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Supply

FUELS LOGISTICS PLANNING

OPR: HQ USAF/ILSP (Mr John F. Lavin)

Certified by: HQ USAF/ILSP (Col John Gunselman)

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This pamphlet establishes basic guidance for planning and executing fuel support operations, particularly at other than main operating bases. It implements Air Force Policy Directive (AFPD) 23-2, *Supplies and Material Management.*. It identifies logistics planning factors and guidance on fuel-related products, equipment, and support procedures. This pamphlet applies to all Air Force activities involved in fuel support operations, including the US Air Force Reserve and the Air National Guard. Submit recommendations for changes in letter form, through command channels, to HQ USAF/ILSP.

The use of any specific manufacturer name, commercial product, commodity, or service in this publication does not imply endorsement by the Air Force.

Chapter 1

GENERAL INFORMATION ABOUT THIS PAMPHLET AND FUELS

1.1. Purpose of This Pamphlet. This pamphlet provides a single source of logistics planning guidance for fuels planners to help them establish a petroleum support capability at airfields other than US Air Force main operating bases.

1.2. Basic Fuels Logistics Planning:

1.2.1. The Air Force must maintain the ability to deploy rapidly and effectively to a variety of base environments ranging from bare bases to fully equipped, international airports. Once in place, US forces must be able to operate with a full spectrum of fuels support. A bare-base must have a runway, taxiway, and parking area adequate for the deployed force and an adequate source of water that can be made potable. Developed foreign military or civilian airfields may be comparable to true bare-base operations because of inadequate real estate and access to a runway. Deploying forces to these locations must prepare to support themselves as in a real bare-base environment.

1.2.2. Fuels personnel at all levels may be required to provide fuels logistics planning to support exercises or real-world contingencies. This publication provides basic guidance for managing the use of logistic resources and for ensuring that critical phases of the fuels planning process are not overlooked. It does not eliminate the need for other directives or technical orders. Information contained in this pamphlet should help you analyze mission requirements and allocate resources to develop an effective and efficient support package.

1.2.3. The Department of Defense (DOD) wartime deliberate planning concept uses the Joint Operation Planning System (JOPS) to develop operational plans. In response to short-notice contingencies, a shortened form of deliberate planning known as the Crisis Action System (CAS) is used. Air Force JOPS guidance can be found in AFR 28-3. Fuels logistics planners are responsible for identifying petroleum, and liquid oxygen and nitrogen requirements; and for determining or arranging the required support. To do this requires at least a limited knowledge of the planning process. This publication provides that background.

1.2.4. For the purpose of this pamphlet, a planning cycle is considered as: (1) a preplanning phase where requirements are determined and an initial support proposal drafted; (2) a site survey phase to verify the feasibility to support the proposal; (3) actual plan execution; and (4) after-action planning where the operation is analyzed for lessons learned. This pamphlet is designed to be especially helpful in those situations where phases 1 and 2 are compressed or eliminated. Phase 4 will hopefully result in additional contributions to this guide. **Attachment 1** gives fuels logistics planning guidance for use during planning and execution.

1.3. Terms and Acronyms. References, Terms and acronyms applicable to this pamphlet are defined in **Attachment 1**.

Chapter 2

FUNCTIONS AND RESPONSIBILITIES

2.1. Fuels Management:

2.1.1. Fuels management personnel generally are trained in all aspects of the fuels operation. Persons involved in exercise or contingency planning should also have a working knowledge of tactical, mobile fuel systems. The senior fuels representative planning or deploying in support of an operation should be prepared to provide standardized refueling support in a nonstandard environment, and, in many cases, to work outside the normal chain of operations. Individuals selected to establish a deployed support capability should be aware that agencies normally available to arrange fuel support may not be available in time to meet operational needs. This may require negotiations with the military and civilian authorities of a foreign country.

2.2. Civil Engineers. In a bare-base environment, civil engineers maintain normal responsibilities of liquid fuels maintenance. Fixed fuel facilities will probably be under operational control of the host airport and not the responsibility of the Air Force engineers. Site preparation, including construction of berms and other environmental protection measures, is a civil engineer responsibility unless the host provides this service.

2.3. Transportation . In addition to normal refueling vehicle maintenance responsibilities, transportation vehicle maintenance personnel also provide maintenance of air-transportable hydrant refueling systems. When deploying Fuels Mobility Support Equipment (FMSE), they should make sure the equipment is accompanied by specialists trained in the maintenance of this equipment.

2.4. Major Command (MAJCOM) Fuels . The Geographic Combatant Commander in Chief (CINC) has the predominant fuels responsibility within a theater, and this responsibility is discharged by the Joint Petroleum Office (JPO). The JPO is responsible for the overall planning of petroleum logistic support for joint operations within their area of responsibility (AOR). The JPOs work closely with their service components and the Defense Energy Supply Center (DESC) to plan, coordinate, and oversee all phases of bulk petroleum support for US forces employed in theater. This includes arranging for movement of fuel and related products, personnel, and support equipment. Close coordination under the direction of the JPO is critical to a successful joint operation.

2.5. Defense Energy Supply Center (DESC) . The DESC and its agencies have the ultimate responsibility for procurement and contracting for fuel, as well as for fuel support at commercial Into-Plane contract locations. Arrange DESC support through MAJCOM channels. If time does not permit DESC support, temporary support may be arranged using an Aircard (SA ALC/SFR); existing into-plane contracts; or by a memorandum of agreement between the host and the US senior commander.

Chapter 3

AIRFIELD SUPPORT

3.1. Airfield Surveys . To assist in future planning, attempt to obtain as much information as possible on the fuel support capability at deployed operational locations. **Attachment 3** may serve as a guide to the type of information desired to update or correct existing information files. You should provide this information to the supporting MAJCOM as part of the after action report.

3.2. Host Nation Support . The fastest and most economical method of obtaining refueling support is to obtain support from the host nation airfield. For this reason, host nation support is especially critical in contingencies when logistic support from US units or equipment may not be readily available. Additionally if the host cannot provide total support, a limited use of their facilities may be possible. US assets can augment any deficiencies.

3.3. Memorandum of Agreement (MOA). Arranging for fuel support, particularly with a foreign government, may require the writing of a Memorandum of Agreement (MOA) or Memorandum of Understanding (MOU) between the United States Government and the host. Only certain agencies of the US Government have the authority to enter into such agreements. The DESC performs this function for fuel support or may delegate such authority. **Attachment 4** depicts a sample MOA.

3.4. Fuel Availability.

3.4.1. Currently, JP-8 is the primary jet fuel for US Air Force aircraft. Alternate fuels include JP-4, JP-5, Jet A, Jet A-1, and Jet B. By definition, alternate fuels (**Attachment 5**) are those authorized for continuous use and which do not impact on aircraft performance. However, alternate fuels, particularly commercial grades, may not contain additives . Reference TO 42B1-1-14 and **Attachment 5** for fuel specifications and interchangeability. The World Wide Into-Plane Contract Listing is available from MAJCOM fuels accountant or DESC.

3.4.2. No single, reliable document is available which lists fuels availability at worldwide military and civil airfields. When deploying to locations outside the United States, the responsible MAJCOM should provide planning information. In a crisis situation, the deploying fuels representative may have to improvise by contacting the local American Embassy, US Defense AttachÈ Offices, airport manager, or local oil company representatives. During initial planning, some additional sources of information are as follows:

3.4.2.1. DOD Flight Information Publication (FLIP). The Defense Mapping Agency publishes these books, also known as En Route Supplements, which are available for worldwide regions. FLIP's are updated approximately monthly and can be found at base operations flight planning facilities. Listings are by airport name (i.e., John F. Kennedy) as opposed to city name. The listings give pertinent airfield information, including a summary of fuel types available, contract refueling support, and availability of LOX and demineralized water. The files give no indication as to quantities available or the rate of dispensing into aircraft. A legend at the beginning of each book provides further guidance on reading the airport summaries.

3.4.2.2. AMC Assault Zone Survey Repository: This is a computerized FAX on demand system that contains detailed airfield site surveys for hundreds of airports worldwide. For access to the system call DSN 576-5565 or commercial (618)-256-5565.

3.4.2.3. Automated Air Facilities Information Files (AAFIF). The Defense Mapping Agency prepares these files, which are available on the Global Command and Control System (GCCS) or on the classified INTERNET linked to the command INTEL page. AAFIF files provide the best available information on non-USAF and especially non-DOD installations worldwide. Information is not currently available for CONUS airfields. Because of sources used and the frequency of updating information files, information should be used with caution because it is not always accurate or current.

3.4.2.4. The Bulk Storage Facilities Report (RCS: DD-A&T(A)506). DESC prepares this report annually. The report lists fuel tank information (type, capacity, status) for locations where US military fuel storage exists. The report also contains information on receiving rates and modes.

3.4.2.5. Base War Support Plan. The fuels annex to this plan is prepared according to AFI 23-201 and maintained by the logistics plans office. Normally a host base is designated for each known bare-base location responsible for preparing the fuels annex for the plan.

3.4.2.6. Unpublished Reports. MAJCOMs, especially those having logistics responsibility for the area of concern, frequently have unpublished airfield surveys which contain in-depth fuels information.

3.4.2.7. Special Fuels (JP-7 and JPTS). 12AF accomplishes all planning for special fuels. Information concerning special fuels may be obtained by contacting 12AF/LGR at the numbers listed in the Air Force Fuels Directory. The Air Force Fuels Directory is published annually by SA-ALC/SF, Kelly AFB TX 78241-5603 (Note: All aircraft -1 checklists have a table that lists suitable alternate fuels and any specific flight restrictions associated with the use of these alternates.

3.5. Quality Control . Quality control of petroleum products at deployed locations takes on a greater significance than at main operating bases because of the lack of control over fuel handling. Quality control is accomplished with a minimum of laboratory equipment and in less than ideal conditions. This is particularly critical when receiving fuel from a foreign source. TO 42B-1-1, presents guidance for quality control procedures at temporary locations.

Chapter 4

FUEL SUPPORT

4.1. Computing Requirements.

4.1.1. Determining fuel requirements may be relatively simple as in the case of supporting a few aircraft of one type, or extremely complex when providing support to a variety of aircraft from different commands and services. Since maximum lead time is required to arrange fuel support, timeliness and accuracy in computing requirements are extremely important. DOD Manual 4140.25 requires the services to provide a military interdepartmental purchase request to DESC not later than 90 days before the first day of fuel consumption. DESC prefers incremental withdrawal of planned fuel requirements (i.e., initially estimating on the high side) vice last minute add-on of fuels requirements which further tax the host capabilities. The impact of underestimating requirements is obvious in that fuel supplies may run out. Limited bulk storage tankage capacities at bare-base locations further complicates requirement computations. Overestimating requirements can also create serious problems, particularly during peacetime exercises. Aside from ending up with too much fuel and perhaps not being able to empty portable systems, this can sometimes force the US Government to pay for fuel based on initial estimates even though the fuel is not actually used. The net result of continued miscalculations or lack of firm estimates could cause host nations to withdraw future support or significantly increase the cost of that support.

4.1.2. Information Source. Logistics planners involved in writing the support plan normally provide the aircraft sortie generation requirements. Sortie requirements can then be converted to fuel, water, and LOX requirements. In reality, obtaining requirements is seldom a simple task, because changing guidelines and funding delay actual aircraft planning until the last minute. Attempt to finalize requirements as early as possible. Get the requirements in writing and carefully analyze inputs from all commands and Services to make sure requirements appear realistic. Provide combined requirements by message to all concerned for review.

4.1.3. Computations. A sortie is defined as one aircraft flying one mission. Flying requirements are stated as either a number of sorties to be flown each day or as a sortie rate. Compute the number of sorties to be flown in a single day by multiplying the number of aircraft available times the sortie rate (i.e., ten aircraft flying a 0.8 sortie rate equates to eight sorties per day). Planners may also provide the fuel on-load per aircraft in which case the daily fuel requirement can be computed by multiplying the number of sorties times the on-load per sortie. If operations planners provide only the planned average duration of a sortie, a reasonably accurate requirement forecast can be obtained by using consumption rates (**Attachment 8**) times the sortie duration in hours to arrive at a fuel on-load. LOX and water requirements are computed in a similar manner. Ground fuel requirements are discussed later.

4.2. Resupply Options .

4.2.1. When the host airfield is unable to provide actual aircraft refueling, it becomes necessary to establish a fuel dispensing capability and obtain fuel from a bulk source. The simplest and most expedient method of resupply is usually to use the same source of supply used by the host airfield, through arrangements with the supplier or the airfield. The following options may apply where resupply is inadequate or not available:

4.2.2. Ocean Tanker. DESC can arrange for tanker shipments of fuel to an available port if given enough lead time. Dependent on location and timing, tankers at sea may be diverted to meet a contingency requirement.

4.2.3. Aerial Bulk Fuel Delivery System (ABFDS). The ABFDS is designed for aerial delivery of fuel to locations where other methods of transportation are impractical. While the ABFDS system can carry from 3,000 to 24,000 gallons per sortie it is not a cost-effective or efficient means of providing fuel resupply, especially in support of large flying operations. Dependent on the contingency location and its distance from a source of fuel, the aircraft may consume more fuel than actually delivered by the system. The system has been qualified for bulk transport of all types of liquid fuel, including special fuels; i.e., JPTS

4.2.4. Aircraft Systems The use of aircraft as the primary resupply mode for fuel is permitted only after all other possible means of support have been exhausted. Airlift is expensive movement with limited capability:

4.2.4.1. Cargo Aircraft. Air Mobility Command (AMC):

4.2.4.1.1. Equipment: C-130, C-141, C-5, and C-17 aircraft.

4.2.4.1.2. Primary Function: Airlift of cargo and personnel.

4.2.4.1.3. Alternate Functions: ABFDS with alternate capability equipment (ACE) for filtration of aviation fuels, 500 gallon drum transport, wet-wing defueling, and aircraft-to-aircraft refueling.

4.2.4.1.4. Interoperability: All AMC aircraft are equipped with the single point refueling receptacle. The single point refueling nozzle and adequate length of discharge (collapsible) hose are required to defuel the aircraft. Normally, nozzle and hose will be provided by the receiver. These cargo aircraft are interoperable with all rotary wing aircraft (except US Army and US Marine Corps UH-1 and OH-68), US Marine Corps and US Navy ground systems, and US Army HEMMET M970 aviation road tankers.

4.2.4.2. Tanker Aircraft. Air Mobility Command (AMC):

4.2.4.2.1. Equipment: KC-135 and KC-10 aircraft.

4.2.4.2.2. Primary Function: Inflight refueling.

4.2.4.2.3. Alternate Functions: KC-135 for passenger or limited cargo; KC-10 for passenger, cargo, and fuel transport for on-ground defueling or wet wing defueling and a/c to a/c refueling.

4.3. Storage Options . Storage requirements may be met by bladder systems, railroad tank cars, or any container which meets operational, safety, and environmental needs. Maximize use of host storage facilities and minimize the construction of berms or use of bladders. The method of resupply, movement of fuel to US dispensing systems, and the need for blending of additives should be considered in the planning and sourcing.

4.4. Additives. Military fuel specifications require additives (corrosion inhibitor, fuel system icing inhibitor, and conductivity additive), which are not always available in commercial jet fuels. While all aircraft can operate on fuel without additives, the resultant damage to some aircraft engines (particularly in F-15

and F-16 fighters) is enough to make additives mandatory in support of all but emergency operations involving these aircraft. Additives pose a particular problem for the fuels planner because host airports will not normally allow additives in their systems. At those locations where fuel additives are required, actions must be taken to ensure fuel meets military specifications.

4.5. Ground Fuels . Ground products (mogas, diesel) are of equal importance to aviation fuel and will probably be required before aircraft arrival to support communications and ground power equipment. Requirements are determined early by contacting potential using agencies, such as the civil engineers, transportation, communications, and aircraft maintenance. Receipt, storage, and issue procedures are basically the same as for aviation fuels except that smaller dispensing systems are normally required. Consider providing adapters to allow standard nozzles to fit into smaller openings of unleaded vehicles.

4.6. Personnel and Equipment Requirements. MAJCOMs are responsible for determining and coordinating all personnel and equipment requirements . As the fuels planner, your early submission of requirements to MAJCOM is crucial. Although no exact formula exists for determining the exact number of personnel and equipment needed, historical data and personal experience will normally aid in the planning. A deployment requirements chart, **Attachment 9**, is provided as a rule of thumb guideline for estimating personnel and equipment requirements. This chart is not all inclusive, nor does it represent any approved table of allowance or authorizations. You should exercise caution to ensure personnel with the needed special experience identifiers and the correct types of equipment are sourced. Additionally, you should state all requirements for other non-refueling vehicles needed in the fuels operations. Although it is not the responsibility of the fuels planner to coordinate for liquid fuels maintenance or refueling maintenance personnel, it is in the best interest of the entire fuels operation to identify the needed skills

Chapter 5

FUELS EQUIPMENT INTEROPERABILITY

5.1. Dispensing Options. AS 158 and AS 929 identify all Fuels and Cryogenics Mobility Equipment (FMSE). All fuels mobility equipment is air transportable in C-130 or larger aircraft. Considering the logistics problems and high cost of airlift, equipment moves should be minimized and host assets used where possible. If time permits, you should sealift the equipment when possible to minimize airlift requirements.(FMSE) is stored in several locations throughout the world. While FMSE can be issued for peacetime disaster and contingency support, it is considered war reserve materiel (WRM). You should arrange movement through the Air Force MAJCOM with the primary responsibility for supporting the exercise or contingency.

5.2. Joint Interoperability . Joint operations between the Services are becoming increasingly important and more frequent. Because fuel is a common item among the Services, delivery of this product into a joint combat environment is one aspect the planner considers and integrates to ensure successful accomplishment of the mission. The Services have traditionally maintained fuel equipment tailored to their own particular needs. Nonstandard refueling techniques may have to be employed to support joint combat operations. **Attachment 11** contains a listing of the Services' major fuel equipment, including the description and interoperability/considerations.

5.3. Nonstandard Refueling Operations Nonstandard refueling operations are primarily between Services of a joint force in which fuel is passing from a unique source, such as aircraft fuel tanks, into a receiving aircraft, ground support storage, or a transport vehicle. It is not within the context of this pamphlet to address all nonstandard refueling considerations that exist. These operations may also include fuel support between two Services conducting ground or sea operations. An example of this would be US Air Force helicopters refueling aboard a Navy vessel. Other examples of nonstandard refueling operations include wet wing defueling to equipment and vehicles and aircraft-to-aircraft refueling. Nonstandard refueling operations are not the primary purpose of US Air Force cargo and tanker aircraft. You should conduct these operations only in time constrained situations where ground fuel resupply means are not reasonably available in forward areas, and acceptable conditions exist to permit air delivery of fuel. Consider this type of operation as a last resort after all other methods of delivery, including sling-load delivery of bladders, or delivery by pipelines, rail, or road tankers, as well as host nation support. The key rule is to follow published technical order procedures for each peculiar circumstance.

5.3.1. Wet Wing Defueling. Wet-wing defueling involves transferring fuel from fixed-wing aircraft fuel tanks to collapsible fabric tanks or tank semitrailers. This method of bulk fuel resupply allows the aircraft to carry an internal load of dry cargo plus jet fuel without requiring additional aircraft to provide fuel support. Wet-wing defueling can supplement other bulk fuel delivery systems. Aircraft used in wet-wing defueling operations include the C-5A, C-141, C-17, and C-130 cargo aircraft, and KC-10 tanker aircraft. Using the correct procedures, wet-wing defueling from the single point refueling receptacle (SPR) of these aircraft into collapsible fabric tanks or tank semitrailers can be done with an acceptable degree of risk.

5.3.2. Forward Area Refueling Point: Concept of operations is designed to provide increased fueling capabilities for Special Operations Forces while operating in austere, covert environments. Mechanics of operations include the ground transfer of fuel with or without a specially designed Forward Area

Manifold Cart (FAM Cart) from cargo tanker aircraft fuel tanks to another aircraft. Operations are conducted with both the tanker and receiver aircraft engines running, normally under the cover of darkness while operators are wearing night vision devices. The typical process employs nine sections of 100 feet by 2 inch of specially designed light weight hose. Refueling nozzles are the typical SPR, overwing, closed circuit type

5.4. Couplings, Nozzles, and Adapters. Attachment 12 lists the Service-unique petroleum equipment couplings, nozzles, and adapters applicable to each system. Additionally, the attachment contains an interoperability matrix. To determine if two systems are compatible, examine the couplings and adapters available on each system. For example, the C-141 aircraft has only the SPR adapter, and the US Army Fuel System Supply Point (FSSP) has no single point refueling nozzle to connect to the aircraft. Therefore, using a provider and receiver rule, the US Army (the receiver) must secure a SPR nozzle and enough hose to reach the aircraft before the two systems are interoperable. Unique circumstances may cause variation from this rule in order to efficiently achieve interoperability. For example, when an aircraft installation would provide the required couplings. This is established because of the operational time constraint and the impracticality of equipping the aircraft with all couplings and adapters needed to interface with all systems.

Chapter 6

CRYOGENICS

6.1. Availability. Liquid oxygen (LOX) and nitrogen (LIN) products are seldom available at commercial airports, but are required worldwide for military aircraft. Consult the DOD Flight Information Publication to determine availability at a particular airfield. If sources are not readily available, the product can be airlifted using a 400 gallon capacity tank equipped with an overboard vent kit. For long term operations, air transportable generating plants are available but require extensive setup and maintenance.

6.2. Storage . Mobility cryotainers are available for deployment; however, host tankage should be used where possible. Contact your MAJCOM fuels office for details. Tank fittings may vary from country to country, particularly on commercial delivery vehicles; therefore, deploy adapters as necessary.

6.3. Issue . Use standard issue procedures. Fill removable aircraft converters directly from storage tanks where possible to avoid double handling and the resultant loss associated with a cryogenic cart servicing.

Chapter 7

DEMINERALIZED WATER

7.1. Background. Demineralized water for thrust augmentation is still a requirement on B52G (1200 gallons per sortie) and KC-135A and Q (670 gallons per sortie) aircraft. B-52H series aircraft do not require water. RC-135, EC-135 (with some exceptions), KC-135R, and KC-135E aircraft have been re-engined with fan jets and do not require water. Demineralized water production and storage are a civil engineer responsibility; however, fuels managers should identify the requirement to the civil engineers and follow-up to make sure this critical support is not overlooked in the planning process.

7.2. Source. Water for thrust augmentation must be clear and free of harmful impurities. Some water which is suitable for human consumption is undesirable for use in water injection systems since it may contain a relatively high concentration of dissolved minerals. These minerals may leave scale deposits on internal engine parts, water regulator passages, solenoid valves, etc., all of which would reduce engine efficiency. TO 42C-1-16 sets the standard for serviceable water at 10 parts per million total solids (maximum) and a pH range between 5.5 and 9.5. At least four options are available for obtaining water, as follows:

7.2.1. Two Bed Deionizer (NSN 4610-01-308-5459). This is similar to the type permanently installed at many bases to support aircraft. A number of these units have been pre-positioned for deployment as portable units. Units have a rated capacity of 1,000 gallons-per-hour production. The unit has two resin tanks to effectively reduce minerals in process water. One removes cations (positive ions) and the other removes anions (negative ions). The cations are exchanged for hydrogen ions obtained from the acid used in regeneration, and anions are exchanged for hydroxide ions obtained from caustic used in regeneration. The unit can produce demineralized water of less than three parts per million from raw water. Because of variations in raw water quality and maintenance and regeneration time, the normal planning factor used is one deminerializer unit for each 10,000 gallons required in a 24 hour period. Only clean filtered water must be introduced into the deionizer unit. Chlorine concentration in excess of 1.00 ppm can be detrimental to the exchange resins. Prefiltration and carbon for chlorine and organics removal must be used with waters containing these contaminants. Cation exchange resins are regenerated with a 30 percent solution of hydrochloric acid (HCL). Anion exchange resins are regenerated with a 50 percent solution of sodium hydroxide (NaOH). The unit requires feed water pressure of 35 psi minimum and 75 psi maximum. Unit requires 120 volt, 60 cycle single phase power with a 15 amp fused disconnect. The drain line shall be 1¾ inch minimum, capable of conveying a maximum of 18 gpm. For drain line over 15 feet, it is recommended to increase drain piping size to 2 inches. The unit is deployed as a kit containing:

1 ea	Deminerializer Unit	NSN 4610-01-308-5459
1 ea	20,000 gal bladder	NSN 5430-01-106-9678
1 ea	gas drive disp. pump	NSN 4320-00-082-6004
15 day	supply chemicals	
1 ea	accessory kit, Ace 26	

Each regeneration requires 25 gallons of hydrochloric acid (HC1) and 12 gallons of liquid caustic (Sodium Hydroxide) or 70 pounds of caustic flakes. Operation and maintenance of these units are the responsibility of the base civil engineer, water and wastewater shop. The MAJCOM civil engineer or logistics plans office can determine availability and arrange movement of these assets.

7.2.2. Boeing Portable Engine Water Demineralizer Assembly (TO 40W1-3-1). This unit (also known as "Belcolite" deminerializer after the resin it uses) is air transportable in the cargo compartment of a KC-135 aircraft. The unit weighs only 140 pounds and will treat an average of 1,000 gallons of water (depending on raw water quality) before the resin must be changed. Output is approximately 10 gallons per minute. Various tanker maintenance organizations maintain the supply and control of these limited units. The limited availability, along with the high cost of resin and low output, make this a less than satisfactory solution to the demineralized water problem. HQ ACC/ LGM can determine unit availability.

7.2.3. Commercial Sources. The most helpful means of obtaining demineralized water at deployed locations would be through local sources to eliminate the lead time and logistical problems associated with Air Force systems. Commercial sources may include local water conditioning services, power generating plants, or soft drink bottling companies. It may still be necessary to provide a mobile dispensing capability (A-2, Water Truck) from US assets.

7.2.4. Tap Water. In situations where water cannot be obtained within acceptable limits (10 ppm and pH 5.5 to 9.5), other water may be used with restrictions outlined in T0 42C-1-16. Do not consider the use of tap water as an automatic option. While an assumption that one-time use of tap water is fully acceptable, it is in fact an emergency option used only after every effort has been made to provide an alternate source:

7.2.4.1. Water with pH outside the above limits may be used a maximum of three occasions per engine if coordination is obtained from the parent command headquarters prior to use. T0 2JJ67-66, paragraph 9-26 or 9-63, requires the engines to be liquid cleaned after each occurrence.

7.2.4.2. Water with total solids from 11 ppm to 25 ppm may be used on three occasions provided the engines are immediately field cleaned (TO 2JJ57-56, paragraph 9-61).

7.2.4.3. Water with total solids from 26 ppm to 60 ppm may be used on one occasion, provided the engines are subjected to field cleaning, as above.

7.2.4.4. Aircraft maintenance personnel shall report to parent headquarters the use of water outside of the pH range of 5.5 to 9.5 and/or total solids in excess of 10 ppm .

