Foreword

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. It was established for the purpose of conducting 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 air power as an instrument of military strategy, for planning the future development of the United States armed forces, and for determining future economic policies with respect to the national defense. A summary report and some 300 supporting reports containing the findings of the Survey in Germany have been published. On 14 August 1945, President Truman requested the Survey to conduct a similar study of the effects of all types of air attack in the war against Japan.

The Survey in Japan, who are all civilians, were:

Franklin Delano Roosevelt, Chairman
Paul H. Nitze, Deputy Chairman
Henry C. Alexander, Deputy Chairman
Harry L. Byrnes
J. Kenneth Galbraith
Roads Ehrlich
Frank A. McNair, Jr.
Paul Smith, Jr.
Horace B. Rogers
Dr. Lewis R. Thompson
Theodore P. Wright, Director
Walker Wilcox, Secretary

The Survey’s complement provided for 500 civilians, 300 officers, and 500 enlisted men. Ninety percent of the military segment of the organization for the Japanese study was drawn from the Army, and 10 percent from the Navy. Both the Army and the Navy gave the Survey all possible assistance in the form of men, supplies, transport, and information. The Survey operated from headquarters in Tokyo, with subheadquarters 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.

The Survey accorded the principal receiving Japanese rewards and interrogated by Army and Navy officers, Government officials, industries, political leaders, and many hundreds of their administrators throughout Japan. It was then possible to reconstruct much of wartime Japanese military planning and execution, engagement by engagement and campaign by campaign, and to secure reasonably accurate data on Japan’s economy and war production, plant by plant, and industry by industry. In addition, studies were made of 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 events and morale among the civilian population, the effectiveness of the Japanese civilian defense organization and the effects of the atomic bomb. Separate reports will be issued covering each phase of the study.

In this Survey Report the civilian officials and directors of the Survey have not undertaken to write a history of the Pacific war, nor to appraise credit for victory among the various components of Allied forces. They have undertaken, as civilians, to present an analysis of the factual material gathered by the Survey and their general approach toward the future.
UNITED STATES STRATEGIC BOMBING SURVEY
SUMMARY REPORT

The attack on Pearl Harbor was designed several months in advance, the scope of its elaboration, and the power of its execution. It was executed with the help of the United States and the British. The attack included the British battlecruiser, Prince of Wales, and the battleship, Repulse. Without air cover, the latter was sunk. The attack was joined by the Loss and the Dutch East Indies, which were virtually eliminated, mostly on the ground, by the Japanese Navy and the Dutch East Indies. Allied air power in the Philippines, Malaysia, and the Dutch East Indies was virtually eliminated, mostly on the ground, in a matter of days. These exercises were, once again, Allied air power had been eliminated, were held open to occupation in a matter of weeks at a cost of less than 10,000 Japanese soldiers killed, and with the loss from all sources in the entire campaign of 80,000 Japanese planes.

As these achievements indicated, the Japanese started the war on the basis of the fact that major offensive action could be undertaken without local control of the air. They also appreciated the vulnerability to air attack of surface units, both on land and at sea. The Japanese failed, however, to appreciate the full scope and complexity of the requirements for controlling the air. The Japanese aircraft production program at the start of the war was inadequate, as the Japanese discovered, not only in relation to that of the United States, but even in relation to the capabilities of their own navy. Their planning and execution were hampered by training, maintenance, logistics, industrial development, intelligence, and communication, with their land and surface forces, now limited in relation to the requirements that subsequently developed. Japanese war plans did not contemplate a war on the level of the Pacific, without the capabilities that it could have contemplated, for example, in the training and maintenance resources of Allied air power.

December 7, 1941, joined the United States and the Allies previously uncommitted in the Pacific, particularly in land and carrier-based air power. The Allied air groups in the Pacific were not only poorly trained but also poorly prepared. The Japanese success had been underestimated. Ninety P-40s and 50 B-17s in the Philippines could not be expected to check the Japanese push westward. Three of our seven aircraft carriers were in the Atlantic and one training in the Gulf of Mexico. Even at that time, however, we had begun to probe - more closely than the Japanese - to the full range of capabilities of our air power. Our progress for training, production, maintenance, intelligence, and intelligence was limited, but as much by lack of concepts as by the time required for their development and fulfillment.

For the original Japanese advance was stopped, how we achieved air superiority, at least locally, but subsequently more and more generally, and over areas deep within the one time Japanese dominated areas, culminating finally in air supremacy over the Japanese home islands themselves, and how that air superiority was exploited in the story of air power in the Pacific and the adjutant matter of this Summary Report. The role of air power cannot be considered separately, however, from the roles of ground and naval forces nor from the broad plan and strategy under which the war was conducted.

JAPAN'S ORIGINAL STRATEGIC PLAN

Japan's governmental structure provided no effective civilian control of her Army and Navy. In the period between the 1871 and the 1890's, the Imperial Military College of Japan wanted a progressively tighter control over the foreign and domestic affairs of the nation. These plans included groups within both the Army and Navy, but because of the repeated military successes of the Japanese Army in Manchuria and China, the prestige and importance of the Navy was somewhat to that of the Army. The final decision to enter the war and to advance into the Philippines, the Dutch East Indies, Malaysia, Borneo and to the southeast was, however, made with the full concurrence and active consent of all important civilian leaders.
This decision to which the Japanese were, in effect, committed by mid-October 1941 was based upon the following conclusions:

1. The threat of Russia on the Manchurian flank had been neutralized by the decisive victory of Germany in Europe which might eventually lead to the complete collapse of the Soviet Union.

2. Great Britain was in such an irrevocably defensive position that, even if she survived, her entire war-making potential would be spent in a desperate effort to protect her home islands.

3. The forces which the United States and her Allies could immediately deploy in the Pacific, particularly in the Marianas, were insufficient to prevent the fully trained and mobilized forces of Japan from occupying within three or four months the entire area enclosed within a perimeter consisting of Borneo, Sumatra, Java, eastern New Guinea, the Bismarck Archipelago, the Gilbert and Marshall Islands, Wake, and from there north to the Kuriles.

4. China, with the Burma Road severed, would be isolated and forced to negotiate.

5. The United States, committed to biding Great Britain, and weakened by the shock on Pearl Harbor, would be unable to mobilize sufficient strength to go on the offensive for 18 months or more. During this time, the perimeter could be fortified and the required forward airfields and bases established. So strengthened, this perimeter would be backed by a mobile surface striking force based on Truk.

6. While the success of the expressed perimeter was undoubtedly American determination to keep the war within limits, the Japanese would quickly expand bases, oil, rubber and strategic forces in Malay, Borneo, the Philippines and the Dutch East Indies, and ship those materials to Japan for processing, in storage and strengthening her industrial and military machine.

7. The extension of the United States to a democracy would make it impossible for her to continue any offensive action in the face of the weight which would be imposed by financially re-energizing Japanese defense, allies and armies, and the elimination of its Allies. The United States in consequence would compensate and allow Japan to maintain a substantial portion of her initial territorial gains.

8. Certain utilities and naval bases were familiar with the United States, the industrial and technological potential, and probable fighting deter-


**EXECUTION OF THE JAPANESE PLAN**

In accordance with the above plan, the Japanese Army was given primary responsibility for conquering Malaya, Borneo and Borneo and, because of the limited range of its planes, for providing initial air support in northern Luzon only about 87 north of Cam Ranh. The Japanese Navy was assigned primary responsibility, in addition to the attack on Pearl Harbor, for initially launching operations in the Philippines, Borneo, Celebes, southern New Guinea, the Bismarck Archipelago and out to the Gilbert Islands and Wake. The Army was to assume control in the Philippines as soon as the landing forces were established on land. On December 7, 1941, the Japanese Army and Navy air forces were accordingly disposed as follows:

<table>
<thead>
<tr>
<th>Unit</th>
<th>Aircraft</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ARMY</strong></td>
<td></td>
</tr>
<tr>
<td>3rd Field Division</td>
<td>300</td>
</tr>
<tr>
<td>5th Field Division</td>
<td>150</td>
</tr>
<tr>
<td>11th Field Division</td>
<td>100</td>
</tr>
<tr>
<td>16th Field Division</td>
<td>150</td>
</tr>
<tr>
<td>1st Field Division</td>
<td>200</td>
</tr>
<tr>
<td>2nd Field Division</td>
<td>250</td>
</tr>
<tr>
<td>4th Field Division</td>
<td>300</td>
</tr>
<tr>
<td>7th Field Division</td>
<td>400</td>
</tr>
<tr>
<td>Total Field Division</td>
<td>1,375</td>
</tr>
</tbody>
</table>

**NAVAL AIR FIELD**

<table>
<thead>
<tr>
<th>Aircraft</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
</tr>
<tr>
<td>150</td>
</tr>
<tr>
<td>100</td>
</tr>
<tr>
<td>150</td>
</tr>
<tr>
<td>200</td>
</tr>
<tr>
<td>250</td>
</tr>
<tr>
<td>300</td>
</tr>
<tr>
<td>400</td>
</tr>
<tr>
<td>1,375</td>
</tr>
</tbody>
</table>
The majority of these planes were of obsolete types. These forces were quickly overwhelmed. Fifty percent of the planes were destroyed on the ground. Out three highly skilled aircraft centers in the Pacific did not contribute a sufficient force to warrant their being risked in these operations.

Following the initial successes at Pearl Harbor, Malaya and in the Philippines, Wake and Guam were occupied in December, and Hawaii in January. The Japanese gained air superiority in Hawaii with the loss of 100 planes and, with troops specially trained for jungle fighting, occupied the area at a cost of 1,200 soldiers killed. At the end of a month, they had carried out the substance of their initial program and with greater ease than they had formerly. Total unbroken shipping losses were 57 ships. Most of the equipment which had originally been scheduled for conveyance into the northern islands was found to be unnecessary and was left behind in order to achieve greater speed. Certain of the Japanese leaders were convinced by the skillful and unexpectedly determined resistance of our ground forces in the Philippines. They calculated this to be the finest Japanese caste-infiltration. But in some circles, the skill and determination with which our isolated forces conducted the defense was currently assessed as an ominous cloud on the horizon.

**JAPANESE OVEREXTENSION**

The magnitude of these maneuvers encouraged the view among Japanese planners to conduct operations beyond the original perimeters. During their discussions, the Destroyers of 10 April 1942 struck Tokyo. Although the damage caused was inconsequential, the result of the attack supported a growing feeling that the Japanese perimeter would gain in strength if it had greater depth in defense.

Accordingly a new plan was approved, providing for (a) an advance into the Solomon and New Guinea, (b) initial contact with the United States, (c) the capture of New Guinea, (d) the capture of Luzon, and (e) the temporary occupation of the Aleutians. Accumulation of such a force would cut off the line of communication between Australia and the United States, reduce the threat from Amea.
and deny the United States all major staging areas more advanced than Pearl Harbor.

By attacking and neutralizing her line of advance, Japan's commandant in the South Pacific area, Rear Admiral Kondo, was able to concentrate his forces in the Central Pacific area, where the Americans had landed on Guadalcanal. This allowed Japan to focus on the American forces in the Central Pacific area, which were smaller and less well-equipped. The Japanese forces were able to defeat the American forces and establish control over the Central Pacific area.

The United States plans had been based on the assumption that the American forces would be able to hold their ground in the Central Pacific area and that the Japanese forces would be unable to advance. However, the Japanese forces were able to exploit this assumption and gain control over the area.

The United States had planned for a prolonged war, but the Japanese forces were able to defeat the American forces and establish control over the region. The success of the Japanese forces was due in part to their ability to take advantage of the American assumptions and plan their operations accordingly.

The United States had planned for a prolonged war, but the Japanese forces were able to defeat the American forces and establish control over the region. The success of the Japanese forces was due in part to their ability to take advantage of the American assumptions and plan their operations accordingly.
Immediately after Midway, the Japanese had a certain fix for action, clearly to be joined by a fifth but of their only 11 warships. In addition, they had 6 carriers under repair or construction. The United States had 2 large carriers operational in the Pacific and 8 carriers, and 15 more carriers, either being readied for operation, or under construction. The Japanese Navy, therefore, was held by its weaknesses in the air, and could not support our forces only at night or under cover of land-based air units until that air strength was rebuilt. A balance of naval air power in the Pacific, and as a consequence, a balance of naval power as a whole, was then achieved at Midway.

