NAVAL AIR TRAINING COMMAND

NAS CORPUS CHRISTI, TEXAS **CNATRA P-816 (01-14)**

FLIGHT TRAINING INSTRUCTION

CV PROCEDURES (UMFO) T–45C

2014

DEPARTMENT OF THE NAVY
CHIEF OF NAVAL AIR TRAINING
250 LEXINGTON BLVD SUITE 102
CORPUS CHRISTI TX 78419-5041

CNATRA P-816
N712
28 Jan 14

CNATRA P-816 (Rev. 01-14)

Subj: FLIGHT TRAINING INSTRUCTION, CV PROCEDURES (UMFO), T-45C

1. CNATRA P-816 (Rev. 01-14) PAT, "FLIGHT TRAINING INSTRUCTION CV PROCEDURES (UMFO), T-45C" is issued for information, standardization of instruction, and guidance for all flight instructors and student aviators within the naval air training command.

2. This publication shall be used as a explanatory aid to support the T-45 Advanced Strike Fighter UMFO Curriculum. It will be the authority for the execution of all flight procedures and maneuvers herein contained.

3. Recommendations for changes shall be submitted via CNATRA TCR form 1550/19 in accordance with CNATRAINST 1550.6E.

4. CNATRA P-816 (Rev. 06-97) PAT is hereby cancelled and superseded.

M. B. TATSCH
By direction

Distribution:
CNATRA Website

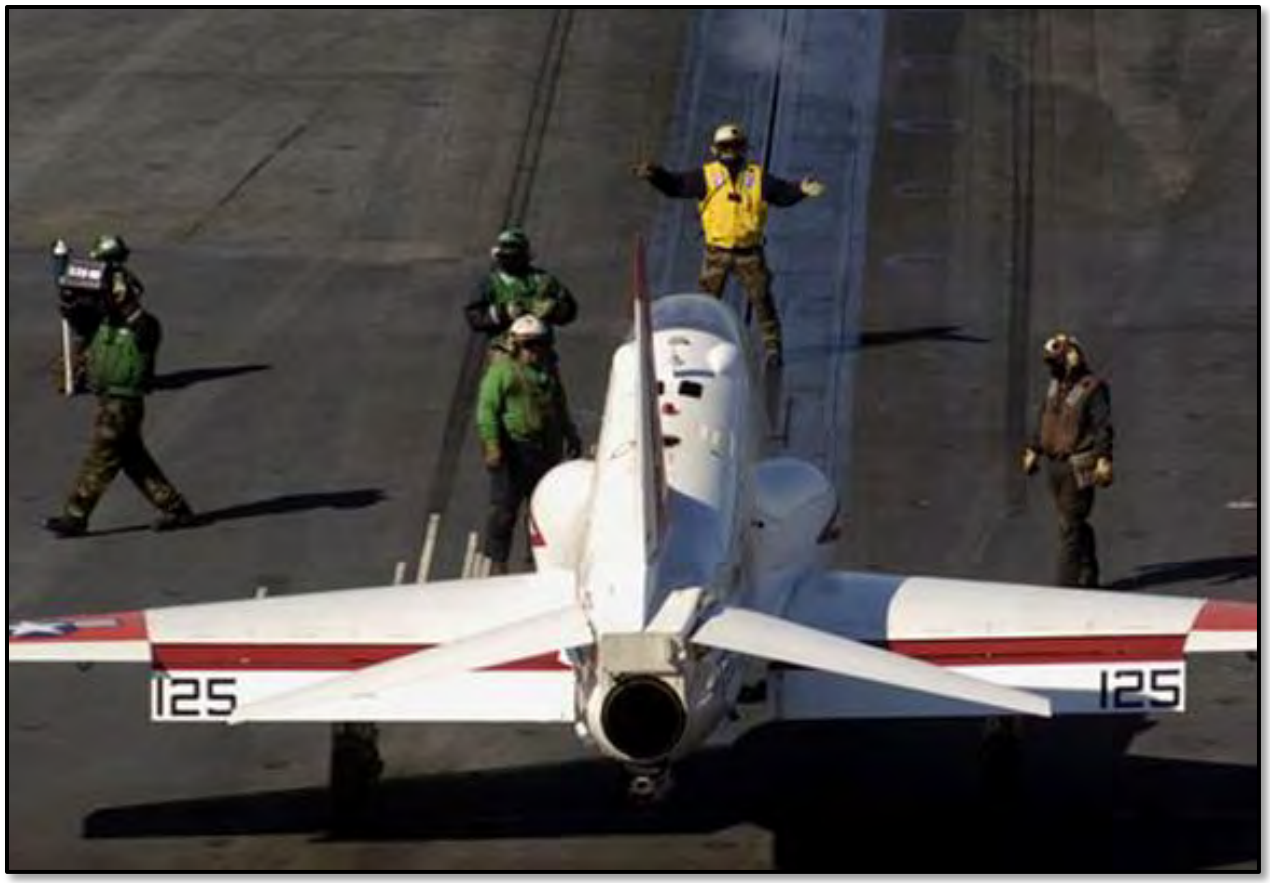
FLIGHT TRAINING INSTRUCTION

FOR

CV PROCEDURES (UMFO)

T-45C

P-816



LIST OF EFFECTIVE PAGES

Dates of issue for original and changed pages are:

Original…0…19 Jun 97
Revision…1…28 Jan 14

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 82 CONSISTING OF THE FOLLOWING:

Page No.	**Change No.**	**Page No.**	**Change No.**
COVER	0	B-12 (blank)	0
LETTER	0	C-1 – C-4	0
iii-vii	0		
viii (blank)	0		
1-1 – 1-16	0		
2-1 – 2-36	0		
A-1 – A-6	0		
B-1 – B-11	0		

INTERIM CHANGE SUMMARY

The following Changes have been previously incorporated in this manual:

CHANGE NUMBER	REMARKS/PURPOSE

The following interim Changes have been incorporated in this Change/Revision:

INTERIM CHANGE NUMBER	REMARKS/PURPOSE	ENTERED BY	DATE

TABLE OF CONTENTS

TABLE OF FIGURES

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER ONE
AIRCRAFT CARRIER OPERATIONS

100. INTRODUCTION

The aircraft carrier (CVN) plays a critical role in the maritime strategy of the United States. Together with a full complement of support and combat warships, the carrier is the centerpiece of the Carrier Strike Group (CSG). The speed and flexibility of the aircraft carrier and its support group provide our nation with the ability to rapidly respond to world hot spots. As sovereign U.S. territory, the aircraft carrier is rapidly deployable and can swiftly bring to bear the entire might of the Carrier Air Wing (CVW), projecting U.S. military power hundreds of miles from the Strike Group. This extremely formidable, yet highly flexible naval force can operate with equal success in confined waters or on the open ocean. This unprecedented force provides the Joint Commander with the operational flexibility and war-fighting capability to meet all Fleet Response Plan (FRP) commitments and presence requirements in support of national strategies.

The six core capabilities essential to our maritime strategy are: ***forward presence, power projection, deterrence, maritime security, humanitarian assistance/disaster response, and sea control***. The flexibility and scalability of the CSG provide the means to support any one of these missions. It is capable of selectively controlling the seas, projecting power ashore, and protecting friendly forces and civilian populations from attack. Power projection can be viewed as the threat or actual use of military force against an adversary to either induce or dissuade it from pursuing a given policy or objective. The expeditionary character and versatility of this maritime force provide the U.S. the asymmetric advantage of enlarging or contracting its military footprint in areas where access is denied or restricted, while still maintaining the six core capabilities. The speed, precision and lethality of the CSG ensure the Nation's primary forcible entry option and provide the means to respond quickly to other crises.

A typical CSG is comprised of an aircraft carrier, at least one cruiser, a destroyer squadron of at least two destroyers and/or frigates, and a carrier air wing of approximately 70 rotary and fixed wing aircraft; additionally, a CSG may also include fast attack submarines, attached logistics ships and a supply ship. The principal role of the carrier and its air wing within the CSG is to provide the primary offensive firepower, while the other ships in the strike group provide defense and support. The aircraft carrier is a sea-going airbase capable of sustaining round-the-clock flight operations in all weather conditions. As the capital ship in the CSG, the carrier is the centerpiece of U.S. power projection. It provides the nation the ability to project air power worldwide without the need for land bases.

Referred to as the "edge of the envelope," carrier flight operations involve the most extreme working conditions in a highly dynamic environment. The extremes of operations at sea as opposed to ashore include sustained high operations tempo (Op Tempo), reduced choice for airfield selection and suitable diverts, and statistically a more complex and hazardous environment. Safety and teamwork are essential elements contributing to mishap free and successful carrier operations. A thorough understanding of the procedures and practices is necessary for success when flying and operating in, on, and around the "boat."

101. CARRIER ORGANIZATION

The mission of an aircraft carrier (CVN) is to support the aircraft that conduct attack, early warning, surveillance, and electronic missions against the full spectrum of targets in support of joint and coalition forces. In order to accomplish this daunting task, the roughly 5,000 (4,660-5,680) personnel on the carrier must work as a team. Personnel can be broken down into two distinct classifications: Air Wing personnel and ship's company. The success of the carrier and the strike group is directly impacted by the effectiveness of the close working relationship between these groups.

1. Air Wing Personnel

The Carrier Air Wing (CVW) is comprised of seven to eight squadrons, numbering approximately 70 rotary and fixed wing aircraft and 2,500 personnel. The typical Air Wing is comprised of:

a. 4 VFA (Hornet/Rhino) squadrons

b. 1 VAQ (Growler/Prowler) squadron

c. 1 VAW (Hawkeye) squadron

d. 1-2 HSC/HSM (Helicopter) squadrons

e. 1 VRC (Greyhound) Logistic Support detachment

Air Wing Commander. The Air Wing Commander is called CAG. CAG has overall responsibility for all aircraft and Air Wing personnel embarked on the carrier. The CAG's executive officer (XO) is the Deputy CAG (DCAG).

Landing Signal Officers. Landing Signal Officers (LSOs) or "paddles" are qualified pilots within the Air Wing that are responsible for the safe and expeditious recovery of fixed-wing aircraft aboard the ship. The LSOs also have the ultimate responsibility for the training of pilots in carrier landing techniques by conducting ground training, counseling, and debriefing individual pilots on their performance. LSOs use radio calls to effect the safe recovery of aircraft. LSO phraseology is categorized into three types of calls: INFORMATIVE, ADVISORY, and IMPERATIVE.

Generally, each squadron will have two or more LSOs that are responsible for the training and evaluation of their squadron pilots. Squadron LSOs are assigned to different teams and report to the CAG LSO regarding pilot landing currency and performance. Each LSO team will be responsible for manning the LSO platform for a 24-hour period during flight operations. Following each recovery, the LSOs will make rounds to all the ready rooms and debrief the pilots who have just landed.

2. Ship's Company

The ship's company is comprised of approximately 3,200 personnel who work directly for the Commanding Officer (CO) of the carrier. These personnel are not assigned to any squadron or the air wing. The senior leadership positions on the carrier are filled by aviators who have undergone rigorous additional training. These include:

a. Commanding Officer (CO)
b. Executive Officer (BIG XO)
c. Navigator (GATOR)
d. Operations Officer (OPSO)
e. Air Operations Officer
f. Strike Operations Officer
g. CDC Officer
h. Air Officer (Air Boss)
i. Assistant Air Officer (Mini Boss)
j. Catapult Officers (Shooters)
k. Aircraft Handling Officer (Handler)

Operations Department. The OPSO is responsible for the control of airborne aircraft except when control is not incidental with actual launch or recovery of aircraft. The OPSO works closely with the Strike Group Commander to plan and coordinate Strike Group operations.

Air Operations. Air Ops is responsible to the OPSO for coordination of all matters pertaining to flight operations, the proper functioning of the Carrier Air Traffic Control Center (CATCC) and shall determine the type of approach and required degree of control. In addition to controlling aircraft at night and in marginal weather conditions, Air Ops coordinates and tracks diverting aircraft, as well as all cargo and passenger transfers.

Carrier Air Traffic Control Center. The Carrier Air Traffic Control Center (CATCC) is the work center directly under Air Operations that is responsible for current flight operations. It performs the same functions as a land-based air traffic control center. CATCC responsibilities include:

a. Tracking the status of all carrier flight operations.

b. Control of all airborne aircraft within the Carrier Control Area (CCA) not under the control of the tower (Boss). The CCA includes all airspace within 50 NM of the carrier.

c. Providing Departure and Approach radar control of aircraft at night and in IMC.

Strike Operations. The department within Ops responsible for future operations is Strike Ops. Strike Ops is responsible for coordinating the Air Tasking Order (ATO) and producing and distributing the Air Plan.

Combat Direction Center. The Combat Direction Center's (CDC) primary responsibility is ship self-defense. Fire controls for all the ship's self-defense weapons (missiles and Close-in Weapon System [CIWS]) are located in CDC. CDC is located next to Air Ops and CATCC; this facilitates close coordination and de-confliction of airborne assets. The CDC Officer is responsible for the defense of the carrier and is charged with mission control of assigned aircraft. CDC will also provide specific information regarding special operations, including Air-to-Surface weapon drops and Air-to-Air missile shoots.

Air Boss/Air Officer. From Primary Flight Control (Pri-Fly), the Air Boss directs all aircraft activity on the flight deck, as well as aircraft operating in the Carrier Control Zone (CCZ). The CCZ is that airspace within 5 NM of the carrier extending from the surface to 2,500 feet. The Air Boss also determines the Case launch/recovery.

Primary Flight Control. Primary Flight Control (Pri-Fly) serves the same function as an air traffic control tower at a traditional airport, tracking the progress of the launch and recovery. It is located six stories above the flight deck, directly over the main bridge, and is manned by crewmembers that work directly for the Air Boss. A squadron representative (Squadron Rep or "Tower Flower") is required to be present in Pri-Fly during all VFR operations. The role of the Tower Flower is to offer assistance during an aircraft emergency. If needed, the Tower Flower can coordinate with the ready room, communicate directly with the airborne aircrew, answer platform/squadron specific questions for the Boss, and relay feedback from the Boss to the ready room. During night and IMC operations, the squadron representative will be located in Air Ops.

Flight Deck Control (FDC). Flight deck control is located on the flight deck at the base of the island. This is where the Handler and his crew track the status of all aircraft on the flight deck and in the hangar bay. The primary tool used to accomplish this task is the "Ouija board," which is a two-level transparent plastic table with etched outlines of the flight deck and hangar bay. The Ouija board is outfitted with scale aircraft models representing each aircraft on board. When an aircraft moves from one place to another, the model is moved accordingly. If an aircraft is down for maintenance, the model is turned over indicating it is out of service. FDC coordinates all aircraft movement on the flight deck, and is where aircraft weight chits are turned into by aircrew prior to preflight/launch.

Flight Deck Personnel. Because the flight deck is such a busy environment, it is imperative that you be able to recognize the deck personnel and their functions. All personnel on the flight deck wear colored jerseys that indicate their role. Figure 1-1 summarizes the different jersey colors and the personnel that wear them.

Yellow	• Plane Directors (Taxi Directors) • Flight Deck Officers • Arresting Gear Officers	• Catapult Officers (Shooters) • Catapult spotters • Aircraft handling Officers
Green	• Air Wing Maintenance personnel • Catapult and Arresting gear crews • Helicopter Landing Signal Enlisted (LSE)	• Cargo-handling personnel • Ground support equipment troubleshooters • Hook runners • Photographers mates
Brown	• Air Wing plane captains	• Air Wing line Petty Officers
Blue	• Aircraft handlers (pushers, chockers, chainers, etc.) • Tractor Drivers	• Messengers and Phone Talkers • Elevator Operators
Purple	• Fueling personnel	
White	• Safety personnel • Medical personnel • LSOs	• Final checkers • Quality Assurance personnel • Air Transfer Officer (ATO)
Red	• Ordnance crews • Crash and salvage crews	• Explosive Ordnance Disposal (EOD)

Figure 1-1 Flight Deck Jersey Chart

NOTE

Flight Deck Officers, Chief Warrant Officers and Chief Petty Officers are the only personnel on the deck that will be wearing "khaki" pants.

The catapult and arresting gear officers also wear orange and green reflective tape on their cranials. Additionally, personnel wearing yellow jerseys (i.e., the "Yellow Shirts") are the only persons authorized to control the movement of the aircraft on the flight deck.

102. CARRIER EQUIPMENT

Because the flight deck is an extremely busy and hazardous environment, it is imperative that you have a working understanding of the basic layout. The general layout of the carrier and flight deck is depicted in Figure 1-2 and 1-3.

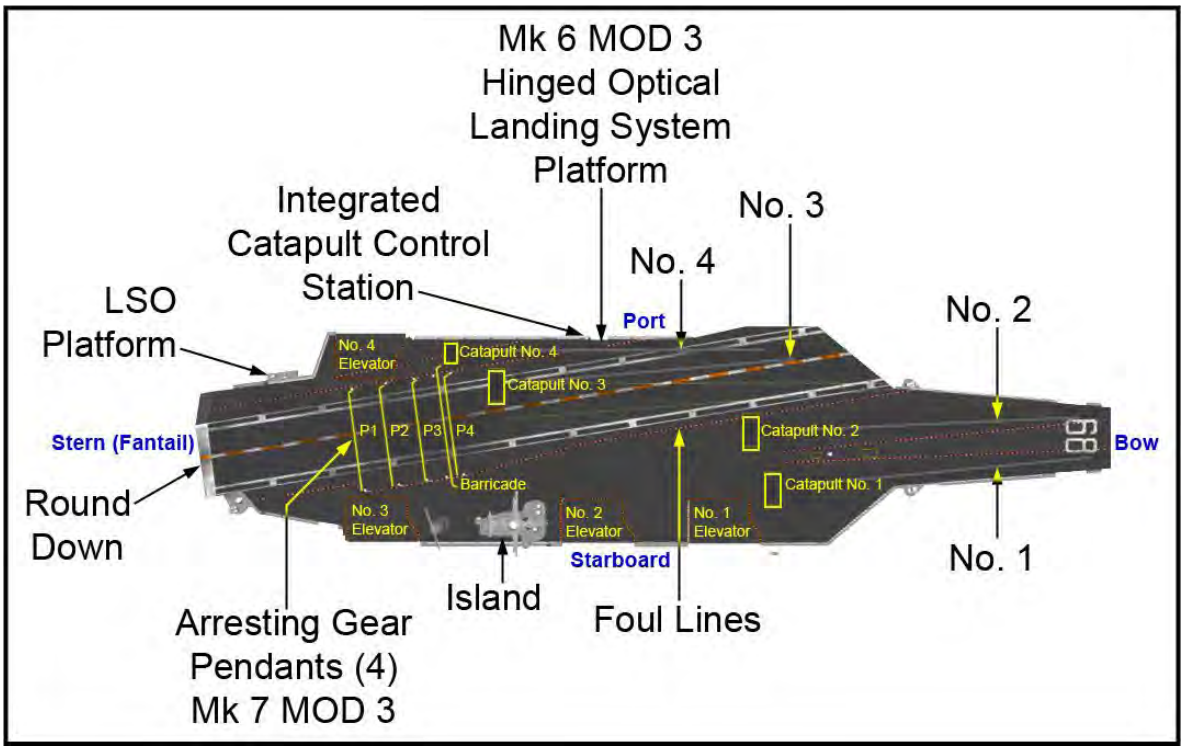


Figure 1-2 Basic Carrier Layout

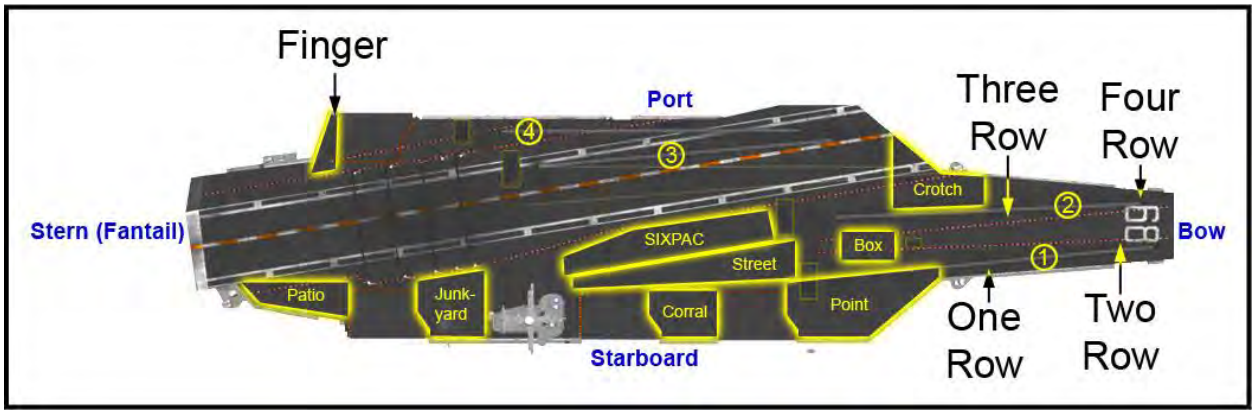


Figure 1-3 Flight Deck Layout

1. Flight Deck Equipment

Arresting Gear. The arresting gear is the heart of carrier operations. This mechanical system allows an aircraft travelling at 150 kts to stop in only 320 feet. Three (or four) steel arresting gear cables span the carrier landing area at 20-foot intervals. The Mk 7 Mod 3 arresting gear system that equips all U.S. carriers is composed of the cross deck pendants, the purchase cables and the arresting engine.

