AC NO: 00-34A

DATE: 7/29/74

ADVISORY CIRCULAR

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

SUBJECT: AIRCRAFT GROUND HANDLING AND SERVICING

1. PURPOSE. This advisory circular contains information and guidance for the servicing and ground handling of aircraft.

*2. CANCELLATION. Advisory Circular 00-34, dated April 12, 1972, is cancelled.

3. GENERAL. The aviation industry has found through experience that firm safety practices deter accidents. This advisory circular contains generally accepted information and safety practices which may help prevent injuries to personnel and damage to aircraft. Revised information regarding fueling procedures has been included. *

4. DIRECTING MOVEMENT OF AIRCRAFT. The person directing an aircraft that is being taxied should stay far enough ahead and to the left of the aircraft for the pilot to have an unobstructed view of him.

   a. Use the standard hand signals illustrated in Figures 1 or 2, as applicable, of Appendix 1 of this circular.

   b. When directing aircraft during darkness or inclement weather, the guideman should use illuminated or reflective wands.

   c. Movement of aircraft in congested areas should be avoided. However, when necessary, additional guidemen should be stationed near the aircraft wing-tips to assure that adequate clearance is maintained.

5. PARKED AIRCRAFT. When an aircraft is parked, the main gear wheels should be chocked fore and aft. If the aircraft is to remain overnight or if winds are expected, flight control locks should be used.

   a. While turbine-powered aircraft are not in service or being worked on, engine plugs should be installed to prevent damage from dust, debris, nesting birds, etc.

Initiated by: AFS-340

b. Ground personnel should develop a habit of making a visual check of the aircraft as soon as it is parked and secured. Before the flight crew departs, advise them of any unsafe condition that may have been observed and determine the nature of services that will be required for the next flight. This procedure may prevent unwarranted delays of the next departure or possible in-flight failures. Examples of conditions that may be observed are: low or flat tires; cracked windows; nicked propeller blades; loose propeller spinners; oil and fuel leaks; damaged flight surfaces; etc.

> CAUTION: Many people have been injured by propellers in a moment of carelessness. When it becomes necessary to position propellers, they should be handled as if the engine is going to start. Before moving a propeller, always check to be sure the ignition switches are in the "off" position, and the throttle and mixture control levers are in the "closed" position. Always stand clear of propeller blade path, particularly when moving the propeller, because of a possible inadvertent engine start. Particular caution should be practiced around warm engines.

6. TIE-DOWN OF AIRCRAFT. Information relating to aircraft tie-down techniques, equipment, and anchor installations is provided in Federal Aviation Administration Advisory Circular 20-35B, Tie-Down Sense. It is a good practice to always tie-down small aircraft after each flight and large aircraft when unusually high winds are expected. When not in use, wheel chocks, tie-down ropes, or chains, and other equipment, may be stored safely near the wing tie-down anchor points on the ramp. These are usually located outside of the aircraft wheel traffic pattern. Wheel chocks should be painted a bright color so they can be easily seen.

7. TOWING OF AIRCRAFT. When towing aircraft, the proper tow-bar must be used. The wrong type of tow-bar, or makeshift equipment, can cause damage to the aircraft. Persons performing towing operations should be thoroughly familiar with the procedures that apply to the type of aircraft to be moved. Particular care must be exercised when pulling or pushing an aircraft with a tow vehicle.

   a. One should never tow an aircraft in congested areas without guidemen to assist in determining that there is adequate clearance.

   b. No less than two people should be used to tow large aircraft, including a qualified person in the cockpit to operate the aircraft brakes, and a qualified tow vehicle operator. One man should be able to safely move a light aircraft with a hand-operated power-towing device or tow-bar provided for the aircraft.

c. The man operating the tow vehicle should assure that the nose wheel scissors or tail wheel lock is disengaged, when applicable, before attempting to move the aircraft. He should also make certain that the nose wheel swiveling limits are not exceeded during the towing operation.

