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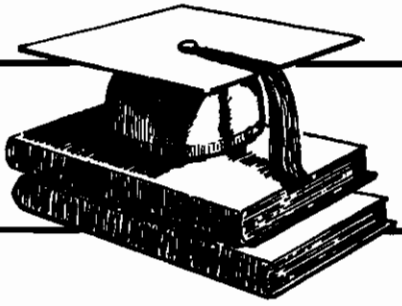

PROFESSIONAL READING

REVIEW ARTICLE
MANAGERIAL STYLE IN THE INTERWAR NAVY: A REAPPRAISAL

by
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and
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In an interesting and provocative essay,† the historian Waldo Heinrichs has argued that understanding the actions of the U.S. Navy in the decade before World War II is impossible unless one realizes that the interests of any peacetime navy are shaped less by military than by bureaucratic and political needs and constraints. Hence, in preparing for war, a peacetime naval establishment ("conservative, complex, and political") will build warships, organize its resources and plan its maneuvers "as efforts to encompass new realities within an existing framework of compromise and consensus," not as the result of "unitary, decisive, and adaptable" planning and a "hierarchical organization." (pp. 197-198) There are two claims here. The first is a hypothesis about the way in which peacetime navies, as institutions, will and must plan and prepare for a war. The second claim is that the U.S. Navy's experiences in the 1930s provide evidence in support of the hypothesis. This paper disputes both claims. The goal is not simply to show that Heinrichs was in several important respects mistaken; it also is to test some conjectures about which factors allow organizations to respond effectively to uncertainty. In order to do this, we argue (1) that the failure to develop the carrier striking forces in the thirties was because of treaty and technical factors, (2) that the Navy's "unrealistic" commitment to Plan Orange (pp. 204-220) was, in fact, realistic, and (3) that financial constraints, far from being lifted in the thirties, continued to press on the Navy and stimulated innovation instead of a stubborn adherence to traditional doctrines. The critique and comments are considered applicable to more situations, to more organizations, than those discussed in detail here.

Hypothesis. Heinrichs holds what is probably a widespread view of the nature of a peacetime navy:

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† "The Role of the United States Navy" in Dorothy Berg and Shumpei Okamoto, eds., *Pearl Harbor as History* (New York: Columbia University Press, 1973), pp. 197-223.

> It is a moored to civilian life. Doctrine, precedent, routine, and habit take hold. Money is scarce and cruising is costly... its most pressing engagement is the battle of the budget.... Within the peacetime navy power is diffuse. Decision is a matter of reconciliation and coordination among diverse groups of specialists.... The impulse at the top is to play safe and rely exclusively neither on the weapons of the last war nor on new, untried ones. (p. 197)

According to Heinrichs, this situation will prevail especially where funds are plentiful or increasing. When funding declines, the pressure to make rhe right decisions builds. "We might hypothesize that a starving bureaucracy is innovative, a fattening one complacent." (p. 199) The policies of the Navy Department between 1929 and 1941 supposedly support this claim. Innovation was greatest in 1930-32 and during 1939-41; in the former period, money was scarce, while in the latter the major constraint was strategic, as the military leaders of the Navy, wrestling with the problems of a two-ocean war, finally examined critically the two-decades-old Orange war plan.

Through most of the thirties, however, Navy Department policy was set by three factors: (1) a commitment to rhe Orange Plan, (2) the goal of a "balanced fleet," and (3) a willingness ro build and to maintain a "treaty navy." (p. 205) Heinrichs lumps these factors together; all, he mainrains, were used ro determine and justify building programs and strategic plans. Though Navy officers complained publicly about the constraints of rhe Washingron and London naval agreement, Heinrichs claims that the constraints served as targets and limits around which rhe service debates about weapons, tactics and strategy could revolve. As he put it:

> These three mutually dependent concepts—the Orange plan, the "balanced fleet," and the "treaty navy"—provided a satisfactory bureaucratic strategy for resolving internal differences and securing external support. (p. 206)

This is a provocative claim. Heinrichs does not hold that military bureaucracies need some doctrine, any doctrine, to turn into or to guide policy. That much he can safely assume. Instead, he has really said that it is (and was) in the organizational interests of a navy (and, in particular, the U.S. Navy) to be decentralized, formally complacent and conservative, and slow moving unless financial pressure, war or the imminent threat of war force drastic organizational and perceptual changes. So the Chiefs of Naval Operations who followed Adm. William V. Pratt (September 1930 to June 1933) were less inclined to support innovation because the benefits of centrally initiated or directed change were not perceived to outweigh the costs of administrative wrangling and political controversy that would inevitably accompany them. In a period of increasing congressional authorizations, strong Chiefs were organizationally unnecessary, even harmful, because the immediate needs of the Navy could be better met by administrators who did not force reevaluations of strategic and tactical assumptions.

To support this argument, Professor Heinrichs gives two examples of peacetime policy failures that proved costly to the Navy in World War II: (1) the failure to develop the carrier striking force, and (2) the unrealistic—if also unenthusiastic—commitment to a strategic offensive in the Pacific (Plan Orange). Our position is that the first "failure" was owed to rechnical problems rather than to organizational lethargy or conservatism. That is, Heinrichs has nor appreciated the very real and very numerous technical issues that characterized carrier aviarion in the 1930s.[1] Heinrichs' analysis of the

Navy's commitment to the Orange Plan is based on stronget evidence than his discussion of the fortunes of carrier aviation, but two observations are appropriate here. The first is that the Navy had to plan for a strategic offensive against Japan in case the Government decided to make political commitments in the Far East that Japan might regard as hostile. As Heinrichs notes, the plans of the Navy and the positions taken by the State Department fed on each other; the more plausible the former, the stiffer the latter and, when the State Department and the President made political commitments to the territorial integrity of China, the Navy had to be prepared to back those commitments with force. The second observation is that the battles of the Philippine Sea and Leyte Gulf look a lot like what was predicted in the 1930s, except that the capital ships of the forties were carriers and not battleships. And that was foreseen by influential officers in the thirties as a likely possibility.