The cross deck pendants, also known as arresting cables or wires, are flexible steel stranded cables that span the landing area in 40-foot intervals. NIMITZ class carriers, with the exception of the ***USS RONALD REAGAN*** and the ***USS GEORGE H.W. BUSH***, are equipped with four arresting cables. These arresting cables are numbered one through four from aft to forward, the aft most cable being the dreaded one wire (or "Ace"). Aircraft engaging the three wire generally indicates a well-executed approach. The ***USS RONALD REAGAN*** and the ***USS GEORGE H.W. BUSH,*** as well as all GERALD R. FORD class carriers, have only three cross deck pendants. Wire supports elevate the deck pendants several inches so the tailhook can engage them. Each cross deck pendant is removed and replaced after one-hundred arrested landings.

Connected to each end of the cross deck pendants are terminal couplings that attach the pendants to the purchase cables. The purchase cables run below decks to the arresting engines. During an arrestment, the purchase cables "pay out" as the wire is engaged and transmit the kinetic energy to the arresting engines. The arresting engines are hydro-pneumatic systems that use a ram and fluid within a cylinder to absorb and disperse the energy of the arrestment.

During a normal approach and landing, the pilot will advance the power to Military Rated Thrust (MRT) on touchdown except E-2 and C-2, who maintain approach power upon landing. In the event the tailhook does not engage a cable, the aircraft can quickly become airborne. If the arrestment is successful, the pilot will reduce power to idle when the aircraft is fully stopped, and expeditiously clear the landing area via taxi director signals. The optimal interval between landing aircraft is 40-60 seconds. The main landing interval limiting factor is the fastest a flight deck crew can get an aircraft cleared of the landing area and the arresting gear reset. This takes approximately 35 seconds.

Barricade. The barricade is an emergency recovery system that is used only when a normal arrestment cannot be made. Physically located between the three and four wires, the barricade is normally in a stowed condition and rigged only when required. To rig the barricade, it is stretched across the flight deck between stanchions, which are raised from the flight deck. Rigging the barricade is routinely practiced by flight deck personnel and should be accomplished in under three minutes.

The barricade webbing consists of upper and lower horizontal loading straps joined to each other at the ends. Vertical engaging straps are connected to each upper and lower load strap. The barricade webbing is raised to a height of approximately 20 feet. The barricade webbing engages the wings of the landing aircraft, wherein energy is transmitted from the barricade webbing through the purchase cable to the arresting engine. Following a barricade arrestment, the webbing and deck cables are discarded and the stanchions are lowered back into their recessed

slots. Situations requiring a barricade landing include emergency fuel during blue water operations, hook malfunctions, landing gear malfunctions and combat damage.

Catapults. The primary system used to launch aircraft off the carrier is the catapult. The catapult launching system accelerates the aircraft from zero to 150 KIAS in under two seconds. Each carrier is equipped with four catapults, numbered one through four from starboard to port. Catapults one and two are referred to as the "bow cats," because they are located on the bow. Cats three and four are referred to as the "waist cats," because they are located on the angle, or waist. NIMITZ class carriers use the traditional steam catapult, while the FORD class carriers will be equipped with the newer Electromagnetic Aircraft Launch System (EMALS).

The steam catapult system consists of two cylinders that are roughly the length of a football field. The cylinders contain free pistons connected to a shuttle that protrudes through a slot (cat track) in the flight deck. The nose wheel of the launching aircraft engages the shuttle with the launch bar. At launch, high pressure steam is ported into the cylinders forcing the piston down the cylinder at a high rate of speed. The effect is that of "slinging" the aircraft off the flight deck. At the completion of the catapult launch, a water brake slows the piston so that it can be retracted for the next launch.

The EMALS catapult system uses a linear motor drive in place of steam pistons. Electric currents generate magnetic fields that propel a carriage down the cat track. Because of the gradual acceleration, EMALS places less stress on airframes. The unique operation of EMALS allows for more precise control of launch performance, allowing it to launch more kinds of aircraft (including unmanned aircraft) than traditional steam catapults.

During day operations when aircraft are being launched from multiple catapults, clearing turns are required to de-conflict the departures. When launching from the waist cats, aircraft will execute a clearing turn to the left. Aircraft launching from the bow cats will execute a clearing turn to the right.

Modern carriers use the Integrated Catapult Control Station (ICCS). This station, also known as the "bubble," is the focal point of the catapult control system. From the bubble, the Catapult Officer (Shooter) ensures the safe and orderly conduct of launching aircraft. In addition to supervising the launch, shooters are responsible for inspecting the cat tracks prior to launch and ensuring they are secured for recovery.

Jet Blast Deflectors. To prevent damage from high energy jet exhaust during catapult launches, each catapult has an associated Jet Blast Deflector (JBD). The JBD is constructed of heavy duty metal panels that are covered in non-skid to match the flight deck. Each JBD is located at the rear of the catapult. When not in use, the JBD is recessed and flush with the flight deck. As an aircraft is positioned on the catapult for launch, the JBD will be raised by several hydraulic cylinders. When the JBD is raised, the hot exhaust from the launching aircraft will be directed upward. This allows another aircraft to be brought into position behind the JBD, where flight deck personnel can perform prelaunch checks and inspections without the danger of jet exhaust.

Hangar Bay. The hangar bay is located two decks below the flight deck and spans approximately two-thirds of the total length of the carrier. It is three stories tall and is broken into four zones. The hangar bay functions as the ship's garage. It can hold more than sixty aircraft, and is the primary site for performing aircraft maintenance. Spare parts (including aircraft engines), fuel tanks and other heavy equipment are stored in the hangar bay.

Elevators. The movement of aircraft and equipment to and from the hangar bay is accomplished by four giant elevators. Each of these high-speed, hydraulic elevators can accommodate over 150,000 pounds and is large enough to hold two fully loaded jet aircraft. Any time the elevator is raised or lowered, guardrail stanchions will be raised from the flight deck providing a safety barrier. In addition to the four main elevators, there are several weapons elevators located around the flight deck.

2. Hazards

Because of the inherently dangerous nature of the flight deck environment, crews should strive to minimize their time "topside." Wandering around on the flight deck during flight operations is never a good idea. Any time you are topside you should remain vigilant (keep your head on a swivel) and continually look around for any potential hazards. It is imperative that you have complete awareness of everything that is happening on the flight deck. Pay particular attention to the following:

a. Turning aircraft. Jet exhaust has the potential to send personnel tumbling across the flight deck and even over the side. A spinning prop will not slow down for a misguided crew member.

b. Ground Support Equipment (GSE). GSE ("yellow gear") is continually in use during flight ops. Getting run over by a tug is not a good way to begin a flight.

c. Chocks, chains, tow-bars and arresting wires. These items are trip hazards and can be especially difficult to see at night.

d. Aircraft armament. More than one crewmember has received stitches after walking into a missile fin.

The slightest inattention on "the roof" can have disastrous consequences. Experienced aircrews will tell you that one of the more dangerous aspects of flying from the ship is getting to and from the aircraft, particularly at night.

3. Instrument Approach Equipment

The aircraft carrier is a floating airport, complete with all the equipment necessary to conduct instrument approaches.

TACAN. The ship's TACAN, referred to as "father," functions in the same manner as a land-based TACAN. It is primarily used for positional navigation and holding. When asked to "mark

your father," aircrew will reply with the radial and DME of the aircraft from the ship's TACAN. The ship itself is referred to as "mother."

Instrument Carrier Landing System (ICLS). The ICLS is very similar to the civilian ILS, and provides all-weather instrument approach guidance from the carrier to the aircraft. The ICLS uses the AN/SPN-41A ("spin 41"), which has separate transmitters for azimuth and elevation. The azimuth transmitter is installed at the stern of the ship, slightly below the centerline of the landing area. The elevation transmitter is located above the flight deck, aft of the island. The aircraft receiver displays the angular information on a crosshair indicator. The vertical needle of the display corresponds to azimuth while the horizontal needle corresponds to elevation (glideslope). Because the ICLS uses a one-way transmission from the ship to the aircraft receiver, it is susceptible to pitching deck conditions.

In order to differentiate between ICLS and Automated Carrier Landing System (ACLS) approaches, the ICLS is referred to as "bullseye."

Automated Carrier Landing System (ACLS). The ACLS is similar to the ICLS in that it displays "needles" that provide approach guidance information to the aircrew. The ACLS uses the AN/SPN-46(V)3 Precision Approach Landing System (PALS), which incorporates a ring laser gyro stabilization unit. This allows the ACLS to provide highly accurate and stabilized glideslope and azimuth information in nearly all sea states. The Spin 46 has two dual-band radar antennas and transmitters that provide it with the capability of controlling up to two aircraft simultaneously in a "leapfrog" pattern. As each approaching aircraft lands, another can be acquired.

The ACLS has three modes for approach:

a. ***Mode I*** is an automatic approach in which the aircraft flight controls are coupled with the ACLS. Command and error signals are transmitted to the aircraft, which then translates them into control actions providing a hands-off approach and landing.

b. ***Mode I Alpha*** is an automatic, hands-off approach down to visual acquisition of the IFLOLS, at which point the pilot takes over and flies the approach.

c. ***Mode II*** is similar to an ILS approach. Error signals are transmitted to the aircraft which displays the needles on a crosshair display.

d. ***Mode III*** is a Carrier Controlled Approach (CCA), which is akin to a GCA. The controller provides azimuth and glideslope information to the pilot.

4. Improved Fresnel Lens Optical Landing System (IFLOLS)

An optical landing system (OLS) provides the pilot with glidepath information during the final phase of the approach. The first OLS utilized a gyroscopically-controlled concave mirror. This mirror was vertically mounted between two horizontal sets of green datum lights. An orange source light was shown in the mirror and would appear as a yellowish-orange "ball" to the pilot.

The position of the ball relative to the datum lights would indicate the relative position of the aircraft to the desired glidepath. If the ball was above the datum lights (a high ball), the aircraft was above the glidepath; conversely, a low ball indicated the aircraft was below glidepath. When the ball and the datum lights were aligned horizontally, the aircraft was on glidepath.

The old mirror system was upgraded to a series of Fresnel lenses called the Fresnel Lens Optical Landing System (FLOLS). The ball seen in the FLOLS was relatively unchanged from the pilot's perspective, but the glidepath information became more precise. The FLOLS is an older generation pilot landing aid consisting of five vertical source lights. A further advance was the IFLOLS. The IFLOLS and the FLOLS work on the same basic principle and have the same overall components, but the primary differences between FLOLS and IFLOLS are:

a. The IFLOLS gives 7 additional cells, for a total of 12. This provides higher definition and allows for more exact glideslope information. Because of the higher definition, the IFLOLS can be referenced out to 1.5 NM; also, the IFLOLS will appear to be much more "sensitive" due to its increased accuracy.

b. The IFLOLS uses a fiber optic "source" light, projected through lenses to present a sharper, crisper light. This has enabled pilots to begin to fly "the ball" farther away from the ship allowing for a smoother transition from instrument flight to visual flight.

c. The number of Datum Lights has increased to 10.

d. The vertical coverage has been increased to 1.7 degrees vice the 1.5 of FLOLS.

e. Acquisition range has been increased from 3/4 NM to 1.5 NM.

IFLOLS Components. The IFLOLS consists of a lens assembly, "cut" lights, waveoff lights, and datum lights. The IFLOLS has three modes of stabilization: Line, Inertial, and Point. Line Stabilization compensates for the ship's pitch and roll. Inertial Stabilization operates the same as Line Stabilization, but also compensates for the up and down motion (heave) of the flight deck. Both of these modes stabilize the glideslope to infinity. The point stabilization mode fixes the glideslope around a point 2500 feet aft of the lens. The system is normally set for a 3.5° glideslope targeting the 3-wire. The IFLOLS comes in both the shore-based and ship-based variants (Figure 1-4).

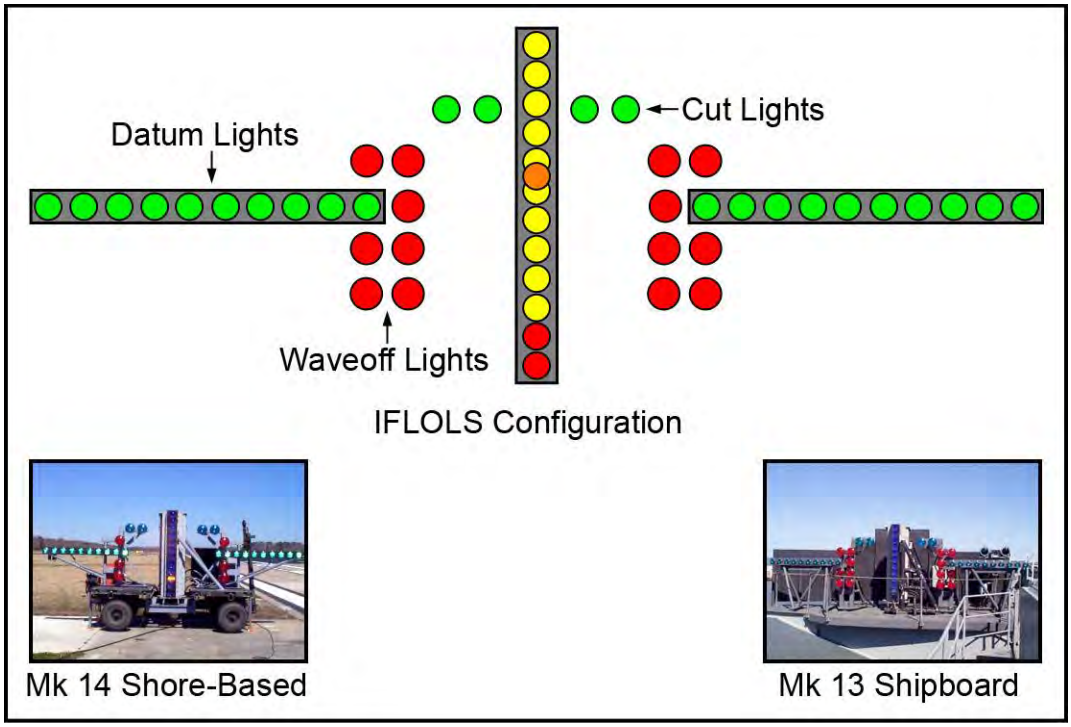


Figure 1-4 Improved Fresnel Lens Optical Landing System (IFLOLS)

Lens Assembly. The lens assembly is a box that contains 12 vertical cells through which fiber optic light is projected. The upper cells are amber in color while the bottom two are red. The aircraft's position on the glidepath determines which cell is visible to the pilot. The visible cell, compared to the horizontal green datum lights, indicate the aircraft position relative to the glideslope (i.e., above, on, or below the optimum glideslope). If a red lens is visible, the aircraft is dangerously low.

Cut Lights. Mounted horizontally and centered above the lens box are four green cut lights. The cut lights are used by the LSO to communicate with the aircraft during Zip Lip or Emissions Controlled (EMCON) operations. As the aircraft approaches the groove, the LSO will momentarily illuminate the cut lights to indicate a "Roger ball" call. Subsequent illumination of the cut lights indicates a call to add power. Zip Lip is normally used during day Case I fleet operations to minimize radio transmissions. EMCON is a condition where all electronic emissions are minimized.

Waveoff Lights. Waveoff lights are mounted vertically on each side of the lens box. These red lights are controlled by the LSO. When they are illuminated, the aircraft must immediately execute a waveoff. The LSO will initiate a waveoff any time the deck is foul (people or equipment in the landing area) or an aircraft is not within safe approach parameters. "Bingo" is signaled by alternating waveoff and cut lights.

Datum Lights. Green datum lights are mounted horizontally to the lens assembly with ten lights on each side. The position of the ball in reference to the datum lights provides the pilot with glideslope information. If the ball is illuminated above or below the datums, the aircraft is high or low respectively (Figure 1-5).

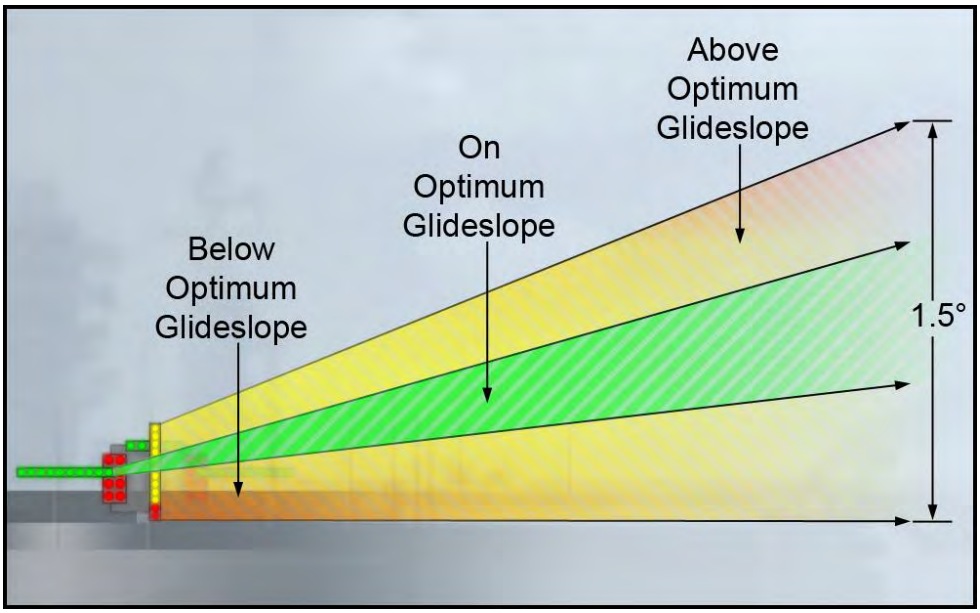


Figure 1-5 Above, On, and Below Glideslope

Because the lens assembly projects a wedge of light, the closer the aircraft comes to the lens, the narrower the wedge becomes. Therefore, smaller glideslope corrections are required as the lower 6 are red. The intensity of the "meatball" can be reduced by closing a set of perforated doors over the light box assembly. The datum box unit contains five separate datum lamps, four waveoff lamps, and one cut lamp on each side (Figure 1-4).

