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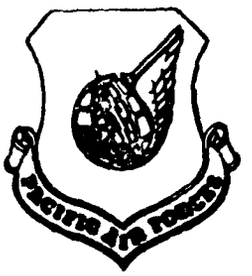

SYSTEM OPERATIONAL CONCEPT FOR THE AERIAL GUNNERY TARGET SYSTEM

PREPARED BY CONCEPTS DIVISION

DIRECTORATE OF JOINT MATTERS

DEPUTY CHIEF OF STAFF, PLANS, HEADQUARTERS TAC

21 NOVEMBER 1980

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DEPARTMENT OF THE AIR FORCE
HEADQUARTERS TACTICAL AIR COMMAND
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3 DEC 1980

SUBJECT: System Operational Concept for the Aerial Gunnery Target System

TO: SEE DISTRIBUTION

1. We are providing this System Operational Concept for the A/A 37U-33 Aerial Gunnery Target System for your information and use. The A/A 37U-33 is a recoverable, towed gunnery target equipped with a real-time acoustic scorer. The objective is to provide the tactical air forces with significant improvements in air-to-air gunnery training effectiveness.

2. Comments or recommendations for revision of this concept should be sent to HQ TAC/XPJC.

EMERY S. WETZEL, JR., Col, USAF
Asst Deputy Chief of Staff, Plans

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System Operational Concept for the
Aerial Gunnery Target System

Readiness is our Profession

SYSTEM OPERATIONAL CONCEPT

FOR THE

AERIAL GUNNERY TARGET SYSTEM

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SYSTEM OPERATIONAL CONCEPT

FOR THE

AERIAL GUNNERY TARGET SYSTEM

SECTION I - INTRODUCTION

A. Purpose: This document establishes an operational concept for the A/A 37U-33 Tow Target as the Aerial Gunnery Target System (AGTS). It will be used as a basic reference from which detailed resource requirements and implementing programs can be derived. The A/A 37U-33 will be employed as a towed aerial target, for use by tactical fighter aircrews in developing and maintaining air-to-air gunnery skills. This concept outlines employment of the AGTS.

B. Background: An improved gunnery target (over the existing TDU-10B Dart) is required to increase the quality of air-to-air gunnery training and to provide a more effective operational test and evaluation target for aerial gun systems. In September 1976, Tactical Air Command (TAC) conducted an evaluation of a French developed target system. This system offered a significant improvement in training effectiveness over the current TDU-10B. Similar results were obtained during an Air Force Flight Test Center (AFFTC) test program September-November 1977. The system, with some changes, was determined to be adequate for operational use. The inventory tow target system will be United States produced with the changes incorporated. Subsequent testing in 1978 has resulted in satisfactory verification of an aircraft-mounted scoring receiver. TAC and Air Force Systems Command (AFSC), through system test and evaluation and operational use in gun system testing, have experience on the reliability, maintainability, and operation of this tow target system.

SECTION II - MISSION TASK

Tactical Air and Air Defense Forces require a realistic aerial gunnery target to support the operational test and evaluation of current gun systems as well as aircrew training in gun system employment in as realistic an environment as practical. A requirement exists for a highly reliable, durable target system equipped with an improved scoring capability. Program Management Directive No. R-P2007(8)/63232F, 23 March 1979, Advanced Aerial Targets Technology, directs the development of a new Aerial Gunnery Target System to meet the requirements of TAF ROC 308-76 and AFFTC TN 1901-73-03. The A/A 37U-33 Target System should significantly increase the quality and efficiency of air-to-air gunnery training. The significant areas of improvement over the TDU-10 Dart are: increased target reliability, better target survivability, a scoring system which provides the shooter with the number of hits after each pass, and more shooter sorties per tow target.

SECTION III - OPERATIONAL SYSTEM

A. Target System Description: A/A 37U-33 is a recoverable, towed aerial gunnery target, equipped with a real-time acoustic scorer. The target system consists of three major subsystems: a cable canister and tow line; a target module containing an acoustic scorer and fabric tetraplane; and a scoring receiver installed in the tow aircraft.