The sense of imminent conflict shifted back to the island south of Rabaul, the Samoan主体, and the island to the south of the Solomon Islands, and were constructing airfields in the主体. The United States had four carriers off the coast of New Guinea, and were constructing airfields in the主体. The United States had four carriers off the coast of New Guinea, and were constructing airfields in the主体. The United States had four carriers off the coast of New Guinea, and were constructing airfields in the主体. The United States had four carriers off the coast of New Guinea, and were constructing airfields in the主体.

While the Southwest Pacific command was building airfields in northern Australia, Port Moresby and Milne Bay, for Japanese landing, on 21 July 1942, at Manus on the north coast of New Guinea, the Japanese seized Port Moresby and infiltrated over the Owen Stanley Range. Their initial communications were cut off, and their advance columns strafed and attacked by our forces. The Japanese tried to reinforce the area, and to secure the landings by air. The Japanese were unable to reinforce the area by air, and our forces landed in the主体. On 8 August 1942, a Japanese landing was made at Manus. Three United States marines paratroopers were killed by the Japanese who landed. The paratroopers were killed at an early stage (later named Henderson Field) which was under construction by the Japanese. Investigation of the subject

Japanese commanders intended in the Solomons campaign indicated that they originally envisaged the strength of our attack and sent in only one reinforcement division of 30,000 men from Borneo. After this battle, they were virtually destroyed. They were sent in at night, which again was not quite sufficient. Eventually, they attempted to send in whole divisions. Thirty thousand troops were landed, but, by the time, it was too late. Land control of the air provided by planes based on Henderson Field made it possible, but barely possible, to defend our remaining supply ships in the主体, and made it impossible for the Japanese to land, except at night and then under intensive anti-aircraft fire. The air was re-supplied with airfields to the west of the Japanese on the west side of Guadalcanal, and at times to our shore installations, reached in a series of night naval surface equipment which moved heavy loads in both orbits. Our air strength was by that time re-supplied with airfields to the west of the Japanese on the west side of Guadalcanal, and at times to our shore installations, reached in a series of night naval surface equipment which moved heavy loads in both orbits.

The Japanese point of view was the inexperience of the Japanese on the west side of Guadalcanal, and at times to our shore installations, reached in a series of night naval surface equipment which moved heavy loads in both orbits.
positions in the Solomon and New Guinea, which threatened the author of their preponderant role. In opposing this threat, the Japanese committed to piecemeal fashion and but at all of their fully trained Navy air units, including those at Milne Bay, and a portion of their best Army air units. The Japanese never fully recovered from this disaster, the effects of which influenced all subsequent campaigns. For the first time, the few Japanese who had all the facts at their disposal appreciated the seriousness of the situation. Clearly expedient programs for the training of pilots and the production of aircraft, radar and communications equipment, antiaircraft guns and ammunition, cargo vessels and tanks, were drawn up, but time was required to implement them.

The initiative had passed to the United States.

FACtORS DETERMINING THE NATURE OF THE SUCCEEDING CAMPAIGN

After the engagements of 1942, certain basic lessons of combat in the Pacific theater had been learned. It appeared that the widely spread Japanese positions could be bypassed or captured, provided that superiority in the necessary area was achieved, and provided the requisite naval support, adequate aircraft and, properly trained troops, and full logistics were available. Major preparations were required before decisive advances could be undertaken. In the meantime, however, assaulting pressure could be kept up on the Japanese.

Due to the geography of the Empire, the Japanese ground forces depended for their effectiveness upon access to support in all areas except the main home islands, and even there, overseas imports of raw materials were required. In China, Korea, and Manchuria, anzewerthlib to the south was involved, and shipping was employed in the supply of troops to Shantung, Formosa, and the central regions of Manchuria. The railheads of the Japanese main line were completely dependent on supply by sea. Deployed as the Japanese ground forces were an outdated and insecure, dependent on inadequate shipping, their defense was necessary only at points of United States advantage. The bulk of them could be kept in the islands.

The Japanese Navy, which included two 60,000-ton battlecruisers and a dozen smaller, had lost both operational freedom and striking power due to its limited carrier-based air strength. By late 1944, the United States had available sufficient carriers for direct support in the air, and had added to the fleet of fleet carriers heavy ships to offer reasonable protection against the Japanese naval surface threat. In the submarines used to the necessity of undersea or other conditions limiting the degree to which our superiority in the air could be brought to bear. The ability to destroy the Japanese underwater and surface force, if they were assembled, was essential. Furthermore, their destruction would increase the freedom and ease of our further advances.

The limitations imposed by geography and the size of Japanese land-based planes made it impossible for the Japanese to utilize sufficient air superiority of their land-based air forces to concentrate their full air strength against us at any crucial point, prior to the invasion of the Philippines and Okinawa. Most of the islands which were too small to support the necessary air fields, and in New Guinea, the Solomons and the Marshalls, logistic, airfield construction and keep costs made such concentration impossible. Even within the limits imposed, poor Japanese staff work and tactics resulted in poor employment of their available air strengths. Over and above these weaknesses, Japanese aircraft production, pilot training and maintenance were so far behind our axes that it was evident that general air superiority over the Japanese could be achieved. This objective must and first priority.

The Japanese shipping target was immediately available. In the first year of the war, the Japanese or long-range offensive action inside the Japanese perimeter, took more than 30 percent and 38 percent of the merchant shipping in the war, the stratification of Japanese merchant network, that began, could be maintained both by the submarine and by attack from the air.

An advance to strategic positions across the Pacific would give us bases from which to complete the interruption of Japan's overseas shipping, to mount large scale air attacks against the Japanese home islands, and to prepare for an invasion of the home islands themselves.
THE ADVANCE ACROSS THE PACIFIC

Such was the situation when the United States began its worldwide offensive. While major preparations were still in progress, and the heavy attrition of the Solomon and New Georgia campaign was having a deep effect on the air groups and depleting its shipping and supplies, the first landings were made in the advance across the Pacific. The North Field was captured in May 1943. On the southern front, the offensive continued with an advance to Kwajalein in June, to Saipan in July, to Iwo Jima in March, and Okinawa in November 1945.

In the Central Pacific it began with the attack on the Gilbert Islands in November 1943. Therefore, the amphibious advance toward Japan continued over two routes. One was the north coast of New Guinea to the Philippines, and the other across the Central Pacific toward the Marshalls to the Mariana and Palau Islands and then substantially across Saipan and Okinawa. Basically, the advance was for the purpose of perfecting the United States power to punch out Japan's supply lines from the south and across the striking range of the Japanese home islands. Objectives were set for one or more of four purposes: To provide forward airfields where the Japanese island bases could be used as bases to推送 a larger air force to the closest Japanese home islands. In this line of advance, it was found possible to achieve objectives for air advance where the enemy was weak, and to use all objectives from expert observation and gunnery itself. In the case of the Mariana, Saipan and other island bases on New Guinea, a line of bases was established from where the Japanese air groups could be pushed forward into the range of lighter aircraft.

For long-range amphibious advances against strongly defended positions, a typical pattern developed. Japanese bases linking the United States objectives were neutralized by a concentration of air power. Such bases as were taken within reach of the enemy in the assault against Iwo Jima and Okinawa, were the bases of the Japanese defense pattern in May 1943. On the northern, the offensive continued with an advance to Kwajalein in June, to Saipan in July, to Iwo Jima in March, and Okinawa in November 1945. In the Central Pacific it began with the attack on the Gilbert Islands in November 1943.

Therefore, the amphibious advance toward Japan continued over two routes. One was the north coast of New Guinea to the Philippines, and the other across the Central Pacific toward the Marshalls to the Mariana and Palau Islands and then substantially across Saipan and Okinawa. Basically, the advance was for the purpose of perfecting the United States power to punch out Japan's supply lines from the south and across the striking range of the Japanese home islands. Objectives were set for one or more of four purposes: To provide forward airfields where the Japanese island bases could be used as bases to push a larger air force to the closest Japanese home islands. In this line of advance, it was found possible to achieve objectives for air advance where the enemy was weak, and to use all objectives from expert observation and gunnery itself. In the case of the Mariana, Saipan and other island bases on New Guinea, a line of bases was established from where the Japanese air groups could be pushed forward into the range of lighter aircraft.

For long-range amphibious advances against strongly defended positions, a typical pattern developed. Japanese bases linking the United States objectives were neutralized by a concentration of air power. Such bases as were taken within reach of the enemy in the assault against Iwo Jima and Okinawa, were the bases of the Japanese defense pattern in May 1943. On the northern, the offensive continued with an advance to Kwajalein in June, to Saipan in July, to Iwo Jima in March, and Okinawa in November 1945. In the Central Pacific it began with the attack on the Gilbert Islands in November 1943.

Therefore, the amphibious advance toward Japan continued over two routes. One was the north coast of New Guinea to the Philippines, and the other across the Central Pacific toward the Marshalls to the Mariana and Palau Islands and then substantially across Saipan and Okinawa. Basically, the advance was for the purpose of perfecting the United States power to punch out Japan's supply lines from the south and across the striking range of the Japanese home islands. Objectives were set for one or more of four purposes: To provide forward airfields where the Japanese island bases could be used as bases to push a larger air force to the closest Japanese home islands. In this line of advance, it was found possible to achieve objectives for air advance where the enemy was weak, and to use all objectives from expert observation and gunnery itself. In the case of the Mariana, Saipan and other island bases on New Guinea, a line of bases was established from where the Japanese air groups could be pushed forward into the range of lighter aircraft.

For long-range amphibious advances against strongly defended positions, a typical pattern developed. Japanese bases linking the United States objectives were neutralized by a concentration of air power. Such bases as were taken within reach of the enemy in the assault against Iwo Jima and Okinawa, were the bases of the Japanese defense pattern in May 1943. On the northern, the offensive continued with an advance to Kwajalein in June, to Saipan in July, to Iwo Jima in March, and Okinawa in November 1945. In the Central Pacific it began with the attack on the Gilbert Islands in November 1943.

Therefore, the amphibious advance toward Japan continued over two routes. One was the north coast of New Guinea to the Philippines, and the other across the Central Pacific toward the Marshalls to the Mariana and Palau Islands and then substantially across Saipan and Okinawa. Basically, the advance was for the purpose of perfecting the United States power to punch out Japan's supply lines from the south and across the striking range of the Japanese home islands. Objectives were set for one or more of four purposes: To provide forward airfields where the Japanese island bases could be used as bases to push a larger air force to the closest Japanese home islands. In this line of advance, it was found possible to achieve objectives for air advance where the enemy was weak, and to use all objectives from expert observation and gunnery itself. In the case of the Mariana, Saipan and other island bases on New Guinea, a line of bases was established from where the Japanese air groups could be pushed forward into the range of lighter aircraft.

For long-range amphibious advances against strongly defended positions, a typical pattern developed. Japanese bases linking the United States objectives were neutralized by a concentration of air power. Such bases as were taken within reach of the enemy in the assault against Iwo Jima and Okinawa, were the bases of the Japanese defense pattern in May 1943. On the northern, the offensive continued with an advance to Kwajalein in June, to Saipan in July, to Iwo Jima in March, and Okinawa in November 1945. In the Central Pacific it began with the attack on the Gilbert Islands in November 1943.

Therefore, the amphibious advance toward Japan continued over two routes. One was the north coast of New Guinea to the Philippines, and the other across the Central Pacific toward the Marshalls to the Mariana and Palau Islands and then substantially across Saipan and Okinawa. Basically, the advance was for the purpose of perfecting the United States power to punch out Japan's supply lines from the south and across the striking range of the Japanese home islands. Objectives were set for one or more of four purposes: To provide forward airfields where the Japanese island bases could be used as bases to push a larger air force to the closest Japanese home islands. In this line of advance, it was found possible to achieve objectives for air advance where the enemy was weak, and to use all objectives from expert observation and gunnery itself. In the case of the Mariana, Saipan and other island bases on New Guinea, a line of bases was established from where the Japanese air groups could be pushed forward into the range of lighter aircraft.

