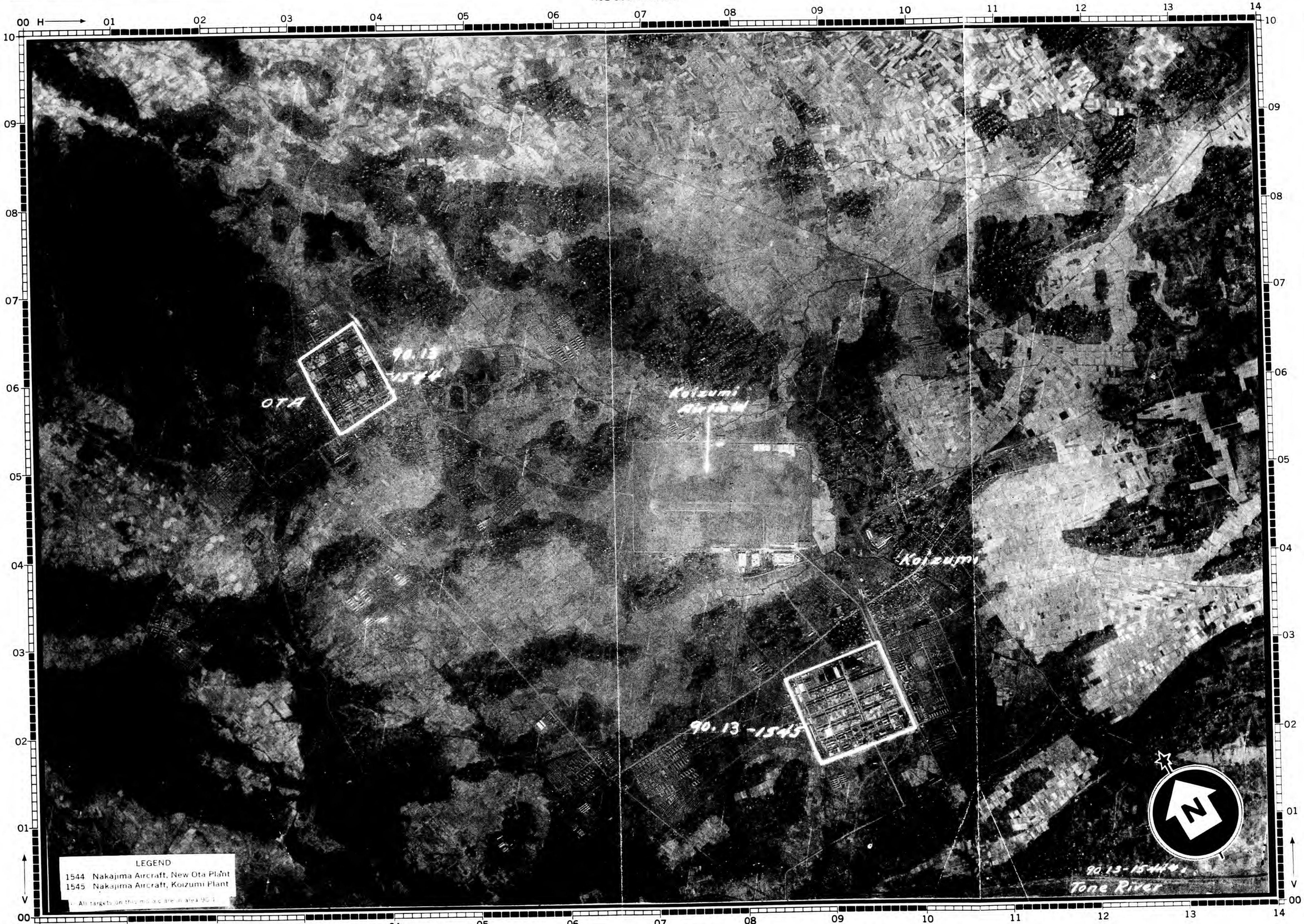

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TARGET NO. 90.13-1544

APPROX. COORDINATES 36° 18' N 139° 23' E

PHOTOGRAPHED 7 NOVEMBER 1944

NAKAJIMA AIRCRAFT— NEW OTA PLANT

TAKASAKI AREA, JAPAN

0 500 1000 1500 2000 2500 3000 FEET

0 ¼ ½ MILE

1:6000 APPROX.

ILLUSTRATION NO. 90.13-1544 P3

ISSUED NOVEMBER 1944

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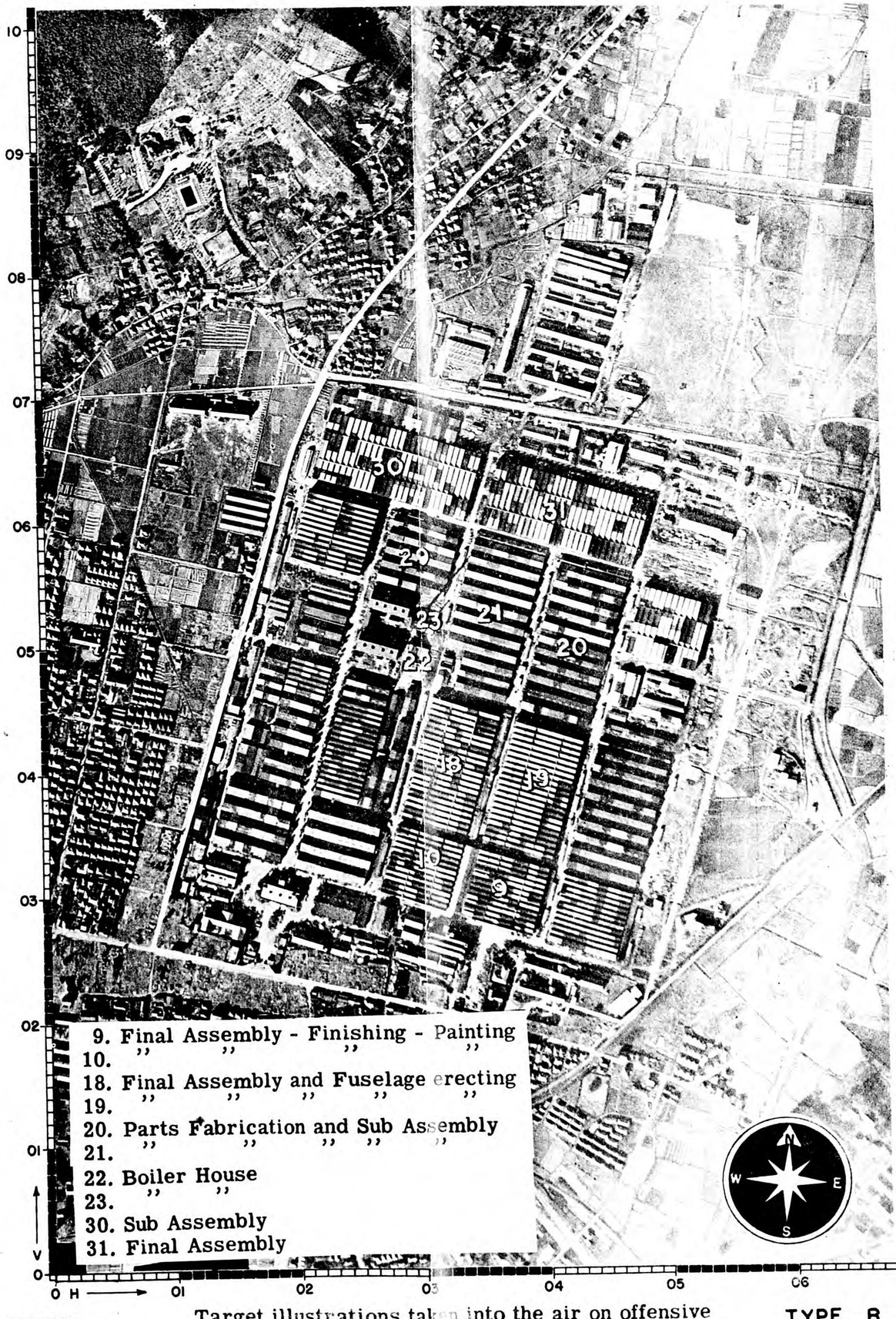

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TYPE B
C5-2604, AF

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Sheet No. 90.13-1545-TI/1-A
Date 21 Feb. 1945
Page No. 1 (2 pages)

JOINT TARGET GROUP, WASHINGTON, D.C.

TARGET INFORMATION SHEET

ANNEX I

Obj. Folder 90.12, 13
Obj. Area 90.13
AAF Target No. 90.13-1545

Place Koizumi (Japan)
Air Target System Aircraft

Lat.: 36°15'N
Long: 139°25'E
Alt.: 125 feet

NAME OF TARGET - NAKAJIMA AIRCRAFT, KOIZUMI PLANT
(Nakajima Hikoki K.K., Koizumi Seisakusho)

(Note: This annex is issued for use by the Navy in conjunction with Target Information Sheet 90.13-1545 TI/1, dated by the Joint Target Group on 21 Feb. 1945,)

ALL PREVIOUS SHEETS CANCELLED

NAVAL CARRIER-BASED AIR ATTACK

Introduction: This sheet is for the use of Naval carrier-based aircraft which are better adapted for attacking the important individual buildings rather than the target as a whole. In view of the complexities involved in estimating bombing accuracies and stowage capabilities of carrier-based aircraft, this discussion is limited to stating the number of hits with various bombs required to achieve given levels of damage on individual buildings. No attempt is made to convert these to number of bombs or planes to be dispatched.

Buildings and Their Importance to Production: Only those buildings rated as "Primary" or "Secondary" on the Fire Susceptibility Plan, Illustration No. 90.13-1545 P5, are taken into consideration; other buildings are of minor productive value and do not merit specific attack. The buildings are listed in Table I below in the order of their importance to production, the relative value of which is indicated by the numbers in the column headed "I.P." (Index of Importance to Production). These indices, based on a scale 10 to 1 (buildings rated 10 being of greatest importance), refer to this target only and should not be used to compare buildings in different targets.

Number of Hits: Table I below gives the number of hits by various HE bombs to achieve 30, 50, and 70 percent serious damage to specific buildings. For other levels of damage within this range, the required number of hits can be obtained by interpolation.

Table I

Number of Hits Required to Achieve 30, 50 and 70 Percent Serious Damage to Individual Buildings
(Refer to Illustration No. 90.13-1545 P5)

Building No.	I.P.	Fraction of Serious Damage	Number of Hits 500-lb GP	1000-lb GP	2000-lb GP
11a	10	30%	21	9	4
		50%	41	17	8
		70%	61	26	11
26a	10	30%	28	16	8
		50%	55	32	16
		70%	81	48	23
30a	9	30%	25	15	7
		50%	49	29	14
		70%	73	43	21
25a	7	30%	21	13	6
		50%	42	25	12
		70%	62	36	17
12a	5	30%	11	5	2
		50%	22	9	4
		70%	32	14	6
14a	5	30%	8	3	1
		50%	15	6	3
		70%	22	9	4

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Sheet No. 90.13-1545-TI/1-A
Date 21 Feb. 1945
Page No. 1 (2 pages)

JOINT TARGET GROUP, WASHINGTON, D.C.

TARGET INFORMATION SHEET

ANNEX I

Obj. Folder 90.12, 13
Obj. Area 90.13
AAF Target No. 90.13-1545

Place Koizumi (Japan)
Air Target System Aircraft

Lat.: 36°15'N
Long: 139°25'E
Alt.: 125 feet

NAME OF TARGET - NAKAJIMA AIRCRAFT, KOIZUMI PLANT
(Nakajima Hikoki K.K., Koizumi Seisakusho)

(Note: This annex is issued for use by the Navy in conjunction with Target Information Sheet 90.13-1545 TI/1, dated by the Joint Target Group on 21 Feb. 1945,)

ALL PREVIOUS SHEETS CANCELLED

NAVAL CARRIER-BASED AIR ATTACK

Introduction: This sheet is for the use of Naval carrier-based aircraft which are better adapted for attacking the important individual buildings rather than the target as a whole. In view of the complexities involved in estimating bombing accuracies and stowage capabilities of carrier-based aircraft, this discussion is limited to stating the number of hits with various bombs required to achieve given levels of damage on individual buildings. No attempt is made to convert these to number of bombs or planes to be dispatched.

Buildings and Their Importance to Production: Only those buildings rated as "Primary" or "Secondary" on the Fire Susceptibility Plan, Illustration No. 90.13-1545 P5, are taken into consideration; other buildings are of minor productive value and do not merit specific attack. The buildings are listed in Table I below in the order of their importance to production, the relative value of which is indicated by the numbers in the column headed "I.P." (Index of Importance to Production). These indices, based on a scale 10 to 1 (buildings rated 10 being of greatest importance), refer to this target only and should not be used to compare buildings in different targets.

Number of Hits: Table I below gives the number of hits by various HE bombs to achieve 30, 50, and 70 percent serious damage to specific buildings. For other levels of damage within this range, the required number of hits can be obtained by interpolation.

Table I

Number of Hits Required to Achieve 30, 50 and 70 Percent Serious Damage to Individual Buildings
(Refer to Illustration No. 90.13-1545 P5)

Building No.	I.P.	Fraction of Serious Damage	Number of Hits 500-lb GP	1000-lb GP	2000-lb GP
11a	10	30%	21	9	4
		50%	41	17	8
		70%	61	26	11
26a	10	30%	28	16	8
		50%	55	32	16
		70%	81	48	23
30a	9	30%	25	15	7
		50%	49	29	14
		70%	73	43	21
25a	7	30%	21	13	6
		50%	42	25	12
		70%	62	36	17
12a	5	30%	11	5	2
		50%	22	9	4
		70%	32	14	6
14a	5	30%	8	3	1
		50%	15	6	3
		70%	22	9	4

Holders of JTG Folders should insert this sheet in Air Target System Folder Japanese Aircraft with corresponding target material.

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JOINT TARGET GROUP - WASHINGTON, D.C.

Sheet No. 90.13-1545-T1/1-A
Date 21 Feb. 1945

ANNEX I *(Cont'd)*

TARGET INFORMATION SHEET

Building No.	I.P.	Fraction of Serious Damage	Number of Hits 500-lb GP	1000-lb GP	2000-lb GP
13a	5	30%	10	4	2
		50%	19	8	4
		70%	29	12	5
31a	4	30%	9	4	2
		50%	17	7	3
		70%	26	11	5
22	3	30%	12	7	3
		50%	24	14	6
		70%	36	21	10
31c	2	30%	6	3	2
		50%	11	6	3
		70%	17	10	4
24	1	30%	4	2	1
		50%	8	5	2
		70%	12	7	3

Examples of Use of Table I:

1. Problem: To obtain the required number of hits with 500-lb GP bombs on Building 30a to achieve 30 percent serious damage.
   Solution: The table gives 25 hits as the number required to achieve 30 percent serious damage.

2. Problem: To obtain the required number of hits with 2000-lb GP bombs on Building 11a to achieve 60 percent serious damage.
   Solution: The table gives 8 hits for 50 percent and 11 hits for 70 percent serious damage. By interpolation 10 hits are required for 60 percent serious damage.

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(P)

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Sheet No. 90.13-1544TI/2
Date 20 Feb. 1945
Page No. 1 (2 pages)

JOINT TARGET GROUP, WASHINGTON, D.C.

TARGET INFORMATION SHEET

ANNEX I

Obj. Folder 90.12,13
Obj. Area 90.13
AAF Target No. 90.13-1544
NAME OF TARGET

Place Ota (Japan)
AIR TARGET SYSTEM Aircraft
NAKAJIMA AIRCRAFT, NEW OTA PLANT

Lat.: 36°18'N
Long: 139°23'E
Alt.: 175 feet

(Note: This annex is issued for use by the Navy in conjunction with Target Information Sheet 90.13-1544 TI/2, issued by the Joint Target Group, 8 Feb. 1945.)

NAVAL CARRIER-BASED AIR ATTACK

Introduction: This sheet is for the use of Naval carrier-based aircraft which are better adapted for attacking the important individual buildings rather than the target as a whole. In view of the complexities involved in estimating bombing accuracies and stowage capabilities of carrier-based aircraft, this discussion is limited to stating the number of hits with various bombs required to achieve given levels of damage on individual buildings. No attempt is made to convert these to number of bombs or planes to be dispatched.

Buildings and Their Importance to Production: Only those buildings rated as "Primary" on the Fire Susceptibility Plan, Illustration No. 90.13-1544 P5, are taken into consideration; other buildings are of minor productive value and do not merit specific attack. The buildings are listed in Table I below in the order of their importance to production, the relative value of which is indicated by the number in the column headed "I.P." (Index of Importance to Production). These indices, based on a scale 10 to 1 (buildings rated 10 being of greatest importance), refer to this target only and should not be used to compare buildings in different targets.

Number of Hits: Table I below gives the number of hits by various HE bombs to achieve 30, 50 and 70 per cent serious damage to specific buildings. For other levels of damage within this range, the required number of hits can be obtained by interpolation.

Holders of JTG Folders should insert this sheet in Air Target System Folder, Japanese Aircraft following 90.13-1544 TI/2.

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Table I

Number of Hits Required to Achieve 30, 50 or 70 Percent Serious Damage to Individual Buildings

(Refer to Illustration No. 90.13-1544 P5)

Building No.	I.P.	Fraction of Serious Damage	Number of Hits 500-lb GP	1000-lb GP	2000-lb GP
30a	10	30%	10	4	2
		50%	19	8	4
		70%	29	12	5
20	10	30%	19	11	5
		50%	38	22	10
		70%	56	32	15
21	10	30%	19	11	5
		50%	38	22	10
		70%	56	32	15
39	9	30%	17	10	4
		50%	33	19	9
		70%	49	28	13
18	7	30%	8	3	2
		50%	16	7	3
		70%	23	10	4
19	7	30%	8	3	2
		50%	16	7	3
		70%	23	10	4
29	5	30%	9	5	2
		50%	17	10	4
		70%	25	14	7
11	3	30%	9	5	2
		50%	17	10	4
		70%	25	14	7
12	3	30%	9	5	2
		50%	17	10	4
		70%	25	14	7

Examples of Use of Table I:

1. Problem: To obtain the required number of hits with 500-lb GP bombs on Building 20 to achieve 30 percent serious damage.

   Solution: The table gives 19 hits as the number required to achieve 30 percent serious damage.

2. Problem: To obtain the required number of hits with 2000-lb GP bombs on Building 39 to achieve 60 percent serious damage.

   Solution: The table gives 9 hits for 50 percent and 13 hits for 70 percent serious damage. By interpolation 11 hits are required.

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JOINT TARGET GROUP, WASHINGTON, D. C.

ECONOMIC DAMAGE ASSESSMENT

NAKAJIMA AIRCRAFT, KOIZUMI PLANT

KOIZUMI . . . . . JAPAN

Sheet No.	90.13–1545–DA
Date	4 April 1945
Page No.	1
Target No.	90.13–1545
Obj. Area	90.13
Obj. Folder No.	90. 12, 90. 13
Air Target System	Aircraft
Lat.:	36°15' N
Long.:	139°25' E
Alt.:	125 Feet

ALL PREVIOUS SHEETS CANCELLED

NOTE.—The poor quality of available post attack photography limits the determination of the extent and severity of building damage and also precludes an estimate of internal destruction. This report should, therefore, be considered a preliminary estimate of economic damage. A revised report will be issued if subsequent photography reveals major differences.

PARTICULARS OF ATTACK

This plant was attacked by Navy carrier based dive bombers in the second Navy Tokyo attack of 25 February 1945. No data are at present available on bomb tonnages dropped or the number of planes attacking.

PREVIOUS REPORTS

None.

SUMMARY OF ECONOMIC DAMAGE

(1) Moderate damage was suffered by this plant. Of the almost 3 million square feet of plan area, at least 6 percent received structural damage while superficial damage was roughly twice as extensive. Damage was concentrated upon the more important production sections of the plant. Better quality photography may reveal that much of the apparent superficial damage is in fact structural.

(2) Estimates of aircraft loss are extremely tentative not only because of the poor photography but also because of insufficient ground intelligence as to the production layout and even as to the plane types being manufactured at this plant. For the plant as a whole a loss of about 6 weeks' output at the estimated preattack production rate of 455 per month appears likely. This amounts to roughly 670 planes.

The estimated aircraft production losses by types are shown in the following table:

Estimated aircraft loss from attacks on Nakajima Aircraft, Koizumi plant

Plane type	Pre-attack monthly output	Estimated aircraft loss		
		Work in process	Loss in repair	Total
Zeke	265	65	200	265
Myrt	15	4	11	15
Jill	50	15	35	50
Frances	75	60	150	210
Irving	45	35	90	125
4-engined planes	5	1	4	5
Total	455	180	490	670

(3) Aircraft loss and recuperation will not be uniform throughout the plant. The eastern half, believed to be engaged in the manufacture of multiple-engined planes, has probably suffered a production loss of more than 2 months' preattack output and will probably require at least 4 months to return to preattack production levels. The western half, thought to manufacture the plant's single-engined planes, has been less severely damaged—1 month's net loss—and could probably be back to preattack production rates within 2 to 3 months.

(4) It is not possible to estimate the extent to which this plant will be repaired. The post-strike photography was taken too soon after the strike to show any repairs. Dispersal of the plant's production may have been underway even before the attack as evidenced by the fact that approximately 500,000 square feet of building area (mostly storage-type buildings) had been removed shortly before the attack and that at least two of the planes thought to be manufactured at this plant (Jill and Myrt) may have been transferred to the firm's aircraft plant at Handa (Target 90.20–1635). On the other hand removal may have been intended merely to reduce the fire hazard by clearing away the more combustible buildings.

