BY ORDER OF THE
SECRETARY OF THE AIR FORCE

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Operations

GUIDE TO BARE BASE DEVELOPMENT

This handbook is designed to assist you in accomplishing your tasks and responsibilities pertaining to bare base preparation. It describes, in outline form, the key construction and installation steps that should be taken and provides a series of checklists that can be followed by various engineer specialty groups. When coupled with quality training and common sense, this handbook will provide a framework around which you can manage the establishment of a bare base operation.

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Pages 109/Distribution F

Figures

Figures

Annexes

INTRODUCTION

GUIDE TO BARE BASE DEVELOPMENT

PURPOSE OF BOOKLET

This pocket guide addresses actions necessary to most effectively and efficiently establish and develop a bare base location (figure 1) using Harvest Falcon mobile assets. It is meant to be used primarily by base level readiness planners and mobility team/crew chiefs responsible for ensuring completion of engineer bare base beddown tasks. Users of this booklet are assumed to have a basic knowledge of bare base assets and their use--readers without this fundamental knowledge should review AFPAM 10-219, Volume 5, Bare Base Conceptual Planning Guide.

Figure 1. Bare Base Location.

SITUATION/ASSUMPTIONS/THREAT

Situation

The majority of bare base force deployments under contingency or wartime conditions use a squadron of aircraft as a basic building block. *Harvest Falcon assets used in such deployments are configured to support a squadron-sized increment with three types of prepackaged sets—housekeeping, industrial, and initial flightline support. If additional aircraft squadrons are deployed to the same location; a fourth set, a follow-on flightline set, is provided for each added squadron.* Any associated population increases are covered by additional housekeeping sets (see Annex A for contents listings of the four types of sets). Table 1 depicts the mix of Harvest Falcon packages supporting up to 3,300 personnel and three squadrons of aircraft.

Table 1. Harvest Falcon Deployment Packages.

HARVEST FALCON BEDDOWN EXAMPLE		
One Squadron 1,100 Personnel	Two Squadrons 2,200 Personnel	Three Squadrons 3,300 Personnel
Housekeeping Set	Housekeeping Set	Housekeeping Set
	Housekeeping Set	Housekeeping Set
		Housekeeping Set
Industrial Operations Set	Industrial Operations Set	Industrial Operations Set
	Initial Flightline Sup Set	Initial Flightline Sup Set
Initial Flightline Sup Set	*Follow-On Flightline Ops Set*	Follow-On Flightline Ops Set
		Follow-On Flightline Ops Set

For purposes of this booklet, discussions will normally be predicated on a single squadron-sized deployment with a base population of approximately 1,100 personnel. Included in Annex B is a listing of the various base functions and associated populations you can expect to see at a bare base. It is not all-inclusive and variations should be expected; however, the listing provides a reasonable snapshot of the personnel complement of a squadron-sized bare base deployment. All of these people probably will not arrive on the same day. Usually the flying operations personnel arrive early with the aircraft along with a sizable maintenance support element and portions of the combat support group function. The remaining base population, primarily combat support group personnel, arrive over the next few days.

Assumptions

Certain assumptions must be made to provide a definitized scope and focus for the task specifics to be addressed later.

- Engineer tasks and priorities must permit combat sortie generation within 72 hours of engineer force arrival.
- Airlift capability to the bare base location exists.
- Sufficient quantities of construction and materials handling equipment will be available although not always as early in the deployment as desired.
- The bare base location could be subject to hostile fire.
- Sufficient quantities of Harvest Falcon equipage are available to support the aircraft and population mix.
- Individual organizations erect their own tentage and shelters with limited technical support from engineer personnel.
- Climatic extremes are not being encountered which force special actions such as installation of cold weather protection packages on bare base assets.

Threat

One of the first items of information engineers must obtain is the threat to the airfield to determine what type of survivability and vulnerability reduction measures will be required. In any environment, aircraft on the ground must be protected, airfield systems must always be kept operational, and logistics support must survive to ensure continual aircraft operations. *The threat also will determine:*

- *How individual facilities and facility groups should be configured, dispersed, or non-dispersed.*
- Whether utility plants can be centralized or dispersed.
- How much and what kind of protection will be required for parked aircraft.
- Whether vulnerability reduction measures (such as facility protection, camouflage, or concealment) will be needed.

ORGANIZATION

Development of a bare base, while comprised of many multi-faceted tasks, is performed with one goal in mind—quickly setting up a base infrastructure capable of supporting aircraft operations. Employment of engineer forces to meet this goal must be similarly focused. One method of providing this focus is to *concentrate engineer efforts and manpower on the main components of the Harvest Falcon mobile asset system.* The following illustrates one way of organizing engineer forces for bare base beddown activities.

Function and Team	**Responsibilities and Tasks**	**AFS**	**Number of Personnel**
Command and Control	*Provide command and control to the engineer force. Establish priorities and allocate resources.*	32E3	3
		3E000	1
		3E090	1
	Operate command center, serve on Wing/Base command staff.	3E291	1
		3E391	1
	Direct workforce efforts and provide on-scene coordination.	3E591	1
		3E651	1
	Provide communication, planning and scheduling support. Perform liaison with other base agencies.	3E671	1
		3E490	1
		8F000	1
	Develop plans. Interface with higher headquarters and local agencies. Provide status reports.	3E971	1
		3E951	2
		3E871	1
	Coordinate nuclear, biological and chemical (NBC) warfare defense and explosive ordnance disposal (EOD) operations.		
		Total	16

Function and Team	Responsibilities and Tasks	AFS	Number of Personnel
Logistics Support			
	Provide input for logistics plans and programs. *Receive, separate, move, inventory, and maintain accountability for bare base assets.* Establish and operate supply storage areas. Order materials and perform follow-up. Develop work-arounds for supply shortfalls. Maintain holding area for bare base assets and assist in repackaging and redeployment activities.	3E651 2S051 2S071	2 3 1
		Total	6
Fire Protection			
	Provide crash rescue and fire suppression support for a squadron of aircraft. Provide limited structural, munitions, and petroleum, oils, and lubricants (POL) fire fighting support. Operate fire department alarm center. Provide command and control. Develop pre-fire plans. Perform extinguisher servicing.	3E731 3E751 3E771 3E791	7 11 5 1
		Total	24

Function and Team	Responsibilities and Tasks	AFS	Number of Personnel
Utilities			
	Establish water points. Treat and haul initial water supplies. Layout and connect initial and long term water distribution systems. Set up and *operate water plants. Establish expedient latrines.* Set up field deployable latrines and shower/ shave units. Install wastewater collection system. Operate sewage collection trailer. Erect and connect fuel bladders. Assist in the installation of mobile aircraft refueling systems. Perform refueling operations for generators and boilers. Operate ice machines. Install grease traps. Connect water and sewer lines to facilities. Operate demineralized water units. Perform insect and pest control.	3E431 3E451 3E471 3E432 3E452 3E472 3E453 3E473	4 9 3 1 1 1 1 1
	Total		21

Function and Team	Responsibilities and Tasks	AFS	Number of Personnel
Engineering			
	Perform site surveys and determine layout of functional group areas, utilities and cantonment areas. Determine airfield clearance zones, arresting barrier locations, navigation aid (NAVAID) sites and revetment locations. Site roads and access ways. Lay out munitions areas and other areas requiring cut and fill operations. Lay out NBC defense areas. Perform topographic surveys. Provide expedient designs and engineering guidance for utility installation. Provide input for engineering plans and construction programs. Provide engineering advice on camouflage, concealment, and deception (CCD); hardening; and air base defense construction efforts.	32E3 3E531 3E551 3E571	3 2 2 1
		Total	8
Explosive Ordnance Disposal			
	Provide command and control assistance. Perform evaluation, identification, render safe, and disposal actions for unserviceable munitions, UXOs, and improvised explosive devices. Perform demolition operations.	3E851 3E871	3 2
		Total	5

Function and Team	Responsibilities and Tasks	AFS	Number of Personnel
Structural/Mechanical			
	Construct expedient facilities. *Erect bare base assets.* Install flooring and hardback tents. Construct grease traps, refuse collection boxes and forms. Mix and pour concrete. Install AM-2 matting. Modify existing facilities. Construct defensive positions and revetments. *Install/maintain heaters, boilers, kitchen equipment, air conditioners,* refer boxes, ice machines, water chillers, compressors, immersion heaters, decontamination units and water fountains. Assist others in facility erection. Perform repackaging and redeployment actions	3E331 3E351 3E371 3E131 3E151 3E171	3 6 3 4 7 3
		Total	26

Function and Team	Responsibilities and Tasks	AFS	Number of Personnel
Electrical			
	Install and maintain airfield lighting systems, static grounds, and area lighting. *Install and maintain aircraft arresting systems. Install/ maintain mobile generators. Set up and operate power plants.* Install grounding networks, fuel bladders and control panels. Layout and install above and below ground electrical distribution systems. Connect electrical service to distribution centers, facility panels and equipment. Perform redeployment and repackaging activities.	3E031 3E051 3E071 3E032 3E052 3E072	4 7 2 2 4 1
		Total	20

Function and Team	Responsibilities and Tasks	AFS	Number of Personnel
Equipment			
	Repair, maintain and upgrade airfield pavements. Provide airfield sweeping operations. Clear base perimeter and airfield obstructions. Construct parking areas, pads, and roads. Perform dust and foreign object damage (FOD) control. Perform grading, excavating, and trenching operations. Construct and operate sanitary land fill and operate incinerators. Perform site preparation and leveling. Construct berms, revetments, air base defense fighting positions, and obstacles. Construct evaporation ponds, lagoons and drainage structures.	3E231 3E251 3E271	3 6 3
		Total	12

The previously described organization of civil engineer forces is but one of many that can be established for bare base taskings. It is predicated on the typical Prime BEEF team structure. For some work requirements, however, specialized skills and equipment will be necessary and you may find RED HORSE forces deployed to your location. A listing of typical RED HORSE tasks is included in Annex C.

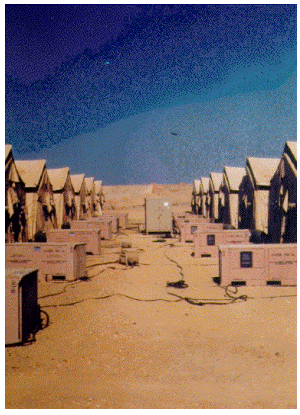
It must be emphasized, however, that although personnel are generally organized around specialties and abilities, multiskilling is inherently critical. Many tasks will require more than one skill for accomplishment and many more are not solely Air Force Specialty (AFS) unique. Requirements such as camouflage, concealment, and deception; dispersal site construction; hardening; revetment erection; facility erection, etc., will require more manpower than is provided by any one AFS. Main points--remain flexible and keep a mission perspective.

BARE BASE STAGES OF DEVELOPMENT

Establishment of a bare base normally follows a pattern which is comprised of four stages. They are the initial, intermediate, follow-on and sustainment. Within these stages the task priorities shown below are generally followed. During the initial and intermediate stages most of the tasks to be accomplished will fall in the upper two priorities; once the follow-on stage is reached, tasks will shift more and more toward the lower priorities on the list. Although timeframes are given with the various stages, some task efforts will overlap stages because of their scope or manpower intensiveness.

- Operational requirements
- Utility systems and services
- (figure 2)
- Transportation network
- Essential support facilities
- Other support facilities

Figure 2. Utility Services



MOVEMENT OF BARE BASE ASSETS

The proper flow of bare base assets into a contingency location is critical toward getting the establishment of an installation started effectively. Obtaining non-essential assets early in the logistics flow merely congests off load areas, increases the potential for loss or damage to items and does little to provide immediate mission capability. As users and installers of much of the bare base equipment and, in some cases, planners for bare base contingency operations, *engineers have a vested interest in and responsibility for influencing the flow of bare base equipage.*

Harvest Falcon assets are transported generally in the order of how they are packaged, i.e., housekeeping set first, followed by the industrial operations set, and lastly, the initial flightline support package (for a single squadron deployment). This sequencing makes sense in that in order to maintain and sustain an aircraft mission capability, an air base infrastructure must exist at least in a rudimentary form. The assets are usually airlifted to their final location, although in major contingency operations some assets could be sealifted. In overseas theaters, where bare base assets are sometimes prepositioned, over-the-road or rail movement could be used.

The order of deployment flow within each of the major packages has a direct bearing on how well the buildup of the base can progress. If you are in a position or have the opportunity to influence the flow of bare base assets to your installation, there are some key items you should normally attempt to obtain first. *From within the housekeeping package, efforts should be concentrated on deploying the reverse osmosis water purification units (ROWPU), initial water distribution system, mission essential power (MEP) generators, remote area light sets (RALS) and a couple of secondary distribution centers (SDC) initially.* Follow these items by a reasonable amount of tentage and the electrical distribution system components. You don't want to receive all the tentage and air conditioners up front since no one will be available to put them up nor will you be able to provide utility service to them. *From the industrial package, your first items should include the water source lines, additional generator, and initial shop facilities.* Let the common use, multi-purpose, and admin facilities as well

as the water loop system and air conditioners arrive later. The initial flightline support package contains mostly aircraft maintenance related facilities and the maintenance community should determine their priority. Included in this package, however, are the mobile aircraft arresting system and emergency airfield lighting set. You may have to request these items be shipped up front with the ROWPUs and generators if the operational situation requires their use.

To support Harvest Falcon beddown operations, vehicle sets have been established to provide base-wide transportation and construction capability. A basic bare base vehicle support package provides about 60 vehicles, mostly engineer and materials handling types. To this package several others sets are added as necessary. These additive packages include M-series vehicles, general purpose vehicles, tractor trailer sets, aircraft maintenance and support vehicles and small quantities of rapid runway repair (RRR) equipment (figure 3). All of these assets are usually shipped into deployment locations either from prepositioned stocks or major command (MAJCOM) assets. You will most likely find vehicle support to be a genuine limitation in your day-to-day work efforts, at least initially. Most general purpose vehicles deployed to your location will not be earmarked for specific organizations; they have to support the entire base populace. *Sharing vehicle assets will be a general order of the day.*

Figure 3. RRR Equipment.

