'The views expressed are those of the author and do not reflect the official policy or position of the US Air Force, Department of Defense or the US Government.'"

USAFA Harmon Memorial Lecture #16
"An Enduring Challenge: The Problem of Air Force Doctrine "
I. B. Holley, Jr., 1973

One sunny morning in January 1924, an Air Service lieutenant by the name of Odas Moon was flying southeast along the Caribbean shoreline from Costa Rica with a cargo of mail for the Army units stationed in the Panama Canal Zone. As he dropped below a cloud formation above the Chiriqui Lagoon, he was amazed to observe below him an armada of naval vessels- 4 battleships, 3 submarines, 21 destroyers, a carrier; and a host of smaller craft, more than he could count. Quite by accident Lieutenant Moon had stumbled upon the Navy's "black" or invasion fleet assembled in secret 125 rniles west of Colon for a sudden descent upon the Army forces defending the Canal Zone as one feature of the annual winter maneuvers.

Here was a target too tempting to overlook. Moreover, by coincidence the lieutenant had available some appropriate ammunition, a case of luscious, ripe, red tomatoes which he was carrying back to Panama for his wife. As a resourceful officer he selected a target without hesitation and closed in a diving attack, scoring three direct hits with his tomato-bombs on the makeshift carrier Langley,[1]

When word of Lieutenant Moon's exploit reached the Canal Zone, he was the toast of the command. But on sober second thought his superiors decided they were not very pleased after all. One of the undeclared purposes of the maneuver was to demonstrate that the Army desperately needed a 10 million dollar appropriation to mount l0 inch coastal defense batteries without which the Canal's defenders were hopelessly outgunned by the assault force. Now, however, after Lieutenant Moon's tomato-bombing there was no little danger that Congress might get the idea that coastal defense guns were no longer needed. Whereupon the umpires gravely announced that the maneuvers would be delayed for one day while the exposed "black" fleet was permitted to slip out and take up a new secret position just as if the airplane had never been invented.

End of story. Doesn't Odas Moon sound like a romantic character from the seat-of-the-pants, wind-in-the-wires era of open cockpit flying? I'm sure you'd enjoy hearing me tell you many more stories about Odas Moon and his contemporaries. But what good would it do you? Instead, I'm going to ask you to follow me down a more serious line of thought. It may not be so much fun but far more valuable. I'm working on the assumption that one of you out there is going to be Chief of Staff in the not too distant future, and I hope I have an important message for you.

Let's go back to Odas Moon. What happened? The Navy was incensed, and there were some ruffled feathers. But more importantly, what did not happen? Why was there no analysis of this experience for its long range implications, no exploratory recasting of doctrine in view of the potential role of aircraft in coastal defense? Why was there no careful assessment of a possible reordering of priorities and a reallocation of appropriations between the Air Service and the Coast Artillery, especially since Billy Mitchell's famous bombing tests beginning in 1921 had already suggested the necessity for such a recasting?

The reason for this failure seems clear. In its primitive state of organization, the Air Service lacked an appropriate agency uniquely devoted to the development of doctrine and its implementation or defense within the War Department.

If we are going to discuss doctrine, it will be useful if we start out with an understanding of what doctrine is and why it is so important. The Joint Chiefs currently define doctrine as "Fundamental principles by which the military forces . . guide their actions. . . . It is authoritative but requires judgment in application."[3]

An earlier definition from the Joint Chiefs expressed the same thought but with a somewhat different emphasis: "Doctrine is a compilation of principles . . . developed through experience or by theory, that represent the best available thought." Such doctrines while serving as guides "do not bind in practice."[4] In short, doctrine is what is officially approved to be taught. But it is far more than just that. Doctrine is the point of departure for virtually every activity in the air arm.

