



Marshalling Detachment Training Manual

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I. Marshaller's Code of Conduct

1. I will follow the CAF's Code of Conduct.
2. I will execute the task/duty of a Marshaller with professionalism, courtesy, respect, caution and "Esprit de Corps".
3. The pilot is always in command of his/her aircraft and will in all cases make the final judgment.
4. When in doubt, for any reason, I will halt the aircraft and review the situation.
5. I will not marshall any aircraft after consuming an alcoholic beverage.
6. I will keep myself and my equipment in a ready and well-maintained condition.
7. I will not interfere with another **Marshaller's** control unless an unsafe condition is observed.
8. Completed the Child Safety protocol as directed by CAF HQ. (Note: failure to comply with this directive will result in a Marshaller being removed from the line and asked to go home or complete the on-line documentation before being allowed to participate.)

II. History of the Detachment

The annual CAF Airsho was held in Harlingen, Texas in the seventies. The popularity of the show was such that each year more and more aircraft arrived to participate. After a 1976 show held in Colorado Springs, a group of CAF colonels began to park the aircraft, organize the ramp, and provide safety to the crowds. Most of these colonels lived in the Dallas/Fort Worth area and were long time members of the DFW Wing. In 1981 the CAF Marshalling Detachment was formed with 16-chartered members. Detachment by-laws were written, and approval was given by CAF Headquarters.

The first Detachment leader was Col. Mike Clark. In the many years since the founding of the Detachment there have been a lot of new faces with members joining from coast to coast. Some of the original sixteen have become CAF pilots.

After the Detachment was formed, the need for a patch was recognized. Col. Ron Cox was the designer and creator of the Marshalling Detachment patch. The propeller indicates the main type of aircraft we work. The motto is from

the Latin meaning “To Serve and Defend”. The flag is a standard orange and white airfield safety flag and has sixteen squares representing the sixteen original members. The color gray is for the CAF. The only change to the patch was in 2002 when the then Confederate Air Force changed its name to the Commemorative Air Force. The primary motto of the Marshalling Detachment is **“TO SERVE AND DEFEND.”** WE DO THIS BECAUSE IT NEEDS TO BE DONE AND WE WANT TO DO IT! We also subscribe to: *"From crisis to crisis with enthusiasm."*

III. Qualifications

1. Current CAF colonel dues paid.
2. Current Detachment dues paid.
3. Willingness to work hard and share camaraderie.
4. Able to take constructive criticism.
5. Completed the on-line Child Protection requirement.

IV. Personal Equipment

1. Good pair of leather shoes. Nylon does not breathe and will become uncomfortable after **10+** or more hours on the ramp.
2. Leather gloves. You may get hot oil or hydraulic fluid on them and cloth gloves will absorb those fluids.
3. Orange ball cap or orange boonie hat with black CAF. These can be ordered through the detachment newsletter.
4. Trainees are asked to wear black cargo pants or black cargo shorts with a gray shirt and orange safety vest. This will help pilots out if there are other people on the ramp wearing orange vests.
5. Qualified Marshallers shall wear the orange ramp shirt with CAF FLIGHT LINE on the back and detachment qualification patch on the right front side above pocket and name. The ramp shirt will be worn with black cargo pants or black cargo shorts. The orange jumpsuit can be worn as an alternate uniform. These will be ordered through the detachment newsletter.
6. A marshalling radio and spare batteries

7. Pen/Pencil and notepad for briefing notes.
8. Sunglasses, sunscreen, lip balm
9. Whistle with neck strap or lanyard.
10. Dzus tool or short flat blade screwdriver.
11. Knife
12. Orange duct tape to mark aircraft positions on the ramp.
13. Stride chart that you can make for yourself using the guidelines from Sec. VII of this guide. A chart with aircraft dimensions can be downloaded from our website: <http://www.marshallingdetachment.org/pages/3>
14. Hand towel, rag, or bandana

V. Marshalling Instructions

The objective of this training is to construct a firm foundation in the marshalling basics for all new members and serve as a refresher for qualified Marshallers.

By the end of this training you will be able to demonstrate the ability to control the aircraft movement on the ramp using **CAF** approved hand signals, recognize the inherent dangers in ramp operations and plan ways to minimize them. **Air Force Instruction (AFI) 11-218 Chapter 2** is the primary source of the marshalling signals. **NAVAIR 00-80T-113 Chapter 2** is the source signals unique to naval aircraft.

The Marshallers are a separate Detachment not associated with any other wing or squadron and are responsible only to headquarters. Our job is to ensure a safe environment for members, aircraft, and visitors at airshows.

The basic function of a Marshaller is to control movement of aircraft prior to and after flight. This function is performed mainly on the ramp at an airport, occasionally on a taxiway, and on the ramp of a wing or squadron hanger event.

We do this before, during and after the waiver period at airshows, fly-ins, static shows or a wing or squadron open house. This function is accomplished using **CAF APPROVED** marshalling hand signals, exercising due care, and ensuring that the movement area is clear of vehicular and pedestrian traffic. Our main objective is the protection and safety of the public, pilots/aircrew, and aircraft/equipment. Because of our high visibility, we must constantly remind ourselves that we represent the **CAF**, even if no **CAF** aircraft are present at the show we happen to be working at the time.

To function as a Marshaller, you must be alert, highly mobile, flexible, knowledgeable, decisive, and a good communicator. You must be able to function in extremes of heat and cold, high noise, wind, hunger, uncooperative spectators,

and occasionally rude pilots. As a trainee, you must be able and willing to accept instruction and **constructive criticism** from qualified Marshalls. As a trainee in the ramp environment, your initial training will mainly be with single engine tail dragger aircraft, keeping in mind that the aircraft commander (pilot) is ultimately responsible for the movement of the aircraft.

Marshalling an airshow is a team effort and the ramp leader is known as **Orange One**. **Orange One** is responsible for the overall activity of the Marshalls at an airshow. He/she is the coordinator, administrator, final decision maker, and is solely responsible to the airshow **Air Boss**. Problems with uncooperative airshow personnel, pilots, spectators, or equipment problems should be brought to the attention of **Orange One**. Another Marshaller will be designated as **Orange Two**. **Orange Two** will be responsible for the ramp when **Orange One** is unavailable. In addition, **Area Chiefs** will be assigned a designated area and will communicate with **Orange One** or **Orange Two** via a marshalling radio or equivalent. Anything that effects ramp operations needs to be approved by **Orange One**. (i.e. positioning of support equipment, individual aircraft activities or additional non-essential personnel on the ramp during show operations, etc.)

As you approach the aircraft that you are going to start engines or marshall out, you should first identify yourself to the Pilot in Charge (PIC), Second in Charge (SIC)/Crew, determine who is 'driving' (for multi-engine aircraft), and confirm start up, taxi, and return to parking procedures (RTP). Depending who is steering with multi engine aircraft, the PIC or SIC, will dictate the Marshaller's positioning during RTP. This may require the use of multiple Marshalls so the PIC or SIC will be able to see the Marshaller's signals throughout the complete parking procedure.

Before an engine is started, look all around, under and behind for anything that may be a potential hazard either to the aircraft or to personnel behind the aircraft. Assume your position in front of the aircraft and *out of the propeller line!* Depending on aircraft type determines what side you are to stand on for engine start. Do a 360* check and prepare to start the engine. Extend left arm to at least head height with the thumb up to indicate, "*Clear to start with no visible prime.*" If prime becomes visible, then invert the thumb on left hand to so indicate. Make small circles with your vertically extended right arm and hand to indicate crank engine (see fig. 14). You need not continue the circling motion with the right hand during the entire cranking process. If starting multi-engine aircraft, indicate with the left hand the number of the engine to be started (not necessarily 1-2-3-4). On a multi-engine aircraft, the engines are numbered from pilots left to right. The pilot will usually indicate the starting order of the engines. When the engine starts, a certain amount of blue-gray smoke will appear. If prime was excessive, a large amount of smoke will appear; this is normal. Check the exhaust

stacks for fire. If fire is observed, give the signal for fire (see fig. 43) and signal to continue cranking. Alternate between fire signal and crank engine signal but **DO NOT** stop cranking the engine (see fig. 14) until fire is blown out. After engine start, all external venting should cease. If any malfunctions or problem appear, inform the pilot.

Anyone helping the Marshaller with aircraft movements, such as a wing watcher, must remember that “**ONLY ONE**” person will have their hands up giving signals. A pilot may think a wing watcher is trying to marshall him if the wing watcher's hand is above the shoulders. Only the person out front of the aircraft will be giving signals as the Marshaller. The wing watcher will indicate to the Marshaller the wing clearance. If the distance is greater than your arms width, then a thumbs up is given. If the distance is smaller than your arms width, then hold hands apart to simulate the actual distance, again, below shoulder level.

