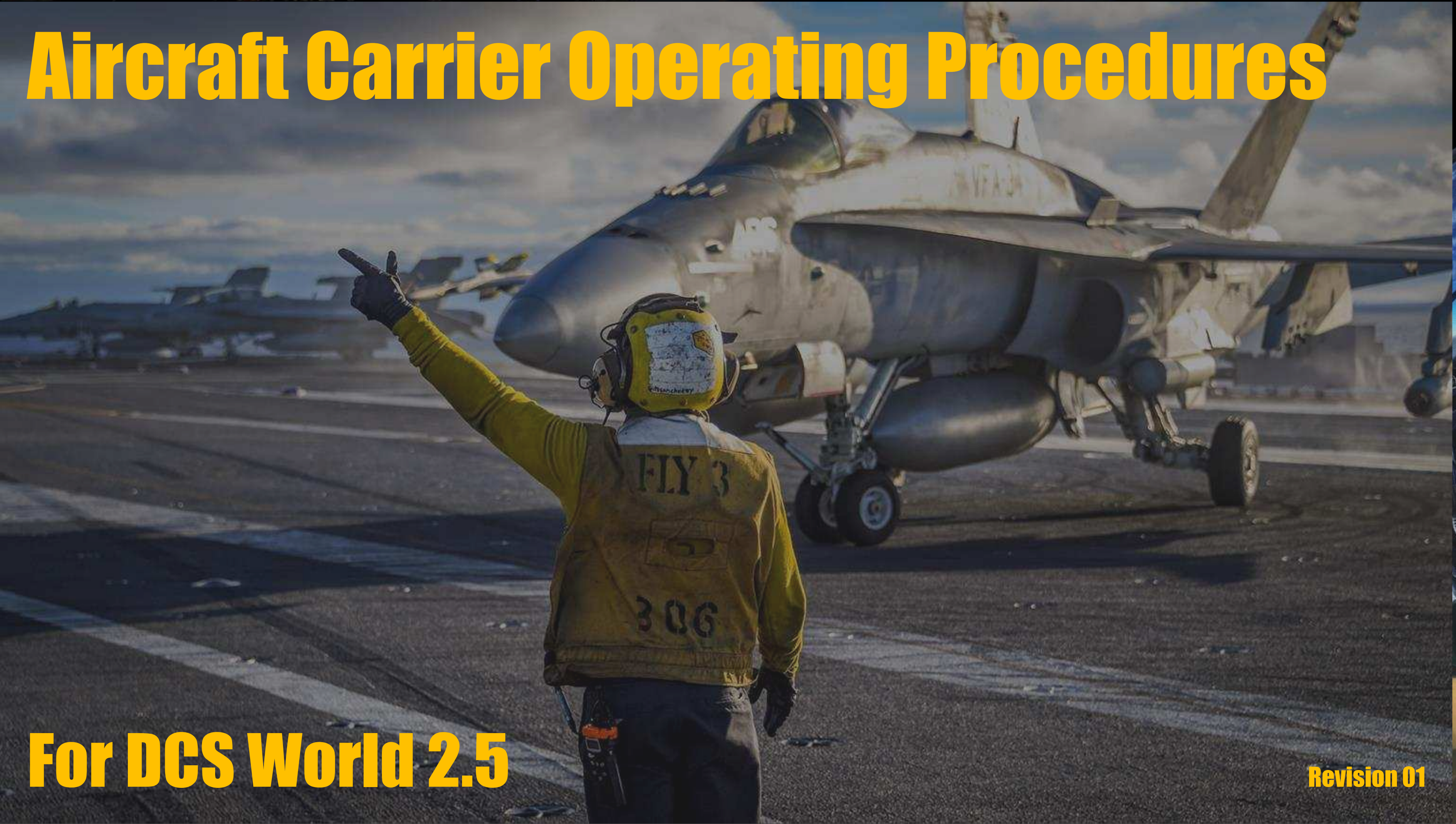
Aircraft Carrier Operating Procedures



For DCS World 2.5

Revision 01

Foreword:

The goal of every Naval Officer who is selected for jet pilot training is to become a tactical carrier pilot. Carrier pilots are the best because they must be the best. **The carrier environment will not tolerate anything less**. Landing and launching aircraft as well as moving equipment and personnel in a relatively small area requires precise coordination for safe operation. Handling aircraft on a flight deck is more complicated than at a field due to the high winds across the deck, small crowded deck, the proximity of the deck edge and the ship's movement. Successful and safe operations in and around the carrier depend on a coordinated team effort in which all team members do their job properly. **There is no excuse for not knowing and not using correct procedures around the ship and there are no exceptions to this rule**.

This manual is written with the intent to achieve the highest possible standard of "Carrier Operations" within DCS World. After studying this manual, you should be able to operate safely and expeditiously on and in proximity of the carrier. While this manual is in no way a replacement of the available CV NATOPS publications, it is there to help guide you through the most important baselines, procedures, and patterns. **While 99% of this manual works for all USN carrier aircraft, some information will be F/A-18C specific.**

The main setup of this manual will be a ground-school section followed by flight deck operations ,departure procedures, pattern specific procedures, recovery operations and is ended with recommended techniques and additional information. The focus of this manual will be on the normal procedures. Non-normal procedures will be mentioned but require the use of the CV NATOPS manual to provide further guidance and information. Links to all information used to write this document are available at the end of this manual. This manual is produced with the intent to teach real life procedures. Virtual CVN Carrier Qualifications "CQ" will be graded by adhering to the procedures published in this manual with great accuracy and as correctly as possible.

While it is impossible to operate within DCS to the exact detail of real life operation, we will stay as close to official normal and non-normal procedures within the boundaries of DCS. In real life carrier operations published mechanics and patterns are used as baselines. Interpretations of this material, as well as real-life manuals are given in the procedural guidance chapter. Usually pilots and other involved parties such as Marshal, Tower, LSOs, and ground personnel work cooperatively together to conduct safe and expeditious operations within the limitations of aircraft and carrier.

The introduction of the SUPERCARRIER in DCS, gives great opportunity to adhere to the procedures published in this manual and efficient use of all in-game provided resources will be needed to successfully operate the procedures described.

Feedback, questions or suggestions:

For any feedback, questions or suggestions regarding this manual please contact cvnopsdcs@gmail.com , S&A or your squadron LSO.

Procedural guidance:

During the investigation required and the writing of this manual it became quite clear to me, that a carrier, or "CVN" in this specific case is much more than just a moving runway on a water surface. Carrier operations translate more closely to a small city or a moving airbase that operates in a dynamic environment, in where no two events will ever be the same. This means that from a pilot's perspective, no launch will ever be like the launch before, no landing will be like the previous and no flight will be like your wingman's. It is therefore needless to say that it is impossible to compare any operations, on or within close proximity of the ship to land aviation. A form of aviation where the runway will not be occupied more than half the time during launch or recovery operations, no dynamic movement is required in a relatively small area, aircraft are perfectly balanced, simultaneous departures are not on order, no vertical or longitudinal movement of the runway, or any of these combined. Often much longer and wider surface areas and high performance fast-jet aircraft keeping visual separation is everything, but the norm and wind speed is often reduced by surrounded buildings. To use the perspective of land based and/or commercial aviation is therefore simply incorrect and incomplete.

It is impossible to create procedures for every possible scenario regarding operations on and within close proximity of the carrier, because of the fluid, highly dynamic, and constant challenging conditions navy aviators operate in. This accounts for airborne as well as ground operations. To achieve a substantial reduction in aircraft mishap rate, and to create a basis for the development of a safe, efficient, and sound operational procedure, CV NATOPS has been created. CV NATOPS gives guidance to ground and flight procedures, baselines, patterns, and solid framework, but also contains a lot of **unfilled blanks** and is **deliberately kept vague** in certain areas. I am sure that has been noticed, and questions asked through different media sources have testified for this.
It is therefore both desirable and necessary to possess the quality and liquidity that enables the pilot to adapt and evaluate, and keep the operations run, smooth, safe, expeditious, proficient, and well. Airmanship in here is more important than in any other form of aviation.

I will try to translate this in a plain language by giving some examples:

- There is not a single way or speed to fly the marshal. You will have to adapt judgement, bank angle, pull, speed, and more importantly airmanship to arrive at the fix at push time, the correct speed, and the correct altitude.
- There is no set way to fly the break that will guarantee you the correct abeam distance every single time, as there are too many variables that will affect you or the airframe during this manoeuvre. Think of different environmental conditions, different weights, speeds etc.
- There is no medal for maintaining exact 600ft AGL on downwind in the pattern if you do not contain the skillset that will allow you to adapt your turn, bank angle and rate of descent that will allow you to end up at the correct position behind the ship, at the correct speed, distance and configuration.

