HEADQUARTERS AIR DEFENSE COMMAND

SPECIAL HISTORICAL STUDY #2

NUCLEAR WEAPONS IN THE AIR DEFENSE SYSTEM

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NUCLEAR WEAPONS IN THE AIR DEFENSE SYSTEM

In the years immediately following World War II the major portion of the national atomic stockpile was set aside for the use of the Strategic Air Command.[1] As more time passed, however, the three military services began to observe the growing stockpile with increasing interest. To this interest, the parallel developments in the field of guided missiles by the three services contributed. The Army, with its development of the NIKE weapon, the Navy with TALOS, and the Air Force with BOMARC, were all drawn towards a consideration of the possibility of increasing the lethality of these weapons by the use of nuclear warheads.[2]

no Neutron Bomb

Although ADC was informed by Headquarters USAF of preliminary studies directed towards the use of an atomic warhead in BOMARC early in 1951, there was little that ADC felt it could contribute directly to the question of nuclear armament for air defense at that time.

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1. "The employment of atomic weapons in air defense has formerly been considered inappropriate due to the over-riding requirement for these weapons for strategic bombing...." SECRET, USAF to ARDC, "Atomic Weapons in Air Defense," 29 May 1952.

2. See SECRET, USAF OOA Working Paper No. 25, "A Generalized Study of the Effects of Atomic Bomb Explosions on Aircraft in Flight," by Scott Rethorst and Richard T. Sandborne, 18 Jul 1951; also SECRET BuOrd, U. S. Navy, "Summary of the Feasibility Studies of an Air Launched Atomic Warhead Rocket," by Donald R. Sunde, Nov. 1951; also SECRET, ORD, Tech. Memo T-131, "A Preliminary Study of Aircraft Vulnerability to Atomic Explosions," by T. J. Wang et al, 15 Dec 1951.

It appeared to ADC that the use of nuclear weapons was a development of the future, and the command was content to watch with great interest the outcome of theoretical studies initiated by Headquarters USAF.[3]

During 1951, however, it became apparent to ADC that the national stockpile of fissionable materials had grown to such an extent that the possibility existed of utilizing immediately a small portion of these materials in air defense. Although it was appreciated by ADC that air rocket and air-launched guided missile development employing atomic warheads was not an immediately practicable matter, a good possibility existed of using existing atomic bombs of relatively small yield in air-to-air bombing of enemy aircraft.[4] By the end of 1951, ADC was convinced that the arming of a number of its interceptor aircraft with atomic bombs would offer many advantages for air defense: high kill capability; a good chance of destroying the enemy bomb as well as the carrier; the conservation of interceptor aircraft; and the psychological advantages of the atomic bomb as a deterrent against an enemy penetration of the air defense system.[5]

On 31 January 1952, ADC presented a formal requirement to Headquarters USAF for the use of atomic weapons in air defense.

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3. SECRET, USAF to ADC, "Atomic Warhead for Use Against Airborne Aircraft," 18 April 1951, and Ind.

4. TOP SECRET, Ltr, Mr. Scott Rethorst, USAF OOA to Mr. F. M. Varney, ADC OOA, 1 Aug 51; Interview, historian with Mr. P. S. Ball, ADC OOA, 28 Oct 1953.

5. SOP SECRET, Hq ADC, Preliminary Study, "Nuclear Explosions In Air Defense," by F. M. Varney and P. S. Ball, 20 Oct 51.

Emphasizing the fact that the existing interceptor armament was sadly deficient for the vital task to be performed, ADC expressed its interest in the use of "an armament for interceptors that would have close to 100% kill-probability even in the presence of enemy countermeasures and evasive tactics."[6] USAF Headquarters was requested to intergrate into the overall Air Force development and testing program for atomic devices, a series of weapons effectiveness tests to obtain (1) data on lethal conditions for enemy bombers, (2) data on danger conditions for ADC interceptors, (3) tests on interceptor delivery capability and -- if the tests warranted -- weapons development directed towards the application of present weapons and fire control systems to nuclear armaments. In addition, with its eye to the future, ADC requested that air-to-air atomic missiles and ground-to-air atomic missiles capable of bearing nuclear warheads be developed.

Headquarters USAF, receptive to ADC's idea, notified ADC late in February 1952, that action had been initiated to undertake a program of study and testing to determine the feasibility of augmenting air defense capability by the use of atomic weapons. First emphasis was to be placed on the feasibility of using existing weapons and systems which would not require extensive development. USAF noted, however, that before a firm requirement could be established for atomic weapons, several important factors had to be taken into consideration: (1) technical feasibility; (2) the operational plan of employment; and

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6. TOP SECRET, ADC to USAF, "Nuclear Armament for Interceptors," 21 Jan 1952.