Your stance should be balanced with legs apart, but relaxed. Position yourself on the inside of the turn for a single engine aircraft. Cross arms above head (stop signal, see fig. 13) to hold them before they start moving, scan the area for conflicts or obstructions. Check for fire bottles, chocks, and other hazards, look over the aircraft for leaking fuel, oil, hydraulic fluid, or open compartments. Check to ensure civilians and ground crew are out of the way. Remember, if you cannot see the pilot, he cannot see you. Make eye contact with pilot, raise both hands/arms above your head to tell the pilot “I am your Marshaller” (see fig. 2). Signal “chocks removed” if necessary (see fig. 22), and give the signal to “move forward” (see fig. 3). If there is a conflict with you being on the outside of the turn, move the aircraft forward to clear the conflict, stop the aircraft by giving the stop signal. Indicate to the pilot that you are moving to the inside of the turn, and continue marshalling the aircraft out of the parking spot. Give the signal to turn left, or right as appropriate (see fig. 4 & 5).

If a pilot appears to be taxiing too fast or you want them to slow for whatever reason, signal them to slow down (see fig. 6). After the aircraft has moved out of its slot onto the taxiway, pass them off to the next Marshaller (see fig. 1), or release to taxi on their own. Most former military guys/gals in the Detachment may render a military salute at this point, however, you are not obligated to do so. **WARNING: Do not marshall backwards!** If it appears that it will be necessary to continue with this aircraft, and no other Marshaller is present, move quickly to the point of constriction, then turn back, and resume normal marshalling. When all appears normal, and no further marshalling is necessary, indicate to the pilot by saluting or giving a thumbs up.

If you are marshalling an aircraft and it is coming toward you, and about to pass you by, **DO NOT** keep control of the aircraft by running backwards. After making sure there is another Marshaller further down in a position to take over, signal to the pilot that you are passing control. If you are the Marshaller who is to take control, **do not** raise your hands to signal, “I am your Marshaller” (see fig. 2) until *after* the aircraft has officially been passed to you. The same applies to

taking control from the “Follow-me” vehicle. **Do not** raise your hands to take control until after the “Follow-me” has officially handed over control.

Arriving/Recovering aircraft normally have the right-of-way on the ramp. The exception to this is during an airshow with only one-way in and out. In this case, aircraft taxiing out to go “on stage” have priority over aircraft who have already performed, unless an overheat problem is occurring. If for any reason you need to approach a running aircraft, you must get the pilot’s attention, point to yourself, and only then approach the aircraft. (See fig. 11) **WARNING: “Proceed with caution!”**

After parking, unless it is an emergency shut down, the pilot will normally run the engine for a few seconds before shutdown. At most venues, the radial engine aircraft may perform the engine oil scavenging procedure prior to coming to the parking spot. Remain in position until the engine stops, call “switches off”, insert chocks, and inform the pilot when chocks are in place (see fig. 21). If you do not have time to wait and must chock or remove chocks with the engine running, obviously remain outboard of prop arc, proceed to the wing leading edge, keeping in mind the position of the pitot tube, and proceed to the main gear with your arm on top of the wing and your side touching the leading edge. Place or remove the chocks, and turn around gracefully, exiting the same way you went in with your shoulder to the leading edge. **Do not** leave any aircraft without integral brakes on a hard surface without chocks.

If chocks are in short supply, and you only have one pair to use on a tail dragger, check the wind. If the wind is a factor, place one chock behind the upwind gear and one in front of the downwind gear, then be alert for a wind shift. If wind is not a factor, chock the left main (either main on nose gear aircraft). Do not leave chocks scattered about the ramp. Always police the ramp area. Put unused chocks under the wing of parked aircraft and lay fire bottles down between aircraft. It is better to have a wheel hit a bottle than a prop. Pick up trash, bits of safety wire, small nuts and bolts, screws, or anything that could conceivably be blown by prop blast into anyone or anything.

If working with jet aircraft or helicopters, all loose items needs to be secured, and hats removed before working around these aircraft. Any loose items could become FOD (Foreign Object Debris) which could damage the aircraft or injure people in the area. It is recommended that hearing protection be worn around running jet engines.

SIGNALS USED ON NAVY AND WING-FOLDING AIRCRAFT

We will touch briefly on the specialized signals used with Navy aircraft and wing folding. Most of the Corsairs now flying have split flaps and can fold with flaps down. However, some Corsairs have solid flaps and must retract flaps prior to wing fold, as do the F6F Hellcat, TBM/TBF Avenger and FM2/FM4 Wildcat. Keep this in mind whenever you plan to fold wings on any Navy aircraft, including the S2 Tracker. The signal sequence is as follows: Hook up (see fig. 35), Flaps up (see fig. 24), and Fold wings (see fig. 32). **WARNING: Never fold the wings of any aircraft, either manual or hydraulic, with someone standing on the wing!**

The SB2C tail hook must be raised and locked in place *manually*. Some pilots of the SB2C and TBM/TBF types will want to open the bomb bay to dispel fumes and check hydraulics (see fig. 28).

This covers most of our hand signals. Practice them until they become second nature, and above all, **be alert**.

EMERGENCY PROCEDURES

Your primary job in the case of an accident, or other emergency, is to provide crowd control, and to ensure emergency vehicles and personnel can swiftly, easily, and safely get to and from the scene. Only Orange One or Orange Two should approach the scene of an accident if it seems apparent that emergency personnel will be delayed. Their job will be to stand fire watch and to make sure that anyone injured should stay where they are unless they need to be moved due to fire. When emergency personnel arrive, they will return to work crowd control unless asked by emergency personnel to say on hand.

At any time during an accident stay off the radio unless necessary and **DO NOT talk to the media directly**. Refer press to the designated spokesperson. This will usually be the Airshow Chairman or Public Information Officer (PIO).

VI. Peculiarities of CAF Aircraft

1. A-26: Nose gear link must be uncoupled to tow. Very narrow area for pilot to see Marshaller between #1 engine and fuselage. Pilot can only steer from left side.
2. B-25: Non-steer able nose gear tends to cock to one side on shutdown.
3. B-26: Nose gear tends to jump to side when trying to taxi slowly.

4. B-24: Nose gear has limited travel; give it as much maneuvering room as possible.
5. JU-52 & HE-111: Air brakes have extremely limited braking; does most of its maneuvering by differential power; easy on the turns.
6. P-51: Low scoop is susceptible to clogging from cut grass, etc.
7. Spitfire/Hurricane: Airbrakes. A/C must sit in chocks while engine is running to build air pressure.
8. P-39: Has hose connection inside nose gear wheel well for cooling water.
9. T-6/SNJ/Harvard: Watch for exhaust stack fire on the right side.
10. AN-2: Airbrakes; must sit in chocks while engine is running to build air pressure.
11. F-4U: Folding wings. If they have split flaps, they can fold with flaps down. If they have solid flaps, they must be retracted before folding wings.
12. TBF/TBM: Must retract flaps before folding wings. Pilot may want to open the bomb bay to dispel fumes and check hydraulics.
13. F4F/FM2: Must retract flaps before folding wings. Wings fold manually, requiring ground crew to push wings into place.
14. F6F: Must retract flaps before folding wings. Wings fold manually.
15. F8F: Must retract flaps before folding wings. Wings fold manually.
16. SB2C: Tail hook must be raised and locked in place manually. Pilot may want to open the bomb bay to dispel fumes and check hydraulics before folding the wings.
17. Avro Lancaster: Starters on engines are nitrogen powered along with the braking system. Engine starting sequence is 4, 3, 2, 1. If the nitrogen charge is depleted before engine #4 cranks then the starting sequence becomes 1, 2, 3, 4. The generators are on engines #1 and #4. Stack fires are more common with low nitrogen starts.

VII. Pacing Wingspans

Some people have an uncanny ability to look at a parking space and say, “that aircraft will fit in that parking space with 6 feet to spare”. Consider yourself lucky if you can do it consistently. For the rest of us mere mortals, we have devised a system that works just as well. We rely on a system of “pacing” to determine how large a space really is. Here is how it works:

First, find out how long your pace is. On your sidewalk, take 10 slightly exaggerated steps, then measure that distance and divide by 10. Your pace may be 30”, 34”, 35”, etc. Keep doing this until you can *consistently* take the same size step every time. Next, convert an aircraft’s wingspan into inches, and then divide that number by the number of inches in **your** pace. For example, a TBM’s span is 54’. $54' \times 12$ (inches in a foot) = 648”, or $48''/36''$ (my pace) = **18** paces. In this example, you must have 18 paces plus 2 more paces to allow for wingtip clearance. If you do not have a space 22 paces wide (allows for two paces on each side), do not try parking a TBM there. Smaller planes can get by with 3’ of wingtip clearance on each side, larger planes should be allowed more. You decide how close together you can safely park aircraft.