1. Cable Canister. The cable canister (approximately 7.8 feet long, 1.2 feet in diameter, and weighing 240 pounds) is attached and retained on the aircraft. This canister contains the nylon tow cable prior to system deployment, and provides an attachment point for the tow cable after launch. A device is incorporated at the cable attachment point to mechanize the release of the cable from the canister during the recovery sequence. The scoring receiver and antenna are mounted in the cable canister.

2. Target Module. The target module is attached to the tow aircraft, tethered to the tow cable, until reaching the gunnery range. Deployment is accomplished by releasing the module (using appropriate circuitry) and allowing it to extract the tow line from the cable canister (average time for complete deployment is 8 seconds). During the last several seconds of this sequence, an 18-foot long fabric mesh tetraplane is allowed to deploy, and is retained just aft of the module. Figure 1 shows the deployed module and tetraplane. The module is constructed chiefly of extruded aluminum and weighs approximately 115 pounds in an all-up configuration. The module houses an acoustic scoring package in addition to the tetraplane.

(a) Acoustic Package. The acoustic package located in the forward section of the module, consists of a nose-mounted microphone, transmitter, externally-mounted antenna and battery pack. The pressure changes caused by passage of supersonic projectiles are sensed by the microphone, superimposed on a 2,290 MHz carrier wave, and transmitted to the tow aircraft scoring receiver.

(b) Tetraplane. The tetraplane is constructed of nylon mesh, supported by a series of collapsible support arms. Prior to deployment, the collapsed tetraplane is stored in the aft section of the module. After deployment (at target module release from the aircraft), air loads force open the folded tetraplane support arms, forming a semi-rigid delta wing cruciform approximately 5 feet in breadth at the rear, tapering to a few inches at the nose. A radar reflector is fixed to the rear of the tetraplane.

3. Aircraft Cockpit Scoring System. Bullets scored by the target sensor are transmitted to the tow aircraft, which is configured with a receiver and a cockpit readout display. Two scoring volumes are selectable; either a 2 and 3 meter radius or a 3 and 5 meter radius. Following each firing pass the results will be displayed in the tow aircraft and relayed to the shooter using air-to-air radio.

4. Recovery. When target release is commanded, the tow line and target are released from the cable canister. The tow line and target freefall to ground where the system is recovered by recovery team personnel.

