P. 108

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THE UNITED STATES

STRATEGIC BOMBING SURVEY

(Pacific)

Evaluation of Photographic Intelligence in the Japanese Homeland

PART ELEVEN

INDUSTRIAL ANALYSIS

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PHOTOGRAPHIC INTELLIGENCE SECTION

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Dates of Survey:
7 October 1945 through 15 May 1946

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JUNE 1946

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F O R E W O R D

The United States Strategic Bombing Survey was established by the Secretary of War on 3 November 1944, pursuant to a Directive from the late President Roosevelt. Its mission was to conduct an impartial and expert study of the effects of our aerial attack on Germany, to be used in connection with air attacks on Japan and to establish a basis for evaluating the importance and potentialities of air power as an instrument of military strategy, for planning the future development of the United States armed forces, and for determing future economic policies with respect to the national defense. A summary report and some 200 supporting reports containing the findings of the Survey in Germany have been published.

On 15 August 1945, President Truman requested that the Survey conduct a similar study of the effects of all types of air attack in the war against Japan, submitting reports in duplicate to the Secretary of War and to the Secretary of the Navy. The officers of the Survey during its Japanese phase were.

Franklin D'Olier, Chairman.

Paul H. Nitze,

Henry C. Alexander, Vice-Chairmen.

Walter Wilds, Secretary.

Harry L. Bowman,

J. K. Galbraith,

Rensis Likert,

Frank A. McNamee,

Fred Searls, Jr.,

Monroe Spaght,

Dr. Louis R. Thompson,

Theodore P. Wright, Directors.

The Survey's complement provided for 300 civilians, 350 officers, and 500 enlisted men. The military segment of the organization was drawn from the Army to the extent of 60 per cent, and from the Navy to the extent of 40 per cent. Both the Army and the Navy gave the Survey all possible assistance in furnishing men, supplies, transport and information. The Survey operated from headquarters established in Tokyo early in September, 1945, with sub-headquarters in Nagoya, Osaka, Hiroshima and Nagasaki, and with mobile teams operating in other parts of Japan, the islands of the Pacific, and the Asiatic mainland.

It was possible to reconstruct much of wartime Japanese military planning and execution, engagement by engagement and campaign by campaign, and to secure reasonably accurate statistics on Japan's economy and war-production, plant by plant and industry by industry. In addition, studies were conducted on Japan's overall strategic plans and the background of her entry into the war, the internal discussions and negotiations leading to her acceptance of unconditional surrender, the course of health and morale among the civilian population, the effectiveness of the Japanese civilian defense organization, and the effects of the atomic bombs. Separate reports will be issued covering each phase of the study.

The Survey interrogated more than 700 Japanese military, government and industrial officials. It also recovered and translated many documents which have not only been useful to the Survey, but will also furnish data valuable for other studies. Arrangements are being made to turn over the Survey's files to a permanent government agency where they will be available for further examination and distribution.

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Chief, G-2

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* Personnel from the U. S. Naval Photographic Intelligence Center gave valuable assistance to USSBS personnel in the preparation and reproduction of Photographic Intelligence Section reports.

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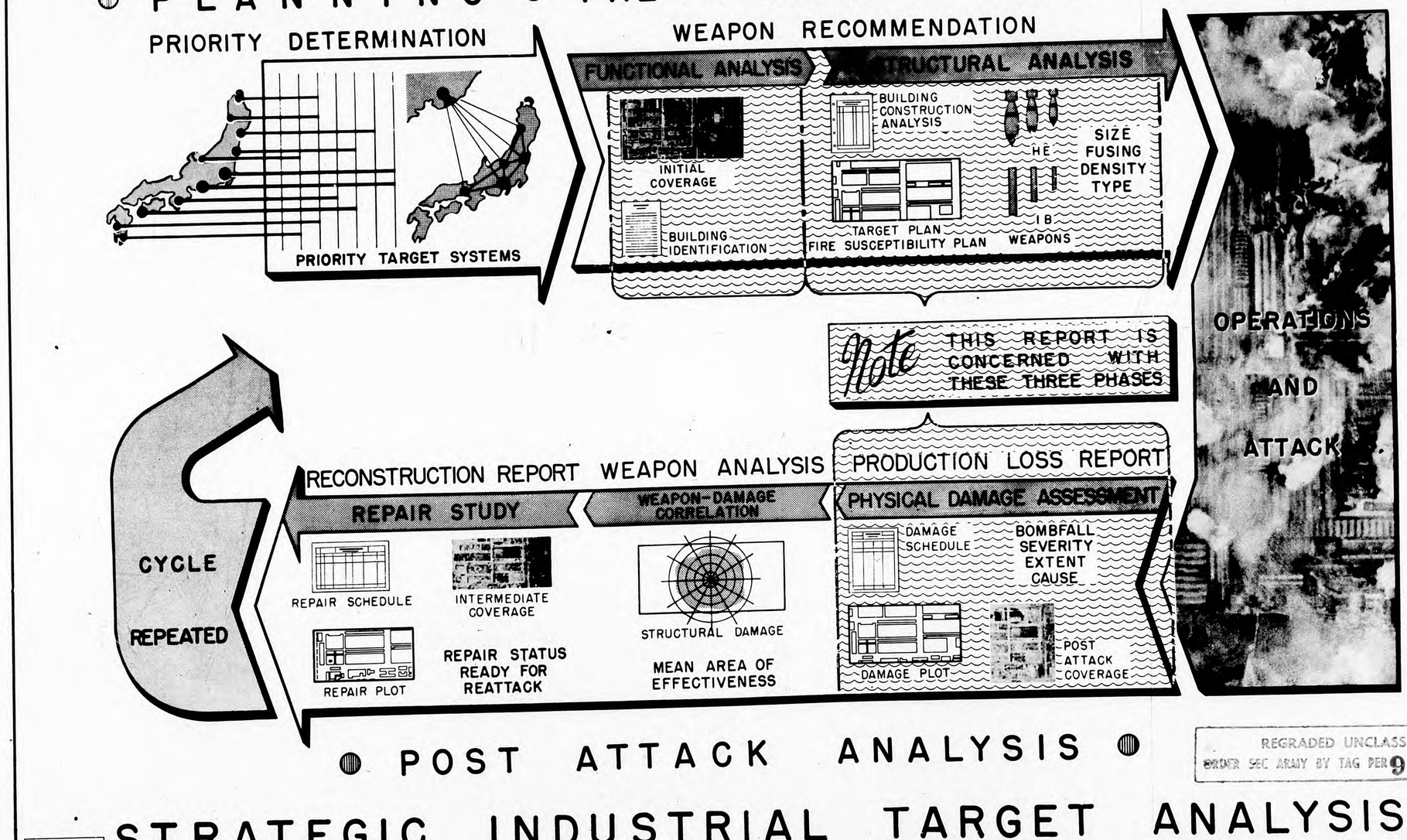

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FIGURE 1 STRATEGIC INDUSTRIAL TARGET ANALYSIS

I PURPOSE AND SCOPE

1. The purpose of this report is (1) to provide a comprehensive evaluation of the accuracy of photographic intelligence pertaining to industrial targets in the Japanese homeland, (2) to analyze the errors found in the photographic interpretation industrial reports, and (3) to suggest changes in techniques and methods of interpretation to make industrial interpretation more effective.

2. This report is based upon the detailed study of selected targets, representative of various important industrial target systems. It includes background information on the nature of industrial interpretation and the agencies originating the reports, the methods used in evaluating the reports, an analysis of the value of industrial photographic intelligence presented in both graphic and tabular form, and recommendations and conclusions reached as a result of the study.

II BACKGROUND OF INDUSTRIAL INTERPRETATION

1. Nature of Work

a. Introduction - Industrial intelligence is derived from two main sources: (1) photographic interpretation, and (2) ground information, e.g. captured equipment, the experience of engineers and economists in the various industrial fields, enemy reports, prisoner of war interrogation, and enemy technical publications. A brief discussion of the relationship of the various types of information provided by photographic intelligence reports to the analysis of industry is given here (Figure 1 shows this graphically). Photographic intelligence studies are divided into two phases, pre-attack and post-attack. Pre-attack studies are of two types, functional analysis and structural analysis. The post-attack phase includes damage assessment and repair studies. The repair studies were of little significance in the Pacific War and are not considered in this report.

b. Pre-attack, Functional Analysis (F/A) - The process of functional analysis is a collaborative effort between the photographic interpreter and the economist. The former supplies data obtained by examination of pre-attack photographic cover, while the latter provides the available ground intelligence and relates the individual plant to others in its industrial system. Identification of the function of both the plant as a whole and each individual building within the plant is undertaken. Many such identifications are at best guesses while some buildings may remain unidentified. The boundaries of the target area are established and a reference number is given to each building. The completed functional analysis provides the basic information for all later reports and for photo target illustrations for operational use.

c. Pre-attack, Structural Analysis (S/A) - The purpose of an S/A report is to determine the vulnerability of a target to blast and fire. This information is then used by specialists who recommend the number and type of weapons necessary to achieve various percentages of damage to the target. Physically the S/A report consists of two parts: (1) the target plan, and (2) the building construction analysis schedule. The target plan is a complete plan of the plant, usually a photographic enlargement, with the outline of each building carefully delineated, subdivided into its structural elements, and each numbered in accordance with the F/A referencing system. The building construction analysis schedule is prepared by the photographic interpreter, and presents in tabular form for each structural element indicated on the target plan the following data: length, width and height of structure; number of floors; size of a typical structural bay; type of roof material; type of construction; vulnerability of the structure to blast; and the combustibility of structure. The three last mentioned are explained below.

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BACKGROUND

(1) Type of construction - A classification system was established for all types of industrial structures in order to simplify the process of reducing the S/A to the statistical form used by the weapons recommendation unit. This classification system appears in table 1.

(2) Vulnerability to blast - A classification system for assigning relative vulnerability ratings to each structural element was established, based on the comparative reaction of each type of construction. The relationship between type of construction and vulnerability rating can be seen in Table 1. Vulnerability ratings range from V1 (least vulnerable) thru V2, V3, V3A, V4, V4A, to V5 (most vulnerable).

(3) Combustibility - Three classifications are recognized for the relative combustibility of structures: Combustible (C), Non-combustible (N), and Fire-resistant (R). A building is called combustible if its frame and/or roof, floors (except ground floor) and walls are constructed of a material which will burn. A building is non-combustible if the materials will not themselves burn, but whose frame will be irrepairably warped or distorted by the heat of a fire within the building. A building is fire-resistant if it will withstand any normal fire without structural damage.

d. Post-attack, Damage Assessment (D/A) - The purpose of a D/A report is to record all of the visible physical damage to a plant which can be seen on the available photographic cover. This report is used as a basis for the determination by economic specialists of the total damage to the plant, e.g. total physical damage, damage to tools and machinery, damage to building contents, loss of manpower and, finally, production loss. There are two forms of D/A reports: (1) the limited damage assessment, which records only the amount of damage and the severity classification of the damage, and (2) the detailed damage assessment, which indicates in addition the cause of damage, blast, fire, or mixed (blast plus fire), and includes a bomb fall plot. Both types of reports comprise a schedule sheet and a target plan on which are indicated the areas damaged and the type of damage. In order to clarify terminology used in describing serverity of damage, the principal damage classifications (structural, superficial, and minor) are discussed below.

(1) Structural Damage - Structural damage to a framed building is defined as breakage or visible distortion of principal structural members, e.g. columns, trusses, and girders. Such damage is considered to extend over all structural bays adjoining the damaged member. Structural damage to a loadbearing structure is defined as damage below the eaves, including floors and exterior or interior bearing walls. Again the entire structural bay or panel affected is considered a part of the area of damage. The term "destroyed" is sometimes used to indicate a building structurally damaged beyond expectancy of repair.

(2) Superficial Damage - Superficial damage is defined as roof or side wall stripping of areas exceeding 40 square feet, or breakage or deformation of minor framing members in framed structures, and as roof damage only in loadbearing structures. The term "gutted" indicates extensive internal fire damage to a building which is superficially damaged.

(3) Minor Damage - This class of damage is often called "Roof Disturbance", and indicates visible damaged areas of less than 40 square feet. In the preparation of reports, minor damage was purposely omitted in all cases except when the interpreter was sure that the visible minor damage was indicative of more serious concealed damage. The reason for not including this type of damage in D/A reports was the relatively little production loss resulting in such instances and the necessity of preparing and issuing reports as quickly as possible after photographs were received.

(4) Photographs 1 - 8 illustrate the principal types of damage discussed here.

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BACKGROUND

TABLE 1

GROUPS AND TYPES OF INDUSTRIAL BUILDINGS

GROUP				Type Symbol	Description	M E Vuln
A	Single story No traveling cranes Spans generally less than 75 feet Heights at eaves generally less than 25 feet Area of 10,000 sq ft or more	1	Sawtooth roofs	A1.1	All buildings of this group with sawtooth roofs other than those included in Types A1.2, A1.3 and A1.4	V4
				A1.2	Frame and roof slab monolithic reinforced concrete.	V4
				A1.3	Exposed top chords of trusses	V4
				A1.4	Stressed skin type reingorced concrete (e.g. Zeiss-Dywidag)	V5
		2	Non-sawtooth roofs	A2.1	Simple beam and column	V4
				A2.2	Arches and rigid frames.	V4
				A2.3	Truss construction.	V4
				A2.4	Frame and roof slab monolithic reinforced concrete.	V4
				A2.5	Stressed skin including concrete shell.	V5
B	Single story With traveling cranes Any length of span Area of 10,000 sq ft or more	1	Bldgs housing heavy cranes	B1	Buildings containing runways for heavy cranes (capacity 25 tons or more) and of height at eaves generally more than 30 ft.	V2
		2	Bldgs housing light cranes	B2	All buildings in this group other than those in B1	V2
C	Single story No traveling cranes Spans greater than 75 feet Heights at eaves generally greater than 25 feet Area of 10,000 sq ft or more	1	Main frame members in two directions	C1.1	Roof trusses supported along one side of building by long-span trusses and along other side by columns. Permits large door along one side, and at ends.	V5
				C1.2	Continuous trusses in one or two directions, long-span in one direction, supported by columns or exterior walls, and by internal walls.	V4A
				C1.3	Exposed-chord sawtooth-roof buildings, exposed-chord trusses supporting major size trusses at 90°. One or both truss systems may be of long span.	V4A
				C1.4	Diamond mesh arch.	V4A
		2	Main frame members in one direction only	C2.1	Long-span arches individually supported along sides of building. May be arranged in multiple spans joined alongside.	V5
				C2.2	Long-span triangular or bowstring trusses individually supported by columns at sides of building. May be arranged in multiple spans joined alongside, using common columns. Roof pitch exceeds 2 in 10	V5
				C2.3	Long-span trusses, top chord of pitch 2 in 10 or less (including exposed-chord sawtooth roofs), individually supported by columns along sides of building. May be arranged in multiple spans using common columns or may be continuous over internal columns.	V4A
		3	Shell type construction	C3	Stressed skin including concrete shell construction	V5
D	Single story Area less then 10,000 sq ft			D	This type covers all single-story industrial buildings, regardless of type of construction, if under 10,000 sq ft in plan area.	V4
E	Multi-story framed buildings	1	Earthquake-resistant	E1	Extremely heavy steel or reinforced concrete multi-story construction, designed to resist heavy lateral loads.	V1
		2	Non-earthquake resistant	E2	Structures of this group other than those in E1	V3
F	Multi-story wall bearing buildings. (May have internal columns.)	1	Earthquake-resistant	F1	Earthquake-resistant wall-bearing construction (walls of reinforced brick, concrete, or very massive masonry).	V3
		2	Non-earthquake resistant	F2	Structures of this group other than those in F1.	V3A
S	Special structures			S	Coke ovens, test cells, fuel storage, boilers in power plants, etc.	Spl.

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PHOTO 1

DESTROYED - Complete destruction by blast to a boiler plant. (Target 90.17 - 357, Bldg 2)

PHOTO 2

DESTROYED - Complete destruction by fire and high exolosion to buildings in foreground. (Target 90.25-263A, Bldg 117)

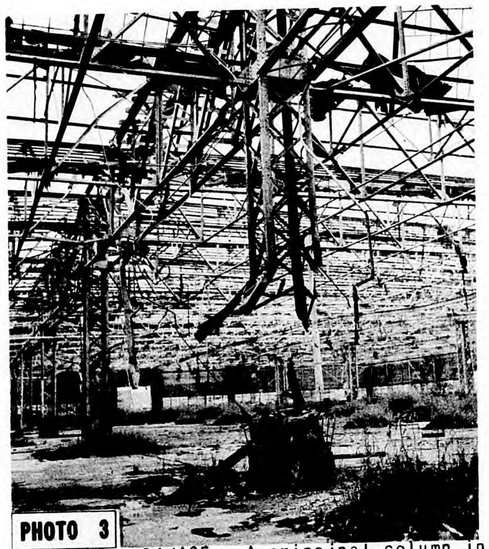

PHOTO 3

STRUCTURAL DAMAGE - A principal column in a steel framed structure cut by explosion. This particular case would be practically impossible to detect on vertical photo. (Target 90.13 - 1544, Bldg 19)

PHOTO 4

STRUCTURAL DAMAGE - Blast caused damage to columns, beams, and trusses in this steel framed structure. (Target 90.25-263A, Bldg 14)

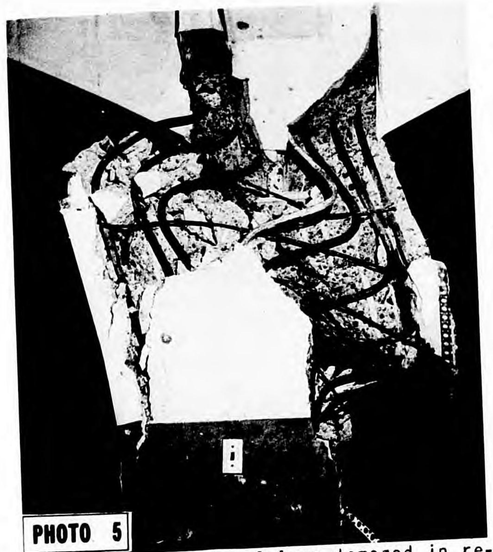

PHOTO 5

STRUCTURAL DAMAGE - Column damaged in reinforced concrete building caused by blast and collapse. (Target 90.17 - 357, Bldg 28)

PHOTO 6

STRUCTURAL DAMAGE - Complete section of reinforced concrete building dropped into crater at foundations. (Target 90.17 357, Bldg 11E)

PHOTO 7

SUPERFICIAL DAMAGE - Widespread damage caused by blast but no principal supporting members cut or distorted. (Target 90.20 - 193, Bldg 74)

PHOTO 8

MINOR DAMAGE - No general damage to covering or supporting members and areas of damage less than 40 sq ft. (Target 90.17 - 357 Bldg 17)

BACKGROUND — METHODS OF EVALUATION

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2. Reporting Agencies

a. Most industrial photographic intelligence on the Japanese homeland was produced by four organizations: Joint Target Group (Washington), Central Interpretation Unit XX AF (Guam), Photographic Interpretation Squadron Two (Guam), and Joint Intelligence Center Pacific Ocean Areas (Pearl Harbor). The first two organizations were the major contributors.

b. The Joint Target Group, organized under the combined Chiefs of Staff, depended upon the Photographic Evaluation Section of the Photographic Branch of AC/AS Intelligence for photographic intelligence. Reports were prepared by personnel from the Army, Navy, and RAF with the assistance of expert civilian specialists. The majority of the personnel had served in similar capacities in the European or Mediterranean Theater of operations. This organization carried out by far the most comprehensive industrial analysis program of any of the four organizations, producing functional, structural, and damage assessment reports as well as a variety of special reports.

c. Central Interpretation Unit XX AF, combining the photographic interpretation elements of the 3rd Photographic Reconnaissance Squadron and the 35th Photographic Technical Unit, worked in direct support of the B-29 operations. Although some functional and a lesser amount of structural analysis was produced by the CIU, by far the greatest effort was directed to damage assessment.

d. Photographic Interpretation Squadron Two was considerably less involved in industrial interpretation than CIU. Damage assessment and the preparation of target material were the principal work, and these were generally limited to targets of Naval interest. A few functional analyses were made, principally of Navy bombardment targets; no structural analyses were made.

e. Joint Intelligence Center Pacific Ocean Areas produced general background studies on Japan which included summaries of industrial activity as well as detailed studies on a few industrial systems and general target material. Information from Japanese Prisoners of War was frequently incorporated in JICPOA publications.

III METHODS OF EVALUATION

1. Selection of Targets

a. Photographic intelligence industrial teams investigated approximately 100 targets of an industrial nature. Thirty-four of these (Exhibit A, Table III) were chosen for detailed field study on the basis of (1) the industry they represented and (2) the F/A, S/A, and D/A reports which had been prepared on each. It is believed that the targets chosen represent a cross section of Industrial Japan and include a wide variety of the problems of analysis encountered.

b. All of the 34 plants investigated in detail were checked for functional analysis, 21 were checked for building construction, and 15 were checked for damage assessment. Detailed evaluations of the photographic intelligence on twelve of these targets are included as Exhibits B through N, appended to this report.

2. Field Work

a. Field data used in this report is from three principal sources: (1) photographic intelligence industrial teams composed of industrial photographic interpreters, language interpreters, and photographers, (2) teams from other divisions of the Survey, principally the Physical Damage Division and (3) photographic interpreters attached to USSBS regional offices. The data was obtained by a thorough inspection of each plant, and by interviewing plant managers, engineers, and supervisors. A careful building by building check was made to determine the function and structure as well as the extent and type of damage each building had sustained. Ground photographs were taken to illustrate the findings.

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METHODS OF EVALUATION

3. Statistical Methods Used for Comparative Analyses

a. General - In checking field data against the reports it was necessary to adopt certain arbitrary standards of evaluation so that the accuracy of the reports could be expressed in quantitative terms, permitting the comparison of various reports and types of reports. Although some discrepancies in methods of recording and in terminology were encountered which prevented precise evaluation, most of the data was readily reducible to quantitative terms. The statistical methods for evaluating each type of report are described in sub-paragraphs b through e below. Seven formulae were used in the computations. Formulae A, B and C are referenced as "Method One" in graphs and tabulations. A and B are based on the number of buildings or installations included in the plant, and C is the ratio between the reported area of damage and the actual area of damage. Formulae D, E, and F are referenced as "Method Two", and are all based on the ratio of the area correctly interpreted to the total area of installations included in the target. The seventh formula is a method of assigning accuracy factors for F/A reports, based on more arbitrary ratings.

b. F/A Reports - The reported functional occupancy of each building in the target fell in one of four categories: (1) correct, (2) similar to actual occupancy, (3) occupancy not reported, or (4) wrong. The accuracy of F/A was assessed by three methods. In two of the three, accuracy was defined as the percentage of either total number of buildings or total area of buildings of correct or similar occupancy. In the third an "F/A accuracy factor" was assigned not only on the basis of the category of the reported information as above, but also on the basis of the preciseness or vagueness of the terminology used by the interpreter. The factors used for the latter method of assessment are shown in Table 2. These three methods are formularized below. Statistics in Graphs 1 to 5 and in Exhibits A to N were computed by these formulae which are referenced there by the letter designations given below.

(1) Formula A.

$$\% \text{ ACCURACY} = 100 \times \frac{\text{Number of installations of correct or similar occupancy}}{\text{Total number of installations}}$$

(2) Formula D is the same as Formula A except that "area of installations" is substituted for "number of installations".

(3) F/A Accuracy Factor.

$$\% \text{ ACCURACY} = \frac{\text{Sum of accuracy values assigned each installation*}}{\text{Total number of installations}}$$

* As computed from Table 2.

c. S/A Reports - Structural analysis reports were evaluated on the basis of HE vulnerability and combustibility factors correctly assigned by the interpreter.

(1) Formula B.

$$\% \text{ ACCURACY} = \tfrac{1}{2}\left[\%\text{ accuracy}^{*}_{\text{combustibility}}\right] + \tfrac{1}{2}\left[\%\text{ accuracy}^{**}_{\text{vulnerability}}\right]$$

$$^{*}\%\text{ ACCURACY}_{(\text{combustibility})} = 100 \times \frac{\text{Number buildings correctly classified for combustibility}}{\text{Total number of buildings}}$$

$$^{**}\%\text{ ACCURACY}_{(\text{vulnerability})} = 100 \times \frac{\text{Number buildings correctly classified for HE vulnerability}}{\text{Total number of buildings}}$$

(2) Formula E is the same as Formula B except that "area of installations" is substituted for "number of installations".

d. D/A Reports. Damage Assessment reports were evaluated by a comparison of actual and reported damage in terms of total visible damage, structural damage, and superficial damage. For purposes of evaluation the interpretation of total visible damage was credited as 40 per cent of the accuracy, and the interpretation of each severity classification as 30 per cent. This arbitrary ratio is thought to approximate the relative value of each type of information to the intelligence value of the reports.

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METHODS OF EVALUATION

(1) Formula C.

$$\%ACCURACY = .4\ \begin{matrix}\%accuracy^{*}\\ \text{total}\\ \text{damage}\end{matrix} + .3\ \begin{matrix}\%accuracy^{**}\\ \text{structural}\\ \text{damage}\end{matrix} + .3\ \begin{matrix}\%accuracy^{***}\\ \text{superficial}\\ \text{damage}\end{matrix}$$

$$^{*}\%\ \text{ACCURACY}_{\text{total damage}} = 100 \times \left[1 - \frac{\text{Difference between actual and reported total damage}}{\text{Actual total damage}}\right]$$

**Substitute "structural damage" for "total damage" in preceeding formula*.

***Substitute "superficial damage" for "total damage" in preceeding formula*.

(2) Formula F is the same as Formula C except that "total area of installations in plant" is substituted for "actual total damage".

e. Buildings included as "primary" in the tabulations are those which were so designated in the Joint Target Group reports. Since the designation of primary buildings is not a photographic interpretation function, no attempt was made to evaluate that phase of the work.

TABLE 2

Accuracy Factors for Assessing Functional Analysis

Correct Interpretation		Similar Occupancy		Unidentified		Incorrect	
100	Specific/dogmatic	100					
95	Specific/probable	95					
90	Specific/possible	90					
85	General/dogmatic	85	Specific/dogmatic	85			
80	General/probable	80	Specific/probable	80			
75	General/possible	75	Specific/possible	75			
		70	General/dogmatic	70			
		65	General/probable	65			
		60	General/possible	60			
				45	Unidentified	45	
						25	General/possible 25
						20	General/probable 20
						15	General/dogmatic 15
						10	Specific/possible 10
						5	Specific/probable 5
						0	Specific/dogmatic 0

Examples of assignment of Accuracy Factors:

1. The report "probable sheet metal shop" is a "specific/probable" report. If the report were correct the accuracy factor would be 95. If the actual function were similar to the reported function, such as "light machining shop", the score would be 80, and if the report were wrong the score would be 5.

2. The report "probable shop" is "general/probable" and would be scored 80, 65, or 20, depending on whether the reported occupancy was correct, similar, or incorrect.

3. In cases where alternative functions were given, such as "shop or storage", the point score of each was selected and averaged. Where a building was reported as both "general/dogmatic" and "specific/probable" or "specific/possible", e.g. "shop, probably sheet metal", the average score was used if the first was correct and the second incorrect. Three points were added to the second if both were right, and subtracted from the second if both were wrong.

EVALUATION

IV EVALUATION

1. The following evaluation of industrial photographic interpretation is based upon a study of the statistics prepared by the methods described in Section III. Explanatory comments are intended to help clarify graphic and tabular presentations of the statistics, and to summarize the more important findings. The graphs are included after the text of this section; the tabulations are included as Exhibit A.

2. Industrial Analysis as a Whole

a. It was found that of the three types of industrial reports investigated, damage assessment reports were the most accurate. The average accuracy for individual reports using formulae D, E, and F, (Exhibit A, Table III) was 80 per cent, 76 per cent and 95 per cent for F/A, S/A, and D/A, respectively. In order to take into consideration the relative sizes of plants, a composite figure for interpretation accuracy was made (Graph I; Exhibit A, Table I) based on the sum of all items correctly interpreted in all plants studied. By this method F/As, S/As, and D/As rated 81 per cent, 78 per cent, and 96 per cent respectively (also calculated by formulae D, E, and F). If each of these two groups of figures is averaged, the accuracy figures for industrial interpretation as a whole would be 84 per cent for the first group and 85 per cent for the second. Although the intelligence value of industrial reports cannot be completely expressed statistically, the figures do indicate that the reports were a reliable source of intelligence.

3. Functional Analysis. (Graphs 2, 3; Exhibit A, Tables II, III, IV, and V)

a. The F/A reports were quite accurate in presenting general plant information (process, products, boundaries, etc.) and in identifying the functional occupancy of primary buildings, but were less accurate in identifying the function of each building.

b. In comparing the accuracy in the several industrial systems, the aircraft industries rated highest and the oil and chemical industries lowest.

c. A study of the basic types of functional occupancy generally found in industry and the accuracy with which each type was identified indicates that assembly buildings, heavy shops, storage buildings, forges and foundries were most often correctly interpreted, and administrative units and special equipment least often.

d. The reports originated by the Joint Target Group in Washington averaged 11 per cent more accurate than field reports using the F/A accuracy factors as criteria. In Washington ground intelligence files of the several intelligence agencies were available to the interpreters, and a panel of consultants composed of persons intimately acquainted with individual industries, and in some instances acquainted with the actual plant under study, were available for conference. It is natural that more accurate intelligence resulted from such cooperative effort.

4. Structural Analysis. (Graphs 2, 4; Exhibit A, Tables II, IV, VI.)

a. Structural analysis reports were found to be reasonably accurate. The analysis was only slightly less accurate for primary buildings than for all buildings.

b. The accuracy in identification of buildings in the three combustibility classifications was quite uniform, despite the fact that Japanese industrial construction made more use of combustible materials than most structural interpreters had anticipated. The fire resistant (R) type of building would not have been as frequently incorrectly reported if the quality of photography had been better; most of those wrongly interpreted were small buildings.

c. HE vulnerability classifications were correctly assigned on 5 per cent more buildings than had been correctly classified as to building construction type. For example B2 buildings were sometimes reported as B1, but since both types have the same vulnerability rating (V2), the vulnerability classification was correct even though the construction type was wrong.

EVALUATION

d. Reports originating in Washington were 10 per cent more accurate than those prepared in the field. This can be attributed to more complete files and the panel of consultants available in Washington.

5. Damage Assessment (Graphs 2,5; Exhibit A, Tables II, IV, VII)

a. Damage assessment reports were generally more accurate than F/A and S/A reports. Damage was reported with 5 per cent less accuracy on primary buildings than on all buildings, using figures obtained by Formula F.

b. Superficial damage was more accurately interpreted than either structural damage or total damage. Total damage was generally more accurately interpreted than structural damage. Calculated on the basis of totals for all plants surveyed the accuracy figures for total, structural, and superficial damage respectively are 91%, 92%, and 92% by Formula C, and 97%, 95%, and 98% by Formula F.

c. Most errors, as well as the average error, were found to be in reporting less than the actual area of damage.

d. Only 5 per cent difference in accuracy was found between Washington and field reports. This can be explained by the fact that files and consultants are not as useful in interpreting damage as in interpreting function and structure.

e. The figures which are the basis for this evaluation are the amounts of structural, superficial, and total damage on each plant. As can be seen from a study of comparative damage plot plans (Exhibits B-N), considerable variance was found between actual and reported areas damaged in individual buildings within a plant. In few cases, however, were major buildings in a plant reported as damaged when no damage existed, or reported undamaged when actually damaged or destroyed. Since these minor discrepancies had little or no effect on the utility of the reports, except to the extent that they were reflected in the plant totals in each category of damage, reports were judged for accuracy on the basis of plant totals alone. Due to incomplete chronological coverage, some confusion existed between buildings removed and those completely destroyed.

f. From the point of view of intelligence the figure representing total visible damage to a plant is most valuable since production loss as an immediate result of attack is related to that figure. Consequently total damage was weighted more heavily than either structural or superficial damage (i.e. 4: 3: 3) in the determination of the overall accuracy of damage assessment. The severity classification of damage (structural and superficial) are important in estimating the duration of plant shut-down, and total production loss.

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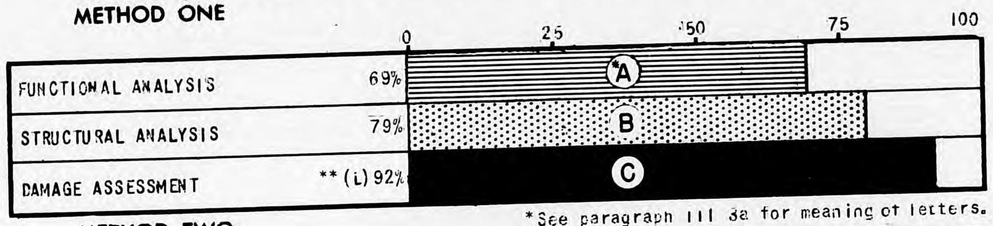
EVALUATION

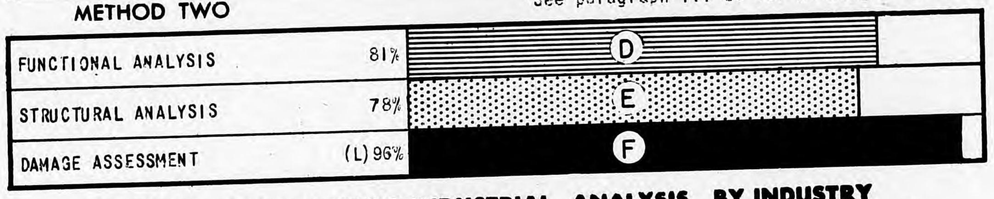
GRAPH 1 — ACCURACY OF INDUSTRIAL ANALYSIS AS A WHOLE

METHOD ONE



*See paragraph III 3a for meaning of letters.

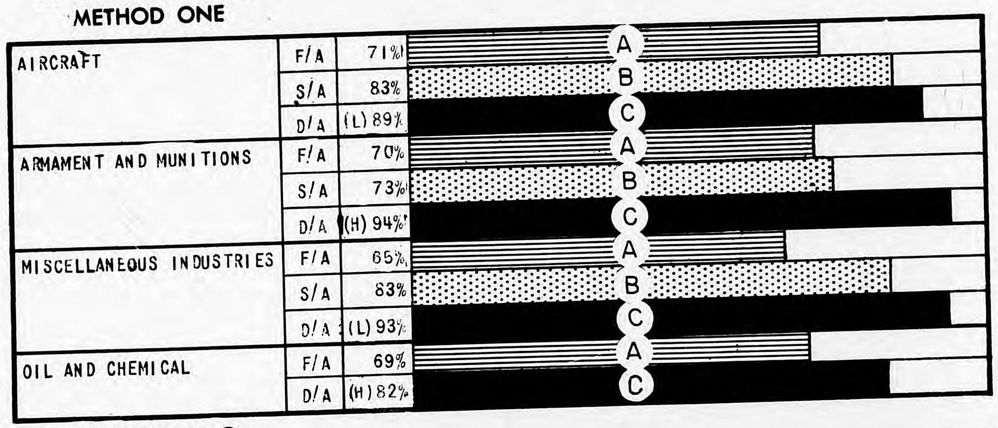
METHOD TWO



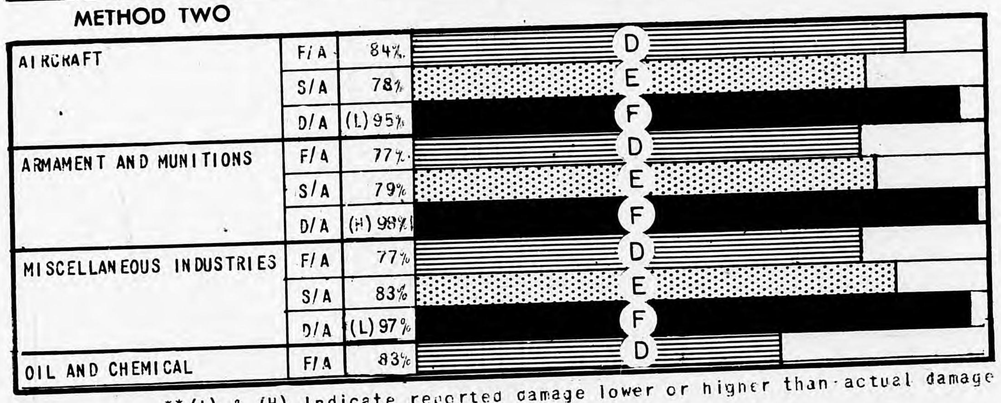
GRAPH 2 — ACCURACY OF INDUSTRIAL ANALYSIS BY INDUSTRY

A. FOR ALL BUILDINGS

METHOD ONE



METHOD TWO



**(L) & (H) Indicate reported damage lower or higher than actual damage

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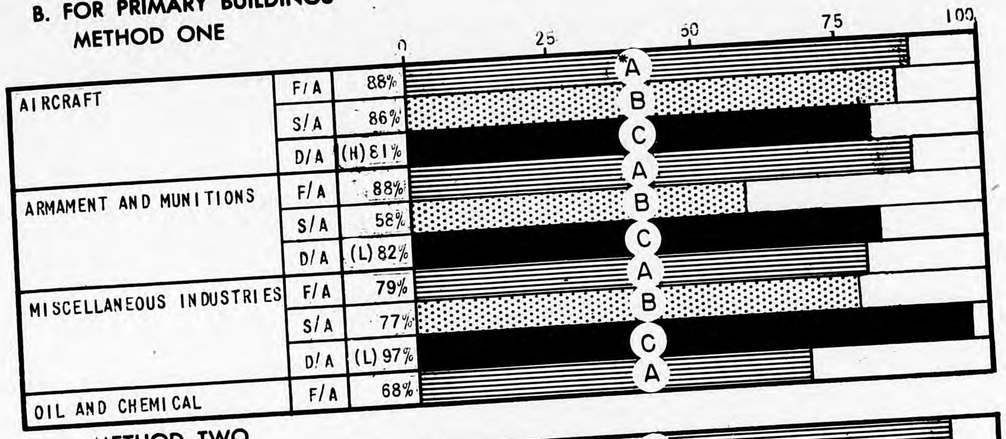
EVALUATION

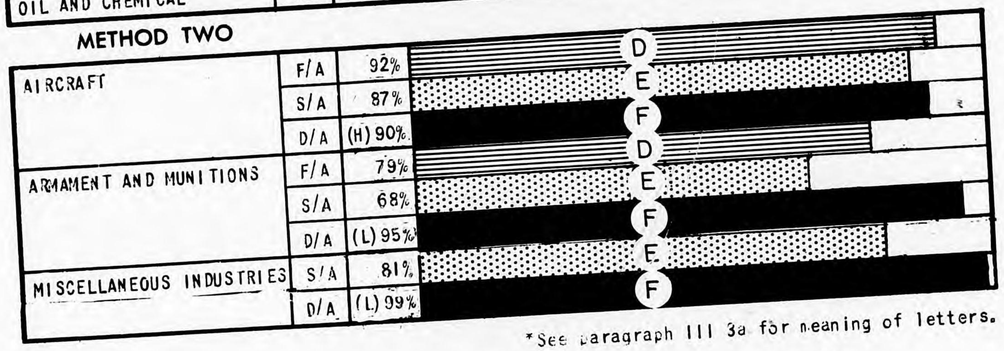
GRAPH 2 — CONTINUED

B. FOR PRIMARY BUILDINGS

METHOD ONE



METHOD TWO

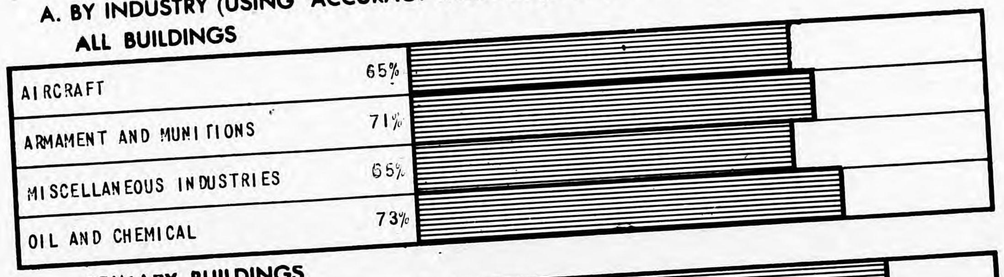


*See paragraph III 3a for meaning of letters.

