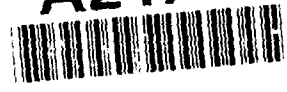
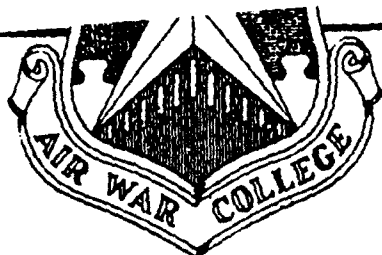


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RESEARCH REPORT

POINTBLANK: A STRATEGIC AND NATIONAL SECURITY
DECISION MAKING ANALYSIS OF THE WORLD
WAR II COMBINED BOMBER OFFENSIVE

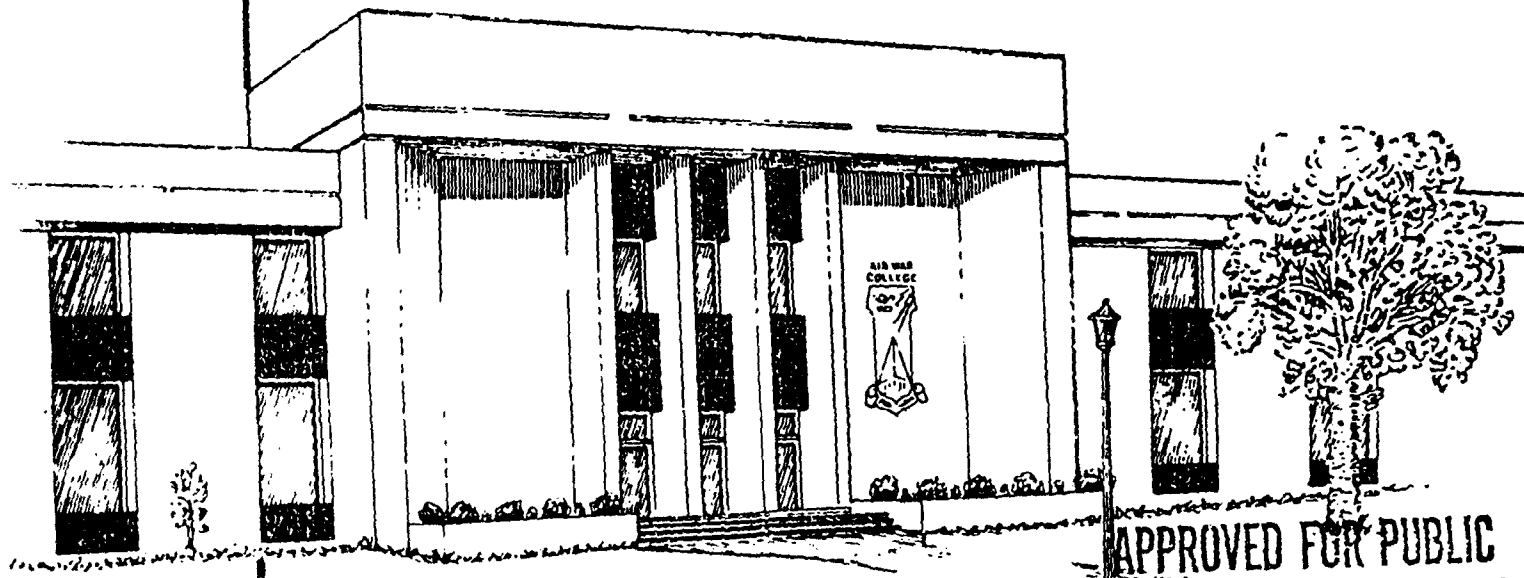
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COLONEL GEORGE E. CROWDER

1991



AIR UNIVERSITY
UNITED STATES AIR FORCE
MAXWELL AIR FORCE BASE, ALABAMA

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POINTBLANK: A Strategic and National Security
Decision Making Analysis of the World
War II Combined Bomber Offensive

by

George E. Crowder
Colonel, USAF

A RESEARCH REPORT SUBMITTED TO THE FACULTY
IN
FULFILLMENT OF THE CURRICULUM
REQUIREMENT

Advisor: Dr. David McIsaac

MAXWELL AIR FORCE BASE, ALABAMA

May 1991

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Col. Ed Crowder, USAF
Air War College
Class of '91
Seminar 1
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Introduction and Overview

