PROGRAM MANAGEMENT PLAN (PMP) FOR RAPID RUNWAY REPAIR (RRR)

15 APRIL 1983

AFESC

ENGINEERING AND SERVICES LABORATORY
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PREFACE

This document is a revision of the Rapid Runway Repair (RRR) Program Management Plan (PMP) dated 31 March 1980. The revised document is based on an information cutoff date of 31 March 1983, and has been prepared in accordance with AFSCP 800-3.

The purpose of this revised PMP is to update the information relative to RRR management activities within the AFESC Engineering and Services Laboratory. It is designed to guide and assist AFESC and other managers in coordinating and accomplishing the many diverse activities associated with improving RRR capabilities. Comments, additions and critique on this draft document should be provided to the Program Manager, Rapid Runway Repair Branch, Mr. James R. Van Orman, RDCR, Tyndall Air Force Base, Florida.

"THIS DOCUMENT SUPERSEDES RRR PMP DATED 31 MARCH 1980."

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1.1 OBJECTIVE AND SCOPE

~~1.1.1~~ The objective of the Rapid Runway Repair (RRR) Program is to provide the US Air Force the capability to recover from conventional weapons attacks on USAF runways and airfields, thereby permitting expeditious launch and recovery of operational aircraft. The RRR Program conceives, develops, tests, and validates: (a) methods, materials, and equipment to rapidly repair airfield pavements following an enemy attack; and (b) designs of alternate launch and recovery surfaces. This program is not expected to produce a single, unique solution, but rather several validated concepts and solutions which can be used in combination to significantly improve USAF readiness posture.

~~1.1.2~~ The scope of this program is limited to development, testing, and fielding of civil engineering techniques to repair paved surfaces, to improve unpaved surfaces, and to create required support to allow aircraft operations from the surfaces in spite of threat attacks. Modification to aircraft will not be attempted even though such modifications may turn out to be more effective than extensive engineering of airfield surfaces. Class II aircraft modification will only be accomplished to support instrumentation sensing devices. ~~If~~ modifications seem warranted, they will be recommended for development at the HQ USAF level, in writing.

1.1.3 The capabilities to expeditiously clear unexploded ordnance (UXO) and to operate in a chemical and biological warfare (CBW) environment are required. R&D in these areas has been assigned to other organizations and will be monitored through exchange programs with explosive ordnance disposal (EOD) and CBW research and development organizations of the US Army, Navy, and Air Force.

1.1.4 The RRR Program responds to a complex problem requiring a systems engineering approach. A finite solution to the problem is not anticipated in the near future. A multiphased program with interim products is required. The program is designed so that interim improvement can be developed, validated, demonstrated, and employed by field commands before program completion. Total USAF RRR capability will be improved as the program proceeds.

1.2 BACKGROUND

1.2.1 The described RRR Program is a follow-on to research and development efforts of the Air Force Weapons Laboratory (AFWL/DE), the Air Force Civil Engineering Center (AFCEC) and Det 1, ADTC Civil and Environmental Engineering Development Office (CEEDO).

1.2.2 The urgent need for this program is established in the Tactical Air Force Statement of Operational Need (TAF SON) 319-79, Postattack Launch and Recovery (SECRET/NOFORN). DOD Directive 1315.6, dated August 26, 1978, gives the USAF the responsibility for emergency repair of war damage to airbases.

1.2.3 In the international arena, NATO STANAG 2929 addresses the need for RRR and establishes overall requirements in this area.

1.2.4 Current USAF RRR capabilities were established against an airfield attack threat which has significantly improved over time. The TAF SON recognized the growing capability of potential enemies to damage USAF airfields. Consequently, there is a deficiency between current RRR capabilities to repair runways and the ability of the threat to cause damage to runways and other airfield facilities. Recognition of this needed improvement led to the creation of this R&D program.

1.2.5 Improvements stemming from the RRR Program have significantly upgraded the existing USAF capability to launch and recover aircraft following a non-nuclear airfield attack. Improvements included: (1) technology to assess airfield damage and select best operating strip within 80 minutes now, vice 210 minutes in 1978; (2) defined allowable roughness for F-4, C-141, and C-130 in 1982, vice none in 1978; (3) crushed stone with fiberglass covered crater repairs available in 1982, vice the need for costly and time consuming AM2 matting in 1978; (4) Silikal® scab repairs in 1982, vice none in 1978; (5) minimum operating strip (MOS) selection method for the F-4 available now, vice none in 1978; (6) thorough RRR interim guidance available now, vice incomplete guidance available in 1978; (7) improved equipment specifications available now as compared to 1978; (8) equipment hardening specifications available now as compared to none in 1978.

1.3 PROGRAM DESCRIPTION

1.3.1 This program was established to develop the capabilities that will permit the USAF to:

(1) Accomplish a limited number of mission aircraft operations (takeoff and landings) from a bomb-damaged airfield within one hour after the ALL CLEAR. This reflects needs stated in the referenced TAF SON and represents a realistic, achievable goal.

(2) Rapidly repair a sufficient portion of the bomb-damaged runway and associated taxiways, to allow sustained aircraft operations within a few hours after the initial attack.

1.3.2 The solution to the problem described in the referenced TAF SON requires significant improvement to current RRR capabilities.

1.3.3 A 9-year program had been planned from FY 78 through FY 86. Due to funding cuts the program was extended.

1.3.4 To accomplish the RRR goals, the program is divided into the following four technical areas: (1) Bomb Damage Repair; (2) Alternate Launch and Recovery Surfaces; (3) Surface Roughness; and (4) Technical Integration (which includes Postattack Environment).

1.3.4.1 The objective of Bomb Damage Repair efforts (Technical Area 1) is to develop methods to rapidly repair pavement damaged by the full range of conventional (non-nuclear) weapons (i.e., from cannon fire to large bombs). Various backfill and capping materials, equipment and techniques will be developed, tested, evaluated and validated.

1.3.4.2 Alternate Launch and Recovery Surfaces (Technical Area 2) will allow the best opportunity for immediate aircraft operations following an attack. The objectives of this area are: (1) to develop economical aircraft launch and recovery surfaces capable of supporting a limited number of aircraft passes that are independent of, and redundant to, the primary airfield pavements (runway, taxiway); (2) to develop a surface or system that would limit the damage from conventional weapons.

1.3.4.3 Closely related and supporting the above two areas is Surface Roughness (Technical Area 3). The objective of this technical area is the determination of the roughness limits for launch and recovery surfaces to prevent aircraft loss of control, structural damage, or loss of fuel stores and ordnance. This technical area includes the HAVE BOUNCE Program and development of Surface Roughness Criteria (SRC). The HAVE BOUNCE Program includes four distinct tasks: (1) develop a computer model that predicts aircraft response to roughness conditions; (2) determine failure criteria for the most critical/vulnerable aircraft components; (3) test an instrumented aircraft over simulated repair profiles and validate the computer model; and (4) recommend operating techniques and aircraft limitations that minimize adverse responses to roughness conditions. Upon completion of the HAVE BOUNCE Program, SRC is developed by performing parametric studies using the validated computer model.

1.3.4.4 Technical Integration and the Postattack Environment are essential elements upon which almost all else depends. The objective is to develop techniques to rapidly assess damage after an attack, and to develop a post attack action plan which states the timely actions that should take place following an attack. Also, under this task the EOD and CBW requirements associated with rapid runway repair will be identified to the agencies responsible for R&D work in these areas. R&D work by these agencies will be monitored to ensure that the RRR requirements are met.

1.3.4.5 The interrelationship of the four areas is shown in Figure 1. The main thrusts in the RRR Program are Bomb Damage Repair and the Alternate Launch and Recovery Surface areas. The other areas provide input and support necessary to accomplish the main thrusts.

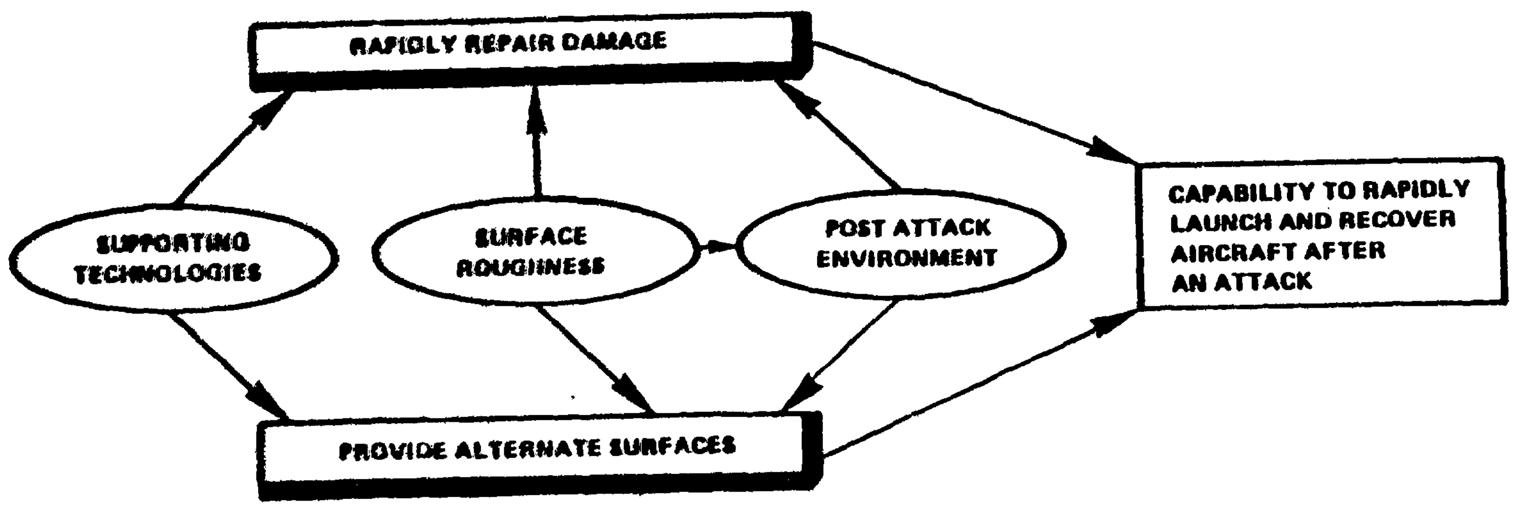

Figure 1. Interrelationship of Program Components

1.4 PROGRAM GOALS

1.4.1 Short-term goals to be accomplished in the FY 83-84 timeframe.

1.4.1.1 Bomb Damage Repair (BDR)

1.4.1.1.1 Advanced BDR System Phase I: Determine and improve engineering properties of previously identified advanced materials.

1.4.1.1.2 Advanced BDR System Phase II: Identify and modify equipment to place advanced materials (continue through FY 86).

1.4.1.1.3 Advanced Scab Repair System: Develop equipment to handle and place previously selected advanced concrete material for scab repair.

1.4.1.1.4 Water Compatible Materials: Determine engineering properties of water compatible materials that may have application to scab and crater repair.

1.4.1.1.5 Foreign Object Damage (FOD) to Aircraft: Measure debris lofting caused by F-4 nose wheel. Collect data on flow fields and engine susceptibility to damage from FOD. Complete F-4 and F-15 analysis.

1.4.1.1.6 Equipment Hardening: Develop, install and test hardening components for RRR equipment such as trucks, front-end loaders, dozers.

1.4.1.1.7 In-House Crater Repair Testing:

(1) Complete optimization of crushed stone repair method with FOD cover.

(2) Test different precast slab repairs for structural adequacy.

(3) Perform tests of advanced materials to support other efforts (continue through FY 86).

1.4.1.1.8 Equipment Evaluation: Test and modify commercial equipment to improve RRR capability (continue through FY 87).

1.4.1.1.9 Crater Repair Computer Model: Conduct sensitivity study of model and develop software to model alternative crater repair methods.

1.4.1.1.10 Review of New Materials: Test new commercially produced materials as possible replacement repair materials (continue through FY 86).

1.4.1.1.11 Water Compatible Materials Equipment: Identify and modify equipment to place water compatible materials (continue through FY 85).

1.4.1.2 Alternate Launch and Recovery Surfaces (ALRS)

1.4.1.2.1 Determine Redundant Surface Geometries: Analyze generic geometric criteria, and optimize redundant surface siting for selected airbases.

1.4.1.2.2 Develop a Rapid Installation Taxiway System: Determine dimensions and load capacities for portable taxiways that permit fighter aircraft movement around damaged pavements, to result in a taxiway system that can be rapidly installed.

1.4.1.2.3 Determine Tire Friction on Different BDR/ALRS: Measure the coefficients of friction between aircraft tires and candidate ALRS/BDR surfaces using laboratory tests.

1.4.1.2.4 Identify Pavement Failure Parameters: Determine mechanism of bomb-caused failure for layered pavements concentrating on penetration path and effects of layering. Once failure mechanisms are known, identify concepts for failure reduction.

1.4.1.2.5 Validate Soil-Aircraft Interaction Computer Code: Compare data from instrumented testing to predictions from computer codes. Adjust formulas in codes to allow accurate prediction of soil response to aircraft traffic.

1.4.1.2.6 Redundant Surface Development: Test and analyze stabilized soil, stone, and asphalt pavement materials for optimal construction of ALRS, within design criteria at minimum costs.

1.4.1.2.7 Validate Concept and Prepare Specifications for Construction of Redundant Surface: Test and validate stabilized soil, stone, and asphalt concrete redundant surface test sections for aircraft traffic testing.

1.4.1.2.8 Interaction Between Arresting Cables and Repaired or Alternate Surfaces: Determine interactions through sled track testing using tail hook and aircraft tire.

1.4.1.2.9 Concepts to Minimize Bomb Damage to Pavements: Determine the merit of concepts developed in FY 83 for hardening existing runways against bomb damage; also for redundant hard surfaces.

1.4.1.2.10 Evaluate New Concepts for ALRS: Investigate new concepts such as the use of geotextiles for application to redundant surfaces.

1.4.1.2.11 Plan for DT&E of ALRS: Complete planning activities and contract for construction necessary for full-scale ALRS demonstration.

1.4.1.2.12 Nondestructive Testing: Evaluate existing nondestructive technology for application to ALRS.

1.4.1.3 Surface Roughness (SR)

1.4.1.3.1 Develop computer model and determine critical components for the A-7, A-10, F-16, and F-111 aircraft.

1.4.1.3.2 Test the A-10 and F-16. (C-5A and F-15 tested in FY 82. A-7 and F-111 will not be tested due to financial constraints and to nonavailability of an F-111 test aircraft.)