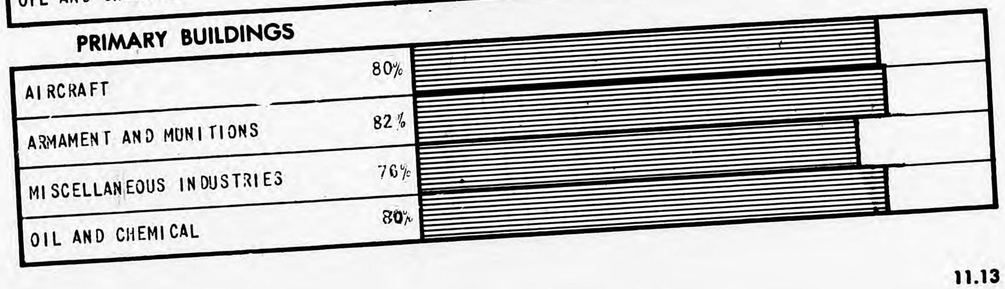
GRAPH 3 — ACCURACY OF FUNCTIONAL INTERPRETATION

A. BY INDUSTRY (USING "ACCURACY FACTORS") SEE PARAGRAPH III 3c

ALL BUILDINGS



PRIMARY BUILDINGS



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EVALUATION

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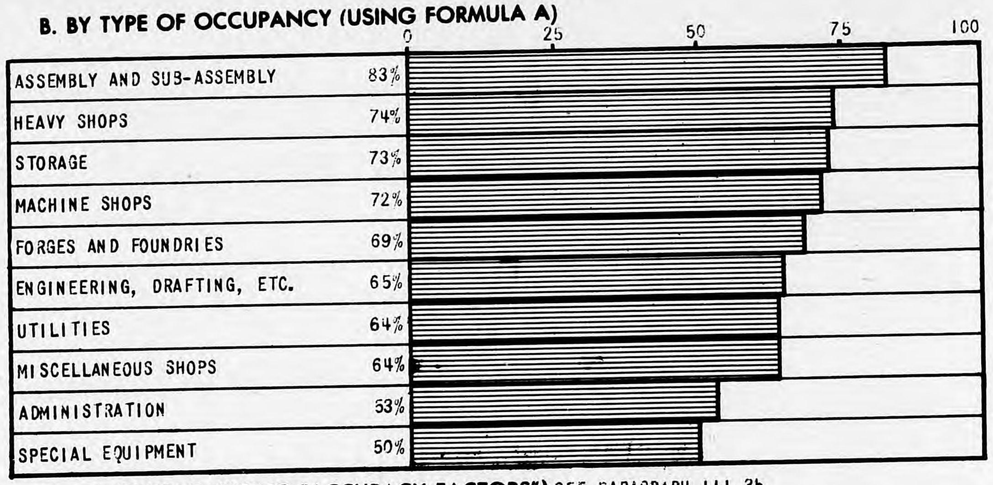
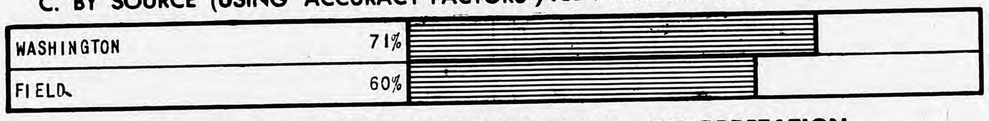
GRAPH 3 - CONTINUED

B. BY TYPE OF OCCUPANCY (USING FORMULA A)

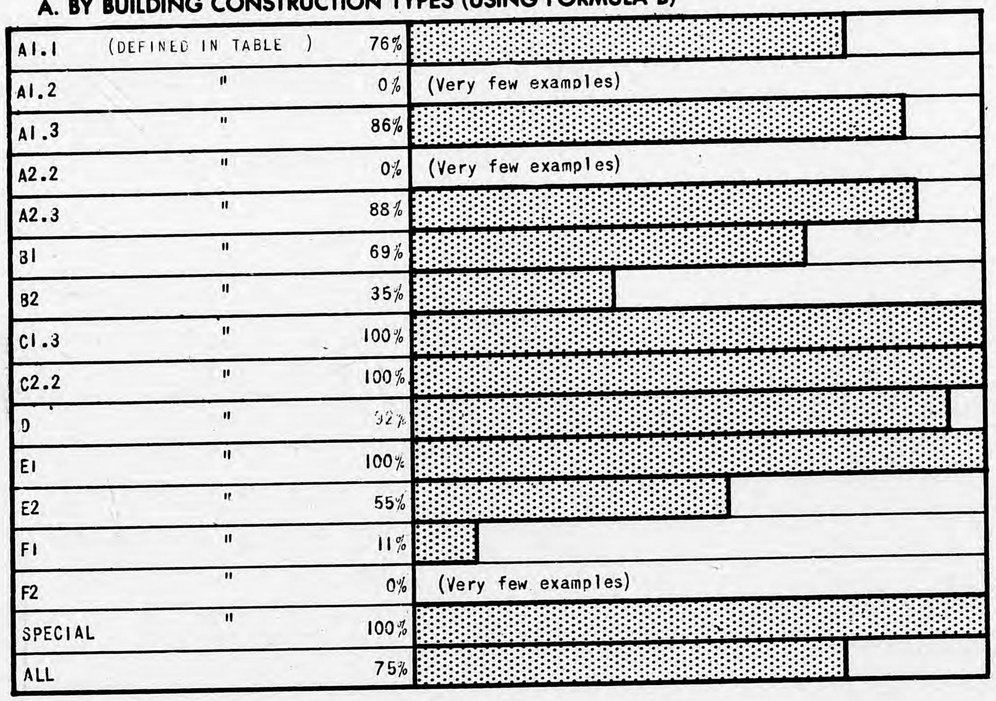


C. BY SOURCE (USING "ACCURACY FACTORS") SEE PARAGRAPH III 3b



GRAPH 4 . ACCURACY OF STRUCTURAL INTERPRETATION

A. BY BUILDING CONSTRUCTION TYPES (USING FORMULA B)



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EVALUATION

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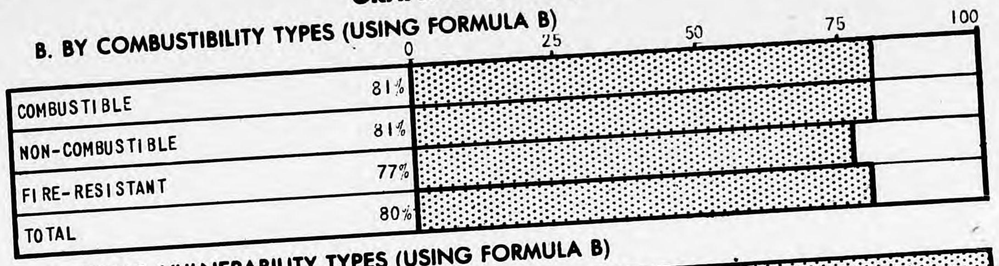
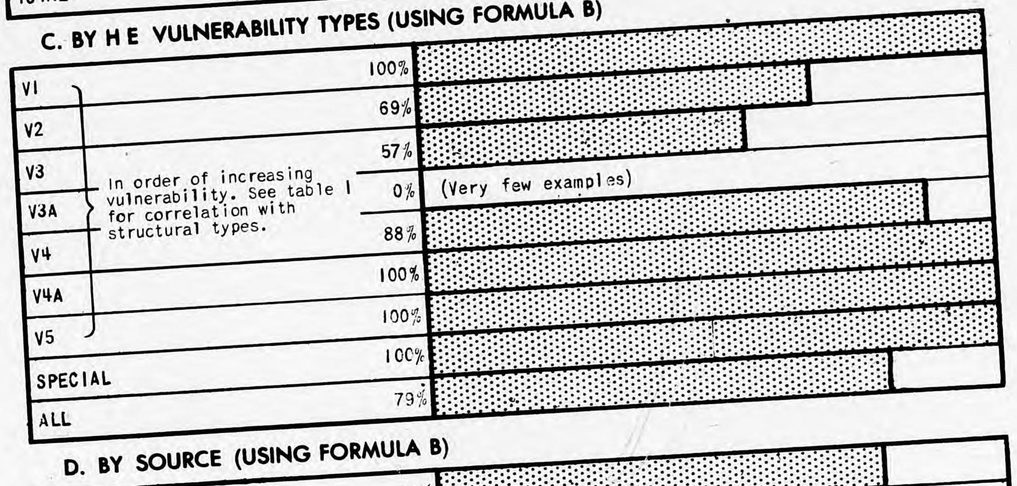
GRAPH 4 - CONTINUED

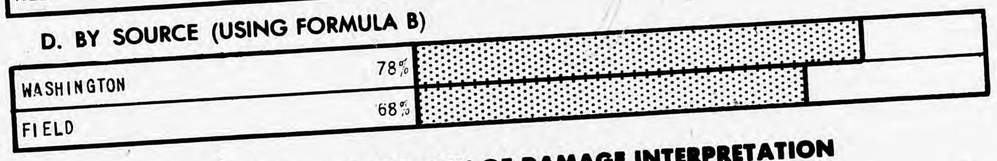
B. BY COMBUSTIBILITY TYPES (USING FORMULA B)



C. BY H E VULNERABILITY TYPES (USING FORMULA B)



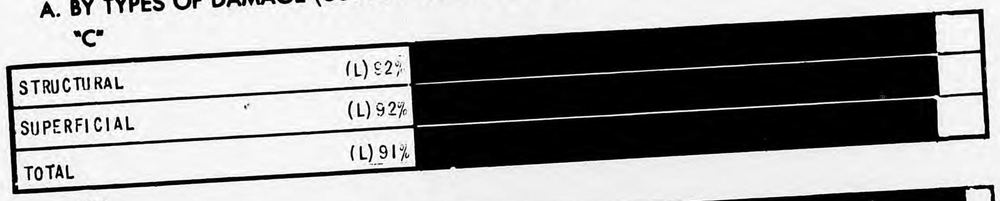
D. BY SOURCE (USING FORMULA B)



GRAPH 5 ACCURACY OF DAMAGE INTERPRETATION

A. BY TYPES OF DAMAGE (USING FORMULA C & F)

"C"



"F"

B. BY SOURCE (USING FORMULA C)

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CONCLUSIONS AND RECOMMENDATIONS

V CONCLUSIONS AND RECOMMENDATIONS

1. Conclusions

a. The program of industrial analysis, developed by photographic intelligence to enable accurate planning and evaluation of strategic air operations against Japanese industry, was adequate for that purpose. Judged by the more absolute standards of the purely technical limitations of such a program, however, it fell considerably short of its potentialities. Had lesser force been available. or had the Japanese made a greater effort to repair and rebuild, more careful selection of targets, planning and assessment of raids would have been required, and it is doubtful that the photographic intelligence program would have been adequate.

b. In Washington, although the reports were generally excellent, and considerably more accurate than those in the field (11 per cent higher for F/A, 10 per cent for S/A, and 5 per cent for D/A), delays in preparation and distribution rendered them very much less useful than they would otherwise have been.

c. In the field (specifically at Guam) although the analyses were most timely, they suffered in accuracy and form through the insufficiency and inexperience of personnel, and lack of source material and expert consultants such as were available in Washington. Efficiency in the field was further reduced by duplication of effort between Army Air Force and Navy units. Not only did this duplicating arrangement fail to make full use of available trained personnel, but it resulted in a general lessening of the acceptance of photographic intelligence as a result of conflicting reports issued from the same photographs.

d. In the majority of strategic industries function can be analyzed by photographic interpretation alone, but in the remainder, ground information is essential if the analysis is to be detailed and accurate. Industrial plants which can be analyzed from photographs alone include the coke, iron and steel industry, power plants, oil refineries, shipyards, and railroad repair shops. Industries which can usually be analyzed from photographs alone unless the process is unfamiliar include the airframe aero engine industries, most nonferrous metals industries, the ceramics industry, fertilizer works, and certain chemical works. Industries which can usually be classified in a general manner (i.e. as heavy, light, chemical, etc.) only on the basis of photographs, but can be adequately analyzed if ground intelligence can determine the process and end products, include ordnance plants, automotive plants, wire and cable mills, textile mills, and aluminum rolling mills.

e. An important prerequisite for accurate structural analysis is a complete workable knowledge of the construction and design practice in the areas being studied. Inadequate knowledge of materials used by the Japanese largely contributed to the 20 per cent error in reporting combustibility. The most prevalent errors in analyzing Japanese structures were found in reporting the following general construction types: multi-storied, wall bearing buildings; non-earthquake resistant, multi-storied, framed, buildings; and buildings housing overhead cranes. In several instances the number of floors in multi-storied buildings was wrongly reported.

f. Damage assessment reports have been found to be a very reliable intelligence source, particularily in reporting total visible damage, and structural damage. One difficulty revealed by the ground survey, was in reconciling minor visible damage (i.e. a roof hole of less than 40 square feet) to severe structural damage to the lower floors in multi-storied, heavy reinforced concrete structures; this was emphasized by not reporting minor damage in limited damage reports. It is believed that a false impression of severity of damage resulted from the use of the term superficial damage' to indicate non-structural damage which nevertheless seriously affected production.

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CONCLUSIONS AND RECOMMENDATIONS

2. Recommendations

a. All industrial photographic intelligence for any theater should be produced by one organization. It is, of course, essential that this organization be adequately staffed and that it have adequate source material.

b. Where the situation makes it impossible to concentrate all industrial photographic intelligence activity for one theater in one organization, e.g. if it were necessary to maintain partially overlapping organizations in both Washington and the field, it is absolutely essential that very close liaison be maintained between the two organizations. Air courier service between two such organizations is essential.

c. Of primary importance in preparing for any future emergency is the procurement of current data on processes, industrial construction, local practices in all countries of interest to both functional and structural analysts, and the effectiveness of all weapons against all types of construction.

d. A panel of consultants representative of the strategically important industries should be available to any pre-attack analysis group for consultation.

e. All interpreters working on industrial targets must be highly trained in this specialized and difficult phase of photographic interpretation. In training future industrial interpreters the same program as used in the Navy Industrial Analysis course is thought to be adequate, except that more detailed specialization is necessary, and more emphasis placed on industrial analysis in connection with urban area analysis is advisable, particularily in studying areas as atomic bomb targets. In general functional analysis training should include a thorough background in all industries with a complete study of available data, and individual specialization and further training in the specific industry in which the interpreter is to work; structural analysis training should be given to architects and engineers only and should include specific training in recognizing structural design types and construction materials, and the use of vertical scale; damage assessment training should include recognition of damage by severity types and by causation, and should be supplemented by a detailed study of examples of damage as related to the actual weapons used.

f. For structual analysis it would seem advisable to review both building construction type and HE vulnerability classification in light of ground findings, and to consolidate some classifications which are of equal vulnerability and difficult to recognize as construction types. A noticeable example of this is B1 and B2 building types (buildings housing cranes) which are both V2 vulneribility. (See the section on Photographic Interpretation in the PDD report on Hiroshima for study of this type of building.)

g. For damage assessment reports it is recommended that uniform and standard terminology be adopted and strictly followed by all reporting agencies. Minor roof damage should be reported if it is believed caused by penetrating bombs which would cause significant damage not visible in photographs. More emphasis should be placed on study by damage assessment interpreters of the effectiveness of weapons. Bomb load data should be available at the time of reporting.

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EXHIBIT A

STATISTICAL TABLES

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TABLE I

ACCURACY OF INDUSTRIAL ANALYSIS AS A WHOLE

ALL BUILDINGS						
*"A" F/A	"B" S/A	"C" D/A	"D" F/A	"E" S/A	"F" D/A	**F/A ACCURACY FACTOR
69%	79%	*** (L) 92%	81%	78%	(L) 96%	68

PRIMARY BUILDINGS						
"A" F/A	"B" S/A	"C" D/A	"D" F/A	"E" S/A	"F" D/A	F/A ACCURACY FACTOR
84%	78%	(L) 84%	91%	83%	(L) 91%	80

*Letters refer to formulae used in computations. See paragraph III 3a for formulae.
**See paragraph III 3b for description of accuracy factors.
*** (L) and (H) indicate reported damage lower or higher than actual damage.

TABLE II

ACCURACY OF INDUSTRIAL ANALYSIS BY INDUSTRY

ALL BUILDINGS							
INDUSTRY	"A" F/A	"B" S/A	"C" D/A	"D" F/A	"E" S/A	"F" D/A	F/A ACCURACY FACTOR
AIRCRAFT	71	83	(L) 89	84	78	(L) 95	65
ARMAMENT & MUNITIONS	70	73	(H) 94	77	79	(H) 98	71
MISCELLANEOUS	65	83	(L) 93	77	83	(L) 97	65
OIL & CHEMICALS	69	NONE	(H) 82	83	NONE	NONE	73
	AVERAGES						
	69%	79%	(L) 92%	81%	78%	(L) 96%	68

PRIMARY BUILDINGS							
INDUSTRY	"A" F/A	"B" S/A	"C" D/A	"D" F/A	"E" S/A	"F" D/A	F/A ACCURACY FACTOR
AIRCRAFT	88	86	(H) 81	92	87	(H) 90	80
ARMAMENT & MUNITIONS	88	58	(L) 82	79	68	(L) 85	82
MISCELLANEOUS	79	77	(L) 97	NONE	81	(L) 99	79
OIL & CHEMICALS	88	NONE	NONE	NONE	NONE	NONE	80
	AVERAGES						
	84%	78%	(L) 84%	91%	83%	(H) 92%	80

TABLE III

ACCURACY OF INDUSTRIAL ANALYSIS BY PLANT

INDUSTRY	NUMBER	PLANT	ALL BUILDINGS "A" F/A	"B" S/A	"C" D/A	"D" F/A	"E" S/A	"F" D/A	F/A ACCURACY FACTOR	PRIMARY BUILDINGS "A" F/A	"B" S/A	"C" D/A	"D" F/A	"E" S/A	"F" D/A	F/A ACCURACY FACTOR
	90.13-1544	NAKAJIMA A/C CO., OTA PLANT	63	68	(L) 87	68	87	(L) 94	60	72	83	(L) 78	77	89	(L) 90	65
	90.13-1545	NAKAJIMA A/C CO., KOIZUMI PLANT	66	94	(H) 95	-	-	(H) 99	67	100	100	(L) 80	-	-	-	79
	90.13-2131	NAKAJIMA A/C CO., UTSUNOMIYA PLANT	73	54	-	83	25	-	58	86	84	-	94	-	-	76
	90.17-356	NAKAJIMA A/C CO., OGIKUBO PLANT	55	66	-	88	93	-	63	50	90	-	77	90	-	64
	90.17-357	NAKAJIMA A/C CO. TAMA-MUSASHINO PLANT	67	77	(L) 82	73	90	(L) 88	65	85	100	(L) 61	88	100	(L) 72	78
	90.17-1391	TOMOIKA ISHIKAWAJIMA ENGINE CO.	92	73	-	-	-	-	79	-	-	-	-	-	-	-
	90.17-2200	JAPAN A/C CO., LTD.	60	88	-	-	-	-	58	100	100	-	-	100	-	100
	90.20-193	MITSUBISHI A/C ENGINE WORKS-NAGOYA	73	92	(L) 85	94	95	(L) 90	71	100	90	(L) 83	100	97	(L) 89	93
AIRCRAFT	90.20-194	MITSUBISHI A/C WORKS-NAGOYA	61	85	(H) 82	-	-	(H) 98	65	-	-	-	-	-	-	-
	90.20-240	KAGAMIGAHARA KAWASAKI A/C WORKS	75	60	(H) 84	-	51	(H) 95	69	100	42	(L) 73	-	42	(H) 89	90
	90.20-1635	HANOA NAKAJIMA A/C WORKS	92	-	(H) 69	-	-	(H) 92	75	80	-	(L) 71	-	-	(L) 96	66
	90.20-1729	AICHI A/C WORKS, EITOKU PLANT	77	-	(L) 82	89	-	(L) 97	75	85	-	(L) 78	95	-	(L) 92	83
	90.20-2010	AICHI A/C ENGINE WORKS	76	71	(H) 97	85	92	(H) 99	75	80	66	(H) 95	97	78	(H) 96	81
	90.25-18	KAWANISHI A/C CO., NARUO	88	71	-	-	-	-	77	100	100	-	-	-	-	93
	90.25-1547	AKASHI KAWASAKI A/C CO.	74	-	-	-	-	-	67	-	-	-	-	-	-	-
	90.25-1702	KAWANISHI A/C CO., FAKAE PLANT	69	-	-	95	-	-	65	100	-	-	100	-	-	-
	90.25-2041	SUMITOMO PROPELLER PLANT	85	89	(L) 83	96	77	(L) 86	72	-	-	-	-	-	-	-
	90.25-2137	TAKARAZUKA KAWANISHI A/C CO.	81	81	—	95	64	-	68	100	54	-	-	55	-	84
	90.20-197	ATSUTA ARSENAL	50	54	(L) 87	54	58	(L) 97	56	58	53	(L) 81	67	49	(L) 96	55
	90.20-198	AICHI ORDNANCE WORKS	45	77	(H) 95	54	84	(H) 95	62	-	-	-	-	-	-	-
ARMAMENT &	90.20-1138	NIPPON EXPLOSIVE WORKS	75	-	-	-	-	-	78	100	-	-	-	-	-	97
MUNITIONS	90.21-1653	TOYOKAWA NAVAL ARSENAL	75	-	-	-	-	-	69	87	-	-	-	-	-	72
	90.23-1169	UJI POWDER WORKS	85	-	-	-	-	-	81	85	-	-	-	-	-	80
	90.30-657A	KURE NAVAL ARSENAL	71	79	(H) 88	90	88	(H) 97	69	-	-	-	-	-	-	-
	90.30-6578	KURE SHIPBUILDING YARDS	86	78	-	95	85	-	86	100	83	-	100	96	-	97
	90.03-378	NIHON STEEL WORKS	55	-	-	-	-	-	63	53	-	-	-	-	-	55
MISCELLANEOUS	90.17-52	JAPAN STEEL TUBING CO.	80	-	-	-	-	-	78	-	-	-	-	-	-	-
INDUSTRY	90.20-241	NIPPON VEHICLE CO.	57	86	(L) 94	76	67	(L) 97	65	89	92	(L) 97	93	79	(L) 99	83
	90.25-263A	SUMITOMO LIGHT METALS CO.	66	82	-	-	90	-	60	83	78	-	-	89	-	79
	90.30-1891	JAPAN STEEL WORKS LTD.	71	83	-	-	68	-	65	100	63	-	-	57	-	94
	90.17-137	SHOWA FERTILIZER CO.	44	-	-	-	-	-	54	55	-	-	-	-	-	75
OIL &	90.20-1684	UTSUBE RIVER OIL REFINERY	74	-	(L) 82	42	-	-	74	-	-	-	-	-	-	-
CHEMICALS	90.25-1203	NIPPON OIL REFINERY	72	-	-	74	-	-	72	85	-	-	77	-	-	84
	90.32-818	UBE NITROGEN FERTILIZER CO.	71	-	-	-	-	-	77	-	-	-	-	-	-	-
Note on D/A columns:		(L) & (H) indicate reported damage lower or higher than actual damage.	"A"	"B"	"C"	"D"	"E"	"F"	F/A ACCURACY FACTOR	"A"	"B"	"C"	"D"	"E"	"F"	F/A ACCURACY FACTOR
			AVERAGES							AVERAGES						
			71	77	(L) 86	80	76	(L) 95	69	85	80	(L) 80	89	79	(L) 91	80

TABLE IV

BASIC STATISTICS FOR TABLES I AND II

A. ALL BUILDINGS

INDUSTRY	FUNCTION																	
	TOTAL BLDGS		IDENTIFICATION															
			CORRECT				SIMILAR OCCUPANCY				UNIDENTIFIED				WRONG			
	NO.	AREA	NO.	%	AREA	%	NO.	%	AREA	%	NO.	%	AREA	%	NO.	%	AREA	%
AIRCRAFT	1327	25960	588	44	15637	60	358	27	6134	24	146	11	853	3	235	18	3336	13
ARM & MUNITIONS	859	8450	402	47	4574	54	195	23	1888	23	158	18	1289	15	103	12	699	8
MISC INDUSTRY	339	443	131	39	272	62	87	26	67	15	55	16	37	8	66	19	67	15
OIL & CHEMICALS	587	915	323	55	439	48	81	14	135	15	129	22	171	19	54	9	170	18
ALL	3112	35768	1444	46	20922	58	722	23	8224	23	488	16	2350	7	458	15	4272	12

INDUSTRY	STRUCTURE											
	H E VULNERABILITY						COMBUSTIBILITY					
	TOTAL BLDGS		CORRECT				TOTAL BLDGS		CORRECT			
	NO.	AREA	NO.	%	AREA	%	NO.	AREA	NO.	%	AREA	%
AIRCRAFT	422	9204	350	83	7573	82	559	14061	457	82	10223	73
ARM & MUNITIONS	388	7980	269	69	5908	74	447	8904	340	76	7505	84
MISC INDUSTRY	191	2803	154	81	2377	85	190	2803	161	85	2229	80
OIL & CHEMICALS						NO	DATA					
ALL	11001	19987	773	77	15858	79	1196	25768	958	80	19957	77

INDUSTRY	DAMAGE (IN THOUSANDS OF SQ FT)									
	PLAN AREA	TOTAL			STRUCTURAL			SUPERFICIAL		
		ACTUAL	RE-PORTED	% AC-CURACY	ACTUAL	RE-PORTED	% AC-CURACY	ACTUAL	RE-PORTED	% AC-CURACY
AIRCRAFT	18949	11773	10311	88	6104	5661	93	5689	4917	86
ARMAMENT & MUNITIONS	7154	4236	4154	98	1835	1667	88	2401	2548	94
MISCELLANEOUS INDUSTRY	446	287	267	93	233	211	91	54	56	96
OIL & CHEMICALS	-	426	420	99	137	205	67	289	216	75
ALL	26549	16722	15152	91	8309	7684	92	8433	7737	92

B. PRIMARY BUILDINGS

INDUSTRY	FUNCTION																	
	TOTAL BLDGS		IDENTIFICATION															
			CORRECT				SIMILAR OCCUPANCY				UNIDENTIFIED				WRONG			
	NO.	AREA	NO.	%	AREA	%	NO.	%	AREA	%	NO.	%	AREA	%	NO.	%	AREA	%
AIRCRAFT	210	16234	130	62	11926	73	54	26	3017	19	12	6	158	11	14	6	1133	7
ARM & MUNITIONS	107	1128	66	62	639	57	28	26	252	22	1	1	-	-	12	11	237	21
MISC INDUSTRY	61	-	28	46	-	-	20	33	-	-	3	5	-	-	10	16	-	-
OIL & CHEMICALS	44	-	30	68	-	-	0	0	-	-	10	23	-	-	4	9	-	-
ALL	422	17362	254	60	12565	72	102	24	3269	19	26	6	158	1	40	10	1370	8

INDUSTRY	STRUCTURE											
	H E VULNERABILITY						COMBUSTIBILITY					
	TOTAL BLDGS		CORRECT				TOTAL BLDGS		CORRECT			
	NO.	AREA	NO.	%	AREA	%	NO.	AREA	NO.	%	AREA	%
AIRCRAFT	53	4495	50	94	4279	95	77	6373	59	77	4991	78
ARMAMENT & MUNITIONS	18	1016	8	44	590	58	18	1016	13	72	785	77
MISC INDUSTRY	41	1651	33	80	1361	82	42	1652	31	74	1327	80
OIL & CHEMICALS						NO	DATA					
ALL	112	7162	91	81	6230	87	137	9041	103	75	7103	79

INDUSTRY	DAMAGE (IN THOUSANDS OF SQ FT)									
	PLAN AREA	TOTAL			STRUCTURAL			SUPERFICIAL		
		ACTUAL	RE PORTED	% AC CURACY	ACTUAL	RE PORTED	% AC-CURACY	ACTUAL	RE PORTED	% AC-CURACY
AIRCRAFT	7148	6469	5447	76	2671	2243	84	3799	3181	84
ARMAMENT & MUNITIONS	640	171	140	82	154	126	82	17	14	82
MISCELLANEOUS INDUSTRY	228	93	90	97	58	56	97	35	34	97
OIL & CHEMICALS					NO	DATA				
ALL	8016	6733	5677	84	2883	2425	84	3851	3229	84

TABLE V

ACCURACY OF FUNCTIONAL ANALYSIS
ADDITIONAL DATA

A. GENERAL

	LOCATION			PROCESS			END PRODUCTS			BOUNDARIES		
	TOTAL	CORRECT	%	TOTAL	CORRECT	%	TOTAL	CORRECT	%	TOTAL	CORRECT	%
AIRCRAFT	18	18	100	*17	16	94	18	18	100	*15	12	80
ARMAMENT & MUNITIONS	7	7	100	7	7	100	7	7	100	7	7	100
MISCELLANEOUS INDUSTRY	5	5	100	5	5	100	5	4	80	5	4	80
OIL & CHEMICALS	4	3	75	4	4	100	4	4	100	4	4	100
ALL	34	33	97	33	32	97	34	33	97	31	27	87

*Complete information not available.

B. BY CATEGORY (USING FORMULA "A")

	**TOTAL BLDGS	CORRECT		SIMILAR OCCUPANCY		UNIDENTIFIED		WRONG	
		NO. BLDGS	%	NO. BLDGS	%	NO. BLDGS	%	NO. BLDGS	%
ADMINISTRATION	440	99	23	133	30	84	19	124	28
ASSEMBLY & SUB-ASSEMBLY	141	75	53	42	30	10	7	14	10
ENGINEERING, DRAFTING, ETC	107	39	37	30	28	19	17	19	18
FORGES & FOUNDREYS	97	37	38	30	31	15	16	15	15
HEAVY SHOPS	69	20	29	31	45	7	10	11	16
MACHINE SHOPS	179	92	51	37	21	28	16	22	12
MISCELLANEOUS SHOPS	397	142	36	112	28	76	19	67	17
SPECIAL EQUIPMENT	588	196	33	101	17	135	23	156	27
STORAGE	884	467	53	179	20	120	14	118	13
UTILITIES	193	105	55	18	9	39	20	31	16
ALL	3095	1272	41	713	23	533	17	577	19

**Field information only partially complete on 53 additional buildings not included in this tabulation.

C. BY SOURCE (USING ACCURACY FACTORS)

	F/A ACCURACY FACTOR
WASHINGTON	71
FIELD	60

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TABLE VI

ACCURACY OF STRUCTURAL ANALYSIS , ADDITIONAL DATA

Note: Only reports using JTG technique were considered in preparing Tables VI A, B and C.

A. BY COMBUSTIBILITY TYPES (USING FORMUAL B)

COMBUSTIBILITY (J T G)	NUMBER OF BUILDINGS	NUMBER CORRECT	% CORRECT
(C) COMBUSTIBLE	698	563	81
(N) NON-COMBUSTIBLE	362	294	81
(R) FIRE RESISTANT	112	86	77
* ALL	1172	943	80

B. BY H E VULNERABILITY TYPES (USING FORMUAL B)

H E VULNERABILITY RATINGS	TOTAL BLDGS CHECKED	NUMBER CORRECT	% CORRECT
V1	18	18	100
V2	106	73	69
V3	104	59	57
V3A	3	0	0
V4	384	336	88
V4A	7	7	100
V5	1	1	100
SPL.	4	4	100
* ALL	627	498	79

In order of increasing vulnerability. See Text Table I for correlation with structural types.

C. BY BUILDING CONSTRUCTION TYPES (USING FORMUAL B)

See Text Table I for definition of types.

BUILDING CONSTRUCTION TYPE	HE VULNERABILITY RATING	AIRCRAFT			ARMAMENT & MUNITIONS			MISC. INDUSTRY			ALL INDUSTRY		
		TOTAL BLDGS	NUMBER CORRECT	% CORRECT	TOTAL BLDGS	NUMBER CORRECT	% CORRECT	TOTAL BLDGS	NUMBER CORRECT	% CORRECT	TOTAL BLDGS	NUMBER CORRECT	% CORRECT
A1.1	V4	13	13	100	38	25	66	3	3	100	54	41	76
.2	V4				1	0	0				1	0	0
.3	V4	1	1	100				6	5	83	7	6	86
A2.2	V4				3	0	0				3	0	0
.3	V4	26	24	92	38	32	84	9	8	89	73	64	88
B1	V2				34	23	68	1	1	100	35	24	69
B2	V2	11	3	27	29	9	31	31	13	42	71	25	35
C1.3	V4A	7	7	100							7	7	100
C2.2	V5	1	1	100							1	1	100
D	V4	79	79	100	79	62	78	88	85	97	246	226	92
E1	V1	7	7	100	11	11	100				18	18	100
E2	V3	36	24	67	28	15	54	31	13	42	95	52	55
F1	V3	4	1	25	5	0	0				9	1	11
F2	V3A				1	0	0	2	0	0	3	0	0
S	S	4	4	100							4	4	100
* ALL		189	164	87	267	177	66	171	128	75	627	469	75

D. BY SOURCE (USING FORMUAL B)

* Only buildings on which complete information was available were included in this tabulation.

	% ACCURACY
WASHINGTON	78
FIELD	68

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TABLE VII

ACCURACY OF DAMAGE ASSESSMENT , ADDITIONAL DATA

(DAMAGE IN THOUSANDS OF SQ FT)

A. BY TYPES OF DAMAGE FOR EACH INDUSTRY

TYPE	AIRCRAFT			ARMAMENT & MUNITIONS			MISC INDUSTRY			OIL & CHEMICALS		
	ACTUAL	REPORTED	% CORRECT	ACTUAL	REPORTED	% CORRECT	ACTUAL	REPORTED	% CORRECT	ACTUAL	REPORTED	% CORRECT
STRUCTURAL	6104	5661	93	1835	1607	88	233	211	91	137	205	50
SUPERFICIAL	5689	4917	86	2401	2548	94	54	56	96	289	216	75
TOTAL	11793	10578	90	4236	4155	98	287	267	93	426	421	99

B. BY TYPES OF DAMAGE FOR ALL INDUSTRIES

TYPE	TOTAL BLDG AREA	ACTUAL	REPORTED	% ACCURACY	
				USING FORMULA C	USING FORMULA F
STRUCTURAL	26549	8309	7684	92	95
SUPERFICIAL	26549	8433	7737	92	98
TOTAL	26549	16742	15421	91	97

C. BY SOURCE (USING FORMULA C)

	% ACCURACY
WASHINGTON	96
FIELD	91

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EXHIBIT B

NAKAJIMA AIRCRAFT CO.

OTA PLANT

90.13-1544

LAT. 36° 18'N - LONG. 139° 23'E

OTA, JAPAN

See Exhibit P for abbreviations used in this exhibit.

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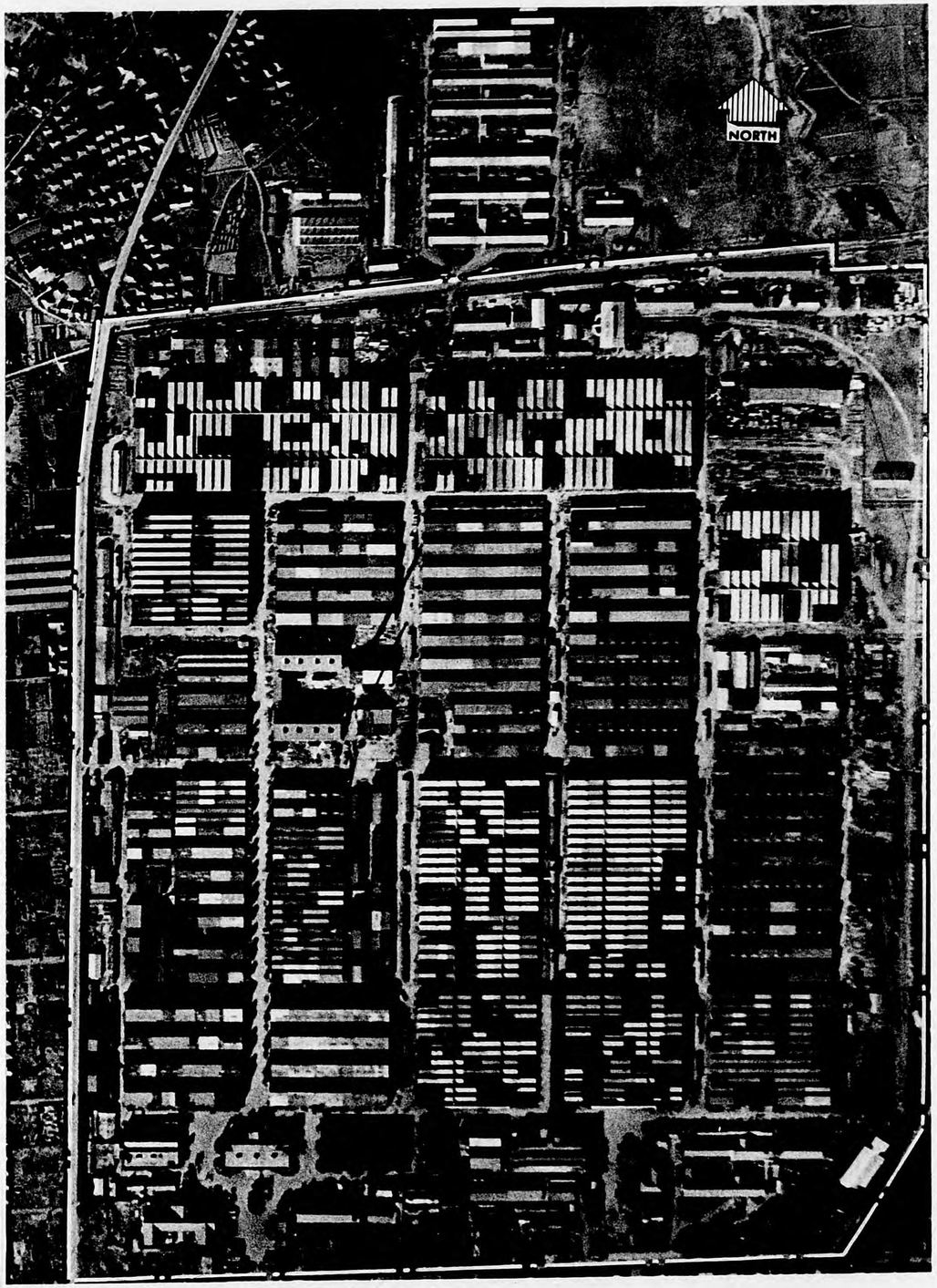
90.13-1544 NAKAJIMA AIRCRAFT CO., OTA



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NAKAJIMA AIRCRAFT CO., OTA 90.13-1544

1. DESCRIPTION OF TARGET

a. The Nakajima New Ota Plant produced about 18 percent of all Japanese combat planes, specializing in the Army fighters Frank and Tojo and the Army bomber Helen.

b. The plant is located on the east side of Ota Village about 40 miles northwest of of Tokyo.

c. The plant comprises 59 listed structures which have a built-up area of approximately 2,808,000 square feet.

2. SUMMARY

a. Two functional analyses were made, one by AC/AS Intelligence which was poor, the other by CIU (XXI BC) which was more accurate, though reporting on fewer buildings. Of 68 buildings reported on by AC/AS Intelligence:

(1) 12 were identified correctly.
(2) 20 were identified as having similar occupancy.
(3) 20 were unidentified.
(4) 16 were identified incorrectly.

Of 37 buildings reported on by CIU

(1) 14 were identified correctly.
(2) 15 were identified as having similar occupancy.
(3) 8 were identified incorrectly

b. The structural analysis was fair. For construction types, 27 out of 37 buildings were correct, and for building combustibility, 25 out of 37 were correct.

c. Both AC/AS Intelligence and CIU damage estimates were poor, being underestimated in each case. Of 2,593,300 square feet of actual total damage, only 1,978,600 square feet were reported by AC/AS Intelligence and 1,732,300 square feet by CIU.

3. SOURCE OF DATA

a. Reported

(1) AC/AS Intelligence Building Construction Analysis Report, 8 February 1945
(2) CIU (XXI BC) Industrial Report #3, 26 February 1945
(3) AC/AS Intelligence Limited D/A Report #20, 24 April 1945
(4) CIU (XXI BC) D/A Report #7, 14 February 1945
(5) CIU (XXI BC) D/A Report #28, 30 March 1945

b. Field Data

(1) USSBS (3-2, PIC) field notes.

90.13-1544 NAKAJIMA AIRCRAFT CO., OTA

4. FUNCTIONAL ANALYSIS

a. Use of Plant

Reported: Manufacture of Army aircraft
Actual: As reported

b. Boundaries

Correct as reported except for the omission of an apprentice school north of the plant.

c. Building Identification (F/A Table)

d. Summary of Tabulation

(1) AC/AS Intelligence Functional Analysis

TABLE 1

F/A ACCURACY FACTOR		PRIMARY BUILDINGS No. Bldgs	PRIMARY BUILDINGS %	TOTAL BUILDINGS No. Bldgs	TOTAL BUILDINGS %
	Correct	2	22	12	18
Total Plant 53	Of Similar Occupancy	3	33	20	29
Primary Buildings 50	Unidentified	0	–	20	29
	Incorrect	4	45	16	24
	Total	9	100	68	100

(2) CIU Functional Analysis

TABLE 2

F/A ACCURACY FACTOR		PRIMARY BUILDINGS No. Bldgs	PRIMARY BUILDINGS %	TOTAL BUILDINGS No. Bldgs	TOTAL BUILDINGS %
	Correct	5	56	14	38
Total Plant 67	Of Similar Occupancy	3	33	15	41
Primary Buildings 78	Unidentified	0	--	0	--
	Incorrect	1	11	8	21
	Total	9	100	37	100

e. Remarks

CIU had a higher score than AC/AS Intelligence chiefly because it analysed fewer buildings. Both had more success with primary buildings than with others.

NAKAJIMA AIRCRAFT CO., OTA 90.13-1544

FUNCTIONAL ANALYSIS TABLE

NAKAJIMA AIRCRAFT CO. NEW OTA PLANT — 90.13 - 1544

BUILDING NUMBER JTG	BUILDING NUMBER CIU XXI BC	PRIMARY	FUNCTION REPORTED: JTG	FUNCTION REPORTED: CIU XXI BOM COM	FUNCTION ACTUAL	EVALUATION: CORRECT	SIMILAR	UNIDENT	WRONG	F/A ACCURACY FACTOR: JTG	F/A ACCURACY FACTOR: CIU XXI BC
1	1D		Administration	Eng'r. and/or Experimental	Drafting & Blue Printing		x			85	85
2	1		Office, Engr. & Drafting	" " " "	Experimental	x				0	100
3	1B		Office, Admin	Administration	Offices, Admin.	x				100	100
4a	1C	•	Storehouse	Eng'r. and/or Experimental	Gym (originally cafeteria & kitchen)				x	0	0
4b			"						x	0	
5			Office, Storeroom		Shipping & Receiving		x			70	
6	2 ID		Unidentified	Probable Hospital	Hospital		x			45	95
7a	2		Offices	" " "	"		x			15	95
b	2 I		"	" " "	"		x			15	95
8	3		Storage - Comp'ts	Sub Assembly	Material Warehouse		x			85	70
9	3A		Final Assembly	Final Assembly	Wing Assembly		x			85	85
10	3B		"	"	" "		x			85	85
10A			Covered Road Way		Storage					65	
11	4	P	Machine Shop	Propable Assembly	Pilot Seat Assby. (originally lumber mill)			x	x	0	80
12	4A	P	" "	" " "	Wing & Fuselage Assembly			x	x	0	80
13			Heat Treatment		Office (originally Paint Shop)					0	
14			" "		Sand Blasting		x			85	
15a	8		Probable Forge	Aluminum Bending & Cutting	Component Parts		x			5	70
b			"	"	" "					5	
16a	7A		Prob. Machining Processing	work Shop	" "		x			80	65
b			" " "	"	" "		x			80	
17	7		Parts Processing & Prob	Sub Assembly	" "						
			Press Shop		" "	x				90	65
17Aa			Warehouses		Material Warehouse			x		0	
b			"		" "				x	85	
c			"		" "				x	85	
d			"		" "				x	35	
18	6A	P	Final Assembly	Sub Assembly	Wing Assembly			x		85	95

NAKAJIMA AIRCRAFT CO.
NEW OTA PLANT

FUNCTIONAL ANALYSIS TABLE

90.13 - 1544

BUILDING NUMBER JTG	BUILDING NUMBER CIU XXI BC	PRIMARY	FUNCTION REPORTED JTG	FUNCTION REPORTED CIU XXI BOM COM	FUNCTION ACTUAL	EVALUATION CORRECT	SIMILAR	UNIDENT	WRONG	CORRECT	SIMILAR	UNIDENT	WRONG	F/A ACCURACY FACTOR JTG	F/A ACCURACY FACTOR CIU XXI BC
19	5	P	Final Assembly	Sub Assembly	Wing Assembly		x			x				85	95
20	11A	P	Parts & Sub Assembly	" "	Engine Mounts, Spars, Seats	x				x				100	100
21	11	P	" " "	" "	" " " "	x				x				100	100
21A			Unidentified		Parts Inspection			x						45	
22	10		Boiler House	Boiler House	Boiler House	x				x				100	100
23	10A		" "	" "	" "	x				x				100	100
24	9A		Poss. Paint Shop	Forging	Offices				x				x	10	0
25	9		" " "	"	"				x				x	10	0
26a	8A		Prob. Press & Hammers	Aluminum Bending & Cutting	Jig Shop		x				x			80	60
b			" " "		" "		x							80	
27			Unidentified		Presses, Drop Hammers			x						45	
28	16		Prob. Machining & Parts	Probable Assembly	Fuselage Assembly				x		x			5	80
29	15	P	Sub Assembly	Work Shop	Presses, Drop Hammers				x		x			0	70
30a	17	P	" "	Sub Assembly	Final Assembly		x				x			85	85
b	20		Storage	Aluminum Bending & Cutting	Forge				x				x	0	0
31	17A		Final Assembly	Sub Assembly	Final Assembly	x					x			100	85
32	19		Boiler House	Power Plant	Boiler House	x				x				100	100
33	18		Storage & Prob. Press	Storage	Lumber Cutting		x				x			65	60
34	14		Post Assembly	Final Assembly	Final Assembly	x				x				100	100
35	12		Small Parts	Stores	Metal Plating		x						x	65	0
36	12B		Unidentified	Stores	Engine Parts Testing			x					x	45	0
37	12A		"	Stores	" " "			x					x	45	0
38			Storage		Material Warehouse		x							70	
39	5	P	Sub Assembly, Parts	Sub Assembly	Heat Treatment & Material Warehouse				x				x	0	0
40			Unidentified		Metal Reclaiming & Collecting			x						45	
			"												
41			"		" " "			x						45	
42			"		" " "			x						45	
43			"		Supply Warehouse			x						45	
44			"		" "			x						45	

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PHOTOGRAPHIC INTELLIGENCE — INDUSTRIAL ANALYSIS EXHIBIT B
90.13-1544 NAKAJIMA AIRCRAFT CO., OTA
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NAKAJIMA AIRCRAFT CO.
NEW OTA PLANT

FUNCTIONAL ANALYSIS TABLE

90.13 - 1544

BUILDING NUMBER JTG	BUILDING NUMBER CIU XXI BC	PRIMARY	FUNCTION REPORTED JTG	FUNCTION REPORTED CIU XXI BOM COM	FUNCTION ACTUAL	EVALUATION CORRECT	SIMILAR	UNIDENT	WRONG	CORRECT	SIMILAR	UNIDENT	WRONG	F/A ACCURACY FACTOR JTG	F/A ACCURACY FACTOR CIU XXI BC
45			Poss. Pump House		Storage				x					0	
46			Unidentified		Battery Recharging			x						45	
47			"		Receiving			x						45	
48			"		"			x						45	
49			"		Office			x						45	
50	1A		Reported Inspection	Eng'r. and/or Experimental	"		x				x			80	85
51			Unidentified		Warehouse for Bldg 2			x						45	
52			"		Wing & Fuselage Assembly			x						45	
53			"		Repair of Elec. Drills			x						45	
54a			"		Jig Shop			x						45	
b			"		" "			x						45	
c			"		" "			x						45	

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EXHIBIT B PHOTOGRAPHIC INTELLIGENCE — INDUSTRIAL ANALYSIS
NAKAJIMA AIRCRAFT CO., OTA 90.13-1544
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90.13-1544 NAKAJIMA AIRCRAFT CO., OTA

5. STRUCTURAL ANALYSIS

a. Check on Scale Measurement

No check was made.

b. S/A (See S/A Table)

c. Summary of Tabulation

(1) Construction type

TABLE 3

Construction Type	PRIMARY BUILDINGS No. Bldgs	No. Corr	% Corr	TOTAL BUILDINGS No. Bldgs	No. Corr	% Corr
Wood Frame (W)	1	0	0	12	5	42
Steel Frame (S)	5	5	100	22	22	100
Reinforced Concrete (R/C)	0	-	---	3	0	0
Total	6	5	83	37	27	73

TABLE 4

Building Combustibility	PRIMARY BUILDINGS No. Bldgs	No. Corr	% Corr	TOTAL BUILDINGS No. Bldgs	No. Corr	% Corr
Combustible (C)	1	0	0	12	4	33
Non-Combustible (N)	6	5	83	22	21	95
Fire-Resistant (R)	0	-	--	3	0	68
Total	7	5	71	37	25	68

d. Remarks

If the extent of the use of wood in place of steel had been realized, the analysis would have been much improved.