Pressure and Response. The U.S. Navy faced a number of severe problems in the 1930s. The most important was the rate of change of military technology. In January 1929 the value of the large, fast "fleet" carrier was demonstrated conclusively in Fleet Problem Number IX.[2] After that date, the issue wasn't whether or not carriers were needed but how best to achieve the optimal number within the limits set by the Washington and London agreements. There was also contention over how best to use carriers and carrier aircraft but, as those in on the debate knew, that could be resolved only after extensive experience with the carriers and their aircraft with the fleet. There were other technical developments that provoked both promise and problems for the Department. Seaplanes, for example, increased in speed, range and bomb capacity rapidly in the 1930s. The *Catalina* PBY flying boat, so prominent during the war, was actually the product of regular, planned peacetime production (the first models were delivered in 1936).[3] The capabilities of that aircraft as a scout, and especially as a bomber, were only a promise of what might come along soon after. That promise was a strategic weapon not limited by treaty; the problem was that the Japanese would also have such aircraft, making the chance of serious naval battles at great distances far more likely. By 1930 centrally directed gunfire in both cruisers and destroyers was at hand or being developed; this meant that smaller vessels could engage one another at ranges open only a few years earlier to battleships. It also gave cruisers and destroyers an antiaircraft capability that they had not had in the twenties. The consequence was pressure on designers to produce, *within the various treaty limitations*, warships of qualitatively greater striking and defensive power. As it turned out, this could not easily or efficiently be accomplished and so, through the decade, the technical pressures on the treaty ceilings mounted.

Battleship design also advanced, especially in one way that revolutionized American straregic thinking. The best speed of the existing battleline was 20 knots.[4] By late 1933, however, it became possible to build a 28-knot battleship, adequately armed and armored against 14-inch shellfire, within the treaty displacement limit of 35,000 tons. Earlier battleship replacement plans had called for a fleet speed not significantly greater than that already used. The understanding that faster ships could be built grew out of special studies conducted within the Bureau of Construction and Repair at the request of Adm. William H. Standley, then Chief of Naval Operations.[5] By 1935 it was clear that future American battleships would be far faster than their predecessors, though

just as heavily armored and possessed of the same great endurance. This gave the battleline of the U.S. Fleet great mobility, and it meant that carriers and battleships would be able to steam together at high speeds.[6] Unfortunately for the Navy, it also meant that a whole new battleline would have to be built, and new destroyers and cruisers, intended to screen the battleships, would have to be even *faster* in order to maneuver around the battleships. Naval constructors were caught between the Scylla of rising technical demands and the Charybdis of treaty limitations. Increasingly efficient engineering plants were one solution, but such a solution created in its turn yet another problem: the new, fast battleships were expensive, and buying them meant less money would be available for other ship types. The Navy was caught in a circle of uncertainty, a circle in which the demands of military technology ran against treaty limitations, and where increasing appropriations were eaten up by more, and more expensive, types of weapons.

The interplay between, first, technological innovation and then strategic possibilities led to still more difficulties. As the speed, reliability and attack potential of carrier aircraft grew, the need for sufficient large carriers could not be met within treaty limitations. Even had there existed no political limitations, however, there would still not have been enough "good" carriers because the characteristics of the "right" design only became apparent after years of operational experience. *Ranger* (CV-4), the first American carrier designed as such, was designed before any lessons had been learned from the regular use of *Lexington* and *Saratoga*.[7] *Ranger* was significantly smaller than the first two carriers (*Langley* was only experimental) for two reasons. Despite their size and aircraft carrying capacity, *Saratoga* and *Lexington* could nor launch many more airplanes much faster than *Langley*, but exercises had demonstrated the value of being able to put a large number of aircraft into the air quickly to thwart any aerial attack. The Bureau of Aeronautics believed that a greater number of smaller carriers would be better able to fill the skies above the fleet with the number of aircraft necessary to protect airplanes spotting for the battleline and to attack enemy carriers.[8] The second reason for the comparatively small size of *Ranger* was that the Washington naval agreements had allowed the Royal Navy nine carriers, and the Bureau of Aeronautics wanted to squeeze as many similar ships as possible out of the tonnage allowed the United States.[9]

As it happened, *Ranger* was not a satisfactory carrier, despite alterations made to it based on experience with its larger predecessors.[10] Unfortunately, the General Board had to set the characteristics of *Yorktown* and *Enterprise* before *Ranger* had even been launched (September 1933) or had conducted regular flight operations (beginning in June 1934).[11] This business of placing the cart before the horse only ended with the design of CV-9 (*Essex* class).[12] Given the unknowns involved, it should not be surprising that it took 10 years to develop the design of the *Essex*-class carriers. The trouble was that none of that group was finished when war began in 1941. But the years of development were neither wasted nor unnecessary, and the "delay" in obtaining the *Essex* type was not the result of bureaucratic conservatism or lethargy. It was instead the result of a lack of sufficient experience.