The using organization for special purpose vehicles is much easier to determine; however, *do not expect to see a full complement of engineer heavy equipment arrive at your base on the first day of deployment.* Potentially, much of it might be sealifted to your location. Annex D provides a listing of the various bare base vehicle and equipment sets and a recommended engineer vehicle package (make sure to make your needs known to the board or agency responsible for base-wide vehicle allocation). If you are deployed to a location where a RRR capability is necessary, be prepared to ask for vehicle packages that are adjusted to that requirement [tailor the basic bare base vehicle unit type code (UTC)].

INITIAL STAGE

During the initial stage of bare base development engineer efforts are concentrated on accomplishing those *tasks* which are *necessary* to meet the requirement *for combat sortie generation within 72 hours.* These tasks (not in sequential order) include:

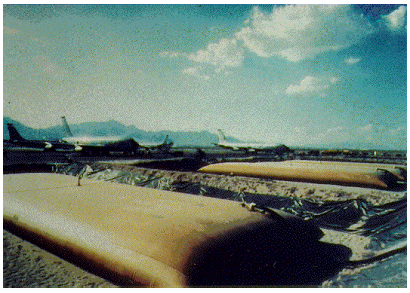
- Establishing and *developing water points.*
- Inspecting airfield pavements for serviceability and accomplishing expedient repairs and marking if required.

- Hauling water from water points to water purification site.
- *Establishing expedient field latrines.*
- *Establishing basic water treatment plant* (facility and purification/ storage.
- Verifying arresting barrier serviceability *or installing mobile aircraft arresting system (MAAS).*
- Verifying airfield lighting serviceability or *installing emergency airfield lighting set (EALS).*

Figure 4. Pavement Repairs. Equipment).

- Providing site preparation support for NAVAIDs and mission critical facilities.
- Assisting with set up of R-14 refueling system (figure 5).
- *Providing mission essential power* to critical facilities using mobile generators (up to 100 kW in size).
- Setting up emergency security/area lighting.

Figure 5. Fuel Storage Bladders.



- Performing EOD inspection of entire installation.
- Preparing site plan for entire installation to include facility group, road and utility system locations.
- *Laying out facility groups and roads.*
- Starting layout of utility systems.

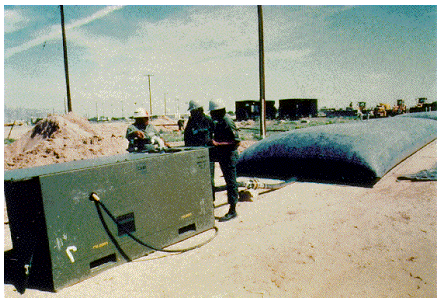
- Grading of primary roads/accessways to major facility group areas.
- Establishing basic base defense network.
- Establishing a munitions holding area.
- *Establishing engineer supply points for receiving, sorting and releasing Harvest Falcon assets.*
- Setting up engineer command and control center and billeting/dining area.
- Establishing a "taxi/bus" service to move work crews to and from work areas (vehicles will be in short supply).
- Establishing a base alerting system and contamination control areas.
- Establishing a fire protection capability.
- Establishing around-the-clock airfield support operations (sweeping maintenance of airfield lights, MAAS, etc.).
- Establishing NBC monitoring points.

INTERMEDIATE STAGE

During the intermediate stage of bare base development, emphasis is on erecting all Harvest Falcon facilities and placing utility systems in service. Some engineer manpower is devoted to system operations and maintenance. The thrust in this stage is to provide the ability for all base agencies and functions to establish basic operating capability within the first ten days of deployment. Engineer tasks (not in priority order) include:

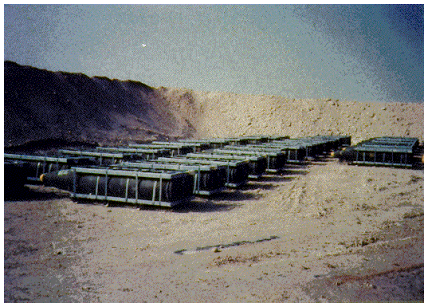
- Establishing fully functioning water plant(s).
- Installing over-the-ground pipeline and pumps from water source to treatment plant (figure 6).

Figure 6. Water System Components.



- *Laying out flexible hose water distribution system* for initial water supply to latrines, kitchens and storage bladders.
- *Installing field deployable latrines* and shower/ shave units.
- Connecting facilities and systems requiring water to the flexible hose distribution system.
- *Establishing a waste collection* capability using sewage collection trailers.
- Starting above-ground layout and connection of hardwall water distribution system once basic softwall distribution system is in service.
- Leveling of sites and constructing berms and dikes for POL storage areas.
- Grading road network throughout installation.
- Clearing of hazards in airfield clearance zones, if necessary.
- Constructing expedient berms for munitions storage area (figure 7).
- Expanding aircraft parking surfaces, if necessary .
- Installing static grounds at fueling points, arming pads, hot cargo pads, maintenance areas, etc.

Figure 7. Munitions Berms.



- *Establishing power plant(s)* using 750 kW generators (includes facility).
- *Laying out (on the ground) and connecting electrical distribution system* to include primary distribution centers, cabling, and secondary distribution centers.
- Connecting base facilities to power system as they are erected.
- Placing MEP generators into service as backup power to mission essential facilities once primary power is provided.
- Installing grounding systems at munitions areas, electrical components, etc.
- Erecting engineer maintenance and shop facilities.
- Providing technical guidance to other base organizations on facility erection.
- Starting construction of evaporation ponds/stabilization lagoons as necessary.
- *Start sanitary landfill operation,* if required.
- Installing heaters in facilities.
- Assisting other base organizations in moving Harvest Falcon assets from holding areas to site locations.
- Increasing engineer supply point operations to include storage of Harvest Falcon shipping containers and engineer related Harvest Falcon equipage.
- Establishing hazardous waste control areas.
- *Laying out and starting construction of aircraft revetments.*

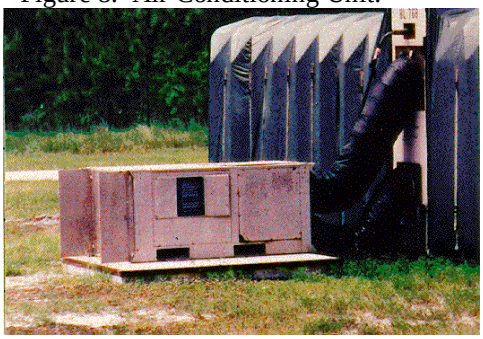
- Clearing perimeter areas and expanding base defense network.

FOLLOW-ON STAGE

During the follow-on stage final installation of Harvest Falcon assets takes place and survivability enhancements to the base are considered. Most of these types of tasks should be *completed within the first 30 days.* Engineer tasks (not in sequential order) for this stage include:

- Burying of the hardwall water distribution system.
- *Installing air conditioners* in facilities (figure 8).
- Constructing aircraft and vehicle wash racks.

Figure 8. Air Conditioning Unit.



- Installing the Harvest Falcon sewage collection system.
- Connecting showers and latrines to the sewage collection system.
- Connecting all facilities requiring water to the hardwall system
- Retrieving and repacking the softwall water distribution system.
- *Burying electrical distribution cables* that were originally on the ground surface.
- Establishing ice making capabilities within water plant(s).
- Building fixed defensive fighting positions around base perimeter.
- Building and placing obstacles supporting base defense requirements.
- Modifying host nation provided facilities for US use.
- *Constructing basic personnel shelters* for survivability purposes.

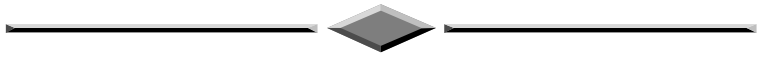
- Siting and developing dispersal locations.
- *Performing CCD activities* with available resources (primarily netting).
- *Hardening critical facilities/utility nodes* with revetments, sandbags and berms.
- Preparing an emergency disposal range for EOD use in munitions destruction.

SUSTAINMENT STAGE

When the sustainment stage has been reached, most Harvest Falcon asset support work has been completed and the *engineer's operational focus shifts to operations, maintenance and upgrade activities.* The extent of many of these activities will be predicated on the anticipated duration of the deployment—this is a command decision that should be made early in the bare base operation. Typical engineer tasks during this period include:

- Providing maintenance and repair support to Harvest Falcon assets and US used in-place facilities.
- Providing essential services such as utility plant operation, refuse collection, airfield sweeping, fire protection, environmental protection, hazardous waste management, etc.
- Upgrading roads by use of soil cement, asphalt paving or crushed stone.
- Constructing flooring in non-critical facilities.
- Establishing material stocks for potential base recovery efforts.
- Developing contingency response plans for base recovery and natural disasters and writing accompanying checklists.
- Establishing supply contracts with local vendors.
- Developing contingency training and exercise programs.
- Providing quality of life improvements such as increased square footage, air conditioning, hot water, etc.
- Constructing basic recreational facilities.
- Providing increased utility support to outlying and heavily populated areas.

- Improving personnel protective shelters.
- Increasing hardening features of base facilities.
- Increasing security measures such as area lighting and fencing.
- Constructing protective structures such as sun shades and wind breaks.
- Replacing temporary pavement surfaces or repairs with permanent fixes.
- Constructing permanent berms for munitions storage areas.



TASK SPECIFICS

SITE PLANNING/LAYOUT

Site planning and layout are critical initial tasks that set the stage for the entire bare base development operation. In a worst case situation where a true bare base is encountered, no existing facilities or developed utility systems will be available and you will have to rely fully on the incoming Harvest Falcon mobile assets.

Your first steps in such a case must be to *obtain the best threat estimate* possible from the intelligence community, verify the *anticipated base population and number of aircraft* with the wing operations staff and *conduct a quick exploratory trip around the installation to* see terrain and topographic features. From this information *determine facility dispersal requirements and feasible locations and approximate sizes of facility groups.* Remember to allow room in each of the facility groups for future expansion if follow-on aircraft squadrons are a possibility. If this expansion possibility is not accounted for initially, you may find yourself having to violate dispersed layout plans or reconfiguring utility systems to meet the added requirements. Next, place these facility groups on paper (base map if available) to ascertain if everything can fit well and the munitions/POL/liquid oxygen (LOX) safety distance criteria can be met (table 2). Attempt to build the overall facility group layout around a road network that provides easy access to various points on the flightline; much

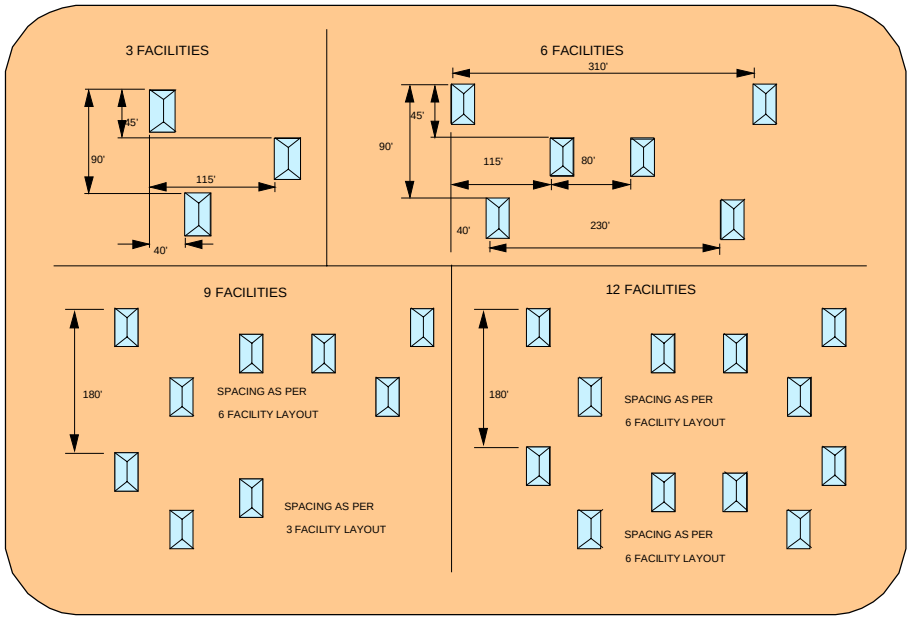
Table 2. Safety Distance Criteria.

FACILITY GROUP AREAS--NONDISPERSED				
Facility Group	All Areas Except LOX, Munitions & POL (feet)	LOX (feet)	Munitions (feet)	POL (feet)
All areas except LOX, Munitions, and POL	150	1500	3150	2640
LOX	1500		3150	2640
Munitions	3150	3150		1800
POL	2640	2640	1800	

of the initial base traffic will be operating from flightline locations. Also *determine the locations for utility plants, stabilization lagoons, and evaporation beds at this time.* Ensure the locations of sewage lagoons are downwind from the base.

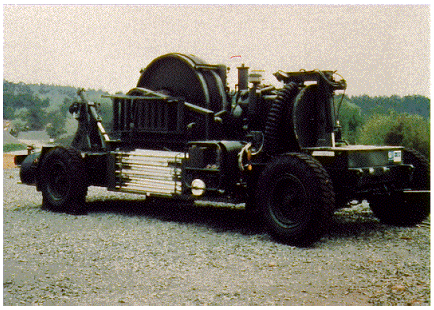
Mark the locations of all large facilities (ACH/FSTFS/Domes) on the base layout map and a representative sampling of the more common GP shelters and TEMPER tents. An indication of the dispersal pattern (figure 9) should also be provided as a general template for the survey crews who will eventually stake out the facility groups.

Figure 9. Facility Dispersal Pattern Template.



Once the base layout plan is completed (should be within the first few hours after arrival), engineer survey crews must begin the sizable task of physically marking the locations of the various bare base assets. Use more than one crew and augment with other shop personnel (or base personnel) if necessary. One of your first actions (if required) is to identify and mark the locations of the mobile aircraft arresting barriers (figure 10) and airfield lighting components. A survey crew qualified in theodolite/transit operation is mandatory here.

Figure 10. Mobile Aircraft Arresting Barrier.



Have your crews initially mark the boundaries (corners and a few intermediate points if distances are long) of the various facility groups. Use markers that are relatively permanent (e.g. driven stakes) since they will become bench marks for starting the location marking of individual facilities and assets. Expedient survey methods are used during this process, for example, "walking off" distances, using vehicle odometers, using a hand compass for turning angles.