Therefore, **use either CV NATOPS or this manual as guidance** that will allow you to create the flexibility to operate safely, efficiently, and expeditiously. Instead of being super precise, sometimes you must make things work, or as Lex likes to say: "Do that Pilot Shit". Obviously, this does not allow you to ignore the provided regulations, procedures or give you an excuse for not knowing right from wrong. Within the provided guidance and procedures, enough leeway is given to get things done and make you a complete naval aviation operator. The carrier environment will not tolerate anything less. Precise coordination for safe operation, airmanship, flexibility, and adaptability is what keeps the operations safe and smooth.

Revision history:

Revision: 01 First public release	Last edited: 04/07/2020	Changes: N/A

DCS: F/A-18C HORNET

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Ground school:

Nimitz class aircraft carrier:

DCS Supercarrier:
The Supercarrier used in the operations of DCS World is the most detailed and realistic simulation of a Nimitz-class aircraft carrier ever created. A Nimitz-class aircraft carrier is a nuclear-powered fortress at sea with a crew of over 5,000 sailors and airmen. The angled flight deck with arrestor wires and four steam-powered catapults support air wing operations of up to 90 aircraft. The ship also includes a formidable air-defense system that includes the RIM-7 Sea Sparrow Missile and RIM-116 Rolling Airframe Missile *(RAM)* missiles, and Close-In Weapon System *(CIWS)* gun system.

A Nimitz-class aircraft carrier is the ultimate power projection weapon. 10 ships of the class have been produced, of which five of the Nimitz Class Carriers are available within DCS World.

Designator:	**Name:**	**TAC callsign:**	**Homebase:**
CVN-71	USS Theodore Roosevelt	**Rough Rider**	North Island, Carolina
CVN-72	USS Abraham Lincoln	**Union**	Naval station Norfolk, Virginia
CVN-73	USS George Washington	**Warfighter**	Naval station Norfolk, Virginia
CVN-74	USS John C. Stennis	**Courage**	Bremerton, Washington
CVN-75	USS Harry S. Truman	**Lone Warrior**	Naval station Norfolk, Virginia

Note: "USS" **United States Ship** *(abbreviated as USS or U.S.S.)* is a ship prefix used to identify a commissioned ship of the United States Navy and applies to a ship only while it is in commission.

Before we can get into any specifics about detailed carrier flight operations, pattern flying, communications and so on, it will be important to understand how areas in, on and in the vicinity of the aircraft carrier are controlled. A NIMITZ - class aircraft carrier is the working place for approximately 40 air traffic controllers. Their workload is based on the prevailing weather situation and tasks given. Whilst deck and flight operations are designed to run smoothly as a choreographed dance, it is important to know who is responsible for each specific area, and how those areas are controlled. Therefore, the most important areas and job-roles will be described below.

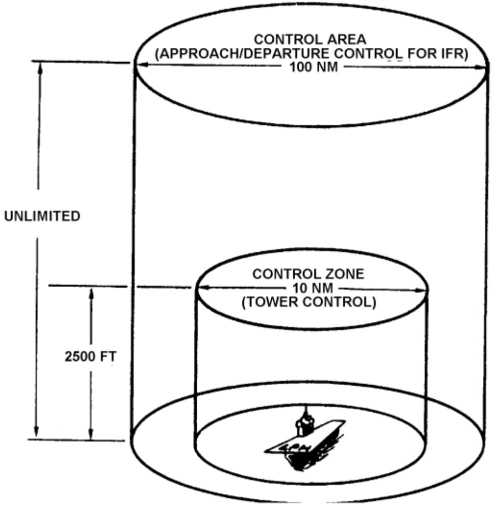
CATCC: Also known as the Carrier Air Traffic Control Center, is comprised of two interdependent work centers, Air Operations *(Air Ops)* and Carrier Controlled Approach *(CCA).* Together they form the centralized agency responsible for the status keeping of all carrier air operations, and control of all airborne aircraft not under the control of Tower/"Boss".

CCA: The Carrier Control Area. The CCA is under control of CATCC and forms a circular airspace within a radius of 50 nm around the carrier. The CCA extends upward from the surface to infinity and will be constantly monitored by radar controllers working in CATCC. The ships Radar controller will use callsign ***"MARSHAL".***

CCZ: Known as Carrier Control Zone. The airspace within a circular limit defined by 5 miles horizontal radius from the carrier, extending upward from the surface to and including 2,500ft AGL unless otherwise designated for special operations. The CCZ is controlled from Pri-Fly, also known as "Tower". Tower is the role of the air officer also known as "Air Boss" or "Boss" along with his assistant, the "Mini-Boss". He/she is responsible for all aspects of operations involving aircraft. This includes the hangar deck, the flight deck, and airborne aircraft out to 5 nm from the carrier. He/she, along with his/her assistant, maintains visual control of all aircraft operating in the carrier control zone and aircraft desiring to operate within the control zone must obtain his approval prior to entry. They will operate under the callsign ***"TOWER".***

Pri-Fly: Short for Primary Flight Control, also known as "Tower". Pri-Fly is where the "Boss" sits and controls all of the operations on the flight deck as well as the airspace within a 10-mile diameter of the carrier.

LSO: The Landing Signal Officer or "LSO", is under supervision of the air officer. It is his/her role to guarantee the safe and expeditious recovery of aircraft. Therefor he/she is responsible for the visual control of aircraft in the terminal phase of the approach immediately prior to landing. He/she controls all fixed-wing aircraft off the 180 to touchdown, during carrier and FCLP landings. The LSOs will operate under the callsign ***"PADDLES".***




Carrier Air Traffic Control Center, "CATCC".


The Airboss "Boss" and "Mini-Boss".


Landing Signal Officers. "LSOs".

CATCC:

Air Operations: "Air Ops"

Department responsible for coordinating all matters pertaining to air operations including the proper functioning of the CATCC.

Carrier Control Approach: "CCA"

Marshal Control:

Responsible for providing control and arrival information to inbound aircraft until handed off to another controlling agency.

App Control:

Responsible for providing positive control of aircraft on approach during Case II and Case III. Tasks include making holes for bolter/waveoff traffic and maintaining appropriate interval.

Final Control:

Responsible for control of aircraft on final approach during Case III until transfer of control to the LSO or the aircraft reaches approach weather minimums. Approach control retains overall responsibility for separation of aircraft.

Dep Control:

Responsible for aircraft Departures. also responsible for monitoring the location and package status of tanker aircraft; the location of low-state aircraft and their fuel requirements.

CATCC in operation.

CATCC will also be responsible for the following:

- Assigning "FB" Final Bearing in case of a Case II or Case III operations.
- Assigning "DRR" Departure Reference Radial.
- Establishing the emergency marshal.
- Designating marshal.
- Assigning inbound bearings/headings.

Note: A full list of CATCC responsibilities and procedures can be found in the U.S. Navy Carrier Vessel Nuclear *(CV/N)* NATOPS Manual.

Carrier Operations:

Cyclic Operations:

Cyclic Ops: Describes the carrier used to its full potential. During Cyclic Operations, the Carrier is an operational air base and conducts actual training and combat missions.

Carrier Qualifications: "CQ"

During Carrier Qualifications "CQ": The carrier is exclusively used for qualification, currency, recency and proficiency training.

Cyclic Operations refer to the launch and recovery cycle for aircraft in groups or "cycles". **Cyclic Operations are the norm for U.S. aircraft carriers**. Cycles are generally about one and a half hours long; 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.

Typical Cyclic Operations in progress during daytime.

Events are typically made up of about 12–20 aircraft and are sequentially numbered throughout the 24-hour fly day. Prior to flight operations, 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 takes generally about 15 minutes),* Event 2 aircraft are made ready for launch about an hour later *(based on the cycle time in use).* The launching of all these aircraft makes room on the flight deck to then land previous launched aircraft. Once Event 2 aircraft are launched, Event 1 aircraft are recovered, refuelled, rearmed, re-spotted, and made ready again to be used for Event 3. Event 3 aircraft are launched, followed by the recovery of Event 2 aircraft. After the last recovery of the day, all of the aircraft are generally stored on the bow *(because the landing area aft needs to be kept clear until the last aircraft lands).* They are then respotted round the flight deck for the next morning's first launch.

Note 1: There are some significant differences between Cyclic Operations and Carrier Qualifications "CQ". The differences will be handles further in this manual.
Note 2: From now on, Cyclic Operations will be abbreviated to "Cyclic Ops" and Carrier Qualifications will be abbreviated to "CQ".
Note 3: When an airwing gets underway for an exercise, workups, or deployment, CQ will be conducted each day until every pilot is current. Then Cyclic Ops will be used from each day forward.

The purpose of CQ is to give pilots a dedicated opportunity to develop fundamental skills associated with operating fixed-wing, carrier-based aircraft and demonstrate acceptable levels of proficiency required for qualification. During CQ, typically far fewer aircraft are on the flight deck than during Cyclic Ops. This allows for much easier simultaneous launch and recovery of aircraft. The waist catapults *(located in the landing area)* are generally not used. Aircraft can trap and be taxied immediately to a bow catapult for launch. The idea is to generate as many cat shots and traps as possible.