Basic doctrine defines the roles and missions of the service, the scope and potential capabilities of its weapon systems. Doctrine lies behind the decisions as to what weapons will be developed and gives guidance as to the relative importance of several competing roles or weapon systems when the time arrives to apportion the invariably inadequate supply of dollars. Doctrine provides the rationale for favoring one weapon system over another. If current doctrine officially placed a higher priority on close support of the ground forces than it granted strategic bombardment, as was the case in the early nineteen twenties, then it follows almost inexorably that the close support mission will be more generously funded; more effort will be invested in developing the weapon systems devoted to close support along with a major share of training facilities, allocations of available manpower and so on. Doctrine is like a compass bearing; it gives us the general direction of our course. We may deviate from that course on occasion, but the heading provides a common purpose to all who travel along the way. This puts a grave burden on those who formulate doctrine, for a small error, even a minute deviation, in our compass bearing upon setting out, may place us many miles from the target at the end of our flight. If those who distill doctrine from experience or devise it by logical inference in the abstract fail to exercise the utmost rigor in their thinking, the whole service suffers. As the old Scot preacher put it, "A mist in the pulpit is a fog in the pews."

Now that we have the notion of doctrine clearly in mind, we can go back to Odas Moon and the Air Service of the nineteen twenties. Undermanned, ill-equipped, and beset with a confusion of voices as to which way to turn, the Service was in serious disarray. Fortunately, however, the Air Corps Act passed by Congress in 1926 marked a significant turning point, establishing, as it did, a clearer charter, better opportunities for advancement, and a mandate for more equipment. But insofar as doctrine is concerned, the critical turning point came sometime between 1926 and 1931 when the Air Corps Tactical School was transferred to Maxwell Field in Montgomery, Alabama.[5] The move from Langley Field in Virginia, where the school had operated ever since 1922, was more than just a physical relocation.[6] What emerged at Maxwell was an improved and highly creative institution. There, in the decade from 1931 to 1941 a small but able and dedicated faculty, in conjunction with a succession of some enthusiastic, if atypical, students, hammered out the doctrinal guidelines for the modern Air Force.

If Billy Mitchell is to be regarded as the revolutionary firebrand in the cause of air power, then it would seem appropriate to identify the generation of officers at the Air Corps Tac School in the thirties as the Founding Fathers who carried out the far more difficult task of writing a suitable constitution for strategic air power. For it was they who took Billy Mitchell's ill-defined and decidedly imperfect conception of bombardment and fleshed it out in detail as basic doctrine. For this we venerate them today.[7]

In many ways the work of the Tac School officers in the thirties represents a remarkable achievement. They had but a slender base of experience in bombardment aviation during World War I; they had to rely upon a sustained effort of creative imagination to lay out what later became the basic doctrines shaping the air arm which fought World War II. Not only did they devise the strategic and tactical means to apply air power; in addition it was their imagination and vision which ultimately lay behind the specifications of such great airplanes as the B-17 Flying Fortress. But, while recognizing the great achievements of the Founding Fathers at the Tac School, we must also look at the other side of the coin. With the advantage of historical hindsight, we can now see that there were some fundamental flaws in the unofficial doctrinal notions developed at Maxwell. When subjected to the brutal test of war these defects in conceptualization promptly surfaced.

In retrospect it is clear that a pivotal misconception of the Tac School thinkers stemmed from their erroneous assumption that high speed strategic bombers would generally elude interception by enemy fighters.[8] From this mistaken premise followed a train of serious miscalculations. If the superior speed of the bomber was such as to make interception improbable, or at worst, infrequent, then no provision need be made for escort fighters to accompany the bombers on their long range mission. The near fatal consequences of this faulty doctrinal inference are too well known to require further elaboration here. Suffice it to say, since no long range escorts were deemed necessary, there was no pressure to develop this kind of hardware.

A second erroneous inference held that if interception would be encountered infrequently, if at all, then it followed that heavy bombers could be relatively lightly armed. As a former aerial gunner I find the implications of this particular misconception not only peculiarly fascinating but highly illuminating.