NAKAJIMA AIRCRAFT CO., OTA 90.13-1544

STRUCTURAL ANALYSIS TABLE

NAKAJIMA AIRCRAFT CO. NEW OTA PLANT. — 90.13 - 1544

BUILDING NUMBER JTG	BUILDING NUMBER C1U XXI BC	1000'S OF SQ. FT. PLAN AREA ACTUAL	1000'S OF SQ. FT. PLAN AREA REPORTED JTG	1000'S OF SQ. FT. PLAN AREA REPORTED C1U	NUMBER OF FLOORS ACTUAL	NUMBER OF FLOORS REPORTED JTG	NUMBER OF FLOORS REPORTED C1U	SIZE OF BAY ACTUAL	SIZE OF BAY REPORTED	ROOF MATERIAL ACTUAL	ROOF MATERIAL REPORTED JTG	ROOF MATERIAL REPORTED C1U	COMBUSTIBILITY OF BUILDING ACTUAL	COMBUSTIBILITY OF BUILDING REPORTED JTG	COMBUSTIBILITY OF BUILDING REPORTED C1U	CONSTRUCTION TYPE ACTUAL	CONSTRUCTION TYPE REPORTED
1	1 D		17.7	12.5	4	4				CONC	N		R	N		R/C	S
2	1		14.0	11.9	2	2				CONC&CA	N		R & N	N		R/C&S	S
3	1 B		11.0	11.9	3	3				CONC	N		R	N		R/C	S
4 a	1 C		18.5	17.7	1	1				B/U	C		N	C		S&C	S
b			5.5		--	1				--	C		--	C		--	S
5			11.0		--	1				--	C		--	C		--	S
6	2 II		8.7	9.5	2	2				T	R		C	R		W	W
7 a	2		17.4	16.0	2	2				T	R		C	R		W	W
b	2 I		12.5	7.6	2	2				--	N		--	N		--	S
8	3		90.0	81.0	--	1				CA	N		N	N		S	S
9	3 A		89.4	81.0	1	1				CA	N		N	N		S	S
10	3 B		99.4	81.0	1	1				--	N		--	N		--	S
10A			21.6		1	1				CA	N		N	N		S	S
11	4		89.4	81.0	1	1				CA	N		N	N		S	S
12	4 A		89.4	81.0	1	1				CA	N		N	N		S	S
13			13.2		1	1				CA	N		N	N		S	S
14			7.6		1	1				--	N		--	N		--	S
15 a	3		22.5	10.0	1	1				SM	N		N	N		W	W
b			9.7		1	1				CA	N		N	N		S	S
16 a	7 A		43.2	90.0	1	1				CA	N		N	N		S	S
b			24.1		1	1				CA	N		N	N		S	S
17	7		96.2	90.0	1	1				CA	N		N	N		S	S
17Aa			23.4		1	1				CA	N		N	N		S	S
b			7.8		1	1				--	N		MIXED	N		--	W
c			3.3		1	1				--	N		MIXED	N		--	W
d			5.3		1	1				CA	N		N	N		S	S
13	6 A		161.4	150.0	1	1				CA	N		N	N		S	S
19	6		161.4	150.0	1	1				--	N		N	N		--	S
20	11 A		192.0	180.0	--	1				--	N		N	N		--	S
21	11		192.0	180.0	--	1				S:I&CA	N		C&N	N		W&S	S
21A			7.5		1	1				CA	N		N	N		S	S
22	10		5.5	7.1	1	1											

NAKAJIMA AIRCRAFT CO.
NEW OTA PLANT.

STRUCTURAL ANALYSIS TABLE

90.13 - 1544

BUILDING NUMBER		1000'S OF SQ. FT. PLAN AREA			NUMBER OF FLOORS			SIZE OF BAY		ROOF MATERIAL			COMBUSTIBILITY OF BUILDING			CONSTRUCTION TYPE	
		ACTUAL	REPORTED		ACTUAL	REPORTED		ACTUAL	REPORTED	ACTUAL	REPORTED		ACTUAL	REPORTED		ACTUAL	REPORTED
JTG	CIU XXI BC		JTG	CIU		JTG	CIU				JTG	CIU		JTG	CIU		
23	10 A		8.1	5.5	1	1				CA	N		N	N		S	S
24	9 A		14.0	13.0	2	1				T	N		C	N		W	S
25	9		14.0	13.0	2	1				T	N		C	N		W	S
16 a	8 A		22.2	49.0	--	1				--	N		--	N		--	S
b			3.2		--	1				--	N		--	N		--	S
27			5.5		1	1				SM	N		C	N		W	S
28	16		90.0	84.0	1	3				CA	N		N	N		S	S
29	15		89.4	180.0	1	1				SM	N		C	N		W	S
30 a	17		197.0	180.0	1	1				CA	N		N	N		S	S
b	20		62.0	50.0	1	1				--	N		--	N		--	S
31	17 A		197.0	180.0	1	1				CA	N		N	N		S	S
32	19		7.2	8.0	1	1				CA	N		C	N		W	S
33	18		15.7	15.7	--	1				--	C		--	MIXED		--	S
34	14		92.4	84.0	1	1				CA	N		N	N		S	S
35	12		11.2	18.0	--	1				--	C		--	MIXED		--	S
36	12 B		9.0	10.0	--	1				--	C		--	MIXED		--	S
37	12 A		11.8	12.0	--	1				--	C		--	MIXED		--	S
38			10.2		--	1				--	C		--	C		--	W
39	5		168.0	150.0	--	1				--	N		--	N		--	S
40			6.5		1	1				--	C		C	C		W	W
41			4.0		1	1				--	C		C	C		W	W
42			6.0		1	1				--	C		C	C		W	W
43			6.0		--	1				--	C		--	MIXED		--	S
44			7.1		--	1				--	C		--	C		--	W
45			4.0		--	1				--	C		--	MIXED		--	S
46			4.0		--	1				--	C		--	C		--	W
47			13.0		--	1				--	C		--	C		--	W
48			8.2		--	1				--	C		--	C		--	W
49			7.5		--	2				--	C		--	C		--	W
50	1 A		15.0	17.0	--	2				--	C		--	C		--	W
51			10.7		2	1				CONC	C		R	C		R/C	W
52			12.5		--	1				--	C		--	C		--	W

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90.13-1544 NAKAJIMA AIRCRAFT CO., OTA

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NAKAJIMA AIRCRAFT CO.
NEW OTA PLANT.

STRUCTURAL ANALYSIS TABLE

90.13 - 1544

BUILDING NUMBER		1000'S OF SQ. FT. PLAN AREA			NUMBER OF FLOORS			SIZE OF BAY		ROOF MATERIAL			COMBUSTIBILITY OF BUILDING			CONSTRUCTION TYPE	
		ACTUAL	REPORTED		ACTUAL	REPORTED		ACTUAL	REPORTED	ACTUAL	REPORTED		ACTUAL	REPORTED		ACTUAL	REPORTED
JTG	CIU XXI BC		JTG	CIU		JTG	CIU				JTG	CIU		JTG	CIU		
53			4.0		1	1				CM	C		N & C	C		S & W	W
54 a			8.0		--	1				--	C		--	C		--	W
b			3.8		--	1				--	C		--	C		--	W
c			3.3		--	1				--	C		--	C		--	W

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NAKAJIMA AIRCRAFT CO., OTA 90.13-1544

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90.13-1544 NAKAJIMA AIRCRAFT CO., OTA

6. DAMAGE ASSESSMENT

a. D/A (See D/A Table)

b. Summary of Tabulation

TABLE 5

	ACTUAL		REPORTED (AC/AS INTELL)		REPORTED (CIU)	
	Sq Ft	% Dam	Sq Ft	% Dam	Sq Ft	% Dam
Total Building Area			2,808,000			
Damage						
Structural	986,900	35	966,100	34	635,300	23
Superficial	948,200	34	815,600	29	975,100	35
Minor	358,500	13	*		35,400	1
Removed	299,700	11	196,900	7	86,000	3
Total Damage	2,593,300	93	1,978,600	70	1,732,300	62

* In general, Minor Damage was purposely omitted in D/A reports.

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NAKAJIMA AIRCRAFT CO., OTA 90.13-1544

NAKAJIMA AIRCRAFT CO. NEW OTA PLANT.

DAMAGE ASSESSMENT TABLE

90.13 - 1544

BUILDING NUMBER		BUILDING AREA	STRUCTURAL (1000'S SQ. FT.)		SUPERFICIAL (1000'S SQ. FT.)		MINOR * (1000'S SQ. FT.)		REMOVED (1000'S SQ. FT.)	
JT3	CIU	JT3	ACTUAL	REPORTED	ACTUAL	REPORTED	ACTUAL	REPORTED	ACTUAL	REPORTED
1	1 D	17.7		1.5						
2	1	14.0								
3	1 B	11.0								
4 a	1 C	19.5								
b		5.6								
5		11.0		11.0					11.0	
6	2 II	9.7	8.7	8.7		8.0				
7 a	2	17.4	17.4	7.5		56.6	14.7			
b	2 I	12.5	12.5	5.5		50.9	35.7			
8	3	90.0		44.9					90.0	45.0
9	3 A	89.4	9.7	32.4						
10	3 B	89.4		11.5					21.6	21.6
10 A		21.6								
11	4	89.4	2.0	18.0				3.8		3.6
12	4 A	89.4	6.5	22.5						1.8
13		13.2								
14		7.6							22.5	22.5
15 a	8	22.5		3.6		46.7	49.5	18.7	4.3	4.4
b		8.7		6.8		21.5	21.1	66.5		
16 a	7 A	43.2	2.5	6.8		11.7		3.0		
b		24.1	7.0					2.7		
17	7	96.2	1.7	5.2		12.8				
17Aa		23.4	2.0							
b		7.8	3.6	5.2		95.8	116.5	4.0		
c	7 B	8.3	8.3	8.3		156.9	159.0			
d		5.8	5.8	5.8			32.0			
18	6 A	161.4	61.5	54.0	16.6	95.9	4.5		78.4	86.0
19	6	161.4	78.7	4.5		82.7				
20	11 A	192.0	192.0	192.0	154.0					
21	11	192.0	192.0	113.0	81.0					
21 A		7.5				1.7	3.8			
22	10	5.5					3.1			
23	10 A	8.1								

*In general, Minor Damage was purposely omitted in D/A reports.

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NAKAJIMA AIRCRAFT CO.
NEW OTA PLANT.

DAMAGE ASSESSMENT TABLE

90.13 - 1544

BUILDING NUMBER		BUILDING AREA	STRUCTURAL (1000'S SQ. FT.)			SUPERFICIAL (1000'S SQ. FT.)			MINOR * (1000'S SQ. FT.)			REMOVED (1000'S SQ. FT.)		
JTG	CIU	JTG	ACTUAL	REPORTED	REPORTED	ACTUAL	REPORTED	REPORTED	ACTUAL	REPORTED	REPORTED	ACTUAL	REPORTED	REPORTED
24	9 A	14.0												
25	9	14.0												
26 a	8 A	22.2		22.2	49.0							22.2		
b		3.2		3.2								3.2		
27		5.5		1.5					5.5					
28	16	90.0	1.5	3.0		57.5	56.5	33.6	31.0					
29	15	89.4	1.0	45.5	90.0				34.8			53.6		
30 a	17	197.0	9.0	16.0		162.7	125.5	168.0	25.3					
b	20	62.0	62.0	50.7	50.0									
31	17 A	197.0	16.3	2.0		150.7	95.8	92.5	30.0					
32	19	7.2												
33	18	15.7	15.7	15.7	15.7									
34	14	92.4	24.5	8.5		67.9	83.9	75.4			7.6			
35	12	11.2	11.2	11.2	20.1									
36	12 B	9.0	9.0	9.0	10.0									
37	12 A	11.8	11.8	11.8	12.0									
38	12 C	10.2	10.2	10.2	5.5									
39	5	168.0	168.0	168.0	117.5			29.0			15.0			
40		6.5	5.3	3.3					1.2					
41		4.0							4.0					
42		6.0	5.2	1.5			2.0		1.8					
43		6.0	6.0	6.0										
44		7.1	7.1	7.1										
45		4.0	4.0	4.0										
46		4.0	4.0	4.0										
47		13.0		13.0								13.0		
48		8.2		8.2								8.2		
49		7.5										7.5		
50	1 A	15.0										15.0		
51		10.7	3.0	3.0										
52		12.5										12.5	12.5	
53		4.0												
54 a		8.0		8.0								8.0		

*In general, inor Damage was purposely omitted in D/A reports.

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90.13-1544 NAKAJIMA AIRCRAFT CO., OTA
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NAKAJIMA AIRCRAFT CO.
NEW OTA PLANT.

DAMAGE ASSESSMENT TABLE

90.13 - 1544

BUILDING NUMBER		BUILDING AREA	STRUCTURAL (1000'S SQ. FT.)			SUPERFICIAL (1000'S SQ. FT.)			MINOR (1000'S SQ. FT.)			REMOVED (1000'S SQ. FT.)		
JTG	CIU	JTG	ACTUAL	REPORTED	REPORTED	ACTUAL	REPORTED	REPORTED	ACTUAL	REPORTED	REPORTED	ACTUAL	REPORTED	REPORTED
54 b		3.8										3.8	3.8	
c		3.3										3.3	3.3	

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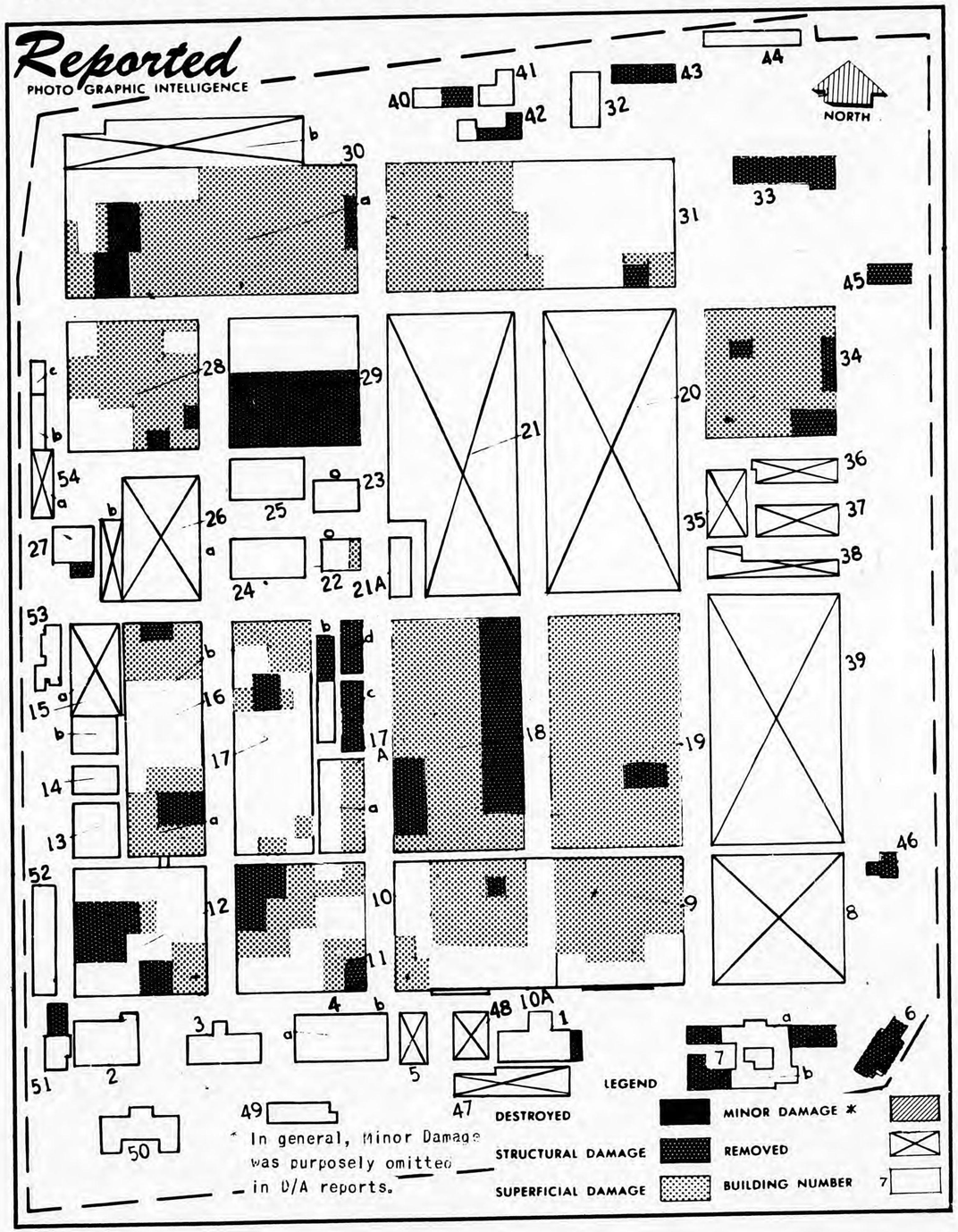
EXHIBIT B PHOTOGRAPHIC INTELLIGENCE — INDUSTRIAL ANALYSIS
NAKAJIMA AIRCRAFT CO., OTA 90.13-1544


Reported
PHOTOGRAPHIC INTELLIGENCE
NORTH
LEGEND
DESTROYED
STRUCTURAL DAMAGE
SUPERFICIAL DAMAGE
MINOR DAMAGE *
REMOVED
BUILDING NUMBER
* In general, Minor Damage was purposely omitted in D/A reports.

Actual
U. S. S. B. S. — COMPILED GROUND INFORMATION
LEGEND
DESTROYED
STRUCTURAL DAMAGE
SUPERFICIAL DAMAGE
MINOR DAMAGE
REMOVED
BUILDING NUMBER

CONFIDENTIAL

EXHIBIT C

NAKAJIMA AIRCRAFT CO.

KOIZUMI PLANT

90.13-1545

LAT. 36° 15'N - LONG. 139° 25'E

KOIZUMI, JAPAN

See Exhibit P for abbreviations used in this exhibit.

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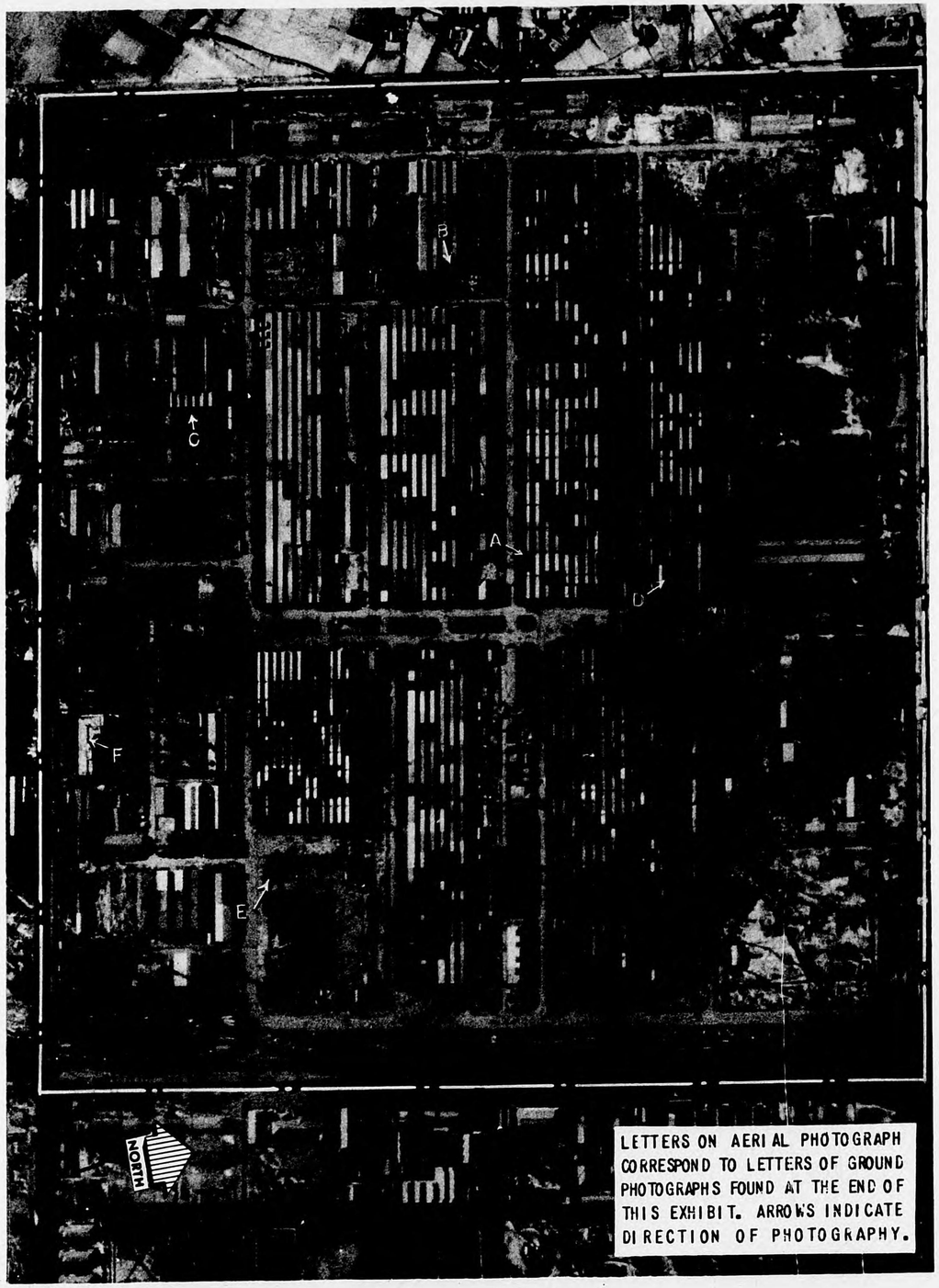
90.13-1545 NAKAJIMA AIRCRAFT CO., KOIZUMI



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NAKAJIMA AIRCRAFT CO., KOIZUMI 90.13-1545

1. DESCRIPTION OF TARGET

a. The Koizumi plant of the Nakajima Aircraft Co., one of the largest assembly plants for Naval aircraft, produced 17 per cent of all Japanese combat aircraft.

b. The plant is situated in the Tone River Valley approximately 40 miles NNW of Tokyo and one mile southwest of Koizumi Village.

c. The plant comprises 58 listed buildings with a built-up area of approximately 3,350,000 square feet.

2. SUMMARY

a. The functional analysis was fair. Of a total of 70 buildings and their subdivisions there were:

(1) 35 identified correctly.
(2) 11 identified as having similar occupancy.
(3) 17 unidentified.
(4) 7 identified incorrectly.

b. The report on structural analysis was excellent. 17 out of 18 buildings were analyzed correctly for combustibility, and 27 out of 29 buildings were analyzed correctly for types of construction.

c. Damage assessment was good for all types. Actual total damage was 2,014,000 square feet and damage reported was 1,934,000 square feet.

3. SOURCE OF DATA

a. Reported.

(1) AC/AS Intelligence F/A Report #6, 27 November 1944.
(2) AC/AS Intelligence S/A Report, 26 December 1944 (revised 19 April 1945).
(3) AC/AS Intelligence Limited Damage Report #11.1, 14 April 1945.
(4) AC/AS Intelligence Limited Damage Report #29, 4 May 1945.

b. Field Data.

(1) USSBS (G-2, PIC) field notes including Japanese damage and production data.

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90.13-1545 NAKAJIMA AIRCRAFT CO., KOIZUMI

4. FUNCTIONAL ANALYSIS

a. Use of Plant.

Reported: Manufacture of aircraft.

Actual: As reported.

b. Boundaries

Correct as reported.

c. Building Identification (F/A Table).

d. Summary of Tabulation.

TABLE I

F/A ACCURACY FACTOR		PRIMARY BUILDINGS No. Bldgs	PRIMARY BUILDINGS %	TOTAL BUILDINGS No. Bldgs	TOTAL BUILDINGS %
	Correct	4	40	35	50
	Of Similar Occupancy	6	60	11	16
	Unidentified	0	--	17	24
Total Plant 67	Incorrect	0	--	7	10
Primary Buildings 79	Total	10	100	70	100

e. Remarks.

The functional analysis of primary buildings was good, of secondary buildings fair.

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NAKAJIMA AIRCRAFT CO., KOIZUMI 90.13 - 1545

FUNCTIONAL ANALYSIS TABLE

NAKAJIMA AIRCRAFT CO.
KOIZUMI PLANT

90.13-1545

BUILDING NUMBER JTG	PRIMARY	FUNCTION REPORTED	FUNCTION ACTUAL	EVALUATION CORRECT	SIMILAR	UNIDENT	WRONG	F/A ACCURACY FACTOR JTG
1		Unidentified	Storage (Cement, Carbide)			x		45
2		Unidentified	Storage (Cement, Carbide)			x		45
3		Unidentified	Dye Casting - Molds			x		45
4		Storage	Maintenance (Plant)		x			70
5		Unidentified	Experimental Plane Assembly			x		45
6		Storage	Lockers - Toilets				x	15
7		Unidentified	Plumber Shop (Pipe Bending)		x			45
8		Storage	Storage (Food & Office Sup.)	x				85
9		Storage	Storage (Food & Office Sup.)	x				85
10		Unidentified	Checking Office				x	45
11a	P	Sub Assembly & Assembly	Final Assembly		x			78
11b		Storage	Storage	x				85
12a	P	Sub Assembly & Assembly	Wing Assembly		x			78
b		Storage	Storage	x				85
13a	P	Sub Assembly	Fuselage Assembly	x				85
b		Storage	Storage	x				85
14a	P	Sub Assembly & Assembly	Fuselage Assembly	x				85
b		Storage	Storage	x				85
15		Storage	Storage	x				85
16		Storage	Storage	x				85
17		Storage	Storage	x				85
18		Storage	Storage	x				85
19		Storage	Storage	x				85
20		Storage	Storage	x				85
21a		Storage	Storage	x				85
b		Storage	Accessories		x			75
22	P	Possible Machine Shop	Accessories				x	45
23		Unidentified	Accessories		x			75
24	P	Possible Machine Shop	Pressing & Accessaries	x				85
25a	P	Pressing & Small Parts Manufacture	Storage	x				85
b		Storage						

NAKAJIMA AIRCRAFT CO.
KOIZUMI PLANT

FUNCTIONAL ANALYSIS TABLE

90.13-1545

BUILDING NUMBER JTG		PRIMARY	FUNCTION REPORTED JTG		ACTUAL	EVALUATION CORRECT	SIMILAR	UNIDENT	WRONG	F/A ACCURACY FACTOR CORRECT	SIMILAR	UNIDENT	WRONG	JTG	
26a		P	Sup Assembly		Accessory Building		x							70	
b			Storage		Storage	x								85	
27			Unidentified		Fabric Covering Building			x						45	
28			Unidentified		Storage			x						45	
29			Unidentified		Parts Packaging (for shipment)		x							45	
30a		P	Sup Assemoly		Metal Cutting - Plating		x							70	
30b			Storage		Storage	x								85	
31a		P	Sub Assembly		Assemoly & Mold Loft	x								85	
b			Storage		Storage	x								85	
32			Unidentified		Loading - Shipping Building			x						45	
33			Boiler House		Boiler House	x								100	
34			Storage		Experimental Buildings				x					15	
35			Workshop		Experimental Buildings		x							70	
36			Unidentified		Experimental Buildings			x						45	
37			Storage		Experimental Buildings				x					15	
38			Storage		Model Making Building				x					15	
39			Storage		Experimental Building				x					15	
40			Offices		Experimental Building		x							70	
41			Unidentified		Blue Print Building			x						45	
42a			Administration		Administration	x								100	
b			Administration		Administration	x								100	
43			Storage		Production Offices				x					15	
44			Unidentified		Mess Hall			x						45	
45			Storage		Labor Office				x					15	
46			Unidentifi ed		Storage			x						45	
47			Storage		Storage	x								85	
48a			Propaole Foundry		Foundry	x								95	
b			Storage		Storage	x								85	
c			Storage		Storage	x								85	
49			Storage		Storage	x								85	
50			Storage		Storage	x								85	

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90.13-1545 NAKAJIMA AIRCRAFT CO., KOIZUMI
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NAKAJIMA AIRCRAFT CO.
KOIZUMI PLANT

FUNCTIONAL ANALYSIS TABLE

90.13-1545

BUILDING NUMBER JTG		PRIMARY	FUNCTION REPORTED JTG		ACTUAL	EVALUATION CORRECT	SIMILAR	UNIDENT	WRONG	F/A ACCURACY FACTOR CORRECT	SIMILAR	UNIDENT	WRONG	JTG	
51			Storage		Storage	x								85	
52			Storage		Storage	x								85	
53			Storage		Storage	x								85	
54			Unidentified		Gas Tank Testing Building			x						45	
55			Unidentified		Tank Cover Buildings			x						45	
56			Storage		Tank Cover Buildings			x						70	
57			Storage		Tank Cover Buildings		x							70	
58			Storage		Storage	x								85	

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EXHIBIT C PHOTOGRAPHIC INTELLIGENCE — INDUSTRIAL ANALYSIS 90.13-1545
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5. STRUCTURAL ANALYSIS

a. Check on Scale Measurement.

Linear dimensions were 3 per cent higher than reported.

b. S/A (See S/A Table).

c. Summary of Tabulation.

(1) Construction type.

TABLE 2

Construction Type	PRIMARY BUILDINGS			TOTAL BUILDINGS		
	No. Bldgs	No. Corr	% Corr	No. Bldgs	No. Corr	% Corr
A1.1	4	4	100	4	4	100
A2.3	0	-	-	8	6	75
B2	0	-	-	2	2	100
C1.3	5	5	100	5	5	100
D	0	-	-	7	7	100
E1	0	-	-	3	3	100
Total	9	9	100	29	27	92

(2) Combustibility.

TABLE 3

Building Combustibility	PRIMARY BUILDINGS			TOTAL BUILDINGS		
	No. Bldgs	No. Corr	% Corr	No. Bldgs	No. Corr	% Corr
Combustible (C)	1	1	100	8	7	87
Non-Combustible (N)	8	8	100	10	10	100
Fire Resistant (R)	0	-	-	0	-	-
Total	9	9	100	18	17	94

d. Remarks.

The structural analysis was excellent. No errors were made on primary buildings, and few were made on the remainder.

STRUCTURAL ANALYSIS TABLE

NAKAJIMA AIRCRAFT CO. KOIZUMI PLANT — 90.13-1545

BUILDING NUMBER		1000'S OF SQ. FT. PLAN AREA		NUMBER OF FLOORS		SIZE OF BAY		ROOF MATERIAL		COMBUSTIBILITY OF BUILDING		CONSTRUCTION TYPE	
	Primary	ACTUAL	REPORTED	ACTUAL	REPORTED	ACTUAL	REPORTED	ACTUAL	REPORTED	ACTUAL	REPORTED	ACTUAL	REPORTED
1				1				CA/WF LT		C	C	D	D
2													
3				1	1			CA/SF LT		N	N	B-2	B-2 A2.3
4											C		
5				1	1			CA/WF LT		C	C	A2.3	A2.3
6											C		A2.3
7				1	1			CA/WF LT		C	C	D	D
8													
9				1	1			LT			C	D	D
10				1	1			LT			C	D	D
11a	P			1	1			CA/SF LT		N	N	C1.3	C1.3
b													
12a	P			1	1			CA/SF LT		N	N	C1.3	C1.3
b											C		A2.3
13a	P			1	1			CA/SF LT		N	N	C1.3	C1.3
b											C		
14a	P			1	1			CA/SF LT		N	N	D	D
b												C1.3	C1.3
15													
16													
17													
18													
19													
20				1	1			CA/WF LT		C	C	A2.3	A2.3
21a				1	1			CA/WF LT		C	C	A2.3	A2.3
b													
22	P			1	1			CA/WF LT		C	C	A1.1	A1.1
23				1	1			CA/WF LT		C	C	A2.3	A2.3
24	P			1	1								
25a	P			1	1			CA/SF LT		N	N	A1.1	A1.1
b								"					
26a	P			1	1			CA/SF LT		N	N	A1.1	A1.1

STRUCTURAL ANALYSIS TABLE

NAKAJIMA AIRCRAFT CO.
KOIZUMI PLANT

90.13-1545

BUILDING NUMBER	1000'S OF SQ. FT. PLAN AREA		NUMBER OF FLOORS		SIZE OF BAY		ROOF MATERIAL		COMBUSTIBILITY OF BUILDING		CONSTRUCTION TYPE	
	ACTUAL	REPORTED	ACTUAL	REPORTED	ACTUAL	REPORTED	ACTUAL	REPORTED	ACTUAL	REPORTED	ACTUAL	REPORTED
Primary												
26				2			CA/SF LT		N	N		E2
27			1	1			CA/SF LT		N	N	A2.3	
28												
29			1	1			CA/WF LT		C	N	A2.3	A2.3
30a			1	1			CA/SF LT		N	N	A1.1	A1.1
30b												
31a			1	1			CA/SF LT		N	N	C1.3	C1.3
b				2				LT		C		E2
32			1	2			CA/WF LT		C	C	A2.3	E2
33			1	1			CA/SF LT			N	D	D
34				2			CA/WF LT			C	?	E2
35			1	1			CA/SF LT			N	B2	B2
36												
37			1	2			T/WF LT			C	A2.3	E2
38			2	2			R/C HV			R	E1	E1
39			2	2			R/C HV			R	E1	E1
40			2	2			R/C HV			C	D	D
41				1			CA/WF LT			R	D	E1
42a			3	3			R/C HV				E1	
b												

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6. DAMAGE ASSESSMENT

a. D/A (See D/A Table).

b. Summary of Tabulation.

TABLE 4

	ACTUAL		REPORTED	
	Sq Ft	% Dam	Sq Ft	% Dam
Total Building Area			3,350,000	
Damage				
Structural	261,900	8	262,800	8
Superficial	750,800	22	809,000	24
Minor	645,300	19	*	
Removed	1,001,300	30	862,200	26
Total Damage	2,659,300	79	1,934,000	58

* In general, Minor Damage was purposely omitted in D/A reports.

c. Remarks.

(1) The damage assessment in all categories except minor damage was good.

(2) The discrepancy between "ACTUAL" and "REPORTED" structural damage for some buildings is due to the fact that these buildings were removed subsequent to the time they were reported as structurally damaged.

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NAKAJIMA AIRCRAFT CO.
KOIZUMI PLANT

DAMAGE ASSESSMENT TABLE

90.13-1545

BUILDING NUMBER	BUILDING AREA	STRUCTURAL (1000'S SQ. FT.)			SUPERFICIAL (1000'S SQ. FT.)			MINOR * (1000'S SQ. FT.)			REMOVED (1000'S SQ. FT.)		
		ACTUAL	REPORTED	REPORTED	ACTUAL	REPORTED	REPORTED	ACTUAL	REPORTED	REPORTED	ACTUAL	REPORTED	REPORTED
1											37.5	37.5	
2													
3											42.0		
4			3.6										
5		11.3	11.3								12.6	12.6	
6											6.1	6.1	
7											6.1	6.1	
8											17.6	17.6	
9													
10											31.0	31.0	
11a		33.0	2.3		191.0	256.2		112.0					
b			2.1		1.5						34.8	19.6	
12a					23.0	16.2							
b			13.2								22.2	22.2	
13a		18.0	13.3		115.0	143.2		28.0					
b											16.8	16.8	
14a					4.0			149.0			11.9	11.9	
b											4.9	4.9	
15											11.2	11.2	
16											11.9	11.9	
17											25.8	25.8	
18											51.0	51.0	
19									5.7		10.0	10.0	
20											14.0	14.0	
21a			23.3		11.0	8.5					123.0	110.2	
b											15.6		
22			12.8								44.0	44.0	
23						15.6							
24											27.3	27.3	
25a					18.0	10.0		204.0			32.0		
b								*In general, Minor Damage was purposely omitted in D/A reports.			40.9	40.9	
26a		108.0	41.4		182.6								
b			1.6		136.0								

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90.13 - 1545 NAKAJIMA AIRCRAFT CO., KOIZUMI
EXHIBIT C PHOTOGRAPHIC INTELLIGENCE — INDUSTRIAL ANALYSIS

NAKAJIMA AIRCRAFT CO.
KOIZUMI PLANT

DAMAGE ASSESSMENT TABLE

90.13-1545

BUILDING NUMBER	BUILDING AREA	STRUCTURAL (1000'S SQ. FT.)			SUPERFICIAL (1000'S SQ. FT.)			MINOR * (1000'S SQ. FT.)			REMOVED (1000'S SQ. FT.)		
		ACTUAL	REPORTED	REPORTED	ACTUAL	REPORTED	REPORTED	ACTUAL	REPORTED	REPORTED	ACTUAL	REPORTED	REPORTED
27								15.4					
28			24.8								24.8		
29		4.0	9.0		6.3	2.7		2.5					
30a		77.0	49.9		139.0	135.0		4.0					
30b			2.7								28.2	28.2	
31a			0		98.0	39.0		55.0					
b								2.0			30.6	28.9	
32			10.0		6.0						14.0	14.0	
33								10.0					
34			4.3								11.0	6.0	
35													
36			8.8					22.9			72.2	72.2	
37											6.0	6.0	
38			8.0					5.0			9.0	9.0	
39													
40													
41											14.4	14.4	
42a													
b											11.5	11.5	
43													
44													
45											22.5	22.5	
46											5.8	5.8	
47			5.8										
48a			2.3		2.0			33.0			21.4		
b								2.5					
c			2.1								4.1		
49											6.8	6.8	
50											7.6	7.6	
51											11.2	11.2	
52											4.5	4.5	
53		10.0										10.0	
54											12.7	12.7	

*In general, Minor Damage was purposely omitted in D/A reports.

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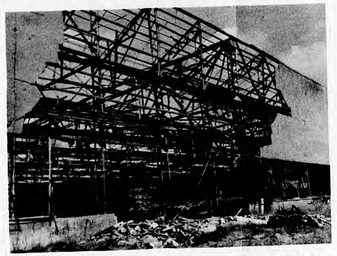
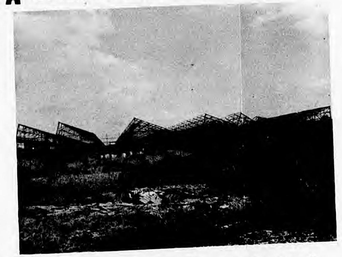
NAKAJIMA AIRCRAFT CO., KOIZUMI 90.13 - 1545
EXHIBIT C PHOTOGRAPHIC INTELLIGENCE — INDUSTRIAL ANALYSIS

PHOTOGRAPHIC INTELLIGENCE — INDUSTRIAL ANALYSIS EXHIBIT C

90.13-1545 NAKAJIMA AIRCRAFT CO., KOIZUMI

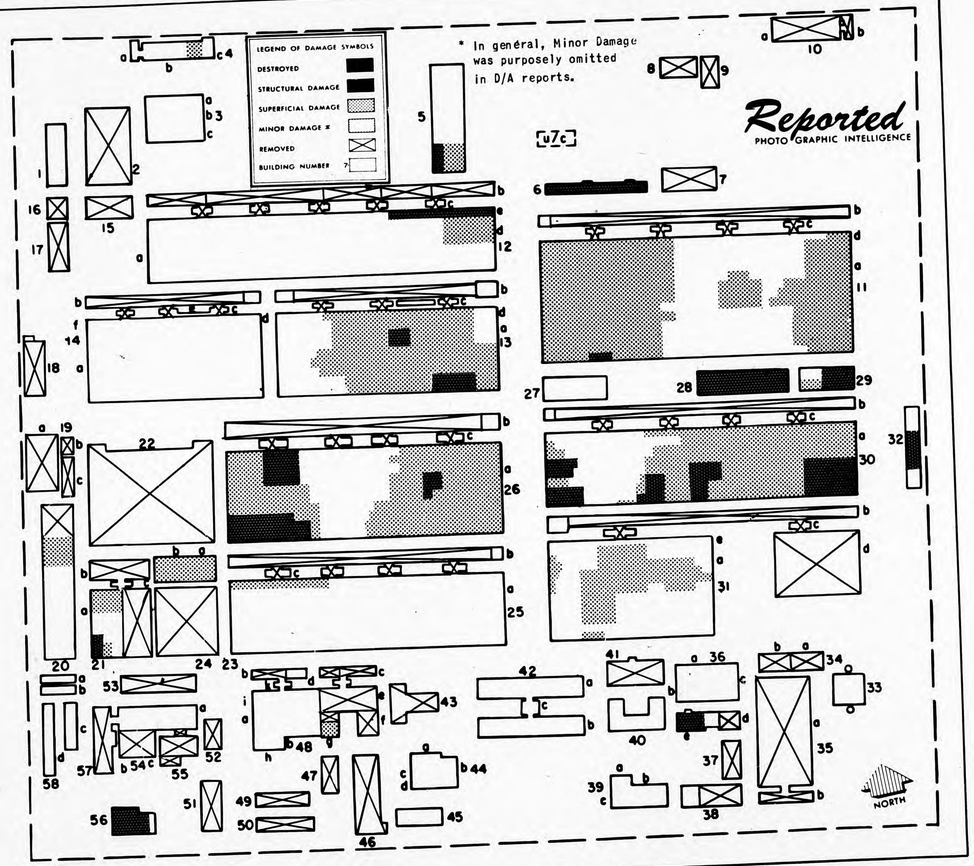


A Fuselage Assembly (Bldg 13 looking North).