d. The aircraft engines should not, under normal circumstances, be operated during towing operations. However, the procedure of pushing transport aircraft away from terminal gates, used by airlines for dispatch, is an exception. If engines are operated during towing operations, procedures will be needed to keep personnel away from rotating propellers and away from the danger zones of jet engines.

e. Prior to movement of any aircraft, all landing gear struts and tires should be properly inflated and brake pressure built up when applicable.

f. The tow vehicle operator should avoid sudden starts and stops. The aircraft brakes should be applied only in an emergency, on command from the tow vehicle operator or his clearance man.

g. Clearance must be obtained from the airport control tower, either by appropriate radio frequency or by prior arrangement through other means, before moving aircraft across runways or taxiways.

8. TAXIING OF AIRCRAFT. Only rated pilots or other qualified persons should be authorized to taxi aircraft. Persons authorized to taxi aircraft should be familiar with the airport control communications procedures and radio frequencies.

9. AIRCRAFT FUELING. Improper fueling procedures may cause aircraft accidents and in-flight incidents. If operators of fueling facilities establish procedures for safe and proper fueling of aircraft and fueling personnel follow these procedures, many aircraft accidents or incidents will be prevented. Fueling personnel should be familiar with the fuel requirements for the models and types of aircraft they are servicing. The following paragraphs contain a description of problems that may be encountered in fueling aircraft and recommended procedures for combating these problems.

a. Water in the Fuel.

(1) Water occurs in aviation fuels in three forms:

(a) Dissolved water occurs similar to the humidity in the atmosphere that converts to droplets and settles out as the fuel temperature decreases during flight.

(b) Suspended water appears in the form of droplets that reflect light. High concentration of droplets will cause fuel to have a cloudy or hazy appearance.

(c) Solid bodies of water may be caused by leakage of storage tanks, leaking filler neck seals, or the settling out of suspended water droplets.

(2) Accumulation of water. There is no way of preventing the accumulation of water formed through condensation in fuel tanks. The accumulation is certain, and the rate of accumulation will vary; so it is recommended that storage tanks, fuel truck tanks and aircraft fuel tanks be checked DAILY for the presence of water. Any water discovered should be REMOVED immediately. In addition to the daily water check, fuel tanks should be CHECKED AFTER EACH DELIVERY as insurance against inadvertent water contamination.

(3) The minimum settling time. Adequate settling time is NECESSARY for accurate testing. The minimum settling time for aviation gas is 15 minutes per foot-depth of fuel and 60 minutes per foot-depth of turbine fuel.

(4) Water checks of storage tanks and fuel trucks may be made by attaching water detecting paste, or litmus paper, to the bottom of the tank dip stick.

(a) Push the dip stick to the bottom of the tank and hold for 30 seconds. When the stick is removed, the detecting paste or litmus paper will have changed color if water is present.

(b) The source of excessive amounts of water must be determined and corrected before further use of fuel from the tank.

b. Rust and scale dislodged from the inside of fuel storage tanks may enter the aircraft fuel tanks and clog systems. Turbine fuel tends to dislodge rust and scale and carry the particles in suspension. Because of this, fuel dispensing equipment filters should be serviced frequently. Aviation gasoline should not be stored in tanks or equipment that have been used for turbine fuel storage.

c. Micro-organic growth thrives in turbine fuel and appears as a soapy, slippery slime on the inside surfaces of fuel storage tanks. Micro-organisms of bacteria and fungi multiply rapidly and may cause serious corrosion in aircraft fuel tanks, as well as clog fuel filters, screens, and control units. Therefore, turbine fuel storage tanks should be checked frequently for the presence of slime or micro-organic growth. If found, the tank should be cleaned thoroughly to assure removal of the micro-organic growth and prevent further contamination.

d. Dirt, lint, and dust may collect on fuel dispensing hose nozzles when proper storage receptacles are not used. Fuel hose nozzles should not be stored in such a manner that dirt or moisture will collect in them. Always check the nozzle for dirt and water before using it.