FUTURE TARGET VALUE

This plant still appears to have considerable target value since four-fifths of it is still intact and within 6 weeks or 2 months it could again be producing on a substantial scale. During the next month it is not likely to turn out many completed aircraft, although it may still be manufacturing parts for itself and other plants. Even if fully repaired it will probably be 3 months before this plant can return to preattack production.

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TARGET NO. 90.13-1545

APPROX. COORDINATES 36°15′ NORTH
139°25′ EAST

PHOTOGRAPHED 27 FEBRUARY 1945

JOINT TARGET GROUP - WASHINGTON, D. C.

NAKAJIMA AIRCRAFT, KOIZUMI PLANT

KOIZUMI, JAPAN

SCALE 1:6,000

500 0 500 1000 FEET

ILLUSTRATION NO. 90.13-1545-DP

ISSUED 21 APRIL 1945

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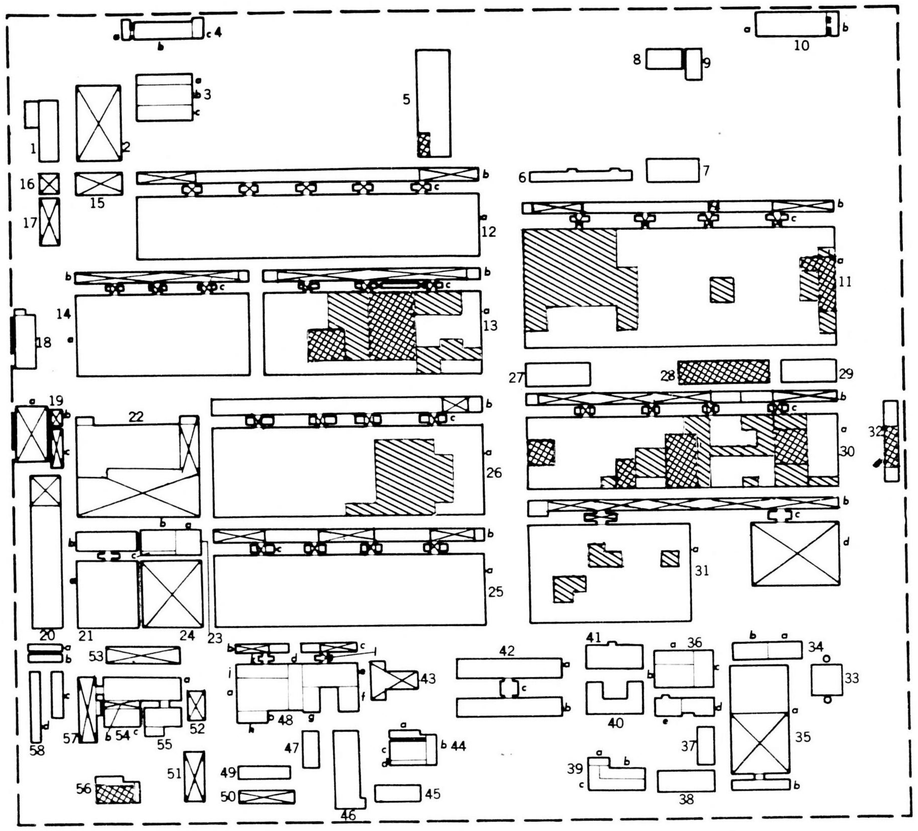

DATE OF ATTACK-24; 25 FEB. 1945

INDUSTRIAL DAMAGE PLAN

AREAS OF VISIBLE DAMAGE

STRUCTURAL DAMAGE

SUPERFICIAL DAMAGE

CIVIL REMOVAL

HOLDERS OF JTG FOLDERS SHOULD INSERT THIS SHEET IN AIR TARGET SYSTEM FOLDER, JAPANESE AIRCRAFT WITH OTHER 90.13-1545 MATERIAL

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TARGET NO. 90.13-1545

APPROX. COORDINATES 36° 15' N 139° 25' E

PHOTOGRAPHED 7 NOVEMBER 1944

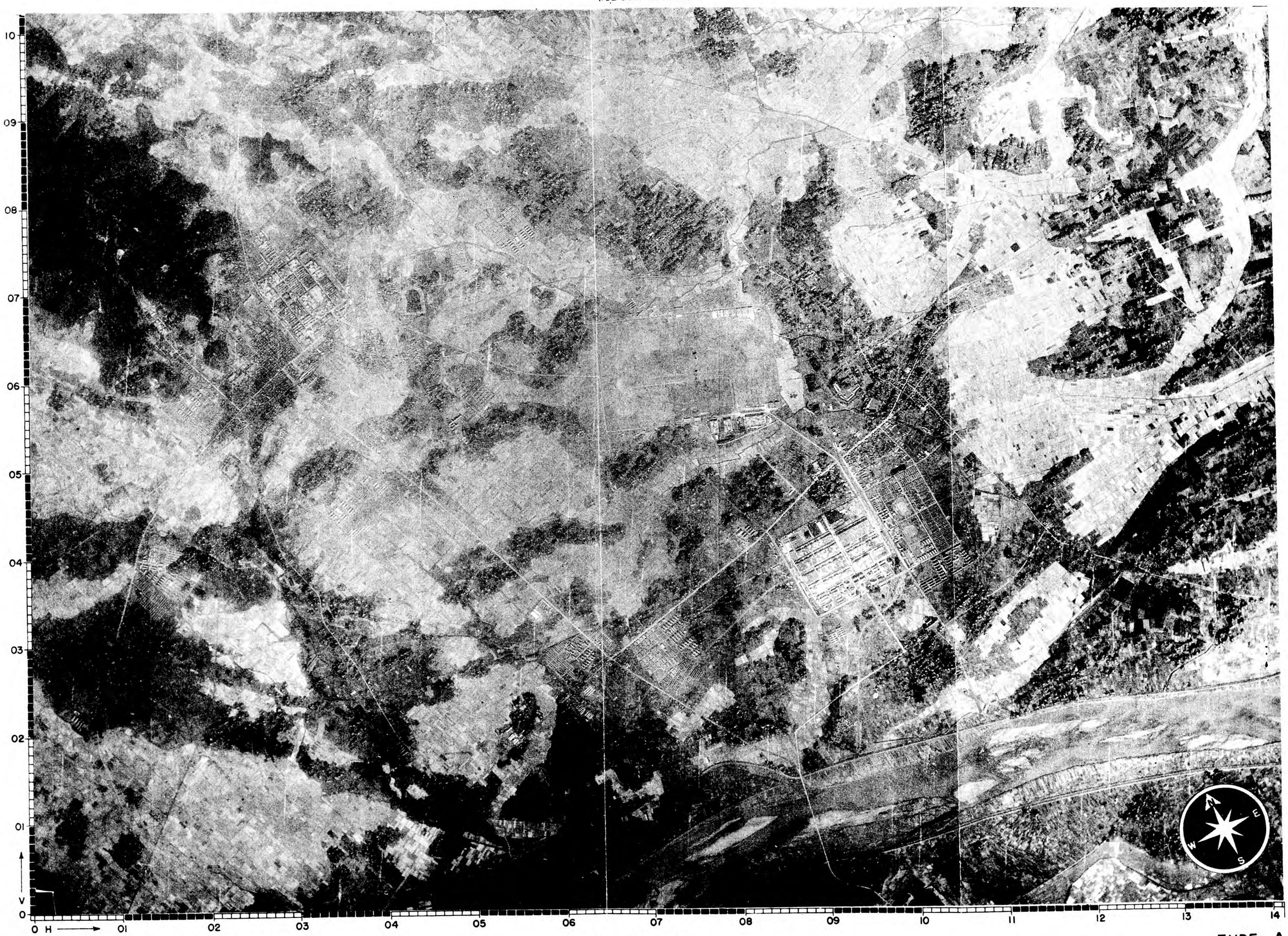
NAKAJIMA AIRCRAFT — KOIZUMI PLANT
TAKASAKI AREA, JAPAN

0 2000 4000 6000 FEET
0 ½ 1 MILE
1:32 000 APPROX.

ILLUSTRATION NO. 90.13-1545 P1

ISSUED NOVEMBER 1944

CONFIDENTIAL



JOINT TARGET GROUP
WASHINGTON, D. C.

NAKAJIMA AIRCRAFT, KOIZUMI PLANT
KOIZUMI JAPAN

0 2000 4000 6000 FEET
0 ½ 1 MILE
1:32 000 APPROX.

ILLUSTRATION No. **90.13-1545 P2/1**
DATE . . . . . **29 April 1945**
TARGET No. **90.13-1545**
COORDINATES . . . **36°15'N 139°25'E**
PHOTOGRAPHED . **7 November 1944**

All targets on this mosaic are in area 90.13

LEGEND
1544 Nakajima Aircraft, New Ota Plant
1545 Nakajima Aircraft, Koizumi Plant

Holders of Joint Target Group Folders should insert this sheet in Air Target System Folder: Japanese Aircraft in place of 90.13.1545 P2.

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JOINT TARGET GROUP • WASHINGTON, D. C.

NAKAJIMA AIRCRAFT, KOIZUMI PLANT
KOIZUMI, JAPAN

TARGET No. 90.13–1545

COORDINATES 36° 15′ N 139° 25′ E

PHOTOGRAPHED 7 NOVEMBER 1944

0 500 1000 1500 2000 2500 3000 FEET

0 1/4 1:6000 APPROX. 1/2 MILE

ILLUSTRATION No. 90.13–1545 P3/1

DATE 26 APRIL 1945

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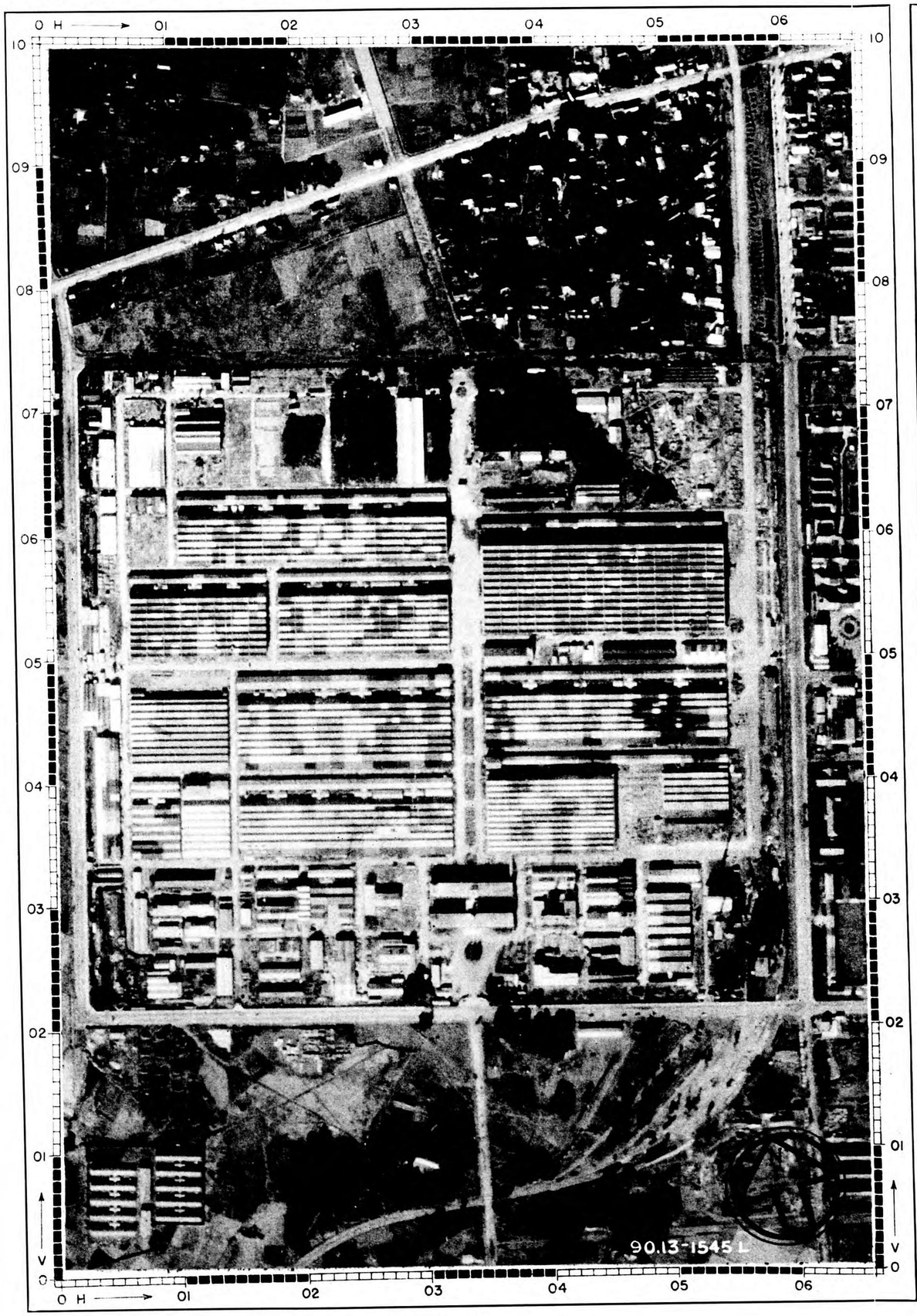

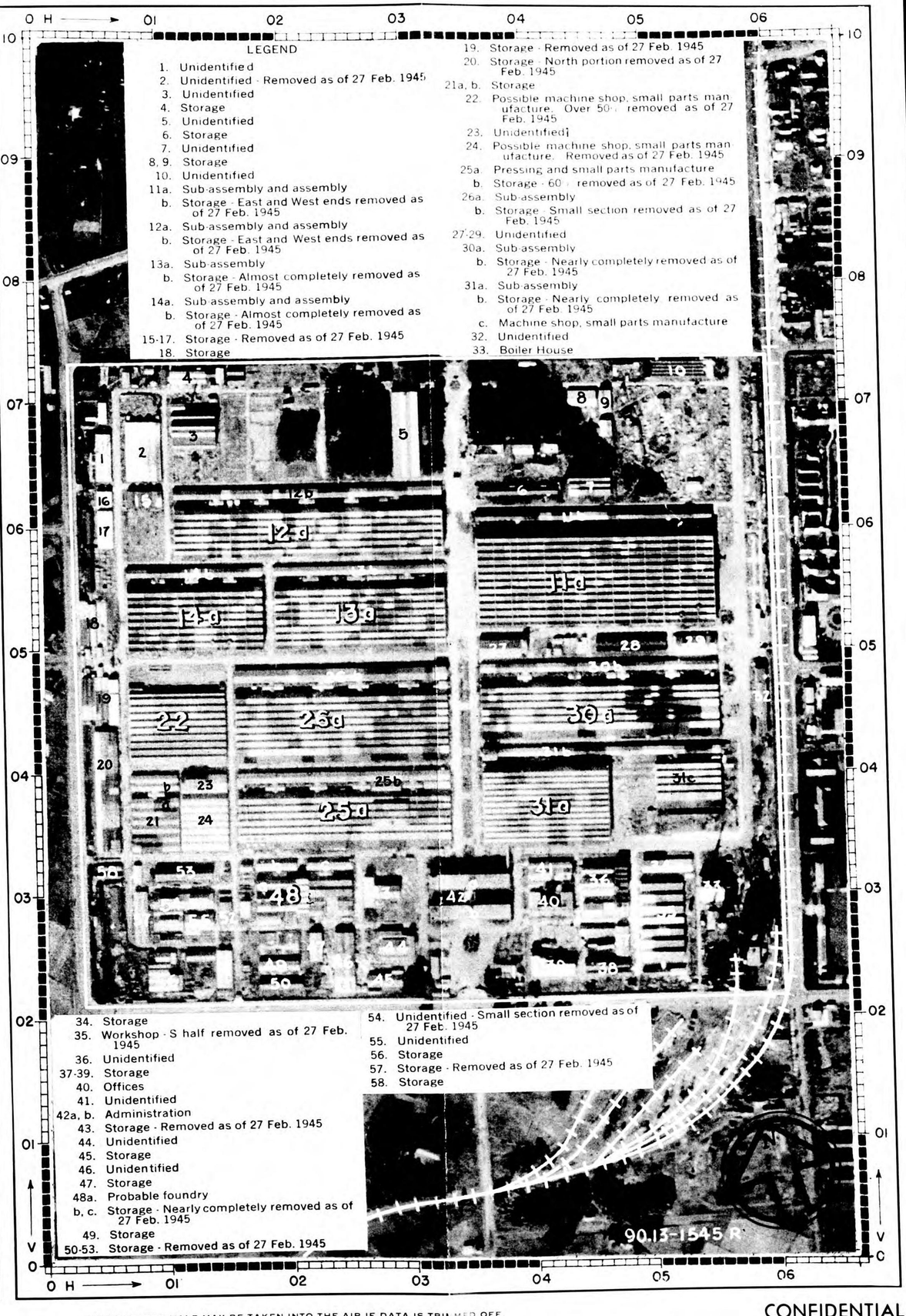

LEGEND

1. Unidentified
2. Unidentified - Removed as of 27 Feb. 1945
3. Unidentified
4. Storage
5. Unidentified
6. Storage
7. Unidentified
8, 9. Storage
10. Unidentified
11a. Sub-assembly and assembly
b. Storage - East and West ends removed as of 27 Feb. 1945
12a. Sub-assembly and assembly
b. Storage - East and West ends removed as of 27 Feb. 1945
13a. Sub-assembly
b. Storage - Almost completely removed as of 27 Feb. 1945
14a. Sub-assembly and assembly
b. Storage - Almost completely removed as of 27 Feb. 1945
15-17. Storage - Removed as of 27 Feb. 1945
18. Storage
19. Storage - Removed as of 27 Feb. 1945
20. Storage - North portion removed as of 27 Feb. 1945
21a, b. Storage
22. Possible machine shop, small parts manufacture. Over 50% removed as of 27 Feb. 1945
23. Unidentified
24. Possible machine shop, small parts manufacture. Removed as of 27 Feb. 1945
25a. Pressing and small parts manufacture
b. Storage - 60% removed as of 27 Feb. 1945
26a. Sub-assembly
b. Storage - Small section removed as of 27 Feb. 1945
27-29. Unidentified
30a. Sub-assembly
b. Storage - Nearly completely removed as of 27 Feb. 1945
31a. Sub-assembly
b. Storage - Nearly completely removed as of 27 Feb. 1945
c. Machine shop, small parts manufacture
32. Unidentified
33. Boiler House
34. Storage
35. Workshop - S half removed as of 27 Feb. 1945
36. Unidentified
37-39. Storage
40. Offices
41. Unidentified
42a, b. Administration
43. Storage - Removed as of 27 Feb. 1945
44. Unidentified
45. Storage
46. Unidentified
47. Storage
48a. Probable foundry
b, c. Storage - Nearly completely removed as of 27 Feb. 1945
49. Storage
50-53. Storage - Removed as of 27 Feb. 1945
54. Unidentified - Small section removed as of 27 Feb. 1945
55. Unidentified
56. Storage
57. Storage - Removed as of 27 Feb. 1945
58. Storage

FOLDERS OF JTG FOLDERS SHOULD INSERT THIS SHEET IN AIR TARGET SYSTEM FOLDER: JAPANESE AIRCRAFT IN PLACE OF SHEET 90.13–1545 P3.

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UNANNOTATED HALF MAY BE TAKEN INTO THE AIR IF DATA IS TRIMMED OFF. ANNOTATED HALF IS NOT TO BE TAKEN INTO THE AIR.

CONFIDENTIAL

TARGET NO. 90.13-1545

APPROX. COORDINATES 36°15′ NORTH 139°25′ EAST

PHOTOGRAPHED 7 NOVEMBER 1944

JOINT TARGET GROUP - WASHINGTON, D. C

NAKAJIMA AIRCRAFT CO.