B Accessory Mfg. (Bldg 25 looking East).

C Foundry (Bldg 48 looking Northwest).



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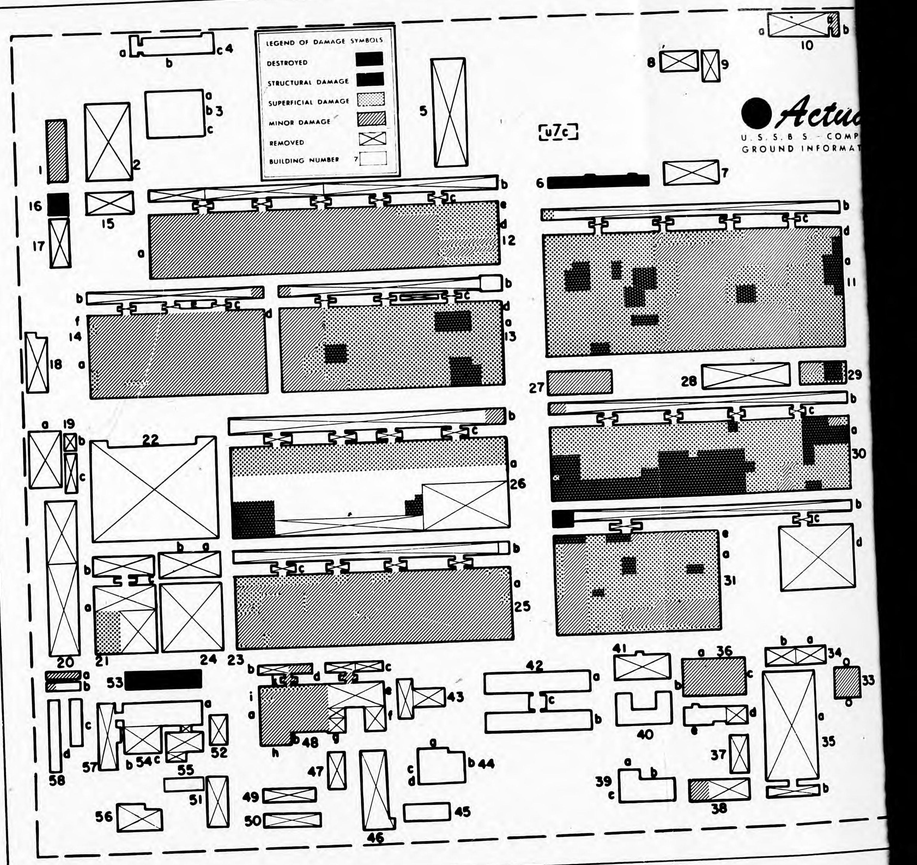
NAKAJIMA A



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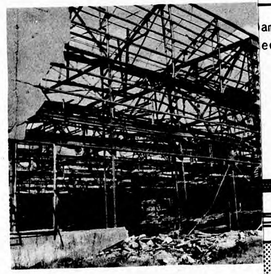
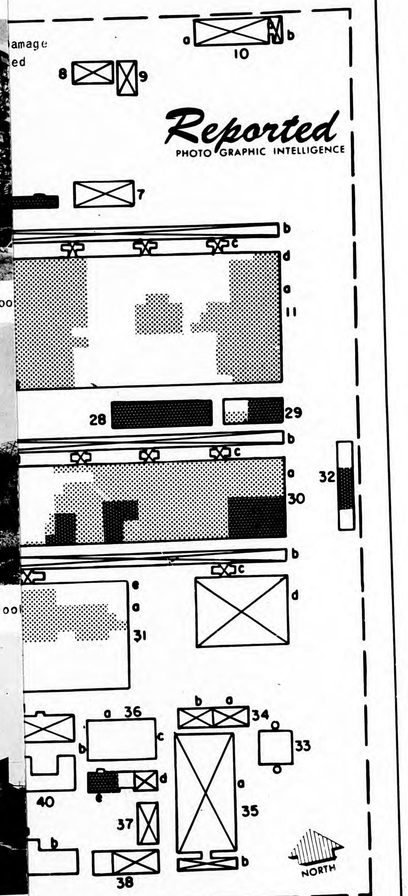


A Fuselage Assembly (Bldg 13 loo

B Accessory Mfg. (Bldg 25 look

C Foundry (Bldg 48 looking



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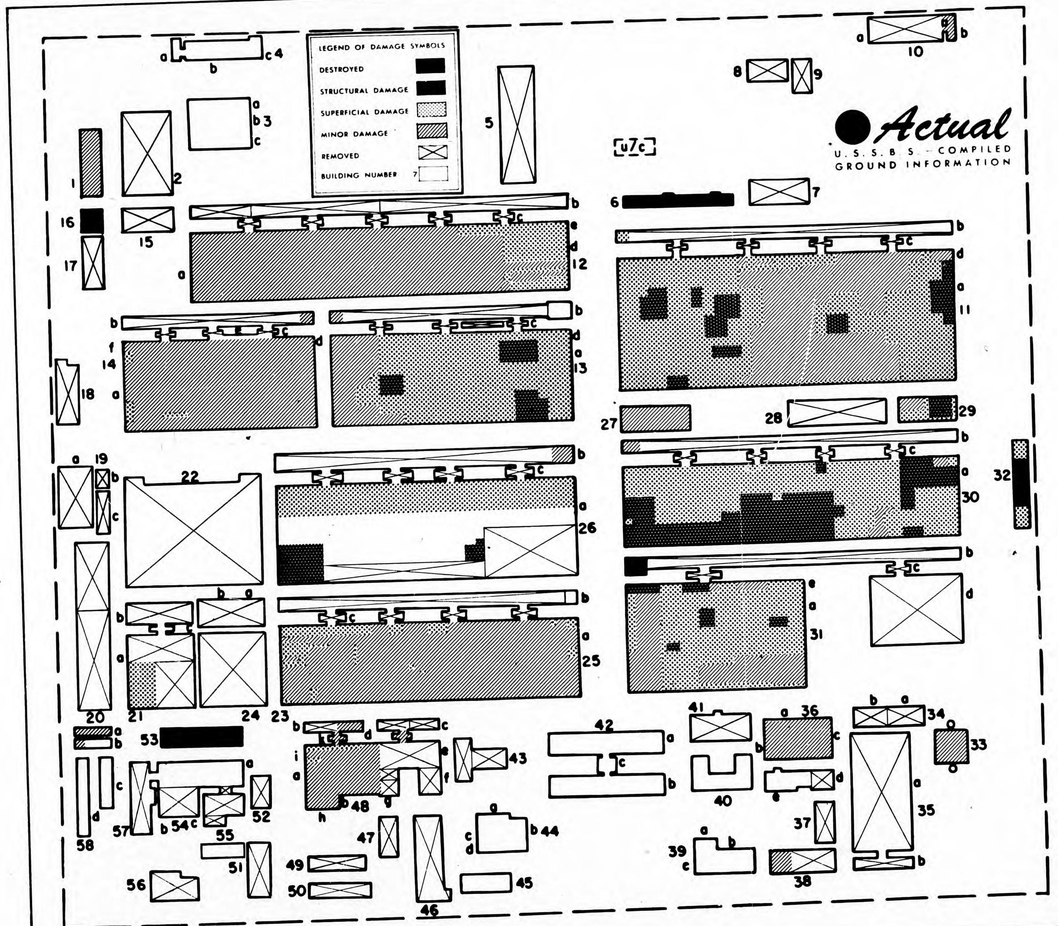
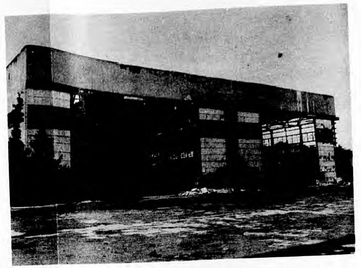
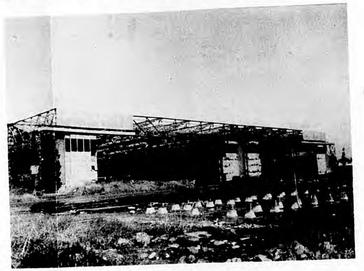




D Assembly (Bldg 12d looking Northwest).



E Assembly (Bldg 31 looking Northwest).

F Experimental building under construction. Note Wind Tunnel in foreground (Bldg 39 looking South).

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EXHIBIT D

NAKAJIMA AIRCRAFT CO.

TAMA-MUSASHINO PLANT

90.17-357

LAT. 35° 43'N - LONG. 139° 34'E

TOKYO, JAPAN

See Exhibit P for abbreviations used in this exhibit.

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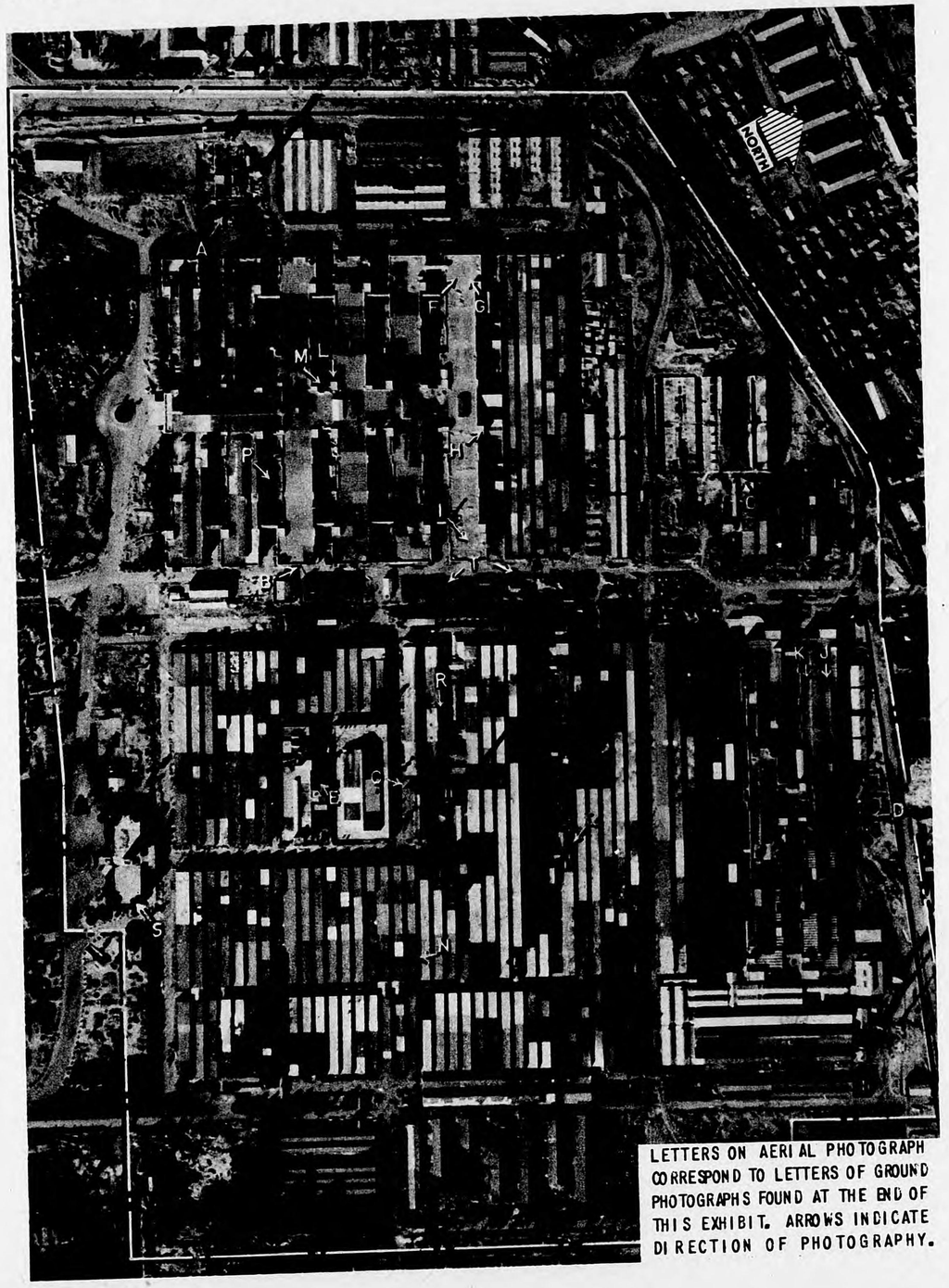
90.17-357 NAKAJIMA AIRCRAFT, TAMA-MUSASHINO



LETTERS ON AERIAL PHOTOGRAPH CORRESPOND TO LETTERS OF GROUND PHOTOGRAPHS FOUND AT THE END OF THIS EXHIBIT. ARROWS INDICATE DIRECTION OF PHOTOGRAPHY.

NAKAJIMA AIRCRAFT, TAMA-MUSASHINO 90.17-357

1. DESCRIPTION OF TARGET

a. The Tama-Musashino aircraft engine plant of the Nakajima Aircraft Co. was one of the two most important targets in the Japanese aircraft industry. By mid-1944, it accounted for 27 per cent of all Japanese aircraft engines. The plant was divided into two parts: the Tama (west part) and the Musashino (east part).

b. The plant is located midway between two main railroad lines leading west from Tokyo, and approximately 10 miles west by north of the Imperial Palace.

c. The plant includes 51 buildings (AC/AS Intelligence list) with a built-up area of approximately 1,832,000 square feet.

2. SUMMARY

a. Two functional analyses were made, one by AC/AS Intelligence and the other by CIU (XXI BC). Both analyses were fair in accuracy. They could probably have been improved by a closer study of the exterior circulation of the plant (stock piles, track activity, etc.) Of the 65 buildings and subdivisions checked by AC/AS Intelligence, there were:

(1) 25 identified correctly.
(2) 18 identified as having similar occupancy.
(3) 4 unidentified.
(4) 18 incorrectly identified.

Of the 55 buildings and subdivisions checked by CIU there were:

(1) 20 identified correctly.
(2) 17 identified as having similar occupancy.
(3) 4 unidentified.
(4) 14 incorrectly identified.

b. The structural analysis made by AC/AS Intelligence was fairly accurate for construction types. Identification of wood-framed buildings gave the interpreter the most difficulty.

(1) 8 out of 24 wood frame buildings were identified correctly.
(2) 14 out of 15 steel frame buildings were identified correctly.
(3) 21 out of 22 reinforced concrete buildings were identified correctly.

Interpretation of the combustibility of the buildings was very accurate.

(1) 21 out of 28 combustible buildings were identified correctly.
(2) 14 out of 17 non-combustible buildings were identified correctly.
(3) 20 out of 20 fire-resistant buildings were identified correctly.

c. The damage assessment by CIU was poor, having been underestimated by 25 per cent. The error was due primarily to underestimation of damage to reinforced concrete buildings which was not visible to the interpreter. The damage to the plant, both actual and reported, is summarized in Table I.

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90.17-357 NAKAJIMA AIRCRAFT, TAMA-MUSASHINO

TABLE 1

	ACTUAL Sq Ft	REPORTED Sq Ft
Structural Damage	1,122,200	789,800
Superficial Damage	450,000	406,300
Minor Damage	128,000	86,700
Total Damage	1,710,200	1,282,800

3. SOURCE OF DATA

a. Reported.

(1) AC/AS Intelligence Illustration 90.17-357, P-5, P-6, T½, 1 & 12 January 1945.
(2) Target Section A-2(XXI BC) Target Information Sheet, 30 March 1945.
(3) AC/AS Intelligence F/A Report #1, 27 November 1944.
(4) AC/AS Intelligence Building Construction Analysis 90.17-357, 6 December 1944.
(5) CIU (XXI BC) D/A Report #195, 5 September 1945.

b. Field Data.

(1) USSBS (G-2, PIC) field notes.

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NAKAJIMA AIRCRAFT, TAMA-MUSASHINO 90.17-357

4. FUNCTIONAL ANALYSIS

a. Use of Plant.

Reported: Aircraft engine production.

Actual: As reported.

b. Boundaries.

As reported.

c. Building Identification (F/A Table).

d. Summary of Tabulation.

(1) AC/AS Intelligence functional analysis.

TABLE 2

F/A ACCURACY FACTOR	PRIMARY BUILDINGS No. Bldgs	PRIMARY BUILDINGS %	TOTAL BUILDINGS No. Bldgs	TOTAL BUILDINGS %
Correct	5	36	25	38
Of Similar Occupancy	7	50	18	28
Unidentified	0	-	4	6
Incorrect	2	14	18	28
Total	14	100	65	100

Total Plant 64
Primary Buildings 78

(2) CIU functional analysis.

TABLE 3

F/A ACCURACY FACTOR	PRIMARY BUILDINGS No. Bldgs	PRIMARY BUILDINGS %	TOTAL BUILDINGS No. Bldgs	TOTAL BUILDINGS %
Correct	6	46	20	36
Of Similar Occupancy	5	39	17	31
Unidentified	0	-	4	7
Incorrect	2	15	14	26
Total	13	100	55	100

Total Plant 66
Primary Buildings 78

e. Remarks.

(1) There were several underground passageways between buildings as well as to plant entrances. The entrances might have been located had a closer study of track activity been made.

(2) An outdoor transformer station was not reported, possibly because of heavy shadows at the time of photography.

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NAKAJIMA AIRCRAFT CO.
TAMA-MUSASHINO PLANT

FUNCTIONAL ANALYSIS TABLE

90.17 - 357

BUILDING NUMBER JTG	BUILDING NUMBER CIU XXI BC	PRIMARY	FUNCTION REPORTED JTG	FUNCTION REPORTED CIU XXI BOM COM	FUNCTION ACTUAL	EVALUATION JTG CORRECT	JTG SIMILAR	JTG UNIDENT	JTG WRONG	CIU CORRECT	CIU SIMILAR	CIU UNIDENT	CIU WRONG	F/A ACCURACY FACTOR JTG	F/A ACCURACY FACTOR CIU XXI BC
1	6		Garage	Gate House	Raw Material Storage				x				x	0	0
2	5		Boiler House	Power Plant	Boiler House	x				x				100	100
3	4		Storage Prob. Packing & Shipping	Storage	Scrap Storage		x			x				85	100
4	2		Receiving & Storage	Storage	Built as Gas Control Room never used		x				x			85	85
5	3		Prob. Tear Down & Reassembly	Storage	Built as Gas Control Room never used				x				x	5	0
6	1		Engine Test Cells	Storage	Storage Shed				x	x				0	100
7			Unidentified		Check in office for employees - Entrance to Tunnel			x						45	
					Storage Shed	x								100	
8			Storage		Wood Shed				x					0	
9			Storage		Storage	x								100	
10			Storage												
11a	10L		Offices	Office Area	Offices - Top Floors Machinery		x				x			85	85
11b	F		Offices	Office Area	Offices - Top Floors Machinery		x				x			85	85
11c	E		Offices	Office Area	Offices - Top Floors Machine Shop		x				x			85	85
11d	K		Offices	Office Area	Offices - Top Floors Machinery		x				x			85	85
11e	J	X	Machine Shops	Experimental or Light Machining	Machine Shop - Offices Top Floor		x				x			85	85
11f	D	X	Machine Shops	Experimental or Light Machining	Machinery - Offices Top Floor		x				x			85	85
11g	C	X	Machine Shops	Experimental or Light Machining	Machinery		x				x			85	85
11h	J	X	Machine Shops	Experimental or Light Machining	Heat Treatment - Machinery				x		x			0	85

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90.17-357 NAKAJIMA AIRCRAFT, TAMA-MUSASHINO

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NAKAJIMA AIRCRAFT CO.
TAMA-MUSASHINO PLANT

FUNCTIONAL ANALYSIS TABLE

90.17 - 357

BUILDING NUMBER JTG	BUILDING NUMBER CIU XXI BC	PRIMARY	FUNCTION REPORTED JTG	FUNCTION REPORTED CIU XXI BOM COM	FUNCTION ACTUAL	EVALUATION JTG CORRECT	JTG SIMILAR	JTG UNIDENT	JTG WRONG	CIU CORRECT	CIU SIMILAR	CIU UNIDENT	CIU WRONG	F/A ACCURACY, FACTOR JTG	F/A ACCURACY, FACTOR CIU XXI BC
11i	H	X	Machine Shops	Experimental or Light Machining	Heat Treatment				x				x	0	0
11k	B	X	Machine Shops	Experimental or Light Machining	Heat Treatment - Light Machines		x			x				85	85
11m		X	Machine Shops		Machinery		x							85	
11n	M		Offices	Office Area	Office Top Floor - Machinery		x			x				85	85
11p	A	X	Machine Shops	Experimental or Light Machining	Machinery		x			x				85	85
11q	G		Possible Cafeteria	Experimental or Light Machining	Machinery				x	x				10	85
12	9		Engine Assembly	Probable Assembly	Gear Cutting - Polishing & Finishing				x				x	0	5
13	8		Storage and Shipping	Storage	Whse. for Finished Aluminum Plate		x			x				85	85
14	7		Engine Test Cells Under Construction	Engine Test	Engine Test Cells Under Construction	x				x				100	100
15	7		Engine Test Cells	Engine Test Cells	Engine Test Cells - Never Used	x				x				100	100
16	11		Engine Test Cells	Engine Test	Engine Test Bldg	x				x				100	100
17	11		Storage	Engine Test	Assembly of Engines (checking after testing)										
					Final Assembly					x		x		0	85
18	12		Storage	Unidentified	Box Storage	x							x	100	45
19	13		Storage	Relates to Foundry	Box Storage	x							x	100	0
20	14		Storage	Relates to Foundry	Bailing Room					x			x	0	0
21	15		Storage	Relates to Foundry	Plating Dept					x			x	0	0
22	16		Static Water Reservoir	Water Reservoir	Water Reservoir for Fire	x					x			100	100
22a			Not Noted		Switching Station						x			0	
23	20		Storage	Partially Removed	Storage	x							x	100	45
24	18		Garage		Gas Meters, Storage, Check										

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NAKAJIMA AIRCRAFT, TAMA-MUSASHINO 90.17-357

NAKAJIMA AIRCRAFT CO.
TAMA-MUSASHINO PLANT

FUNCTIONAL ANALYSIS TABLE

90.17 - 357

BUILDING NUMBER JTG	BUILDING NUMBER CIU XXI BC	PRIMARY	FUNCTION REPORTED JTG	FUNCTION REPORTED CIU XXI BOM COM	FUNCTION ACTUAL	EVALUATION JTG CORRECT	JTG SIMILAR	JTG UNIDENT	JTG WRONG	CIU CORRECT	CIU SIMILAR	CIU UNIDENT	CIU WRONG	F/A ACCURACY FACTOR JTG	F/A ACCURACY FACTOR CIU XXI BC
					In Bldg., Entrance Underground				x					0	
					Garage			x						45	
25	19		Unidentified		Offices	x				x				100	100
26	32		Offices	Administration	Machine Shops	x				x				100	100
27	31	X	Machine Shops	Machine Tools	Offices	x					x			100	85
28	30		Offices	Plant Engineering	Cafeteria	x				x				95	100
29	29		Probable Cafeteria	Mess Hall	Boiler House	x				x				100	100
30	28		Boiler House	Power House	Heat Treatment	x				x				100	100
31	27		Heat Treatment	Heat Treatment - Foundry	Machine Shop	x				x				100	100
32	26	X	Machine Shop	Machine Tools	Machine Shop				x	x				0	100
33	25		Assembly Shop	Machine Tools	Machine Parts Light & Heavy		x						x	85	0
34	24	X	Machine Shops	Assembly	Office, Engine Assembly Gear Cutting		x				x			85	85
35	23		Office & Machine Shop	Light Machining - Sub Assembly	Oil Storage			x					x	45	10
36	21		Unidentified	Possible Nitriding	Boiler House - Air Compressor		x			x				85	100
37	33		Boiler House	Power House	Boiler House	x								100	
38			Boiler House		Heat Treatment				x		x			0	85
39	34		Foundry and Storage	Processing or Rough Forging	Toilet				x				x	0	0
40	36		Part of Foundry Pattern Shop and Storage	Same as above	Office and Sand Blasting				x				x	0	0
41	35		Part of Foundry Pattern Shop and Storage	" " "	Electro-Plating				x				x	0	0
42	37		Part of Foundry Pattern Shop and Storage	Storage	Electro-Plating Metals				x				x	0	0
43	37		Receiving and Storage	Processing of Rough Forging	Storage of Parts - Machines				x				x	0	0
44	38		Raw Stock Storage & Machine Shop	Machine Tools - Forges	Machine Shop			x					x	85	0
45	26A	X	Machine Shop	Machine Tools	Machine Shop	x				x				100	100
46	26A	X	Machine Shop	Machine Tools	Machine Shop	x				x				100	100
47	26A	X	Machine Shop	Machine Tools	Machine Shop	x				x				100	100

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90.17-357 NAKAJIMA AIRCRAFT, TAMA-MUSASHINO

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NAKAJIMA AIRCRAFT CO.
TAMA-MUSASHINO PLANT

FUNCTIONAL ANALYSIS TABLE

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BUILDING NUMBER JTG	BUILDING NUMBER CIU XXI BC	PRIMARY	FUNCTION REPORTED JTG	FUNCTION REPORTED CIU XXI BOM COM	FUNCTION ACTUAL	EVALUATION JTG CORRECT	JTG SIMILAR	JTG UNIDENT	JTG WRONG	CIU CORRECT	CIU SIMILAR	CIU UNIDENT	CIU WRONG	F/A ACCURACY FACTOR JTG	F/A ACCURACY FACTOR CIU XXI BC
48	41		Storage	Destroyed -. Unidentified	Storage	x					x			100	45
49	40		Storage	Unidentified	Storage	x					x			100	45
50	38A		Storage		Storage	x								100	
51	39		Storage	Storage	Storage	x				x				100	100

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EXHIBIT D PHOTOGRAPHIC INTELLIGENCE — INDUSTRIAL ANALYSIS

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5. STRUCTURAL ANALYSIS

a. Check on Scale Measurement.

No scale check was made,

b. S/A (See S/A Table).

c. Summary of Tabulation.

(1) Construction type.

TABLE 4

Construction Type	PRIMARY BUILDINGS No. Bldgs	No. Corr	% Corr	TOTAL BUILDINGS No. Bldgs	No. Corr	% Corr
Wood Frame (W)	0	-	-	24	8	33
Steel Frame (S)	6	6	100	16	14	88
Reinforced Concrete (R/C)	8	8	100	22	21	96
Total	14	14	100	62	43	69

(2) Combustibility.

TABLE 5

Building Combustibility	PRIMARY BUILDINGS No. Bldgs	No. Corr	% Corr	TOTAL BUILDINGS No. Bldgs	No. Corr	% Corr
Combustible (C)	0	-	-	28	21	75
Non-Combustible (N)	6	6	100	17	14	83
Fire-Resistant (R)	8	8	100	20	20	100
Total	14	14	100	65	55	85

d. Remarks.

Plaster-covered, wood-framed buildings were used extensively and were often incorrectly interpreted as fire resistant. In addition, many structures which would normally be steel-framed in the United States and which were reported as such, were found to be wood-framed at this plant.

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NAKAJIMA AIRCRAFT, TAMA-MUSASHINO 90.17-357

STRUCTURAL ANALYSIS TABLE

NAKAJIMA AIRCRAFT CO., TAMA-MUSASHINO PLANT — 90.17 - 357

BUILDING NUMBER JTG	BUILDING NUMBER C I U	1000'S OF SQ. FT. PLAN AREA ACTUAL	1000'S OF SQ. FT. PLAN AREA REPORTED JTG	1000'S OF SQ. FT. PLAN AREA REPORTED C I U	ROOF MATERIAL ACTUAL	ROOF MATERIAL REPORTED JTG	SIZE OF BAY ACTUAL	SIZE OF BAY REPORTED	COMBUSTIBILITY OF BUILDING ACTUAL	COMBUSTIBILITY OF BUILDING REPORTED JTG	NUMBER OF FLOORS ACTUAL	NUMBER OF FLOORS REPORTED JTG	CONSTRUCTION TYPE ACTUAL	CONSTRUCTION TYPE REPORTED JTG
1	6		5.0	9.4	T/WF				C	C	1	1	WF	LB
2	5		10.5	10.0	CA/WF				MIXED	N	1	1	WF	SF
3	4		20.4	20.2	CA/WF				C	C	1	1	WF	LB
4	2		14.0	14.4	CA/SF				N	C	1	1	SF	LB
5	3		14.7	14.4	T/WF				C	N	1	1	WF	SF
6	1		34.5	36.2	CA/WF				C	R	2	1	WF	
7			3.0		T/WF				C	C	1	1	WF	LB
8			4.8		CA/WF				C	C	1	1	WF	LB
9			2.4		W/WF				C	C	1	1	WF	LB
10			4.2		W/WF				C	C	1	1	WF	LB
11a	101		21.0	21.7	R/C				R	R	1	1	R/C/F	SF*
b	F		21.0	21.7	R/C				R	R	3	2	RC/F	SF*
c	E		21.0	21.7	R/C				R	R	3	2	RC/F	SF*
d	K		21.0	21.7	R/C				R	R	3	2	RC/F	SF*
e	J		21.0	21.7	R/C				R	R	3	2	RC/F	SF*
f	D		21.0	21.7	R/C				R	R	3	2	RC/F	SF*
g	C		21.0	21.7	R/C				R	R	3	2	RC/F	SF*
h	I		21.00	21.7	R/C				R	R	3	2	RC/F	SF*
i					T/SF				MIXED	R	1		SF	
j			21.0	21.7	R/C				R	R	3	2	RC/F	SF*
k	B		21.0	21.7	R/C				R	R	3	2	RC/F	SF*
m			37.8		R/C				R	R	3	2	RC/F	SF*
n			24.3		T/SF				MIXED	R	4	3	RC/F	SF*
p	A		21.0	21.7	R/C				R	R	3	2	RC/F	SF*
q	G		21.0	21.7	R/C				R	R	3	2	RC/F	SF*
12	9		100.5	110.0	CCA/SF				MIXED	N	1	1	SF	SF
13	8		21.0	22.5	W/F				C	C	1	1	WF	WF
14			25.2						C	R	1	1	WF	SF
15	7		25.2	59.4	RC/F				R	R	1	1	SF*	LB
16	11		9.6	30.6	RC/F				R	R	BASE 1	1	WF	WF
17			9.6		CA/SF				N	N	BASE 1	1	SF	LB
18	12		5.0	5.3	CA/WF				C	C	1	1	WF	LB

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NAKAJIMA AIRCRAFT CO.
TAMA-MUSASHINO PLANT

STRUCTURAL ANALYSIS TABLE

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BUILDING NUMBER		1000'S OF SQ. FT. PLAN AREA			NUMBER OF FLOORS		SIZE OF BAY		ROOF MATERIAL		COMBUSTIBILITY OF BUILDING		CONSTRUCTION TYPE	
		ACTUAL	REPORTED		ACTUAL	REPORTED	ACTUAL	REPORTED	ACTUAL	REPORTED	ACTUAL	REPORTED	ACTUAL	REPORTED
JTG	CIU		JTG	CIU		JTG				JTG		JTG		JTG
19	13		3.5	4.7	1	1			CA/WF		C	C	WF	LB
20	14		3.5	7.7	1	1			CA/WF		C	C	WF	LB
21	15		7.0	6.7	1	1			CA/WF		C	C	WF	LB
22			6.0											
22a					1								SF	
23	20		12.8	15.8	1	1			CA/WF		C	C	WF	LB
24			13.5	13.0	1	1			T/WF		C	C	WF	LB
25			1.8		1	1			CA/WF		C	R	WF	
26	32		13.8	13.0	2	2			RC/F		R	R	RC/F	SF*
27	31-31A		120.7	128.4	1	1			CA/SF		N	N	SF	SF
28	30		15.0	17.6	3	2			RC/F		R	R	RC/F	SF*
29	29		30.0	32.4	BASE 1	2			CA/SF		MIXED	R	RC/F	SF*
30	28		8.4	7.8	1	1			CA/SF		N	N	SF	SF
31	27		23.2	30.0	1	1			CA/SF		N	N	SF	SF
32	26		125.8	292.9	1	1			CA/SF		N	N	SF	SF
33	25		125.8	138.6	1	1			CA/SF		N	N	SF	SF
34	24		125.8	138.6	1	1			CA/SF		N	N	SF	SF
35	23		84.0	119.9	BASE 3	2			RC/F		R	R	RC/F	SF*
35e			32.5		BASE 4	3			RC/F		R	R	RC/F	SF*
36	21		6.0	8.2	1	1			CA/WF		C	C	WF	WF
37			6.6		1	1			CA/SF		N	N	SF	SF
37c			2.4		1	1			RC/F		R	R	RC/F	SF*
38			1.5		1	1			CA/SF		N	N	SF	SF
39	34		36.6	43.2	1	1			CA/SF		N	N	SF	SF
40			3.0		1	1			CA/WF		C	R	WF	SF
41	36		7.5	12.5	1	1			CA/WF		C	C	WF	WF
42			4.0		1	1			CA/WF		C	C	WF	WF
43	37		6.8	10.8	1	1			CA/WF		C	C	WF	WF
44	38-38A		166.6	189.1	1	1			CA/SF		N	N	SF	LB
45	26A		44.2	SEE JTG	1	1			CA/SF		N	N	SF	SF
46	26A		44.2	#32	1	1			CA/SF		N	N	SF	SF
47	26-26A		52.0		1	1			CA/SF		N	N	SF	SF

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NAKAJIMA AIRCRAFT CO.
TAMA-MUSASHINO PLANT

STRUCTURAL ANALYSIS TABLE

90.17 - 357

BUILDING NUMBER		1000'S OF SQ. FT. PLAN AREA			NUMBER OF FLOORS		SIZE OF BAY		ROOF MATERIAL		COMBUSTIBILITY OF BUILDING		CONSTRUCTION TYPE	
		ACTUAL	REPORTED		ACTUAL	REPORTED	ACTUAL	REPORTED	ACTUAL	REPORTED	ACTUAL	REPORTED	ACTUAL	REPORTED
JTG	CIU		JTG	CIU		JTG				JTG		JTG		JTG
48	41		28.8	32.5	1	1			CA/WF		C	C	WF	WF
49	40		30.8	34.5	1	1			CA/WF		C	C	WF	WF
50			25.2		1	1			CA/W		C	C	WF	WF
51			50.4		1	1			W/W		C	C	WF	WF

*Interpreter was limited to calling this bldg. S/F (JTG bldg const. anal. form contains no space for reinforced concrete bldg.) It is believed that the interpreter held that this bldg. was of reinforced concrete construction.

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EXHIBIT D PHOTOGRAPHIC INTELLIGENCE — INDUSTRIAL ANALYSIS

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6. DAMAGE ASSESSMENT

a. D/A (See D/A Table).

b. Summary of Tabulation.

TABLE 5

	ACTUAL		REPORTED	
	Sq Ft	% Dam	Sq Ft	% Dam
Total Building Area			1,832,000	
Damage				
Structural	1,122,200	61	789,000	43
Superficial	460,000	25	406,300	22
Minor *	128,000	7	86,700	5
Total Damage	1,710,200	93	1,282,000	70

* In general, Minor Damage was purposely omitted in D/A reports.

c. Remarks.

(1) Two large reinforced concrete buildings in this plant, buildings 11 and 35, illustrate a major shortcoming of industrial damage assessment by photographic interpretation. When buildings of this type are attacked with delayed action HE weapons, the full extent of the damage cannot be estimated within reasonable limits by present methods. The solution to the problem appears to be collaboration between photographic interpretets and weapons analysts so that visible roof damage can be translated into a reasonable estimate of actual floor area damage.

(2) In the entire plant the total actual damage was 1,710,200 square feet or 25 per cent more than had been reported. The bulk of this difference was not visible to the interpreter because of the nature of the construction of the two buildings mentioned above.

(3) Both buildings were of heavy, earthquake-resistant, reinforced concrete construction with three full floors and with a fourth floor over part of the area. The bombs penetrated the roofs, leaving in most cases a relatively small opening, and exploded below the roof, causing damage inside as well as roof fracturing which could not be seen on aerial photographs. The reported roof damage was 37,700 square feet, while actual roof damage amounted to 234,100 square feet. The difference between reported and actual roof damage is due to the impossibility of seeing fractures in roof slabs and beams in aerial photographs which, however insignificant they may appear on the ground, indicate severe damage.

(4) The damage to the interior was extensive and, of course, could not be seen in the photographs. In these two buildings (#11 and #35) the interior damage amounted to 335,670 square feet. This resulted in total damage of 569,700 square feet to roof and interior floors of which only 37,700 square feet had been reported.

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DAMAGE ASSESSMENT TABLE

NAKAJIMA AIRCRAFT CO.
TAMA-MUSASHINO PLANT

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BUILDING NUMBER		BUILDING AREA	STRUCTURAL (1000'S SQ. FT.) C1U		SUPERFICIAL (1000'S SQ. FT.) C1U		MINOR * (1000'S SQ. FT.) C1U		REMOVED (1000'S SQ. FT.)	
JTG	C1U	1000'S SQ. FT.	ACTUAL	REPORTED	ACTUAL	REPORTED	ACTUAL	REPORTED	ACTUAL	REPORTED
1	6	9.4					9.4			
2	5	10.0	10.0	10.0					10.1	
3	4	20.2	10.1	20.2	1.0		13.4	14.4		
4	2	14.4								
5	3	14.4	14.4	14.4						
6	1	36.2	36.2	36.2						
11a	101									
11b	10f									
11c	10e									
11d	10k									
--	10m	334.5	113.7	12.0	39.6	13.7				
11f	10d									
11g	10c									
11h	10i									
11k	10b									
11l	10j									
11p	10a						22.5	10.0		
11q	10g	110.0	24.7	20.0	62.8	80.0				
12	9	22.5	22.5	22.5						
13	8	59.4					10.3			
15	7	30.6								
16-17	11	5.3	5.3	5.3						
18	12	4.7	4.7	4.7						
19	13	7.7	7.7	7.7						
20	14	6.7	6.7	6.7						
21	50	15.8	6.3						9.5	
23	20	13.0	13.0	2.0						
26	32	89.0	53.8	70.0	72.9	30.0	1.6			
27	31	39.4								
27	31a	39.4								
28	30	17.6	17.6	5.0	16.5	21.0				
29	29	32.4	15.9	6.0						
30	28	7.8		7.8	7.8					

* In general, Minor Damage was purposely omitted in D/A reports.

NAKAJIMA AIRCRAFT CO.
TAMA-MUSASHINO PLANT

DAMAGE ASSESSMENT TABLE

90.17 - 357

BUILDING NUMBER		BUILDING AREA	STRUCTURAL (1000'S SQ. FT.)			SUPERFICIAL (1000'S SQ. FT.)			MINOR * (1000'S SQ. FT.)			REMOVED (1000'S SQ. FT.)		
JTG	CIU	1000'S SQ. FT.	ACTUAL	CIU REPORTED	REPORTED	ACTUAL	CIU REPORTED	REPORTED	ACTUAL	CIU REPORTED	REPORTED	ACTUAL	REPORTED	REPORTED
31	27	30.0	9.4			20.6								
32	26	138.6	127.7	143.0		10.9	49.9							
33	25	138.6	104.2	45.0		34.4	93.6							
34	24	138.6	50.4	10.0		67.2	80.0		21.0	25.0				
35	23	119.9	78.2	10.0		2.6				2.0				
36	21	8.2	8.2	8.2										
39	34	43.2	0.7			12.1	19.0		30.4					
41	36	12.5	12						12.5					
43	37	10.8	7.1	10.8					3.7					
44	38 & 38a	189.1	131.8	168.0		57.3	19.1			30.0				
45	26a	154.3	104.7	WITH #32		49.6	WITH #32							
46														
47														
48	41	32.5	32.5	32.5										
49	40	34.5	34.5	34.5										
	3a	2.7												
	4a	3.8	3.8											
	16								3.2					
	17	6.4	3.2	6.4										
	18	13.0	13.0	13.0								1.7		
	19	1.7		1.7										
	22									5.3				
	33	5.3				4.7								
	35	9.7		6.0										
	39a-g	50.2	50.2	50.2										

*In general, Minor Damage was purposely omitted in D/A reports.

PHOTOGRAPHIC INTELLIGENCE — INDUSTRIAL ANALYSIS EXHIBIT D
90.17-357 NAKAJIMA AIRCRAFT, TAMA-MUSASHINO

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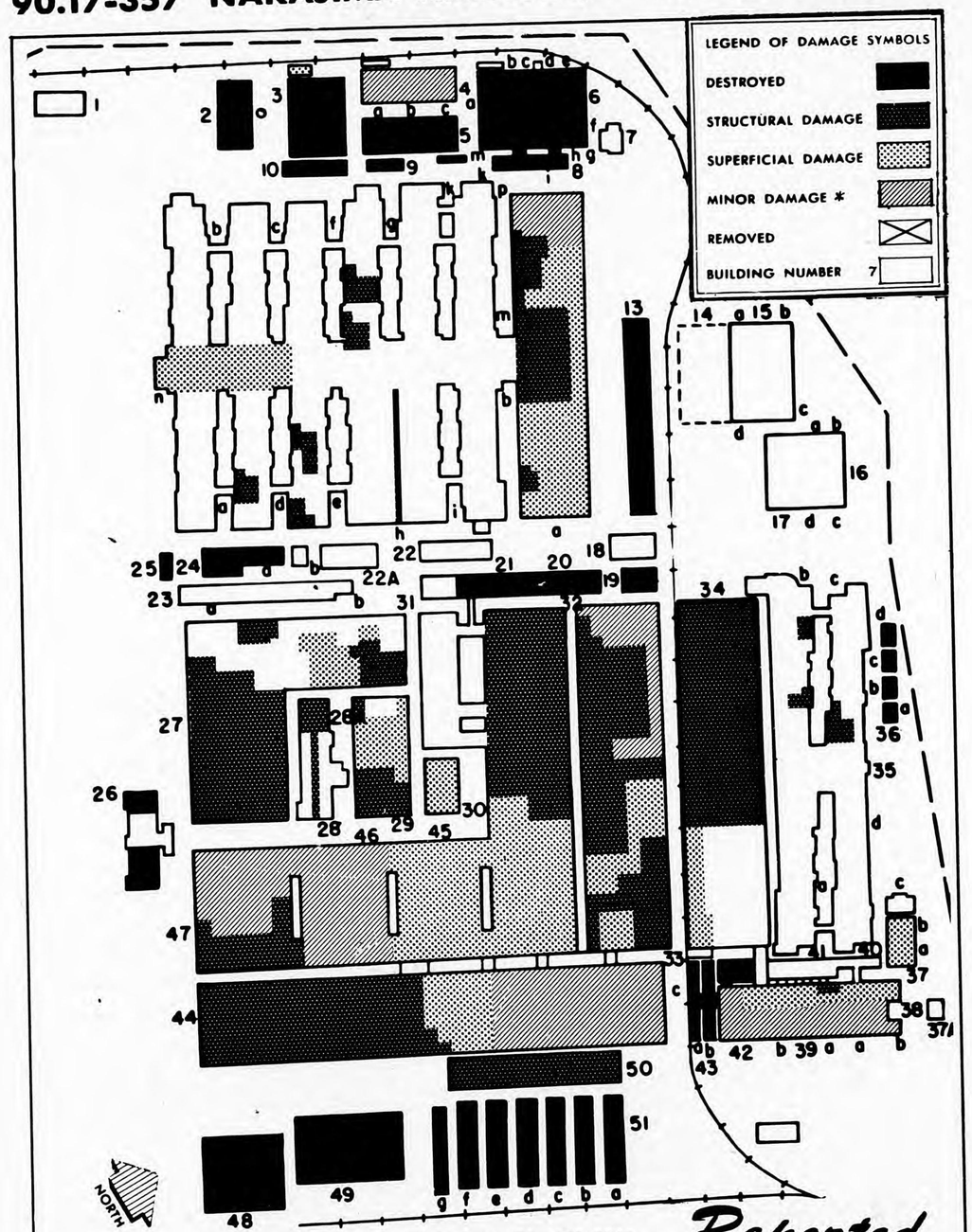

* In general, Minor Damage was purposely omitted in D/A reports.