e. Contamination with other types or grades of fuel can cause aircraft engine damage and possible failure in flight. Turbine fuels mixed with aviation gasoline reduce the antiknock and volatility of fuels required for reciprocating engines. Quantities of aviation gasoline mixed with turbine fuels will cause damaging lead deposits to collect in jet engines when used indiscriminately. Transportation or storage of turbine fuel in tanks previously used for storage or transportation of aviation gasoline is not recommended as contamination from rust and scale, or a possible change of fuel specification, may result.

f. Additives. Certain turbine-engine-powered aircraft require the use of fuel containing anti-icing additives. Therefore, fuel personnel must know whether or not the fuels they dispense contain additives. When anti-icing additives are to be added to the fuel, the manufacturer's instructions (usually printed on the container) should be followed to assure proper mixture. Anti-icing additive content in excess of 0.15% by volume of fuel is not recommended as higher concentration can cause the aircraft fuel capacitance system to give erroneous indications. Concentrations of at least 0.05% additive by volume of fuel are effective in eliminating microbial growth.

g. Fuel-Dispensing Equipment. Fuel-servicing vehicles should be conspicuously and legibly marked to indicate the type and grade of fuel.

(1) Markings should be displayed on each side and on the rear of the vehicle in CONTRASTING colors.

(2) Fuel hydrants and pit installations should be identified similarly, according to type of fuel and grade.

(3) Turbine-fueling vehicles should be marked to show whether or not anti-icing additives are contained in the fuel being dispensed.

(4) Leaking or otherwise defective pumping equipment, plumbing, hoses, nozzles, and grounding cables of fuel-dispensing vehicles and stationary facilities should be repaired before further use. Fuel-nozzle-lever stop notches should be removed to avoid the possibility of an inadvertent blocking-open of the valve.

(5) Fuel-dispensing vehicles, and stationary facilities, should be equipped with appropriate fire extinguishers, fire blankets, static grounding cables, explosion proof flashlights, and ladders. Fire extinguishers should be located so they are accessible from either side of the vehicle and remote from probable fire hazard.

(6) Fueling vehicles should be positioned as distant from the aircraft as permitted by the length of the fuel dispensing hose. Mobile units should be parked parallel to or heading away from the aircraft wing leading edge, so it may be moved away quickly in the event of an emergency. When the fueling operation is completed, the fueling vehicle should be parked at least fifty feet from aircraft or buildings and positioned in a manner to permit removal from the area without delay.

h. Fueling procedures. Fueling personnel should first check with the flight crew to determine the type and grade of fuel required, including additives for the aircraft. It is a good practice to have the pilot sign a request for service, identifying the grade and quantity of fuel desired. In the absence of the flight crew, fueling personnel should check the placard located near the aircraft fuel tank filler port, or the aircraft owner's manual that is usually carried in the aircraft, to determine the type and grade of fuel required.

(1) Check to ensure that:

(a) No electrical or radio equipment in the aircraft is energized or being maintained while fuel is being dispensed into the aircraft, except those switches that may require energizing to operate fuel selector valves and quantity gauge systems.

(b) Qualified personnel should be stationed at the aircraft fuel control panel during pressure fueling operations.

(c) Fueling personnel should not carry objects in the breast pockets of their clothing when servicing aircraft or filling fuel service vehicles because loose objects may fall into fuel tanks.

(d) Matches or lighters should never be carried during fueling operations.

* (e) Because of the high lead content, direct fuel contact with skin or the wearing of fuel saturated clothing should be avoided. Skin irritation or blisters may result from direct contact with fuel.

(f) Immediate medical attention should be sought if fuel enters the eyes. *

(g) In the event of fuel spillage, discontinue fueling operations until the spill can be removed, using proper safety precautions.

(2) Fueling from mobile equipment. The following sequence should be followed by the fueling crew.