7.2.4.5. No further utilization in excess of these limits is authorized between engine overhaul, except in war operations and in an emergency to prevent hazards to aircraft safety.

7.3. Storage . Demineralized water bulk storage tanks are also a civil engineer responsibility. Recommended storage for tactical deployment is the 20,000 gallon capacity water storage bladder (NSN 5430-01-106-9678). TO 42C-1-16 also allows use of unused fabric fuel tanks for emergency or tactical situations. If daily demand permits, dispensing units may be used for storage as long as quality control considerations are met. We recommend a dispensing pump (NSN 4320-00-082-6004) to pump treated water from storage to trucks. While A-2 water trucks have the capability to draw water from bladders, age and reliability of these vehicles make the use of an auxiliary pump advisable

7.4. Dispensing . Demineralized water can be serviced into aircraft using either a 2,600 gallon capacity demineralized water truck, type AIS32A-2. The trucks are equipped with an aluminum tank with a filter unit ahead of the servicing hose. Under emergency circumstances, you may use a fire truck or similar vehicle if reasonable protection of water quality is assured.

7.5. Accounting . Demineralized water issues require no accounting documents.

7.6. Quality Control . Demineralized water quality control testing should comply with TO 42C-1-16. You should coordinate with the civil engineering organization to avoid duplication of test apparatus.

Chapter 8

SPECIAL FUELS

8.1. Background. JP-7 and Thermally Stable Jet Fuel (JPTS) are special petroleum products used only for support of SR-71 and U-2/TR-1 aircraft, respectively. HQ ACC/LGSSF and SA-ALC/SFSC manage these fuels outside the Fuels Division of the Air Force stock fund. These organizations must approve the use of special fuels in all other non-special fuel aircraft. JP-7 and JPTS are narrow cut kerosene type fuels with several critical properties which are extremely sensitive to contamination (TO 42B1-1-16).

8.2. Resupply . Because of their special characteristics, JP-7 and JPTS are available only from a limited number of refineries in the CONUS and from pre-positioned storage throughout the world. Movement is by railroad tank car or tank truck within the CONUS; by ocean tanker or specialized containers to overseas locations; or in 55-gallon drums (JPTS only) or in 6K Bulk Fuel Containers. Once notified of reconnaissance activity, HQ ACC/LGSSF provides SA-ALC/SFSC with projected requirements.

8.3. Storage. Because of their critical properties, JP-7 and JPTS require special storage and handling. As a minimum, storage tanks should be epoxy coated; and pipelines, pump components, etc. which come in contact with the fuel must be of noncorrosive materials such as stainless steel, aluminum, or glass-fiber reinforced plastic (AFM 88-16). TO 42B1-1-16, section X, outlines the fabric storage bladders procedures which require that bladders be flushed with special fuel and then allowed to soak for a minimum of 72 hours before use. JP-7 support is not normally required at a deployed site. At a deployed location, store JPTS in the container used for shipment and offload directly into the dispensing unit.

8.4. Dispensing . The preferred method of dispensing JPTS and JP-7 is to use a standard refueler equipped with a filter/separator and aluminum tank. JPTS resupply to a deployed location is by 55-gallon drums. Fuel can be transferred to the refueler using the dedrumming capability of the refueler or by using a dedrumming unit. It is possible to transfer the fuel directly to the aircraft overwing receptacles using the PMU-27, although this method is not recommended due to potential quality problems. Recovery operations are accomplished with JP-7 using a ground-to-ground refueling assembly transferring fuel from KC-135T or KC-10 aircraft.

Chapter 9

ADMINISTRATION AND ACCOUNTING

9.1. Reporting Petroleum Damage Deficiency Reports (REPOL) (RCS: HAFLEX (D&AR) 7108 and other such reports are not required from a deployed location unless specifically directed. However, fuel status reports are extremely important in a contingency operations where continued availability of fuel is uncertain. A uniform reporting policy at the deployed site should be established to provide all persons the same information. Primary responsibility is to provide accurate status to the senior commander who has to make operational decisions.

9.2. Security . All aspects of security should receive special emphasis in a deployed operation. Physical security of fuel systems becomes critical because of the lack of hardening in portable system design. Additionally, the normal perimeter security, lighting, and security patrols may not be provided to the same extent as a main operating base. Ensure the proper storage of classified information. Remember that actions taken during an exercise or contingency reflect actual operation plans and may reveal classified procedures and capabilities to unauthorized persons. Ensure you take appropriate precautions.

9.3. Communications . You should ensure adequate consideration of communications in the planning process, or upon arrival at a contingency location. Do not plan to deploy with radios from your main operating base without first consulting with communications specialists involved in the deployment planning. Radio frequencies may not be compatible with those of the deployed area and may interfere with the host radio frequencies.

9.4. Transportation . Transportation requirements may also include arranging transportation, through the vehicle operations flight, for fuels personnel when workshifts do not permit use of normal shuttle bus service.

9.5. Accounting . Issue of fuel at a deployed site requires all the normal accounting procedures at at a main operating base, unless issues are totally accomplished by an into-plane contract or AF Form 15 or 315 purchases. If daily issue processing into the computer is not possible, then give special consideration to orderly files maintenance procedures to accomplish processing at a later date. It is also important to note that commercial vendors or foreign governments may not want US accounting documents. Determine what alternate documentation agreement will satisfy their needs. Use of alternate documentation does not negate the need for those documents required by AFM 67-1 for our own use. AFM 67-1, Volume I, Part III, Chapter 1, provides accounting procedures for special exercises, where large-scale exercises are programmed for foreign locations on short notice and large volumes of fuel are required from either a commercial or military source in-country. Because of their importance in fuels contingency support, procedures are summarized as follows:

9.5.1. Fuels procedures that follow are for use when fuel costs are authorized to be paid by the fuels division, Air Force stock fund, and will be used only in countries or in specified operational areas where all other following conditions exist:

9.5.1.1. There are no US DOD installations that issue aviation fuel.

9.5.1.2. There are no DOD or Canadian Department of National Defense into-plane refueling contracts.

9.5.1.3. There are no replacement-in-kind agreements for aviation fuel support between the DOD and the foreign country.

9.5.1.4. There are no other reciprocal support agreements or procedures, such as STANAG 3113.

9.5.2. These procedures can't be used to avoid normal AF Form 15 or 315 payment procedures under other circumstances.

9.5.3. Upon notification of an exercise, the organization responsible for logistic support shall attempt to obtain into-plane contract coverage through their MAJCOM. If there is insufficient lead time, the organization sends a message to the applicable overseas (USAFE, PACAF, or USCENTAF) fuels management office and director of accounting and finance. When airlift service industrial fund aircraft are involved, include the 375 AAW/ACFM, Scott AFB IL, and HQ AMC/ACI as message addressees. The message will include as a minimum:

9.5.3.1. Unclassified exercise name.

9.5.3.2. Exercise transit locations.

9.5.3.3. Aircraft data, including owning command, home station, and number of aircraft by mission, design, and series.

9.5.4. The command fuels officer of the command responsible for logistic support:

9.5.4.1. Appoints a responsible individual (project officer) for each exercise location; provides the name, grade (enlisted or officer) and organization of the project officer to USAFE, PACAF, and CENTAF Directors of Accounting and Finance. The project officer need not be a qualified fuels specialist, but must be briefed in the performance of duties. Refueling Document Control Officers should be used for this job.

9.5.4.2. Briefs the project officer to retain all refueling documents issued during the exercise.

9.5.4.3. In coordination with the command accounting and finance office, appoints a BFMO to process individual transactions through the Air Force Contingency Support Squadron (AFCSS) / host base account and an accounting and finance office (AFO) to make payment. The US defense attachÈ or in-country US Air Force liaison office will be requested to perform any in-country payment of contractor invoices. The Director of Accounting and Finance notifies the applicable USDAO or USAFLO of the exercise name, location, project officer, and appointed AFO.

9.5.5. The project officer:

9.5.5.1. Verifies fuel issues on a daily basis or periodically, depending on the issue activity and arrangements made with servicing personnel.

9.5.5.2. Verifies the total quantity of fuel issued at the termination of the exercise and prior to departure of the project officer.

9.5.6. The project officer furnishes copies of all refueling documents to the appointed fuels office for processing through the AFCSS.

9.5.7. The Designated AFO or the USDAO/USAFLO makes payments according to AF19I 177-206, section 8.

Chapter 10

PERSONNEL

10.1. Responsibilities . The responsibilities shared by personnel on a main operating base become doubly important at a deployed location. Contingency operations frequently result in strained personnel relations because augmentees come from several different locations, personnel are often not told where or why they are going, and no single individual is placed in charge. In this situation, the senior fuels representative shall accept the responsibility for leadership, provide mission support, and satisfy the needs of subordinate personnel. No individual can become a specialist. Although assigned specific tasks, all individuals shall accept total responsibility toward the mission. The senior fuels member shall also evaluate the command structure at the deployed site to ensure an effective chain of command is available to provide support where necessary and to ensure an upwards flow of fuels information to the senior commander.

WILLIAM P. HALLIN, Lt General, USAF
DCS/Installations & Logistics

Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

References

Air Force and DOD publications from which information was taken are listed below. The subject of each publication is listed next to the number:

AFM 67-1, volume I, part 3, Stock Fund Procedures

AFI 23-110, volume II, part 2, Standard Base Supply

AFR 67-24, AF Form 15, United States Air Force AVFuels Invoice

AFM 10-401, Operation Plan and Concert Plan Development and Implementation

AFM 85-16, Maintenance of Permanent Facilities

AFI 23-201, Fuels Management

AFOSH 91-38, Hydrocarbon Fuels, General

DODM 4140.25, Management of Petroleum Products

FM 10-69, Petroleum Supply Point Equipment and Operations

MIL-HDBK-114, Mobility Fuels User Handbook

MIL-HDBK-200, Quality Surveillance

MIL-HDBK-201, Petroleum Operations

MIL-HDBK-210, Conversion Factors for Petroleum

MIL-HDBK-318, Cargo Aircraft Compartment Dimensions

TO 00-25-172, Ground Servicing of Aircraft

TO 35D3-2-1, 500 Gal LOX Tank Type C-1

TO 35E13-73-11, PMU-27

TO 35E13-82-1, AM32-22

TO 36A12-13-17-1, A/S32R-9

TO 36A12-13-17-81/91, A/S32R-11

TO 36A12-13-31-1, HSV-12-AF

TO 37-1-1, 0peration, Inspection of Permanent Fuel Systems

TO 37A-1-101, Fuel/Water Dispensing Equipment

TO 37A-1-111, Seal Drums

TO 37A8-2-5-1, FFU15/E Filter

TO 37A9-3-5-1, A/E32R-14 Fuel System

TO 37A9-3-7-1, C-130 ABFDS

TO 37A9-3-8-11, A/M32R-25 Fuel System

TO 37A9-3-11-1, GRU-17/E

TO 37A12-15-1, 10K/50K Bladders

TO 37C2-8-10-3, 400 Gal LOX Tank Type TMU-24E

TO 42B-1-1, Quality Control

TO 42B1-1-1, Fuels for Piston and Turbine Equipment

TO 42B1-1-15, Fuels for USAF Aircraft

TO 42B1-1-1, NATO/ASCC/Interchangeability

TO 42B1-1-16, Quality Control of JP-7 and JPTS

TO 42B6-1-1, Quality Control of Oxygen

TO 42B7-6-1-1, Quality Control of Nitrogen

TO 42C-1-16, Demineralized Water/Water Alcohol

Supporting Information

AAF1F—See Automated Airfield Information File

ABFDS—Aerial Bulk Fuel Delivery System.

Absolute Viscosity—The force required to move a plane surface of one square centimeter over another plane surface at the rate of one centimeter per second when the two surfaces are separated by a layer of liquid one centimeter in thickness.

Accelerated Gum—The nonvolatile material remaining in a glass beaker after a sample of oxidized and filtered fuel has been evaporated in accordance with the test method prescribed in the applicable specification.

Additive—An agent used for improving existing characteristics or for imparting new characteristics to certain petroleum products. (Examples are fuel system icing inhibitor and corrosion inhibitor.)

Advanced Echelon (ADVON)—An initial deployment element of personnel and equipment within a specific unit type code (UTC). The ADVON portion of a UTC normally consists of the equipment and personnel required to establish an austere operational capability for a period of up to 7 days.

ALCE—Airlift Control Element.

Alternate Capability Equipment (ACE)—Hose and filter assembly that allows aircraft to be refueled direct from the ABFDS.

Alternate Fuel—Per TO 42B1-1-14, an alternate fuel is, "a fuel authorized for continuous use. The operating limits, thrust outputs and thrust transients, shall not be adversely affected. The applicable aircraft flight manual shall define limitations, if any, of a significant nature on aircraft performance parameters such as range, altitude, loiter time, or rate of climb, and engine performance parameters, such as specific fuel consumption or starting and stopping time. The use of an alternate fuel may result in a change of maintenance or overhaul cost. External engine trim adjustments may be necessary or desirable for use of an alternate fuel."

American Petroleum Institute (API)—An institute that represents and is supported by the petroleum industry. It standardizes the tools and equipment used by the industry and promotes the advancement of research in the petroleum field.

American Society for Testing and Materials (ASTM)—Organization which provides standardized laboratory testing procedures, in the form of ASTM handbooks, to ensure all laboratories use the same procedures and tests.

API Gravity—Arbitrary scale for measuring the density of liquid petroleum products adopted by the American Petroleum Institute. Gravity is important to petroleum personnel because it can indicate which product is heavier in relation to a comparative product and is, therefore, used in product identification.

APOD-Aerial Port of Debarkation—Point at which airlifted supplies are offloaded.

APOE-Aerial Port of Embarkation—Point at which cargo aircraft are loaded.

Area Lab—Laboratory which provides testing services on samples of petroleum and related products. Conducts specification tests to determine the quality of products under procurement and in the Air Force supply system.

AS—Allowance Standard

Ash Content—An expression of the inorganic matter in a combustible material. It is determined by completely burning the substance and weighing the residue. Important in a fuel where requirements demand minimum ash residue after combustion. The ideal fuel is one which burns and does not leave any ash.

ASTM—See American Society for Testing and Materials.

ATHRS—Air Transportable Hydrant Refueling Systems.

Autoignition—The spontaneous ignition, and the resulting rapid reaction, of a portion of the air-fuel mixture in an engine. The flame speed is many times greater than that which follows normal spark ignition. In a reciprocating engine, the noise associated with it is called knock.

Autoignition Temperature—Temperature of spontaneous ignition of a petroleum product in the absence of a flame when tested in accordance with the provisions of ASTM Method D 2155.

Automated Airfield Information File—Information data base prepared by the Defense Mapping Agency, which lists comprehensive airfield information, to include fuel support capability at overseas military and civilian airfields.

AVFUELS—Aviation fuels, both gasoline and turbine.

AVGAS—Aviation gasoline for reciprocating engine aircraft. AVGAS is characterized by high vapor pressure, low distillation range, and higher tetraethyl lead content.

AWACS—Airborne Warning and Control System. Refers to E-3 Sentry or similar aircraft used to provide radar coverage and combat control over a battle area.

Bare Base—A base that has a runway, a taxiway, a parking area, and a source of water that can be made potable.

Bare Base System—An Air Force system that consists of Harvest Eagle, Harvest Bare, and fuels mobility support equipment. The bare base system is designed to provide minimum essential troop

cantonment facilities and operational support.

Barrel—Standard unit of measurement of petroleum liquids, consisting of 42 US standard gallons at 60 degrees F. A barrel is not a container. Usually confused with a drum.

BBLS—Barrels.

BCE—Base Civil Engineer.

Benzene—Colorless liquid hydrocarbon with six carbon atoms and six hydrogen atoms arranged in a hexagonal ring structure. It is used in the manufacture of various products, as a solvent, and as a component in high octane gasoline.

Benzin—Term used in some countries, meaning gasoline.

Black Cargo (dirty cargo)—A general term used to describe liquid cargoes of crude oil or fuel oils. Important because of necessary cleaning of container to be used for clean fuels.

Boiling Point—The temperature at which a substance begins to boil or to be converted into vapor by bubbles forming within the liquid. The temperature varies with the atmospheric pressure. Important in refining because different products boil at different temperatures.

BPD—Barrels per day.

BTU—Abbreviation for British Thermal Unit, a unit of heat commonly used in heat engineering. It is the amount of heat necessary to raise the temperature of one pound of water one degree Fahrenheit. Important in flying operations because it indicates the amount of heat energy that can be obtained from a given weight of fuel.

Bulk Petroleum Products—Liquid petroleum products transported by various means and stored in tanks or containers having an individual fill capacity greater than 260 liters.

Carbon Residue—Laboratory test, the results of which give an estimation of the carbonizing properties of a lubricating oil or fuel. Used more as an identification tool than as an indication of carbon formation in an engine.

C-Day—The unnamed day on which a deployment operation commences or is to commence. The deployment may be movement of troops, cargo, weapon systems, or a combination of these elements utilizing any or all types of transport. The letter C will be the only one used to denote the above. The highest command or headquarters responsible for coordinating the planning will specify the exact meaning of C-day within the afore mentioned definition. The command or headquarters directly responsible for the execution of the operation, if other than the one coordinating the planning, will do so in lieu of the meaning specified by the highest command or headquarters coordinating the planning.

Cetane Number—Diesel fuel ignitability performance measured by the delay of combustion after injection of the fuel. It represents a comparison of a fuel with standards which are cetane in alpha-methyl-napthalene. The cetane number is related to operating and starting characteristics at low temperatures. The higher the cetane value, the better or easier the starting capability. Varying designs of diesel engines require various types of diesel fuels of varying cetane numbers. In general, large, slow-speed diesel engines of stationary installations do not require high cetane numbers (below 40); smaller, high-speed engines having 1,000 rpm or more require fuels of high cetane number (above 40).

CI—See Corrosion Inhibitor.

Civil Reserve Air Fleet (CRAF)—A group of commercial aircraft with crews which may be allocated in

time of emergency for exclusive military use in both international and domestic service.

Class III—Category of supplies including petroleum fuels, lubricants, compressed gases, chemicals, etc.

Class of Fires—Needed to determine type of fire extinguishers required. Class A, fire of ordinary combustibles, such as paper, wood, etc., and extinguished by water; Class B, fire of flammable liquids like gasoline, oil, and grease, and extinguished by smothering; Class C, fires involving electrical equipment, and extinguished by nonconducting agents; Class D, fires involving burning metal.

Clean Cargo—Cargo such as aviation and motor gasoline, diesel oils, lubricating oils, jet fuels, and kerosene. See also black cargo.

Cloud Point—The temperature at which paraffin or other solid substances begin to crystallize out or separate from solution, imparting a cloudy appearance to the oil, when oil is chilled under prescribed conditions. It is especially important in arctic or polar operations. Crystals of wax can be detrimental to operations. If this happens in a diesel fuel, the wax crystals will plug the fuel injectors and the engine will stop.

COB—See collocated operating base.

Collocated Operating Base—An active allied host nation base designated for joint use by US wartime augmentation forces or for the wartime relocation of in-place forces. COBs are not US bases.

Color—Various types of petroleum products, such as aviation and automotive gasoline, are dyed to permit a rapid visual determination of product and grade. Visually detectable changes in color intensity or hue may be an indication of product contamination or deterioration. Aviation turbine fuels have no color limitations on procurement or use; however, this is not to be construed to mean visual color determination is without significance. Progressive darkening of jet and distillate type fuels during storage is a good indication that oxidation is occurring.

Colorimeter—An apparatus used to determine the color of petroleum products. Color is sometimes important for visual inspection of contamination. Usually as an oil starts to deteriorate, it becomes darker owing to oxidized particles.

Commingling—The mixture of two or more petroleum products resulting from improper handling.

Common Servicing—That function (provision of bulk petroleum distribution and storage facilities and services) performed by one military service in support of another military service for which reimbursement is not required from the service receiving the support. See also cross servicing.

Composite Sample—A sample which is a mixture of samples taken from the upper, middle, and lower thirds of a container.

COMSC—Commander Military Sealift Command.

COMSEC—Communications security.

Conductivity—Test which measures the electrical conductance of the fuel in picosiemens per meter, normally referred to as conductivity units (CU). The higher this number, the more rapidly the fuel will dissipate any electrical charge within the fuel. The addition of a conductivity additive in recommended concentrations raises this number to a point where the fuel is unlikely to accumulate electrical charges strong enough to cause sparks and subsequent ignition

Conductivity Additive—Fuel additive which aids in relaxing static charges in fuel by increasing its conductivity.

CONPLAN—An operation plan in an abbreviated, concept format which would require expansion into an OPLAN or OPORD prior to implementation .

Continuous Sample—A sample taken from a flowing pipeline in such a manner that the sample is a representative average of the streams during the period of sampling.

CONUS—Continental United States. Term applies to the contiguous 48 states, excluding Alaska and Hawaii.

Copper Strip Corrosion—A qualitative method of determining the corrosivity of a product by its effects on a small strip of polished copper suspended or placed in the product.

Corrosion Inhibitor (CI)—A substance added to a petroleum product that interferes with or retards rusting or corrosion of metal in contact with the product. CI is also used in fuel as a lubricating agent.

CRAF—See Civil Reserve Air Fleet.

Cross Servicing—That function (provision of bulk petroleum distribution and storage facilities and services) performed by one military service in support of another military service for which reimbursement is required from the service receiving the support. See also, common servicing.

Cryogenics—Science of refrigeration and very low temperatures. Usually refers to liquefied gases LOX and LIN.

Cube—For airlift operations, refers to the cubic foot displacement of an item prepared for shipment. Weight and cube of an item are necessary information when requesting movement.

D-Day—The unnamed day on which a particular operation commences or is to commence.

Defense Fuel Regions/Offices (DFR/Os)—DFSC field offices which provide direct liaison with base level customers to work fuel quality and delivery issues.

Defense Energy Supply Center (DESC)—Worldwide integrated material manager (IMM) for wholesale bulk petroleum product. Manages bulk petroleum product procurement, transportation, and facilities maintenance, repair, and construction.

Defense Fuel Supply Point (DFSP)—A military or commercial bulk fuel terminal that stores DLA owned POS and/or PWRMS in support of one or more retail activities.

Defuel—Removal of fuel from aircraft tank into a dispensing unit or hydrant system. May be either a hot defuel (single-point defueling of aircraft with one engine running) or a cold defuel (conventional defueling of aircraft which do not have an engine running).

Density—Specific weight or mass of a substance per unit volume (pounds per cubic foot or gallon or grams per cubic centimeter). Specific gravity is the ratio of the mass of any volume of a substance to the mass of an equal volume of some standard substance (water in the case of liquids) at 40 degrees C.

Deployment—In a strategic sense, the relocation of forces to desired areas of operation.

Deployment Manning Document (DMD)—A document listing the manpower authorizations tasked to support a given capability of a squadron or element while in a deployed state. The DMD contains individual line numbers for each manpower deployment requirement.

DFSC Contract Bulletin—A publication distributed by the Defense Fuel Supply Center (DFSC) to disseminate information concerning all contracts awarded for direct support of installations.

DFSP—See defense fuel supply point.

DIA—Defense Intelligence Agency.

Dissolved water—See water, dissolved.

Distillate—That portion of liquid which is removed as a vapor and condensed during a distillation process.

Distribution Plan—A summarization of contract award data prepared and published by DFSC to advise CONUS and overseas fuel regions and other petroleum management activities of how all requirements of a specified procurement program and delivery period will be supported.

DLA—Defense Logistics Agency.

DMA—Defense Mapping Agency.

DMD—See Deployment Manning Document.

DOS—Days of sustainability(or supply).

Downgrading—The procedure by which a product is approved for use as a lower grade of the same or similar product, usually performed as a result of contamination or an off-specification condition.

Drum—A 16 or 18 gauge steel cylinder container (generally, 55 gallon size) for petroleum products. Often, erroneously referred to as a barrel.

Drum Thief—A metal or plastic tube used to withdraw samples from drums.

DSN—Defense Switched Network.

EAD—Earliest arrival date.

ECM—Electric countermeasures.

Emergency Fuel'—Per TO 42B1-1-14, "a fuel which may cause significant damage to the engine or other systems; therefore, its use shall be limited to one flight. The applicable aircraft flight manual or system manager should be consulted regarding operating restrictions and post-flight maintenance actions necessary when using an emergency fuel. Examples of conditions that might warrant use of emergency fuels are: Accomplishing an important military mission; countering enemy actions; emergency evacuation flights; emergency aerial refueling."

Entrained Water—See water, Entrained.

Existent Gum—Test which measures the amount of nonvolatile residue present in gasoline or aviation turbine fuel at the time of the test. The results indicate the quantity of gum deposition which may occur if the product is consumed immediately, but do not indicate the stability of the product toward gum formation on storage. As the name implies, the gum is a sticky, tacky, varnish-like material which is objectionable in fuel systems. When present in excess, it tends to clog fuel line filters and pump screens, aircraft engine fuel systems, and carburetor jets; and tends to cause manifold deposits and sticky intake valves.

Explosive Limits—The limits of percentage composition of mixtures of gases and air within which an explosion takes place when the mixture is ignited. The lower limit of flammability corresponds to the minimum amount of combustible gas and the upper limit to the maximum amount of combustible gas capable of conferring flammability on the mixture. Also referred to as flammable limits and explosive

range.

FARE—Forward Air Refueling Equipment.

FARRP—See Forward Area Refueling and Rearming Point.

Filtration Time—Test which determines the filterability of aviation turbine fuels; it is designed to identify those fuels which can cause rapid differential pressure build up in filtration equipment.

Fire Point—The lowest temperature at which, under specified conditions in a standardized apparatus, a petroleum product vaporizes rapidly enough to form an air-vapor mixture above its surface which burns continuously when ignited by a small flame.

Flammable—A term describing any combustible material which can be ignited easily and which will burn rapidly. Petroleum products which have flash points of 37.8 degrees C (100 degrees F) or lower are classed as flammable.

Flash Point—The lowest temperature at which vapors rising from a petroleum product will ignite momentarily (i.e., flash) on application of a flame under specified conditions.

FMSE—See fuels mobility support equipment.

Forward Area Refueling and Rearming Point (FARRP)—An operation used to hot refuel aircraft in areas where fuel is otherwise not available. Fuel is transferred from a source aircraft's (C-130, C-141, C-17 or C-5) internal tanks to receiver aircraft while both aircraft's engines are running. Typically at remote locations under black-out conditions.

Free Water—See water, free.

FSII—See Fuel System Icing Inhibitor.

Fuels Mobility Support Equipment (FMSE)—Air transportable fuels handling equipment (excluding refueler vehicles) used to provide fuel receipt and issue capability at bare base locations and to augment locations with fixed fuel facilities. Examples include air transportable hydrant systems (R-14s), bulk pumps (R-22s), and filter separators (FFU-15s).

Fuel System Icing Inhibitor (FSII)—An agent (diethylene glycol monomethyl ether) used as an anti-icing additive for jet turbine engine fuels.

GPH—Gallons per hour.

GPM—Gallons per minute.

