STRATEGIC TARGET ANALYSIS

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AS THE awesome spectacle of destruction witnessed by members of the U. S. Strategic Bombing Survey teams in Europe and Japan unfolded into an evaluation of the many aspects of the air war, it became apparent that the disintegration of a nation's ability and will to wage war could be planned and effected to a remarkable degree through systematic air attacks on its strategic components. This was the proof of the validity of the strategic concept—a concept so embracing that by it warfare was completely revolutionized and the future course of history dependent upon a completely different set of principles.

During the years between World Wars I and II, many theories as to the most effective use of the air weapon were held. One school contended that its proper function was one of coordination with land and sea forces. Another claimed that it was a weapon sufficient in itself in that its independent use would achieve victory. Experience had not yet demonstrated just what position the relatively new and rapidly evolving aircraft would hold in a future war. U. S. planning, therefore, proceeded on the theory that it would be employed in many ways. A strong and dominating conviction prevailed however that its most productive application would be against those strategic targets which represented the sustaining source of military power.

The British Spitfire and the U. S. Flying Fortress were the products of early World War II emphasis by both countries. The British necessarily concentrated on defensive fighters in the initial stages because of her geographically vulnerable position. The German Airforce had been created primarily for use in support of the Panzer divisions, which utilized the short range bomber, the idea being that air power would be most effective in Blitzkrieg operations. When this Airforce was assigned the mission of conducting a strategic bombing campaign against Britain, it was defeated. This German failure to create a bomber force adequate in range and defensive capabilities can be assigned as one of the causes of the defeat.

The U. S. objective of the invasion of the continent and the defeat of Germany on the ground called for the utilization of many types of aircraft. However, planning emphasis on strategic bombing was fully justified by the Casablanca conference in 1943. It authorized, "the destruction and dislocation of the German military, industrial, and economic system and the undermining of the morale of the German people to the point where their capacity for armed resistance is fatally weakened."

As the Royal Air Force and the American Air Force began the strategic offensive, the complex problems involved in selecting the targets, weapons, aiming points and force requirements to produce the maximum damage to the German war effort with the least operational cost led to the initiation of a new type of inquiry in the field of military intelligence. In the town of Princes Risborough, forty miles from London, the British Ministry of Home Security began the study by assigning a group of scientists to evaluate the bomb damage in England from the strategic viewpoint. At first the data were poor and incomplete. However, as more and more incidents of damage to various types of industrial installations and dwelling units were examined for economic and structural susceptibility to various types of German bombs, a consistent pattern of reaction began to develop. From this mounting experience, the techniques and procedures of target analysis evolved which served as a theoretical base for attack on the continent.

American military and civilian personnel were assigned to Princes Risborough to learn the methods developed and to assist in the research and operational efforts. Experience had shown that the types of civilian specialists required included architects, civil, industrial, chemical, and fire insurance engineers, mathematicians and economists. Each had his own contribution to make to what was developing into an extremely vital adjunct to the air war. The hit or miss methods of bombing in the primary stages were gradually becoming attacks of increasing precision and effectiveness, due in large measure to growing target-analysis proficiency. The sequence followed was to prepare pre-attack analyses, to evaluate the effects of the attack and to facilitate the next attacks by applying the knowledge gained to the new circumstance:

Deep rooted and indispensable in this new born science was the aerial photograph which represented a major repository for the innumerable types and vast amount of information required. Research had shown how to analyze in detail on the photograph the many physical and economic aspects necessary in the selection of the target and its destruction. Post-attack photography provided the analysts with a quick and reliable intelligence source which enabled them to supply planning staffs with rapid and accurate appraisals of the success of the mission.

In the fall of 1944, the A.A.F. and the U. S. Navy established the Joint Target Group in Washington, an organization designed to continue the Princes Risborough activities for air operations against Japan. Many of the U. S. Military and civilian personnel who were stationed at Princes Risborough were assigned to this organization. With the accumulation of additional experience and research, methods and techniques of the many phases of target analysis were refined. Here the aerial photograph proved to be an even more valuable intelligence tool, for the paucity of other sources of information on Japan placed a greater reliance on the photograph. As a result of these demands for new and varied types of information, photographic analysis advanced in scope and responsibility.