1.4.1.3.3 Recommend operating techniques and aircraft limitations for the A-7, A-10, C-5, F-15, F-16, and F-111.

1.4.1.3.4 Complete data analyses and final report for F-15 and C-5A surface roughness criteria.

1.4.1.3.5 Complete SRC analysis and begin the reporting process for the F-16 and A-10.

1.4.1.4 Technical Integration (TI) and Postattack Environment (PAE)

1.4.1.4.1 Develop an airfield damage assessment concept, identify an R&D and acquisition strategy, and define the specifications for an airborne damage assessment system.

1.4.1.4.2 Exercise the MOS selection code. Evaluate the impact to optimal MOS selection by varying the parameters of the problem. Knowledge gained from this analysis will lead to more efficient procedures for MOS selection and aid the development of a final MOS selection software program.

1.4.1.4.3 Complete the Postattack Requirements Study and manual damage assessment system development. Publish interim guidance to the field.

1.4.2 <u>Mid-term goals</u> to be accomplished in the FY 84-86 timeframe:

1.4.2.1 Bomb Damage Repair

1.4.2.1.1 Continue review of new materials.

1.4.2.1.2 Continue advanced BDR system Phase II.

1.4.2.1.3 Complete water compatible materials program.

1.4.2.1.4 FOD to Aircraft: Conduct limited engine damage testing and F-16 analysis.

1.4.2.1.5 Procure validated materials and equipment for systems field testing in European demonstration.

1.4.2.2 Alternate Launch and Recovery Surfaces

1.4.2.2.1 Complete construction of ALRS at selected airbase in Europe.

1.4.2.2.2 Demonstrate use of full-scale ALRS at a USAFE airbase.

1.4.2.3 Surface Roughness Criteria

1.4.2.3.1 Complete reporting process for F-16 and A-10.

1.4.2.3.2 Complete data analysis and final report for A-7 and F-111.

1.4.2.3.3 Ensure data are available for use in pavement repair in Postattack Launch and Recovery (PALR) Development Test and Evaluation (DT&E).

1.4.2.4 Technical Integration and Postattack Environment. Improved damage assessment procedures and manual MOS selection will be available for use in early FY 84.

1.4.3 The overall technological risk to accomplish the short-term and mid-term goals is low. The technological risk to achieve the final goal is moderate to high, and major breakthroughs in pavement repair technology and alternate launch and recovery surfaces are required. However, as R&D is devoted to the chemical and physical relationships of candidate systems, improved capabilities via technology spinoffs are very likely and should provide a step function of increased capability with time. The overall buildup to a new RRR technology must be viewed as a continuously increasing function, with useful spinoffs to the field at intermediate phase points, and not as a single quantum jump in technology.

1.5 AUTHORITY

This program is directed by AFSC program direction (PD) numbers 63723-83-01, 28 October 1982, and 64708-83-02, 26 January 1983, that implement HQ USAF Program Management Directive (PMD) Numbers R-Q2162(1)/63723F, 10 September 1982, and R-P7103(5)/64708F, 3 December 1982.

1.6 PRECEDENCE

RRR efforts under Program Element 63723F, Project 2104, and Program Element 64708F, Project 2621, have a precedence rating of 2-7 (FAD II).

SECTION 2
INTELLIGENCE

2.1 IDENTIFICATION OF THE THREAT

The rapid repair of runways may be required due to damage caused by attacks from aircraft or surface (land or sea) launched weapons. Threat forces considered capable of such attacks include among others, the Soviets, Warsaw Pact nations, and North Korea. These attacks may include ordnance which significantly impacts rapid runway repair. Such ordnance could consist of mines, submunitions, chemical agents and unexploded ordnance. While other countries might also pose a threat, the Soviets and other Warsaw Pact members pose the largest threat in both quality and quantity. Nuclear weapons are specifically excluded as beyond the scope of this program.

2.1.1 Surface-launched weapons which pose a threat are:

(1) Rocket with submunition and chemical or biological warheads

(2) Surface-to-Surface ballistic missiles with submunition, chemical or biological warheads

(3) Cruise missiles with high explosives, submunition, and chemical or biological warheads.

2.1.2 Air-launched weapons which pose a threat are:

a. Delivery aircraft

(1) Aircraft of Tactical Air Armies

(2) Aircraft from Long-Range Aviation

b. Aircraft-delivered weapons

(1) Conventional general-purpose bombs

(2) Mines

(3) Submunitions

(4) Specially designed runway penetration munitions

(5) Rockets

(6) Air-to-surface missiles including cruise missiles

(7) Chemical and biological

c. Aircraft guns

2.2 IDENTIFICATION OF RELEVANT FOREIGN TECHNOLOGIES

Relevant foreign technologies in this area would be any new technique which a foreign power might develop to either (1) more rapidly repair a runway, or (2) operate more efficiently in adverse environments such as chemical, biological, or mine-infested areas. These technologies will be investigated on a recurring basis.

2.3 DOCUMENTATION OF INTELLIGENCE REQUIREMENTS

Continuous analysis must be maintained for new developments in runway cratering methods as well as associated chemical, biological, mine, and submunition technology. In addition, knowledge of foreign intent to use runway cratering or other runway attack techniques is essential. Recurring information exchange with intelligence support organizations will provide information on foreign capabilities and intentions.

2.4 REFERENCE INTELLIGENCE DOCUMENTS

The following documents contain information regarding the threat definition:

1. Threat Assessment Annex to TAF SON 319-79, June 1979 (S-NOFORN).

2. Warsaw Pact Airbase Attack, November 1979, (S-NOFORN).

3. Aircraft Armament Handbook (Characteristics and Performance) - Eurasian Communist Countries (U), DST-1360H-002-75, 14 Apr 76, Chng 18. (S-NOFORN)

4. Biological and Chemical Weapons Capabilities (Aerospace) - USSR (U), DIA ST-CS-03-70. (S-NOFORN)

5. Land and Air-Launched Cruise Missiles (Current & Projected) - ECC (U), DIA DST-1220S-014-76, 25 Jun 76. (S-NOFORN)

6. Defense Intelligence Projections for Planning, Soviet Military Forces, Sec IVB, General Purpose Naval Forces (U), S-4059/DE-1, May 77. (S-NOFORN)

7. Aerodynamic Missile Guidance and Control - ECC (U), DST-1330S-003-76, 15 Mar 77. (S-NOFORN)

8. Land Mine Capabilities (Current & Projected) Foreign (U), ST-CS-07-08-74, 15 Jan 74. (S-NOFORN)

9. Antipersonnel and Armor-Detecting Ammunition Guide - Eurasian Communist Countries (U), ST-CW-07-126-75, Dec 74. (CONFIDENTIAL)

10. Fighter Aircraft (Trends) Eurasian Communist Countries (U), DST-1320S-006-76, 27 Nov 76, DIA. (S-NOFORN)

11. Fighter-Launched Missiles (Current and Projected) - ECC (U), DST-1360S-020-76, 3 Sep 76, DIA. (S-NOFORN-WNINTEL)

12. Avionics Capabilities - Eurasian Communist Countries (U), DST-1700S-033-76, Chg 2, 27 Feb 76, DIA. (S-NOFORN)

13. Aerodynamic Vehicles (Designers) - USSR (U), FTD-CW-09-SE-70, 15 Jul 72, DIA. (S-NOFORN)

14. Weapons System Studies:

SYSTEM	SHORT TITLES (U)	DATE	DOC. CLASS
FRESCO	ST-CS-09-47-70	11 Sep 70	SECRET
FARMER	ST-CS-09-58-71	1 Dec 71	SECRET/NOFORN
FITTER A	DST-1320S-447-77	9 Aug 72	SECRET/NOFORN
FISHPOT	ST-CS-09-50-71	7 Apr 71	SECRET/NOFORN
FISHBED A-H	DST-CS-09-27-72-1320S-027-77	13 Apr 73	SECRET/NOFORN
FOXBAT	DST-1320S-031-75	10 Dec 75	SECRET/NOFORN
FIDDLER	ST-CS-09-7A-71	6 Feb 74	SECRET/NOFORN
FLAGON	DST-1320S-133-76	13 Sep 74	SECRET/NOFORN
FLOGGER	ST-CS-09-105-75	14 Mar 75	SECRET/NOFORN
FIREBAR	ST-CS-09-254-73	14 Nov 72	SECRET/NOFORN
VTOL FIGHTER	DST-1320S-282-75	12 Aug 75	SECRET
FITTER B/C	DST-1320S-448-75	8 Dec 75	SECRET/NOFORN

15. Communist-World Weapons Effectiveness, Selection and Requirements Handbook (U), DDB-2660-21-80, 1 April 1980, DIA. (S-NOFORN)

16. Fender Weapon System (U), DST-1320S-228-76, 17 March 1978, DIA. (S-NOFORN)

17. VGW Fender Weapon System (U), DST-1320S-448-78, 20 March 1978, DIA. (S-NOFORN)

18. FLOGGER Weapon System (U), DST-130S-105-78, 24 March 1978, DIA. (SECRET)

19. Air Threat to Central Europe 1978-1988 (U), ATC-PD-1300-073-078, Department of the Army: US Army Intelligence and Security Command, US Army Intelligence and Threat Analysis Center, August 1978. (S-NOFORN)

20. Warsaw Pact Capabilities Against the NATO Central Region (U), May 1972, HO USAF, ASCI. (SECRET)

21. Chemical and Biological Warfare Capabilities - ECC, Less USSR, Summary Report (U), DST-1600S-037-76, Jun 76, DIA. (S-NOFORN-WNINTEL)

22. Chemical and Biological Warfare Capabilities - USSR (U), DST-1600S-034-76, Supp 1 with Amendments A & B, Mar 78, DIA. (SECRET)

23. Defense Intelligence Projections for Planning Non-Soviet Warsaw Pact Military Forces (U), S-4081/DE-1, Jun 77, DIA. (S-NOFORN)

24. Defense Intelligence Projections for Planning - Soviet Military Forces Section IVC Frontal Aviation (U), S-4116/DE-1, Oct 77, DIA. (S-NOFORN)

25. Defense Intelligence Projections for Planning - General Purpose Forces, Section IV (U), S-4135/DE-1, Sep 76, DIA. (S-NOFORN)

26. Warsaw Pact Attack Scenarios Against Western Europe (Background Data, Annex 1 & 2) (U), DDI-1100-46-75, Nov 75, DIA. (SECRET)

27. Warsaw Pact Conventional Air Threat To NATO Air Bases, USAF/IN, 29 July 1977. (SECRET)

28. Soviet Armed Forces Tactical Air Support of Ground Operations (U), DI-210-38-73, Jul 73, DIA. (CONFIDENTIAL)

29. Soviet Non-nuclear Breakthrough Operations (U), DDI-100-75-76, Apr 76, AIA. (SECRET)

30. Soviet Exploitation of a Non-nuclear Breakthrough (U), DDI-1100-117-76, Jul 76, DIA. (SECRET)

31. Antipersonnel and Armor Defeating Ammunition Guide - Eurasian Communist Countries (U), ST-CS-07-126-75, Dec 74, DIA. (CONFIDENTIAL)

32. Aircraft Armament (Trends) ECC (U), DST-13605-046-77, 13 Oct 1976, DIA. (S-NOFORN)

33. Support Aircraft (Trends) - Eurasian Communist Countries (U), DST-1350S-018-76, 24 Jan 1976, DIA. (S-NOFORN)

34. Fighter Aircraft Handbook - Eurasian Communist Countries (U), DST-1320H-321-76, Chg 2, 30 Jun 1976, DIA. (S-NOFORN-NO CONTRACT)

35. Chemical and Biological Warfare Capabilities - European Communist Countries (less USSR) (U), DST-1600S-037-76, Summary Report, DIA. (SECRET)

36. Chemical and Biological Warfare Capabilities European Communist Countries (less USSR) (U), DST-1600S-037A-76-Sup-1, Summary Report, DIA. (SECRET)

37. Chemical and Biological Warfare Capabilities - USSR, (U), DST-1600S-034-76-Sup-1, DIA. (SECRET)

SECTION 3
PROGRAM MANAGEMENT

3.1 GENERAL

3.1.1 AFESC/RDCR is the program office with overall program management responsibility. Overall program direction flows from HQ USAF/RD and HQ AFSC/DL/SD to AFESC/RDCR. In addition, the Airbase Survivability System Management Office (AD/YQ) will provide coordination of efforts which contribute to meeting the requirements of the TAF SON 319-79. Aeronautical Systems Division (ASD) will manage the HAVE BOUNCE portion of the surface roughness area in accordance with the AFESC/ASD HAVE BOUNCE Memorandum of Understanding (MOU). Project HAVE BOUNCE will develop validated computer simulations of the dynamic response of fighter (F-4, F-15, F-16, F-111, A-7, A-10) and logistic (C-130, C-141, C-5) aircraft for operation over bomb damage repairs.

3.2 ORGANIZATION OF TECHNICAL EFFORT

3.2.1 To partially satisfy the requirements of the TAF SON 319-79, a Rapid Runway Repair Program has been established. The organizational structure of the program office is described in Section 10. The program office is under the direction of a Program Manager (PM) appointed by the Director of the Engineering and Services Laboratory. The technical area managers and a program integration director to manage program control and support functions report to the PM.

3.2.2 A balanced in-house AFESC and contractual development program is necessary to achieve significant technology improvements in RRR. AFESC will conduct in-house efforts and efforts with other government agencies and contractors. A RRR Engineering Services Support Contract (ESSC) will be implemented to provide maximum program capability and flexibility in all technical areas. The RRR ESSC permits tasking as work requirements are defined to assure proper resources are available to meet demands.

3.2.3 Alternate technical solutions will be evaluated with respect to capability and life-cycle cost analyses. The solutions that are most cost-effective will be selected as elements in the overall solution matrix.

3.3 SCHEDULE

3.3.1 The anticipated program progression for the technical areas is shown on AFSC Form 103 in Figures 2 - 5. These schedules indicate the major task efforts and the duration of each.