Manually Operated Visual Landing Aid System (MOVLAS)

MOVLAS is a backup shipboard landing aid system that is used when the primary system is inoperable, stabilization limits for the IFLOLS exceeded, or for pilot/LSO training.

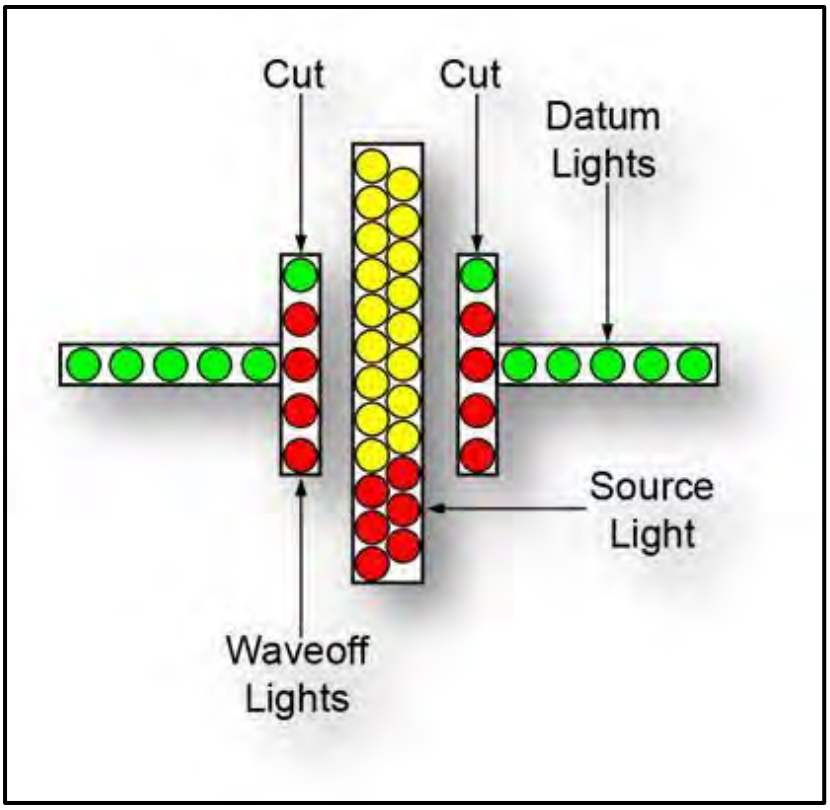


Figure 1-6 MOVLAS Components

a. Station 1: The MOVLAS is installed on the port side of the ship, directly in front of the primary system (IFLOLS).

b. Station 2: The MOVLAS is installed on the port side of the ship, 75-100 feet aft of the primary system.

c. Station 3: The MOVLAS is installed on the starboard side of the landing area, aft of the island and outboard of the safe parking line. The Air Officer or LSO will generally determine the exact location.

For MOVLAS station 1, the datum box unit is not used. The light box assembly is mounted directly in front of the primary lens and utilizes the waveoff, cut and datum lights from the IFLOLS. For MOVLAS stations 2 and 3, the datum box unit is mounted on each side of the light box assembly. Station 3 MOVLAS operations may require that aircraft on the flight deck be moved.

During MOVLAS operations, the LSO directly controls the ball by moving the hand controller up and down. If the aircraft is above the desired glidepath, the LSO will show the pilot a high ball by raising the hand controller. Likewise, if the aircraft is low, the LSO will lower the hand controller to show the pilot a low ball. By using MOVLAS, the LSO can control the glidepath of the approaching aircraft, and modify it as necessary to accommodate a pitching deck. A MOVLAS repeater is also located on the LSO platform. This allows the LSO to monitor the glideslope that is being presented to the pilot.

Meatball Motherhood

a. Attempt to fly the "cresting" ball, because slightly above glideslope (high) is better than below (low).

b. Never lead a low or slow.

c. Always lead a high or fast.

d. If low and slow, correct low then slow.

e. If high and fast, correct fast then high.

f. Fly the ball all the way to touchdown.

g. Never re-center a high ball in close, but stop a rising ball.

5. Long Range Laser Lineup System

The small size of the landing area requires precise lineup control by approaching aircraft. The nature of angled deck carriers presents a unique challenge to arriving aircraft, because the landing area is constantly moving from left to right relative to the nose of the aircraft. To aid aircrew during the approach, carriers are equipped with a Long Range Laser Lineup System. The Long Range Laser Lineup System uses eye-safe, color-coded lasers to provide visual lineup information to approaching aircraft. These low intensity lasers are projected aft of the ship and are visible out to 10 miles at night. Figure 1-7 illustrates the visual presentation of the Long Range Laser Lineup System.

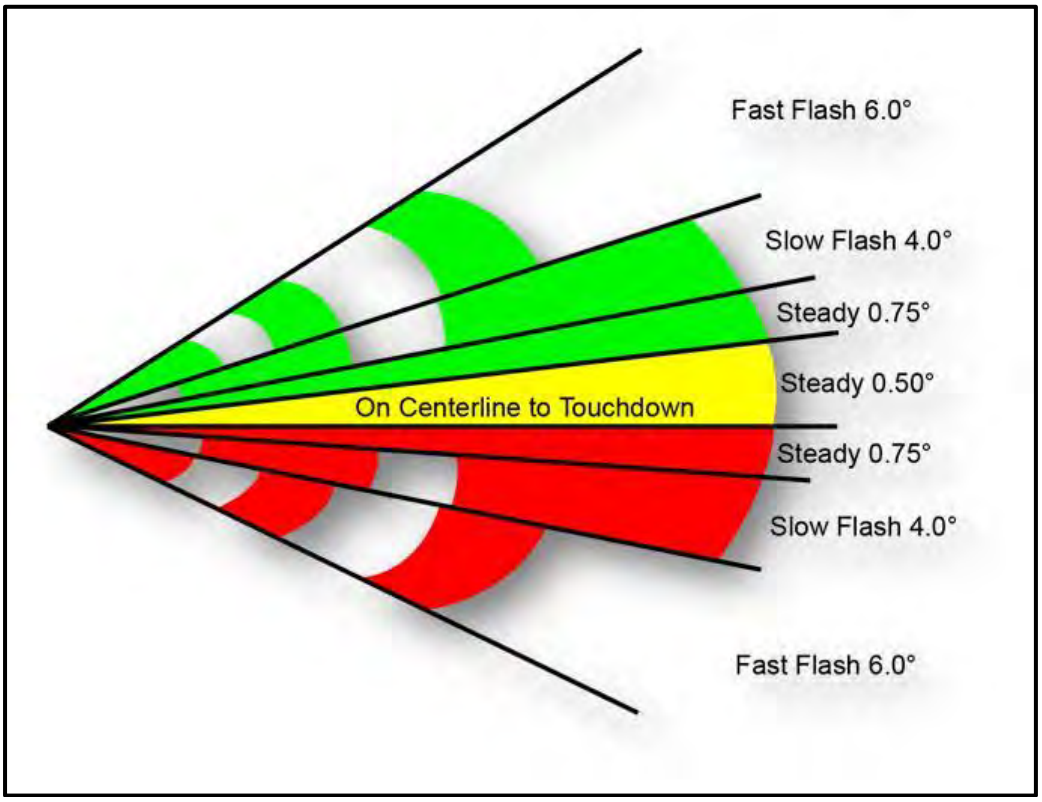


Figure 1-7 Long Range Laser Lineup System

CHAPTER TWO
FLIGHT PROCEDURES

200. INTRODUCTION

The catapult launch and arrested landing separate the Naval Aviator from all other aviators. The nature of shipboard operations demands extreme vigilance and standardization. There is no margin for error when operating around the ship. You must be thoroughly familiar with all procedures prior to your first flight to the carrier.

"In looking back over everything that I've done in the Navy and in the Space Program, I think absolutely nothing matched night carrier aviation. I still think that separates the men from the boys. It's more difficult than any of the other things I did, including landing on the moon."

Charles "Pete" Conrad, Captain, USN

201. AIR PLAN

In order to obtain maximum efficiency from personnel and equipment, flight operations on the carrier must be precisely scheduled in every respect. The two divisions, within the Operations Department, on the carrier that are responsible for providing this scheduling are Air Operations and Strike Operations. These two divisions coordinate closely in the preparation of the daily Air Plan. An Air Plan is used to organize the operations of the carrier air wing (CVW) within the Carrier Strike Group (CSG). The Air Plan provides the daily scheduling for all air operations, ordnance loading, and EMCON condition.

In theater, the Air Plan is largely driven by the Air Tasking Order (ATO), which is handed down from the Joint Force Air Component Commander (JFACC). The ATO is the master document created by the theater Air Operations Center (AOC) that coordinates all air assets within a specific theater of operations. The ATO delineates all required sorties for each 24-hour period and assigns them by mission and aircraft type. The AOC personnel identify specific targets and missions and then assign them to individual components and subordinate units. The ATO typically provides specific tasking, including call signs, targets, and controlling agencies. The ATO will also include general instructions pertinent to theater flight operations.

Strike Operations will review the ATO and collect all necessary information for the preparation of the Air Plan. The Air Plan will then be submitted to the Operations Officer, via the Air Operations Officer, for approval and signature. Once signed, the Air Plan will normally be distributed the evening before scheduled operations; however, due to the fluid nature of contingency operations, the Air Plan may not be promulgated until very late in the evening or early the next morning.

The Air Plan will include the following information:

a. Event numbers

b. Launch times

c. Recovery times

d. Mission

e. Number and model of aircraft, including spares

f. Total sorties

g. Sunrise, sunset, moonrise, moonset, moon phase

h. Date

i. Fuel

j. Alert aircraft

k. Logistics aircraft

l. Tactical frequencies

m. Ordnance loading

n. Daily Air Plan Cartoon

o. Notes as required. Notes shall include the following:

    i. EMCON/Zip Lip conditions

    ii. Ready deck schedule

    iii. Any other hazards/restrictions to flight or other pertinent information

Upon receipt of the daily air plan, each squadron will prepare and distribute its daily flight schedule. Individual squadron or unit requirements should be requested far enough in advance so that they are reflected on the Air Plan and can then be published on the schedule.

202. FLIGHT DECK OPERATIONS

Flight deck operations are very complicated and extremely hazardous. This FTI only supplements more important, primary sources of information regarding carrier operations. A thorough knowledge and understanding of these operations cannot be overemphasized.

1. Reference Publications

Your aircraft Naval Air Training and Operating Procedures Standardization (NATOPS) manual contains sections specifically dedicated to carrier operations. You should also familiarize yourself with both the CV NATOPS and LSO NATOPS manuals. These manuals govern aircraft operations around the ship, including launch, recovery and flight deck procedures. The CV NATOPS provides information regarding procedures and practices for operating around the carrier. The LSO NATOPS is the primary reference used by LSOs and provides technical information and guidance. The primary focus of this manual is the recovery phase of operations.

2. Cyclic Operations

Cyclic Operations refers to the continuous process of launching and recovering aircraft. In order to maximize efficiency, aircraft are launched and recovered in groups or "cycles." Each cycle is approximately one hour and thirty minutes long (1+30 cycle). ATO requirements may necessitate longer or shorter cycles. Longer cycles can accommodate more launches and recoveries, while shorter cycles limit the number of aircraft that can be launched or recovered. The cycle time also has an impact on fuel for airborne aircraft. Longer cycles may necessitate additional tanking.

Each cycle, or event, is usually made up of 12-20 aircraft. These events are sequentially numbered and correspond to the respective cycle in the 24-hour fly day. Event 1 corresponds to the first cycle, Event 2 to the second cycle, and so on. Prior to flight operations, the aircraft on the flight deck are arranged ("spotted") so that Event 1 aircraft can easily be taxied to the catapults once they have been started and inspected. Once the Event 1 aircraft are launched, which generally takes about 15 minutes, Event 2 aircraft are readied for the next cyclic launch. The launching of aircraft makes room on the flight deck to land aircraft. Once Event 2 aircraft are launched, Event 1 aircraft are recovered, fueled, re-armed, re-spotted and readied to be used for Event 3. Event 3 aircraft are launched, followed by the recovery of Event 2 aircraft (and so on throughout the fly day/night). After the last launch of the night, all of the aircraft are generally stored up on the bow in order to keep the landing area clear until the last aircraft lands. They are then re-spotted about the flight deck and secured until the next morning's first launch.

3. Weather Criteria

In order to standardize flight operations in all weather conditions, day or night, carrier aviation utilizes three specific cases of operations. These are known as Case I, Case II and Case III. Each of these cases is dependent on existing weather conditions. The Air Boss is responsible for determining the case of launch and recovery operations.

a. Case I departures and recoveries are utilized during daytime operations (day ops) when weather conditions are VMC. Case I weather requires the ceiling to be no lower than 3,000 feet and not less than 5 NM visibility.

b. Case II operations are utilized during day ops when it is anticipated the aircraft may enter IMC. Case II weather requires the lowest ceiling to be 1,000 feet or above and 5 NM visibility. Case II is normally called for when an overcast layer is present.

c. Case III weather is any ceiling below 1,000 feet or a visibility less than 5NM. All night operations are conducted under Case III. For the purpose of determining Case III operations, night is defined as 30 minutes prior to sunset until 30 minutes after sunrise.

203. LAUNCH AND DEPARTURE

1. Briefing

As with shore operations, all carrier flight operations begin with a thorough briefing. Each mission will begin with a briefing that typically commences one-hour and forty-five minutes (1+45) prior to scheduled launch time. The briefing process usually progresses from a generalized overview down to aircraft and aircrew specific items. The preflight briefing will include a briefing from the Carrier Intelligence Center (CVIC), which will be broadcast over the ship's TV. The CVIC briefing will usually be five to ten minutes in duration, and will cover any information that is pertinent to all flight operations. This includes, but is not limited to, current and forecasted weather, the ship's current and forecasted position, significant operations in the area, recent intelligence analysis, SAR (or Combat Search and Rescue (CSAR)) specifics, divert airfield information and current operating conditions in the region.

For missions involving multiple aircraft and assets, the overall strike lead will then brief the mission. Individual elements will separate and brief those items specific to their element; lastly, aircrew will brief aircraft-specific items. Complex missions may require more time to accomplish the briefing due to the complexity of the tasking and the coordination of multiple assets. In these cases, the mission lead will notify all players of any adjustments to the briefing time.

2. Pre-Flight

Following the briefing, aircrew will proceed to maintenance control to review the Aircraft Discrepancy Book (ADB). Aircrew should pay particular attention to the A-sheet's basic weight, fuel and store loads to ensure the gross weight calculation is correct. This is particularly important when launching from the boat because the catapult needs to be set correctly. Once the ADB is reviewed and the weight is verified, the crew will deliver the weight sheet (weight chit) to flight deck control prior to aircraft preflight. Some squadrons use an automated computer program by which the squadron SDO can send each jet's weight chit down to flight deck control for each launch. The weight annotated on the weight chit must match the weight you see on the weight board as you taxi up to the catapult.

After reviewing the ADB, aircrew will proceed to the paraloft to suit up. The aircrew will ensure that they arrive on the flight deck, in full flight gear with gloves on and visors down, no later than 45 minutes prior to the scheduled launch time. Your knowledge of the ship's layout will help you select the flight deck entrance nearest your aircraft.

Once at the aircraft, conduct a normal preflight in accordance with NATOPS. Begin the preflight by checking the area around the aircraft for FOD, leaking or pooling fluid (oil, hydraulic fluid, fuel, etc.) and the general condition of the aircraft. Take note of any intake/exhaust covers on the aircraft. Make sure tie down chains are not rubbing against any brake lines or hydraulic lines. Observe whether a tow bar is connected and that the nose wheel is centered. Check the landing gear struts, tire pressure and integrity, launch bar, and holdback. Inspect the tailhook and ensure the hook point is greased. If the tail of the aircraft is over water, do not attempt to preflight that portion of the aircraft. The plane captains will check your tailhook during the hook check after taxiing clear of the edge. During the preflight, remain vigilant of jet exhaust and other hazards.

After manning up, conduct normal cockpit inspection and checks, ensuring both ANTI-SKID switches are set to OFF. Check that the cockpit panels, gauges and instruments are secure. Loose gauges or instruments can be dangerous during a catapult launch. All crews must be strapped in and ready to start no later than 30 minutes prior to scheduled launch. The Air Boss will make a "start engines" call over the flight deck announcing system (5 MC), and the start signal will be given by the yellow shirts. At that time, and not before, crews will run through the normal start sequence adhering to any plane captain signals. The normal sequence for engine start is:

a. Perform the prestart checklist.

b. Start the engine when authorized by the yellow shirt. A plane captain (brown shirt) will monitor the engine start.

c. Close the canopy when appropriate.

d. Complete the post-start checklist.

e. Complete the plane captain's checks.

f. Complete the taxi/takeoff checklist prior to taxiing.

NOTE

The takeoff checklist is the same as for shore-based procedures with emphasis placed on the following:

1. Position the ANTI-SKID switch to OFF.

2. Ensure the stabilator trim is set to 3-1/2 degrees nose up.

3. Check the HOOK BYP switch to CARRIER.

g. When ready to taxi, give the "up and ready" call to tower with aircraft gross weight. Ensure no one is landing (referred to as "on the ball") prior to making the "up and ready" call.

NOTE

Oxygen masks must be on whenever the aircraft is not chocked and chained.

Following the start, the aircraft will be "broken down" and chocks/chains removed. Taxiing up to the catapult, a green shirt will hold up the weight board. If the weight on the board matches the weight on the weight chit, acknowledge with thumbs up (daylight) or circling flashlight (night). If the weight needs to be adjusted up or down, pass hand signals to the green shirt as follows:

a. During the day:

i. To raise the gross weight, hold hand flat with palm up and move in a vertical direction, emphasizing the upward motion.

ii. To lower the gross weight, hold hand with palm down and move in a horizontal direction.

b. At night:

i. To raise the gross weight, move flashlight in a vertical direction, emphasizing the upward motion.

ii. To lower the gross weight, move flashlight in a horizontal direction.

The weight will be adjusted in 500 or 1000 increments in accordance with applicable launch bulletins. If the weight on the board is off by more than two weight increments, or there is confusion regarding adjustments, a radio call stating "Callsign, Gross weight is XX thousand X hundred" shall be made.

NOTE

Ensure the takeoff checklist is completed and trim set to 3.5 degrees nose-up with flaps/slats set to FULL prior to crossing the JBD. Roger the weight board.

3. Catapult Procedures

To ensure proper spotting on the catapult, aircrew must precisely follow the signals from the taxi director. Signals given above the director's waist are for aircrew while signals given below the

waist are for deck crew. The normal sequence of visual signals for catapult operations is as follows:

a. **Extend launch bar**: Director rests right elbow in left palm at waist level with right hand held up vertically and then brings right hand down to horizontal position.

b. **Disengage nose wheel steering**: Director points right index finger to his nose and presents a lateral wave with open palm of the left hand at shoulder height.

c. **Taxi ahead**: Director extends arms forward at shoulder level with hands up at eye level, palms facing backward and makes beckoning arm motion, speed of arm movement indicates desired speed.

d. **Slight turn left/right**: Director will nod head in direction of turn while giving taxi ahead signal.

e. **Brakes on (when in holdback)**: Director extends arms above head with open palms toward aircraft and then closes fists.

f. **Tension**: Director extends arms slightly overhead with fists closed and then opened with palms forward (indication to release brakes); then hand toward bow is swept down to a 45-degree position toward deck, while other hand is swept up 45 degrees toward sky. Pilot releases brakes, heels to deck, stays at idle awaiting runup signal.

g. **Retract launch bar**: Director rests right elbow in left palm with right arm extended horizontally at waist level and then raised to vertical.

h. **Engine runup**: Catapult Officer/Catapult Safety Petty Officer (CSPO) makes circular motion with index and middle finger at head level. Pilot advances throttle to MRT and executes Control Check “wipeout” and engine instrument check.

i. **Acknowledge salute**: Catapult Officer/CSPO returns salute.

j. **Launch signal**: Catapult Officer/CSPO squats, touches the deck and returns the hand to horizontal in the direction of the launch.

k. **Hang fire**: Catapult Officer/CSPO extends right-hand index finger overhead and points horizontally at left palm extended vertically.

l. **Suspend**: Catapult Officer/CSPO raises arms above head with wrists crossed (indicating the launch is to be suspended).

m. **Throttle back**: Catapult Officer/CSPO extends arm in front of body at waist level and thumb extended up, then grasps thumb with other hand and rocks as if pulling throttle back.

