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SURVEY OF

THE

GAM-77

WEAPON SYSTEM

FW #250,225



A REPORT

SURVEY OF THE GAM-77 WEAPON SYSTEM

Conducted by the Directorate of Procurement
Inspection Under the Provisions of AFR 123-1

18 February through 20 March 1959

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transmit ltr 8 May 59

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08 June 2010

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SERIES A

SURVEY OF THE GAM-77 WEAPON SYSTEM

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18 February - 20 March 1959

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SURVEY OF THE GAM-77 WEAPON SYSTEM

18 February - 20 March 1959

SECTION I - PURPOSE AND SCOPE

1. The purpose of this survey was to determine and evaluate those conditions which may affect the timely and economical introduction of the GAM-77 Weapon System into the Air Force inventory and the capability to perform its intended mission. (Unclassified)

SECTION II - MISSION

2. The primary mission of the GAM-77 Weapon System is to augment existing strike capabilities of B-52 aircraft by providing a means of attacking and destroying heavily defended targets without subjecting the carrier aircraft to unacceptable attrition. (Secret)

SECTION III - SUMMARY

3. The GAM-77 Weapon System is an accelerated program, but is well managed, vigorously supported and should enter the Air Force inventory as scheduled. It will be operationally suitable but will have a limited capability to survive in the low level attack mode. Further, early squadrons will be hampered in conducting initial training and attaining an early operational capability due to shortages of: some technical data, engine test stands, fully trained personnel, test data and information upon which to establish spares levels. The delivery schedule for modified B-52 carriers is attainable. However, the risk involved in meeting this schedule increases in FY 61 with the incorporation of the Low Level feature and ALQ-27 electronic counter-measure equipment. Therefore, modified B-52 carriers will be the pacing item that determines when the programmed 29 squadrons receive all Unit Equipment. (Secret)

4. The facts supporting the above summary are contained under Section IV, "Findings." (Unclassified)

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SECTION IV - FINDINGS

5. The GAM-77 Weapon System was originally scheduled to become operational in the Third Quarter FY 61. However, on 14 February 1958, Headquarters USAF approved a nine month acceleration which changed the operational date to Fourth Quarter FY 60. This acceleration has resulted in the GAM-77 becoming a "high risk," "buy-before-fly" program. (Ref Page 7, Par 1) ~~(Secret)~~

6. The timing and sequence of the concepts and plans required by AFR 5-47, Weapons Systems Documentation, were unsuited to support the accelerated GAM-77 program. Consequently, deviations from this regulation were necessary to support the program. (Ref Page 7, Par 2) ~~(Confidential)~~

7. Adherence to the established delivery schedule for modified B-52 carriers becomes increasingly difficult in FY 61 if incorporation of the Low Level and ALQ-27 electronic counter-measure equipment remains mandatory. The final configuration of this equipment had not been determined. As a result, ARDC and AMC personnel were not confident that this equipment would be available in time to meet the established program and would become the pacing item which would determine when squadrons would receive full Unit Equipment. (Ref Page 13, Par 6) ~~(Secret)~~

8. In all cases where requirements were fully justified, funds were provided to support the GAM-77 program. However, deficiencies existed in areas involving technical data, factory training facilities, engine test stands and ARDC Weapon System Project Office travel funds. (Ref Page 8, Par 1; Page 17, Par 3; Page 18, Par 4; and Page 22, Par 2) ~~(Confidential)~~

9. The GAM-77 will have a limited capability to survive in the low level attack mode. The "radar altimeter" programmed for the GAM-77A will not appreciably improve survivability. Unless refinements can be achieved that will significantly improve operational characteristics, the expenditure of additional funds on this feature should be re-examined. (Ref Page 9, Par 1) ~~(Secret)~~

10. The GAM-77 flight test program on the Eglin Gulf Test Range will be adversely affected in the FY 60 - 61 time period based upon increased range requirements and present plans for development testing and operational training. In addition, lack of a centralized range control, potential interference with airline operations, limitations on timely data processing and possible oil right problems further compound this condition. (Ref Page 10, Par 2) ~~(Confidential)~~

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11. There was no quick visual means of determining the condition of the thruster cartridge in the collet release system after its initial installation. Accidental discharge of this cartridge during ready storage or while the missile is installed on the alert B-52 would not be visible prior to takeoff. This would preclude the capability to release the GAM-77 by either normal or emergency means. (Ref Page 11, Par 3) (~~Secret~~)

12. There are no provisions in the missile fuel system to prevent fuel icing. Unless this condition is corrected, fuel icing problems similar to those encountered in the B-52 can be expected. (Ref Page 12, Par 4) (~~Secret~~)

13. There was no evidence of intent to verify calculated temperature conditions in the missile astro-tracker during the flight test program. Therefore, temperatures may exceed design limitations and result in a degraded circular error probable. (Ref Page 12, Par 5) (~~Confidential~~)

14. There was no approved program for compatibility testing of all penetration aids in a single B-52. Further delay in establishing a test program will increase the probability of redesign. This could require changes to modification kits, additional aircraft down time and program delays which would result in a degraded operational capability for a significant portion of the B-52 fleet. (Ref Page 13, Par 6) (~~Secret~~)

15. An "operational flight safety system" was programmed for the GAM-77A. This requirement should be re-evaluated since this feature was determined unnecessary by the using command, will cost an estimated 15 million dollars and was not considered essential for the first 250 missiles. (Ref Page 14, Par 7) (~~Secret~~)