3.3.2 The primary thrusts in this program are the Bomb Damage Repair and Alternate Launch and Recovery Surface technical areas. The other two

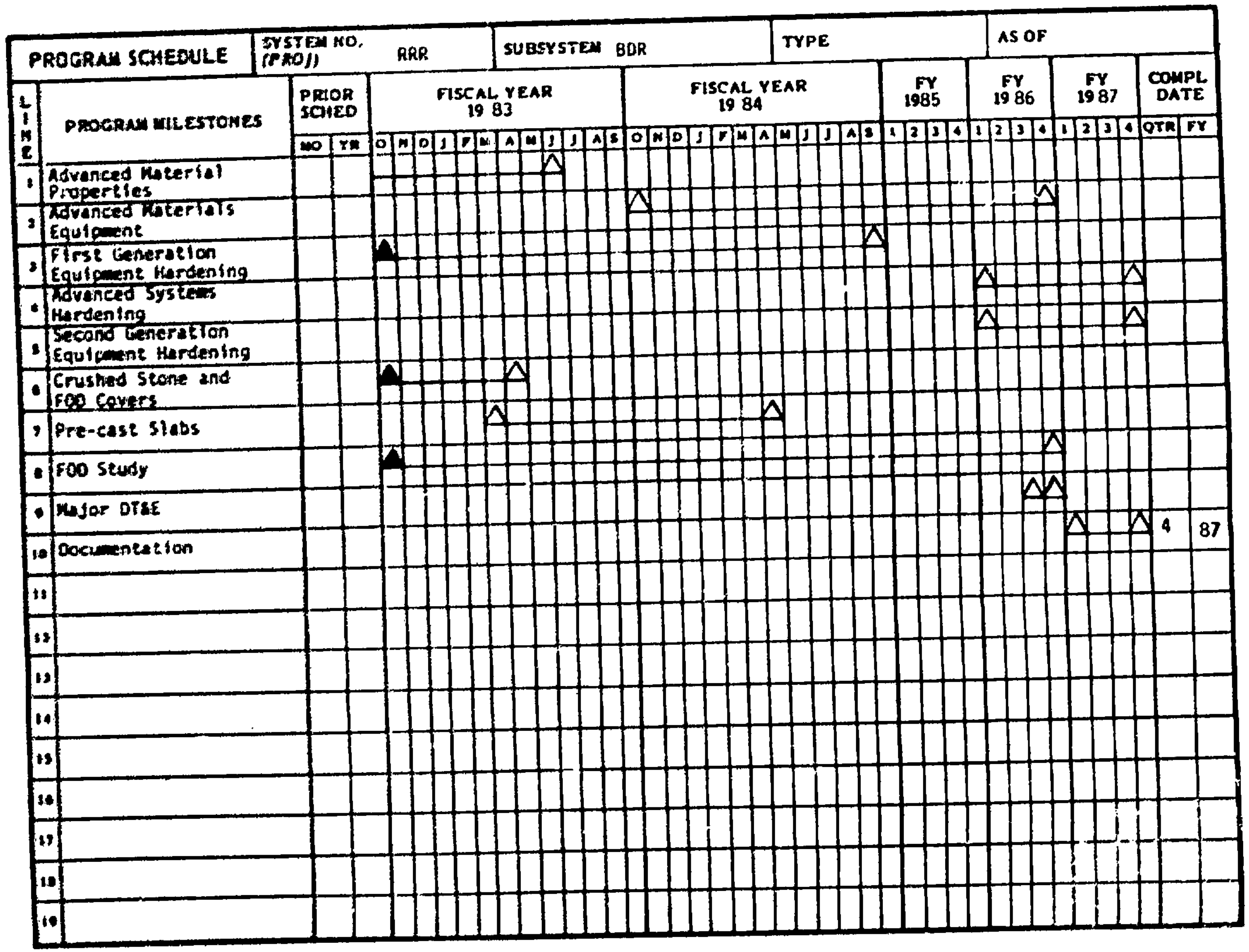

Figure 2. Program Schedule for BDR

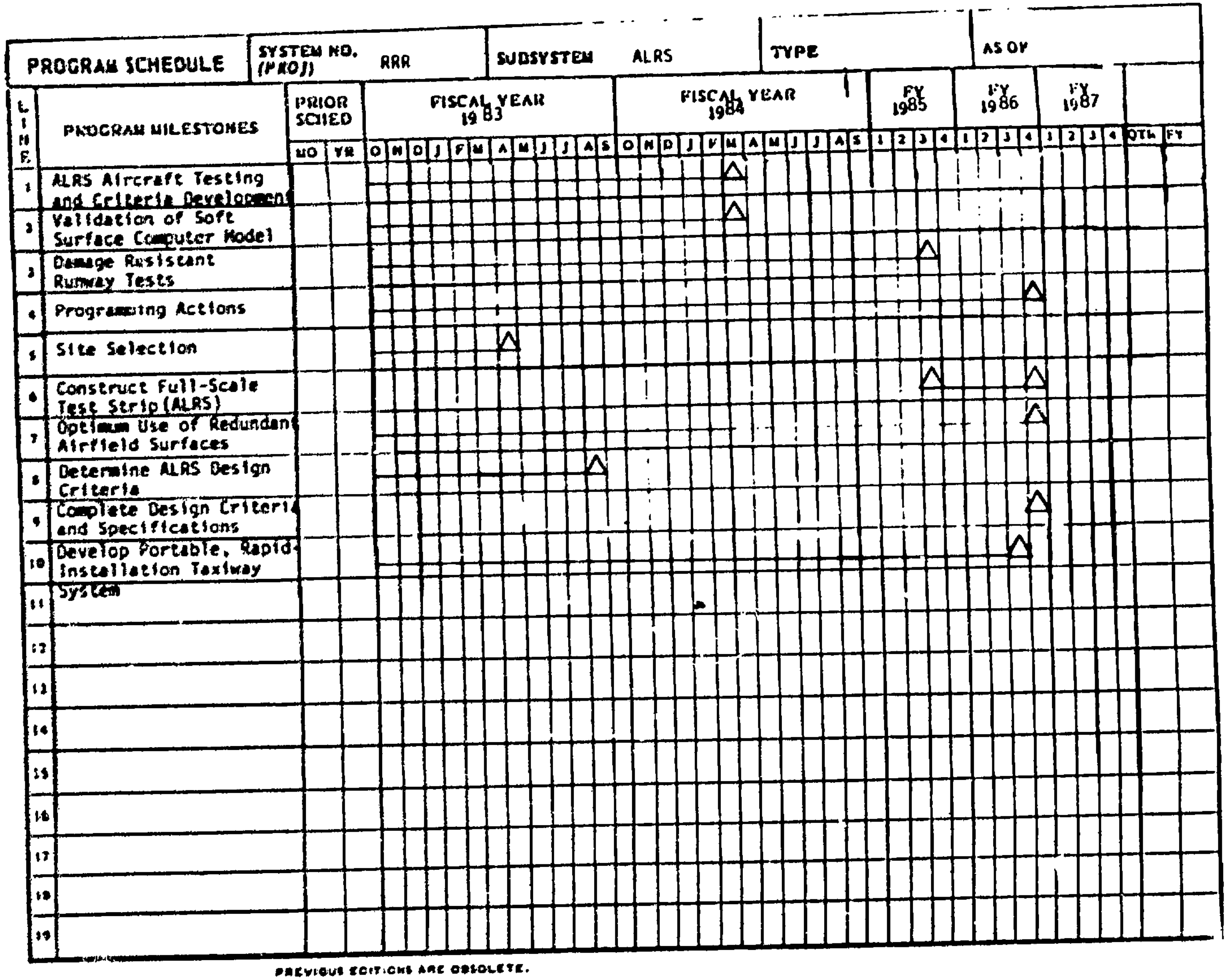

Figure 3. Program Schedule for ALRS

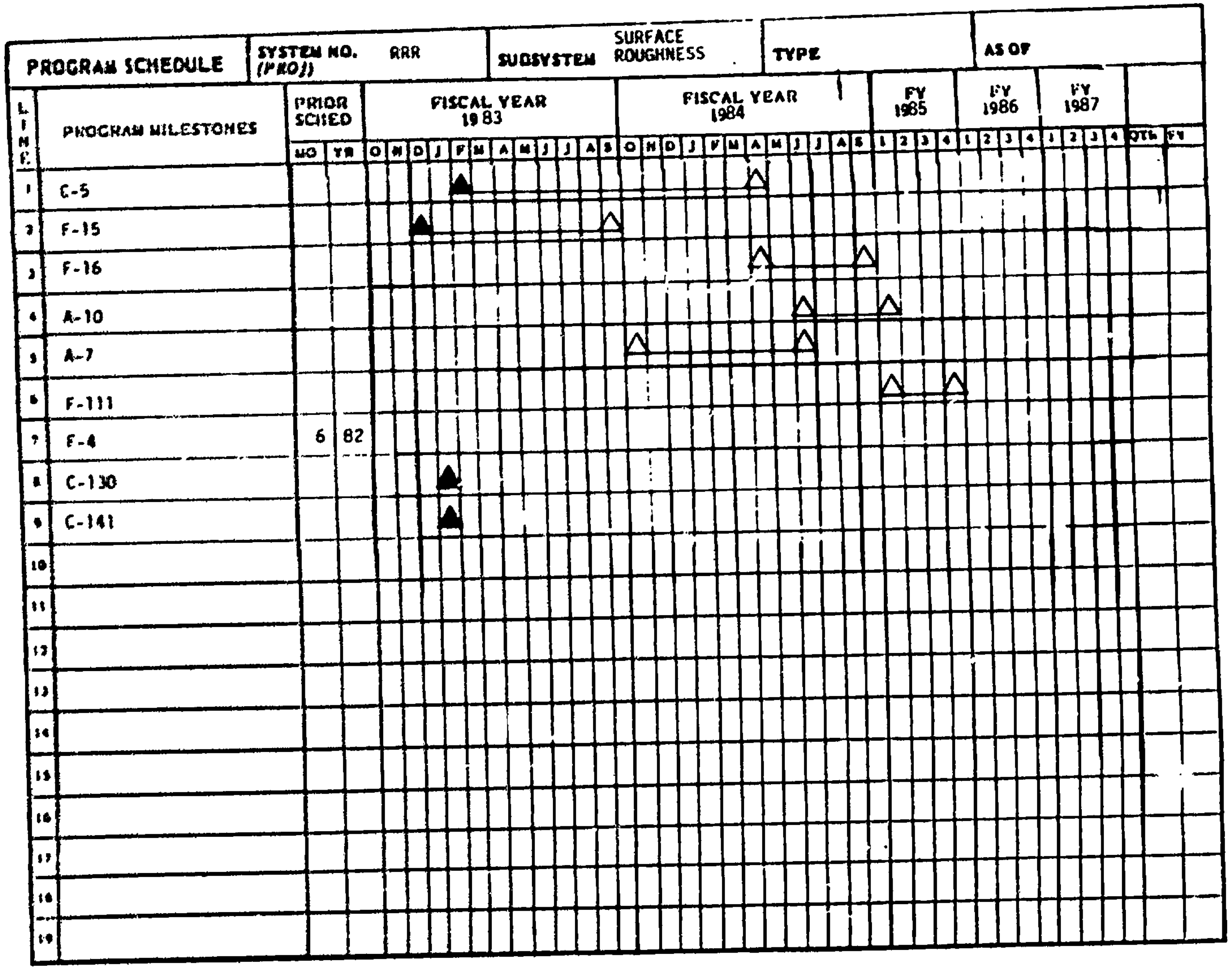

Figure 4. Program Schedule for Surface Roughness

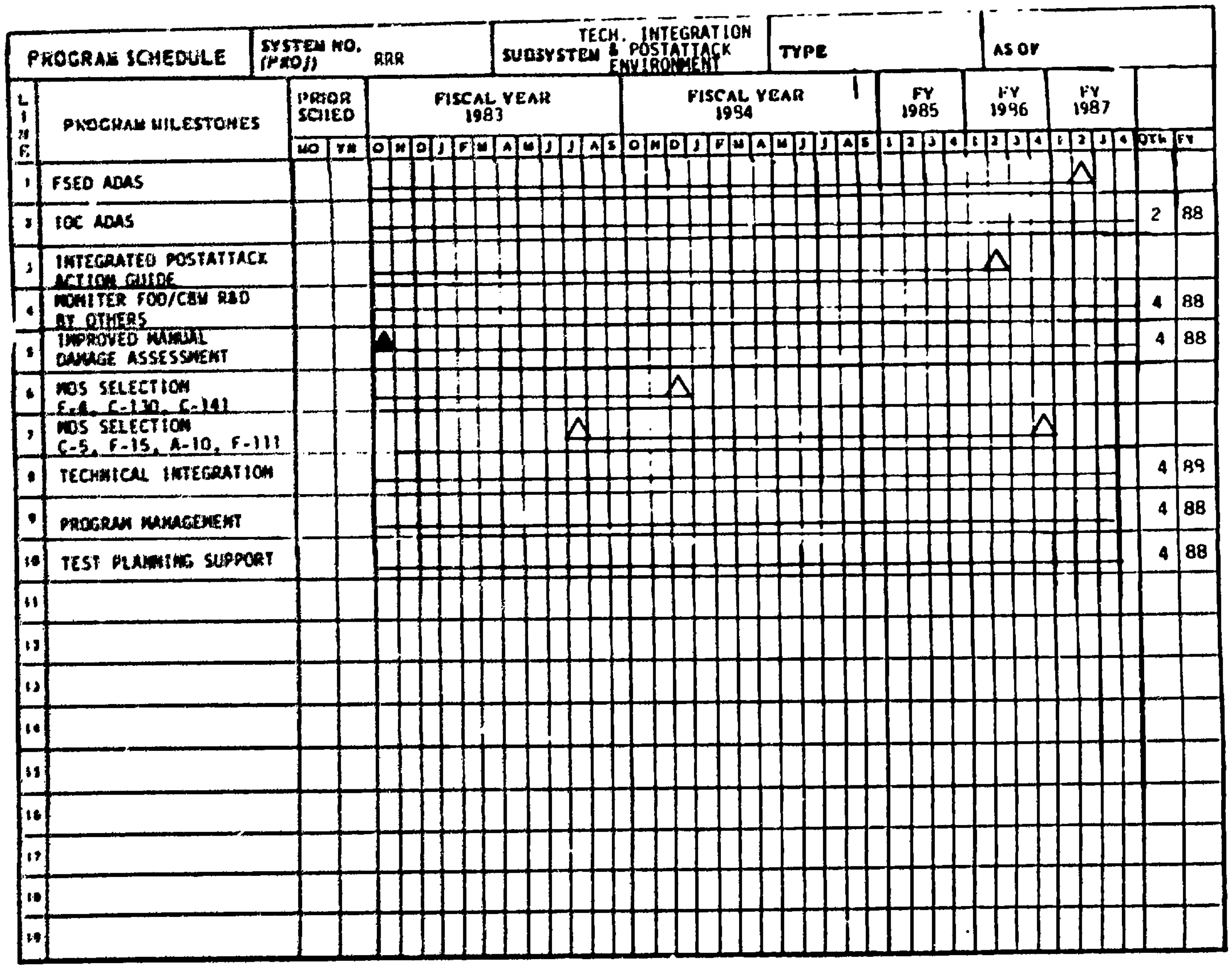

Figure 5. Program Schedule for Technical Integration and Postattack Environment

areas (Postattack Environment and Surface Roughness) will provide critical inputs to the principal areas. The program schedules show the most likely progression of the program, based on current knowledge. However, these schedules could change significantly, depending upon technological advances, funding, test results, and other factors.