For long-range amphibious advances against strongly defended positions, a typical pattern developed. Japanese bases linking the United States objectives were neutralized by a concentration of air power. Such bases as were taken within reach of the enemy in the assault against Iwo Jima and Okinawa, were the bases of the Japanese defense pattern in May 1943. On the northern, the offensive continued with an advance to Kwajalein in June, to Saipan in July, to Iwo Jima in March, and Okinawa in November 1945. In the Central Pacific it began with the attack on the Gilbert Islands in November 1943.
still believed on Formosa supported this operation. The landing at Leyte Gulf in the Philippines was correctly assumed by the Japanese as their last opportunity, short of a defense of the Japanese home islands, to throw in all their available forces to check the United States advance in a decisive engagement.

These days after the landing at Leyte they committed their entire fleet in a three-pronged attack. The plan contemplated that a carrier force advancing from the north would draw off our main strength, while heavy surface forces approaching through Surigao and San Bernardino Straits, and covered by Japanese Army and Navy planes from airfields in the Philippines, would destroy our transports and supporting strength of the landing force. The Japanese strategy succeeded in drawing off our main strength to the north. The southern Japanese force was destroyed in a night surface engagement in Surigao Strait. Four cruisers in the northern force were sunk off Luzon. Although one of these cruisers had been sunk by torpedoes planted in our transport stream, the central force prevented close in our transports still possessed of overwhelming surface strength. The Japanese commander of the central force notified the survey that lack of expected fuel had forced the air and naval reconnaissance vessels to return to the surveys available for the mission, and many as to his fuel reserves induced him to withdraw. At a result of this decision to retire, the Japanese failed to secure the objectives for which they had hoped. We have now thrown the two main Japanese forces into its 10th and 12th divisions, and from them is the case of the Philippines. The Japanese had all the recently and supplies to which that they had ordered to supply the forces in Manchuria and Manchuria.

The Japanese army in the Philippines was equipped with the Central Pacific force under the command of the Imperial forces had been stationed in the Philippine Islands.

While the liberation of the Philippines was being completed, the Central Pacific forces made the difficult move into the Sea of Okhotsk.

CHINA-Burma-India

The Allied strategic plan contemplated that this period until the end of the war. The principal objectives were air superiority in the China theater. This was the transportation from India by air of the necessary supplies, and for which were allocated the supply of Chinese ground forces. As a result, the B-24s had sufficient supplies for only a small number of aircraft per month.

The survey in India established that the B-24s would arrive in India unscheduled and that the aviation industry and supplies used by the B-24s might have been more profitably allocated to an expansion of the
tactical and antishipping operations of the Fourth Air Force in China. The necessary training and combat experience with B-29s provided by this operation might have been scored through attacks on "Water Zones" targets, from bases more easily supplied. In November 1944, long-range bomber attacks from Guam, Saipan and Tinian were initiated. The B-29s based in China were transferred to these bases in April 1945.

By March 1945, prior to heavy direct air attack on the Japanese home islands, the Japanese air force had been reduced to kamikaze forces, her bases had been seized or immobilized, her merchant marine decimated, large portions of her ground forces isolated, and the demoralization of her enemy well begun. What happened in each of these aspects of Japan's waning air power is analyzed in the following sections.

ELIMINATION OF JAPANESE CONVENTIONAL AIR POWER

Japanese production of aircraft of all types rose from an average of 482 planes per month during the first 6 months of the war to a peak of 5,405 planes per month in September 1944. The rise was particularly great during 1945, after the Japanese had learned the lessons of the 1942 campaigns. Aggregate production during the war was 50,300 planes.

Japanese army and navy planes losses from all causes, combat and noncombat, rose from an average rate of some 800 planes per month in the early months of the war to over 2,000 per month in the latter months of 1944. Aggregate losses during the course of the war were of the order of magnitude of 30,000 planes, of which something less than 16 percent were combat losses, andmore than 40 percent were training, factory, and other noncombat losses.

The Japanese were thus able to increase the numerical strength of their air forces in place, in almost every month of the war. Numerical strength increased from 8,393 tactical planes at the outbreak of the war to 5,000 initial planes, plus 1,000 kamikazes, at the time of surrender. Aggregate flying personnel increased from approximately 12,000 at the outbreak of the war to over 31,000 at the time of surrender.

United States aircraft production and pilot training exceeded the Japanese twice by wide margins, but only a portion of this strength could be deployed in the Pacific. United States first line strength in the Pacific west of Truk Harbor increased from none in 1941 to 11,000 planes in August 1945. It was not until late 1943 that we attained numerical superiority over the Japanese air force in the field. Even in 1944, however, the relatively few United States air units in the Pacific were able to inflict greater losses than they sustained on the numerically superior Japanese. Aggregated United States plane losses during the course of the Pacific war, not including training losses in the United States, were approximately 17,000 planes. Of these losses, 5,000 were in combat operations; the remainder were training, ferrying and other noncombat losses. Of the combat losses, 80 percent were to anti-aircraft fire.

As previously stated, Japanese pilots at the outbreak of the war were well trained. The average Army pilot had some 200 hours before entering combat and Navy pilots 400 hours. These experienced pilots were largely expended during the latter campaigns of the opening year and a half of the war. The Japanese paid for his attention to the training of their trained pilots, and were severely hampered in their training program by a growing shortage of training gasoline. Aggregate flying experiences fell off throughout the war, and was just over 100 hours, compared to 350 hours for United States pilots, at the time of surrender. Inadequately trained pilots were no match for the skilled pilots developed by the United States.

At the time of the initial Japanese attack, Japanese fighter planes, although less steady, more reliable and stable in power than the United States fighters, had certain flight characteristics superior to those of United States fighters then available in the Pacific. The Japanese improved the quality of their planes during the war, greatly increasing the power of their aircraft engines, ultimately reaching United States fighters in power and had excellent aircraft in the design and experimental stage at the end of the war. They lacked, however, the widespread industrial skill to match the United States in quantity production of reliable planes with increased range, performance and durability. After the initial campaigns, the United States always enjoyed superiority in the over-all performance of its planes.

By American standards, the Japanese never
fully appreciated the importance of adequate maintenance, logistic support, communications and control, and air fields and bases adequately preplanned to handle large numbers of planes. As a result, they were unable to concentrate air power in such large proportions of their air strength at any one time or place. Neither did they appear to have the ability to control large formations in the air with any degree of efficiency.

Local air control and their tactical exploitation left the Japanese understated and achieved in their early offensives.

But along with all other military power prior to the war, the Japanese had failed fully to appreciate the strategic situation brought about by the increased capability of air power. The ability to maintain general and controlling central control of the air was not sought and was not a requirement in their battle war strategy, as was the planned destruction of the United States Fleet. Had this basic requirement been understood it is difficult to conceive that they would have undertaken a war of limited objectives in the first place. Once started on a strategic plan which did not provide the means to assure maintaining air control, there was no way in which they could revise their strategic to reverse the growing predominance in the air of a basically stronger opponent who came to understand this requirement and whose war was being fought accordingly.

CONVERSION OF JAPANESE AIR FORCES TO KAMIKAZE FORCE

By the summer of 1943, it had become evident to the Japanese air commanders that there was no way in which they could equal the United States air forces at any point. Their losses were excessive, while the results that they were achieving were meager. The end result at which they were converging was the willingness of their pilots to accept certain death. Under these circumstances, they developed the Kamikaze technique. A pilot who was prepared to fly his plane directly into a ship would require but little skill to hit his target, provided he got through the interposing screen of enemy fighters and anti-aircraft fire. The effect of Japanese planes attacked en masse by the enemy would be impossible to prevent a certain proportion from getting through. Even though losses would be 100 per cent of the planes and pilots the calculated results, instead of being negligible, might be sufficient to cause damage beyond that which we would be willing to endure.

From October, 1944, to the end of the Chinese surrender, the Japanese flew 2,500 Kamikaze missions, of which 45, or 18.4 per cent, were effective in scoring hits or damaging our mines. Warships of all types were damaged, including 35 aircraft carriers, 10 battleships, and 18 light and escort carriers. However, no ship larger than an escort carrier was sunk. Approximately 60 merchant ships were sunk, the bulk of which were destroyers. The Japanese were misled by their own inflated claims of heavy ships sunk, and ignored the advice of their technical staffs to hoist the aggression flag required to trick our ships. To the United States the losses actually sustained were minor, and caused great concern. Two thousand R-20 missiles were diverted from direct attacks on Japanese силов and installations to wrecking Kamikaze airfields in Kyushu. Had the Japanese been able to maintain an attack of greater power and concentration they might have been able to cause us to withdraw or to revise our strategic plans.

At the time of surrender, the Japanese had more than 2,500 planes in the home islands available for Kamikaze attack, and more than 8,000 had already been supplied for suicide attack to retake our planned invasion.

DESTRUCTION OF THE JAPANESE FLEET

As stated earlier in this report Japan started the war with 30 carriers. Six were sunk during the engagements of 1942. The Japanese during the course of the war constructed or converted from other types of ships a total of 17 additional carriers including 3 escort carriers; of these the first one was made on a有限 Scarlett battleship hull and two, carrier only in part, were the result of converting the other carriers of battleship and installing small hangars and launching tubs. Due to the loss of limited carrier air groups in 1943 and the time required to build new ones, the Japanese did not commit their carriers again until 1944. To the engagements of that year the Japanese lost 7 carriers without themselves scoring appreciable results. Seven more were lost in home waters in suicide or air attack. All Japanese carriers sunk were lost either to our carrier-based aircraft or in submarines with the exception of one which was finished off by war.
was and much of it had been mortally damaged by enemy air attack.

The Japanese had two major airbases, each of 60,000 tons, armed with 18-inch guns and 30-degree anti-aircraft, which were more powerful than any Allied warship. One was sunk in the Sibuyan Sea, the other near the Ryukyu, both by carrier-based planes.

For the battleship, the Japanese warships aggregated approximately 1,275,000 tons. An additional 418 combat ships totaling 1,283,000 tons were constructed during the war. Approximately 1,360,000 tons of Japanese warships in the carrier, battleship, cruiser, and destroyer categories were subjected to the aggregate tonnage sunk. Of this total roughly 418,000 tons were sunk by Navy and Marine aircraft, 370,000 tons by submarines, 269,000 tons by surface vessels, 25,000 tons by Army aircraft, and 42,000 tons by various agents. Only 109,000 tons in these categories remained at the end of the war. The tonnage sunk by surface ships was principally in high actions. A shortage of Japanese destroyers after 1944 and inadequate Japanese air anti-submarine measures contributed to the successes of United States submarines against the Japanese fleet.

After the liberation of the Philippines and the capture of Okinawa, oil imports into Japan were completely cut off, fuel oil stocks had been used, and the few surviving Japanese warships, being without fuel, were dismasted and used only as training platforms. Except for the increased concentration of Japanese aircraft on land bases, the war in the Pacific was conducted primarily on land bases.

The attack on Pearl Harbor brought the United States into the war. In less than 3 months of fighting, the United States emerged victorious. The war against Japan cost the lives of thousands of Americans and was marked by significant technological advancements. The war ended with the atomic bombings of Hiroshima and Nagasaki, which led to Japan's surrender on August 15, 1945.
after their original advance had been completed they would be able to return to increasing numbers of ships to the movement of raw materials for their basic economy. After the beginning of the invasion campaign, however, they were kept under such constant and unexpected military pressure that the contemplated return after that date was never possible.

Up to the end of 1942, ship sinkings exceeded new acquisitions by a small margin. Therefore, the aggregate tonnage sunk increased far more rapidly than could be matched by the expansion of the Japanese shipbuilding program. The size of the edible fleet thus declined continuously and at the end of the war amounted to little more than 20 percent of its original tonnage. The Japanese belatedly attempted to build up a convoy system, to re-route traffic movements to rail lines, and to absorb more distant sources of supply; but these measures acted only as palliation and not as cure. For instance, convoying and re-routing decreased the freights per ton by a factor amounting to 40 percent, but the sinking of ships by submarines and mine countermeasures was increasing at an annual rate of 4 percent per year. In 1944 entire convoys became small prizes and were thereafter the first concern of the Japanese shipping authorities.

The basic economic consequences of ship sinking will be discussed in a later section. From the standpoint of the Japanese armed forces in the end it will be noted that 17 percent of army supplies shipped from Japan were sunk in 1943, 30 percent in 1944, and 60 percent in 1945. A shortage of fuel, therefore, was a continuing limitation on the mobility of the Japanese fleet and contributed to its defeat in the two crucial battles of the Philippine Sea. Roadside logistic support, due in large part to lack of shipping, was one of the principal handicaps of the Japanese air forces.