WARNING

Do not throttle back until the catapult officer walks in front of the aircraft and gives the throttle back signal during suspended launches.

4. Prelaunch Procedures

When directed by the catapult director (yellow shirt), the launch bar switch is placed to EXTEND. The nose wheel steering (NWS) is automatically disengaged with the launch bar extended. The yellow shirt may signal to reengage NWS to get the launch bar seated properly into the catapult track.

CAUTION

Never operate the parking brake beyond the JBD to prevent blowing tires if the catapult is fired with parking brake engaged.

Following the taxi director's signals, taxi forward slowly to position the launch bar over the shuttle (significant power may be required). When the launch bar drops over the shuttle, the aircraft will be stopped as the holdback engages the catapult buffer.

CAUTION

To prevent the possibility of breaking the holdback link, taxi speed must be kept to a crawl.

The pilot will apply and hold the brakes when signaled. When the take tension signal is given by the catapult director, the brakes are released. As tension is taken, the aircraft will squat. When engine Runup Signal is given by the catapult director, power is advanced to MRT and the controls are wiped out (INCLUDING RUDDER!). The launch bar switch is placed to RETRACT once engine RPM reaches 95 percent. The launch bar will be held down by shuttle tension. Place your heels on the deck and assume the correct body position for launch.

WARNING

Selecting launch bar RETRACT before receiving the retract signal from the aircraft director may raise the launch bar before it is properly seated in the shuttle spreader assembly, resulting in a mis-positioned launch bar.

CAUTION

1. If launch bar is retracted below max RPM, an ACCEL light may illuminate.

2. Failing to use the catapult grip could result in power settings less than MRT during the cat stroke.

During the engine run-up and checks, the catapult director will pass control to the catapult officer. Check the engine instruments (EGT, rpm, fuel flow) and monitor the central warning system (CWS) indicators and advisory lights. Observe the cockpit wipeout and verify the full throw of the stick and rudder in all directions.

WARNING

Brakes may inadvertently be applied during a catapult launch, resulting in a blown tire, even with heels placed on the deck.

5. Launch

When ready for launch, the pilot will crisply give a right-handed salute to the Catapult Officer/CSPO (at night aircraft external lights are turned on meaning the same as the daytime hand salute). The catapult officer will make final checks, looking fore and aft, and then touch the deck. After a delay of approximately one second, the catapult will fire and the aircraft will accelerate, reaching end speed in about two seconds. If the launch is a "bubble launch," the CSPO will return salute. The Catapult Officer will affect the launch after clearing fore and aft.

The edge of the flight deck should pass under the nose at 120 KIAS minimum, or excess end airspeed, whichever is greater. Refer to the Catapult Launch Minimum Endspeed Chart in NATOPS Chapter 8. As the aircraft clears the end of the stroke, the pilot will rotate to 10-12 degrees nose up attitude and establish a positive rate of climb. Gear and flaps will be raised in accordance with NATOPS.

When clearing turns are called for, they are governed by the ship's policy. Clearing turns will be made to the right for launches off the bow catapults and to the left for launches off the waist catapults. During Carrier Qualification (CARQUAL) evolutions, clearing turns will not normally be required.

6. Departure Procedures

Departure procedures are predicated on case operations.

a. **Case I.** Case I departures are flown during day VMC conditions (WX 3,000-5 or better). Once the aircraft clears the catapult and a positive rate of climb is established, the pilot will execute a clearing turn, climb to 500' and parallel base recovery course (BRC). The Case I departure is flown at 500' and 300 KIAS paralleling BRC until 7 DME. When directed, or at 7 DME, the aircraft shall climb VMC on course (Figure 2-1).

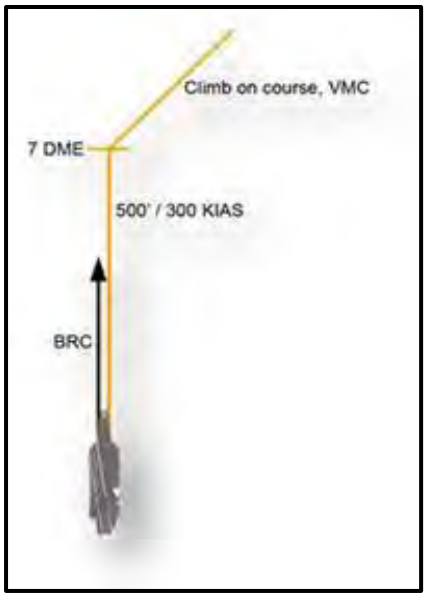


Figure 2-1 Case I Departure

b. **Case II.** Case II departures are flown when visual conditions are present at the ship, but a controlled climb is required (WX less than 3000-5, but greater than 1000-5). Departure Control frequency will be used for the launch. After the clearing turn, proceed straight ahead at 500 feet and 300 KIAS paralleling BRC. At 7 DME, turn to intercept the 10 DME arc, maintaining visual conditions until established on the departure radial (Figure 2-2). The 500-foot altitude restriction is lifted after 7 DME, if the climb can be continued in VMC. Maintain 300 KIAS until VMC on top. If you are still IMC passing 18,000 feet, report "Popeye" to receive instructions.

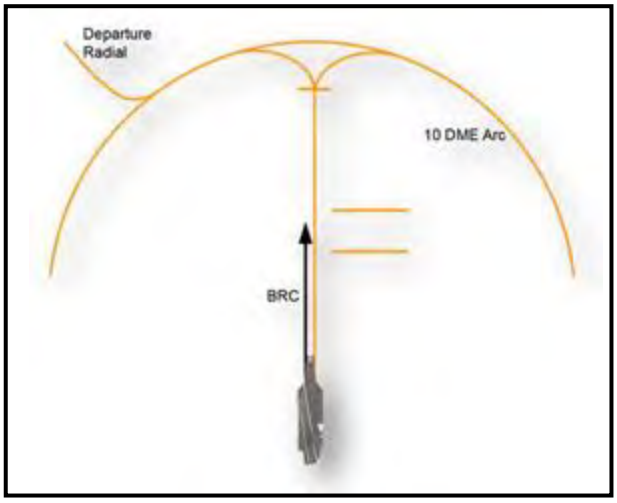


Figure 2-2 Case II Departure

c. **Case III.** Case III departures are flown at night and when weather conditions are IMC (WX below 1000-5), and a controlled climb is required. The aircraft will launch on Departure Control frequency, with a minimum launch interval of 30 seconds between aircraft. Following the launch, climb straight ahead at 300 kts, crossing 5 NM at 1500 AGL or above; at 7 NM, turn to intercept the 10 NM arc. Continue climbing and join the departure radial. The following voice reports and examples are commonly used during Case III departures:

i. Airborne - *"Departure, 405, airborne"*

ii. Passing 2,500 feet - *"Departure, 405, passing 2.5"*

iii. Arcing (turning onto the 10 NM arc) - *"Departure, 405, Arcing"*

iv. Established outbound (on assigned radial) - *"Departure, 405, Established outbound"*

v. Popeye, with altitude - *"Departure, 405, Popeye, Angels eighteen"*

vi. On top, with altitude - *"Departure, 405, On top, Angels twelve"*

vii. Kilo (indicates the aircraft is mission-ready) - *"Departure, 405, Kilo"*

204. ARRIVAL AND RECOVERY

Following the mission, aircraft will proceed back to Mother to arrive at their scheduled cyclic land time. After checking out on the mission frequency, contact the CSG air defense controller (Red Crown) with your call sign, position and altitude. Red Crown will pass instructions, and then hand you off to Strike Control. This hand off should occur prior to entering the 50 NM Carrier Control Area (CCA). The check in with Strike will be the same as for Red Crown except you will also include the low fuel state in your flight. If any aircraft in the flight have maintenance discrepancies ("alibis"), pass them to the Strike controller who will then relay them to the ready room. Time permitting; Strike will give the current weather, anticipated Case recovery and any other general information for the recovery.

Once inside the CCA, Strike will hand aircraft off to the Marshal controller. Check in on Marshal Frequency with call sign, position, altitude and low state. Marshal will assign case recovery holding instructions (including assigned altitude) and pass the ship's weather, altimeter setting, BRC and bingo information. BRC is the ship's heading during the recovery.

For Case I recoveries, Marshal will clear aircraft to the overhead holding pattern and instruct you to call "see me" at 10NM from the ship. This call indicates you have visual contact with Mother.

For Case II and III recoveries, Marshal will give holding instructions and an expected approach time (push time).

Example radio calls:

405 - "*Red Crown, 405, Mother's 250 for 75, Angels 17"*

Red Crown - *"405, sweet/sweet, contact Strike"*

405 - *"Strike, 405, Mother's 250 for 55, Angels 12, State 2.4. No alibis"*

Strike - *"405, sweet/sweet, Mother is VFR, Case I. Contact Marshal"*

405 - *"Marshal, 405, 250 for 52, Angels 9, State 2.4"*

Marshal - *"405, Case I. BRC is 015, Expected Charlie time 22. Report see me"*

Or

"405, Case II (or III). BRC is 015. Marshal on the 245 radial at 25 DME, Angels 10. Expected approach time 22, Approach button 17, altimeter 29.94"

1. Case I

Case I recoveries are used to the maximum extent possible, provided the weather is better than 3,000/5.

a. **Overhead (Port) Holding.** After the initial check in with Marshal, proceed directly to Mother and enter overhead holding at your squadron's holding altitude. When in visual contact with Mother, notify Marshal with the "see you" call. Aircraft returning for Case I recoveries must be established at their respective holding altitudes no later than 10 NM. Proceed to overhead holding, and enter the pattern tangentially (Figure 2-3).

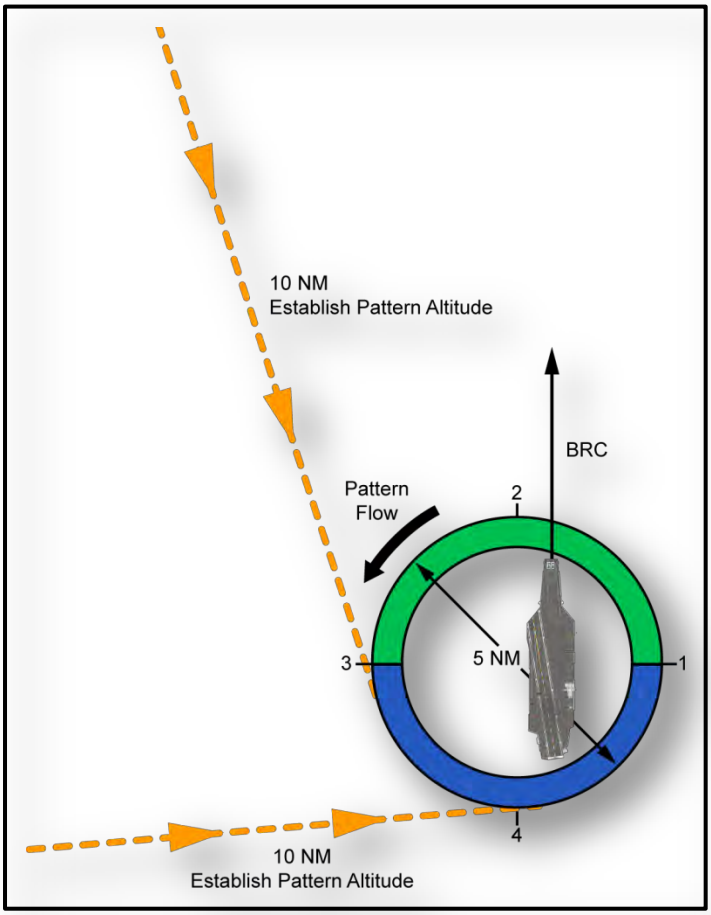


Figure 2-3 Case I Port Holding Pattern Entry

The overhead holding pattern is a left-hand pattern, with Point 1 located directly overhead the carrier. Points 2, 3 and 4 sequentially follow in 90-degree increments (Figure 2-4). This holding pattern is often referred to as the "stack," and all aircraft must remain within 5 NM and no lower than 2,000 feet AGL. While holding, the flight will remain at max conserve fuel flow unless briefed otherwise.

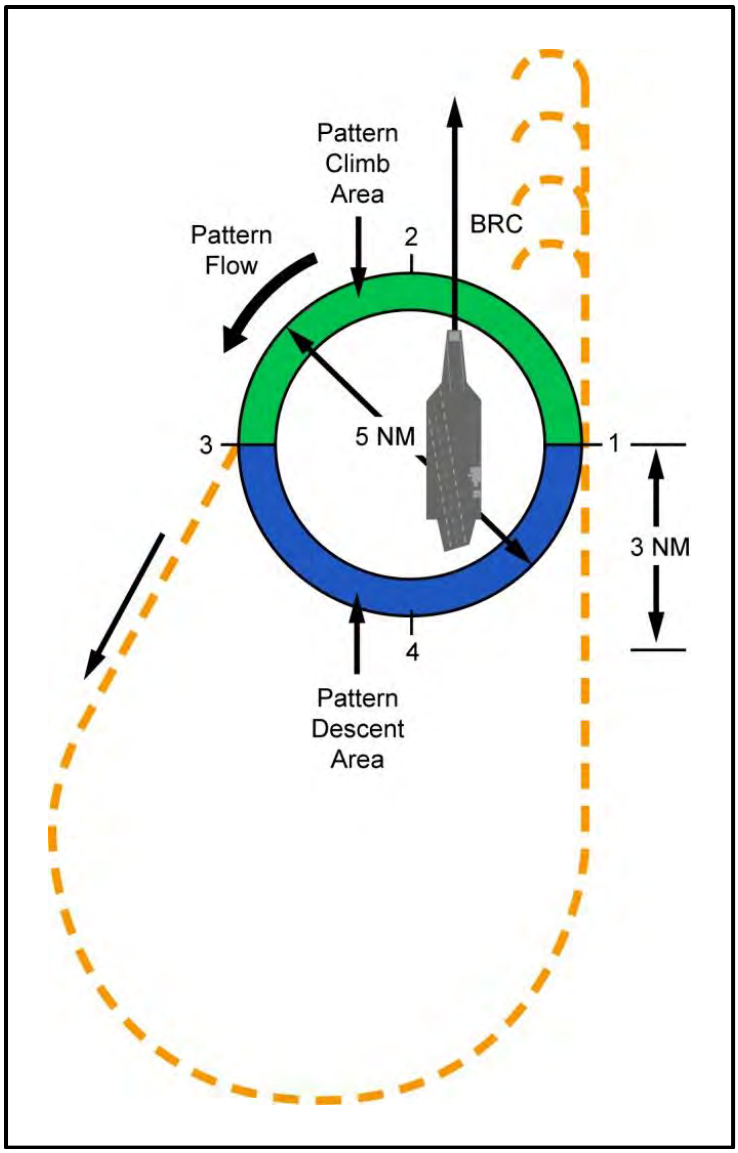


Figure 2-4 Case I Overhead Holding Pattern

Each squadron has an assigned holding altitude in the stack, beginning at 2,000 feet AGL. These assigned altitudes are separated vertically by a minimum of 1,000 feet and are assigned by the CVW SOP. Once established in holding, any altitude changes within the pattern are accomplished as follows:

i. Climbs: Performed between points 1 and 3.

ii. Descents: Performed between points 3 and 1.

The lowest aircraft in the stack must closely monitor the launch so as to arrive in the groove at the expected ramp time. When the last aircraft is launching, or when given a "Signal Charlie" call from Tower, the flight will depart the holding pattern on a heading of approximately 210 degrees relative to BRC. As altitudes in the stack are

vacated, aircraft at the next highest altitude will descend to the next lower vacated altitude.

b. **Breaking the Deck.** The majority of Case I operations are conducted under Zip Lip conditions, meaning that radio communications are minimized (unless CQ, low visibility, or safety of flight). In this situation, the Boss will not make a "99, Charlie" call on the radio; therefore, it is incumbent on aircraft holding overhead to determine when to depart holding, fly to the initial and break. The goal is to arrive in the groove just as the flight deck is made ready for recovery operations (ready deck). This is called breaking the deck and is a skill that must be mastered in order to maximize the efficiency of recovery operations.

To effectively break the deck, aircraft in overhead holding will stagger their intervals to ensure equal spacing from all flights at the same altitude. If there are two total flights, then they should be 180-degrees apart. Three flights should be 120-degrees apart. Four flights will be 90-degrees apart. This ensures aircraft are crossing point 1 (Mother) at regular intervals. Each flight will observe the departure operations and determine whether or not to depart holding for the break at point 3.

c. **Break.** When departing holding, the flight will descend outside of point 3 to 800 feet and proceed to the initial 3NM astern of the ship. The flight will continue inbound and fly just outboard the starboard side of the ship at 800 feet, paralleling BRC. Break altitude is 800 feet, and all breaks will be level. The break interval is determined by the last aircraft in the landing pattern. A 15-20 second break interval will correspond to a 40-60 second landing interval.

No breaks will be performed more than 4 NM ahead of the ship. If you are unable to break before 4 NM, you will have to depart and reenter the pattern. To accomplish this, maintain 800 feet until 5 NM, then climb to 1,200 feet and execute a left-hand arc back to the initial. Tower must be notified of your intentions.

d. **Spin Procedures.** If the pattern is full (more than six aircraft in the pattern) when the flight arrives at the fantail, the flight will have to "spin it." To perform a spin, the flight will simultaneously climb to 1,200 feet and perform a left-hand turn remaining within 3 DME. After 270 degrees of turn (aft of abeam), the flight will descend to 800 feet and proceed inbound for the break. Aircraft reentering the break from the spin pattern have priority in the break. Upwind interval is determined by "first to the bow," whether that is break traffic, waveoff, touch-and-go, or bolter. However, caution must be exercised when reentering the initial so as to avoid conflict with other aircraft inbound for the break.

e. **Carrier Landing Pattern.** The carrier landing pattern is nearly identical to the landing pattern at the field. The biggest difference is that the 180 and Abeam positions are co-located at the carrier. Additionally, the downwind heading at the ship is the reciprocal of the BRC vice the landing heading (which will be approximately 10 degrees less than BRC due to the angled deck).

When established on downwind, individual aircraft will descend to pattern altitude of 600 feet, perform landing checks and closely monitor the abeam distance. The carrier landing pattern is illustrated in Figure 2-5.