Gravity—See specific gravity and API gravity.

Ground Products—Those refined petroleum products normally intended for use in administrative, combat, and tactical vehicles; materiel handling equipment; special purpose vehicles; and stationary power and heating equipment. Products include motor gasolines, diesel fuels (except DFM/F76), fuel oils, kerosene, and ground equipment lubricating oils.

Harvest Bare—A nickname for an air transportable package of hard wall shelters and equipment designed to support Air Force operational squadrons and personnel under bare-base conditions. The package includes housekeeping, aircraft maintenance, and some vehicular support. Harvest Bare is intended to provide a broad base of logistics support for sustained Air Force operations.

Harvest Eagle—A nickname for an air transportable package of housekeeping equipment, spare parts,

and supplies required for support of Air Force general purpose forces and personnel under bare-base conditions. Each kit is designed to provide soft wall housekeeping support for 1,l00 persons. Harvest Eagle is not intended to be an all-inclusive package of logistics support for sustained air operations; however, it may be used until augmented by Harvest Bare.

Headquarters Emergency Relocation Team (HERT)—A major command headquarters component that deploys to an unspecified location to establish an alternate command post capability in a survivable environment.

HERT—See Headquarters Emergency Relocation Team.

H-hour—The specific hour on D-day at which a particular operation commences.

HNCS—Host nation contingency support.

Host—Civilian, military, or government which maintains operational control over an airfield or, at a bare base, who has logistical responsibility in support of beddown forces.

HPOX—High pressure oxygen.

Ignition Point—The point on a temperature scale at which a substance may be ignited or produce combustion.

Ignition Temperature—See Autoignition temperature

Integrated Material Manager (IMM)—A organization designated as a centralized commodity manager. DESC on behalf of DLA, is the IMM for petroleum responsible for supporting DoD and other US Government agencies.

Inhibitor—A substance, the presence of which in small amounts in a petroleum product prevents or retards undesirable chemical changes taking place in the product, or in the condition of the equipment in which the product is used. In general, the essential functions of inhibitors are to prevent or retard oxidation or corrosion, prevent freezing of free water in the fuel, retard bacterial growth, and increase the fuel's conductivity to more quickly relax the electrostatic energy generated.

Innage—The measured height of liquid in a tank or container as measured from the bottom of the tank to the top surface of the liquid .

Into-Plane—The requirement and procurement of fuel and lubricating oils for contractor delivery into government-owned aircraft at nonmilitary air facilities.

Inventory—Bulk tankage contents measured to current product level. Includes tank bottoms, refueling units, and associated pipeline fill.

JPO-Joint Petroleum Office—CINC petroleum operations staff providing liaison to and assisting DESC and DFR/Os in IMM.

Kinematic Viscosity—See viscosity.

L-Hour—Specific hour on C- Day, expressed in Coordinated Universal Time (Zulu), that serves as a common reference time from which the movement of weapon systems, equipment, supplies, personnel, and transportation is measured during deployment operations. Preplanned deployment activities may be scheduled prior to or after L-hour.

LIMFAC—Limiting factor.

Limiting factor—A factor or condition that either temporarily, or permanently, impedes mission accomplishment.

LIN—Liquid nitrogen.

LOC—Lines of communication.

LOX—Liquid oxygen.

LRC-Logistics Readiness Center—The logistics support area of a headquarters command post.

MAJCOM—Major Command.

Malpositioned war reserves—Terminal held war reserve stocks of fuel that cannot be moved to the facility for which they are backup stocks before properly positioned war reserves would be drawn down to the regional war reserve safety level.

Marine Fuels—Those refined petroleum products normally used in the propulsion of ships and boats and for the operation of marine equipment. Products include DFM/F76, NDF, and NSF. Although DFM is primarily a marine fuel, it also has substantial application as a ground fuel.

Maximum Fill Level—The highest point to which a petroleum storage tank may be filled with a product, allowing for product expansion and other safety considerations.

M-Day—The term used to designate the day on which mobilization is to begin.

MDS-Mission, Design, Series—Alphanumeric designation of an aircraft; e.g., B-52 .

Measurement Ton—A unit of volume used in transportation by sea, commonly equal to 40 cubic feet.

MIKE (M)—Single letter abbreviation used to designate units in thousands; e.g., 200,000 barrels may be referred to as 200M barrels or 200 MIKE barrels.

MILSPEC—Military Specification.

Mission Support Kit (MSK)—An air transportable package of supplies and spare parts for aircraft, engines, support equipment, ground communications, and munitions equipment used to support deployed operations when use of a war readiness spares kit (WRSK) is not authorized.

MOB—Main Operating Base.

Mobility Equipment—Oganizational equipment authorized during peacetime that, upon deployment, goes with the unit to support its planned wartime or contingency mission.

Mobilization—The process by which the reserve forces or part of them are brought to the state of readiness for war or other national emergency. This includes activating all or part of the Reserve components as well as assembling and organizing personnel, supplies, and materiel.

MOA—Memorandum of Agreement.

MOGAS—Refers to all grades of automotive gasoline.

MOU—Memorandum of understanding.

MSK—See mission support kit.

NAF—Numbered Air Force.

Naptha—A general term applied to refined, partly refined, and unrefined petroleum products and liquid

products derived from natural gas which distill chiefly between 175 degrees C (347degF) and 237.8 degreesC (462degF).

NAOC—National Airborne Operations Command Post.

Nonrecoverable Tank Bottoms—The quantity of fuel below the suction manifold or drawoff line of storage tanks. This quantity is not available in normal operations.

Nonunit Related Cargo—All equipment and supplies requiring transportation to an area of operations, other than those identified as the equipment or supplies of a specific unit (e.g., resupply, military support for allies, and support for nonmilitary programs, such as civil relief).

Nonunit Related Personnel—All personnel requiring transportation to or from an area of operations, other than those assigned to a specific unit (e.g., fillers, replacements, TDY or TAD, civilians, medical evacuees, and retrograde personnel).

Non-US Air Force Airfield—Any airfield used by the US Air Force and Air Reserve Forces in peacetime or planned to be used in wartime that is under the peacetime jurisdiction of another military service or civil authority.

NSN—National Stock Number.

OMC—Office of Military Cooperation.

Operation Order—A directive issued by a commander to subordinate commanders for the purpose of effecting the coordinated execution of an operation.

Operation Plan—A plan for a single or series of connected operations to be carried out simultaneously or in succession. It is usually based upon stated assumptions and is the form of directive employed by higher authority to permit subordinate commanders to prepare supporting plans and orders.

OPLAN—See Operation Plan.

OPORD—See Operation Order.

OPR—Office of primary responsibility.

OPSEC—Operations Security.

Organic Airlift—Use of mission support aircraft, such as tankers, to haul cargo on a space available basis.

Outage—See ullage.

Outsize Cargo—A single item that exceeds the dimensions of 810 inches by 117 inches by 105 inches but is less than 1,453 inches by 216 inches by 114 inches.

Oversize Cargo—A single item that exceeds the usable dimensions of a 463L pallet, 104 inches by 84 inches, and a height established by the cargo envelope of the particular model aircraft (96 inches for military aircraft and 48 inches for Civil Reserve Air Fleet) but not to exceed 810 inches by 117 inches by 105 inches.

PAA—Primary Aircraft Authorization.

Packaged Fuel—Those bulk petroleum fuels which, because of operational necessity, are packaged and supplied in containers of 5- to 55 gallon capacity. Fuels in military collapsible containers of 500 gallon capacity or less are also included in this category.

PDSS—Pre-Deployment Site Survey.

Petrol—Term used, usually in England, to designate petroleum or its derivatives.

pH Value—The degree of acidity or alkalinity of a solution on a scale of 1 to 14. Pure water and neutral solutions have a pH value of 7; acid solutions have values less than 7; alkaline solutions have values greater than 7.

Pipeline Time Quantity—That quantity calculated by multiplying the daily demand rate by the amount of time, in days, required to deliver product from source to terminal, including discharge and settling times as applicable.

PMC—Partially mission capable.

POL—Petroleum, Oils, and Lubricants. Also, often refers to all products handled by Air Force fuels management personnel including LOX, demineralized water, etc.

POS—See primary operating stock.

Pour Point—The lowest temperature at which an oil will pour or flow when chilled without disturbance under specified conditions. By ASTM instruction, it is taken as the temperature 5 degrees F above the solid point.

Pre-Positioned War Reserve Materiel Requirement—That portion of the war reserve materiel requirement which the current Secretary of Defense guidance dictates be reserved and positioned at or near the point of planned use or issue to the user prior to hostilities, to reduce reaction time and to ensure timely support of a specific force or project until replenishment can be effected.

Pre-Positioned War Reserve Materiel Stock—The assets that are designed to satisfy the pre-positioned war reserve materiel requirement.

Primary Fuel—Per TO 42B1-1-14, the fuel or fuels used during aircraft tests to demonstrate system performance (contract compliance) through the complete operating range for any steady state and transient operating condition."

Primary Operating Stocks—Logistics resources on hand or on order necessary to support day-to-day operational requirements and which, in part, can also be used to offset sustaining combat requirements. Also called POS.

Primary Stockage Objective (PSO)—The maximum quantity of materiel authorized to be on hand to sustain current operations. It consists of the safety level quantity and the economic resupply quantity.

PRIME BEEF-Base Engineering Emergency Forces—Worldwide civil engineer forces organized to provide trained military elements used in direct combat support or emergency recovery from natural disasters.

PRIME RIBS (Readiness in Base Services)—Worldwide base services forces organized and trained for wartime support.

Product Use Limits—The extent that properties of a product may change without rendering the product unsuitable for its intended use.

PSO—See primary stockage objective.

PTQ—See Pipeline Time Quantity.

PWRMR—See pre-positioned war reserve materiel requirement.

PWRMS—See pre-positioned war reserve materiel stocks.

Rate—See sortie rate.

RDD—Required delivery date.

Reconstitution—Measures taken after a national disaster to bring residual resources together to constitute an effective US Air Force operational force and support function. Also, post deployment actions.

Recovery—In air operations, that phase of a mission which involves the return of an aircraft to a base.

Redeployment—The transfer of a unit, an individual, or supplies deployed in one area to another area, or to another location within the area, or to the zone of interior for the purpose of further employment.

RED HORSE-Rapid Engineer Deployment, Heavy Operational Repair—Squadrons, Engineering--Red Horse squadrons are established to provide the Air Force with a highly mobile, self-sufficient, rapidly deployable civil engineering heavy force beddown and facility repair capability in a high threat environment.

Refueling—Servicing aircraft with fuel. May be either hot refueling (single point pressure refueling of aircraft with one engine idling) or cold refueling (conventional refueling of aircraft which do not have an engine operating).

Reid Vapor Pressure (RVP)—The measure of pressure exerted by a product on the interior of a special container under specified test conditions due to its tendency to vaporize.

REPOL—Petroleum Damage Deficiency Report.

RO/RO—Roll on/Roll off. Designates type of cargo ships where equipment is driven (or towed) on and driven off.

Rqmt—Requirement.

SA-ALC/SF—San Antonio Air Logistics Center, Directorate of Aerospace Fuels Management.

Saybolt Viscosity—The time, in seconds, for 60 ml of fluid to flow through a capillary tube in a Saybolt Viscometer at specified temperatures.

SBS—Support Battle Staff. Group of individuals in a command post who provide technical expertise to aid in decision making of the battle.

SBSS—Standard Base Supply System.

SEI—See Special Experience Identifier.

Shell Capacity—The gross volume of a petroleum storage tank as determined from tank calibration. The term is synonymous with rated storage capacity.

Shortfall—The lack of forces, equipment, personnel, materiel, or capability (allocated to and identified as a plan requirement) that would adversely affect the command's ability to accomplish its mission.

Short Ton—Unit of weight equal to 2,000 pounds.

SIOATH—See source identification and ordering authorization.

SIOP—Single Integrated Operations Plan.

Slates—Monthly reports of planned requirements for tanker delivery.

SLOC—Sea Lines of Communication.

Smoke point—A measure of the burning cleanliness of jet fuel and kerosene. Defined as the maximum flame height in millimeters at which the fuel will burn without smoking, when determined in accordance with prescribed conditions.

Sortie—In air operations, an operational flight by one aircraft.

Sortie rate—Rate at which assigned aircraft are scheduled to fly. Example, if a squadron of 18 aircraft was expected to achieve a 1.5 sortie rate, it would have to fly a total of 27 missions (1.5 times 18) in 1 day.

Sour—A term applied to petroleum products that show a positive doctor test; that is, contain hydrogen sulfide or mercaptans.

Source Identification and Ordering Authorization (SIOATH) Form—A form used to advise the contractor supply source the effective prices for activities authorized to order or requisition product from that source and the target quantity to be withdrawn by each. It also advises the ordering activities of all the supply data necessary to schedule product and place a proper order.

Special Experience Identifier (SEI)—A three digit number used to identify personnel with special training or skills. SEIs in fuels are FARRP--035; cryotainer maintenance-036; cryo production-037; Laboratory—039; Accounting—040; ABFDS—369; and ATHRS—387.

Specifications—Prescribed limits of control tests used to maintain uniformity of a specific product. Usually published as federal or military specifications.

Specific gravity—The ratio of the weight of a given volume of the material at 60 degrees F to the weight of an equal volume of distilled water at the same temperature, both weights being corrected for buoyancy of air.

STANAG—Standardization Agreement.

Storing Command—The major command with authority over a base or facility that is responsible for providing war reserve materiel support for US forces. If the base is not under authority of a major command, the storing command is the host activity or command that is assigned area logistics responsibility in the war and mobilization plan.

Surfactant—A substance capable of reducing the surface tension of a liquid in which it is dissolved. Fuel additives such as FSII, CI and JP-8+100 additive package components act as surfactants resulting in reducing the effectiveness of fuel system filter separators in removing water and particulate matter.

Sweet—A term applied to petroleum products that show a negative doctor test; that is, do not contain hydrogen sulfide or mercaptans.

Time Phased Force and Deployment List—Appendix 1 to Annex A of the operation plan. It identifies types and/or actual units required to support the operation plan and indicates origin and ports of debarkation or ocean area. It may also be generated as a computer listing from the time-phased force and deployment data . Also called TPFDL.

Time Phased Transportation Requirements List (TPTRL)—Tab A to Appendix 4 to Annex D of an OPLAN. A list of transportation requirements consisting of units, fillers, and replacement personnel, and non-unit-related cargoes, to be moved by common user and/or CINC assigned or attached capability. May also be generated as a computer listing.

TPFDL—See time phased force and deployment list.

TPTRL—See time phased transportation requirements list.

Ullage (or outage)—The difference between the top surface of the liquid in a drum, tank car, etc. and the top of the container. Also, the difference between the full (rated) capacity and actual contents of a storage container. In some tanks (and tank cars) it is the difference between a reference mark and the surface of the liquid. It is important that some appreciable difference always exist in order to allow a free space for the expansion of the contents in case of a rise in temperature.

Unit type code (UTC)—The five-character, alphanumeric code that uniquely identifies each unit type. UTCs identify specific capability of personnel and/or equipment to be deployed in support of various operations.

Unusable Inventory—That portion of the inventory required to prime the storage and distribution system. It consists of cross-country pipeline fill, manifold inventory, and tank bottom inventory below the suction line. The inventory is not available to meet day-to-day operations.

Usable Storage Capacity—Net volumetric capacity (including pipeline and manifold capacity) that can be used for product storage. It is measured from maximum fill level to, and including, non recoverable tank bottoms.

USDAO—United States Defense AttachÈ Office.

Using Command—The major command responsible for geographic wartime support of the forces for which war reserve material is authorized.

UTC—See Unit type code.

Vapor Pressure—The outward pressure of a mass of vapor at a given temperature when enclosed in a gas-tight vessel. It is an index to the volatility of the liquid from which the vapor was produced.

Vapor Space—Space at the top of a tank which is reserved for expansion of contents resulting from increases in temperature.

Viscosity—The measure of the internal friction or the resistivity to flow of a liquid. (e.g., cold molasses has high viscosity; by comparison, water has low viscosity).

Volatility—A measure of the propensity of a substance to change from the liquid or solid state to the gaseous state. A volatile liquid is one which readily vaporizes at comparatively low temperatures. Volatility is important because if a fuel is too volatile, it may vaporize too soon and prevent the flow of liquid in fuel lines (vapor lock). If a fuel is not sufficiently volatile, an engine may not start.

WAA—Wartime Aircraft Activity. A listing of planned aircraft sortie rates in support of an OPLAN.

War Consumables Distribution Objective (WCDO)—A document prepared by major commands to provide the war reserve materiel prepositioning requirements for war consumables for support of the wartime activities.

Mobility Readiness Support Package (MRSP)—An air transportable package of WRM spares, repair parts, and related maintenance supplies required to support planned wartime or contingency operations of a weapon or support system for a specified period of time pending resupply. MRSP may support aircraft, vehicles, communication systems and other systems as appropriate.

War Reserve Materiel (WRM)—Materiel which must be on hand at the time a conflict begins. War

reserve materiel, when added to primary operating stocks and mobility resources must be capable of sustaining combat consumption rates until resupply pipelines can become operative.

Water Bottom—Any part of the tank below the suction line filled with water intentionally or due to leakage or condensation; more generally, that part of the tank occupied by water and sediment.

Water, Entrained—Free water which is suspended throughout a fuel sample and has not settled to the bottom of the container. This water should be separated from the fuel by ground servicing equipment filter separators.

Water, Free—All water present in fuel which has not been dissolved into the fuel. This water should be separated from the fuel by ground servicing equipment filter separators.

Water Separation Index Modified—The WSIM test measures the water separation characteristics of fuels. The test reflects the ease with which a fuel releases dispersed or emulsified water. Surfactants have an adverse effect on the WSIM rating. Fuels having low WSIM ratings will poison filter separators and prevent them from functioning properly.

WCDO—See war consumables distribution objective.

Weathering—Loss of the most volatile component of crude oils and light products during storage and handling, and at the formation of product oxidation.

WMP—War and Mobilization Plan.

WRM—See war reserve materiel.

WSIM—See water separation index modified.

Attachment 2

FUELS LOGISTICS PLANNING GUIDANCE

The items are arranged into categories for convenience. To be used effectively, all items need to be read and reviewed periodically during planning and execution.

A2.1. Requirements:

A2.1.1. Have redeployment fuel requirements been identified early enough to ensure that adequate but not excessive fuel is available?

A2.1.2. Are daily fuel requirements continuously recomputed to ensure drawdown of stocks in bladders by end of the exercise or contingency?

A2.1.3. Have plans been worked out in advance for handling of fuel spills?

A2.1.4. Are berm liners considered and ordered well in advance if required?

A2.1.5. Are fuel additives available from the host?

A2.1.6. Have timely messages been provided to all concerned organizations during the planning phase to allow review of agreed upon fuel requirements and identification of errors?

A2.1.7. Does the host understand what units of measure are used for fuel requirements (to avoid delivery of liters when gallons were requested)?

A2.1.8. Is every attempt made to arrive at firm fuel figures and submit them through Service channels to DFSC a minimum of 90 days prior to the first requirement date?

A2.1.9. Are operations personnel providing fuels personnel with a daily statement of requirements 24 hours in advance?

A2.1.10. Have airlift requirements been identified?

A2.1.11. Have requirements been accurately determined for jet fuel, motor gasoline, diesel fuel, and cryogenics?

A2.1.12. Have fuel additives been considered?

A2.1.13. Have arrangements been made to provide motor oil at the deployed location?

A2.1.14. Is a source of fuel supply identified?

A2.2. Manning

A2.2.1. Are all locations provided with at least one experienced NCO (ADVON) capable of making sound decisions and coordinating actions? Do these individuals have sufficient rank to be effective in their jobs?

A2.2.2. Have sufficient SEI 387 ATHRS operators ,SEI 039 Laboratory Technicians SEI 040 Accountants, and SEI 037 Cryogenic Specialists been provided to cover all locations?

A2.2.3. Are sufficient and adequately trained refueling maintenance personnel provided?

A2.2.4. Have adequate storage personnel been planned, not only for storage at the operations site, but also to coordinate resupply from terminals to on-base storage on a 24 hour basis if necessary?

A2.2.5. Are adequate personnel provided for the advance team to lay out bladders? Are these personnel scheduled on the first increment of the Deployment Manning Document?

A2.3. Ground Fuel Support:

A2.3.1. Have adequate ground fuel vehicles been provided to support flightline operations?

A2.3.2. Has adequate consideration been given to meet early ground fuel requirements?

A2.3.3. If no unleaded fuel will be available, has consideration been given to impact on vehicles, and the fact that standard nozzles will not fit in unleaded vehicle receptacles?

A2.3.4. Can electrical generators use commercial jet fuel instead of diesel?

A2.3.5. If collapsible seal drums are used, are fittings provided to allow filling from vehicle servicing nozzles?

A2.4. Communication:

A2.4.1. Has adequate radio communication been considered, with sufficient portable units to provide full-span control?

A2.4.2. Have telephone and computer support requirements been coordinated with appropriate communications personnel?

A2.5. Site Preparation:

A2.5.1. Are portable ground rods needed for LOX tanks, etc.?

A2.5.2. Are fuel systems laid out with consideration for protection of the environment?

A2.5.3. Are servicing locations dispersed for better servicing and survivability in case of attack or accident?

A2.6. Safety:

A2.6.1. Have plans been worked out in advance for handling of fuel spills?

A2.6.2. Has consideration been given to safety distance criteria between fuels operations and other airfield activity?

A2.6.3. Have no-smoking and product identification signs been prepared for deployment? Are these signs bilingual if necessary?

A2.6.4. Has adequate fire protection (fire extinguishers) been provided?

A2.6.5. Is adequate physical security provided for US fueling operations and equipment?

A2.7. Command and Control:

A2.7.1. Has a central point of control been established to prioritize aircraft servicing?

A2.7.2. Has a senior individual assumed control over the entire fuels operation?

A2.7.3. Has a chain of command been clearly established?

A2.7.4. Have command and control relationships been clearly defined?

A2.7.5. Is daily fuel status reporting provided to appropriate personnel?

A2.8. Personnel:

A2.8.1. Have per diem funds been arranged for fuels personnel, especially those going into an area of operation before accounting and finance paying agents arrive.

A2.8.2. Have provisions been made for food and water for fuels personnel arriving early at an operational location? If necessary, arrange for these personnel to deploy with their own rations.

A2.9. Support Concept :

A2.9.1. Are pertinent directives and checklists made available to the deployed site?

A2.9.2. Has maximum consideration been given to minimizing deployed personnel and equipment without impacting mission support?

A2.9.3. Has the requirement for a defuel capability been considered?

A2.9.4. Has a battery or solar powered calculator with paper tape been provided?

A2.9.5. Has a spare bladder been considered for recovery of fuel spills?

A2.9.6. Are calibrated in-line meters needed to verify fuel quantities?

A2.9.7. Have arrangements for a language interpreter been made?

A2.9.8. Have adequate suction hoses been provided for equipment drawing fuel from underground tanks?

A2.9.9. Does the exercise plan provide for security of the activity or operation, and does it contain adequate instructions for implementing the information security program?

A2.9.10. Have host capabilities been surveyed to determine how much fuel support would be available to our forces?

A2.9.11. Have operating guidelines, refueling points, etc., been agreed to (preferably in writing) prior to deployment to avoid controversy on the operational site?

A2.9.12. Has consideration been given to use of soft hose instead of hard hose on the inlet side of bladders for ease of handling and to prevent rupture in temperature extremes?

A2.9.13. Are provisions made for providing personnel protective equipment?

A2.9.14. Have plans been made to involve the deploying senior fuels supervisor throughout the exercise planning phase?

A2.9.15. Are provisions made for a fuels control center?

A2.9.16. Are additional jet fuel identaplates available?

A2.9.17. Have provisions been made for blending additives in commercial fuel that does not have additives?

A2.9.18. Is the advance team provided with adequate radio communication to handle emergencies and provide safe operations?

A2.9.19. Has consideration been given to the use of an R-22 and hosecart configuration in lieu of an R-14 and FF-U-15E to reduce shipping weights?

A2.9.20. Has consideration been given to offloading full cryo tanks from aircraft (forklift, crane)?

A2.9.21. .Has the impact of weather conditions that would affect fuel support capabilities been determined?

A2.9.22. Has responsibility for exercise and contingency support been clearly established to preclude dual tasking and planning?

A2.9.23. Has fuel additive injection equipment been provided or have procedures been worked out in advance for on-site blending?

A2.9.24. If host is providing fuel support, has consideration been given to support during nonstandard servicing hours?

A2.9.25. Has previous exercise correspondence been reviewed for lessons learned under a similar scenario?

A2.9.26. Have necessary memoranda of agreement and understanding been negotiated?

A2.9.27. Have movement priorities and modes of transportation been clearly identified to ensure first-in and last-out support?

A2.9.28. Are the assumptions in the plan valid, reasonable, and necessary?

A2.9.29. Has the fuel support plan been coordinated between staff sections, organizations, and commands; and are all agencies aware of their responsibilities?

A2.9.30. Have all resupply considerations been clearly identified: Levels of supply, requisitioning, resupply time, reorder and shipping time, etc.?

A2.9.31. Does the plan provide for waivers to safety criteria when safety is the limiting factor to plan execution?

A2.10. Mobility Equipment:

A2.10.1. Has consideration been given to the problem of sand in wheel bearings, etc.?

A2.10.2. If equipment is shipped with dry filters, are necessary precautions planned to preclude static-caused fires when wetting the filters?

A2.10.3. Has refueling equipment been ensured as fully serviceable prior to deployment to minimize maintenance problems at the deployed location?

A2.10.4. Has a towing capability been considered for hose carts, mobility equipment, etc.?

A2.10.5. Are dust covers provided for equipment as appropriate?

A2.10.6. Have sufficient oil and oil filters been provided for fuels equipment?

A2.10.7. Has A PMU-27 or similar pump been provided to drain bladder tanks?

A2.10.8. Are provisions made to operate mobility equipment for a prolonged period prior to deployment to ensure its serviceability?

A2.10.9. Has consideration been given to proper size fittings, kamlocks, reducers, etc., to ensure compatibility of deployed equipment?

A2.10.10. Have provisions been made to stretch fabric tanks before deployment if possible, to avoid rupture on initial fill?

A2.10.11. Has antifreeze been tested for alkalinity and freeze point to ensure serviceability prior to shipment to both cold and hot weather operating locations?

A2.10.12. Has a method of accountability for all equipment and supplies been determined?

A2.10.13. Have support equipment spares and spare parts lists been prepared?

A2.10.14. Has adequate transportation been arranged for fuels personnel operating on odd shifts, at isolated locations, etc.?

A2.10.15. Do individual specialists understand their responsibility to the entire operation as well as their individual tasks areas?

A2.10.16. Even if host nation support is planned, have fuels personnel been provided with a basic trouble-shooting package of hand pumps, tools, water finding paste, tapes, bobs, etc.?

A2.10.17. Do all deployed personnel fully understand the exercise scenario's command relationships, and their particular duties?