To illustrate the problem we need only go back and look at the defensive armament of the original XB-17. The type specifications for heavy bombers drawn up in 1935 by the Air Corps called for a minimum of three caliber .30 machineguns. Boeing proposed to increase this to five, but Air Corps officials resisted, pointing out that there were not enough crew members free to man five guns continuously. Boeing went ahead anyway and brought in the X-model with five guns, one in the nose, one in a roof hatch, one on each side and one in a floor hatch. All of these guns were limited to relatively restricted fields of fire which left large areas of approach unprotected.[9] The B-17 certainly wasn't any "Flying Fortress" then! Because the Air Corps thinkers put their faith in high speed, serious restrictions on the all-around coverage by fields of fire were probably unavoidable. The only way to improve the scope of defensive fire was to add blisters or turrets. And protuberances such as these cut down on the speed which was expected to outrun interception. Because high speed was weighted more heavily than defensive armament in design competitions, aircraft manufacturers had a powerful incentive to minimize armament when preparing their bids. Even if bombers were faster than interceptors, this still left open the possibility of a frontal approach from head on. To test this possibility, a trial was arranged with a Curtiss P-36 flying at just over 300 mph on a collision course with a Martin B-10 bomber flying at just over 200 mph. The participants must have been fainthearted; at any rate, they concluded that nose attacks were not feasible.[10] The approaching fighter pilot reported that he barely had time to pull away after identifying the on-coming bomber. As a consequence the Tac School doctrine on bomber defense was allowed to stand unshaken. The vigor with which Luftwaffe pilots subsequently pressed nose attacks on 8th Air Force formations over Festung Europa provides all the commentary that is necessary for this particular bit of doctrinal myopia.

More curious still is the disparity between what the doctrine said and the bombers built in the light of that doctrine. It was officially estimated that 80 percent of all attacks by enemy fighters would fall within a 45 degree cone extending from the bomber tail. But it was precisely this region behind the tail which was left unprotected. Need I remind you that the original B-17, like its predecessors, had no tail gun? The official rationale for the absence of a tail gun was that considerations of weight and balance made it impractical to install a weapon behind the tail assembly. It was even suggested that the high accelerations which would be experienced by a gunner stationed there further reinforced the decision not to install tail guns. This conclusion is all the more curious because at the very time the Air Corps reached it, the British were developing the prototype Vickers Wellington bomber, a weapon system with all the grace and beauty of a freight car, mounting power-operated four-gun turrets at both nose and tail.[11] Under the circumstances it is difficult not to suspect that a substantial element of wishful thinking may have entered into the calculations of the Tac School authors of bomber doctrine during the between-war years. The outbreak of war in Europe, however, spelled an abrupt end to self-delusion. Just how far the doctrine of bomber defense had to be modified is evident in the B-17E which appeared in September 1941. It fairly bristled with armament: upper turret, lower turret, a twin-gun tail position, plus two handheld flexible guns, one on either side in the waist, two more flexible

guns in the nose, and one in the roof hatch. What is more, these were not peashooter caliber .30s but 50s with significantly greater killing power. The B-17G added a chin turret, bringing the total to 13 guns in all, eight of which could be fired forward.[12] Yet even all these guns proved to be inadequate without long range escorts when the assault on Hitler's Europe was undertaken in earnest. At this point it might appear that my intent is to play the iconoclast, debunking the Founding Fathers at the Air Corps Tac School and the doctrines they devised. Let me remind you that the role of the historian is neither to praise nor to blame- only to understand. In all humility we may ask: would we, you and I, have done any better had we stood in their shoes back in the nineteen thirties at Maxwell? Would we have done as well? Even with the advantage of looking back after the event, can we be sure what went wrong? Historians are not blessed with 20/20 hindsight; all too often they see in the past only what they set out to find. The most difficult task confronting the historian is to be sure he is asking the right questions. With this in mind, let us put aside the Founding Fathers and the Tac School for the moment and turn now to the Air Force of today. By contrasting the present with the nineteen thirties we may be able to develop some insights on the whole problem of how doctrine is devised.