Once you have determined that a the aircraft will, in fact, fit the spot you have selected, divide the number of paces required in half to get the distance from the wingtip to the fuselage centerline. Standing even with the adjacent aircraft’s wingtip (or the adjacent obstacle) take a step or two to allow wingtip clearance, then step off the number of paces needed to get to the aircraft’s centerline. That is the spot where you direct the pilot to put his aircraft's nose. Once he has started his turn in on your centerline mark, step to the side and make sure you have your necessary tip clearance, making minor adjustments as needed as the plane moves closer to you. Pre-arrange to have a fellow Marshaller watch the opposite wingtip if you cannot see it yourself (**very** necessary on larger aircraft).

NOTE: Once you have your paces down put them on an index card and laminate it to keep in your pocket or put them on the back of your gloves using a fine tip Sharpie. The paces for the other aircraft have been rounded up so several of the strides have the same number of paces.

Remember: You must develop a consistent pace. Plan ahead, you cannot wait until the aircraft is 50’ away before you start your pacing. Allow reasonable wingtip clearance. If something is not right, stop the aircraft and ask for help. It is much better to apologize to the pilot for your goof-up than it is to pay out big dollars to fix his crumpled wingtip. **Always think safety first! And remember: *Safety is Intentional.***

List of Aircraft Wingspans and Lengths

World War 2 A/C	Span	Lgth	Modern Military A/C	Span	Lgth
A-20 Havoc	62'	48'	A-1 Skyraider (24' folded)	50'	39'
A-26A,B,C Invader	70'	50'	A-4 Skyhawk	28'	40'
AT-19 Reliant	42'	28'	A-6 Intruder/Prowler	53'	55'
B-17 Flying Fortress	104'	75'	A-7 Corsair	39'	46'
B-24 Liberator	110'	68'	A-10 Thunderbolt II	58'	58'
B-25 Mitchell/PBJ	68'	53'	A-26K Invader	72'	52'
B-26 Marauder	71'	58'	An-2 Colt	60'	41'
B-29 Superfortress	142'	99'	B-1 Lancer	137'	146'
BT-13/BT-15/SNV	42'	29'	B-2 Spirit	172'	69'
C-45/SNB/Twin Beech	48'	35'	B-52 Stratofortress	185'	160'
C-46 Commando	98'	76'	C-5 Galaxy	223'	247'
C-47/53/R4D/DC-3/Skytrain	95'	64'	C-17 Globemaster III	170'	174'
C-54 Skymaster	118'	94'	C-130 Hercules	133'	98'
C-60 Lodestar	66'	50'	E-2A Hawkeye (36' folded)	81'	58'
CJ-6	34'	28'	E-3A Sentry	146'	153'
F4F/FM-2 Wildcat (14' folded)	38'	29'	E-6 Mercury	148'	150'
F4U/FG-1/F3A Corsair (17' folded)	41'	34'	EA-18 Growler	45'	60'
F6F Hellcat (19' folded)	43'	34'	F/A-18 Hornet	45'	60'
F7F Tigercat (34' folded)	52'	46'	F-4 Phantom	39'	63'
F8F Bearcat (24' folded)	36'	28'	F-5 Tiger (30' w/ missiles)	27'	48'
FW-190A Butcher Bird	35'	30'	F-15 Eagle	43'	64'
FW-190D Dora	35'	34'	F-16 (33' w/ missiles)	30'	50'
HU-16 Albatross	97'	63'	F-22 Raptor	45'	62'
Hurricane	40'	32'	F-35 Lightning II	35'	51'
J2F Duck	39'	34'	F-86 Sabre	37'	37'
L-2 Grasshopper	36'	23'	KC-135 Stratotanker	131'	136'
L-3 Grasshopper	35'	21'	L-17 Navion	34'	27'

World War 2 A/C	Span	Lgth	Modern Military A/C	Span	Lgth
L-4/J-3 Cub	35'	23'	L-19/O-1 Birddog	36'	26'
L-5 Stinson	34'	24'	L-29 Delfin	34'	36'
Me-108	35'	27'	L-39 Albatross	31'	40'
Me-109	33'	30'	Mig-15 Faggot	33'	33'
Me-262	41'	35'	Mig-17 Fresco	32'	37'
Mosquito	54'	41'	Mig-21 Fishbed	24'	48'
N3N	34'	26'	O-2 Skymaster	38'	30'
P-38 Lightning	52'	38'	OV-1 Mohawk	48'	41'
P-39 Airacobra	34'	30'	OV-10 Bronco	40'	42'
P-40 Warhawk	38'	32'	P-3 Orion	100'	116'
P-47 Thunderbolt	41'	36'	P-8 Poseidon	124'	130'
P-51 Mustang	37'	32'	S-3A Viking (30' folded)	69'	54'
P-63 King Cobra	38'	33'	T-2A Buckeye	38'	38'
PBY Catalina	104'	64'	T-6 Texan II	34'	34'
PT-17/N2S Kaydet/Stearman	32'	25'	T-28 Trojan	40'	33'
PT-19/23/26	36'	28'	T-33 Shooting Star	39'	38'
PT-22 Recruit	30'	23'	T-34 Mentor	33'	29'
PV-2 Harpoon	66'	52'	T-37 Tweet	34'	30'
SB2C Helldiver (23' folded)	50'	37'	T-38 Talon	25'	48'
SBD Dauntless	42'	33'	T-41 Mescalero/Cessna 172	36'	27'
Seafury	38'	35'	T-44 Pegasus/U-21/King Air	50'	36'
Spitfire	37'	30'	T-45 Goshawk	31'	40'
T-6/SNJ Texan	42'	29'			
T-50/UC-78 Bobcat	42'	33'	AH-64 Apache	48'	59'
TBF/TBM Avenger	55'	41'	CH-47 Chinook	60'	100'
Yak 9	32'	28'	UH-1 Huey	48'	57'
Yak-50/52	33'	26'	UH-60 Blackhawk	54'	65'
Zero A6M	39'	30'	Mil-24 Hind	58'	57'
			V-22 Osprey	85'	57'

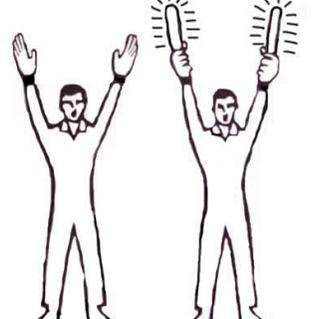
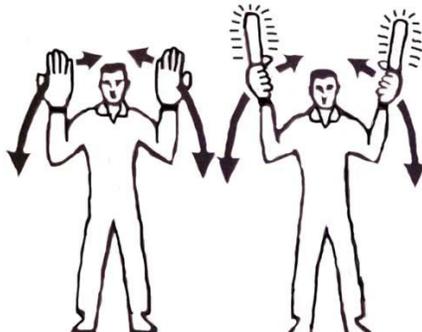
VIII. Signals Used For Aircraft Movement On The Ramp

Where possible signals comply with North Atlantic Treaty Organization (NATO) Standardization Agreement 3117, Air Standardization Coordinating Committee Air Standard 44/42a, the International Civil Aviation Organization (ICAO), and the Federal Aviation Administration (FAA) signals.

The marshaller will signal facing the aircraft while standing in one of these positions:

1. Fixed-wing aircraft. The marshaller will stand forward of the aircraft to the pilots left. **Remember if you can not see the pilot he can not see you!**
2. Helicopters. The marshaller will stand in front in full view of the pilot.

During night operations, the marshaller will use a pair of same color light wands. During taxiing or parking, the pilot must stop immediately if one or both of the Marshaller's wands fail.