Attacks by submarines, long-range search and attack planes, mines, and carrier and land-based planes were equally devastating and complicated the Japanese defenses. Long-range air search found its acceptance for submarines conveying which offered more protection against submarines in war than in peace. At the same time, it was not feasible to drive ships out of shallow water into values where submarines could operate. Had we constructed more submarines, earlier concentrated on tanks and more fully coordinated long-range air search and attack missions with submarine operations, the ship sinking program might have been more effective.

DESTRUCTION OR ISOLATION OF JAPANESE GROUND FORCES

The Japanese built up their army ground forces from a strength of approximately 1,200,000 at the outbreak of war, to a peak strength of approximately 2,000,000. Japanese army medical records indicate that the aggregate number deployed in the Solomon, New Guinea, Marshall, Gilbert, Carolines, Marianas, Philippines, Okinawa, Iwo Jima, and the Aleutians was approximately 550,000, of whom 301,000 were killed in action; some 121,000 were killed in Borneo, of whom 11,000 were killed; and 1,000,000 were deployed in China, of whom 10,000 were killed. Most of the remainder were in Manchuria, Korea, or other overseas areas, and they did not participate in the decisive campaigns of the war.

The strategy of our advance and the limitations imposed upon Japanese overwater forces required that the Japanese could concentrate only a small portion of their available Army ground forces strength along of the critical island positions which we determined to capture. Japanese soldiers were unique in their willingness to face death and execute hardships. At every point where our Army or Marines forces engaged the Japanese on the ground after 1943, we enjoyed full air superiority. In every instance, except Okinawa in the key carrier campaign, we had eliminated Japanese ability to reinforce the critical areas with other invasion troops. At Okinawa the Japanese were able to land 40,000 troops, but those reinforcements arrived weeks after the initial landing and were embattled to death in a well-entrenched position. As a result the Japanese were able to hold 10,000 troops, but their reinforcements arrived weeks after the initial landing and were embattled to death in a well-entrenched position. As a result the Japanese were able to hold 10,000 troops, but their reinforcements arrived weeks after the initial landing and were embattled to death in a well-entrenched position.

In every instance where the Japanese had Pre-determined defenses in a leading axis these had been reinforced up by naval bombardment and usually by naval shelling as well. If often proved impossible, however, to destroy more than a small portion of the defending Japanese soldiers in pre-determined positions, reducing any operations of even the greatest intensity. The Japanese were dug in, in tunnels, trenches and caves which were hard to find and often impossible to destroy, either by bombing or by naval shelling. Most of their fired artillery positions were eliminated, but even more of them survived.

The
weight of fire on the immediate invasion beaches was generally such that the Japanese retained a short distance inland, but once we advanced beyond the beaches, it became necessary to destroy the remaining Japanese in costly close-range fighting. It was demonstrated, however, that Japanese resistance was effectively weakened and our casualties light when the appropriate weapons were employed with sufficient weight and accuracy in both preliminary softening-up operations and subsequent close-support.

A Japanese estimate indicates that in the north- ern region, approximately 20 percent of their combat deaths resulted from aerial bomb and shell fire, 18 percent from small arms fire, 12 percent from artillery, and the remaining 5 percent from other causes.

In those places where it was essential to elimi- nate Japanese ground resistance in close-range fighting, great precision had to be developed in air-support operations in order to be certain not to kill our own troops, and to assure fires on the small target which the isolated Japanese positions presented. This required highly specialized training and the closest coordination between the ground and air forces through an intimate system of ground and air observers and mutual control by ground and air radio communications. In the Pacific this system was continuously improved by the Navy and Marines in connection with succeed- ing amphibious operations against strongly defended positions and reached a high degree of effectiveness. In the Philippine campaign, the Army air forces employed comparable techniques, and General Yamashita has testified to the feeling of complete helplessness when confronted with this new type of opposition.

In the Southwest Pacific, it often proved possible to effect landings at lightly held positions and thus bypass large bodies of enemy ground forces. In the Central Pacific, many of the islands the Japanese expected us to attack were bypassed, and the garrisons left to defend the perimeter. Ground commanders of the bypassed islands in the Pacific and interviews of the Japanese survivors confirmed this unfavorable situation. Their plans and ground installations were destroyed by air attack. Cut off from ship reinforcements, except occasionally by submarine, their food ran out. On certain of the islands, Japanese actually ate Japanese. It appears, however, that our air attacks on these bypassed positions were often continued longer and in greater weight than was reasonably required or profitable.

THE JAPANESE ECONOMY PRIOR TO SUSTAINED DIRECT AIR ATTACK

The reconstruction of the Japanese economy toward war began in 1934, and continued with increasing emphasis during the Manchurian and Chinese conquests. By 1940, total production had risen by more than 70 percent; heavy industrial production by almost 100 percent and 17 percent of Japan’s total output was being devoted to direct war purposes and expansion of her munitions in- dustry, as against 2.6 percent that time in the United States. Construction of industrial facili- ties in these years assumed— for the Japanese conditions— gigantic proportions. Her aircraft, ammunition, machine tools, automotive, and tank industries were erected, almost from nothing during this period.

The industrial expansion was based and de- pended on the availability of raw materials. Great efforts were devoted to the increase of raw material output in the home islands. In more re- spect, major results were achieved. Coal produc- tion in Japan rose from 13,000,000 tons in 1931 to 28,000,000 tons in 1943. Domestic iron mining became considerably more important. Nevertheless, no country could have been farther from self-suffi- ciency, with respect to raw materials, than Japan. The development of basic material sources on the continent of Asia constituted almost the central issue of Japanese economic policy during this period.

Although progress in Manchuria and China helped significantly to alleviate Japan’s raw ma- terial shortages in regard coal, iron ore, steel, and foods, insufficiency of raw materials continued to be the most important limiting factor on Japanese industrial output. Notable exceptions of oil and iron bands sources existed within Japan’s “Inner Zone.” Output of aluminum ingots had risen from 19 in 1931 to 51,760 in 1942, 10 percent of which was produced from bands imported from the Dutch East Indies. Plans to develop a syn- thesis oil industry failed to yield significant results and Japan was almost wholly dependent on oil imports from the United States or the Dutch East Indies, although dependent on importation of rubber, copper, and much iron used for rails, iron, etc., such as magnesium,
dimes, nickel, cobalt and tungsten, and for ferrous metals such as tin, lead and mercury.

Proofing errors and economic exploitation of the oils and bauxite resources in the southern area, stock piling of these vital materials was a necessity. By the end of 1944, bauxite stocks of 230,000 tons, constituting a 7 months' supply, and 43,000,000 barrels of oil and oil products were stored in Japan.

Considering the economic performance of the decade, one cannot but be impressed by the tenacity of the effort and the magnitude of the re- sults. Nevertheless, Japan remained in an economy having on approximately 80 percent of the potential of the United States economy. It was extremely vulnerable to attack on its shipping. Having a comparatively small, newly developed industry, it had to work without much control of under-staffed physical plant capacity. Having had little experience with mass production, the country had no opportunity to build up a large force of technically and mechanistically trained personnel. This meant shortage of skills, ingenuity and ability to improve later on, when the economy was under the pressure and stress of large-scale wars.

This economic potential could support a short war or a war of limited duration. The accumu- lated stocks of necessities, oil, planes and ships could be thrown into action and produce a devastating effect on our economic assets. When this initial blow failed to result in peace, Japan, with- out significant help from Germany, was doomed. Its economy could not support a protracted cam- paign against an enemy even half as strong as the United States.

In addition, the success of the initial Japanese military operations delayed total economic mobilization until after the defeat of late 1944. Contrary to earlier reports, the gross national product rose to a level of $42 billion in the fiscal year ending March 31, 1946, to only 41 billion in the fiscal year 1945. That this was due to an inadequate estimation of requirements and inadequate planning, and not to the inherent limitations of the Japanese economy, is clear from the ex- perience that was secured after 1945. In the fiscal year 1942, the gross national product rose to 42.4 billion yen, and in 1944 to 80 billion yen.

The share of the gross national product devoted to direct war and defense expenditures increased from 21 percent in 1941 to 51 percent in 1942, 60 percent in 1943 and 67 percent in 1944. In 1944, half of the remaining national product was accounted for by food. In 1943, however, the United States was devoting 50 percent of its nearly greater national product to direct war purposes. By the middle of 1944, the Japanese had exhausted the possibility of forcing a greater share of their economy into direct war activities. Their plants, railroad and mine works being, and had been for some time, under-maintained to a point where breakdowns were becoming so common and so costly. The civilian population was underfed, was receiv- ing practically no new clothing or miscellaneous civilian supplies, and was being worked to a degree of fatigue which was reflected in rising rates of absenteeism.

By 1944, Japan had increased import steel capacity to 250 percent of the 1937 capacity. A shortage of raw materials, however, which began with the United States embargo on scrap iron ex- ports in July 1941 and was never overcome, pre- vented the operation of Japanese steel mills at any approaching capacity. Japanese coal would not provide satisfactory raw materials without the subterfuge of using terminal re- cycling and domestic iron ore was back ordered in quantity and of lower grade than imported ore. The utilization of limited quantities of high- grade imported raw materials and low-grade domestic materials held production of ingot steel in the home islands to $390,000,000 in 1943, to a peak of $2,000,000,000 in 1944, and caused it to decline to $23,000,000 in 1945. This compared with a $907 production of $2,000,000,000 tons and a theoretical capacity of $10,000,000 tons in 1944. By the middle of 1944, the increasing stringency of shipping and the in- troduction of enemy of Japan's shipping routes had reduced coal and ore imports by two-thirds. Shipments of imported materials had already been heavily rationed, and steel production be- gan to decline rapidly. In March 1945, imports of ore virtually ceased, and to ore was cut off entirely, so the Japanese elected to devote their remaining shipping capacity to the handling of vitally needed foodstuffs and mail. It is estimated by the Survey that, using only domestic raw materials, the Japanese steel industry could not have manu- factured a rate of production of ingot steel in excess of 1,000,000 tons per annum. By August 1945, the rate of output was still somewhat in excess of this.
...figure, but would soon have been reduced. The decline in Japan's steel production can be attributed to a depression in shipbuilding and the destruction of the shipping. Had this industry not been mortally wounded by shipping and had its destruction by bombing been called for, the effectiveness of the few strategic bombing units dis-...ected against the steel industry -- the destruction of the principal plants by bombing or paralysis of the industry by disruption of railroad transportation would have been possible, but only at a higher cost.

The steel shortage constituted an over-all limitation on the war potential of the Japanese economy. Japanese planners were, however, able to secure a substantial increase in the production of those military products which the experience of the war had demonstrated to be of outstanding importance. Aircraft production of all types, including training planes, was stepped up from 750 planes per month in the summer of 1942 to 2,893 planes in September 1944. Aircraft engine production was not only increased correspondingly in numbers, but also increased in horsepower and gasoline consumption. Production was expanded artificially. Radar and communications equipment was stepped up fivefold. The most important consumer of steel was the shipbuilding industry. The increasing critical nature of Japan's shipping situation caused her to expand her naval and merchant shipbuilding programs to a point where 83 percent of all steel consumed was being used in that industry alone. Construction of merchant ships increased from approximately 28,000 tons in 1941, to 1,100,000 tons of steel ships and 240,000 tons of wooden ships in 1944. During 1944, 840,000 tons of merchant ships were completed and 1,144,600 tons of merchant ships were on the stocks. In 1944, the largest aircraft carriers of 114,400 displacement tons and 141,800 tons of escort vessels were delivered. The increase in high-priority items involved the rolling down of steel availability for lower priority items, such as tanks, larger naval guns, and trucks, and the almost complete elimination of steel for civilian requirements, contruction, or export. During 1944, the effect of the cutback of ship-... building and ship repair decreased somewhat in the latter part of the year as larger vessels became possible to meet even high-priority war production by further shifting of allocations of scarce materials from items of lesser priority. In addition to steel, other basic elements of the economy were involved. Oil, although not as important as steel in its impact on the remainder of the economy, was of critical importance to Japan's military mobilization and to her merchant marine. Oil imports from the south began declining in April 1942, and had been eliminated by April 1944. Crude oil stocks were virtually exhausted; refinery operations had to be curtailed; and stocks of aviation gasoline fell to less than 1,200,000 barrels, a point so low as to require a drastic cut in the pilot-training program and in the combat air missions. January imports declined from 130,000 tons in the second quarter of 1943 to 6,000 tons in the third, and stocks were only 7,000 tons. Stockpiles and the time delay between the various stages of production combined for a time to in the inevitable effects of the blockade on refined petroleum products, but by November 1944, the over-all level of Japanese war production had begun to turn down, including even the highest priority items, such as aircraft engines.