3.3.3 The RRR Program must retain flexibility at this date because of the complex interrelationships between elements of the program and developing technologies. Therefore, schedules shown in this PMP may require periodic updating.

3.4 CONCEPT

3.4.1 No single repair method is expected to solve the total RRR problem. Instead, this program is expected to produce several solutions (or solution matrices) with each solution designed to solve a specific condition within the total problem. The RRR Program is designed to give the USAF a rapid capability to launch and recover combat aircraft following an attack that employs any mix of conventional (non-nuclear) weapons. The repair techniques and materials will be designed for an all-weather capability.

3.4.2 This program is designed to conceive, develop, test, and validate concepts, materials, techniques, and equipment to improve the overall USAF RRR capability. Where new equipment systems must be developed to implement the program such systems acquisition efforts will be transferred to the appropriate organization for full-scale development and production. Section 9 of the PMP describes the acquisition and logistical processes in greater detail. Responsible agencies for full-scale development and production will be as follows:

(1) Commercial, off-the-shelf equipment will be acquired by AFLC. AFALD/LWA is the point of contact.

(2) Modifications to inventory equipment will be accomplished by AFLC. Again, AFALD/LWA is the point of contact for initiating this work.

(3) Full-scale development and initial acquisition of new equipment will be accomplished by one of the AFSC product divisions. Concept validation models will first be fabricated and tested by AFESC. It is expected that most equipment in this category would then be transferred to ASD for full-scale development (e.g., damage assessment system, construction equipment, etc.).

3.4.3 Work efforts in this program will be accomplished through in-house efforts, the RRR ESSC, other contractors, and other government organizations. RDCR will coordinate with test agencies and major commands involved.

3.5 END-PRODUCTS

3.5.1 When completed, this program is expected to produce the following:

(1) Technology to rapidly handle repair damage from the full range of conventional munitions.

(2) New materials, prototype equipment, and vehicles for repair of aircraft operational surfaces, along with hardening packages.

(3) Repair manual that provides a selection of repair systems for various types of damage, repair times, aircraft type, and anticipated traffic levels.

(4) Surface roughness criteria for selected operational aircraft (F-4, F-15, F-16, F-111, A-7, A-10, C-130, C-141, and C-5).

(5) Design criteria for construction of alternate launch and recovery surfaces, including maintenance and repair procedures and periodic certification procedures for the surfaces.

(6) Rapid methods to assess bomb damage.

(7) Design criteria for the construction of damage resistant ALRS pavements.

(8) Postattack plan for minimum time to recover from an attack.

3.6 INTERRELATIONSHIPS

3.6.1 Participating Department of Defense organizations and agencies and their involvement in this program are as follows:

HQ USAF/RDQ /RDP /XOD	The Directorate of Operational Requirements/Directorate of Development and Programming are the HQ USAF focal points for overall planning and programming.
HQ USAF/LEE	The Directorate of Engineering and Services will provide coordination for program implementation and review.
AFESC	The Air Force Engineering and Services Center has overall program management responsibility.
HQ AFSC/DLW /SDN	The Air Force Systems Command has overall responsibility for developing the improved RRR

/TE	capability. DLW has primary management control over matters pertaining to PE 63723F. The Directorate of Operational Support Systems (SDN) has primary responsibility within AFSC for matters pertaining to PE 64708F. The Directorate of Test and Evaluation (TE) will ensure aircraft are made available for test phases requiring aircraft, and will monitor flight test activities.
AD	The Armament Division will provide technical services and computational support. In addition the Airbase Survivability System Management Office will interface with AFESC/RDCR on airbase survivability matters.
ASD	The Aeronautical Systems Division provides: a single focal point for all technical and management efforts accomplished by the ASD organizations; acts as project manager for HAVE BOUNCE; insures engineering management and technical support in specialty engineering problems such as ADAS and the soft soil model; provides periodic updates on the chemical/biological warfare matters; acts as project manager for the airborne damage assessment system development and initial equipment acquisition; assists in aircraft instrumentation and modification as necessary; and provides consultation services to AFFTC and AFWAL.
AFFTC	The Air Force Flight Test Center will serve as Responsible Test Organization for aircraft developmental field testing and will be responsible to ASD for any aircraft testing required for validation. ASD will provide testing requirements to AFFTC.
AFWAL/ML	The Air Force Wright Aeronautical Laboratories/ Materials Laboratory will serve as consultant to the program office in the area of materials development and application.
AFWAL/FI	The Flight Dynamics Laboratory will serve as the responsible technical activity on matters pertaining to total aircraft system dynamic response to operation on RRR surfaces. AFWAL/FI will also perform additional efforts deemed necessary to obtain the RRR end objective. AFWAL/FI will interface with and provide results of appropriate efforts to ASD, AFLC and AFESC.
HQ AFLC	The Air Force Logistics Command will serve as logistics advisor through the appropriate Management Division, as systems requiring specialized logistics support are identified. Also, in response to requirements

generated by ASD, the appropriate Systems Manager will provide analysis, maintenance, instrumentation, and other support for aircraft testing.

AFALD/LWA /PTET-OL	The Air Force Logistics Division will ensure that logistical concerns are addressed during the acquisition process. The operating office at Eglin AFB will help with logistical portions of the PMP, Test Plan, logistical support, and other efforts involving acquisition, fabrication, and modification of equipment.
HQ TAC/DR/DO USAFTAWC/THL PACAF/XP /DE USAFE/DOQ /DE	TAC, USAFE, and PACAF are the principal using commands. Each will generate user requirements and develop scenarios and tactics to assist in the development/evaluation of RRR. TAC is the lead command, representing USAFE and PACAF, and coordinating all operational requirements for the Tactical Air Forces (TAF). TAC is also the operational test and evaluation (OT&E) command. In coordination with USAFE and PACAF, TAC will appoint a Test Director for the OT&E of the final repair systems and alternate runway prototype launch surfaces. The RRR systems, for the most part, will be employed on airbases operated by USAFE and PACAF.
HQ MAC/DEP HQ SAC/XP /DE	MAC and SAC are other using commands. Each of these HO commands will appoint a representative from the planning staff who will represent the command in program reviews and who will be responsible to ensure that the unique requirements of the command are considered. They will also appoint a civil engineering representative to provide facility and civil engineering implementation interface.
NCEL	The Naval Civil Engineering Laboratory at Point Hueneme, California, has a major responsibility for airfield construction and repair for the Navy and Marine Corps. Their activities will be closely monitored for products useful to RRR.
NAVEODFAC	The Navy Explosive Ordnance Disposal Facility will provide current updates on their EOD program. NAVEODFAC will also provide consulting assistance to the PM on all matters related to ordnance disposal.
DET 63 (AFLC) DFEM	The Air Force Liaison Office at NAVEODFAC monitors progress of Project ORACLE which includes development of an area clearance blade to remove unexploded ordnance from runway surface.

WES	The US Army Engineers Waterways Experiment Station will provide engineering consulting assistance to the PM on BDR and ALRS. WES will also provide periodic updates on their own programs.
HQ USAFA/ DFEM	The US Air Force Academy will provide engineering consultation as required.
DET 2 AFTEC/ AFTEC/TE/XR	The Air Force Test and Evaluation Center will provide advice and assistance as required by HQ USAF on management of OT&E; provide OT&E inputs to HQ USAF PMDS; and monitor IAW AFR 80-14 specific OT&E as directed by HQ USAF.
HQ ATC/XPQ	The Air Training Command will ensure that the necessary training is provided to airbase civil engineering personnel on systems developed in the RRR Program.

3.6.2 Each Air Force organization identified in paragraph 3.6 will appoint a project officer to the RRR Program and will provide the name and phone number to the PM by letter. The appointed project officer will have the responsibility to: (a) successfully accomplish/monitor/follow-up efforts assigned to the respective organization; (b) ensure that the respective organization's interest is identified; and (c) provide coordination and liaison between the program office and his respective organization.

3.7 REPORTING REQUIREMENTS

3.7.1 RRR Program progress will be reported quarterly. Reporting will include status, problem areas and any special interest items. Program baseline requirements will also be followed where appropriate. Reporting requirements are also discussed in Section 4 of the PMP.

3.8 FINANCIAL

3.8.1 All funds for this program will be budgeted and managed by AFSC. Budgeting will conform to Program Baseline requirements and appropriate PMDs. In accordance with Comptroller policy, each organization will budget for and manage its own TDY funds.

3.9 CONTRACT SUPPORT

3.9.1 Procurement of contractor support will be of major importance in this effort. An Engineering Services Support Contract (ESSC) has been awarded to provide technical assistance and technical integration support. In addition, several other contractual efforts will be required in each technical area. Contracts may be multiple or sole source, and there will be agreements with other government agencies for the conduct of specific pieces of work. Advance acquisition plans and requests for Determination and Findings will be prepared where required.

3.10 PRODUCTION

3.10.1 Procurement of production items will be required by the RRR program. Production plans will be formulated when it appears that production of special equipment or materials will be required. These will be coordinated closely with the appropriate USAF agencies.

3.11 DATA MANAGEMENT

3.11.1 Contractor-generated data will be required in support of management engineering functions. Data requirements will be solicited and consolidated for contractual application in accordance with AFR 310-1 and TO-00-5-1. Pre-contract award reviews will be conducted to ensure the selection of only the data absolutely required to assure adequate program management.

3.12 PROGRAM MANAGEMENT RESPONSIBILITY TRANSFER (PMRT)

3.12.1 Systems developed under the RRR Program will be transferred in accordance with AFR 800-4 and AFSC/AFLC Supplement 1 with dates determined in concert with AFSC and AFLC.

3.13 RISK ANALYSIS

3.13.1 General. Due to the many facets of this program, efforts must be made to review and analyze program risks in technical performance, schedule, and costs. A systematic approach has been taken that consists of a regular review of each area. Additionally, frequent reviews are held by the PM. In these reviews, technical performance, cost, and schedule topics are covered. The PM will evaluate each effort described below to assure that the product contributes to reducing risks. The risk levels are defined below.

3.13.1.1 Low Risk - Basic technology exists. Major effort is adapting existing technology to the RRR problem and developing required designs and procedures.

3.13.1.2 Moderate Risk - Advance in technology is required. Precedence for such advance does exist, or it is a natural continuation of present trends in technology.

3.13.1.3 High Risk - Existing technology is inadequate and major advances in the state-of-the-art are required.

3.13.1.4 Extremely High Risk - Requirements are far in advance of existing technology. A major breakthrough in technology is required.

3.13.2 Bomb Damage Repair Technical Area

3.13.2.1 State-of-the-Art - Existing repair technology among NATO countries is limited to the simultaneous repair of three large craters (approximately 65 feet in diameter) from conventional bombs in four hours, and depends on the use of extruded aluminum landing mats or pre-cast slabs for surfacing. Individual countries' repair methods differ in type of landing mat, quantity and size of construction equipment, and backfill techniques, but the basic technology is the same. NATO considers repair of scab (spalled) areas, but the level of repair technology remains the same - steel plates bolted over the scab (spall) area.

3.13.2.2 Required Improvements - Significant improvements are needed if the 4-hour repair time is to be shortened. An improved capability must be developed to rapidly repair pavement damage from the full range of conventional weapons.

3.13.2.3 Risk - The estimated risk in improving the present repair times is shown in Table 1. For comparison purposes, it has been assumed that the future BDR equipment will also be sufficient to repair either three large or three small craters. The times shown are for repair only, and do not include time needed for damage assessment or EOD clearance or for adverse CBW environment.

3.13.3 Surface Roughness Technical Area

3.13.3.1 State-of-the-Art - Criteria do not exist that would allow adequate determination of aircraft capability to withstand roughness of the type encountered in bomb damage repair of airfields or on unconventional alternate surfaces.

3.13.3.2 Required Improvements - Criteria must be developed that defines allowable roughness and surface tolerances (surface roughness and rutting) for repaired pavements and on alternate launch and recovery surfaces.

3.13.3.3 Risk - Definition of criteria for existing repair methods with mats can be considered as a low risk research effort. Development of a set of general surface roughness criteria to include variations in surface roughness and rutting is a difficult dynamics problem and must be considered as high risk.

3.13.4 Alternate Launch and Recovery Surface Technical Area

3.13.4.1 State-of-the-Art - USAF bases have investigated and planned for constructing alternate launch and recovery surfaces in the past. This planning envisioned construction of ALRS facilities by widening and extending existing runway and taxiway systems, but was not carried out.

3.13.4.2 Required Improvements - Methods of preparing areas for possible aircraft traffic at reasonable cost need to be developed. Adaptation of

TABLE 1. ESTIMATED RISK TO IMPROVE CAPABILITIES BY 1988

	3 LARGE CRATERS	3 SMALL CRATERS	SCABS (SPALLS) (See Note 2)	BDR (See Note 4)	ALRS	POST-ATTACK ENVIRONMENT (See Note 3)
EXISTING CAPABILITY	4 HRS.	3 HRS. (Estimated: See Note 1)	NIL	AM-2 MAT	CONVENTIONAL WIDENING AND EXTENDING OF CONVENTIONAL SURFACES	4-6 HRS.
LOW TO MODERATE RISK	3 HRS.	2 HR.	1 MIN.	AM-2 MAT CRUSHED STONE	USE OF EXISTING TECHNOLOGY TO PROVIDE ALRS AND DEVELOPMENT OF CRITERIA FOR SUCH USE	COMPLETE POST-ATTACK PLANNING GUIDE
MODERATE TO HIGH RISK	2 HRS.	1½ HR.	½ MIN.	CRUSHED STONE PRECAST SLAB		AIRFIELD DAMAGE ASSESSMENT SYSTEM REQUIRING < ½ HR TO COMPLETE ASSESSMENT
EXTREMELY HIGH RISK	1 HR.	1 HR.	1/10 MIN.	POLYMER CAP AND ADVANCED MATERIALS	DAMAGE RESISTANT ALRS	AUTOMATED REAL-TIME ASSESSMENT SYSTEM

NOTE 1: a. EXISTING CAPABILITY FOR REPAIR TIMES FOR 3 SMALL CRATERS IS BASED ON RESULTS OBTAINED FROM SMALL CRATER REPAIR TRIALS AT TYNDALL AFB.

b. ASSUME TACTICAL AIRCRAFT ONLY. IMPACT OF LOGISTIC AIRCRAFT COULD ADD TO REPAIR TIMES.

NOTE 2: SCAB (SPALL) REPAIR TIMES SHOWN ARE FOR THE REPAIR OF ONE SCAB, ALTHOUGH MANY SCAB REPAIRS CAN BE DONE CONCURRENTLY.