Seaplanes could relieve carriers of scouting duties and serve as a separate striking force, and so *large* seaplane development was pursued (and defended) vigorously by the Bureau of Aeronautics.[13] The Bureau also experimented with airship aircraft carriers as a means of extending the

scouting capacity of the fleet.[14] The Navy failed to replace *Akron* and *Macon* because of (1) Presidential intervention, (2) the progressive increase in seaplane scouting ranges, and (3) the lengthy construction time involved. When the General Board was asked to pass on the value of airship aircraft carriers in 1937, the head of the Bureau of Aeronautics noted that aircraft would have the range of the airships within 5 or 6 years; it might be better, he observed, to put the available money into aircraft development and production. That position did not carry the General Board because, as they already knew, the airships, if *successful*, could take the place of a large number of expensive aircraft.[15]

These are only a few illustrations of the rather rapid and significant changes that pressured the Navy in the 1930s. The great increase in the offensive power and scouting capabilities of aircraft presaged battle at great distances and challenged the very idea of concerted fleet movement. Increases in the speed of all warships made the likelihood of a mobile Pacific war greater, placing a premium on the construction of a larger fleet train. However, the need for warships and the shortage of trained personnel delayed the construction and commissioning of auxiliaries.[16] The "treaty" Navy could not carry out the Orange Plan.[17] Yet that same Navy would have to gain the operational experience so necessary if the "two-ocean navy" authorized after the collapse of treaty restrictions were to tackle the Japanese successfully.

Heinrichs does not seem to understand this. Neither does he appear to understand that the design of any warship is a matter of technical, tactical and strategic compromise among officers committed to the achievement of different but necessary goals.[18] Treaty restrictions only make it harder to reach an optional compromise; they do not eliminate the need for compromise. In the case of carriers, conflict and mutual concessions were unavoidable. The Bureau of Aeronautics wanted at least four squadrons of airplanes (72) on each carrier, plus spares, room for pilots, gas and ammunition for the airplanes, etc. The Bureau of Ordnance wanted each carrier to mount adequate antiaircraft batteries. Steam Engineering wanted enough space and weight in the ships to give them the powerplant necessary for the required high speed. The War Plans Division of the Office of the Chief of Naval Operations wanted the ships to have endurance and ruggedness. Each bureau presented its case to the General Board. The Board then sampled opinion from within the fleet and from the staff of the Bureau of Construction and Repair (charged with producing the final design). Only then were the specific characteristics of a class of ship set. Contrary to what Heinrichs leads one to expect, there were lively disputes among the bureaus as their spokesmen attempted to sway the opinions of the General Board.[19] This was true in the case of carriers, battleships, destroyers, cruisers and submarines.[20] In the case of each such design the General Board had to write specifications that were the product of compromises because there was, given the uncertainties, no obvious optional design.[21] Significantly, the larger carrier designs were some of the more successful of these. The smaller carriers (*Ranger* and *Wasp*) lacked the tonnage necessary to give them adequate speed, protection and airplane capacity.[22] Unfortunately, there was no way to demonstrate that before such vessels were actually tested.

Innovation and Compromise. Heinrichs also takes too narrow a view in suggesting that financial considerations played a major role in holding down the Navy's investment in aviation:

> Naval aviation was an exceedingly costly initial investment.... To place it in the central position

> before the war would have required a radical restructuring of the navy that leading admirals were not disposed to attempt.[23]

This implication is wrong on several counts. First, Heinrichs cannot claim that the middle and late years of the thirties were not financially short ones for the Navy and then argue that expense was the reason why naval aviation programs were not pursued more vigorously. His real point is that a bureaucratic commitment to a "balanced fleet" (first set forth in the 1916 naval authorizations) prevented the Navy from seeing before the war what would become its wartime strategy. Our point is that the Department sought a balanced fleet as a hedge against technical uncertainty. Advances in aircraft came rather quickly, but dive bombing wasn't practical until the development of radial aircraft engines, and level bombers and torpedoplanes did not look impressive until the heavier monoplanes of the late thirties.[24]

In 1934, *after* the General Board had set the characteristics of *Yorktown* and *Enterprise* (both authorized in 1933), carrier bombers able to carry thousand-pound loads still had "very poor" performance.[25] The Bureau of Aeronautics had great confidence in the future of carrier aviation, but the CNO's staff had recommended *against* building too many models of any carrier-launched airplanes on the grounds that advances in design would too soon render existing types obsolete.[26] There was also the problem of having more aircraft than the carriers could handle. Carrier airplanes and pilots were extremely specialized; the former were not suitable for use by the Army (so the Navy could not easily pawn off surplus airplanes) and the latter had to spend much of their time in carriers if they were not to lose the special skills needed to fly from such vessels. That is, only a limited number of pilots could be kept qualified in carriers unless more carriers were built, and more carriers could not be built until the treaty limitations were lifted and adequate experience gained with *Yorktown* and *Enterprise*. We do not question Heinrichs' observation that senior officers hesitated to invest more resources in naval aviation. We do question his explanation for their reluctance, and we maintain that our explanation is more accurate.

The evidence indicates that innovation actually increased, and it did so because the Navy could financially support a greater variety of projects. As it happened, enough of these "projects" were both successful (or promising) and expensive enough to absorb the additional funds appropriated the Navy by Congress after the summer of 1933. An illustration of this is the Navy's response to the treaty limits set on aircraft carrier tonnage. Carriers were scarce, so attempts were made to spare them certain less essential tasks and to give them better protection from air attack. The Bureau of Aeronautics designed and purchased large seaplanes to relieve carriers of long-range scouting and attack duties, but that meant money had to be spent on seaplane ramps, hangars and tenders. Director-controlled antiaircraft fire became a reality for cruisers and destroyers in the late thirties, so the scarce carriers could be shielded by a fast cruiser/destroyer screen. The catch was that directors were heavy and expensive, and any increase in the number of antiaircraft guns per ship made necessary increased complements when the money for additional personnel was not available.[27] Submarine attack, a second real threat to the carriers, was countered by mounting underwater sound ranging sets on carriers and cruisers, as well as on destroyers. This too cost a lot of money and, as it happened, was not very effective.[28]

The Orange war plan was itself a goad to Navy planners and designers.