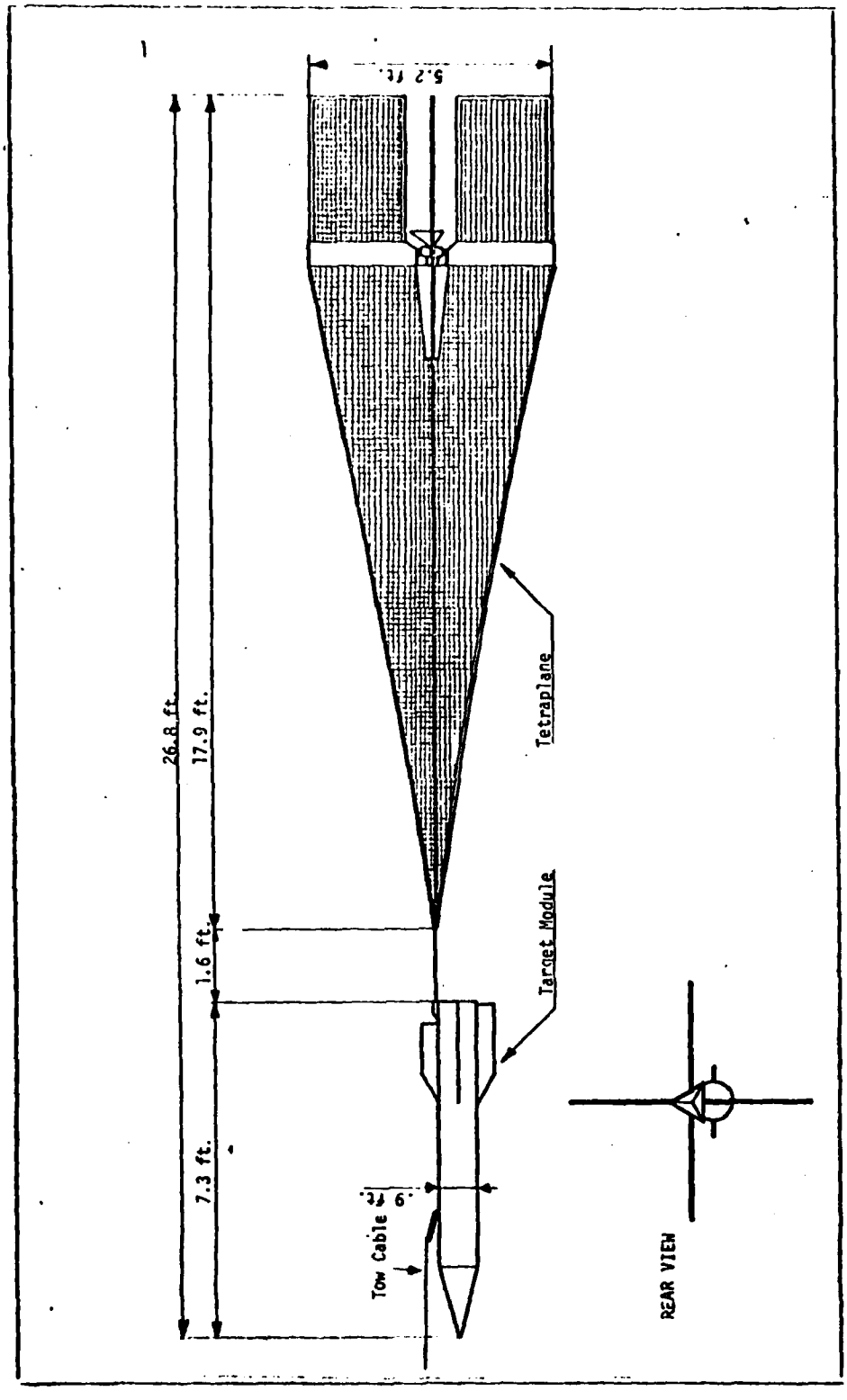

Figure 1. Deployed Target Module.

SECTION IV - OPERATIONAL ENVIRONMENT

A. Employment Environment: The A/A 37U-33 Aerial Gunnery Target System will be used as a simulator and as such will be operated in a non-hostile environment. Range environment for air-to-air gunnery will be the same as for existing tow targets. In operational training, the system will be used in accordance with appropriate major command 51 and 55 series manuals.

B. Recovery Environment: Maximum economy of operation requires the rapid recovery/reuse of most of the system components. Recovery will be made by cutting the tow cable over a designated drop zone. Specific weather minimums for recovery will be established.

1. Recovery in Airfield Environment. To facilitate timely target recoveries, recovery drop zones will be established within the airfield environment. The provisions of Air Force Manual 86-8, Airfield and Airspace Criteria, will apply. A Drop Zone Officer (DZO) will be designated to control all aspects of the recovery not associated with air traffic control responsibilities. The drop zone will be at least 500 ft by 2000 ft. Drop zones will be appropriately marked to preclude inadvertent entry during recovery operations. Drop zone approaches will be surveyed for hazards such as power lines, trees, and inhabited structures. During recovery, all personnel will remain at least 2000 ft from the planned impact point until after impact and clearance is given by the DZO to complete the recovery. Two-way radio communications will be necessary between the tow pilot and tower personnel. Drop zones should be located so that recovery operations will not interfere with normal airfield operations. It may be necessary for safety reasons to interrupt some flight operations during tow ship final run-in.