NOTE 3: ASSUMES LIMITED EOD AND CBW PROBLEMS.

NOTE 4: RISK ANALYSIS BASED ON MEETING SURFACE ROUGHNESS CRITERIA existing technology, such as soil stabilization, can be used effectively. Advances are required to develop methods and equipment for stabilization of areas economically and to define aircraft capability to operate on marginal surfaces. Methods to construct surfaces that would resist damage by conventional weapons need to be investigated.

3.13.4.3 Risk - Adaptation of existing technology to provide alternate launch strips would be low risk research. Evaluation and development of criteria for aircraft operation on unconventional surfaces (stabilized or unstabilized) would be of moderate risk. Development of damage resistant surfaces would be of high risk.

3.13.5 Postattack Environment Technical Area

3.13.5.1 State-of-the-Art - Present methods of assessing airfield damage and defining an optimum repair plan are rudimentary and slow, requiring several hours to accomplish, even if the EOD and CBW problems are not severe. Existing guidance to the field for postattack planning is also very limited.

3.13.5.2 Required Improvements - The assessment of airfield damage and provision of an optimum repair plan must be accomplished in 30 minutes or less after an attack. In addition, a detailed postattack planning guide must be developed.

3.13.5.3 Risk - Development of a system to assess airfield damage and provide an optimum repair plan in less than 30 minutes is rated as a high risk. A postattack planning guide can be developed at low risk.

3.14 <u>INFORMATION</u>

3.14.1 As a matter of policy, no government or contractor organization will release any information concerning the development, test, or evaluation aspects of this program without prior approval of the PM.

3.15 <u>RSI IMPLICATIONS</u>

3.15.1 The need for coordination to achieve rationalization, standardization, and interoperability (RSI) in a NATO environment is necessary in this program. The PM through membership in NATO working groups will coordinate at that level. Interface with host nations and discussion of their contributions will be accomplished through discussion with TAC and USAFE and PACAF.

SECTION 4
SYSTEMS ENGINEERING AND CONFIGURATION MANAGEMENT

4.1 MANAGEMENT

4.1.1 The RRR Program will result in RRR systems that airbases can use to rapidly launch and recover aircraft following conventional enemy attack. The RRR systems will include as products the procedures, materials, and equipment items required. This section describes the management efforts required to transform TAF SON requirements into a system engineering framework of configuration and performance parameters, such that engineers and managers involved in system design, support, test and evaluation, and production will have an accepted and integrated framework with which to work. Program phases and program factors (such as reliability, maintainability, survivability, human factors, safety, and others) are to be integrated to produce optimal RRR systems. Definition and organization using systems engineering and configuration management will help insure compatibility between physical, functional, and program management efforts at all phases of the systems life-cycle.

4.1.2 The program goal is to satisfy the requirements of TAF SON 319-79. The operational concept is to provide the USAF a capability to: (a) launch combat aircraft within one hour following enemy attack using alternate launch and recovery surfaces; and (b) rapidly repair conventional bomb damaged pavements in order to permit sustained combat operations within a few hours after the attack. These general requirements contain implicit and explicit requirements which will require interaction and integration of numerous subsystems.

4.2 SYSTEM DEFINITION

4.2.1 The RRR systems combine procedures, repair materials, equipment items, and trained personnel to satisfy finite and identifiable requirements, each designed to integrate its components with those of the other subsystems so that postattack airfield recovery can be accomplished in a rapid, responsive, and cost-effective manner. Integration functions will be accomplished to coordinate the final product in terms of operational and support capabilities. Integration must consider both interim and final system capabilities which means that improved RRR systems must be viable with the current system as well as with other elements of the final system.

4.2.2 The RRR Program has two main thrusts. The first requires development of systems to rapidly repair aircraft pavements damaged by the full range of conventional weapons, or the bomb damage repair (BDR) technical area. Development of the BDR system requires improvements in the following areas:

(1) Equipment, materials, and procedures to repair craters and scabbed (spalled) areas.

(2) Equipment and procedures to excavate craters, remove damaged pavement, and clear debris.

(3) Materials and procedures, if required, to cover repaired areas in order to minimize the possibility of foreign object damage to aircraft.

(4) Procedures to integrate the above with each other and within the total RRR and airbase environment.

(5) Personnel training to allow accomplishment of all the above.

4.2.3 The second thrust involves development of alternate launch and recovery surface (ALRS) systems. These surfaces must be independent of the conventional pavements and must function as alternate runways and taxiways to provide the airbase with redundant operational surfaces for use during contingencies. They also serve to diffuse the focus and weaken the extent of threat attacks. These ALRSs will be low cost, designed for installation during peacetime conditions, and designed for a limited number of aircraft sorties. This aspect of the program requires development of:

(1) Methods, criteria, and plans to permit creation of the ALRSs on operational bases.

(2) Procedures, material, and equipment needed for portable rapid installation taxiway systems.

(3) Procedures to integrate the ALRS system within the total RRR and airbase systems.

(4) Personnel training programs to allow accomplishment of all the above.

4.2.4 In addition to the two main thrusts, the RRR Program has other areas requiring technical efforts to achieve improved capability. These fall into the areas of surface roughness, postattack environment, and program integration.

4.2.4.1 Surface roughness requirements will provide allowable criteria for surface roughness after repairs have been made to conventional pavements or ALRSs.

4.2.4.2 Efforts in the technical integration and postattack requirements area will result in development of:

(1) Planning and control of development test and evaluation (DT&E) to prove the RRR systems.

(2) Procedures, equipment, and systems to satisfy postattack requirements, such as damage assessment.

(3) Methods to select the optimal minimum operating strip (MOS) to be used or repaired immediately after an attack.

(4) Procedures and guidance for performing under different environmental conditions in the postattack environment.

4.3 SYSTEM COMPONENTS DESCRIPTION

4.3.1 The general framework within which the total RRR system must function is one of constant readiness on each main operational base (MOB) in forward areas such as USAFE and PACAF. The system must be capable of use on a 24-hour day basis, under all weather conditions. The major subsystems, equipment components, and critical items that are to be developed are described in the paragraphs below. The descriptions include general capabilities and areas of interface of each. Components that are currently used for RRR functions and expected to be used in the developing RRR systems are not described in this section as adequate descriptions exist elsewhere.

4.3.2 The key components under development for the BDR technical area are:

4.3.2.1 Polymer materials to be used for crater caps. Polymer construction materials were selected because they are capable of achieving the flexural strength required to support operational aircraft passes in short setting times. They will be applied to the crater after backfill has been added. The material should have a long storage life under standard storage conditions, be relatively inexpensive, be relatively invulnerable to ambient conditions when placed, and integratable with existing or developing material mixing and dispensing equipment.

4.3.2.2 Materials for scab repair should be simple to place, and exhibit high strength after short setting periods. Characteristics should resemble those of materials for cap repairs to the greatest extent possible.

4.3.2.3 Water compatible materials are to be evaluated to see if they offer advantages for use in BDR.

4.3.2.4 New commercial materials will be reviewed for their applicability to the RRR system as they are developed.

4.3.2.5 Advanced material placement equipment for mixing and dispensing capping material must be capable of separate component storage, rapid and large volume mixing and dispensing, and have maneuverable dispensing mechanisms. It should be independently mobile or towed, have an internal power source, and be able to readily accept material component delivery from standard AF equipment.

4.3.2.6 The material placement equipment for scab repair should be mobile, be capable of rapid application and should be operable by one to two personnel. It should integrate the functions required for scab repair, such as removing debris, drying surfaces, placing or treating material. It should be relatively low cost.

4.3.2.7 Water compatible material placement equipment will be conceptualized when promising materials are developed.

4.3.2.8 Off-the-shelf commercial equipment will be evaluated as to its ability to rapidly perform specialized functions such as excavation of debris, removal of damaged pavement, and others. Excavating and concrete cutting items will receive special attention. The equipment will be evaluated as to its ability to reduce repair times and to readily integrate into the existing and developing operational and support system.

4.3.2.9 Equipment hardening concepts and kits will provide equipment items and operators protection from expected fragment and CBW attack. These will fit standard equipment items with minimal degradation of performance and will be easy to apply using standard tools and procedures.

4.3.2.10 The crater repair computer model will be designed to optimize expected repair procedures using variations of the critical path method. Modeling will be based on times and data derived from empirical observation and experimentation.

4.3.3 The key items being developed for the ALRS technical area are:

4.3.3.1 An evaluation of different concepts and materials to provide ALRSs. The ALRS must achieve sufficient strength for aircraft operations, and can include such techniques as asphalt work, hardened runways, site optimization and others.

4.3.3.2 Rapid installation portable taxiway system. This system will be designed so that it can be easily and rapidly transported to and installed in cratered areas that are needed to provide access to the MOS or ALRS.

4.3.3.3 Criteria to be used in development of ALRS. Criteria must include the geometries and the standards for initial application of ALRS, for postattack preparation for use and for damage repair, and other descriptions as required to permit full use of the surfaces.

4.3.3.4 Design specifications for ALRS materials and the ALRS, to include considerations of soft soil and aircraft tire response. Pavement failure modes and concepts to overcome them, and the interactions between the ALRS and barrier cable systems are also needed.

4.3.3.5 An investigation of new alternative materials and systems for ALRS, to include geotechnical fabrics. Such materials will provide the same capabilities as first generation ALRS materials, to include integration into the RRR systems.

4.3.4 Key components under development for the surface roughness (SR) technical area are:

4.3.4.1 SR criteria for the operational aircraft expected to use the repaired surfaces or ALRSs. Criteria will be developed that define conditions such that operational aircraft will not suffer damage during takeoff or landing on the surfaces.

4.3.5 The following describes the key components under development for the postattack environment technical area:

4.3.5.1 Development of an effective ground-based damage assessment system will continue. An airborne damage assessment system (ADAS) that permits speedy and accurate reconnaissance of the airfield immediately after the attack may be required. The system should be capable of determining location and extent of damage, UXO hazards, and other problems associated with base repair and recovery, and reporting such information to the survival recovery center or similar command and control organization. The system is expected to consist of an airborne sensor or observer linked to a ground analysis center than can assess damage while minimizing risks to personnel and equipment. The airborne system would operate from available aircraft.

4.3.5.2 A method for quickly determining the optimum minimum operating strip (MOS) to be repaired must be developed. It must be capable of using information provided by the ADAS or ground damage assessment systems and selecting the best option to achieve operational capability.

4.3.6 The program management and integration technical area will provide management and integration support between the different technical areas. It will also provide test planning support for developmental and operational testing.

4.4 SYSTEMS REQUIREMENTS

4.4.1 The general system requirements for RRR systems are developed from the TAF SON. Major requirement parameters are for speed of recovery, constant operational capabilities (24 hours a day, all year), application in expected climatic extremes, cost-effectiveness, capability to recover from all expected levels of conventional attack, and integration into existing airbase systems.

4.4.2 The specific systems requirements for each product in each technical area have not been defined beyond the levels of System Component

Descriptions (Section 4.3). As more detailed system requirements become available, they will be published.

SECTION 5
TEST AND EVALUATION

5.1 GENERAL

5.1.1 Test and Evaluation (T&E) is directed toward verifying concepts, procedures, and equipment that can be employed for RRR. T&E for RRR will include runway repair materials and equipment, alternate launch and recovery surfaces, application of roughness criteria, and the equipment and procedures for selecting the minimum operating strip. Development test and evaluation (DT&E) will play the primary role in evaluating the results of the RRR program. Operational testing will be conducted as required.

5.1.2 A variety of materials, equipment, vehicles, and techniques for rapid runway repairs and construction of alternate launch and recovery surfaces will be tested and evaluated. Allowable surface roughness limits will be determined and operational characteristics on unconventional surfaces will be evaluated.

5.1.3 Essentially, concepts for rapid runway repair and alternate launch and recovery surface systems will first be developed and studied analytically. This will be followed by laboratory tests, model tests, computer simulation, and field tests as appropriate to allow evaluation of concepts. Prior to completion of this program, a full-scale repair system will be established and an alternate launch and recovery surface system constructed. Both systems will be sufficiently tested to ensure program goals are met. A major RRR PALR DT&E will be conducted in Europe to test the full system.

5.2 TEST MANAGEMENT

5.2.1 HQ AFESC will be the Responsible Test Office (RTO) for DT&E. AFESC will conduct DT&E to demonstrate that engineering is reasonably complete and that design problems have been resolved. AFESC will appoint a test director who will be responsible for conduct of the test and will chair the Test Plan Working Group (TPWG). The TPWG will consist of representatives from each organization involved in the test program and will serve as a forum for T&E. It will establish the objectives and evaluation baseline and define organizational responsibilities. A primary function of the TPWG is to ensure the Test and Evaluation Master Plan (TEMP) is maintained current. The operational and participating commands, TAC, MAC, USAFE, PACAF, and ATC will provide support as required. AFTEC will monitor testing.

5.2.2 Organizational Structure

5.2.2.1 AFSC is the implementing command and is responsible for overall program management in accordance with AFR 80-14.

5.2.2.1.1 AFESC has been tasked to conduct the research, development, test and evaluation needed to satisfy the damage assessment, pavement repair, and alternate launch and recovery surfaces requirements of TAF SON 319-79 (within existing funding constraints).

5.2.2.1.2 ASD will manage the HAVE BOUNCE project using the AFFTC as the HAVE BOUNCE RTO. ASD will do full-scale engineering development for the airborne damage assessment system (ADAS). The RRR PM will provide funding and overall program management of these efforts, use the HAVE BOUNCE data, and be responsible for integration of the ADAS system into the RRR Program.

5.2.2.1.3 The Armament Division (AD) through the Airbase Survivability System Management Office will provide support to the RRR Program in areas of their expertise.

5.2.2.2 AFLC is a supporting command. The system managers in the Air Logistics Centers (ALC) will provide data and expertise on aircraft and aircraft engines in support of the RRR Program. The ALCs will provide data and procurement actions for rapid runway repair heavy equipment (compaction roller, front-end loaders, etc.).

5.2.2.3 Operating commands include TAC, MAC, USAFE, PACAF, and AAC. The operating commands will furnish equipment, personnel, and operational expertise required by the implementing agency to conduct the research, development, test and evaluation of the RRR Program. The operating commands are responsible for conduct of operational tests.

5.2.2.4 Participating commands include MAC, SAC, AFCC, AFTEC, and ATC. Participating commands will provide resources and expertise for conduct of DT&E and OT&E by the implementing agency and the OT&E commands. Details of these resource requirements will be identified in the TEMP and the detailed test plan.

5.2.2.5 AFTEC and the operating commands will serve as the OT&E commands in accordance with AFR 80-14.

5.2.3 Research, Development, Test and Evaluation Facilities

5.2.3.1 BDR test facilities include the AFESC explosive crater test facility and the small crater test facility at Tyndall AFB. Contractors' facilities will be used as well as government airfields, test centers, and other facilities.