Responsibility for the formulation of doctrine in the Air Force today rests in a special Air Staff Directorate for Doctrine, Concepts and Objectives located under the Deputy Chief of Staff for Plans and Operations. In contrast to the all but non-existent organization for doctrine in the Air Service in the nineteen twenties, and the part-time employment of faculty members at the Air Corps Tac School in the nineteen thirties, the present day arrangement provides an agency exclusively devoted to doctrinal matters. It defines the objectives and concepts of the Air Force; defends them when subjected to criticism and attack; and monitors their implementation throughout the service. More than 50 officers, aided by an additional supporting staff, devote their full energies to this important business.[13] How different the problems are now from what they were back in the Tac School days at Maxwell. Then they started from a virtually clean slate. The Air Corps inventory of a few hundred first line operational aircraft was too small to constitute a hostage to any particular conceptual interpretation. With few aircraft available and operating funds scarce, the range of experience it was possible to acquire remained sharply limited. Doctrine then was derived largely by attempting the soundest possible theoretical extrapolations from the narrow base of experience available, most of it from World War I.[14] Now, today, the situation is totally different. The Air Force inventory of aircraft numbers in the thousands, and each functional type of aircraft has its dedicated advocates, ready and articulate. As a consequence, the promulgation of doctrine today is no longer a matter of comparing the merits of rival abstractions or theoretical formulations. Instead it has become a contest between contenders who usually have large quantities of existing hardware and many thousands of expensively trained men as the basis for their claims. While all the major operational commands in the Air Force vie with one another for resources and therefore compete for roles and missions, the major doctrinal battles today are more often found on the inter-service level. Perhaps the easiest way to illustrate how these contests take place is to plunge in with an example of an on-going doctrinal problem. Even if we have time for no more than a glimpse at the process, it should prove informative. The National Security Act of 1947 assigned the Air Force a virtual monopoly on air activity vis-a-vis the Army. The L-series aircraft, puddle-jumpers used for liaison and artillery-fire correction, were but a trivial exception.[15] This was a comfortable posture for the Air Force, snug behind the statutory assurance that there would be no major shift in the scope of its mission without congressional approval. This comfortable arrangement offered a good deal of security- indeed, almost a certainty- of a major share in the available appropriations. And sure enough, after a decade of existence the newly independent Air Force received sums ranging upward to nearly half the total defense outlay.[16] But as the great, late Justice Holmes once put it, "To rest upon a certainty is a slumber which, prolonged, means death."

The air arm monopoly was not to endure; the very scale of its funding gave the other services a powerful incentive to seek congressional support for taking over portions of the Air Force mission. In fact, the Secretary of Defense subsequently gave his blessing to such moves, saying in effect to the

several services, "Whoever can do the job better and cheaper gets the assignment." As a result, the services in recent years have engaged in a series of running battles, semantic contests, in which each attempts to carve out a definition of roles and missions that will enhance or at the very least preserve its existing posture.[17]

Typically, these doctrinal contests have come about when one of the services comes in proposing to assume a mission by using a piece of hardware developed for an entirely different purpose. An example of this kind of ploy at the intra-service level took place in Vietnam when some imaginative and resourceful young officers converted transport aircraft into gunships which proved highly cost-effective truck killers to the consternation of a large number of spokesmen for some expensive aircraft in the Tactical Air Command, the organization to which current Air Force doctrine assigns the interdiction role.[18] If the instinct for self-preservation in holding on to roles and missions is acute even within the Air Force, one can readily understand how much more intense the struggle becomes at the level of inter-service competition.

In the limited time at our disposal one example of inter-service rivalry, albeit an important one, will have to suffice. When the Secretary of Defense during the Eisenhower Administration gave the Air Force responsibility for strategic nuclear weapons, the Army was explicitly limited to the development of tactical nuclear weapons of sharply circumscribed range for battlefield support only. These short range, surface-to-surface nuclear weapons were visualized as providing a protective umbrella over Army units operating in any given battlefield area.[19]

The Air Force could scarcely take exception to this arrangement inasmuch as it was little more than a nuclear application of the covering-fire doctrine which had existed for many years in connection with the use of conventional field artillery. But then, in came the Army with a request to extend the range of its tactical nuclear weapons substantially so as to provide an umbrella which would cover groups of Field Armies maneuvering in conjunction with one another. There was a persuasive logic to this, so the Secretary of Defense approved the request. Appropriately improved hardware was developed, and trained units deployed to the field.

At this juncture, the US Army in Europe came up with a list of formidable targets, military targets of the Warsaw Pact powers, lying beyond the East-West frontier. Since the Army's tactical nuclear weapons were already available, why not assign them to counter the Eastern bloc threat in a persuasively cost-effective manner?