A2.10.18. Have all personnel been briefed on the mission?

A2.10.19. Are all personnel briefed on OPSEC and COMSEC?

A2.10.20. Has consideration been given to vehicle support for deployed fuels personnel?

A2.10.21. Are all personnel briefed on local customs and courtesies, to include a discussion on host nation relations?

A2.10.22. Has an alternative to bladder storage been considered for MOGAS storage at locations with high temperatures?

A2.11. After Action:

A2.11.1. Have lessons learned been documented and provided to MAJCOMs for future planning?

A2.11.2. Have recommended changes to this pamphlet been provided to HQ USAF/ILSP?

Attachment 3

AIRFIELD FUELS SITE SURVEY

The following is a sample of the type of information you should attempt to obtain on the fuel support capability at deployed operational locations. This attachment may serve as a guide to the type of information desirable to maintain current capability.

A3.1. POL Bulk Storage Data:

A3.1.1. What products will be stored? Where will they be stored, on or off base?

A3.1.2. How many tanks are available and what is the storage capacity? What are the minimum and maximum inventory levels?

A3.1.3. How many fillstands are there and what is their pumping capacity? Are they bottom loader or top loader types?

A3.1.4. Where are the fillstands located in regard to the refueling area? Are they equipped with meters?

A3.1.5. What is the method of resupply and what is the resupply capability? Are special adapters needed to receive fuel?

A3.1.6. How many off-loading headers exist and where are they located?

A3.1.7. How many trucks can off load simultaneously?

A3.1.8. What is the total per-hour receiving rate utilizing all methods of receipt for each grade of product (in gallons)?

A3.1.9. Are programs in being to add or phase out POL storage systems?

A3.1.10. Can fuel be resupplied year round?

A3.1.11. Is LOX, LIN, DW,or deicing fluid available? If not, where can they be obtained, and what is the resupply rate?

A3.1.12. How and from what source (location and distance) will ground fuels be resupplied?

A3.1.13. Does a ground products service station exist? If so, where is it located and what products are stored and dispensed?

A3.1.14. Are bulk storage tanks dedicated to sole USAF, Joint Service, or Combined Ops use?

A3.1.15. Do earthen or sandbagged dikes exist for 50,000 gl bladder placement or will dikes need to be constructed?

A3.1.16. Does FMSE positioning facilitate combat quick turns?

A3.1.17. Are trained personnel available to assemble FMSE systems?

A3.1.18. Is back-up power available for the storage pump house, fillstands, and the ground fuels service station?

A3.1.19. Who is designated to maintain the system?

A3.2. POL Hydrant Data:

A3.2.1. What types of hydrant systems are available: fixed, portable, etc., and what is condition of the systems?

A3.2.2. What is the storage capacity?

A3.2.3. What is the receipt capability and can it receive directly from a commercial source?

A3.2.4. How many laterals and outlets are available?

A3.2.5. What is the refueling capacity of the system?

A3.2.6. How many aircraft can be serviced simultaneously and what is the flow rate?

A3.2.7. Can large aircraft (C-5, B-52, etc.) be parked on hydrant outlets? Can they taxi on and off, or do they have to be towed?

A3.2.8. Are outlets spaced far enough apart to permit simultaneous parking of more than one large aircraft on the same lateral?

A3.2.9. How many fillstands are available and what is their location and pumping capacity?

A3.2.10. How many and where are the offloading headers located for defueling operations?

A3.2.11. How many hosecarts are available and what is their condition? Do any need special adapters?

A3.2.12. Who will maintain the system and equipment?

A3.2.13. Is emergency power available?

A3.3. POL Refueling Equipment:

A3.3.1. How many refueling units are available and what is their condition?

A3.3.2. Who will maintain the refueling fleet?

A3.3.3. How many general purpose vehicles are designated for POL?

A3.3.4. What type of communication equipment is available; i.e., the number of phones, hot lines, mobile radios, and is computer connectivity available etc.?

A3.3.5. Where will the Fuels Control Center (FCC) be located? (Building and phone number) Does the facility have back-up power?

A3.3.6. Are any WRM units designated for your deployed location?

A3.3.7. When will the WRM units arrive?

A3.3.8. What security measures are available for the compound?

A3.3.9. Where will the refueler parking area be located?

A3.3.10. What is the average turnaround time for a refueler from full on the line, to to the fillstand and back to the flight line?

A3.4. POL Laboratory :

A3.4.1. Is a fuels lab available at the host site? If not, where will the lab be located (building and phone number)?

A3.4.2. Is the host lab equipped, supplied and manned with trained technicians to perform requisite analysis?

A3.4.3. Where and how far (distance and travel time) is the nearest commercial or area laboratory?

A3.5. POL Personnel:

A3.5.1. What is the host base fuels personnel strength?

A3.5.2. How many are designated to arrive?

A3.5.3. Are provisions ready, such as quarters, latrines, and meals?

A3.5.4. Will additional fuels personnel are required due to the increased flying?

A3.5.5. Are there sufficient numbers of SEI qualified personnel to man lab, accounting, cryogenics and FMSE functions?

A3.6. Identify any limiting factors or shortfalls that would adversely impact the mission of the deployed unit.

Attachment 4

SAMPLE MEMORANDUM OF UNDERSTANDING (MOU)

MEMORANDUM OF UNDERSTANDING BETWEEN THE GOVERNMENT OF THE UNITED STATES OF AMERICA AND THE GOVERNMENT OF PETROLAND RELATING TO THE PROCUREMENT AND LOGISTIC SUPPORT OF REFINED PETROLEUM PRODUCTS IN PETROLAND

The Government of the United States of America (USG) and the Government of Petroland (GOP) hereinafter referred to as the Governments: Noting that the Government of the United States of America has requested the GOP to assist in obtaining refined petroleum products for US forces to consume during mutually agreed to projects in Petroland; therefore, they have entered into this MOU to achieve this aim.

1. Authority DOD Directive 5530.3, DOD Directive 4140.25, and US Central Command (USCENTCOM) Regulation Number 27-7.

2. The GOP will supply fuel requirements (jet fuel, gasoline, and diesel), meeting both quantity and quality standards to include additives as requested by the US Department of Defense (DOD) and agreed to by GOP in Appendix I.

3. The DOD will purchase fuel specified in Appendix I from GOP at prices identified in Appendix II.

4. Billing by GO_ will be US dollars. Payment by DOD will be made to the GOP by US Treasury check drawn in US dollars and paid in accordance with Appendix III. Invoices for any and all payments will be submitted and certified by the GOP to the DOD Defense Energy Supply Center, Attention: DESC-R, 8725 John J. Kingman Road, Fort Belvoir, Virginia 22060-6222, USA. Billing procedures will be in accordance with Appendix III.

5. Other appropriate provisions and details not set forth in this basic MOU will be set forth in Appendix IV.

6. To the extent permitted by law and regulation, refined petroleum products will be supplied free of duties, taxes, and administrative charges.

7. The activities of the United States Government in furtherance of this MOU shall be undertaken in accordance with applicable US procurement practices and procedures. Any actions not consistent with or included in this MOU, or any mutually agreed amendment thereto, are not applicable to this arrangement.

8. Both sides will undertake their best efforts to efficiently and economically assist in implementing this MOU.

9. Appendices I, II, III and IV made and entered into become part of this agreement after being initialed and dated by representatives of the Governments on each page of such appendices.

4 Appendices:

I. Requirements--Quantity, Quality, and Location

II. Cost and Pricing

III. Receipt, Accountability, Billing, and Payment

IV. General Provisions

APPENDIX I

Requirements--Quantity, Quality and Location

1. Product Specification The Petroland Air Force will provide products to support US Forces for exercise Big Deal 90, which begins 1 Oct 1990. The products and specifications are as follows:

a. Jet Fuel (Jet A-1) ASTM D-1655 (Latest Revision)/D. Eng. RD. 2494, Issue 8.

b. Gasoline 85 Octane, Petroland Specifications.

2. Quality Surveillance. The Defense Contract Management Command International (DCMCI} will send Quality Assurance Representatives (QAR) to participate pate in the exercise. The QARs will monitor the quality assurance of fuels provided or services performed by the Petroland Air Force. QARs will have access to the fuel laboratories at all participating (PAF) air bases. QARs will be permitted to observe the tests and review the test results of fuel samples tested at source refinery or terminal, and by the Petroland Air Force personnel. The QARs will work with US Air Force (USAF) and Petroland Air Force personnel to ensure that quality fuel is delivered to aircraft and ground equipment. The (GOP) will perform normal fuel sample testing of refueling equipment and their storage tanks as indicated in their documented quality system. The QARs will assist US and (GOP) personnel in affecting corrective action to be taken in the event of product quality discrepancies or equipment failures.

3. Product Delivery. The quantity of product, method of delivery, and specific tasks to be provided by the PAF base X are as follows:

a. Product. Jet A-1 in US gallons;

(1) October 1-5: 115,600

(2) October 6-10: 180,200.

(3) October 11-16. 105,00.

b. The following fuel additives will be provided by the PAF and blended in the servicing equipment by the (PAF):

(1) Fuel System Icing Inhibitor (FSII)

(2) Corrosion Inhibitor

c. The PAF will deliver Jet A-l to US aircraft at Petrobase using four R-9/R-11 refueling vehicles. The Petroland Air Force will blend corrosion inhibitor and FSII into the bulk Jet A-1 stocks prior to loading the R-9/R-11 servicing equipment.

d. Ground Products: Motor gasoline. The PAF will provide motor gasoline to exercise vehicles and US bulk servicing equipment at the base service station. The estimated quantity of motor gasoline required from 1 October 1990 through 15 October 1990 is 13,000 gallons.

4. Title and Acceptance. The title and acceptance of the fuel will pass from the PAF to the US military forces as follows:

a. For all Jet A-1 delivered by the PAF refuelers, title will pass at the skin of the aircraft.

b. For all motor gasoline delivered by the PAF at the base service station, title and acceptance will pass at the servicing nozzle on the service station pump.

5. Quantity Option. The United States Government has an option to increase or decrease quantities of jet fuel, gasoline, and diesel fuel by 25 percent at the same prices listed in Appendix 11.

APPENDIX II

Cost and Pricing

1. Product Costs:

a. The prices that DOD will pay for Jet A-1 and gasoline will be as follows:

(1) Jet A-1, $0.35 per liter.

(2) Motor gasoline, $0.28 per liter.

b. The price includes cost of fuel, delivery of fuel to aircraft, quality services, delivery of fuel to ground vehicles at service station, cost of FSII and corrosion inhibitor, cost of additive blending, and administrative charges.

2. Conversion Factor: The factor to be used in converting liters to gallons is 3.785 liters equal to one US gallon.

APPENDIX III

Receipt, Accountability, Billing and Payment

1. Receipt: Receipt of all PAF fuel into dedicated PAF fuel trucks will be accomplished in accordance with established practices governing quantity and quality control procedures. Normal physical quantity inspection and quality surveillance checks will be made at the point of receipt. USAF fuels laboratory personnel will work with PAF laboratory personnel on routine base level fuel analysis.

2. Accountability:

a. Jet fuel issues made by PAF refuelers to US aircraft will be documented on AF Form 1994, Fuels Issue/ Defuel Document. This is for USAF internal accountability and the USAF fuels representative will accomplish this task. Summary of invoice vouchers for PAF and USAF accountability will be maintained at the base fuel depot (fill stand). Issues to US aircraft will be recorded on these vouchers. As a minimum, the following entries will be made at the time of fill: (1) date, (2) time, (3) registration number of the aircraft or vehicle, (4) name of the PAF fuels representative, (5) name of the USAF fuels representative, (6) quantity of fuel issued.

b. Ground fuel issues of motor gasoline made by the PAF to US Forces vehicles or equipment from the motor pool gas station will be recorded on a summary of issue voucher. The following information will be recorded: (1) date, (2) time, (3) registration number of vehicle or equipment, (4) name of PAF fuels representative, (5) name of US representative, (6) quantity of fuel issued.

c. As of 0800 hours each day, the senior USAF fuels representative and the PAF base Fuels Officer will review the previous days transactions to make sure the totals agree and prepare and sign the PAF daily summary of fuels transactions covering all issues during the previous 24 hour period.

d. At the end of the exercise, a total fuel consumption record will be prepared reflecting the total issues of each product delivered by the PAF. The figures on these documents will be the total of the daily PAF summary of fuel transactions, less any returns for credit. All products will be included on the total fuel consumption record. This document will be prepared in 8 copies and will be signed by the PAF base fuels officer and the USAF senior fuels representative. The invoices submitted by the PAF must be supported by the final PAF fuel consumption record.

Figure A4.1. Summary of Issue Vouchers.

DATE TIME ACFT/VEH REG# PAF FUELS REP. QUALITY LTR/GAL USAF FUELS REP.

(NOTE: Use AF Form 3131, General Purpose, or plain bond paper. Enter the required information under the appropriate headings in column format.)

Figure A4.2. Daily Summary of Fuel Transactions.

DATE:

Quantity of fuel issued (Petroland Air Force summary)

JET A-1_____ LITERS:_____GALLONS

MOGAS_____ LITERS:_____GALLONS

TOTAL_____ LITERS:_____GALLONS

Chief of Air Base Fuels Flight

NAME:_____

RANK:_____DATE:_____

SIGNATURE:_____

Quantity of fuel received (US Air Force Summary)

JET A-1_____ LITERS:_____GALLONS

MOGAS_____ LITERS:_____GALLONS

TOTAL_____ LITERS:_____GALLONS

I certify that the quantities reflected above represent the total fuel transaction as of 0800 hours for the previous 24 hour period. These figures have been mutually agreed upon by both Governmental parties whose signatures appear on this summary.

Senior USAF Fuels Representative,

NAME:_____

RANK:_____DATE:_____

SIGNATURE:_____

Figure A4.3. Total Fuel Consumption Record.

Total fuel issued by Petroland Air Force for all exercise locations in Petroland in support of subject exercises.

JET A-1_____LITERS:_____GALLONS

MOGAS_____LITERS:_____GALLONS

Total fuel received by US forces in Petroland (Note: This figure will be the sum total of all daily fuel summary transaction documents. A copy of each daily summary sheet must be attached to this record.)

JET A-1_____LITERS:_____GALLONS

MOGAS_____LITERS:_____GALLONS

We the undersign, certify that all fuel issues and receipts as supported by separate daily summary of issue vouchers are maintained in this final (grand total) PAF issue voucher and USAF consumption record. This is the document on which payment will be made.

Chief, PAF Representative Senior USAF Fuels Representative

NAME:_____NAME:_____

RANK:_____DATE:_____RANK:_____DATE:_____

SIGNATURE:_____SIGNATURE:_____

3. Billing:

a. Billings will be accomplished by the Government of Petroland.

b. Invoices submitted by the Government of Petroland will be in 8 copies and supported by PAF issue vouchers.

c. Invoices will reference this MOU as authority. They will contain description of each type of supplies, quantity in liters and US gallons, unit price per liter, and extended total.

d. Payment terms will be net 30 days after receipt of proper invoice and supporting documents for proof of issued receipt.

e. Each invoice will reflect remittance address for payment.

4. Payment:

a. Payment will be made in US dollars via US treasury check within 30 days after receipt of proper invoice.

b. The US Government will hand deliver the check to the Chief of the Procurement Office, Embassy of the Government of Petroland, 1234 L. Street, NE, Washington, DC 20000-0000. The US Government will send a letter to the Procurement Office, advising them to send the check to the Government of Petro-

land. When the check is delivered, the US Government will send a telegram to the GOP advising them that the Procurement Office has received the check.

APPENDIX IV

GENERAL PROVISIONS

1. Officials Not To Benefit: No member of or delegate to the US Congress, or resident Commissioner of the United States, shall be admitted to any share or part of this arrangement or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this arrangement if made with a corporation for its general benefit.

2. Covenant Against Contingent Fees: The Government of Petroland warrants that no person or selling agency has been employed or retained to solicit or secure this arrangement upon an agreement or understanding for a commission, percentage, brokerage, or contingent fees, excepting bonafide employees or bonafide established commercial or selling agencies maintained by the Government of Petroland for the purpose of securing business. For breach or violation of this warranty, the Government of the United States shall have the right to cancel this arrangement without liability or in its discretion to deduct from the arrangement price or consideration, or otherwise recover, the full amount of such commission, percentage, brokerage, or contingent fee.

3. Gratuities:

a. The United States Government may, by written notice to the Government of Petroland, terminate the right of the Government of Petroland to proceed under this arrangement if it is found, after notice and hearing, by the Secretary or the duly authorized representative, that gratuities (in the form of entertainment, gifts, or otherwise) were offered or given by the Petroland Government, or any agent or representatives of Petroland, to any officer or employee of the US Government with a view toward securing and arrangement or securing favorable treatment with respect to the awarding or amending, or the making of any determinations with respect to the performing of such arrangement; provided that the existence of the facts upon which the Secretary or the duly authorized representative makes such findings shall be in issue and may be revised in any competent court.

b. In the event this arrangement is terminated as provided in the preceding paragraph, the US Government shall be entitled to pursue the same remedies against the Government of Petroland as it could pursue in the event of a breach of the arrangement by the Government of Petroland, and as a penalty in addition to any other damages to which it may be entitled by law, to exemplary damages in an amount (as determined by the Secretary or the duly authorized representative) which shall be not less than three nor more than ten times the cost incurred by the Petroland Government in providing such gratuities to any such officer or employee.

c. The rights and remedies of the United States Government provided in this clause shall be exclusive and are in addition to any other rights and remedies provided by law or under this arrangement.

Attachment 5

PRODUCT SPECIFICATIONS AND TYPICAL PROPERTIES

A5.1. Cryogenics:

	OXYGEN*	**NITROGEN**
Boiling Point	-297(F), -183(C)	-320(F), -196(C)
Freezing Point	-361(F), -218(C)	-346(F), -210(C)
Liquid Density	9.52lb/gal at -297(F)	6.74 lb/gal at -320(F)
Liquid Density	1.14 g/ml at -183(C)	0.807 g/ml at -196(C)
PROCUREMENT/USE LIMITS (liquid)		
Oxygen (ppm by vol)	----------	5000 max
Total Hydrocarbons (max)	----------	58.3 (ppm by vol as methane)
Odor	None	None
Purity (% by vol)	99.5 min/no limit	99.5 min
Moisture (max)	0.005 mg/liter	26.3 (ppm by vol)
Particulate (mg/liter)	not required	1.0 max
Carbon Dioxide (ppm by vol)	5 max/10 max	---
Methane (ppm by vol)	25 max/50 max	---
Acetylene (ppm by vol)	0.05 max/0.1 max	---
Ethylene (ppm by vol)	0.2 max/0.4 max	---
Ethane and higher hydrocarbons (ppm by vol)	3 max/6 max	---
Nitrous Oxide ppm	2 max/4 max	---
Halogenated Compounds (ppm by vol)		
Refrigerants	1 max/2 max	---
Solvents	0.1 max/0.2 max	---
Others (ppm by vol)	0.1 max/0.2 max	---
Reference	TO 42B6-1-1	TO 42B7-3-1-1
Specification	MIL-O-27210	MIL-P-27401

* NOTE: Per TO 42B6-1-1, Aviators Liquid Breathing Oxygen (ABO) may be considered for use under emergency conditions provided: (1) each contaminate content does not exceed two times the use limit; and (2) a sample is submitted immediately after resupply of the base storage tankage.

A5.2. Aviation Fuels:

	JP-4	**JP-5**	**JET A**	**JET A-1**	**JET B**	**JP-8**	**JP-7**	**JPTS**	**100/130**
MIL- SPEC	MIL-T-5624	MIL-T-5624	ASTM-D-1655	ASTM-D-1655	ASTM-D-1655	MIL-T-83133	MIL-T-38219	MIL-T-25524	MIL-G-5572
NSN	9130-00-256-8613	9130-00-273-2379	9130-00-359-2026	9130-00-753-5026	9130-00-111-7350	9130-00-131-5816	9130-00-180-6385	9130-00-551-2264	9130-00-179-1122
Density (lb/gal)	6.4	6.8	6.8	6.7	6.4	6.7	6.6	6.5	6.0
Flash Point (×F)	-20	140	100	100	-20	100	140	110	-25
Freeze Point (×F)	-72	-51	-40	-53	-58	-53	46	-64	-76
API Gravity (max)	57.0	48.0	51.0	51.0	57.0	51.0	50.0	53.0	-
API Gravity (min)	45.0	36.0	37.0	37.0	45.0	37.0	44.0	46.0	-
NATO/ASCC Sym-bol	F-40	F-44	F-35-	F-34	F-18	F-34			
Specific Gravity (typical)	0.769	0.817	0.817	0.805	0.769	0.805	0.793	0.782	0.703
Vapor Pressure (psi)	2.0-3.0	-	-	2.0-3.0	-	3.0 max	3.0 max	5.5-7.0	
Viscosity at -40×C, CS (est)	3.6	16.5	15	15	3.6	15	-	-	1.2
BTU per Gal (min)	115,000	120,000	119,000	119,000	115,000	119,000	-	-	109,000
BTU per Lb (min)	18,400	18,300	18,400	18,400	18,400	18,400	18,700	18,400	18,700
FSII	Yes	Yes	Optional	Optional	Optional	Yes	Yes	Yes	No
Corrosion Inhibitor	Yes	Yes	Permitted	Permitted	Permitted	Yes	Yes	Yes	Optional

A5.3. Ground Fuels:

	MGX	**DF-1/FO-2**	**DFM**	**DF-2**
Density (lb/gal)	6.2	6.9	7.0	6.9
Flash Point (×F)	-30 (approx)	100	140	125
Freeze Point (×F)	-75 (approx)	41 (approx)	30	34 (approx)
API Gravity (max)	71	-	-	42
API Gravity (min)	47	-	-	33
MIL-SPEC	VV-G-190	VV-F-800	MIL-F-16884	VV-F-800
NSN	9130-00-264-6128	9130-00-286-5286	9140-00-273-2377	9140-00-2865294
NATO/ASCC Symbol	F46/F49/F50	F-54	F-76	F-54
Cetane Number	-	45	45	45
Cloud Point ×F-max	-	-60	30	Spec by user
Pour Point ×F-max	-	Spec by user	20	Spec by user
Viscosity min	-	1.4cSt	1.8cSt	2.0cSt
Viscosity max	-	3.0cSt	4.5cSt	4.3cSt
Sulfur % max	0.10	0.5	1.00	0.5
Operating Tem Range	-	-25 to 32	-	-
Flash Point F-min	-	-	140	-
Reference	TO 42B 1-1-1	TO 42B 1-1-1	TO 42B 1-1-1	TO 42B 1-1-1

A5.4. Utilization of Off-Specification Products: (Obtain laboratory guidance first, if available, prior to following the guidance below.)

PRODUCT	DEVIATION	BLEND RATIO OFF-SPEC-ON-SPEC	USE AS
Avgas	Low Octane	50% Avgas--50% Mogas	Mogas (note)
	Vapor Pressure (3-5)	30% Avgas--70% Mogas	Mogas
	Vapor Pressure (3-5)	20% Avgas--80% Avgas	Avgas
	Distillation	50% Avgas--50% Mogas	Mogas
Mogas	Octane	1% Mogas--99% JP-8	JP-8
	Vapor Pressure	1% Mogas--99% JP-8	JP-8
Diesel	Distillation	50% Diesel--50% FO#2	FO#2
JP-4	Vapor Pressure (below 1.5)	5% JP-4--95% Mogas	Mogas
	Vapor Pressure (below 1.5)	50% JP-4--50% Diesel	Diesel (note)
	Vapor Pressure (below 1.5)	25% JP-4--75% JP-4	JP-4
	Distillation	50% JP-4--50% Diesel	Diesel (note)
	Thermal Stability	50% JP-4--50% Diesel	Diesel (note)
JP-5	Flash Point	20% JP-5--80% JP-8	JP-8
	Thermal Stability	50% JP-5--50% DL/F-1/2	DL/F-1/2
JPTS	Thermal Stability	50% JPTS--50% JP-8	JP-8
	Flash Point	50% JPTS--50% JP-8	JP-8
	Flash Point	50% JPTS--50% DL/F-1	DL/F-1
JP-7	Thermal Stability	20% JP-7--80% JP-8	JP-8
	Thermal Stability	50% JP-7--50% DL/F-1/2	DL/F-1/2
	Flash Point	20% JP-7--80% JP-8	JP-8
	Flash Point	50% JP-7--50% DL/F-1/2	DL/F-1/2
JP-8	Thermal Stability	50% JP-8--50% DL/F-2	DL/F-1

NOTE: Per TO 42B 1-1-1, use is allowed only under emergency conditions.

A5.5. Fuel Reference Chart (Extracted from TO 42B-1-1-1). The alternate emergency fuels in a given category are listed in order of preference indicated by alphabetical letters (example: under diesel vehicles, primary fuels are diesel with next preference being DFM commercial jet fuels and/or JP-5/JP-8 followed by Fuel Oil 1 and 2 and JP-4 blended (as emergency only).

EQUIPMENT	JP-4 SUPPORT EQUIPMENT	DIESEL SUPPORT EQUIPMENT	DIESEL POWER GENERATOR	DIESEL VEHICLE	MOGAS VEHICLE	UNLEADED MOGAS VEHICLE	HEATING PLANT BOILERS
JP-4	Primary	D(1)(2)(6)	D(1)(2)(6)	D(1)(2)	---	---	---
JP-5	Primary	B(6)	B(6)	B	---	---	A*
JP-8	Primary	B(6)	B(6)	b	---	---	A*
AVGAS	Blended C(1)(4)	---	---	---	Blend(3)	---	---
MOGAS	Blended C(1)(4)	---	---	---	Primary	---	---
Unleaded MOGAS	Blended C(1)(4)	---	---	---	A(1)(7)(8)	Primary	---
Combat MOGAS	Blended C(1)(4)	---	---	---	Primary	---	---
Fuel Oil 1 And 2	---	C(9)	C(9)	C(9)	---	---	Primary
DFM	A(1)(5)	A	A	A	---	---	A*
Commer. JET A/A-1	Primary	D(1)(2)(6)	D(1)(2)(6)	D(1)(2)	---	---	---
Commer. JET B	Primary	D(1)(2)(6)	D(1)(2)(6)	D(1)(2)	---	---	---
DF-1	A(1)	Primary	Primary	Primary	---	---	---
DF-1	A(1)	Primary	Primary	Primary	---	---	---
DF-1	A(1)	Primary	Primary	Primary	---	---	---
Gasohol	---	---	---	---	B(limited) (1)(7)(8)	Primary	---

*Blending and burning alternate fuels with conventional boiler fuel must be coordinated with civil engineering at command level. For detailed engineering data on blending, contact AFESC, Tyndall AFB FL 32401-5350, DSN 970-6361.

NOTES:

(1) EMERGENCY ONLY.