Adherence to the plan meant that counters had to be found to the increasingly powerful threats of land-based and carrier-based aircraft, and of long-range submarines. As war experience would later show, the fundamentals of the Orange Plan were correct. That is, to wage a strategic offensive against Japan, the Navy would have to destroy or immobilize the capital ships of the Imperial Japanese Navy, reduce the Japanese merchant marine, and conquer Japanese possessions in the mandates so that the first two goals could be achieved. The Washington and London agreements denied the Navy the forces necessary to achieve these tasks, bur the Department was still responsible for preparing a war plan and forecasting the means by which it could be fulfilled. To that end the "treaty" fleet undertook a series of "problems," or full-scale, realistic maneuvers, to find ways of best employing the forces it had and those it would build in the event of mobilization. These exercises were rather effective tests of doctrine and material, whether conventional or innovative.

Fleet problems revealed strengths and weaknesses. The latter often simulated innovations. The Marine Corps, for example, was seriously concerned about its ability to take and then hold advanced bases within reach of Japanese sea and air attacks. In 1938 Marine officers complained to the General Board about inadequate air and gunfire support for assault troops, and they asked the Board to support their request for more land-based aircraft. The Marine aviators feared that they would not have enough airplanes to shield an island their infantry had taken because carriers could not remain near such a contested area for extended periods of time.[29] Their testimony reads like a forecast of Guadalcanal. The Marines did not get the airplanes they asked for, but not because the Bureau of Aeronautics or the General Board could not understand the issue. Even had the aircraft been purchased, there was no agreed-upon means of transporting them to a newly conquered island, nor were there enough auxiliaries to supply them once they were shipped to the frontlines. Finally, there was no consensus on just what type of aircraft the Marines should have, whether carrier-launched models, amphibians, or Army designs. There were real advantages and disadvantages to each. Had there in fact been no shortage of money for airplanes, the issue would not have been placed before the General Board. The monies appropriated to build, equip and maintain the "treaty" fleet fell short of the amount necessary to prepare all parts of that fleet to carry out Plan Orange.

The Navy was caught in a double bind. So long as treaty tonnage limitations were in force, the bureaus responsible for design and construction were forced into frustrating compromises. One sees this clearly in the hearings before the General Board. As one member put it during some long and exasperating hearings covering battleship design in 1936, "We are reaching out and grasping for too many remote contingencies in this design. We have got to dismiss some of these remote contingencies."[30] In other words, a compromise had to be reached, whether entirely satisfactory (from a military point of view) or not. And as if that weren't trouble enough, there was only money sufficient for these poor compromises. Heinrichs is wrong to maintain that the balanced "treaty" Navy was a budgetary stratagem. It made sense for the Navy Department to request money and vessels to bring the fleet to "treaty" strength, but a fleet at that strength was quite unable to fulfill Plan Orange. There was also the chance that exercises with such a fleet would *not* reveal the proper form and composition of the mobilization fleet. Such dilemmas were the norm;

they were resolved through extensive analysis of experience.

The Case for Decentralization. We shall now show that the Heinrichs paper rests on an incorrect premise: decentralized administrations (like that of the Navy in the 1930s) are an obstacle to effective action and innovation. Heinrichs argued that "No central authority existed to rationalize separate [bureau] technical competencies or enforce priorities. Each bureau in effect had a veto on change."[31] The evidence does not support this position. The General Board was the Navy's central authority during the 1930s; though in statutory terms its authority was only advisory, its influence made it a "court of last resort" when there arose serious disputes among the bureaus, or between the office of the Chief of Naval Operations and a bureau. The bureaus were not centrally directed, but they were compelled to seek the arbitration of the Board at regular intervals. Ship design, for example, was a continuing activity; when specific vessels were not being designed, possible vessels were, and there was almost always contention among the bureaus (Construction and Repair, Ordnance, and Engineering) primarily responsible for construction over the proper balance to be struck among the various desirable characteristics (speed, range, firepower, protection, etc.). The divisions of the office of the Chief of Naval Operations (CNO) were often drawn into these debates, especially the divisions of Fleet Training and War Plans. Under this system, no bureau had an absolute veto on policy. The periodic confrontations before the General Board encouraged the bureaus to experiment and to innovate. Indeed, when a military bureaucracy is faced with difficult compromises and strategic dilemmas, decentralized management and organized conflict among administrative units may be more productive than central direction and discipline.[32]

In the case of aircraft carriers, there was disagreement over their proper purpose and future potential even within the Bureau of Aeronautics. In 1931 the chief of the Bureau argued that:

> ...the primary function of the main body of carriers is certainly to increase the major attack power of the fleet.... The use of heavy attack planes from carriers is comparatively undeveloped and the results of endeavors in this direction should be such as will warrant placing fleet carriers in exactly the same category as battleships for improving the striking power of the battle line.[33]

This forecast was challenged on several grounds. First, the vulnerability of carriers to attack had been demonstrated in fleet maneuvers. Even the very airminded captain of *Ranger* was arguing in 1939 that the Navy should have put its money into smaller carriers with armored decks.[34] Second, carrier aircraft had great difficulty operating at night or in poor weather, and surface ships (especially battleships) did not.[35] Third, exercises had indicated that carrier airplanes might be expended early in any major surface action, so that surface ships might, by simply holding on long enough, determine the outcome of an engagement.[36] Fourth, operations had suggested that attacks by torpedo and dive bombers on surface ships were successful to the degree that they were coordinated, but it was an open question whether that coordination would survive under adverse weather conditions or under the stress of wartime emergencies.[37] These challenges were not raised by "battleship admirals" intentionally blind to the potential of carrier aviation but in the course of realistic exercises.