KOIZUMI JAPAN

500 0 1:6,000 500 1000 FEET

ILLUSTRATION NO. 90.13-1545-P5

ISSUED JANUARY 1945

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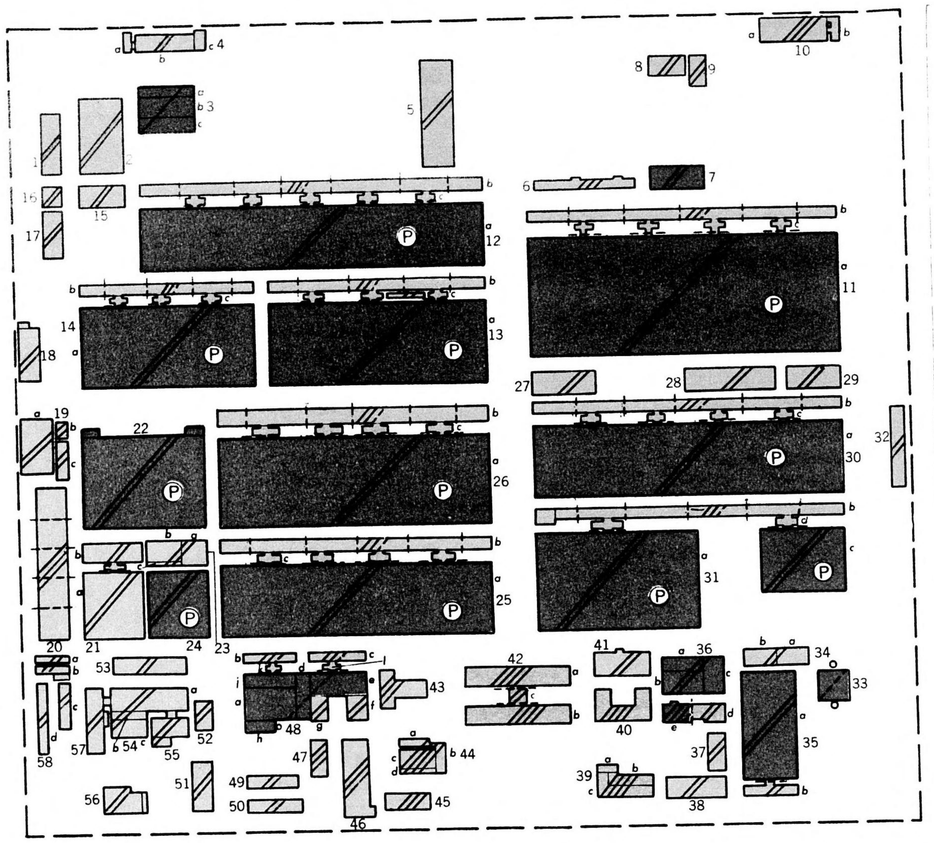

FIRE SUSCEPTIBILITY PLAN

PRIMARY BUILDINGS (P) FIRE WALL, CERTAIN

SECONDARY BUILDINGS (S) FIRE WALL, PROBABLE

BUILDINGS	CONTENTS
COMBUSTIBLE	NON-COMBUSTIBLE
NON-COMBUSTIBLE	SLIGHTLY COMBUSTIBLE
FIRE RESISTANT	MODERATELY COMBUSTIBLE
COMBINATION I.E. COMBUSTIBLE ROOF RESISTANT FLOORS	HIGHLY COMBUSTIBLE
WATER TANK (W)	EXTREMELY COMBUSTIBLE
	INTERMEDIATE VALUES

AREA IN SQ. FT.	PRIMARY	ALL BLDGS. SHOWN
NO. OF BUILDINGS	11	58
NO. OF FIRE DIVISIONS	11	117
PLAN AREA	2,125,000	3,350,000
TOTAL FLOOR AREA	2,125,000	3,500,000
SITE AREA	7,875,000	

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Sheet No.90.13-1545 P6
Date 21 Feb. 1945
Page No. 1 (1 pages)

JOINT TARGET GROUP, WASHINGTON, D.C.
FUNCTIONAL IDENTIFICATION SHEET
(To be read in conjunction with Illustration No. 90.13-1545 P5)

Obj. Folder 90.12, 13
Obj. Area 90.13
AAF Target No. 90.13-1545

Place Koizumi (Japan)
Air Target System Aircraft

Lat.: 36° 15'N
Long: 139° 25'E
Alt.: 125 feet

NAME OF TARGET NAKAJIMA AIRCRAFT, KOIZUMI PLANT
(Nakajima Hikoki KK, Koizumi Seisakusho)

ALL PREVIOUS SHEETS CANCELLED

Building No.	Function of Building
1-3	Unidentified
4	Storage
5	Unidentified
6	Storage
7	Unidentified
8-9	Storage
10	Unidentified
11a	Sub-assembly and assembly
11b	Storage
12a	Sub-assembly and assembly
12b	Storage
13a	Sub-assembly
13b	Storage
14a	Sub-assembly and assembly
14b, 15-21b	Storage
22	Machine shop, small parts manufacture
23	Unidentified
24	Machine shop, small parts manufacture
25a	Pressing and small parts manufacture
25b	Storage
26a	Sub-assembly
26b	Storage
27-29	Unidentified
30a	Sub-assembly
30b	Storage
31a	Sub-assembly and assembly
31b	Storage
31c	Machine shop, small parts manufacture
32	Unidentified
33	Boiler house
34	Storage
35	Workshop
36	Unidentified
37-39	Storage
40	Offices
41	Unidentified
42a, b	Administration
43	Storage
44	Unidentified
45	Storage
46	Unidentified
47	Storage
48a	Probable foundry
48b, c, 49-53	Storage
54-55	Unidentified
56-58	Storage

(Based on F/A Report No. 6, AC/AS, Intelligence, Photographic Division, dated 27 November 1944).

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JOINT TARGET GROUP, WASHINGTON, D. C.
TARGET LOCATION SHEET

NAKAJIMA AIRCRAFT, KUMAGAYA PARTS PLANT

KUMAGAYA — JAPAN

SHEET No. . . . . 90.13-1650—TL
DATE . . . . . 10 May 1945
TARGET No. 90.13-1650
AIR TARGET SYSTEM
End Prdt. Ind.—Aircraft
COORDINATES . . . . 36°09'N 139°22'E
ALTITUDE . . . . . 17 feet

SIGNIFICANCE:

Engine parts plant supplying the principal Nakajima engine factories, also reported to be making airframe parts. A new Nakajima engine plant has been reported in the locality which may be this plant or may be the plant located in the open country W of this target outlined by dotted lines.

LARGE SCALE ILLUSTRATION—SCALE APPROX.: 1:16,550

SMALL SCALE ILLUSTRATION—SCALE APPROX.: 1:50,000

Holders of Joint Target Group Folders should insert this sheet in Air Target System Folder: Japanese Aircraft with other 90.13-1650 material.

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JOINT TARGET GROUP, WASHINGTON, D. C.
TARGET INFORMATION SHEET

SHEET . . . 90:13-2131—TI
DATE . . . . . 26 May 1945
PAGE 1

NAKAJIMA AIRCRAFT, UTSUNOMIYA PLANT

UTSUNOMIYA **JAPAN**

TARGET 90:13-2131
OBJ. AREA 90:13
OBJ. FOLDER . . New Target
CATEGORY
End Prdt. Ind.—AIRCRAFT

LAT. . . . . 36° 32′ N
LONG. . . . . 139° 52′ E
ALT. . . . . 367 feet

SIGNIFICANCE

This new plant, built since 1941, started production of the newly developed Nakajima army fighter, Frank, in the summer and early fall of 1944. It has probably reached substantial output by now, and the size of the plant suggests an eventual production of between 125 and 175 completed aircraft per month. It is likely that unless damaged, present output will increase rapidly during the summer of 1945 as it takes over production of other Nakajima plants that have suffered bomb damage. Both ground information and study of the floorspace indicate that this plant was also making parts or subassemblies for other Nakajima airframe plants prior to the destruction of the Nakajima new Ota Plant (TARGET 90:13-1544) and the Nakajima Koizumi Plant (TARGET 90:13-1545). Parts and subassemblies now being produced are presumably being used at the Utsunomiya plant.

LOCATION

(Refer to Illustration No. 90:13-2131 P2.) About 65 miles N of Tokyo Bay on the plain that stretches N from Tokyo, with peaks of nearly 3000 feet to the E, and of 6000-8000 feet to the W. It is about 1.5 miles S of the main road intersection in the town of Utsunomiya, and about 1 mile N of the hangars at the factory airfield. The main runway of this airfield points almost due N towards the target and a taxiway joins it to the SE corner of the plant site. A highway, running S from Utsunomiya to Ishibashi and Oyama, passes immediately E of the factory. The railroad from Oyama runs parallel to this road until opposite the plant, at which point it swings NE to enter the Utsunomiya freight yards. A spur line forms the northern boundary of the site.

DESCRIPTION AND LAYOUT

(Refer to Illustration No. 90:13-2131 P4.) The target area is an irregular rectangle, oriented E-W. Excepting a small storage area at the NE corner and a small foundry and storage area at the S, it measures about 3600 feet E-W by 2400 feet N-S. Plan (roof) area is approximately 1,750,000 square feet.

The principal buildings believed devoted to production of Frank aircraft lie in two E-W rows in the N half of the plant (16, 22, 30, 35 in the N row and 18, 23, 31, 36 in the S row), occupying an area about 2,700 feet E-W by 800 feet N-S. Airframe production flow apparently moves from the W shops (16, 18) to final and post assembly buildings (35, 36) at the E. S and W of the area assigned to Frank production lie shops (mainly 4, 5, 20) believed formerly engaged in the parts fabrication for other Nakajima Plants.

There is evidence that the plant is still being expanded. A railroad siding enters the W side where raw materials are stored and parts made. Finished aircraft move S to the factory airfield by a direct taxiway.

PRIMARY OBJECTIVES

(Refer to Illustration No. 90:13-2131 P4.) The shops engaged in subassembly and machining of Frank components are primary objectives. Secondary objectives are the parts fabrication shops and final assembly. These are:

Primary Objectives	Secondary Objectives
16	20
18	36
22	4
23	5
30	
31	

CONSTRUCTION AND VULNERABILITY

Production buildings are predominantly of medium span, one-story, gable roof design with several long span, exposed chord, sawtooth roof structures. Probably all are of noncombustible, steel frame construction with roofs and walls of light weight sheet materials. These structures are mostly in HE vulnerability class V4 (see JTG/M-3/1). Minor buildings are of medium to short span wood frame construction and are predominantly in vulnerability class V4.

WEAPON RECOMMENDATIONS

Instructions with regard to weapons will usually be given in Field or Operational Orders, but in the absence of such instructions and to assist Planners in formulating such orders the following information is given:

An attack with a combination of high explosive and incendiary bombs is recommended. A preliminary structural and occupancy analysis of the plant indicates the following weapons should be selected:

	High Explosive	Fuzing	Incendiary
Preferred:	1000-lb GP or 500-lb GP or 2000-lb GP	0.01 N/ND T	AN-M50 4-lb or AN-M69 6-lb (in aimable clusters for high level attack)
Alternative:	250-lb GP	0.01 N/ND T	AN-M47 70-lb AN-M76 500-lb Fire bombs (jettisonable gas tanks, Napalm filled)
Not recommended:	100-lb GP SAP or AP bombs Depth bombs		

Note: (a) The 250-lb GP and fire bomb are not recommended as alternative weapons in the case of high and medium altitude attacks.
(b) Use 0.1 or 0.025 N if 0.01 N fuzes are unavailable, and 0.01 T if ND T fuzes are unavailable. The ND fuzing is recommended as the majority of the buildings have light roofs and are best destroyed by blast effects.
(c) The above recommendations are on a weight for weight basis.

CAMOUFLAGE, DECOYS, AND SMOKE SCREENS

Photography of 6 April 1945 shows two buildings poorly camouflaged. No evidence of decoys or smoke screens has been received.

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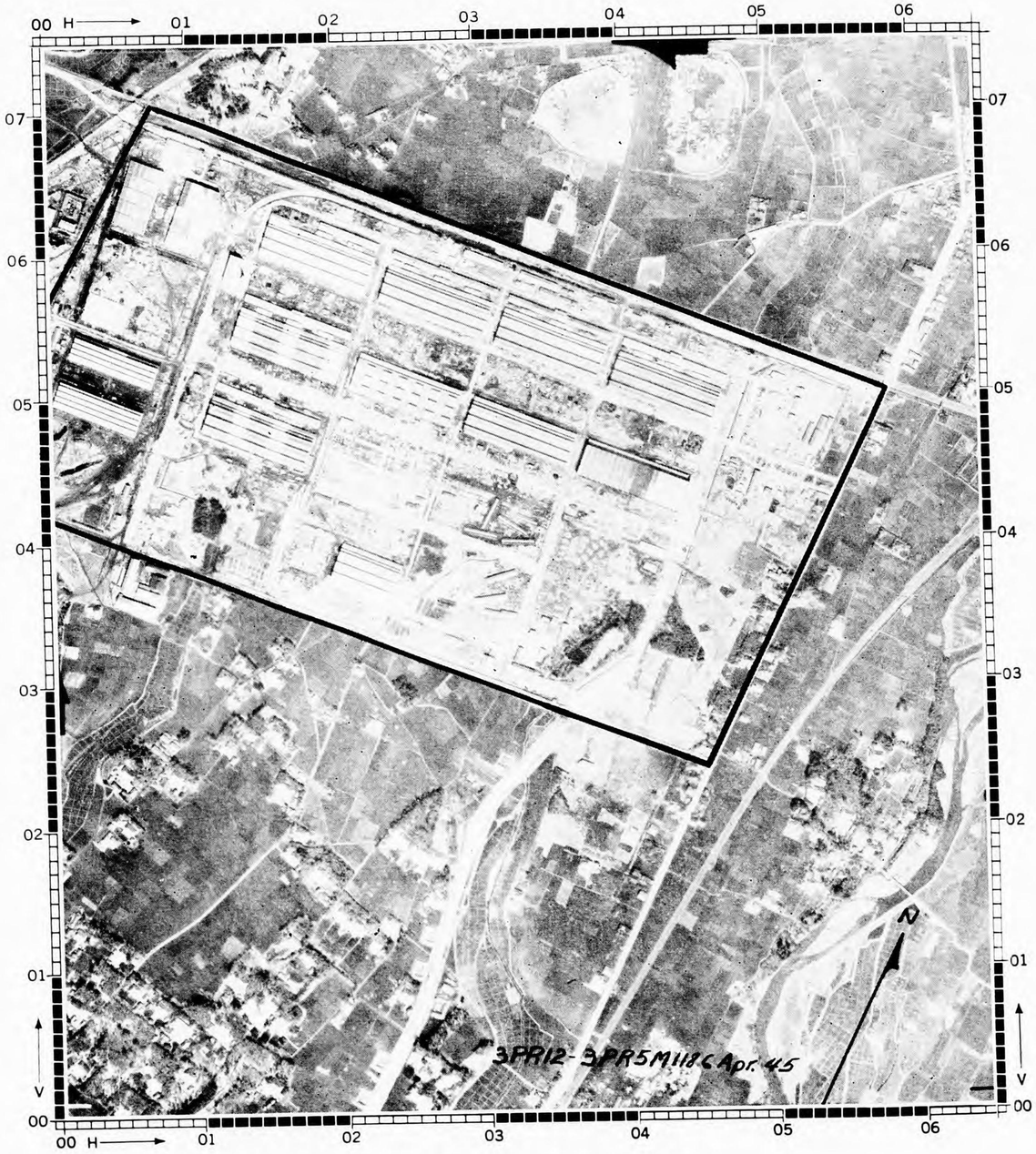
NAKAJIMA AIRCRAFT, UTSUNOMIYA PLANT
UTSUNOMIYA JAPAN

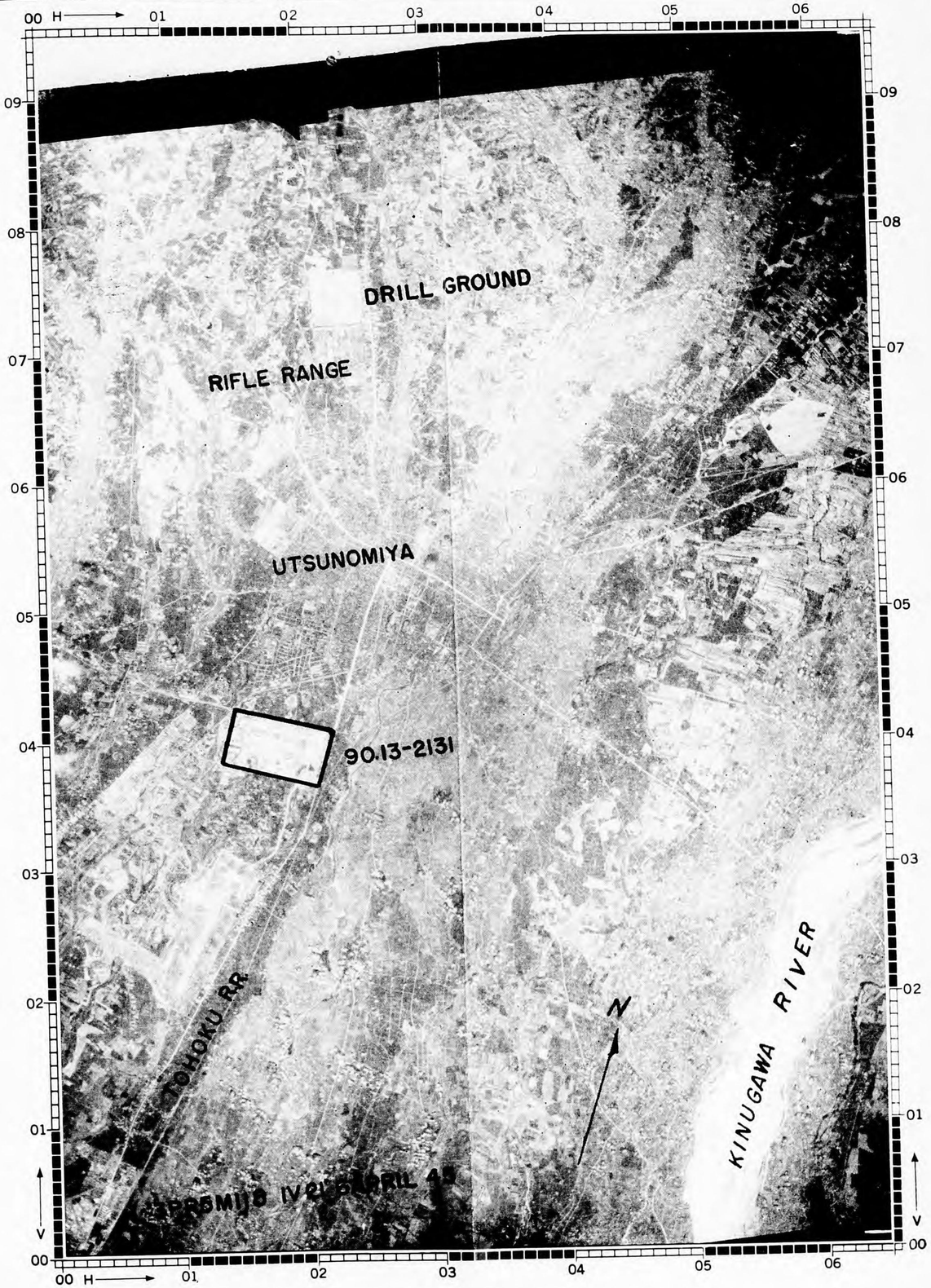
SHEET No. . . . . 90.13-2131—TL
DATE . . . . . 8 May 1945
TARGET No. 90.13-2131
AIR TARGET SYSTEM
End Prdt. Ind.—Aircraft
COORDINATES . . . . 36°32'N 139°52'E
ALTITUDE . . . . . 367 feet

SIGNIFICANCE:

This is a new Nakajima plant which is thought to be currently turning out an important single-engine fighter, probably Frank, and parts for other Nakajima plants. The present capacity of this plant is probably 75 single-engine aircraft per month plus parts for other plants. There is evidence, however, of expansion.