Types and requirements:

CQ are performed for new pilots and periodically for experienced pilots to gain/maintain carrier landing currency. Requirements *(the number of landings/touch-and-goes required)* are based on the experience of the pilot and the length of time since his last arrested landing. Civilian pilots can also receive qualification; CIA pilots did so with the Lockheed U-2 in 1964.

Undergraduate CQ:

For student naval aviators, currently completed in the T-45 Goshawk and consisting of 14 day landings *(10 arrested; up to four can be "touch-and-go").*

Initial CQ:

Flown in a newly designated aviator's first fleet aircraft *(F/A-18, EA-6B, or E-2C),* consisting of 12 *day (minimum 10 arrested)* and eight night landings *(minimum 6 arrested).*

Transition CQ:

For experienced pilots transitioning from one type of aircraft to another, consisting of 12 day landings *(minimum 10 arrested)* and six night arrested landings.

Requalification CQ:

For experienced pilots who have not flown from the carrier within the previous six months, consisting of six day arrested landings and four night arrested landings.

While The above mentioned information seems quite dry, there are some important differences regarding CQ compared to Cyclic Ops:

- During CQ operations, the pilot shall transmit aircraft side number, and gross weight *(rounded to the nearest thousand)* during a two-way radio check. The same transmission is required not only for the initial launch but also after hot refuelling and after a pilot switch. Fuel quantity is not to be confused with gross weight during this transmission.
- During CQ, the flight deck is continuously open for flight operations for hours at a time. This as opposed to cyclic Ops, where the flight deck is only open for a short time on a "Cyclical basis".
- Launching will normally only occur from the bow; Cat 1 and Cat 2.
- Clearing turns will only be performed if departing the pattern on a Case I or Case II departure. If the intention is to directly enter the landing pattern, no clearing turn is required.
- **During CQ there are no ZIPLIP conditions.**
- CQ aircraft do not leave the marshal unless given a "Charlie".
- **CQ aircraft in the marshal stack, do not change altitude unless instructed to do so.**
- Further Special procedures can be found in chapter 6.7 of the CV NATOPS Manual and P-1238.

CQ in operation during daytime.

An aircraft carrier's "Island" is the command center for flight-deck operations, as well as the ship as a whole. The island is about 150 feet *(46 m)* tall, but it is only 20 feet *(6 m)* wide at the base, so it will not take up too much space on the flight deck. The top of the island, well above the height of any aircraft on the flight deck, is spread out to provide more room. The top of the island is outfitted with an array of radar and communications antennas, which keep tabs on surrounding ships and aircraft, intercept and jam enemy radar signals, target enemy aircraft and missiles and pick up satellite phone and TV signals, among other things.

Primary Flight Control, or **Pri-Fly**. In the Pri-Fly, the Air Officer and Air Officer assistant *(known as the "Boss" and the "Mini Boss")*, both experienced aviators, have an array of computers and communications equipment to keep tabs on everything. Their most important information source is required just by looking out their windows, six stories above the flight deck. To direct the landing procedure The **Landing Signals Officers "LSOs", will take over control of the aircraft from the 180 during Case I and Case II, or three quarter of a mile during Case III recovery operations.** At the same level as the Pri-Fly, crew and visitors can walk out onto vulture's row, a balcony platform with a great view of the entire flight deck.

The next level down is the **Bridge**, the ship's command center. The commanding officer *(the captain)* usually cons *(controls)* this ship from a stately leather chair surrounded by computer screens. The commanding officer directs the helmsman, who actually steers the carrier, the lee helmsman, who directs the engine room to control the speed of the ship, the Quartermaster of the Watch, who keeps track of navigation information, and a number of lookouts and support personnel.

The level below the bridge is the **Flag Bridge**, the command center for the admiral in charge of the entire carrier group. Below that, there are various operational centers, including the flight deck control and launch operations room. In this tight area, the aircraft handling officer *(also called the Handler)* and his/her crew keep track of all the aircraft on the flight deck and in the hangar. The handler's primary tracking tool is the "Ouija Board," a two-level transparent plastic table with etched outlines of the flight deck and hangar deck. Each aircraft is represented by a scale aircraft cut-out on the table. When a real plane moves from point to point, the handler moves the model plane accordingly. When the plane is out of service, because it needs repair work, the handler turns it over.

Flight deck operations:

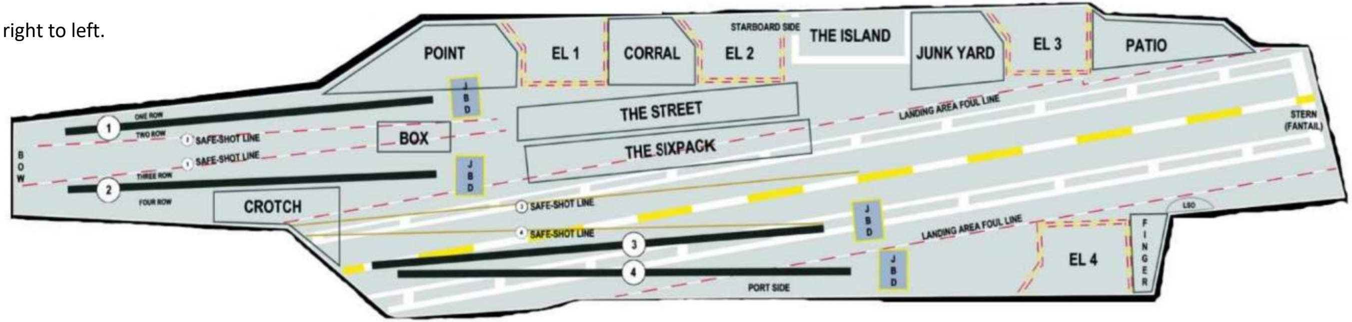
Deck layout:

To enhance effective communication regarding flight deck operations we need to have a good understanding of the different areas on the flight deck.

Let's have a look at the Diagram of a Modern Aircraft Carrier (CVN) Flight Deck.

- **JBD;** denotes the location of a jet blast deflector.
- **EL;** denotes the location of one of four elevators.
- **A circled number; (1)** over a long black line provides the location and identification of each catapult.

Note: Notice that the catapults are numbered from right to left.



Other Important areas to remember on the fight deck are as follows:

- **The "Barrier"** That's a huge net that is used to land planes if they are not able to accomplish a conventional landing.
- **The "Junkyard"** That's the area aft of the island where the tractors, fire engines and the crane *(the "yellow equipment")* are parked.
- **The "Hummer Hole"** That's the area next to the island where the E-2C and C-2 planes are parked.
- **The "Box"** That's the space between Catapult 1 and 2.
- **The "Street"** That's the space directly behind Catapult 1 and 2.
- **The "Rows"** These are the areas right of Catapult 1 and left of Catapult 2 where F/A-18s are parked in rows during landing operations.
- **The "Finger"** That's the small area aft of Elevator 4 where a single plane can be parked.
- **The "Ramp"** That's the beginning of the flight deck at the stern of the carrier. If a plane crashes into the carrier's stern during its approach it's called a "Ramp Strike".
- **The "Bomb Farm"** That's the area between the island and the rail where bombs and missiles are stored during flight operations. From there they are brought to the aircraft.
- **The "Crotch"** This is the place where the angled deck ends and the port bow begins.
- **The "Six Pack"** That's the area where the row of planes is parked along the "foul line".
- **The "Corral"** That's the area in front of the island: from the "foul line" on the left, all the way up to Elevator 1.
- **The "LSO platform"** From this platform the Landing Signal Officers control the approaches of the incoming planes.

Rainbow wardrobe:

On a carrier flight deck, specialised crew are employed for the different roles utilised in managing air operations. The different flight deck crews wear coloured jerseys to visually distinguish their functions. If the color of their pants is blue, he/she is a sailor rank E-6 and below. If the color is khaki, he/she is a Chief or Officer rank E-7 or above. "UI" on the cranial means "under instruction".

Yellow shirts are worn by aircraft handlers and aircraft directors that shuttle aircraft around the carrier's tight and chaotic deck. Catapult Officers and Arresting Gear Officers also wear yellow shirts. Because yellow shirts are so involved with taxiing aircraft, they are often featured prominently in dramatic photos depicting carrier deck operations.

Green shirts are worn by some of the hardest-working sailors on the deck, including ones who run and maintain the ship's catapults and arresting gear. Hook Runners who make sure the ship's cross-deck pendants *(wires)* make it back into position to trap another aircraft by coercing them with a five-foot steel bar wear green shirts. This is one of the most dangerous positions on the flight deck as the wires can snap across the deck at high speed, slicing through whatever or whoever they come in contact with. Air wing maintenance personnel, those who work on the aircraft directly, also wear green shirts, as do cargo handling personnel, ground support equipment trouble-shooters, enlisted helicopter landing signal personnel and photographer's mates.

White shirts are worn by a wide mix of deck crew. These include many quality and safety observers such as air wing quality control personnel, individual squadron plane inspectors, and safety observers. Yet probably most well-known white shirt wearers are Landing Signal Officers *(LSOs)* who help talk down approaching aircraft while also making sure the deck is clear for their arrival. The LSOs are sourced from each squadron in the air wing and are usually pilots with historically high landing scores themselves.