5.2.3.2 Alternate launch and recovery surface development and testing will use the facilities at AFESC, WES, AFWAL/FI, and other selected sites.

5.2.3.3 Surface Roughness Criteria (SRC) will incorporate data from HAVE BOUNCE tests conducted by AFFTC. SRC will be incorporated into any aircraft validation tests performed.

5.2.3.4 Postattack Environment testing of the prototype damage assessment system (DAS) sensors will be conducted at Eglin AFB and at other locations.

5.3 CRITICAL ISSUES AND AREAS OF RISK

5.3.1 General. The complexity of meeting the RRR objectives requires several levels of testing. The small-scale test sites will be used for load carts to demonstrate various repair methods, materials, and techniques. In these tests, the critical issues are material performance under operationally realistic loads and traffic. Large-scale tests are necessary to demonstrate reaction to dynamic loadings, integration of activities, overall timing, and equipment performance. The DT&E and OT&E critical issues to be determined by test will be detailed in the test plans.

5.3.2 Research, Development, Test and Evaluation Issues

(1) Can a damage assessment system be effective and adequate to meet the requirement of the TAF SON?
(2) Is the manual MOS selection process adequate or will automated systems be required to meet the TAF SON requirements?
(3) Can runway repair capabilities meet the TAF SON timelines?
(4) Are C^3 procedures and equipment adequate for control of RRR?
(5) What is the most effective ALRS that can be constructed?
(6) What is the effect of CBW gear on repair times? Can the TAF SON requirements be met in CBW gear?

5.4 SPECIFIC TESTS AND OBJECTIVES

5.4.1 BDR materials and the equipment for laying these materials for crater and scab repair will be developed and tested. The BDR equipment will be hardened sufficiently to meet a defined threat. These materials and equipment will be developed and tested by AFESC, then will undergo acceptance testing and DT&E. The composite PALR DT&E planned for a Europe test site will be a basewide exercise including all the RRR tasks. This test will interface with the operational units and determine the degree to which BDR can satisfy the TAF SON timelines. USAFTAWC in coordination with AFESC and under the guidance of HQ TAC will be included in this system testing.

5.4.2 Alternate Launch and Recovery Surfaces will be developed and tested. The relative merits of different geometry for redundant surfaces will be analyzed along with an evaluation to determine optimum siting to minimize damage from air attacks. To support ALRS operations, a rapid installation taxiway system to permit fighter aircraft movement over or around damaged pavement will be developed and tested. Various surfaces and subgrades will be evaluated to determine optimum combinations. Cost is an important consideration. Test sections will be built for load cart and aircraft testing. These data will play a major role in final material and procedure selections. Analysis will be performed on tire friction and various materials interacting with aircraft. An instrumented F-4 trafficking selected soils will produce data for inclusion in a computer code designed to accurately predict soil response to aircraft traffic. Together, these development test and evaluations will result in a specification for construction of test sections of redundant surfaces on which aircraft traffic will operate. The interaction between barrier cables and repaired or alternate surfaces will be tested. This evaluation will be used as an input to specifications for a redundant surface built in Europe. The PALR DT&E should include operations of mission aircraft from this ALRS.

5.4.3 Surface roughness criteria will be considered in the damage assessment system, the selection of the MOS and in the BDR and ALRS planning. Therefore, tactical and support aircraft sensitivity to roughness must be determined. The TAF SON 319-79 identified the F-4, F-15, A-10, F-111, F-16, and A-7 tactical aircraft and C-141, C-130, C-5, DC-10, and Boeing 747 support aircraft for evaluation. To determine the runway roughness that can be allowed for these aircraft requires detailed simulation, validation, and analysis. Several simulation programs or models were developed to predict aircraft responses to surface roughness. These simulations are validated by comparing them with test data from the HAVE BOUNCE program. (HAVE BOUNCE data is generated by instrumented aircraft traversing representative repaired surfaces.) These data are then used to develop the SRC for BDR, BDR model, DAS, MOS selection, and ALRS. MAC, TAC, and AFSC will provide resources and operational expertise for conduct of the test and evaluation. R&D funds are not adequate to provide for full surface roughness criteria for all specified aircraft.

5.4.4 The postattack environment portion of the RRR Program covers the numerous immediate actions which must be taken after an attack. These actions involve procedures, equipment, and systems which must be tested. An interim and a mature airfield DAS will be developed and tested. The interim DAS will require considerably more time and personnel, and must undergo T&E to ensure it is functional. Procedures must be developed, personnel identified and trained, and the system regularly exercised to ensure readiness. The more advanced DAS will use an advanced sensor to feed a computer-based damage analysis program. The MOS computer program must be developed, tested, and validated. Manual MOS selection would not likely meet the timelines established in the TAF SON, but is necessary as an interim and backup capability. To support DAS and MOS selection detailed pre-attack planning guides, airfield repair plans, and RRR training and training kits must be developed, tested, produced, and exercised. This includes identifying the people, conducting the training and regularly exercising the system. It is essential that EOD be an integral part of each plan and be included in all training and testing. These many parts of the postattack environment area of RRR will be a critical part of PALR DT&E and could well drive the success or failure of RRR to meet TAF SON requirements.

5.4.5 PALR DT&E. The Air Force demonstration of RRR products, PALR DT&E, is planned for Europe. Each RRR technical area consists of many subelements or parts, each of which must be developed, tested, procured, shipped, and included in the PALR DT&E. Many levels of testing will be required to determine the effectiveness and suitability of these subelements and systems. These laboratory tests, field tests, acceptance tests, and DT&E will be detailed in the individual test plans. These detailed test plans will also include the criteria, the methods of test, and the threshold and goals of performance.

5.5 REPORTING

5.5.1 Reporting will be in accordance with AFR 80-14, AFM 55-43 and the tasking PMD, TEMP and detailed test plans.

SECTION 6
COMMUNICATIONS/ELECTRONICS

6.1 GENERAL

6.1.1 Command, control, and communications (C^3) capabilities are essential in order to meet the requirements of TAF SON 319-79. These capabilities should be evaluated during test and evaluation so that C^3 support is available as one of the fielded RRR programs. Enhanced C^3 capabilities can be realized given current inventory communications/electronics (C/E) equipment. Development of C/E systems will not be part of the RRR program although some changes in the type and quantity of standard C/E equipment may be required. Optimal C^3 for RRR will be determined through operational test and evaluation of the interface between RRR activities and systems. The following sections provide a conceptual approach for providing C^3 interfaces between RRR systems, to include estimates of types of C/E equipment components required. First, the final operational system, as expected to develop, is described. Then the anticipated C^3 and C/E requirements for test support are described, with the final section showing how C/E and C^3 must be integrated at the program management level. This progression permits understanding of the importance of C^3 to operational requirements.

6.2 THE OPERATIONAL SYSTEM

6.2.1 Fielding of C^3 and C/E for the improved RRR systems will take place within the operational and organizational structures described elsewhere in the PMP. C/E and C^3 requirements will be systematically developed and integrated using the process described in Section 4 of this PMP.

6.2.1.1 Responsibility for airbase launch and recovery capabilities rest with the Wing Commander, supported by the Base Civil Engineer (BCE). These individuals must have rapid and uninterrupted access to all agencies involved with base operations in a postattack scenario. This includes reliable and uninterrupted C/E links to the major organizations responsible for repairs to the runway. The Airfield Recovery Commander (ARC), who is responsible for all efforts leading to restored operational capabilities for the airfield, must have access to the Wing Commander and/or the BCE.

6.2.1.2 The ARC in turn must have uninterrupted C^3 capabilities with all his repair resources in order to insure expeditious repair of the MOS.

6.2.1.3 The MOS repair activities are expected to be based on an area concept whereby an area leader directs the repair of damage over a specific runway area. The area repair team leader is the focal point for all communication within the area repair team, to the ARC, and to the SRC if needed. The area leader commands and controls teams assigned him by the ARC. As repair progresses, team assignments may be reallocated, based on requirements communicated between the MOS area leader and the ARC. These leaders will probably be confronted with the greatest C^3 challenge. They may control numerous repair teams as well as other resources depending on the type and extent of damages.

6.2.1.4 It is anticipated that specialized teams will be used to support the general repair activities of the area repair teams. Leaders of these teams will be confronted with many of the same type challenges as area repair team leaders. They must be able to maintain constant contact with the ARC so they can quickly move to and accomplish their missions. Once in position, they must be able to direct their team and maintain contact with the BDR team leader, area MOS leader, and ARC, as required.

6.2.1.5 Proper C/E and C^3 resources are essential for all teams with postattack responsibilities. The repair environment is expected to be confusing, noisy, and hazardous. Certain elements of repair equipment will be masked by protective armoring measures, making the use of traditional command and control measures such as shouting and hand and arm signals difficult. An executable plan for control and communications of all repair elements in this type environment is essential. Such a plan must be supported by appropriate types and quantities of communications equipment and must be thoroughly practiced within the team and as part of the overall repair and airbase environment.

6.2.2 Teams involved in other phases of operational system restoration must also be given appropriate C^3 support. For example, damage assessment teams and MOS selection teams must have the means to quickly report information on the location and extent of damage and unexploded ordnance (UXO) or other munitions to a Recovery Control Center (RCC). This requires communications equipment to support several teams simultaneously. Throughout the repair process, there is a need to communicate with teams responsible for local or airfield security, and other teams performing various missions.

6.2.3 The quantity of equipment required in the damage repair phase is dependent on the size of the base, the extent of damage, and the number and types of teams in the repair organization. The types of equipment that can be anticipated include:

(1) Receive/transmit ground radios,
(2) Public address systems,
(3) Telephone and switchboard systems, and
(4) Short-range, man-portable radio systems.

6.2.4 Support for C/E resources will include storage facilities and maintenance requirements. These requirements are discussed in Sections 8 and 9. Storage areas must be readily accessible to repair teams on short notice.

6.2.5 Communications security is not expected to be a program development issue. Current inventory equipment will be used.

6.3 TEST SUPPORT

6.3.1 The full level of C^3 resources must be available during full-scale operational testing and validation. These resources must replicate the resources that would normally be available to the team in terms of quantity, types, and locations under actual deployment circumstances. C/E and C^3 requirements should be considered and exercised during limited developmental testing as well, so that problem areas for actual deployment can be discovered and corrected.

6.4 PROGRAM MANAGEMENT SUPPORT

6.4.1 Communications/electronics requirements are not anticipated for support of program management, except as required for test and evaluation.

6.4.2 Program management will insure that C/E resources used for RRR are integrated with other airbase and Air Force systems. For example, specialized NAVAID and air traffic control systems used for RRR must be compatible with existing systems in terms of operational signatures, support, and other requirements. Other C/E equipment used in the postattack environment and for systems integration may also require Air Force wide coordination and standardization.

6.4.3 The program management office will consider NATO interoperability and standardization in developing C/E and C^3 concepts for the RRR organizational setting.

SECTION 7
OPERATIONS

7.1 GENERAL

7.1.1 When operationally deployed, the RRR systems will improve the capability of the airbase commander to quickly restore aircraft launch and recovery capability after an attack. Although system development uses state-of-the-art technology in several technical areas, the fielded system need not be a high technology product. However, the system is complex and requires precise interaction between many people, components, and activities in order to achieve TAF SON 319-79 goals. Deployment of the operational system will require detailed coordination and interaction with operational commanders and their staffs, to include the Base Civil Engineer. Coordination must insure that support organizations and procedures conform to new system products. Especially critical are considerations of maintenance, supply and spare parts, organizational structure, personnel availability and skills, training, and command and control. Guidance contained in this section is the product of the implementing command; however, as more detailed input from the operating command becomes available, it will be incorporated.

7.1.2 A major characteristic with regard to operational deployment of RRR systems is that they will be fielded in increments over a period of years. Many products that provide interim improvements will be fielded as they complete development, testing, and validation. Operational integration of each product will require careful preparation and close coordination between the developer, the operational user, and the logistician.

7.2 MISSION

7.2.1 The operational mission is to provide the most efficient and timely capability to launch and recover aircraft after an attack on an operational airbase. The classified operational requirements related to this program are described in the Concept and Operations section of TAF SON 319-79. It calls for a capability to perform airfield recovery operations under environmental conditions expected at USAFE and PACAF main operating bases against modern threat airfield attack systems.

7.2.2 Missions implicit within the TAF SON document include the need to preserve the repair and recovery force during initial attack and reattacks. The recovery system must provide repairs that can support viable levels of aircraft operations in wartime. The system must not depend upon contractor or indigenous assistance for the repairs, but must be an all-encompassing military system capable of achieving all explicit and implicit missions.

7.3 LIMITATIONS

7.3.1 Air Force RRR capabilities are not designed for achieving permanent repairs to the airfield. The Army Corps of Engineers is responsible for permanent repairs to airbases. Air Force civil engineering assets (Prime BEEF teams, RED HORSE Squadrons) may be used for installation or construction of ALRS. These alternate surfaces are designed for use at operational bases and are not expected to fulfill requirements such as emergency means of providing expedient bare base launch and recovery surfaces.

7.4 DEPLOYMENT/OPERATIONAL PLAN

7.4.1 Deployment of the RRR systems will be achieved in an incremental manner as individual improvements are available. The RRR systems envisioned in this plan are expected to be available for USAFE and PACAF main operating bases by 1988.

7.4.2 The local operational commander should ensure that improvements in RRR be incorporated into base emergency planning as they become available. The plan should address BDR, ALRS, and general postattack recovery and include the coordination and interfacing required between organizations that have a part in restoring postattack launch and recovery capabilities. The plan should receive wide dissemination. Exercises of the operational system or its components should be based on the guidance contained in the plan, and shortcomings resulting from such exercises should be addressed and rectified on a high priority basis.

7.4.3 Repair systems should be prepositioned at selected bases and manned by the local Civil Engineering Squadron as currently done under AFR 93-2. Developing repair systems may require revision of AFR 93-2. Air transportability of the RRR package is desirable if it can be achieved at no expense to operational capability.

7.5 COMMAND/CONTROL/COMMUNICATIONS (C^3)

7.5.1 Command and control of the RRR systems will be the direct responsibility of the local operational commander. The full concept for RRR systems C^3 is presented in Section 6.2 of this PMP.

7.6 READINESS

7.6.1 The RRR systems must achieve a high level of operational readiness so that it can be employed at any time. Sufficient quantities of equipment, material, and personnel must be allocated to assure mission accomplishment in spite of enemy operations or other adverse circumstances. Sufficient training and exercises should be programmed to ensure that all personnel are capable of accomplishing operational recovery within specified time limits.