	<p>Fig. 1 <u>PROCEED TO NEXT MARSHALLER</u> Right or left arm down, other arm moved across body and extended to indicate direction of next marshaller.</p>
	<p>Fig. 2 <u>THIS MARSHALLER</u> Arms above head in vertical position with palms facing toward aircraft.</p>
	<p>Fig. 3 <u>MOVE FORWARD</u> Arms a little aside, palms facing backwards and repeatedly moved upward-backward from shoulder height.</p>

	<p>Fig. 4 <u>TURN TO THE LEFT</u> Point right arm downward, left arm repeatedly moved upward-backward. Speed of arm movement indicating rate of turn. Make fist in right hand to indicate apply break.</p>
	<p>Fig. 5 <u>TURN TO THE RIGHT</u> Point left arm downward, right arm repeatedly moved upward-backward. Speed of arm movement indicating rate of turn. Make fist in left hand to indicate apply break.</p>
	<p>Fig. 6 <u>SLOW-DOWN</u> Arms down with palms toward ground then moved up and down several times.</p>
	<p>Fig. 7 <u>SLOW-DOWN ENGINE(S) ON SIDE INDICATED</u> Arms down with palms toward ground, then either hand moved up and down several times to indicate which side should be slowed down.</p>
	<p>Fig. 8 <u>MOVE BACK</u> Arms by sides, palms facing forward, arms swept forward and upward repeatedly to shoulder height. Do not bend arms at the elbow.</p>

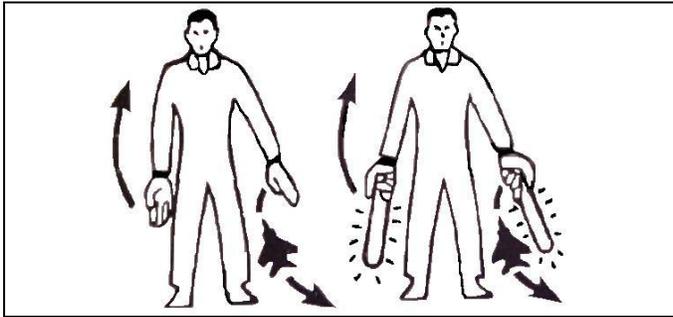


Fig. 9 **TURN WHILE BACKING-TAIL TO THE RIGHT**

Point left arm down and right arm at side with palm facing forward, is swept forward and upward repeated to shoulder height. Do not bend arms at the elbow.

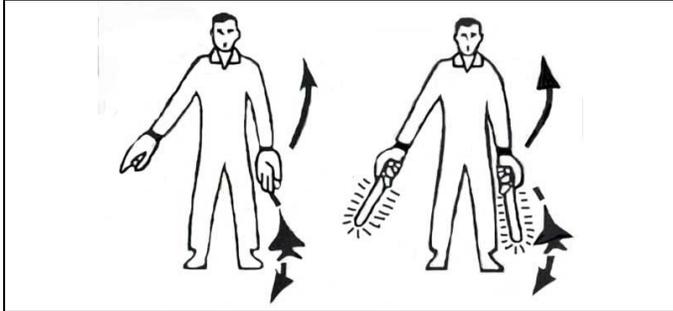


Fig. 10 **TURN WHILE BACKING-TAIL TO THE LEFT**

Point right arm down and left arm at side with palm facing forward, is swept forward and upward repeated to shoulder height. Do not bend arms at the elbow.

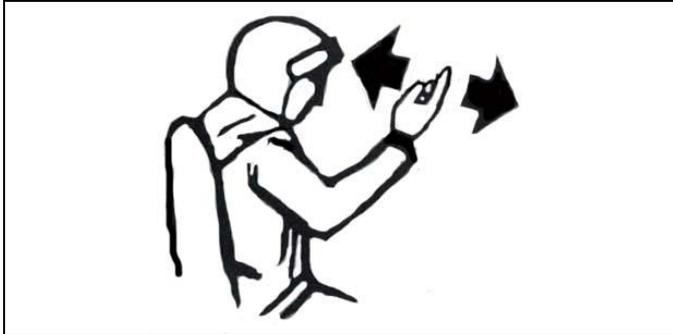


Fig. 11 **CLEARANCE FOR PERSONNEL TO APPROCH AIRCRAFT**

A beckoning motion with right hand at eye level.

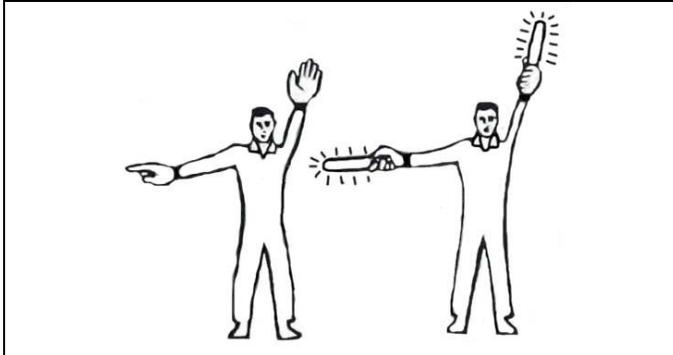


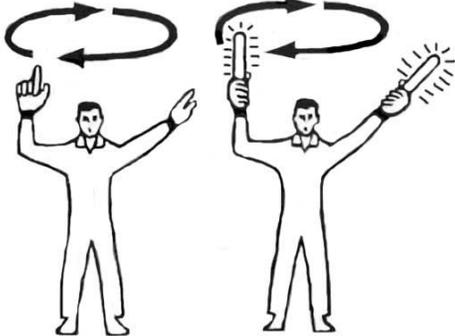
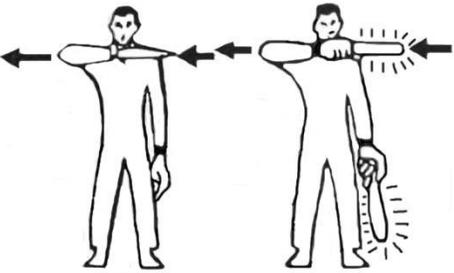
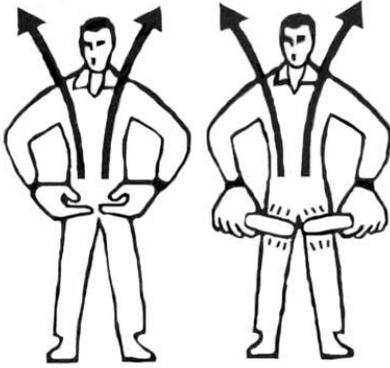
Fig. 12 **PERSONNEL APPROCH AIRCRAFT**

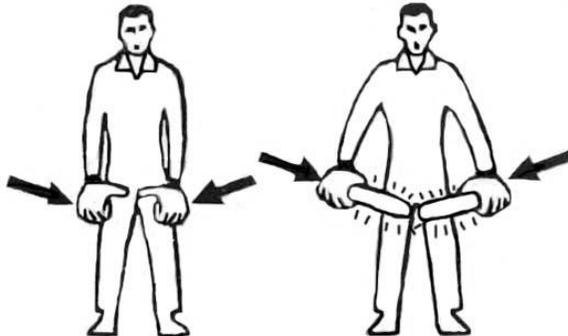
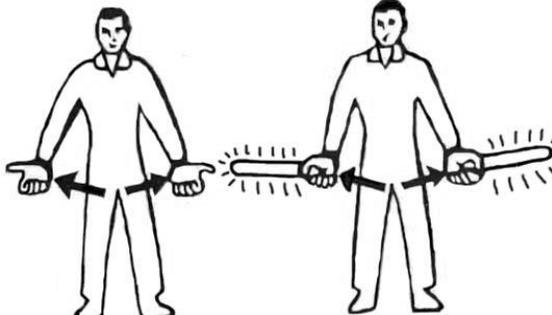
Left hand raised vertically overhead, palm towards aircraft. The other hand indicates to personnel concerned and gestures towards aircraft.



Fig. 13 **STOP**

Arms crossed above the head, palms facing forward. This is the FAA signal for emergency stop.

	<p>Fig. 14 <u>START ENGINES</u> Circular motion of right hand at head level with left arm pointing to engine. Number of fingers extended on left hand indicates engine to be started. Thumb of right hand extended to indicate prime.</p>
	<p>Fig. 15 <u>CUT ENGINES/ROTOR</u> Both arm and hand level with shoulder, hand moving across throat, palm downward.</p>
	<p>Fig. 16 <u>ABANDON AIRCRAFT</u> Simulate unfastening seat belt and shoulder straps and throwing them up and off.</p>
	<p>Fig. 17 <u>APU CONNECTED</u> Hands above head, left fist partially clenched, right hand moved in direction of left hand with first two fingers extended and inserted into the circle made by fingers of the left hand.</p>
	<p>Fig. 18 <u>APU DISCONNECTED</u> Hands above head, left fist partially clenched, right hand moved away from left hand, withdrawing first two fingers from circle made by fingers of the left hand.</p>

	<p>Fig. 19 <u>EXTERNAL STARTING AIR CONNECTED</u> Hands above head, left hand cupped, right fully clenched, right fist moved in direction of left hand and inserted into cup made by left hand.</p>
	<p>Fig. 20 <u>EXTERNAL STARTING AIR DISCONNECTED</u> Hands above head, left hand cupped, right fist moved away from left hand withdrawing fist from cup made by left hand.</p>
	<p>Fig. 21 <u>CHOCKS - INSERTED</u> Arms down, fists closed, thumbs extended inwards, swing arms from extended position inward.</p>
	<p>Fig. 22 <u>CHOCKS - REMOVED</u> Arms down, fists closed, thumbs extended outwards, swing arms outwards.</p>