Yet, the test of operations had to be met. As airplanes got better, and the handling and coordination of them more sophisticated, the promise of carriet aviation became performance. By 1938, for example, the Director of War Plans was arguing in a memo to the CNO that any Pacific war would be won by that navy that could establish and then exercise command of the sea, even if the opposing navies never met in a one-shot fleet engagement. His point was that the power and flexibility of carrier aircraft made possible victory against Japan even if the Japanese Navy were not first destroyed. The Orange Plan was based on the assumption that an American move into the Western Pacific would eventually be challenged by Japan's battleline. By 1938 a new kind of war seemed possible, one in which opposing fleets avoided direct conflict and struck at one another's supply lines and bases, using mobile task forces carrying long-range planes. This analysis was not unwarranted speculation, but was a reasonable estimate based upon maneuvers and the expected future of aircraft development.[38]

When carrier aircraft proved to be decisive in 1942, the first optimal carrier design in the Navy was already being built and the bases and training routines so essential to the preparation of qualified pilots already existed. Proponents of a balanced fleet did have doubts about the potential of carriers, but their concerns did not stem from a selfish desire to retain a fleet organization that reserved flag commands for surface-ship officers only. There was just not enough evidence that aircraft carriers had become the dominant ship type. The Navy's continuing commitment to the battleline concept, though subsequently shown to be mistaken, appeared sensible when battleship designs were prepared in the middle and late thirties. Indeed, the uncertainty over the future of tactical naval warfare led logically to a balanced fleet. If one portion of the "balanced" mix proved ineffective, then the nucleus of the effective forces would at least exist, so it made sense to build up simultaneously surface ship strength, submarines, carriers, seaplanes and their bases and training establishments. That is, such redundancy was a rational, *if expensive*, response to the uncertainty resulting from rapid change.[39]

Bureau autonomy did have negative consequences for the Department. One prominent example was the inability of the Bureau of Ordnance to develop an effective middle-range antiaircraft gun. Ordnance did design the 5-inch, 38-caliber gun, which proved effective at longer ranges, but it was a barrage weapon. Any aircraft that penetrated its curtain of exploding shells would face no challenge until brought under fire by .50-caliber machineguns. Something was needed to bridge the gap between the barrage weapon and the machine-gun. Ordnance designed and tested a 1.1-inch machine cannon, but the weapon was not reliable, nor was a companion director produced for it. Ordnance failed to produce a better weapon because its staff did not keep up on improvements in aircraft performance, especially improved dive bomber speeds.[40] Ordnance first used a radio-controlled drone aircraft to simulate dive bombing attacks in *1939*, and the results were devastating. The existing barrage weapons (the 5-inch, 25 and 38-caliber guns) were unable to protect the ships upon which they were mounted.[41] The tests prompted research and development that did produce effective weapons (though the 40mm and 20mm guns used by the Navy during World War II were, respectively, Swedish and Swiss designs) and directors for them, but that cannot excuse the failure of Ordnance to do better in the 1930s.

Autonomy also worked the other way, however. In aircraft design, the Bureau of Aeronautics faced the challenge of land-based aircraft all

through the decade.[42] The speed, power and range of Army pursuit and bomber aircrafr grew steadily, especially in the early thirties.[43] By 1936, when the Army tested its first squadron of B-17s, a land-based bomber could avoid the antiair-crafr fire of surface ships and ourfly most carrier aircraft.[44] Land-based aircraft did not have to meet the standards imposed on carrier aircraft. The latter had to work from very shorr runways; they had to be rugged and reliable enough to take the shock of landing on a rolling and pitching deck; later models had to have folding wings so that carriers could store enough of them. Such planes were, *all through the thirties,* inferior to rheir land-based counterparts. However, Aeronautics continued development and testing, and by 1941 effective carrier-launched aircraft, such as the TBF-1 and F4U-1, were in production or being designed.

Heinrichs failed to consider enough examples such as these in evaluating the performance of the Navy's organizational structure. Take, for example, his characterization of the General Board:

> The General Board had a limited scope of activity and operated under the predominant influence of senior officers on the verge of retirement who were out of touch with new weapons and tactics.[45]

The Board's scope of activity *was* limited, though not so much as to render its opinions ineffectual, but its members were not a band of crusty traditionalists. One of them went so far as to argue, *in 1935,* that the next war in the Pacific would not be decided by a confrontation of battleships but by the battles between carrier air forces, with carriers escorted by fast battleships.[46] Such certainly cannot be rermed a "conservative" position, nor were such views always the *minority* position. In 1931 the Bureau of Ordnance, in commenting upon the designs that were to become the carriers *Enterprise* and *Yorktown,* advocated that the vessels be furnished a large battery of six-inch, dual-purpose guns, despite the fact that such weapons had not yet been built. Ordnance, aware that the number of carriers was limited by treary, wanted to give rhe new models rhe maximum prorection possible. The Bureau of Aeronaurics opposed the idea because the weighr taken up by a bartery of such guns would reduce weight available for aircraft accommodations and limit roo much the speed and endurance of CV-5 and 6. The Board, afrer hearings and srudy, sided with Aeronautics.[47]