In terms of cost-effectiveness, the Army's proposal was decidedly convincing and received the nod from the Department of Defense. From the point of view of the Air Force and its doctrinal watchdogs, the issue had other ramifications. Here was a classic example of the dangers to be encountered when one lets the camel get his nose under the tent. What had started out as a purely tactical weapon offering a nuclear supplement to conventional artillery doctrine, now seemed to be subtly transformed into a strategic weapon encroaching upon a mission assigned to the Air Force.[20]

This in itself was enough to alarm the guardians of Air Force doctrine, but an even greater threat soon appeared on the horizon when the Army surfaced a proposal to modify the existing tactical nuclear weapon with improved electronic gear to enable its missiles to search for, identify and lock on to rapidly moving targets such as an advancing column of tanks.[21]

Here the contest was clearly joined. If the Air Force were to sit idly by while the Army upgraded the capabilities of its missiles beyond the normal scope of battlefield defense to take on strategic roles and interdiction roles, the very existence of the Tactical Air Forces might be gravely threatened. If more than enough funds were always available, this would not be so. With ample appropriations the Army and the Air Force could both develop their capabilities along complementary and mutually reinforcing lines. But funds are never ample enough to permit redundant and overlapping procurement.

The sunk costs of the initial Army missile at issue here have amounted to more than a billion and a half dollars over the past decade. Even greater costs can reasonably be projected over the next

decade. The guardians of Air Force doctrine must assess the probable impact on their service if this threat is not met. If Congress pours a billion and a half dollars into this Army missile over the next decade, what affect will this have on the funding of components such as the tactical wings assigned to do the same job?

At this point the proponents of Air Force doctrine begin to build the best case they can against the Army missile and in favor of an air arm solution. They observe that the missile launching unit is prodigiously expensive in manpower, requiring nearly three times as many people as a fighter wing. They plunge into a study of all the parameters and variables involved: what is the accuracy of the missile and how does it compare with the performance of tactical aircraft? What is the response time of the missile? How many missiles can be launched in a given period? How does the missile compare with air arm alternatives as to flexibility in use? If it cannot be re-programmed in flight, it suffers a serious shortcoming; score one for the Air Force.

But meanwhile the Army advocates have been doing their best on the other side of the argument. They come down heavily on the all-weather capability of the missile in contrast to the vulnerability of aircraft in this respect. Score one for the Army. And so the issue is fought out, item by item, characteristic by characteristic, costs against benefits.

Surely it is evident to you all that as a historian my function is not to come down on one side or the other. I am not qualified to speak authoritatively on the relative merits of Army missiles and tactical aircraft. Nor is it my intention to do so. Here we are interested only in the process by which air arm doctrine is formulated. And now that we have had occasion to catch a glimpse of that process at three widely separated points along the historical continuum, the nineteen twenties, the nineteen thirties, and today, it is time to stand back and try to determine what it all means. What insights of present significance can we derive from the record of experience in the Air Service, the Air Corps and the Air Force?

The Air Service era we can dismiss rather quickly. There was no organization devoted exclusively to the study of doctrinal questions. And the organizations which did exist, at least down to 1926, were largely dominated by the ground arms.

The Air Corps era affords more substance for thought. While the Tac School faculty was not exclusively devoted to the search for suitable doctrine, the academic setting at Maxwell proved to be almost ideal for the stimulation of creative imagination. One is reminded of Henry Steele Commager's suggestion that most of the truly creative eras in history have revolved around relatively small, intellectually active communities: Athens in the Golden Age, Florence in the Renaissance, the London of Shakespeare and Elizabeth, the Concord of Emerson and Thoreau, and the best of the modern universities

In some measure the Air Corps Tactical School of the nineteen thirties shared in the qualities which characterized these imaginative and highly productive communities- an academic mountain top sufficiently removed from the cares and pressures of day-to-day operations to provide its members, faculty and students alike, the leisure in which to think. But the Air Corps Tactical School, good as it was, suffered as we have seen from a nearfatal defect. Not only did it suffer from the absence of authority to promulgate doctrine officially, but what was perhaps worse, it lacked an adequate, built-in mechanism for rigorous self-criticism. As a consequence, some of its most constructive contributions to the concepts and doctrines of strategic air power were seriously and dangerously flawed.