(2) BLENDED WITH 50% DIESEL (DF-2 ONLY) BY VOLUME --- AVIATION FUEL GRADE JP-4 should be used only when no other fuels are available. JP-4 and mixtures of JP-4 with other fuels are dangerous due to the extremely low flashpoint of JP-4. Where this fuel or fuel mixtures must be used in "DAY TANKS" or operating tanks located inside buildings or structures, every precaution must be taken to protect the product from any ignition source. BASE GROUND SAFETY PERSONNEL MUST BE CONSULTED PRIOR TO IMPLEMENTING USE OF JP-4 IN DIESEL ENGINES. Tanks containing this mixture should be temporarily marked "BLENDED FUEL IN USE--DANGER."

(3) AVGAS (100/130 only) FOR USE AS MOGAS--Must be blended 50/50 with MOGAS. THIS MIXTURE SHOULD BE USED ONLY IN EXTREME EMERGENCIES WHEN NO OTHER TYPE OF MOGAS IS AVAILABLE AND REQUIREMENT IS MISSION ESSENTIAL.

(4) Blended 50/50 JP-4 (Under no circumstances should this blend be premixed and stored). Equipment utilizing this blend should be temporarily tagged 'BLENDED FUEL IN USE."

(5) Some mobile electric power units are authorized to operate on JP-4/JP-5/JP-8 type fuels as a primary or alternate fuel. Refer to the applicable equipment manual for instructions (Ref MIL-STD-644). If further clarification is necessary, contact applicable AFLC technical office.

(6) Some diesel powered units are authorized to operate on JP-4/JP-5/JP-8 type fuels as a primary or alternate fuel. Refer to the applicable equipment manual for instructions (Ref MIL-STD-1650).

(7) An acceptable alternate fuel for use until supplies of the primary fuel are available, unless specifically denied by the applicable equipment Technical Order.

(8) Extended use in vehicles not specifically designed for unleaded fuel will result in rapid valve wear. Consult applicable equipment Technical Order.

(9) Fuel oil grades 1 and 2 are suitable for use in all Air Force diesel support equipment, diesel power generators, and diesel vehicles provided the sulfur content does not exceed 0.5% (by weight) and particulate matter does not exceed 8 mg/liter.

Attachment 6

MISSION SUPPORT KIT

Operations at a deployed, bare-base location require adequate administrative and housekeeping supplies to support the mission. At the same time, consideration must be given to cost of airlift; therefore, supplies should be kept to the minimum essential required. Additionally, the development of the JFDES Fuels Support Kit provides a specific list of items and quantities for bases tasked to deploy this UTC during a contingency. A complete JFDES contents list (packing list) may be obtained at any local LGX office. Following is a list of items that may be useful:

QUALITY CONTROL (see note)	**MAINTENANCE**	**MISCELLANEOUS**
Sample Cans (1 gal)	3/32 Ground Wire	Cord or Rope
Matched wt Monitors	Copper Ground Clips	Lightweight Table
Water Detector Pads	Pressure Gauge (100 psi)	Radio Antennas
Test Tubes	S/P Nozzle Strainer	Toilet Paper
Laboratory Soap	Allen Wrenches	Sewing Kit
Polyethylene Bottles	Screwdrivers	Cotton Gloves
Weighted Bottle	Pliers	5-Gal Gas Cans
Drum Thief	Lug Wrench	Clipboards
Forceps	Electrical Tape	Masking Tape
In-line sample kit	Nozzle Dust Caps	Paper Towels
Fuel Contam Standard	S/P Nozzle Parts Kit	Spare Batteries
Beakers 400 ml	Tire Gauge	Hand Soap
AEL Water Detector Kit	Plastic Bags	Lint-free Rags
Separatory Funnels	Combination Wrenches	Matches
Thermometers	Vise Grips	Razor Blades
9” Adjustable Wrench (2)	Single wt Monitors	Leather Gloves
Metal Funnels	12” Adjustable Wrench (2)	Antiseize Tape
Detector Pad Holder	Nozzle O-rings	Lightweight Chairs
Graduated Cylinders	Ground Plugs	Plastic Sheeting
Solvent Dispensers	Oil Spout	Compass
Distilled Water	Water Can	Cloth Tape
Writing Paper	PUBLICATIONS	Safety Goggles
Watch Glasses	TO 42B-1-1	Duct Tape
Batteries for AEL Kit	TO 42B1-1-14	Safety Wire
Pipettes	TO 42B6-1-1	Mason Jars
Rubber Stoppers	TO 00-25-172	First Aid Kit
Kimwipes	AFI 23-201	Flexible Wire

QUALITY CONTROL (see note)	MAINTENANCE	MISCELLANEOUS
Aluminum Foil	TO 37-1-1	Felt Tip Marker
AEL Printed Standards	TO 37A-1-101	Air Mattress
Ultraviolet Lamp	GAUGING/STORAGE	Flashlight Bulbs
Drum Spout	Fire Extinguisher	Drum Pump
Flexible Plastic Hose	Tank Thermometer	Tent
Rubber Suction Bulb	Fuel Finding Paste	Insect Repellent
Hydrometer	Water Finding Paste	Sunburn Cream
B/2 Refractometer	Tape & Bob	Hand Cleaner
ADMIN/ACCTG	MISCELLANEOUS	LOX/LIN
Calculator	Pocket Knife	Rubber Apron
Forms	Padlocks	Filter Pads
Paper, etc.	Record Book	Face Mask
Pencils/Pens	Ruler	LOX Gloves
	Ear Protectors	Casualty Blanket
	Flashlights	Protective Boots

Table A6.1. Sample & Analysis Equipment.

		FSN/Part #	Manufacturer	Recommended Quantity
1.	SOLIDS AND WATER TEST			
	Aqua Glo Series III Combination Kit Model GTP	6640-01-138-2563	Gammon-Technical	1 ea
	Turbine Fuel Contamination color stand.	6640-00-326-7684	Millipore	1 ea
	1 Gal Sample Cans	8110-00-128-6819	Central Can Co.	3 ea
	Sample Jars	8125-00-297-1728		6 ea
	Water Detector Pads (25 mm)	6640-00-235-3820	Gammon-Technical	2 bx
	Single Wt Monitors	6630-00-445-3662	Millipore	2 bx
2.	FSII TEST FSII Test Kit	6630-01-165-7133	H.B. Industries	1 ea
3.	CONDUCTIVITY TEST			
	Digital CU Meter or	6630-01-115-2398	Emcee-Electronics	1 ea
	Electrical Meter	6630-01-072-6060	Emcee-Electronics	1 ea
4.	PRODUCT FREEZE POINT TEST			
	Low Temperature Thermometer (-50C to +50C)	Pt# 15-030	Fisher-Scientific	2 ea
	Test Tubes 25x100mm	Pt# 14-956K	Fisher-Scientific	12 ea
	600 ml Beaker, Polypropylene	Pt# 02-591-10F	Fisher-Scientific	2 ea
	Stir Wires	Made Locally		2 ea
	2 Hole Stoppers Size 4	Pt# 14-140F	Fisher-Scientific	2 ea
	Isopropyl Alcohol	6810-00-855-6160		1 gl
5.	SPECIFIC GRAVITY TEST			
	Hydrometer MA-1	6630-00-527-6149		1 ea
6.	CONTAINER	8145-00-501-9138		1 ea

Attachment 7

CONVERSION FACTORS

GRAVITY CONVERSION CENTER

$$\text{Degrees API Gravity} = \frac{141.5}{\text{Specific Gravity (60 deg F)}} - 131.5$$

$$\text{Specific Gravity} = \frac{141.5}{131.5 + \text{Degrees API}}$$

TEMPERATURE CONVERSION

Celsius (Centigrade) = (°F+40) x 1.8-40

or

(F+40) x 5 /9 -40

Fahrenheit = (°C+40) /1.8-40

or

(C+40) x 9 /5-40

TO CONVERT	TO	MULTIPLY BY
	AREA	
Acres.....	Square feet	43.560
	Square yards	4.840
	Square miles	0.0015625
	Square meters	4,046.873
	Hectares	0.4046873
Hectares.....	Square yards	11,959.85
	Acres	2.47104
	Square miles	0.003861
	Square meters	10,000.0
	Square kilometers	0.01
	Square feet	107,600.0
Square centimeters...	Square feet	0.001076
	Square inches	0.1550
	Square meters	0.0001
	Square miles	3.861 x 10-11
	Square millimeters	100.0
	Square yards	0.000196
Square feet.....	Acres	0.0000296
	Square centimeters	929.0
	Square meters	0.09290
	Square inches	144.0
	Square yards	0.111111
	Square miles	3.587 x 108
	Square millimeters	9.29 x 104
Square inches.....	Square centimeters	6.452
	Square feet	0.6944
	Square millimeters	645.2
	Square yards	0.000716
Square kilometers...	Acres	247.1
	Square centimeters	1010
	Square feet	10.76 x 106
	Square inches	1.55 x 109
	Square meters	106
	Square miles	0.3861
	Square yards	1.196 x 106
Square meters.....	Acres	0.0002471
	Square centimeters	10,000.0
	Square feet	10.76
	Square inches	1,550.0
	Square miles	3.861 x 107

TO CONVERT	TO	MULTIPLY BY
	Square millimeters	106
	Square yards	1.196
Square miles.....	Acres	640.00
	Square feet	27.88 x 106
	Square kilometers	2.59
	Square meters	2.59 x 106
	Square yards	3.096 x 106
Square yards.....	Acres	0.0002066
	Square centimeters	8,361.0
	Square feet	9.0
	Square inches	1,296.0
	Square meters	0.8361
	Square miles	3.288 x 107
	Square millimeters	8.361 x 105
	FLOW	
Barrels/day.....	Gal/hr	1.75
	Gal/min	0.0292
Barrels/hour.....	Cu ft/min	0.0936
	Gal/min	0.7
Gallons/hour.....	Cu ft/hr	0.1337
	Cu ft/min	0.002228
	Gal/min	0.016667
Gallons/min.....	Bbl/day	34.2857
	Bbl/hr	1.4286
	Bbl/min	0.02381
	Cu ft/day	192.50
	Cu ft/min	0.1337
	Gal/day	1,440.0
	Liters/sec	0.6308
	Cu ft/sec	0.002228
Cu ft/min.....	Gal/sec	0.1247
	Liters/sec	0.4720
	Cu centimeters/sec	472.0
Cu ft/sec.....	Million gals/day	0.646317
	Gals/min	448.831
Cu yards/min.....	Cu ft/sec	0.45
	Gals/sec	3.367
	Liters/sec	12.74
Liters/min.....	Cu ft/sec	0.0005886
	Gals/sec	0.004403
	FORCE (PRESSURE)	
Pounds/square inch	Kilograms per sq.m.	703.06687

TO CONVERT	TO	MULTIPLY BY
	Inch of mercury	2.036009
	Feet of water	2.306009
	Atmospheres	0.0680457
	Kilograms per sq.cm.	0.07036
Kilograms per sq. m.	Pounds per sq. inch	0.00142234
	Pounds per sq. foot	0.2048169
	Inches of mercury	0.0028959
	Feet of water	0.003280833

LENGTH

TO CONVERT	TO	MULTIPLY BY
Centimeters.....	Feet	0.03281
	Inches	0.3937
	Kilometers	1 x 105
	Meters	0.01
	Miles	6.214 x 106
	millimeters	10.0
	Mils	393.7
	Yards	0.01094
	Microns	10,000.0
Feet.....	Centimeters	30.48
	Kilometers	0.0003048
	Meters	0.3048
	Miles (Nautical)	0.0001645
	Miles (Statute)	0.0001894
	Millimeters	304.6
	Mils	12,000.0
	Microns	30,480.0
Kilometers.....	Centimeters	1 x 105
	Feet	3,281.0
	Inches	39,370.0
	Meters	1,000.0
	Miles	0.6214
	Millimeters	106
	Yards	1,094.0
League.....	Miles	3.
Meters.....	Centimeters	100.0
	Feet	3.281
	Inches	39.37
	Kilometers	0.001
	Miles (Nautical)	0.0005396
	Miles (Statute)	0.0006214
	Millimeters	1,000.0

TO CONVERT	TO	MULTIPLY BY
	Yards	1.094
	Microns	1 x 106
Miles (Nautical).....	Feet	6,080.27
	Kilometer	1.853
	Meters	1,853.0
	Miles (Statute)	1.1516
	Yards	1,760.0
Miles (Statute)	Centimeters	1.609 x 105
	Feet	5,280.0
	Inches	63,360.0
	Kilometers	l.609
	Meters	1,609.0
	Miles (Nautical)	0.8684
	Yards	1,760.0
Millimeters.....	Centimeters	0.1
	Feet	0.003281
	Inches	0.03937
	Kilometers	106
	Meters	0.001
	Miles	6.214 x 107
	Miles	39.37
	Yards	0.001094
	Microns	1,000.0
Microns.....	Centimeters	1 x 104
	Inches	3.937 x 105
	Meters	1 x 106
Yards (US).....	Centimeters	91.4402
	Fathoms	0.03
	Feet	3.0
	Inches	36.0
	Meters	0.9144
	Miles	5.68182 x 104

WEIGHTS

TO CONVERT	TO	MULTIPLY BY
Pounds (avoirdupois)	Grams	453.59
	Kilogram	0.45359
	Ounces (avoirdupois)	16.0
	Ounces (troy)	14.5833
	Long tons	4.4643 x 104
	Short tons	5 x 104
Short tons.....	Kilograms	907.185
	Long tons	.892857

TO CONVERT	TO	MULTIPLY BY
	Metric tons	.907185
	Pounds	2,000.00
Kilograms.....	Pounds	2.20462
	Short tons	0.0011023
	Metric tons	0.001
	Long tons	9.842 x 104
Long tons.....	Kilogram	1,016.05
	Metric tons	1.01605
	Pounds	2,240.0
	Short tons	1.12
Metric tons.....	Kilogram	1,000.0
	Long tons	0.98421
	Pounds	2,204.6
	Short tons	1.10231

VOLUME

TO CONVERT	TO	MULTIPLY BY
Barrels (U.S.).....	U.S. gallons	42.0
	Cubic inches	9,702.0
	Cubic feet	5.6146
	Imperial gallons	34.9726
	Liters	158.984
	Cubic meters	0.15899
Cubic centimeters.....	Cubic feet	3.531 x 105
	Cubic inches	0.06102
	Cubic meters	106
	Cubic yards	1.308 x 106
	Gallons (US liquid)	0.0002642
	Liters	0.001
	Pints (US liquid)	0.002113
	Quarts (US liquid)	0.001057
Cubic feet.....	Cubic Centimeters	28,320.00
	Cubic inches	1,728.00
	Cubic meters	0.02832
	Cubic yards	0.03704
	Gallons (US liquid)	7.48052
	Liters	28.32
	Pints (US liquid)	59.84
	Quarts (US liquid)	29.92
Cubic inches.....	Cubic Centimeters	16.39
	Cubic feet	5.787 x 104
	Cubic meters	1.639 x 105
	Cubic yards	2.143 x 105

TO CONVERT	TO	MULTIPLY BY
	Cubic gallons	0.004329
	Liters	0.01639
	Mil feet	1.061 x 105
	Pints (US liquid)	0.03463
	Quarts (US liquid)	0.01732
Cubic meters.....	Bushels (dry)	28.38
	Cubic centimeters	1 x 106
	Cubic feet	35.31
	Cubic inches	61.023
	Cubic yards	1.308
	Gallons (US liquid)	264.2
	Liters	1,000.0
	Pints (US liquid)	2,113.0
	Quarts (US liquid)	1057.0
Cubic yards.....	Cubic centimeters	7.646 x 105
	Cubic feet	27.0
	Cubic inches	46,656.0
	Cubic meters	0.7646
	Cubic gallons	202.0
	Liters	764.6
	Pints (US liquid)	1,615.9
	Quarts (US liquid)	807.9
Gallons (Imperial)..	Cubic inches	277.42
	Cubic feet	0.160544
	US gallons	1.20094
	US barrels	0.028594
	Liters	4.54596
	Cubic meters	0.004546
Gallons (US).....	Cubic centimeters	3,785.0
	Cubic feet	0.1337
	Cubic inches	231.0
	Cubic meters	0.003785
	Cubic yards	0.004951
	Liters	3.785
	Pints	8.0
	Quarts	4.0
Liters.....	Bushels (US dry)	0.02838
	Cubic centimeters	1,000.0
	Cubic feet	0.03531
	Cubic inches	61.02
	Cubic meters	0.001
	Cubic yards	0.001308

TO CONVERT	TO	MULTIPLY BY
	Gallons (US liquid)	0.2642
	Pints (US liquid)	2.113
	Quarts (US liquid)	1.057

NOTE: See Table A7.1. for fuel factors and Table A7.2. for ocean tanker capacities.

Table A7.1. Fuel Factors.

	POUNDS PER BARRELS	BARRELS PER LONG TON	BARRELS PER METRIC TON	BARRELS PER SHORT TON
JP-4	267.58	8.366	8.234	7.469
JP-5	286.86	7.809	7.686	7.686
JP-8	281.95	7.945	7.818	7.094
Jet A-1	281.95	7.945	7.818	7.094
JPTS	276.75	8.094	7.966	7.227
115/145	246.10	9.102	8.958	8.127
100/130	247.97	9.033	8.891	8.065
100LL	250.49	8.943	8.801	7.984
MGR	260.74	8.599	9.410	7.678
Kerosene	285.18	7.854	7.730	7.013
DFA	283.58	7.900	7.774	7.053
DF2	293.66	7.628	7.508	6.811
DFM	295.43	7.582	7.462	6.770
FO-1	284.38	7.877	7.752	7.033
FO-2	296.31	7.560	7.440	6.750
FO-4	319.91	7.002	6.891	6.252
FO-5 (light)	333.94	6.708	6.602	5.999
FO-5 (heavy)	336.31	6.663	6.557	5.949
FO-6	341.80	6.554	6.450	5.851
Navy Special	331.04	6.766	6.660	6.041

Table A7.2. Ocean Tanker Capacities.

DESIGN OF TANKER	DRAFT FULLY LOADED	CAPACITY OF CARGO (BBLS)	CAPACITY OF PUMPS (BBLS/HR)
AO-22 (USN)	32’-0”	138,000	8,000
AO-51 (USN)	36’-0”	151,000	36,800
AO-143 (USN)	35’-0”	187,000	17,000
AOR-1 (USN)	36’-0”	170,000	41,000
AOE-1 (USN)	38’-0”	166,000	42,700
T2-M-BT2	19’-3”	31,000	4,290
T2-SE-A1	31’-0”	138,335	9,075
T5-S-12a	33’-8”	196,000	24,800
T5S-RM2a	36’-1”	180,000	24,800
Colombia Class	36’-4”	303,315	35,700
Victory Class	39’10”	372,000	21,130
Sohio Intrepid	43’-6”	598,000	52,454
Arco Anchorage	51’-8”	924,000	91,468
T10-S-101b	70’-2”	1,655,000	102,400

Attachment 8

AIRCRAFT PLANNING FACTORS

The following factors are for contingency or exercise planning only. Fuel and LOX quantities are averages. Actual consumption varies due to mission profile. Helicopter length is the length of the fuselage, while the span is the main rotor diameter. All fuel quantities are in US gallons. Normal load indicates the normal aircraft capacity, excluding ferry tanks. Reference numbers are to notes at the end of this section.

NOTE: Fuel grades are for planning purposes only. This publication does not constitute authority to use a grade of fuel other than specified for a particular aircraft. Official aircraft consumption factors are prescribed in AFI 65-503, U.S. Air Force Cost and Planning Factors.

MDS	NAME	GPH	NORM LOAD	SPAN FT-IN	LENGTH FT-IN	REMARKS
A-4F	Skyhawk	490	810	27-6	40-3	5
A-6E	Intruder	890	2320	59-5	54-7	5
A-10	Thunderbolt	615	1644	57-6	53-4	4,4,10,12
AH-1	Cobra	93	259	44-0	44-6	4,10,13
AH-64	Apache	210	375	48-0	48-2	4,15
AV-8A	Harrier	630	760	25-3	45-6	6
B-1B	Lancer	3544	30842	136-9	147-0	4,12
B-2	Spirit		25,373	172-0	69-0	4,12
B-52H	Stratofort	3266	46630	185-0	160-0	4,17,13,LOX 5 gal
B-707-300C		2077	23885	145-9	152-11	5,19
B-727		1395	7680	108-0	153-2	5,19
B-747-100F		4000	51000	195-8	231-4	5,19
B-747-200		4000	51430	195-8	231-4	5,19
B-747-400F		51000	195-8	231-4	231-4	5,19
C-2A	Greyhound	600	1824	43-9	36-6	5,13
C-5	Galaxy	3500	53083	222-9	247-10	4,7,13
C-9	Nightingale	995	5492	93-5	119-4	4,17,13
C-12	Super King	96	250	54-6	43-9	4,7,13
C-17	Globemaster 3	2260	27024	170-0	175.2-0	4,7
C-20A	Gulfstream	540	1700	777-10	83-1	4,7
C-21	Learjet 35	136	500	39-6	48-8	4,7,19
C-23	Sherpa	160	500	74-8	58-1	4,7
C-117	Skytrain	150	1626	90-0	67-9	2,3,18
C-118	Liftmaster	380	5410	117-6	105-7	2,3,18
C-130	Hercules	800	6662	132-7	97-9	4,7,13

MDS	NAME	GPH	NORM LOAD	SPAN FT-IN	LENGTH FT-IN	REMARKS
C-131	Samaritan	200	1730			4,7,18
C-140	Jet Star	720	2660	54-5	60-5	4,7,13
C-141	Starlifter	2075	23593	159-11	168-4	4,17,13
CH-3S	Sea King	164	685	57-3	62-0	5
CH-21	Shawnee	80	300	44-0	52-7	2,18
CH-34	Choctaw	76	262	56-0	46-9	2,18
CH-37	Mojave	200	398	72-0	64-11	2.18
CH-53	Stallion	310	628	27-7	73-4	5
CH-54	Skyhook	535	1350	72-0	88-0	4,10,13
CT-39	Sabreliner	310	610	44-5	43-9	4,7,13
DC-8-50/61		2077	23393	148-5	187-5	5,19
DC-8-62/63		2077	24275	148-5	187-5	5,19
DC-9-301		990	3679	93-5	125-7	5,19
DC-10-20CF		2538	26500	165-4	182-0	1,5,19
DC-10-30CF			3077	36000	165-4a182 -0	5,19
E-2	Hawkeye	340	1784	80-7	57-7	5,13
E-3A	Sentry	2100	23855	145-9	152-11	4,7,13
E-4	NAOC	4320	51300	195-8	231-4	4,17,12
EC-135	Stratolifter	1700	31200	130-10	136-3	4,7,13,LOX2 gal
EF-111	Raven	1450	2800	63-0	73-6	4,7,13
F-4	Phantom	1800	1889	38-8	63-0	4,7,13
F-5	Tiger II	560	680	26-8	48-6	4
F-14	Tomcat	1055	2400	64-1	62-0	5
F-15	Eagle	1580	2400	42-10	63-9	4,15,16
F-16	Falcon	800	1072	32-10	49-6	4,15,16
F-18	Hornet	870	1597	37-6	56-0	5
F-111	Aardvark	1770	2500	63-0	73-6	4,7,13
FB-111	Aardvark	1375	4994	70-0	88-3	4,7,13
F-117	Nighthawk	1400	1158	43-0	65-11	4,7
H-47	Chinook	200	630	12-5	51-0	4,11
HH-1	Iroquois	90	220	48-0	39-8	5
HH-2	Seasprite	125	274	44-0	38-4	5
HH-3	Pelican	115	685	57-3	61-0	5
HH-3E	Jolly Green	164	685	57-3	62-0	4,7,12
HH-21	Workhorse	80	300	44-0	52-7	2,18

MDS	NAME	GPH	NORM LOAD	SPAN FT-IN	LENGTH FT-IN	REMARKS
HH-53	Super Jolly	305	305	72-3	67-2	4,7,13
HH-60D	Night Hawk	130	362	53-8	50-1	4,15
KC-10	Extender	2650	52000	165-4	181-7	4,7
KC-135	Stratolift	2070	31200	130-10	136-3	4,7,13,LOX5 Gal, Wat 670
KC-135E	Stratolift	1800	31200	130-10	136-3	4,7,13,LOX5 Gal
KC-135R	Stratolift	1630	31200	130-10	136-3	4,7,13,LOX . 5 Gal
L-1011	Tri-Star	2570	23000	155-4	177-8	5,19
NC-121	Constellation	640	7550	123-0	116-21	3,14
O-1	Bird Dog	10	42	36-0	25-10	3,18
OH-6A	Cayuse	20	59	26-4	23-6	4,10,13
OH-13	Sioux	20	43	35-2	30-5	2,18
OH-23D	Raven	20	46	35-5	28-5	2,18
OV-1	Mohawk	170	297	42-0	41-1	4,10,13
OV-10	Bronco	95	250	40-0	41-7	4,7,13
P-2	Neptune	330	3010	97-9	95-11	6
P-3A	Orion	680	9200	99-8	116-10	5,13
RC-135	Stratolift	1960	25085	130-10	136-3	4,7,13,LOX 10 Gal
RF-4	Phantom	1450	1889	38-8	63-0	4,7,12
S-3A	Viking	395	1933	68-8	53-4	5
SH-3A	Sea King	140	685	62-0	54-9	5
T-6A	Texan II	71	164(s/p) 179(o/w)	33-5	33-4	4
T-37	“Tweet”	185	680	33-3	29-3	4,7,13,18
T-38	Talon	400	583	25-3	46-4	4,13,17
T-43	Boeing 737	820	3500	93-0	100-0	4,7,13
TR-1		280	2775	103-0	63-0	JPTS, (exp) LOX 9 GAL Gal, Wat 670
U-1A	Otter	30	214	58-0	41-10	2,3,9,12,18
U-2	Dragon Lady	290	2775	103-0	63-0	JPTS,18, LOX 9GAL
U-3A	Cessna 310	20	130	36-11	36-0	2,8,9,12,18
U-6A	Beaver	20	95	48-0	30-5	2,8,9,12,18
U-8	Seminole	35	230	45-3	31-6	2,8,12,18

MDS	NAME	GPH	NORM LOAD	SPAN FT-IN	LENGTH FT-IN	REMARKS
U-11	Aztec	25	144	37-3	31-3	2,3,18
U-21	UTE					4,10,13
UH-1	Iroquois	90	220	48-0	39-8	4,7,12
UH-10	Chicasaw	60	175	53-0	42-3	2,18
UH-60A	Blackhawk	130	362	53-8	50-1	4,15
US-3A	Viking	160	1923	68-8	53-4	5

Explanation of reference numbers in the remarks column:

1. Primary fuel JP-4 (TO 42B 1-1-14)
2. Primary fuel 100/130 (TO 42B 1-1-14)
3. Primary fuel 115/145 (TO 42B 1-1-14)
4. Primary fuel JP-8 (TO 42B 1-1-14)
5. Approve fuel ashore JP-5, JP-4, JP-8 (TO 42B 1-1-14)
6. Approve fuel ashore 115/145 or 100/130 (TO 42B 1-1-14)
7. Alternate fuel JP-5, Jet A, Jet A-1, Jet B (TO 42B 1-1-14)
8. Alternate fuel 115/145 (TO 42B 1-1-14)
9. Alternate fuel 80/87 (TO 42B 1-1-14)
10. Alternate fuel JP-5, JP-8 (TO 42B 1-1-14)
11. No alternate fuel, JP-8, JP-5, Jet A Jet A-1, and AVGAS listed as emergency fuels. (TO 42B 1-1-14)
12. No emergency fuels listed. (TO 42B 1-1-14)
13. Emergency fuel AVGAS (TO 42B 1-1-14)
14. Alternate fuel 100/130(TO 42B 1-1-14)
15. Alternate fuel JP-5, JP-8, Jet A-1, Jet B (TO 42B 1-1-14)
16. Emergency fuel Jet A (TO 42B 1-1-14)
17. Alternate fuel Jet B, Emergency fuel JP-8, JP-5, Jet A-1, Jet A. (TO 42B 1-1-14)
18. Overwing refueling only.
19. Primary fuel Jet A (TO 42B 1-1-14)

Attachment 9

DEPLOYMENT REQUIREMENTS CHART

The following chart is designed to help plan for personnel support requirements. THIS IS A GUIDE ONLY! Tailor requirements to fit individual and mission needs. NOTE: Systems below do not include bladders in slings.