It is not claimed that the decisions of the Board were always correct. It is true, however, that the Board played an analytic, or managerial, role rhat was and is essenrial to proper (i.e., openminded and innovative) administration. Hearings held by the Board allowed the bureaus to argue their often disparate cases, giving staff and line officers a chance to release their frustrations and give vent to their concerns. Heinrichs argues that this is the weakness of peacetime naval administration: its focus on conciliation and compromise. We believe that compromise is inevitable in the design of weapons and weapons systems, and that those compromises thar are agreed to will work when there exists a coordinating body of great prestige like the General Board. The members of the Board were line officers, but most of their working contacts were with the staff corps, thus blending the two perspectives in the making of Department policy. The wide scope of the issues considered by the Board kept its members from cultivating only narrow interests; the fact rhat the Board's membership was drawn from the ranks of line officers, plus the fact that high ranking line officers had usually held both line and staff positions during their careers, made less likely the informal collusion of members and nonmembers that might have discredited the Board's authority. The

Board not only compelled innovation by forcing high operational standards on ship designs prepared by the bureaus, it also saved the bureaus the time and energy they might orherwise have spent building coalitions to support their favorite projects. Innovation requires energy, money and a means of testing new ideas that provides evidence to show what works and what doesn't. The Board could and did force innovation; it also passed judgment on those innovations that were produced. At the same time, however, it respected the technical competence of the bureaus by assuming they could handle the problems assigned them.[48]

If there was anything wrong with the General Board, it was that its deliberations lacked sufficient scope. Design, engineering and personnel issues were not beyond its purview, but only rarely did the Board confront the issue of the proper Pacific strategy. Japan had been seen as a potential enemy for 35 years; the issue for the Board was how best to design ships for the fleet that would defear Japan, not how or whether the Japanese should be fought. War Plans, committed to the Orange Plan through most of the thirties, was part of the CNO's office, and so neither under the control of the General Board nor suhject to rhe same kind of influence that the Board could exert over the bureaus. When warships were designed, there had to be compromise; tonnage limitations pressed against military technology to insure that. When personnel policies were set, there had to be compromise; a shortage of money running smack against a need for additional qualified people insured that. Where the compromise was easy, where indeed there was no need for real compromise because there was no organized dispute, was in the field of strategy. Conflicts over designs and spending (and even promotions) were inevitable because the bureaus could be counted on to press their different needs and perspectives. No such conflicts arose over strategic plans. An assertive Navy Secretary might have carried a debate with War Plans before the General Board and then to the President, but Claude Swanson was not an assertive cabinet officer, and his successor, Charles Edison, was apparently not very sophisticated.[49] When issues came before the General Board, they received careful scrutiny. However, many "issues" not raised before or by the Board are only that in hindsight. At that time, for example, the office of the CNO accepted the Orange Plan; we believe that no realistic alternative to that plan was developed until war threatened because there was no *institutional* conflict, within the Navy, over the basics of the plan itself. That is, alternate plans did not have institutional proponents.

Conclusion. Organizational research on milirary research and development indicates that programs are more effective when (1) parallel development efforts are initiated in a deliberare attempr ro keep the programs flexible in the early stages of development (to take advantage of what is learned), (2) systems and subsystems are not initially stated in final form, and (3) an effort is made to keep subsystems nonspecialized, so thar they can be compatible with a wide range of alternatives.[50] Case studies of industry development of new technology (e.g., Bell Laboratory's development of the microwave relay system between 1952-58) suggest the same points.[51]

Although the specifics of each case are different, there is an interesting parallel between the problems of the interwar Navy and the development of the Fleet Ballistic Missile System (FBM) in the 1950s. In the 1930s, Navy officers recognized that there could be no one best way to conduct a strategic war at sea against Japan. Several *possible* ways had

to be pursued simultaneously, even though money and personnel shortages made that task difficult and risky. A loose, flexible managerial style made it possible for the Navy to deal with these difficulties. A similar managerial style in the FBM program made it possible to surmount analogous difficulties in the 1950s. For example, it was not at all clear in 1955 that a sea-launched ballistic missile would be strategically useful or necessary, nor was the technology at hand to make such a planned system operational. To clear up some of these difficulties, the Special Projects Office, created to develop the FBM, employed competing organizations to "generate design alternatives in each subsystem and in the FBM as a whole."[52]

These competing organizations were not managed according to the conventional wisdom regarding hierarchy and control. The management style of the Special Projects Office was loose, flexible and opportunistic. Sapolsky has noted that, "based on the Polaris experience, disciplined hierarchy seems capable of suppressing precisely the information needed to cope with [technological and political] uncertainty."[53] What counted was that the FBM, as developed, was effective. The missile worked, was deployed ahead of schedule, there was no hint of a cost overrun, and the ballistic missile-carrying submarines were completed rapidly. It should also be noted that there is evidence supporting these conclusions from other fields, such as development administration.[54]

Strict adherence to initial plans and objectives courts failure.[55] The reason given for this conclusion is substantially what we have argued in reconstructing the Navy's interwar history: the final form of a successful project or program is based on knowledge not at hand in the initial stages.[56] Furthermore, a flexible, opportunistic style simulates the growth of knowledge as development proceeds, telling the administrators about other parts of the project and how these parts may be related. Thus, what may seem like conservative and crude ways to plan and organize for the uncertainties of war actually are good reasons for success.

NOTES

1. And these decisions reflected a "satisficing strategy." Herbert A. Simon and James G. March, *Organizations* (New York: Wiley, 1958), pp. 140-141; and see Charles E. Lindblom, "Still Muddling, Not Yet Through," *Public Administration Review*, November/December 1979, pp. 517-526.

2. Clifford L. Lord, "The History of Naval Aviation, 1898-1939," Part VI, "Between the Wars," Unpublished Manuscript, Navy Department Library, Naval Historical Center, Washington Navy Yard, n.d., pp. 1197-1202.