(a) Connect a grounding cable from the fueling vehicle to a satisfactory ground. Grounding posts usually consist of pipes or rods driven far enough into the ground to result in a zero potential. *

(b) Connect a ground cable from ground to the aircraft (on landing gear axle or other unpainted surface). Do not attach ground cables to the propeller or radio antenna.

(c) Connect a grounding cable from the fueling vehicle to the aircraft. The fueling vehicle may be equipped with a "T" or "Y" cable permitting ground attachment first and grounding of the aircraft with the other end.

(d) Connect a grounding cable from the fuel nozzle to the aircraft before removing the aircraft tank cap. This bond is most essential and needs to be maintained throughout the fueling operation and until the fuel cap is replaced.

CAUTION: Conductive-type fuel hose does not provide a satisfactory method of bonding.

(e) The fuel-dispensing equipment grounding cables should be removed in the reverse order of the sequence outlined above.

(3) Fueling from hydrants, pits, and cabinets.

(a) Connect the grounding cable from the dispenser to the aircraft.

(b) Connect the grounding cable from the hose nozzle to the aircraft before removing the fuel cap.

(4) Overwing fueling. The fuel-filler hose should be draped over the wing leading edge. Never lay the fuel-filler hose over the wing trailing edge because aircraft structural damage may result. A simple rubber shower mat may be used to provide protection for wing leading edges during fuel operation. Step ladders or padded upright ladders may be used to provide easy access to high-wing and large aircraft. Standing on wing surfaces should be avoided and never stand on wing struts. Hold the fuel nozzle firmly while it is inserted in the fuel tank filler neck and never block the nozzle lever in the open position. Be sure that fuel filler caps are replaced and securely latched when fueling is completed.

(5) Underwing fueling. Discharge possible static buildup in the fuel dispensing hose by touching the pressure nozzle to an unpainted part of the aircraft, such as a landing gear axle, before attaching to the aircraft filler receptacle. No static ground wire between the filler nozzle and the aircraft is necessary.

(6) The aircraft fuel tank sumps should be drained before each fuel servicing to remove water that may have accumulated from condensation or entered the tank during fueling operations. Draining fuel sumps immediately after fueling serves little purpose because the agitation action of fuel entering the tank may suspend water and contaminants - which can remain suspended for many minutes and may not settle out until the aircraft is airborne.

10. SERVICING OF OXYGEN SYSTEMS. Certain precautions should be observed whenever aircraft oxygen systems are to be serviced.

a. Before servicing any aircraft with oxygen, consult the specific aircraft service manual to determine the type of equipment required and procedures to be used.

b. Oxygen system servicing should be accomplished only when the aircraft is located outside of hangars.

c. Personal cleanliness and good housekeeping are imperative when working with oxygen. Oxygen under pressure and petroleum products create spontaneous results when they are brought in contact with each other. Service people should be certain to wash oil and grease (including lip salves, hair oil, etc.), and dirt from their hands before working around oxygen equipment. It is also essential that clothing and tools are free of oil, grease, and dirt.

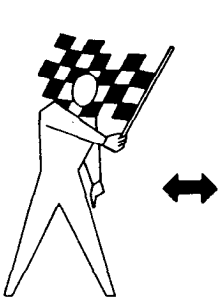
d. Aircraft with permanently installed oxygen tanks usually require two persons to accomplish servicing of the system. One man should be stationed at the service equipment control valves, and the other stationed where he can observe the aircraft system pressure gauges.

e. Oxygen system servicing is not recommended during aircraft fueling operations or while other work is performed that could provide a source of ignition.

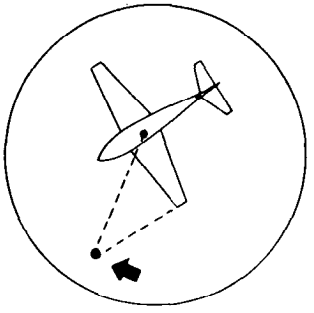
f. Oxygen system servicing while passengers are on board the aircraft is not recommended.