Blue Shirts are Plane Handlers, who work under the direction of the yellow shirt wearing aircraft handlers, assist in moving aircraft around the deck. They also can operate the carrier's massive aircraft elevators, drive tractors and work as messengers and verbal liaisons.

Red Shirts is no mistake as the crewmen that wear this colour are usually near very hazardous things or situations. Ordnance-men deal with building, moving, and mounting weapons and arming the air wing's aircraft. They use their own hardened elevators to move live bombs and missiles up to the deck before loading them on the aircraft, which can including literally lining up and heaving a 500 pound missile over their shoulders to get it attached to the aircraft's weapons station. Explosive Ordnance Disposal *(EOD)* crews also wear red shirts along with crash and salvage crews. Crash teams have their own mini tug-sized fire fighting vehicles and are ready at a moment's notice to respond to mishap on the deck.

Brown shirts are worn most notably by Plane Captains. Loosely equivalent to a Crew Chief in the Air Force, Plane Captains are responsible for overseeing the maintenance, launch and recovery and general well-being of their aircraft as well as the others in their squadron. The old adage is the plane captain is the one who truly "owns the jet", and the pilot just borrows it for a couple hours at a time. Air wing line leading Petty Officers, the hands-on leadership of the air wing and its enlisted personnel, also wear brown shirts.

Purple shirts, better known as "Grapes", are all about aviation fuels. They fuel and de-fuel the carrier's aircraft, often on very tight schedules. Obviously, pumping fuel at high-pressure into jets loaded with explosives and full of hot electronics and mechanical devices is not exactly a low-risk proposition. One spark, caused by a grounding issue or one of many other possibilities, could cause a real disaster. Grapes are masters of pumping the air wing's go-juice under the most challenging of conditions.

Taxiing from parking to launch:

On a modern aircraft carrier deck *(also known as Flight Deck),* all movements are controlled by the use of non-verbal communication techniques. After start-up, when the pilot indicates he is ready to go flying, he will pass the thumbs-up to the plane captain *(Brown shirt)*. The Plane Captain and pilot will then standby until a Yellow Shirt arrives to take over control of the aircraft. **An aircraft on the flight deck never moves unless under a yellow shirt's control**. Whether it is taxiing or being towed, these "directors" will always be there to control all aircraft's movements.

As a rule, all signals passed to pilots will be passed above the waist and all signals to others on the flight deck will be below the waist. **All the aircraft turns will be made at idle power** to avoid sweeping high amounts of thrust and sending people overboard. For all movement ***on the flight deck the maximum Engine RPM allowed for taxiing is 75%*** unless given special permission by the "Boss".

During all movements, "yellow shirts" are not allowed to move while taxiing an aircraft. This is to prevent the illusion that an aircraft is moving when it is not *(especially crucial at night!).*

Approaching the catapult, the aircraft will be given the signal to spread the wings: *(a sweeping motion of the arms from the chest to the fully outward extended position)*. A green shirt will show you the "weight board". If the weight board is correct *(referencing the checklist page)*, the pilot will pass a thumbs up. If the weight needs to be lowered, the pilot will give a horizontal hand slicing motion. If it needs to be raised, the pilot will give a palm-up vertical hand motion. Each of those will give a 500-pound change. Once correct, the pilot will give a thumbs up. When aligned with the catapult and stopped in position the director will signal to lower the launch bar.

Note 1: The weight board is for the shooter to set the catapult correctly. During CQ his initial estimate is from the up and ready call. During Cyclic Ops it is from a weight chit that the pilots fill out before walking to the airplanes. The weight chit is given to the shooters.
Note 2: For weights that will require numerous iterations, the pilot can tell Tower: "Tower, 301 needs a 38k shot".
Just prior to settling into position on the cat, an aircraft loaded with ordnance will need to be armed. A red shirt *(Ordie),* will pass the hands-up signal to ensure that during this dangerous evolution no unexpected movement will occur. The pilot will again keep both hands visible as an indication that no cockpit switches will be actuated at that time.


Unfold Wings

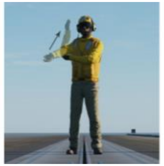

Turn left


Taxi Forward


Turn right


STOP


Extend Launch Bar


Retract Launch Bar


Run up Engines


Launch


Weight board

Once armed-up, the aircraft can taxi fully into the catapult and take tension. It takes a lot of power to taxi these few feet to overcome the force of the holdback fitting on the back of the nose gear. The next signal is one of the most frequently seen in cruise videos; the "take tension" signal. The yellow shirt will look both ways before doing two hand signals at once. One hand will be raised with a palm open to indicate "off the brakes" and the other hand will be outstretched straight forward to indicate "take tension".

CATAPULT THROTTLE SETTINGS

Weight Board	Engine Power
44,000 lbs and below	MIL MIL/MAX MAX
45,000 lbs and above	MAX

The jet then squats into position and is now at the end of a loaded gun. That last director will then "pass" control to the "Shooter", who will wave his hand in the air furiously for the "run-up" signal. The pilot will set military power, raise the launch bar *(it will not actually rise until after launch),* wipe out the controls, and do a final check of the instruments. If the weight-chit submitted to flight deck control prior to start-up requested a "combat" shot, the shooter will then pass the "select afterburner" signal that looks like "raising the roof". Satisfied, the pilot will salute the shooter and then place his hand on the "towel rack" on the canopy bow, or on the stick, which is just a matter of personal technique. The shooter will return the salute, point to the each of his final check items and then touch the deck and point forward, signalling the launch.

Taxiing from recovery to parking:

Now we have had a look at how to proceed from parking to launch, as well as various signals used on the flight deck, let's have a look at the flight deck movement flow after recovery.

After landing, the signals are much simpler. Looking to his right from the landing area, the pilot will see a yellow shirt pulling one of his thumbs backwards, indicating to throttle back after the trap. A moment later, the hook up signal is passed by moving one thumb up into an open palm. When initially told to taxi ahead out of the landing area, raise the flaps to half and then unlock the wings. **Do not fold them until given the signal.** The pilot will then pass a thumbs up or down to the flight deck chief indicating that the jet is either up or down for maintenance. From there, the aircraft will taxi until the yellow shirt passes the same signal as before to install chocks and chains, before handing the jet over to the plane captain. If the plane would still be carrying some sort of ordnance after landing *(training or real ordnance will all be treated the same),* the plane will first be handed over to the red shirt "Ordie" to dis-arm the ordnance. The pilot will again keep both hands visible as an indication of not actuating any cockpit switches at that time.

Note 2: An F/A-18C Hornet assigned to Strike Fighter Squadron One Four Seven (VFA-147) taxis into the de-arming area of the flight deck after a successful mission.

Taxi Guidance:

- Slow is the key word. There is nothing to gain by taxiing fast. Often not much more than idle power is required. *(Allow Response time after applying thrust)*
- **Max Engine RPM for taxiing on the flight deck is 75%** unless given special permission by the "Boss".
- **All turns shall be made with the power at idle.**
- **Eye's outside at all times.**
- Follow the Yellow Shirt instructions *(promptly and accurately).*
- Take extra caution on painted surface marks as foul lines. They may be slippery.
- Shiny deck appearances may indicate slippery conditions.

Note 1: For taxiing at night, Naval Aviators use the phrase "half the speed and twice the caution".

Immediate launch after recovery:

If During CQ the intention is to launch immediately again, perform the FTR-D *(pronounced "fighter D")* checklist:

- Flaps Half.
- Trim Set.
- RADALT Reset.
- Displays Set.

Communication control:

All aircraft are considered under positive communication control while operating at sea unless otherwise directed. **Pilots shall not shift frequencies without notifying and/or obtaining permission from the controlling agency.** Communication procedure during ZIPLIP/EMCON conditions shall be specified during pre-flight briefing.

Voice Procedures:

Strict radio discipline is mandatory. Voice procedures must be concise and should not vary appreciably from standard air traffic control phraseology as set forth in the Carrier Air Traffic Control Handbook NAVAIR AE-CVATCOPM- 000, FAA Order 7110.65 and ACP 165. Squadron tactical calls are not used when communicating with ship related authorities. Only side number is to be used with carrier agencies.

Used properly, the clearances, instructions and information transmitted will greatly assist in the safe and expeditious operation of aircraft. A transmitted radio message will contain at least one of the elements listed but may contain all three elements if required. Pilots and ground personnel should be aware of the elements of each transmission to ensure only those elements that are required to be read back are transmitted. **Verbose transmissions are to be avoided, and one of the most common faults in radiotelephony is the unnecessary retransmission of simple instructions and information.**

The use of standard procedures and phraseology will avoid misunderstanding and reduce the need for repeat transmissions. Incidents and accidents have occurred in which a contributing factor has been the misunderstanding caused by the use of non-standard phraseology and not understanding the important elements of the message. The importance of using correct and precise standard phraseology cannot be over-emphasised.