3. Enzo Angelucci and Paolo Matricardi, *World War II Airplanes* (New York: Rand McNally, 1978), v. 2, pp. 28-29.

4. James O. Richardson, *On the Treadmill to Pearl Harbor: The Memoirs of Admiral James O. Richardson, USN*, as told to George C. Dyer (Washington: Naval History Division, 1973), p. 372.

5. "Characteristics of Capital Ships," Hearings before the General Board of the Navy, 1936 (hereafter cited as *Hearings*), 30 October 1936, p. 134, in Navy Classified Operational Archives (NCOA).

6. The new battleships would not steam at the carrier speed of 33 knots because an adequately armed and armored ship of 35,000 tons displacement would not have enough power to steam more than 27 or 28 knots. But a 27-knot ship could accompany carriers. See "Capital Ships," *Hearings*, 22 October 1935, pp. 204-205, NCOA.

7. "Design of Future Aircraft Carriers," Annex A, 7 October 1931, Serial No. 1533 in General Board File 420-5, p. 4. This was a memorandum to the Secretary of the Navy from the members of the Board. This, and related documents, were made available to the authors by the Head of the Operational Archives, Dr. Dean Allard and his staff. The Archives themselves are located in Building 210 of the Washington Navy Yard.

8. "Design of Future Aircraft Carrier," memo from the Chief of the Bureau of Aeronautics to the General Board, 12 November 1931, in General Board File 420-5, p. 2, NCOA.

9. *Ibid.*, p. 1.

10. "Aircraft Carriers-Speed of," from Commander, Aircraft Battle Force, to the Chief of Naval Operations, General Board File 420-7. Also, "Aircraft Carrier Characteristics," memo from the Board to the Chief of Naval Operations and the bureau chiefs, 30 June 1939, General Board File 420-5, Serial No. 1861, p. 2. See also, "U.S.S. Ranger (CV-4), Proposed Modification in Design Affecting Military Characteristics," General Board File 420-5, Serial No. 1591, 30 November 1932. All three documents in NCOA.

11. "Design of Future Aircraft Carriers," pp. 6-7.

12. "Aircraft Carrier Characteristics"; also "Enclosure A" in the same memo. In "New Carrier Characteristics," memo of 5 November 1938 from the Director, War Plans Division, to the CNO, it was made clear that it was finally possible, "*first* to consider what needs or functions new carriers must provide, *next* decide the necessary characteristics to accomplish these functions, *and then* determine the size which will best and most economically embody those characteristics." In General Board File 420-7, NCOA, para. 5. See also Norman Friedman, *Ship's Data* 7 (Annapolis: Leeward Publications, 1977).

13. "Facilities for Enlarged Aviation Program" *Hearings*, 1934, v. I, p. 108. According to the chief of the Bureau of Aeronautics, "Patrol planes are powerful striking force[s]; they are not limited in number by Treaty as are carrier planes," NCOA.

14. Richard K. Smith, *The Airships Akron and Macon, Flying Aircraft Carriers of the United States Navy* (Annapolis: U.S. Naval Institute, 1965).

15. "Lighter-Than-Air Ship Policy," *Hearings*, 1 February 1937, NCOA.

16. See the various *Annual Reports* of the Secretaries of the Navy. A common observation, from one year to the next, was that though the quality of enlistees was extremely high, there were just not enough of them.

17. Thomas C. Hone, "The Effectiveness of the 'Washington Treaty' Navy," *Naval War College Review*, November-December 1979, pp. 35-59.

18. See Norman Friedman, *Battleship Design and Development, 1905-1945* (Greenwich, England: Conway Maritime Press, 1978), especially chap. 2.

19. Wildavsky makes a similar argument with respect to budget outlays. See "Implementation in Context," in Jeffrey Pressman and Aaron Wildavsky, *Implementation*, 2nd ed. (Berkeley: University of California Press, 1979), pp. 167-168.

20. The arguments surfaced in General Board *Hearings*. For carriers, see "Aircraft Building Program-1939," 4 October 1937, p. 271ff. The arguments over battleship, cruiser and destroyer design were carried before the Board on a number of occasions; examples are "Capital Ship," 22 October 1935, p. 203ff, "Proposed Military Characteristics of Destroyers," 1 March 1935, p. 70ff, and "U.S.S. Wichita-Change in Secondary Battery," 4 May 1936, p. 69ff. Submarines were the source of less controversy, but see "Characteristics of Submarines," 6 March 1936, p. 8ff. All in NCOA.

21. The Board, in responding to the President's request for faster ship design and construction, had noted that "The Board in formulating characteristics for new ships considers service opinion, experiences with previous designs, new matters and improvements which appear worthy of inclusion and what is known of foreign designs." Hence it was "wrong" to duplicate even proven designs unless experience showed such was wise. General Board File 420-2, Serial No. 1744, "Expediting Naval Shipbuilding," 18 February 1937, para. 2, NCOA.

22. "Aircraft Carrier Characteristics," p. 2.

23. Waldo H. Heinrichs, Jr., "The Role of the United States Navy" in Dorothy Berg and Shumpei Okamoto, eds., *Pearl Harbor as History* (New York: Columbia University Press, 1973), p. 206.

24. On dive bombing, see Charles M. Melhorn, *Two-Block Fox, The Rise of the Aircraft Carrier, 1911-1929* (Annapolis: Naval Institute Press, 1974). On the deficiencies of larger bombers in the early thirties, see "Facilities for Enlarged Aviation Program," 10 August 1934, *Hearings*, v. I, 1934, p. 112, in NCOA.

25. "Facilities for Enlarged Aviation Program," p. 112.

26. "Aircraft Building Program-1939," p. 272.

27. Making destroyers effective against aircraft, submarines *and* surface ships placed pressure on tonnage limitations and increased complements. See "Proposed Military Characteristics of Destroyers," p. 70ff.