31

See 7 and ADC 14 Nov 192

(3) the availability and allocation of nuclear materials. ADC was directed to work out the operational plan for employment and ARDC was to establish the technical feasibility.[7]

USAF's directive to ARDC noted that "at some future date it might be advisable to assign atomic weapons" for air defense.[8] ARDC was directed to prepare a feasibility study to include (1) the lethal volume of bombers and fighters in various attitudes and as a function of the yield of the bomb and height of the burst, and (2) the methods of delivery of atomic weapons with the associated bombing errors, flexibility, and escape tactics of the bombing aircraft. Although ARDC was asked to consider all aspects of the problem in its long range implications as well, special emphasis was laid by USAF on the consideration of air-to-air bombardment using level or "toss" bombing techniques, "utilizing existing weapons and systems which would not require extensive and lengthy development."[9]

While waiting for ARDC to complete its study, ADC embarked on an extensive study and fact-finding campaign of its own to determine the current status of nuclear weapons, and to become familiar with developmental work in the field in order to prepare its own operational plan. During 1952 close liaison was established with the Air Force

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7. TOP SECRET, 1st Ind, USAF to ADC, 21 Feb 1952, to ADC to USAF, "Nuclear Armament for Interceptors," 31 Jan 1952.

8. SECRET, USAF to ARDC, "Atomic Weapons in Air Defense," 29 May 1952.

9. Ibid

Special Weapons Center at Kirtland AFB, the agency to which ARDC Headquarters had assigned the feasibility studies, and AFSWC was kept busy answering a barrage of questions presented to it by ADC.[10]

Early in January 1953, ADC was gratified by certain conclusions on the subject of atomic weapons in air defense reached by the Joint Air Defense Board, which had been directed to study the overall aspects of the problem by the Joint Chiefs of Staff.[11] The JADB unequivocably recommended that atomic weapons be developed for use in air defense, noting that extensive operational analysis and war-gaming would have to be used in determining the optimum family of air defense weapons and the proportions therein. It was emphasized that the use of atomic weapons should be predicated on the attainment of a reliability of at least 90% in the delivery vehicle. Finally, the JADB recommended that a requirement be established for a small-sized, low-yield, minimum-cost atomic weapon.

Although ADC's preliminary operational concepts were concerned

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10. See SECRET, ADC to ARDC, "Nuclear Weapons for Air Defense," 21 May 1952; SECRET, "Trip Report of Conference at ARDC, 3-5 Jun 52," by P. S. Ball (Hq ADC); SECRET, ARDC, Development Directive No. 3022, 12 Jun 1952; TOP SECRET, AFSWC to ADC, "Project HEAVENBOUND," 23 Jul 52; SECRET, AFSWC to ADC, "Project HEAVENBOUND," 24 Oct 52; CONFIDENTIAL, ADC to ARDC, "Project HEAVENBOUND," 23 Mar 53.

11. On 4 February 1952, the C/S US Army recommended to the JCS that the Joint Air Defense Board: investigate the problems associated with the use of atomic weapons in air defense; recommend concepts for using atomic weapons in air defense; and recommend guidance for the R&D Board, the Director of Guided Missiles, and the Military Liaison Committee to the AEC. The Army recommendation was approved on 27 February 1952, and on 20 March 1952 the JADB was so directed by the C/S USAF. The first Progress Report of the JADB was published on 1 July 1952, and the final report, TOP SECRET, "Project JADB No. 19," on 14 January 1952. 3

with an interim program which would utilize existing weapons for air-to-air bombing, as 1952 progressed ADC began to give increasing attention to the long-range aspects of integrating weapon capabilities currently under development into its projected future air defense plans.

To this end, on 23 March 1953 ADC formally requested Headquarters USAF to provide it with a light-weight atomic warhead of the lowest possible cost, with yields within the range of "b3" .[12] The object of this requirement was to provide the air defense system with atomic warhead for (1) air-to-air rockets, (2) long range surface-to-air guided missiles, and (3) short range surface-to-air guided missiles. The guided missiles to be thus armed were designated by ADC as the BOMARC and TALOS respectively. ADC indicated that its plans called for the arming of "b3" of these weapons with atomic warheads.[13]

In reply to ADC's requirements, Headquarters USAF answered on 2 April 1953 that an atomic warhead capability for the BOMARC and TALOS had been approved by the Joint Chiefs of Staff, and that development was under way. As to ADC's requirement for an air-to-air rocket armed with an atomic warhead, USAF pointed out that ADC's choice, the TERROW, was too small to be used with an implosion-type atomic warhead, but that the BOAR rocket, currently under development at the Naval Ordnance Test Station at Inyokarn, was expected to be effective for

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12. SECRET, ADC to USAF, "Requirement for Development of Atomic Warheads for Air Defense Weapons," 23 Mar 1953.