	TACTICAL		STRATEGIC	
	FIGHTERS	AIRLIFT	TANKERS	BOMBERS
Fuel Load	2,500	10,000	30,000	40,000

PAA	9	18	24	48	72	8	16	24	32	5	10	15	20	25	6	8	14	28
R-14	2	3	3	4	6	2	3	4	6	2	3	3	4	6	2	2	3	6
R-22	1	1	1	2	2	1	1	2	2	1	1	1	2	2	1	1	1	2
PMU-27	1	1	2	2	3	1	2	2	3	1	1	2	2	3	1	1	2	3
200K BSS	0	0	1	2	3	0	0	1	2	0	0	0	1	2	0	0	1	2
50K BAG	4	7	7	9	14	4	7	9	14	4	7	7	9	14	4	4	7	14
10K BAG	0	0	0	2	4	0	0	2	4	0	0	0	2	4	0	0	2	4
R9/R11	1	2	3	4	6	1	1	3	4	1	2	3	6	6	1	2	3	6
C-300	0	0	0	2	2	0	0	2	2	0	0	2	2	2	0	0	2	2
FFU-15	1	1	2	2	2	1	1	2	2	1	1	2	2	2	1	1	2	2
JFDES KIT	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
SEAL DRM	4	4	8	8	12	4	8	8	12	4	4	8	8	12	4	4	8	12
HAND PMP.	4	4	8	8	8	4	8	8	8	4	4	8	8	8	4	4	8	8
LOX TANK	2	2	3	4	6	2	2	4	6	2	2	3	4	6	2	2	3	6
LIN TANK	1	1	2	3	4	1	1	3	4	1	1	2	3	4	1	1	2	4
2F0X1	9	18	22	45	68	9	22	45	68	9	18	22	45	54	9	12	22	68
MSK	1	1	1	2	2	1	1	2	2	1	1	1	2	2	1	1	1	2

DECISION LOGIC TABLE

The following decision logic table is designed to provide suggested equipment and personnel required to support a particular scenario. Choose the servicing requirement in the top chart, then refer to the bottom chart for the appropriate support package. THIS IS A GUIDE ONLY! Tailor the requirements to fit individual and mission needs. NOTE: Systems below do not include bladders in slings.

THOUSANDS OF BARRELS PER DAY (Bpd)

# SERVICINGS	2BPD	5Bpd	10Bpd	15Bpd	20Bpd	25Bpd	30Bpd	35Bpd	40Bpd
0-25	A	F	G	H	H	--	--	--	--
25-50	B	B	G	H	I	J	K	--	--
51-75	B	C	C	I	L	K	M	N	O
76-100	C	C	E	J	L	L	N	N	O
101-125	C	C	E	J	M	M	N	N	O
126-150	C	C	F	K	M	M	N	N	O
151-175	C	C	G	K	N	N	O	O	O
176-200	C	C	H	L	N	N	O	O	O

EQUIPMENT	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
R-14	2	4	6	1	2	3	3	3	4	4	6	6	6	8	9
R-22	1	1	2	1	1	2	2	2	2	2	3	3	3	4	4
PMU-27	1	1	2	1	1	2	2	2	2	2	2	2	2	2	2
50K BAG	4	10	14	2	4	6	6	6	8	8	12	13	14	19	22
10K BAG	0	0	2	0	0	0	0	0	2	2	2	4	5	5	5
R9/R11	0	0	1	0	0	0	0	0	0	2	2	2	4	4	6
C-300	0	0	1	0	0	0	0	0	0	2	2	2	2	3	3
FFU-15	1	1	2	1	1	1	2	2	2	2	2	2	3	3	3
JFDES KIT	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2
SEAL DRUM	2	4	6	2	3	4	6	6	6	6	6	6	6	8	8
HAND PMP.	2	4	6	2	3	4	6	6	6	6	6	6	6	8	8
LOX TANK	1	1	1	1	1	2	2	2	2	2	3	3	4	4	4
2F0X1	9	18	15	9	9	12	18	22	25	40	40	68	86	136	154
MSK	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Attachment 10

ADDITIVE BLENDING

A10.1. FUEL SYSTEM ICING INHIBITOR (FSII): A compound which lowers the freezing point of water entrained in fuel, preventing the formation of ice which could clog filter elements and result in aircraft engine stalls. FSII does not lower the freezing point of the fuel, just the water in the fuel. Unlike commercial and most US Navy aircraft, Air Force aircraft do not have fuel system heaters to prevent moisture in the fuel from freezing. When using fuels without FSII, sump drain procedures must be strictly complied with to eliminate possible water accumulation. Flight crews should be advised when fuel does not contain icing inhibitor. Water removes FSII from fuel and therefore, introduction of water must be avoided to the greatest extent possible. Free water must be removed at any point where it accumulates, including aircraft tanks. FSII is diethylene glycol monomethyl ether MIL-I-85470, and is available in 55 gallon drums (NSN 6850-01-089-5514) or bulk delivery (NSN 6850-01-057-6427). FSII is blended at the rate of one gallon FSII per 1,000 gallons of fuel (reference TO 42B-1-1).

A10.2. CORROSION INHIBITOR (CI): Originally added to fuel to prevent corrosion of steel surfaces. However, CI provides lubricity to fuel pumps and fuel controls. Without CI, for example, F-15 and F-16 aircraft are limited to 10 consecutive flying hours. Corrosion inhibitor must conform to MIL-I-25017 and is available in 55 gallon drums (NSN 6850-00-292-9780) and 1 gallon cans (NSN 6850-01-180-1074). CI is blended at the rate of 65 ml CI per 1,000 gallons of fuel (reference TO 42B-1-1).

A10.3. STATIC DISIPATOR ADDITIVE (SDA): Additive added to fuel aids in relaxing static charges, decreasing the possibility of fires or explosions caused by static electricity. DuPont Stadis 450 is the only approved conductivity additive. The use of conductivity additive does not reduce or eliminate the need to follow grounding and bonding procedures outlined in TO 00-25-172. If Jet A-1 at commercial locations is available, it may already contain conductivity additive. This should be determined with a conductivity meter prior to mixing. Stadis 450 is available in one gallon cans (NSN 6850-01-097-2060) or five gallon cans (NSN 6850-01-099-4015). Conductivity additive is first diluted one part additive to nine parts jet fuel. If the conductivity level of the fuel to be treated is less than 50 conductivity units (CU), this diluted mixture is then blended at the rate of 40 ml per 1,000 gallons of fuel (for ambient temperatures above 60 degrees Fahrenheit); 60 ml per 1,000 gallons of fuel (for ambient temperatures between 20 and 60 degrees Fahrenheit); or 80 ml per 1,000 gallons of fuel (for ambient temperatures below 20 degrees Fahrenheit). As a general rule, when CU values are from 0 to 50 CU, blend 31 ml per 1,000 gallons of fuel; and when between 50 to 100 CU, blend 19 ml per 1,000 gallons of fuel (reference TO 42B-1-1).

A10.4. BLENDING PROCEDURES:

A10.4.1. The Air Force has a recently developed fuel injectors specifically designed for use in a forward operating location or location where no commercial in-line injection system is in place. This piece of equipment is called the Hammonds 4T-4A Fuel Additive Injector (NSN 4930-01-418-2694), manufactured by Hammonds Technical Services Inc. Houston Texas. This injector requires no outside power source and is powered by the fuel flow through the injector turbine.

A10.4.2. In the event a Hammonds Injector is not available, additives must be manually blended into the fuel. FSII and CI may be premixed prior to adding to fuel. Conductivity additive must be added to the fuel separately and must not be premixed with other additives. Additives may be introduced

into refuelers using a funnel and length of hose with one end submerged below the surface of the fuel. Approximately 150 percent of the refueler capacity should then be circulated before issuing fuel. Alternate method is to add required quantities of additives to a refueler filled to not more than one-third capacity, then finish filling the unit. Fuel can then be issued without circulation (reference TO 42B-1-1).

A10.5. BLENDING CHART: The following chart provides guidance on blending fuel additives for tanker aircraft based on the quantity of fuel requested for the tanker. For the required fuel load, add the indicated amount of additive to approximately 4,500 gallons of fuel in a refueler; rotate 4,500 gallons to blend the additive; service the aircraft tanks with the correct proportion of blended fuel; then fill the aircraft tanks to the required capacity with unblended fuel. This method has been used successfully at overseas commercial airports where additive injection equipment was not available. All conversions at 6.7 pounds per gallon:

TRUCK FUEL RQMT. (LBS)	BLENDING FUEL RQMT. (GAL)	FSII (GAL)	CORROSION INHIBITOR (MILLILITER)
30000	4478	4.48	448
40000	5970	5.97	597
50000	7463	7.46	746
60000	8955	8.96	896
70000	10448	10.45	1045
80000	11940	11.94	1194
90000	13433	13.43	1343
100000	14925	14.94	1493
110000	16418	16.42	1642
120000	17910	17.91	1791
130000	19403	19.40	1940
140000	20896	20.90	2090
150000	22388	22.39	2239
160000	23881	23.88	2388
170000	25373	25.37	2537
180000	26866	26.87	2687
190000	28358	28.36	2836
200000	29851	29.85	2985
210000	31343	31.34	3134
220000	32836	32.84	3284
230000	34328	34.33	3433
240000	35821	35.82	3582
250000	37313	37.31	3731
260000	38806	38.81	3881

270000	40299	40.30	4030

NOTES:

1. The aircraft crew chief will advise the USAF fuels operator of the total onload requirement for each aircraft.

2. POL will blend the required additive in one refueler according to the guide above.

3. The crew chief will compute the amount of blended fuel to go into each aircraft tank and advise the truck operator of the required quantity.

4. During fueling, the truck operator will watch the meter and advise the crew chief of the quantity metered into each tank.

Attachment 11

INTERSERVICE REFUELING EQUIPMENT AND SYSTEMS

Section A11A—USAF

A11.1. Aerial Bulk Fuel Delivery Systems (ABFDS):

A11.1.1. Primary Function: Bulk haul of fuel onboard C-130, C-141, C-5, and C-17 aircraft.

A11.1.2. Alternate Function: Ground refueling of aircraft in forward areas when the Alternate Capabilities Equipment (ACE) kit is installed.

A11.1.3. Manufacturer: Air Logistics, NSN: 4930-833-4393, T.O. 37A9-3-7-1

A11.1.4. Standard Aircraft Configurations:

Aircraft	# 3K Bladders	Total Capacity
C-130	Two	6,000 gallons
C-141	Three	9,000 gallons
C-17	Three	9,000 gallons
C-5	Eight	24,000 gallons

A11.1.5. Pump Capacity: Two 600 GPM pumps. The pumps may be operated separately or concurrently. Maximum issue rate with ACE is 350 GPM.

A11.1.6. Issue Nozzle: Single Point Refueling, 2.5 inch.

A11.1.7. Issue KAM-LOK Coupler: 4 inch male, 4 inch female, 3 inch female.

A11.1.8. Refill Connections: 4 inch female KAM-LOK, Single Point Refueling 2.5 inch adapter.

A11.1.9. Airlift Data: Each 3,000 gallon bladder is mounted on a 240 inch long by 108 inch wide platform. Platforms may be stacked for shipment when transported as cargo. Both pumps and the ACE kit, when installed, are secured to a single 88 inch long by 108 inch wide 463L pallet. UTC: JFDGB (2 personnel) or JFDGC (5 personnel). Platform Size: 568L x 108W x 30H. Shipping Weight: 6400 lbs.

A11.1.10. Operation and Installation:

A11.1.10.1. Two AFSC 2F0X1 Special Experience Identifier (SEI) 369 qualified ABFDS operators are required for operation of the ABFDS or ABFDS with ACE. The aerial fuel delivery standard configuration utilizes all available pallet sections inside the aircraft cargo compartment. The number of fuel bladders may be reduced if missions require concurrent delivery of freight and fuel. The pump module must be located on the aft ramp during engine operation to permit engine exhaust hoses to extend outboard of the cargo compartment.

A11.1.10.2. Some ABFDS have been modified with alternate capability equipment (ACE) to provide a capability to refuel aircraft direct from the ABFDS. Commanders may authorize the one time use of non-ACE equipped ABFDS for aircraft servicing when an emergency situation devel-

ops and support cannot be provided by other means. Under these circumstances, it must again be remembered that the normal ABFDS has no filter separator capability.

A11.1.11. Interoperability: The ABFDS is versatile in its capability to interface with other equipment. ABFDS can be used for delivery of all grades of jet fuels, diesel or heating fuels, and gasoline. The system can deliver fuel to all other services' road tankers, bulk fuel storage systems, and aircraft except the UH-1 and OH-58 helicopters. Advance notice is required for US Air Force to obtain the CCR nozzle or open port nozzle for refueling the UH-1 and OH-58 helicopters. The ABFDS can also receive fuel from the USA Fuel System Supply Point (FSSP), Tactical Airfield Fuel Dispensing System (TAFDS), and all road tankers.

A11.2. R-14 Air Transportable Hydrant Refueling System (ATHRS):

A11.2.1. Primary Function: Aircraft refueling.

A11.2.2. Alternate Function: Aircraft defuel and unit fillstand.

A11.2.3. Description: The R-14 ATHRS is equipped with two 50,000 gallon standard fuel bladders, a multifuel diesel engine, filter separator, pressure controls, hoses, nozzles, and adapters to create a self-contained aircraft refueling system. Manufacturer: Multiple contractors, NSN: 4930-00-112-2432, T.O. 37A9-3-5-1/21.

A11.2.4. Tank Capacity: 100,000 gallons in normal configuration. The R-14 can be configured with any size and number (usually two) of bladder storage tanks or tied directly into a bulk storage system.

A11.2.5. Pump Capacity: 600 GPM

A11.2.6. Issue Nozzle: Single Point Refueling 2.5 inch and Open Port 2 inch.

A11.2.7. Issue KAM-LOK Couplers: 4 inch male, 3 inch female.

A11.2.8. Receipt KAM-LOK Couplers: 4 inch male, 4 inch female, 3 inch female.

A11.2.9. Airlift Data: UTC: JFDEG, Shipping Weight: 10,960 lbs., Cubic Feet: 773, Over all Dimensions: 156L x 87W x 83-102H.

A11.2.10. Operation and Installation: A diked area 80 by 80 feet inside with an interior sand surface area is needed to prevent bladder puncture and spreading of fuel to the parking apron. The dike should be a minimum of 3.5 feet high at the lowest point to prevent fuel migration. The dike forward area must be within 250 feet of the receiving aircraft refueling adapter to permit installation and aircraft refueling with available hose sections. Fuel is normally offloaded into the bladders by use of a 600 GPM type A/M 32, R-22 pump and a type FFU-15E 600 GPM filter separator. Eighty feet of 4 inch KAM-LOK hose sections and isolation valves are supplied with the A/M 32 R-22 pump. If the R-14 is configured to be tied into an existing storage system, caution must be exercised to ensure adequate safety precautions are included; i.e., a pumping unit (R-22), pressure relief valve, and isolation valves are installed between the storage system and the R-14 unit. When requesting R-14 systems, keep in mind the R-14 is sometimes described as being complete with two bladder tanks in the slings, while at other times the bladders are considered completely separate from the pumping unit. Be specific about the number of pumping units and bladders required.

A11.2.11. Interoperability: The R-14, in addition to supporting all US Air Force aircraft, can refuel all other services' aircraft using the SPR or open port nozzle. The R-14 can also receive from and issue fuel to all US Army and US Marine Corps road tankers through the 4 inch KAM-LOK coupling.

A11.3. R-22 Trailer Mounted 600/900 GPM Pump:

A11.3.1. Primary Function: Provide bulk fuel transfer capability.

A11.3.2. Alternate Function: Refuel aircraft when used in conjunction with MH-2 series hosecart or FFU-15E filter separator.

A11.3.3. Description: The R-22 is a trailer mounted pumping unit powered by a multifuel diesel engine, and consists of a V4 engine, engine housing, basket strainer, control panel, fuel tank, and accessories. The unit is designed to rapidly and safely pump large quantities of fuel under any operating condition. The R-22 is usually used to pump fuel from a bulk storage system to the R-14 bladder tanks. Manufacturer: Multiple Contractors. NSN: 4320-00-131-9185. T.O. 35E13-82-1/11.

A11.3.4. Tank Capacity: None

A11.3.5. Pump Capacity: 900 GPM.

A11.3.6. Issue KAM-LOK Coupler: 6 inch male, 4 inch male.

A11.3.7. Receipt KAM-LOK Couplers: 6 inch female, 4 inch female.

A11.3.8. Airlift Data: UTC: JFDEJ. Shipping Weight: 2520 lbs. Cubic Feet: 290. Overall Dimensions: 116L x 69W x 80H.

A11.3.9. Operation and Installation: The R-22 has no filtering or pressure control system, and thus is not normally authorized for use in servicing aircraft. However, the R-22 systems have been used effectively in conjunction with MH-2 series hose carts and in some respects may be superior to a R-14 for providing an immediate fueling capability where airlift is at a premium. The R-22 through its simplicity is more reliable, lighter, and easier to operate and maintain than the R-14. The R-22 is designed to transfer fuel at rates up to 900 GPM. Normally installed at the fill end of 50,000 gallon bladders and used for off-load from mobile delivery units. Designed for installation in 6 inch pipeline sections when operating pressures of 150 PSI or less is required.

A11.3.10. Accessory Support War Reserve Support Kit : 8 each, 4 inch by 8 foot hoses with KAM-LOK hose end couplings; 4 each, 4 inch valves equipped with 4 inch KAM-LOK couplings.

A11.3.11. Interoperability: Compatible with other services' transportable fuel systems. With appropriate reducers, the pump can be connected with all size KAM-LOK connectors.

A11.4. PMU-27 Pumping Unit:

A11.4.1. Primary Function: Refuel small aircraft and transferring small quantities of fuel.

A11.4.2. Alternate Function: Ground fuels dispensing unit, aircraft defueling, and dedrumming.

A11.4.3. Description: The PMU-27 is a trailer mounted, engine powered unit consisting of a 50 GPM pump, filter separator, meter, hoses, connections, and nozzles. It is designed to support servicing of small aircraft and transfer of small quantities of fuel. It also is capable of defueling four 55-gallon drums simultaneously, pumping from an external source and defueling aircraft auxiliary tanks. The unit is also an effective ground fuels dispensing unit. Manufacturer: Multiple Contractors. NSN: 4320-00-754-7573. T.O. 35E13-73-11/21.

A11.4.4. Tank Capacity: None. Connects to 55 gallon drums, 500 gallon seal drums, 10,000 gallon bladders, etc.

A11.4.5. Pump Capacity: 50 GPM.

A11.4.6. Issue Nozzle: Open Port 1.5 inch.

A11.4.7. Issue KAM-LOK Coupler: 1.5 inch male.

A11.4.8. Receipt KAM-LOK Coupler: 1 æ inch female and 2 inch female.

A11.4.9. Airlift Data: (without support kit) UTC: JFDEK(1) or JFDET(2). Shipping Weight: 1180 lbs. Cubic Feet: 94. Overall Dimensions: 100L x 45W x 35H.

A11.4.10. Operation and Installation: Past experience has shown that PMU-27 units may not generate sufficient suction to lift fuel from underground tanks. R-22 pumps or even a C-300 refueling unit may perform this function better. The PMU-27/M is converted to a service station, for vehicles and equipment when an accessory Mobility Readiness Spares Package (MRSP) kit is added.

A11.4.11. Accessory Support MRSP Kit: 6 each, 500 gallon seal drums, 2 each, æ inch service station nozzles, 24 feet, æ inch discharge hose, 100 feet, 2 inch suction hose, 1 each, 10 GPM hand pump with stand, and 2 tow yokes for filled 500 gallon seal drums.

A11.5. 4T-4A Additive Injector:

A11.5.1. Primary Function: Injection of fuel additives into bulk fuel storage.

A11.5.2. Alternate Function: None

A11.5.3. Description: The additive injector is a skid-mounted module capable of injecting three (3) separate additives simultaneously using three separate injector pumps driven by a common turbine. The additive injection rates are proportional to the fuel flow rates. Manufacturer: Hammond Technical Services. NSN: 4930-01-418-2694 (replacing the 3” version NSN 4930-01-213-3014). T.O. 37A9-3-15-1.

A11.5.4. Inlet KAM-LOK Coupler: One 4 inch female.

A11.5.5. Outlet KAM-LOK Coupler: One 4 inch male.

A11.5.6. Airlift Data: (Crated) UTC: JFDGE. Shipping Weight: 296 lbs. Cubic Feet: 22. Overall Dimensions: 45L x 31W x 26H.

A11.5.7. Operation and Installation: Unit can be installed in-line to a fixed bulk petroleum system or used in conjunction with truck fillstands, an R-14, or R-22 system. Fuel System Icing Inhibitor is drawn from 55 gallon drums and injected in the jet fuel stream along with corrosion inhibitor and static dissipater additive which are simultaneously drawn from the two blend tanks, usually 55 gallon drums.

A11.5.8. Interoperability: The additive pump can be used by all services, for injection of additives provided their equipment and systems can adapt to the pump’s couplers.

A11.6. FFU-15E Skid Mounted Filter Separator:

A11.6.1. Primary Function: Remove particles and free water from hydrocarbon fuels.

A11.6.2. Alternate Function: None

A11.6.3. Description: The FFU-15E is a skid-mounted, 600 GPM filter separator, designed to filter and separate particulate and water from fuel. It is capable of handling diesel fuel at a rate of 450

GPM, jet fuels at 600 GPM, and gasoline at a rate of 750 GPM. Manufacturer: Multiple contractors. NSN: 4930-00-936-7328. T.O. 37A8-2-5-1.

A11.6.4. Tank Capacity: N/A

A11.6.5. Pump Capacity: 600 GPM.

A11.6.6. Outlet KAM-LOK Coupler: 4 inch male.

A11.6.7. Inlet KAM-LOK Coupler: 4 inch female.

A11.6.8. Airlift Data: UTC: JFDEP. Shipping Weight: 785 lbs. Cubic Feet: 97. Overall Dimensions: 66L x 42W x 60H.

A11.6.9. Operation and Installation: Uses multiple configurations where additional filtration is required. Normally, used in conjunction with the R-22 Trailer Mounted Pump.

A11.6.10. Interoperability: Can be used with other services' equipment and systems which can adapt to the FFU-15E inlet/outlet couplers.

A11.7. C-300 Ground Products Refueler:

A11.7.1. Primary Function: Ground product refueling.

A11.7.2. Alternate Function: Ground product defueling and bulk fuel hauling.

A11.7.3. Description: Manufacturer: Multiple Contractors. NSN: 2320-01-314-2912. T.O. 36A12-13-35-1.

A11.7.4. Tank Capacity: 1200 gallons.

A11.7.5. Pump Capacity: 100 GPM.

A11.7.6. Issue Coupler: 2 ¾ inch faucet/over wing type nozzle.

A11.7.7. Receipt Coupler: 3 inch dry break coupler

A11.7.8. Airlift Data: UTC: JFDEF. Shipping Weight: 13,840. Cubic Feet: 1405. Overall Dimensions: 272L x 96W x 93H.

A11.7.9. Operation and Installation: The C-300 is designed for operation on hard or improved surfaces at low to moderate speeds. A 4WD C-301 version of the same vehicle is also available for use in more austere conditions.

A11.7.10. Interoperability: Can refuel any service vehicle/bulk tank with ground fuel using the over wing nozzle or an optional service station nozzle that can be easily installed in place of the O/W nozzle. The C-300 can also defuel bulk tanks with the proper hose configuration.

A11.8. R-9 Tank Truck Aircraft Refueler:

A11.8.1. Primary Function: Aircraft Refueling.

A11.8.2. Alternate Function: Aircraft defueling and bulk fuel hauling.

A11.8.3. Description: Manufacturer: Kovatch. NSN: 2320-00-433-5695. T.O. 36A12-13-17-31.

A11.8.4. Tank Capacity: 5,000 gallons.

A11.8.5. Pump Capacity: 600 GPM.

A11.8.6. Issue KAM-LOK Coupler: SPR 2.5 inch, open port.

A11.8.7. Receipt KAM-LOK Couplers: Refilled via 2.5 inch SPR bottom loading adapter.

A11.8.8. Airlift Data: UTC: JFDEB(1) or JFDEC(3). Shipping Weight: 21,340. Cubic Feet: 2465.2. Overall Dimensions: 406L x 102W x 114H.

A11.8.9. Operation and Installation: The R-9 is designed for operation on hard surfaces at low speeds under 25 MPH within the air base area. Maintenance problems should be anticipated if converted to over-the-road haul at speeds up to 55 MPH.

A11.8.10. Interoperability: Can refuel other Services' aircraft which use the SPR nozzle or open port nozzle. Advance notice is required for the US Air Force to obtain a KAM-LOK adapter in the event the R-9 tanker is to receive fuel from other Services' ground fuel systems not equipped with the SPR discharge nozzle.

A11.9. R-11 Tank Truck Aircraft Refueler:

A11.9.1. Primary Function: Aircraft Refueling.

A11.9.2. Alternate Function: Aircraft defueling and bulk fuel hauling.

A11.9.3. Description: Manufacturers: Oshkosh/Kovatch. NSN: 2320-01-239-5371. T.O. 36A12-13-17-81.

A11.9.4. Tank Capacity: 6,000 gallons.

A11.9.5. Pump Capacity: 600 GPM.

A11.9.6. Issue KAM-LOK Coupler: SPR 2.5 inch, open port.

A11.9.7. Receipt KAM-LOK Coupler: Refilled via 2.5 inch SPR bottom loading adapter.