Once facility groups are laid out, concentrate on locating individual facilities within each facility group. In smaller groups (e.g., aerial port, squadron operations, alert area, etc.), location of all facilities can be pinpointed at one time. In large groups, such as the billeting complex, locate only a portion of the total requirement initially--don't get hung up on trying to locate positions of facilities for people who won't be arriving for a few days. Come back and finish these large areas once other, more important operational portions of the base are completed. Use expedient survey methods for laying out individual facilities as well. Because individual facility layout is repetitious with respect to distances between buildings, a couple of pieces of rope cut to the proper spacing intervals can be used as a quick and accurate way of measuring and locating facility positions.

From a utilities perspective you should mark the locations of utility plants early in the site layout process. This allows the other shop craftsmen to begin setting up utility services as soon as generation/purification equipment is received. As individual facilities are staked out in the various facility groups, locations of electrical primary and secondary distribution centers should also be identified. Once most of the base facilities are sited, survey crews can then be diverted to layout of utility lines.

You can expect a few functional areas to rearrange facility sites to ease or streamline their operations. This should not be a serious problem provided you keep them informed on implications to utility service. Certain functional areas will have sufficient inherent expertise to be able to site their own requirements. Communications (for NAVAIDS and communications equipment) and Security Police (for fighting positions and obstacles) are prime examples. Let these groups do the initial siting of such requirements; just give them an engineering sanity check to ensure something isn't grossly wrong with the locations chosen.

AIRFIELD UPGRADE/SUPPORT

Many airfield related tasks are potentially necessary at the onset of a bare base establishment. Most involve heavy equipment operators and you will likely find these people stretched extremely thin throughout the initial beddown process. You will also probably find that many of the heavy equipment items you need may not be on the first series of incoming airlift sorties. When these items do arrive, be prepared to use them immediately. In the interim, *work with the contracting officer to find local sources of heavy equipment and materials*.

Immediate requirements would include expedient repairs to aircraft operating surfaces, pavement sweeping and cleaning, pavement marking and striping, site preparation for NAVAID installation and arresting barrier installation/site preparation. *Pavement repairs during this initial period of beddown must be rapid in nature,* e.g., compacted crushed stone, cold mix, quick set cements, etc. Come back at a future time to accomplish permanent fixes. The goal is to enable combat aircraft operations to commence by the end of the initial 72-hour window, sooner if possible. Plan on immediately dedicating equipment personnel to around-the-clock sweeping operations since there will be considerable aircraft and vehicular traffic on pavement surfaces as bare base assets are delivered, off-loaded, and transported from ramp areas. Support for NAVAIDs includes clearing and leveling various sized areas for mobile communications equipment set up. Normally these areas are not particularly large (2,500 SF or so) but plan on having to clear and grade vehicle accessways up to 1,000 feet long to these sites.

Once initial airfield operational requirements are met, concentrate your efforts on aircraft parking pavement expansions (if required); requirements supporting aircraft servicing operations such as arming pads, grounding points and tie downs; and clearance of airfield hazards. Some parking pavement expansion requirements will be self evident. If severe problems are being encountered in expeditiously off-loading transport aircraft, chances are additional ramp space is needed. *Expanded parking areas can*

be constructed adjacent to existing aircraft pavements *using expedient techniques such as graded and compacted earth, compacted crushed stone, or AM-2 matting (figure 11) over a compacted subbase.* Start these

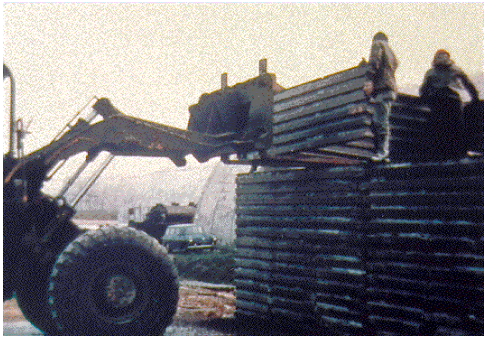
Figure 11. AM-2 Matting.

expansion efforts as soon as problems are realized; otherwise, your base will be faced with as massive backlog of aircraft flow and serious congestion in material and asset movement on the ground. Pavement expansion could also be required for parking of incoming deployed aircraft. Your initial contact with wing operations during the site planning process will have identified the probable numbers of aircraft to be supported. Check with the maintenance people concerning aircraft parking plans and, if more parking positions are needed, similar construction techniques to those used for ramp expansion can be employed. Potential tasks in support of aircraft servicing operations include special pavement areas such as arm/dearm pads, hot cargo pads, quick turn areas, compass rose, wash racks, etc., along with the accompanying tie downs and static grounds. Sometimes existing pavements can double for some of these requirements; however, if you are forced to provide these items be sure the safety distance criteria associated with some of them are maintained (arm/dearm, hot cargo). At most bare bases you should not be faced with numerous obstacles or hazards in the airfield clear zones, but if some do exist you should remove or at least mitigate them early on in the beddown process. Be especially observant of terrain features or obstacles that could affect wing tip clearance of wide-body aircraft. On

the other hand, don't waste time attempting to remove items in the outer edges of the clear zones that produce minimal danger (a culvert head wall for example)—in some cases we will just have to accept the risk initially. Also check the shoulders of runways and taxiways and the grounds around and access routes to aprons and ramps for potential FOD producing areas. Use a soil cement mix or an oil-based spray to help stabilize these areas.

Past contingency experience has shown that installation of aircraft revetments (figure 12) is a major airfield support task for civil engineers. In all likelihood, manpower will not be available to start this task during the first few days of the deployment and the revetment materials probably will not be received until later on in the Harvest Falcon asset flow. However, some preliminary planning should be accomplished in preparation for this job. Identify the locations for the revetments and their configuration early and coordinate this information with the wing operations and maintenance communities. Also identify a source (on-base quarry or off-base vendor) for revetment fill material. The erection of the revetments is normally a RED HORSE task due to equipment requirements and manpower intensiveness. Once revetment materials do arrive and the revetment erection process is started by RED HORSE, Prime BEEF forces may be tasked to assist.

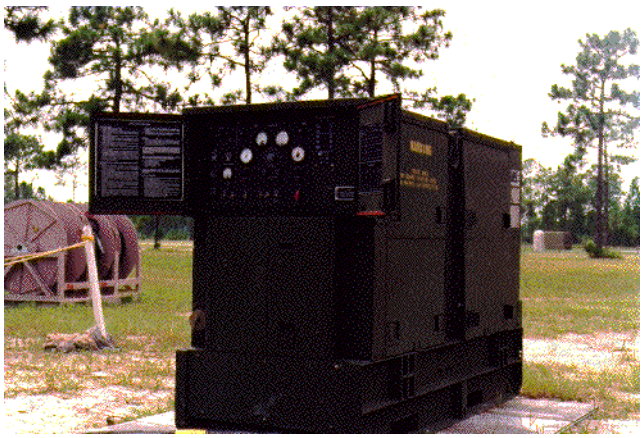
Figure 12. Aircraft Revetment Erection.



ELECTRICAL DISTRIBUTION SYSTEM

Installation of the Harvest Falcon bare base electrical system is basically a two-phase approach. The first phase is to provide mission essential power (MEP) using 60-100 kW generators (figure 13) to those functions critical to initial base operation. The second and much more complex phase is to establish primary power plants and install the overall base electrical distribution network. It is advantageous to have several of your electrical personnel fork lift qualified so these phases can be more expeditiously, independently and concurrently carried out. Additionally, use the multiskilling capabilities of all your electrical and power production personnel--certain tasks may at times be more than a single specific AFS can handle efficiently.

Figure 13. Typical MEP Generator.



During the initial bare base planning and layout stages, locations for certain critical base facilities that require MEP support must be precisely identified. Typical of these facilities would be the wing command post, 9-1 kitchen complex, water plant, squadron operations, communications, central security control, fire department alarm center, etc. Choice of what facilities

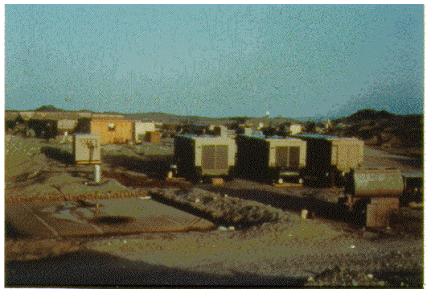
receive MEP support is a local decision, based on mission requirements--involve the wing/base command sections in the process. Once facilities to receive MEP support are identified and located, electrical personnel must decide what size generator to use at the various locations. Since there will be only a limited number of MEP generators available (about 9 for an 1,100-person package), secondary distribution centers (SDC) (figure 14) will probably have to be used to allow establishment of multiple circuits from single generators.

Attempt to place these SDCs in positions where they can eventually be integrated into the primary distribution network without moving them to a different site. As the various facilities are erected, electrical personnel then hook up the secondary service to the facility distribution panels and internal equipment when appropriate. Once MEP generators are on line, personnel will have to be specifically designated to accomplish operational checks, maintenance, and refueling. You can anticipate that in some cases some MEP generators will have to be used as prime power for up to 10-15 days--it could take that long before all facilities are erected and associated base electrical distribution grid installed.

Figure 14. Secondary Distribution Center

Concurrent with the installation of the MEP generators, the generators (750 kW) comprising the main power plant(s) (figure 15) are set up. This effort includes generator placement, fuel bladder set up and connection, control panel (figure 16) connection, primary distribution center (PDC) (figure 17) set up and connection, and grounding system installation. Following the base layout plan, other electrical personnel place SDCs at their required locations and begin connecting the SDCs to PDCs at the power plants. As facilities are erected, secondary distribution connections between the SDCs and facility distribution panels (figure 18) are made as well as internal connections of equipment within facilities. For planning and installation purposes, use the following "rules of thumb" regarding SDC use (assumes air conditioners will be employed at the bare base location):

Figure 15. Power Plant Set Up.



- Limit the load on each SDC circuit to a maximum of 21.6 kVA.
- Limit the load on each SDC to 150 kVA.
- Limit the number of shelters on an SDC to twelve (12).
- Put no more than five (5) SDCs on a single PDC output circuit.
- Put no more than 30 SDCs on a single PDC.

Figure 16. Control Panel.

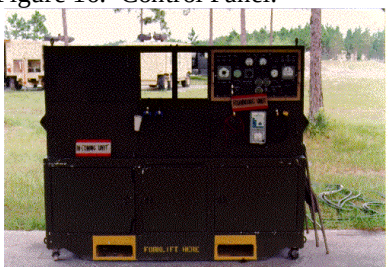
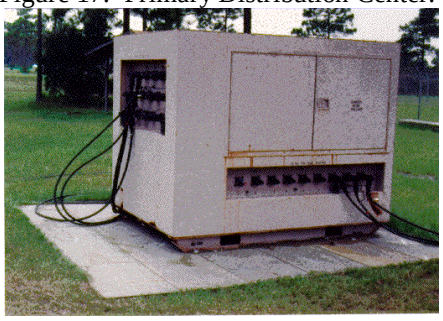
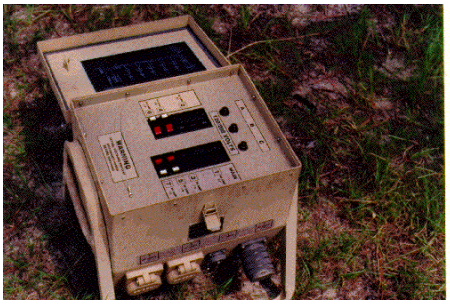


Figure 17. Primary Distribution Center.



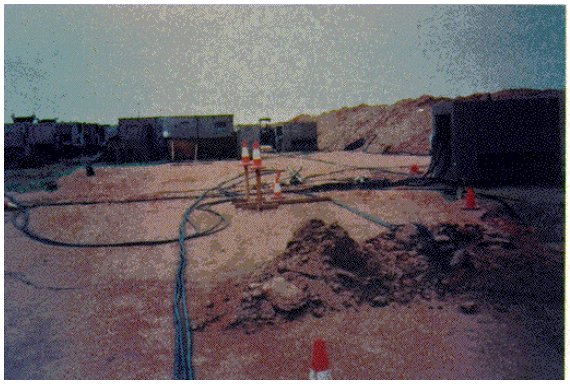
Connections between all components should be left on the ground surface at this time (figure 19). Cables crossing roads are an exception to this situation, however. They should be buried or otherwise protected to prevent vehicle traffic from causing damage of the contingency situation warrants, all cables will eventually be buried. You should not wait until the entire electrical

Figure 18. Typical Facility Distribution Panel.



distribution system is set up before energizing. Bring the base onto the electrical grid in stages as population increases and functional area activities dictate. Whenever the primary electrical grid can pick up the requirements served by the smaller MEP generators, reconnect these 60-100 kW units as standby backup power. Obviously, as the primary power plants are brought into service, you will have to devote a portion of your electrical crews to plant operations and maintenance.

Figure 19. Typical Above Ground Electrical Distribution.



Make sure your power plant operators keep accurate records of power plant meters (amperes per leg, kW, power factor, peak demand periods, etc.) for future analysis and consumption statistics.

Several remote area lighting sets (RALS) are included in the Harvest Falcon package. Most should arrive relatively early in the overall asset flow. These units are connected to SDCs and are used for supporting area lighting requirements for such functions as aerial port offloading, aircraft maintenance, POL transfer, and security of critical assets. Keep alert to the overall base build up and when these functions come on line, provide the RALS support.

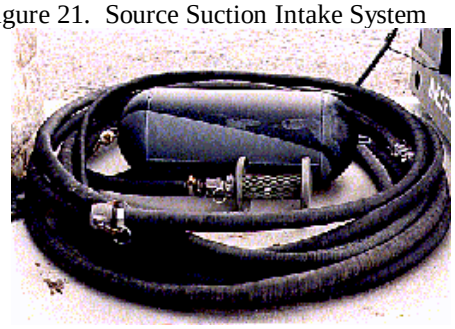
Figure 20. Burying Electrical Distribution Cable.