LARGE SCALE ILLUSTRATION—SCALE APPROX.: 1:9600



SMALL SCALE ILLUSTRATION—SCALE APPROX.: 1:64,000

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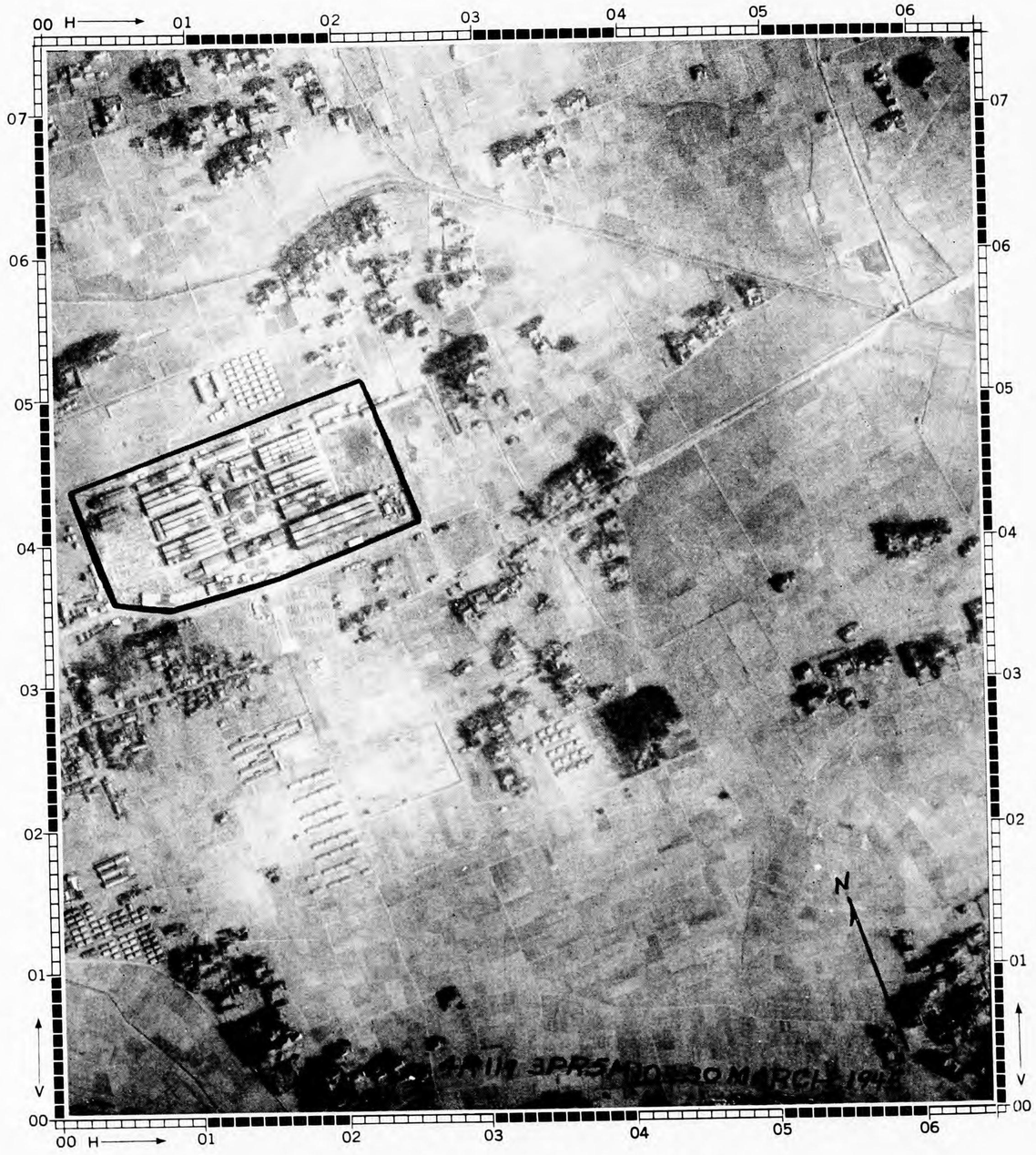
NAKAJIMA AIRCRAFT, OJIMA PLANT
OJIMA JAPAN

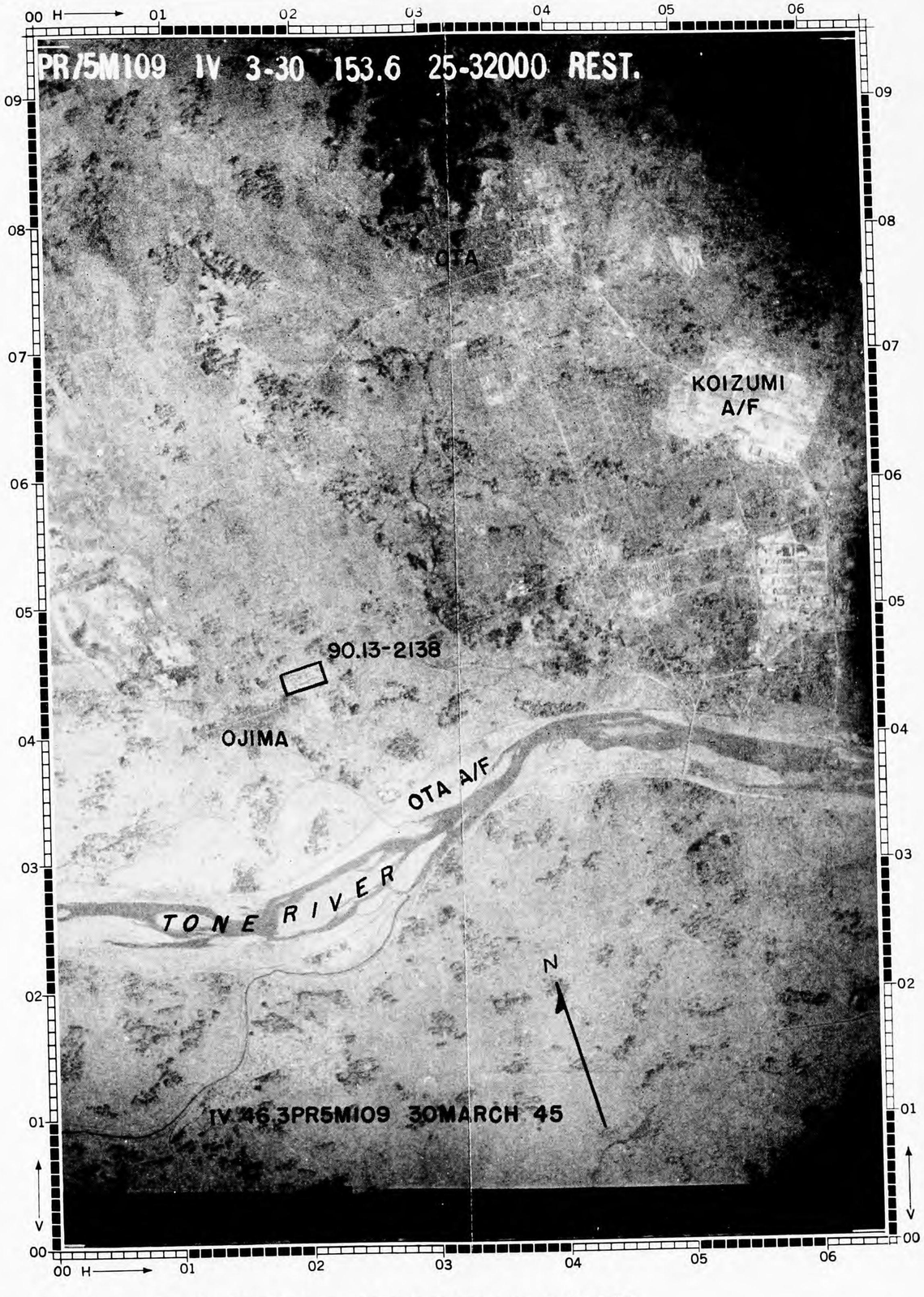
SHEET No. . . . . 90.13-2138—TL
DATE . . . . . 8 May 1945
TARGET No. 90.13-2138
AIR TARGET SYSTEM
End Prdt. Ind.—Aircraft
COORDINATES . . . . 36°15'N 139°20'E
ALTITUDE . . . . . 108 feet

SIGNIFICANCE:

This plant is reported to be making important aircraft components for Army Aircraft made by the principal Nakajima factories. One PW also reports that fuselages are made at this plant. Machine tools for Nakajima factories may also be made here.



LARGE SCALE ILLUSTRATION—SCALE APPROX.: 1:8400



SMALL SCALE ILLUSTRATION—SCALE APPROX.: 1:64,000

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JOINT TARGET GROUP, WASHINGTON, D. C.

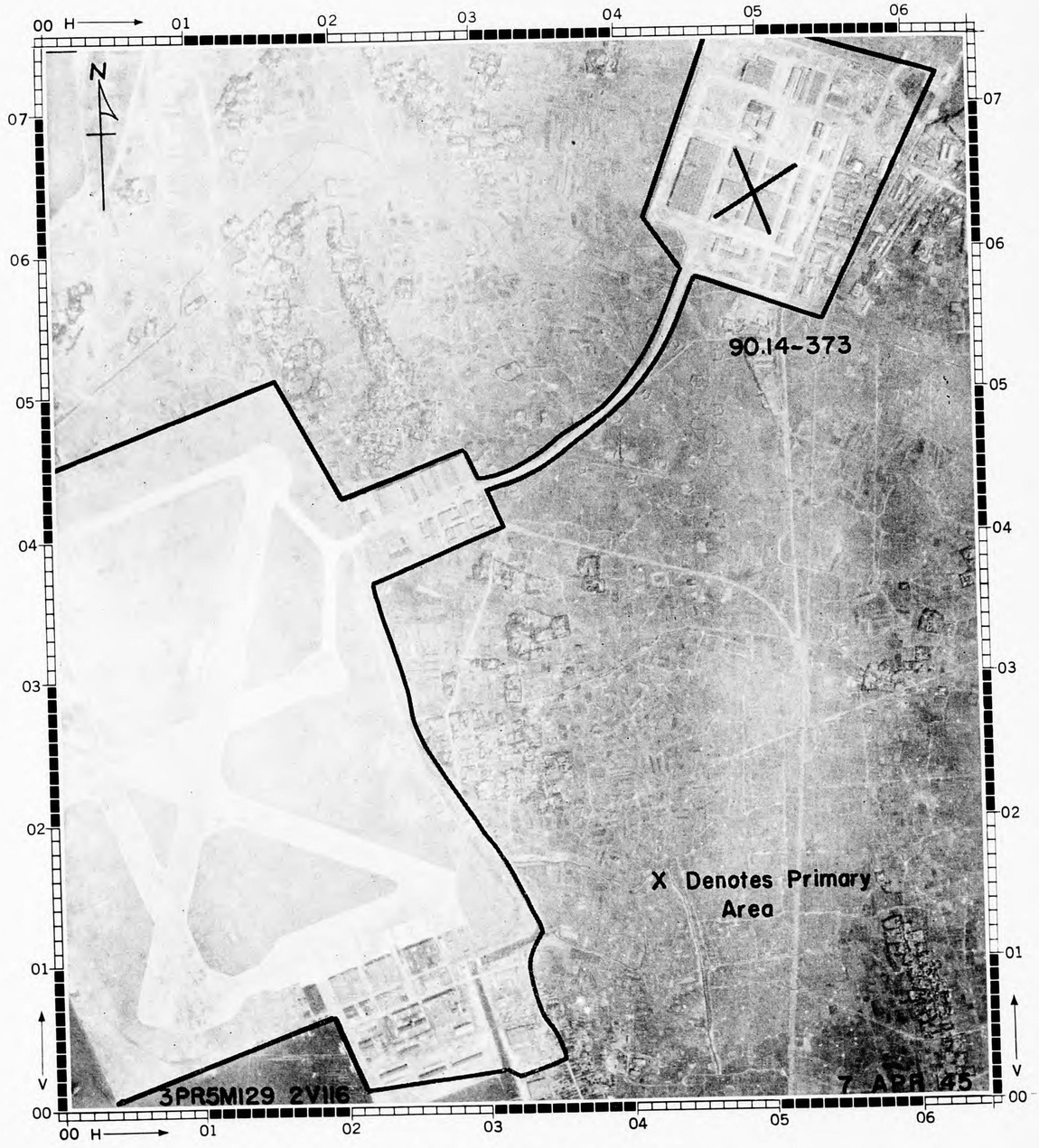
TARGET LOCATION SHEET

KISARAZU NAVAL AIR STATION
KISARAZU JAPAN

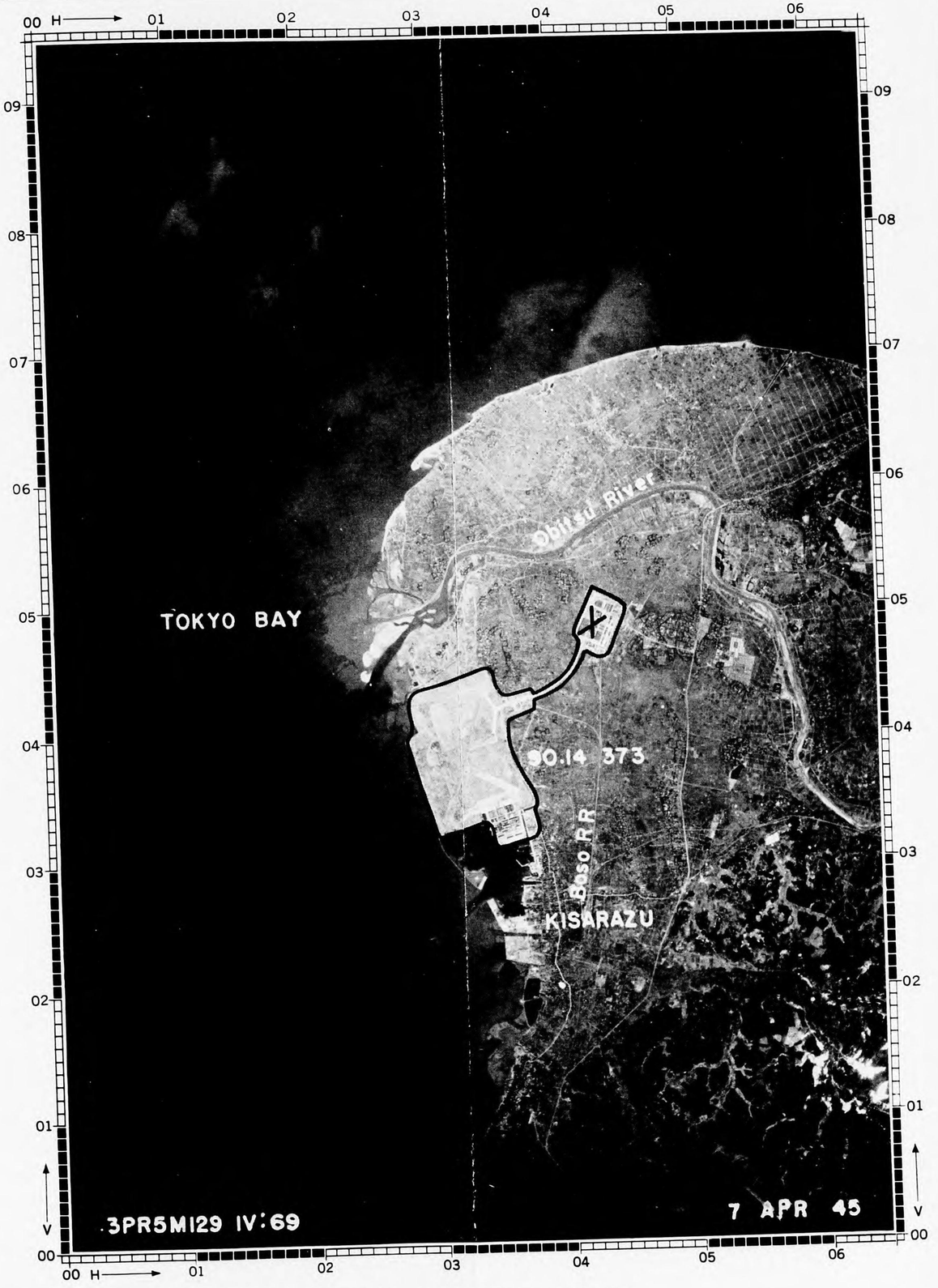
SHEET No. . . . . 90.14-373—TL
DATE . . . . . 16 May 1945
TARGET No. 90.14-373
CATEGORY . . . . End Prdt. Ind.—Aircraft
COORDINATES . . . . 35°24'N 139°55'E
ALTITUDE . . . . . 10 feet

SIGNIFICANCE:

One of the most important naval air stations and also the 2*nd* Naval Air Depot which has facilities for the repair and modification of aircraft. In addition the station serves as an intermediate training base and a test field for new aircraft. Engine and aircraft component storage is also reported at this base.



LARGE SCALE ILLUSTRATION—SCALE APPROX.: 1:14,500



SMALL SCALE ILLUSTRATION—SCALE APPROX.: 1:58,000

Holders of Joint Target Group Folders should insert this sheet in Air Target System Folder: Japanese Aircraft with other 90.14-373 material.

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JOINT TARGET GROUP, WASHINGTON, D. C.
TARGET INFORMATION SHEET

SHEET No. . 90.14-2016-TI
DATE . . . . . 5 May 1945
PAGE 1

KISARAZU AIRCRAFT ENGINE PLANT

TARGET No. . . 90.14-2016
OBJ. AREA 90.14
OBJ. FOLDER No. New Target
CATEGORY . . . . . Aircraft

KISARAZU — JAPAN

LAT. . . . . 35°19'N
LONG. . . . . 139°55'E
ALT. . . . . Not Available

SIGNIFICANCE

The exact function of this plant is not known and it is not now an important target. Air cover of 13 December 1944 and 2 April 1945 indicates it is probably engaged in engine overhaul and repair, although it might possibly be manufacturing new engines on a small scale. The plant is only 9 per cent built-up, and considerable expansion is possible.

LOCATION

(Refer to Illustration No. 90.14-2016 P2.) ENE across Tokyo Bay from Yokosuka Naval Base. It is situated on the N bank of the Koito River, approximately 3.2 miles ESE of its mouth on Tokyo Bay. The city of Kisarazu lies roughly 4.5 miles N by E.

DESCRIPTION AND LAYOUT

(Refer to Illustration No. 90.14-2016 P4, P5.) The target area is roughly rectangular, measuring about 4750 feet NW-SE and 2000 feet NE-SW. It is divided into two fairly well defined groups of buildings on the NW and SE. The more important group on the SE includes the only two large buildings, one (49) of 110,900 square feet, and the other (50) of 88,000 square feet. These are probably engaged in engine tear-down, overhaul, and re-assembly. Several small shops surrounded them on the NE and W. There are 12 engine test cells of the hangar type S of building 50, and an equal number appear to be under construction.

PRIMARY OBJECTIVES

(Refer to Illustrations No. 90.14-2016 P4, P5.) The primary and secondary objectives of this target, listed in approximate order of productive importance, are as follows:

PRIMARY		SECONDARY	
Building No.	Function	Building No.	Function
49	Engine repair/assembly	47	Machine shop
50	Engine repair/assembly	37	Shop
		38	Small machine shop
		39	Small machine shop

The primary buildings also may contain machine tools and other valuable equipment. Their destruction would result in the loss of engines under repair and possibly in the final stages of construction. The secondary units are believed to house precision machine tools, vital in aero-engine plants.

CONSTRUCTION AND VULNERABILITY

(Refer to Illustrations No. 90.14-2016 P4, P5.)

Primary and secondary objectives listed in approximate order of importance:

Building No.	Plan area (sq. ft.)	Stories	Roof[1]	Combustibility	HE vulnerability[2]
49	110,900	1	Light	Noncombustible	V4
50	88,000	1	Light	Noncombustible	V4
47	19,000	1	Light	Noncombustible	V4
37	28,400	1	Light	Noncombustible	V4
38	13,200	1	Light	Noncombustible	V4
39	13,200	1	Light	Noncombustible	V4

Classification of buildings:

	Primary and secondary objectives	Whole Target
Total plan area of buildings (square feet)	272,700	721,200
Total floor area of buildings (square feet)	272,700	775,800
HE vulnerability (per cent of total plan area in each class):		
V1 (least vulnerable)	.....	....
V2	.....	....
V3 . . . . . 2-story	.....	8%
V4 . . . . . 1-story	100%	84%
V5 (most vulnerable) 1-story	.....	....
S—Special—Engine Test Cells	.....	8%
Combustibility (per cent of total plant area in each class):		
Fire resistant (R) . . . . . 1-story (Engine Test Cells)	.....	8%
Noncombustible (N) 1-story	100%	50%
Combustible (C) 2-story	.....	8%
1-story	.....	34%
Combustibility (per cent of total FLOOR area in "Combustible" class)	.....	46%
Susceptibility of contents to incendiary bombs (whole target)[3]	.....	Fair

[1] Lightweight roofs are readily penetrated by all types of incendiary bombs. Initiation of HE tail fuzes by these roofs cannot be depended upon except for bombs striking structural members (30 to 40 per cent of bombs striking buildings).

[2] For explanation of HE vulnerability classifications refer to JTG Memorandum No. JTG/M-3/1, dated 26 March 1945 (nontechnical), or JTG/M8 (technical).

[3] Degrees: none, poor, fair (i.e., average industrial fire occupancy), good, excellent. For detailed study of fire susceptibility of structures and contents refer to Illustration No. 90.14-2016 P5.

WEAPON RECOMMENDATIONS

Reference should be made to Weapon Recommendations Sheet No. 90.14-2016-WR1 for high and medium altitude attack and to Weapon Recommendations Sheet No. 90.14-2016-WR2 for low altitude attack.

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CAMOUFLAGE, DECOYS, AND SMOKE SCREENS

Photography of 2 April 1945 shows extensive use of disruptive roof painting. There was no camouflage indicated in photography of 13 December 1944. No use of smoke screens has been reported.

ADDITIONAL INFORMATION

This plant is believed to be a part of, or related to, the Second Naval Air Depot, one of the most important in Japan, whose principal installations are outside of Kisarazu.

(Refer to Illustrations No. 90.14-2016 P4, P5.) Air cover of 2 April 1945 shows the following buildings removed or in the process of removal:

3	Removed
9	20 per cent removed
10	40 per cent removed
12	40 per cent removed
22	Being dismantled
35	Removed
48	Removed

This removal appears to have been for possible additional fire protection, as it has broken up blocks of buildings.

Holders of Joint Target Group Folders should insert this sheet in Air Target System Folder: Japanese Aircraft after 90.14-2016-TI, page 1.

JOINT TARGET GROUP, WASHINGTON, D. C.
WEAPON RECOMMENDATIONS SHEET

SHEET No. **90.14-2016 WR1**
DATE..... **10 May 1945**
PAGE..... **1**

KISARAZU AIRCRAFT ENGINE PLANT

KISARAZU **JAPAN**

TARGET No.. **90.14-2016**
OBJ. AREA..... **90.14**
OBJ. FOLDER No. **New Target**
AIR TARGET SYSTEM **Aircraft**

LAT..... **35°19'N**
LONG..... **139°55'E**
ALT..... **Not Available**

HIGH AND MEDIUM ALTITUDE ATTACK

(See also 90.14-2016-TI and associated target illustrations.)

AIMING POINT

(Refer to Illustrations No. 90.14-2016 P4, P5). For maximum damage to the primary and secondary objectives the aiming point should be in the vicinity of building 39. This sheet applies to an attack against an area of the target including only buildings 21 through 52.

WEAPONS AND FUZING

	High Explosive	Fuzing	Incendiary
Preferred:	1000-lb GP	0.01 N/ND T	AN-M50 4-lb (in aimable clusters)
	or 500-lb GP	0.01 N/ND T	or AN-M69 6-lb (in aimable clusters)
Alternative:	2000-lb GP	0.01 N/ND T	AN-M47 70-lb AN-M76 500-lb

Not recommended: Smaller GP bombs
SAP or AP bombs
Depth bombs

Notes: (a) Use 0.1 N fuzes if 0.01 N fuzes are not available and 0.01 T fuzes if ND T fuzes are not available. ND tail fuzing is recommended since most buildings have light roof material and are best destroyed by blast effects.

(b) The above recommendations are on a weight for weight basis.