Note 1: While within the world of DCS a lot of "chat-hungry" aviators are operating. We should try to adhere to correct voice procedures as much as we can. Not everything can be covered and sometimes "plain speech" is required. That is better than not communicating at all. In that case *keep your message clear and concise,* (**avoid jabber)!**
Note 2: In a carrier environment you will have to use your modex (side number) for all communications on the primary radio "PRI".

Communication bullet points:

- **In a carrier environment you shall use your modex (side number) for all communications on the primary radio "PRI".**
- It is standard to use tactical callsigns for the flight on the auxiliary radio "AUX".
- Unlike commercial aviation, **most readbacks require *(only)* the side-number to be read-back i.e. "201".** Clearances however required a full readback, and examples will be given later in this manual
- **Never transmit on the radio when another aircraft is on the ball, unless required for safety of flight.**

Note 3: If an aircraft is transmitting while an airplane is on the ball, the LSO will come up and say, "On the ball" on the radio.

During flight deck operations the following applies:

- There are *normally* no voice communications during Cyclic Ops before launch unless they are calls required for safety. i.e. NWS failure etc.
- During CQ, the pilot shall transmit aircraft side number and gross weight during a two-way radio check. The same transmission is required not only for the initial launch but also after hot refuelling and after a pilot switch.

External lights during day operations:

1. During daytime operations:
- Exterior lights master switch "OFF".
- Taxi/Landing light "OFF".

Note 1: This will apply from the moment electrical power is applied to the aircraft until the aircraft has come to a complete stop and power has been removed regardless of mission.
Note 2: Turning lights on and/or lowering the hook during daylight deck operations signal a loss of brakes.

External lights during night operations:

1. On the deck:
- Exterior lights master switch "OFF".
- Position lights "BRT".
- Strobe light "ON".
- Formation lights "ON".

2. Launch:
- At night, aircraft external lights are turned on meaning the same as the daytime hand salute. When ready for launch, place the external lights master switch to "ON". The pilot shall ensure no exterior lights are on before illuminating them for cat launch.

Note 3: All lights should be on bright with the strobes on. If expecting to encounter instrument meteorological conditions shortly after launch, the strobes may be left off at the discretion of the pilot.

3. In Flight:
- As required by the wingman.
  a. Single aircraft - "BRT", *(or as weather conditions dictate)*
  b. Formations - "AS REQUIRED BY WINGMAN" The last aircraft in formation should have external lights on "BRT", unless tactical situation demands otherwise

4. Arrestment and exit from the landing area:
- During the approach, all exterior lights should be "ON", with the exception of taxi/landing light. *(This allows the LSO to see the Approach Lights).* Following arrestment, immediately turn the external lights master switch off. Taxi clear of the landing area following the plane director's signals.

Note 4: As technique: move the exterior light master switch *(pinky switch)* "AFT", when the throttles go to idle, post trap.

Note 5: Turning lights on and/or lowering the hook during night deck operations signal a loss of brakes.

Brake Failure:
Brake failure: pilot drops arresting hook and turns on lights.

Loss of communications: "NORDO".
During both day and night operations, the flashing of the taxi light indicates that radio communications have been lost(`NORDO`). The flashing of the taxi light will happen at the following positions:
- Case I: In the groove
- Case II: In the groove
- Case III: On final bearing

After the flashing of the taxi light, the taxi light will remain "OFF".

Approach Light Failure:
During night operations, aircraft without approach lights shall be waved off for a visual check of landing gear, launch bar/tow link *(if applicable),* and hook status.

Note 1: The following exceptions apply: Verbal confirmation of "gear down and locked" may be substituted for an approach light for aircraft in extremis. Prior liaison with the ship's commanding officer shall be accomplished to identify what constitutes an extremis situation.

Aircraft lighting malfunctions:
At night, abnormal aircraft lighting configurations because of lighting or other aircraft malfunctions pose many potential problems for the LSO. These problems may include the following: misidentification or late identification of aircraft type; misidentification of a navigation or other aircraft light as an approach light; inability to confirm aircraft configuration: degradation of depth or range perception, associated with loss of normal visual cues; and effects of autokinesis from a singular aircraft light source. The LSO should be aware of these potential problems and how they may complicate his ability to provide proper control of aircraft. The LSO shall positively confirm aircraft type and configuration if any doubt exists.

Note 4: For aircraft without any external lights at night, the LSOs ability to provide timely control is severely limited. The decision to recover an aircraft under these circumstances' rests solely with the commanding officer.

Section CCA due Failures effecting navigation aids comm equipment etc:
A section CCA may be necessary in the event a failure occurs affecting navigation aids, communications equipment, or other aircraft systems. Normally, the aircraft experiencing the difficulty flies the starboard wing position during the approach. The section leader detaches the wingman when the meatball is sighted and continues straight ahead, offsetting as necessary to the left to determine if the wingman lands successfully. Lead shall continue descending to not lower than 300 feet and turn on all lights to bright and strobes on. This provides the wingman with a visual reference in the event of a bolter or waveoff. The wingman should not detach until the meatball is in sight. If the wingman fails to arrest, the leader begins a climb to 1,200ft AGL or remains VFR at 150 knots during the rendezvous, but in no case should a rendezvous be attempted below non-precision minimums.

Reduced visibility operations:
Recovery operations during severely reduced visibility operations the time available for the LSO to acquire the approaching aircraft, evaluate aircraft type and configuration, and provide assistance to the pilot is extremely limited. Under extreme low ceiling/visibility conditions, the LSO should use all available means to track and determine aircraft position to facilitate LSO visual acquisition at greater ranges.

This may include use of:
- HUD SPN-42/46 information
- Close attention to CATCC/CCA calls for approaching aircraft
- Aircraft illumination of landing/taxi lights. "99, taxi lights ON". This will trigger all aircraft to place the landing/taxi-light switch to "ON".

The LSO will frequently visually acquire the approaching aircraft prior to the pilot having positive reference to the landing environment *(meatball and line-up).* Late acquisition of aircraft necessitates the LSO being prepared to provide immediate, concise, meaningful voice calls to assist the pilot in getting to stabilized approach parameters for recovery. During severely reduced visibility operations, the LSOs will likely to be a lot more vocal compared to normal recoveries. It is not uncommon for the LSO to talk to the aircraft all the way to touchdown.

DCS: F/A-18C HORNET

Departure procedures:

Weather effects on carrier operations:
In the Carrier Control Zone "CCZ", weather is the most prominent factor affecting the type of departure and/or recovery. The three types of departure and recovery operations are Case I, II, or III. After the Air Officer determines the Case launch and/or recovery, ATV, in conjunction with the officers and supervisors in CATCC, must determine which type of approach and degree of control will be used for each launch and recovery cycle.

Weather criteria	Anticipated weather conditions to be encountered by flights during daytime departures and recoveries	Ceiling and visibility in carrier control zone
Case I	Will not encounter instrument conditions	3,000 feet and 5 nm
Case II	May encounter instrument conditions	1,000 feet and 5 nm
Case III*	Will encounter instrument conditions	Less than 1,000 feet and less than 5 nm

Note 1: Departures and/or recoveries do not necessarily have to be conducted under the same conditions of each other

Departure Communications:
- Case I departures will be conducted on "Button 1".
- Case II and Case III Departures will be conducted on "Button 2".

Button 1*:* Will be monitored by "Paddles" and "Tower", but can be monitored by other involved parties.
Button 2: Will be monitored by "Departure", and can be monitored by other involved parties

Note 2: It is incorrect to assume that "Paddles" and "Tower" are always on "Button 1". They have the luxury to control and or monitor different frequencies. i.e. During Case III, Paddles will be on approach frequency *(Button 15 and Button 17, alternating).* The "Boss" will be there as well, along with "Button 2" during the launch. At both Paddles' and Boss' stations, they have the ability to transmit/receive on any frequency they choose, including any preset "Button".

Departure and Recovery Restrictions

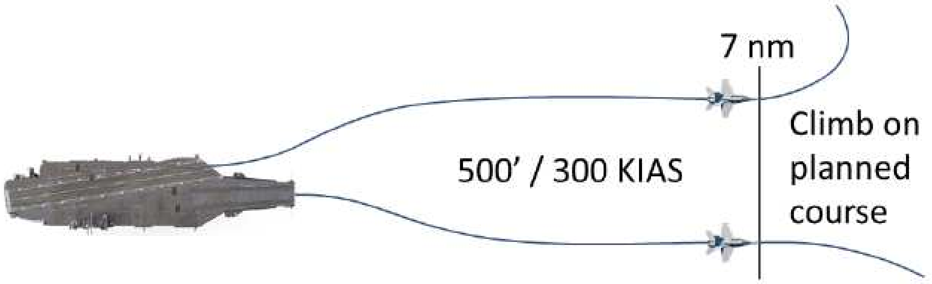
Table 11-5 provides the restrictions that apply to different departures and recoveries.