2. Recovery of Air-to-Surface Ranges. When recovery at the airfield is not possible, air-to-surface range areas will provide an alternate recovery site. Because of the remote nature of air-to-surface ranges and the danger of explosive ordnance in the surrounding target areas, recovery of the tow target will require detailed planning and timely execution to avoid interfering with air-to-surface training. If recovery at an air-to-surface range is required, an area outside of normal drop zones for practice ordnance will be the preferred location for recovery drop zone. During recovery, all personnel will remain at least 2000 ft from the planned impact point until after impact, and clearance is given by the DZO to complete the recovery. Approach corridors will be developed to allow delivery into the prevailing wind while preventing overflight of personnel and structures. Drop zone approaches will be surveyed for hazards such as power lines,

trees and inhabited structures. Specific recovery procedures will be incorporated into the operational directives for each range in accordance with Air Force Regulation 50-46, Weapon Ranges. Recovery operations will be scheduled to minimize conflict with air-to-surface training. The following table provides a comparison of distances that the tow plane would have to fly for recovery operations either at the airfield (air-to-air range to base) or at the air-to-surface range (air-to-air range to air-to-surface range to base). Distance must be considered to insure timely recovery and turn.

OPERATING AND RECOVERY LOCATIONS

Operating AF Bases	Air-to-Air Ranges (Distance Range to Base)	Alternate Air-to-Surface Recovery Ranges (Distance A/A Range to A/S Range to Base)
Edwards	R2502 Leach Lake (70 NM)	Leach Lake (70 NM)
Nellis	R4806 Dart East or West (46 NM)	Ranges 65 or 63 (46 NM)
Holloman	R5107B Yonder (32 NM)	Oscura (94 NM)
Seymour Johnson	W-122 (100 NM)	Dare County (185 NM)
Langley	W-386B (104 NM)	Dare County (210 NM)
Hill	R-6406 (70 NM)	Eagle (80 NM)
Eglin	W-151 (60 NM)	C-62 (80 NM)
Luke	R-2301 (80 NM)	Gila Bend (90 NM)
MacDill	W-168 (60 NM)	Avon Park (170 NM)
Homestead	W-174 (90 NM)	Avon Park (285 NM)

3. Recovery at Other Designated Areas. Specific local conditions may prevent incorporation of either of the two previous options. Drop zones may be designated on other approved federal land in the vicinity of the operating base. Special review and approval will be required by HQ USAF.

SECTION V - SCOPE

The first year's operation will establish usage rates and costs. From these data detailed schedules, budgetary costs, implementation plans, production plans, integrated logistics support plans, and operations plans will be developed for follow-on program implementation. The A/A 37U-33 must be operational beginning in FY 81. A/A 37U-33 procurement will provide a transition period of two to three years to fully replace current Dart operations. Initially, tow aircraft will be limited to the F-4. F-5, F-15 and F-16 compatibility test planning is under way and this capability is desired as soon as possible. Until tow compatibility is achieved with the A/A 37U-33, F-4 tow aircraft support will be provided from combat and training forces.

SECTION VI - EMPLOYMENT

A. Performance: A/A 37U-33 will be flown as a cooperative target representing a high performance threat subsonic fighter aircraft. The system is capable of being carried at 420KCAS/ .9M from sea level to 40,000 feet to the employment area. Once deployed, the target is capable of being towed to 500KCAS/.95M from sea level to 40,000 feet with up to 5 tow aircraft Gs.

B. Anticipated Tactics: A/A 37U-33 will be flown as a cooperative target for initial crew familiarization, progressing to a high evasive target for development of advanced skills. Gunnery attacks would be conducted as realistically as possible, not only to enhance training, but to improve tactics and techniques. Low angle (race track) and high angle (butterfly and combat dart) patterns will be flown.

C. Availability:

1. Operational Reliability. The target launch release system is significantly more reliable than the TDU-10 Dart. (Actual values have not been established. Goal is 95 percent at 90 confidence level.) The scoring system has operated reliably during the evaluations of the target system. (Actual values have not been established. Goal is 95 percent at 90 confidence level.)

2. Maintainability. The target preparation, system check-out, target recovery and system turnaround/download are easily accomplished.