LOADING TABLE FOR INITIAL ATTACK

The table below is prepared for an initial attack on this target. For its application to later attacks see JTG Memorandum No. 3/1.

LOADING TABLE FOR PREFERRED COMBINATION OF BOMBS**

Tons (actual) Dispatched	Percent of bombs dispatched falling within 1000 feet of aiming point.							
	10%		15%		20%		30%	
	Tons HE-IB	F* %	Tons HE-IB	F* %	Tons HE-IB	F* %	Tons HE-IB	F* %
100	30- 70	20	20- 80	30	15- 85	35	10- 90	40
200	30-170	35	20-180	40	25-175	45	80-120	50
400	60-340	45	170-230	50	225-175	55	280-120	60
800	460-340	55	570-230	60	—	—	—	—
1200	860-340	60	—	—	—	—	—	—

* Expected percent of serious damage to area of the target including only buildings 21 through 52.

** If alternate bombs are used, the distribution of the load between HE and IB should be the same. The expected percent of damage will, of course, be lower.

Holders of Joint Target Group Folders should insert this sheet in Air Target System Folder: Japanese Aircraft with other 90.14-2016 material.

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JOINT TARGET GROUP, WASHINGTON, D. C.

WEAPON RECOMMENDATIONS SHEET

SHEET No. 90.14-2016-WR2
DATE..... 10 May 1945
PAGE 1

TARGET No... 90.14-2016
OBJ. AREA..... 90.14
OBJ. FOLDER No. New Target
AIR TARGET SYSTEM Aircraft

LAT..... 35°19'N
LONG..... 139°55'E
ALT..... Not Available

KISARAZU AIRCRAFT ENGINE WORKS

KISARAZU **JAPAN**

Holders of Joint Target Group Folders should insert this sheet in Air Target System Folder: Japanese Aircraft following 90.14-2016 WR1.

LOW ALTITUDE ATTACK

(See also 90.14-2016-TI and associated target illustrations.)

TYPE OF ATTACK

This sheet applies primarily to an attack by carrier based aircraft, fighter bombers, or other similar aircraft which carry out dive, glide, low level, or minimum altitude attacks.

BUILDINGS CONSIDERED

Data are given below for an attack on primary and secondary buildings only (Illustrations No. 90.14-2016 P4, P5). Other buildings are of insufficient importance to merit specific attack.

WEAPONS AND FUZING

A pure HE attack (no incendiaries) may be launched against the buildings specified in the table below. The choice of a particular HE weapon for attack on a given building can be made by considering both the number of hits on that building required for the various bombs (see the table below) and the stowage capabilities of the aircraft to be used. The proper fuzings for the HE weapons to be used against the individual buildings are given in the table below, with the exception that for minimum altitude attacks an 8-15 sec. delay is required for safety of the aircraft. *The use of SAP, AP, smaller GP, or depth bombs is not recommended for this target.*

NUMBER OF HITS

Number of Hits Required to Achieve 50% Serious Damage to Individual Important Buildings*

Buildings in order of importance to production. (Ill. No. 90.14-2016 P4, P5)	Number of Hits			Fuzing**
	500-lb GP	1000-lb GP	2000-lb GP	
49	19	10	5	Against all buildings use 0.01 N/ND T fuzing.
50	15	8	3	
47	3	2	1	
37	5	2	1	
38	2	1	1	
39	2	1	1	
Total Number of Hits	46	24	12	
Total Tons***	12.1	11.9	12.5	

* To obtain the number of hits required to achieve 30% serious damage to individual important buildings, multiply the appropriate entry in the preceding table by 0.5; for 70% serious damage, multiply by 1.7.

** Use 0.1 N fuzes if 0.01 N fuzes are not available, and 0.01 T fuzes if ND T fuzes are not available. ND tail fuzing is recommended since the buildings have light roof material and are best destroyed by blast effects.

*** Tonnages are based on actual (not nominal) weights.

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JOINT TARGET GROUP
WASHINGTON, D. C.

KISARAZU AIRCRAFT ENGINE PLANT
KISARAZU JAPAN

0 2000 4000 6000 FEET
0 ½ 1 MILE
1:32 000 APPROX.

ILLUSTRATION No. . . . 90.14-2016 P1
DATE . . . . . 20 May 1945
TARGET No. 90.14-2016
COORDINATES . . . 35°19'N 139°55'E
PHOTOGRAPHED . 13 December 1944

Holders of Joint Target Group Folders should insert this sheet in Air Target System Folder: Folder: Japanese Aircraft with other 90.14-2016 material.

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JOINT TARGET GROUP
WASHINGTON, D. C.

KISARAZU AIRCRAFT ENGINE PLANT
KISARAZU JAPAN

0 2000 4000 6000 FEET
0 ½ 1 MILE
1:32 000 APPROX.

ILLUSTRATION No. . . . 90.14-2016 P2
DATE . . . . . 20 May 1945
TARGET No. 90.14-2016
COORDINATES . . . 35°19'N 139°55'E
PHOTOGRAPHED . 13 December 1944

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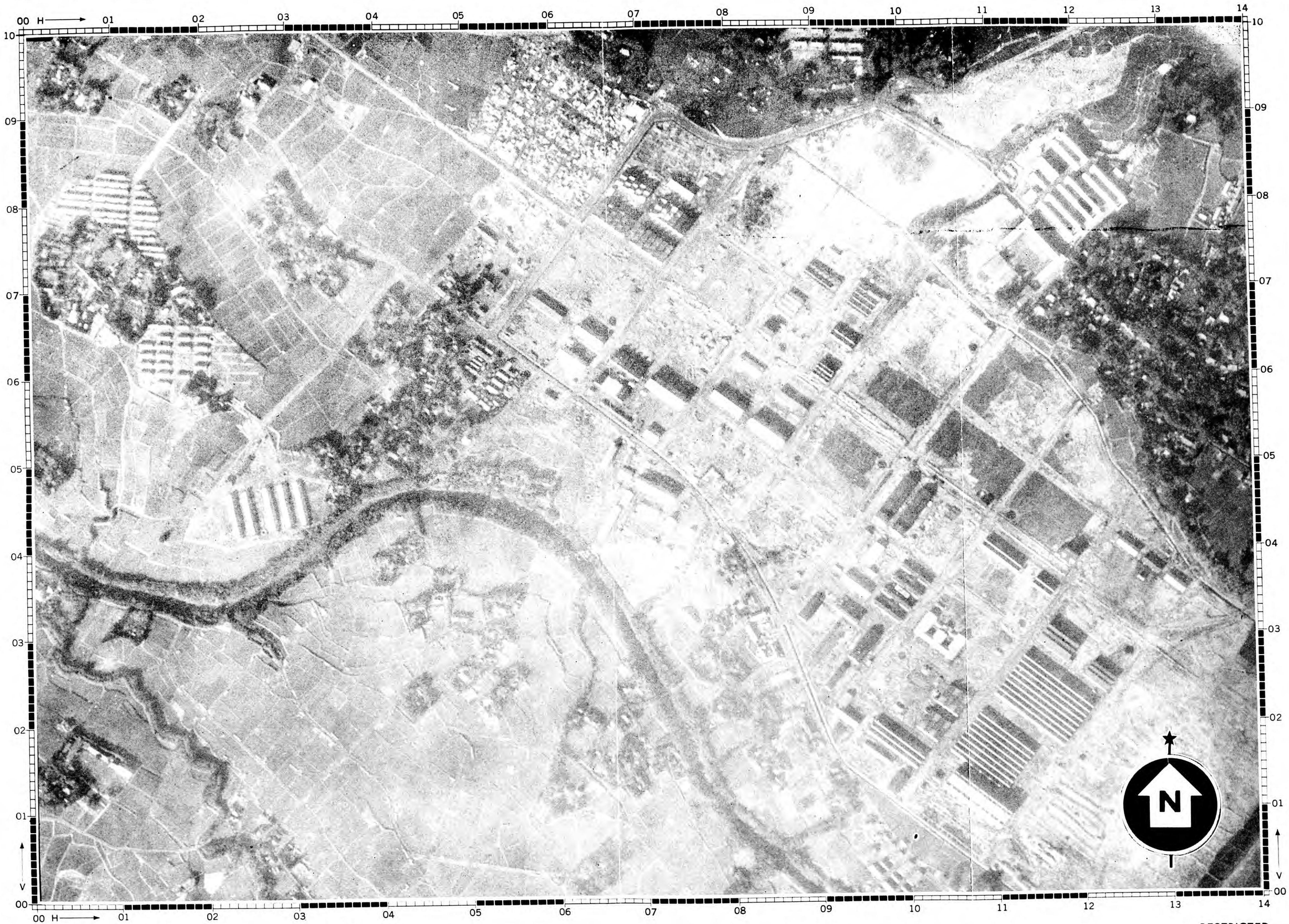
JOINT TARGET GROUP
WASHINGTON, D. C.

KISARAZU AIRCRAFT ENGINE PLANT
KISARAZU JAPAN

0 500 1000 1500 2000 2500 3000 FEET
0 1/4 1:6000 APPROX. 1/2 MILE

ILLUSTRATION No. . . . 90.14-2016 P3
DATE . . . . . 20 May 1945
TARGET No. 90.14-2016
COORDINATES . . . 35°19'N 139°55'E
PHOTOGRAPHED . 13 December 1944



Holders of Joint Target Group Folders should insert this sheet in Air Target System Folder: Japanese Aircraft with other 90.14-2016 material.

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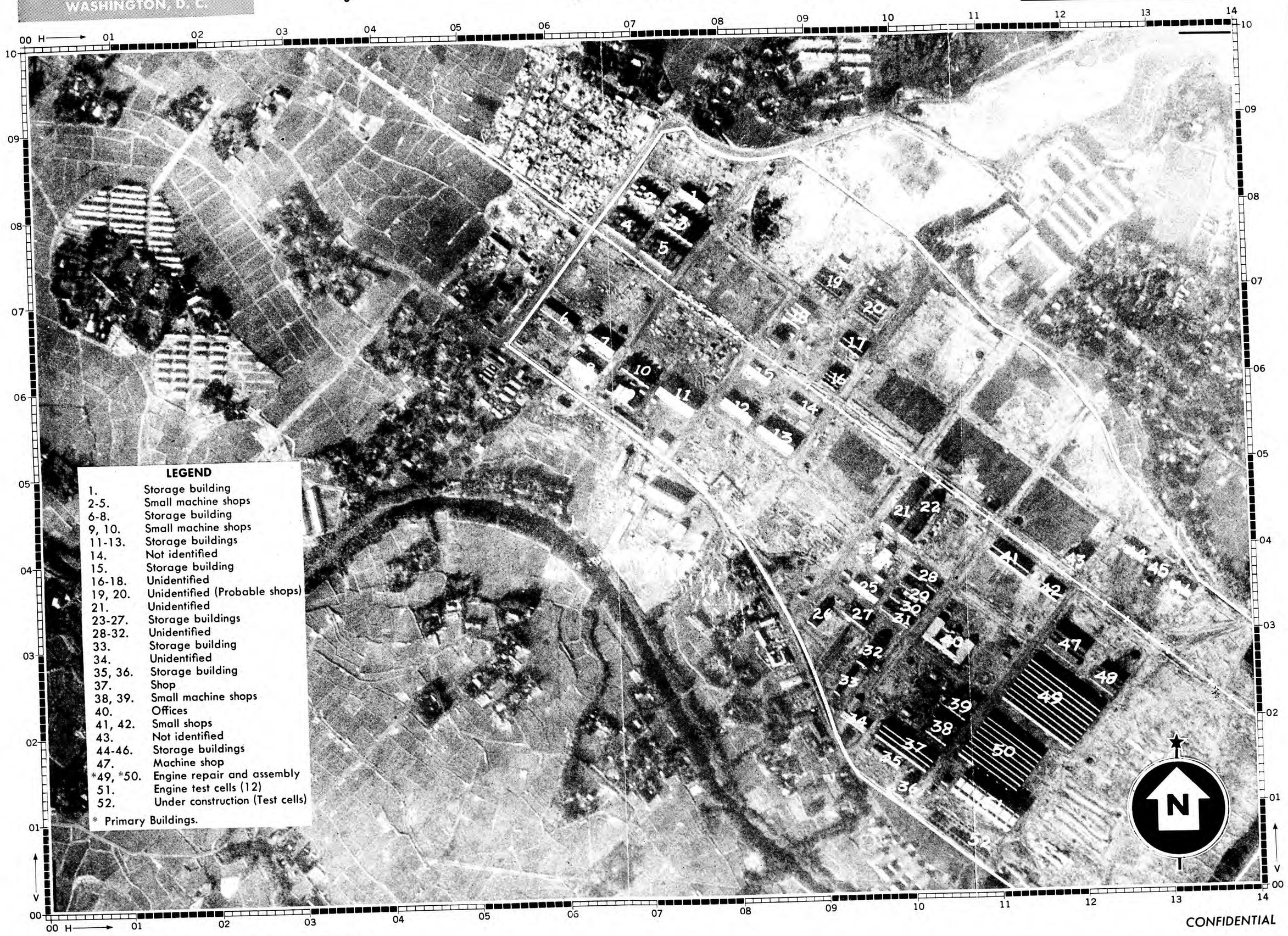
WASHINGTON, D. C.

KISARAZU AIRCRAFT ENGINE PLANT
KISARAZU JAPAN

ILLUSTRATION No.	90.14-2016 P4
DATE	20 May 1945
TARGET No.	90.14-2016
COORDINATES	35°19'N 139°55'E
PHOTOGRAPHED	13 December 1944

0 500 1000 1500 2000 2500 3000 FEET
0 1/4 1:6000 APPROX. 1/2 MILE



LEGEND

1.	Storage building
2-5.	Small machine shops
6-8.	Storage building
9, 10.	Small machine shops
11-13.	Storage buildings
14.	Not identified
15.	Storage building
16-18.	Unidentified
19, 20.	Unidentified (Probable shops)
21.	Unidentified
23-27.	Storage buildings
28-32.	Unidentified
33.	Storage building
34.	Unidentified
35, 36.	Storage building
37.	Shop
38, 39.	Small machine shops
40.	Offices
41, 42.	Small shops
43.	Not identified
44-46.	Storage buildings
47.	Machine shop
*49, *50.	Engine repair and assembly
51.	Engine test cells (12)
52.	Under construction (Test cells)

* Primary Buildings.

Holders of Joint Target Group Folders should insert this sheet in Air Target System Folder: Japanese Aircraft with other 90.14-2016 material.

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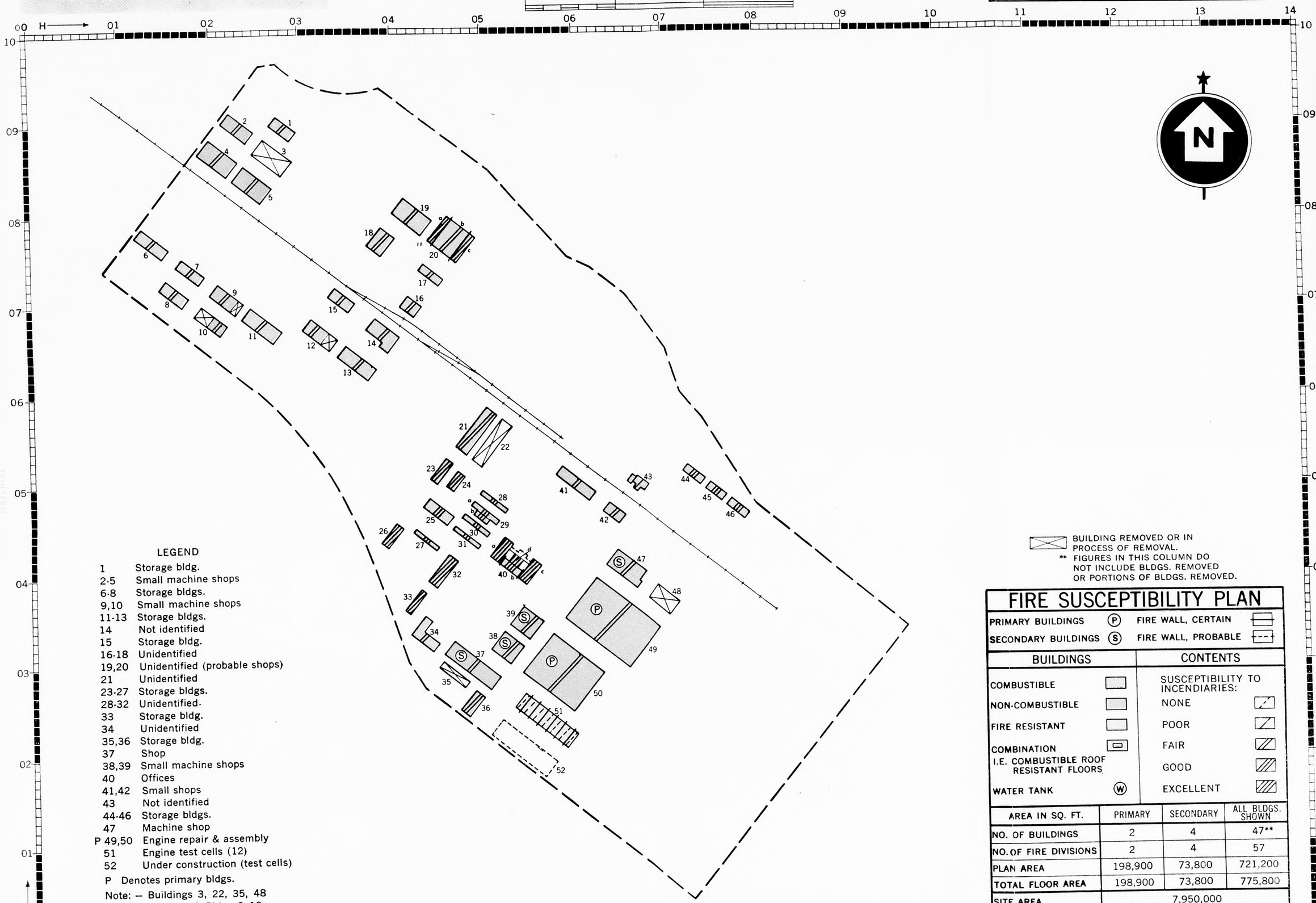
KISARAZU AIRCRAFT ENGINE PLANT,
KISARAZU, JAPAN

SCALE 1:6,000
500 0 500 1000 FEET

ILLUSTRATION NO. 90.14-2016-P5
DATE 28 APRIL 1945
TARGET NO. 90.14-2016
COORDINATES 35°19′ NORTH 139°55′ EAST
PHOTOGRAPHED 13 DECEMBER 1944 AND 2 APRIL 1945



LEGEND

1	Storage bldg.
2-5	Small machine shops
6-8	Storage bldgs.
9,10	Small machine shops
11-13	Storage bldgs.
14	Not identified
15	Storage bldg.
16-18	Unidentified
19,20	Unidentified (probable shops)
21	Unidentified
23-27	Storage bldgs.
28-32	Unidentified
33	Storage bldg.
34	Unidentified
35,36	Storage bldg.
37	Shop
38,39	Small machine shops
40	Offices
41,42	Small shops
43	Not identified
44-46	Storage bldgs.
47	Machine shop
P 49,50	Engine repair & assembly
51	Engine test cells (12)
52	Under construction (test cells)

P Denotes primary bldgs.

Note: – Buildings 3, 22, 35, 48 have been removed. Bldgs. 9, 10, 12 have been partially removed.

BUILDING REMOVED OR IN PROCESS OF REMOVAL.
** FIGURES IN THIS COLUMN DO NOT INCLUDE BLDGS. REMOVED OR PORTIONS OF BLDGS. REMOVED.

FIRE SUSCEPTIBILITY PLAN

PRIMARY BUILDINGS (P) FIRE WALL, CERTAIN
SECONDARY BUILDINGS (S) FIRE WALL, PROBABLE

BUILDINGS	CONTENTS
COMBUSTIBLE	SUSCEPTIBILITY TO INCENDIARIES:
NON-COMBUSTIBLE	NONE
FIRE RESISTANT	POOR
COMBINATION I.E. COMBUSTIBLE ROOF RESISTANT FLOORS	FAIR
WATER TANK (W)	GOOD
	EXCELLENT

AREA IN SQ. FT.	PRIMARY	SECONDARY	ALL BLDGS. SHOWN
NO. OF BUILDINGS	2	4	47**
NO. OF FIRE DIVISIONS	2	4	57
PLAN AREA	198,900	73,800	721,200
TOTAL FLOOR AREA	198,900	73,800	775,800
SITE AREA	7,950,000		

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Sheet No. 90.17-274-TI
Date 9 Feb. 1945
Page No. 1 (3 pages)

JOINT TARGET GROUP, WASHINGTON, D.C.
TARGET INFORMATION SHEET

Obj. Folder 90.17
Obj. Area 90.17
AAF Target No. 90.17-274

Place Yokosuka (Japan)
AIR TARGET
SYSTEM Shipping- Shipbuilding and Repair

Lat.: 35° 17'N
Long: 139° 40'E
Alt.: 10 feet

NAME OF TARGET YOKOSUKA NAVY YARD

ALL PREVIOUS SHEETS CANCELLED

SIGNIFICANCE

This is one of the four largest and most important navy yards in Japan. It is compactly laid out and equipped to repair, construct and fit out every type of Japanese naval vessel. It contains six dry docks, two of which can accommodate the largest type naval vessels, four building ways and a marine railway. Two of these ways are relatively wide and will accommodate several small vessels at one time. The yard contains complete repair facilities including a foundry, forge shop, boiler shop, diesel engine plant, and machine, ordnance and engine shop; also two structural shops, a new and old mold loft, a landing craft engine factory, and many other supplemental and complementary buildings. There are several thousand feet of docking space, a long slender finger pier and many large fixed, movable, and floating cranes. Important engineering research laboratories are reported to be located here. It is apparent that there is considerable activity at this yard. Photography of 1 November 1944 showed the docks, wharves and piers to be crowded with small and medium size naval vessels, landing craft, and small boats. The dry docks and building ways are all in use.