It is the opinion of the Survey that by August 1943, even without direct air attack on her cities and industries, the over-all level of Japanese war production would have declined below the year levels of 1942 by 10 to 15 percent solely as a result of the interruption of overseas imports. By mid-1944 these Japanese in possession of the basic information and with reasonable clarity, the accurate diagnosis which was inevitably de-...veloped as Japan. Furthermore, they were saved of the disastrous import of long-range bombing on Germany, and, with the loss of the base of Tokyo, could furnish similar attacks on Japan's Japanese Islands could furnish similar attacks on Japan's Islands could furnish similar attacks on Japan's Islands could furnish similar attacks on Japan's Islands. In its influence, however, was not sufficient to overcome the influence of the Army which was confident of its ability to avoid invasion.

THE AIR ATTACK AGAINST THE JAPANESE HOME ISLANDS

The United States strategy contemplated that the final decision in the Japanese war would be obtained by an invasion of the Japanese home islands. The long-range bombing offensive from the Marianas was initiated in November 1944, with that in mind as the primary objective. As in Europe prior to D-Day, the principal measure of success set for strategic air action was the ex-
test in which it would weaken enemy capability and will to resist our offensive forces at the time of landings. This led, originally, to assertions of the impossibility of the Japanese armed forces to resist the United States land forces in November 1944. This was, in part, a result of the nation's economic state and the degradation of its armed forces. The Japanese, however, were in a much better state of preparedness for the invasion than the Americans. The destruction of most of the main industrial plants of Japan's mainland and the destruction of the nation's transportation system would be necessary in order to prevent the invasion.

With the help of Midgley, it appeared that the main objectives of the invasion were the destruction of the main industrial plants of Japan and the destruction of the nation's transportation system. The Japanese were in a much better state of preparedness for the invasion than the Americans. The destruction of most of the main industrial plants of Japan's mainland and the destruction of the nation's transportation system would be necessary in order to prevent the invasion.

The main objectives of the invasion were the destruction of the main industrial plants of Japan and the destruction of the nation's transportation system. The Japanese were in a much better state of preparedness for the invasion than the Americans. The destruction of most of the main industrial plants of Japan's mainland and the destruction of the nation's transportation system would be necessary in order to prevent the invasion.

On 6 March 1945, a large division of the invasion force landed on the coast of central Japan. The invasion force consisted of two divisions and a large number of support troops. The main objective of the invasion was the destruction of the main industrial plants of Japan and the destruction of the nation's transportation system. The Japanese were in a much better state of preparedness for the invasion than the Americans. The destruction of most of the main industrial plants of Japan's mainland and the destruction of the nation's transportation system would be necessary in order to prevent the invasion.

The main objectives of the invasion were the destruction of the main industrial plants of Japan and the destruction of the nation's transportation system. The Japanese were in a much better state of preparedness for the invasion than the Americans. The destruction of most of the main industrial plants of Japan's mainland and the destruction of the nation's transportation system would be necessary in order to prevent the invasion.

On 6 March 1945, a large division of the invasion force landed on the coast of central Japan. The invasion force consisted of two divisions and a large number of support troops. The main objective of the invasion was the destruction of the main industrial plants of Japan and the destruction of the nation's transportation system. The Japanese were in a much better state of preparedness for the invasion than the Americans. The destruction of most of the main industrial plants of Japan's mainland and the destruction of the nation's transportation system would be necessary in order to prevent the invasion.

The main objectives of the invasion were the destruction of the main industrial plants of Japan and the destruction of the nation's transportation system. The Japanese were in a much better state of preparedness for the invasion than the Americans. The destruction of most of the main industrial plants of Japan's mainland and the destruction of the nation's transportation system would be necessary in order to prevent the invasion.

On 6 March 1945, a large division of the invasion force landed on the coast of central Japan. The invasion force consisted of two divisions and a large number of support troops. The main objective of the invasion was the destruction of the main industrial plants of Japan and the destruction of the nation's transportation system. The Japanese were in a much better state of preparedness for the invasion than the Americans. The destruction of most of the main industrial plants of Japan's mainland and the destruction of the nation's transportation system would be necessary in order to prevent the invasion.

The main objectives of the invasion were the destruction of the main industrial plants of Japan and the destruction of the nation's transportation system. The Japanese were in a much better state of preparedness for the invasion than the Americans. The destruction of most of the main industrial plants of Japan's mainland and the destruction of the nation's transportation system would be necessary in order to prevent the invasion.

On 6 March 1945, a large division of the invasion force landed on the coast of central Japan. The invasion force consisted of two divisions and a large number of support troops. The main objective of the invasion was the destruction of the main industrial plants of Japan and the destruction of the nation's transportation system. The Japanese were in a much better state of preparedness for the invasion than the Americans. The destruction of most of the main industrial plants of Japan's mainland and the destruction of the nation's transportation system would be necessary in order to prevent the invasion.

The main objectives of the invasion were the destruction of the main industrial plants of Japan and the destruction of the nation's transportation system. The Japanese were in a much better state of preparedness for the invasion than the Americans. The destruction of most of the main industrial plants of Japan's mainland and the destruction of the nation's transportation system would be necessary in order to prevent the invasion.

On 6 March 1945, a large division of the invasion force landed on the coast of central Japan. The invasion force consisted of two divisions and a large number of support troops. The main objective of the invasion was the destruction of the main industrial plants of Japan and the destruction of the nation's transportation system. The Japanese were in a much better state of preparedness for the invasion than the Americans. The destruction of most of the main industrial plants of Japan's mainland and the destruction of the nation's transportation system would be necessary in order to prevent the invasion.

The main objectives of the invasion were the destruction of the main industrial plants of Japan and the destruction of the nation's transportation system. The Japanese were in a much better state of preparedness for the invasion than the Americans. The destruction of most of the main industrial plants of Japan's mainland and the destruction of the nation's transportation system would be necessary in order to prevent the invasion.

On 6 March 1945, a large division of the invasion force landed on the coast of central Japan. The invasion force consisted of two divisions and a large number of support troops. The main objective of the invasion was the destruction of the main industrial plants of Japan and the destruction of the nation's transportation system. The Japanese were in a much better state of preparedness for the invasion than the Americans. The destruction of most of the main industrial plants of Japan's mainland and the destruction of the nation's transportation system would be necessary in order to prevent the invasion.

The main objectives of the invasion were the destruction of the main industrial plants of Japan and the destruction of the nation's transportation system. The Japanese were in a much better state of preparedness for the invasion than the Americans. The destruction of most of the main industrial plants of Japan's mainland and the destruction of the nation's transportation system would be necessary in order to prevent the invasion.
ECONOMIC EFFECTS OF AIR ATTACK
AGAINST THE JAPANESE HOME ISLANDS

The physical destruction resulting from the air
attack on Japan approximates that suffered by
Germany, even though the tonnage of bombs
dropped was far smaller. The attack was more
devastated in time, and the target was smaller
and more vulnerable. Not only were the
Japanese defenses overwhelmed, but Japan's
will and capacity for reconstruction, defense,
and positive defenses were less than Germany's.
The aggregate was 10 percent of the built-up area
of the 46 cities attacked was destroyed. A
substantially 50 percent of the entire urban population
of Japan lost their homes and many of their
possessions. The physical destruction of industrial
plants subjected to high-explosive attacks was
similarly impressive. The total bomb load of the
18,409 tons of bombs per
area in the post-war
were used. The destruction
was generally more complete than in Germany.
Plants specifically attacked with high-explosive
bombs were, however, limited in number.

The railroad system had not yet been subjected
to substantial attack and remained in reasonably
good operating condition at the time of surrender.
Little damage was suffered which interfered with
normal line operations. Trains were running
through Hiroshima 48 hours after the dropping
of the atomic bomb on that city. Damage to local
transport facilities, however, seriously disrupted
the movement of supplies within and between
cities, thereby hindering production, repair work,
and disposal operations.

Japan's electric power system was properly
protected for specific attack because of the large
number of small transmitters. Urban incendiary
attacks destroyed the electric distribution systems
in the burned-out area simultaneously with the
consumption load previously served by them.
The hydro-electric generating plants and the trans-
mission networks survived without substantial
damage. Twenty-six urban steam-generating
plants were damaged in an incident to other
attacks, the aggregate in-service capacity being lost less
than one-quarter of the total generating capacity.

The urban area incendiary attacks eliminated

related area were burned to the ground. The
weight and intensity of this attack caught the
Japanese by surprise. No subsequent urban area at-
tack was equally destructive. Two days later, an
attack of similar magnitude on Nagoya destroyed
9 square miles. In a period of 40 days starting
9 March, a total of 1,472 sorties delivered 9,737
tons of bombs against Tokyo, Nagoya, Osaka, and
Kobe destroying 31 square miles of those cities at
a cost of 10 aircraft. The generally destructive
effect of incendiary attacks against Japanese cities
had been demonstrated.

Thereafter, urban areas attacked alternated with
visual and area attacks against selected industrial
or military targets. As April, an extensive pro-
gress of storing mulladness in channels and harbors
at night was observed. In the aggregate, 104,600 tons
of bombs were delivered on 60 urban areas; 14,110
tons were directed at airfields; 10,838 tons
at oil refineries; 8,721 at arsenals; 2,790 tons at
airfields, and oil tanks in support of the Okinawa
operation; and 16,364 mines were sunk.

Bombing altitudes after 9 March 1945 were
lower, in both day and night attacks. Japanese
opposition was not effective even at the lower alti-
tudes, and the percentage of bombs to area action
decreased as the number of attacking planes
increased. Bomber loads increased and operating
hours declined in part due to less strain on engines
at lower altitudes. Bombing accuracy increased
substantially, and averaged 50 to 60 percent within
1,000 feet of the aiming point in daylight attacks
from 20,000 feet or lower.

Monthly tonnage dropped increased from 1,490
tons in March to 48,000 tons in July, and, with the
activation of the Eighth Air Force on Okinawa,
would have continued to increase thereafter to a
peak of 20,000 tons per month, had the war not come to an end.

Three-quarters of the 7,409 tons of bombs
dropped by carrier planes on the Japanese home
islands were directed against airfields, warships,
and miscellaneous military targets, and one-quarter
against railroad yards and other objectives.
The ratio of warships sank in home ports
had already been immensely for lack of fuel.
The accuracy of low-level carrier plane attack was
high, being at least 20 percent hit within 500 feet
of the aiming point. The attack against the
Hokkaido-Amurail rail ferry in July 1945 sunk or
damaged all twelve of the ferries, 170 mile ships,
and 143 smaller ships.
fully the residential and small commercial and industrial structures in the affected areas and a significant number of important plants, but a portion of the men substantially evacuated office buildings and factories in these areas and the underground utilities survived. By 1944 the Japanese had also eliminated naval and heavy industry in their war economy. They still relied, however, on plants employing less than 2,900 workers for subcontracted parts and equipment. Many of these smaller plants were concentrated in Tokyo and accounted for 20 percent of the total industrial output of the city. Such plants suffered severe damage in urban incendiary attacks.

Fires and heavy losses occurred in all and all products, 33,000 tons of foodstuffs and 2 billion square yards of textiles were destroyed by air attacks. Ninety-seven percent of Japan's stocks of gun, shell, explosive, and other military supplies were thoroughly positioned in dispersed or underground storage depots, and were not vulnerable to air attack.

Physical damage to plant installations by either air or precision attacks, plus decreases due to dispersal enforced by the threat of further physical damage, reduced physical productive capacity by roughly the following percentages of preattack plant capacity: oil refineries, 50 percent; aircraft engine plants, 73 percent; airframe plants, 67 percent; electronics and communication equipment plants, 50 percent; army ordnance plants, 33 percent; naval ordnance plants, 30 percent; merchant and naval shipyards, 30 percent; light metals, 33 percent; and steel, 20 percent; cement, 33 percent.