D. Mission Scenarios:

1. Sortie Mix and Duration: Normally, there will be four shooters per tow mission at 1.5 hours/mission. Six or more firing presentations per tow mission is achievable based on previous flight results.

2. Mission Mix: Not a factor.

E. Utilization Rates: Table 1 provides projected shooter requirements at each operating location after the two to three-year transition period. Requirements are projected based upon four shooters per tow mission and a maximum usage rate of approximately three missions per target. Although this usage rate is applicable for some of the components that are more susceptible to bullet and recovery damage, it does not consider that most of the parts

are reusable after three missions. For example, the nosecone and all of the metallic parts of the forebody, except the fins, are reusable unless they sustain a direct bullet hit. Other examples are the electrical cables, transmitter and transmitter mounting bracket.

F. Force Structure: A/A 37U-33 will be integrated into operations of bases listed in priority order in Table 2. Each location will be established with assets sufficient to allow operations to meet initial monthly sortie goals prior to establishing the next location.

G. Command Support: Not a factor.

H. Survivability to Attack: The target is designed to sustain numerous hits and still maintain a stable flight path. It is repairable and capable of being reflown.

I. Payload: Not applicable.

J. Command and Control Communication: Not a factor.

K. Interoperability: Target must be compatible for F-4, F-5, F-15 and F-16 aircraft. Until F-5, F-15 and F-16 tow capability is achieved, F-4 tow aircraft support will be provided from combat and training forces.

L. Environmental Effect Factors: Establishment of airfield drop zones will require use of new aircraft approach zones and parameters.

M. Spectrum Considerations: Not a factor.

N. Standardization Considerations: Not a factor.

O. Security: Not a factor.

TABLE 1

LONG TERM (FY 80-86) ANNUAL REQUIREMENTS

	SHOOTER SORTIES	TOW SORTIES	TARGETS
AAC	990	249	83
PACAF	900	225	75
TAC			
Base 1	1214	304	102
Base 2	706	177	59
Base 3	900	225	75
Base 4	900	225	75
Base 5	554	139	47
Base 6 (FY 80)	369	93	31
Base 7 (FY 80)	1135	284	95
Base 8 (FY 81)	900	225	75
Base 9 (FY 82)	1154	289	97
Base 10 (FY 84)	1154	289	97
Base 11 (FY 85)	774	194	65
Base 12 (FY 86)	1154	289	97
USAFE	1636	409	137
OT&E			
AFSC	150	38	13
TAC (TAWC & TFWC)	250	63	21

TABLE 2

OPERATING LOCATIONS FOR TRANSITION (TDU-10 TO A/A 37U-33)

Priority	Type	F-15/16 Unit	F-4 From	F-4/AGTS Operating Base	Initial Monthly Tow Sortie Goal	AGTS Support Location	Remarks
1	Tng	49TFW	35TTW	Holloman AFB	11	Holloman AFB	
2*	Tng	USAFE	WTD	Decimomannu/ Zaragoza	11	Decimomannu/ Zaragoza	
3*	Tng	PACAF	3TFW	Clark AB	11	Clark AB	
4	Tng	1TFW	4TFW	Seymour-Johnson AFB	11	Seymour-Johnson AFB	When F-15 tow authorized, assets will be transferred to Langley AFB.
5	Tng	388TFW	474TFW	Hill AFB	11	Hill AFB	
6	Tng	33TFW	347TFW	Eglin AFB	6	Eglin AFB	
7	Tng	405TTW	58TTW	Luke AFB	11	Luke AFB	
8	Tng	AAC	18 & 43 TFS	Elmendorf AFB	11	Elmendorf AFB	
9	Tng	57TFW	474TFW	Nellis AFB	3	Nellis AFB	
10	Tng	56TFW	56TFW	MacDill AFB	3	MacDill AFB	

* Note: Priorities shown assume Operations/Support can be established outside of the CONUS early during the system introduction to TAF inventory. If problems are encountered (log support, freq authorization, etc), overseas introduction will be accomplished ASAP after resolution of difficulty.