LOCATION

Along the entire W side of Yokosuka Peninsula which lies about 27 air miles S of Tokyo, at the southern end, western side, of Tokyo Bay. Sagami Bay is about 5 miles to the SW across the Miura Peninsula on which hills rise to about 800 feet. The base is about 10 miles N from the S tip of Miura Peninsula. Chiba Peninsula across Uraga Strait, is about 8 miles to the E at its closest point. It is connected with Yokohama by a branch line RR and a 3 lane macadam highway. A second branch connects with the Tokaido Mainline RR at Ofuna about 8 miles to the NW.

DESCRIPTION AND LAYOUT

(Refer to Illustration No. 90.17-274 P4). The target area is of irregular shape measuring about 7,000 feet long from N to S and about 3,000 feet wide at its widest point. The buildings, ways, docks and wharves are tightly packed in every available space throughout the yard. Relatively high hills have been cut into and land has been reclaimed. Railroad tracks and roads serve all parts of the yard.

The S end of the target area is occupied by three slipways, 1100 920, 260 feet in length (Slipways Nos. 1, 2 and 4), a marine railway, 525 feet in length (Slipway No. 3), a structural shop and old mold loft (Bldgs. 4 and 5), and supplementary structures. Photography of 1 Nov. 1944 showed four destroyer-type and a number of smaller vessels under construction in these ways.

The central section of the yard, on a small peninsula jutting NW into Yokosuka Harbor, has at its northern end dry dock No. 5, about 1,015 feet in length and dry dock No. 4, about 750 feet long; at its southern end, dry dock No. 3, about 300 feet in length, dry dock No. 2, approximately 460 feet long, and dry dock No. 1, about 420 feet long. Photography of 1 November 1944 showed that dry dock No. 1 contained two vessels 135 and 120 feet long, dry dock No. 2 a 350 foot vessel, dry dock No. 3 possibly a small submarine, dry dock No. 4 a 265-foot vessel (afloat), dry dock No. 5 two 280-foot vessels. All five of these docks are served by the major buildings adjacent to them on the small peninsula, including a foundry and machine shop (34), forge shop (27 and part of 28), boiler shop (33 also reported as a forge shop) diesel engine shop (59), and a machine, ordnance and engine shop (46, also reported as a pattern shop, 47 and 49). Other identified shops such as copper, pipe, electrical and sheet metal shops are also located in this area. A landing craft engine factory (17) is also located on this peninsula. The N edge of this

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peninsula is used as fitting out and repair and replacement area, as is the water's edge N from this small peninsula to dry dock No. 6. A long slender finger pier (pontoon) extends into the opening formed between Yokosuka Peninsula and the small peninsula. Photography of 1 November 1944 showed a large number of small vessels tied up along this dockage, including six or seven destroyer-type vessels.

The N end of the target area, the most recently constructed section, contains the largest dry dock in the yard, No. 6, over 1060 feet long. This is a construction dock, equipped with six large cranes, a large new structural shop (91), about 690 feet long and about 485 feet wide at its widest point, new mold loft (90), and supporting shops and equipment. Immediately to the NW of this structural shop are located several contiguous slipways (Slipway 5), 435 feet long, 165 feet wide, for the construction of small vessels, and presumably supporting shops. Photography of 1 November 1944 showed several small craft under construction on these ways.

There appeared to be, in the photography, a large quantity of material stored adjacent to the building ways and dry docks. There were many 80 foot to 110 foot vessels along the fitting-out wharves and piers. Adjacent to the landing craft engine factory (17) were craft measuring approximately 50 feet in length. Large numbers of small boats were also packed around the S end of the yard adjacent to Slipway 4.

(Refer to Illustration No. 90.17-274 P2). There is known to be extensive anchorage facilities for all sizes and types of ships in Yokosuka and nearby Harbors. On the E side of Yokosuka Peninsula are located an artillery school, military warehouses, naval barracks, naval hospital, machinist school, and a naval headquarters. On the W side of Yokosuka Harbor are located huge oil storage areas (Azuma Peninsula), the Azuma Oil Storage (TARGET 90.17-297); Yokosuka Arsenal and Armament Works (TARGET 90.17-282); and Oppama Naval Air Station (TARGET 90.17-298).

PRIMARY OBJECTIVES

(Refer to Illustration No. 90.17-274 P4). The primary objectives vary, depending upon whether repair facilities, new construction plant, or work in process is given the principal weight in evaluation. The machine, ordnance, and engine shops (46, 47, and 49) are probably the most vital area from a repair standpoint, the new and old structural shops and new and old mold lofts (4, 5, 90, and 91), are the most important from a new construction viewpoint, and the actual work in process in the dry docks, alongside the wharves, and on the ways, the most important for immediate front line effect. The destruction of the dry dock caissons and pump houses would probably put the dry docks out of operation for the longest period of time, but are very small targets and the pump houses may be cross connected.

CONSTRUCTION VULNERABILITY

(Refer to Illustration No. 90.17-274 P4). The majority of the buildings are one-story steel frame with corrugated iron roofing and siding. Sawtooth roofed buildings have spans of about 35 feet and are approximately 38 feet high to the eaves. Spans of 85 feet are found in monitor roofed buildings whose heights to eaves are about 45 feet. The smaller shed type buildings have spans of 30 to 40 feet and are 15 to 18 feet high to the eaves. Buildings 27, 28, 33, 34, 49, 59, and 91 probably contain gantry cranes which necessitate extra heavy steel framing along the side walls. Drydocks are of standard heavy concrete or granite block construction.

WEAPON RECOMMENDATIONS

Instructions with regard to weapons will usually be given in Field or Operational Orders, but in the absence of such instructions and to assist Planners in formulating such orders the following information is given:

A preliminary structural and occupancy analysis of the yard indicates that weapon recommendations should vary according to the following objectives:

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TARGET INFORMATION SHEET *(Contd.)*

OBJECTIVE	*WEAPON RECOMMENDATIONS*
1. Heavy engineering shops (repair and new construction facilities)	1. 2000-lb G.P., fuzed 0.1 sec. nose/ 0.025 sec. tail Alternate: 1000-lb G.P., fuzed similarly.
2. Caissons and pump houses (dry docks)	2. 500-lb G.P., fuzed 0.1 sec. nose/ 0.025 sec. tail. Alternate: 1000-lb G.P., fuzed similarly.
3. Ships (work in progress)	3. 500-lb G.P., fuzed 0.1 sec. nose/ 0.025 sec. tail. Alternate: 1000-lb G.P., fuzed similarly.

Large G.P. bombs are necessary to cause maximum damage in the heavy engineering shops, which contain large, massive equipment and in some units, gantry cranes. The 2000-lb bomb, which produces a crater 40 to 45 feet in diameter, has the best chance of undermining two or more main columns and thus causing primary collapse of the crane runway. Maximum cratering will result from 0.025 fuzing.

The caissons and pump houses of the dry docks are small. Direct hits with bombs of 500-lbs upwards are needed for maximum effectiveness.

Photography of 1 November 1944 shows most of the vessels in the area to be destroyer-type or smaller craft. Therefore, the 500-lb bomb is recommended rather than larger G.P.'s.

Incendiary bombs are not recommended against this target, as the objectives are largely non-combustible.

LEVEL OF DAMAGE

CAMOUFLAGE, DECOYS AND SMOKE SCREENS

Photography of 1 November 1944 shows no attempt at camouflage or use of decoys. No use of smoke screens has been reported.

ADDITIONAL INFORMATION

The following changes in targets at Yokosuka have been made: TARGETS 90.17-276, 277, 278, 295, 1452, 1453, 1454, 1457, and 1458 are cancelled. The name of TARGET 90.17-274 is changed from "Shipyard of Yokosuka Naval Base" to "Yokosuka Navy Yard" and the boundaries of the target area are extended to include the former TARGETS 90.17-276, 277 and 1454. The arsenal area of this base, TARGET 90.17-282, is located about 9,000 feet W of this yard.

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Incendiary bombs are not recommended against this target, as the objectives are largely non-combustible.

LEVEL OF DAMAGE

CAMOUFLAGE, DECOYS AND SMOKE SCREENS

Photography of 1 November 1944 shows no attempt at camouflage or use of decoys. No use of smoke screens has been reported.

ADDITIONAL INFORMATION

The following changes in targets at Yokosuka have been made: TARGETS 90.17-276, 277, 278, 295, 1452, 1453, 1454, 1457, and 1458 are cancelled. The name of TARGET 90.17-274 is changed from "Shipyard of Yokosuka Naval Base" to "Yokosuka Navy Yard" and the boundaries of the target area are extended to include the former TARGETS 90.17-276, 277 and 1454. The arsenal area of this base, TARGET 90.17-282, is located about 9,000 feet W of this yard.

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JOINT TARGET GROUP, WASHINGTON, D. C.

TARGET LOCATION SHEET

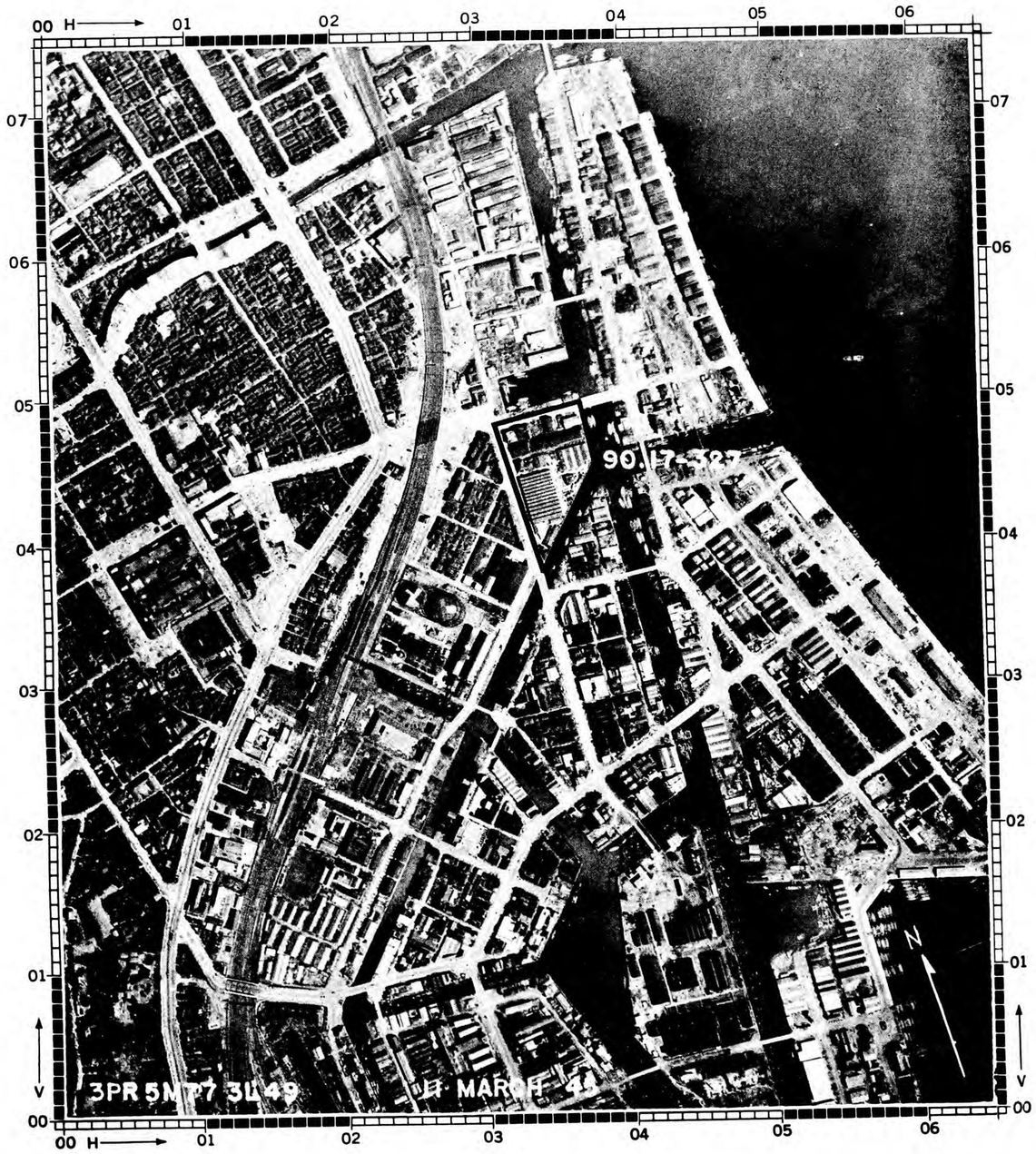
MITSUBISHI AIRCRAFT, SHIBAURA PLANT

TOKYO JAPAN

SHEET No.	90.17-327-TL
DATE	19 May 1945
TARGET No.	90.17-327
CATEGORY	End Prdt. Ind.—Aircraft
COORDINATES	35°38'N 139°46'E
ALTITUDE	10 feet

SIGNIFICANCE:

A small plant of the Mitsubishi company, the exact function of which is not known. It is variously reported as producing aircraft engines and engine parts but photo cover indicates little likelihood of production of engines or major engine components.



LARGE SCALE ILLUSTRATION—SCALE APPROX.: 1:9,900

SMALL SCALE ILLUSTRATION—SCALE APPROX.: 1:66,000

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Sheet No. 90.17-356-TI/2
Date 20 Dec. 1944
Page No. 1 (2 pages)

JOINT TARGET GROUP, WASHINGTON, D.C.

TARGET INFORMATION SHEET

Obj. Folder 90.17
Obj. Area 90.17
AAF Target No. 90.17-356

Place Tokyo (Japan)
Category Aircraft

Lat.: 35°42'N
Long: 139°37'E
Alt.: 154 feet

NAME OF TARGET NAKAJIMA AIRCRAFT, OGIKUBO PLANT
(Nakajima Hikoki K.K., Tokyo Seisakusho)

ALL PREVIOUS SHEETS CANCELLED

SIGNIFICANCE

The Nakajima Ogikubo plant is known to produce such engine parts as oil filters, fuel valves, pressure valves and carburetors. Plant originally manufactured engines, but this is thought to have ceased late in 1942 or early 1943 when Nakajima engine production was concentrated in the large Musashino-Tama (Musashi) Plant (TARGET 90.17-357). It is possible that this plant is producing internal engine parts for the Musashino plant but confirmation is lacking. There is also evidence that part of the plant is devoted to research and experimental work.

LOCATION

Approximately 7½ miles W by N of the Imperial Palace in Tokyo. It is located about midway between two main RR lines which lead W from the city. The Ogikubo RR station is about one mile to the SE. The improtant Nakajima Aircraft Engine Musashino-Tama Plant (TARGET 90.17-357) is located about 2 1/8 miles W. A main highway passes the S end of the compound before making a curve to the NW, and an athletic field is located approximately 4000 ft NNW, just S of a RR line. The target is on the northern fringe of a built-up area extending out from Tokyo.

DESCRIPTION & LAYOUT

(Refer to Illustration No. 90.17-356 P3). The target area is irregular in shape extending about 1100 ft N-S and 1100 ft E-W. The area is compactly built-up with installations occupying 750,000 sq ft, about 70 percent of the total. The three largest buildings (4,7, and 11) are believed to house the chief machining and processing facilities. Building 3 (a) is the electrical shop and 3 (c) and 14 are devoted to research; 3 (e) is the foundry. Building 13 is believed to be used for testing purposes.

CONSTRUCTION & VULNERABILITY

The majority of the buildings are one story, some with mezzanine floors, framed in steel with short internal spans (less than 60 ft) and about 20 to 30 ft high to the eaves. The roof covering is probably either corrugated iron or asbestos, and roofs are of sawtooth and double pitch design.

PRIMARY OBJECTIVES

(Refer to Illustration No. 90.17-356 P3). Buildings 7, 11, and the northern half of building 4, all of which house machining and processing facilities. They aggregate approximately 300,000 sq ft.

WEAPON RECOMMENDATIONS

Instructions with regard to weapons will usually be given in Field or Operational Orders, but in the absence of such specific instructions and to assist Planners in formulating such orders the following information is given:

A combined attack with HE and incendiary weapons is recommended, with HE as the major weapon. A preliminary structural and occupancy analysis of the plant indicates that the following weapons will be most effective:

AN-M64 500 lb. GP bomb, fuzed 0.1 sec nose/0.01 sec tail.
AN-M47 70 lb. or AN-M50 4 lb. (in M17 aimable clusters) IB's.

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Sheet No. 90.17-356 TI/3
Date 20 FEB. 1945
Page No. 1 (2 pages)

JOINT TARGET GROUP, WASHINGTON, D.C.

TARGET INFORMATION SHEET

ANNEX I

Obj. Folder 90.17
Obj. Area 90-17
AAF Target No. 90.17-356
NAME OF TARGET

Place Tokyo (Japan)
AIR TARGET
SYSTEM Aircraft
NAKAJIMA AIRCRAFT, OGIKUBO PLANT

Lat.: 35°42'N
Long: 139°37'E
Alt.: 154 feet

(Note: This annex is issued for use by the Navy in conjunction with Target Information Sheet 90.17-356 TI/3, issued by the Joint Target Group on 18 Jan. 1945.)

NAVAL CARRIER-BASED AIR ATTACK

Introduction: This sheet is for the use of Naval carrier-based aircraft which are better adapted for attacking the important individual buildings rather than the target as a whole. In view of the complexities involved in estimating bombing accuracies and stowage capabilities of carrier-based aircraft, this discussion is limited to stating the number of hits with various bombs required to achieve given levels of damage on individual buildings. No attempt is made to convert these to number of bombs or planes to be dispatched.

Buildings and Their Importance to Production: Only those buildings rated as "Primary" on the Fire Susceptibility Plan, Illustration No. 90.17-356 P5, are taken into consideration; other buildings are of minor productive value and do not merit specific attack. The buildings are listed in Table I below in the order of their importance to production, the relative value of which is indicated by the numbers in the column headed "I.P." (Index of Importance to Production). These indices, based on a scale 10 to 1 (buildings rated 10 being of greatest importance) refer to this target only and should not be used to compare buildings in different targets.

Number of Hits: Table I below gives the number of hits by various HE bombs to achieve 30, 50 and 70 percent serious damage to specific buildings. For other levels of damage within this range, the required number of hits can be obtained by interpolation.

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LEVEL OF DAMAGE

Weight for weight, the 500 lb. GP bomb will be the most effective against this target, as the principal buildings are one story, short span, and not subject to spreading collapse. The 0.01 sec tail fuzing will cause the bomb to burst 6 to 10 feet beneath the roof, thus damaging the machines as well as the structure.

The buildings are in a compact group, and the fire divisions are reasonably large. Therefore, multiple hits will be obtained in each fire division with either the AN-M47 or AN-M50 IB's.

CAMOUFLAGE, DECOYS AND SMOKE SCREENS

Photography of 7 Nov. 1944 shows some disruptive roof painting on a few buildings. There is no evidence of decoy buildings or smoke screens.

ADDITIONAL INFORMATION

This is the oldest Nakajima plant and formerly produced engines in the Sakae series. Parts now manufactured will go in the Sakae engines as well as the 1800 HP Homare engine used in the fighters Sam, George, Denko, Tenrai. The carburetors produced are used in the Zeke.

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Table I

Number of Hits Required to Achieve 30, 50 or 70 Percent Serious Damage to Individual Buildings

(Refer to Illustration No. 90.17-356 P5)

Building No.	I.P.	Fraction of Serious Damage	Number of Hits 500-lb GP	1000-lb GP	2000-lb GP
7abc	10	30%	13	8	4
		50%	25	15	7
		70%	44	26	12
4bc	8	30%	12	7	3
		50%	24	14	7
		70%	42	24	11
11abc	7	30%	9	5	3
		50%	18	10	5
		70%	31	18	8

Examples of Use of Table I:

1. Problem: To obtain the required number of hits with 500-lb GP bombs on building No. 7abc to achieve 30 percent serious damage.

   Solution: The table gives 13 hits as the number required to achieve 30 percent serious damage.

2. Problem: To obtain the required number of hits with 2000-lb. GP bombs on building No. 4bc to achieve 60 percent serious damage.

   Solution: The table gives 7 hits for 50 percent and 11 hits for 70 percent serious damage. By interpolation 9 hits are required for 60 percent serious damage.

HOLDERS OF JTG FOLDERS SHOULD INSERT THIS SHEET IN AIR TARGET SYSTEM JAPANESE AIRCRAFT AFTER 90.17-356 TI/3

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TARGET NO. 90.17-356

JOINT TARGET GROUP-WASHINGTON, D. C.