	<p>Fig. 23 <u>LOWER WING FLAPS OR FLAPS ARE EXTENDED</u> Hands in front, palms together horizontally then opened from the wrist.</p>
	<p>Fig. 24 <u>RAISE WING FLAPS OR FLAPS ARE UP</u> Hands in front, horizontally, with palms open from the wrists, then closed.</p>
	<p>Fig. 25 <u>TAIL WHEEL/NOSE WHEEL LOCKED</u> Hands together overhead, palms open from the wrist in a vertical V, and then closed.</p>
	<p>Fig. 26 <u>TAIL WHEEL/NOSE WHEEL UNLOCKED</u> Hand overhead, palms together then opened from the wrists to form a vertical V.</p>
	<p>Fig. 27 <u>TILLER BAR/STEERING ARM IN PLACE</u> Hold nose with left hand, right hand moving horizontally at waist level.</p>

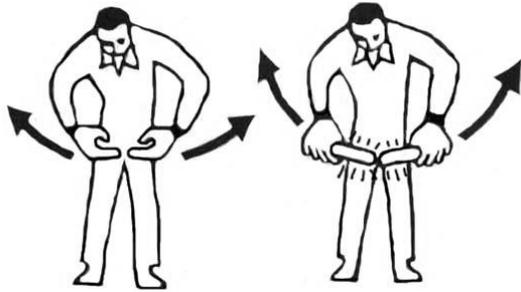


Fig. 28 **WEAPON BAY OPEN**
 Body bent forward at the waist, hands held with fingertips touching in front of body and elbow bent at approx. 45 degrees then arms swing downwards and outwards.



Fig. 29 **WEAPON BAY CLOSED**
 Body bent forward at the waist and arms extend horizontally, then arms swung downwards and in until fingertips touch in front of body and elbows bent at approx. 45 degrees.



Fig. 30 **AFFIRMATIVE (ALL CLEAR)**
 Hand raised and thumb up.



Fig. 31 **NEGATIVE (NOT CLEAR)**
 Arm held out and thumb down.

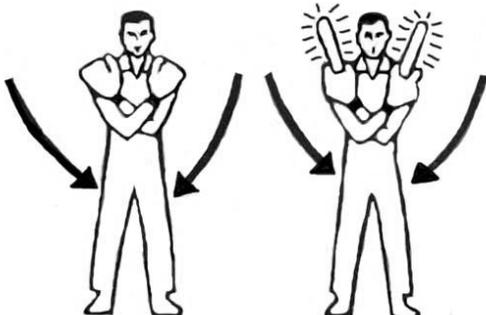


Fig. 32 **FOLD WINGS/HELO BLADES**
SWEEP WINGS BACK
 Arms straight out at sides, then swept forward and hugged around shoulders.

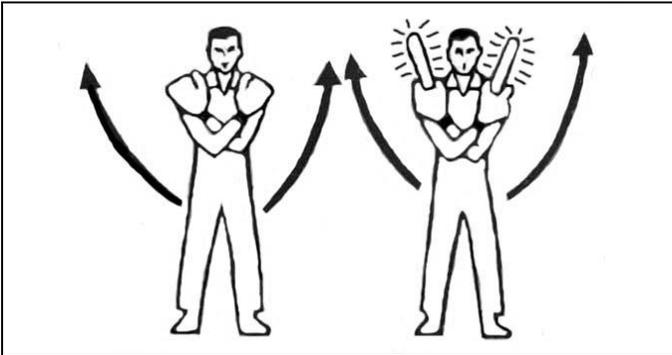


Fig. 33 **SPREAD WINGS/HELO BLADES SWEEP WINGS FORWARD**
 Arms hugged around shoulders, then swept straight out to the sides.

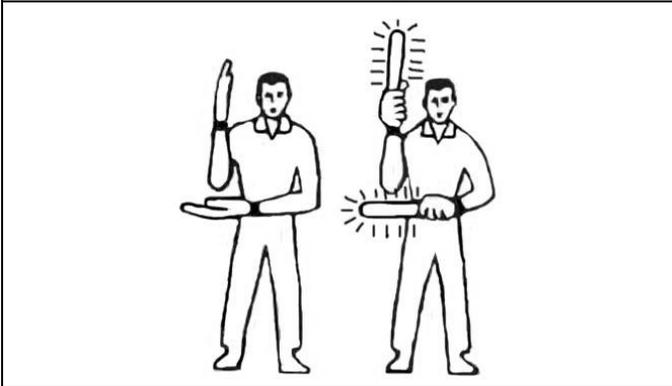


Fig. 34 **LOCK WINGS/HELO BLADES**
 Hit right elbow with palm of left hand.

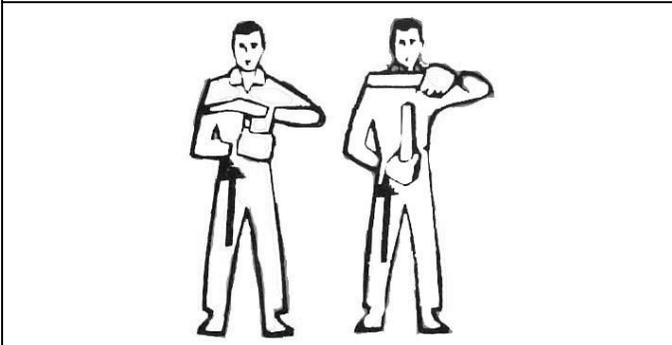


Fig. 35 **TAIL HOOK UP**
 Right fist, thumb extended upward raised to meet horizontal palm of left hand.

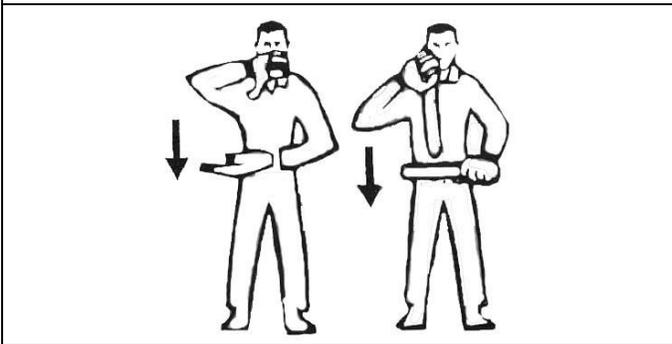


Fig. 36 **TAIL HOOK DOWN**
 Right fist, thumb extend downward lowered to meet horizontal palm of left hand.

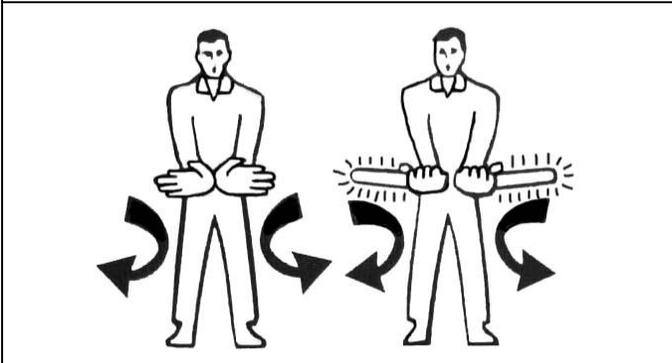


Fig. 37 **AIRSPEED BRAKES OPEN**
 Hands in front, palms together vertically, then opened from the wrists.

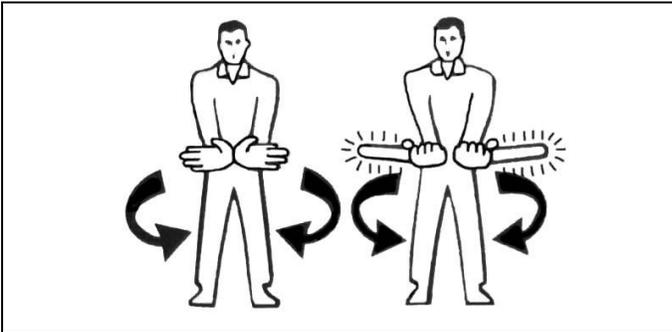


Fig. 38 **AIRSPEED BRAKES CLOSED**
 Hands in front, vertically with palms open from the wrists, then closed.