16. The maximum limits of the inlet and exhaust noise levels of the J52-P-3 engine had not been determined at the time of the survey. However, preliminary investigations indicated that this will be the noisiest jet engine in the Air Force inventory. As a result, problems affecting communications, efficiency of personnel, development of sound suppressors, and siting of GAM-77 facilities can be expected. (Ref Page 15, Par 8) (Unclassified)

17. The level at which maintenance (organizational or depot) will be performed on GAM-77 subsystem components had not been established. Therefore, information on which to realistically determine requirements for tools, test equipment, training, personnel and spares provisioning was not available. (Ref Page 17, Par 1) (Unclassified)

18. The fuel filter used in the engine fuel pump on the J52-P-3 engine has a 10-hour service life. However, the maintenance cycle of the missile is planned at approximately 30 to

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50 hours; consequently, replacement of this item every 10 hours will disrupt the maintenance cycle and decrease the in-commission rate of the missile. (Ref Page 17, Par 2) (Unclassified)

19. Headquarters AMC failed to include the Logistic Support Manager's requirements for GAM-77 technical manuals in the FY 59 Buy Program. This will result in late receipt of numerous manuals essential to early squadrons activation and operation. (Ref Page 17, Par 3) (Unclassified)

20. Lack of a timely decision in selecting standardized engine test equipment had exhausted the lead time required to procure engine test stands. As a result, early squadrons will not have engine test stands in time to support initial training and operational requirements. (Ref Page 18, Par 4) (Unclassified)

21. The contractor had not received the required quantities of receiver-selector units (AN/ARW-62) to support the flight test program. Unless this condition is corrected, a slippage in the flight test schedule can be expected. (Ref Page 19, Par 5) (Unclassified)

22. At the time of the survey, ATC contracts for training preparation and assembly of trainers negotiated with North American Aviation, Inc., had not received final approval. Therefore, the contractor was under no legal obligation to accomplish preparatory work incidental to factory training. As a result, the factory training program was in danger of slipping. This would adversely affect support of the early operational squadrons. (Ref Page 21, Par 1) (Unclassified)

23. As of 18 March 1959, ATC had not issued procurement authorization for classroom facilities required for factory training commencing in July 1959. North American Aviation, Inc., required authority to proceed by 2 March 1959. Consequently, a day-for-day slip in the factory training program can be expected. This will result in a shortage of trained personnel to support initial operational squadrons. (Ref Page 22, Par 2) (Unclassified)

24. Training responsibilities assigned by AFR 80-14 and AFR 50-9, are not clearly defined as they pertain to AMIC and ATC in support of testing and evaluation of new weapon systems. This has resulted in the duplication of some training courses by both commands. (Ref Page 23, Par 1) (Unclassified)

25. Coordination and expected responsiveness between ATC and the Weapon System Project Office was not consistent with the emphasis required to support an accelerated program of this nature. As a result, the Weapon System Project Office was not regularly informed of potential training problems which precluded that office from taking appropriate action to assure timely training support of the program. (Ref Page 24, Par 2) (Unclassified)

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SECTION V - ADMINISTRATIVE DETAILS

24. This survey was conducted under the provisions of AFR 123-1, The Inspection System, dated 12 April 1956 as amended. (Unclassified)

25. Itinerary. (Unclassified)

<u>Places</u>	<u>Date</u>
North American Aviation, Inc. Downey, California	18-20 February 1959
Boeing Airplane Company Wichita, Kansas	23-25 February 1959
Hq Oklahoma City Air Materiel Area Tinker Air Force Base, Oklahoma	26-27 February 1959
Hq Strategic Air Command Offutt Air Force Base, Nebraska	2-3 March 1959
Hq Air Training Command Randolph Air Force Base, Texas	5-6 March 1959
Hq Air Proving Ground Center Eglin Air Force Base, Florida	5-6 March 1959
Hq United States Air Force Washington 25, D. C.	9-10 March 1959
Pratt & Whitney Aircraft Division of United Aircraft Corporation East Hartford, Connecticut	9 March 1959
Hq Air Materiel Command and Detachment #1 of Air Research and Development Command, and Wright Air Development Center Wright-Patterson Air Force Base Ohio	12-18 March 1959
Hq United States Air Force Washington 25, D. C.	19-20 March 1959

26. Critiques. Formal critiques were held as follows:
(Unclassified)

a. 18 Mar 59 - Wright-Patterson AFB, Ohio, with personnel from Detachment #1 of ARDC, Headquarters AMC, SAC, and OCAMA attending. (Unclassified)

b. 20 Mar 59 - Headquarters USAF, Washington, D. C., with personnel from the Air Staff attending. (Unclassified)

27. Distribution is being made to The Inspector General, USAF, and Commanders, AMC, ARDC, ATC and the Commander-in-Chief, SAC. (Unclassified)

Signed

LINN E. MANN
Lt Colonel, U. S. Air Force
Inspector General

Approved
6 April 1959

Signed

EDWARD B. GALLANT
Brigadier General, U. S. Air Force
Director, Procurement Inspection
The Inspector General