NAKAJIMA AIRCRAFT, OGIKUBO PLANT

TOKYO, JAPAN

ILLUSTRATION NO. 90.17-356 P1

APPROX. COORDINATES 35° 42' N 139° 37' E

ISSUED JANUARY 1945

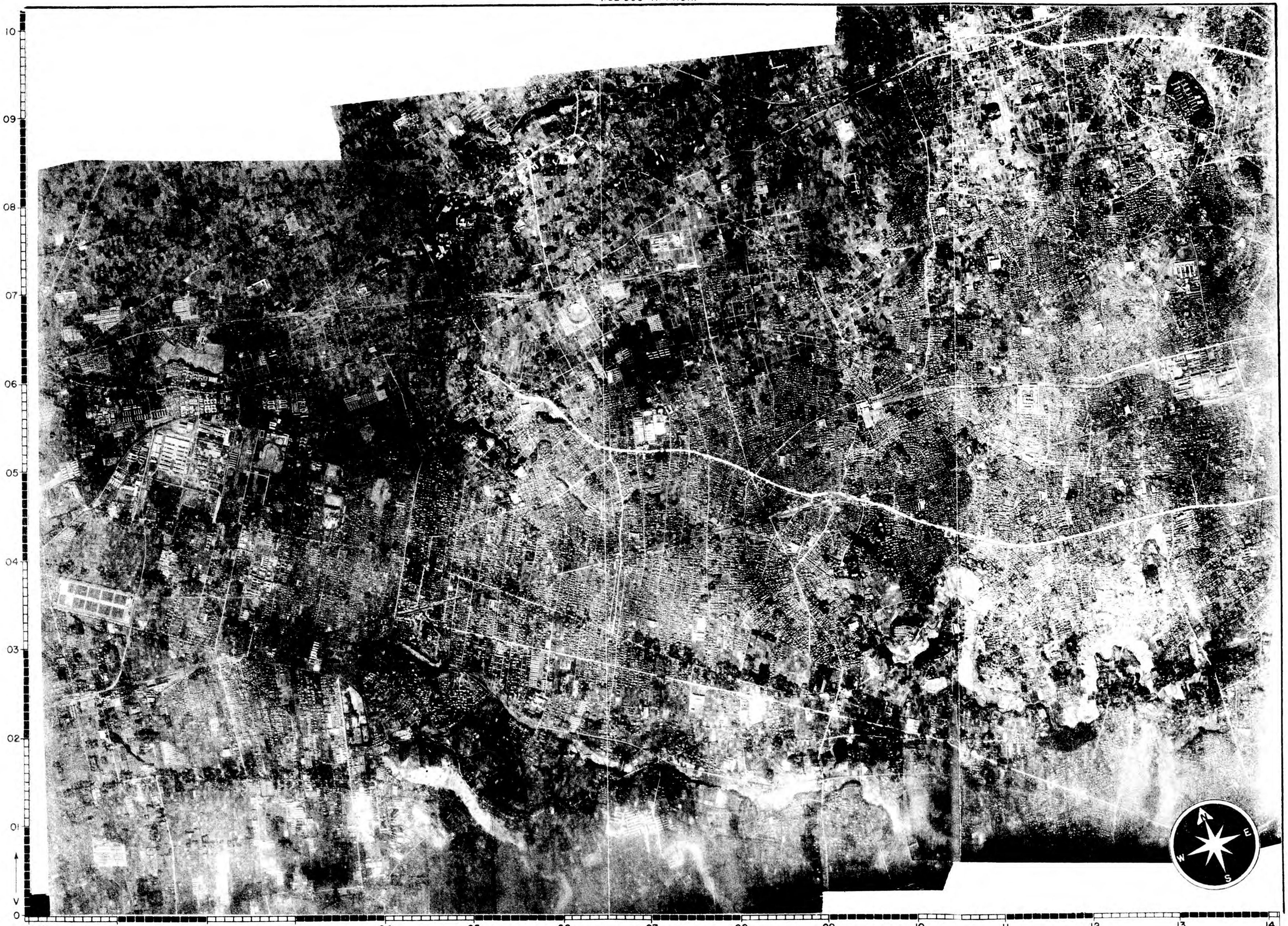
PHOTOGRAPHED 7 NOV. 1944

RESTRICTED

0 2000 4000 6000 FEET

0 ½ 1 MILE

1:32 000 APPROX.



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TYPE A

TARGET NO. 90.17-356

JOINT TARGET GROUP-WASHINGTON, D. C.

NAKAJIMA AIRCRAFT, OGIKUBO PLANT

TOKYO, JAPAN

ILLUSTRATION NO. 90.17-356 P 2

APPROX. COORDINATES 35° 42' N 139° 37' E

ISSUED JANUARY 1945

PHOTOGRAPHED 7 NOV. 1944

CONFIDENTIAL

0 1000 4000 6000 FEET

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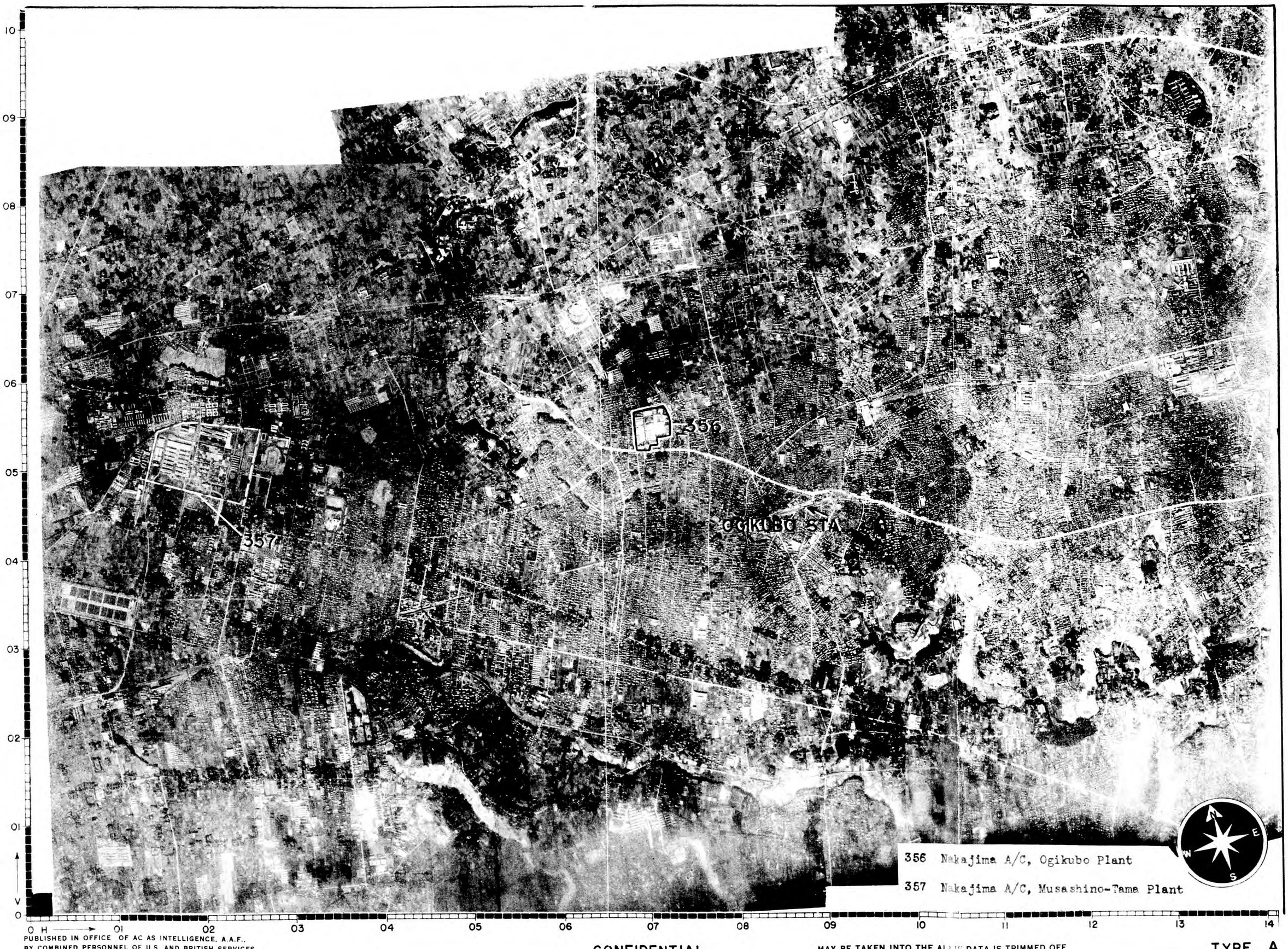
1:32 000 APPROX.



356 Nakajima A/C, Ogikubo Plant

357 Nakajima A/C, Musashino-Tama Plant

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TYPE A

JOINT TARGET GROUP • WASHINGTON, D. C.

TARGET No. 90.17–356

NAKAJIMA AIRCRAFT, OGIKUBO PLANT

TOKYO, JAPAN

ILLUSTRATION No. 90.17–356 P3/1

COORDINATES 35° 42′ N 139° 37′ E

PHOTOGRAPHED 7 NOVEMBER 1944

0 500 1000 1500 2000 2500 3000 FEET

0 ¼ 1:6000 APPROX. ½ MILE

DATE 26 APRIL 1945

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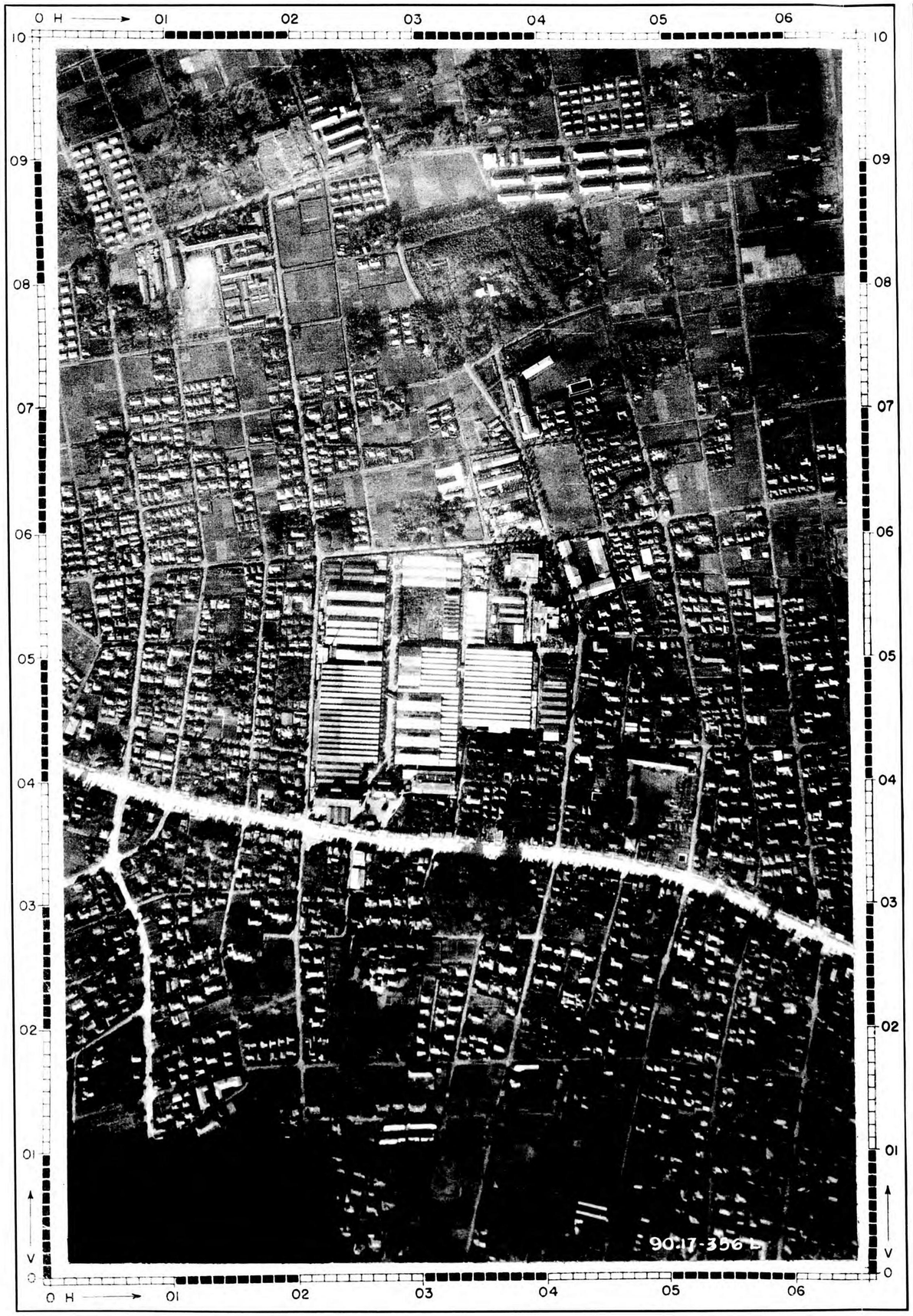

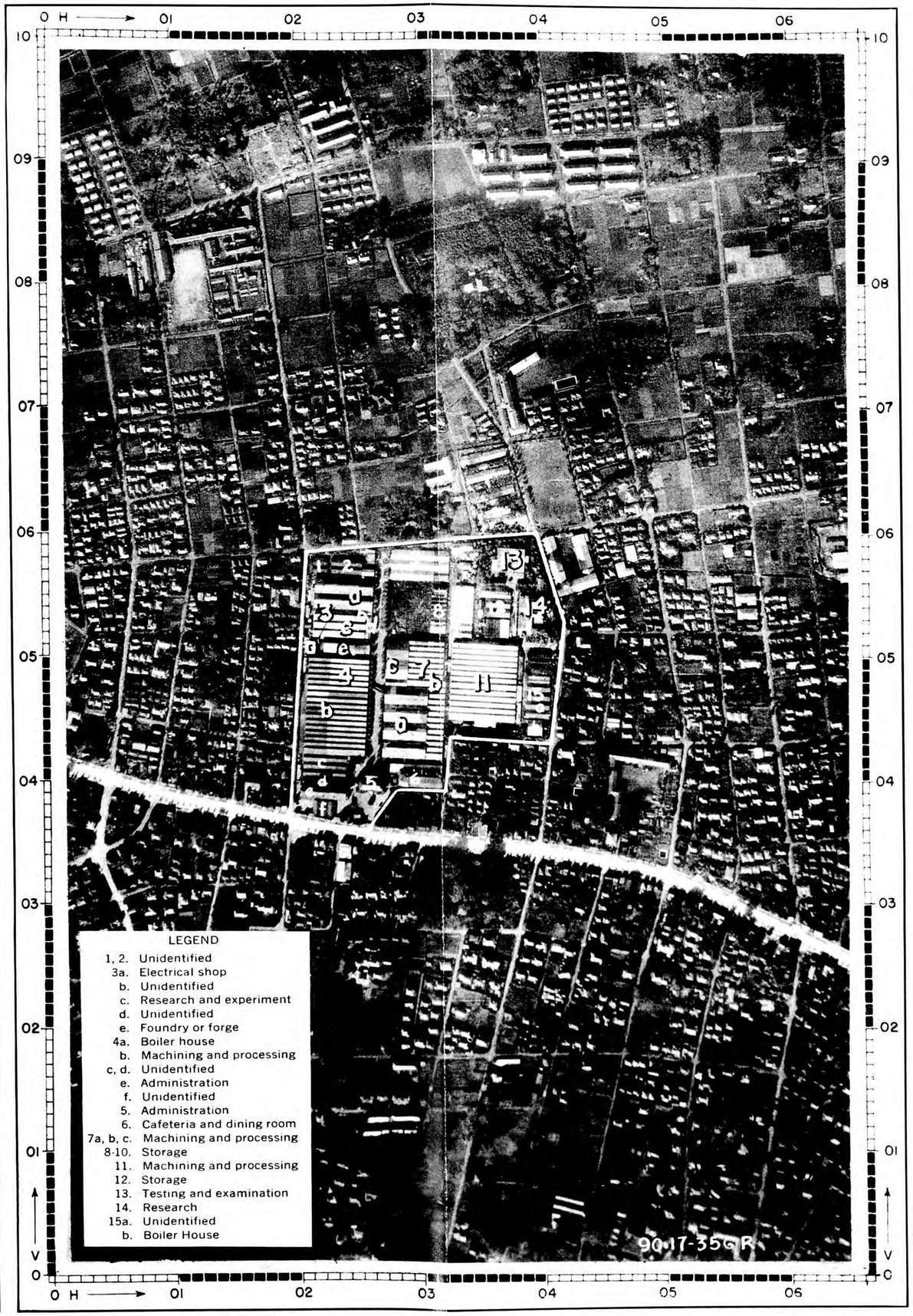

LEGEND

1, 2. Unidentified
3a. Electrical shop
b. Unidentified
c. Research and experiment
d. Unidentified
e. Foundry or forge
4a. Boiler house
b. Machining and processing
c, d. Unidentified
e. Administration
f. Unidentified
5. Administration
6. Cafeteria and dining room
7a, b, c. Machining and processing
8-10. Storage
11. Machining and processing
12. Storage
13. Testing and examination
14. Research
15a. Unidentified
b. Boiler House

HOLDERS OF JTG FOLDERS SHOULD INSERT THIS SHEET IN AIR TARGET SYSTEM FOLDER: JAPANESE AIRCRAFT IN PLACE OF SHEET 90.17–356 P3.

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NAKAJIMA AIRCRAFT
OGIKUBO PLANT
TOYKO, JAPAN

TARGET NO. 90.17-356
APPROX. COORDINATES 35°42′ NORTH 139°37′ EAST
PHOTOGRAPHED 7 NOVEMBER 1944

ILLUSTRATION NO. 90.17-356-P5/1
ISSUED **FEBRUARY 1945**
CONFIDENTIAL

SCALE 1:6,000 APPROX
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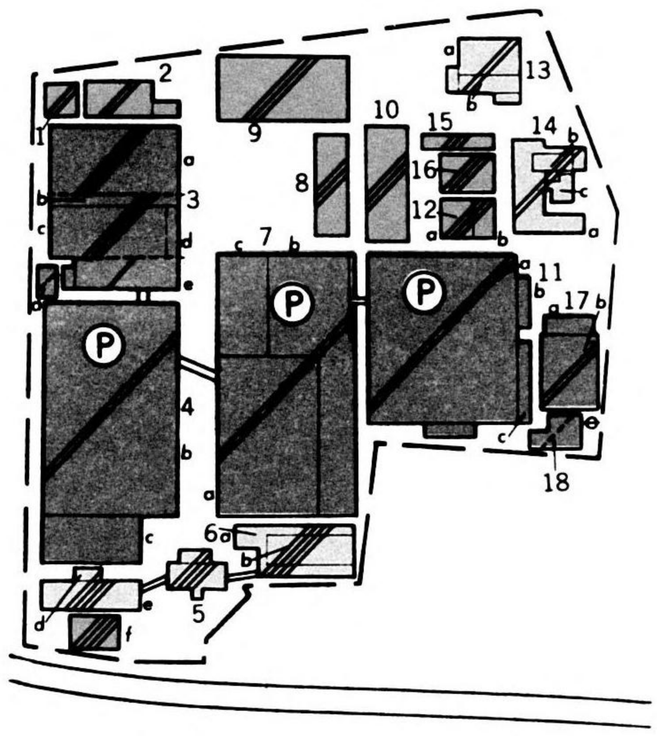

FIRE SUSCEPTIBILITY PLAN

PRIMARY BUILDINGS	(P)	FIRE WALL, CERTAIN	
SECONDARY BUILDINGS	(S)	FIRE WALL, PROBABLE	

BUILDINGS		CONTENTS	
COMBUSTIBLE		NON-COMBUSTIBLE	
NON-COMBUSTIBLE		SLIGHTLY COMBUSTIBLE	
FIRE RESISTANT		MODERATELY COMBUSTIBLE	
COMBINATION I.E. COMBUSTIBLE ROOF RESISTANT FLOORS		HIGHLY COMBUSTIBLE	
		EXTREMELY COMBUSTIBLE	
WATER TANK	(W)	INTERMEDIATE VALUES	

AREA IN SQ. FT.	PRIMARY	ALL BLDGS. SHOWN
NO. OF BUILDINGS	3	21
NO. OF FIRE DIVISIONS	3	19
PLAN AREA	348,000	609,000
TOTAL FLOOR AREA	348,000	695,000
SITE AREA	1,045,000	

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T A R G E T I N F O R M A T I O N S H E E T

Ref: Objective Folder
Tokyo (90.17)
15 Sept. 1943

Place: Tokyo
Objective Area: 90.17
Category: Aircraft

Lat. : 35°45'N
Long. : 139°35'E
Alt. : 183 feet

NAKAJIMA AIRCRAFT ENGINE PLANT, MUSASHINO-TAMA (MUSASHI) PLANT
(Nakajima Hikoki K.K., Musashino Seisakusho)

AAF Target No. 90.17-357

J T G

ALL PREVIOUS SHEETS ARE CANCELLED

NOTE: Prior to photo coverage it was thought that the Musashino and Tama Plants of Nakajima (TARGETS 90.17-357 and 90.17-1662 respectively) were separate. Photo coverage shows that they are, in fact, one plant. Accordingly they have been combined as one target under the name shown in the caption to this sheet and NAKAJIMA AIRCRAFT, TAMA PLANT, TARGET 90.17-1662 IS STRICKEN FROM THE AAF TARGET LIST. Target files should be amended accordingly.

SIGNIFICANCE: This plant produces almost all of the Nakajima type engines used by the Japanese Army and Navy. It is the largest known Japanese engine plant estimated to produce about 1500 engines per month or over 40% of all operational engines for the JAF. Production is believed to be nearly equally divided between Army and Navy types. Actual capacity may be greater than present production but large scale conversion to higher power models (Homare and Ha 45) now taking place may delay capacity production.