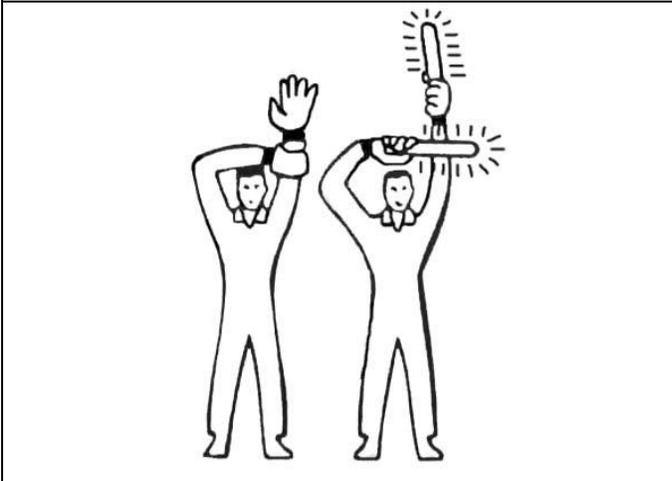


Fig. 39 **LANDING GEAR PINS INSTALLED**
 With arms above head, the right hand clasps left forearm.

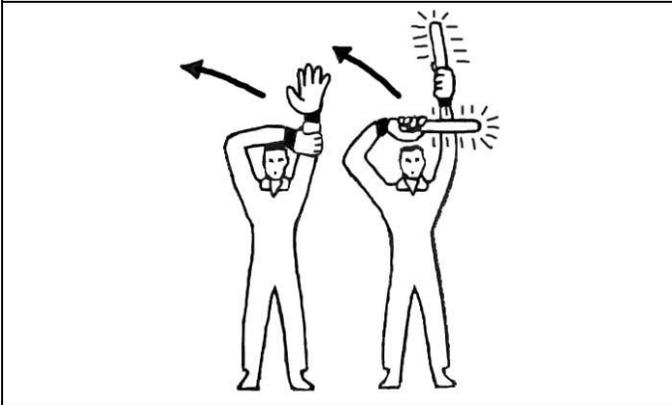


Fig. 40 **LANDING GEAR PINS REMOVED**
 With arms and hands in the “INSTALLED” position, the right hand unclasps left forearm.

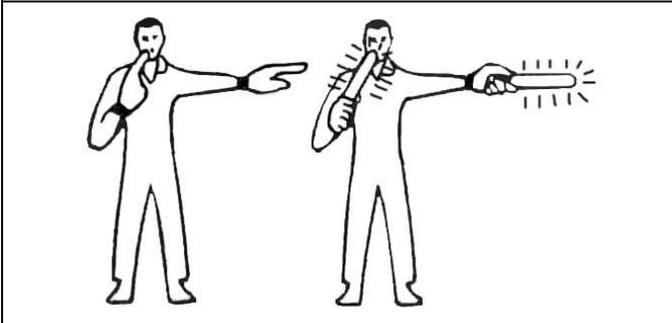


Fig. 41 **ENGAGE NOSE GEAR STEERING**
 Point to nose with the index finger while indicating direction of turn with the other index finger.

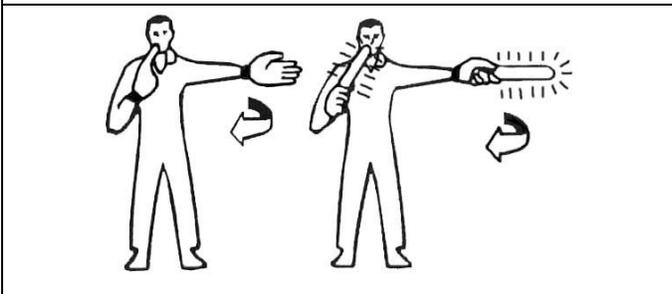
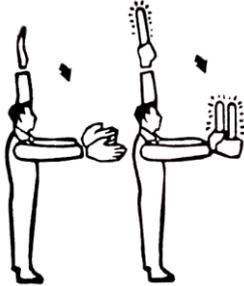
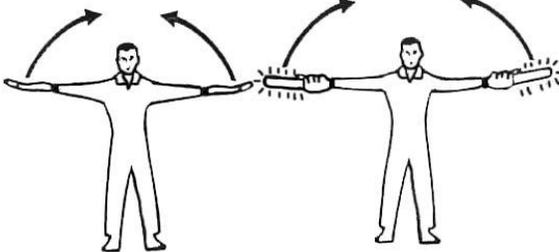
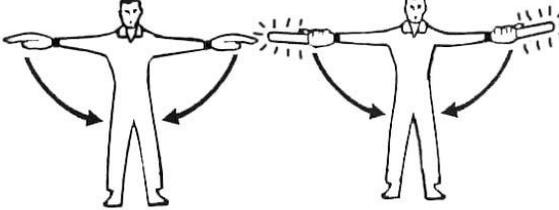
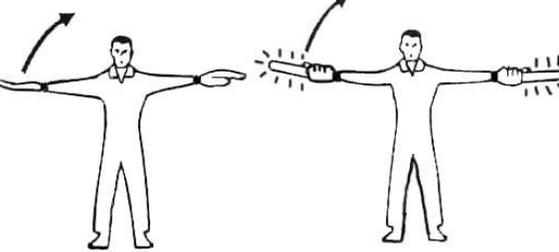
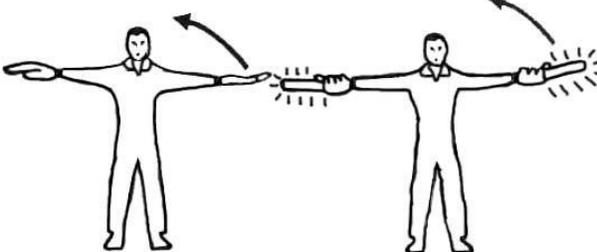
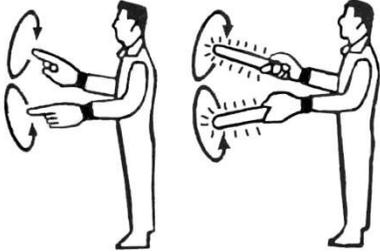


Fig. 42 **DISENGAGE NOSE GEAR STEERING**
 Point to nose with the index finger, lateral wave with open palm of other hand at shoulder height.

	<p>Fig. 43 <u>FIRE IN ENGINE OR APU</u> Make rapid horizontal figure-eight motion at waist level with either arm, pointing at source of fire with the other hand.</p>	
	<p>Fig. 44 <u>HOT BRAKES</u> Arms extended with forearm perpendicular to ground. Palms facing body.</p>	
	<p>Fig. 45 <u>HOT BRAKES LEFT SIDE</u> Arms extended with forearm perpendicular to ground. Gesture indicates left side.</p>	
	<p>Fig. 46 <u>HOT BRAKES RIGHT SIDE</u> Arms extended with forearm perpendicular to ground. Gesture indicates right side.</p>	
<p>Fig. 58 <u>NEED FUEL</u></p>	<p>Fig. 59 <u>LIGHTS ON</u></p>	

SIGNALS USED FOR HELICOPTERS

	<p>Fig. 47 <u>LANDING DIRECTION</u> Marshaller turns and faces toward point where aircraft is to land, the arms are lowered repeatedly from a vertical position to a horizontal position, stopping finally in the horizontal position.</p>
	<p>Fig. 48 <u>VERTICAL MOVEMENT UPWARD</u> Arms extended horizontally sideways beckoning upwards, with palms turned up. Speed of movement indicates rate of ascent.</p>
	<p>Fig. 49 <u>VERTICAL MOVEMENT DOWNWARD</u> Arms extended horizontally sideways beckoning downwards, with palms turned down. Speed of movement indicates rate of descent.</p>
	<p>Fig. 50 <u>VERTICAL MOVEMENT TO THE RIGHT</u> Left arm extended horizontally sideways in direction of movement and other arm swung over the head in same direction, in a repeating movement.</p>
	<p>Fig. 51 <u>VERTICAL MOVEMENT TO THE LEFT</u> Right arm extended horizontally sideways in direction of movement and other arm swung over the head in same direction, in a repeating movement.</p>
	<p>Fig. 52 <u>LOWER WHEELS</u> When helo approaches with landing gear retracted, marshaller gives signal by side view of a cranking circular motion of the hands.</p>

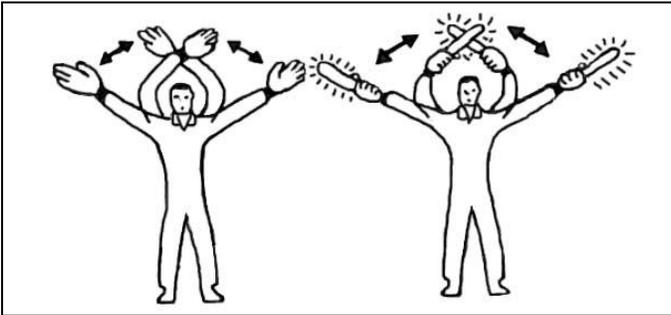


Fig. 53 **WAVE OFF**
Waving of arms over the head.