Once all major forces arrive at the bare base and the electrical system is fully functional a portion of your electrical personnel should be detailed to bury all above ground electrical lines (figure 20) if it has been determined that sustained military operations will take place. Bury lines a minimum of 18" and keep accurate records of where cables are located.

WATER DISTRIBUTION SYSTEM

Your first task when arriving at a bare base will be to ensure the local water source is sufficiently developed to support the anticipated base population and projected mission. This entails several activities--establishing water points, setting up purification and treatment operations, setting up storage capability, running a temporary distribution network, and installing the more permanent distribution system. Complicating the situation somewhat is the fact that you will not receive the total water distribution system package all at one time early in the deployment. The initial items to be received should be the reverse osmosis water purification units (ROWPU) and an initial "softwall" water distribution set. Later on additional assets should arrive which enable "hardwall" loop system to be installed. If needed, a source run package could also be received.

Figure 21. Source Suction Intake System

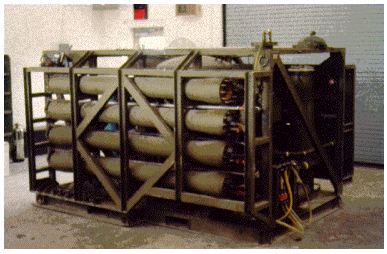


Several concurrent activities supporting water production at a bare base must be started immediately upon arrival. The source of water itself must be developed to allow pumping into transport bladders and eventually pipelines. This could involve clearing a road to the source, setting up an expedient water intake system (figure 21), or even building a temporary dam to create an expedient reservoir. Once a location is found or made usable, raw water pumps are installed and used to fill trailer-mounted bladders (figure 22) or water buffaloes for transport to the site chosen for the water plant(s). As the water source location is being developed, the ROWPUs (figure 23) are being set up along with the associated small operational storage tanks (figure 24). When setting up the ROWPUs, leave sufficient space to later install several 20,000-gallon water storage bladders (figure 25). Water production is started

Figure 22. Trailer-Mounted Bladder.

as soon as possible. Be sure that electrical crews installing MEP generators are aware of the water plant location(s) and that power is provided when needed. Also be sure that the brine discharge lines from the ROWPUs lead to an area that can accommodate a large volume of water or more ideally, back to the source itself. Once the ROWPUs are in operation you will have to dedicate manpower both for plant and pump operation and water hauling on an around-the-clock basis. While the plants and water sources are being established, another utilities crew lays out the above ground flexible hose distribution system (figure 26) to key facilities requiring potable water. These include the 9-1 kitchen, showers, latrine areas, laundry, hospital, and selected shop facilities. Fill points for both potable and nonpotable water are also established to support fire department and remote location requirements.

Figure 23. Reverse Osmosis Water Purification Unit



When the remaining components of the water distribution system arrive, upgrades and operational improvements are started. If a source run additive package is received, its installation should probably be started before the hardwall loop system to alleviate the requirement for constant hauling of water from the source to the treatment plants. The length of this line is limited to about two miles so keep this in mind when choosing water plant

locations with respect to the source. Also be prepared to provide heavy equipment support for clearing and grading right-of-ways for the source line.

Figure 24. Onion Storage Tank.

By the time the hardwall loop distribution package arrives and you have sufficient personnel available to start its installation, most of the bare base facility assets should be erected. The hardwall loop system incorporates most components of the flexible hose initial package. It is installed above ground first throughout the base. Attempt to minimize road crossings and when there is no alternative, ensure the pipeline is sufficiently protected (covered/ buried) from vehicular traffic. Have several of your utilities people backhoe/ trencher qualified to allow work to proceed without dependence on other shops. If the decision is made that sustained operations will take place, the above-ground hardwall lines are buried after all other higher priority tasks are completed. Besides providing protection from damage, burying the pipelines decreases the heat gain from solar radiation. Experience has shown water in above-ground pipelines can reach temperatures of up to 160 degrees Fahrenheit. The water bladders provided in the water production, initial distribution and standard package should be sufficient to provide a 5-day storage capacity for 1,100 people. These bladders should be allocated more or less evenly between water plants for dispersal purposes. About 60% of the base's water storage capacity should be dedicated to treated water, the remaining 40% can be untreated.

Figure 25. Water Storage Bladder.

Figure 26. Above-Ground Water Distribution Hoses.

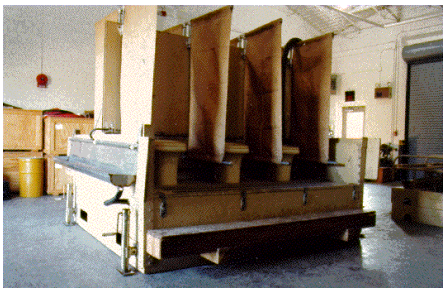
If ice machines (not the ones supporting the 9-1 kitchen) are received for your bare base operation, they should be installed at one of the water treatment plants. These machines are meant to supply the base populace, e.g., work crews on the flightline or at remote locations and medical support requirements. A 150-cf refrigeration unit should be co-located with the ice machines to provide ice storage capability.

WASTEWATER COLLECTION SYSTEM

To maintain hygienic conditions throughout a bare base and prevent spread of disease, wastewater must be properly collected and discharged. Initially, expedient methods are exclusively used since Harvest Falcon assets comprising the wastewater collection system will not arrive early in a deployment. Additionally, you most likely will not have the manpower available at the onset of a deployment to fully install the wastewater system--people will be primarily tied up with water system establishment.

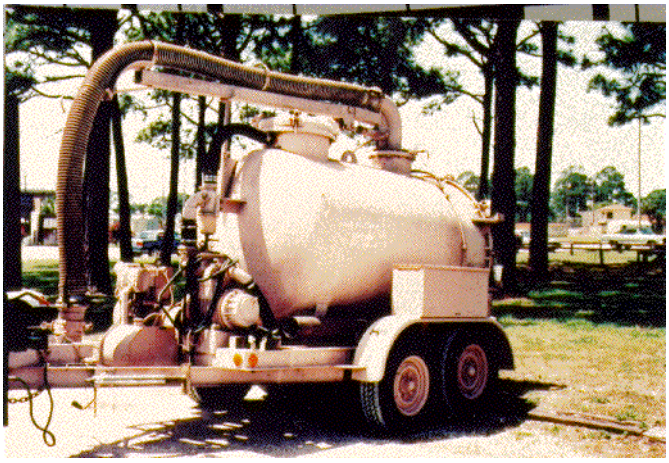
The immediate need from a wastewater collection aspect is to provide expedient latrine facilities for the initial personnel on the ground and those arriving over the first days of a deployment. This need is normally met by constructing urine soakage pits and ventilated improved pit, straddle trench, burnout or pail latrine facilities at base wide locations. You will have to rely solely on locally available materials for these facilities. When the Harvest Falcon field deployable latrines (figure 27) start to arrive, they are first set up in the cantonment areas where the maximum usage will occur.

Figure 27. Field Deployable Latrine.



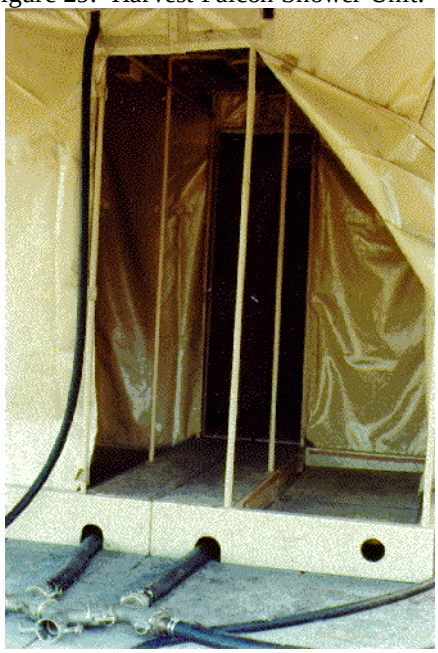
If sufficient Falcon latrine units are available, they then will replace the expedient ones constructed in the industrial and flightline areas of the base. Once expedient and Harvest Falcon latrines are established, personnel must be dedicated to periodic servicing of these facilities. The expedient latrines will require spraying and occasional closing and relocation. Harvest Falcon latrines will require periodic (at least daily) pumping using wastewater disposal trailers (figure 28). In many locations you may be able to find contract support for latrine servicing--use this avenue if at all possible. You will have to find or construct an environmentally acceptable temporary holding area for this wastewater. Even if a wastewater collection piping system is installed, you can expect the requirement for expedient and stand-alone Harvest Falcon latrine servicing to continue--you will have latrines in outlying areas (munitions area, for example) that are not connected to a main system due to distance or lack of pipe materials.

Figure 28. Wastewater Disposal Trailer.



Another immediate task necessary when first establishing the bare base will be to provide a capability for collecting and disposing of wastewater (greywater) from the laundry, kitchen and showers (figure 29). This is normally accomplished by constructing evaporation beds. You will need support from the heavy equipment shop for this task since it is far beyond hand work. If heavy equipment has not arrived yet and you cannot find contract equipment support, look for natural depressions that can serve as temporary evaporation beds. Be sure to install grease traps in any lines running from the kitchen complex and show services personnel how to clean and maintain these traps. If you have very porous soil at your beddown location, soakage pits can be used for greywater disposal--again you will need heavy equipment support to prepare these items. If you have a few facilities which only give off small quantities of greywater, French drains at each location might suffice. Where quantities of wastewater generated are too large for French drains and too small to warrant evaporation beds, collection pit boxes (1,000-2,000 gallon capacity) can be used. They must be pumped out occasionally, however, with the wastewater disposal trailer.

Figure 29. Harvest Falcon Shower Unit.

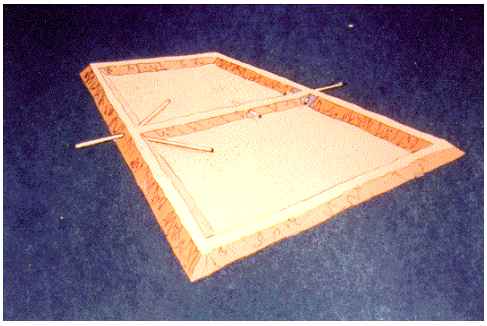


Few bare bases will receive Harvest Falcon wastewater system components. Experience has shown that most Air Force deployment locations have at least a local contractor capability for sewage disposal and many have basic wastewater collection systems installed. Only locations that are truly barren and remote will receive the hardwall Harvest Falcon wastewater collection system and only if the duration of the deployment warrants installation of the system. Installation of the system is relatively time consuming and extremely site specific in nature. Careful review of initial plans for the location of the system should be the first step taken. Remember, you may not have had good base maps at first and you certainly haven't had time to perform a topographic survey. Additionally, facilities may have been moved somewhat from the original plans and the location of any pipelines and proposed lagoons may have to be altered. Once this review is complete, make a field visit to all proposed pipeline routings to verify routings are indeed feasible, e.g., not running through a rock outcropping or overly high terrain. The Harvest Falcon wastewater collection system is primarily a gravity flow system and this feature should be exploited whenever possible. Use the system's lift stations only when there is no other choice. When the system layout is considered suitable, work should begin on pipeline installation and lagoon construction concurrently--these are both long term construction efforts. Heavy equipment operators will be needed for lagoon construction, but pipeline excavation can be accomplished by utilities personnel qualified in backhoe operation. Without using this multiskilling capability, your installation

time will probably increase or other heavy equipment related tasks will slip. If lift stations have to be used, keep in mind the electrical requirement for pump operation--an SDC has to be nearby.

If you are fortunate enough to be able to discharge wastewater off base, only stabilization lagoons (figure 30) need be constructed. One lagoon about 125 feet square should be sufficient for a population of 1,100 personnel. Be sure to locate the lagoon downwind from the base. If you cannot discharge wastewater off base, you will have to construct evaporation lagoons. These lagoons require considerable land area (up to several acres) and effort to construct. The number of evaporation lagoons required depends on evaporation rates, base population, and anticipated duration of deployment.

Figure 30. Stabilization Lagoon.



FACILITY ERECTION

Successful Harvest Falcon facility erection depends upon several actions being carried out prior to and during personnel arrival at a bare base. Some of these actions you can directly control; others you cannot easily influence. The ones you cannot easily influence include the degree of training the base populace has had on erecting Falcon facilities (which could dictate the degree of involvement engineers will have in erecting other people's facilities) and the order and timing of facility asset arrival at the bare base. In reality, you will have to make the best of whatever situation faces you;

for purposes of this booklet, it is assumed that both of these actions are positive, i.e., the base populace is generally knowledgeable in facility erection and assets flow into your base in a reasonable manner.

It is doubtful that many people at a bare base will be able to easily identify all the various Harvest Falcon facility and utility components as they arrive--this task will have to be accomplished by engineer personnel since it is an engineer responsibility to place most of these items in service (this drives a peacetime Prime BEEF training requirement of educating personnel on the various Falcon items). You should designate some of your supply and operations personnel to act as asset expediters as the Falcon items arrive. These people will assist aerial port personnel in identifying equipment, arrange to have engineer-related items moved from the ramp area to the job site or interim holding area, and maintain some method of accountability so quantities on hand are known. A reasonably large open storage area should be identified immediately upon arrival at a bare base for temporary engineer asset storage and eventual longer term storage for shipping containers. As facility and utility assets are off loaded, they should be separated by type of system or building and moved to the holding area or work site if needed at the time. It is wise to have your supply and operations personnel fork lift qualified so movement of items can be performed in-house if necessary. Plan on having most bare base facilities delivered to the engineer holding area, then moved to their final location for erection by user personnel as they arrive. In concert with base supply personnel, you will have to make arrangements for consolidating all the ship/store containers (figure 31) once they are empty. If arrangements cannot be made early in the deployment, plan on storing these containers in the engineer holding area at least initially.

As assets are being off loaded from incoming aircraft or vehicles, site layout and site preparation should be well underway. Attempt to have enough heavy equipment operators on the job so as not to fall way behind the site layout crews. Obviously this tactic is dependent on equipment availability and the number of other heavy equipment tasks ongoing; however, the speed of facility erection is directly related to the degree of site preparation completed. If you have heavy equipment shortfalls, look to contract support to fill the gaps. If you have relatively level terrain, the site

Figure 31. Harvest Falcon Shipping Containers.

preparation task should go fast; if terrain is irregular, you will have to size the heavy equipment support accordingly. As a rule of thumb during site preparation for facilities, the slope of terrain under the facility should not exceed 18 inches over the projected floor area.