The economic consequences of the physical damage brought by air attack are clearly interrelated with the concurrent effects of the interdiction of imports, the cumulative effects of under-maintenance of plants, and the declining health, vigor and determination of the Japanese people.

Let us first consider the level of Japanese industrial activity in July 1943, the last full month before surrender. Electric power and coal consumption were both about exactly 50 percent of the peak recorded in 1941. Production efficiency had, however, declined and the overall industrial output was approximately 40 percent of the 1941 peak. Output varied considerably as between industries, but it also varied among plants and by area. Output of air frames was 69 percent of the 1944 peak; aircraft engines, 55 percent; shipbuilding, 15 percent; army ordnance, 40 percent; and naval ordnance, 69 percent. Oil refining had declined to less than 10 percent of the 1943 peak.

In some cases, the decline was 17 percent of the 1944 peak. Oil refining had fallen to less than 10 percent of the 1943 peak.

Although electric power consumption fell, because more power was not available, and demand had declined. Coal supply was primarily limited by the demand for food and fuel, the lack of food and fuel, the inability to control the coal industry to fill the gap. Despite a decline in demand, shortages of coal were universal throughout the economy. Aircraft production was limited primarily by the continuing effects of the dispersal program brought on by the initial bombing, and aggravated by the subsequent destruction of munitions plants prior to completion of dispersal. Had the level of production been any higher, however, aluminum supplies would have been exhausted and aluminum would have become the controlling bottleneck. In any event, not enough aircraft engines were being produced to apply the airframe. Aircraft engine production was plagued by shortages of special steels, but in July 1943, plant damage and inky in completing the underground and dispersed plants started in the spring of the year had temporarily prevented the full use of the small stocks of such steels available at the time. Output of radar and radio equipment was limited by plant capacity, the small factories supplying parts having been destroyed in the Tokyo city raids and many of the larger plants either destroyed or forced to disperse. Shipbuilding and heavy ordnance production was limited by the unavailability of steel. Oil refineries, aluminum plants and steel plants were basically limited by lack of foreign raw materials. Explosives plants were still using up inventories of nitrate and coal and would shortly have had to resort their output to the current availability of their raw materials.

The Japanese war industries had declined in efficiency due to exhaustion and fatigue, the destruction of much of the urban housing and the difficulties of local transportation. Production...
Many of Japan's coastal and inter-island traffic had already been forced on to her inadequate railroads. The principal railroad routes of Japan are located on Kyushu and Hokkaido. This coal traffic, formerly water borne, was moving by railroads employing the Kawanabe tunnels and the Hakodate-Annai mail ferry. The railroads on Honshu include few main lines and time lines traverse bridges of considerable vulnerability. Japan is largely a mountainous country lacking railroads except some on the Akita and the Kanazawa and 19 bridges and vulnerable portions of lines total to those as to set up some means of complete introduction would have virtually eliminated further coal movement, would have ruined the remainder of the rail system through lack of coal, and would have completed the stagnation of Japan's economy. This elimination would have more effectively and efficiently disrupted the economic structure of the country than individually destroying Japan's cities and factories. It would have reduced Japan to a series of isolated communities, inaccessible by any known industrial production, incapable of raising food from the agricultural area to the cities, and incapable of major large-scale movements of troops and munitions.

The survey believes that such an attack, had it been well planned and executed, might have been initiated by sea-based attack on shipping and on the Hakodate ferry in August, 1914, could have been followed by aerial mining of inland waterways beginning in December, 1914, and could have been further continued by initiating the railroad attack as early on April 1915. The survey has estimated that from requirements to effect complete interruption of the railroad system would have been 405 B-39 steam mines carrying 8,000 tons of high explosive bombs. Monthly tonnage equal to one and one-half times that required to effect the original interruption should have been sufficient, in view of the Japanese lack of preparatory storage in off-shore in effecting repairs, to maintain the interruptions by destroying such bridges and other facilities as the Japanese were able to repair. The use of atomic guided bombs, which could have been made available at that time, would have greatly increased accuracy against targets of this type and reduced from requirements to approximately one-third of those given above. An inte...
pewed program employing both carrier planes and B-29s would have capitalized on the differing operational capabilities of each. The economic effects of the transportation attack would have had a direct impact on the Japanese people and on their determination to continue the war. In order to bring maximum pressure on the civilian population and to complete further the Japanese economic problems, night and low weather attacks on shipping could have been carried out simultaneously with the transportation attack. One of the important factors hindering Japan's leaders to accept unconditional surrender was a realization that the Japanese armed forces had lost their ability to protect the people and to endure the impact of direct air attack and Israel leadership in their confidence in victory and determination to continue the war were rapidly declining.

THE HEALTH AND MORALE OF THE JAPANESE CIVILIAN POPULATION UNDER ASSAULT

Total civilian casualties in Japan, as well as the result of the air attack, including those from the atomic bombs, were approximately 800,000. Of these, approximately 80,000 were fatalities. These casualties probably exceeded Japan's entire population which the Japanese estimated at having totaled approximately 700,000 during the entire war. The estimated total of civilian death or injury was 1.4 million. Of the total casualties approximately 800,000 were inflicted in the initial attack on Tokyo on 9 March 1945. Casualties in many extremely destructive attacks were comparatively low. Tokyo, a city of 500,000 population, was 50 percent destroyed in a single attack lasting less than an hour. The fatalities inflicted were less than 900.

The Japanese had constructed extensive firebreaks by tucking down all buildings to the ground level. The total number of buildings burned down in this program, as reported by the Japanese, amounted to 1.0 million as against 830,000 destroyed by the air attacks themselves. These firebreaks did not effectively stop the spread of fire as incendiaries were dropped on both sides of the break. They did, however, constitute an effective measure for the civilian population.

The Japanese instituted a civilian-defense organization prior to the war. It was not until the summer of 1944, however, that effective steps were taken to reduce the vulnerability of Japan's civilian population to air attack. By that time, the shortage of steel, copper, and other construction materials which adequate air raid shelters could no longer be built. The obligation of preventing loss with some kind of an armament proved to be a waste of time. In addition, targets were dug into the sides of hills wherever the topography permitted.

Japanese planning and the manner for carrying out the plans were quite different for a bringing down of civilians. In spite of their limitations, such civilian defense measures as they were able to put through contributed substantially in minimizing casualties. School children and other unessential urban dwellers were evacuated to the countryside. Those who remained were organized in mutual aid and to provide mutual assistance. The air raid warning system was generally efficient. The weight of the individual attacks was, however, far heavier than the Japanese had estimated or were able to cope with. In the major air attacks, the civilian defense organizations were simply overwhelmed.

The growing food shortages was the principal factor affecting the health and morale of the Japanese people. Prior to Pearl Harbor the average per capita caloric intake of the Japanese people was about 3,000 calories or against 2,300 in the United States. The average of male labor in Japan is only 5 percent of that of the United States to support the population over half a large. In order to provide the necessary labor, this surplus storage was more intensively cultivated, using more manpower and larger quantities of fertilizer than in any other country in the world. Fishing was developed into a major industry and rice, soybeans, and other foodstuffs amounting to 10 percent of the calorie intake were imported. Despite the rations of food beginning in April 1944, the food situation became critical. As the war progressed, imports became more and more difficult, the water available in the fishing fleet and the ships and fuel oil for use became increasingly unsatisfactory. The shortage of essential food production itself was affected by the drafting of the younger males and by an increasing shortage of fertilizers. By 1944, the average per capita caloric intake had declined to approximately 1,300 calories per day.
20 percent of the people believed Japan could not achieve victory. By March 1945, when the night secondary attacks began and the food ration was reduced, this percentage had risen to 19 percent. In June it was 61 percent, and just prior to surrender, 89 percent. Of those who had come to the belief over one-half attributed the principal cause to air attacks, rather than the atomic bombings attacks, and one-third to military defense. Sixty-four percent of the population stated that they had reeled a point or more earlier when they felt personally unable to go on with the war. Of these, less than one-half attributed the cause to military defense, one-quarter attributed the cause to shortages of food and civilian supplies, the largest part to air attacks.

A striking aspect of the air attacks was the pervasiveness with which its impact on morals devastated Japan. Roughly one-quarter of all people who lived died or were wounded, and these casualties, who themselves were of singularly low morale, helped spread discouragement and disaffection for the war throughout the islands. This moral degradation from the losses included an estimated 500,000 persons. Throughout the Japanese islands, whose people had always thought themselves remote from attack, United States planes reenacted the same with an effective Japanese air anti-aircraft opposition. That this was an indication of impending defeat because as ob

Progressively lowered morale was characterized by loss of faith in both military and civilian leaders, loss of confidence in Japan's military might, and increasing distrust of government's honesty and propaganda. People became short-tempered and more outspoken in their criticism of the government, the war, and affairs in general. Until the end, however, national traditions of obedience and conformity, reinforced by the police organization, remained effective in controlling the behavior of the population. The Emperor largely escaped the criticism which was directed at other leaders, and remained the people's faith in him. It is probable that most Japanese would have passively faced death in a continuation of the hopeless struggle, had the Emperor not ordered. When the Emperor announced the unconditional surrender, the first reaction of the people was one of regret and surprise, followed directly by relief.

The incarceration of military, economic and na
The effects of the atomic bombs

On 6 August and 9 August 1945, the first two atomic bombs to be used for military purposes were dropped on Hiroshima and Nagasaki respectively. Over one hundred thousand people were killed, 80,000 miles or over 70 percent of the building area of the two cities were destroyed. The first and crucial question about the atomic bomb was an entirely new and as yet unanswerable: what would it do to the Japanese people? Atomic energy had been mastered for military purposes and the devastating effects of its possibilities had been demonstrated. A detailed examination of the physical, economic, and moral effects of the atomic bomb occupied the attention of a major portion of the Army's staff in Japan in order to arrive at a more precise definition of the present capabilities and limitations of this radically new weapon of destruction.

Eyewitness accounts of the explosion all describe similar pictures. The bombs exploded with a tremendous flash of blue-white light, like a giant magnesium flare. The flash was of short duration and accompanied by intense glare and heat. It was followed by a tremendous pressure wave and the rumbling sound of the explosion. This sound was not clearly conditioned by those who survived near the center of the explosion, although it was clearly heard by others as far as fifteen miles away. A huge white-cloud shot rapidly into the sky and the scene on the ground was obscured first by a black haze and then by a purple-brown cloud of dust and smoke.

The complete band of radiations, from X-rays through ultraviolet and light rays to the most intense form of infra-red rays, travelled with the speed of light. The shock wave created by the enormous pressure built up almost instantaneously at the point of explosion but moved out more slowly, that is at about the speed of sound. The superheated gas surrounding the original bomb expanded outward and upward at a slow rate.

The light and radiant heat accompanying the shock travelled in a straight line and any exposed object, even a single bed of a vital, shielded objects lying behind it. The duration of the flash was only a fraction of a second, but it was sufficiently intense to cause third degree burns to exposed human skin up to a distance of a mile. Clothing ignited, though it could be quickly blown out, telephones, poles, charred, charred houses might fly. Black or other dark-colored surfaces of combustible materials absorbed the heat and immediately charred or burst into flames. White or light-colored surfaces reflected a substantial portion of the rays and were not scorched. The heavy black clay tiles which are an almost universal feature of the roofs of Japanese houses blistered at distances up to a mile. Tests of samples of this tile by the National Bureau of Standards in Washington indicate that temperature in excess of 1,800° C. must have been generated in the surface of the tile to produce such an effect. The surface of granite blocks exposed to the flash burned and spalled at distances up to almost a mile. In the immediate area of ground zero (the point on the ground immediately below the explosion), the heat charred concrete beyond recognition.

X-radiations such as gamma-rays exposed X-ray films stored in the basement of a concrete building about 140 yards from ground zero. Symptoms of their effect on humans begins close to the center of the explosion, who received such effects, were generally delayed for two or three days. The seriousness and extent of the process of blood formation were affected. The white corpuscles went down and the hematocrit process of restoring in bone marrow were destroyed. Death generally followed shortly thereafter.