If the recovery is:	The departure can be:
Case I	Case I or II only
Case II	Case I or II only
Case III	Case I, II, or III

If the departure is:	The recovery can be:
Case I	Case I, II, or III
Case II	Case I, II, or III
Case III	Case III only

Note 3: The above table is referring to Cyclic Ops *(during a specific cycle time).* Subsequent cycles might be conducted in different weather conditions allowing the Departure and Recovery to be changed. For example, an aircraft can launch Case I, and when it is time to recover, the weather deteriorated, requiring Case III to land.

The Case I Departure can be executed from all available catapults.
Once the aircraft clears the catapult and a positive rate of climb is established, the pilot will execute a clearing turn *(direction is dependent on launch position)*, climb to 500ft AGL and parallel base recovery course "BRC". The Case I departure is flown at 300 KIAS paralleling BRC until 7 DME. When directed, or at 7 DME, the aircraft shall climb VMC on course.



Case I departure communications:
During Case I Departures no communications are required. This is "ZIPLIP".

Normal communication procedure on a Case I departure:
- "Button 1" will be used for departure.

Note 1: Aircraft shall normally launch on the departure frequency that shall be monitored by Tower.
- At 7 DME, you would check in with "Strike" on button 3 and then "Red Crown" on button 4.

Note 2: If the mission does not allow this, check in with MBC or AWACS.

Case I Rendezvous:
Prior to launch, it is normal practice that the sequence of launch is determined by a Launch Sequence Plan "LSP" that the Handler is aware of. If no LSP is used, then the launch order will be primarily be determined by parking spots. This could cause aircraft working together on the same mission being launched out of sequence. Therefore, aircraft working together on the same mission may require to rendezvous when airborne. This is accomplished at a predetermined location, usually at the tanker, overhead the carrier or at an on-route location.

Clearing turns:
When launching from the waist cats *(Cat 3 and Cat 4)*, aircraft will execute a clearing turn to the left. Aircraft launching from the bow cats *(Cat 1 and Cat 2)* will execute a clearing turn to the right. The purpose of these turns is to provide aircraft lateral separation on multiple launches from the carrier.

Mechanics of a clearing turn: Once airborne, turn to achieve a heading 20 degrees left or right of the BRC *(30 degrees AOB max).* As soon as the 20 degrees of heading change has been achieved, reverse the turn to parallel the BRC.

Note 3: Normal practice is to turn 20 degrees from the heading you get airborne on.

After a clearing turn, proceed straight ahead at 500ft AGL paralleling the BRC. At 7 nm or directed the 500ft AGL restriction is lifted; proceed VMC on course.

Note 4: Clearing turns shall not be executed when the aircraft intends to remain in the landing pattern.
Note 5: Performing a clearing turn using excessive roll rates and/or angles of bank prior to ensuring that the aircraft has achieved safe flying speed and establishing a positive rate of climb may result in loss of directional control or departure from controlled flight.
Note 6: During Cyclic Ops, if the Launch Sequence Plan has members of the same flight launching simultaneously *(a "covey launch")*, **the "Boss" may clear the aircraft to join once the clearing turns are complete**. A covey launch can only be done with one aircraft on a bow cat and one on a waist cat. **Covey launches are only applicable for Cyclic Ops and Case I departures.**

The Case II departure can be executed from all available catapults. 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 "Button 2". After the clearing turn, proceed straight ahead at 500ft AGL and 300 KIAS paralleling BRC. At 7 DME, turn to intercept the 10 DME arc, maintaining visual conditions until established on the departure radial. **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 18,000ft AGL, report "Popeye" to receive instructions.

Case II departure communications:
During Case II Departures no communications are required (it is "ZIPLIP"), unless the arc is required or the departure radial will be hit.
Departure Control frequency will be used for the launch; "Button 2". The Boss will be up on that frequency.

When instructed by departure, check in with "Strike" on button 3 and then "Red Crown" on button 4.

Note 1: If the mission does not allow this, check in with MBC or AWACS.
Note 2: *"*Strike" and "Red Crown" are not used for ATC related calls.

Case II Rendezvous:
Case II aircraft shall rendezvous between 20 and 50 miles from the carrier on the left side of the departure radial at a prebriefed altitude *(for example, 1,000 ft above the cloud layer).* This does not preclude other visual rendezvous procedures as directed by air wing doctrine.

Departure Radial:
Departure radials are based on the use of TACAN for providing lateral separation. The minimum standard separation of departure radials under instrument conditions is 20 degrees.

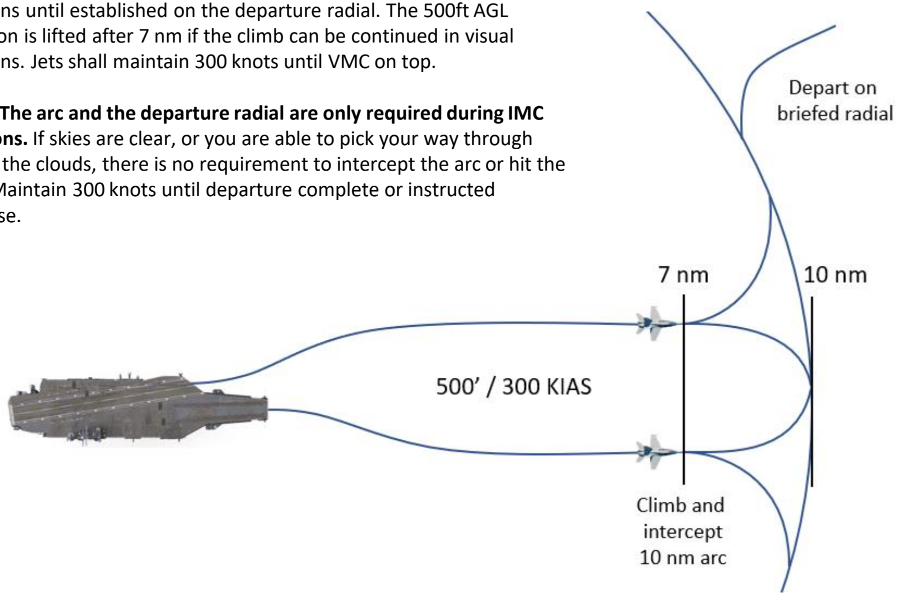
Assignment of departure radials is normally dependent on the following:
- Mission of the aircraft.
- Number of carriers in the formation.
- Topographical features in the area.
- Those radials reserved for emergencies, let-downs, or helicopter holding.

Direct routing will be utilized as much as possible in order to lessen delay time in the execution of departures.

Note 3: Although the above described rendezvous technique is theoretically correct. **Common practice is to rendezvous as described in the "Case I Departure" section.**

Case II departure mechanics:
After a clearing turn, proceed straight ahead at 500ft AGL paralleling the BRC. At 7 DME, turn to intercept the 10 nm arc, maintaining visual conditions until established on the departure radial. The 500ft AGL restriction is lifted after 7 nm if the climb can be continued in visual conditions. Jets shall maintain 300 knots until VMC on top.

Note 4: The arc and the departure radial are only required during IMC conditions. If skies are clear, or you are able to pick your way through holes in the clouds, there is no requirement to intercept the arc or hit the radial. Maintain 300 knots until departure complete or instructed otherwise.



Note 5: When in IMC conditions, Popeye will be a mandatory report for departing aircraft passing FL 180 *(or assigned departure altitude if lower)* if not on top.

Case II departure:

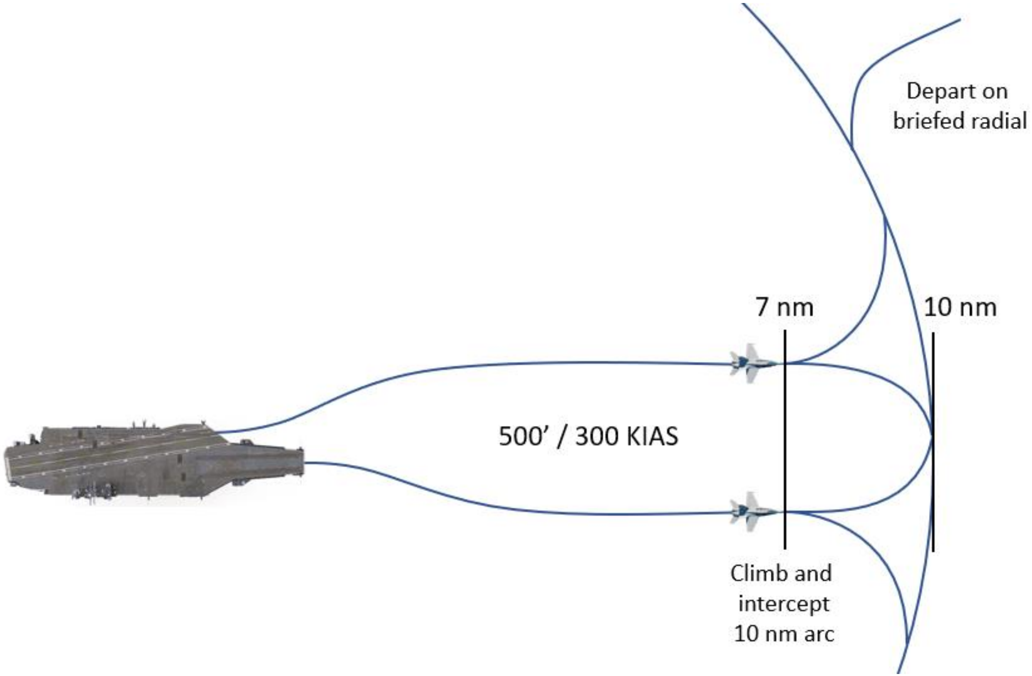
Clearing turns:
When launching from the waist cats *(Cat 3 and Cat 4)*, aircraft will execute a clearing turn to the left. Aircraft launching from the bow cats *(Cat 1 and Cat 2)* will execute a clearing turn to the right. The purpose of these turns is to provide aircraft lateral separation on multiple launches from the carrier.