As site layout and preparation are underway, a concurrent action of delivering assets to the job sites should be started. Plan on doing this with engineer forces. Have someone with the base layout plan and a general list of facility allocations oversee this effort. Virtually all functional areas receive TEMPER tents (figure 32) so delivery of these assets should be reasonably straightforward. GP shelters (figure 33) and ESCs (figure 34), on the other hand, are unique to certain areas and must be apportioned carefully. As a starting point for facility allocation, Annex B provides an outline of what facilities are usually used to support various base functional areas. The final facility allocation will have to be determined by senior personnel locally. Make sure the base and wing command staff are involved. Deliver the facility assets as close as possible to their final

locations; don't stockpile all facilities at one corner of a facility group area-- you'll just have to move them again later. When returning to the holding area after delivering assets, pick up empty ship/store containers on the way. This keeps the base area less cluttered and protects the containers from damage or misuse. Remember, you will have to repack Falcon assets in these containers before you leave the base; you don't want them damaged or otherwise made unserviceable.

Figure 32. TEMPER Tent.

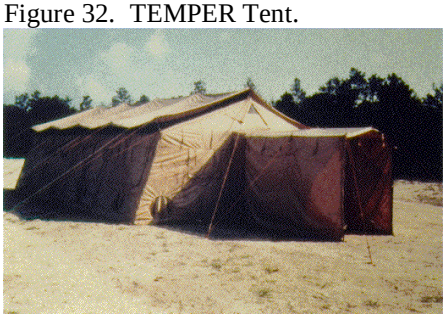
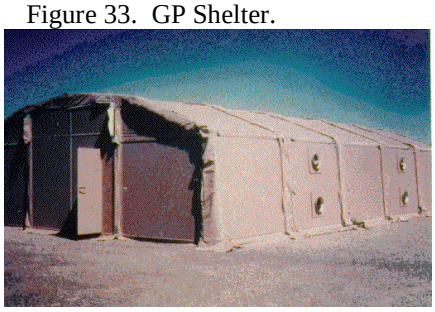


Figure 33. GP Shelter.



Large facilities such as the aircraft hangar (figure 35), dome shelter, and frame supported tension fabric shelter (figure 36) are not erected by users, but rather RED HORSE squadrons or the 49th Material Maintenance Group from Holloman AFB. It is best to let these organizations handle the movement, unpacking, and erection of these larger facilities since they have the requisite training and skills available. Limit your activities to site layout and temporary storage of the assets. -

Figure 34. Expandable Shelter Container.

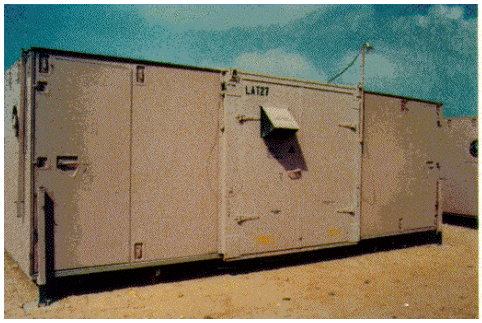
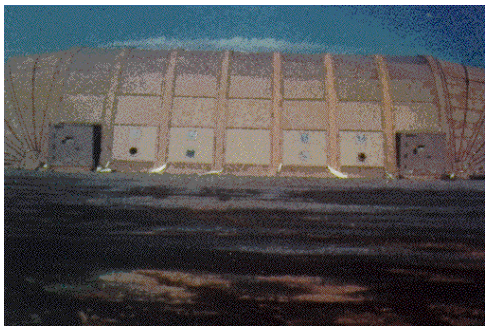


Figure 35. Aircraft Hangar.



From an engineer aspect, a basic premise of bare base development is that users will erect their own facilities; thereby freeing engineer personnel for other, more critical beddown tasks. This does not mean, however, that no level of support for facility erection is provided from engineer resources. Plan on having to erect all GP shelters--these are probably too complex for most base organizations to handle and training is not readily available. You must also plan on having a small cadre of personnel, knowledgeable on TEMPER tent and ESC erection techniques, available to assist the base

populace. There will be occasions where untrained people will be faced with facility erection tasks and we must be prepared to help out with supervisory and instructional guidance. However, do not encourage the base populace to attempt utility connections, as basic as they may be, to facilities. The potential for damage to system components and harm to both base personnel and our electrical crews is too great.

Figure 36. Frame Supported Tension Fabric Shelter.

PROTECTIVE SHELTERS/HARDENING

To enhance the mobility features, primarily ease of installation and lighter weight, of Harvest Falcon assets, tradeoffs in survivability were encountered. Most facilities in the Falcon package cannot withstand even small arms fire, let alone fused munitions detonation. This makes it imperative that personnel and asset protection be seriously considered at bare base locations, especially in high threat areas. In fact, in serious high threat areas, one of your first tasks might well be digging foxholes and protective trenches and earthworks for personnel protection.

The Harvest Falcon package does include material assets for aircraft protection--bin revetment kits. Because of their weight, however, don't expect to receive these kits until well into the deployment timeline. In fact, they may even come by ship rather than air. Nevertheless, do your preplanning and have all parking plans, revetment locations and configurations, and fill material sources identified early. When the kits do arrive, immediately start their installation.

Once installation of all Harvest Falcon assets nears completion, attention should be turned to providing protective shelters for the base populace. This task should be a base-wide effort; it would take an inordinate amount of time for engineer forces to complete this work independently. Several types of shelters can be constructed using general construction materials in above ground, underground, and cut-and-cover modes (figures 37-39). It is prudent to start to gather materials as the bare base is being established since some will be natural by-products of beddown activities. Look for and store such items as 55-gallon drums, pieces of revetment material, structural steel shapes, timber and wood packing materials, ship dunnage, steel culvert sections, CONEX boxes, steel piping, unserviceable aluminum matting, pallets, residual construction materials, etc. Do not consider using any of the Harvest Falcon ship/store containers for shelter components, however. Start construction of these shelters in the more populated areas of the base, e.g., billeting areas, kitchen area, and major flightline areas. Work within the limits of the materials you have. Don't attempt to build large facilities that hold many people with building components that cannot bear high static loads or do not lend themselves to structurally sound construction practices.

You're better off having several smaller shelters (10-12 people each) since dispersal can be more easily accomplished. Plan on providing heavy equipment and welding support and technical instruction to units building their own shelters. You will probably have to provide tools also in some cases--try to arrange for local sources of tools and hardware since you will experience some breakage and loss. Develop simplified construction drawings for base units to follow and assist with facility siting to ensure drainage patterns are not disrupted or utility services damaged.

Figure 37. Metal Culvert Shelter.

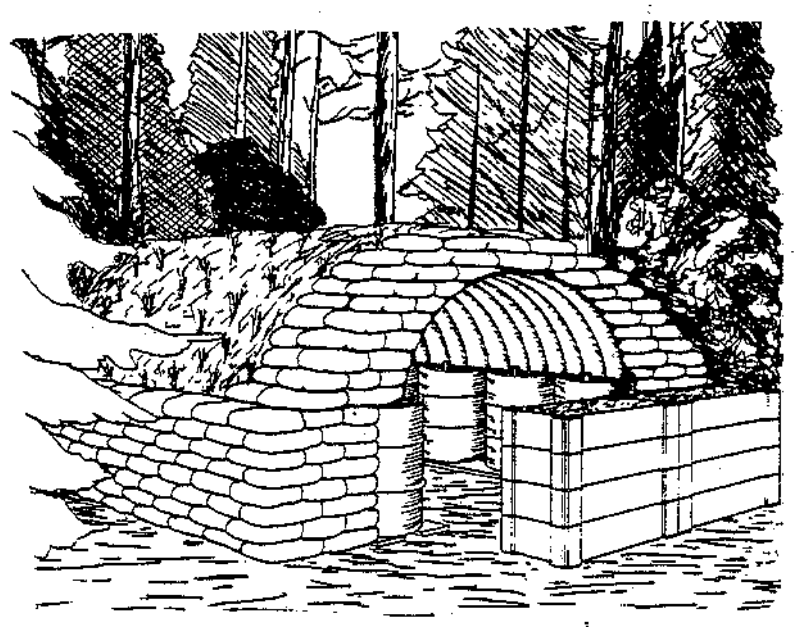


Figure 38. CONEX Container Shelter.

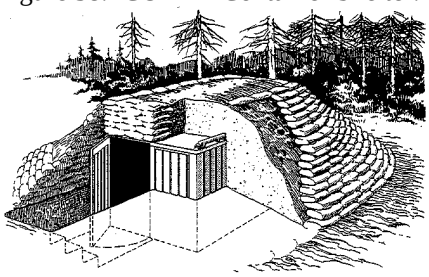
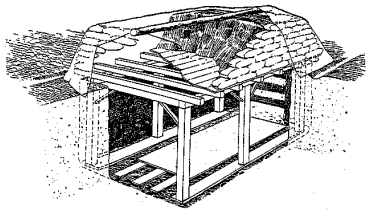


Figure 39. Timber Shelter



Protection of selected critical facilities and utility nodes should also be considered. You probably will not be able to construct protective features for all candidate locations quickly due to material, time or manpower shortfalls, so prioritize your requirements carefully. Look primarily at mission sensitivity. Consider the water and power plants early without these utility services bare base operations will rapidly shut down. Also consider key SDCs, maintenance shops (ESCs) and command posts. Your primary hardening method to use will be expedient revetments (figures 40-42)--sand bag, timber, earth berm, and soil cement.

Figure 40. Soil Cement Revetment.

Figure 41. Timber and Soil Revetment.

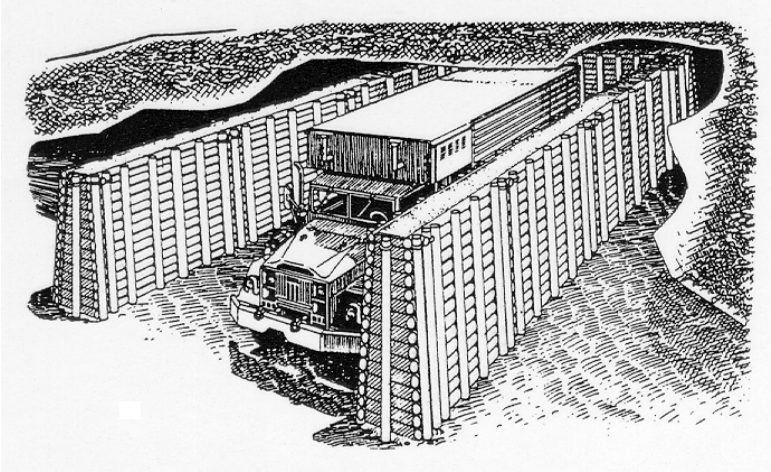
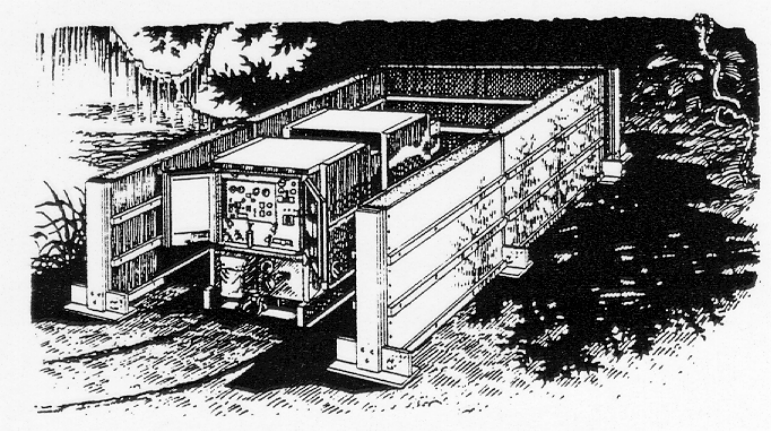
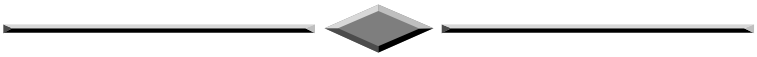


Figure 42. Plywood Wall Revetment.