PART II

SUPPLEMENTARY DATA

SURVEY OF THE GAM-77 WEAPON SYSTEM

18 February through 20 March 1959

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TAB A

PLANS AND PROGRAMS

1. Program Acceleration. When GOR 148 was published in March 1956, Headquarters ARDC estimated that an air-to-surface missile, capable of fulfilling the stated requirements, could be available in 1962. Subsequent to this estimate, PG-59-1B was published scheduling the first operational squadron of GAM-77's in the Third Quarter of FY 61 - an acceleration of a minimum of nine months. On 14 February 1958, PG-60-1A changed the operational date to the Fourth Quarter of FY 60, adding another nine months acceleration to the program. Although there was an official program acceleration of only nine months, an actual eighteen months program compression occurred resulting in a "Buy-Before-Fly" policy with attendant "high risks."
(-Secret)

2. Air Force Regulation 5-47. The timing and sequence of the concepts and plans required by AFR 5-47 Weapons Systems Documentation, was unsuited to support the accelerated GAM-77 program. This condition was reported in previous OTIG surveys, for example: Survey of the B-58 Weapon System, 24 October - 23 November 1957; and Survey of Weapon System Programming Documents, AFR 5-47, 15 January - 5 February 1958. However, this was recognized early by the GAM-77 Weapon System Project Office and the Weapon System Phasing Group. Consequently, if a deviation from the rigid interpretation of this regulation had not been obtained, many concepts and plans would not have been available on time nor would the sequence have been appropriate. It was determined during the April 1958 Weapon System Phasing Group Meeting that documentation would have to be accelerated from one to twelve months. Otherwise, such documents as the Final Operational Plan, Training Plan, Logistic Plan, and Installation Plan would not be published until June 1959 had AFR 5-47 been followed. However, Weapon System Project Office was convinced these documents were required one year earlier if the program was to meet development and operational objectives. As a result of the Weapon System Project Office's foresight and early action, documents were available on time. (-Confidential)

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TAB B

FUNDING

1. General. The program was well supported commensurate with the priority assigned. All funds requested that were adequately justified were allocated to the program. Irrespective of the excellent over-all funding support of the GAM-77 program, some problems were encountered. These were primarily due to the inability of Air Force agencies to establish firm requirements, generate convincing justification and control administrative delays which were accentuated by an accelerated program. (Unclassified)

a. During March 1959, there were insufficient travel funds available to ARDC personnel of the GAM-77 Weapon System Project Office. As a result, personnel were unable to accomplish the travel necessary in support of the program. During this period a requirement existed for Weapon System Project Office personnel to travel to the Atlantic Missile Range concerning the Flight Test Program, to Oklahoma City Air Materiel Area for an Engineering Change Proposal conference, and to North American Aviation, Inc., Downey, California, for a Development Engineering Inspection. At the time of the survey, one Weapon System Project Office member departed for the Atlantic Missile Range on orders without the benefit of per diem. Due to the importance of the Design Engineering Inspection, another individual was contemplating travel to North American Aviation, Inc., Downey, California, at his own expense. Although this condition in itself is not considered a major problem affecting the GAM-77 program, it is another example of funding problems related to the establishment of firm requirements, adequate justification, and control of administrative delays which could hamper effective program management. (Unclassified)

b. Additional examples of funding problems are contained on page 17, paragraph 3; page 18, paragraph 4; and page 22, paragraph 2. (Unclassified)

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TAB C

DEVELOPMENT

1. GAM-77 Low Level Capability. The GAM-77 will have a limited capability in the low level mode. The "radar altimeter" programmed for the GAM-77A will not appreciably improve this capability. Unless refinements can be achieved that will enhance operational potential, the expenditure of further funds on this feature are questionable. Re-evaluation is desirable for the following reasons: (Secret)

a. At low level, the GAM-77 is restricted in range, and accuracy can also be expected to suffer if operation is conducted under cloud cover or turbulent conditions. However, the major weakness of the missile to survive in the low level attack mode is the limitation of the pressure sensing altitude control system. This system is generally considered to have a minimum altitude operating capability of 1200-1500 feet above the highest terrain enroute and consequently, the average missile profile is even higher during some portions of the flight. Current intelligence estimates indicate the existence of a low altitude surface-to-air missile of the "Hawk" type in the enemy defense environment during the operational life of the GAM-77. As a result, SAC had initiated a requirement for an improved low altitude capability and Headquarters USAF had directed a go-ahead on the radar altimeter feature for the GAM-77A. More recent studies, however, have shown that a GAM-77 missile would be vulnerable to a "Hawk" type weapon at low altitudes above 500 feet. As a result, the operational capability to be gained with the radar altimeter, at an estimated development cost of 2.5 million dollars, has made the requirement questionable. (Secret)

b. Headquarters USAF had directed SAC to furnish further justification for the radar altimeter by 30 March and had indicated that approval of this feature for the GAM-77A will be retracted unless it can be reasonably proven that it will significantly increase the weapon's effectiveness or chances of survival. The contractor predicts a capability of 185 feet over level terrain and 635 feet over rolling hills. However, this estimate is considered optimistic and the Air Force should expect a low level capability of 650-700 feet over land. Consideration should be given to the realistic capabilities of the radar altimeter, latest intelligence estimates of enemy detection and defense capabilities, and our probable routes of entry as criteria for continuing the program of incorporating this improvement in the GAM-77A. (Secret)

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c. Final evaluation could possibly demand a revision to the General Operational Requirement, specifying very low altitude requirements that could only be satisfied by development of a different or more refined system. (Secret)