By contrast, the present-day Directorate of Doctrine, Concepts and Objectives, whatever its limitations, provides a large, full-time staff exclusively devoted to doctrinal matters. Another difference is evident. Because the Air Corps Tac School faculty could start with a virtually clean slate, uninhibited by large existing forces, they could envision whatever force they thought best. Those who draw up doctrine today confront a different situation.

There are tens of thousands of individuals in the Air Force whose training and traditions lead them to identify with one or another of the major commands, with SAC, or TAC, or MAC. And each

of these bespeaks a vested interest. Each such interest must be placated, reconciled, accommodated. These necessities, along with the never-ending confrontations with the other services fighting for roles and missions, keep the present-day guardians of Air Force doctrine eternally on the run. They are so busy putting out fires, few of them find time in which to think at leisure. This is not the criticism of an outside observer but the assessment of the participants themselves.[22]

In short, if the Tac School of the nineteen thirties was perhaps too much of an academic mountain top, it may well be that the Directorate of Doctrine today is too much in the marketplace. Or, as one officer in the organization put it: "Sometimes we feel we are so busy stamping ants we let the elephants come thundering over us.[23] Undoubtedly some sort of arrangement can be worked out with the schools at the Air University to foster the creativity and detachment of the mountain top while at the same time retaining the undeniable stimulation of the marketplace afforded by the daily battles on the Air Staff.

Whatever mix is eventually worked out, surely one feature in which the present-day organization is vastly superior to the old Tac School will be retained. Today's organization, as we have seen, provides precisely that quality which was most lacking at Maxwell in the nineteen thirties- a built-in, assured arrangement for criticism, a mechanism to provide rigorous and objective evaluation.

From the newspaper headlines one can readily get the impression that inter-service rivalry is essentially vicious, endless bickering and backbiting, selfish partisanship operating to the detriment of the public interest. Partisanship there undoubtedly is, and it can be harmful, but should we not recognize that competition amongst the services, no less than competition amongst the several commands within the Air Force, serves a useful purpose, especially in matters doctrinal.

Competition helps to keep us honest by providing a highly motivated mechanism for insuring that every argument put forward will be subjected to the most searching scrutiny by a rival with great interest at stake. The competition provided by inter-service rivalry under the aegis of the Department of Defense today would almost certainly have rectified the defects in bomber doctrine which so jeopardized our initial foray into the strategic offensive during World War II. Air Force Maj Gen. Glenn Kent made the point with refreshing candor not long ago when he suggested that whatever objectivity the services achieve in their presentations stems not so much from the purity of their motives as from simple fear of rebuttal.[24]

Now for a few words in conclusion. In looking back at 50 years of air arm history, from 1924 to 1974, we have tried to make two points: first, that doctrine is crucially important in the Air Force, and second, that we should be as concerned with the process by which doctrine is derived as we are with doctrine itself. For, as Marshall McLuhan might phrase it, the medium has a most disconcerting way of becoming the message!

As to our first point, the official Air Force line holds that doctrine is indeed highly important. There has long been a regulation which requires all Air Force officers to possess and be familiar with AFM 1-l, the manual on basic doctrine. If my own highly fallible, informal survey is to be trusted, however, that regulation appears to be more ignored than obeyed.[25]

As to our second point, concern for the process by which doctrine is devised: surely it is significant that the official Air Force historical bibliography appearing as recently as 1971 does not even carry an index entry for the term doctrine.[26]

Let me send you away with an anecdote, a cautionary tale, on the importance of thinking doctrinal matters all the way through. This comes from a friend in the RAF during World War II. The supply of magnetic mines for planting in the mouth of the Elbe to tie up the port of Hamburg had run dangerously short. Then some sharp operator reasoned that it is not the number of actual kills which makes river mining so effective but the delays imposed on shipping while the mines are being swept Why worry about the shortage of real mines when we can plant dummy mines filled with concrete. Since the enemy won't know until all are retrieved if any or none are dangerous, even dummy mines will tie up the river.

So the RAF planted a number of dummy mines in the Elbe estuary. It worked beautifully. The conscientious Germans spent days retrieving every last one. River traffic came to a standstill and presented lucrative targets for RAF bombers.