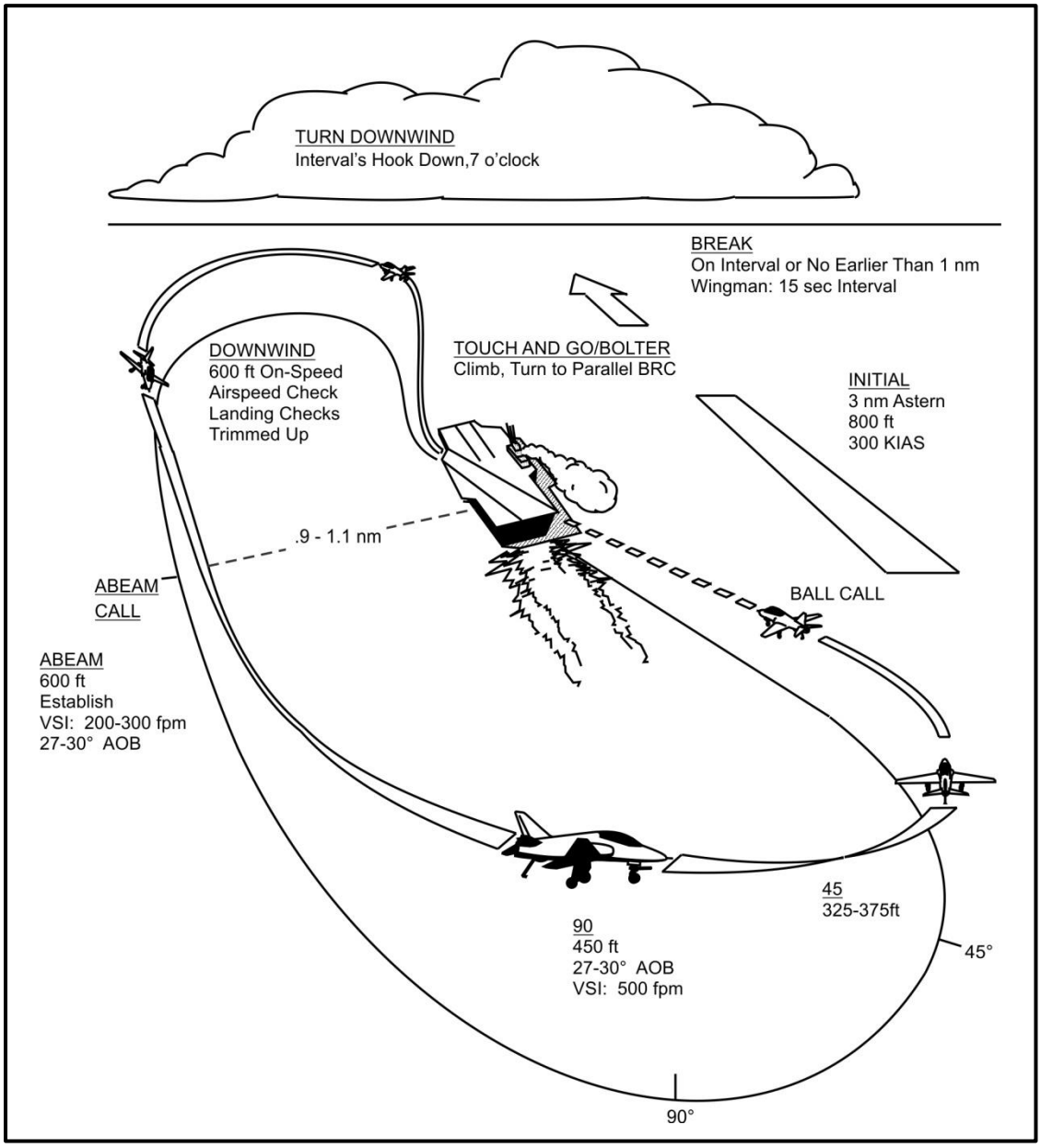


Figure 2-5 Carrier Landing Pattern

f. **Touch and Go/Bolter.** The procedures for touch and go landings and bolters are identical. Continue to fly the ball all the way to touchdown. Upon touchdown, simultaneously advance power to MRT, retract speed brakes, and rotate to optimum AOA. Maintain wings level and verify a positive rate of climb and maintain optimum AOA. Once a positive rate of climb is established and your aircraft is abeam the bow, use a shallow right turn to parallel the BRC. Take interval on any aircraft that

reaches the bow prior to you, either entering the break or launching off the cat. Climb to pattern altitude (600 feet) and turn downwind with proper interval.

CAUTION

To avoid interfering with aircraft off the cat or in the break, do not cross the ship's bow.

g. **Waveoff.** Waveoffs are MANDATORY. All waveoffs are made up the angled deck unless otherwise directed by the LSO or the tower (i.e. "waveoff starboard side"). All aircraft must comply with waveoff signals, whether they are verbal or solely with the waveoff lights on the lens. Waveoffs may result from a fouled deck, winds out of limits, or aircraft not being set up for a safe landing.

To perform a waveoff, simultaneously advance power to MRT, retract speed brakes, maintain landing attitude (not to exceed optimum AOA), level wings, and climb up the angled deck. Verify a positive rate of climb and maintain optimum AOA. Once you have established a positive rate of climb and you are abeam the bow, use a shallow right turn to parallel the ship's BRC. Climb to 600 feet and turn downwind with proper interval.

h. **Delta Procedures.** If a signal Delta is given by the tower while in the pattern, maintain pattern altitude and fly the same landing pattern. Fly the pattern on-speed in the landing configuration with speed brakes retracted (Delta Easy). Delta clean equals 200 KIAS and altitude as assigned. When cleared from the Delta pattern, the first aircraft to reach the 180 position resumes the normal approach.

i. **Carrier Arrestment.** Execute the approach exactly as a touch and go, flying the ball all the way to touchdown. When the aircraft touches down, advance the power to MRT and retract the speed brakes. Do not anticipate an arrested landing. Maintain MRT until the aircraft comes to a complete stop and the yellow shirt located at the 1 to 2 o'clock position signals for power back. The yellow shirt will then signal for brake release and a pull-back, followed by a stop signal and hook up signal. The pull-back allows for the wire to clear the hook. If the pilot applies the brakes during the evolution, the aircraft will tilt back, potentially damaging the tail section. Follow the yellow shirt's instructions/commands.

j. **Communications.** For Case I recoveries, Marshal will provide the case recovery, current BRC and expected "Charlie" time upon initial check in. Charlie time is the time at which launch operations are complete and recovery operations begin; additionally, Marshal will request notification when the carrier is in sight, normally around 10 NM. Sample communications are as follows:

i. **405 -** *"Marshal, 405, 250 for 42, Angels 9, State 2.4"*

ii. **Marshal -** *"405, Case I. BRC is 015, Report, see me"*

iii. **405** - *"405, Wilco"*

At 10 NM or when visual with the ship:

iv. **405** - *"405, See you at 10"*

v. **Marshal** - *"405, Switch Tower"*

Once switched to Tower frequency, just monitor the frequency. The majority of Case I operations are conducted "Zip Lip." This means that radio calls in the pattern are neither required nor desired. However, in low-visibility situations, the following calls will be made:

i. Descending out of overhead holding to the initial: *"405, commencing"*

ii. Initial (3 NM astern): *"405, initial"*

iii. Entering the spin pattern (when applicable): *"405, spinning"*

iv. 90 degrees from initial when spinning: *"405, spin 90"*

v. Departing the landing pattern to re-enter port holding: *"405, Departing _____ NM, upwind"*

vi. Breaking: *"405, breaking at X"* where X is the DME

vii. Ball call, when rolling into the groove, and the pilot sees the ball: *"405, Goshawk Ball, 2.2"* where 2.2 is the fuel state

viii. Clara when the ball is not visible: *"405, Clara"*

During Zip Lip operations, the ball call will not be made. The LSO will acknowledge an implied ball call with a momentary flash of the cut lights (same as a "roger ball" call from the LSO) as the aircraft rolls into the groove. If the ball is not visible, a "clara" call will be made. At any time during Zip Lip operations, radio calls will be made for any safety of flight situations.

NOTE

Never transmit on the radio when another aircraft is on the ball, unless required for safety of flight.

2. Case II

Case II recoveries will be used when weather conditions are such that a flight may encounter IMC during the descent to the VFR pattern. The minimum weather requirements are 1,000 feet ceiling and 5 NM visibility. During Case II recoveries, formation flights are limited to two aircraft. Formations larger than two aircraft will have to be separated into smaller flights.

During Case II, Case III procedures are used outside 10 NM and Case I procedures are used inside 10 NM, or after reporting "see you." This approach will be flown until the ship is in sight, at which point, the flight will contact tower and proceed inbound as if Case I. If the flight does not see the ship by 5 NM, the aircraft will be vectored into the bolter/waveoff pattern and instructions will be given for a Case III recovery.

a. **Marshal Holding.** If Marshal directs a Case II recovery, the flight will proceed to Case II/III marshal pattern holding fix. Ideally, the holding fix will be on the 180 radial relative to BRC. Weather and airspace considerations may not allow for this. Generally, the holding radial will be within 30 degrees of the 180 radial. Aircraft will hold on the assigned radial at a distance equal to 1 NM for every 1,000 feet of altitude plus 15. In other words, the distance of the holding fix is determined by adding 15 to the assigned holding altitude in angels. For example, if instructed to hold on the 220 radial at angels 8, the fix would be determined as follows:

   i. Distance = Angels + 15 = 8 +15 = 23

   Therefore, hold on the 220 radial at 23 DME at 8,000 feet. Figure 2-6 illustrates the Case II/III Marshal pattern. The lowest altitude for assignment is 6,000 feet for turboprop and jet aircraft.

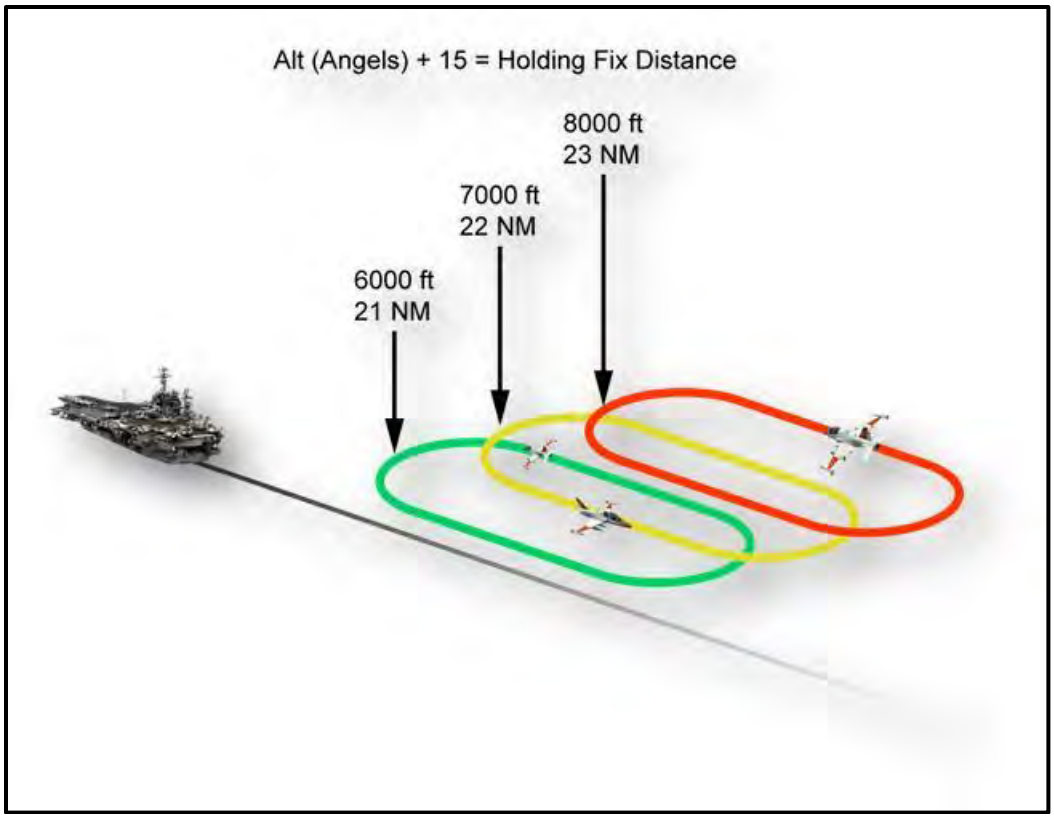


Figure 2-6 Case II/III Marshal Holding

The holding pattern is a six-minute left-hand pattern. Unless otherwise briefed, the pattern will be flown at max conserve fuel flow or NATOPS holding airspeed. Two-minute turns and one-minute legs are normally used for the pattern. Aircraft must be established at assigned holding altitudes by 10 NM from the Marshal "stack." Aircraft in the stack will be separated by 1,000 feet vertically.

Strict management of the holding pattern is required to arrive at the fix, at the assigned approach time (push time). For example, arriving in holding at time 16 with a push time of 27, one 6-minute pattern and one 5-minute pattern could be used. But regardless of how the pattern is managed, aircraft must arrive at the holding fix on airspeed (250 kts) and ready to commence the approach at the Expected Approach Time (EAT) plus or minus 10 seconds. If unable to do this, notify Marshal so that timing adjustments to the landing interval can be made.

b. **Emergency Marshal Fixes.** In the event of an emergency, fixed wing aircraft are issued an emergency marshal radial 150-degree relative to the expected final bearing at a distance of 1 mile for every 1,000 feet of altitude plus 15 miles (angels +15). As with the normal Marshal pattern, the lowest altitude for assignment is 6,000 feet for turboprop and jet aircraft. The holding sequence is jets, then turboprops. The emergency holding pattern is a right-hand, 6-minute racetrack patterns.

c. **Approach.** Aircraft push times will normally be separated by one minute. Upon commencing the approach, aircraft will establish a 4,000 feet per minute rate of descent at 250 KIAS. At 5,000 feet (platform), the rate of descent will be reduced to 2,000 feet per minute. This will be maintained until reaching the level-off altitude of 1,200 feet. Aircraft will proceed inbound at 1,200 feet and report a "see me" when the ship is in sight. Marshal will switch the flight to Tower frequency for a normal Case I recovery. If the ship is not in sight by 10 NM, a descent to 800 feet is authorized. If the ship is still not in sight at 5 NM, notify Marshal for further instructions and vectors into the bolter/waveoff pattern for an instrument approach. The Case II approach profile is shown in Figure 2-7.

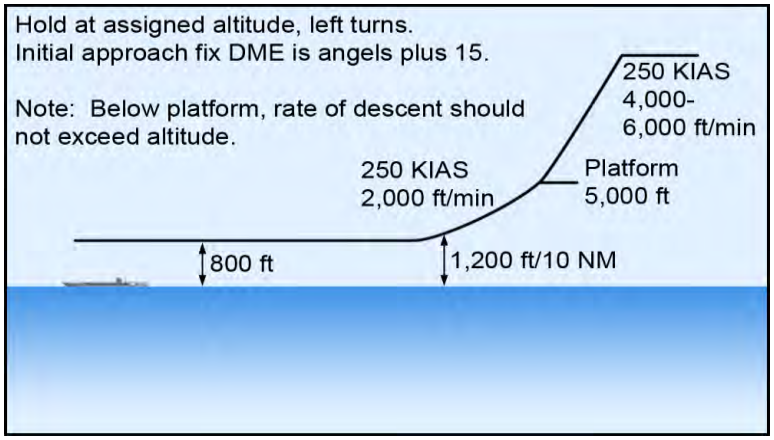


Figure 2-7 Case II Approach Profile

d. **Communications.** For Case II recoveries, Marshal will provide the following information upon check in:

i. Current weather and altimeter

ii. Case recovery

iii. Marshal instructions

iv. Expected final approach button (frequency) if required

v. Expected approach time (EAT)

vi. Expected BRC

vii. Additional information such as divert field, fuel data and bingo information.

Notify Marshal when established in holding. Marshal may periodically update the weather and BRC. Notify Marshal when the approach is commenced. When the ship is in sight, aircrew will call "see you" and Marshal will switch them to Tower. To reduce radio traffic, items of general or collective interest may be transmitted as a "99" broadcast by Marshal or approach control.

Sample communications are as follows:

i. **405** - *"Marshal, 405, 250 for 42, Angels 14, State 2.4"*

ii. **Marshal** - *"405, Mother's weather is 1,500 overcast, visibility 5 miles, altimeter 29.87. Case II recovery. Marshal on the 160, 22, angels 7. BRC is 015, Expected approach time 22."*

iii. **405** - *"405, altimeter 29.87. Marshal on the 160, 22, angels 7. Expected approach time 22."*

When established in holding:

iv. **405** - *"405, established angels 7. State 2.3"*

While holding:

v. **Marshal** - *"99, altimeter 29.88. BRC 020"*

When beginning the penetration:

vi. **405** - *"405 commencing, 29.88, State 2.2"*

When visual with the ship:

vii. **405** - *"405, see you at 12"*

viii. **Marshal** - *"405, switch Tower"*

ix. **405** - *"405, switching Tower"*

Approaching the initial with nobody on the ball:

x. **405** - *"Tower, 405 initial"*

xi. **Tower** - *"405, roger"*

Normal Case I calls will be made in the landing pattern.

3. Case III

The Case III recovery is used for all night operations, as well as during the day when the weather is below Case II minimums (less than 1,000-3). Case III recoveries are limited to single aircraft only. Section approaches will be approved only when an aircraft emergency situation exists. Formation penetrations/approaches by dissimilar aircraft shall not be attempted except in extreme circumstances when no safer options are available for recovery.

a. **Holding.** The Case III marshal holding pattern is identical to Case II. During Case III recoveries, aircraft will commence from the Marshal stack and fly the CV-1 Approach.

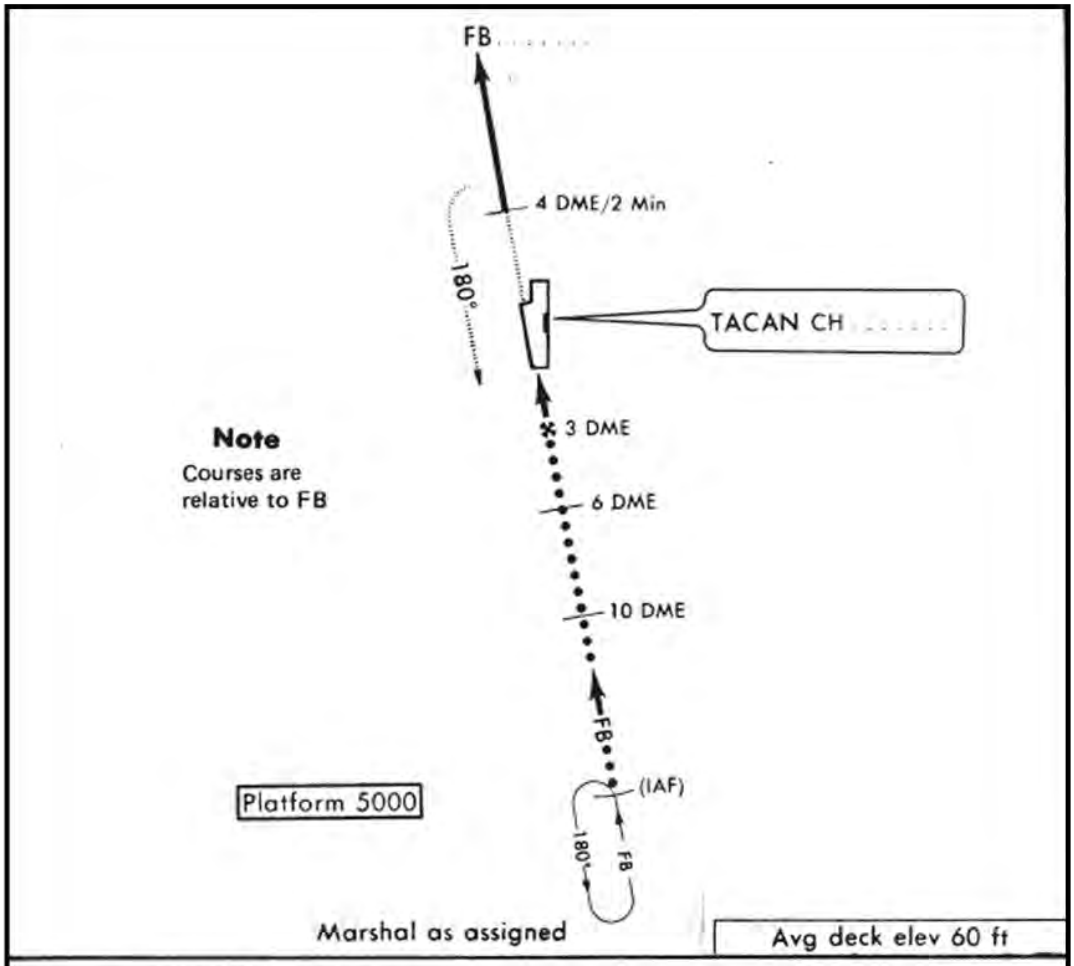
b. **Approach.** The CV-1 Approach is illustrated in Figure 2-8.