A11.9.8. Airlift Data: UTC: JFAXP(1). Shipping Weight: Oshkosh 26,400 lbs., Kovatch 24,000 lbs. Cubic Feet: Oshkosh 2853.2. Kovatch 2807.4., Overall Dimensions: Oshkosh 456L x 106 w x 102H. Kovatch 447L x 106.4W x 102H.

A11.9.9. Operation and Installation: The R-11 is designed to be driven on improved roads and on a limited basis on unimproved roads. Refueler road speed, fully loaded, is 60 MPH, depending on road and weather conditions.

A11.9.10. Interoperability: Can refuel other Services' aircraft using the SPR or open port nozzle. The types of fuel servicing include high-flow refueling, low-flow refueling, and defueling.

A11.10. NRU-5E Air Transportable Liquid Nitrogen (LN2) Skid Mounted Tank:

A11.10.1. Primary Function: Aerial and surface transport of LN2 from military and commercial production plants to operational areas for support of aircraft strut and tire servicing requirements.

A11.10.2. Alternate Function: Bulk storage of LN2.

A11.10.3. Description: Manufacturer: Multiple Contractors. NSN: 3555-01-080-4187. T.O. 37C2-8-10-3.

A11.10.4. Tank Capacity: 400 gallons.

A11.10.5. Issue Coupling: One inch left-handed thread coupling, C8991171.

A11.10.6. Receipt Coupling: One inch left-handed thread coupling, CC8991171.

A11.10.7. Airlift Data: UTC: JFDER. Shipping Weight: 1,500 lbs. Cubic Feet: 158. Overall Dimensions: 84L x 54W x 60H.

A11.10.8. Interoperability: Provided with industry standard 1 inch couplings common to all US commercial and DOD activities.

A11.10.9. Accessories: Supplied with a vent kit to connect tanks to the transport aircraft overboard vent ports.

A11.11. TMU-24E Air Transportable Liquid Oxygen (LOX) Skid Mounted Tank:

A11.11.1. Primary Function: Aerial and surface transport of LOX from military and commercial production plants to operational areas for support of aviator breathing and medical oxygen requirements.

A11.11.2. Alternate Function: Bulk storage of LOX.

A11.11.3. Description: Manufacturer: Multiple Contractors. NSN: 3655-00-995-8575. T.O. 37C2-8-10-3.

A11.11.4. Tank Capacity: 400 gallons.

A11.11.5. Issue Coupling: One inch right hand thread coupling, C8991173.

A11.11.6. Receipt Coupling: One inch right hand thread coupling, C8991173.

A11.11.7. Airlift Data: UTC: JFDEQ. Shipping Weight: 1,500 lbs. Cubic Feet: 158. Overall Dimensions: 84L x 54W x 60H.

A11.11.8. Interoperability: Provided with industry standard 1 inch couplings common to all US commercial and DOD activities.

A11.11.9. Accessories: Supplied with a vent kit to connect tanks to the transport aircraft overboard vent ports.

A11.12. Bulk Fuel Storage System, 200,000 Gallons:

A11.12.1. Primary Function: Provide a jet fuel bulk storage system at bare base areas to refuel/offload aircraft refuelers.

A11.12.2. Alternate Function: May be used for storage of other fuel grades.

A11.12.3. Description: Manufacturer: Multiple Contractors. NSN: 4930-01-135-5210. T.O. Multiple.

A11.12.4. Tank Capacity: 200,000 gallons (4each, 50K bladders)

A11.12.5. Pump Capacity: 600/900 GPM.

A11.12.6. Issue KAM-LOK Coupler: 4 inch male.

A11.12.7. Receipt KAM-LOK Coupler: 4 inch female.

A11.12.8. Airlift Data: UTC: JFAXC. Shipping Weight: 14,800 lbs. Cubic Feet: 3,320. Square Feet: 115. Width: 42in. Height: 60in.

A11.12.9. Operation and Installation: The 200K bulk storage system (UTC: JFAXC) is assembled by use of one R-22, 600 GPM pump (UTC: JFDEJ); one FFU-15E 600 GPM filter separator (UTC: JFDEP); four 50,000 gallon standard DOD fuel bladders (UTC: JFDEM); a 35 PSI hose end pressure regulator; SPR nozzle, hose sections, and valves to permit off load or issue of fuel.

A11.12.10. Interoperability: This system can offload any Services' tank truck equipped with a 4 inch male KAM-LOK discharge coupling, and can fill any Service tank trucks equipped with a SPR bottom load adapter or a 4-to-3 inch female KAM-LOK reducer coupling. Size adjustments to the KAM-LOK coupling can be made using the appropriate reducers or adapters.

A11.13. Collapsible Coated Fabric Tanks:

A11.13.1. Description: Collapsible fuel tanks normally are provided in either 10,000 or 50,000 gallon capacity. Tanks are constructed of a single ply, nylon fabric material with reinforced corners. The interior of the tank is coated with polyester, while the exterior is of nylon, or equivalent fabric, impregnated with urethane or nitrile. The weight of a 50,000 gallon tank is approximately 1,400 pounds, while the 10,000 gallon tank weighs approximately 200 pounds. Dimensions of an empty 50K bladder are 24 feet by 65 feet. Dimensions of an empty 10K bladder may be 12 feet by 42 feet, or 22 feet by 22 feet. Fabric tanks are tested from -40 degrees Fahrenheit to 160 degrees Fahrenheit to prove reliability in any climate. Tanks can be manifolded together and are repairable in the field.

A11.13.2. Considerations: If plans are to use bladders, a suitable site must be selected. Overall area should be approximately 100 feet wide by 160 feet long for an R-14 system, be free of rocks and obstructions, and provide adequate drainage. Dike should be placed as close to the aircraft apron as practically possible. The ground should be as level as possible with maximum slope of three degrees to prevent the tank from creeping or crawling. Avoid low areas to prevent accumulation of trapped vapors. Careful attention should be given to receiving capabilities, such as rail cars, taxiways, and roads. If the site is dependent on aerial bulk fuel delivery system for resupply, the tank area must be placed 100 feet from a parking apron. Do not place the site uphill or upstream from other installations because of possible contamination or fires due to bladder rupture. Where possible, a dike or berm should be constructed with a capacity of at least 1¾ times the capacity of the tanks within. Collapsible tanks have also been approved for storage of special fuels (JP-7 and JPTS) with precautions outlined in this pamphlet.

A11.13.3. Airlift Data:

(1) Designation:	10K Bladder	50K Bladder
(2) Shipping wt:	225 lbs.	1,500 lbs.
(3) Cubic feet:	60	126
(4) NSN:	5430-00-349-9156	5430-00-090-3517
(5) Length (in):	104 (Rolled)	136 (Rolled)
(6) Width (in):	31 (Rolled)	40 (Rolled)
(7) Height (in):	32 (Rolled)	40 (Rolled)
(8) Manufacturer:	Uniroyal	Uniroyal, Goodyear, etc.
(9) T.O.:	37A12-15-1	37A12-8-11

(10) UTC:	JFDEL	JFDEM

A11.14. Seal Drums:

A11.14.1. Description: Seal Drums are collapsible rubber, nonvented containers for transporting and storing fuel. Drums are available in 55 or 500 gallon capacities. Drums are constructed of 4 ply tire cord and are equipped with swivel plates and anchor shackles at both ends which allow tiedown aboard aircraft, and ground towing (rolling) using a special lifting and towing yoke. Internal tanks are equipped with fuel/defuel valves and are complete with external fuel servicing adapters.

A11.14.2. Considerations: Drums are filled and emptied through an elbow coupler valve, check valve adapter in the front closure plate and SPR for filling. Field repair kits are available. Because drums are non-vented, they must be kept shaded to prevent fuel expansion and drum rupture. Below 20 degrees Fahrenheit the drum becomes brittle.

A11.14.3. Airlift Data:

(1) Designation:	500 Gal. Seal Drum	55 Gal. Seal Drum
(2) Shipping Weight:	305 lbs.	27 lbs.
(3) Cubic Feet:	93 (full)	6.3 (full)
(4) NSN:	8110-00-065-2321	8110-00-8B-5909
(5) Length (in):	72-89	37-38
(6) Width (in):	36-48	24-33
(7) Height (in):	9-48	6-24
(8) Manufacturer:	US Rubber	US Rubber
(9) Tech. Order:	37A-1-111	37A-1-111
(10) UTC:	JFZ99	JFZ99

A11.15. Hose Carts:

A11.15.1. Description: MH-2 series hose carts are trailer mounted units designed for transfer of fuel between fixed hydrant system outlets and single-point refueling receptacles of aircraft. Carts are equipped with a filter separator, meter, flow control valve and inlet/outlet hoses. Carts do not have pumping capability. Carts can also be used to provide filter/meter capability for filling refueling units from hydrant systems, for bare-base refueling using bladder storage, and R-22 pumping systems; and as a substitute for the FFU-15 filter separator. The UTC for hose carts is JFDE1.

A11.15.2. Considerations: While all hose carts use standardized single-point refueling nozzles, the hydrant quick-coupler valve (moose head) that connects onto the installed hydrant outlet on the aircraft parking differs, dependent on the type of hydrant outlet connector in use at an airfield. This is an obvious concern when intending to use Air Force supplied hose carts on a host airfield. Use of a hose cart in conjunction with a R-22 pumping system requires removal of the hydrant quick-coupler valve and replacement with a 4 inch KAM-LOK coupler.

A11.15.3. Airlift Data:

(1) Designation:	MH-2B	MC-2C
(2) Shipping Weight:	1,700 lbs.	1,760 lbs.
(3) Cubic Feet:	377	448
(4) NSN:	4930-00-070-1077	4930-01-089-4581
(5) Length (in):	119	138
(6) Width (in):	68	70
(7) Height (in):	80.5	80
(8) Pump Capacity:	600 GPM (2 pumps)	
(9) Manufacturer:	Garsite	Beta
(10) T.O.:	37A2-2-4-41	37A2-2-2-4-71

Section A11B—US Army Refueling Equipment and Systems

A11.16. Forward Area Refueling Equipment (FARE) System:

A11.16.1. Primary Function: Refuel helicopters in forward areas.

A11.16.2. Alternate Functions: Refuel ground vehicles; fill fuel cans and drums.

A11.16.3. Tank Capacity: No fuel storage is organic to the FARE. Generally, 500 gallon collapsible drums are used as a source of supply; however, the FARE has adapters for sourcing from collapsible tanks (2-4 inch KAM-LOK) or tank vehicles (2-3 inch KAM-LOK).

A11.16.4. Pump Rate: 100 GPM.

A11.16.5. Issue Nozzles: CCR nozzles with open port nozzle adapter.

A11.16.6. Issue Couplers: N/A.

A11.16.7. .Receipt Couplers: 2, 3, and 4 inch KAM-LOK.

A11.16.8. Airlift Data: 820 lbs. (storage tanks not included).

A11.16.9. NSN: 4930-00-133-3041.

A11.16.10. UTC: N/A.

A11.16.11. Operation and Installation: The FARE system consists of a 100 GPM pump assembly (with gasoline engine), a 100 GPM filter separator, 50 feet of 2 inch suction hose, 200 feet of 2 inch discharge hose, 2 closed circuit refueling nozzles (with open port adapters), and various fittings.

A11.16.12. Interoperability: The FARE can use USMC or USAF collapsible tanks as a source of fuel and can also source fuel from USMC tank trucks. However, to source fuel from a USAF tank truck, advance coordination is required with the USAF to ensure a SPR nozzle with KAM-LOK coupling is available. The FARE can be used to refuel other Services' aircraft which will accept CCR or open port nozzles. When used as a refueling point for ground vehicles, the FARE can refuel any Services' ground equipment.

A11.17. Fuel System Supply Point (FSSP):

A11.17.1. Primary Function: Tactical receipt, storage, and issue point for bulk fuel.

A11.17.2. Alternate Functions: Rapid refueling system for rotary wing aircraft (requires the addition of CCR nozzles with open port adapters).

A11.17.3. Tank Capacity: No fuel storage is organic to the FSSP. Generally, six 10,000 gallon collapsible tanks are used as storage; however, additional or larger collapsible tanks could be used provided additional hoses, fittings, and valves were made available.

A11.17.4. Pump Rate: 350 GPM.

A11.17.5. Issue Nozzles: 1 inch open port nozzles.

A11.17.6. Issue Couplers: 1, 1.5, 2, 3, and 4 inch KAM-LOK.

A11.17.7. Receipt Couplers: 3 or 4 inch KAM-LOK, 6 inch grooved couplings.

A11.17.8. Airlift Data: 9,500 lbs., 400 cubic feet (storage tanks not included).

A11.17.9. NSN: 4930-00-142-5313.

A11.17.10. UTC: N/A.

A11.17.11. Operation and Installation: The FSSP normally consists of two 350 GPM pumping assemblies, two filter separators, approximately 1,200 feet of discharge hose, and 1,200 feet of suction hose. It is normally configured to provide six tank truck bottom loading points, two 500 gallon collapsible drum filling points, and six points for refueling ground vehicles/filling cans and drums. The FSSP can receive fuel from tank trucks, rail tank cars, pipelines, hose lines, and aircraft. It can also be divided in half to handle two different types of fuel at two different locations.

A11.17.12. Interoperability: The FSSP can receive and issue fuel to and from USMC tank trucks or hose lines. The FSSP can also receive and issue fuel to and from the USAF ABFDS but cannot receive fuel from USAF aircraft via wet wing defueling without an SPR nozzle with KAM-LOK couplings. The same nozzle would be required to transfer fuel between the FSSP and USAF tank trucks. The FSSP can refuel any Services' ground equipment.

A11.18. Tactical Petroleum Terminal:

A11.18.1. Primary Function: Receive, store, and issue bulk petroleum fuels.

A11.18.2. Alternate Functions: Refuel ground vehicles; fill fuel cans and drums.

A11.18.3. Tank Capacity: Eighteen Bulk Fuel Tank Assemblies (BFTA) with a capacity of 5,000 barrels each and ten 50,000 gallon collapsible tanks.

A11.18.4. Pump Rate: 300 and 600 GPM.

A11.18.5. Issue Nozzle: 1 inch open port nozzle.

A11.18.6. Issue Couplers: 1, 1.5, 2, 3, 4, and 6 inch KAM-LOK and a 6 inch grooved coupling.

A11.18.7. Receipt Couplings: 6 inch grooved coupling and KAM-LOK couplings.

A11.18.8. Airlift Data: N/A.

A11.18.9. NSN: Not Assigned.

A11.18.10. UTC: N/A.

A11.18.11. Operation and Installation: The tactical petroleum terminal (TPT) is a fuel storage and handling system which serves as a base, intermediate, or head terminal in an undeveloped theater and may be used in the developed theater to supplement existing facilities that are inadequate or damaged. The TPT can store up to 30,000 barrels of fuel in each of its three fuel units. Each fuel unit is normally dedicated to mogas, diesel fuel, and jet fuel. Fuel can be received from a pipeline or from tank vehicles. The TPT can dispense fuel directly to user vehicles or to bulk fuel transport vehicles. It can also return fuel to the pipeline for distribution downstream. The system can receive fuel at rates up to 800 GPM. The major components which make up the TPT include: Eighteen BFTA's with a capacity of 5,000 barrels each; ten 50,000 gallon collapsible tanks; a 350 GPM pump; six 350 GPM filter separators; fifteen 600 GPM hose line pumps (6 inch); nineteen fire suppression systems; 42,000 feet of hose; a beach interface unit; and associated valves and manifolds.

A11.18.12. Interoperability: The TPT (as a terminal) would normally receive fuel from the Navy's Offshore Petroleum Distribution System (6 inch flexible steel pipe). The TPT can also receive and issue fuel to and from USMC tank trucks and hose lines, and the ABFDS, but cannot receive fuel from USAF aircraft via wet wing defueling without a SPR nozzle with KAM-LOK couplings. The same nozzle would be required to transfer fuel between the TPT and USAF tank trucks. The TPT can refuel any Services' ground equipment.

A11.19. Tank and Pump Unit:

A11.19.1. Primary Function: Refuel ground equipment.

A11.19.2. Alternate Functions: Fill and empty five gallon cans, 55 gallon drums, and 500 gallon collapsible drums; refuel aircraft.

A11.19.3. Tank Capacity: 1200 gallons (two 600 gallon tanks).

A11.19.4. Pump Rate: 50 GPM.

A11.19.5. Issue Nozzles: Two 1.5 inch open port nozzles.

A11.19.6. Issue Couplers: 1.5 inch KAM-LOK.

A11.19.7. Receipt Couplers: 2 inch KAM-LOK.

A11.19.8. Airlift Data: 1376.5 lbs/217.5 cubic feet.

A11.19.9. NSN: 4930-01-130-7281.

A11.19.10. UTC: N/A

A11.19.11. Operation and Installation: The tank and pump unit is designed to be transported on the 5 ton, 6 by 6, cargo truck. The unit consists of two 600 gallon aluminum tanks with inside baffles, a 50 GPM pump (gasoline and electric models), a 50 GPM filter separator, two hose reels (each with a 40 foot length of 1.5 inch noncollapsible discharge hose) and two open port or pistol grip nozzles.

A11.19.12. Interoperability: In an interoperability role, the tank and pump unit can receive and issue bulk fuel to and from other Services' fuel systems that can connect with the 2 inch KAM-LOK coupling on the tank and pump unit. The unit can issue bulk fuel to other Services' ground equipment and to aircraft which can accept an open port nozzle.

A11.20. M49A2C Tank Truck:

A11.20.1. Primary Function: Refuel aircraft and ground vehicles.

A11.20.2. Alternate Functions: N/A

A11.20.3. Tank Capacity: 1200 gallons.

A11.20.4. Pump Rate: 80 GPM.

A11.20.5. Issue Nozzles: Open port nozzles available.

A11.20.6. Issue Couplers: 1.5 inch KAM-LOK.

A11.20.7. Receipt Couplers: 1.5 inch KAM-LOK.

A11.20.8. Airlift Data: 14,740 lbs/1411.28 cubic feet.

A11.20.9. NSN: 2320-00-077-1631.

A11.20.10. UTC: N/A

A11.20.11. Operation and Installation: The M49A2C tank truck is used for refueling ground vehicles and aircraft. A rotary, positive-displacement pump, located in the rear equipment compartment, pumps fuel from the tank truck. The pump is rated at 80 GPM at 700 RPM. The speed of the pump is governed by a speed control linkage assembly. There is also an upright filter separator in the rear equipment compartment. A 35 foot length of ¾ inch reinforced hose with a standard 1¾ inch nozzle is mounted on the left side of the tank body. The M49A2C tank truck can carry bulk petroleum both on and off the road. However, it can carry only 600 gallons when it travels off the road because the forward tank must be left empty. The truck can also be used to fill 500 gallon collapsible drums and 55 gallon drums.

A11.20.12. Interoperability: The tank truck can receive and issue bulk fuel from and to other Services' fuel systems that can connect with the 1.5 inch KAM-LOK coupling on the tank truck. The tank truck can issue bulk fuel to other Services' ground equipment and to aircraft which can accept an open port nozzle.

A11.21. M978 Heavy Expanded Mobility Tactical Truck (HEMTT):

A11.21.1. Primary Function: Refuel ground equipment.

A11.21.2. Alternate Functions: Refuel aircraft.

A11.21.3. Tank Capacity: 2,500 gallons.

A11.21.4. Pump Rate: 300 GPM.

A11.21.5. Issue Nozzles: Open port nozzles (can use CCR and SPR nozzles when provided).

A11.21.6. Issue Couplers: 1.5, 3, and 4 inch KAM-LOK.

A11.21.7. Receipt Couplers: 3 inch KAM-LOK.

A11.21.8. Airlift Data: 36,989 lbs/2,264.4 cubic feet.

A11.21.9. NSN: 2320-01-100-7672.

A11.21.10. UTC: N/A

A11.21.11. Operation and Installation: The M978 tank truck is a 10 ton, 8 by 8, on the road, all weather and terrain vehicle. The tank is a stainless steel, single compartment shell with one man hole

cover. A cabinet at the rear of the vehicle houses the vehicle's fuel delivery manifold system, hose reels, ground cables, deadman shutoff, and filter separator. A 300 GPM centrifugal pump is driven by a power takeoff from the vehicle's engine. The vehicle also has an alternate fuel delivery pump. This 25 GPM pump is powered by 24 volts DC from the vehicle electric system. There is a sampling probe on the discharge side of the filter separator for use with the Aqua-Glo water test kit. The tank truck has two hose reels. Each hose reel has 50 feet of 1¾ inch dispensing hose. The hose ends have male KAM-LOK couplings, fittings and bonding connections. Each hose reel has a fuel servicing nozzle. The HEMTT also has a 15 foot section of 3 inch hose.

A11.21.12. Interoperability: The HMETT can receive bulk fuel from other Services' fuel systems that can connect with the 3 inch KAM-LOK coupling. The HEMTT can issue bulk fuel to other Services' ground equipment and to aircraft which can accept an open port nozzle.

A11.22. M131A5C Tank Semitrailer:

A11.22.1. Primary Function: Bulk fuel delivery.

A11.22.2. Alternate Functions: Refuel ground equipment and aircraft.

A11.22.3. Tank Capacity: 5,000 gallons (two 2,500 gallon compartments).

A11.22.4. Pump Rate: 225 GPM.

A11.22.5. Issue Nozzles: 1.5 and 2.5 inch open port nozzles.

A11.22.6. Issue Couplers: 3 inch KAM-LOK.

A11.22.7. Receipt Couplers: 3 inch KAM-LOK.

A11.22.8. Airlift Data: 13,850 lbs/2,232 cubic feet.

A11.22.9. NSN: 2330-00-226-6080.

A11.22.10. UTC: N/A

A11.22.11. Operation and Installation: The M131A5C is the most commonly used fuel servicing tank semitrailer in the Army today. The auxiliary engine and pump assembly has a 2 cylinder, 4 cycle, air cooled gasoline engine, a self-priming centrifugal pump, and a 24 volt battery. A filter separator is also located on the curbside.

A11.23. M967 Tank Semitrailer:

A11.23.1. Primary Function: Line haul, bulk delivery of fuel.

A11.23.2. Alternate Function: N/A

A11.23.3. Tank Capacity: 5,000 Gallons.

A11.23.4. Pump Rate: 600 GPM.

A11.23.5. Issue Nozzles: N/A

A11.23.6. Issue Couplers: 4 inch KAM-LOK.

A11.23.7. Receipt Couplers: 4 inch KAM-LOK.

A11.23.8. Airlift Data: 13,000 lbs./2,128 cubic feet.

A11.23.9. NSN: 2330-01-050-5632.

A11.23.10. UTC: N/A

A11.23.11. Operation and Installation: The M967 is designed for general highway and limited cross-country use. It does not have the fuel servicing capability (no filter separator) of the M969 or the M970. The four-cylinder, four-cycle auxiliary engine and pumping system can deliver bulk fuel at a rate of up to 600 GPM and self-loading (using it's internal pumps) at a rate up to 300 GPM.

A11.23.12. Interoperability: The M967 can receive and issue bulk fuel from and to other Services' fuel systems that can connect with the 4 inch KAM-LOK coupling.

A11.24. M969 Tank Semitrailer:

A11.24.1. Primary Function: Bulk fuel delivery.

A11.24.2. Alternate Function: Refuel aircraft and ground equipment.

A11.24.3. Tank Capacity: 5,000 gallons.

A11.24.4. Pump Rate: 600 GPM.

A11.24.5. Issue Nozzles: Open port nozzles available.

A11.24.6. Issue Couplers: 4 inch KAM-LOK.

A11.24.7. Receipt Couplers: 4 inch KAM-LOK.

A11.24.8. Airlift Data: 15,000 lbs./2,218 cubic feet.

A11.24.9. NSN: 2330-01-050-5634.

A11.24.10. UTC: N/A

A11.24.11. Operation and Installation: The M969 semitrailer has the same bulk delivery and self-load capabilities as the M967. The tank body and the auxiliary engine and pump assembly are identical to those of the M967. The M969, however, has the equipment needed for ground equipment refueling and limited aircraft refueling. The M969 has three dispensing hose assemblies. Three 14 foot sections of 4 inch suction hose are stored in troughs on the vehicle. This assembly has a bulk delivery rate of up to 600 GPM and a self load rate of 300 GPM. The other two hose assemblies are located in the hose reel compartment. Each of these 100 GPM assemblies has a dispensing nozzle. The M969 may be used for open port refueling of aircraft.

A11.24.12. Interoperability: The M969 can receive and issue bulk fuel from and to other Services' fuel systems that can connect with the 4 inch KAM-LOK coupling. The M969 can issue bulk fuel to other Services' ground equipment and to aircraft which can accept an open port nozzle.

A11.25. M970 Tank Semitrailer:

A11.25.1. Primary Function: Refuel aircraft.

A11.25.2. Alternate Functions: Refuel ground equipment and line haul bulk fuel.

A11.25.3. Tank Capacity: 5,000 gallons.

A11.25.4. Pump Rate: 300 GPM.

A11.25.5. Issue Nozzles: 2.5 SPR, CCR, and open port nozzles.

A11.25.6. Issue Couplers: 4 inch KAM-LOK.

A11.25.7. Receipt Couplers: 2.5 inch SPR, 1.5, 2, and 4 inch KAM-LOK.

A11.25.8. Airlift Data: 15,200 lbs./2,218 cubic feet.

A11.25.9. NSN: 2330-01-050-5635.

A11.25.10. UTC: N/A

A11.25.11. Operation and Installation: The M970 is specifically designed for underwing and overwing refueling of Army aircraft. It has a 300 GPM bulk delivery capability and a self load capability. The M970 has the same 5,000 gallon tank and same auxiliary engine as the M967 and M969; however, the M970 has a 3 inch, high pressure centrifugal pump and recirculation system. The M970 also has special purpose equipment required for overwing and overwing aircraft refueling. It has the same filter separator as the M969 and a 300 GPM meter located in the hose reel cabinet. The meter serves all three dispensing assemblies. There are three dispensing assemblies on the M970 tank semitrailer. One is made up of three 14 foot sections of 4 inch suction hose stored in hose troughs on the vehicle. One system is for underwing refueling. It includes 50 feet of 2¾ inch hose with an electric rewind reel, deadman control, and a D-1 nozzle. The overwing refueling system has 50 feet of 1¾ inch hose and overwing dispensing nozzle and a hose reel with electric rewind.

A11.25.12. Interoperability: The M970 can receive and issue fuel from and to other Services' fuel systems that can connect with the M970's receipt couplers. The M970 can be used to refuel other Services' aircraft and is the only Army tank truck which has an organic D-1 (SPR) nozzle. The M970 can refuel any Services' ground equipment.

A11.26. Hoseline Outfit (Assault/Invasion Hoseline):

A11.26.1. Primary Function: Transport bulk fuel.

A11.26.2. Alternate Functions: N/A

A11.26.3. Tank Capacity: N/A

A11.26.4. Pump Rate: 350 GPM.

A11.26.5. Issue Nozzles: N/A

A11.26.6. Issue Couplers: 4 inch grooved.

A11.26.7. Receipt Couplers: 4 inch grooved.

A11.26.8. Airlift Data: 5,000 lbs/80 cubic feet.