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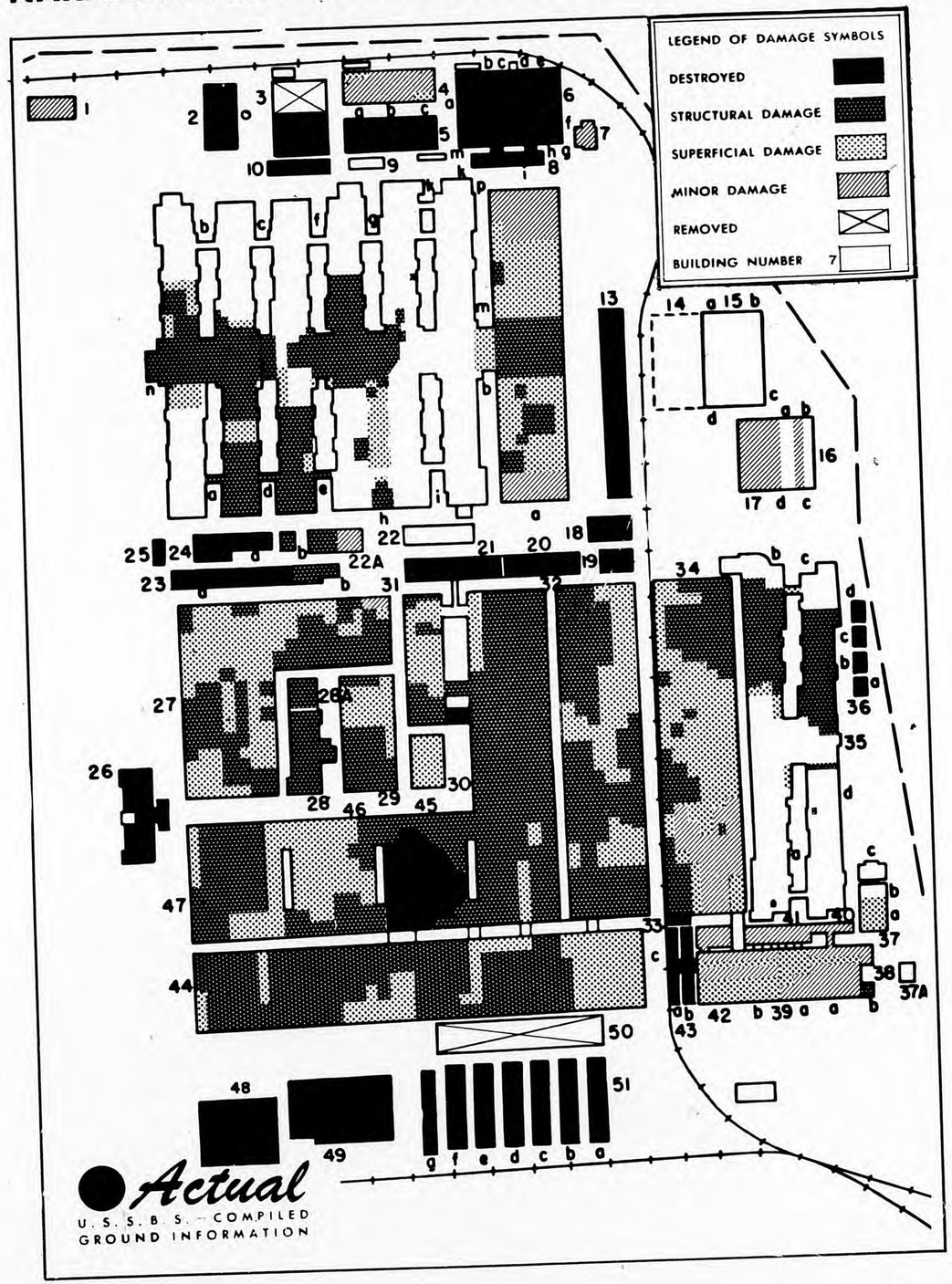

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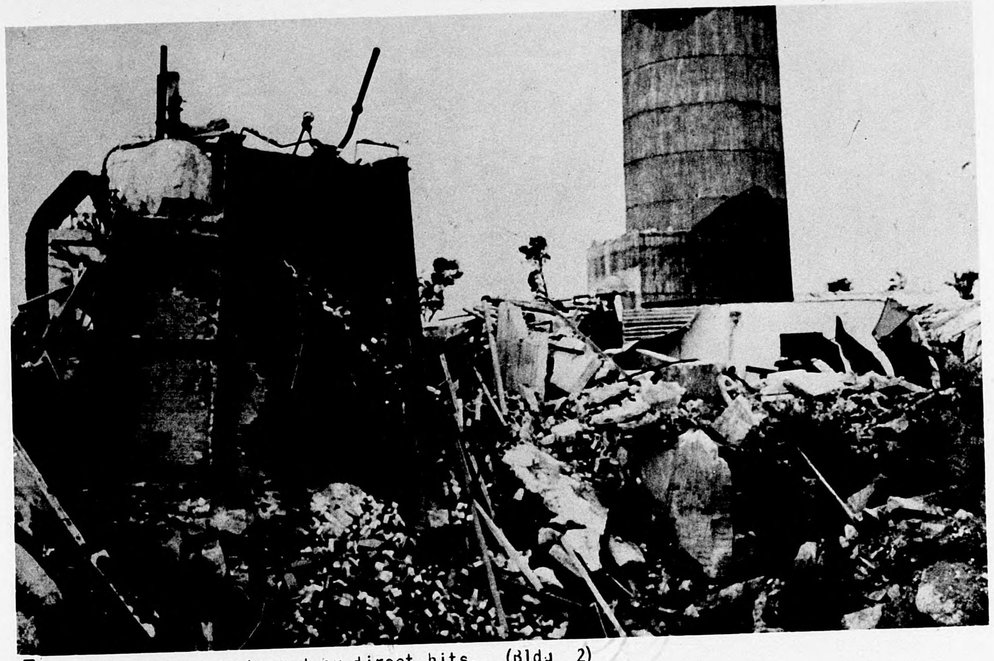

A Boiler house destroyed by direct hits. (Bldg 2)

B Structural collapse caused by explosions below roof of heavy reinforced concrete building. Notice small crater visible in roof surface caused by entrance of bomb. (Bldg 11 e).

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C Reinforced concrete engine test building under construction before raids. (Bldg 15)

D A type of structural damage that does not show on vertical aerial photographs. (Bldg 35 c).

E Reinforced concrete building destroyed by direct hits. Notice that third story has dropped into second story on rear building. (Bldg 28)

NAKAJIMA AIRCRAFT, TAMA-MUSASHINO 90.17-357

F An example of the visible damage to a reinforced concrete roof caused by the entrance of a bomb. In this case the bomb was a dud and made the entrance path shown in photo G. In many instances the only evidence of extensive interior structural damage visible in vertical photography was a small hole like that illustrated above (See photos h, i, j (Bldg 11P)

G View of path made by dud through 3 floors looking up from 1st floor. See photo F for evidence visible on roof (Bldg 11 p).

H Hole on underside of roof caused by entrance of bomb. Severe structural damage on floors below. See photo F for evidence visible on roof. Repairs to reinforcing steel had been started when photograph was taken. (Bldg 11 q).

I Structural damage to second floor caused by bomb similar to photo H and F. Repairs had been started when photo was taken. (Bldg 11 q).

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J View on third floor of a reinforced concrete building showing structural damage. Notice small holes visible in roof where bombs entered. (Bldg 35 c)

K Another view on third floor of Bldg 35 C. See photo j.

L Structural roof damage visable in vertical photograph. (Bldg 11 f and 11 g)

M View showing depth of damage at inside corner. (Bldg 11 f and 11g)

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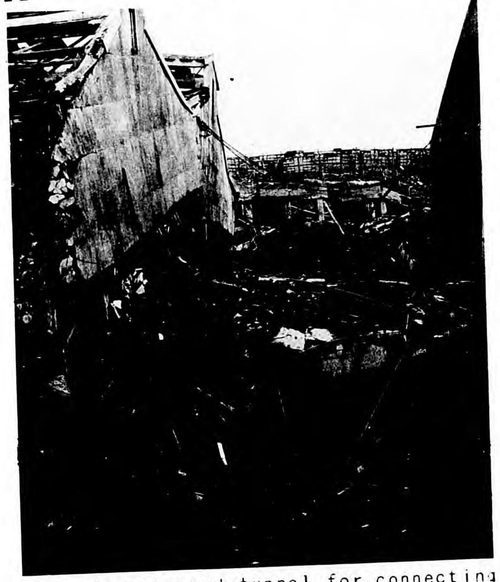
NAKAJIMA AIRCRAFT, TAMA - MUSASHINO 90:17-357

N Crater and resulting damage, showing the opening to an underground building tunnel on the left. Height indicated is six feet. (Bldg 45)



O Underground tunnel for connecting buildings. in foreground. (Bldg 31)

P Severe structural damage to reinforced concrete building resulting from cratering at foundations of columns. (Bldg 11 e)

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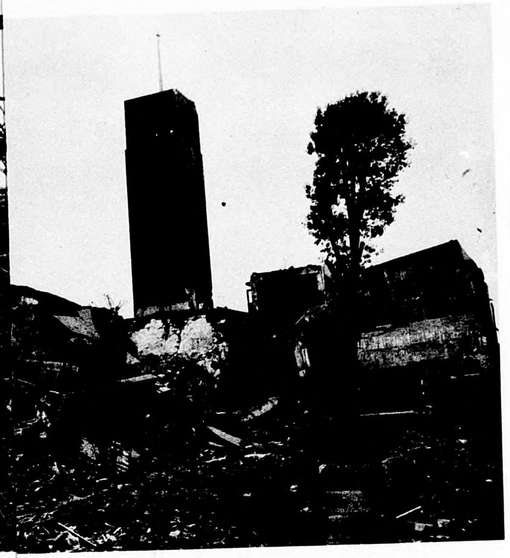
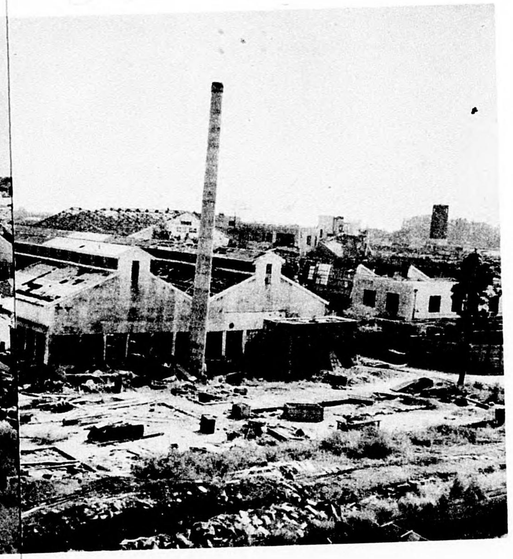
Q Cratering and structural damage to frame building. (Bldg 33)



l concrete building destroyed by direct hits. er is still intact. (Bldg 26)



T Panoramic view from roof of bu

Q Cratering and structural damage to saw-tooth type steel frame building. (Bldg 33)

R Interior of building 31 showing results of earth shock and cratering outside of building.

S Reinforced concrete building destroyed by direct hits. Notice tower is still intact. (Bldg 26)

T Panoramic view from roof of building 11 looking toward buildings 31 to 35.

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EXHIBIT E

MITSUBISHI AIRCRAFT ENGINE WORKS

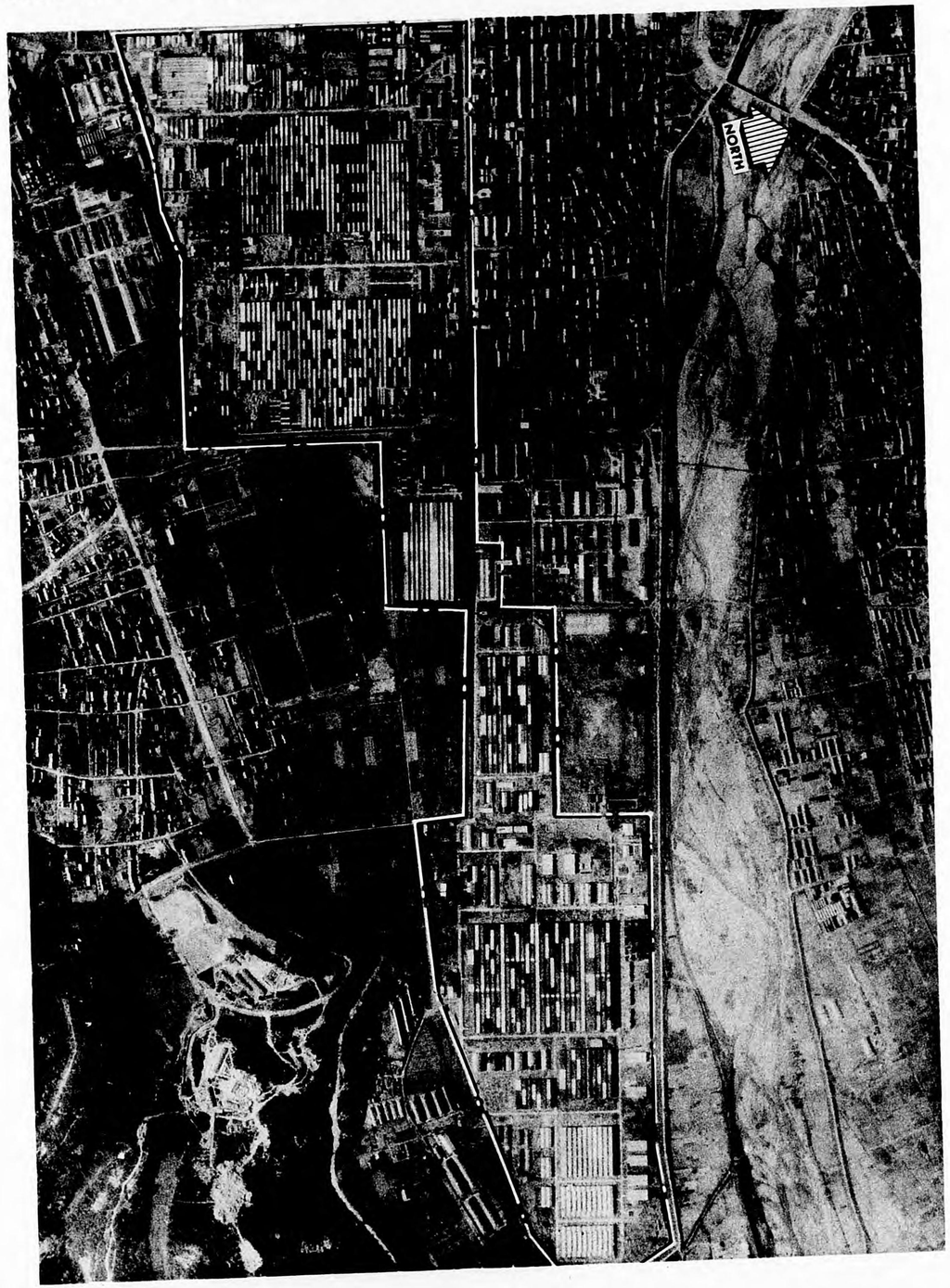
90.20-193

LAT. 35° 11'N - LONG. 136° 57' E

NAGOYA, JAPAN

See Exhibit P for abbreviations used in this exhibit.

90.20-193 MITSUBISHI AIRCRAFT ENGINE WORKS



MITSUBISHI AIRCRAFT ENGINE WORKS 90.20-193

1. DESCRIPTION OF TARGET

a. The Mitsubishi Aircraft Engine Works, Nagoya, was the principal producer of aircraft engines for Mitsubishi and one of the two largest producers of combat aircraft engines in Japan. It produced both Army and Navy types and accounted for about 33 per cent of all Japanese combat engine production.

b. The plant is located in the northeast section of Nagoya, about 2½ miles east of Nagoya Castle and about 8 miles northeast of the mouth of the Hori River.

c. The plant comprises 125 buildings with a built-up area of approximately 3,931,000 square feet.

2. SUMMARY

a. The functional analysis of the primary buildings was excellent, with 8 out of 10 being correctly identified. For the 55 buildings (out of 125) on which field data were available, the building identification was good.

(1) 35 were identified correctly.
(2) 5 were identified as having similar occupancy.
(3) 4 were unidentified.
(4) 11 were identified incorrectly.

b. The structural analysis was excellent. For construction types on which comparable data were available, 112 buildings out of 125 were correctly analyzed. In the combustibility category, of 120 buildings, 112 were correctly analzed.

c. Two damage assessment reports were used for the comparison. One by AC/AS Intelligence the other by CIU (XXI BC). Both reports were good on total damage, but the classification of damage by both organizations was poor, as shown in TABLE I

TABLE I

	ACTUAL	REPORTED AC/AS Intell	REPORTED CIU
	Sq Ft	Sq Ft	Sq Ft
Structural Damage	1,634,800	2,541,100	785,900
Superficial Damage	1,960,100	794,400	2,324,300
Minor Damage *	327,900	207,200	184,400
Total Damage	3,922,800	3,542,700	3,294,600

* In general, Minor Damage was purposely omitted in D/A reports.

3. SOURCE OF DATA

a. Reported.

(1) AC/AS Intelligence Building Construction Analysis, 18 December 1944.
(2) AC/AS Intelligence Limited Damage Interpretation Report # 28, 2 May 1945.
(3) CIU (XXI BC) D/A Report # 38, 16 April 1945.

b. Field Data.

(1) USSBS (G-2, PIC) field notes.

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4. FUNCTIONAL ANALYSIS

a. Use of Plant.

Reported: Production of aircraft engines.
Actual: As reported.

b. Boundaries.

As reported.

c. Building Identification (F/A Table).

d. Summary of Tabulation.

TABLE 2

F/A ACCURACY FACTOR

Total Plant 70
Primary Buildings 92.5

	PRIMARY BUILDINGS		TOTAL BUILDINGS	
	No. Bldgs	%	No. Bldgs	%
Correct	8	80	36	64
Of Similar Occupancy	2	20	5	9
Unidentified			4	7
Incorrect			11	20
Total	10	100	56	100

e. Remarks.

Functional analysis data from the field were available on only 56 buildings out of the total of 126. All major buildings, however, are included in the above total.

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MITSUBISHI AIRCRAFT ENGINE WORKS 90.20-193

FUNCTIONAL ANALYSIS TABLE

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BUILDING NUMBER	PRIMARY	REPORTED: Joint Target Group	ACTUAL	EVALUATION: CORRECT	SIMILAR	UNIDENT	WRONG	F/A ACCURACY FACTOR
JT3			FUNCTION					
1		Storage	Storage	x				85
2		Storage	Storage	x				85
3		Storage	Storage	x				85
4		Storage	Storage	x				85
5		Storage	Storage	x				85
6		Storage	Storage	x				85
7	x	Shop, Foundry, Forge	Forge - Foundry	x				85
8		Shop	Shop (Values)		x			45
9		Unidentified	Grinding Shop		x			45
10		Unidentified	Pump House	x				100
11		Boiler House - Possible Smelter	Steam Plant				x	25
12		Possible Electrical Shop	Mess Hall					
13		Storage	No Field Data Available		x			15
14		Storage	Aircompressor		x			15
15		Storage	Sub Station	x				85
16		Storage	Storage	x				85
17		Storage	Storage	x				85
18		Storage	Storage					
19		Unidentified	No Field Data Available					
20		Storage						
21		Possible Office						
22		Possible Office						
23		Mess Hall						
24		Offices	Office	x				100
25		Offices						
26		Possible Quarters	Laboratory		x			75
27		Offices	Mach. Shop & Heat Treat	x				90
28		Office Type - Possible School	Wood Pattern Shop	x				85
29	x	Shop - Possible Engine Machine & Heat Treat	Messhall				x	70
30		Shop						
31		Shop						

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FUNCTIONAL ANALYSIS TABLE

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BUILDING NUMBER JTG	PRIMARY	FUNCTION REPORTED	ACTUAL	EVALUATION CORRECT	SIMILAR	UNIDENT	WRONG	F/A ACCURACY FACTOR
32		Test Cells (6) and Shop	6 Test Cells	x				100
33		Unidentified	Engine Testing Room		x			45
34		Mess Hall	Eng. Testing Room			x		0
35		Mess Hall	Testing Room			x		0
36		Test Cells (48)	Eng. Test Cells	x				100
37		Test Cells (16)	Eng. Test Cells	x				100
38		Probable Shop (Tool)	Plating Shop			x		20
40		Unidentified						
41		Unidentified						
42		Unidentified						
43		Unidentified						
44		Unidentified						
45		Unidentified						
46		Warehouse						
47		Warehouse						
48		Warehouse	No Field Data Available					
49		Warehouse						
50		Warehouse						
51		Warehouse						
52		Warehouse						
53		Warehouse						
54		Warehouse						
55		Warehouse						
56		Warehouse						
57		Warehouse						
58		Unidentified	Sub-Station & Compressor			x		45
59		Possible Dispensary	No Field Data Available					
60		Possible Fire house						
61		Shop	Manufacturing Plant	x				85
62	x	Unidentified						
63								

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FUNCTIONAL ANALYSIS TABLE

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BUILDING NUMBER JTG	PRIMARY	FUNCTION REPORTED	ACTUAL	EVALUATION CORRECT	SIMILAR	UNIDENT	WRONG	F/A ACCURACY FACTOR
64		Unidentified						
65		Storage						
66		Foundry	No Field Data Available					
67								
68		Storage						
69		Storage						
70		Storage						
71		Storage	Storage	x				85
72		Storage	No Field Data Available					
73		Storage	Machine Shop	x				100
74	x	Machine Shop	Storage	x				85
75		Storage	Storage	x				85
76		Storage	Storage	x				85
77		Storage	Storage	x				85
78		Storage	Storage	x				85
79		Storage	Manufacturing (Engine Dept.)		x			80
80	x	Probable Foundry						
81		Storage	No Field Data Available					
82		Storage						
83		Storage						
84		Storage	Sub Station			x		15
85		Storage	No Field Data Available					
86		Storage	Air Compressor Building			x		15
87		Storage	No Field Data Available					
88		Storage	Boiler House	x				100
89		Boiler House						
90		Storage						
91		Storage						
92		Storage	No Field Data Available					
93		Storage						
94		Storage						

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FUNCTIONAL ANALYSIS TABLE

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BUILDING NUMBER	PRIMARY	REPORTED FUNCTION	ACTUAL	CORRECT	SIMILAR	UNIDENT	WRONG	F/A ACCURACY FACTOR
JT3		Joint Target Group						
95		Storage	No Field Data Available					
96		Storage						
97		Storage						
98		Storage						
99		Probable Transformer Station						
100		Storage	16 Engine Test Cells	x				100
101		Test Cells (16)						
102		Test Cells (4)	No Field Data Available					
103		Test Cells (4)						
104		Test Cells (4)						
105	x	Shop Machine Shop Engine Assembly	Manufacturing Dept	x				100
106		Offices						
107		Storage						
108		Storage						
109		Storage	No Field Data Available					
110		Storage						
111		Storage						
112		Storage	Wash Stand	x				15
113		Shop	Messhall	x				15
114	x	Machine Shop	Heat Treat Shop			x		85
115		Storage	Shop	x				15
116		Storage	Storage & offices				x	70
117		Storage	Storage				x	85
118		Storage	Storage				x	85
119		Storage	Storage				x	85
120		Storage	Storage				x	85
121	x	Machine Shop	Tool Shop				x	100
122	x	Machine Shop	Tool Shop				x	100
123	x	Machine Shop	Tool Shop				x	100
124		Storage	No Field Data Available					
125 & 125		Storage						

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MITSUBISHI AIRCRAFT ENGINE WORKS 90.20-193

5. STRUCTURAL ANALYSIS

a. Check on Scale Measurement.

Scale used was correct. An AC/AS Intelligence measurement of 1478 feet actually measured 1480 feet on the ground.

b. S/A (See S/A Table).

c. Summary of Tabulation.

(1) Construction Type.

TABLE 3

	PRIMARY BUILDINGS			TOTAL BUILDINGS		
	No. Bldgs	No. Corr	% Corr	No. Bldgs	No. Corr	% Corr
Construction Type						
Wood Frame (W)	3	2	67	99	91	92
Steel Frame (S)	7	7	100	17	15	88
Reinforced Concrete (R/C)	0	—	—	9	6	67
Total	10	9	90	125	112	90

(2) Combustibility.

TABLE 4

	PRIMARY BUILDINGS			TOTAL BUILDINGS		
	No. Bldgs	No. Corr	% Corr	No. Bldgs	No. Corr	% Corr
Building Combustibility						
Combustible (C)	3	2	67	97	91	94
Non-Combustible (N)	7	7	100	16	15	94
Fire-Resistant (R)	0	—	—	7	6	86
Total	10	9	90	120	112	93

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MITSUBISHI AIRCRAFT ENGINE WORKS

STRUCTURAL ANALYSIS TABLE

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BUILDING NUMBER		1000'S OF SQ. FT. PLAN AREA			NUMBER OF FLOORS			SIZE OF BAY		ROOF MATERIAL			COMBUSTIBILITY OF BUILDING			CONSTRUCTION TYPE	
		ACTUAL	REPORTED		ACTUAL	REPORTED		ACTUAL	REPORTED	ACTUAL	REPORTED		ACTUAL	REPORTED		ACTUAL	REPORTED
1													C	C		W	W
2													C	C		W	W
3													C	C		W	W
4													C	C		W	W
5													C	C		W	W
6													N	N		S	S
7													N	N		S	S
8													C	C		W	W
9													N	N		W	W
10													N	N		S	S
11													N	N		S	S
12													C	N		W	S
13													N	C		S	W
14													R	C		RC	W
15													C	C		W	W
16													C	C		W	W
17													C	C		W	W
18													C	C		W	W
19													C	C		W	W
20													C	C		W	W
21														C			W
22													C	C		W	W
23													C	C		W	W
24													C	C		W	W
25													C	C		W	W
26													R	R		RC	RC
27													R	R		RC	RC
28													N	N		S	S
29													N	N		S	S
30													N	N		S	S
31													Mixed	Mixed		RC	RC
32																	

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MITSUBISHI AIRCRAFT ENGINE WORKS

STRUCTURAL ANALYSIS TABLE

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BUILDING NUMBER		1000'S OF SQ. FT. PLAN AREA			NUMBER OF FLOORS			SIZE OF BAY		ROOF MATERIAL			COMBUSTIBILITY OF BUILDING			CONSTRUCTION TYPE	
		ACTUAL	REPORTED		ACTUAL	REPORTED		ACTUAL	REPORTED	ACTUAL	REPORTED		ACTUAL	REPORTED		ACTUAL	REPORTED
33													C	C		W	W
34													N	N		S	S
35													N	N		S	S
36													R	R		RC	RC
37													R	R		RC	RC
38													C	C		W	W
39													C	C		W	W
40													C	C		W	W
41													C	C		W	W
42													C	C		W	W
43													C	C		W	W
44													C	C		W	W
45													C	C		W	W
46													C	C		W	W
47													C	C		W	W
48													C	C		W	W
49													C	C		W	W
50													C	C		W	W
51													C	C		W	W
52													C	C		W	W
53													C	C		W	W
54													C	C		W	W
55													C	C		W	W
56													C	C		W	W
57													C	C		W	W
58													C	C		W	W
59													C	C		W	W
60													C	C		W	W
61													N	N		S	S
62													C	C		W	W
63													C	C		W	W
64																	

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MITSUBISHI AIRCRAFT ENGIN WORKS

STRUCTURAL ANALYSIS TABLE

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BUILDING NUMBER		1000'S OF SQ. FT. PLAN AREA			NUMBER OF FLOORS			SIZE OF BAY		ROOF MATERIAL			COMBUSTIBILITY OF BUILDING			CONSTRUCTION TYPE	
		ACTUAL	REPORTED		ACTUAL	REPORTED		ACTUAL	REPORTED	ACTUAL	REPORTED		ACTUAL	REPORTED		ACTUAL	REPORTED
65													C	C		W	W
66													C	C		W	W
67													C	C		W	W
68													C	C		W	W
69													C	C		W	W
70													C	C		W	W
71													C	C		W	W
72													C	C		W	W
73													N	N		S	S
74													C	C		W	W
75													C	C		W	W
76													C	C		W	W
77													C	C		W	W
78													C	C		W	W
79													N	N		S	S
80													C	N		W	S
81													C	C		W	W
82													C	C		W	W
83													R	R		RC	RC
84													C	C		W	W
85													C	C		W	W
86													C	C		W	W
87													N	N		S	S
88													C	C		W	W
89													C	C		W	W
90													C	C		W	W
91													C	C		W	W
92													C	C		W	W
93													C	C		W	W
94													C	C		W	W
95																	
96																	

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MITSUBISHI AIRCRAFT ENGINE WORKS

STRUCTURAL ANALYSIS TABLE

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BUILDING NUMBER		1000'S OF SQ. FT. PLAN AREA			NUMBER OF FLOORS			SIZE OF BAY		ROOF MATERIAL			COMBUSTIBILITY OF BUILDING			CONSTRUCTION TYPE	
		ACTUAL	REPORTED		ACTUAL	REPORTED		ACTUAL	REPORTED	ACTUAL	REPORTED		ACTUAL	REPORTED		ACTUAL	REPORTED
97													C	C		W	W
98													C	C		W	W
99													C	N		RC/W	S
100													C	C		W	W
101																RC	RC
102													C			W	RC
103													C			W	RC
104													C			W	RC
105													N	N		S	S
106													C	C		W	W
107													C	C		W	W
108													C	C		W	W
109													C	C		W	W
110													C	C		W	W
111													N	C		S	S
112													C	N		S	S
113													N	C		S	S
114													C	C		W	W
115													C	C		W	W
116													C	C		W	W
117													C	C		W	W
118													C	C		W	W
119													C	C		W	W
120													C	N		W	S
121													C	C		W	W
122													C	C		W	W
123													C	C		W	W
124													C	C		W	W
125																	
126																	

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6. DAMAGE ASSESSMENT

a. D/A (See D/A Table).

b. Summary of Tabulation.

TABLE 5

	ACTUAL		REPORTED (AC/AS Intell.)		REPORTED (CIU)	
	Sq Ft	% Dam	Sq Ft	% Dam	Sq Ft	% Dam
Total Building Area*			3,931,000			
Damage						
Structural	1,634,800	42	2,541,100	65	785,900	20
Superficial	1,960,100	50	794,400	20	2,324,300	59
Minor **	327,900	7.8	207,200	5.5	184,400	4.7
Total Damage	3,922,800	99.8	3,542,700	90.5	3,294,600	83.7

* Based on AC/AS Intelligence roof area figures.
**In general, Minor Damage was purposely omitted in D/A reports.

c. Remarks.

Reported total damage was reasonably accurate, but there were very large errors in the classification of damage, particularly in the case of the CIU report. Much of the discrepancy between the AC/AS Intelligence and the CIU reports can be traced to a lack of standardization of terms between PI units in the description of different types of damage, and the lesser time available in the field than at AC/AS Intelligence to produce reports of comparable detail.

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DAMAGE ASSESSMENT TABLE

MITSUBISHI AIRCRAFT ENGINE WORKS — 90.20-193

BUILDING NUMBER	BUILDING AREA	STRUCTURAL (1000'S SQ. FT.) ACTUAL	STRUCTURAL (1000'S SQ. FT.) REPORTED	SUPERFICIAL (1000'S SQ. FT.) ACTUAL	SUPERFICIAL (1000'S SQ. FT.) REPORTED	MINOR * (1000'S SQ. FT.) ACTUAL	MINOR * (1000'S SQ. FT.) REPORTED	REMOVED (1000'S SQ. FT.) ACTUAL	REMOVED (1000'S SQ. FT.) REPORTED
JTG	JTG		JTG		JTG		JTG		
	9.6	9.6	9.6				CIU		
1	12.0	12.0	12.0			1.1			
2	4.8	4.8	4.8						
3	3.4	2.3	2.3				4.0		
4	4.0	4.0	4.0						
5	4.0	4.0	4.0						
6	214.0	42.2	35.0	100.0	52.2	44.2	3.9		
7	62.4	11.7	25.2	50.7	28.8		8.4		
8	7.2	7.2	7.2				38.1		
9	10.5	10.5	10.5						
10	13.3	13.3		19.1		13.3			
11	28.8	9.7	4.4				24.4		
12	7.2	7.2	7.2	2.4		2.4			
13	4.8		4.8	None	None	None	None		
14	5.6	None	None						
15	6.6	6.6	6.6						
16	6.6	6.6	6.6						
17	6.6	6.6	6.6						
18	11.4	11.4	11.4	22.8					
19	22.8								
20	7.2	7.2	7.2						
21	7.2	7.2	7.2						
22	22.5	22.5	22.5						
23	6.6	6.6	6.6						
24	8.4	8.4	8.4	2.6					
25	7.7	5.1	7.7		3.6				
26	33.6	6.9	7.4	None		None			
27	13.2	None		473.1	123.4	50.0	166.5	104.0	
28	697.4	174.3	452.1			20.4			
29	20.4					20.2			
30	20.2		7.3	26.9					
31	26.9								
32									

* In general, Minor Damage was purposely omitted in D/A reports.

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MITSUBISHI AIRCRAFT ENGINE WORKS

DAMAGE ASSESSMENT TABLE

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BUILDING NUMBER	BUILDING AREA	STRUCTURAL (1000'S SQ. FT.)			SUPERFICIAL (1000'S SQ. FT.)			MINOR * (1000'S SQ. FT.)			REMOVED (1000'S SQ. FT.)		
		ACTUAL	REPORTED	REPORTED	ACTUAL	REPORTED	REPORTED	ACTUAL	REPORTED	REPORTED	ACTUAL	REPORTED	REPORTED
JTG	JTG		JTG	CIU		JTG	CIU		JTG	CIU			
33	7.2	7.2	7.2	7.2									
34	14.4	7.2	7.2	7.2	7.2	7.2	7.2						
35	14.4				14.4	14.4	14.4			3.2			
36	57.6	5.5	14.5					None					
37	19.0	None			None								
38	36.0	27.0	18.8	15.4	9.0	17.2	21.0						
39	7.2	7.2	7.2	7.2									
40	9.6	9.6	9.6	9.6									
41	5.4	5.4	5.4	5.4									
42	8.4	8.4	8.4	8.4									
43	7.2	7.2	7.2	7.2									
44	7.2	7.2	7.2	7.2									
45	7.2	7.2	7.2	7.2									
46	4.8	4.8	4.8	4.8									
47	7.2	7.2	7.2	5.5									
48	7.2	7.2	7.2	3.6									
49	7.2	7.2	7.2	7.2									
50	7.2	7.2	7.2	7.2									
51	7.2	7.2	7.2	7.2									
52	7.2	7.2	7.2	7.2									
53	7.2	7.2	7.2	7.2									
54	7.2	7.2	7.2	7.2									
55	7.2	7.2	7.2	7.2									
56	7.2			7.2	7.2	7.2							
57	7.2	7.2	7.2	7.2									
58	7.2	7.2	7.2										
59	9.9	9.9	9.9	9.9									
60	7.0	7.0	7.0										
61	7.0	7.0	7.0	7.6									
62	628.4	294.4	306.0		334.0	322.4	411.2						
63	7.2	7.2	7.2										
64	7.2	7.2	6.4										

*In general, Minor Damage was purposely omitted in D/A reports.

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MITSUBISHI AIRCRAFT ENGINE WORKS

DAMAGE ASSESSMENT TABLE

BUILDING NUMBER	BUILDING AREA	STRUCTURAL (1000'S SQ. FT.)			SUPERFICIAL (1000'S SQ. FT.)			MINOR * (1000'S SQ. FT.)			REMOVED (1000'S SQ. FT.)		
		ACTUAL	REPORTED	REPORTED	ACTUAL	REPORTED	REPORTED	ACTUAL	REPORTED	REPORTED	ACTUAL	REPORTED	REPORTED
JTG			JTG	CIU		JTG	CIU		JTG	CIU			
65	5.4	5.4	5.4	5.4									
66	7.2	7.2	7.2	7.2									
67	7.2	7.2	7.2	7.2									
68	7.2	7.2	7.2	7.2									
69	7.2	7.2	7.2	7.2									
70	7.2	7.2	7.2	7.2									
71	7.2	7.2	7.2	7.2									
72	35.0	30.0	35.0		5.0								
73	12.6	12.6	12.6										
74	189.4	20.7	48.9		135.3	137.8	80.0	33.2		1.0			
75	14.4	14.4	14.4	14.4									
76	7.2	7.2	4.5			2.7							
77	7.2	7.2	7.2	7.2									
78	7.2				7.2					7.2			
79	7.2	1.2							6.0	7.2			
80	208.8	48.4	133.9		148.7	52.5	18.3	11.7					
81	7.2	7.2		7.2									
82	16.8	16.8	16.8	16.8									
83	7.2	5.4	7.2		1.8		4.1						
84	7.2	7.2	7.2	3.0			4.2						
85	6.8			6.8									
86	6.8	6.8	6.8	6.8									
87	4.0	3.0	4.0	4.0	1.0								
88	3.9	3.9	3.9	3.9									
89	9.8			9.8	9.8	9.8							
90	14.4	14.4	14.4	14.4									
91	14.4	14.4	14.4	14.4									
92	14.4	14.4	14.4	14.4									
93	7.2	7.2	7.2	7.2									
94	7.2	7.2	7.2	7.2									
95	7.2	7.2	7.2	7.2									
96	7.2	7.2	7.2	7.2									

*In general, Minor Damage was purposely omitted in D/A reports.

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DAMAGE ASSESSMENT TABLE

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BUILDING NUMBER	BUILDING AREA	STRUCTURAL (1000'S SQ. FT.)			SUPERFICIAL (1000'S SQ. FT.)			MINOR * (1000'S SQ. FT.)			REMOVED (1000'S SQ. FT.)		
		ACTUAL	REPORTED	REPORTED	ACTUAL	REPORTED	REPORTED	ACTUAL	REPORTED	REPORTED	ACTUAL	REPORTED	REPORTED
JTG	JTG		JTG	CIU		JTG	CIU		JTG	CIU			
33	7.2	7.2	7.2	7.2									
34	14.4	7.2	7.2	7.2	7.2	7.2	7.2						
35	14.4				14.4	14.4	14.4			3.2			
36	57.6	5.5	14.5					None					
37	19.0	None			None								
38	36.0	27.0	18.8	15.4	9.0	17.2	21.0						
39	7.2	7.2	7.2	7.2									
40	9.6	9.6	9.6	9.6									
41	5.4	5.4	5.4	5.4									
42	8.4	8.4	8.4	8.4									
43	7.2	7.2	7.2	7.2									
44	7.2	7.2	7.2	7.2									
45	7.2	7.2	7.2	7.2									
46	4.8	4.8	4.8	4.8									
47	7.2	7.2	7.2	5.5									
48	7.2	7.2	7.2	3.6									
49	7.2	7.2	7.2	7.2									
50	7.2	7.2	7.2	7.2									
51	7.2	7.2	7.2	7.2									
52	7.2	7.2	7.2	7.2									
53	7.2	7.2	7.2	7.2									
54	7.2	7.2	7.2	7.2									
55	7.2	7.2	7.2	7.2									
56	7.2			7.2	7.2	7.2							
57	7.2	7.2	7.2	7.2									
58	7.2	7.2	7.2										
59	9.9	9.9	9.9	9.9									
60	7.0	7.0	7.0										
61	7.0	7.0	7.0	7.6									
62	628.4	294.4	306.0		334.0	322.4	411.2						
63	7.2	7.2	7.2										
64	7.2	7.2	6.4										

*In general, Minor Damage was purposely omitted in D/A reports.

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90.20-193 MITSUBISHI AIRCRAFT ENGINE WORKS

EXHIBIT E PHOTOGRAPHIC INTELLIGENCE — INDUSTRIAL ANALYSIS

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MITSUBISHI AIRCRAFT ENGINE WORKS

DAMAGE ASSESSMENT TABLE

BUILDING NUMBER	BUILDING AREA	STRUCTURAL (1000'S SQ. FT.)			SUPERFICIAL (1000'S SQ. FT.)			MINOR * (1000'S SQ. FT.)			REMOVED (1000'S SQ. FT.)		
		ACTUAL	REPORTED	REPORTED	ACTUAL	REPORTED	REPORTED	ACTUAL	REPORTED	REPORTED	ACTUAL	REPORTED	REPORTED
JTG			JTG	CIU		JTG	CIU		JTG	CIU			
65	5.4	5.4	5.4	5.4									
66	7.2	7.2	7.2	7.2									
67	7.2	7.2	7.2	7.2									
68	7.2	7.2	7.2	7.2									
69	7.2	7.2	7.2	7.2									
70	7.2	7.2	7.2	7.2									
71	7.2	7.2	7.2	7.2									
72	35.0	30.0	35.0		5.0								
73	12.6	12.6	12.6										
74	189.4	20.7	48.9		135.3	137.8	80.0	33.2		1.0			
75	14.4	14.4	14.4	14.4									
76	7.2	7.2	4.5			2.7							
77	7.2	7.2	7.2	7.2						7.2			
78	7.2				7.2				6.0	7.2			
79	7.2	1.2											
80	208.8	48.4	133.9		148.7	52.5	18.3	11.7					
81	7.2	7.2		7.2									
82	16.8	16.8	16.8	16.8									
83	7.2	5.4	7.2		1.8		4.1						
84	7.2	7.2	7.2	3.0			4.2						
85	6.8			6.8									
86	6.8	6.8	6.8	6.8									
87	4.0	3.0	4.0	4.0	1.0								
88	3.9	3.9	3.9	3.9									
89	9.8			9.8	9.8	9.8							
90	14.4	14.4	14.4	14.4									
91	14.4	14.4	14.4	14.4									
92	14.4	14.4	14.4	14.4									
93	7.2	7.2	7.2	7.2									
94	7.2	7.2	7.2	7.2									
95	7.2	7.2	7.2	7.2									
96	7.2	7.2	7.2	7.2									

*In general, Minor Damage was purposely omitted in D/A reports.