7.6.2 Personnel readiness to accomplish RRR functions must be maintained at all times. Procedures should be established by the commander to ensure that required personnel are available at all stages of alert. Readiness should be periodically assessed through exercises or training simulations.

7.6.3 Repair equipment should be operational in accordance with applicable directives and technical standards. Equipment readiness will be assessed through periodic exercises using standard availability criteria.

7.6.4 Material should be stored in conformance with applicable guidance and be readily accessible. Storage facilities must meet required environmental standards established in the ILS process or manufacturer specifications. Additional information on storage facilities can be found in Section 8.3 of this PMP.

7.7 OPERATIONAL TEST AND EVALUATION

7.7.1 Operational test and evaluation (OT&E) policies and procedures will be adhered to prior to deployment of any of the component parts of the RRR systems. OT&E considerations are addressed in Section 5 of this PMP. Detailed criteria, factors, and procedures are discussed in more detail in the RRR Test and Evaluation Master Plan (TEMP) (to be published).

7.7.2 In general, OT&E will be required for every product of the research and development program. It will not begin until DT&E for the product is complete and standards for that component product have been met. OT&E will be accomplished in a setting that simulates the actual environment as realistically as possible, without relaxing safety standards for personnel and equipment systems.

7.8 UNIT MAINTENANCE

7.8.1 Maintenance is a vital prerequisite for constant operational capability of the RRR systems. Responsibility for RRR systems maintenance, as for maintenance and operation of all other systems on the airbase, falls ultimately on the base commander. The BCE or other leaders of Prime BEEF, RED HORSE, and other civil engineering organizations down to the lowest level must supervise day to day maintenance. It is important that all leaders understand and adhere to RRR maintenance requirements for all RRR systems components.

7.8.2 Specific details of maintenance responsibility, criteria, and schedules associated with developing systems will be developed using the ILS process, based on developmental, manufacturer, and test and evaluation guidance.

7.8.3 The principal area of maintenance concern is for the equipment and materials which will be used to accomplish bomb damage repair and other activities associated with RRR. This includes hardening kits, NAVAIDS for

ALRS and similar RRR requirements, and other assets rarely used during normal operations. Another area of maintenance concern pertains to the operational status of pavements, alternate surface areas, taxiways, roads, and other routes which connect operational base facilities to each other. The upkeep of these primary and alternate base assets are principally a facility engineering function, yet they may also require periodic maintenance or emergency repair from RRR team elements.

7.9 SUPPLY

7.9.1 Responsibility for supply functions of the fielded RRR system lies with the operational airbase commander and his subordinates. The base Deputy Commander for Resources and his Supply Squadron Commander must coordinate with the BCE to ensure that appropriate components, end items, parts, and other supplies are available for RRR.

7.9.2 During development of RRR systems the developer should assemble and organize pertinent logistical data that can be used by logistical agencies. Data developed during research, product development, and testing stages can be used to formulate concepts and guidance to support operational and support organizations during operational testing and initial deployment. Most of the data will be documented in the ILS process.

7.9.3 Guidance on proper stockage and ordering procedures should be developed prior to deployment of the systems. An effective means of managing supply requirements for RRR components should be established. In the case of equipment items, the parts can be tracked using the appropriate Air Force inventory system. For certain engineering materials, it may be necessary to develop inventory methods which do not already exist.

7.10 METEOROLOGY AND ENVIRONMENT

7.10.1 Developmental activities will ensure that program materials, equipment, and procedures have all weather capabilities for their areas of operational deployment. Modifications may be needed for extreme climatic conditions of moisture or humidity, temperature, and combinations of these, such as frozen ground conditions.

7.10.2 An assessment of climatic effects on RRR operations has been conducted as part of the RRR Program. Pertinent data and findings from the analysis will be incorporated into appropriate guidance materials for deploying the final RRR product. This guidance will be contained in technical manuals for equipment, in individual and organizational training packages for personnel, and in procedural guidelines (such as a revision of AFR 93-2) for materials, procedures, and management functions.

7.10.3 The RRR Program considers chemical and biological warfare (CBW) agent effects in airfield attack by monitoring intelligence materials and developmental actions of research and development activities. The major impact on the CBW threat is most directly felt by personnel activities which in turn impact the procedures of RRR. To a limited degree, CBW impacts materials, to include components of repair equipment such as tires, paint, and others. Results of research and analysis in the area of equipment hardening and operator protection, and associated developmental activities, will help reduce such impacts.

7.11 TRANSPORTATION

7.11.1 The RRR systems must have the mobility to move to any part of the airbase requiring RRR efforts using either organic transportation or transportation means specially arranged and clearly specified in the operational plan. It is desirable that RRR systems be air transportable.

7.12 ORGANIZATIONAL STRUCTURE

7.12.1 The developing RRR systems may require changes in procedures, techniques, equipment, and training requirements when integrated in the final phases of development and testing. Changes required will probably emphasize modification of internal BCE structures and responsibilities in order to most effectively operate new equipment, emplace new materials, or implement new procedures.

7.13 PERSONNEL/MANPOWER

7.13.1 Personnel and manpower assets are critical to operational RRR capabilities. Systems analysis of mission performance versus time constraints can yield valuable insight into personnel requirements. Such analysis can help define the personnel quantities, grade levels, training requirements, and organizational structure. The current RRR structure as defined in AFR 93-2 can be used as a base from which to modify the personnel system using developmental and operational test and evaluation as the basis on which to justify changes.

7.14 OPERATIONAL TRAINING

7.14.1 Proper types of operational training must be provided at appropriate intervals to ensure appropriate skills for all personnel assigned RRR responsibilities. Many current operational training materials will remain valid for new RRR systems, where procedures remain fairly constant and there is little change in system products. In other cases, new operational training materials are expected to evolve from the special training materials used for test and initial deployment of recently developed RRR products. A more detailed discussion of training is provided in Section 11 of this PMP.

7.14.2 Guidance for training personnel for operational use of RRR systems should be initiated during system R&D. Guidance should consider the specific function to be trained and the status of personnel who perform the function (AF Specialty Code or additional duty). The operational user can then consider personnel turbulence, operational environment, and other factors that vary from base to base when formulating specific training and readiness requirements.

7.15 SAFETY

7.15.1 Applicable AF safety regulations and directives will be adhered to for all aspects of RRR systems development, test, and deployment. Contractors (R&D or manufacturing) will perform hazard analyses for deliverable items to identify and describe potential hazards in accordance with MIL-STD-882. Information on such hazards or safety requirements associated with system component use will be included in operational, logistical, training, and other documentation prior to operational deployment of the RRR systems.

7.16 FACILITIES

7.16.1 Guidance on facilities for adequate storage, maintenance, housing, testing and operational support of all components of RRR systems will be developed. Information and guidance for such facilities will be disseminated to operational commands as it becomes available to allow the operational command time to develop such facilities where needed.

7.16.2 Facilities used to support current RRR resources may be available and adequate for the new RRR systems. Section 8 provides additional detail on facility requirements.

SECTION 8
CIVIL ENGINEERING

8.1 GENERAL

8.1.1 Implementation of the RRR Program requires civil engineering site development and improvement activities during both developmental and operational stages. Site changes during system development will occur at test facilities to include one operational USAFE base. Operational deployment of the RRR systems at USAF bases is expected to require permanent changes to base structure and inventory of facilities for both BDR and ALRS programs, and will require Military Construction Program (MCP) funds. The real property improvements will require considerable lead time for programming, design, construction, testing, maintenance, and acceptance. Therefore, as real property requirements and criteria resulting from developmental products are identified, they should be coordinated with the using bases as quickly as practical.

8.1.2 It is essential that base real property facilities be available to support the different phases (development and testing, and operational deployment) and the different technical products in a timely and well coordinated manner. For purposes of this section, the technical products which may require facility support are categorized as follows:

(1) Products required for bomb damage repair activities
(2) Products required for ALRS construction and maintenance
(3) Products required for postattack environment activities, damage assessment, surface roughness measurements, integration of the recovery process, training materials, and other miscellaneous products.

8.2 MANAGEMENT

8.2.1 Real property requirements for developmental and testing use of government-owned facilities will be identified in the Test and Evaluation Master Plan (TEMP). Requirements are expected to have minimal impact on operational bases due to the limited scale of permanent site changes expected during test and evaluation associated with product development.

8.2.2 Responsibility for initiating dissemination of information concerning real property requirements for developing systems rests with the PM. Such information should be disseminated as soon as possible. The PM will coordinate real property requirements for RRR through the MAJCOM involved.

8.3 OPERATIONAL DEPLOYMENT REQUIREMENTS

8.3.1 Bomb Damage Repair (BDR) real property requirements are expected to include covered storage facilities for essential repair materials and some equipment items, secure outdoor hardstand-type storage for less environmentally sensitive materials and equipment, hardstand siting of other materials along airfield perimeters, and development of limited new taxiway and road systems as required to support RRR functions.

8.3.1.1 Covered storage facilities will be required for advanced materials. These facilities may require new construction such as storage tanks or silos. Requirements for underground storage of materials, either liquid or solid, may be desirable in which case pumps or conveyor systems will be required. Temperature and humidity regulating systems may be required for cost-effective, long-term storage of certain materials.

8.3.1.2 Enhancement of RRR capabilities is expected to require increased outdoor hardstand storage requirements. Hardstand facilities are anticipated for select fill materials where sources (quarries, rockpiles) are not otherwise readily available. Such facilities can also be used to house repair equipment. Hardstand areas for equipment and possibly high-value material may require fences, lighting, or other types of real property for security purposes.

8.3.2 Alternate Launch and Recovery Surfaces (ALRS) real property requirements may involve acquisition of non-government-owned property, but in most cases will simply require improvements to unused areas of the base. Requirements to reroute roads and utility systems, remove vegetation, or perform cut and fill operations may result from development of required ALRSs. These modifications may change drainage patterns, which will require engineering efforts to develop culverts, drainage ditches, or underground conduits.

8.3.3 Real property changes may also result from surface roughness, integration, or postattack environment activities. High value equipment and material items will require secure area storage or hardstand space. Storage space must be provided for RRR protective equipment and kits, MOS marking and NAVAID systems, decontamination equipment and similar items. Maintenance facilities will be needed for installing hardening kits and performing other functions. Development of these additional storage and maintenance facilities must be scheduled and funded at the earliest possible time.

8.4 DEVELOPMENT AND OPERATIONAL TESTING REQUIREMENTS

8.4.1 Civil engineering requirements for the test, evaluation, and product validation phases of the program will attempt to minimize negative real property impact on operational airbases. In general, these activities will be accomplished at contractor-owned or leased test facilities, or at government-owned test facilities. Most civil engineering efforts will use small-scale test beds and will not result in real property modifications. Pavements used for RRR BDR training can be left in the repaired state, returned to their original condition, or returned to equivalent levels of repair quality, depending on mission requirements. Areas changed as a result of ALRS efforts will probably be left in their improved condition or returned to their original condition. Considerable operational impact is expected for the airbase used for PALRS testing.

8.4.1.1 A variety of contractor test sites will be used to test and validate repair materials and some repair equipment.

8.4.1.2 Government-owned test facilities are more appropriate for large-scale testing operations. Examples are Eglin AFB, the principal site for Prime BEEF training; North Field, S.C.; Edwards AFB; and AFESC's facilities at Tyndall AFB.

8.4.1.3 Large-scale testing in a simulated CBW environment may require use of remote airbase facilities or the establishment of a permanent full-scale civil engineering training facility that permits realistic exercise of all RRR capabilities. An AF facility equivalent to the US Army National Training Center may permit exercise of all civil engineering and RRR functions in a realistic setting.

SECTION 9
LOGISTICS

9.1 MANAGEMENT AND PROCEDURES

9.1.1 General. The RRR systems being developed include equipment, material, personnel, and procedures. Although the specific equipment systems requirements are not yet fully described, equipment can be grouped into generic categories for ease of logistical support planning. The first category is the standard equipment already organic to the using commands, installations or units. The second category is the unmodified commercial equipment, not already organic to the user. The third category is commercial equipment not already organic to the user that requires major modifications. The fourth category is the developmental equipment not yet available. Similarly, the required material can be categorized as commercially available or developmental material.

9.1.2 Logistics management and planning must consider all system categories to ensure that they are logistically viable. Logistic support planning must be an integral part of the system design and system engineering processes for each RRR equipment or material system. This can be achieved through a realistic application of logistic considerations as a design parameter for developing equipment or as one of the principal criteria in the selection of commercial equipment. Application of the integrated logistics support (ILS) process will ensure consideration of all logistical parameters. ILS will apply to all stages in the life-cycle of the RRR system. DOD Directive 5000.39, Development of Integrated Logistics Support for Systems and Equipment, and AF Regulation 800-8, Integrated Logistics Support Program, provide the general policies and set the rules for applying ILS. Application of these documents will promote the acquisition of a system that is not only technically sound but is also cost-effective and logistically and operationally supportable. ILS must be tailored to the specific requirements of the RRR systems. Since the system includes various categories of equipment (paragraph 9.1.1), it is essential that the ILS program address the ILS elements as they pertain to each separate category of equipment and material. The management tool to ensure that all ILS activities are accomplished properly and timely is the ILS plan.

9.1.3 ILS Responsibility. The Program Manager (PM) is responsible for implementing the ILS program as part of the overall program acquisition process prescribed in the PM Directive and AF Regulation 800-8.

9.1.4 The AFALD/LWA, a field level organization, has the AFLC responsibility for acquisition logistics management and procedures. Its primary responsibility in the RRR system program is to:

(1) Help the PM identify and delegate program related logistics responsibilities,
(2) Help the PM prepare and issue ILS plans,

(3) Help the PM in conducting tradeoffs between design characteristics and operational, support, and manpower requirements,
(4) Develop and refine innovative support techniques, procedures and processes, and
(5) Provide general logistics assistance.

9.1.5 The PM will ensure that all major program documents are coordinated with AFALD/LWA. Documents relating to AFLC actions and requiring logistics participation in the program will be forwarded to AFALD/LWA for action.

9.1.6 This section serves as the Integrated Support Logistics Plan (ILSP).

SECTION 10
MANPOWER AND ORGANIZATION

10.1 ORGANIZATION OF THE PROGRAM OFFICE

10.1.1 A program office has been formed to accomplish the RRR Program. The program office is not a complete entity and does not have the resources and charter to accomplish all research and development, validation, test and evaluation, acquisition, integrated logistics, and other activities required to fulfill program requirements. The program office is managed by the RRR Program Manager (PM) who is directly responsible to the Chief of the Engineering Research Division within the Air Force Engineering and Services Center.

10.1.2 The organization of the program office is shown in Figure 6. Reporting to the PM are three technical area managers and a technical integration director.