2. Eglin Gulf Test Range. There are several problem areas confronting the future of the Eglin Gulf Test Range, any one or combination of which could become critical to the point of adversely affecting not only the compressed GAM-77 flight test program, but any other programs that are scheduled to utilize this range. (Confidential)

a. In the FY 60-61 time period there is a very rapid build up in the number of weapon systems that will be demanding time on the Eglin Gulf Test Range in both the research and development and operational training categories. In fact, the build up is such that Eglin personnel are concerned about reaching the saturation point. A preliminary survey of anticipated range utilization indicated a range load of approximately 284 flights in FY 60 and approximately 348 in FY 61. Systems considered included both development and training requirements of ARDC, SAC, and ADC for the GAM-77, GAM-72, IM-99A and B, WS-224-1, HTV-3 and WS-138-A. To this must be added the range requirements of ADC's Armament Evaluation Centers at Tyndall and MacDill. (Secret)

b. With the sharp build up in range utilization, it is recognized by most agencies concerned that a centralized range control is necessary. It is presently necessary to coordinate all range scheduling between four military commands (SAC, ARDC, ADC and the Navy), as well as airline and maritime agencies. To date this has presented no major problems, however, as range utilization is increased, this coordination problem will rapidly gain in magnitude, and without a central control, efficient utilization of the range will become increasingly difficult. (Confidential)

c. There are ten scheduled and two nonscheduled airline flights operating through the Eglin Gulf Test Range daily. To date, it has been possible to adjust range functions to the point where there was no major interference with either airline or flight test operations. However, as the range moves into full scale utilization, it will become extremely difficult to schedule flight test missions on a noninterference basis with airline schedules and costly delays to range operation can be expected. The airlines had estimated it would cost 9 million dollars a year to circumnavigate the range and they would undoubtedly exert considerable pressure to avoid this restriction. Headquarters USAF has also indicated that it does

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not intend to attempt closing this airway because of a SAC requirement, so the problem again becomes one of close coordination and scheduling and only further emphasizes the need for a centralized range control. (Confidential)

d. Data processing limitations were emphasized as a major problem area by Eglin Test Force personnel and will become increasingly critical as the range workload builds up. The area of greatest concern was focused on the doubtful capability of the Center to reduce the test data on a timely basis. This would have an impact on all test operations but would particularly affect the accelerated GAM-77 test program which is scheduled to build up to an ambitious launch rate of 3 and 4 missiles per month by mid-1960. There was evidence that the problem was not necessarily centered around lack of data processing equipment but was due to lack of personnel to prepare the data for this equipment. (Confidential)

e. As a result of Public Law 337, 85th Congress, any time the military services want exclusive use of public domain lands in excess of 5000 acres, legislation is required. Off-shore tidelands out to the 100 fathom mark are classed as public domain and as such are subject to lease by the Department of Interior. Practically the entire Eglin Gulf Test Range falls in this category. It is known that several major oil companies have been making explorations in the Eglin Gulf Test Range areas. Headquarters USAF had expressed considerable concern over the possibility of having to contend with oil drilling operations within the range and resulting impact on test operations. This is especially significant because to date legislation had not been passed which would protect the extensive military interests in any portions of the range or the installations that utilize and support it. (Unclassified)

3. Release System Thruster Cartridge. The missile is attached to the B-52 and supported by two collet finger-type suspension devices in the pylon which grasp two knob fittings on the missile. The collets are tied together and will operate simultaneously upon actuation of their mechanical linkage. Under both normal and emergency operation, actuation of this mechanical linkage which opens the collet and releases the missile, is accomplished by firing an explosive thruster cartridge. A positive locking pin in the mechanical linkage must be electrically removed during the normal launch sequence prior to thruster ignition. If the thruster cartridge was fired with the lock pin in place, release could not occur. The release system circuitry is well designed and contains several safety and backup features that will insure reliable

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operation; however, there is a possibility that the thruster cartridge could be fired by some accidental means such as static electricity, radio frequency energy, or lightening. Inadvertant discharge of this cartridge after its initial installation, while the missile was in ready storage or on alert status could go unnoticed prior to takeoff and would render impossible all means of accomplishing release. There is presently no quick check that can be made to determine the thruster cartridge condition. Strategic Air Command personnel expressed concern over the problem and the Weapon System Project Office indicated they would take action to determine whether a requirement exists for making the minor change that would be necessary to eliminate this situation. (Confidential)

4. Fuel Icing. There are no provisions in the missile fuel system to prevent fuel icing. Unless this condition is corrected, fuel icing problems similar to those encountered in the B-52 can be expected. The Weapon System Project Office had recognized this situation and had taken action to have both the contractor and the WADC laboratories take a very close look at the problem. A meeting had been scheduled for early April to evaluate the requirements. The original feeling expressed by the contractor was that there should be no problems experienced with the missile if the Air Force insured that the fuel utilized by the B-52's met proper specification; however, he has now become quite concerned with the problem in view of the difficulties experienced with the bomber fuel system. There are several solutions under consideration - one is to install a heat exchanger in the missile similar to the type to be installed in the B-52; another is the possible use of fuel additives, if development proves satisfactory and they are compatible with missile operation. The WADC laboratories are of the opinion that the fuel additives, although they appear promising, will not be available in time to correct the GAM-77 icing problem. Early resolution of this problem is needed in order to allow time for providing any necessary space requirements, plumbing or other design changes dictated by the solution. Should a heat exchanger be selected, timely procurement of a suitable unit may also present a problem in view of the demands for equipping the B-52 and KC-135 fleets. (Secret)