AREA AND PRECISION ATTACKS

The objective of strategic bombardment is the long range attempt to destroy the will and ability to make war by attacks on industrial and civilian economies. In order to achieve this objective two types of attack can be undertaken; area and precision. The object of an area attack is to interfere with an enemy's military effort by damage to factories and equipment and/or by casualties, dehousing, disruption of utilities, services, and general administrative disorganization. They are directed against cities, sections of cities, or groups of factories and not at specific plants. In addition to the destruction of industrial potential, area attacks also have deep psychological, sociological and political implications.

The object of precision attack is the direct interference with the production of specific installations manufacturing items of military importance. The precision target, then, is the individual plant.

TARGET SELECTION AND VULNERABILITY

The great flexibility of an airforce permits the opportunity for attacking at a variety of points. Its most judicious use demands that, from the many possible objects of attack, those be chosen which will be most effective.

Target selection, the initial phase in the intelligence process, begins with an examination of those items which must receive attention within the framework of the military situation in which the enemy is viewed. From this study, target

systems evolve, some of which are necessarily more important than others because of their unequal contribution to the war economy. These systems are appraised by applying a series of criteria which will indicate the importance of each as a target and their vulnerability to air attack. An appraisal of the vulnerability of a target system involves a study of the system in general and of the individual targets within the system from the geographic, economic, and physical viewpoints in order to determine the type of attack necessary to produce the desired reduction. Important factors bearing on vulnerability are: numbers of targets in a system; extent, area and location to bombing bases; concentration of importance; capacity for the diversion of less essential activities to meet the shock of damage; reserves; recuperability; and the physical characteristics of buildings, equipment, and processes.

Because all targets differ considerably in their vulnerability characteristics, it is necessary to perform individual analyses on each. The selection of aiming points, weapons, and force requirements are dependent upon a consideration of all the economic and physical factors in the target area. In an industrial plant, it must be known if there is a continuous flow of new materials to the final product. If this be true, an interruption at any stage brings the operation of the entire plant to a halt, e.g., in the synthetic oil production process, the destruction of vital gas producing installations, such as coke ovens or water gas generators, would render the plant inoperable. On the other hand, metal working or mechanical industries do not have the same continuity and it is more difficult to stop whole plant operation. Structural features of the target buildings are significant because of the different reaction of the various types of buildings to various bomb effects which include penetration, blast, earth shock, fragmentation, cratering, and fire. Steel and concrete framed buildings are less susceptible to structural damage than those which are timber framed and therefore demand the use of a weapon of higher destructive potential. Load bearing walls increase the possibility of structural collapse and detonation at the proper point in such a building causes general demolition and falling debris with consequent severe damage to equipment. Domestic structures compartmented into fire divisions by fire walls necessitate a larger weight of incendiary attack than when this phenomenon is not present. Susceptibility of building contents to blast or fire damage is also important and influences weapon selection.

INTELLIGENCE SOURCE MATERIALS

The quantity and quality of source material will of course determine the excellence of the intelligence product. All too frequently, much of the information required is not at hand and it becomes necessary to put the bits and pieces together from many sources to get as complete a story as possible. Some of these sources are: pre-war publications, newspapers, trade journals, etc., refugees, prisoners of war, government statistics, captured documents, captured equipment, radio intercepts, and aerial photographs. Most sources must be evaluated for reliability and substantiality before they can be fully exploited for all possible meaning, statistics, combinations and correlations. The worth of the aerial photograph, however, is not diminished by possible error, rumor, or deception for it always contains the same information which it secured on the day of exposure. Its limitations lie in the quantity of information it can provide. In many cases the photograph must be supplemented by other data to obtain a full analysis. The quality of the photograph is extremely important, for upon it depends the ability to extract minute detail.