10.1.2.1 The manager of each technical area and the technical integration director are responsible for work ranging from initial concept through analysis, laboratory testing, model studies, and equipment and material development, to concept field testing and validation.

10.1.2.2 The technical integration director is responsible for providing the overall program support, integration, and coordination functions for the program office. The technical integration director is also responsible for managing the efforts of the task order contract (see paragraph 3.2.2) and the Postattack Environment technical area.

10.1.2.3 Assistance in accomplishing procurement functions is the responsibility of AFALD/LWA. A procurement officer should be assigned to the program office to advise the Program Manager. This individual should advise and coordinate procurement functions.

10.2 ROLES OF OTHER AGENCIES

10.2.1 Relationship and roles of other agencies are discussed in paragraph 3.6.

10.2.2 RRR Program participating organizations' support requirements will be formalized by Memoranda of Understanding (MOU) prepared jointly by the program office and the supporting agencies.

10.3 MANPOWER REQUIREMENTS

10.3.1 AFESC manpower and that of all participating organizations denoted in the most recent HQ USAF Program Management Directive and AFSC program direction can provide the full support required. Armament Division provides advice on systems engineering matters to include reliability, maintainability, integrated logistics support, producibility, and technical

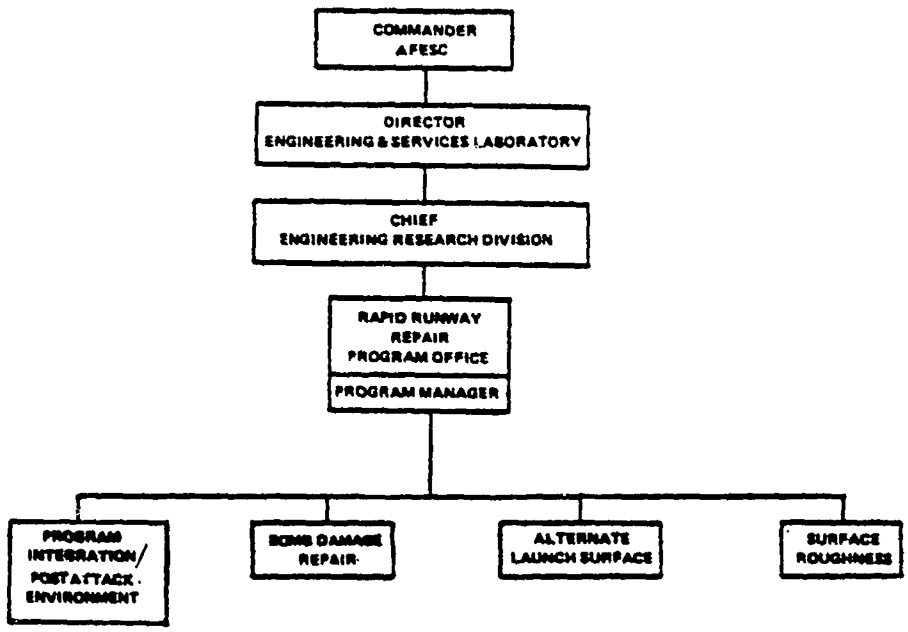

Figure 6. Program Office Organization Chart

data. The RRR Task Order Contract provides technical support and integration for the RRR Program.

10.3.2 The program as described in this PMP can be accomplished with available AFESC resources. Efforts described in the PMP will be accomplished with heavy reliance on the Task Order Contractor (TOC). There may be additional manpower requirements in the areas of acquisition and procurement and testing and evaluation as the program progresses.

10.3.3 Validation phases of this program will become highly labor-intensive, due to the large amount of in-house testing required. The expertise to accomplish such work as field tests using ordnance and tactical aircraft performance over various surface conditions does not exist outside the DOD. Most RRR expertise exists within AFESC due to past research efforts, field experience, and availability of existing facilities for the conduct of validation tests. Extensive coordination will be required between AFESC and external test organizations and facilities as RRR systems development progresses.

SECTION 11
PERSONNEL TRAINING

11.1 GENERAL

11.1.1 Personnel training must be developed to insure proper use of newly developed RRR materials, equipment, and procedures. Training development will conform to the Instructional Systems Development (ISD) process as described in AFR 50-8. Special training will be used for developmental and operational testing and initial deployment. This will permit incremental improvements in recovery capability, as individuals, teams, and organizations become skilled in working with new products and subsystems, until full operational capability is achieved. Training targeted at increasingly higher organizational levels will ultimately permit optimal accomplishment of the RRR mission. After full capability is achieved for RRR systems, regular training procedures and packages will be used to maintain RRR proficiency.

11.2 TYPES OF TRAINING

11.2.1 The types of training required to implement the developing RRR systems can be categorized as special or regular training. Special training as defined by AFR 50-9 will be used for test and evaluation (DT&E and OT&E) and for initial operational deployment of the new systems. It will be provided at the individual, team, crew, and organizational levels. Special training can be expected to evolve into regular training programs as the new systems are operationally deployed.

11.2.2 Special training of concern to the RRR Program falls into one of the following AFR 50-9 categories: Type 1, 2, or 4. Each is briefly described.

11.2.2.1 Type 1 training is provided to Air Force and other DOD personnel by contractors or factory representatives and is arranged by the Air Training Command (ATC). It may be conducted at the contractor's location or a DOD facility. Examples of this training that pertain to the RRR system may include:

(1) Operational and support management procedures and techniques training

(2) Depot overhaul and repair training

(3) Computer operator and systems analyst training

11.2.2.2 Type 2 training is usually conducted by ATC instructors at an operating location, usually to qualify initial cadres of operations and maintenance personnel assigned to crew or support a new or modified system.

11.2.2.3 Type 4 training is special or regular on-site training conducted by Field training Detachments (FTD) or Mobile Training Teams (MTT). These teams consist of ATC instructors temporarily assigned to provide training on-site at operational unit locations.

11.3 DETERMINATION OF SPECIAL TRAINING REQUIREMENTS

11.3.1 RRR Program special training requirements result from the need to complete developmental and operational testing (DT&E and OT&E) and initiate deployment of the RRR systems that have been conceptualized and developed to date. Special training must selectively provide equipment and material users with appropriate types and levels of skill. Once basic individual skills are achieved, the training program must integrate individual capabilities so that crew, team, and unit missions can be accomplished. Training design must establish realistic operational standards. The ISD process analyzes training requirements to establish realizable standards, conditions, and criteria to effectively test individuals and units. Management personnel must be trained to perform the supervisory and coordination functions essential to effective RRR and postattack recovery.

11.3.2 Major participants in the process of determining planning and coordinating training requirements for the RRR Program include:

11.3.2.1 HQ USAF has ultimate policy and planning responsibilities for special training matters.

11.3.2.2 Air Training Command (ATC) has responsibility for reviewing and validating of requests for training, and for assisting in the determination of the type of training needs associated with developing RRR systems. These must be communicated to the ATC to arrange appropriate special training for RRR.

11.3.2.3 The MAJCOMs have responsibility to plan, program, and control special training for their units. AFSC and TAC, as lead MAJCOMs for the RRR Program, must interface with development, acquisition, and support organizations to determine training needs associated with developing RRR systems. These must be communicated to the ATC to arrange appropriate special training for RRR.

11.3.2.4 The Acquisition Agency is responsible for acquiring system components and therefore plays a critical role in identifying training requirements for new equipment, material, and procedural systems. Responsiblities for acquisition for RRR are shared by AFSC and AFLC, depending on the type of acquisition. AFESC is closest to the problem and will therefore take the lead in planning and coordinating training requirements through AFSC. AFSC also provides technical guidance for airbase survivability, procurement, and integration training. AFLC provides input on training guidance for specialized logistical and maintenance support.

11.3.2.5 The Responsible Test Organization (RTO) is responsible for operational and developmental testing and evaluation of a new system. AFESC has historically taken the lead in testing of RRR Program components, to include preparation of training materials and programs, and is expected to continue in this role. AFFTC is RTO for aircraft test requirements and should provide training input to AFESC on requirements in that area. The RTO for system IOT&E has not yet been identified, but is expected to be TAC. It is important that test organizations understand the value of proper training and take steps to insure its availability prior to testing.

11.3.2.6 The Supporting Command for testing is the MAJCOM (USAFE) where full scale system testing and demonstration is expected to be conducted. The Supporting Command for system implementation will be both USAFE and PACAF.

11.3.2.7 The Supporting Unit is the host unit at the Air Force installation where training is to be provided. It has not yet been identified. It must be prepared to train appropriate personnel in the functions required to support the RRR systems.

11.3.2.8 The Using Unit(s) that will receive the RRR special training have yet to be identified.

11.3.3 Once special training requirements have been identified they must be programmed into the ATC request for fiscal year requirements. AFSC should coordinate training requirements internally, with other user MAJCOMs, and with other supporting organizations. Requests for planning, allocating, and controlling formal training will be sent through the Pipeline Management System (PMS).

11.3.4 Early evaluation of special training requirements for personnel involved in T&E and initial deployment is especially critical when planning or acquiring new RRR systems. Special training is required during the transition of such systems through the stages of research and development (R&D), test and evaluation (DT&E and OT&E), and operational deployment. RRR systems are in various stages of the process leading to operational deployment. Broad and identifiable training requriements for development, test and evaluation, and deployment in each of the four technical areas of the RRR Program are described below:

11.3.4.1 Bomb Damage Repair training requirements:

(1) Crushed stone w/FOD cover repair procedures
(2) Concrete cap repair procedure
(3) Scab repair procedure
(4) Structural cap placement equipment operations and maintenance
(5) Advanced materials handling
(6) Concrete cutting systems operations and maintenance
(7) BDR equipment hardening modification and installation
(8) BDR hardened equipment and operations and maintenance
(9) Excavator operations and maintenance

11.3.4.2 Alternate Launch and Recovery Surface training requirements:

(1) Repair and maintenance of ALRS systems
(2) Aircraft operating procedures on an ALRS
(3) Portable taxiway system installation

11.3.4.3 Surface Roughness training requirements:

(1) Use of surface roughness criteria in BDR

11.3.4.4 Progeram Integration (and Postattack Environment) training requirements:

(1) Damage assessment procedures
(2) Procedures for optimum selection of the minimum operating strip (MOS)
(3) Procedural modification based on climatic conditions
(4) Management training for postattack or other crisis scenarios
(5) C^3 of integrated recovery and repair functions
(6) Training for support of the RRR system components

11.3.5 As developmental and technical work progresses, technical area leaders should estimate and describe new training requirements through program management channels so that effective and timely training can be planned and developed.

11.4 REGULAR TRAINING REQUIREMENTS

11.4.1 Regular Air Force training requirements for civil engineering personnel are expected to develop as a result of this program. Coordination for these developments should begin as early after testing, selection, and initial procurement of developing materials and equipment, or after approval of new concepts and procedures. Use of materials developed for special training should be emphasized in order to make full use of lessons learned in actual test and deployment exercises. This should prove to be the most cost-effective approach to development of regular training programs.

11.4.2 It is anticipated that regular RRR training for Prime BEEF and other BCE individuals and units will eventually be conducted at Eglin AFB and Shepard AFB, as they are current BCE training sites. It may be desirable to give consideration to a training site dedicated to full scale RRR training, including aspects of EOD, CBW, and other essential RRR requirements.

SECTION 12
SECURITY

12.1 GENERAL

12.1.1 . Information directly affecting the USAF's ability to respond to a conventional attack will be generated in this program.

12.1.2 The equipment, materials and techniques developed in this program are not expected to require classification. The conduct of the R&D program itself is not classified; however, the requirements to accomplish certain elements of the program entail classified inputs.

12.2 CLASSIFICATION GUIDELINES

12.2.1 Information from this program will be classified in accordance with guidelines of AFR 205-29 and AFR 205-37 and the Security Classification Guide for Rapid Runway Repair Technology. OPSEC (AFR 55-30) will be considered in handling all unclassified material.

12.2.2 AFESC security, COMSEC and OPSEC monitors will periodically review procedures of this program to ensure applicable directives are being followed.

12.2.3 The PM will be responsible for preparing more detailed classification guidelines and DD Form 253, Contract Security Classification Specification, as required during the life of the program.

12.2.4 All release of information concerning this program will be reviewed and approved by the PM using the guidance contained in the Security Classification Guide for Rapid Runway Repair Technology.

SECTION 13
APPLICATION OF DIRECTIVES

13.1 GENERAL

13.1.1 This section lists the primary directives applicable to the Rapid Runway Repair (RRR) Program.

13.2 APPLICATION

13.1.1 Directives are itemized according to the functional areas addressed in each section.

DOCUMENT NUMBER	TITLE
	SECTION 1
	NOTE: Program Authorization Directives are listed in Section 1.
	SECTION 2
AFSCR 80-11	Intelligence Requirements
AFSCM 200-2	Disclosure of Military Information to Foreign Governments and Foreign Nationals
	SECTION 3
AFR 57-1	Policies, Responsibilities and Procedures for Obtaining New and Improved Operational Capabilities
AFR 80-2	Documents used in the Management of AF Research and Development
AFR 800-2	Program Management
AFR 800-4	Transfer of Program Management Responsibilities
AFSCM 57-7	PR and MIPR Operations
AFSCP 800-3	A Guide for Program Management
	SECTION 4
AFR 19-2	Environmental Assessments and Statements
AFR 127-8	Responsibilities for USAF System Safety Engineering Programs

SECTION 5

AFR 80-14	Test and Evaluation

SECTION 6

SECTION 7

AFR 93-2	Disaster Preparedness and Base Recovery Planning

SECTION 8

AFR 86-1	Programming Civil Engineer Resources
AFR 80-22	Funding to Acquire Research and Development Facilities and Install R&D Equipment

SECTION 9

AFR 66-14	Equipment Maintenance Policies, Objectives, and Responsibilities
AFR 67-19	Logistic Support of Research, Development, Test and Evaluation Activities
AFR 400-26	Logistics Support for Systems/Equipment Test Programs
AFR 800-2	Acquisition Program Management
AFR 800-8	Integrated Logistics Support (ILS) Program
T.O. 00-35D-54	USAF Material Deficiency Reporting and Investigation System
AFP-800-7	Integrated Logistics Support: Implementation Guide for DoD Systems and Equipments

SECTION 10

AFM 26-3	Air Force Manpower Standards
AFR 26-10	Manpower Utilization

SECTION 11

AFR 50-8	Instructional System Development
AFR 50-9	Special Training

SECTION 12

AFR 205-1	Information Security Program
AFR 205-49	Security Classification of Air Force Weapons Systems, Supporting Systems, and Associated Subsystems
AFR 190-17	Review and Clearance of Department of the Air Force Information