5. Astro-Tracker Heating. Pylon aerodynamic heating calculations indicate that under certain low level launch conditions the temperature rise in the astro-tracker may exceed design temperature limits. For example, an ambient temperature of 120°F sustained for 30 minutes around the pylon is expected to produce a temperature of approximately 155°F at the astro-tracker photo tube. When this occurs,

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a thermal sensor, set for $\pm 160^{\circ}$ to $\pm 165^{\circ}$ F, in the astro-tracker will deactivate the photo tube and it will remain inoperative as long as the excessive heating condition persists. However, a temperature drop to acceptable levels will allow the astro-tracker to function normally. Under actual low launch strike conditions, the possibility exists that carrier aircraft may remain in a free air temperature environment adverse enough to render the astro-tracker useless during pre-launch conditioning of the missile. This would deny the guidance system vital azimuth information and result in increasing the circular error probable beyond desired limits. Further, the flight test program did not indicate that this particular heating problem would be proved or disproved even though the problem is based on theoretical calculations. Consequently, until this potential problem is verified and corrected or refuted one aspect of the missile low level capability will remain in doubt. (Confidential)

6. Problems Relating to Penetration Aids. There was no approved program for compatibility testing of the GAM-77, GAM-72, ALQ-27, and Low Level "penetration aids" combination, in a single carrier aircraft prior to the time this capability will be incorporated in operational aircraft. Further delay in approving a test program will result in the increased risk of: possible redesign, required changes to modification kits, additional aircraft down time, program delays, and a degraded operational capability for SAC. Each of the four penetration aids is a complex, "high risk," "buy-before-you-fly" program. With their integration into a common carrier aircraft they physically compete for space and are electronically interdependent upon each other and the risk of achieving compatible operation is further increased. This is especially evident when considering the ALQ-27 and Low Level systems, which include several new equipment developments, some of which have not been fully defined. In order to maintain minimum aircraft down time for the B-52's it was considered mandatory to perform the penetration aid carrier modifications as a "packaged - one down time operation." The first of 99 B-52E's and 53 B-52G's will start to flow through the retrofit lines of SAAMA and OCAMA in July 1960 and are programmed to receive the GAM-77/72, Low Level modifications. The first of 88 B-52F's are scheduled to start through the retrofit line at Boeing, Wichita in October 1960 and are programmed to receive all four of the penetration modifications. Prior to and after this time, another 140 B-52G's and 112 follow-on aircraft are programmed to have part or all of these capabilities incorporated in the production line. Unless provisions are made for a prototype aircraft to accomplish compatibility testing, the first appearance of a carrier which contains all four of the penetration aid capabilities will be

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the first "follow-on" "G" or "H" model programmed for delivery in January 1961 or the first output of the Boeing "F" retrofit line in May of 1961. At this point in time (May 1960), approximately 49 "E's," 17 "F's," 181 "G's," and 22 follow-on "G's" or "H's" (for a total of 269) will have been committed to one stage or another of the penetration aids carrier "retrofit" or "production" program without the benefit of any combined testing. Any design or installation changes required at this point to achieve system compatibility will prove extremely costly, require more aircraft down time and further limit SAC's over-all operational capability. The B-52 Weapon System Project Office had recognized the seriousness of the problem and requested funds from USAF, and allocation of an aircraft to be utilized as a prototype for testing complete systems compatibility, but to date USAF approval has not been received. Latest Boeing proposals indicated that development of a prototype aircraft could possibly be achieved by September 1960 if given an immediate go-ahead. (Secret)

7. Operational Flight Safety System. The requirement for the operational flight safety system programmed for the GAM-77A is questionable. This feature was listed by the Nuclear Weapons System Safety Group as one which did not require incorporation into the missile system in order to provide an adequate safety level; but one which would improve safety and reliability from a nuclear safety viewpoint. It was not considered essential for the first 250 GAM-77's that will enter the inventory, but is presently programmed to be incorporated in all GAM-77A's. In view of the following, it is essential that careful re-evaluation be given to the decision for including this operational flight safety feature in the GAM-77A: (Secret)

a. The using command has indicated that there is no requirement for this feature and considers it an unnecessary redundancy for operational stockpile weapons. Both the Weapon System Project Office and the contractor support this position. (Confidential)

b. Detailed technical evaluation by the contractor has indicated that the original consideration of using a simple gyro, plus timer "heading checker" type unit would impose undue restrictions on the system as to launch position and heading. A target vicinity indicator type device appeared to be the only solution. This unit would measure distance through integration of velocity and cannot be considered a simple system. (Confidential)