EUGENE A. LUPIA, Maj General, USAF
The Civil Engineer



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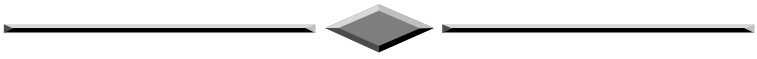


ANNEX A

1,100-PERSON HARVEST FALCON DEPLOYMENT PACKAGE

Harvest Falcon Housekeeping Set (XFBKA)

ITEM	QUANITY
Water Production Package	1
Initial Water Distribution	1
Generators, 60kW MEP-006	4
Generators, 100-kW MEP-007	3
Generators, 750-kW MEP-012A	4
Primary Cable Skids	4
Secondary Distribution Centers	20
Power Plant ESC/PDC/SDC/Bladder System	1
Remote Area Light Sets	5
Environmental Control Units	150
TEMPER Tents, Admin	16
TEMPER Tents, Billeting	92
TEMPER Tents, Briefing	2
TEMPER Tents, Laundry	2
TEMPER Tents, Mortuary	1
GP Shelters, General Use	3
Field Latrines & Tents	6
Shower/Shaves & Tents	4
9-1 Kitchen	1
Camo Net/Pole Pallets	2
Light Carts	20
Primary Distribution Center (PDC)	1

ANNEX A

Harvest Falcon Industrial Operations Set (XFBRB)

ITEM	QUANITY
Water Source Run (If Needed)	1
Water System, Standard Package	1
Water High Threat Additive (If Needed)	1
Generator, 750-kW MEP-012A	1
Fuel Bladder, 10,000 Gallon	1
Secondary Distribution Centers	4
Environmental Control Units	42
8000 SF FSTFS, General Use	3
8000 SF FSTFS, Packing and Crating	1
8000 SF FSTFS, Supply	1
4000 SF FSTFS, Vehicle Ops/Maint	2
ESCs, General Use	5
ESCs, Supply	2
ESCs, Tactical Field Exchange	2
GP Shelters, General Use	2
GP Shelters, CE Shops	2
TEMPER Tents, Admin	4
TEMPER Tents, CE Shops	9
TEMPER Tents, Chapel	1
TEMPER Tents, Mortuary	1
TEMPER Tents, Multipurpose	4
TEMPER Tents, Tactical Field Exchange	2
Mobile Kitchen Trailers	2
Latrines with Tents	6

ANNEX A

Harvest Falcon Initial Flightline Support Set (XFBS1)

ITEM	QUALITY
Emergency Airfield Lighting System	1
Mobile Aircraft Arresting System	1
BAK-12 Systems (two energy absorbers each)	1
B-1 Revetment Kits	42
Generators, 60-kW MEP-006	2
Secondary Distribution Centers	8
Environmental Control Units	42
TEMPER Tents, Alert Billeting	3
TEMPER Tents, Fire Station	3
8000 SF FSTFS, General Use	1
8000 SF FSTFS, Propulsion Shop	1
4000 SF FSTFS, General Use	2
ESCs, General Use	3
ESC, Avionics	1
ESC, Bearing Cleaning	1
ESC, Electrical Maintenance	1
ESC, Fuels Lab	1
ESC, Life Support	1
ESC, NDI Lab	2
ESC, Parachute Shop	1
ESC, Pneudraulic/Environmental	2
ESC, Aircraft Wheel/Tire Shop	1
GP Shelters, General Use	9
GP Shelters, Power/Non-power AGE	2
Aircraft Hangars	2
Flightlight Fire Extinguishers, 150 lb	24
Light Cart	2
Latrines with Tents	2

ANNEX A

Harvest Falcon Follow-On
Flightline Operations Set (XFBS2)

ITEM	QUALITY
Secondary Distribution Centers	4
Environmental Control Units	12
ESC, Avionics	1
ESC, Life Support	1
ESC, Electrical Maintenance	1
GP Shelter, General Use	1
GP Shelter, Power/Non-power AGE	2
GP Shelter, Propulsion	1
Aircraft Hangar	1
Flightline Fire Extinguishers, 150 lb	18
Latrine with Tent	2

ANNEX B

TYPICAL BARE BASE SQUADRON-SIZE POPULATION

FUNCTION	PERSONNEL	TYPICAL FACILITY SUPPORT
Aviation Package		
Operations	33	TEMPER Tents GP Shelters ESCs
Admin	8	TEMPER Tents
Maintenance	347	GP Shelters ESCs TEMPER Tents FSTFSs/Dome Shltr ACHs
Supply	13	TEMPER Tents ESCs
Intelligence	13	TEMPER Tents
Medical	3	TEMPER Tents
Headquarters	58	TEMPER Tents ESCs
A/C Maint Additive	99	ACHs FSTFSs/Dome Shltr GP Shelters TEMPER Tents ESCs
Munitions Maintenance	48	GP Shelters TEMPER Tents

ANNEX B

FUNCTION	PERSONNEL	TYPICAL FACILITY SUPPORT
Aircraft BDR	34	TEMPER Tents ACHs GP Shelters
Intelligence Additive	3	ESCs
Fuels	18	TEMPER Tents ESCs
Weather	2	TEMPER Tents
Combat Camera	6	TEMPER Tents
Medical	43	TEMPER Tents ESCs
Supply	58	TEMPER Tents ESCs FSTFSs/Dome Shltr
Postal	3	TEMPER Tents
Security Police	66	TEMPER Tents
OSI	2	TEMPER Tents
Information Mgt	9	TEMPER Tents
Personnel	14	TEMPER Tents
Transportation	45	TEMPER Tents FSTFSs/Dome Shltr
Finance	9	TEMPER Tents
Base Operations	3	TEMPER Tents
Contracting	4	TEMPER Tents
AFCOMS	8	TEMPER Tents
Engineers	138	TEMPER Tents GP Shelters
MWRS	39	TEMPER Tents

ANNEX B

FUNCTION	PERSONNEL	TYPICAL FACILITY SUPPORT
MWRS	39	TEMPER Tents ESCs GP Shelters
Communications	60	TEMPER Tents ESCs

ANNEX C

TYPICAL RED HORSE TASKINGS

- Erection of critical vehicle revetments.
- Erection of Harvest Falcon aircraft hangars, dome shelters, and frame supported tension fabric shelters (FSTFS)..
- Erection of steel POL tanks and supporting hardwall distribution system.
- Construction of aircraft wash racks.
- Erection of K-Span or similar storage facilities.
- Construction of aircraft parking pavements, pads and ramps.
- Erection of major earthwork revetments and bunkers.
- Installation of expeditionary aircraft arresting systems.
- Construction of AGE and vehicle wash racks.
- Construction of paved roads and accessways.
- Expansion and development of water sources.
- Erection of modular and pre-engineered facilities.
- Performance of major base denial activities.

ANNEX D

BARE BASE VEHICLE PACKAGES

BARE BASE SUPPORT PACKAGE (UFSWA)

VEHICLE TYPE	QTY	VEHICLE TYPE	QTY
Container Handler	1	Ambulance 4x4	2
Truck Refrigerated	1	Truck Highlift 9T	1
Truck Highreach 45ft	1	Truck Fuel 1,200 gal	2
Truck Dump 5T	1	Truck Dump 8CY	6
Trac Tow Bobtail	3	Trl Manhole CLN	1
Trl Trencher	1	Crane 7.5T	1
Trac Industrial	1	Dozer D7	1
CLNR Vac Multi	1	Sweeper, Towed	1
LDR Scoop w/Backhoe	1	LDR Scoop 2.5CY	1
LDR Scoop 4CY	1	Grader SZ2	1
Roller Vibr	1	Dist Wtr 1,500 gal	1
Excavator, Wheeled	1	Trencher, Pneu Tire	1
Forklift 4K STD	3	Forklift 6K R/T	5
Forklift 6K STD	3	Forklift 10K STD	2
Forklift 10K A/T	3	Forklift 13K A/T	3
Trailer M105	1	Truck Fire P-19	2
Truck Fire P-10	1	Truck Fire P-20	1
Truck Fuel R-9	2	Tractor Tow MB-4	1
Trl Fuel A1B 600 gal	1		

TOTAL 61

ANNEX D

GENERAL PURPOSE PACKAGE (UFSWC)

VEHICLE TYPE	QTY	VEHICLE TYPE	QTY
Bus 28 PAX	3	Multistop	3
Truck P/U 3 PAX 4x4	6	Truck P/U 6 PAX 4x4	5
Truck Cargo 2.5T	3		

TOTAL 20

M-SERIES BARE BASE SUPPORT PACKAGE (UFSWB)

VEHICLE TYPE	QTY	VEHICLE TYPE	QTY
Truck Utility, M1009	3	Truck Utility, M10026	6
Truck Cargo, M1008	1	Truck Shelter, M1028	1
Truck Cargo 2.5T,M35	9	Trl Cargo 3/4T,M101	3
Truck Wrecker,M936	1	Tractor Tow, MB-4	1
Trl Water 400 gal	9		

TOTAL 34

ORGANIC MOVEMENT SUPPORT PACKAGE (UFSWD)

VEHICLE TYPE	QTY	VEHICLE TYPE	QTY
Truck Trac 10T 6x4	9	Trailer Tilt 22T	2
Trailer Semi 20T 25 ft	6	Trailer Semi 20T 40 ft	6

TOTAL 23

ANNEX D

BOMBER/TANKER AIRCRAFT SUPPORT PACKAGE (UFSWF)

VEHICLE TYPE	QTY	VEHICLE TYPE	QTY
Bus 28 PAX	2	Multistop	4
Truck Trac 10T 4x6	6	Trailer Semi 20T 40 ft	8
Tractor Bobtail	9	Truck Utility, M1026	4
Truck Fuel R-9	2	Truck Water Demin A-2	4
Tractor Tow MB2			

TOTAL 41

FIGHTER AIRCRAFT SUPPORT PACKAGE (UFSWE)

VEHICLE TYPE	QTY	VEHICLE TYPE	QTY
Multistop	2	Truck Trac 10T 6x4	2
Trailer Semi 20T 25 ft	3	Tractor Bobtail	9
Truck Utility, M1026	4	Truck Fuel R-9	2
Tractor Tow, MB4			

TOTAL 25

CARGO AIRCRAFT SUPPORT PACKAGE (UFSWG

VEHICLE TYPE	QTY	VEHICLE TYPE	QTY
Multistop	2	Truck Trac 10T 4x6	4
Trailer Semi 20T 25 ft	1	Trailer Semi 20T 40 ft	3
Tractor Bobtail	3	Loader AC 25K	3
Losfrt SV 50K	2	Forklift 10K A/T	4
Loader AC Widebody	2	Truck Utility, M1026	4
Truck Fuel R-9	2	Tractor Tow MB2	2

TOTAL 32

ANNEX D

AIRCRAFT SQUADRON ADDITIVE PACKAGE (UFSWH)

VEHICLE TYPE	QTY	VEHICLE TYPE	QTY
Multistop	12	Truck P/U 3 PAX 4x4	12
Truck P/U 6 PAX 4x4	14		

TOTAL 38

AIR HOSPITAL PACKAGE (UFSWJ)

VEHICLE TYPE	QTY	VEHICLE TYPE	QTY
Bus Ambulance	2	Ambulance 4x4	1

TOTAL 3

RAPID RUNWAY REPAIR PACKAGE (UFSWK)

VEHICLE TYPE	QTY	VEHICLE TYPE	QTY
Truck Dump 8CY	4	Roller Vibr	1
Excavator Wheeled	1		

TOTAL 6

ANNEX D

RECOMMENDED ENGINEER BARE BASE VEHICLE PACKAGE (BEDDOWN)

VEHICLE TYPE	1,100 POP QTY	2,200 POP QTY	3,300 POP QTY	TOTAL
Truck, High Reach	1	1		2
Truck, Fuel 1,200 gal	2			2
Truck, Dump 5T	2			2
Truck, Dump 8CY	4	2	2	8
Trencher	1	1		2
Tractor, Industrial	2			2
Dozer, D7	2			2
Vacuum Sweeper	2			2
Sweeper Towed	2			2
Frontend Loader w/Backhoe	1	1		2
Frontend Loader 2.5CY	1	1	1	3
Frontend Loader 4CY	2			2
Grader	1			1
Roller Vibratory	1	1		2
Water Truck 1,500 gal	1			1
Trencher Pneu Tire	1	1		2
Forklift 6K R/T	1			1
Forklift 6K STD	1			1
Forklift 10K A/T	2			2
Forklift 13K A/T	3			3
P-19 Fire Truck	2	1	1	4
P-20 Fire Truck	1	1		2
P-10 Fire Truck	1			1

ANNEX D

RECOMMENDED ENGINEER BARE BASE VEHICLE PACKAGE (BEDDOWN)

VEHICLE TYPE	1,100 POP QTY	2,200 POP QTY	3,300 POP QTY	TOTAL
Truck, HMMWV	3	1	1	5
Truck Cargo 2.5T	3	1		4
Trailer Cargo 3/4T	2			2
Bus 28 PAX	1			1
Truck P/U 4x4 3 PAX	3	1	1	5
Truck P/U 4x4 6 PAX	2	1		3
Truck Cargo Comm 2.5T	1	1		2
Truck Tractor 10T	2	1	1	4
Trailer Tilt 22T	1			1
Trailer Semi 20T 25 ft	2			2
Trailer Semi 20T 40 ft	2			2
Paint Machine	1			1
Water Dist Tlr 400 gal	3	2	2	7

ANNEX D

RECOMMENDED ENGINEER BARE BASE VEHICLE PACKAGE (RRR ADDITIVE)*

VEHICLE TYPE	QTY
Truck Dump 5T	2
Truck Dump 8CY	7
Dozer D7	1
Frontend Loader 2.5CY	3
Frontend Loader 4CY	7
Grader	2
Roller Vibratory	4
Excavator	6
Truck HMMWV	1
Truck Tractor 10T	2
Trailer Tilt 22T	2
Trailer Semi 20T 25 ft	4
Trailer Semi 20T 40 ft	4
Trailer 60T	3
RRR Trailer	6
Paint Machine	1

*Total RRR package is similar to but not intended to mirror an R-2 set at a main operating base.