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MITSUBISHI AIRCRAFT ENGINE WORKS 90.20-193

EXHIBIT E PHOTOGRAPHIC INTELLIGENCE — INDUSTRIAL ANALYSIS

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90.20-193 MITSUBISHI AIRCRAFT ENGINE WORKS

DAMAGE ASSESSMENT TABLE

MITSUBISHI AIRCRAFT ENGINE WORKS — 90.20-193

BUILDING NUMBER	BUILDING AREA	STRUCTURAL (1000'S SQ. FT.)		SUPERFICIAL (1000'S SQ. FT.)		MINOR * (1000'S Sq. FT.)		REMOVED (1000'S SQ. FT.)	
		ACTUAL	REPORTED	ACTUAL	REPORTED	ACTUAL	REPORTED	ACTUAL	REPORTED
JTG			JT3		JT3		JT3		
97	7.2	7.2	7.2		C1U		C1U		
38	7.2	7.2	7.2						
99	6.0			6.0	6.0				
100	7.2	7.2	7.2		3.5				
101	23.0	None		None		None			
102	3.3	3.3	3.3						
103	3.3	3.3	3.3						
104	3.3	3.3	3.3						
105	531.2	187.0	524.0	344.2	7.2	5.0	3.2		
106	7.5	None		3.3	2.0				
107	5.0	1.7	3.0						
108	6.0	6.0	6.0	6.0					
109	6.0	6.0	6.0	6.0					
110	5.0	5.0	5.0	5.0					
111	6.0	6.0	6.0						
112	5.0			12.4					
113	35.7	10.0	35.7	35.7	86.1				
114	87.0	18.0	87.0	59.0		6.6	6.6		
115	6.6					6.6	6.6		
116	6.6	6.6	1.1						
117	6.6	6.6	6.6	6.6					
118	6.6	6.6	6.6						
119	6.6	6.6	6.6	6.6					
120	6.6	6.6	6.6		87.0				
121	87.0	40.0	87.0	47.0					
122	51.0	51.0	51.0						
123	51.0	51.0	51.0						
124	7.2	7.2	2.7	7.2	3.6				
125	7.2	7.2							
126	7.2	7.2	7.2	7.2	7.2	7.2			

*In general, Minor Damage was purposely omitted in D/A reports.

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MITSUBISHI AIRCRAFT ENGINE WORKS 90.20-193

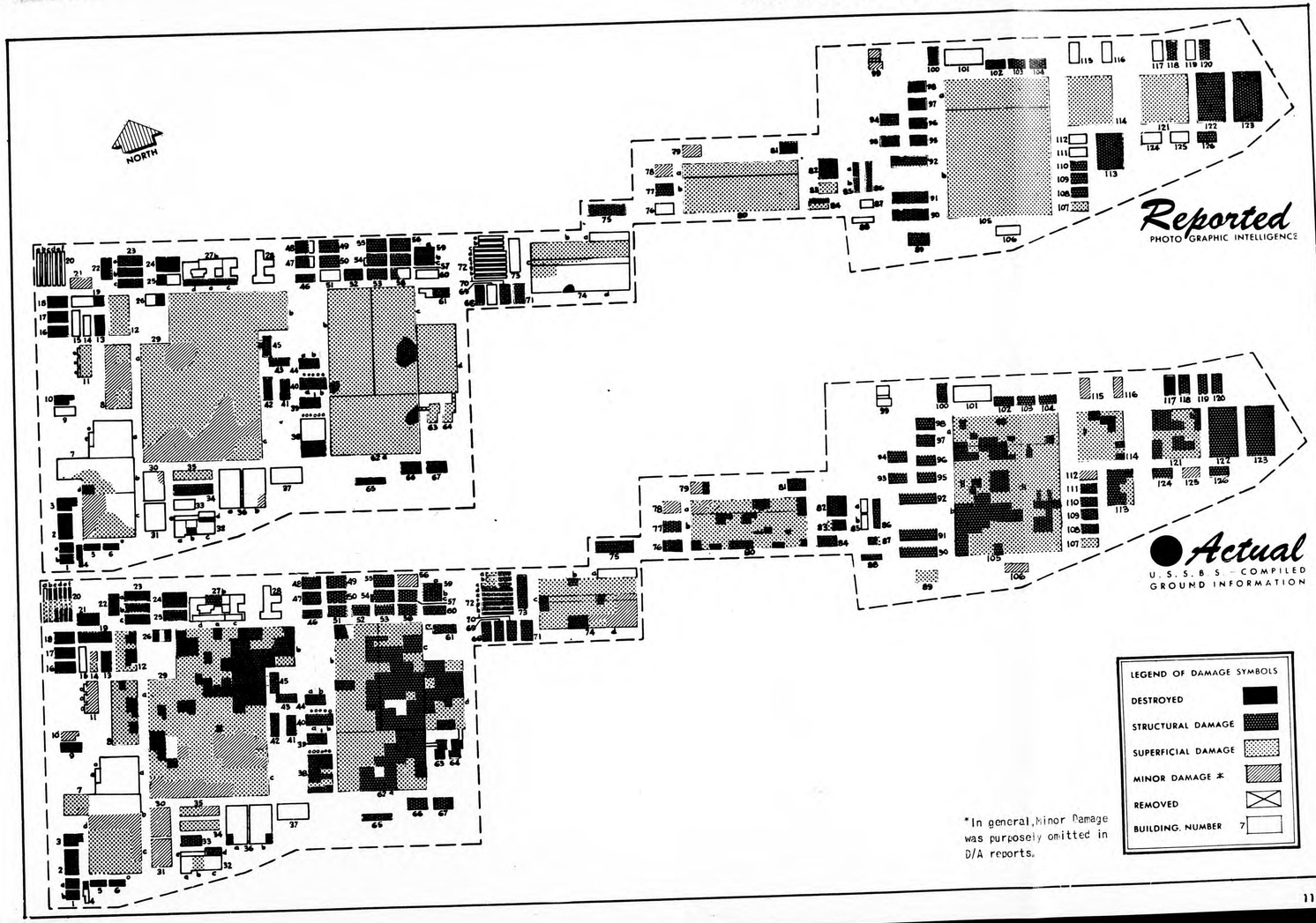

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EXHIBIT F

SUMITOMO KANZAKI PROPELLER PLANT

90.25 - 2041

LAT. 34° 44'N - LONG. 135° 25'E

AMAGASAKI, JAPAN

See Exhibit P for abbreviations used in this exhibit.

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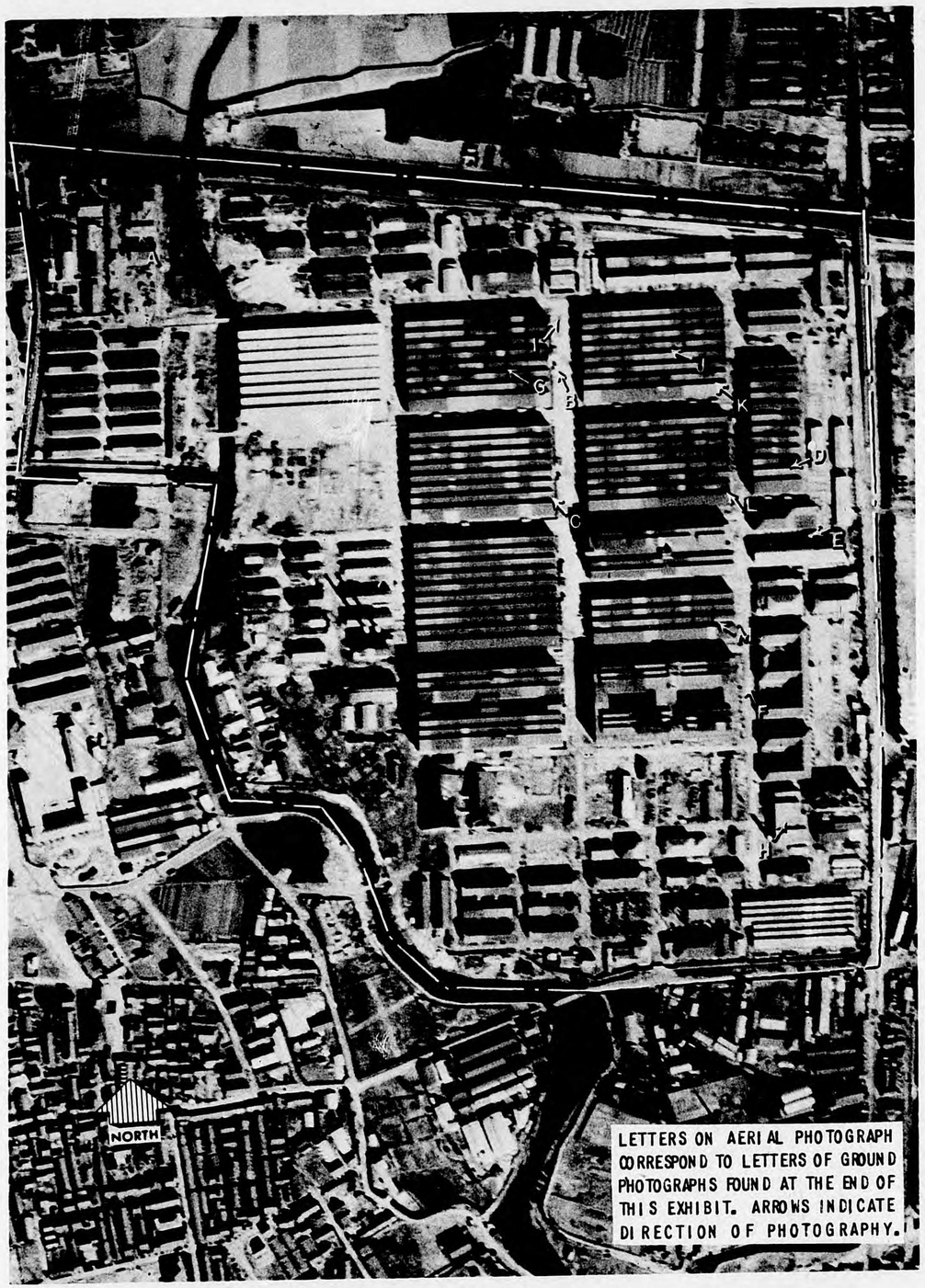
90.25 - 2041 SUMITOMO PROPELLER PLANT



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SUMITOMO PROPELLER PLANT 90.25 - 2041

1. DESCRIPTION OF TARGET

a. The Sumitomo Kanzaki Propeller Plant manufactured about 27 percent of the propellers used on Japanese combat aircraft.

b. The plant is located ½ mile due north of Amagasaki, a northern suburb of Osaka.

c. The plant comprises 71 listed structures with a total built-up area of approximately 1,570,600 square feet.

2. SUMMARY

a. The overall interpretation of building functions was good. Of a total of 71 buildings there were:

(1) 35 identified correctly.
(2) 25 identified as having similar occupancy.
(3) 8 unidentified.
(4) 3 identified incorrectly.

b. The structural analysis was good. For construction types, 61 out of 70 buildings analyzed were correct, and for building combustibility, 63 out of 71 were correct. The greatest difficulties in the analysis were experienced in determining the combustibility of roofs.

c. The assessment of total damage was good. Of 1,076,200 square feet of actual total damage, 1,034,200 square feet were reported.

d. Incendiary attack was far more effective than had been indicated from photographic studies because of the use by the Japanese of wooden floor blocks and fiberboard ceilings.

3. SOURCE OF DATA

a. Reported.

(1) AC/AS Intelligence F/A Report #95, 22 March 1945.
(2) AC/AS Intelligence S/A Report #43, 14 March 1945.
(3) CIU (XXI BC) D/A Report #100, 24 June 1945.

b. Field Data.

(1) USSBS (G-2, PIC) field notes; Japanese plans and damage data.

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90.25 - 2041 SUMITOMO PROPELLER PLANT

4. FUNCTIONAL ANALYSIS

a. Use of Plant.

Reported: Manufacture of propeller hub parts.

Actual: Manufacture of propeller blades and hubs.

b. Boundaries.

As reported.

c. Building Identification (F/A Table).

d. Summary of Tabulation.

TABLE I

F/A ACCURACY FACTOR	TOTAL BUILDINGS	
	No. Bldgs	%
Correct	35	49
Of Similar Occupancy	25	36
Unidentified	8	11
Incorrect	3	4
Total	71	100

Total Plant 72

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SUMITOMO PROPELLER PLANT 90.25 - 2041

FUNCTIONAL ANALYSIS TABLE

SUMITOMO KANZAKI PROPELLER PLANT — 90.25 - 2041

BUILDING NUMBER	REPORTED PRIMARY FUNCTION J T G	ACTUAL FUNCTION	EVALUATION CORRECT	SIMILAR	UNIDENT	WRONG	F/A ACCURACY FACTOR
1	Unidentified	Workers' dormitories			x		45
2	Unidentified	Workers' dormitories				x	45
3	Unidentified	Propeller testing bldg				x	45
4	Finished stores	Warehouses	x				85
5	Finished stores	Temporary shed				x	85
6	Unidentified	Oil storage bldg			x		45
7	Unidentified	Storage				x	45
8	Storage	Storage			x		85
9	Storage	Storage					85
10	Storage	Warehouses - material	x				85
11	Storage	Warehouses - material					85
12	Storage	Warehouses - material	x				85
13	Unidentified	Mess hall				x	45
14	Possible test cells	Sub station		x			75
15	Storage	Warehouse		x			85
16	Storage	Warehouse & equipment		x			85
17	Storage	Warehouse & inspection office					85
		Machine shop - prop. hub	x				85
18	Machine shops	Machine shop - large & small hubs		x			85
19	Machine shops			x			85
20	Machine shops	Machine shop - expansion					85
21	Machine shops	Machine shop - pistons & accessories			x		85
22	Machine shops	Machine shop			x		85
23	Former propeller assembly	Tools - small machinetools	x				85
24	Shops	Warehouses for bldg 23				x	70
25	Shops	Warehouses for bldg 23				x	70
26	Shops	Warehouses for bldg 23			x		70
27	Unidentified	Experimental bldg				x	45
28	Storage	1st tools - 2nd offices				x	70

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SUMITOMO KANZAKI PROPELLER PLANT

FUNCTIONAL ANALYSIS TABLE

90.25 - 2041

BUILDING NUMBER		PRIMARY	FUNCTION REPORTED J T G		FUNCTION ACTUAL	EVALUATION CORRECT	SIMILAR	UNIDENT	WRONG	F/A ACCURACY FACTOR CORRECT	SIMILAR	UNIDENT	WRONG
29			Machine Shop & benchwork		Plate shop - heat treatment								
					- assembly		x			85			
30			Machine shop		Small parts manufacture	x				85			
31			Plant maintenance shops		Elec. appliances warehouses		x			70			
32			Plant maintenance shops		Elec. appliances warehouses		x			70			
33			Plant maintenance shops		Electricians office & supply		x			70			
34			Plant maintenance shops		Electricians office & supply		x			70			
35			Plant maintenance shops		Bldg. maintenance	x				100			
36			Plant maintenance shops		Carpenter shop	x				85			
37			Plant maintenance shops		Warehouse		x			85			
38			Plant maintenance shops		Plumbers shop	x				85			
39			Plant maintenance shops		Plumbers shop	x				85			
40			Plant maintenance shops		Compressors		x			70			
41			Boiler house		Boiler room	x				100			
42			Foundry		Foundry	x				100			
43			Benchwork		Assembly of propellers		x			70			
44			Benchwork		Blade manufacture		x			70			
45			Machine shop		Assembly - blade finishing		x			70			
46			Administration		Employees' locker house	x				85			
47			Administration		Office supplies	x				85			
48			Administration		Offices	x				85			
49			Administration		Dining hall	x				85			
50			Administration		Administration	x				85			
51			Administration		Drafting rooms	x				85			
52			Administration		Research laboratory	x				85			
53			Storage		Experimental bldg.		x			70			
54			Possible engineering & research		Experimental - Models	x				75			
55			Storage		Contractor shack	x				70			
56			Storage		Carpenter shop for contractors	x				70			

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PHOTOGRAPHIC INTELLIGENCE — INDUSTRIAL ANALYSIS EXHIBIT F

90.25 - 2041 SUMITOMO PROPELLER PLANT

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SUMITOMO KANZAKI PROPELLER PLANT

FUNCTIONAL ANALYSIS TABLE

90.25 - 2041

BUILDING NUMBER		PRIMARY	FUNCTION REPORTED J T G		FUNCTION ACTUAL	EVALUATION CORRECT	SIMILAR	UNIDENT	WRONG	F/A ACCURACY FACTOR CORRECT	SIMILAR	UNIDENT	WRONG
57			Unidentified		Kitchen & mess hall			x					45
58			Possible apprentice school		Cement storage shed				x				25
59			Possible apprentice school		Canteen		x						60
60			Possible apprentice school		Dispensary		x						60
61			Possible apprentice school		Experimental bldg.		x						60
62			Possible apprentice school		Model making bldg		x						60
63			Possible apprentice school		Locker room		x						60
64			Possible apprentice school		Auditorium	x							75
65			Possible apprentice school		Mess hall & meetings	x							75
66			Possible apprentice school		Guard house	x							75
67			Possible apprentice school		Labor office		x						60
68			Possible apprentice school		Locker room for workers	x							75
69			Possible apprentice school		Locker room for workers	x							75
70			Possible apprentice school		Cement storage				x				25
71			Possible apprentice school		Cement storage				x				25

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EXHIBIT F PHOTOGRAPHIC INTELLIGENCE — INDUSTRIAL ANALYSIS

SUMITOMO PROPELLER PLANT 90.25 - 2041

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90.25 - 2041 SUMITOMO PROPELLER PLANT

5. STRUCTURAL ANALYSIS

a. Check on Scale Measurement.

Linear dimensions were 5 per cent greater than reported.

b. S/A (See S/A Table).

c. Summary of Tabulation.

(1) Construction Type

TABLE 2

Construction Type	No. Bldgs	No. Corr	% Corr
A1.1	6	6	100
A1.3	1	1	100
A2.3	1	1	100
B2	2	0	0
D	28	28	100
E1	4	4	100
E2	25	19	76
F1	2	1	50
S	1	1	100
Total	70	61	87

(2) Combustibility.

TABLE 3

Building Combustibility	No. Bldgs	No. Corr	% Corr
Combustible (C)	53	48	91
Non-Combustible (N)	13	11	85
Fire-Resistant (R)	5	4	80
Total	71	63	88

d. Remarks.

Most of the roofs were of corrugated asbestos, tile, or sheet metal and the bulk of these were incorrectly interpreted as being of combustible material.

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SUMITOMO PROPELLER PLANT 90.25 - 2041

STRUCTURAL ANALYSIS TABLE

SUMITOMO KANZAKI PROPELLER PLANT — 90.25 - 2041

BUILDING NUMBER	1000'S OF SQ. FT. PLAN AREA		NUMBER OF FLOORS		SIZE OF BAY IN FT		COMBUSTIBILITY OF BUILDING		ROOF MATERIAL		CONSTRUCTION TYPE	
	ACTUAL	REPORTED	ACTUAL	REPORTED	ACTUAL	REPORTED	ACTUAL	REPORTED	ACTUAL	REPORTED	ACTUAL	REPORTED
1			2	1			C	C			E2	D
2			2	2			C	C			E2	E2
3			2	2			R	R	R	R	E1	E1
4	27.0		1	1			C	C	C	R	D	D
5	4.8		1	1			C	C	C	C	D	D
6	4.0		--	1			N	C	N	C	D	D
7			2	2			C	C			E2	E2
8	14.0		2	2			C	C			E2	E2
9	14.0		1	1			C	C			D	D
10			1	1			C	C			D	D
11	5.6		2	2			C	N			E2	E2
12	7.0		1	1			R	R	R	R	A1.1	A1.1
13	20.8		2	1			C	C	C	C	S	S
14			2	2			C	C	C	R	E2	E2
15	28.0		2	2			C	C	C & R	C & R	F1	F1
16	12.4		3	3			C	C	C	C	E2	E2
17	11.6		2	2			N	N	N	N	A1.11	A
18	100.0		1	1	60x66	57x62	N	N	N	N	A1.1	A
19	100.0		1	1	60x66	57x62	C	N	C	N	A1.3	A
20	100.0		1	1	60x66	57x62	N	N	N	N	A1.1	A
21	100.0		1	1	60x66	57x62	N	N	N	N	A1.1	A
22	100.0		1	1	60x66	57x62	--	N	N	N	E2	A
23	46.8		2	1							D	D
24			1	1							D	D
25			1	1							D	D
26	6.3		2	2					R	C	F1	E2
27	15.0		2	2					C	C	E2	E2
28	48.0		3	4					N & R	N & R	E1	E1
29	128.0		1	1	42wide	57wide			N	N	A1.1	A
30			1	1					C	N	D	D
31			1	1					C	C	D	D
32												

SUMITOMO KANZAKI PROPELLER PLANT	STRUCTURAL ANALYSIS TABLE	90.25 - 2041

BUILDING NUMBER		1000'S OF SQ. FT. PLAN AREA			NUMBER OF FLOORS			SIZE OF BAY IN FT		ROOF MATERIAL			COMBUSTIBILITY OF BUILDING			CONSTRUCTION TYPE	
		ACTUAL	REPORTED		ACTUAL	REPORTED		ACTUAL	REPORTED	ACTUAL	REPORTED		ACTUAL	REPORTED		ACTUAL	REPORTED
33					1	1				C	C		C	C		D	D
34					1	1							C	C		D	D
35					2	1				C	C		C	C		E2	D
36					1	1				C	C		C	C		D	D
37					1	1							C	C		D	D
38					1	1				C	C		C	C		D	D
39					1	1				C	C		C	C		D	D
40					1	1							C	C		D	D
41					1	1				N	N		N	N		D	D
42					1	1				N	N		N	N		D	D
43		84.0			3	4				N	N		N	N		E2	E1
44		84.0			3	4				N	R		N	R		E2	E1
45		50.0			1	1		60x66	57x62	N	N		N	N		B2	A
46		4.6			2	1				N	C		C	C		E2	D
47		4.6			1	1				N	C		C	C		D	D
48		6.5			2	2				N	C		C	C		E2	E2
49		6.5			2	2				N	C		C	C		E2	E2
50		23.6			2	2				N	C		C	C		E2	E2
51		15.8			2	2				N	C		C	C		E2	E2
52					3	4				R	R		R	R		E1	E1
53					1	1				N	C		C	C		D	D
54					2	3				R	R		R	R		E1	E1
55		5.0			1	1				N	C		C	C		D	D
56		4.6			1	1				N	C		C	C		D	D
57		8.5			1	1				N	N		C	N		A2,3	A
58		5.6			1	1				N	C		C	C		D	D
59		2.6			2	2				N	C		C	C		E2	E2
60		5.8			2	2				N	C		C	C		E2	E2
61					1	1				N	C		C	C		D	D
62		39.4			1	1				N	N		C	N		B2	A
63		5.5			2	2				N	C		C	C		E2	E2
64		11.7			2	2				N	C		C	C		E2	E2

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PHOTOGRAPHIC INTELLIGENCE — INDUSTRIAL ANALYSIS EXHIBIT F

90.25 - 2041 SUMITOMO PROPELLER PLANT

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SUMITOMO KANZAKI PROPELLER PLANT	STRUCTURAL ANALYSIS TABLE	90.25 - 2041

BUILDING NUMBER		1000'S OF SQ. FT. PLAN AREA			NUMBER OF FLOORS			SIZE OF BAY		ROOF MATERIAL			COMBUSTIBILITY OF BUILDING			CONSTRUCTION TYPE	
		ACTUAL	REPORTED		ACTUAL	REPORTED		ACTUAL	REPORTED	ACTUAL	REPORTED		ACTUAL	REPORTED		ACTUAL	REPORTED
65		10.9			2	2				N	C		C	C		E2	E2
66		4.5			2	1				N	C		C	C		D	D
67		7.4			2	2				N	C		C	C		E2	E2
68		19.5			2	2				N	C		C	C		E2	E2
69		21.0			2	2				N	C		C	C		E2	E2
70		4.9			1	1				N	C		C	C		D	D
71		4.9			1	1				N	C		C	C		D	D

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EXHIBIT F PHOTOGRAPHIC INTELLIGENCE — INDUSTRIAL ANALYSIS

SUMITOMO PROPELLER PLANT 90.25 - 2041

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90.25 - 2041 SUMITOMO PROPELLER PLANT

6. DAMAGE ASSESSMENT

a. D/A (See D/A Table).

b. Summary of Tabulation.

TABLE 4

	ACTUAL		REPORTED	
	Sq Ft	% Dam	Sq Ft	% Dam
Total Building Area			1,570,600	
Damage				
Structural	870,200	55	663,900	42
Superficial	178,500	11	168,800	11
Minor*	27,500	2	201,500	13
Total Damage	1,076,200	68	1,034,200	66

* In general, Minor Damage was purposely omitted in D/A reports.

c. Remarks.

Nearly all errors in the damage assessment were due to underestimation of both area and degree of incendiary damage.

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SUMITOMO PROPELLER PLANT 90.25 - 2041

DAMAGE ASSESSMENT TABLE

90.25 - 2041

SUMITOMO KANZAKI PROPELLER PLANT

BUILDING NUMBER	BUILDING AREA	STRUCTURAL (1000'S SQ. FT.)		SUPERFICIAL (1000'S SQ. FT.)		MINOR * (1000'S SQ. FT.)		REMOVED (1000'S SQ. FT.)	
		ACTUAL	REPORTED	ACTUAL	REPORTED	ACTUAL	REPORTED	ACTUAL	REPORTED
4h, i, k, l, m	27.0	27.0	27.0						
5	4.8	4.8	4.8						
6	4.0	4.0			1.0				
8a, b	14.0	14.0	14.0						
9a, b	14.0	14.0	14.0						
11	5.6	5.6	5.6						
12	7.0	7.0	7.0						
13a, b	20.8	20.8	20.8						
15a, b, d, e	28.0	28.0	28.0						
16a, b	12.4	12.4	12.4						
17a, b	11.6	11.6	11.6						
18	100.0	100.0	100.0						
20	100.0	5.5		36.5	38.0	2.5			
21	100.0	37.0		59.0	38.0	3.0	53.0		
22	100.0	100.0	100.0						
23a, b	46.8	46.8			19.8		27.0		
27a	6.3	6.3	6.3						
28a, b, c	15.0	15.0	15.0						
30	128.0	115.0		13.0	37.0		91.0		
43	84.0			28.0	21.5	12.0	6.5		
44	84.0	2.0		14.0	13.5	10.0	6.5		
45	50.0	50.0	50.0						
46	4.6	4.6	4.6						
47	4.6	4.6	4.6						
48	6.5	6.5	6.5						
49	6.5	6.5	6.5						
50	23.6	23.6	23.6						
51	15.8	15.8	15.8						
55	5.0	5.0	5.0						
56	4.6	4.6	4.6						
57b	8.5	8.5	8.5						
58	5.6	5.6	5.6						
59	2.6	2.6	2.6						

*In general, Minor Damage was purposely omitted in D/A reports.

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SUMITOMO KANZAKI PROPELLER PLANT

DAMAGE ASSESSMENT TABLE

90.25 - 2041

BUILDING NUMBER	BUILDING AREA	STRUCTURAL (1000'S SQ. FT.)			SUPERFICIAL (1000'S SQ. FT.)			MINOR * (1000'S SQ. FT.)			REMOVED (1000'S SQ. FT.)		
		ACTUAL	REPORTED	REPORTED	ACTUAL	REPORTED	REPORTED	ACTUAL	REPORTED	REPORTED	ACTUAL	REPORTED	REPORTED
60	5.8	5.8	5.8										
62	39.4	39.4	39.4										
63	5.5	5.5	5.5										
64	11.7	11.7	11.7										
65	10.9	10.9	10.9										
66	4.5	4.5	4.5										
67	7.4	7.4	7.4										
68	19.5	19.5	19.5										
69	21.0	21.0	21.0										
70	4.9	4.9	4.9										
71	4.9	4.9	4.9										
29a, b	48.0	20.0	24.0		28.0				24.0				

*In general, Minor Damage was purposely omitted in D/A reports.

PHOTOGRAPHIC INTELLIGENCE — INDUSTRIAL ANALYSIS EXHIBIT F

90.25 - 2041 SUMITOMO PROPELLER PLANT

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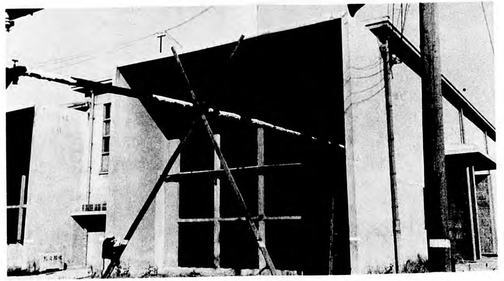
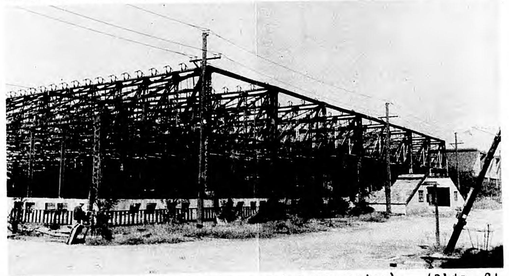
90.25 - 2041 SUMITOMO PROPELLER PLANT



A Propeller Testing (Bldg 3)

B Machine shop (hubs, pistons & cylinders). Compare with photo below of same type building with covering blown off.



C Machine shop (pistons and accessories). (Bldg 21 looking NW)

Reported
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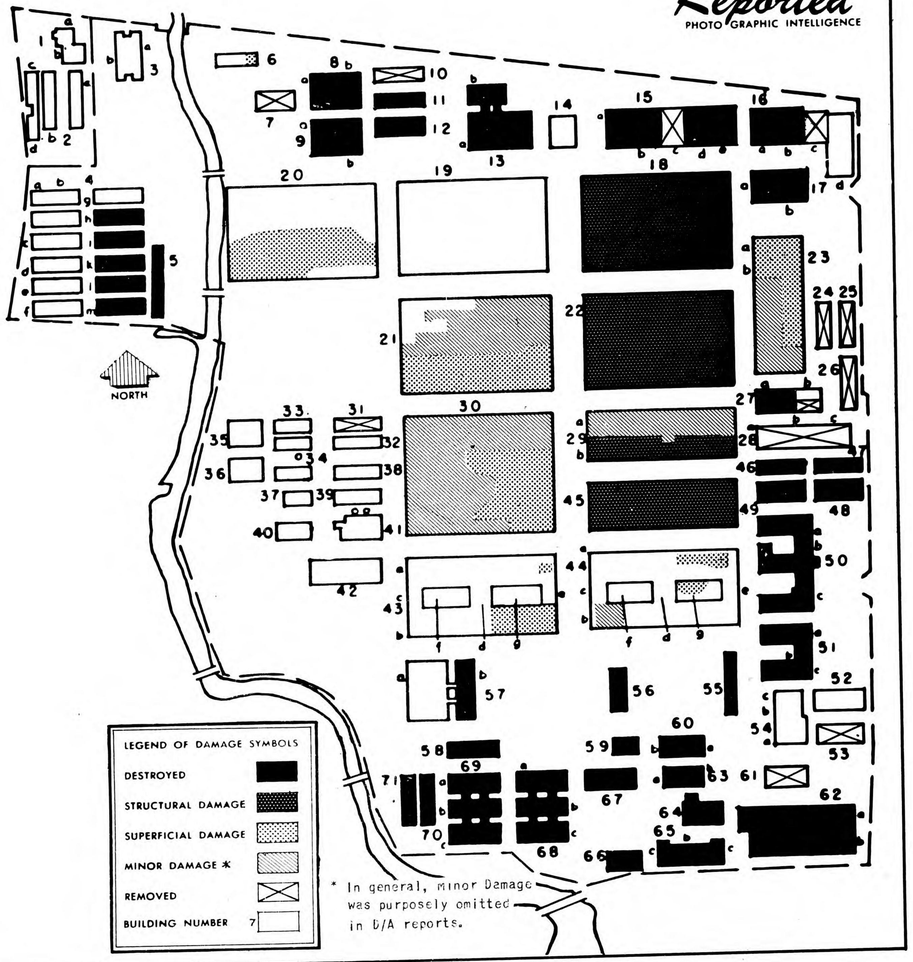
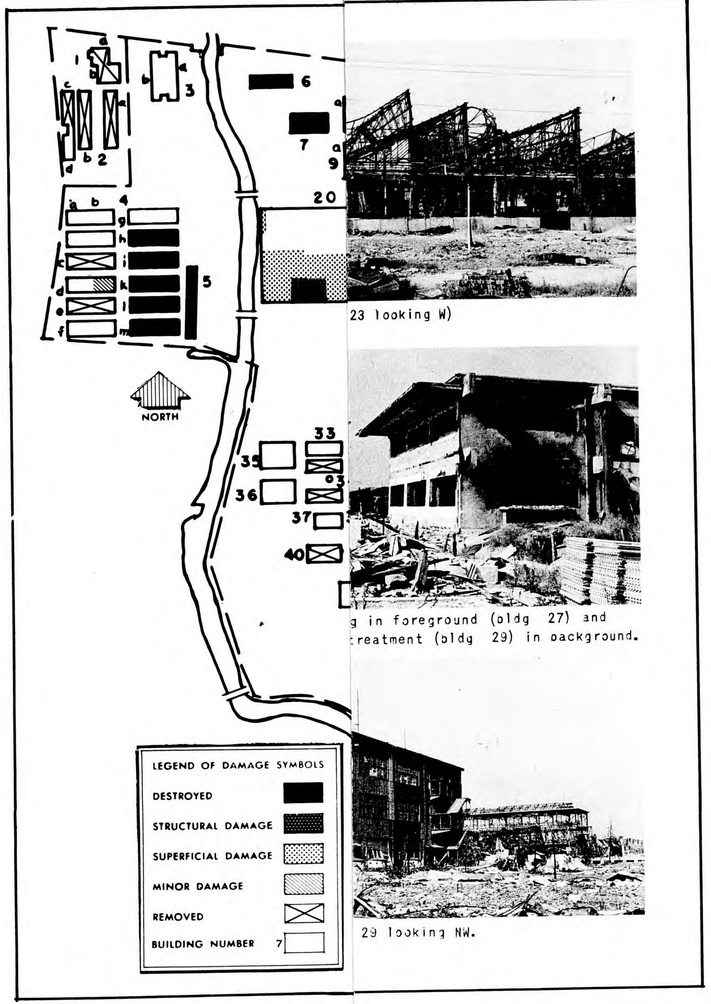


* In general, minor damage was purposely omitted in D/A reports.

ELLER PLANT 90.25 - 2041

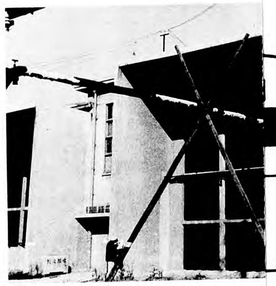


23 looking W)

g in foreground (bldg 27) and
treatment (bldg 29) in background.

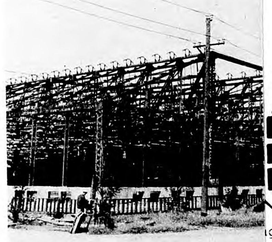
29 looking NW.

90.25 - 2041 SUMITOM



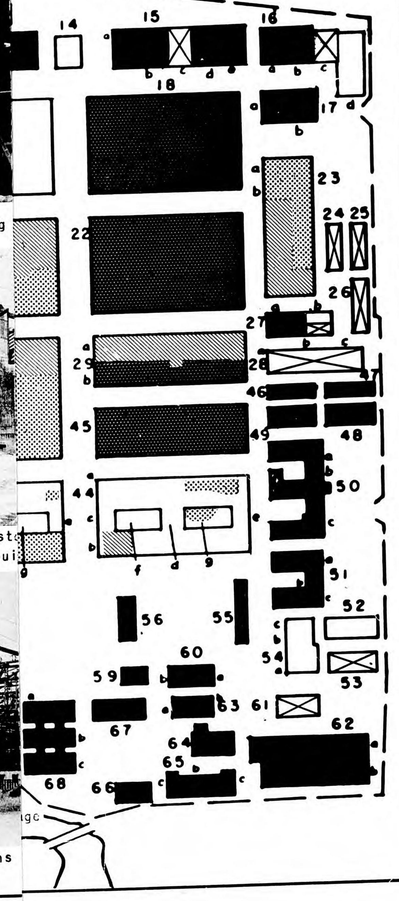
A Propeller Testing (Bldg

B Machine shop (hubs, pist
photo below of same type bui

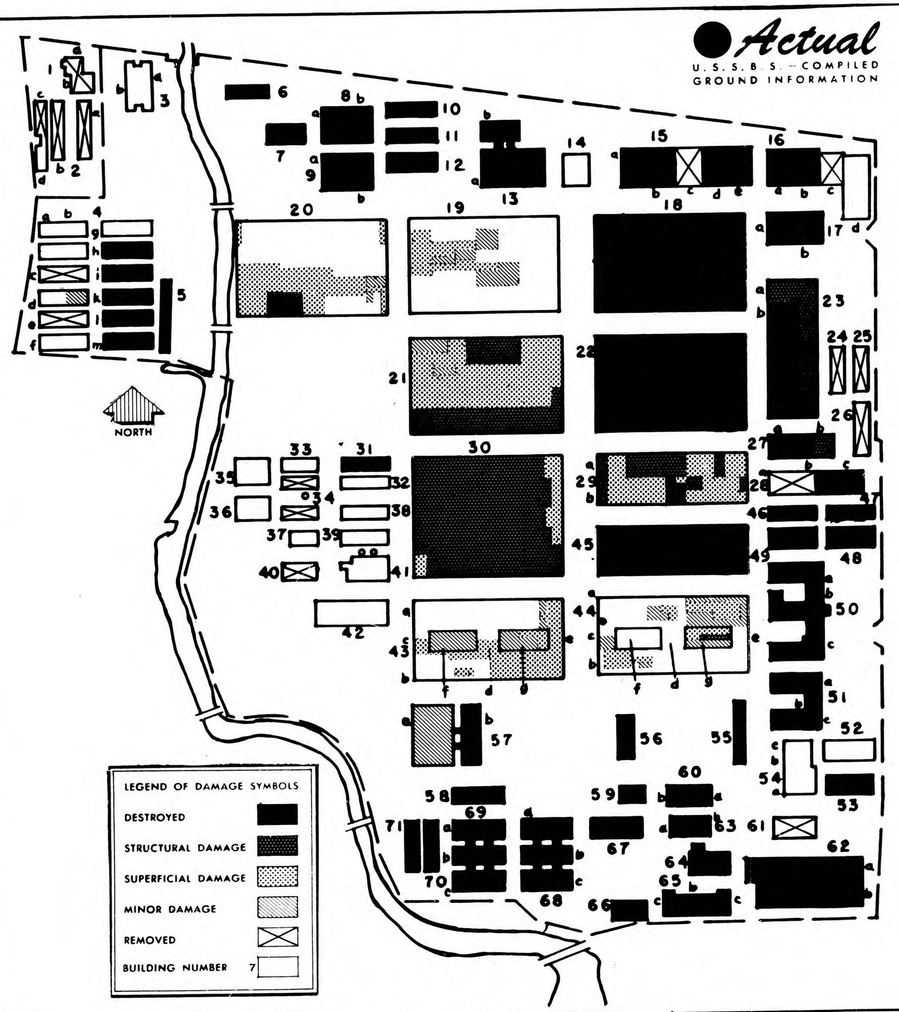


C Machine shop (pistons
looking NW)

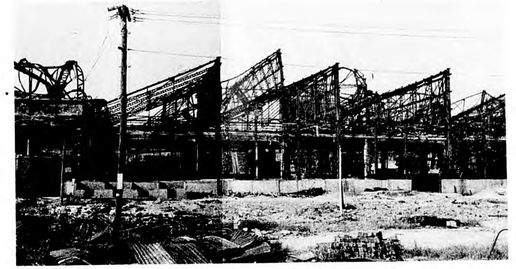
Reported
PHOTOGRAPHIC INTELLIGENCE



Actual
U. S. S. B. S. — COMPILED
GROUND INFORMATION



SUMITOMO PROPELLER PLANT 90.25 - 2041



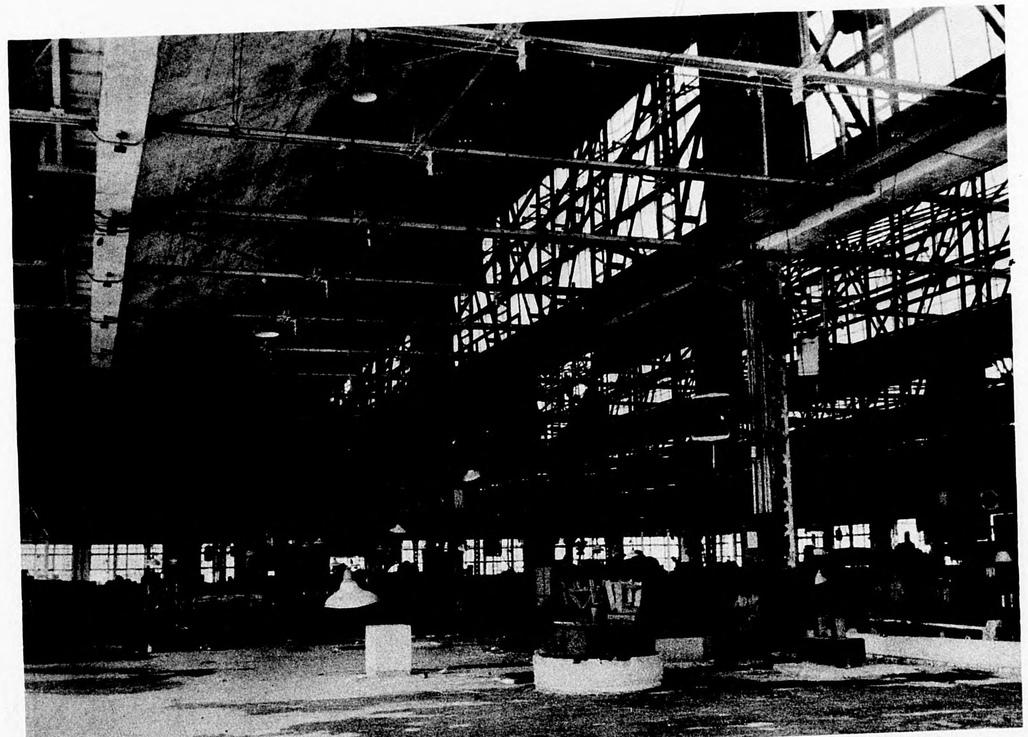
D Machine tools (bldg 23 looking W)

E Experimental building in foreground (bldg 27) and plate shop and heat treatment (bldg 29) in background.

F Buildings 44, 45 and 29 looking NW.