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c. Cost of this feature had increased from an initial estimate of .5 million dollars for the simple heading checker unit to an estimated 15 million dollars for a "target vicinity indicator," i.e., one million for development and 30-50 thousand dollars per missile for production. (Confidential)

d. Reliability calculations indicate that only 12 out of 1000 missiles launched will fail due to malfunction of the auto-navigator and autopilot systems; and it is believed that only a small percentage of these failures would cause the missile to deviate toward friendly territory. (Confidential)

e. The guidance system is energized and checked during several hours of captive flight prior to launch which should promote the confidence necessary to determine that the missile will function properly in free flight. (Confidential)

f. A state of war will exist when the missiles are launched and SAC is strongly opposed to any situation that could reduce the number of live warheads delivered to the target or adjacent areas. (Secret)

g. Because of the requirement for a GAM-77 "free fall ballistic" capability the system must incorporate an on-off switch. This would allow the flight safety feature to be cut out of the system before launch at the discretion of the operator. (Secret)

h. The "safe separation timer" which will be incorporated in all missiles offers considerable safety insurance that the missile won't fall on friendly territory. (Confidential)

i. Pre-launch checkout of the proposed system may be impossible during actual use. (Unclassified)

j. The limits to which the target vicinity indicator would be confined could be as high as 2500 to 10,000 square miles, unless an extremely complex system is developed. (Confidential)

k. Any additional systems will only add complexity and lower over-all reliability. (Unclassified)

8. J52-P-3 Engine Noise Levels. The maximum limits of the inlet and exhaust noise levels of the J52-P-3 engine had not been determined at the time of the survey. However, preliminary investigations indicated that this will be the noisiest jet engine in the Air Force inventory. As a result,

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problems affecting communications, efficiency of personnel, development of sound suppressors and siting of GAM-77 facilities can be expected. North American Aviation, Inc., submitted a report entitled: "Noise Environment and Communication Problems in GAM-77 Engine Runup Area," in July 1958. The information contained in this report was based on noise level tests conducted on J-57 engines rather than the J-52 since the two engines are similar. However, it was suspected that the upper frequency range would increase in the J-52 engine because of its rotational speed and the number of blades in the first three stages of the compressor. The maximum noise level of the J-57 engine at idle run was 118 decibels and 150 decibels at maximum power setting. These figures were expected to increase with the J-52 engine making the complete runup area a danger zone. (Unclassified)

a. The GAM-77 engine runup during combined systems check will last approximately 216 minutes with three different power settings; idle, maximum continuous, and maximum. The majority of the operation will be conducted at idle settings. However, during this time the missile will be rotated through several degrees of axis for flight control checkout. At the maximum degrees of pitch, roll and yaw, much of the engine noise will be deflected from the exhaust noise suppressor into the checkout area. Preliminary tests indicate that the J-52 will have up to 125 decibel levels in the low octaves but no tests have been conducted to determine the extent of high octave range. (Unclassified)

b. Testing of unpodded engines for the GAM-77 will require longer periods of maximum continuous and maximum power settings. Therefore, noise levels from this area will be higher than those experienced in the combined system checkout. (Unclassified)

c. Since the maximum limits for inlet and exhaust noise levels are expected to be high, the addition of an inlet suppressor may be required in order to reduce the decibel level to acceptable limits. In addition, without final data on noise levels, violation of the quantity distance and sound level criteria used in siting GAM-77 facilities can be expected. Furthermore, telephone communication will be difficult and voice communications will require shouting within one to two feet to be understood. Under these conditions, maintenance personnel working in the GAM-77 area will require special protective devices in order to maintain efficiency. (Unclassified)

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SUPPLY AND MAINTENANCE

1. Levels of Maintenance. The levels at which maintenance will be performed (organizational or depot) on GAM-77 components, assemblies, subassemblies and plug-in units had not been established. As a result, difficulties had been encountered in accomplishing provisioning action on spares for this program. In addition, this deficiency has a direct impact upon the unit manning document, establishment of training courses, and development and authorization of ground support equipment. Therefore, until levels of maintenance are established for GAM-77 subsystem components information on which to determine realistic requirements for tools, test equipment, training, personnel and spares will not be available. Although this problem had been common to most weapon systems, it was accentuated in the GAM-77 due to compression of the program. (Unclassified)

2. Engine Fuel Filter. The fuel filter used in the engine fuel pump on J52-P-3 engines is rated at 10 hours of operation prior to replacement. However, the maintenance cycle of the missile is expected to be scheduled between 30 and 50 operating hours. Therefore, a requirement to replace the fuel filter after 10 hours of operation will disrupt the maintenance cycle and decrease the in-commission rate of the missile. Wright Air Development Center personnel stated that specifications for this item were adequate for an increased operational life; however, special flight testing data would be necessary prior to granting any extension. Therefore, until sufficient flight testing information from the GAM-77 program is available, the service life of this item cannot be increased to a point where it will be compatible with the programmed maintenance cycle of the missile. (Unclassified)

3. Technical Data. Headquarters AMC failed to include the Logistic Support Manager's requirements for P-131 funds for GAM-77/72 Contractor Furnished Equipment and Contractor Furnished Aeronautical Equipment technical manuals in the FY 59 Buy Program. This had resulted in delays in receipt of sufficient P-131 funds for procurement of technical data. As a result, numerous manuals essential to early squadron activation and operation will not be available when required. The Logistic Support Manager (OCAMA) for the GAM-77 Weapon System submitted a FY 59 requirement of \$1,400,000 to Headquarters AMC to procure these manuals. This