About a week later, however, a Luftwaffe raid passed over the Thames estuary, liberally mining the river well up toward London. River traffic was backed up for days while the minesweepers did their work. I need not tell you what they eventually dredged up: the original British dummy canisters filled with concrete. Each one still bore the inscription, "compliments of the RAF." For ought I know, that story may be apocryphal. No matter, it will serve us nicely as our text when reflecting on matters doctrinal.[27]

1. This account is drawn largely from the author's unpublished biography of Brig. Gen. John M. Palmer, chapter 49. See also, New York Times, Jan 2, 1924, 19:8 and Jan 16, 1924, 1:3, and author's interview with Gen. T.D. White, May 22, 1964, and Maj. Gen. H.M. Jones, May 27, 1964, Washington, DC.
2. New York Times, Jan25, 1924, 1:6.
3. Joint Chiefs of Staff, Dictionary of US Military Terms for Joint Usage (Washington, DC, Aug 1, 1968). See also AFM 11-1, Air Force Glossary of Standardized Terms and Definitions (Jan 1, 1973).
4. Quoted in R. F. Futrell, "Some Patterns of Air Force Thought," in Air University Review (Jan 1964) 84. The author is heavily indebted to Frank Futrell as are all other serious students of doctrine for this provocative article as well as the exhaustive research reflected in his massive two volume study, Ideas, Concepts, Doctrine: A History of Basic Thinking in the United States Air Force, 1907-1964 (Aerospace Studies Institute, Air University, Maxwell AFB, June 1971.)
5. Something of the limitations on doctrinal studies at the Langley Field Tactical School is suggested by the fact that as late as 1923 some 25 hours of the course were devoted to the care and management of horses. See J G. Taylor, "They Taught Tactics," 13 Aerospace Historian (summer 1966) 67. See also USAF Historical Studies: No.89, The Development of Air Doctrine in the Army Air Arm, 1917-1941, USAF Historical Division, Research Studies Institute, Air University, Maxwell AFB, Sept 1955, pp 16, 29-30.
6. An Air Service Field Officers School opened at Langley in Oct 1920. Its name was changed to the Air Service Thctical School in 1922.
7. Strictly speaking, the conceptions of strategic air power taught at the Air Corps Tactical School were not "doctrine" because they had not received official approval from the War Department Genetal Staff. These conceptions finally received official sanction, albeit implicit and indirect, with the approval of AWPD-1, the air annex of the Army strategic plan of Sept 1941. For the best accounts of this backdoor entry of air power doctrine, see Maj. Gen. H. S. Hansell, Jr., The Air Plan That Defeated Hitler (Atlanta, GA, 1972) ch 4, and David MacIsaac, "The United States Strategic Bombing Survey, 1944-1947," (Duke University, Durham, NC, 1969) 6-21.
8. Futrell, Ideas, Concepts, Doctrine, I, 58-59, 70 and 75 documents the shift in Air Corps thinking regarding the probability of successful interception. For the drastic reversal of views during World War II, see, ibid 139. See also MacIsaac, op cit 17, and C. L. Chennault, Way of a Fighter (New York, 1949) 20-26.
9. I. B. Holley, Jr., Development of Aircraft Gun Thrrets in the AAF 1917-1944, USAF Historical Study No.54, 1947, ch 4, pp 73-4.
10. Memo, Maj. R. C. Coupland, Ordnance Dept, for Chief, Air Corps, Feb 9, 1940, quoted in Holley, op cit, Ch 3, f.n. 26, p 54. Another factor which may have impaired the development of bomber armament was the relative neglect of gunners, their training, etc. See, for example, M. C. Olmstead, "First of the US Heavies: The Martin Bombers," 20 Aerospace Historian (Sept 1973)152.
11. Holley, Turrets . . . ch 4. See also William Green. Famous Bombers of the Second War (Garden City, NY, 1959) 64. The Vickers Wellington Mk I, first production model which first flew Dec23,