SECTION VII - DEPLOYMENT

A. Use of Main Operating Base (MOB): The modernization of TAF forces is under way with F-15/F-16 aircraft. When target compatibility is established, target resources will be transferred (CONUS bases only) to F-15/F-16 units/bases. Subsequently, all tow sorties will be provided by the units performing the training.

B. Use of Deployment Operating Bases: Not a factor.

C. Bare Base: Not a factor.

D. Use of Training Bases: F-4, F-5, F-15 and F-16 crew training bases will employ the target system for initial crew training.

E. Dispersal, Hardening, and Mobility Requirements: Not a factor.

F. Basing to Include System Distribution and Configuration(s): See subparagraph A.

G. Command and Control Communications at Each Location: Not a factor.

SECTION VIII - SUPPORT

A. Manpower Requirements:

1. Staff Support. Not required.

2. Operations Support. Not required.

3. Maintenance. The Aerial Gunnery Target System manpower requirements per wing consist of eight 431X1s, TAC Aircraft Maintenance Specialists, and two 328X0s, Avionics Communications Specialists, broken out by grade and skill at each location as follows:

1	TSGT	43171
2	SSGT	43151
3	SGT	43151
1	A1C	43151
2	A1C	43131
1	SSGT	32850
1	A1C	32850

This number could increase as the local operating needs become more fully defined. Prior to beddown an initial training cadre will be established one quarter before unit beddown. The cadre will consist of:

1	TSGT	43171
2	SSGT	43151
1	SGT	43151
1	SSGT	32850

The cadre will be established at each location. Present indications reflect a January 1981 time frame for unit beddown. Future requirements may change, depending on recovery locations. The average distance from the recovery range to the main operating base is 80 miles. The longest distance is 150 miles. If recovery on air-to-surface ranges is required, manpower requirements may increase.

4. Security Police. Not required.

5. Base Operating Support. Not required.

6. Organization. This program does not affect the standard organizational structure.

B. Logistics:

1. This maintenance concept is written to comply with AFR 66-14 and is compatible with the Operational Concept to the extent that it has been defined. Since the A/A 37U-33 has been selected to fulfill requirements for the AGTS, the system will be treated basically as an "off the shelf" system in lieu of a new system under development. The concept will specify the general requirements anticipated to accomplish on-equipment maintenance, off-equipment maintenance and depot maintenance. For the purpose of this concept, on-equipment maintenance is defined as all maintenance requirements to include loading, removing, connecting, checking, testing and troubleshooting while the AGTS is located at or on the tow vehicle. Off-equipment maintenance is defined as that base level maintenance that is required to service, adjust, check, troubleshoot, mate, erect, store, inspect, and prepare in a location remote from the tow vehicle such as a shop environment. Depot maintenance is defined as that maintenance required at a location away from the using organization's facilities such as depot shops or contractor facilities. That maintenance which requires support from depot or contractor personnel, although at the using organization's facilities, shall also be considered depot maintenance.

2. The operational concept determines that there will be separate CONUS locations using and maintaining the AGTS. These locations will support operational requirements by providing tow targets for shooters coming to the tow location or by the tow aircraft and personnel being temporarily assigned to a distant location. This maintenance concept therefore will address identical requirements at these locations, although flexibility must be maintained so that locations can be supported that have unequal mission requirements and size.

3. Maintenance Environment. As outlined in the operational concept, there will be locations in the CONUS providing F-4 tow target aircraft. These locations will provide aircraft and base level repair for the target system and will provide east and west coast operational support. Deployed operations, similar to the F-5 aggressor training, are anticipated as the "worst case" (but realistic) support requirements. No maintenance other than loading and checking is anticipated during deployments. This would include removal and replacement of the microphone and battery, providing the target canister is otherwise serviceable.