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request was received by the Comptroller, Headquarters AMC rather than its intended recipient, the Directorate of Maintenance Engineering. As a result, the requirement was not included in the FY 59 Buy Program. However, the AMC Aeronautical Systems Center released \$310,000 to the Logistic Support Manager on 21 July 1958 and subsequently increased this amount to \$972,225 on 4 February 1959. These funds were exhausted as of 27 February 1959. Therefore, at the time of the survey, the Logistic Support Manager was holding in abeyance, firm requirements totaling \$644,008 for GAM-77 technical manuals. Until additional funds are made available, numerous field-level and bench-type manuals devoted to airborne components and systems (Contractor Furnished Aeronautical Equipment) as well as appropriate operating-maintenance manuals for complex ground support consoles will not be delivered in time to support early squadron activation and operation. This problem was compounded by the acceleration of the program which narrowed the lead time for funding, procurement and preparation of the required manuals. (Unclassified)

4. Engine Test Stand. Lack of a timely decision in selecting standardized engine test equipment to support GAM-77/72 Weapon Systems had exhausted the lead time required for procurement of engine runup stands to support early GAM-77 squadrons. As a result, these squadrons will not have engine runup stands in time to support initial training and operational requirements. This will affect the in-commission rate and/or operational capability of the missile. Conferences and studies were conducted in late CY 58 by WADC, AMC and ARDC personnel to determine the engine test equipment that would be most beneficial for the combined GAM-77/72 facilities in checking the J-52 and J-85 engines. Under consideration were the Air Logistic Corporation Model 12,000A stand and the Space Corporation AF/M-37T-1 stand. It was determined in February 1959 that the AF/M-37T-1 stand modified with fuel flow and thrust measuring equipment would suffice for both the GAM-77/72 engine checkout. However, the lead time required to obtain this item was quoted by Headquarters WRAMA (prime on this item) as 15 months. Thus, if immediate procurement action was taken, (April 1959) the first item would not be available until June 1960, even though it was required to support the first squadron in December 1959. To resolve this deficiency, a decision was made on 16 March 1959 by representatives of WADC, AMC and ARDC to procure seven modified Air Logistic Corporation Model 12,000A engine runup stands to be delivered to the first seven squadrons. In order

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to meet the schedule, equipment specification for this item must be furnished by WADC no later than 31 March 1959, and funds must be made available for both engineering changes and production go-ahead no later than April 1959. (Unclassified)

5. Shortage of AN/ARW-62 Units. Command control of the GAM-77 during the flight test program is required for range maneuvering, exercising certain control functions in the missile and to satisfy range safety requirements. The subsystem that will provide these control elements is the AN/ARW-62, Receiver-Selector unit, furnished North American Aviation, Inc., as a Government-furnished aeronautical equipment item. This equipment is essential to the GAM-77 flight test program since both the Atlantic Missile Range and Eglin Gulf Test Range will not allow unmanned test vehicles on these ranges without AN/ARW-62 units. At the time of the survey, the status of this requirement was: (Unclassified)

a. In August, 1959, North American Aviation, Inc., established a requirement for 49 of these units to support the Category I and II flight test program with first delivery of four units the following month. The requirement and delivery schedule for these units was accepted as valid by the Weapon System Project Office and procurement action was obtained in less than two months. However, since the production lead time for this item is approximately six months, delivery of the first units could not occur before March 1959 - seven months later than required. (Unclassified)

b. To fill this gap in the actual delivery schedule, 13 units were obtained from other sources and released to North American Aviation, Inc., between September and November 1958. To date, no additional units have been provided the missile contractor. In addition, the 13 units did not meet Air Force vibration specifications; consequently, two units were reshipped to WADC, two were retained for use on non-fly missiles and the balance (nine) were modified by North American Aviation, Inc., to meet vibration requirements for installation on a comparable number of flight test missiles. (Unclassified)

c. The missile contractor should have received at least 24 AN/ARW-62 units to satisfy his requirements. Of this quantity, only 12 units were required for installation in flight test missiles. However, of the total quantity actually received by North American Aviation, Inc., only nine were suitable, after

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modification, to support the flight test program - leaving a shortage of three units. (Unclassified)

d. The estimated delivery schedule established by the AN/ARW-62 manufacturer (Avco) has slipped; consequently, the first 12 units that were to come off the production line in March 1959 will not be delivered until April and possibly later. On the other hand, Avco was optimistic that they could deliver approximately 18 units in April, leaving a shortage of six units based on their estimated delivery schedule. If this occurs, North American Aviation, Inc., quantity requirements will be met, providing all these units are committed to the GAM-77 program. (Unclassified)

e. The lack of additional AN/ARW-62 units for the preceding five months period has prevented an orderly installation of this equipment during research and development missile production and failed to provide spares to support flight testing. As a result, out-of-sequence installation of these units will affect adversely the contractor's program to prove missile maintenance reliability/stability and can cause a slippage in the flight test program. (Unclassified)

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TAB E

PROCUREMENT AND PRODUCTION

1. Air Training Command Contracts. At the time of the survey, ATC contracts for training preparation and the assembly of trainers, negotiated with North American Aviation, Inc., in January 1959, had not received final approval. Therefore, the contractor was under no legal obligation to accomplish the preparatory work specified in these contracts essential to the Type I factory training scheduled to commence in July 1959. As a result, the factory training program was in danger of slippage and would adversely affect support of the early operational squadrons. Referenced contracts were Fixed Price negotiated contracts over \$100,000 which was beyond the delegated procurement authority of ATC, and as such required the approval of AMC before becoming valid contracts. These contracts were negotiated the latter part of January 1959 and forwarded to the AMC procurement committee in early February. As a result of AMC review, ATC was notified on 5 March that contract AF 41(689)-187 for fabrication or assembly of trainers was being returned without approval for the following reasons: (Unclassified)

a. Determination and Finding required for sole source procurement did not describe actual services involved. (Unclassified)

b. Fixed price nonpersonal services type of contract used was questionable. (Unclassified)

c. Exception taken to escalation-type clause contained in the (Fixed Price) contract which provided that in the event the Air Force approved North American Aviation, Inc., Incentive Compensation Plan, cost of contract would be increased to cover its share of the plan. (Unclassified)