28. "Underwater Sound Echo-Ranging Installations," 16 September 1938, *Hearings*, p. 98ff, in NCOA.

29. "Procurement of Airplanes for Fleet Marine Force," 22 September 1938, *Hearings*, p. 175, in NCOA.

30. "Characteristics of Capital Ships," 30 October 1936, *Hearings*, p. 75, in NCOA.

31. Heinrichs, p. 200.

32. Charles E. Lindblom, "Some Limitations on Rationality: A Comment," in Carl J. Friedrich, ed., *Rational Decision* (New York: Atherton Press, 1964); Martin Landau, "Linkage, Coding, and

Intermediacy: A Strategy for Institution Building," *Journal of Comparative Administration*, February 1971, pp. 401-429; Martin Landau and Russell Stout, Jr., "To Manage is not to Control: Or the Folly of Type II Errors," *Public Administration Review*, March/April 1979, pp. 148-156.

33. "Design of Future Aircraft Carriers."

34. "Suggested Design for New Carriers," 1 March 1939, from Capt. John S. McCain to R. Adm. E.J. King, Commander, Aircraft, Battle Force, General Board File 420-5, Serial No. 1861, in NCOA.

35. See Robert A. Winston, *Dive Bomber* (New York: Holiday House, 1939).

36. Lord, pt. IV, p. 1214.

37. *Ibid.*, pp. 1398-1404.

38. "New Carrier Characteristics."

39. Not only is this duplication and overlap a rational response to the uncertainties encountered, but the redundancy adds reliability to the fleet. See Martin Landau, "Redundancy, Rationality, and the Problem of Duplication and Overlap," *Public Administration Review*, July/August 1969, pp. 346-358; Landau, "Linkage, Coding, and Intermediacy: A Strategy for Institution Building," pp. 401-429; and see John Von Neumann, "Probabilistic Logics and the Synthesis of Reliable Organisms from Unreliable Components," in C.E. Shannon and J. McCarthy, eds., *Automata Studies* (Princeton: Princeton University Press, 1956); Herbert A. Simon, "The Organization of Complex Systems," in Howard H. Pattee, ed., *Hierarchy Theory: The Challenge of Complex Systems* (New York: George Braziller, 1973).

40. See Buford Rowland and William Boyd, *History of the Bureau of Ordnance in World War II* (Washington: U.S. Govt. Print. Off., 1953).

41. "Radio Controlled Target Airplanes-Exercises with during current quarter, advance partial report," General Board File 436, Serial No. 3908, 12 February 1939, in NCOA.

42. Lord, pt. IV, chap. 3.

43. See F.G. Swanborough and P.M. Bnwers, *United States Military Aircraft Since 1909* (London: Putnam, 1963).

44. Thomas Collison, *Flying Fortress* (New York: Scribner, 1943), chap. 4.

45. Heinrichs, p. 200.

46. "Fast Capital Ship," 29 October 1935, *Hearings*, 1935, p. 237, NCOA.

47. Memo to the Secretary of the Navy from the General Board, 10 December 1931, with "Design of Future Aircraft Carrier," 12 November 1931, General Board File 420-5, NCOA.

48. Hyman G. Rickover, "The Role of Engineering in the Navy," Speech before the National Society of Former Special Agents of the FBI, Seattle, Wash., 30 August 1974.

49. At least Admiral Richardson didn't regard Navy Secretary Charles Edison as very sophisticated. See his *On the Treadmill to Pearl Harbor*, p. 371.

50. Burton Klein and William Meckling, "Application of Operations Research to Development Decisions," *Operations Research*, May/June 1958, pp. 352-363; Burton Klein, *The Decision-Making Problem in Development* (Santa Monica: The Rand Corporation, 1960), p. 1916; Richard R. Nelson, "Uncertainty, Learning, and the Economics nf Parallel Research and Development Efforts," *Review of Economics and Statistics*, November 1961, pp. 351-364; Robert L. Perry, "The Atlas, Thor, Titan, and Minuteman," in Eugene M. Emme, ed., *The History of Rocket Technology* (Detroit: Wayne State University Press, 1964); Landau, "Redundancy, Rationality, and the Problem of Duplication and Overlap," pp. 346-358.

51. Thomas A. Marschak, "Strategy and Organization in a System Development Project," *The Rate and Direction of Inventive Activity: Economic and Social Factors* (Princeton: Princeton University Press, 1962).

52. Harvey M. Sapolsky, *The Polaris System Development: Bureaucratic and Programmatic Success in Government* (Cambridge: Harvard University Press, 1972), p. 90.

53. *Ibid.*, p. 204; see Harold Brown, "Management of Defense Research and Development," in Fremont E. Kast and James E. Rosenzweig, eds., *Science, Technology, and Management* (New York: McGraw-Hill, 1963); David C. Murphy, et al., *Determinants of Project Success* (Washington, NASA, 1974).

54. This research suggests that open and flexible strategies are more effective than centralized control in dealing with the problems and uncertainty of rural development programs. See David K. Leonard, *Reaching the Peasant Farmer* (Chicago: University of Chicago Press, 1977), p. 210; Landau, "Linkage, Coding, and Intermediacy: A Strategy for Institution Building," pp. 401-429.

55. Landau and Stout, "To Manage is not to Control: Or the Folly of Type II Errors," pp. 148-156; Russell Stout, Jr., *Management or Control?* (Bloomington: Indiana University Press, 1980).

56. Albert O. Hirschman and Charles E. Lindblom, "Economic Development, Research and Development, Policy Making: Some Converging Views," *Behavioral Science*, April 1962, pp. 211-222.