4. Program Decision Factors. Since this is basically an off the shelf system, Rand M factors already exist and would

not therefore drive design. We accept as adequate the service life and reliability as specified in the contractor's maintenance concept but feel that they must be proven and met contractually.

a. Full Mission Capable Rate (FMC). Once the AGTS has been assembled, ready for installation on the tow aircraft, and checked for operability including the transmitter, the system should be capable of being loaded on a tow aircraft after 90 days in storage without further checks or preparation and be 95% fully capable of a successful mission at a confidence level of 90%.

b. Sortie Generation. As outlined in operational concept.

c. Mission Completion Success. Once loaded on the tow aircraft and verified operable, 98% of all missions must result in a successful deployment of the tow target operation of the scoring system and release mechanism, with a 95% confidence to be demonstrated by the 150th mission. A success rate of 7 out of 10 OT&E missions will be required.

d. Maintenance Personnel Per Unit. Additive personnel will be required to support the AGTS at the MOBs. As a minimum, 8 each 431X1 and 2 each 328X0s will be required at each location. This number could increase as the operational concept is more fully defined to specify concurrency of deployment tasking.

5. Data Collection Sources. Normal MDC, 00-35D-54 and a special mission success report in format to be determined by AFLC.

6. Support Equipment (SE). SE must be held to an absolute minimum whether CFE or GFE. SE will be specified for range recovery of jettisoned assets. SE calibration will be at least 180 days intervals.

7. Technical Data. All on-equipment maintenance tech data will be in job guide format comparable to MILM 83495 style and format. Off-equipment tech data may be presented in commercial format IAW MILM 7298C.

8. Packaging, Handling and Transportability. This equipment must be designed and designated to support requirements to transport assets from range recovery areas to the MOBs in such a way as to prevent damage and modes of transportation to include air, rail, and truck - both military and commercial.

9. Spares Support. Initial spares support list will be used to prestock parts required to support on and off equipment maintenance at using organization's base. Depot or contract maintenance performed at the using organization location will be provided unique supply support through its own channels. (Ref para B1.)

C. Training: Basic simplicity of the A/A 37U-33 system presents no unusual training requirements. The initial training currently required for the 431X1C career field will provide the necessary background to progress to the required skill levels with on-the-job training and a minimum of formal classroom training. An initial cadre for each location (four each 431XX and one each 328X0) should receive Type 1 training to cover on and off equipment tasks for base level requirements. Follow on training will consist of Type III.

1. Units requiring AGTS training should submit requests for special training (AF Form 403) to their respective headquarters for input into the Pipeline Management System.

2. Site MAT should determine if training can be accomplished under Consolidated Aircraft Maintenance Training (CAMT) Phase III concept. If CAMT can be used, MAT should develop training program and requisition applicable technical data.

D. Communications Support: Not applicable.

E. Intelligence: Not applicable.

SECTION IX - SAFETY CONSIDERATIONS

A. General: An effective, integrated safety program is vital to the successful operation of the A/A 37U-33 Target System. Safety requirements will be in accordance with Military Standard System Safety Program Requirements (MIL-STD-882A) and AFR 127-8, USAF System Safety Engineering Program.

B. System: System safety engineering studies and analysis will be oriented towards minimizing personnel injury and accidental system or equipment loss and damage. Envelopes will be established for all phases of operation to prevent damage to target system/ tow aircraft and will be strictly adhered to during development and employment. Specific fail-safe mechanisms will be designed to prevent inadvertent release or jettison and to insure proper deployment sequencing and recovery operations. Alternate jettison procedures will be designed to minimize loss of equipment. Munitions related items will be designed or modified in accordance with AFR 127-100.

C. Industrial/Occupational: System design and operation will be in accordance with existing standards to protect the safety and health of crewmembers and maintenance personnel. Ground operations during recovery of target equipment will be strictly controlled by designated personnel. Ground recovery personnel will remain at least 2000 feet clear of a Desired Impact Point (DIP) until impact. Recovery drop zone location will insure hazards to personnel and equipment are minimized. Provisions of AFR 127-101 and AFM 86-8 will be adhered to or waivers requested.

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20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This document presents the Air Force System Operational Concept for the Aerial Gunnery Target System (AGTS). The AGTS (A/A 37U-33) is a recoverable towed areal gunnery target equipped with a real-time acoustic scorer.

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