Contract AF 41(689)-176 for training preparation was given conditional approval contingent upon the contract being revised to eliminate paragraph "c" above and certain obsolete standard clauses. As of 18 March, AMC procurement committee indicated that both contracts had received conditional approval. Regardless, ATC still was in the position of having to renegotiate with North American Aviation, Inc., the above aspects of these contracts. In the meantime, North American Aviation, Inc., in an effort to maintain schedules on a compressed program had continued to incur costs without legal means of reimbursement.

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In addition, the Air Force is in the unenviable position of renegotiating these contracts on an after-the-fact basis. Thus, any element of risk the contractor may have assumed in initial Fixed Price negotiations may be lost when negotiations are reopened. (Unclassified)

2. Factory Training Classroom Facilities. As of 18 March 1959, ATC had not furnished AMC procurement authorization for classroom facilities required for factory training commencing in July 1959. North American Aviation, Inc., required contractual authority by 2 March 1959. Consequently, a day-for-day slip in the availability of classrooms is being experienced and will affect the July starting date for factory training. This will result in a shortage of trained personnel to support initial operational squadrons. At the time ATC negotiated with North American Aviation, Inc., for the training preparation contract, the amount of \$95,000 later reduced to \$75,000 was an item under discussion for cost of rearranging a portion of the Government owned facilities, for classrooms necessary for the factory training program. It was concluded at that time that since a facility contract with North American Aviation, Inc., was in being the funds and requirements for training facilities would be excluded from the ATC training preparation contract and ATC would issue a procurement authorization to AMC for inclusion in the facility contract. Air Materiel Command had North American Aviation's facility request along with all necessary documentation, however, the procurement authorization was not forthcoming from ATC. (Unclassified)

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TAB F

TRAINING

1. Training Responsibilities. Training responsibilities assigned to ARDC and ATC by AFR 80-14 and AFR 50-9 in support of testing and evaluation of new weapon systems are not clearly defined. Air Force Regulation 80-14, dated 19 August 1958, paragraph 8g (2) states, ATC will: "plan, develop and procure adequate and timely training for personnel required to test, operate, and maintain equipment undergoing tests in accordance with AFR's 50-9 and 23-6." On the other hand, AFR 50-9, dated 23 January 1959, paragraph 4d (3) allows ARDC to provide "opportunity for familiarization, experience, and limited training on new equipment for using command and ATC personnel in accordance with AFR 80-14." This had resulted in duplication of some training courses and caused confusion in both commands. For example: (Unclassified)

a. A supervisor and planners course was conducted in 1958 under the research and development contract AF 33(600)-36040, involving training of approximately 135 Air Force personnel. The ATC training preparation contract AF 41(689)-170 negotiated in January 1959, in addition to the provisions requiring certain preparatory work for the factory training program provided for training of two classes of supervisors and planners in June 1959. (Unclassified)

b. Training of ARDC technician personnel to support the flight test program commenced in December 1958. This training program allowed ARDC personnel to participate as regular members of two missile launch crews established by North American Aviation, Inc. These crews were composed of approximately 22 people of which half were Air Force personnel. This training effort was in direct support of the flight test program and was obtained under a research and development contract. If this training had not been arranged by ARDC at an early date, the flight test program would have suffered. (Unclassified)

c. It is evident that while ATC's training responsibilities are more clearly defined, those assigned to ARDC are too general and subject to varied interpretations. Furthermore, training in support of flight testing is more properly the responsibility of ATC. Consequently, it appears that had more effective and continuous coordination been established between

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ATC and ARDC in the early phases of the GAM-77 program, training problems could have been reduced or eliminated. (Unclassified)

d. There appears to be a trend developing in certain ARDC Weapon System Project Offices to assume greater training responsibilities in support of flight test programs than presently envisioned by existing regulations. For example: the F-108 and B-70 Weapon System Project Offices appear to be strong proponents for greater Weapon System Project Office control in procuring factory training. Particularly since these weapon systems have been procured under a single contract weapon system manager concept. (Unclassified)

2. Weapon System Project Office - Air Training Command Coordination. Coordination and expected responsiveness between ATC and the Weapon System Project Office was not consistent with the emphasis required to support an accelerated program of this nature. As a result, the Weapon System Project Office was not regularly informed of potential training problems which precluded that office from taking appropriate action to assure timely training support of the program. The need for close coordination is accentuated by program compression where lead times are short and reaction time must of necessity be rapid. This cannot be achieved when the manager of the program, the Weapon System Project Office, is not kept informed of potential problems that could adversely affect the program. For example, The Weapon System Project Office was not aware of the following: (Unclassified)

a. Lack of firm contractual coverage on the training preparation and trainer assembly contract. (Ref Page 21, Par 1) (Unclassified)

b. Lack of contractual coverage for classroom facilities. (Ref Page 22, Par 2) (Unclassified)

c. North American Aviation, Inc., stated concern about their ability to provide instructors for the Factory Training Program. (Unclassified)

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