POINTBLANK was the code name for the British-American Combined Bomber Offensive of World War II, a campaign that was mandated by the 1943 Allied "Casablanca Directive" and carried out from May 1944 to April 1945. POINTBLANK has become almost mythical in today's Air Force as the campaign that "proved" the decisiveness of air power in war and consequently led to the establishment of the Air Force as a separate Service in 1947. With this legacy of notoriety and importance, an analysis of POINTBLANK could be expected to produce national security decision making and strategic insights of general applicability to policy makers and strategists alike, if such insights are to be gleaned from any WW II campaign.

Toward this end, the analysis which follows begins by examining the political background affecting the Roosevelt Administration from 1932-1941, and then proceeds to weigh the importance of the American-British staff conversations of March 1941 and the related RAINBOW 5 plan. Subsequently, the so-called AWPD-1 plan, the strategic foundation and predecessor of POINTBLANK, is dissected in detail. Finally, after a review of POINTBLANK campaign results, lessons for today's national security decision makers and military strategists are drawn from the analysis.

Political Background

In the United States during the twenties and thirties aviation enthusiasts, notably including Lindbergh and Mitchell, popularized the airplane as a better instrument of both transportation technology and war. Although Douhet and others emphasized the offensive nature of air power, Mitchell emphasized the utility of long-range bombardment aircraft for defense, an idea more in tune with American public opinion of the time.¹ Due largely to Mitchell's public efforts, Americans came to view Army aviation as:

...a way to uphold New Era virtues of economy, efficiency, and technological innovation. The argument for air power appealed to widespread sentiment for reduction of federal expenditures...It also responded to postwar disillusionment with involvement in European wars by portraying a self-reliant America that would defend its shores without venturing abroad....Above all, arguments for air power fed on a widespread image of naval armaments as the foremost expression of militarism....The fighting within the military services sharpened the image of airmen as challengers of militarism and waste.²

With this public sentiment as backdrop, during his 1932 presidential campaign Roosevelt courted and flattered Mitchell and supported the idea of a major role for air power in U.S. national defense. And as late as 1937 the Roosevelt Administration was still popularizing military aviation as a primarily defensive arm for the stopping of invasion by air or sea.³

The Munich crisis, however, initiated a change in the

administration's private, if not public, view of air power. In September 1938, William Bullitt, the U.S. Ambassador to France, summarized his analysis of the Munich appeasement in a cable to Roosevelt: "If you have enough airplanes you don't have to go to Berchtesgaden."⁴ Thus Bullitt and other members of the Roosevelt Administration felt that the threat of Nazi air attack was one reason for British and French appeasement of Hitler.⁵ Lindbergh, who was in Germany in October 1938, reported to Roosevelt through Joseph Kennedy, the U.S. Ambassador to England, that "Germany now has the means of destroying London, Paris, and Prague if she wishes to do so."⁶

Based on public opinion, the threat, and Bullitt's admonition, Roosevelt developed the idea that a large air force would serve as an offensive deterrent to further German aggression.⁷ Furthermore, in September 1938 Roosevelt predicted that aerial warfare "...would cost less money, would mean comparatively fewer casualties, and would be more likely to succeed than a traditional war by land or sea."⁸ Soon afterward, at a meeting with key members of his administration in November 1938, Roosevelt announced that he wanted to expand the air forces to ten thousand aircraft and production capacity to ten thousand planes a year. This "...was a bolt from the blue..."⁹ and "...far beyond the airmen's own plans for expansion that autumn."¹⁰ General H.H. Arnold, Chief of the Army Air Corps, left the meeting delighted "...with the feeling that the Air Corps had finally 'achieved its Magna Carta.'"¹¹ Finally, Roosevelt also envisioned an added benefit: high levels of airplane manufacturing would

"...mean prosperity in this country and we can't elect a Democratic Party unless we get prosperity...Let's be perfectly frank."¹²