Aircraft push times will normally be separated by one minute. Upon commencing the approach, aircraft will establish a 4,000 feet per minute rate of descent at 250 KIAS. If the Marshal radial is not the reciprocal of the final bearing, a correction to final bearing will be required at 20 DME as follows:

i. A gradual correction shall be made when the final bearing is within 10° of the reciprocal of the marshal radial.

ii. A 30° correction at 20 DME will be used when the final bearing is greater than 10° from the reciprocal of the marshal radial. If not established on the final bearing by 12 miles, fly the 12-mile arc until intercepting final bearing.

At 5,000 feet (platform), the rate of descent will be reduced to 2,000 feet per minute. This will be maintained until reaching the level-off altitude of 1,200 feet. At some point during the penetration or level off, Marshal will switch the aircrew to the final approach control frequency and they will check in with altitude. Landing checks will be initiated at 10 DME, and aircraft will reduce speed to cross 6 DME at 150 kts. Landing gear should be down no later than 8 DME. At 6 DME, aircraft will slow to final approach speed. ACLS lock-on will occur sometime between 8 DME and 4 DME. At lock-on, compare the needles with bullseye (ACLS to ICLS) to ensure a good lock. Approach will ask the crew to “say needles.” The pilot will reply with the relative position of both the glideslope needle and the azimuth needle, such as “fly up, fly right” or “fly up, on.” If this concurs with the readout on the approach radar scope, the controller will direct, “fly the needles.” If there is a disagreement, the controller will break lock and attempt a new lock. In this case, he will say “fly the bullseye” (ICLS) until he acquires a new ACLS lock.



CATEGORY	JET	TURBOPROP
ICLS	360-3/4	300 (300-3/4)
ICLS/ILM with SPN-42/46 monitor	(Mode 1 — As Certified)	
S—PALS	260-1/2	200 (200-1/2)
S—ASR	600-1-1/4 540 (600-1-1/4)	400-1 340 (400-1)
S—TAC		

Figure 2-8 CV 1 Approach

Once a good ACLS lock has been confirmed, the pilot will fly the needles. As a backup, always perform a self-contained GCA, comparing actual altitude with calculated altitude as follows:

i. 3 NM 1,200 feet

ii. 2 NM 800 feet

iii. 1 NM 400 feet

iv. 0.5 NM 200 feet

At 3/4-mile, the final controller will instruct aircrew to call the ball. The LSOs will roger the ball call. Continue to monitor the approach as the pilot transitions from an inside to outside scan.

c. **Bolter/Waveoff Pattern.** In the event of a waveoff or bolter, climb to 1,200 feet at 150 kts and raise the gear to save fuel, leaving flaps down. When instructed by approach, turn downwind. Perform the landing checks on downwind, and notify approach with fuel state when abeam the ship. Expect a turn back to final 4-8 NM past abeam for another approach, lowering the landing gear as you start this turn to final.

If no instructions are received by 4 DME upwind, attempt to contact approach. If unable to contact approach, turn downwind and perform the normal checks. Make the abeam call, and if contact has not been reestablished with approach by 4 NM (2 minutes) past abeam, turn final. Intercept the ICLS and fly a normal approach. Call the ball at 3/4-mile. If this call is not acknowledged, look for the cut lights.

d. **Communications.** For Case III recoveries, Marshal will provide the following information upon check in:

i. Current weather and altimeter

ii. Case recovery

iii. Marshal instructions

iv. Expected final approach button (frequency)

v. Expected approach time (EAT)

vi. Expected final bearing

vii. Additional information such as divert field, fuel data and bingo information.

Notify Marshal when established in holding. Marshal may periodically update the weather and BRC while in holding. Notify Marshal when the approach is commenced. Marshal will hand aircraft off to the final controller during the penetration, ideally before reaching platform.

Sample communications are as follows:

i. **405** - *"Marshal, 405, 250 for 42, Angels 14, State 2.4"*

ii. **Marshal** - *"405, Mother's weather is 600 overcast, visibility 3 miles, altimeter 29.87. Case III recovery, CV-1 approach. Marshal on the 160, 22, angels 7. Expected final bearing 015, expected approach time 22. Approach button 18."*

iii. **405** - *"405, altimeter 29.87. Marshal on the 160, 22, angels 7. Expected approach time 22."*

When established in holding:

iv. **405** - *"405, established angels 7. State 2.3"*

While holding:

v. **Marshal** - *"99, altimeter 29.88. New final bearing 020"*

When beginning the penetration:

vi. **405** - *"405 commencing, 29.88, state 2.2"*

vii. **Marshal** - *"405, roger"*

Handoff to approach:

viii. **Marshal** - *"405, switch Approach, button 18"*

ix. **405** - *"405 switching button 18*

Check in with Approach:

x. **405** - *"405 checking in, state 1.5"*

xi. **Approach** - *"405, final bearing 017"*

At platform:

xii. **405** - *"405 platform"*

At ACLS lock-on:

xiii. **Approach -** *"405, say needles"*

xiv. **405 -** *"405, fly up, on"*

xv. **Approach -** *"405, fly your needles"*

At ¾ mile:

xvi. **Approach -** *"405, ¾ mile, call the ball"*

xvii. **405 -** *"405, Goshawk ball, 2.0"*

xviii. **LSO -** *"Roger ball"*

205. EMERGENCIES

1. Aircraft Emergencies

a. **Bingo.** Bingo is an emergency situation. It means the aircraft is at emergency fuel level, not minimum fuel.

The fuel state of every aircraft is constantly monitored by Air Ops and Tower. When the fuel state reaches hold-down, as set by Air Ops, the aircraft will be held on deck for refueling. If directed to taxi to the catapult with a fuel state at or below hold-down, make a call to Tower.

b. **Computing Bingo Profile (Clean).** In a clean configuration, the computation of the bingo profile will be computed as follows (refer to Figure 2-9):

i. Determine the distance to base.

NOTE

Aircraft will receive information on bearing/distance (pigeons) to the divert field and bingo fuel state from Marshal on initial check-in. This information is periodically updated and broadcast over Marshal and tower frequencies. Always write down bingo and pigeons information.

ii. Refer to the PCL to determine proper bingo information.

(a). Fuel required

(b). Time required for bingo (total time required from start of climb to landing)

(c). Speed (KIAS) for climb

(d). Cruise altitude

(e). Cruise (KIAS/IMN) speed at cruise altitude

(f). Descent (KIAS) speed

(g). Descent point

Always verify the bingo figures passed by the ship with the bingo fuel chart based on the distance to the bingo field. Refer to the PCL or NATOPS for current charts. Example bingo profile computation problem:

i. Determine proper bingo information given the following:

(a). Aircraft configuration: gear up, flaps up

(b). Zero fuel weight: 10,500 lb.

(c). Drag index: 0

(d). Distance to bingo field: 100 NM

ii. Solution:

(a). DIST TO BASE = 100 NM

(b). FUEL REQD = 712 lb.

(c). CLIMB SPEED = 300 KIAS/.75 IMN

(d). CRUISE ALT = 20,000 feet

(e). CRUISE SPEED = 218 KIAS .48 IMN

(f). DESCENT SPEED = 180 KIAS

(g). DESCENT DIST = 55 NM (from bingo field)

NOTE

Fuel required includes 300 pounds reserve fuel, maximum thrust climb to indicated altitude, and idle thrust descent to sea level.

BINGO

GEAR UP - FLAPS UP

	MAXIMUM RANGE CRUISE									SEA LEVEL CRUISE		
	DIST TO BASE	FUEL REQD NO WIND	FUEL REQD 100 KT HEAD WIND	CLIMB SPEED	CRUISE ALT	CRUISE SPEED	DESCEND SPEED	DESCEND DIST NO WIND	DESCEND DIST 100 KT HEAD WIND	FUEL REQD NO WIND	FUEL REQD 100 KT HEAD WIND	CRUISE SPEED
	NM	LB	LB	KCAS	FEET	KCAS	KCAS	NM	NM	LB	LB	KCAS
DRAG INDEX = 0	25	420	515		5,000	221		14	6	429	535	220
	50	528	682		10,000	222		27	13	559	771	221
	75	625	815		15,000	219		41	21	690	1,006	221
	100	712	921		20,000	218		55	29	820	1,240	222
	125	795	1,006	300/	25,000	225	180	69	37	952	1,474	222
	150	869	1,081	0.75	30,000	224		83	46	1,083	1,707	223
	175	935	1,150		35,000	215		97	55	1,216	1,940	224
	200	999	1,238		35,000	216		97	55	1,349	2,172	224
	225	1,063	1,327		35,000	216		97	55	1,482	2,404	225
	250	1,127	1,392		40,000	213		111	65	1,616	2,635	226
DRAG INDEX = 50	25	433	542		5,000	214		12	5	441	562	214
	50	551	731		10,000	214		24	11	582	823	215
	75	656	875		15,000	214		37	17	724	1,085	216
	100	752	993		20,000	213		49	24	867	1,348	216
	125	840	1,089	265/	25,000	215	170	61	31	1,010	1,610	216
	150	924	1,175	0.70	30,000	214		74	39	1,153	1,872	217
	175	1,000	1,259		35,000	208		86	47	1,297	2,135	217
	200	1,074	1,361		35,000	208		86	47	1,442	2,398	218
	225	1,147	1,464		35,000	208		86	47	1,587	2,661	218
	250	1,221	1,568		35,000	209		86	47	1,733	-	219
DRAG INDEX = 100	25	444	566		5,000	210		11	5	452	589	209
	50	572	773		10,000	208		22	10	604	877	209
	75	685	993		15,000	207		33	15	757	1,165	210
	100	788	1,060		20,000	207		44	21	911	1,454	211
	125	880	1,132	245/	30,000	201	165	66	34	1,066	1,742	211
	150	965	1,257	0.60	30,000	201		66	34	1,221	2,030	212
	175	1,051	1,358		35,000	195		77	41	1,377	2,318	212
	200	1,133	1,477		35,000	195		77	41	1,533	2,606	213
	225	1,216	1,597		35,000	196		77	41	1,690	2,893	213
	250	1,299	1,717		35,000	196		77	41	1,848	-	214

GEAR UP - FLAPS UP

NOTES:

1. FUEL REQUIRED INCLUDES 300 LB RESERVE FUEL
2. INITIAL ALTITUDE IS SEA LEVEL
3. MAXIMUM THRUST CLIMB TO CRUISE ALTITUDE
4. IDLE THRUST MAXIMUM RANGE DESCENT TO SEA LEVEL (SPEEDBRAKES RETRACTED)

Figure 2-9 Clean Bingo Chart

c. **Bingo Flight Procedures (Clean).** Upon reaching bingo fuel status, turn to bingo heading, clean up, accelerate to 300 KIAS, and fly the bingo profile (climb at MRT). Do not delay performing the turn or climb, but be aware of the ship's position and other aircraft in the pattern. Communicate intentions to the ship. Do not delay in executing a bingo profile while awaiting Tower reply. Squawk 7700 and communicate to any appropriate controlling agency.

At the descent point, begin idle descent to the bingo field at the descent airspeed.

CAUTION

Always cross-check your wet compass once established on a bingo.

NOTE

If the Bingo Profile is properly flown, aircraft should arrive overhead the field with 300-500 lbs. of fuel. This allows enough fuel to make a turn downwind or a 360-degree turn in the event you are unable to make a safe approach on the first try. Use good headwork.

d. **Computing Bingo Profile (Dirty).** Since bingo profiles are normally flown in a clean configuration, bingo information calculated from the CV is for a clean bingo; however, if the aircraft has a gear and/or flap/slat malfunction resulting in a dirty configuration, the fuel requirements will be higher. Dirty bingo information is computed in the same manner as clean bingo except that a different chart is used (Figure 2-10). Refer to the PCL or NATOPS for current charts.

When in a dirty configuration, compute the bingo profile as follows:

i. Determine the distance to base.

ii. Refer to the PCL to determine proper bingo information.

(a). Fuel required

(b). Speed (KIAS) for climb

(c). Cruise altitude

(d). Cruise (KIAS/IMN) speed at cruise altitude

(e). Descent (KIAS) speed

(f). Descent point

Example bingo profile computation problem:

iii. Given the following information, determine proper bingo information:

(a). Aircraft configuration: gear down, flaps full

(b). Zero fuel weight: 10,500 lb.

(c). Drag index: 0 to calculate speed

(d). Distance to bingo field: 100 NM

iv. Solution:

(a). DIST TO BASE = 100 NM

(b). FUEL REQD = 1,950 lb.

(c). CLIMB SPEED = 120 KIAS

(d). CRUISE ALT = 15,000 feet

(e). CRUISE SPEED = 118 KIAS/.24 IMN

(f). DESCENT SPEED = 110 KIAS

(g). DESCENT DIST = 15 NM (from bingo field)

NOTE

Fuel required includes 300 pounds reserve fuel, maximum thrust climb to indicated altitude, and idle thrust descent to sea level.

e. **Bingo Flight Procedures (Dirty).** Upon reaching bingo fuel status, turn to the bingo heading. Do not delay performing the turn or climb, but be on the lookout for other aircraft. Fly the computed bingo profile and climb at MRT. Communicate the same information as if executing a clean bingo.

f. **Blown Tire.** The most common reason for a dirty bingo is a blown tire. If a wingman can visually inspect you and confirm no damage or debris in the flaps, you can raise the flaps and perform a gear down/flaps up dirty bingo to save fuel. Procedures for handling a blown tire depend on the situation under which the malfunction occurs. If the tire blows during a touch and go or after a catapult launch, aircraft may trap aboard or be directed to divert. If it occurs after an arrestment, follow the yellow shirt's signals to taxi or be towed out of the landing area. If instructed to divert, fly the dirty profile; this will require careful fuel monitoring.

BINGO

GEAR DOWN - FULL FLAPS

	MAXIMUM RANGE CRUISE									SEA LEVEL CRUISE		
	DIST TO BASE	FUEL REQD NO WIND	FUEL REQD 50 KT HEAD WIND	CLIMB SPEED	CRUISE ALT	CRUISE SPEED	DESCEND SPEED	DESCEND DIST NO WIND	DESCEND DIST 50 KT HEAD WIND	FUEL REQD NO WIND	FUEL REQD 50 KT HEAD WIND	CRUISE SPEED
	NM	LB	LB	KCAS	FEET	KCAS	KCAS	NM	NM	LB	LB	KCAS
DRAG INDEX = 0	25	743	1,001		8,000	122		8	4	758	1,074	123
	50	1,142	1,598		12,500	118		12	7	1,226	1,858	124
	75	1,541	2,187		15,000	117		15	9	1,704	2,652	126
	100	1,950	2,809		15,000	118		15	9	2,195	-	127
	125	2,369	-	120	15,000	119	110	15	-	2,697	-	129
	150	2,819	-		12,500	120		12	-	-	-	-
	175	-	-		-	-		-	-	-	-	-
	200	-	-		-	-		-	-	-	-	-
	225	-	-		-	-		-	-	-	-	-
	250	-	-		-	-		-	-	-	-	-
DRAG INDEX = 50	25	749	1,011		8,000	121		8	4	764	1,087	122
	50	1,155	1,620		12,500	117		12	7	1,239	1,885	124
	75	1,562	2,221		15,000	116		14	9	1,725	2,694	125
	100	1,979	2,854		15,000	117		14	9	2,222	-	127
	125	2,406	-	120	15,000	118	110	14	-	2,732	-	128
	150	2,866	-		12,500	120		12	-	-	-	-
	175	-	-		-	-		-	-	-	-	-
	200	-	-		-	-		-	-	-	-	-
	225	-	-		-	-		-	-	-	-	-
	250	-	-		-	-		-	-	-	-	-
DRAG INDEX = 100	25	754	1,022		8,000	121		8	4	771	1,100	123
	50	1,169	1,643		12,500	116		12	7	1,252	1,912	123
	75	1,583	2,257		15,000	116		14	8	1,745	2,737	125
	100	2,007	-		15,000	117		14	-	2,250	-	126
	125	2,442	-	120	15,000	118	110	14	-	2,766	-	127
	150	-	-		-	-		-	-	-	-	-
	175	-	-		-	-		-	-	-	-	-
	200	-	-		-	-		-	-	-	-	-
	225	-	-		-	-		-	-	-	-	-
	250	-	-		-	-		-	-	-	-	-

GEAR DOWN - FULL FLAPS

NOTES:

1. FUEL REQUIRED INCLUDES 300 LB RESERVE FUEL
2. INITIAL ALTITUDE IS SEA LEVEL
3. MAXIMUM THRUST CLIMB TO CRUISE ALTITUDE
4. IDLE THRUST MAXIMUM RANGE DESCENT TO SEA LEVEL (SPEEDBRAKES RETRACTED)

Figure 2-10 Dirty Bingo Chart

Even if well above bingo fuel, still fly the dirty bingo profile (the most fuel efficient profile). Refer to the PCL or NATOPS for proper field arrestment procedures. Not following these procedures explicitly may result in a hook skip.

WARNING

Directional control on the runway will be extremely difficult with one or both main tires blown.

Upon touchdown, with a single blown main tire, the aircraft will begin an immediate and rapid yaw or swerve into the side of the blown tire; additionally, the aircraft will establish an Angle of Bank (AOB) of approximately 3-degrees opposite the direction of yaw (i.e., right yaw, left AOB). During the initial swerve, and subsequent pilot inputs to correct it, cockpit lateral accelerations (side-to-side) can reach up to 0.5 g; this can be very uncomfortable. Landing area lateral deviations will vary depending on how rapidly correct control inputs (rudder inputs opposite the swerve) are applied.

For a shipboard arrested landing attempt, the LSO may elect to adjust the touchdown point by targeting the 2-wire. The pilot should be prepared for the possibility of a bolter/hook skip. Should this occur, aggressive and rapid rudder pedal deflection after touchdown (requiring up to 180-pounds of force within 0.25 seconds) is required to counter the swerve of a single blown tire to stay within the lateral confines of the landing area. Once airborne, center the rudder pedals and establish a flyaway attitude.

g. **Cross-Deck Pendant/Hook Point Failure.** Immediately determine if the aircraft can be stopped on the deck. If the aircraft cannot be stopped on the deck, determine if there is adequate airspeed for flight. If airspeed is not adequate, eject. If airspeed is adequate, maintain MRT, check speed brakes retracted, and smoothly rotate to optimum AOA. If the sink rate is not arrested, increase the AOA to 24 units, maintain wings level, and establish a positive rate of climb.

h. **NWS Failure On Flight Deck.** The indications of a nose wheel steering failure are as follows:

i. MSTR ALERT light flashes

ii. Caution tone sounds in headset

iii. NOSE WHEEL STR amber caution light illuminated

iv. NOSE WHEEL STR green advisory light extinguished (if high gain selected)

v. Rudder pedals ineffective for steering

If these indications are present, stop the aircraft. Do not taxi with inoperable NWS. Inform the tower of NWS failure. Confirm the pilot has pressed the paddle switch to

disengage NWS and pressed the MSTR ALERT light (to cancel the light and tone). The deck crew will attach a tow bar. While being towed, follow the flight director's signals.