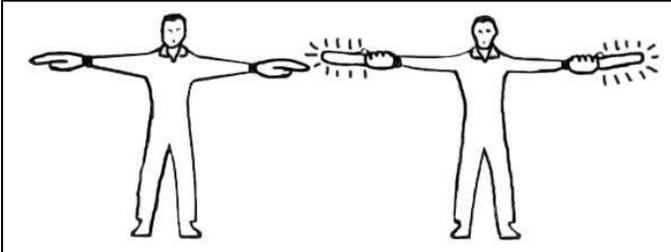


Fig. 54 **HOVER**
Arms extended horizontally, palms downward.

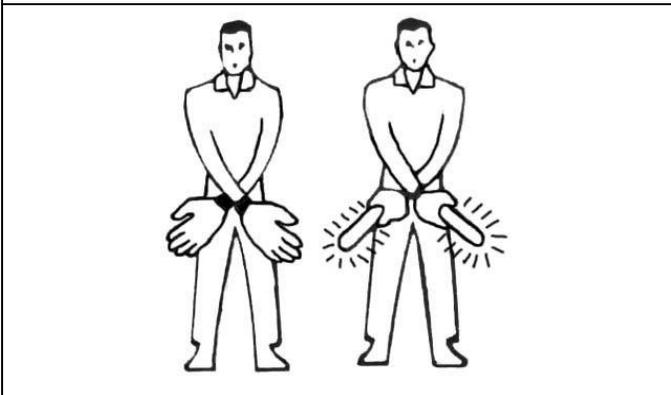


Fig. 55 **LAND**
Arms crossed and extended downwards in front of the body.

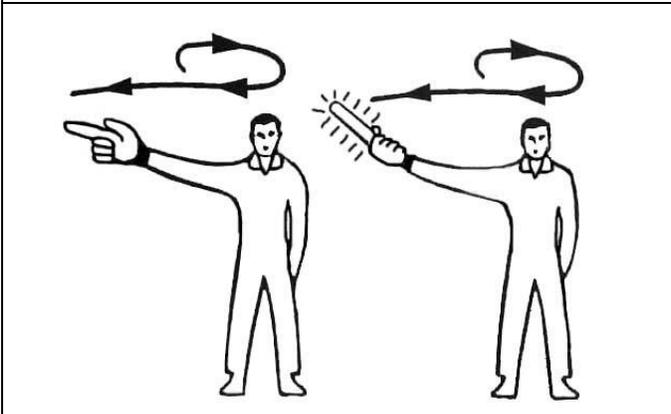


Fig. 56 **TAKE OFF THIS WAY (at pilot's discretion)**
Marshaller conceals left hand and makes circular motion of right hand over head in horizontal plane ending in a throwing motion of arm towards direction of take off.

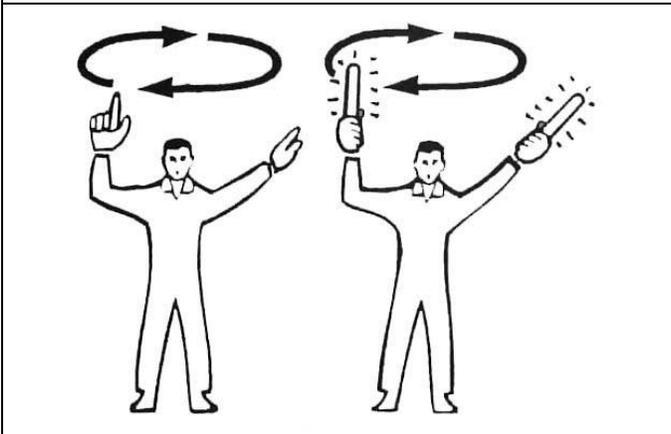
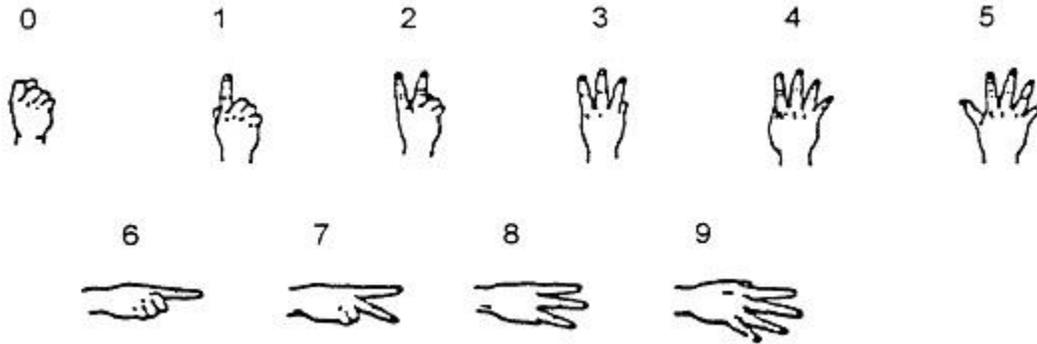


Fig. 57 **ENGAGE ROTOR(S)**
Circular motion in horizontal plane with right hand above head.

Hand Signals



IX. Ground Vehicle Operations

This guide provides a general overview of safe procedures for driving on an airport. It is not intended to cover specific conditions at all airports. (Provided by FAA)

1. Airport Basics

The following information explains the basic features of any airport. There may be important unique aspects to the airports on which you drive, such as dedicated vehicle lanes, areas not visible to controllers, or nonstandard traffic patterns. Be aware and know the rules of the airport.

Runways (see item A in the Appendix)

Runways have specific markings on them that are white. They will have numbers on each end and stripes down the middle with white lines on the edges. Runways that are served by an instrument approach will have more elaborate markings such as those shown in the figure. The most important thing to remember about a runway is that it is meant for aircraft use, so never drive your vehicle on it unless you are authorized to do so.

Taxiways (see item A in the Appendix)

Taxiways are areas used by the aircraft to get to and from the ramp and the runway. Taxiways look similar to runways, but are usually not as wide and they do not have the same kinds of markings. Taxiway markings are yellow and use letters instead of numbers. Like runways, taxiways are meant for aircraft use. Authorization is normally required before you operate a vehicle on a taxiway. Most aircraft cockpit windows are designed for pilots to see other aircraft. It can be difficult or impossible for the flight crew of larger aircraft to see vehicles, particularly behind wings or under the nose of the aircraft. Aircraft have the right of way so you will need to move off the taxiway and stop outside the wingtip. You may proceed after the aircraft passes.

Aprons or Ramps

Aprons or ramps are the areas where aircraft park, load, and unload. Watch out for aircraft that are moving and unless you are the follow me vehicle or helping to clear the ramp then you will yield the right-of-way. Don't assume the pilot can see you. They may be busy with other things like radio communications, checklist items, or watching the follow-me vehicle or the marshallsers.

Signs

The color and sizes of signs are important. If the sign has white numbers on a red background, it is a runway holding position sign. These signs are important because they mean you are on the edge of the protected area around a runway and must have permission to proceed.

A yellow sign with black letters is a guidance sign. A black sign with yellow letters is a location sign. The taxiway at your airport may have these signs next to them. Examples are CARGO or TERM with an arrow to identify the parking area and direction to find that area.

A taxiway sign with yellow letters and a black background will tell you which taxiway you are on and helps you determine your location. Some airports have these signs painted on the taxiways. Other airports have geographic position markings to use in determining a point on a taxiway. Not all airports have implemented location signs and geographic position markings.

Lights

Runways are edged with white lights and taxiways have blue lights. Just be careful if you must leave the taxiway as these will be very low and might be out of your line of sight.

Markings

Runways are painted white while taxiways are painted yellow. The center of the taxiway has a solid yellow stripe. The sides may have one or two solid stripes along the edge. Again, not all airports have these markings. As a taxiway comes up to the edge of the runway, you may see a "hold short" line. It is two solid yellow stripes followed by two broken yellow strips. Along the side of the taxiway next to the hold line, there may be a runway holding position sign. This would be a red and white with the runway number. ILS hold markings are a solid horizontal stripe with pairs of vertical solid lines topped by another horizontal solid stripe. ILS hold markings advise pilots and vehicle operators where to stop to avoid interfering with aircraft navigational signals. At tower-controlled airports, a clearance is required to pass either of these markings and enter or cross the runway. Be certain to cross the markers on the other side before stopping your vehicle.