C. R. MELUGIN, JR.
Acting Director, Flight Standards Service

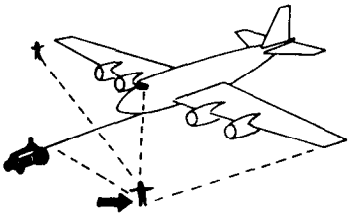
FIGURE 1. AIRCRAFT OPERATING SIGNALS



FLAGMAN DIRECTS PILOT TO SIGNALMAN IF TRAFFIC CONDITIONS REQUIRE



SIGNALMAN'S POSITION

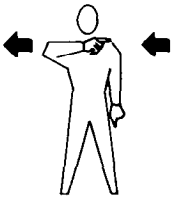


SIGNALMAN DIRECTS TOWING

STOP

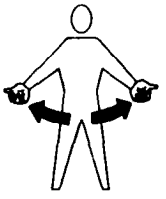
COME AHEAD

EMERGENCY STOP

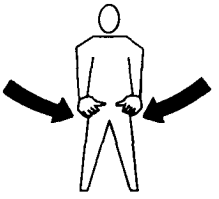


CUT ENGINES

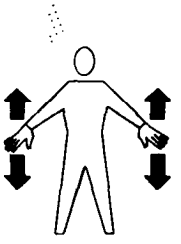
START ENGINES



PULL CHOCKS

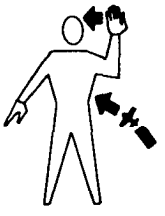


INSERT CHOCKS

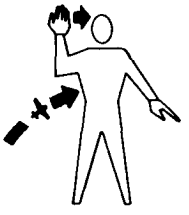


SLOW DOWN

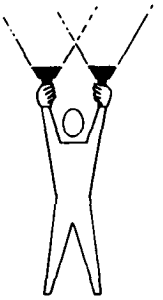
ALL CLEAR (O.K.)



LEFT TURN



RIGHT TURN

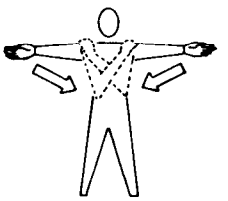


NIGHT OPERATION

FIGURE 2. HELICOPTER OPERATING SIGNALS

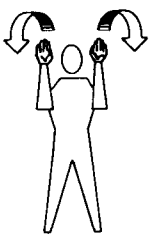
START ENGINE

ENGAGE ROTOR



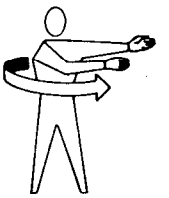
STOP ROTOR

STOP

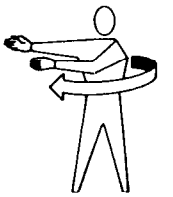


MOVE BACK

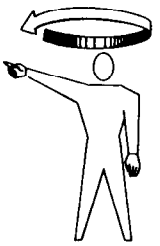
MOVE FORWARD



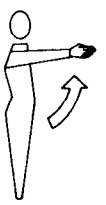
MOVE RIGHT



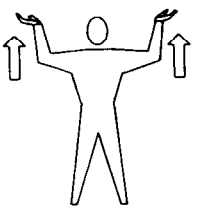
MOVE LEFT



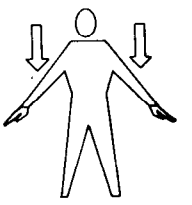
TAKE OFF



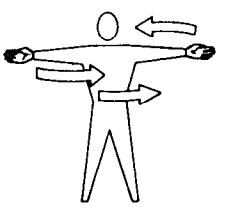
LANDING
DIRECTION



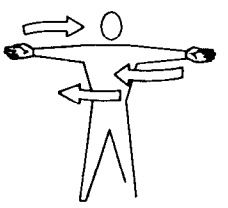
GO UP



GO DOWN



SWING TAIL
TO RIGHT



SWING TAIL
TO LEFT

FIGURE 3 POSITIONING FUEL TRUCK