WARNING

Do not reengage NWS or use differential braking while the tow bar is attached.

i. **Brake Failure.** The illumination of the HYD 1 PRESS caution light, a low indication of pressure on the brake pressure gauge, or a decrease or loss of brake pedal pressure are indications of brake failure. If these indications occur, use high gain nose wheel steering and available braking to maintain directional control while stopping. If only one brake fails, use NWS and the functioning brake to stop the aircraft.

Engage the parking brake if available and drop the arresting hook (to signal deck personnel that a brake failure has occurred), ensure that the ANTI-SKID switch is in the OFF position.

Advise the tower of the situation. Move the throttle to OFF only if a collision is unavoidable because shutting down the engine will lose NWS and any remaining hydraulic services. Make every effort to keep the aircraft on the flight deck, even if it means running into the island or another aircraft. If the aircraft is leaving the flight deck, eject. Once a wheel is off the flight deck (i.e., aircraft is no longer level), the aircraft may be out of the ejection envelope and ejection is no longer recommended. The following water egress procedures may be necessary:

i. Pull the Mild Detonating Cord (MDC) firing handle and activate emergency oxygen. In the event of an underwater egress, it is possible to breathe under water with the oxygen equipment to a depth of 16 feet.

ii. If possible, evacuate with the survival kit, release the upper Koch fittings, pull the emergency restraint release (to release leg restraints), evacuate the aircraft with the seatpack, and inflate the life preserver unit (LPU).

iii. When evacuating without the survival kit, release the upper Koch fittings, pull the emergency restraint release, release the lower Koch fittings, disconnect oxygen/communication connectors, and inflate the LPU.

iv. If the cockpit has flooded, the LPU may have inflated due to the water-activated automatic inflation device. If so, care must be taken during exit to avoid damage to the LPU.

j. **Launch Bar Malfunction (Airborne).** A launch bar malfunction is indicated by the red L BAR warning light accompanied by the warning tone. If these indications occur, verify that the launch bar switch is in the RETRACT position. If the launch

bar fails to retract, inform the LSO/tower and refer to the Landing Gear Malfunction-Landing Guide chart in your PCL. If the launch bar is visually confirmed to be in the DOWN position, clean up, exit the pattern using standard procedures, and rendezvous overhead according to tower instructions. Expect to divert and land ashore with the short-field arresting gear de-rigged.

2. Catapult Malfunctions/Emergencies

If an aircraft emergency occurs while on the catapult, perform catapult suspend procedures:

- Use a head shake as a negative signal and transmit, "Suspend, suspend, suspend."
- Maintain MRT until the catapult officer steps in front of the aircraft's wing and gives the throttle back signal.

CAUTION

Keep both hands down in the cockpit and out of sight so that hand movements cannot be confused with a salute.

a. **Hang Fire (Catapult Malfunction).** A catapult hang fire occurs when the catapult officer has touched the deck, the button has been pushed to launch the aircraft, but the catapult does not fire. If a hang fire occurs, the catapult officer will give the suspend signal followed by the hang fire signal. Once the catapult is safe, he will step in front of the aircraft and give the throttle back signal.

b. **Holdback Fitting Failure.** Once the aircraft is in tension, a holdback fitting failure may occur. When a holdback fitting fails, the aircraft will begin rolling forward and feel like it is on a normal takeoff roll as opposed to a catapult stroke. If this happens, retard the throttle immediately to IDLE, extend speed brakes and apply maximum braking. If necessary, use NWS to remain on the deck. The launch bar must be retracted or the NWS button pressed to activate the NWS.

CAUTION

Failure to perform the above procedures immediately may make it impossible to keep the aircraft on the flight deck, requiring an ejection. If unable to eject, pull the MDC handle, activate emergency oxygen, ride the aircraft into the water, and perform a water egress.

c. **Catapult Malfunction (Cold/Soft Catapult).** Immediately determine if the aircraft can be stopped on the deck. If the aircraft cannot be stopped on the deck, determine if there is adequate airspeed for flight. If airspeed is not adequate, eject. If airspeed is adequate, maintain MRT and smoothly rotate aircraft to optimum AOA to stop sink rate. If the sink rate is not arrested, increase AOA to 24 units. Maintain wings level and establish a positive rate of climb.

d. **Communication Failure.** In the event of a communications failure, always troubleshoot the system by checking switches and looking for loose connections.

e. **Lost Comm Enroute To Ship.** Using hand signals, notify the lead of your NORDO condition and fuel state. The lead will contact Marshal and coordinate a recovery or a divert.

f. **Lost Comm In The Pattern.** Fly a normal pattern to the start and call the ball. If no cut lights are received, wave off the approach and do not descend below 300 ft. Fly up the angled deck, rocking the wings. When abeam the ship's bow, turn to parallel BRC, then climb and maintain 500 feet, and accelerate to 150 KIAS. Continue in the pattern, turning on interval.

CAUTION

1. When climbing, stay alert for other aircraft. Remain within 5 NM of the ship and do not lose sight of the ship.

2. If bingo fuel state is reached, or an emergency occurs that requires an immediate landing, proceed to the divert field and squawk 7700. Cross-check the wet compass and HSI to ensure that heading is properly aligned. Another aircraft may join as an escort to the bingo field.

g. **Lost Comm On The Flight Deck.** Never taxi to a catapult for launch with a known communication malfunction. Give the communication failure signal to the yellow shirt (point at ears or mask followed by a thumbs down) and follow the yellow shirt's signals to a parking area. Troubleshoot the malfunction when practicable (cycle the switches and check the mask and helmet connections).

APPENDIX A
GLOSSARY

A100. GLOSSARY OF CV PROCEDURES FOR T-45C

Air Boss: Officer (located in Pri-Fly) in charge of all flight deck and tower operations within 5 nautical miles of the ship

Air Operations Officer: The officer who coordinates all matters pertaining to air operations including CATCC

Air Plan: Schedule of carrier flight operations published daily but subject to change

Angels: Altitude in thousands of feet. For example, Angels 1.5 = 1,500 feet

Axial Winds: Winds down the longitudinal axis of the ship created by the ship's forward movement. This causes a right-to-left crosswind across the angled deck.

Ball: See "Meatball."

Bingo: Refers to the minimum fuel state required to divert safely to the nearest suitable field. ***Bingo is an emergency situation.***

Bingo Fuel: Aircraft fuel state in sufficient quantity necessary to fly to the bingo field with X lbs. remaining; depending on aircraft type.

Bolter: A touchdown on the carrier in which the arresting hook does not engage the arresting wires

BRC: Base recovery course, which is the ship's magnetic course

Breaking the Deck: First aircraft to land for each cycle

Buster: Proceed at maximum airspeed, generally for an immediate Charlie

Carrier Air Traffic Control Center (CATCC): The centralized department responsible for the status-keeping of all carrier air operations and control of all airborne aircraft involved in launch and recovery

Carrier Control Zone (CCZ): The airspace within a circular limit defined by a 5 mile radius around the ship surface up to and including 2,500 feet under the cognizance of the Air Boss during VFR conditions

Case I: Refers to departure/recovery procedures and landing patterns conducted in VMC conditions when 3,000/5 or greater exist (3,000-foot ceiling and 5-NM visibility within the carrier control zone). Case I recoveries will marshal overhead the ship and enter the pattern via the break.

Case II: Weather less than 3,000/5 but greater than 1,000/5 exist at the ship. Case II recovery is a controlled IMC descent to the break and the VFR pattern. It is used when a VFR penetration cannot be made. The approach may be via radar vectors or a TACAN or ADF approach. In no case will more than a section of two aircraft execute a Case II recovery. Case II departure is a procedure used to climb through IFR conditions to VMC.

Case III: Used for weather less than 1,000/5, or at night.

CCA: Carrier-controlled approach similar to a GCA

Charlie: Refers to the time the first aircraft is expected at the ramp. A "Charlie" or "Charlie on arrival" call is a directive to enter the pattern now. "Charlie five" means be at the ramp in five minutes.

Cherubs: Altitude in hundreds of feet. For example, Cherubs 3 = 300 feet (Normally used for helicopters).

Chicks: Wingmen in a flight

Clara: Meatball is not in sight

Clearing Turn: Associated with a Case I or II departure. Immediately after launch, aircraft from bow cats initiate a right turn then a turn to parallel the BRC. Aircraft launched from the waist cats initiate a left turn then a turn to parallel the BRC. The purpose of these turns is to provide aircraft lateral separation on multiple launches from the carrier.

C.Q.: Carrier qualification

Cross-Deck Pendant (CDP): Arresting gear wire

Cut Lights: Green lights mounted horizontally and centered above the IFLOLS lens box (controlled by the LSO). Utilized during Zip Lip and EMCON conditions instead of UHF to give pilots clearance to land, i.e., "Roger Ball." Subsequent cut lights mean "power." Also, used in conjunction with waveoff lights to signal bingo.

Datum Lights: Green reference lights mounted horizontally on the IFLOLS, seen on each side of the centered cell

Delta: Enter holding pattern as directed or continue to hold

Delta Clean: Signal for aircraft in the pattern to raise gear and flaps/slats and hold as directed

Delta Easy: Signal for aircraft to remain at pattern altitude with gear and flaps/slats down and speed brakes retracted

Departure Reference Radial (DRR): Preassigned radial usually passed during the brief or as standing SOP

Divert: An order for an aircraft to proceed and land at the field specified. This is a non-emergency situation.

Emergency Expected Approach Time (EEAT): The future time, assigned prior to launch, at which time an aircraft is cleared to depart inbound or penetrate from a pre-assigned fix under lost communications conditions

Emergency Marshal: A marshal established by CATCC and given to each pilot prior to launch with and altitude and EEAT. The emergency marshal radial will have a minimum of 30 degrees of separation from the primary marshal radial.

Emission Control Procedures (EMCON): Electronic emission control procedures are in effect at the ship to avoid detection. All radio, radar, and navigation equipment transmissions are eliminated except as required for safety of flight.

Expected Approach Time (EAT): The future time at which an aircraft is cleared to depart inbound or penetrate from a pre-assigned fix. Aircraft depart and commence approach at assigned time if no further instructions are received.

Father: Code name for the ship's TACAN

Feet Wet or **Feet Dry:** Aircraft crossing the coastline enroute to or returning from the ship

Field Carrier Landing Practice (FCLP): LSO-graded landings conducted at the field prior to any carrier evolution

Final Bearing (FB): The magnetic bearing assigned by CATCC for final approach (an extension of the landing area centerline); usually BRC minus the landing area angle of 10°.

Foul Deck: Landing area is not free of all obstructions or the flight deck is not ready to recover aircraft.

Foul Line (ship only): A line painted on both sides of the landing area to define the minimum area that must be free of obstructions in order to consider the deck clear

Fuel Ladder: A quick snapshot reference of total fuel breakdown and airborne time remaining used in the formulation of fuel requirement decision making

Gadget: Radar

Hangar Deck: Area below the flight deck used to store and repair aircraft

Hawk: Term used for a lead safe. (Hawking chicks)

Holdback: Metal fitting designed to break or release at a preset level of force during a catapult stroke

Hold-Down: Fuel state at which an aircraft will be refueled on deck prior to launch

Hook to Eye: The vertical distance measured between the pilot's eye and the aircraft's hook

Hook to Ramp: The clearance distance between the aircraft's hook point and the flight deck as it crosses the ramp

Hot Refueling: Aircraft receives fuel with engine turning

Hot Seat: The replacement of one pilot by another pilot while the engine is turning

Improved Fresnel Lens Optical Landing System (IFLOLS): Pilot's landing aid, i.e., meatball

Interval: The time between you and the aircraft you are to follow

In the Middle Position: A distance on the groove that is between the "start" and the "in close" position. The middle-third of the groove.

Jet Blast Deflector (JBD): Hydraulically lifted deck plate mounted behind each catapult

Kilo Report: An aircrew coded report indicating aircraft mission readiness

Landing Signals Officer (LSO). Controls all fixed-wing aircraft off the 180 to touchdown during carrier and FCLP landings

Launch Bar: Metal arm attached to the nose gear and used to launch the aircraft

Mark your Father: State bearing and distance from ship

Marshal:

1. Holding pattern during Case I, II, and III recoveries
2. The term used for the ship's radar controller

Meatball: Light projected by source lens on the IFLOLS

Mirror: Landing aid used prior to the development of the Fresnel lens

Mother: Code name used to signify the carrier

Ninety-nine Aircraft: A collective call to all aircraft in the launch or recovery

On the Ball: LSO call stating hold your transmission until aircraft in the groove has landed

Overhead Time: The scheduled time a flight of aircraft is expected overhead the ship for pattern entry

Paddles: The call sign for the LSO

Parrot: IFF

Pigeons: The magnetic bearing and distance to the divert field named

Pilot Landing Assistance Television (PLAT): Video camera system used to record carrier operations

PIM: Position of intended movement

Plane Guard: SAR helicopter or ship assigned during aircraft launch and recovery, usually located in starboard Delta for a helicopter, three miles astern for a ship

Platform: A reporting point in the ship's TACAN approach (normally at 20 NM from the ship at 5,000 feet) at which the rate of descent is decreased to 2,000 feet per minute

Pogo: Return to previous frequency if unable to establish communications on frequency assigned

Popeye: Code word used to signify that aircraft is operating IMC

Pri-Fly: Tower location where the Air Boss oversees the pattern and flight deck operations

Primary Marshal Radial: The radial assigned by Marshal that is used as the primary if there is a requirement for more than one Marshal stack/radial (geopolitical constraints or additional battle groups operating in the same area)

Pull Back: Action following arrestment whereby the wire is partially retracted to allow the pilot to raise the tailhook

Push Back: Action taken anytime the aircraft needs to be moved back by deck personnel

Ramp: The aft end of the flight deck.

Ramp Time (Ready Deck): Anticipated time specified by the Air Boss that the flight deck will be ready to recover aircraft. Time the first aircraft in Case III recovery is expected to be at ramp.

Red Crown: Air Defense Unit generally located on a Destroyer (DDG) or CG that protects the battle group airspace, and verifies IFF checks

Roger Ball: The call made by the LSO that indicates you are cleared to land and the LSO has positive control (call made less than a mile prior to landing)

Roll Angle: Movement of the lens about the roll axis (set for each type of aircraft) to maintain a constant targeted hook touchdown point

Round Down: The aft end of the landing area that is curved downward

RTB: Signal to return to base

See You: Communication used to indicate that flight lead has the ship in sight

Shuttle: The portion of the catapult that attaches to the launch bar during catapult launches

Spin: A delaying circle at 1200', performed at the bow when the pattern is too full to allow all members of the flight to break by 4 NM.

Starboard Delta: Holding pattern used by the helicopters and COD aircraft flown on the starboard side of the ship and using right-hand turns at 500 feet

Start: The first-third of the groove length

Steer: A heading to an airfield for normal divert from the ship when not in bingo profile. When directed, proceed to the field named.

Strangle Your Parrot: Turn off your IFF.

Suspend: Stop the catapult launch sequence.

Sweet Lock: Positive TACAN lock-on

Tension: The portion of the catapult launch sequence when the shuttle is hydraulically moved forward to remove slack

Tiedown: Chocks and chains used to secure aircraft on the flight deck

Trick or Treat: Aircraft in pattern that has enough fuel for one more approach. If the aircraft does not trap, it will have to bingo or in-flight refuel (if able).

Zip Lip: Condition in which radio communications are minimized

APPENDIX B
FLIGHT DECK SIGNALS

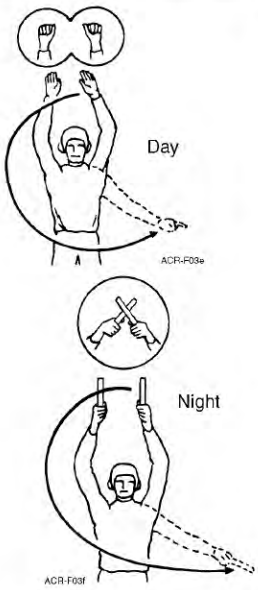
SIGNAL	FROM	TO	EXECUTION
 EXTEND or LOWER STRUT(S)	Director	Pilot	Day: Extend arms to one side, palms together and horizontal. Then, open arms. Night: Same except hold wands horizontally. **Note** For lowering strut, reverse the procedure for extending strut.
 LOWER LAUNCH BAR/TOW LINK	Director	Deck Crew, Pilot	Day: Rest right elbow in left palm at waist level. Bring right hand down to horizontal position. Night: Same except with wands.
 RAISE LAUNCH BAR/TOW LINK	Director	Deck Crew, Pilot	Day: Rest right elbow in left palm at waist level. With right forearm horizontal, bring right hand up to shoulder level. Night: Same as day except rest right elbow on wand.
 TENSION AIRCRAFT ON CATAPULT	Director	Catapult Crew, Pilot	Day: Extend arms overhead. Open clenched fists, palms forward to indicate pilot release brakes. Then sweep one hand across chest and point in direction of launch. Pilot will release brakes and apply appropriate power in accordance with aircraft NATOPS Manual. Night: Same using wands except indicate pilot release brakes by opening crossed wands above head.

Figure B-1 Flight Deck Signals 1

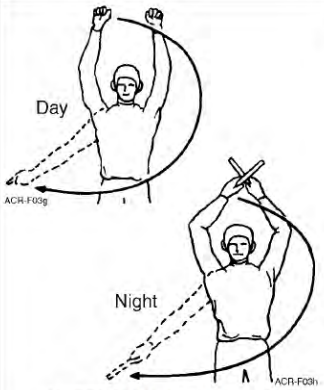
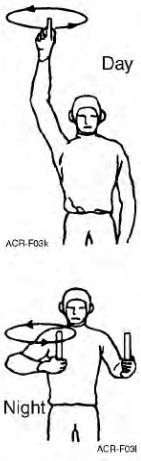
SIGNAL	FROM	TO	EXECUTION
 UNTENSION AIRCRAFT ON CATAPULT	Launching Officer	Catapult Crew, Pilot	Day: Extend arms overhead, fists clenched to indicate pilot hold brakes. Then sweep one fist across chest and point in opposite direction of launch. Pilot will hold brakes. Night: Hold wands crossed overhead to indicate pilot hold brakes. Then sweep one wand across chest and point in opposite direction of launch. Pilot will hold brakes.
 FIRST TURNUP	Launching Officer	Pilot	Day: Extend arm overhead, forefinger pointing up. Hesitate, then rotate hand rapidly in a horizontal circle. Night: Hold RED and GREEN wands at chest level, rotating the green wand in a horizontal circle. Remarks: Signal is optional, given at request of pilot. Also can be used for deck launch.

Figure B-2 Flight Deck Signals 2

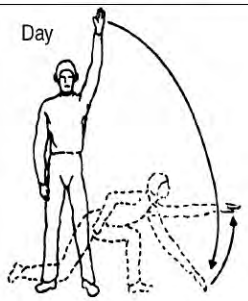
SIGNAL	FROM	TO	EXECUTION
  **AFTERBURNER**	Launching Officer	Pilot	Day: Give "final turnup" signal (no. 9). Wait 2 or 3 seconds while pilot turns up to military rated thrust and checks instruments. Then, hold open hand toward pilot, fingers extended vertically. Night: Same except hold GREEN wand vertically and move up and down. Remarks: Pilot select afterburner, check instruments, and: 1. Day — Salute when ready to launch. 2. Night — turn on only his running lights (STEADY), and keep them on until clear of the ship.
 **FIRE/LAUNCH**	Launching Officer	Catapult Crew, Pilot	Day: Extend arm overhead. Ensure that pilot's head is against headrest and deck is clear forward. Sweep up-raised hand downward in the direction of launch, touching the deck and returning hand to the horizontal in the direction of launch Night: Raise GREEN wand vertically overhead. Wait 2 or 3 seconds for pilot to position head against headrest. Ensure that deck is clear forward. Sweep wand in a wide arc, ending by pointing in the direction of launch, touching the deck and returning wand to the horizontal in the direction of launch. **WARNING** The launching officer shall remain in the crouched position with his hand/wand held horizontally in the direction of launch until the aircraft has passed his position or a suspend/hangfire situation is indicated. **Note** Also used for free deck launches.