Mechanics of a clearing turn: Once airborne, turn to achieve a heading 20 degrees left or right of the BRC *(30 degrees AOB max).* As soon as the 20 degrees of heading change has been achieved, reverse the turn to parallel the BRC.

Note 1: Normal practice is to turn 20 degrees from the heading you get airborne on.

After a clearing turn, proceed straight ahead at 500ft AGL paralleling the BRC. At 7 nm, turn to intercept the 10 nm arc, maintaining visual conditions until established on the departure radial. The 500ft AGL restriction is lifted after 7 nm if the climb can be continued in visual conditions. Jets shall maintain 300 knots until VMC on top.

Note 2: Clearing turns shall not be executed when the aircraft intends to remain in the landing pattern.
Note 3: Performing a clearing turn using excessive roll rates and/or angles of bank prior to ensuring that the aircraft has achieved safe flying speed and establishing a positive rate of climb may result in loss of directional control or departure from controlled flight.
Note 4: Although is nothing in writing that prevents a simultaneous launch "Covey launch" to be executed during Case II departures, it is often restricted to Case I only by the "Boss". **Therefore we will read covey launches as only being applicable to Case I departures.**



Case III departure:

The Case III departure can be executed from all available catapults. This departure shall be used whenever existing weather at the ship is below Case II departure minimums and during all night operations except as modified by the "OTC" or Commanding Officer. **Case III departures are compatible only with Case III recoveries.** The launch shall be on departure control frequency "Button 2". **A minimum launch interval of 30 seconds shall be used between aircraft.** When possible, a 60-second interval will be provided when launching a jet aircraft following a turboprop. Following the launch, climb straight ahead at 300 KIAS, crossing 5 DME at 1500ft AGL or above; at 7 DME, turn to intercept the 10 DME arc. Continue climbing and join the departure radial. During Case III Departures, no clearing turns are performed.

The air officer must be acutely aware of the responsibility to ensure the initial separation between bolter/waveoff traffic and departing aircraft during CQ and cat-trap-cat evolutions. CATCC's restricted radar coverage (blind spot) ahead of the ship requires aircrew to exercise good lookout doctrine upon departure.

Case III Departure Communications:
These reports will vary with weather, state of training, EMCON condition, and the type of operation.

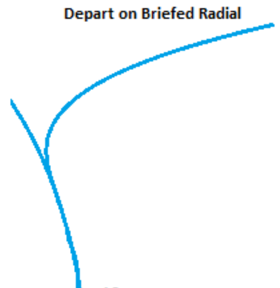
201 – *"Departure, 201 Airborne".*
Departure – *" 201, radar contact, altimeter 29.95".*
201 – *"201".*

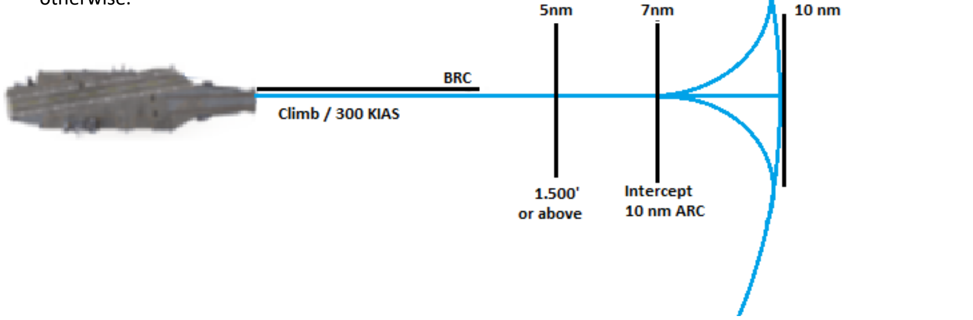
The following reports are commonly used and Departure will acknowledge.
201 – *"201 passing 2,5 Kilo"; (kilo is a coded report indicating aircraft mission readiness)*
201 – *"201, Arcing".*
201 – *"201, Established outbound", On Assigned Radial.*
201 – *"201, Popeye, Angels Eighteen".*
201 – *"201, On top, Angels Twenty".*

Departure – *"201, Cleared to switch".*
201 – *"201".*
Note 1: "Strike" and "Red Crown" are not used for ATC related calls.

Case III departure mechanics: Following the launch, climb straight ahead at 300 KIAS, crossing 5 DME at 1500ft AGL or above; at 7 DME, turn to intercept the 10 DME arc. Continue climbing and join the departure radial. During Case III Departures, no clearing turns are performed.

Note 2: The arc and the departure radial are only required during IMC conditions. If skies are clear, or you are able to pick your way through holes in the clouds, there is no requirement to intercept the arc or hit the radial. Maintain 300 knots until departure complete or instructed otherwise.





Note 3:
When in IMC, Popeye will be a mandatory report for departing aircraft passing FL 180 (or assigned departure altitude if lower) if not on top.

Case III Rendezvous:

Case III aircraft shall rendezvous between 20 and 50 miles from the carrier on the left side of the departure radial at a prebriefed altitude *(for example, 1,000ft above the cloud layer)*. This does not preclude other visual rendezvous procedures as directed by air wing doctrine.

Departure Radial:

Departure radials are based on the use of TACAN for providing lateral separation. The minimum standard separation of departure radials under instrument conditions is 20 degrees.

Assignment of departure radials is normally dependent on the following:

- Mission of the aircraft
- Number of carriers in the formation
- Topographical features in the area
- Those radials reserved for emergencies, let-downs, or helicopter holding.

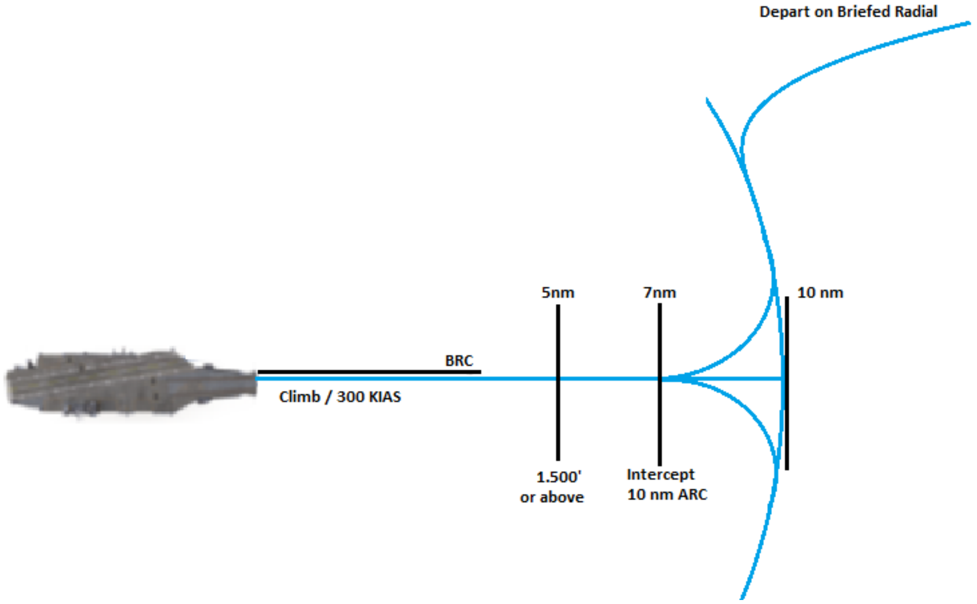
Direct routing will be utilized as much as possible in order to lessen delay time in the execution of departures.

Note 1: Although the above described rendezvous technique is theoretically correct. **Common practice is to rendezvous as described in the "Case I Departure" section.**

Clearing Turns:

Clearing turns shall not be executed by aircraft during case III departures.

Note 2: Covey launches are not applicable to Case III departures.



Departures during Carrier Qualifications: "CQ"

Departures during CQ normally happen from Cat 1 and Cat 2, while Cat 3 and Cat 4 are used for recovery. After recovery this allows options to use Cat 1 and Cat 2 for launch again. As stated before, during CQ there is normally a lot less movement on the flight deck and aircraft and crew numbers will be significantly lower.