The Munich crisis did not change the sentiments of the public and Congress, however. The isolationists did not trust Roosevelt, no matter how strongly he professed his intention to avoid war. In Congress, isolationists introduced a constitutional amendment requiring a national referendum to declare war, a threat which Roosevelt took seriously.¹³ Republicans urged Roosevelt "...to take a firm stand for peace,...to steer clear and keep quiet."¹⁴ And even after the German invasions of Poland and France in 1939 and 1940, public and Congressional opinion opposed direct U.S. participation in the war.¹⁵

In the three years following Munich, Roosevelt simultaneously tried to prepare for and prevent war and he continued to emphasize air power as the best instrument for achieving these objectives:¹⁶

For Roosevelt, air power seemed an ideal instrument, decisive yet humane, for deterring, limiting, or at the worst, waging war. Meanwhile, it also served American and hemispheric defense, objectives so uncontroversial that the expansion of American air power could proceed with minimal opposition...Therefore, Roosevelt's new aerial policy squared with the dominant prejudices and priorities of Americans: alarm over fascist aggression, aversion to military expenditures abroad, desire to preserve America's isolation,¹⁷ and faith in aviation as a benign technology.

ABC-1 and RAINBOW 5

In 1940, consistent with his policy of preparing for war while trying to prevent it, President Roosevelt approved a proposal for a secret conference between American and British military staffs. Held from January to March 1941, the conference produced a final report, known as ABC-1, which had the following key provisions:¹⁸

(1) The European theater is where the main effort should be. The strategic defensive should be maintained in the Pacific.

(2) There will be a sustained air offensive against Germany and other regions under enemy control that contribute to German military power.

(3) Forces will be built up for an invasion and offensive on the Continent.

Ironically, the Army Air Corps was not the driving force behind point (2) of ABC-1 because no Army Air Corps representative was invited to take part in ABC-1. Instead, the inclusion of point (2) was the work of Air Vice Marshal Slessor, RAF, a strong advocate of strategic bombing.¹⁹

Following the issuance of ABC-1, the Joint Army-Navy Board (a joint planning organization) directed the modification of the joint plan called RAINBOW 5 so as to include the provisions of ABC-1. Subsequently the Joint Board and the Secretaries of War and the Navy approved both ABC-1 and the modified RAINBOW 5 and submitted them to Roosevelt for his approval. Roosevelt, however, never approved or disapproved them, but Secretary Stimson

nevertheless directed the Army to follow their provisions since they had not been explicitly disapproved.²⁰

AWPD-1

On 9 July 1941 Roosevelt wrote the Secretaries of War and the Navy requesting that they develop production requirements needed to win a possible war with the Axis. The Joint Board, anxious to respond rapidly to his request, decided that each Service would develop its own requirements, but within the guidance of ABC-1 and RAINBOW 5.²¹

The Army General Staff War Plans Division (WPD) was tasked to develop requirements for the Army, including the Army Air Corps. However, in an audacious move with great impact on the strategy of WW II, Lt. Col. Harold L. George, chief of the newly created Air War Plans Division (AWPD) of the Air Staff, argued for and won the right for the AWPD to develop requirements for the Army Air Corps.²²

The requirements plan subsequently developed by the AWPD, called AWPD-1, established the strategy that was later used in POINTBLANK. To analyze this strategy, it is instructive to use a simple model that breaks strategy down into three components: military objectives based on national policy, military strategic concepts (i.e., how to achieve the objectives), and military resources. Military resources can be either the resources available or the resources required to carry out a military strategic concept, depending on whether the strategy is an

operational strategy or a force development strategy, respectively.²³

The simplest approach for determining resource requirements was the path taken by the WPD for determining those of the Army. The WPD developed force requirements comparable in size and capability to the forces then fielded by the Axis, discounted by the quantity and capability of fielded British forces.²⁴

The AWPD took a different approach: they developed a strategy and then calculated requirements from that.²⁵ Thus AWPD-1 was a requirements plan based on a force development strategy: a strategy for how the war should be fought if the required resources were actually produced and available in the time frame envisioned.