LOCATION: This plant lies about 11 miles W of the center of Tokyo, midway between the two main RR lines which lead W and W by N from the city. It lies about 4000 feet slightly E of N of a large city reservoir.

DESCRIPTION: That part of the plant located in the eastern portion of the compound lying S of building 34 and E of buildings 11 and 12 is the older portion which originally produced only Army engines. Subsequent to 1939 the western half of the present plant, the so-called Tama Plant, was built to produce Navy aero-engines which up to this time had been produced at the Nakajima Ogikubo Plant (TARGET 90.17-356). Buildings N of 33 were added to the Tama Plant at about the same time. Ogikubo then turned to production of components and accessories.

While the plant grew up in two sections apparently devoted to separate production, there is evidence that some facilities are used in common by both sections. The extent of this common use can not be determined precisely but it is believed that:

a. The long building E of Number 45 holds the receiving, inspection and raw material storage facilities for both sections.

b. The buildings immediately N of this storage building contain the only foundry facilities at the plant.

c. The proximity and connection of building 34 to the foundry suggests that the castings for both sections are machined in building 34.

TARGET INFORMATION SHEET (Cont'd.)

d. Buildings 45, 46, 47 contain basic machining facilities for both Army and Navy engines.

The whole factory area contains 2.4 million square feet of floor space. About 900,000 square feet is included in the Tama section, about 900,000 in the Musashino section and the remainder in the part of the plant which serves both.

CONSTRUCTION: a. Musashino Plant (Buildings S of No. 34 and E of Nos. 11 and 12). The plant is rectangular in shape and very compactly built-up. The majority of the buildings are one story steel framed structures with sawtooth roofs and corrugated steel or asbestos sheet roofing. Height to eaves is moderate and not more than 20 feet. On the N end of the complex is an H-shaped structure, flat roofed and of reinforced concrete construction, probably 3 storied.

b. Tama Plant (Western section of plant). This plant is adjacent to and WNW of the Musashino plant. The main building consists of 6 long parallel wings centrally connected. It is flat roofed, of reinforced concrete construction and 3 story high. At the N end of the plant is a one story steel framed sawtooth building of same construction as buildings of the Musashino Plant.

CAMOUFLAGE: The principal buildings in the Musashino plant area are camouflaged with disruptive paint. There is no camouflage in the Tama plant section.

CRITICAL POINT: The areas believed devoted to machining operations are the critical points of this plant. These include machine shops No. 27 and 32, cylinder head mfg. No. 34, machine shops Nos. 45, 46, 47 and 11.

ADDITIONAL INFORMATION:

Production of principal engines is at present roughly estimated to be as follows:

Engine	Monthly Output	For Planes	Comments
Army Types			
Type 2, 1150	375	Oscar	Production believed declining
Type 2, 1450	200	Tojo 2, Helen	
Ha 45	150	Frank	Production believed increasing
Total Army	725		
Navy Types			
Sakae 21	150	Rufe, Irving	Production probably declining
Sakae 31	375	Zeke 52	
Homare	225	George, Grace Frances	Production probably increasing
Total Navy	750		
Total Engines	1475		

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90.17-357 TI/1
28 Nov 1944

TARGET INFORMATION SHEET (Cont'd)

WEAPON RECOMMENDATIONS

Instructions with regard to weapons will usually be given in Field or Operational Orders, but in the absence of such specific instructions and to assist Planners in formulating such orders the following information is given:-

The Musashino and Tama plants are considered as one target as they form one compact group. (83 acres).

A combined attack with HE and IB is recommended, HE being the major weapon. A preliminary structural analysis of the target indicates that the following weapons would be most effective:

AN M66 2000 GP bombs fuzed .1 sec nose/.025 sec tail
M47A2 70 lb IB.

The 2000 lb and 500 lb bombs are about of equal effectiveness on the single story sheds in the Musashino portion of the target, but the 2000 lb GP bomb is twice as effective as the 500 lb GP on the multi-story, reinforced concrete, framed buildings of the Tama portion of the plant. Therefore, the 2000 lb bomb is recommended.

The M47 is recommended because it will penetrate the roofs of the Tama portion as well as the Musashino portion of the plant and in addition, the fire divisions are large enough to insure high expectancy of multiple hits in each.

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JOINT TARGET GROUP, WASHINGTON, D.C.
TARGET INFORMATION SHEET

Sheet No. 90.17-357-II/2
Date 12 Jan. 1945
Page No. 1 (7 pages)

Obj. Folder 90.17
Obj. Area 90.17
AAF Target No. 90.17-357

Place Tokyo (Japan)
Air Target
System - Aircraft

Lat.: 35° 43'N
Long: 139° 35'E
Alt.: 183 feet

NAME OF TARGET NAKAJIMA AIRCRAFT ENGINE PLANT, MUSASHINO-TAMA (MUSASHI) PLANT
(Nakajima Hikkoki K.K., Musashino Seisakusho)

ALL PREVIOUS SHEETS CANCELLED

SIGNIFICANCE

This plant is currently estimated to produce nearly 40 per cent of all Japanese operational aircraft engines. It is known to produce the Army Ha 45 and the Navy Homare (both 18 cylinder 1800-2000 HP engines) and is believed to be the largest Japanese maker of engines in this HP range. Production of the higher power engines is apparently increasing while output of the lower powered Type 2, 1150 and Sakae 21 is declining.

Early 1944 production is estimated by MID,WDGS to be 1100-1200 engines per month. The output at present is probably above 1500. Principle types are shown below.

Engine	*For Planes*	*Made At*
	Army Types	
Type 2 1150	Oscar	Tachikawa (90.17-792)
		Nakajima, Ota (90.13-1544)
Type 2 1450	Tojo 2 Helen	Nakajima, Ota (90.13-1544)
Ha 45	Frank	Nakajima, Ota (90.13-1544)
	Navy Types	
Sakae 21	Irving	Nakajima, Koizumi (90.13-1545)
	Rufe (?)	?
Sakae 31	Zeke 52	Nakajima, Koizumi (90.13-1545)
		Mitsubishi, Nagoya (90.20-194)
Homare	George	Kawanishi, Naruo (90.25-18)
	Grace	Aichi, Eitoku (90.20-1729)
	Frances	Nakajima, Koizumi (90.13-1545)

The ultimate capacity of this plant may not yet be reached. New construction under way (including 20 new test cells) suggests a considerable expansion in output. The conversion to new models may now, however, be causing a temporary reduction in output of engines.

As the above table indicates, this plant produces engines for the two large Nakajima airframe plants at Ota and Koizumi and for three others, Tachikawa Aircraft at Tachikawa, Mitsubishi Aircraft at Nagoya, and Aichi Aircraft (Eitoku plant) at Nagoya. The Nakajima, Ota and Koizumi plants depend upon this plant for nearly all engines, with the exception of 50-60 engines for Jill furnished Koizumi by Mitsubishi, while the others depend upon it for only certain types. Only one other plant, the Kawasaki Aircraft Co., Akashi plant, (TARGET 90.25-1547) makes Nakajima type engines, the Army Type 2-1150. The relatively low output of this model at Akashi could partially compensate for the loss of production at Musashino-Tama but only at the expense of engines for the Lily bomber.

LOCATION

Approximately 9.75 miles W by N of the Imperial Palace in Tokyo. It is located about midway between two main RR lines leading W from the city, and about 4000 feet NNE of a large reservoir. The Nakajima

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DESCRIPTION AND LAYOUT

Aircraft, Ogikubo Plant (TARGET 90.17-356) is about 2.2 miles to the E. The target is on the NW edge of a built-up area extending out from Tokyo.

(Refer to Illustration No. 90.17-357 P3, P5 and P6). The total target area is about 3000 x 2000 feet, roughly rectangular with the major axis lying in a WNW-ESE direction. The major units are compactly built. The plant is divided N-S into two sections.

The original Nakajima Plant at this location was in the eastern portion of the present site and included buildings 26-33 and 44-47. It was called the Musashino Plant and produced only Army type engines. Subsequent to 1939 it was expanded to the N (buildings 34-43) and the large plant on the western part of the site was built. The latter addition, originally known as the Tama Plant, was constructed to produce Navy aero-engines which up to this time had been made at the Nakajima Ogikubo Plant (TARGET 90.17-356). The Ogikubo Plant then was shifted to component production. The combined plant is called Musashi by the Japanese.

There is considerable evidence to suggest that some, if not all, of the facilities are used in common for the production of Army and Navy types:

1. The Musashino portion of the plant is about 40 per cent larger than the Tama portion, yet the output of engines for the Army is believed only equal to that of Navy types.

2. According to ground intelligence believed reliable, building 44 houses receiving and stores of raw materials. The new buildings (48-51) E of building 44 are apparently used for the same purpose. Since there are apparently no large storage buildings and no extensive railway spur on the Tama side of the plant it is probable that storing and receiving for the whole plant is done in these areas. Buildings 38-43 are believed to house foundry facilities; their proximity and connection to building 34 suggest that the castings (probably cylinder heads) are machined in this building for both portions of the plant. The well developed roadway leading from building 34 to building 11 strengthens the evidence of this probable tie.

3. Proximity to the storage area indicates (in conformity with usual plant layout) that the rough machining of stores for both sections of the plant is carried out in building 45-47 and then distributed to the rest of the plant.

4. The above distribution of function would bring the floor space devoted to Army and Navy types into equilibrium and thus into proportion with the estimated output figures. There is thus believed to be about 900,000 square feet in each section of the plant with some 500,000 square feet serving both.

5. The names of "Tama" and "Musashino" have been dropped by the Japanese and the plant is now referred to as the Musashi plant.

Further integration of these facilities may exist but this cannot be proved at present. The necessity for high levels of output suggests that components identical to both the Army and Navy types would be machined at one place. Such rationalization would increase

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the importance of this target, as partial damage to the factory might completely destroy the fabrication of one component used in both sections.

CONSTRUCTION AND VULNERABILITY

(Refer to Illustration No. 90.17-357 P3, P5 and P6). The buildings in the Musashino (eastern) portion of the plant are largely single-story, while those in the Tama (western) section are multi-story units.

Construction and Walls: One-story buildings: The majority of these buildings are steel framed with short to medium spans; some small buildings used for storage, receiving, etc., are timber framed. Wall panels are corrugated asbestos or iron.

Multi-story construction: These are of short span, reinforced concrete frame construction, with wall panels of reinforced concrete.

Roofs: One-story buildings: Roofs are predominantly non-combustible, of corrugated asbestos and iron over exposed steel.

Multi-story buildings: Roofs are cast-in-place, reinforced concrete, 4 to 5 inches in thickness.

Floors: Floors in all major buildings are of concrete, the floors in multi-story buildings being of reinforced concrete, 6 to 8 inches in thickness.

Number of stories: Seventy-two per cent of the entire target (plan area) consists of one-story buildings.

Number of fire divisions: Eighty-three in 51 buildings.

The Fire Susceptibility Plan shows the vulnerability to fire of each building and its contents. Contents are of low to moderate combustibility. It is estimated that 21 per cent of the productive capacity can be destroyed by fire. The target therefore is a fair choice for attack with a combination of high explosive and incendiary bombs.

PRIMARY OBJECTIVES

(Refer to Illustration No. 90.17-357 P3, P5, and P6). The principal machine shops (buildings 11e, f, g, h, j, k, m, p, 27, 32, 34, 45, 46, 47) are the primary objectives. With the exception of building 34, they lie in a compact area 1700 x 800 feet. Their dimensions are as follows:

Building	*Approximate Floor Area*
11e,f,g,h,j,k,m,p	370,000 square feet
27	120,000
32	126,000
34	126,000
45	44,000
46	44,000
47	52,000

The floor space of these buildings is 882,000 square feet, about 40 per cent of the total floor area. According to normal American practice, this should account for all machine tools in the plant. Total destruction in this area will cause the greatest overall reduction in plant output since the machine tools in these buildings will take the maximum time to repair or replace.

Destruction of final assembly buildings (32 and 12) will reduce output for a much shorter time as there is little machinery to be damaged and assembly can be resumed in temporarily repaired buildings

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	or in any other building which has sufficient floor space. Equipment in the boiler houses (2, 30 and 37) and the heat treatment shop (31) is either more easily repaired or replaced than machine tools, or is not absolutely necessary for production. The SW corner of building 32 is selected as the aiming point. All the principal buildings lie within a 1200 foot radius centering on this point.
WEAPON RECOMMENDATIONS	The most effective weapons for high level attack against his target are the AN-M66 2000-lb G.P. and the AN-M50 4-lb incendiary (in M17 clusters). Maximum damage to structures and contents will result if the high explosive bombs are fuzed 0.1 sec. nose and 0.025 sec. tail. The presence of many fire walls and the wide dispersal of combustible material in the principal buildings require multiple hits in order to achieve a suitable level of damage. Thus, the 4-lb bomb is slightly more effective than the AN-M47 70-lb incendiary and much more effective than the AN-M76 500-lb bomb. The chance of fire spread is believed negligible due to the modern construction of the buildings and the presence of fire walls. (Allowance has been made in the analysis for the concrete roofs found in the Tama complex). The 2000-lb bomb is recommended as it is equal in effectiveness to the AN-M64 500-lb G.P. on the short to medium span buildings in the Musashino plant, and twice as effective as the 500-lb bomb on the multi-story, reinforced concrete units of the Tama plant. Confined blast is the key factor in producing structural damage to buildings such as those found in the Tama complex, and the 2000-lb G.P., with its relatively high charge weight (1,117 lbs of TNT), thus has the best chance of causing maximum damage. The 0.025 fuzing gives the best expectancy of the bomb detonating beneath the top floor where it will be most effective. (If 0.025 sec. nose fuzes, M140, are available, they should be used in place of the 0.1 sec. nose setting). The following Loading Table, computed for the most effective weapons, shows the per cent of structural damage to the target which can be expected for different weights of attack and various accuracies of bombing. Accuracy is measured by the per cent of bombs dispatched expected to fall within 1000 feet of the aiming point. (Allowance has been made for the fact that this target lies within a 1200-foot radius of the recommended aiming point).

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Table I

LOADING TABLE - MOST EFFECTIVE WEAPONS

High Explosive: AN-M66 200-lb G.P. (1)
Incendiary: AN-M50 4-lb (in M17 clusters) (1)

Nakajima Aircraft Engine Plant, Musashino-Tama (Musashi) Plant

Total Load in Tons (4)	Per cent of bombs dispatched expected to fall within 1000 feet of aiming point (2)											
	10%			15%			20%			30%		
	H.E. Tons (4)	I.B. Tons (4)	F(3)	H.E. Tons (4)	I.B. Tons (4)	F(3)	H.E. Tons (4)	I.B. Tons (4)	F(3)	H.E. Tons (4)	I.B. Tons (4)	F(3)
100	35	65	.12	25	75	.16	20	80	.20	15	85	.24
200	35	165	.20	30	170	.24	75	125	.27	115	85	.31
300	50	250	.24	130	170	.29	175	125	.32	215	85	.39
400	150	250	.28	230	170	.33	275	125	.37	315	85	.45
500	250	250	.31	330	170	.37	375	125	.42	415	85	.51
600	350	250	.34	430	170	.41	475	125	.46	515	85	.56
700	450	250	.36	530	170	.45	575	125	.51	615	85	.61
800	550	250	.39	630	170	.48	675	125	.55	715	85	.65
900	650	250	.42	730	170	.51	775	125	.59	815	85	.69
1000	750	250	.44	830	170	.54	875	125	.61	915	85	.72
1100	850	250	.47	930	170	.57	975	125	.64	1015	85	.75
1200	950	250	.49	1030	170	.60	1075	125	.67	1115	85	.78
1300	1050	250	.50	1130	170	.62	1175	125	.69	1215	85	.80
1400	1150	250	.52	1230	170	.65	1275	125	.71	1315	85	.83
1500	1250	250	.54	1330	170	.67	1375	125	.73	1415	85	.85
1600	1350	250	.56	1430	170	.69	1475	125	.76	1515	85	.86
1700	1450	250	.57	1530	170	.71	1575	125	.78	1615	85	.87

NOTES:

(1) Because of the considerable difference in effectiveness of the various G.P. bombs, this table should not be used for the 1000 and 500-lb bombs. However, as there is only slight difference in the effectiveness of the AN-M50 and the AN-M47 against this target, the table is suitable for use with the AN-M47.

(2) In the examples following this table, this number is called "Index of Mission Efficiency"; it is a measure of bombing accuracy. In computing this loading table, allowance has been made for the fact that the target lies in a circle of 1200 feet.

(3) Expected fraction (per cent) of structural damage to the target.

(4) Load is given in tons of actual (not nominal) weight of bombs.

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Method of use:

1. Determine index of mission efficiency:
   (a) Estimate per cent of dispatched planes bombing primary target.
   (b) Estimate per cent of bombs over target expected to fall within 1000 feet of aiming point.
   (c) Multiply (a) by (b) and round off to nearest percentage figure in table.

2. Read under computed index of mission efficiency and opposite the total load dispatched the recommended high explosive-incendiary loading and the expected per cent of damage.

Examples Illustrating Use of Loading Table:

1. *To find best H.E.-I.B. combination and resulting per cent of damage for a given force:*
   Given: Planes expected to bomb primary target, 70 per cent of mission. Per cent of bombs over target expected to fall within 1000 feet of aiming point, 30 per cent.
   Mission of 100 planes with a total load of 300 tons.
   Solution: 70% x 30% equals 21%; i.e., 20% is index of mission efficiency.
   Opposite 300 tons in 20% column find loading:
   H.E. 175 *tons* (equal to 58 plane loads at 3 tons per plane)
   I.B. 125 *tons* (equal to 42 plane loads at 3 tons per plane)

   Fraction of damage equals 32 per cent.
   Hence, for optimum loading 58 planes will carry H.E. and 42 planes I.B., but if groups of 12 are to carry only one kind of bomb per group, this may be revised to 5 groups with H.E.'s and 3 groups with I.B.'s.

2. *To find force required to achieve a recommended level of damage.*
   Given: Recommended level of damage, 50 per cent. Same Index of Mission Efficiency as in Example 1.
   Individual A/C bomb load, 4 tons.
   Solution: In 20% mission efficiency column take:
   F equal 51% and find load *H.E.* 575 *tons*
   I.B. 125 *tons*
   Total 700 tons
   requiring a total force of 175 A/C or 16 groups of 12 A/C.

LEVEL OF DAMAGE

Approximately 20 per cent structural damage to the buildings housing machine tool processes will result in a net loss in production of three weeks to three months, varying on the concentration of bomb hits and upon the type of material destroyed. While some tools will be injured, the increased use of similar equipment already in the plant and other temporary expedients can be employed to restore full operations in a relatively short time.

Damage on the level of 50 per cent is far more serious, and probably will result in net production loss of five to eight months. Damage totaling 70 per cent would net seven to nine months production loss. At levels exceeding 50 per cent there would be a heavy loss of material in production.

Since this target is one of the foremost known producers of aero-engines in Japan, damage exceeding 50 per cent to the machine shops is recommended.

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JOINT TARGET GROUP - WASHINGTON, D.C.

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TARGET INFORMATION SHEET (Cont'd)

CAMOUFLAGE, DECOYS AND SMOKE SCREENS	Photography of 7 Nov. 1944 shows camouflage by the use of disruptive painting on the Musashino part of the plant. A fairly effective smoke screen was used during December 1944 attacks. The nearby reservoir, 4000 feet to the S, is being concealed by netting.
ADDITIONAL INFORMATION	

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Sheet No.90.17-357 TI/2
Date Feb. 1945
Page No. 1 (2 pages)

JOINT TARGET GROUP, WASHINGTON, D.C.

TARGET INFORMATION SHEET

ANNEX I

Obj. Folder 90.17
Obj. Area 90.17
AAF Target No. 90.17-357

Place Tokyo (Japan)
AIR TARGET Aircraft
SYSTEM

Lat.: 35 43'N
Long: 139 35'E
Alt.: 183 feet

NAME OF TARGET NAKAJIMA AIRCRAFT, MUSASHINO-TAMA (MUSASHI) PLANT
(Nakajima Hikkoki K.K., Musashino Seisakusho)

(Note: This annex is issued for use by the Navy in conjunction with Target Information Sheet 90.17-357 TI/2, issued by the Joint Target Group on 12 January 1945.)

NAVAL CARRIER-BASED AIR ATTACK

Introduction: This sheet is for the use of Naval carrier-based aircraft which are better adapted for attacking the important individual buildings rather than the target as a whole. In view of the complexities involved in estimating bombing accuracies and stowage capabilities of carrier-based aircraft, this discussion is limited to stating the number of hits with various bombs required to achieve given levels of damage on individual buildings. No attempt is made to convert these to number of bombs or planes to be dispatched.

Buildings and Their Importance to Production: Only those buildings rated as "Primary" on the Fire Susceptibility Plan, Illustration No. 90.17-357 P5, are taken into consideration; other buildings are of minor productive value and do not merit specific attack. The buildings are listed in Table I below in the order of their importance to production, the relative value of which is indicated by the number in the column headed "I.P." (Index of Importance to Production). These indices, based on a scale 10 to 1 (buildings rated 10 being of greatest importance), refer to this target only and should not be used to compare buildings in different targets.

Number of Hits: Table I below gives the number of hits by various HE bombs to achieve 30, 50 and 70 per cent serious damage to specific buildings. For other levels of damage within this range, the required number of hits can be obtained by interpolation.

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