Figure B-3 Flight Deck Signals 3

SIGNAL	FROM	TO	EXECUTION
 **SUSPEND**	Launching Officer	Catapult Crew, Pilot	Day: Cross arms overhead indicating the launch is off. Night: Hold RED wand high overhead indicating the launch is off. GREEN wand is turned off. Remarks: After this signal, pilot must remain ready for launch and not throttle back until after the "untension" and "throttle back" signals are given by the launching officer/catapult safety observer (ICCS). **Note** Any flight deck or catapult personnel may signal a SUSPEND to the launching officers. The DAY signal is the same as the launching officer's. The NIGHT signal is a horizontal movement of a wand or light.
 **HANGFIRE**	Launching Officer/ Catapult Safety Observer (ICCS)	Catapult Crew, Pilot	Day: Give "suspend" signal (no. 12). Then point index finger of one hand at palm of other hand. Night: Give "suspend" signal (no. 12). Then hold RED wand overhead in a horizontal position. GREEN wand remains off.

Figure B-4 Flight Deck Signals 4

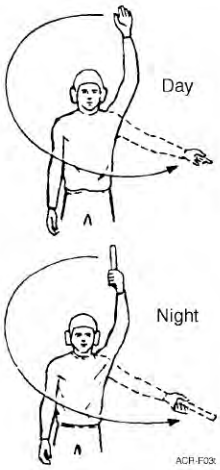
SIGNAL	FROM	TO	EXECUTION
 **UNTENSION AIRCRAFT ON CATAPULT (Following suspend or hangfire)**	Launching Officer Catapult Safety Observer (ICCS)	Catapult Crew Launching Officer (ICCS)	Day: With arms in "suspend" or "hangfire" position, sweep one hand from above head across chest and point in opposite direction to launch. Night: With RED wand in "suspend" or "hangfire" position, sweep it across chest and point in opposite direction of launch.
 **THROTTLE BACK**	Launching Officer/ Catapult Safety Observer (ICCS)	Pilot	Day: Hold one fist at waist level, thumb extended up. Grasp thumb with other hand and rock as if adjusting throttle. Night: Hold RED wand horizontally across chest. Raise and lower horizontal wand. GREEN wand is off.
 **PUSH/PULL BACK**	Director	Deck Crew	Day: Make for-to-aft sweeping motion with arms extended downward, palms forward. Night: Same except with wands.

Figure B-5 Flight Deck Signals 5

SIGNAL	FROM	TO	EXECUTION
 ACCEPT CONTROL	Catapult Officer	Director	Day: Hold both hands with fists clenched in front at waist height. Night: Hold wands vertically in front of body. Turn wands on.
 PASS CONTROL	Director	Catapult Officer	Day: With both arms at shoulder height, point in direction of person receiving control. Night: Same as day signal except point wands.
 RETRACT SHUTTLE	Catapult Officer	Deckedge Operator	Day: Finger pointing towards the bow at waist level. Sweep arm in a complete large circular motion. Stopping the sweeping motion with the finger pointed aft at waist level. Night: Same except use RED wand. Remarks: Deckedge Operator retract shuttle.
 ADVANCE SHUTTLE	Catapult Officer	Deckedge Operator	Day: Finger pointing aft at waist level. Sweep arm in a complete large circular motion. Stopping the sweeping motion with the finger pointed towards the bow at waist level. Night: Same except use RED wand. Remarks: Deckedge Operator retract shuttle.

Figure B-6 Flight Deck Signals 6

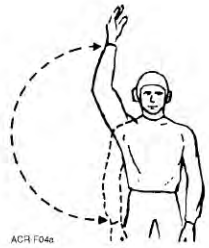
SIGNAL	FROM	TO	EXECUTION
 CLEAR DECK	Flight Deck Officer/ Director	Arresting Gear Officer	Day: Sweep arm from overhead position to side position and return. Night: Same as day except with AMBER wand.
 FOUL DECK	Flight Deck Officer/ Director	Arresting Gear Officer	Day: Cross arms overhead, fists clenched. Night: Crossed AMBER wands held overhead
 PULL BACK	Hook Runner Director	Director Pilot Deckedge Operator	Day: Make fore-to-aft sweeping motion with arms extended downward, palms aft. Night: Same motion except with RED stubby wand. Day: Make fore-to-aft sweeping motion with arms extended, palms forward. Night: Same motion except with two AMBER wands.

Figure B-7 Flight Deck Signals 7

SIGNAL	FROM	TO	EXECUTION
 CEASE PULL BACK	Director Hook Runner	Deckedge Operator Director	Day: Cross arms below waist Night: Horizontal movements of wand below waist.
 RAISE HOOK	Director	Pilot	Day: Position left hand horizontally in front of body, palm down. Move right hand upward, bringing extended thumb into left palm. Night: Position left wand horizontally in front of body. Position right wand vertically to form a "T".

Figure B-8 Flight Deck Signals 8

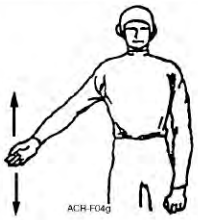
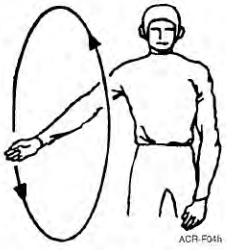
SIGNAL	FROM	TO	EXECUTION
 LOWER HOOK	Director	Pilot	Day: Position left hand horizontally in front of body, palm up. Move right hand downward, bringing extended thumb into left palm. Night: Position left wand horizontally in front of body. Position right wand vertically to form an inverted "T".
 WIRE CLEAR	Hook Runner	Director	Day: Make a vertical motion with arm pointed at the taxi director. Night: Same, holding RED stubby wand.
 WIRE RETRACT	Hook Runner	Deckedge Operator	Day: Make large circular motion with arm extended to one side. Night: Same, holding RED stubby wand.

Figure B-9 Flight Deck Signals 9

SIGNAL	FROM	TO	EXECUTION
 ACR-F05a TILLER BAR IN PLACE OR ENGAGE NOSEWHEEL STEERING	Director	Pilot	Day: Touch end of nose with forefinger. Then, give thumbs up signal with same hand. Night: Touch end of nose with wand. Then, give "up" signal with same wand.
 ACR-F05b TILLER BAR REMOVED OR DISENGAGE NOSE WHEEL STEERING	Director	Pilot	Day: Touch end of nose with forefinger. Then, sweep arm downward in direction of aircraft movement. Night: Touch end of nose with wand. Then, sweep wand downward in direction of aircraft movement.
 ACR-F05d INSTALL TIEDOWNS	Director	Pilot, Brake Rider	Day: Rotate hands in a vertical circle in front of body. Night: Same as day except with AMBER wands.
 ACR-F05e TIEDOWNS IN PLACE	Director	Pilot, Brake Rider	Same as "Install Tiedowns" adding a thumbs up signal.
 ACR-F05f REVERSE THRUST TAXI	Director	Pilot	Day: Palms facing aircraft at eye level with a pushback motion. For turns, the director points in direction tail is to move. Night: Same, holding wands.

Figure B-10 Flight Deck Signals 10

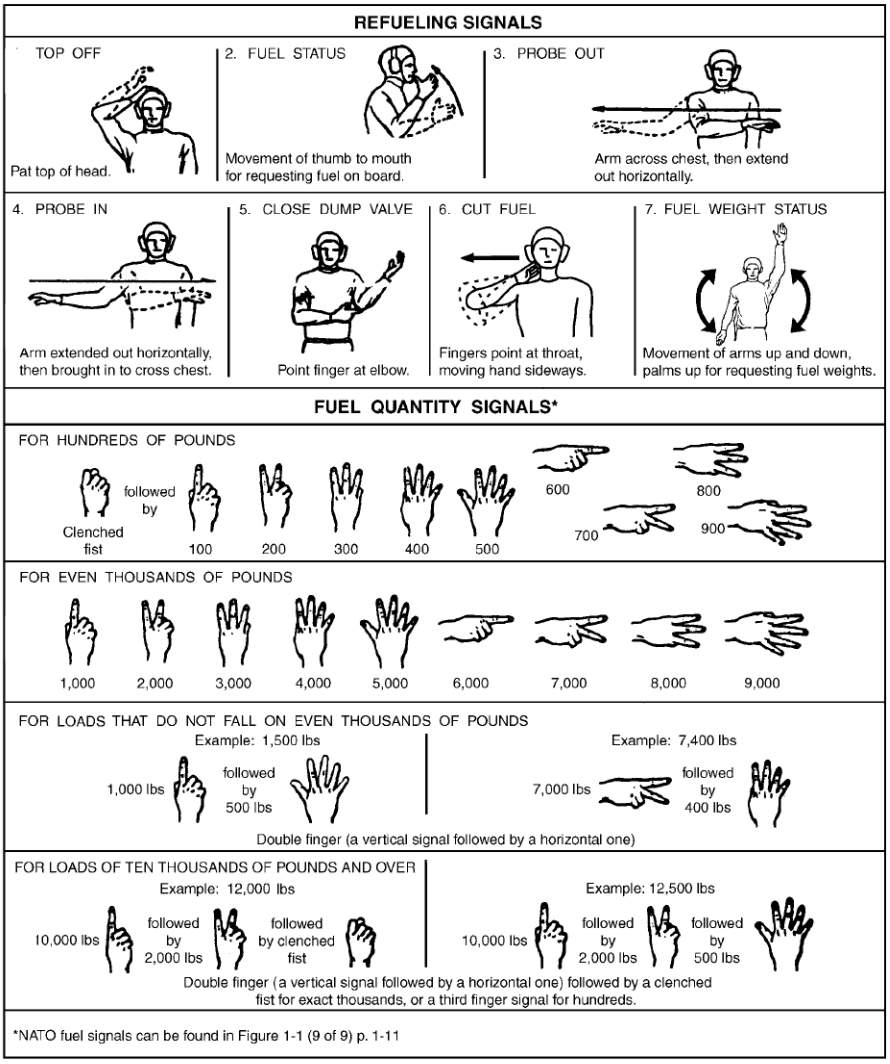


Figure B-11 Flight Deck Signals 11

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX C
LSO RADIO CALLS

INFORMATIVE CALLS

Used to inform pilots of existing situations.

TRANSMISSION	MEANING	RESPONSE (Aircraft in Manual Mode)	RESPONSE (Aircraft in APC Mode)
"You're (a little) high."	Aircraft is (slightly) above optimum glide-slope.	Adjust sink rate with power/nose attitude to establish center ball.	Adjust sink rate with nose attitude to establish center ball. (Avoid using in close.)
You're (a little) low."	Aircraft is (slightly) below optimum glide-slope.	Adjust glide slope immediately.	Adjust glide slope immediately.
"You're going high (low)."	Unless corrected, aircraft will go above (below) optimum glide-slope.	Adjust sink rate with power/nose attitude to maintain center ball.	Adjust sink rate with nose attitude to maintain center ball.
"You're on centerline."	Self-explanatory.	N/A	N/A
"You're on glideslope/glidepath."	Self-explanatory.	N/A	N/A
"You're on speed."	Self-explanatory.	N/A	N/A
"You're lined up left/right."	Aircraft has undershot/overshot centerline.	Reestablish centered lineup.	Reestablish centered lineup.
"You're drifting left/right."	Aircraft is drifting left/right of center-line.	Correct lineup to centerline.	Correct lineup to centerline.
"You're (a little fast/slow)." (To be followed by "Go manual" if auto.)	Self-explanatory.	Adjust nose attitude/power to establish optimum AOA.	APC is not maintaining aircraft at optimum AOA. Disengage APC and adjust power/attitude to maintain optimum AOA.
"Roger Ball" ("Auto"/"Coupled" as appropriate).	LSO acknowledges pilot has meatball acquisition, lineup reference, and angle of attack.	N/A	N/A
"Paddles contact."	LSO assuming control from CCA.	N/A	N/A
"Continue."	LSO acknowledges CLARA call but is not able to assume control from CCA	Continue approach to minimums	Continue approach to minimums
"The deck is moving down/up (a little)."	OLS information may be invalid (to be followed by advisory/imperative calls).	Adjust power and attitude under LSO guidance.	Adjust attitude under LSO guidance.
"The deck is steady."	OLS information is valid	Fly normal approach.	Fly normal approach.
"Winds are (slightly) starboard/port/axial."	Self-explanatory.	Monitor lineup to maintain centerline.	Monitor lineup to maintain centerline.
"You're underpowered/ overpowered."	Self-explanatory.	Adjust attitude and power as required.	Not used.
"Ship's in a starboard/port turn."	Self-explanatory.	Adjust lineup as necessary.	Adjust lineup as necessary.
"MOVLAS recovery."	MOVLAS is in use.	Fly published pattern altitude until "Roger ball" received.	Fly published pattern altitude until "Roger ball" received.

Figure C-1 LSO Radio Calls 1

ADVISORY CALLS

Used to direct pilot's attention to potential difficulties and prevent possible control errors.

TRANSMISSION	MEANING	RESPONSE (Aircraft in Manual Mode)	RESPONSE (Aircraft in APC Mode)
"Keep your turn in."	If angle of bank is not adjusted, the aircraft will overshoot the centerline.	Adjust angle of bank.	Adjust angle of bank.
"Check your lineup." (Start only.)	Aircraft lineup is not optimum.	Correct lineup drift or position to maintain aircraft on centerline.	Correct lineup drift or position to maintain aircraft on centerline.
"Back to the right/left."	Aircraft is drifting such that if drift is not corrected, it will overshoot the centerline.	Correct lineup drift to remain on centerline.	Correct lineup drift to remain on centerline.
"Don't settle." "Don't go low."	Aircraft will settle below optimum glideslope if not corrected.	Check sink rate and meatball to avoid settling below glideslope.	Check sink rate and meatball to avoid settling below glideslope.
"Don't climb." "Don't go high."	Aircraft is on or above optimum glideslope with insufficient rate of descent to maintain constant glideslope.	Adjust power/attitude to stop the ball from rising.	Adjust power/attitude to stop the ball from rising.
"Don't go any lower (higher)."	Aircraft is maintaining position well below (above) optimum glideslope with insufficient or no correction.	Adjust power/attitude to make positive correction toward optimum glideslope.	Adjust attitude to make positive correction toward optimum glideslope.
"Don't chase it"	Advises pilot the deck is moving up/down and may present an illusion of a climb or descent	Disregard deck motion and adjust power/attitude to maintain rate-of-descent and optimum airspeed.	Disregard deck motion and adjust power/attitude to maintain rate-of-descent and optimum airspeed.
"Hold what you've got."	OLS information is invalid. Present rate-of-descent is correct to maintain proper glideslope.	Adjust power/attitude. Hold present rate-of-descent and optimum airspeed.	Adjust attitude. Hold present (optimum) rate-of-descent.
"Fly the ball."	OLS information is valid.	Scan the lens and adjust power/attitude to maintain optimum glideslope.	Scan the lens and adjust attitude to maintain optimum glideslope.
"Easy with it."	Magnitude of power correction immediately preceding this transmission is excessive.	Reduce magnitude of power correction to intercept and reestablish optimum glideslope and airspeed.	Reduce magnitude of nose attitude correction to intercept and reestablish optimum glideslope and airspeed.
"Easy with your nose."	Magnitude of nose attitude correction immediately preceding this transmission is excessive.	Reduce magnitude of nose attitude correction to establish optimum aircraft attitude.	Not used.
"Easy with your wings."	Magnitude of lineup correction immediately preceding this transmission is excessive.	Reduce magnitude of lineup correction to intercept and reestablish centerline.	Reduce magnitude of lineup correction to intercept and reestablish centerline.

Figure C-2 LSO Radio Calls 2

IMPERATIVE CALLS

Used to direct the pilot to execute a specific control action. MANDATORY IMMEDIATE RESPONSE

TRANSMISSION	MEANING	RESPONSE (Aircraft in Manual Mode)	RESPONSE (Aircraft in APC Mode)
"A little power."	Aircraft is decelerating or settling.	Correct with power.	Not used.
"Power back on."	Pilot has made an excessive power reduction.	Add power to maintain optimum glideslope/AOA.	Disengage APC. Add power to maintain optimum glideslope/AOA.
"Power."	Aircraft is low/slow.	Add power.	Disengage APC. Refer to Note.
"Burner."	Aircraft is extremely underpowered or in extremis.	Select afterburner power.	Select afterburner power.
"Go manual."	Disengage APC.	Not used.	Disengage APC. Refer to Note.
"Attitude." ("A little attitude.")	Manual: Aircraft nose is low. Auto: Aircraft is low/setting or nose is low.	Increase nose attitude (slightly) to establish landing attitude.	Increase nose attitude (slightly) to reduce sink rate or to establish landing attitude.
"(A little) right/left rudder."	Aircraft does not have enough right or left rudder and will land yawed right or left if not corrected.	Adjust rudder to return aircraft to balanced flight.	Not applicable.
"(A little) Right for lineup." "(A little) Come left."	Aircraft will land left/right if not corrected.	Correct lineup to centerline, then level wings.	Correct lineup to centerline, then level wings.
"Bolter."	Self-explanatory.	Execute bolter in accordance with model NATOPS manual.	Execute bolter in accordance with model NATOPS manual.
"Waveoff" or "Waveoff, foul deck."	Self-explanatory.	Execute waveoff in accordance with model NATOPS manual.	Execute waveoff in accordance with model NATOPS manual.
"Waveoff up the starboard side."	Discontinue turning attempt to overfly the landing area.	Execute waveoff in accordance with model NATOPS manual starboard of the landing area (island).	Execute waveoff in accordance with model NATOPS manual starboard of the landing area (island).
"Cut."	Aircraft is in a position to land.	For barricade recovery, retard throttle(s) to idle and secure engine(s) once safely on deck.	For barricade recovery, retard throttle(s) to idle and secure engine(s) once safely on deck.
"Speedbrakes."	Speedbrakes are extended.	Retract speedbrakes.	Retract speedbrakes.
"Extend speedbrakes."	Self-explanatory.	Comply.	Comply.

Figure C-3 LSO Radio Calls 3

IMPERATIVE CALLS (Cont.)

TRANSMISSION	MEANING	RESPONSE (Aircraft in Manual Mode)	RESPONSE (Aircraft in APC Mode)
"Drop your hook."	Self-explanatory.	Comply.	Comply.
"Drop your gear."	Self-explanatory.	Comply.	Comply.
"Drop your flaps."	Self-explanatory.	Comply.	Comply.
"Level your wings."	Aircraft is in angle of bank.	Comply.	Comply.
"Downgrade."*	Disengage ACLS.	Disengage ACLS.	Disengage ACLS.
"Climb."	Aircraft has boltered/waved off but has not established proper attitude/power for positive rate of climb.	Adjust nose attitude to optimum, level wings, and maintain MRT (afterburner if required) to establish positive rate of climb.	

Note

* Aircraft is considered to be in manual mode immediately after the "Downgrade" call. Manual calls/responses are subsequently applicable.

Figure C-4 LSO Radio Calls 4