National Policy Guidance

Roosevelt's letter to the Secretaries of War and the Navy contained only one piece of national policy guidance: to defeat potential enemies. Although vague, it was important because it was interpreted as a call for military victory, not containment, deterrence, or passive defense. In addition, the Joint Board had directed that requirements be developed in accordance with the policies in ABC-1 and RAINBOW 5 which explicitly included a sustained air offensive against Germany.²⁶

Military Objectives

Based on the policy guidance in ABC-1 and RAINBOW 5, there was much debate in the AWPD regarding the objectives of their air

strategy. They considered three alternative military objectives:²⁷

(1) Defeat of Germany, followed by a defeat of Japan, through air power alone.

(2) An attempt to defeat Germany (and later Japan) through air power alone, but failing that to prepare the way for a land invasion of the Continent (and again Japan).

(3) Prepare the way for an invasion of the Continent, followed by defeat of Germany through air-land operations against the enemy army (with similar operations to follow in the Pacific).

Army doctrine dictated the selection of (3) as the military objective for AWPD-1.²⁸ On the other hand, Army Air Corps doctrine as taught at the Air Corps Tactical School (ACTS) and the collective heart of the members of the AWPD, all former instructors at the ACTS, dictated (1) as the objective.²⁹ But the collective brain of the AWPD dictated the selection of (2) as the objective for the very practical reason that they knew they couldn't "sell" (1) to the Army, which would have to approve AWPD-1.³⁰

Strategic Concepts

When completed, AWPD-1 listed four air tasks that would be accomplished in the postulated war:³¹

(1) Conduct a sustained air offensive against Germany to destroy its will and capability to continue the war and make an invasion either unnecessary or feasible without excessive cost.

(2) Provide air operations in defense of the Western

Hemisphere.

(3) Provide air operations in Pacific defense.

(4) Provide support for land forces in the invasion of the Continent and the campaigns thereafter. Large tactical air forces would be required for this task when the Army was ready for invasion.

The first air task contained the premier strategic concept selected for AWPD-1: strategic bombardment against the will and capability of Germany to continue the war. Another strategic concept, an invasion with subsequent air-land operations, was addressed in the fourth air task, but was not specifically used to generate requirements for AWPD-1. The AWPD assumed that an invasion might not be required due to the strategic bombing campaign, but if it were necessary, large tactical air forces could be planned for and obtained when closer to D-Day.³²

Strategic bombardment was a doctrine that had been enthusiastically adopted and advocated by the faculty of the ACTS in the 1930s, which had included the four members of the AWPD. It was based on the following postulates:³³

(1) Vital Targets Postulate. Modern nations need industries to produce weapons for their forces and to provide products and services to their populations. Industries contain vital targets that if destroyed will cause the industries to be paralyzed, which in turn will undermine both the enemy's capability and will to fight.

(2) Bomber Accuracy Postulate. Bombs can be delivered with adequate accuracy to destroy the vital targets.

(3) Bomber Invincibility Postulate. Unescorted bombers can penetrate air defenses on their way to the vital targets without unacceptable losses.

In their search for vital targets the AWPD identified three critical German industries: (1) electric power, (2) transportation, and (3) oil. To hedge against the possibility that bombers were not invincible, they added to this list the "overriding intermediate" goal of neutralizing the Luftwaffe. The AWPD then identified 154 vital targets in these industries and decided that these targets should be attacked so as to destroy them in six months. In an otherwise detailed account of the development of AWPD-1, there is no hint of a rationale for the six months figure--it was apparently arbitrary.³⁴

Resources

Having identified vital targets, the AWPD officers proceeded to calculate the bomber force required to destroy the 154 targets in six months. Other calculations were performed for non-bomber aircraft based on the required number of bombers and the non-bombing air tasks that had to be performed. However, there was one type of aircraft for which they did not calculate requirements: escort fighters. After all, their doctrine said escort fighters were not needed.³⁵ Nevertheless, following a discussion of German air defenses, the AWPD planners did include the following statement regarding escort fighters in AWPD-1:

Consideration of all these factors leads to the conclusion, that by employing large numbers of aircraft with high speed, good defensive firepower, and high altitude, it is feasible to make deep penetrations into Germany in daylight [emphasis in original].