Techniques of photographic analyses differ for the area and the precision

target, because of the separate vulnerability problems that each presents; the area target necessarily contains a much greater number of additional items which must be considered. Their analysis does however bear a similarity in that both are regarded from their functional and physical aspects. To the precision target analyst, the photograph yields information on the identification, specific operations, and productive capacity of an installation through an examination of the individual buildings, raw materials, finished products, and activities around the plant such as chimneys, gas holders, traffic, etc. It also reveals the nature and integration of plant utilities and services, such as railroads, water transportation, and power facilities. Structurally, the photograph is used to determine the factors which must be known for proper weapon utilization such as construction type, composition of roof, height, width, plan area, number of floors, size of structural bay, and size of fire division; the assignment of the degree of combustibility, penetrability and resistence to blast depends upon this evidence.

The area analyst views his subject in a larger framework. For him, the aerial photograph is used to resolve the broad functional components of a city into zones of occupancy such as residential, industrial, storage, transportation, etc. and to provide information leading to an assessment of their importance to the civilian and military economies. He examines the propinquity of buildings from the standpoint of conflagration and other hazards which are present in the various categories of building density. He classifies structures in terms of those characteristics which are significant in the case of mass attack. Data on other aspects which comprise the area organism such as railroad, port, and power complexes are also extracted from the photograph.

There is an overlapping of interest in the area and precision target, when the precision target is located within the periphery of the area target. The precision target in this case is analyzed separately from the two viewpoints i.e. as part of the precision target system which it represents and as part of the area target in which it resides.

Photographic analysis supplies all phases of pre-attack area and precision target analysis with vital information as to what to hit, with what, and how much. The ultimate decision regarding the target to be attacked and the methods to be used, however, rests with the air force commander. He must consider all of the operational and tactical factors inherent in the mission, such as enemy fighter and ground opposition, radar, weather, availability and range of aircraft, operating experience of crews, weapons on hand, and distance to target. These numerous conditions, which necessarily shape the ultimate constituency of a mission, highlight the necessity for good target intelligence. Accurate economic and physical vulnerability appraisals enable the airforce commander to launch attacks at a particular target or group of targets which are within the operating capabilities of his striking force and which assure maximum effective destruction for the time and effort expended. Another important role of the photograph is its use in actual operations, for it renders a most important briefing and recognition service. Before leaving the ground, plane crews become familiar with the layout of the target as it appears from the air and with the recognition points to be sighted along the approach and actual bombing run. In the air, annotated photographs of the target enable the bombardier to spot accurately the selected aiming point.

Pre-attack analysis, in producing details of the physical target, can influence the design of weapons, for, if sufficient of this information is available in the design stage, the potential of the weapon can be suited to the degree of physical vulnerability presented by a particular type of target.

DAMAGE ASSESSMENT

The pre-attack phase of target analysis can be considered essentially a prediction of what the physical, economic, and military effects of attacks on certain targets would be. The determination of the accuracy of these predictions is of the utmost importance and, in order that they may be evaluated in light of certain knowledge, the evidence appearing on post-attack aerial photographs and in other intelligence sources is assiduously studied. However, because damage reporting demands that reliable information be provided as quickly as possible, photographic analysis becomes the most satisfactory single medium for systematic assessments. In addition, damage assessments furnish data on the success of numerous phases of operational and target intelligence involved in planning the attack. Bombing economy demands that careful analysis of these phases be undertaken in order that the next attacks be as effective and efficient as possible.

The first reconnaisance photography of the results of the attack is usually taken during the attack. These strike-attack photographs enable interpreters to make an immediate general report on the probable results of the mission by identifying buildings or areas suffering fire or blast damage. Craters and actual fires are often clues in this stage of analysis. Strike reports can by no means be considered complete damage assessments for several reasons: not all damage is shown on the photograph, fires have not had time to run their course, and the presence of smoke and dust prevents clarity.

Bomb fall incidents recognized within concentric circles around an aiming point, dimensions of the bomb pattern, together with operational considerations, are examined in order to perfect bombing procedures. The degree of damage inflicted on a structure reveals the advocacy of applying the same weapon and fuzing on another occasion.