A11.26.9. NSN: 3835-00-892-5157.

A11.26.10. UTC: N/A

A11.26.11. Operation and Installation: The hoseline outfit, also called the assault/invasion hoseline, is a temporary system used to transport bulk petroleum. The hoseline outfit consists of 13,000 feet (approximately 2.5 miles) of 4 inch collapsible hose, a 350 GPM pumping assembly, a flow control kit, a roadway crossing guard, a hoseline suspension kit, a hoseline displacement and evacuation kit, a sling assembly, a hoseline packing kit, and a repair kit. The 4 inch, lightweight, collapsible rubber

hose has a rated safe working pressure of 150 PSI and is packed in 13 flaking boxes with 1,000 feet to a box. Each 1,000 foot section consists of two 500 foot lengths joined together with an aluminum grooved coupling. A swivel joint with grooved ends is attached to one end of the assembly. This joint lets the hose assembly rotate continuously at the swivel connection. The hose is black with a yellow lay-line. The outfit can also be used at an airfield complex where bulk supplies are delivered by aircraft equipped with the ABFDS.

A11.26.12. Interoperability: The assault hoseline can connect to other Services' bulk fuel storage systems and to USMC hoselines.

Section A11C—USMC Refueling Equipment and Systems

A11.27. Amphibious Assault Fuel System (AAFS):

A11.27.1. Primary Function: Provide fuel storage and distribution ashore.

A11.27.2. Alternate Function: N/A

A11.27.3. Tank Capacity: 600,000 gallons multi-fuel (5 tank farms of 120,000 gallons capacity each).

A11.27.4. Pump Rate: 350 GPM/600 GPM.

A11.27.5. Issue Nozzles: Single point refueling nozzle (D-1); open port nozzle.

A11.27.6. Issue Couplers: 2, 4, and 6 inch KAM-LOK (male).

A11.27.7. Receipt Couplers: 2, 4, and 6 inch KAM-LOK (female).

A11.27.8. Airlift Data: 140,164 lbs; 11,350 cubic feet; 2,837.5 square feet.

A11.27.9. NSN: 4910-01-113-9173.

A11.27.10. UTC: N/A

A11.27.11. Operation and Installation: AAFS is the USMC primary fuel system for receipt, storage, and issue of bulk fuel in support of amphibious operations. It is the aggregate of a number of self contained unit components capable of receiving and storing gasoline, diesel, or jet fuel. Each AAFS consists of a beach unloading station, two drum unloading units, two booster stations, two dispensing stations of six outlets each, and five farms of 120,000 gallons capacity each. The AAFS includes sufficient hoseline to accommodate a ship distribution distance of 3 miles. It can dispense fuel at a rate up to 350 GPM.

A11.27.12. Interoperability: Compatible with all Service aircraft and systems equipped with single point refueling receptacle and KAM-LOK couplings. The system will receive and transfer from ships, drums, assault amphibious vehicles (AAVS), tank trucks, bulk tanks, and railhead tank cars. It will dispense fuel to the same systems; however, it is used with the TAFDS to dispense fuel to aircraft.

A11.28. Tactical Airfield Fuel Dispensing System (TAFDS):

A11.28.1. Primary Function: Aircraft refueling.

A11.28.2. Alternate Functions: Aircraft defueling, truck filling.

A11.28.3. Tank Capacity: 120,000 gallons (6 each 20,000 gallon bladders).

A11.28.4. Pump Rate: 350 GPM.

A11.28.5. Issue Nozzles: Single point refueling nozzle (D-1); open port nozzle.

A11.28.6. Issue Couplers: 2, 4, and 6 inch KAM-LOK (male).

A11.28.7. Receipt Couplers: 2, 4, and 6 inch KAM-LOK (female).

A11.28.8. Airlift Data: 36,327 lbs; 250 cubic feet; 593 square feet.

A11.28.9. NSN: 4930-01-094-0026.

A11.28.10. UTC: N/A

A11.28.11. Operation and Installation: TAFDS is compromised of self contained components that can be assembled to meet numerous operational requirements in an expeditionary airfield environment. The system can receive aviation fuel from the AAFS, aircraft, tank trucks, or drums; and is capable of storing up to 120,000 gallons in collapsible 20,000 gallon tanks, and dispense aviation fuel directly into aircraft or aircraft refuelers. TAFDS is capable of refueling up to six aircraft simultaneously, at a combined flow rate of 675 GPM when the pumps are in a parallel configuration. The system can accommodate additional aircraft with equipment augmentation. The system can be packaged for transportation aboard amphibious/commercial shipping, highway, rail or air.

A11.28.12. Interoperability: Compatible with all Service equipment and systems equipped with single point refueling receptacle or KAM-LOK couplings. Can refuel OH-58 and UH-1 with open port nozzle.

A11.29. Helicopter Expedient Refueling System (HERS):

A11.29.1. Primary Function: Helicopter refueling at forward locations.

A11.29.2. Alternate Functions: Ground equipment refueling.

A11.29.3. Tank Capacity: 9,000 gallons (18 each 500 gallon collapsible fuel drums).

A11.29.4. Pump Rate: 100 GPM.

A11.29.5. Issue Nozzles: Single point refueling (D-1); open port nozzle.

A11.29.6. Issue Couplers: 2 inch KAM-LOK.

A11.29.7. Receipt Couplers: 2 inch KAM-LOK.

A11.29.8. Airlift Data: 6,134 lbs; 505 cubic feet; 120 square feet.

A11.29.9. NSN: 4930-01-114-9930.

A11.29.10. UTC: N/A

A11.29.11. Operation and Installation: HERS is a modular, compact system designed for refueling helicopters at forward bases. The system is completely air transportable, and designed to permit handling by personnel with a minimum of specialized equipment. HERS contains all the equipment, including pump, hoses, filter separator, nozzles, meters, and storage drums required to operate two pumping stations, each of which can refuel a helicopter at the rate of 50 GPM.

A11.29.12. Interoperability: Compatible with all equipment and systems equipped with an SPR or 2 inch KAM-LOK couplings.

Section A11D—U.S. Navy Refueling Equipment

A11.30. US Navy aircraft refuelers found at Naval installations are similar to the USAF R-9 refueler with the exception of a higher pumping rate for the USAF R-9.

Attachment 12

COUPLINGS, NOZZLES, AND ADAPTORS

A12.1. Single Point Refueling (SPR) Adaptor and Receptacle: Used for aircraft refueling. All US Air Force, US Navy, US Marine Corps, and most US Army aircraft are equipped with the SPR receptacle to receive the SPR nozzle. Provides for closed circuit pressurized refueling of aircraft.

A12.2. Single Point Refueling (SPR) Nozzle: Attaches to a hose with a dry break coupler and provides closed circuit pressurized refueling of aircraft. The D-1 SPR nozzle refers to a SPR with 36 degree elbow. The SPR nozzle is also an International Civil Aviation Organization (ICAO) standard fitting used on commercial aircraft.

A12.3. Closed-Circuit Refuel (CCR) Nozzle: An Army 2 inch nozzle which locks into the fuel tank of Army aircraft. A valve in the nozzle prohibits fuel flow unless the nozzle is mated to the CCR port on the aircraft. The nozzle has a maximum flow rate of 150 GPM at 15 PSI. It includes a grounding cable and bonding wire, and a 2 inch female KAM-LOK coupling to attach to a 2 inch hose. The nozzle is in the FARE system and on the M970 tank semitrailer.

A12.4. Closed-Circuit Refuel (CCR) Nozzle With Open-Port Nozzle Adaptor: This 1 inch open-port nozzle adapter attaches to the Army CCR nozzle to refuel aircraft not equipped with the CCR port (or when the CCR port is damaged). The open-port nozzle adapter is like conventional automotive-type nozzles, except that it locks into the discharge end of the CCR nozzle. The adapter is in the FARE system.

A12.5. Open-Port Nozzle: Standard æ inch, 1 inch, 1.5 inch, and 2.5 inch automotive-type nozzles used to refuel aircraft and ground equipment. This type nozzle is found with all Army fuel equipment except the M967 tank semitrailer and the hoseline outfit.

A12.6. KAM-LOK Coupling: Standard hose coupling used by all military services and commercial industry. Connection requires the mating of male and female coupling halves which lock together by means of two levered cams. The coupling is available in a wide range of sizes and adapters.

A12.7. Grooved Coupling: Standard split-ring groove-type coupling used on Army 6 and 8 inch tactical pipelines. The coupling consists of two housing segments, two bolts and nuts, and a synthetic rubber, oil-resistant, self-sealing gasket. This type of coupling is used with the Army's Tactical Petroleum Terminal (TPT), is included as an accessory of the Fuel System Supply Point (FSSP), and is used with the 4 inch Hoseline Outfit.

A12.8. NATO Tank Truck Adapter Coupling: A 5 piece coupling which when used in different combinations provides the capability to cross-load between US Army 5,000 gallon tank semitrailers and other NATO bulk fuel semitrailers. The coupling also provides the capability for Army semitrailers to bottom load at Central European Pipeline System (CEPS) depots.

Attachment 13

FUELS PERSONNEL AND EQUIPMENT UNIT TYPE CODES (UTC)

JFARP FORWARD AREA REFUEL TEAM

FUNCTIONAL AREA	AFSC	SEI	QTY
Fuels Journeyman	2F051	035	3
Fuels Craftsman	2F071	035	1
TOTAL:			**4**

MISCAP: Provides personnel and specialized equipment to establish and operate a forward area refueling point (FARP). Used primarily in quick-turn support of special operations aircraft. Includes 3 specially trained 2F051 and 1 specially trained 2F071 supervisor.

JFAXA 6 PAA TFS FUELS-LOX EQUIPMENT

MISCAP: Provides equipment to support 6-9 PAA tactical fighter squadron or 8 C-130 or 6 B-52 or 5 KC-135 aircraft. Provides capability for receipt, storage, and issue of LOX, LIN, aviation and ground fuels with non-self propelled equipment. This UTC assumes LOX, LIN, and fuel resupply is available. UTC includes 2 R-14 systems with 4 50K bladders, 1 PMU-27, 1 R-22 trailer mounted pump with unloading manifold, 1 FFU-15E filter separator, 4,500 gallon sealed drums with 4 handpumps and 1 towing yoke, 2 TMU-24E 400 gallon LOX tanks with 400 gallons of LOX, 1 NRU-5E 400 gallon LIN tank with 400 gallons of LIN. Package includes associated MRSP kits. Each LOX and LIN tank will include an aircraft overboard vent kit.

JFAXB POL 06 PAA TFS FUELS-LOX

FUNCTIONAL AREA	AFSC	SEI	QTY
Fuels Management	2F070		1
Qual Cont/Insp-POL	2F050	039	1
Fuels Operations	2F050	387	3
Fuels Operations	2F050		1
Fuels Operations	2F030		2
POL Account/Admin	2F070	040	1
TOTAL:			**9**

MISCAP: Provides personnel support to manage LOX, LIN, aviation, and ground fuel receipt, storage and issue systems. Deployable to a MOB/COB/SB/LB/BB. People and Equipment.

JFAXC 1 200K BULK STORAGE SYSTEM

MISCAP: Provides for 200,000 gallons of bulk petroleum storage, receipt, transfer, and truck fillstand capability. This UTC includes 4 50K bladders, 1 R-22 trailer mounted pump (600-900 GPM), 1 FFU-15E filter separator, 480 feet of 4 inch hose and 100 feet of 3 inch hose. Package includes associated MRSP.

JFAXE 18 PAA TFS FUELS-LOX EQUIPMENT

MISCAP: Provides equipment to support 18 PAA tactical fighter squadron or 10 KC-135 aircraft. Provides capability for receipt, storage, and issue of LOX, LIN, aviation and ground fuels with non-self propelled equipment. This UTC assumes LOX, LIN, and fuel resupply is available. UTC includes 3 R-14 systems with 7 50K bladders, 1 PMU-27, 1 R-22 trailer mounted pump with unloading manifold, 1 FFU-15E filter separator, 4,500 gallon sealed drums with 4 handpumps and 1 towing yoke, 2 TMU-24E 400 gallon LOX tanks with 400 gallons of LOX, 1 NRU-5E 400 gallon LIN tank with 400 gallons LIN. Package includes associated MRSP kits. Each LOX and LIN tank will include an aircraft overboard vent kit.

JFAXG 24 PAA TFS FUELS-LOX EQUIPMENT

MISCAP: Provides equipment to support 24 PAA tactical fighter squadron or 14 PAA B-52 or 15 PAA KC-135 or 16 PAA C-130 aircraft. Provides capability for receipt, storage, and issue of LOX, LIN, aviation and ground fuels with non-self propelled equipment. This UTC assumes LOX, LIN, and fuel resupply is available. UTC includes 3 R-14 systems with 7 50K bladders, 2 PMU-27, 1 R-22 trailer mounted pump with unloading manifold, 1 FFU-15E filter separator, 8,500 gallon sealed drums with 8 handpumps and 2 towing yokes, 3 TMU-24E 400 gallon LOX tanks with 400 gallons of LOX, 2 NRU-5E 400 gallon LIN tank with 400 gallons LIN. Package includes associated MRSP kits. Each LOX and LIN tank will include an aircraft overboard vent kit.

JFAXJ 48 PAA TFS FUELS-LOX EQUIPMENT

MISCAP: Provides equipment to support 48 PAA tactical fighter squadron or 24 C-130 or 20 KC-135 aircraft. Provides capability for receipt, storage, and issue of LOX, LIN, aviation and ground fuels with non-self propelled equipment. This UTC assumes LOX, LIN, and fuel resupply is available. UTC includes 4 R-14 systems with 9 50K bladders, 2 PMU-27, 2 R-22 trailer mounted pump with unloading manifold, 2 FFU-15E filter separator, 8,500 gallon sealed drums with 8 handpumps and 2 towing yokes, 4 TMU-24E 400 gallon LOX tanks with 400 gallons of LOX, 3 NRU-5E 400 gallon LIN tank with 400 gallons LIN. Package includes associated MRSP kits. Each LOX and LIN tank will include an aircraft overboard vent kit.

JFAXM 72 PAA TFS FUELS-LOX EQUIPMENT

MISCAP: Provides equipment to support 72 PAA tactical fighter squadron or 32 C-130 or 28 B-52 or 25 KC-135 aircraft. Provides capability for receipt, storage, and issue of LOX, LIN, aviation and ground fuels with non-self propelled equipment. This UTC assumes LOX, LIN, and fuel resupply is available. UTC includes 6 R-14 systems with 14 50K bladders, 3 PMU-27, 2 R-22 trailer mounted pump with unloading manifold, 2 FFU-15E filter separator, 12,500 gallon sealed drums with 12 hand-pumps and 3 towing yokes, 6 TMU-24E 400 gallon LOX tanks with 400 gallons of LOX, 4 NRU-5E 400 gallon LIN tank with 400 gallons LIN. Package includes associated MRSP kits. Each LOX and LIN tank will include an aircraft overboard vent kit.

JFAXP 1 R-11 FUEL TANK TRUCK

MISCAP: Provides 1 R-11 refuel/defuel truck (6000 gallon) to augment other UTC packages or provide limited servicing capabilities at deployed locations.

JFAXQ POL 18 PAA TFS FUELS CORE SQ

FUNCTIONAL AREA	AFSC	SEI	QTY
Fuels Apprentice	2F031		5
Fuels Journeyman	2F051	387	4
Fuels Journeyman	2F051		3
Fuels Craftsman	2F071	387	2
Fuels Craftsman	2F071		1
TOTAL:			**15**

MISCAP: Provides personnel support to operate LOX/LIN, aviation, and ground fuel receipt, storage and issue for an independent fighter squadron at MOB/COB/SB/LB/BB. People only. Can integrate with any POL personnel UTC to enhance combat operations support.

JFAXR POL 15 PAA FUELS CARE/FOLLOW-ON

FUNCTIONAL AREA	AFSC	SEI	QTY
Fuels Apprentice	2F031		4
Fuels Journeyman	2F051	387	3
Fuels Journeyman	2F051		3
Fuels Craftsman	2F071	387	1
Fuels Craftsman	2F071		1
TOTAL:			**12**

MISCAP: Provides personnel support to operate LOX/LIN, aviation, and ground fuel receipt, storage and issue systems for a dependent fighter squadron and all other MDS squadrons at a MOB/COB/SB/LB/BB. People only. Can integrate with any POL personnel UTC to enhance combat operations support.

JFAXS POL LAB/ACCOUNTING AUG SUPPORT

FUNCTIONAL AREA	AFSC	SEI	QTY
Fuels Journeyman	2F051	039	1
Fuels Journeyman	2F051	040	1
TOTAL:			**2**

MISCAP: Provides personnel support to operate Fuels Laboratory and provide fuels accounting support of LOX/LIN, aviation, and ground fuel products. People only. Can integrate with any POL personnel UTC to enhance combat operations support.

JFAXT POL FUELS OPERATIONS AUG SUPPORT

FUNCTIONAL AREA	AFSC	SEI	QTY
Fuels Apprentice	F031		6
Fuels Journeyman	2F051	387	3
Fuels Craftsman	2F071		1
TOTAL:			**10**

MISCAP: Provides personnel support to operate LOX/LIN, Aviation and ground fuel receipt, storage, and issue systems when follow-on support is indicated at a MOB/COB/SB/LB/BB. People only. Can integrate with any POL Personnel UTC to enhance combat operations support.

JFAXV POL FUELS ATHRS/FMSE SUPPORT

FUNCTIONAL AREA	AFSC	SEI	QTY
Fuels Journeyman	2F051	387	6
Fuels Craftsman	2F071	387	2
TOTAL:			**8**

MISCAP: Provides personnel support at a MOB/COB/SB/LB/BB to operate the Air Transportable Hydrant Refueling System (ATHRS) and associated Fuels Mobility Support Equipment (FMSE) for receipt, storage and issue of aviation and ground fuel. People only. UTC can integrate with any POL personnel UTC to enhance combat operations support.

JFAXW POL FUELS MGMT AUG SUPPORT

FUNCTIONAL AREA	AFSC	SEI	QTY
Fuels Craftsman	2F071	039	1
Fuels Superintendent	2F091		1
TOTAL:			**2**

MISCAP: Provides senior fuels management augmentation support at MOB/COB/SB/LB/BB locations. 2F000 may be substituted for a 2F091. 2F071 must be a MSGT, no substitution. People only. Integrates with other POL personnel UTCs to provide upper level supervision in the Branch and Quality Control disciplines to enhance combat operations support.

JFDEA POL FUELS PERSONNEL AUG

FUNCTIONAL AREA	AFSC	SEI	QTY
Fuels Journeyman	2F051		3
TOTAL:			**3**

MISCAP: Provides personnel support/augmentation for aviation and ground fuel receipt, storage and distribution systems at MOB, COB, LB, SB, and BB locations. People only. Provides three (3) 2F051 Fuel specialists.

JFDEB 1 R-9 FUEL SERVICING TANK TRUCK

MISCAP: Provides 1 R-9 refuel/defuel truck (5000 gallon) to augment or provide limited servicing capabilities at deployed locations.

JFDEC 3 R-9 FUEL SERVICING TANK TRUCKS

MISCAP: Provides 3 R-9 refuel/defuel trucks (5000 gallon) to augment or provide limited servicing capabilities at deployed locations.

JFDEF 1 C-300 GROUND FUEL SERVICING TANK TRUCK

MISCAP: Provides 1 C-300, 1200 gallon ground fuel servicing tank truck for support at deployed locations.

JFDEG 1 R-14 ATHRS FUELS STORAGE AND SERVICING SYSTEM

MISCAP: Provides 1 R-14 ATHRS system (one 600 GPM pumping module and two 50K bladders) to provide limited capability for receipt, storage and issue of aviation fuel at deployed locations. Assumes fuel availability and includes associated MRSP kit.

JFDEJ 1 R-22 TRAILER MOUNTED PUMP

MISCAP: Provides 1 R-22 600/900 GPM trailer mounted pump with unloading manifold and 200 feet of 4 inch hose for use when bulk fuel transfer or delivery vehicle offload capabilities are required at a deployed location. UTC includes MRSP kit.

JFDEK 1 PMU-27 FUEL SERVICING PUMP

MISCAP: Provides 1 PMU-27 50 GPM pumping module that may be used for ground fuel servicing at deployed locations. UTC includes 4,500 gallon sealed drums with 4 hand pumps and 1 towing yoke. Package also includes associated MRSP kit.

JFDEL 1 10K FUEL STORAGE BLADDER

MISCAP: Provides one 10,000 gallon fuel storage bladder to increase storage capacity at deployed locations. Bladder will be rolled and crated for shipment.

JFDEM 1 50K FUEL STORAGE BLADDER

MISCAP: Provides one 50,000 gallon fuel storage bladder to increase storage capacity at deployed locations. Bladder will be rolled and crated for shipment.

JFDEN GRU-17E FUEL SERVICING UNIT

MISCAP: Provides one GRU-17E pantograph arm to perform hot or combat quick-turn refueling at a deployed location.

JFDEP 1 FFU-15E FUELS FILTER SEPARATOR

MISCAP: Provides one FFU-15E 600 GPM filter separator for receipt of fuel into bladders at deployed locations or at locations where additional filtration is required.

JFDEY 1 BULK FUEL DELIVERY SYSTEM (ABFDS) WITH ACE

MISCAP: Provides 1 ABFDS with ACE (Alternate Capability Equipment). System includes two 600 GPM pumps, two 3,000 gallon fuel bladders, and one 350 GPM filter separator. Provides aerial bulk fuel delivery of aviation fuel to forward areas for direct servicing aircraft to aircraft. System is flown aboard C-130, C-141, C-5, and C-17 aircraft.

JFDEZ POL FUELS MGMT OFFICER

FUNCTIONAL AREA	AFSC	GRADE	SEI	QTY
Supply	021S3	03	LLI	1
TOTAL:				**1**

MISCAP: Provides fuels management and accountable officer for core UMT and augmentation support when required.

JFDGB POL 01 ABFDS OPERATIONS CREW

FUNCTIONAL AREA	AFSC	SEI	QTY
Fuels Journeyman	2F051	369	2
TOTAL:			**2**

MISCAP: Provides two (2) AFSC 2F051/71 SEI 369 personnel. Operators are qualified to crew ABFDS with plane to plane servicing capability alternate capability equipment (ACE). This UTC should be sourced with UTC JFDEW, JFDEX, or JFDEY. Deployable to MOB, LB, SB, COB, and BB.

JFDGC POL 02 ABFDS OPERATIONS CREW

FUNCTIONAL AREA	AFSC	SEI	QTY
Fuels Journeyman	2F051	369	4
Fuels Craftsman	2F071	369	1
TOTAL:			**5**

MISCAP: Provides one (1) 2F071 and four (4) AFSC 2F051 SEI 369 personnel. Operators are qualified to crew ABFDS for Aerial Bulk Fuel Delivery or crew ABFDS with plane to plane servicing capability alternate capability equipment (ACE). This UTC should be sourced with UTC JFDEW, JFDEX, or JFDEY. Deployable to MOB, LB, SB, COB, and BB.

JFDGE FUEL ADDITIVE INJECTOR

MISCAP: Provides one TPI-4T-4 Hammonds fuel additive injector designed to safely inject fuel additives (FSII, SDA, CI) into jet fuel when required at deployed locations.

JFDJA ONE 1.5 TON MOBILE CRYOGENICS PRODUCTION PLANT

MISCAP: Provides one air/land/sea transportable cryogenic production plant capable of producing 285 gallons of LOX or 385 gallons of LIN per day. Capable of producing 12.5 gallons of LOX or 28.5 gallons of LIN per hour. Cryogenic production meets 99.5 percent purity MILSPEC standard. One integrated shelter and two support kits are included in this UTC. Power requirements are 460 volts 60HZ or 380 volts 50HZ. Shelter built on material handling skid with forklift positions built in. Support kits include one year's supply of consumables.

JFDJB POL CRYOGENIC PRODUCTION TEAM

FUNCTIONAL AREA	AFSC	SEI	QTY
Fuels Journeyman	2F051	037	1
Fuels Journeyman	2F051		3
Fuels Craftsman	2F071	037	1
TOTAL:			**5**

MISCAP: Provides specialized cryogenics augmentation to the combat fuels activity at a MOB/COB/SB/LB/BB. This element produces, stores, and issues cryogenics products and performs complete maintenance on production plants. Two persons must have SEI 037 and remaining three must have PDS Code XJF. People only. No substitutions.

JFDJC ONE 1 TON CRYOGENICS PRODUCTION PLANT

MISCAP: This UTC provides a transportable cryogenics production plant capable of producing 150 gallons of LOX and 175 gallons of LIN per day at deployed locations.

JFDEQ ONE 400 GALLON TMU-24E LOX STORAGE TANK

MISCAP: Provides one TMU-24E 400 gallon LOX storage tank with 400 gallons of LOX and aircraft overboard vent kit to augment support at deployed locations.

JFDER ONE 400 GALLON NRU-5E LIN STORAGE TANK

MISCAP: Provides one NRU-5E 400 gallon LIN storage tank with 400 gallons of LIN and aircraft overboard vent kit to augment support at deployed locations.

JFDES 1 FUELS SUPPORT KIT

MISCAP: Provides fuels laboratory equipment, tools, accounting forms and housekeeping supplies in one kit to ensure quality control and accountability at a deployed location. A minimum of 30 days of supply will be maintained in this UTC. This UTC will be deployed in conjunction with other UTC packages to each location where aircraft servicing will be conducted and where in-place support by a United States fuels laboratory is not available.

JFDET 2 PMU-27 FUEL SERVICING PUMPS

MISCAP: Provides two PMU-27 50 GPM pumping modules that may be used for ground fuel servicing at deployed locations. UTC includes 8,500 gallon sealed drums with 8 hand pumps and 2 towing yokes. Package also includes associated MRSP kit.

JFDEU 3 R-14 ATHRS FUEL STORAGE AND SERVICING SYSTEMS

MISCAP: Provides three R-14 ATHRS systems (three 600 GPM pumping modules and seven 50,000 gallon bladders) to provide capability for receipt, storage and issue of aviation fuel at deployed locations. Assumes fuel availability and includes associated MRSP kit.

JFDEW 1 BULK FUEL DELIVERY SYSTEM (ABFDS)

MISCAP: Provides one ABFDS (two 600 GPM pumps and two 3,000 gallon bladders). Provides aerial bulk fuel delivery of aviation and ground fuels. System is flown aboard C-130, C-141, C-5, and C-17 aircraft. This UTC is **NOT EQUIPPED** with aircraft to aircraft servicing equipment (ACE).

JFDEX 4 BULK FUEL DELIVERY SYSTEMS (ABFDS)

MISCAP: Provides four ABFDS (eight 600 GPM pumps and eight 3,000 gallon bladders). Provides aerial bulk fuel delivery of aviation and ground fuels. Systems are flown aboard C-130, C-141, C-5, and C-17 aircraft. This UTC is **NOT EQUIPPED** with aircraft to aircraft servicing equipment (ACE).