It is believed that the degree of reliability of conducting sustained offensive air operations would be greatly enhanced by development of an escort fighter.³⁶

The four men of the AWPB completed AWPB-1 nine days after they began. And to their relief, both Gen. Marshall and Secretary Stimson approved AWPB-1 in September 1941. Why? According to the historian Michael Sherry:

The general staff still believed that destruction of the enemy's ground armies was the only sure path to victory. But doubts about the survival of Britain and Russia ran large in the War Department, making a land invasion of the Continent seem remote at best: hence even conservative officers acknowledged the imperative of weakening Germany by bombing. Strategy, then, along with Roosevelt's wishes about how to fight the war, made the War Department amenable to a vision of air war that would have seemed...fanciful a few years earlier.³⁷

The Victory Program and the Leak

Roosevelt incorporated the AWPB-1 requirements, along with those of the Army land forces and the Navy, into his so-called Victory Program. Public opinion at the time seemed to favor an increased defense production program: it was good for the economy. But on December 4, the entire Victory Program plan (classified SECRET), including the AWPB-1 objectives and target lists, was leaked to the Chicago Tribune and the Washington Times-Herald by Senator Burton Wheeler who had obtained it from a source within

the Air Corps. Wheeler and both newspapers were staunchly isolationist and they believed public exposure of the plan would prove Roosevelt's intention to lead the nation to war.³⁸ Public outcry over the plan was silenced three days later by the Japanese attack on Pearl Harbor, and for the most part the Victory Program was funded by Congress, thus providing the resources required for the eventual POINTBLANK campaign.³⁹

However, German agents in the U.S. cabled the plan to Berlin where the German General Staff immediately recognized its importance. On December 12, Hitler issued his "Führer Directive 39" in reaction to the Victory Program, which included massing air defenses around key German industrial targets, increasing attacks in the Atlantic to prevent U.S. forces from reaching Europe, and assuming the strategic defensive on the Eastern Front. Fortunately for the future Allied war effort, after visiting the Eastern Front and witnessing setbacks there, Hitler angrily and irrationally rescinded Directive 39 on December 16 and thereby minimized the damage done by Wheeler's security leak.⁴⁰

POINTBLANK

POINTBLANK Strategy

An updated requirements plan, called AWPD-42, was completed under the direction of then Brigadier General Hansell in September 1942. AWPD-42 envisioned a combined bomber offensive with the Army Air Forces conducting daylight attacks and the RAF conducting night attacks.⁴¹ Like AWPD-1, AWPD-42 did not include

requirements for escort fighters, nor did it even mention the need to develop escort fighters as had AWPDP-1, but instead presented this optimistic assessment:

With our present types of well armed and armored [unescorted] bombers, and through skillful employment of great masses, it is possible to penetrate the known and projected defenses of Europe and the Far East without reaching a loss-rate which would prevent our waging a sustained offensive.⁴²

Even though they had been approved as production requirements plans only, AWPDP-42 and AWPDP-1 were accepted by Eighth Air Force as authoritative strategic plans until January 1943 when Roosevelt and Churchill met with their Combined Chiefs of Staff at Casablanca to discuss Allied strategy.⁴³ This conference produced a document known as the "Casablanca Directive," a paper drafted by Air Marshal Slessor and approved by the principals at the conference. Like ABC-1, the Casablanca Directive called for a sustained air offensive and stated that its purpose was:

To bring about the progressive destruction and dislocation of the German military, industrial and economic system and the undermining of the morale of the German people to a point where the capacity for armed resistance is fatally weakened.⁴⁴

In response to the Casablanca Directive, a team began developing the POINTBLANK operations plan which, unlike AWPDP-1 and AWPDP-42, had to be based on existing capabilities. The general POINTBLANK strategy differed from AWPDP-1 strategy in only one respect: like AWPDP-42, it called for the RAF to continue bombing enemy cities at night. Daylight precision bombing in accordance

with AWPD-1 principles and ACTS doctrine was to be the mission of the Army Air Forces.⁴⁵

The final POINTBLANK operations plan, which retained German fighter strength as an "overriding intermediate" objective but changed other AWPD-1/42 target types and priorities in accordance with the latest operations analysis, was presented to and approved by the Joint Chiefs of Staff in Washington on April 30, 1943 by Ira Eaker, Commanding General, Eighth Air Force.⁴⁶ Sometime between this date and final approval of the POINTBLANK plan by the Combined Chiefs of Staff at the Trident Conference on May 18, 1943, the Combined Chiefs made a one sentence addition to the Casablanca Directive which, to the American and British airmen, changed its whole thrust:

To bring about the progressive destruction and dislocation of the German military, industrial and economic system and the undermining of the morale of the German people to a point where the capacity for armed resistance is fatally weakened. This is construed as meaning so weakened as to permit initiation of final combined operations on the Continent [emphasis added].⁴⁷

According to General Hansell, for the Combined Chiefs "...the real objective of the bombing offensive was making possible an invasion of the Continent,"⁴⁸ whereas the airmen thought that "'Fatal weakening' meant impending collapse of the entire German state, not simply a breach in the coast defenses of France."⁴⁹

POINTBLANK Campaign Results

The POINTBLANK campaign began in May 1943, but weather, heavier than anticipated attrition of unescorted bombers, diversions of bombers from POINTBLANK to other operations, and changes in targets by the Combined Chiefs of Staff all hampered the initial effort. In particular, heavy losses from fighter attacks soon proved that bombers were definitely not invincible, so that a high priority was given to fielding escort fighters.⁵⁰ Consequently, full-scale bombing operations did not get underway until February 1944 and operations uninterrupted by diversions to other missions did not get underway until September 1944, well after the OVERLORD invasion in June.⁵¹

Nevertheless, POINTBLANK was successful in achieving the neutralization of the Luftwaffe prior to the initiation of OVERLORD. Much of this success was due to the addition of long-range escort fighters to the bomber formations and the resultant attrition of German fighters and their pilots, something not envisioned in AWPD-1/42.⁵² The diary of German fighter pilot Heinz Knoke tells how it was:

Once again Division Control reports those blasted concentrations in sector Dora-Dora...This report has now come to have a different significance for us: it is a reminder that, for the moment, we are still alive...Every time I close the canopy before taking off, I feel that I am closing the lid of my own coffin...Every day seems an eternity. There is nothing now--only our operations, which are hell, and then more waiting--that nerve-wracking waiting for the blow which inevitably must fall, sooner or later.⁵³

And though controversial, the U.S. Strategic Bombing Survey and Hitler's Armaments Minister, Albert Speer, thought POINTBLANK post-OVERLORD operations were "decisive," especially in their effects on oil and transportation. According to Speer:

I shall never forget the date May 12 [1944]...On that day the technological war was decided...With the attack...of the American Eighth Air Force upon several fuel plants..., a new era in the air war began....It meant the end of German armaments production.⁵⁴

The U.S. Strategic Bombing Survey had this to say about transportation:

The attack on transportation was the decisive blow that completely disorganized the German economy. It reduced war production in all categories and made it difficult to move what was produced to the front.⁵⁵

Yet it must be noted that the term "decisive" is misleading if it is taken to mean that strategic air power was all that was necessary to win the war. In actuality air power was not employed alone in WW II, so there is no empirical evidence on what its solitary impact might have been. All we do know is that it had considerable impact in combination with the Soviet land campaign on the Eastern Front and the Allied OVERLORD invasion in the west. The following passage shows that "decisive" in context meant something like "made a major contribution:"

Allied air power was decisive in the war in Western Europe. Hindsight inevitably suggests that it might have been employed differently

or better in some respects. Nevertheless it was decisive. In the air its victory was complete. At sea, its contribution, combined with naval power, brought an end to the enemy's greatest naval threat--the U-boat; on land, it helped turn the tide overwhelmingly in favor of Allied ground forces. Its power and superiority made possible the success of the invasion [emphasis added].⁵⁶

Superior air power was, then, a necessary, but not sufficient condition for Allied victory in Europe in WW II: air power alone could not guarantee victory, but neither could the Allies have won without it.

Lessons

There are three major lessons that can be drawn from the preceding analysis of POINTBLANK and its strategic and policy foundations. None of these lessons are about policies and strategies per se, but instead they are primarily lessons about the policy and strategy formulation processes.