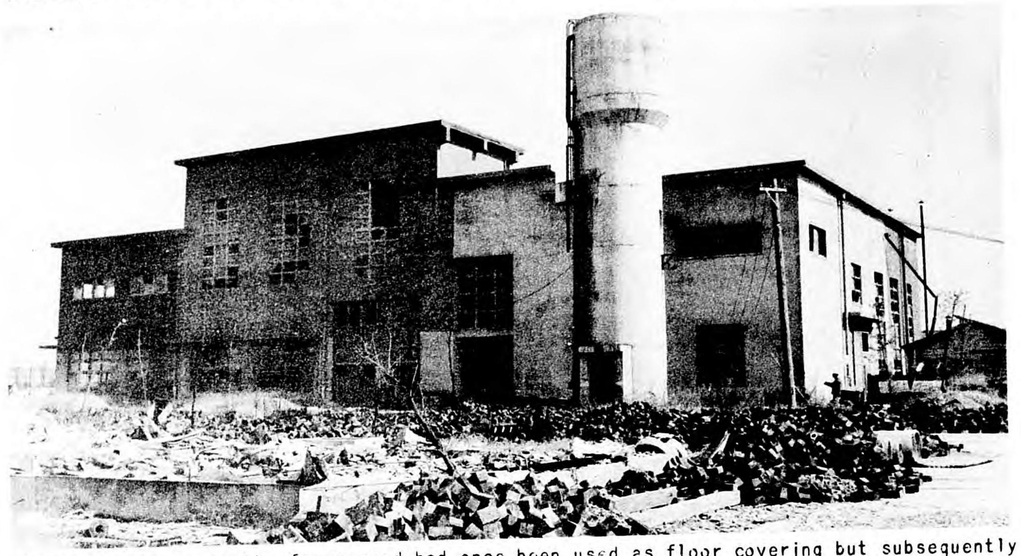
SUMITOMO PROPELLER PLANT 90.25 - 2041

The Sumitomo Kanzaki Propeller Plant near Osaka had some buildings which theoretically were non-combustible. These structures had concrete floors, concrete walls to the window sills, exposed steel frames covered with corrugated metal or asbestos and glass windows. From aerial photographic study these buildings would not have supported a fire of any general intensity. On ground investigation, it was found that the floors had been covered with wood blocks, in many areas soaked by oil from the machines. To insulate the buildings against heat loss in winter, a fibre insulation board made of wood shavings and cement was placed on the interior of all corrugated surfaces. When incendiary bombs started a fire on the floors or roof it produced a fire which was intense enough to cause severe and disastrous buckling and collapse of the supporting steel framing.



Wooden blocks have been removed from the floor but fiber board ceiling remains. (Building 19 looking Northwest)

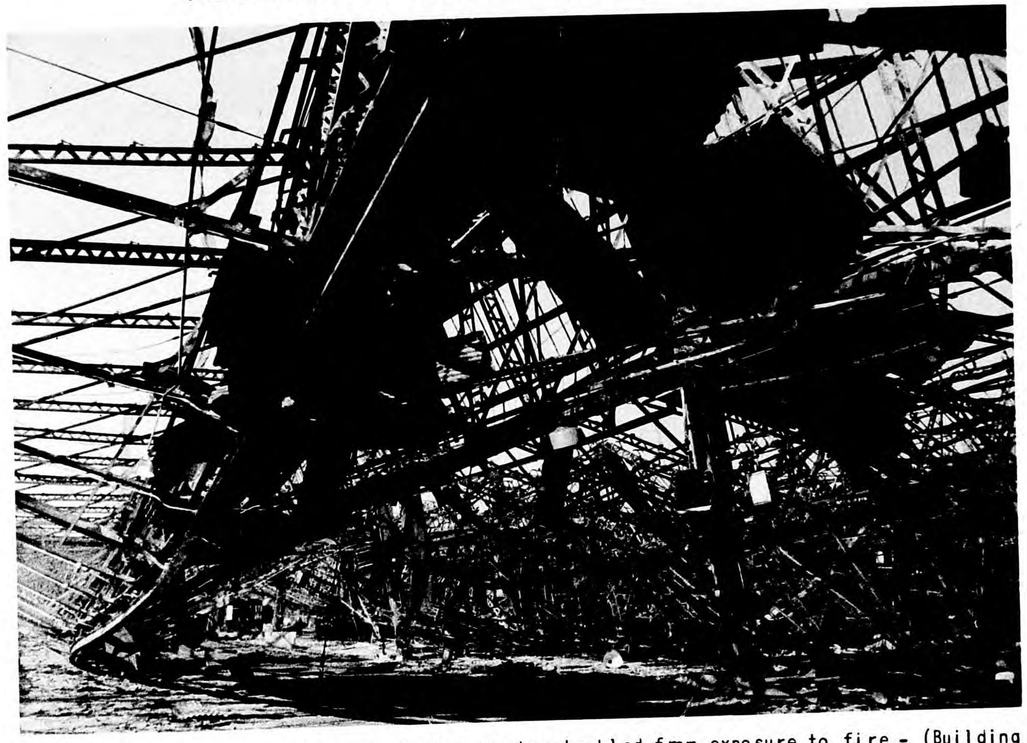
90.25 - 2041 SUMITOMO PROPELLER PLANT



H Wooden blocks in the foreground had once been used as floor covering but subsequently were removed as fire hazards - (Building 54)

I Close-up view of fiber board ceiling. (Building 19)

SUMITOMO PROPELLER PLANT 90.25 - 2041



J Steel framework extending over long spans has buckled from exposure to fire - (Building 18 looking Northwest)

K Outside columns have bent from heat and spreading collapse. (Building 18)

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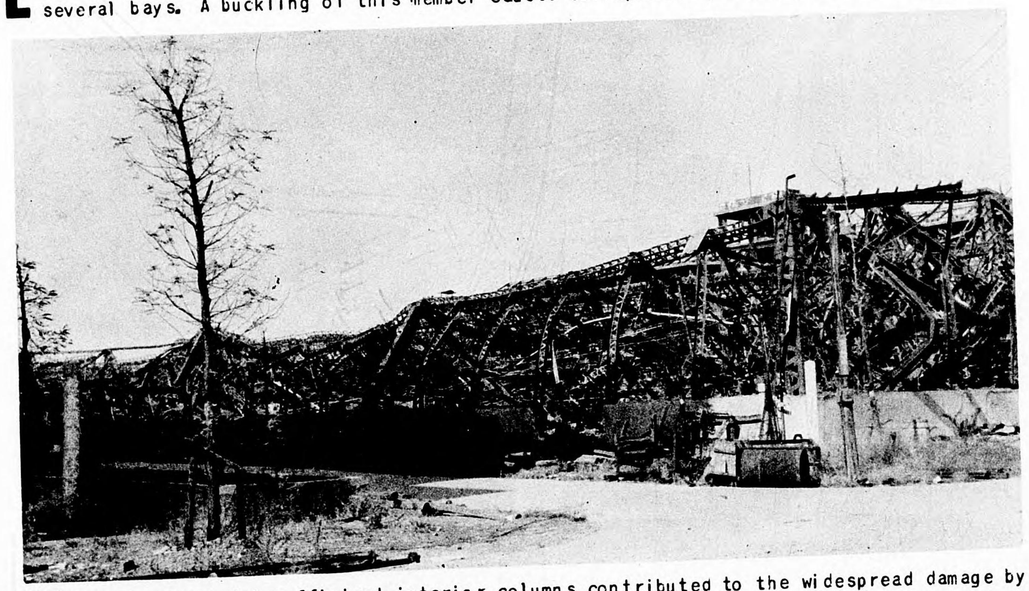
90.25 - 2041 SUMITOMO PROPELLER PLANT

The small lattice girder connecting the sawtooth peaks took the compressive stress of several bays. A buckling of this member caused collapse of great areas. (Building 22)



Large spans and insufficient interior columns contributed to the widespread damage by fire. (Building 45 looking Northwest)

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EXHIBIT G

ATSUTA FACTORY, NAGOYA ARSENAL

90.20-197

LAT. 35° 08 'N - LONG. 136° 55 'E

NAGOYA, JAPAN

See Exhibit P for abbreviations used in this exhibit.

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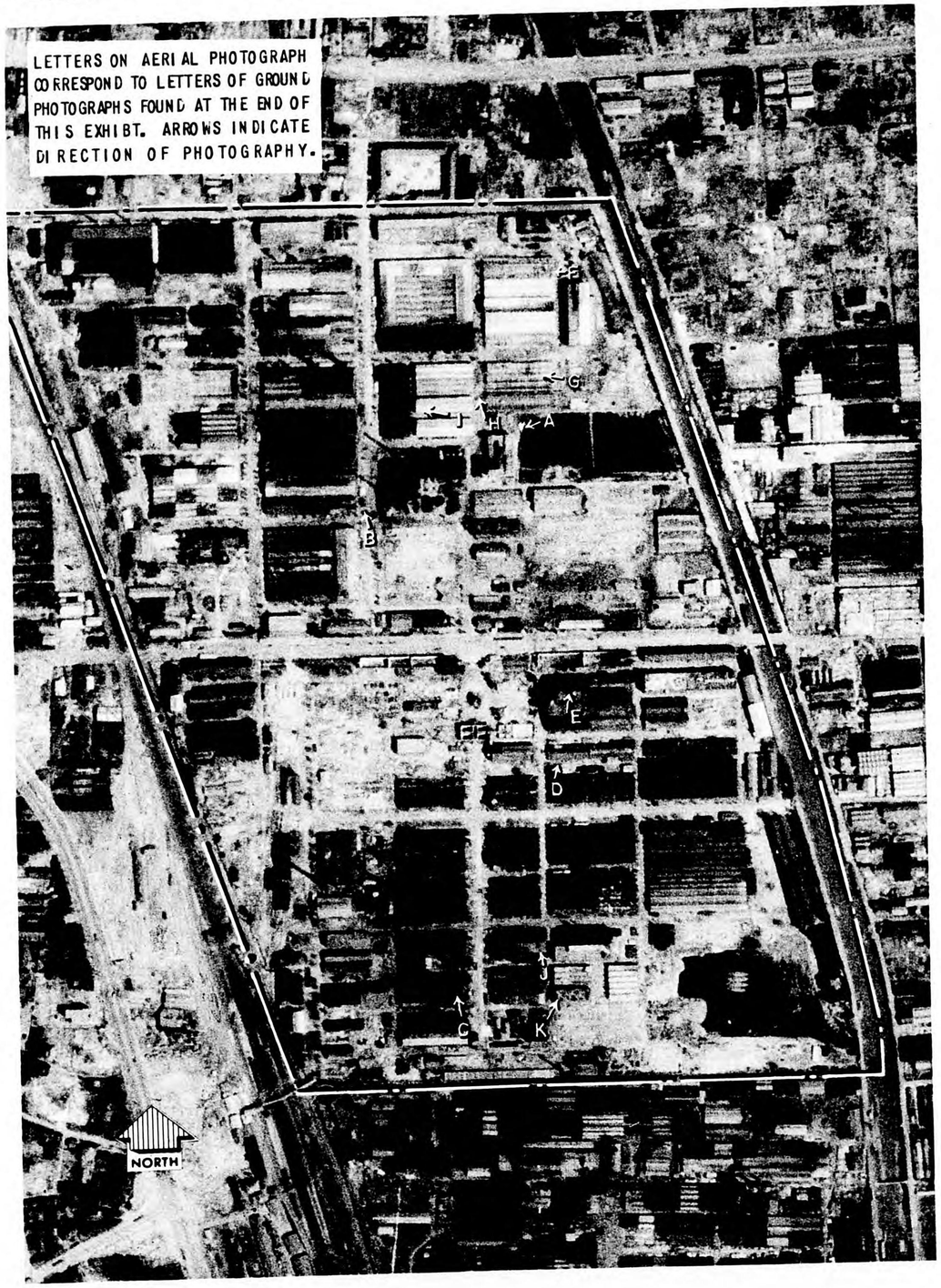
90.20-197 ATSUTA FACTORY, NAGOYA ARSENAL



ATSUTA FACTORY, NAGOYA ARSENAL

1. DESCRIPTION OF TARGET

a. This was one of four major arsenals in Japan. Designed originally as a weapons factory, it was converted in 1939 to aircraft production. In 1943, the plant was reconverted to ammunition and weapons manufacturing.

b. The arsenal is located in the south central section of Nagoya City, approximately 3 miles northeast of Nagoya Harbor.

c. The plant comprises 112 listed structures which have a total built-up area of approximately 2,299,000 square feet.

2. SUMMARY

a. The interpretation of building functions for all buildings was poor. Field data is available for all the 112 buildings reported upon. Of these there were:

(1) 27 identified correctly
(2) 29 identified as having similar occupancy
(3) 31 unidentified
(4) 25 identified incorrectly

b. The overall structural analysis was poor. A comparison of 88 buildings shows that 42 were correctly classified as to construction type, and 47 of the 65 combustible buildings were reported as such. Building combustibility was underestimated to some extent because of the Japanese use of wood framing in buildings normally steel-framed.

c. The total damage assessment was good. There was, however, a tendency to underestimate the degree of damage. Only 673,900 sq ft of the 725,800 sq ft of structural damage was reported, while the 163,000 sq ft of reported superficial damage is 24,500 sq ft more than the actual figure.

3. SOURCE OF DATA

a. Reported

(1) JTG Sheet 90.20-197 P6, 12 March 1945
(2) AC/AS Intelligence Limited Damage Report #37, 4 July 1945

b. Field Data

(1) USSBS (G-2, PIC) field notes and Japanese plans, building areas, and damage data.

ATSUTA FACTORY, NAGOYA ARSENAL

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4. FUNCTIONAL ANALYSIS

a. Use of Plant

Reported: Manufacture of medium and heavy field artillery and anti-aircraft guns.
Actual: Manufacture of artillery and shell casings.

b. Boundaries

c. Building Identifications (F/A Table)

d. Summary of Tabulation

TABLE I

F/A ACCURACY FACTOR		PRIMARY BUILDINGS No. Bldgs.	PRIMARY BUILDINGS %	TOTAL BUILDINGS No. Bldgs.	TOTAL BUILDINGS %
Total Plant 55	Correct	5	27	27	24
Primary Buildings 56.8	Of Similar Occupancy	6	32	29	26
	Unidentified	0	-	31	28
	Incorrect	8	41	25	22
	Total	19	100	112	100

e. Remarks

This plant was converted from an arsenal to an aircraft factory and back again to an arsenal. As a result of these changes many buildings were used for purposes other than for which designed, and consequently, functional analysis was very difficult.

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ATSUTA FACTORY, NAGOYA ARSENAL

FUNCTIONAL ANALYSIS TABLE

ATSUTA FACTORY OF NAGOYA ARSENAL — 90.20-197

BUILDING NUMBER	PRIMARY	REPORTED FUNCTION	ACTUAL FUNCTION	EVALUATION: CORRECT	SIMILAR	UNIDENT	WRONG	F/A ACCURACY FACTOR
1		Unidentified	Transmitter - Sub station			x		45
2		Possible foundry	Press shop - 75 mm Shells		x			60
3		Machine Shop	Metal Cutting shop		x			70
4		Possible Storage	Warehouses	x				85
5		Possible Storage	Warehouses	x				85
6		Possible Storage	Bath house				x	15
7		Unidentified	Hydraulic Power House				x	45
8		Assembly type Bldg	Hydraulic Press Shop		x			30
9		Unidentified	Final Assembly				x	45
10		Forge or Foundry type Bldg	Mold Shop				x	15
11		Forge or Foundry type Bldg	Rolling Mill			x		70
12		Possible boiler house	Dye Making Shop				x	15
13		Storage	Shell finishing				x	15
14		Storage	Forging			x		75
15		Possible foundry	Press Shop 37mm		x			100
16		Storage	Warehouse		x			100
17		Storage	Warehouse		x			100
18		Storage	Paint Shop				x	15
19	x	Machine Shop or Assembly	Machine Shop		x			90
20		Possible Machine Shop	Heat Treat & Warehouse				x	45
21		Unidentified	Final Assembly		x			85
22	x	Assembly Type Bldg	Press Shop				x	70
23	x	Machine Shop	Press Shop				x	70
24	x	Machine Shop	Sand & Water Washing				x	45
25		Unidentified	Press Shop				x	30
26	x	Assembly Type Bldg	Hydraulic Pump				x	45
27		Unidentified	Boiler Room				x	45
28		Unidentified	Friction Press Shop				x	30
29		Assembly Type Bldg	Sub Station				x	45
30		Unidentified	Oil Recovery				x	45
31		Unidentified						

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ATSUTA FACTORY OF NAGOYA ARSENAL

FUNCTIONAL ANALYSIS TABLE

90.20-197

BUILDING NUMBER	PRIMARY	FUNCTION REPORTED	FUNCTION ACTUAL	EVALUATION CORRECT	SIMILAR	UNIDENT	WRONG	F/A ACCURACY FACTOR
32		Unidentified	Warehouse		x			45
33		Unidentified	Warehouse		x			45
34		Unidentified	Kitchen		x			45
35		Unidentified	School		x			45
36		Warehouse	Water Well				x	10
37		Warehouse	Nursery (Child)				x	0
38		Warehouse	Garage		x			70
39		Warehouse	Guard House		x			70
40		Warehouse	Canteen				x	10
41		Unidentified	School Auditorium			x		45
42		Unidentified	Laboratory			x		45
43	x	Machine Shop	Machine Shop	x				100
44		Warehouse	Offices				x	15
45		Warehouse	Warehouse	x				100
46	x	Assembly Bldg	Machine Shop		x			70
47		Warehouse	Inspection of incoming material		x			85
48		Prob. Ad. Bldg	Hospital		x			85
49		Prob. Ad. Bldg	Hospital		x			85
50		Prob. Ad. Bldg	Club House		x			85
51		Warehouse	Mess Storage	x				90
52		Warehouse	Mess Storage	x				90
53		Warehouse	Canteen		x			85
54		Warehouse	Machine Repair & Maintenance		x			85
55		Warehouse	Machine Repair & Maintenance		x			70
56		Warehouse	Warehouse	x				100
57		Warehouse	Print Shop		x			70
58		Unidentified	Weapon Storage				x	45
59		Unidentified	Warehouse				x	45
60	x	Machine Shop & Assembly	Weapon Storage				x	15
61	x	Machine Shop & Assembly	Weapon Storage				x	15
62	x	Machine Shop & Assembly	Material Warehouse				x	15

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PHOTOGRAPHIC INTELLIGENCE — INDUSTRIAL ANALYSIS EXHIBIT G
90.20-197 ATSUTA FACTORY, NAGOYA ARSENAL
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ATSUTA FACTORY OF NAGOYA ARSENAL

FUNCTIONAL ANALYSIS TABLE

90.20-197

BUILDING NUMBER	PRIMARY	FUNCTION REPORTED	FUNCTION ACTUAL	EVALUATION CORRECT	SIMILAR	UNIDENT	WRONG	F/A ACCURACY FACTOR
63		Assembly Type Bldg	Office				x	10
64		Unidentified	Fire House		x			45
65		Unidentified	Warehouse		x			45
66		Warehouse	Warehouse	x				100
67		Prob. Office Bldg	Mess Hall		x			65
68		Prob. Office Bldg	Equipment		x			65
69		Prob. Office Bldg	Offices	x				100
70		Assembly Type Bldg	Offices				x	10
71		Assembly Type Bldg	Equipment		x			60
72		Assembly Type Bldg	Lumber Drying		x			60
73		Old Hanger	Assembly			x		50
74		Warehouse	Warehouse	x				100
75		Warehouse	Warehouse	x				100
76		Unidentified	Accessories for 79-82				x	45
77		Unidentified	Garage				x	45
78		Warehouse	Warehouse	x				100
79		Unidentified	37mm & Artillery Manuf				x	45
80		Warehouse	Mess Hall				x	25
81		Warehouse	Warehouse		x			100
82	x	Machine Shop	Artillery Manufacture	x				85
83	x	Machine Shop	Tool & Equip Shop			x		85
84	x	Machine Shop	Accessory Manufacture		x			80
85	x	Machine Shop	Tool & Equip. Shop			x		85
86	x	Machine Shop	Accessory finishing	x				90
87	x	Assembly Type Bldg	Hydraulic Press Bldg				x	25
88		Unidentified	Forge				x	45
89		Possible Power House	Boiler House		x			90
90		Unidentified	Warehouse				x	45
91		Unidentified	Warehouse				x	45
92		Unidentified	Warehouse				x	45
93		Unidentified	Warehouse				x	45

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EXHIBIT G PHOTOGRAPHIC INTELLIGENCE — INDUSTRIAL ANALYSIS
90.20-197 ATSUTA FACTORY, NAGOYA ARSENAL
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FUNCTIONAL ANALYSIS TABLE

ATSUTA FACTORY OF NAGOYA ARSENAL — 90.20-197

BUILDING NUMBER	PRIMARY	FUNCTION REPORTED	ACTUAL	EVALUATION: CORRECT	SIMILAR	UNIDENT	WRONG	F/A ACCURACY FACTOR
94		Probable Storage	Warehouse	x				95
95		Prob. Storage	Warehouse	x				95
96		Prob. Storage	Auditorium		x			65
97		Prob. Storage	Warehouse	x				95
98		Prob. Storage	Warehouse	x				95
99		Prob. Storage	Mess Hall				x	20
100		Assembly Type Bldg	Forge				x	15
101		Assembly Type Bldg	Forge				x	15
102		Assembly Type Bldg	Paint Shop		x			70
103		Assembly Type Bldg	Wood Drying		x			70
104		Unidentified	Casting Bldg				x	45
105		Unidentified	Casting Bldg				x	45
106		Machine Shop or Assembly	Sub Station				x	15
107	x	Machine Shop or Assembly	Crate lumber				x	15
108	x	Unidentified	Crate lumber				x	15
109		Unidentified	Boiler House				x	45
110		Unidentified	Boiler House				x	45
111		Warehouse	Warehouse		x			100
112		Unidentified	Unidentified				x	45

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5. STRUCTURAL ANALYSIS

a. Check on Scale Measurement

No scale check made.

b. S/A (See S/A Table)

c. Summary of Tabulation

(1) Construction Types

TABLE 2

Construction Type	PRIMARY BUILDINGS No. Bldgs	PRIMARY BUILDINGS No. Corr	PRIMARY BUILDINGS % Corr	TOTAL BUILDINGS No. Bldgs	TOTAL BUILDINGS No. Corr	TOTAL BUILDINGS % Corr
Wood Frame (W)	9	6	67	48	32	67
Steel Frame (S)	2	1	50	14	9	64
Reinforced Concrete (R/C)	6	0	0	26	1	4
Total	17	7	41	88	42	48

(2) Combustibility

TABLE 3

Building Combustibility	PRIMARY BUILDINGS No. Bldgs	PRIMARY BUILDINGS No. Corr	PRIMARY BUILDINGS % Corr	TOTAL BUILDINGS No. Bldgs	TOTAL BUILDINGS No. Corr	TOTAL BUILDINGS % Corr
Combustible (C)	14	10	71	65	47	72
Non-combustible (N)	3	2	67	14	6	43
Fire-Resistant (R)	0	-	-	9	1	11
Total	17	12	70	88*	54	62

d. Remarks

(1) Identification of the number of floors was fairly accurate. There was a tendency to overestimate the number of floors in the large buildings and to underestimate in the small.

(2) Analysis of roof material was only fair. Many corrugated asbestos roofs were reported as combustible, and many wooden roofs as non-combustible.

(3) In determination of construction types, the greatest error was in reporting wooden structures and load-bearing wall buildings as steel-framed.

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ATSUTA FACTORY OF NAGOYA ARSENAL

STRUCTURAL ANALYSIS TABLE

90.20-197

BUILDING NUMBER		1000'S OF SQ. FT. PLAN AREA			NUMBER OF FLOORS			SIZE OF BAY		ROOF MATERIAL			COMBUSTIBILITY OF BUILDING			CONSTRUCTION TYPE	
	Primary	ACTUAL	REPORTED		ACTUAL	REPORTED		ACTUAL	REPORTED	ACTUAL	REPORTED		ACTUAL	REPORTED		ACTUAL	REPORTED
1					1	1				Conc	C		R	C		R/C	W
2					1	1				SM	N		C	N		S	S
3	X				1	1				W	N		C	N		W	S
4					1	2				CA	C		C	C		W	W
5					1	2				CA	C		C	C		W	W
6					1	1				CA	C		C	C		W	W
7					1	3				CA	N		C	N		W	S
8					1	1				W	N		C	N		W	S
9					1	2				SM	N		N	N		Load B	S
10					1	1				W	N		C	N		W	S
11					1	1				W	C		C	C		Load B	W
12					1	1				W	N		C	N		W	S
13					1	1				W	N		C	N		W	S
14					1	1				SM	C		N	C		S	W
15					2	1				CA&W	N		C	C		W	W
17					1	1				CA	C		C	C		Load B	W
19	X				1	1				CA	C		C	C		B&S	W
21					1	1				SM	C		N	C		S	W
22	X				2	1				SM	C		C	C		W	W
23	X				1	1				W	N		C	N		S	S
24a	X				1	1				W	N		C	N		W	S
b	X				1	1				SM	N		N	N		Load B	S
26	X				1	2				W	N		C	N		W	S
27					1	1				W	N		C	N		W	S
28					1	2				W	C		C	C		Load B	W
29					1	2				W	N		C	N		W	S
31					1	1					N		C	N		W	S
32					2	1				W	C		C	C		W	W
33					1	1				W	C		C	C		W	W
34					1	1				W	N		C	N		W	S
35										W	C		C	C		W	W
36					2	1				R/C	C		R	C		R/C	W

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EXHIBIT G PHOTOGRAPHIC INTELLIGENCE — INDUSTRIAL ANALYSIS

90.20-197 ATSUTA FACTORY, NAGOYA ARSENAL

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ATSUTA FACTORY OF NAGOYA ARSENAL

STRUCTURAL ANALYSIS TABLE

90.20-197

BUILDING NUMBER		1000'S OF SQ. FT. PLAN AREA			NUMBER OF FLOORS			SIZE OF BAY		ROOF MATERIAL			COMBUSTIBILITY OF BUILDING			CONSTRUCTION TYPE	
	Primary	ACTUAL	REPORTED		ACTUAL	REPORTED		ACTUAL	REPORTED	ACTUAL	REPORTED		ACTUAL	REPORTED		ACTUAL	REPORTED
37													C	C		W	W
38					1	1				CA	C		C	C		W	W
39					2	1				W	C		C	C		W	W
41					1	1				CA	C		C	C		W	W
42					2	1					No Data J I C						
43										W	C		C	C		W	W
44					2	2				W	C		C	C		W	W
45					1	1				CA	C		C	C		Conc	W
46	X				2	2				W	C		C	C		W	W
48					1	1				W	C		C	C		W	W
49					1	1				W	C		C	C		W	W
51					1	2				W	C		C	C		Load B	W
52					2	2				Conc	C		N	C		Load B	W
53					1	1				SM	C		C	C		Load B	W
54					1	1				CA&W	N		C	N		W	S
58					1	1	1			W	C		C	C		W	W
59					-	-				W	C		C	C		W	W
60	X				-	-				W	C		C	C		W	W
61	X				-	-				Conc	C		R	C		Conc	W
64					2	1				Conc	C		R	C		Conc	W
65					1	1				CA&W	C		C	C		Load B	W
66					1	1				SM&W	C		C	C		Conc	W
69					2	2				SM	C		C	C		W	W
70					2	1				W	C		C	C		W	W
71					-	-				Conc	C		R	C		Load B	W
72					1	1				SM	N		N	N		S	S
73					1	1				CA	C		N	C		Load B	W
74					1	2				T	C		C	C		Load B	W
75					2	2				Conc	R		R	R		Conc	Conc
76					2	2				CA	C		C	C		W	W
78					1	1				W	N		C	N		S	S
79					2	2											

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EXHIBIT G PHOTOGRAPHIC INTELLIGENCE — INDUSTRIAL ANALYSIS

90.20-197 ATSUTA FACTORY, NAGOYA ARSENAL

STRUCTURAL ANALYSIS TABLE

90.20-197

ATSUTA FACTORY
OF NAGOYA ARSENAL

BUILDING NUMBER	1000'S OF SQ. FT. PLAN AREA		NUMBER OF FLOORS		SIZE OF BAY		ROOF MATERIAL		COMBUSTIBILITY OF BUILDING		CONSTRUCTION TYPE	
	Primary ACTUAL	REPORTED	ACTUAL	REPORTED	ACTUAL	REPORTED	ACTUAL	REPORTED	ACTUAL	REPORTED	ACTUAL	REPORTED
80			1	1			T&W	C	C	C	W	W
81			1	1			T&W	C	C	C	W	W
82	X		2	2			CA&W	C	C	C	S&Conc	W
83	X		1	1			SM	C	C	C	Load B	W
84	X		2	2			SM&W	C	C	C	W	W
85	X		1	1			SM	N	N	N	Load B	S
87	X		1	1			SM	N	C	N	W	S
88			1	1			SM	N	C	N	W	S
89			1	1			SM	C	N	C	S	W
90			1	1			W	C	C	C	W	W
93			1	1			SM	C	N	C	S	W
94			1	1			SM	C	N	C	S	W
95			1	1			SM	C	C	C	W	W
96			1	1			W	C	C	C	W	W
98			1	1			SM	N	C	N	S	S
100			1	1			W	C	C	N	S	W
101			1	1			R/C	C	R	C	R/C	W
103			1	1			W	N	C	C	S	S
104			1	1			SM	N	N	N	Load B	S
105			1	1			R/C	N	R	N	R/C	S
106			3	1			SM	C	N	C	S	W
107	X		1	1			SM	C	C	C	W	W
109			1	1			SM&W	C	C	C	W	W
111			1	1			C	C	C	C	Conc	W
112			2	2			Conc	C	R	C		

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6. DAMAGE ASSESSMENT

a. D/A (See D/A Table)

b. Summary of Tabulation

TABLE 4

	ACTUAL		REPORTED	
	Sq ft	%Dam	Sq Ft	% Dam
Total Building Area			2,229,800	
Damage				
Structural	725,800	33	673,900	30
Superficial	138,500	6	163,000	7
Total Damage	864,300	39	836,900	37

In general, Minor Damage was purposely omitted in D/A reports.

c. Remarks

(1) Damage assessment was fairly accurate.

(2) The greatest error was in underestimating the amount of structural damage to primary buildings.

(3) AC/AS Intelligence damage assessment report contained no diagram of damage to plant, therefore no diagramatic comparison of "ACTUAL" damage to "REPORTED" damage is made in this report on the plant. A diagram of "ACTUAL" damage only is shown.

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ATSUTA FACTORY OF NAGOYA ARSENAL

DAMAGE ASSESSMENT TABLE

90.20-197

BUILDING NUMBER	Primary	BUILDING AREA 1000'S SQ. FT.	STRUCTURAL (1000'S SQ. FT.) ACTUAL	STRUCTURAL REPORTED	STRUCTURAL REPORTED	SUPERFICIAL (1000'S SQ. FT.) ACTUAL	SUPERFICIAL REPORTED	SUPERFICIAL REPORTED	(1000'S SQ. FT.) ACTUAL	(1000'S SQ. FT.) REPORTED	(1000'S SQ. FT.) REPORTED	REMOVED (1000'S SQ. FT.) ACTUAL	REMOVED REPORTED	REMOVED REPORTED
1		13.0							In general, Minor Damage was purposely omitted in D/A reports.					
2		81.8												
3	x	40.8												
4		13.0					.3					13.0		
5		22.3		4.8								22.3	22.3	
6		9.1	9.1	9.1										
7		13.3	1.5			15.8	15.8							
8a		7.7	7.7				7.7							
b		12.1	12.1				12.1							
c		12.1				12.1	2.4							
d		12.1				12.1	.9							
e		12.1				12.1	.1							
f		12.1	5.5			6.6								
9		84.4	63.8	31.5			32.3							
10		24.6										15.0		
11		50.4												
12		6.7												
13		6.7										2.0		
14a		4.9		2.8										
b		5.6	5.6				5.6							
c		5.0												
15		32.3												
16		13.7		13.7										
17		7.8	7.8	7.8										
18		12.0	12.0	12.0										
19	x	29.0	29.0	9.0										
20		16.2												
21		7.4												
22	x	38.3										5.7		
23	x	95.3					5.7					11.4		
24	x	34.2										24		
25		24.0												
26	x	30.6				1.3								

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ATSUTA FACTORY OF NAGOYA ARSENAL

DAMAGE ASSESSMENT TABLE

90.20-197

BUILDING NUMBER	Primary	BUILDING AREA 1000'S SQ. FT.	STRUCTURAL (1000'S SQ. FT.) ACTUAL	STRUCTURAL REPORTED	STRUCTURAL REPORTED	SUPERFICIAL (1000'S SQ. FT.) ACTUAL	SUPERFICIAL REPORTED	SUPERFICIAL REPORTED	(1000'S SQ. FT.) ACTUAL	(1000'S SQ. FT.) REPORTED	(1000'S SQ. FT.) REPORTED	REMOVED (1000'S SQ. FT.) ACTUAL	REMOVED REPORTED	REMOVED REPORTED
27		10.8												
28		21.6												
29a		11.0	11.0	4.5			6.5							
b		15.4	7.0	1.1		8.4								
c		11.0	1.0			10.0	11.9							
30		9.0												
31		12.4					12.4							
32		10.9				.6	10.9							
33		8.8		5.8			3.0							
34		18.9												
35		30.0	30.0	30.0										
36		5.0	5.0	30.0										
37		3.4	3.4	3.4										
38		4.2		4.2										
39		5.5	3.0									4.3		
40		4.3												
41		12.3	7.5	7.5										
42		9.8												
43		43.7	43.7	43.7										
44-45-46		81.6										8.4		
47		10.2												
48		7.0	7.0	7.0										
49		5.3	5.3	5.3										
50		4.0												
51		5.2	3.2	3.2										
52		8.1												
53		20.0	3.5	4.0			6.3							
54		24.0												
55		15.8	15.8	15.8										
56		8.8	3.8	3.8										
57		8.1	8.1	8.1										
58		5.0												
59		29.1	29.1	29.1										

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ATSUTA FACTORY OF NAGOYA ARSENAL

DAMAGE ASSESSMENT TABLE

90.20-197

BUILDING NUMBER	Primary	BUILDING AREA 1000'S SQ. FT.	STRUCTURAL (1000'S SQ. FT.) ACTUAL	STRUCTURAL (1000'S SQ. FT.) REPORTED	STRUCTURAL (1000'S SQ. FT.) REPORTED	SUPERFICIAL (1000'S SQ. FT.) ACTUAL	SUPERFICIAL (1000'S SQ. FT.) REPORTED	SUPERFICIAL (1000'S SQ. FT.) REPORTED	(1000'S SQ. FT.) ACTUAL	(1000'S SQ. FT.) REPORTED	(1000'S SQ. FT.) REPORTED	REMOVED (1000'S SQ. FT.) ACTUAL	REMOVED (1000'S SQ. FT.) REPORTED	REMOVED (1000'S SQ. FT.) REPORTED
60	x	24.0	24.0	24.0										
61	x	22.8	22.8	22.8										
62	x	18.0	18.0	18.0										
63		6.8	6.8	6.8										
64		7.3	3.2	3.7			3.6							
65		9.6	4.8	4.8										
66		9.5	9.5	9.5										
67		11.7	11.7	11.7										
68		6.0	6.0	6.0										
69		6.8	1.4											
70		15.8	5.3			10.5	15.8							
71		26.1	26.1	26.1										
72		14.5				.7								
73		50.0												
74		15.0	12.0	15.0		3.0								
75		11.6	11.6	11.6										
76		20.3												
77		13.1	13.1	13.1										
78		9.5	9.5	6.0										
79		61.5	15.0	14.7		25.7								
80		10.5	10.5	10.5										
81		25.9	25.9	25.9										
82	x	94.7												
83	x	33.0	30.5	17.6		2.5	8.2							
84	x	22.4												
85	x	21.5										19.8		
86	x	19.8		19.8										
87	x	51.5												
88		32.3	14.6	6.8										
89		11.8												
90		14.4												
91		12.0	12.0	12.0										
92		3.4	3.4	3.4										

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ATSUTA FACTORY OF NAGOYA ARSENAL

DAMAGE ASSESSMENT TABLE

90.20-197

BUILDING NUMBER	Primary	BUILDING AREA 1000'S SQ. FT.	STRUCTURAL (1000'S SQ. FT.) ACTUAL	STRUCTURAL (1000'S SQ. FT.) REPORTED	STRUCTURAL (1000'S SQ. FT.) REPORTED	SUPERFICIAL (1000'S SQ. FT.) ACTUAL	SUPERFICIAL (1000'S SQ. FT.) REPORTED	SUPERFICIAL (1000'S SQ. FT.) REPORTED	(1000'S SQ. FT.) ACTUAL	(1000'S SQ. FT.) REPORTED	(1000'S SQ. FT.) REPORTED	REMOVED (1000'S SQ. FT.) ACTUAL	REMOVED (1000'S SQ. FT.) REPORTED	REMOVED (1000'S SQ. FT.) REPORTED
93		7.0				3.5	2.4							
94-95-96		12.9												
97		7.0	7.0											
98		15.7	3.7	2.5										
99		6.1												
100-101		35.7										20.0		
102		20.0												
103		23.0	23.0	14.7										
104-105		36.0												
106		17.0												
107	x	30.6	20.0	4.8		10.6								
108	x	30.7	30.7	30.7										
109		6.0	3.0			3.0								
110-111		15.4	15.4											
112		4.5												

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PHOTOGRAPHIC INTELLIGENCE — INDUSTRIAL ANALYSIS EXHIBIT G
90.20-197
ATSUTA FACTORY, NAGOYA ARSENAL
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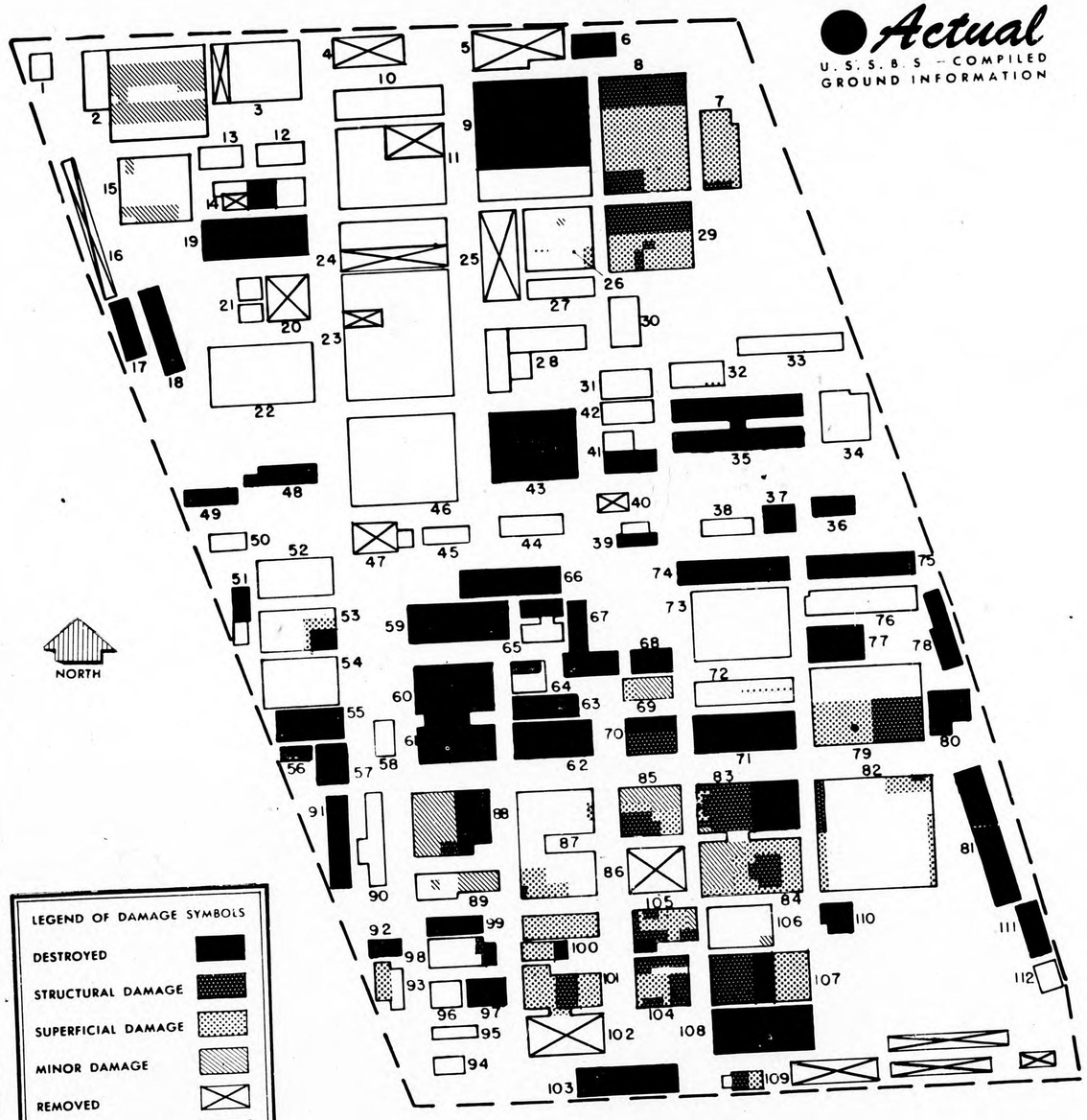
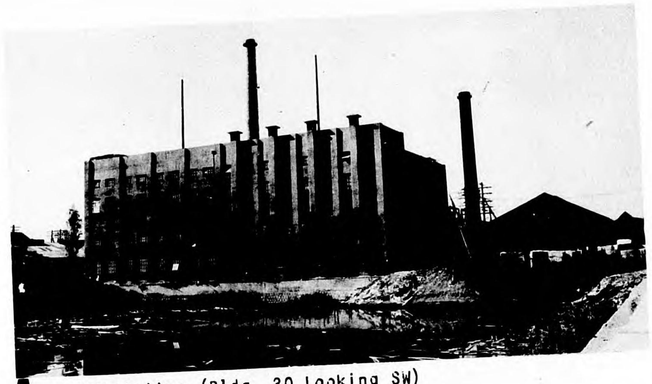
ATSUTA FACTORY, NAGOYA ARSENAL
EXHIBIT G PHOTOGRAPHIC INTELLIGENCE — INDUSTRIAL ANALYSIS
90.20-197

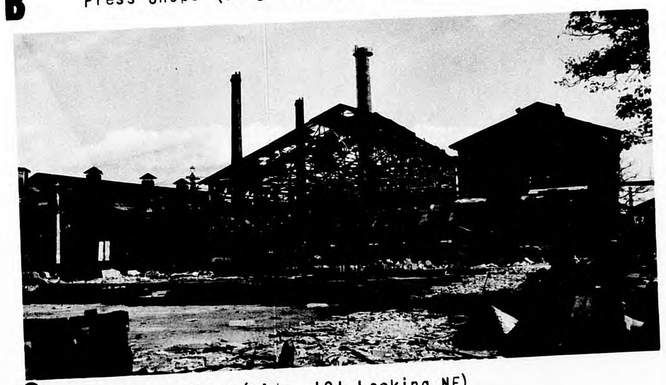
ATSUTA FACTORY, NAGOYA ARSENAL





A Substation (Bldg 30 Looking SW)

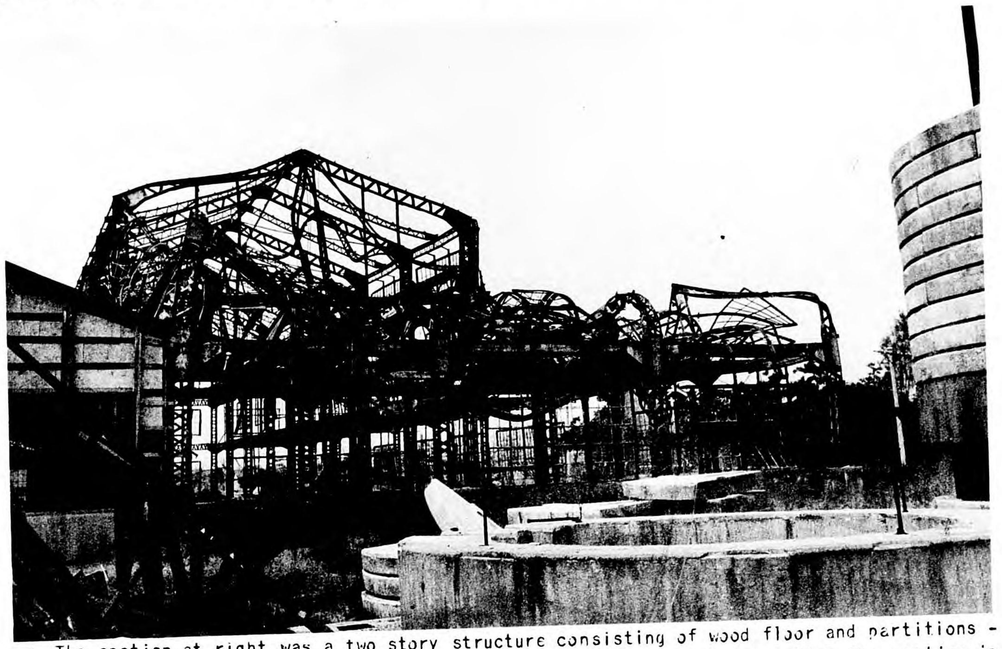
B Press Shops (Bldg 23 Looking NW)