The majority of radiation cases who were at greater distances did not show severe symptoms until 3 to 6 weeks after the explosion. The first symptoms were loss of appetite, loss of appetite, and general discomfort. Within 2 to 6 hours, fever became evident in many cases, going as high as 100° to 103° F, which in fatal cases continued until death. If the fever subsided, the patient usually...
showed a rapid disappearance of other symptoms and soon regained his feeling of good health. Other symptoms were loss of white blood corpuscles, loss of hair, and decrease in sperm count.

Even though rays of this nature have great power of penetration, interesting statistics fitter still prove them. As the weight of the interesting material increases the percentage of the rays penetrating given depth. It appears that a few feet of concrete, or an almost greater thickness of earth, furnished sufficient protection to increase, even those close to ground zero, to prevent serious after effects from radiation.

The blast wave which followed the flash was of sufficient force to pass in the works of numerous concrete structures and to flatten completely all less sturdy structures. Due to the height of the explosion, the peak pressure of the wave at ground zero was no higher than that produced by a shower of high-explosive bombs, and decreased at greater distances from ground zero. Reflection and shielding by intervening hills and structures produced some unevenness in the pattern. The blast wave, however, was of far greater extent and duration than that of a high-explosive bomb and most reinforced concrete structures suffered structural damage or collapse up to 500 feet at Hiroshima and 2,000 feet at Nagasaki. Brick buildings were flattened up to 7,000 feet at Hiroshima and 8,000 feet at Nagasaki. Typical Japanese houses of wood construction suffered total collapse up to approximately 2,000 feet at Hiroshima and 8,000 feet at Nagasaki. Beyond these distances structures received less serious damage to roofs, walls, partitions, and the like. Glass windows were blown out at distances up to 5 miles. The blast wave, being of longer duration than that caused by high-explosive detonations, was accompanied by tornados and debris. Window frames, doors, and partitions which would have been shaken loose by a high-explosive bomb were hurled at high velocity through those buildings which did not collapse. Machine tools and most other production equipment at industrial plants were destroyed or damaged by the blast wave. Buildings were damaged by collapsing buildings or ensuing ground fires.

The above description assumes all the area ground was made up of a great deal of dirt caused by the atomic bombs on Hiroshima and Nagasaki. There were no other types of action. Nothing was ve-

25 / 34...
center of the city were destroyed. However, the big plants on the periphery of the city were almost completely undamaged and 94 percent of their output was active. The factories necessitated for 74 percent of the industrial production of the city. It is estimated that they could have resumed substantial normal production within 30 days of the bombing, but the war continued. The network running through the city were repaired for the re-occupation of through traffic on 8 August, 4 days after the attack.

Nagasaki was a highly congested city built around the harbor and up into the hills and over valleys of the surrounding hills. Smoke from these hills covering close to the head of the bay divided the city roughly into two sections. The hills themselves were 2.4 miles south of which the mires were relatively flat. The pot resource of 395,000 had been reduced to around 300,000 by August 1945, largely by prior evacuations. Nagasaki had been attacked specifically prior to 9 August by an aggregate of 126 planes which dropped 1,500 tons of high explosives and 38 tons of incendiary bombs. Some 9 percent of the residential buildings had been destroyed and heavily damaged; three of the large industrial plants had received severe damage. The city was essentially intact at the time of the atomic bombing.

The blast was improperly given and therefore few persons were in shelters. The bomb exploded over the northeast portion of the city; the intersecting hills protected a major portion of the city lying in the adjoining valley. The blast radiation and blast effects of the Nagasaki bomb were more severe than those of the bomb dropped on Hiroshima. Reinforced concrete structures were structurally damaged at greater distances; the heavy steel frame buildings of the Mitsubishi steel works and the four plants were pushed out of alignment and the windows were blown out. The blast winds were blown in but all the contents back from the blast wave, even in three stories almost directly under the explosion. Those not in a direct line with the explosion were unharmed. The buildings were safe for roughly 100,000 persons. The people who were unharmed, and those inside shelters were filled to capacity, the loss of life in Nagasaki would have been substantially lower.

The city has estimated that the damage caused by incendiary bombs at Hiroshima by the one atomic bomb dropped from a single plane would have resulted 200,000 tons of incendiary bombs, 400 tons of high-explosive bombs, and 100 tons of antipersonnel fragmentation bombs, if conventional weapons, rather than as atomic bomb, had been used. One hundred and twenty-five B-29s carrying 1,200 tons of bombs
would have been required to appreciate the dangers and misfortunes of Nagasaki. This estimate presupposed bombing under conditions similar to those existing when the atomic bombs were dropped and bombing accuracy equal to the accuracy attained by the Twentieth Air Force during the last 3 months of the war.

As might be expected, the primary reaction of the population to the bomb was fear, uncontrollable terror, strengthened by the sheer horror of the destruction and suffering witnessed and experienced by the survivors. Prior to the dropping of the atomic bombs, the people of the two cities had few misgivings about the war than people in other cities and their morale held up after it better than might have been expected. Twenty-nine percent of the survivors interviewed indicated that they could not form a conviction that they had been in the bomb; twenty-four percent stated that because of the bomb they felt personally unable to carry on with their lives; forty percent testified to various degrees of fear. A greater number (54 percent) expressed themselves as being impressed with the power and scientific skill which underlay the discovery and production of the atomic bomb than expressed anger at its use (50 percent). In many instances, the reaction was one of mitigation.

The effect of the atomic bomb on the confidence of the Japanese civilian population outside the two cities was more restrained. This was in part due to the fact that the bomb was not so easily understood by the rest of the atomic energy, and the impact of other dehumanizing experiences. The role of the atomic bomb in the surrender must be considered along with all the other factors which bear upon that question with Japan.

JAPAN'S FIGHTING TO END THE WAR

The preparatory structure was such that in practice the Emperor never agreed to the de-nuclearization of his forces. A consensus among the leaders of the Emperor of whom Murayama Kiichiro, who was Kajiro's superior, was the most important, the emperors, constituting the supreme body of state administrations, and the sub-

27 / 34
war. With the loss of Salpig, it was possible to build up sufficient pressure to force 26th Army to surrender.

The government of General Kiso, who was chosen by the pro-occupied Kido to head the surrender cabinet, did not have the strength to stand up to the military and was a disappointment to the new authority. The Kido administration, which was instructed by the Supreme War Council, an interim cabinet that replaced the earlier administration, was eventually dissolved.

The condition and strength of the peace party was increased by the continued Japanese military defeat, and by the Kido cabinet's ability to develop itself against the overwhelming weight of air attacks on the home islands. On 7 August 1945, less than a week after United States landings on Okinawa, Kise was arrested and Meiyoyo Kido initiated Admiral Suzuki as premier. Kido testifies to the survey that, in his opinion, Suzuki should have shown the way and continued the peace talks with the military, and there was no end.

Early in May 1945, the Supreme War Council began active discussions of ways and means to end the war, and talks were initiated with Soviet Russia seeking her intervention as mediator.

The talks with the Japanese ambassador in Moscow and with the Soviet ambassador in Tokyo did not make progress. On 9 July, the Emperor, in a secret directive, called the six members of the Supreme War Council to a conference and told them it was necessary to have a plan to close the war as soon as possible and to withdraw from the homestead.

The final of the Potsdam Conference was signed with a view to send Prince Hirohito to Moscow as a special embassy to seek peace at any price. Although the Supreme War Council, in its deliberation on the Potsdam Declaration, their aim was to reach the condition of the Imperial Declaration, the Emperor announced that the admiral of the war, the four of his ministers, the Army Minister, the Navy Minister, and the Chief of Staff of the Imperial Japanese Army, had prepared to accept unconditional surrender, while the Chief of Staff, the Army Minister, and the Chief of Staff of the Imperial Japanese Army, had prepared to accept unconditional surrender. On 6 August, the atomic bomb was dropped on Hiroshima, and on 9 August, Russia entered the war. In the succeeding meetings of the Supreme War Council, the difference of opinion prevails and exists until the Potsdam terms are finally accepted by the Emperor and the Prime Minister.

The conditions of the Emperor's cabinet, which undertook the political and military desire of the United States and the USSR, in 1945, was thus secured prior to invasion, and while Japan was still possessed of one 200,000 troops and over 1200 planes in the home islands, military defense is in the air, at sea and on the land, destruction of shipping by submarines and by air, and direct air attacks with conventional as well as atomic bombs, all contributed to this accomplishment.

There is little point in attempting to impede Japan's unconditional surrender to any one of the numerous causes which jointly and cumulatively were responsible for Japan's disaster. The line between military importance and political capacity of the inevitable might have been shorter had the political structure of Japan permitted a more rapid and decisive determination of national policy. Nevertheless, it seems clear that even without the atomic bombing attack, Japan could have been swiftly submerged under a most magnificent maneuver and brought about the surrender of Japan.

Based on a detailed investigation of all the facts, and supported by the testimony of the surviving Japanese leaders involved, it is the survey's opinion that such action is a necessary step toward peace. Although the Emperor announced that the admiral of the war, the four of his ministers, the Army Minister, the Navy Minister, and the Chief of Staff of the Imperial Japanese Army, had prepared to accept unconditional surrender, while the Chief of Staff, the Army Minister, and the Chief of Staff of the Imperial Japanese Army, had prepared to accept unconditional surrender, on 6 August, the atomic bomb was dropped on Hiroshima, and on 9 August, Russia entered the war. In the succeeding meetings of the Supreme War Council, the difference of opinion prevails and exists until the Potsdam terms are finally accepted by the Emperor and the Prime Minister.
CONCLUSION

The opposing forces each of the central roles in the war in the Pacific, including the effects of the atomic bomb. The Survey has already reported on the month-covered by air power in the European war.

It remains to point out the degree to which the Pacific study modifies, adds to or accepts the arguments the future which had been by the European study to state the extent to which its elaboration suggests that air power might have been differently or better employed in the Pacific; to discuss the effects of the existence of atomic bombs, in the role of air power; and to state the Survey's recommendations. First, however, it is necessary to point out in some of the unique features of the Pacific war which must be kept in mind while considering bombs to be learned from it.

Unipolus of Pacific War

The Pacific war was unique in many respects, as was the European war, and great emphasis should be placed in meaning that what was effective at effective under one circumstances would be similarly effective at other times and under different circumstances. Japan's initial war strategy called for a war of limited objectives. Her opportunities did not permit an attack on our basic supporting strength. She was, however, a strategically determined enemy, well prepared initially, and the fighting quality of her soldiers, sailors, and pilots should not be underestimated.

Japan's geographical situation determined that the Pacific war should be a war for control of the sea and to ensure control of the sea, for control of the air over it. As a result, attacks against warships and merchant ships and amphibious operations for possession of island positions, on which forward bases could be located, were close to the heart of the struggle. Carrier task forces, speeded up to provide logistic support, and submarine operations themselves assumed great importance.

Japan's industrial potential was approximately equal to that of the United States. Even though her research and technical design work was not greatly initiated, her ability to develop reliable operating equipment in the new field was fine. Her radio and communications equipment was weak. She could not build sufficient ships or meet needs. She lacked construction equipment to build adequate airfields. She was always hampered by a lack of oil. Her soldiers were undependable. She could not economically afford to build adequate shelters for her population. She could not both destroy her industry and lose repair damaged plants. She chose repaired rather than new, but she had insufficient means even to repair effectively.

Nippon

Not only the uniqueness of the Pacific war but new developments in weapons and tactics make it impossible to meet that argument to the future derived from the Pacific war will apply with equal force to other situations. The Survey believes, however, that the following arguments on the role of air power should be given through consideration by those working out the additions to new problems arising under differing conditions.

1. Control of the air was essential to the success of every major military operation. Control of the air made possible victory in the sea as far as that control extended, even within range of enemy land-based airfields. Control of the air permitted close support to ground forces, the effectiveness of which was decisive when fully employed. Control of the air over lines of communications permitted effective interception of them to the enemy and preserved them for use.

2. Control of the air permitted close air support to ground forces, the effectiveness of which was decisive when fully employed. Control of the air also permitted early detection of hostile activity and early warning of hostile activities.

3. Control of the air permitted the destruction of the enemy's industry and the enemy's population by using the air for strategic purposes.

4. Control of the air permitted the destruction of the enemy's population by using the air for strategic purposes.
virtual freedom of the skies over the Japanese home islands themselves.