Multiple Roles of the President

The first and most important lesson for national security decision makers and military strategists alike is the impact of the three-fold nature of the presidency. Because the President is the head of his political party, head of the executive branch of the government, and commander-in-chief of the armed forces, the Clausewitzian notion that national defense and politics are inextricably intertwined is an inescapable truth in our government. As with early air power theory and its related

national policies and strategic concepts, many politicians, including the President, embrace or oppose policies and strategies for all the wrong reasons from a military or national security point of view. Conversely, many strategists do not consider political factors when devising strategy, forgetting the President is more than commander-in-chief. For example, domestic politics and economics, the desires of an ally, and relatively uninformed public opinion all played major roles in the formulation of national security policy and strategy for POINTBLANK.

This is certainly not a new discovery, but it is one often wished away by military strategists and inadequately recognized by civilian national security policy makers and influencers. Mutual recognition and accomodation must be a feature of both the policy making and strategy formulation processes, otherwise large disconnects may result, to the detriment of the national security.

Panacea Strategies

From 1932 until at least 1941 the Roosevelt Administration was searching for a military strategy that would: (1) be popular with the public, (2) be relatively inexpensive, (3) have a low public profile, (4) result in low casualties, and (5) produce quick victory with minimum effort: a "panacea" strategy. Although most of the upper levels of the War Department held a more realistic view of strategy, the planners of the AWPD and their superiors in the Air Staff had not only conducted a similar search for a panacea strategy, but thought they had found it.

The fact that the POINTBLANK campaign turned out well, at

least according to the Strategic Bombing Survey and Albert Speer, has led some subsequent policy makers and strategists to continue the search for panacea strategies and to continue to think air power alone might provide one. This was certainly true with the Vietnam ROLLING THUNDER campaign and appeared to still be a hope in some quarters relative to Operation Desert Storm. In fact, however, it seems clear that the real lesson of WW II was that neither air power nor land power alone was responsible for the defeat of Germany, but both together were.

In the final analysis, panacea strategies are invalid because they address only "war on paper." In real warfare, fog and friction ensure that there are no effective panacea strategies and the principle of mass dictates that where possible we apply both air power and land power against the enemy's center of gravity.

Strategies of Doctrine

Another important lesson of POINTBLANK is that strategies do not spring into being as detached rational solutions to objectively perceived military problems. Rather, they are formulated to respond to subjectively perceived problems and tend to be constructed of existing military doctrines. Therefore strategies are not necessarily rational, in the sense of having been optimized for the situation at hand. The reason this is true has been addressed by Graham Allison with his organizational process model.

Allison maintains that in order for organizations such as government departments to make decisions on and carry out complex

policies, strategies, or plans, they must use previously established standard procedures, or authoritative statements of the way things are done in the organization.⁵⁷ Of course, this is a rough definition of the term doctrine.

Especially under time pressure, an organization tasked to develop a policy, strategy, or plan, will use already available doctrines as building blocks, even if those doctrines are not completely in consonance with the actual strategic situation. The resultant strategies of doctrine may therefore contain small or large flaws that will have to be addressed during execution of the strategy or fail.

In AWPD-1/42, the lack of escort fighters was such a doctrine-based flaw that fortunately was able to be rectified during the execution of POINTBLANK. That escort fighters would be needed could have been gleaned from common sense and both Luftwaffe and RAF wartime experience, but ACTS doctrine said the bomber could always get through without escort fighters and the authors of AWPD-1 and AWPD-42 were steeped in that doctrine. The point here is that because of the organizational process basis of decision-making, correct strategies depend on correct doctrines. Strategists should be in the forefront of those trying to ensure that doctrines are experienced-based, realistic, and up-to-date, or their efforts are bound to be flawed and failure-prone.

Conclusion

The lessons of POINTBLANK are lessons about the processes of national security policy making and military strategy formulation. Unfortunately, many texts and educational programs, as well as most "shop talk," seem to focus on the product of these processes: the policies and strategies themselves. Although there is no doubt that studying historical national security products is a valuable endeavor for policy makers and strategists, the foregoing analysis of POINTBLANK demonstrates the equal need to study the processes involved, for the simple reason that a policy maker or strategist who uses a faulty process or misunderstands the nature of the process will have difficulty producing a product that is not faulty too.

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