The major question which is answered by a damage assessment of the area or precision target is the success of the attack and the need for re-attack. The success of the attack is measured against the level of dislocation which is desired in the planning stage. As in pre-attack analysis, the methods of precision and area post-attack analysis differ because of the physical and economic vulnerability characteristics peculiar to each type of target. Careful photographic analysis in each case must determine the extent of damage and classify it according to severity and cause. These results are then compared with the various aspects of the pre-attack estimate of the situation. Intangibles such as production loss naturally cannot be determined directly from the structural damage seen on the photograph. It is arrived at by relating the structural damage to intermediate factors which reflect production loss, e.g., by applying the ratio which exists between structural damage and machine tool damage in a particular building type. Because of the statistical nature of damage assessment, it is necessary that a high degree of standardization of procedure be maintained in the photographic analysis upon which it is based.

After a series of attacks, it is very possible that the enemy's military situation has changed, necessitating a reallocation of target priorities. Post-attack analysis which has reported the results of the attacks has by the same token provided the substance for this phase of planning.

REPAIR ANALYSIS

Repair analysis is an involved process embracing the history of the target during the period of recovery. At regular intervals, reconnaissance photography of a damaged target is flown in order that the extent, rate and pattern of repair of damage may be kept under constant surveillance. This provides information

on the current status of the target and the time interval required for reattack. In addition, it furnishes a valuable insight on the relative importance of installations and structures and on the probable time of recovery from future attacks.

CONCLUSIONS

The German and Japanese experience demonstrated that no nation, regardless of its resiliency and determination, can long continue in a war in which its important industries and cities are pulverized into helplessness by concentrated attacks from the air. In both theaters, the large numbers of key cities attacked had an average of 40% of their dwelling units destroyed or seriously damaged. These area attacks claimed an increasing amount of the energies of the people and caused diversion from war to civilian manufacture. The psychological effects manifested were defeatism, fear, hopelessness, fatalism and apathy. Large numbers of strategically important plants situated in urban areas were crushed. Precision attacks on vital industries helped grind the military economy to a virtual stand-still. In Europe, six months of attack on oil caused a 90% decrease in the output of aviation gas and nitrogen. Three months of attack on the Ruhr cut that area's steel production by 80%. In Japan, the pre-attack capacity of oil refineries was reduced 83%, aircraft engine plants 75%, and airframe plants 60%.

No small amount of the credit for the results achieved by strategic bombing is due to the influence of photographic analysis.

"During hostilities, intelligence appraisals made by photo interpreters were the principal source upon which to determine types of construction, assess bomb damage, compute weapon effectiveness and decide when a plant should again be hit. The field studies of the Survey checked to a considerable degree the accuracy of Photo Interpretation when related to building types and building damage. As would be expected there were minor errors in detail, but these tended to balance and were of relative unimportance. Several special studies made in advance and later checked on the ground disclosed a high degree of skill in the work of the photo interpreter. Also, many targets were hit with good timing when, following repair, they were about to go back into large scale production. The ability to achieve such results came from the practice of using photo interpreters who were specialists in the particular industries in assessing results in those industries".[1]

The major shift in the perspective of warfare caused by the atomic bomb will not necessarily create a fundamental change in the conception of target analysis. However frightful the destructive capacity of the bomb may become, the difference between it and conventional weapons is one of degree which is measurable and calculable. In Hiroshima and Nagasaki, structures reacted to blast and fire much the same as if the attacks had been made with incendiaries and high explosives delivered in large numbers.

Essentially, the characteristics of the atomic bomb make possible the destruction of a target with far less operational effort than with ordinary weapons, thus permitting attacks on a number of targets to be more concentrated in time. In a future conflict of this dimension, the tempo of intelligence must be consistent with the accelerated pace of bombing operations. Photographic analysis, by nature ideally suited to fill such a requirement, will as a consequence be expected to make an even more significant contribution than it has in the past.

[1] Over-all Report U. S. Strategic Bombing Survey (Europe). P. 93.