3. The limitations of air control deserve special mention. It was never completely possible to deny the air to the enemy. It was considered that we had control of the air when the enemy would not operate in it without prohibitive loss in relation to results achieved, while our own planes could operate in it at will and with negligible risk of loss. The Japanese increased their ratio of results achieved to losses by adopting kamikaze tactics. This was a measure of desperation, but the results obtained were considerable and, had they been much greater, might have to some extent withheld or to modify our strategic plans. The principle involved involves the degree to which defensive air control must be imitated or enemy losses kept beyond the range of enemy suicide planes or guided missiles from such land or sea as we propose to use.

4. Given air control, there were also limitations as to the specific results which could be achieved in exploiting such control by aircraft carrying conventional high-explosive bombs. For bases, undersea bedrock reinforcements and other preponderant defenses could not in many cases be reduced, and it was necessary to assume remaining ground forces in costly close-range fighting even though these forces were isolated and completely cut off from supplies and reinforcements.

Weather and darkness limited exploitation of air control, but as the war progressed technical and tactical advances were made which progressively reduced these limitations.

Combat ratio of fighters and time on patrol at maximum radius, although greater by several factors, required that airfields or carriers be available within 2000 miles or less of the enemy and that in some cases of surface combat for optimum fighter cover. The effective radius of our longest range bombers was limited to 2,300 miles and bases still close to Japan were considered essential for emergency landing and fighter support.

The importance of reducing these limitations of control of the air and its exploitation by the application of research and development work is obvious.

6. The experience of the Pacific war supports the findings of the Survey in Europe that heavy, contained and accurate attack against carefully selected targets is required to produce decisive results when attacking an enemy's sustaining resources. It further supports the findings in Germany that no nation can long survive the free exploitation of air weapons over its homeland. For the future it is important fully to grasp the fact that many plans enjoying control of the sky over each land can be as disastrous to each country as its occupation by physical invasion.

Highlight

Midnight historically suggests that in some respects air power might have been differently or better employed.

Prior to the Pacific war, no understanding the predominant role that air power was to play and allocated to it too small a share of even the inadequate resources then available to the Navy and Army. At the outbreak of the Pacific war, air deficiency was particularly great in modern land-based fighters and in carriers. Over one thousand planes in the Philippines, at least equal in performance to the best then available to the Japanese, including types effective against shipping, well armed, equipped and supplied, and disposed on some 60 airfields, would have certainly impeded the original Japanese advance if knowledge of their existence had not entirely disclosed the Japanese intent making the assault. The loss of relatively antiquated battleships at Pearl Harbor had little effect on the Navy's combat capabilities at that time, while the addition of a few carriers would have enormously increased its capabilities. Larger annual appropriations to the armed forces, beginning at the time of Japanese occupation of Manchuria when the threat to peace in the Far East became evident, might have saved war unnecessary and would have paid for itself many times over in reduced casualties and expenditures had war still been unavoidable.

Upon entering the war, we were deficient not only in numbers, but in quality of many of our aircraft types. We were forced thereafter into hasty and costly modification and technical development programs to raise the performance of our aircraft to acceptable standards. These programs could have been conducted more efficiently and economically during peacetime years.

In the actual conduct of the war we more quickly grasped the strategic revolution brought about by the capabilities of air power than did the Japanese. By the end of 1943 we had achieved
though combat and the augmentation of our forces, each side cut severally over the Japanese to all elements of air power that eventual victory was assured.

In explaining the superiority greater accuracy of effort was possible. Illustration of our own military organisation proved no ana, but the President, for integrating our atomic forces, under the pressure to war the Joint Chiefs of Air was the most decisive mechanism then possible to fill this gap. Each of its members had in effect the power of veto and the required unity was produced by compromise. It proved impossible to agree on an overall commander for the Pacific as a whole. Our military and economic dispositions, however, made it possible to plan and execute a dual line of advance across the Pacific. To support an air attack of sufficient weight to induce unconditional surrender concurrently with the preparations for the full scale invasion.

...as a significant factor in the success of atomic bombing... Atomic bombs had been designed to be used as nuclear weapons against Japan. Though the Hiroshima and Nagasaki bombings were attacks on individual cities, their effects were vast and immediate. The cities were destroyed, and the populations destroyed. The atomic bombs were not used as conventional weapons, but as strategic tools.

The question of whether to use atomic bombs was a subject of intense debate among Allied leaders. The decision was made after careful consideration of the potential effects of atomic bombings. The use of atomic bombs was a significant factor in the success of the war against Japan. The bombings were used to destroy infrastructure, industrial and military targets, and to force the surrender of the Japanese military and civilian populations.
number of enemy planes or guided missiles may be able to avoid all our defenses and to attack any objectives within range.

The threat of immediate retaliation with a striking force of our own should deter any aggressor from striking.

If we are to be uncommitted out of hand, in the event we are warily attacked, we need reduce substantially our vulnerability to such attack. The explosion of both the Pacific and European war emphasized the extent to which civil and other forms of passive defense can reduce a country's vulnerability to air attack. Civilian defense and facilities can be reduced by presently known techniques, to one-twentieth or less of the extent to which would be afforded were those techniques not employed. This does not involve making everything underground, but does involve a progressive evacuation, dispersal, warning, air-raid shelter, and potential emergency existence program, the foundations for which can solely be held in possession. The results of the efforts of the atomic bomb in Hiroshima and Nagasaki indicate that the above statement is just as true and much more terribly significant in an age of atomic bomb than it was in an age of conventional weapons. Similarly, economic vulnerability can be exceedingly decreased by a well worked out program of stockpiling, dispersal and special construction of particularly significant segments of industry. Such a program in the economic field can also be worked out satisfactorily only in possession.

As the strictly military field the impact of atomic weapons and guided missiles on strategy and tactics can only be developed by military specialists. It is the Survey's opinion, however, that further study by such specialists will support the conclusion that dispersal of military forces, and therefore speed and distance to which it can be effective, will be significant considerations: that heavy bombers similar to those used in this war will not be able to operate effectively and at a survival basis much beyond the range of protective fighters, and that since types of offensive weapons and new tactics must be developed to do any that forward air bases will have to be defended or more advanced bases acquired step by step. In the case of atomic weapons, will be found to remain. If such in the case, atomic weapons will not have eliminated the need for ground troops, for surface vessels, for airborne weapons, or for the full mobilization among them, the supporting services and the civil effort, but will have changed the extent to which they are employed to a degree that radically changed equipment, training and tactics will be required.

Recommendations

Our plan should be in the following recommendations: scattered throughout preceding sections of this report, of which the recommendations that we develop precision for our civil population and for our economy is one of the most important. The Survey has been impressed with the need for concrete and prompt action to encourage adequate research and development in certain areas and to increase the national appreciation of the necessity for continued strength of the United States as a force for peace.

Research and Development. The "thinking" phase has now entered a new stage. This consists of deriving the elements from the European war, strongly supported by the Japanese experience. A mobilized and well-trained striking force employing a certain technical superiority can overwhelm in short order the forces of a country of the greater long-term strength. In the opening phase of the Pacific war the Japanese were able to overrun 350,000,000 people and an area of enormous strategic importance in the space of a few months. This may be in spite of the fact that from the time of the Munich conference in 1938 we had been on notice that aggression against the peace of the world was possible and that the intervening years and the experience of our allies had been invaluable in permitting us to take the necessary steps to arrive at our second objective, to apply our advanced scientific and military resources to the improvement of our weapons and to heighten our industrial and military mobilization. The difference in the Pacific fortunately gave us, and therefore time, in which to absorb the initial blow while our increasing strength and Japan's increasing logistic problems reversed the initial advantages before our advanced forces.
factually destroyed in a single day every Japanese city with a population in excess of 25,000 people.

In the future, national security will depend on a large degree on technical superiority of weapons and on operating and maintaining proficiency of personnel. Peaceful military strategic planning must be planned to and supported by a significant program of scientific research and development.

If the United States is not to be forced to hasty and inadequate mobilization every time there is a threat of aggression, and in the world, it is essential that in the field of military weapons and tactics she be technologically not merely ahead of, but actually ahead of any potential aggressor. It is not generally realized the degree to which basic scientific research was neglected in the United States during the course of the war in order to concentrate on the halted development of the specific weapons immediately required, nor the degree to which we lagged behind (Japan) in advanced electronics, jet propulsion and the development of guided missiles. In air speed, range, and speed, even the Japanese were ahead of us. One or two years' lag in either basic research or in the development of reliable military application of such research can only be made up with difficulty, if at all. This type of work has become so complex that expenditures for research and development in the order of one billion dollars annually may be required to assure an acceptable degree of national security.

Intelligence—At the start of the Pacific war, our strategic intelligence was highly inadequate, and our early war plans, insofar as they were based on faulty information and faulty interpretation of accurate information, were in error. As Paul Herter observed, the obtaining and analysis of economic and industrial information necessary for the planning of an attack on Japan's existing munitions required several years of the most serious effort on the part of the United States to ascertain her potential power. If a comparable lack of intelligence should exist at the start of a future national emergency, it might prove disastrous.

In the field of operational intelligence considerable forward strides were made during the Pacific war. The requirements in this field, for a long time too poorly detailed and inadequate, for complex analysis to rapidly changing conditions of forces and defenses, and for speed, all place a heavy burden on training, competence and organization. These requirements were not fully met in the Pacific war. The deficiency was serious. This was a large measure attributable to a general lack of trained and competent operational intelligence officers to provide an adequate staff for an expanding organization.

The basic for adequate intelligence can only be in the planning. The relative cost of this help to the decision-making process in this field appears to be the greatest concentration is to be provided by the National Intelligence Authority, particularly in the war in which suitable coordination and dissemination. It appears desirable to integrate into the various operating organizations of appropriate intelligence tasks, adequate budgets and personnel for intelligence work, and a sufficient increase in the prestige attached to such work to attract the highest quality of personnel. This latter can only come from a change in the traditional and active training of intelligence officers on the part of other Army, Navy, and Government officials. The present lack of administrative responsibility for intelligence work by the various operating organizations and the general shortage of trained and competent intelligence personnel give cause for concern and require correction.

Integration of the military establishment—Organizational deficiencies in the Japanese Government contributed to Japan's defeat. The war was not only a military conflict and the intelligence community, but a political and economic one. The separation of the military from the political and economic needs of the state was one of the chief weaknesses of the Japanese military. This was accentuated by the military's lack of coordination between the Army and Navy. Military policy was determined by the cabinet, the Japanese Army and Navy by their own foreign policy in accordance with their individual aims, objectives, and requirements. During the war, there was a considerable rivalry between the Army and Navy in developing new weapons, the development of inadequate logistics and the efficient utilization of Japan's economic resources. The existence of such joint or coordinated organizations as the Supreme War Council, the Supreme War Direction Council, the Board of Field Marshals and Fleet Admirals, the Imperial General Headquarters served mainly to hide the fact that real unity, integration, and coordination were non-existent.
Strength as a force for peace—The survey's report on the European war stated that the great lesson to be learned in the hallowed cities of Bagdad and the ruined cities of Germany is that the best way to win a war is to prevent it from occurring. This is fully supported by the examples of the devastated cities of Japan and their unhappy and hungry survivors. The prevention of war must be the ultimate and to which our best efforts are devoted. It has been suggested, and wisely so, that this objective is well served by increasing the strength and security of the United States. The United States was founded and has since lived upon principles of tolerance, freedom, and good will at home and abroad. Strength based on these principles is no threat to world peace. Prevention of war will not be furthered by neglect of strength or lack of preparedness on one or both sides. These who contemplate evil and aggressive plans must expect to meet resistance. The Japanese would never have attacked Pearl Harbor had they not correctly assessed the weakness of our defenses in the Pacific and had they not incorrectly assumed the fighting determination of the United States when attacked.

Suggestions for assuring the military strength and security of the United States are by no means intended as a recommendation for a race in arms with other nations; nor do they reflect a lack of confidence in the prospect of international relationships founded upon mutual respect and good will which will themselves be a guaranty against future war. The development of an intelligent and coordinated approach to American security can and should take place within the framework of the security organization of the United Nations. The United States as a member of the United Nations has contributed not to see forces except in defense of law as embodied in the purposes and principles of the United Nations' Charter. As one of the great powers we must be prepared to act in defense of law and to do our share in assuring that other nations live up to their obligations. The United States must have the will and the strength to be a force for peace.