ANNEX E

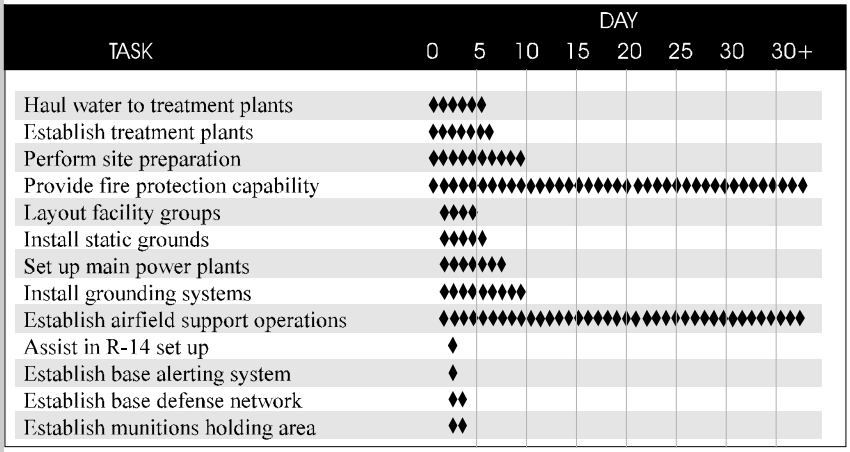
BARE BASE DEVELOPMENT TASK TIMELINES

BARE BASE DEVELOPMENT TASK TIMELINES

TASK	DAY 0	5	10	15	20	25	30	30+
Establish/develop water points	♦							
Prepare base layout/site plan	♦							
Set up expedient latrines	♦							
Accomplish expedient airfield repairs	♦							
Install MAAS	♦							
Install EALS	♦							
Set up emergency/area lighting	♦							
Perform EOD inspection	♦							
Establish engineer holding area	♦							
Set up engineer cantonment area	♦							
Set up MEP generators	♦♦							
Check TF-1 light carts	♦♦							
Grade primary roads	♦♦♦							

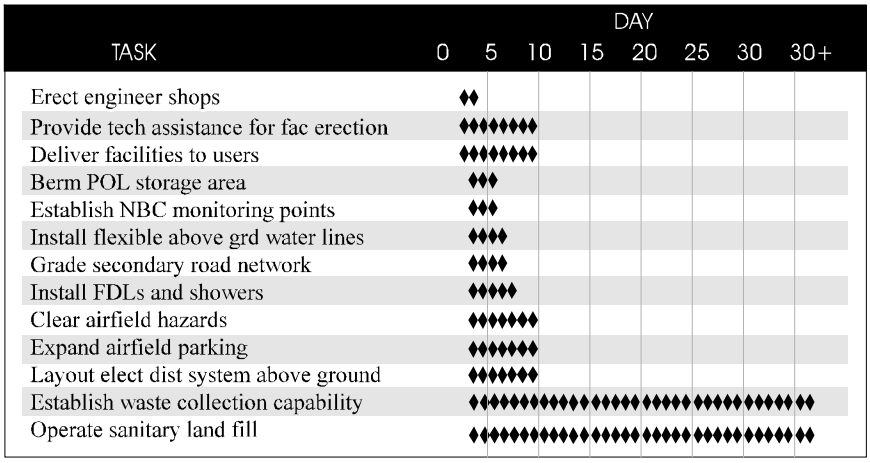
ANNEX T

BARE BASE DEVELOPMENT TASK TIMELINES (cont)



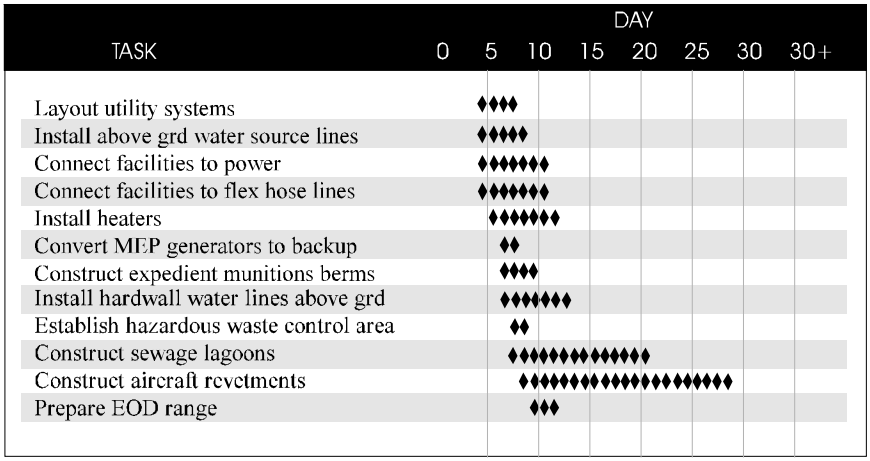
ANNEX E

BARE BASE DEVELOPMENT TASK TIMELINES (cont.)



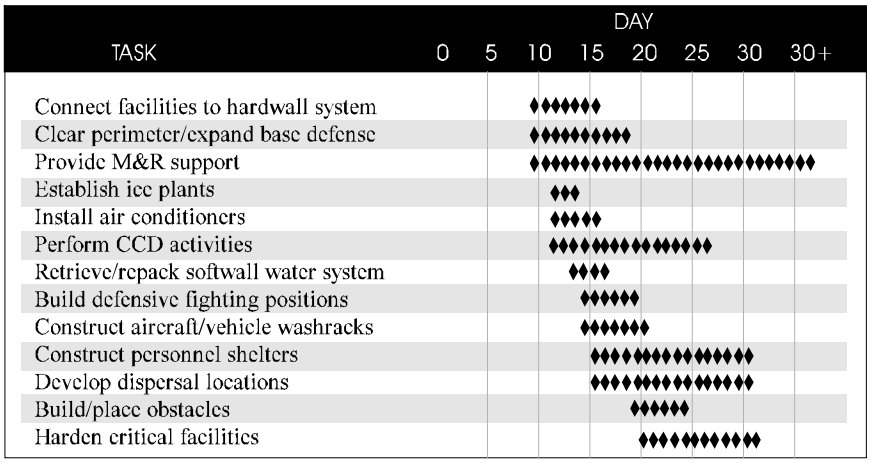
ANNEX E

BARE BASE DEVELOPMENT TASK TIMELINES (cont.)



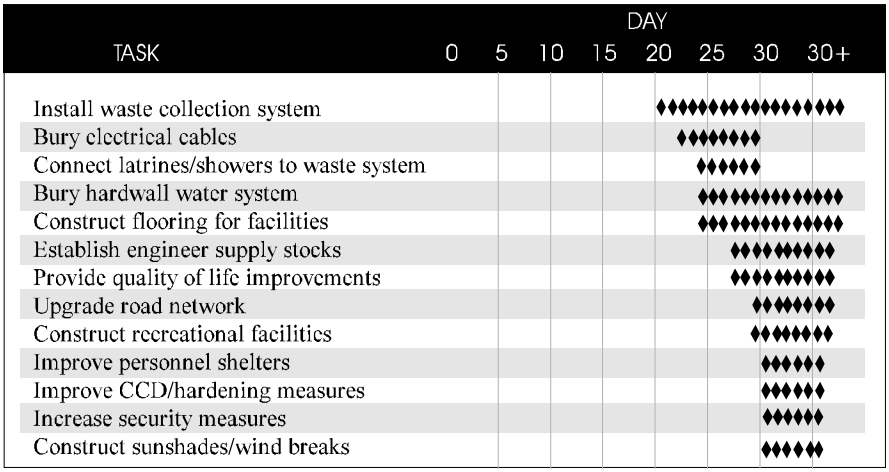
ANNEX E

BARE BASE DEVELOPMENT TASK TIMELINES (cont.)



ANNEX E

BARE BASE DEVELOPMENT TASK TIMELINES (cont.)



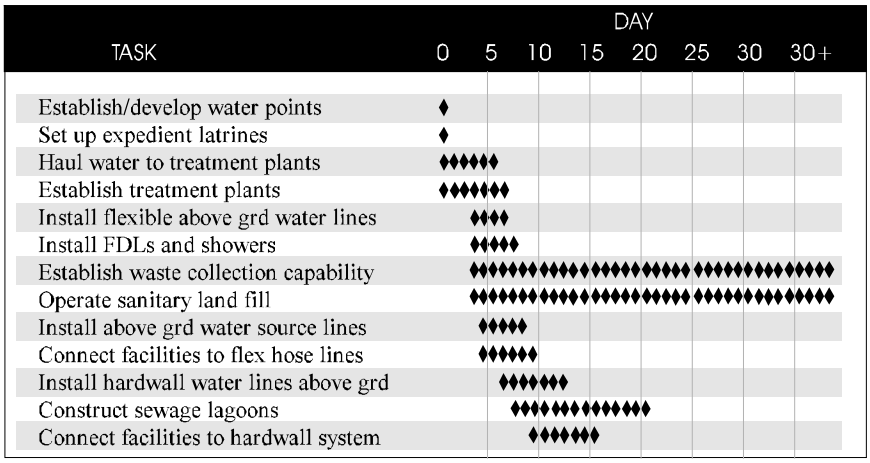
ANNEX E

BARE BASE DEVELOPMENT TASK TIMELINES (cont.)

TASK	DAY 0	5	10	15	20	25	30	30+
Construct permanent berms for munitions							♦♦♦♦♦♦	
Provide permanent pavement repairs							♦♦♦♦♦♦	
Develop recovery plans/training programs							♦♦♦♦♦♦	

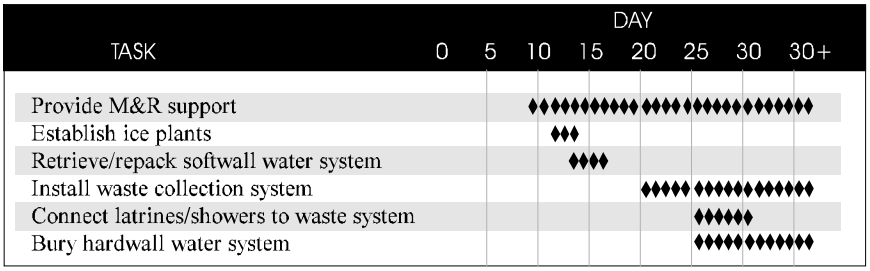
ANNEX E

BARE BASE DEVELOPMENT (WATER AND WASTE)



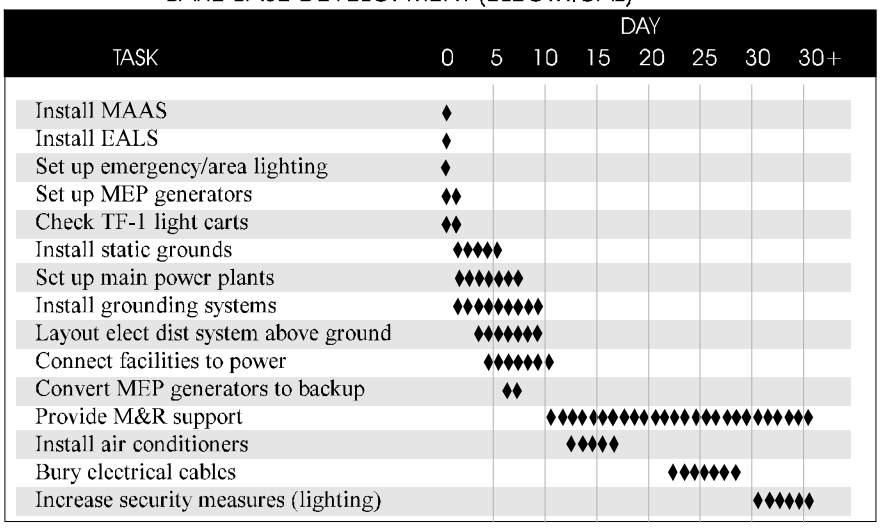
ANNEX E

BARE BASE DEVELOPMENT (WATER AND WASTE) cont.



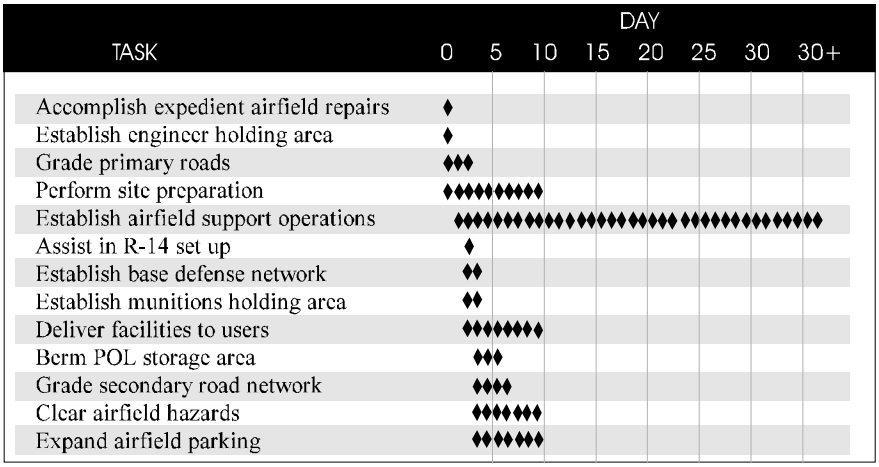
ANNEX E

BARE BASE DEVELOPMENT (ELECTRICAL)



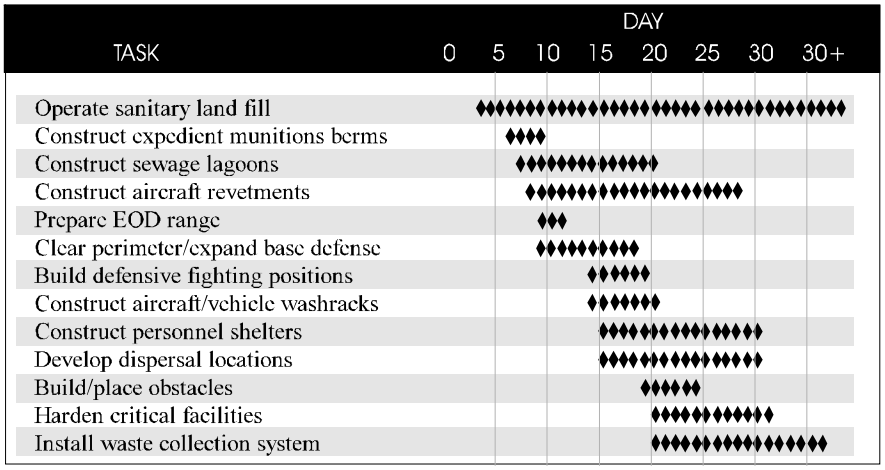
ANNEX E

BARE BASE DEVELOPMENT (EQUIPMENT OPERATIONS)



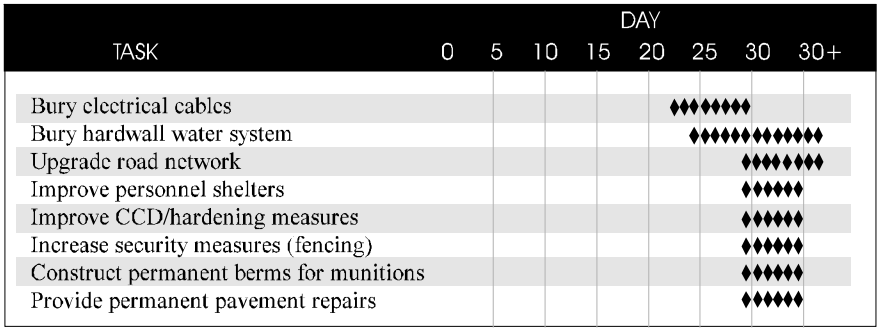
ANNEX E

BARE BASE DEVELOPMENT (EQUIPMENT OPERATIONS) cont.