Some airports have designated helicopter-landing areas. This is depicted with an “H” inside of a square. Be especially careful when you drive near these and be sure to look up for landing helicopters.

Ramps may have a solid yellow line to indicate the way to exit the ramp to the taxiways.

2. Controlled Airport

If your airport has an air traffic control tower, it is called a “controlled” airport whenever the tower is operating. Aircraft on the ground and vehicles must get permission from the controller to be on the runway or taxiways. These areas are called movement areas. As an operator of a vehicle, you must get the controller’s permission before you go onto a runway or taxiway, their associated safety areas, or any other part of the movement area. There are at least two ways to get permission, by radio or advanced coordination with ATC. Check your airport diagram and be sure of the location of the movement areas.

Radio Communications Procedures

1. Use a transceiver with the airports ground frequency on it. Each vehicle should have a call sign identifying the vehicle. (i.e. Orange 1, Orange 2, etc.)
2. Know the proper phraseology and never use Citizen’s Band (CB) lingo or law enforcement “Ten” codes.
3. Think about what you are going to say before calling the controller.
4. Use the proper sequence in calling the controller.
 - a) say who you are calling and who you are. (Ground, Orange 1)
 - b) wait for the controller to respond. Sometimes it may take awhile if they are busy. When the controller responds, state where you are and where you want to go. (Orange 1 is on CAF ramp and would like to proceed to the general aviation ramp (heavies)).
 - c) The controller will either approve or deny your request, or issue special instructions. Acknowledge that you have heard the controller. The section titled “Aviation Phraseology” lists ground control phrases and definitions. You should know what they mean before going onto any taxiway or runway. **Note: Use extreme caution when you hear the phrase “go ahead”. Controllers use this to mean “state your request” not to proceed to where you want to go.**

Communications are not difficult with a little practice. If you are ever unsure what the controller said, or if you don’t understand an instruction, **ASK THE CONTROLLER TO REPEAT IT WITH “SAY AGAIN”**. A controller, even one who is busy would rather repeat and explain something than have a misunderstanding lead to an accident or runway incursion. Don’t precede thinking that the instructions will become clear once you go a little further.

3. Non-towered Airports

When the tower is closed or if there is no tower, the airport is called non-towered. At a non-towered airport you don't have to get a controller's permission before going onto a taxiway or runway. You should, however, always carry a radio tuned to the airport's common traffic advisory frequency (CTAF) usually called UNICOM. When you get near the taxiway or runway, **SLOW DOWN** or **STOP**. Look both ways, and then look up for aircraft that may be in the pattern. Always yield the right-of-way to taxiing aircraft and give them plenty of room. If an aircraft is on the same taxiway as you and headed your way, move out of the aircraft's way. Be careful not to hit taxiway lights. If an aircraft is about to land or takeoff on a runway you need to cross, stop and yield to the aircraft until it has taken off or landed and taxied clear of the runway. Then proceed. Sometimes the runway gradient makes it impossible to see the entire length of the runway and an aircraft can suddenly appear when you are crossing. It is best to cross runways at the end.

Extra vigilance is essential at non-towered airports. Aircraft do not have to communicate or announce their position in the pattern or on the surface. Some aircraft may not have radios. You can be lulled into complacency at non-towered airports because they aren't usually busy. If you are used to not seeing any other traffic, don't expect this to always be the case. If your vehicle has a rotating beacon, be sure to turn it on anytime you are on the airport surface. If you do not have a beacon then use your emergency flashers.

4. Aviation Phraseology

Definitions

Acknowledge – Let me know you have received and understand this message.

Advise intentions – Tell me what you plan to do.

Affirmative – Yes

Confirm – My version is .. is that correct?

Correction – An error has been made in the transmission and the correct version follows.

Go ahead – State your request.

Hold – Stop where you are.

Hold short of .. – Proceed to, but hold short of a specified point.

Negative – No, permission not granted, or that is not correct.

Proceed – You can begin or continue moving.

Read back – Repeat my message back to me.

Roger – I have received all of your last transmission. (It should not be used to answer a yes or no question)

Say again – Repeat what you just said.

Standby – Wait.. I will get back to you.

Unable – I can't do that.

Verify – Request confirmation of information.

Wilco – I have received your message, understand it, and will comply.

Aviation Alphabet

<u>A</u> lpha	<u>B</u> ravo	<u>C</u> harlie	<u>D</u> elta	<u>E</u> cho	<u>F</u> oxtrot
<u>G</u> olf	<u>H</u> otel	<u>I</u> ndia	<u>J</u> uliet	<u>K</u> ilo	<u>L</u> ima
<u>M</u> ike	<u>N</u> ovember	<u>O</u> scar	<u>P</u> apa	<u>Q</u> uebec	<u>R</u> omeo
<u>S</u> ierra	<u>T</u> ango	<u>U</u> niform	<u>V</u> ictor	<u>W</u> hiskey	<u>X</u> -ray
<u>Y</u> ankee	<u>Z</u> ulu				

Light Signals

Air traffic controllers have a backup system for communicating if their radios fail. They have a light gun with different colors to let you know what to do. If you are ever working on a runway, taxiway or ramp and your radio quits, you should turn your vehicle towards the tower, start flashing your headlights and the controller will signal you with the light gun.

This may take some time if the controller's attention is directed towards another part of the airport. **BE PATIENT!** Even a failed radio is not an excuse for proceeding without a proper clearance.

Light signals and their meaning:

Steady green – OK to cross runway or taxiway, proceed or go.

Steady red – Stop

Flashing red – Clear runway or taxiway.

Flashing white – Return to starting point.

Alternating red & green – General warning signal. Use extreme caution. This can be followed by another signal as circumstances permit.

X. Aircraft Ground Handling

This guide provides information and guidance for the handling of aircraft on the ground. The aviation industry has found through experience that firm safety practices deter accidents. This guide contains generally accepted information and safety practices, which may help, prevent injuries to personnel and damage to aircraft. (FAA Document AFS-340)

Direct movement of aircraft. The person directing an aircraft that is being taxied should be far enough ahead and to the pilots left so that the pilot has an unobstructed view of him.

- a. Use standard hand signals as applicable.
- b. When directing aircraft during darkness or inclement weather the marshaller should use illuminated or reflective wands.
- c. Movement of aircraft in congested areas should be avoided. However, when necessary, additional marshallsers or security should be stationed near the aircraft wing-tips to ensure that adequate clearance is maintained.

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 and the aircraft tied down.

Visual check of aircraft. If it is possible you should make it a habit of visually inspecting the aircraft before the crew boards or leaves the aircraft. Advise them of any unsafe condition that may have been observed. This procedure may prevent unwarranted delays of the next departure. Examples of conditions observed: low or flat tires, cracked windows, 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 around warm engines.

Tie-down aircraft. 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.

Towing of aircraft. Persons performing towing operations should be thoroughly familiar with the procedures that apply to the type of aircraft being 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 guide men or marshalls 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.
- c. The man operating the tow vehicle should assure that the nose wheel or tail wheel lock is disengaged where applicable. He should also make certain that the nose wheel swiveling limits are not exceeded during the towing operation.
- d. The aircraft engines should not be operated during towing operations.
- e. The tow vehicle operator should avoid sudden starts and stops Aircraft brakes should be applied only in an emergency, on command from the tow vehicle operator or his clearance man.

- f. 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 taxiways or runways.

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.

Aircraft fueling. The FAA requires a **50 foot** minimum distance between the aircraft and other personnel. Only essential crew members and the fueling crew should be near the aircraft.

XI. FAA Airshow and Flying Event Safety Requirements

At air shows and flying events, the U.S. Department of Transportation (DOT) Federal Aviation Administration (FAA) National Policy N 8900-488 Appendix A is our governing guidelines for spectator distance separation requirements. This guideline spells out the distances we must maintain from air show operations with running engines and spectators or non-essential personnel. We have two situations we deal with on the ramp. The first situation is to have an open ramp where spectators are touring the aircraft and is in amongst the aircraft. The second situation is a closed, “Sterile” or “Hot” ramp where only essential personnel are allowed in during flying operations. Per N 8900-488, any type of operations that have running engines must have a distance separation from spectators or non-essential personnel. These distances are:

- a. with a guarded rope/fence line or barrier, a minimum of **50 feet** is required to the nearest running engine.
- b. without a guarded rope/fence line or barrier, a minimum of **100 feet** is required to the nearest running engine.
- c. for helicopter operations, whether there is a rope/fence or barrier or not, a minimum of **200 feet** must be maintained to the spinning rotor blades.
- d. for aircraft refueling operation, a minimum of **50 feet** is required.