13. Ibid

air defense as well as for tactical operation. USAF informed ADC that the feasibility of using the latter weapon with the F-89 and F-102 interceptors was to be tested by the Air Research and Development Command.[14]

It has been noted that the Air Defense Command had presented Headquarters USAF with two general requirements: (1) air-to-air bombing with nuclear bombs as a short-range project, and (2) the incorporation of guided missiles armed with atomic warheads into the air defense system as a longer range project. On 6 May 1953, ADC presented to Headquarters USAF its plan for the utilization of manned interceptors and guided missiles in the intermediate period to 1960, before the BOMARC became available in quantity. Reiterating that a requirement existed for both manned interceptors and guided missiles using atomic weapons, ADC proceeded to spell out the general manner in which each of the two types would be used in air defense.[15]

According to this plan, ADC's manned interceptors, armed with atomic bombs, were designated as area defense weapons, and were destined for deployment at the outer limits of the specified combat zone. The local defense weapons, i.e., surface-to-air guided missiles armed with nuclear warheads, would be used as high-kill insurance against those

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14. SECRET, 1st Ind, USAF to ADC, 2 Apr 1953 to ADC to USAF, "Weapons System," 18 Feb 1953.

15. SECRET, ADC to USAF, "Requirement for Weapons with Atomic Capability in the Air Defense System" 6 May 1953.

enemy bombers near the target area which had penetrated the area defenses. In order to carry out this plan, ADC presented a requirement for approximately 200 interceptors and about 200 TALOS missiles, equipped with atomic weapons.

Operationally, the air defense interceptor was to make the initial attack upon the enemy formation. The purpose of the atomic bomb at this point was two-fold: First, the inflict heavy attrition upon the enemy force, and second, to break up the formation so that conventional weapons could be brought to bear. The atomic-equipped TALOS missile, placed in a ring around the target area in heavily industrial and populated regions, would inflict a high kill on that part of the bomber force which escaped the area defense weapons. Within the target area itself there would be conventional antiaircrat and guided missiles as a last resort. All atomic weapons were to be detonated at the optimum altitude to effect a kill on the enemy, while causing only minimum destruction on the surface. ADC requested that urgent action be undertaken so that the F-89D interceptors and the TALOS missile could be modified for atomic use in time to become available by late in 1955.

On 8 June 1953, the long-awaited AFSWC feasibility study was published.[16] In some respects the conclusions reached by the ARDC agency were disappointing to ADC. While admitting that atomic weapons

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16. SECRET, AFSWC, "Feasibility of Nuclear Weapons for Air Defense," Technical Report 53-9, 8 Jun 1953. The feasibility study had been given the code name HEAVENBOUND at its outset, and was generally known by that title.

in air defense were generally feasible, it rejected ADC's proposal of air-to-air bombing by currently-equipped interceptors, especially in all-weather conditions. Its objections were based upon the critical nature of current fire control equipment, and the extreme difficulty of effecting a hit by "free-fall" methods against a maneurving target. AFSWC did emphasize, however, the practicability of a high-velocity, rocket-propelled TX-12 warhead with adequate fire control. A statement that it was technically feasibility to mount the Mk-7 and TX-12 bombs currently available on the F-94C interceptor was, in the light of the foregoing objections, of little satisfaction to ADC. It was quite clear to ADC that in future development, emphasis had to be placed upon the accuracy of the projection of the atomic weapon into the enemy formation.

In spite of AFSWC's conclusion that the probability of a bomber kill employing air-bombing was practically zero if the target maneuvered or if visibility was impaired, ADC still believed that the technique offered some value against large formations of enemy bombers performing only limited maneuvers and in optimum sighting conditions. Where "free-fall" air-to-air bombing offered even a slight possibility of an increase in air defense potential, ADC decided to press further investigation into the matter until it could be convinced that it was not feasible.

In the light of the excellent information to be found in the HEAVENBOUND report of AFSWC, and stemming from ADC's own researchers,

the course of action to be followed in the development of an atomic capability for air defense was considerably clarified. At a conference held on 30 June 1953, representatives from ADC, USAF and ARDC recommended the following program: (1) investigation of "free-fall" bombing as a joint ADC-APGC project, to be completed by March 1954; (2) development of the F-89/E6A fire control system and/or the F-102-K9 fire control system using the series 42 BOAR rocket with the Mk-7 warhead; (3) development improvements to embrace the high-velocity 44 series BOAR with the Mk-12 warhead; (4) study of the SHRIKE guided air rocket as an interim atomic weapon; and (5) the development of a low-yield, small-diameter warhead for guided air rockets of 12 to 15 inch diameter.[17]

Those recommendations were formally communicated to Headquarters USAF on 13 July 1953.[18] Authority was duly given to the Air Proving Ground Command by USAF to investigate "free-fall" air-to-air bombing, and preliminary work on this project was begun at a joint ADC-APGC conference held in October. ARDC, in its turn, was directed to study the accommodation of small warhead to guided aircraft rockets, and to report to ADC progress on the BOAR project.[19]

With 1953 drawing to a close, ADC could look back upon the last two years as a profitable period of research and planning. Although

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17. SECRET, ADC to USAF, "Requirement for a Study of an Air-to-Air Guided Rocket with Atomic Warhead in the Air Defense System," 13 Jul 1953.

18. Ibid

19. SECRET, Msg, USAF to ADC, 22 Sep 1953.

Disappointed in its quest for an immediate atomic capability in air defense, ADC's prospects for the future looked promising. As a result of intensive efforts on the part of all three services, development had reached a point where ADC was presented with the attractive project of having a number of rockets, guided missiles and atomic warheads from which to choose in the future.