ANNEX E

BARE BASE DEVELOPMENT (EQUIPMENT OPERATIONS) cont.



ANNEX F

SITE PLANNING/LAYOUT CHECKLIST

- Are basic planning source documents available?
  - ♦ AFPAM 10-219, Vol 5, Bare Base Conceptual Planning Guide
  - ♦ Base Support Plan (if published/applicable)
  - ♦ Joint Support Plan (if published/applicable)
  - ♦ AFPAM 10-219, Vol 6, Planning and Design of Contingency Air Bases (formerly AFCESA Pamphlet 93-12, Vol 5)
  - ♦ Base maps (if available)
- Has Wing Intelligence been contacted to provide the latest threat estimate?
- Has Wing Operations been contacted to provide verification on numbers/types of aircraft and base population to be supported?
- Has an exploratory trip been made around the base to ascertain terrain features, land area available, locations of existing pavements, location of water source, locations of useable structures, etc?
- Has the Wing Weather function been contacted to obtain germane climatic factors?
- Has a decision been made concerning a dispersed versus a non-dispersed layout?

ANNEX F

- Have areas unsuitable for facility layout been highlighted on the base layout maps?
- Have all facility groups (e.g. maintenance, supply, engineer, transportation, etc.) been sized based on typical quantities of facility assets and appropriate spacing distances?
- Have the facilities within each facility group been laid out with consideration given to utility system routings, i.e., reasonably straight runs and vehicle access ability?
- Have feasible locations for all facility groups been identified taking into account their functional relationship with the base mission and other base organizations?
- Has an allowance for future expansion been included in each facility group when appropriate?
- Does the layout of all facility groups meet the safety distance/quantity distance criteria pertaining to munitions. LOX, and POL storage?
- Has a road network been planned between facility groups which permits easy access and egress to and from the flightline?
- Have utility plants been sited?

ANNEX F

- Have areas for construction of evaporation beds and sewage lagoons been identified downwind of the main base area?
- Have areas for temporary disposal of waste and wastewater been identified pending completion of permanent lagoons and evaporation beds?
- Have site layout maps been made for survey crews who will mark locations of facility group areas and individual facilities?
- Have site layout crews been identified?
- Have stakes or similar marking devices been obtained?
- Have vehicles (if available) been identified for site layout crews?
- Have site layout crews been briefed on how to accomplish their tasks and the timeframe they have to work within?
- Do site layout crews have the surveying equipment necessary to layout the more complex requirements, e.g., the mobile aircraft arresting barrier?
- If other functional areas participated in site layout of their facilities and equipment, have the chosen locations been checked for suitability, e.g., drainage patterns, safety distance criteria, airfield clear zones, etc?

ANNEX G

ELECTRICAL SYSTEMS CHECKLIST

- Has a holding area for temporary storage of incoming electrical system components been established?
- Have mission essential facilities been identified and coordinated with the appropriate command elements?
- Have the locations of mission essential facilities been identified?
- Has a requirement for sustained operations at the contingency location been confirmed?
- Has an initial estimate of the electrical loads of mission essential facilities been made to aid in sizing generators to the requirements?
- Has vehicle/equipment support for moving electrical equipment to site locations been arranged?
- Do all electrical installation crews have an individual capable of operating materials handling equipment?
- Have SDCs been placed at locations where MEP generators can serve multiple mission essential facilities?
- Have MEP generators been connected to mission essential facilities?

ANNEX G

- Have TF-1 light carts been operationally checked and allocated to critical flightline functional areas?
- Have personnel been identified to perform routine maintenance and refueling operations on MEP generators?
- Have electrical feeder schedules been developed based on the layout of the various base facility groups?
- Have SDC circuits been sized to handle future air conditioning loads (if applicable)?
- Has a plan showing the layout of the electrical distribution system been developed?
- Have locations for power plants been determined?
- Have 750-kW generators been positioned at power plant locations?
- Have fuel bladders been installed at power plant locations?
- Have fuel bladders been properly bermed?
- Have control panels been correctly connected to the 750-kW generators?
- Have PDCs been placed and connected at power plants?
- Have adequate grounding systems been installed at the power plants?

ANNEX G

- Have SDCs been allocated to and placed in the various facility groups in such a way that portions of the groups can be brought on line as facilities are erected?
- Have SDCs been placed in areas accessible to vehicles yet not adjacent to heavy traffic or personnel flow?
- Have SDCs been grounded?
- Have the cables connecting facilities, panel boxes, SDCs, PDCs initially been installed along the surface of the ground?
- Have cables that cross roadways been adequately protected from damage by vehicle traffic?
- Have facilities been brought onto the base electrical grid as soon as reasonably possible once electrical connections have been completed?
- Have MEP generators serving mission essential facilities been placed in back up power mode once power plant electrical service was available?
- Have personnel been specifically designated to provide around-the-clock power plant operation?
- Have RALS units been installed at locations requiring large scale area lighting?

ANNEX G

- If sustained operations are planned and the electrical system is fully functional in an above ground mode, have efforts been started to bury electrical cables?
- Have accurate records/drawings been made of the locations of buried electrical cables?
- Have power plant operators been informed of what plant operation records to maintain?
- Have arrangements been made for power plant refueling?

ANNEX H

WATER SYSTEMS CHECKLIST

- Has a holding area for temporary storage of incoming water system components been established?
- Has the installation's source of water been identified and located?
- Has the water source been developed sufficiently to allow pumping?
- Has vehicle/equipment support for moving water system components to site locations been arranged?
- Have vehicles been identified for use in hauling water from source locations to treatment plants?
- Have water trailers or bladders mounted on trailers been identified to support the water hauling requirement?
- Have raw water pumps been installed at water source locations?
- Have locations for water plants been determined?
- Has the distance from the water source to the nearest treatment plant been limited to two miles or less?
- Have ROWPUs been delivered to the water plant locations?
- Have arrangements been made to have electrical power support readily available at the water plant locations?

ANNEX H

- Have personnel been assigned to set up ROWPUs and associated storage tanks and begin water production?
- Have personnel been assigned to continuously haul water from the water source location to the water plants?
- Have brine discharge lines from the ROWPUs been laid out to discharge brine back to the source or into a low lying contained area?
- Has sufficient space been allowed around the water treatment plants to permit installation of additional water storage bladders at a later time?
- If demineralized water is required, has a 20,000-gallon water bladder been specifically identified for demin water storage?
- Have key facilities (hospital, 9-1 kitchen, etc.) requiring potable water been identified?
- Has the layout of above-ground flexible hose from the treatment plants to key facilities requiring potable water been started?
- Have hoses that cross roadways been adequately protected from vehicle traffic?
- Have fill points for both potable and non-potable water been set up?

ANNEX H

- Has a reasonably level and clear path been made between the nearest water treatment plant and the water source?
- Has the hardwall source line been installed between the water source and the nearest water treatment plant?
- Have installation personnel verified in the field the planned locations of the hardwall distribution system for feasibility and practicability?
- Do all utilities crews have an individual capable of operating trenching equipment or a back hoe?
- Has the hardwall distribution system been initially installed along the ground surface?
- Have pipelines that cross roadways been adequately protected from damage by vehicle traffic?
- Have the additional water storage bladders provided as part of the hardwall distribution system been installed at the water treatment plants?
- Have the storage bladders been installed so that approximately 60% of the storage capacity is dedicated to potable water?
- Has a requirement for sustained operations at the contingency location been confirmed?

ANNEX H

- If sustained operations are planned and the water system is fully functional in an above-ground mode, have efforts been started to bury the distribution system?
- Have ice machines and refrigeration boxes (if available) been installed at one of the water plants to supply general base needs?
- Have accurate “as-built” drawings of pipe locations been made ?
- Have system shipping containers and the flexible hose initial distribution system been serviced and stored properly?

ANNEX I

WASTE SYSTEMS CHECKLIST

- Has a holding area for temporary storage of incoming waste system components been established?
- Have locations for construction of expedient latrines been identified?
- Have personnel been identified to construct expedient latrines at all required locations?
- Have the locations of Harvest Falcon field deployable latrines been identified?
- Has the potential of tapping into off base sewage collection systems been investigated?
- Have locations downwind of the base been identified for stabilization lagoons and evaporation ponds?
- Have areas for temporary disposal of waste and wastewater been identified pending completion of permanent lagoons and evaporation beds?
- Have personnel been identified for servicing of expedient latrines?
- Are personnel available who are qualified to operate the wastewater disposal trailer?
- Has local contract support for waste disposal been investigated?

ANNEX I

- Have greywater lines from the showers, laundry, and kitchen been run to evaporation beds?
- Have grease traps been installed in greywater lines leading from the kitchen?
- Have services personnel been instructed in grease trap use?
- Has a plan for the layout of the waste collection system been developed?
- Have installation personnel verified in the field the planned locations of the hardwall collection piping and lift stations for feasibility and practicability?
- Are lift stations located near a source of electrical power (not MEP generator)?
- Do utilities crews have personnel qualified to operate trenching equipment, back hoes and materials handling equipment?
- Has a requirement for sustained operations at the contingency location been confirmed?
- If sustained operations are planned and all required system components are on hand, have efforts been started to install the underground sewage collection system and construct stabilization lagoons/ evaporation ponds?

ANNEX I

- Have stabilization lagoons and evaporation ponds been sized for the anticipated base population and duration of deployment?
- Have accurate "as-built" drawings of pipeline locations been made?
- Have arrangements been made for continued servicing of latrines which are not connected to the collection system?

ANNEX J

FACILITY ERECTION CHECKLIST

- Has a holding area for temporary storage of incoming facility assets been established?
- Have selected engineer personnel been designated to identify and segregate engineer-related Harvest Falcon assets as they arrive?
- Are some of the individuals selected to identify incoming assets qualified to operate materials handling equipment?
- Has a method of asset accountability been established?
- Has an allocation of facility assets been made to the various facility groups to be set up at the bare base?
- Has command level (wing/base) agreement been reached on the asset allocation?
- Has a site layout been made identifying locations of facility groups and representative types of buildings within the groups?
- Have the specific locations of all dome shelters, frame supported tension fabric shelters and aircraft hangers been identified?Is the site preparation task underway and sufficiently manned so as not to delay facility delivery and erection?
- Are facilities delivered to the erection sites or engineer holding area (as appropriate) when they arrive?

ANNEX J

- Has the capability for engineer personnel to assist in the delivery of facilities to erection locations been established?
- Are facilities being delivered close to their final set up locations?
- Have engineer shop and cantonment facilities been set up fairly early in the beddown process?
- Have selected engineer personnel been designated to provide technical expertise to the base populace in erecting facility assets?
- Have instructions been given to the base personnel erecting their own facilities concerning facility orientation and meaning of layout stakes/markers?
- Are dome shelter, frame supported tension fabric shelter and aircraft hanger facility components being identified and set aside for RED HORSE or 49th MMG activities?
- Have engineer crews been designated for all GP shelter erection?
- Have engineer crews been identified to provide utility connections to facilities once facilities are erected and utility services are in place?
- Are shipping containers being collected and stored in the holding area once they are empty?

ANNEX K

PAVEMENTS AND EQUIPMENT CHECKLIST

- Have contract options been investigated for obtaining and/or augmenting heavy equipment assets?
- Have heavy equipment assets been thoroughly checked for serviceability upon arrival?
- Has an airfield survey been made to identify emergency maintenance, repair and operations requirements?
- Have potential “show stopping” airfield pavement repairs been made?
- Has construction required to develop a water source been completed?
- Has a road or accessway from the water source to the water treatment plants been established?
- Has site preparation for aircraft arresting barrier installation been accomplished?
- Have airfield pavement sweeping operations been instituted?
- Has site preparation for NAVAID installation been accomplished?
- Has site preparation for facility erection begun?
- Has a road network from the flightline been established?

ANNEX K

- Has an engineer holding area (open storage) been established?
- Have roads or accessways to locations of each of the planned facility groups been graded?
- Have temporary munitions holding areas been established?
- Have berms been constructed around aircraft refueling bladders?
- Have aircraft parking expansion requirements been completed?
- Have specialized aircraft pavements (hot cargo pads, arm/dearm pads, etc.) been completed?
- Have critical obstacles in airfield clear zones been removed?
- Have critical base drainage conditions been corrected?
- Have serious FOD producing areas been corrected?
- Have sources of supply for revetment fill materials and general horizontal construction been located?
- Have berms for POL storage areas and power plant fuel storage been completed?
- Has a sanitary land fill operation been established?

ANNEX K

- Have perimeter clearing and base defense network expansion operations been started?
- Has aircraft revetment erection been started?
- Have hazardous waste control areas been identified and established?
- Has construction of stabilization lagoons and evaporation ponds been started?
- Has construction of personnel protective shelters been started?
- Has construction of facility revetments been started?
- Have permanent munitions storage berms been constructed?
- Has support for burying utility lines been provided?
- Have obstacles and barricades been fabricated and placed?
- Have dispersal locations been developed?
- Have roads been upgraded to withstand sustained vehicle traffic?
- Have airfield pavement expedient repairs been replaced with permanent repairs?

ANNEX L

FIRE PROTECTION CHECKLIST

- Has contact been made with local fire protection officials to determine host nation support possibilities?
- Have firefighters set up the TEMPER tents that comprise the fire station?
- Has a fire alarm communications center (FACC) been established?
- Have communications been established between the FACC and appropriate base agencies and command posts?
- Has vehicle availability been ascertained?
- Have vehicle shortfalls been identified and passed to higher headquarters for action?
- Has firefighting agent availability been determined?
- Have shortfalls in agent availability been identified?
- Have water sources for firefighting been identified and located?
- Have fire extinguishers contained in the Harvest Falcon package been checked, serviced, and distributed?

ANNEX L

- Has a dispersal plan for fire protection equipment and materials been developed?
- Have dispersal locations been prepared (hardened and camouflaged)?
- Have fire protection assets that cannot be moved been hardened and camouflaged?
- Have fire protection officials participated in initial base layout planning?
- Have fire reporting procedures been established and disseminated to the base population?
- Has auxiliary firefighting equipment, e.g., extinguishers, shovels, hoses, etc., been made available for use in tent city areas?
- Have prefire plans been developed for critical facilities, tent

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