1937, had power turrets in both nose and tail; there was also a ventral gun. See also C. G. Gray and L. Bridgeman, eds, Jane's All the World's Aircraft, 1938, (London, 1938) 75c.
12. Leonard Bridgeman, ed, Jane's All the World's Aircraft, 1943-44, (London, Aug 1944)164-Sc.
13. AF Regulation 1-2, Dec 9, 1971, Aerospace Doctrine: Responsibilities for Doctrine Development. The Air Staff reorganization of Feb 1963 moved responsibility for the promulgation of doctrine from the Air University, where it had been since 1947, to the Air Staff. (See Futrell, op cit 750 ff). To the objective observer it seems clear that while there were certain advantages derived from proximity to the seat of authority and from direct relationships with the Army and Navy, the shift undoubtedly went too far in removing virtually all responsibility for doctrinal matters from the Air University.
14. The constraints imposed on the formulation of sound doctrine by limited resources, including not only aircraft and airfields but operating funds, may be pointedly illustrated by recalling those instances in the 1930s when "red" and "blue" air forces for the opposing sides in a maneuver were forced for want of adequate resources to operate from the same airfield!
15. House of Representatives Committee on Armed Services, Hearings on Military Posture and HR 9751. . . . 87 Cong 2 Sess, 1962, pp 1359,1362,3266. See also Dept of Army and Dept of Air Force, Combat Joint Operations, Joint Army-Air Force Adjustment Regulation No.5-10-1, 1949, cited in Stephen B. Webber, "Air Support for the Ground Forces: The Evaluation of Roles and Missions for Army Aviation, 1949-1967" (Duke University, Durham, NC, 1974) p 17 f.n. 27, and USCA Title 10, ch 3, sect 125.
16. StatisticalAbstract of the United States (Washington, DC) 1954, 242; 1958 p243; 1959 p 245; and 1961 p 236.
17. See House Com on Armed Services, Hearings on Military Posture and HR 9751 ..... 87 Cong 2 Sess, 1962, p 433, and interview with Col J. B. Shaw, Doctrine Implementation Br, Aerospace Doctrine Div, Directorate of Doctrine, Concepts and Objectives, Jan 4, 1974.
18. Lt. Col. J. S. Ballard, "The Air Force in Southeast Asia: Development and Employment of Fixed-Wing Gunships, 1962-1971." Office of Air Force History, Jan 1974. For an unclassified review of this source, see Friday Review of Defense Literature, May 24, 1974, p 5. See also, interview with Col. James L. Sibley, DCS/Education, Hqrs, Air University, Jan 11, 1974.
19. For an overview of the tactical nuclear doctrinal problem, see C. W. Tarr, Jr., "Weapons in Search of a Strategy," 44 Military Review (Sept 1964) 49-55. See also, interviews, Lt. Col. D. R. Waddell and Col. R. H. Reed, Doctrine Development Br, Aerospace Doctrine Div, Directorate of Doctrine, Concepts and Objectives, Jan 3-4, 1974.
20. Ibid.
21. John W. R. Thylor, ed, Jane's All the World's Aircraft 1972-73, (London, 1973) 584, and R. T. Pretty and D. H. R. Archer, eds, Jane's Weapon Systems, 1973-74, (New York, 1973) 34-35.
22. This observation is based on interviews with a dozen officers assigned to the Directorate of Doctrine, Concepts and Objectives. See, for example, interview with Col. D. M. Murane, Acting Deputy Director, Jan 3, 1974.
23. Interview with officers cited immediately above.
24. Maj. Gen. Glenn A. Kent, "Decision-Making," 22 Air University Review (May 1971) 63-.
25. See AFR 5-54 (May 17, 1954) which appeared soon after the appearance of the first USAF major doctrinal statement in March 1953.
26. Office of Air Force History, United States Air Force History; An Annotated Bibliography (Washington, 1971). It should be pointed out, however, that Futrell's major study, mentioned above in footnote 4, did not appear in print until after this bibliography was published.
27. Maj. Gen. W. Y. Smith, Director of Doctrine, Concepts and Objectives in the Air Staff, and Lt. Gen. M. E Rogers, Commander, Air University, while in no way responsible for my conclusions, have my gratitude for making available the resources of their organizations in connection with the research for this address. At the Air Force Academy so many people put me in their debt with many kind

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