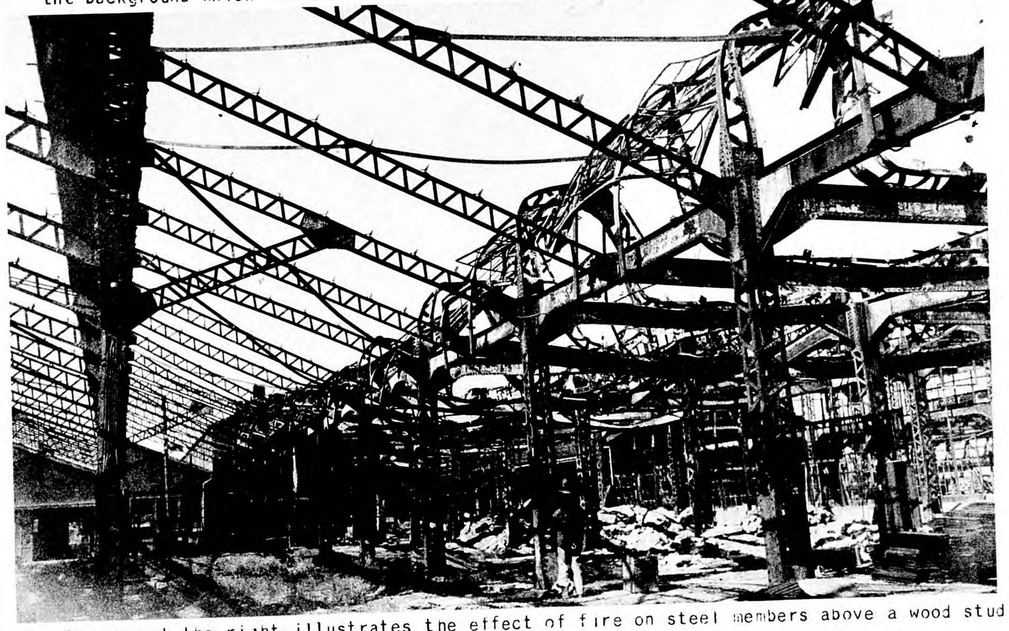
C Machine Shop (Bldg 101 Looking NE)

D Large hangar-type building constructed originally for airplane assembly and converted to gun assembly - Such conversions make interpretation difficult. (Bldg 73)

E Interior of hangar (above) showing detail of arch truss. This building was undamaged. (Bldg 73)

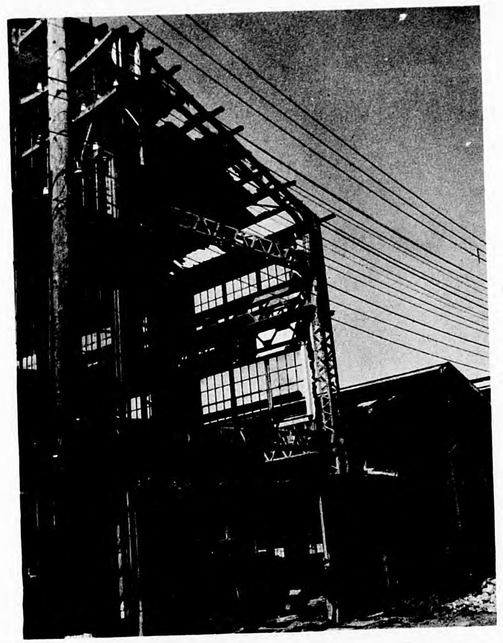


F The section at right was a two story structure consisting of wood floor and partitions - Note how the steel members above this section twisted and collapsed, while the section in the background which had no combustible floors, collapsed only along the walls. (Bldg 8)

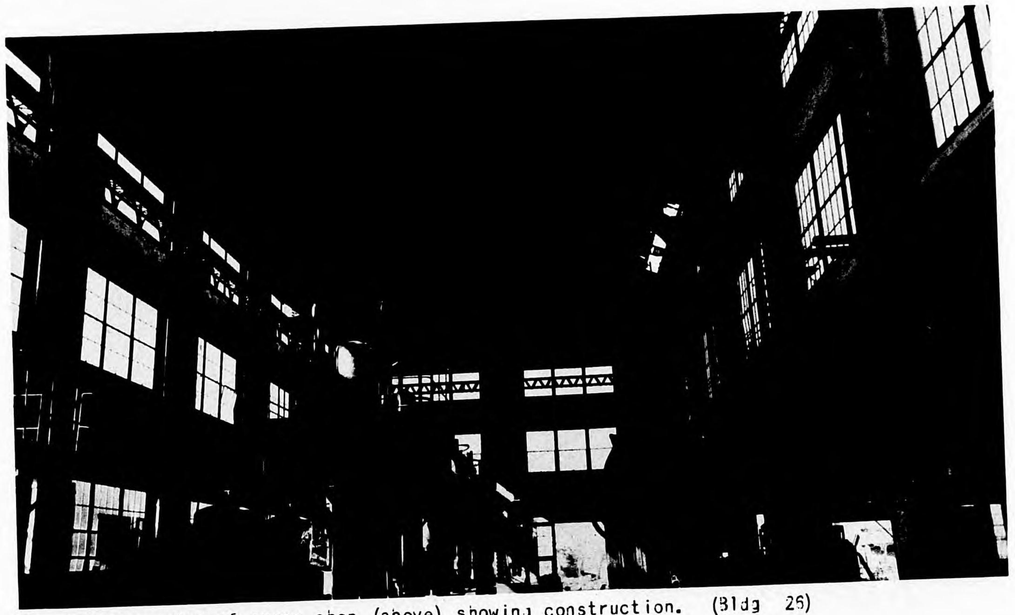


G The bay at the right illustrates the effect of fire on steel members above a wood stud and a combustible floor. (Bldg 29)

90.20-197 ATSUTA FACTORY, NAGOYA ARSENAL

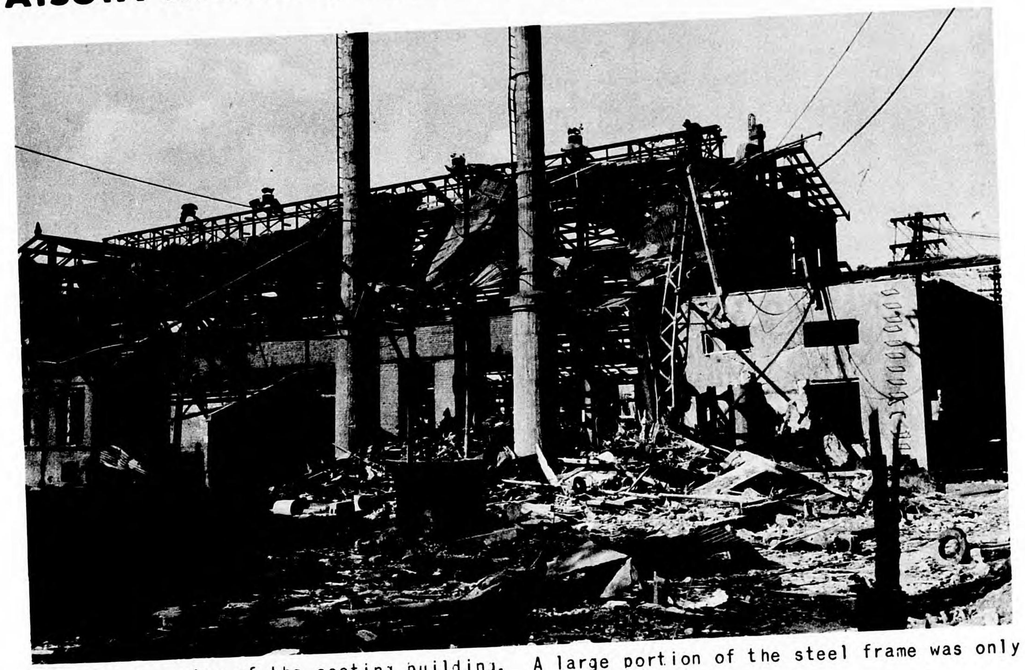


H This is a type of a combustibile building. The walls are of pressed seaweed nailed to 4 in by 4 in studs. The roof is of wood sheathing on 4 in by 4 in purlins. Note interior view of construction below - photo I. Fire damage to this building after being hit by an incendiary bomb during attack of 19 March 1945 was no greater because of efficient fire fighting.



I Interior view of press shop (above) showing construction. (Bldg 25)

ATSUTA FACTORY, NAGOYA ARSENAL 90.20-197



J Exterior view of the casting building. A large portion of the steel frame was only superficially damaged. (Bldg 105).

K This concrete structure was shattered by a series of HE bombs. This type of damage is difficult to assess correctly, for in a vertical photograph the building would appear virtually intact. (Bldg 107)

EXHIBIT H
AICHI ORDNANCE PLANT
90.20-198

LAT. 35° 07'N - LONG. 136° 55'E

NAGOYA, JAPAN

See Exhibit P for abbreviations used in this exhibit.

90.20-198 AICHI ORDNANCE PLANT

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AICHI ORDNANCE PLANT 90.20 - 198

1. DESCRIPTION OF TARGET

a. Aichi Ordnance Plant, Nagoya, was engaged in the manufacture of precision ordnance (torpedoes, mines. and bombs) and in the assembly of airframes.

b. The plant is located 2½ miles south of the center of the city, 4 miles south of Nagoya Castle, and 2 miles north of Nagoya Harbor.

c. The plant comprises 44 buildings which have a total built-up area of approximately 1,152,000 square feet.

2. SUMMARY

a. Two functional analyses were made, one by AC/AS Intelligence which was good, the other by CIU (XXI BC) which was poor. Both reports failed to identify the function of the part of the plant engaged in aircraft assembly. Of the 60 buildings and subdivisions checked in the AC/AS intelligence report there were:

(1) 26 identified correctly
(2) 21 identified as having similar occupancy
(3) 6 unidentified
(4) 7 incorrectly identified

Of the 61 buildings and subdivisions checked in the CIU report, there were:

(1) 10 identified correctly
(2) 49 unidentified
(3) 2 identified incorrectly

b. The structural analysis by AC/AS Intelligence was good. In the construction type category, of 106 buildings and subdivisions on which comparable data were available, 77 were correct. In the combustibility category of 144 buildings and subdivisions checked 112 were correct.

c. Damage assessment reports were made by AC/AS Intelligence CIU, and OAS (Operational Analysis Section - XXI BC).

(1) AC/AS Intelligence damage assessment checked very closely with the field data as shown in Table I

TABLE I

	ACTUAL Sq Ft	REPORTED Sq Ft
Structural Damage	528,500	579,900
Superficial Damage	562,700	527,200
Total Damage	1,091,200	1,207,100

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(2) CIU damage assessment was less accurate than that of AC/AS Intelligence and is shown in Table 2.

TABLE 2

	ACTUAL Sq Ft	REPORTED Sq Ft
Structural Damage	528,500	363,500
Superficial Damage	562,700	767,300
Total Damage	1,091,200	1,130,800

(3) The OAS damage assessment was the least accurate of the three as shown in Table 3.

TABLE 3

	ACTUAL Sq Ft	REPORTED Sq Ft
Structural Damage	528,500	634,000
Superficial Damage	562,700	194,900
Total Damage	1,091,200	828,900

3. SOURCE OF DATA

a. Reported.

(1) AC/AS Intelligence F/A Report #222, 16 July 1945
(2) CIU (XXI BC) Industrial Report #9, 27 March 1945
(3) AC/AS Intelligence S/A Report #72, 30 July 1945
(4) AC/AS Intelligence Limited D/A Report #59, 20 July 1945
(5) CIU (XXI BC) D/A Report #89, 14 June 1945
(6) OAS (XXI BC) Report on Mission #193, 30 June 1945

b. Field Data.

(1) USSBS Phsical Damage Team #5 field notes.

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4. FUNCTIONAL ANALYSIS

a. Use of Plant

Reported: Manufacture of precision ordnance and aircraft parts.

Actual: Manufacture of precision ordnance (torpedoes, mines, bombs) and assembly of airframes.

b. Boundaries.

Correct except for inclusion of 4 small buildings just north of extreme northern tip of plant area.

c. Building Identification (F/A Table).

d. Summary of Tabulation.

TABLE 4

F/A ACCURACY FACTOR

Total Plant (AC/AS Intell) 71

Total Plant (CIU) 52

	(AC/AS Intell) TOTAL BUILDINGS		(CIU) TOTAL BUILDINGS	
	No. Bldgs	%	No. Bldgs	%
Correct	26	43	10	16
Of Similar Occupancy	21	35	0	--
Unidentified	6	10	49	81
Incorrect	7	12	2	3
Total	60	100	61	100

e. Remarks.

The analysis by AC/AS Intelligence is good; that of CIU is poor. A very appreciable error is noted in the failure of both reports to identify the function of the part of the plant engaged in aircraft assembly.

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FUNCTIONAL ANALYSIS TABLE

AICHI ORDNANCE PLANT — 90.20 - 198

BUILDING NUMBER			FUNCTION: REPORTED		FUNCTION: ACTUAL	EVALUATION: JTG				EVALUATION: CIU				F/A ACCURACY FACTOR	
USSBS	JTG	CIU	JTG	CIU		CORRECT	SIMILAR	UNIDENT	WRONG	CORRECT	SIMILAR	UNIDENT	WRONG	JTG	CIU
	1a		Probable Residential		Residential										
	1b														
	1c														
2e		1a	Shop, probable light machining and benchwork	Probable instrument assembly		x				x				91	83
2f	2A	1b										x			45
		1c			Machine Shop, Finishing and Welding							x			45
2a	2a	2a										x			45
2b	2b	2b	Shop, probable light machining and benchwork			x								91	
2c	2c	2c										x			45
	2f									x					100
2d	2d	2d			Transformer House							x			45
22a	2c	3a		Transformer House	Acetylene Gas Plant										
22c		3b			Machine Shop		x					x		70	45
22b	22	4			Storage		x					x		70	45
3a	3a	22	Shop		Storage			x				x		0	45
3b	3b	21	Shop		Finishing Shop		x					x		70	45
3c	3c	23	Boiler House		Storage										
4	4	20	Shop				x			x				75	90
5a	5a	19a		Machine shop and probable heat treatment	Forge and Heat treatment										
5b	5b	19b													
5c	5c	19c													
5d	5e		Possible Foundry												
5f															
5e	5f	19d			Storage										
5g	5d				Paint Warehouse	x								85	
6	6		Storage		Boiler House	x								100	
7a	7a		Boiler House		Machining/Finishing	x				x				100	95
7b	7b	18b	Shop. Prob. Machining&Parts	Probable Machine shop	Machining/Finishing					x					95
7c	7c	18c		Probable Machine Shop				x					x	45	45
	8	17	Unidentified		Sand Blast		x						x	65	45
9	9	24	Probable Storage												

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FUNCTIONAL ANALYSIS TABLE

AICHI ORDNANCE PLANT — 90.20 - 198

BUILDING NUMBER			FUNCTION: REPORTED		FUNCTION: ACTUAL	EVALUATION: JTG				EVALUATION: CIU				F/A ACCURACY FACTOR	
USSBS	JTG	CIU	JTG	CIU		CORRECT	SIMILAR	UNIDENT	WRONG	CORRECT	SIMILAR	UNIDENT	WRONG	JTG	CIU
11c	12b	25	Storage		Warehouse				x			x		0	45
13a	13a	26	Water Treatment		Shop			x				x		45	45
11a	11a	27	Unidentified		Boiler House										
11b	11b				Torpedo Finishing	x						x		65	45
12a	12a	28	Storage		Storage										
12b					Torpedo Test		x							85	
13c	13b		Filter Tanks		Torpedo Assembly/Testing		x					x		85	45
13b	13c	29	Water Treatment		Sand Blast										
12c					Machining/Finishing	x						x		98	45
10a	10a	16a	Shop, probable machining		Compressor House			x				x		45	45
10d	10d	16b	(Omitted from table)		Forms and Sand Blast			x						45	
10c	10b	15c	(Omitted from table)												
	10c	15b	Poss Expansion of rptd Hydraulic Press Room	Plate work and finishing			x							85	
					Storage			x						45	
10e	10e		(Omitted from table)		Plate work		x			x				80	100
10f	10f		Probable assembly		Plate work		x							80	
10g	10g	15b	Probable assembly		Finishing	x								95	
10h	10h		Probable assembly		Finishing		x							70	
10j	10j	15a	Storage		Scrap Storage	x							x	78	0
14a	14e	31a	Shop	Torpedo testing	Finishing							x			45
14b	14b	31b			Boiler House	x						x		100	45
15a	15a	31c	Boiler House												
15b	15b				Machining/Finishing		x					x		70	45
16	16	30	Storage		Pattern Room - Storage	x						x		85	45
17a	17b	34	Storage		Pattern Room - Storage							x			45
17b	17a	33			Pattern Rm - Woodworking	x								85	
18	18		Storage												
19a	19a	32b	Prob. Forge and Foundry	Iron Foundry	Foundry and Forge		x					x		95	95
19b	19b														
19c	19c														
19d	19d	32a													

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FUNCTIONAL ANALYSIS TABLE

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BUILDING NUMBER			FUNCTION REPORTED		ACTUAL	EVALUATION							
						JTG			CIU			F/A ACCURACY FACTOR	
USSBS	JTG	CIU	JTG	CIU		CORRECT	SIMILAR	UNIDENT WRONG	CORRECT	SIMILAR	UNIDENT WRONG	JTG	CIU
19e	19e		Boiler House		Storage			x				0	
	19f				Washroom		x					70	
20	20		Storage		Sandblast		x					70	
21	21		Storage			x					x	85	15
22b	22	4	Shop	Offices									
23	23a		Shop-rptd. Machining/	Machine Shop	Machine Shop	x			x			85	100
	23b		Finishing of Torpedo										
	23c	14	Tubes, Mines, Fuses										
	23d				Dining Room			x				15	
28	28		Shop-rptd. Electric Shop										
24a	24a				Machining/Finishing	x					x	98	45
	24b	35a	Shop-Prob. Machining and								x		45
24b	24c	35b	Assembly of Small Parts										
	24d				Main Office	x			x			100	100
25	25	5	Office	Offices							x		45
26a	26a	13b			Offices	x					x	100	45
26b		13a	Office										
26c	26b										x		45
27a	27a	12b			Laboratory		x				x	85	45
27b	27b	12a	Office		Blueprints/Records								
27c	27c				Office, Mess, Machine Shop	x					x	100	45
29	29	11	Offices, Prob. Engineering		Electric Sub-Station	x					x	100	45
30	30	38a	Electric Sub-Station		Machining and	x					x	100	45
31	31a	36	Shop-Prob. Assembly and		Finishing								
	31b		Machining of small parts		Machine Shop/Laboratory	x					x	85	45
32	32	37	Shop		Woodworking		x				x	70	45
33a	33a	38b	Storage		Wood and prob. Shop			x				5	
33b	33b		Prob. rptd. Regulator Plant		Storage								
33c					Storage								
33d													

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FUNCTIONAL ANALYSIS TABLE

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BUILDING NUMBER			FUNCTION REPORTED		ACTUAL	EVALUATION							
						JTG			CIU			F/A ACCURACY FACTOR	
USSBS	JTG	CIU	JTG	CIU		CORRECT	SIMILAR	UNIDENT WRONG	CORRECT	SIMILAR	UNIDENT WRONG	JTG	CIU
34	34a		Office		Garage		x					85	
	34b	6a									x		45
35a	35a	6b			Machine Shop						x		45
35c		6cd	Office		Steel Warehouse			x			x	0	45
35b	35b				Oil/Gas Storage								
36	36		Office		Steel Warehouse			x				0	
	37a		Shop - reported										
37a	37b	10h	Formerly		Assembly	x						85	
	37c		Airplane Assembling										
37b	10d	10g			Warehouse								
39c	39c	10f		Probable Fuselage	Assembly						x		100
39d	39b	10d		Assembly	Warehouse								
39e	39a				Assembly								
39a	39d		Complex Building:			x						97	
	39c		all types of machining,		Machining/Finishing,								
	39e	10a	benchwork, fabrication		Heat treatment								
39b	39f	10b											
	39g	10c											
	39h				Sheet/Plate Shop	x					x	85	45
38b	38a	7a	Shop, probable light mach-		Storage						x		45
38a		7b	ining and benchwork								x		45
		7c											
40a					Hardening Room						x		45
40b	40	39	Reported Paint Shop								x		45
41c	39j	40			Wind Tunnel			x			x	70	45
41a	41a	41	Storage		Storage			x				45	
41d	41b				Boiler House	x					x	100	45
41b	41c	42	Boiler House		Inspecting		x				x	70	45
42	42a	43	Storage		Room								
	42b				Warehouse		x				x	80	45
43	43	9a	Prob. rptd. Packing/Shipping										

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FUNCTIONAL ANALYSIS, TABLE

AICHI ORDNANCE PLANT — FUNCTION

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EVALUATION — F/A ACCURACY FACTOR

ACTUAL	JTG: CORRECT	JTG: SIMILAR	JTG: UNIDENT	JTG: WRONG	C I U: CORRECT	C I U: SIMILAR	C I U: UNIDENT	C I U: WRONG	JTG	C I U
Shop	x								80	45
Shop							x			45
							x			45

BUILDING NUMBER USSBS	JTG	C I U	REPORTED FUNCTION: J T G	REPORTED FUNCTION: C I U
44a	44	9b	Prob.rptd.Packing/Shipping	
44b		8		
		18a		

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5. STRUCTURAL ANALYSIS

a. Check on Scale Measurement.

(1) Accuracy on linear dimensions varied from 91.0 per cent to 99.8 per cent.
(2) Plan areas were about 93 per cent correct.

b. S/A (See S/A Table).

c. Summary of Tabulation.

(1) Construction Type

TABLE 5

Construction Type	No. Bldgs	No. Corr.	% Corr.
A1.1	33	26	79
A2.3	16	15	94
B1	3	3	100
B2	7	5	71
D	42	24	57
E1	2	2	100
E2	2	1	50
S	1	1	100
Total	106	77	73

(2) Combustibility

TABLE 6

Building Combustibility	No. Bldgs	No. Corr.	% Corr.
Combustible (C)	52	33	63
Non-Combustible (N)	81	70	86
Fire-Resistant (R)	11	9	82
Total	144	112	78

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STRUCTURAL ANALYSIS TABLE

AICHI ORDNANCE PLANT — 90.20-198

BUILDING NUMBER USSBS	BUILDING NUMBER JTG	1000'S OF SQ. FT. PLAN AREA ACTUAL	1000'S OF SQ. FT. PLAN AREA REPORTED	NUMBER OF FLOORS ACTUAL	NUMBER OF FLOORS REPORTED	SIZE OF BAY (Ft) ACTUAL	SIZE OF BAY (Ft) REPORTED	ROOF MATERIAL ACTUAL	ROOF MATERIAL REPORTED	COMBUSTIBILITY OF BUILDING ACTUAL	COMBUSTIBILITY OF BUILDING REPORTED	CONSTRUCTION TYPE ACTUAL	CONSTRUCTION TYPE REPORTED
	1a	-	.6	1	1		20		Light	-	C	D	D
	1b	-	.4	1	1		15		Light	-	C	D	D
	1c	-	.3	1	2		20		Light	-	C	-	E2
2e	2Aa	4.9	4.2	1	1	Uncert	40		Light	C	N	A2.3	A2.3
2f	2Ab	23.8	19.4	1	1	21	20		Light	C	N	A1.1	A1.1
	2Ac	4.9	4.2	1	1	28	26		Light	C	N	-	A1.1
2a	2a	17.2		1	1	-	50		Light	N	N	A1.1	A2.3
2b	2b	25.2		1	1	-	30		Light	C	N	A1.1	A2.3
2c	2c	14.7		1	1	21	20		Light	C	C	A1.1	A2.3
2d	2d	4.2	71.5	2	1	42	45		Light	C	C	A2.3	A2.3
22a-c	2e	3.1		1	1		20		Light	N	C	-	-
	2f			1	1	18	20		Light	N	N	-	-
3a	3a	1.0	1.0	1	1		20		Light	N	N	D	D
3b	3b	.4	1.0	1	1		20		Light	N	C	D	D
3c	3c	2.3	2.8	1	1		40		Light	C	C	D	D
4	4	4.0	4.1	2	1		27		Light	N	C	E2	D
5a	5a	4.5	4.6	1	1		30		Light	N	C	D	A2.3
5b	5b	5.3	6.2	1	1		20		Light	N	N	D	A1.1
5c	5c	9.7		1	1		25		Light	N	N	D	A2.3
5f-g	5d	1.6	23.9	1	1		60		Light	C	N	D	B2
5d	5e	7.2		1	1		50		Light	N	N	D	A2.3
5e	5f	2.9		1	1		20		Light	N	N	D	D
6	6	1.4	1.7	1	1	36	35		Light	N	C	D	D
7a	7a	2.5	3.0	1	1	56	50		Light	N	C	D	D
7b	7b	10.6	10.8	1	1		40		Light	C	C	unknown	A2.3
7c	7c	42.1	6.2	1	1	18	20		Light	N	N	A1.1	A1.1
	7d		40.8	1	1		19		Light	N	N	A1.1	A1.1
	8	1.0	1.0	1	1		20		Light	unknown	C	D	D
9	9	3.9	4.5	1	1	39	45		Light	C	C	D	D
10a	10a	39.0		1	1	24	20		Light	N	N	A1.1	A1.1
10c	10b	12.0		1	1		30		Light	C	C	A2.3	A2.3
	10c		43.0	1	1		65		Light	N	N	B2	B.2

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STRUCTURAL ANALYSIS TABLE

AICHI ORDNANCE PLANT — 90.20-198

BUILDING NUMBER USSBS	BUILDING NUMBER JTG	1000'S OF SQ. FT. PLAN AREA ACTUAL	1000'S OF SQ. FT. PLAN AREA REPORTED	NUMBER OF FLOORS ACTUAL	NUMBER OF FLOORS REPORTED	SIZE OF BAY (Ft) ACTUAL	SIZE OF BAY (Ft) REPORTED	ROOF MATERIAL ACTUAL	ROOF MATERIAL REPORTED	COMBUSTIBILITY OF BUILDING ACTUAL	COMBUSTIBILITY OF BUILDING REPORTED	CONSTRUCTION TYPE ACTUAL	CONSTRUCTION TYPE REPORTED
10d-37b	10d	1.2		1	1		30		Light	C	C	D	D
10e	10e	-	-	1	1		10		Light	C	C	A2.3	A2.3
10f	10f	8.6	8.8	1	1	48	50		Light	N	N	A2.3	A2.3
10g	10g	10.3	12.0	1	1	43	50		Light	N	N	B2	A2.3
10h	10h	7.2	7.2	1	1	30	30		Light	N	N	A2.3	A2.3
10j	10j	14.3	14.4	1	1	60	60		Light	C	N	A2.3	A2.3
	10k	in above	9.9	1	1		20		Light	N	N		A1.1
	10m	in above	11.5	1	1		20		Light				A1.1
11a	11a	1.8	2.0	1	1		15		Light	C	C	D	D
11b	11b	.2	.6	1	1	18	20		Light	C	C	D	D
12a-b	12a	4.3	6.3	1	1	18	30		Light	C	C		
11c	12b			1	1		50		Light	C	C	D	D
13a	13a	2.4	3.0	1	1		50		Light	C	C	D	D
13c	13b	2.4	2.0	1	1		-		Light	R	R	S	S
13o	13c	6.1	6.0	1	1		50		Light	C	C	D	D
14a	14a	5.4	6.4	1	1		26		Light	C	C	A2.3	A2.3
14b	14b	22.0	24.8	1	1	36	40		Light	N	N	B2	A2.3
15a	15a	1.8	1.2	1	1		20		Light	N	C	D	D
15b	15b	1.4	1.2	1	1		36		Light	C	C	D	D
16	16	2.6	3.6	2	2	55	20		Light	C	C	D	E2
17b	17a	4.8	5.2	1	1	42	50		Light	C	C	D	A2.3
17a	17b	1.8	2.0	2	2		16		Light	C	C	D	E2
18	18	1.7	2.0	1	1	36	40		Light	C	C	D	D
19a	19a	18.2		1	1	60	57		Light	N	N	B2	B2
19b	19b	1.3		1	1	47	30		Light	N	N	D	A2.3
19c	19c	14.1	41.9	1	1		20		Light	N	N	A2.3	A2.3
19d	19d	1.7		1	1	28	30		Light	N	N	D	A2.3
19e	19e	.6		1	1		20		Light	C	C	D	D
	19f			1	1				Light	C	C		
20	20	1.6	1.8	1	1		30		Light	C	C	D	D
21	21	.8	1.7	1	1		35		Light	C	N	D	D
22b	22	12.5	12.5	1	1		24		Light	N	N	A2.3	A1.1

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STRUCTURAL ANALYSIS TABLE

AICHI ORDNANCE PLANT — 90.20-198

BUILDING NUMBER USSBS	BUILDING NUMBER JTG	1000'S OF SQ. FT. PLAN AREA ACTUAL	1000'S OF SQ. FT. PLAN AREA REPORTED	NUMBER OF FLOORS ACTUAL	NUMBER OF FLOORS REPORTED	SIZE OF BAY (Ft) ACTUAL	SIZE OF BAY (Ft) REPORTED	ROOF MATERIAL ACTUAL	ROOF MATERIAL REPORTED	COMBUSTIBILITY OF BUILDING ACTUAL	COMBUSTIBILITY OF BUILDING REPORTED	CONSTRUCTION TYPE ACTUAL	CONSTRUCTION TYPE REPORTED
	23a			1	1	41	45		Light	N	N	A2.3	A2.3
	23b			1	1	30	30		Light	N	N	A1.1	A1.1
23	23c	57.6	58.9	1	1	30	35		Light	N	N	A2.3	A2.3
	23d			1	1	30	30		Light	N	N	A1.1	A1.1
	23e			1	1	30	30		Light	N	N	A1.1	A1.1
24a	24a	13.0	13.7	1	1	66	65		Light	N	N	A2.3	A2.3
	24b		4.0	1	1	18	20		Light	N	N	A1.1	A1.1
24b	24c	23.8		2	2	30	16		Light	N	N	A1.1	A1.1
	24d		20.0	1	1		16		Light	N	N	A1.1	A1.1
	24e			1	1		20		Light	N	N	A1.1	A1.1
	25a			1	1	17-20	15	Conc	Conc	R	R	E1	E1
25	25b	9.8	12.6	4	3	17-20	15		Conc	R	R		
	25c			1	1	17-20	15		Conc	R	R		
	25d			1	1	17-20	15		Conc	R	R		
26a	26a	2.3	3.1	1	1		13		Light	C	C	D	A2.3
26b-c	26b	7.4		1	1		13		Wood	C	C	D	E2
	26c		8.1	1	1		13		Wood	C	C	D	E2
	26d			1	1		13		Wood	C	C	D	E2
27a	27a	3.2	2.8	1	1		16		Wood	C	C	D	E2
27b	27b	1.5	1.8	2	2		15		Light	R	C	E2	E2
27c	27c	.9	.8	3	2		20		Light	N	C		A2.3
	27d			1	1		30		Light	C	C		A2.3
28	28	8.6	9.2	1	1	18	40		Light	N	C	D	D
	29a			1	1	16-20	15		Conc	R	R	E1	E1
29	29b	13.5	14.0	3	3	16-20	15		Conc	R	R	Steel	
	29c			1	1	16-20	15		Conc	R	R		
	29d			1	1	16-20	15		Conc	R	R		
30	30	1.7	2.5	1	1		50		Light	R	N	D	D
	31a			1	1	uncert	20		Light	N	N	A1.1	A1.1
31	31b			2	1	uncert	20		Light	N	N	A1.1	A1.1
	31c	43.2	43.4	1	1	uncert	20		Light	N	N	A1.1	A1.1
	31d			1	1	uncert	20		Light	N	N	A1.1	A1.1

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STRUCTURAL ANALYSIS TABLE

AICHI ORDNANCE PLANT — 90.20-198

BUILDING NUMBER USSBS	BUILDING NUMBER JTG	1000'S OF SQ. FT. PLAN AREA ACTUAL	1000'S OF SQ. FT. PLAN AREA REPORTED	NUMBER OF FLOORS ACTUAL	NUMBER OF FLOORS REPORTED	SIZE OF BAY (Ft) ACTUAL	SIZE OF BAY (Ft) REPORTED	ROOF MATERIAL ACTUAL	ROOF MATERIAL REPORTED	COMBUSTIBILITY OF BUILDING ACTUAL	COMBUSTIBILITY OF BUILDING REPORTED	CONSTRUCTION TYPE ACTUAL	CONSTRUCTION TYPE REPORTED
	31e			1	1	uncert	20		Light	N	N	A1.1	A1.1
	31f			1	1	uncert	20		Light	N	N	A1.1	A1.1
32	32	13.1	12.6	1	1	21	20		Light	N	N	A1.1	A1.1
33a	33a	5.8	23.2	1	1		15		Light	N	N		A2.3
33b	33b	16.0		1	1		20		Light	N	N		A1.1
33c	33c	.6	1.5	1	1		20		Light	N	N		A1.1
33d	33d	.6		1	1		20		Light	N	N		A1.1
	33e			1	1		60		Light	N	N		A2.3
34	34a			1	1-2-3		25		Light	C	C		D
	34b	5.0	5.4	1	1		15		Conc	C	R		E1
	34c			1	1		15		Conc	C	R		E1
35a-c	35a	1.6		1	1		30		Light	C	C	D	D
35b	35b	1.0		1	1		30		Light	C	C	D	D
36	36	4.5	5.6	1	1		65		Wood	C	N	D	D
	37a			1	1	uncert	75		Light	N	N	B1	B1
	37b	40.4	110.4	1	1	uncert	90		Light	N	N	B1	B1
37a	37c	62.6		1	1	uncert	75		Light	N	N	B1	B1
37b	37d			1	1	uncert	30		Light	N	N	B2	B2
	37e			1	1	uncert	30		Light	N	N	B2	B2
38a	37f			2	1	uncert	30		Light	N	N	B2	B2
38b	38a	84.4	87.1	1	1	18	18		Light	N	N	A1.1	A1.1
	38b			1	1	18	18		Light	N	N	A1.1	A1.1
	38c			1	1	36	40		Light	N	N	A2.3	A2.3
	38d			1	1	18	18		Light	N	N	A1.1	A1.1
	38e			1	1	36	40		Light	N	N	A2.3	A2.3
	38f			1	1	25	25		Light	N	N	A1.1	A2.3
	38g			1	1		35		Light	N	N		D
39e	39a	4.5		1	1	uncert	52		Light	C	N	A2.3	A2.3
39d	39b	7.2		1	1		80		Light	C	N	A1.1	A2.3
39c	39c	4.9		1	1		45		Light	C	N	A1.1	A2.3
39a	39d	66.6		1	1		18		Light	N	N	A1.1	A1.1
	39e			1	1		30		Light	N	N	A1.1	A1.1

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STRUCTURAL ANALYSIS TABLE

AICHI ORDNANCE PLANT — 90.20-198

BUILDING NUMBER USSBS	BUILDING NUMBER JTG	1000'S OF SQ. FT. PLAN AREA ACTUAL	1000'S OF SQ. FT. PLAN AREA REPORTED	NUMBER OF FLOORS ACTUAL	NUMBER OF FLOORS REPORTED	SIZE OF BAY (Ft) ACTUAL	SIZE OF BAY (Ft) REPORTED	ROOF MATERIAL ACTUAL	ROOF MATERIAL REPORTED	COMBUSTIBILITY OF BUILDING ACTUAL	COMBUSTIBILITY OF BUILDING REPORTED	CONSTRUCTION TYPE ACTUAL	CONSTRUCTION TYPE REPORTED
39d	39f	201.7		1	1		30		Light	N	N	A1.1	A1.1
	39g			1	1		30		Light	N	N	A1.1	A1.1
	39h			1	1		30		Light	N	N	A1.1	A2.3
41c	39j	1.1	299.7	1	1		50		Light	C	N		A1.1
	39k			1	1		18		Light	N	N		A2.3
	39m			1	1		55		Light	N	N		A1.1
	39n			1	1		18		Light	N	N		A2.3
	39p			1	1		50		Light	N	N		A1.1
	39q			1	1		18		Light	N	N		A1.1
	39r			1	1		18		Light	N	N		A2.3
	39s			1	1		60		Light	N	N		A1.1
	39t			1	1		18		Light	N	N	D	D
40b	40	3.1		1	1		35		Light	C	C		A2.3
41a	41a	2.6		2	1		35		Light	C	C		A2.3
41d	41b	.6	10.7	1	1		20		Light	C	C		A2.3
41b	41c	2.3		2	1		30		Light	C	C		A2.3
	41d			1	1		30		Light	C	C		D
42	42a			1	1		35		Light	N	C		D
	42b			1	1		15		Light	C	C	D	D
43	43	3.6	4.5	1	1		14		Light	C	N	A1.1	A2.3
44a-b	44	31.2	33.5	1	1		50		Light	C			
	12c						55		Light				
	40a												

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6. DAMAGE ASSESSMENT

a. D/A (See D/A Table).

b. Summary of Tabulation.

TABLE 7

	ACTUAL		REPORTED (AC/AS Intell.)		REPORTED (CIU)		REPORTED (OAS)	
	Sq Ft	% Dam	Sq Ft	% Dam	Sq Ft	% Dam	Sq Ft	% Dam
Total Building Area	1,152,000		1,231,000		1,188,000		1,165,700	
Damage								
Structural	528,500	46	579,900	47	363,500	31	634,000	55
Superficial	565,700	49	627,200	51	767,300	65	194,900	17
Total Damage	1,094,200	95	1,207,100	98	1,130,800	96	828,900	72

In general, Minor Damage was purposely omitted in D/A reports.

c. Remarks.

(1) The AC/AS Intelligence damage assessment was quite accurate.

(2) The CIU assessment was somewhat less accurate probably due to the shorter time available in the field.

(3) The OAS assessment was very poor and indicates either careless work or an inexperienced interpreter.

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DAMAGE ASSESSMENT TABLE

AICHI ORDNANCE PLANT — 90.20 - 198

Building No. USSBS	JTG	CIU	OAS	Bldg. Area	Structural (1000s sq. ft) A	JTG	CIU	OAS		Superficial (1000s sq. ft) A	JTG	CIU	OAS		Removed (1000s sq. ft) A	R	R
	1a																
	1b																
	1c																
2e		1a		4.9	4.9		1.0			23.8		7.5	19.6				
2f	2A	1b	1	23.8		31.2						19.0					
		1c								13.3		18.0					
2a	2a	2a		17.2	3.9	5.2											
2b	2b	2b		25.2	25.2	0.9	25.0			10.5		12.0					
2c	2c	2c	2	14.7	4.2	3.2	4.0	35.4			19.4						
	2f					37.0											
2d	2d	2d		4.2	4.2	0.8	4.0										
22a	2e	3a	3	2.3	2.3	2.7	2.4	2.3									
22c		3b		0.8	0.8		2.6				12.6	13.0	12.0				
22b	22	4	4							1.0							
3a	3a	22		1.0		1.0	1.7			0.4							
3b	3b	21		0.4		1.0	1.4			1.1							
3c	3c			2.3	1.2												
4	4		20	4.0	0.8						5.8	12.0					
5a	5a	19a		4.5							1.7	10.0					
5b	5b	19b		5.3						9.7	2.5	9.6					
5c	5c	19c		9.7		3.0				7.2			15.6				
5d	5e		19	7.2				9.7									
5f				1.4	1.4					2.9		3.5					
5e	5f	19d		2.9													
5g	5d					0.6							22.2				
6	6			1.4	1.4	1.7											
7a	7a		18	2.5	2.5	3.0		12.7									
7b	7b	18b		10.3	10.6	10.8	9.6			38.6	38.0	45.0			4.0		
7c	7c	18c		42.1	3.5	9.0	5.0										
	8	8				1.0	4.0										
			17								3.8						
9	9	24	24	3.9	3.9	4.5					2.4						
11c	12b	25	25			1.5		3.6									
13a	13a	26	26	2.4	2.4	3.0											
11a	11a	27		1.8	1.8	0.6	25.3				2.2						
11b	11b			0.2	0.2	1.0											
12a	12a	28	28	3.6	3.6	6.3											

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EXHIBIT H PHOTOGRAPHIC INTELLIGENCE — INDUSTRIAL ANALYSIS
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DAMAGE ASSESSMENT TABLE

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Building No. USSBS	JTG	CIU	OAS	Bldg. Area	Structural (1000s sq. ft) A	JTG	CIU	OAS		Superficial (1000s sq. ft) A	JTG	CIU	OAS		Removed (1000s sq. ft) A	R	R
12b				0.7						0.7							
13b	13c	29	29	6.1	6.1	6.0				3.3							
12c				3.3						6.5							
10a	10a	16a	16	39.0	32.5	50.2	32.5										
10d	10d	16b		1.2		1.6	3.2			12.0	1.9						
10c	10b	15c		12.0			1.5				9.4						
	10c					1.3											
10e	10e					0.3				6.9	8.2		8.3				
10f	10f		15	8.6	1.7			45.7		10.3	12.0	20.0					
10g	10g	15b		10.3			15.0			5.8	7.2						
10h	10h			7.2	1.4						14.4						
10j	10j	15a		14.3	14.3		15.0					27.0					
14a	14a	31a	31	5.4	5.4	6.4				12.3	9.5						
14b	14b	31b		22.0	9.7	20.3	7.6										
15a	15a	31c		1.8	1.8	1.2	1.4										
15b	15b			1.4	1.4	1.9											
16	16	30	30	2.6	2.6						1.0	3.3					
17a	17b	34	33	1.8	1.8			3.1					4.3				
17b	17a	33		4.8	4.8						5.2	3.0					
18	18		34	1.7	1.7								0.8				
19a	19a	32b		18.2						18.2	17.8	18.0					
19b	19b			1.3						1.3	1.5						
19c	19c		32	14.1	2.8			21.8		11.3	17.8		18.6				
19d	19d	32a		1.7						1.7	2.1	21.0					
19e	19e			0.6							1.0						
	19f										1.6						
20	20			1.6		0.7					1.1						
21	21			0.8		1.7											
22b	22	4	4	12.5						12.5	12.6	13.0	12.0				
23	23a			57.6	46.1	6.4				11.5	4.4						
	23b					14.1					7.5						
	23c	14	14			6.4	30.0	68.6			2.0	30.0					
	23d					18.1											
28	28			8.6	8.6	9.2											
24a	24a	35a		13.0	3.0	1.7				10.0	5.1	17.0					
	24b		35			4.0					2.8		37.8				
24b	24c	35b		23.8						23.8	9.6	25.0					
	24g					4.1					10.3						

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