In the previous pages all 3 different Case departures have been described but it is worth highlighting the following: ***A "Case I or III departure" is not always flown during CQ.***

In most actual cases, you proceed straight into the pattern unless landing weight limited, which requires the dump or burn of excess fuel. Technically this should not be required unless you are possibly operating in the first go of the day. Throughout the day pilots "hot pump/hot seat," meaning they refuel and change pilots with engine*(s)* running. They will then only take 1000 pounds more than max trap weight, instead of topping off.

Note 1: During Night CQ, you are required to do a full Case III recovery on your first pass. All subsequent launches will be directly into the bolter/waveoff pattern.

Direct entry in to "the pattern" during case I recovery operations:
- Climb to 600ft AGL .
- Lower flaps to full.
- Hook Down.
- Turn downwind with your interval.
- Perform landing checklist.

Direct entry into "the bolter/waveoff pattern" during Case III recovery operations:
- Gear Up.
- Flap Half *(F/A-18C Hornet).*
- Speed 150.
- Call "airborne" to approach: 201 - "201, Airborne".
- Follow the bolter/waveoff pattern as instructed by approach.
- Perform landing checklist.

Note 2: Details of "The pattern" and "The bolter/waveoff pattern" will be discussed later in this manual.

CQ Departure communications:
- ZIPLIP conditions are not active during CQ.
- During CQ operations, the pilot shall transmit aircraft side number and gross weight *(rounded to the nearest thousand)* during a two-way radio check. The same transmission is required not only for the initial launch but also after hot refuelling and/or after a pilot switch.

201 – *"Tower, 201, Up and Ready, 43K".*
Tower – *"201, Roger, 43K".*

Clearing turns:
If the aircraft plans to fly a Case I departure, follow clearing turns as described below.

When launching from the waist cats *(Cat 3 and Cat 4)*, aircraft will execute a clearing turn to the left. Aircraft launching from the bow cats *(Cat 1 and Cat 2)* will execute a clearing turn to the right. The purpose of these turns is to provide aircraft lateral separation on multiple launches from the carrier.

Note 3: Normally only from Cat 1 and Cat 2, while Cat 3 and Cat 4 are unavailable due to the recovery

Mechanics of a clearing turn: Airborne, 30 degrees AOB max, turn to achieve a heading 20 degrees left or right of the BRC. Normal practice is to turn 20 degrees from the heading you get airborne on. As soon as the 20 degrees of heading change has been achieved, reverse the turn to parallel the BRC.

Note 4: Normal practice is to turn 20 degrees from the heading you get airborne on.

After a clearing turn, proceed straight ahead at 500ft AGL paralleling the BRC. At 7nm or directed, the 500ft AGL restriction is lifted proceed VMC on course.

Note 5: Clearing turns shall not be executed by aircraft during case III launches or when the aircraft intends to remain in the landing pattern.
Note 6: Performing a clearing turn, using excessive roll rates and/or angles of bank prior to ensuring that the aircraft has achieved safe flying speed and establishing a positive rate of climb may result in loss of directional control or departure from controlled flight.
Note 7: Case II departures are not mentioned here, as they are not a requirement for CQ.

Communication loss on departure:

Lost Communications During Departures:
If communications are lost during departure, squawk Modes I and III as listed on the right side.. If in VMC when communications are lost, remain VMC. If able, return to the ship by visual means for recovery. If on top/IMC, proceed to the applicable emergency marshal and commence a descent to depart that fix at EEAT.

Good azimuth and *(no)* DME:
In the event of lost communications and a loss of TACAN DME, the following departure procedure shall be followed utilizing TACAN azimuth. Continue with the prebriefed departure; utilize DR procedures to maintain the appropriate arc until reaching assigned departure radial. Proceed to approximately 50 miles, reverse course, proceed inbound on the assigned departure radial at the emergency marshal assigned altitude, and enter overhead holding using the prebriefed expected final bearing for proper holding orientation. Conserve fuel and be alert for join up. If not joined by an escort aircraft, commence approach at EEAT. Use prebriefed expected final bearing to determine outbound and inbound tracks.

Good azimuth and *(good)* DME:
All aircraft will continue with prebriefed departure, climbing outbound on departure radial unless modified by CATCC or until reaching 50 and commence left-hand holding between 40 and 50 DME. After holding for 30 minutes, proceed inbound on the departure radial, climbing or descending to the emergency marshal assigned altitude. When reaching the distance prescribed for emergency marshal, arc in the shortest direction until reaching the assigned emergency marshal fix, enter holding, and commence approach at assigned EEAT.

Mode III — Lost communications (transmitter and/or receiver) squawk Code 7600. Emergencies squawk 7700.

Mode I — The following codes will amplify difficulties in conjunction with a Code 7600 or 7700. No receiver shall mean that the primary UHF, auxiliary receiver, and UHF/VHF Guard receiver are inoperative. If any receiver is operative, the controller is capable of controlling the aircraft utilizing IFF standby squawks and/or aircraft turns to acknowledge receipt of instructions.

Note

Below 2,500 feet, pilots must be aware of the dangers of changing IFF codes.

1. HEFOE Squawks		
Mode I		Mode III
First digit	Second digit	
0 — OK	0 — No radio reception PALS/ILM OK 1 — No radio reception, TACAN OK	
1 — Hydraulic		7700/7600 (with HEFOE code, use Code 7700)
2 — Electrical	2 — No radio reception, ADF OK	
3 — Fuel	3 — Radio reception, OK, no NAVAIDs	
4 — Oxygen		
5 — Engine		
2. Assistance Required Squawks		
All 7 — Mode I squawks indicate no receiver and no NAVAID(s).		
Mode I		Mode III
70 — Desire tanker to join		Fuel on board (up to 7,400)
71 — Intend bingo		
72 — Desire aircraft to assist		
3. Limited Communication Squawks		
Require a 1-minute cycling of Mode III from 7600/7700 to desired channel.		
Mode I		Mode III
60 — Aux. Rec. (ADF) channel ____________		Channel usable (0100–2000, and 2100 = Guard)
61 — No NAVAID(s) Rec. on channel __________		
62 — TACAN OK. Rec. on channel _____________		

Emergency catapult flyaway:

Emergency Catapult Flyaway; also know as "E-CAT Flyaway".

Off the catapult, several emergencies may cause the aircraft to settle and/or lose lateral directional control. Aircraft settle may be the result of insufficient catapult endspeed or loss of thrust by the engines. Lateral directional control may be degraded by FCS malfunctions or engine thrust asymmetry. Accordingly, a single engine malfunction may be characterized by settle and reduced controllability. Priorities during emergency catapult flyaway are to establish control of aircraft, arrest settle, and accelerate for climb-out. Establishing control of the aircraft is predicated on arresting roll and yaw rates. Full rudder pedal input opposite yaw/roll may be required to do so. Rudders are the only means of controlling yaw, and are effective in countering roll, therefore they should be used as the initial control input. If rudders are not sufficient to control roll, judicious lateral stick inputs can be used to supplement the rudders and will help control bank angle. However, large lateral stick inputs may produce adverse yaw and exacerbate controllability.

Angle of attack is critical to maintaining aircraft control and arresting settle. AOA must be high enough to minimize altitude loss, while low enough to ensure controllability. An AOA range of 10-12° provides the best compromise. In most cases, proper AOA control is automatically provided by the flight control system, however several scenarios (mis-trimmed aircraft, AOA system failure, flight control malfunction) require the pilot to actively set the flyaway attitude. Stores jettison is crucial to emergency catapult flyaway. Timely emergency jettison minimizes altitude loss and improves controllability by reducing weight and lateral asymmetry in many configurations.

If flyaway airspeed available, perform the following actions without delay:

1. Throttles - MAX
2. Rudder pedal - FULL AGAINST YAW/ROLL
3. EMERG JETT button - PUSH
4. Maintain 10° pitch attitude with (**W)** symbol.

Note 1: Do not exceed half lateral stick

Warning:
- Inputs in excess of ½ lateral stick deflection may result in adverse yaw departure.
- Exceeding 10° pitch attitude may result in rapid loss of lateral- directional control.
- Raising flaps will increase aircraft settle.

If unable to arrest yaw/roll or stop settle:

5. **EJECT.**

Warning:
- Delay in determining controllability will likely place aircraft outside the ejection envelope.

Note 2: For launch, the RADALT is set to 40 feet. This will enhance SA during a settle off the catapult. If during a cold cat shot you hear the RADALT and your trend hasn't improved, **EJECT!**

Ejection:

The ejection seat must be used to escape from the aircraft in flight. If the canopy fails to jettison, the seat will eject through the canopy. Analysis of ejections shows:

1. Optimum speed for ejection is 250 knots and below.
2. Between 250 and 600 knots, appreciable forces are exerted on the body, making ejection more hazardous.
3. Above 600 knots, excessive forces are exerted on the body making ejection extremely hazardous.

When possible, slow the aircraft before ejection to reduce the forces on the body. Never actuate the manual override handle before ejection. When the handle is actuated, the arm/safe handle is rotated to the safe position, the pilot is released from the seat, and the harness cannot be reconnected. Ejection is impossible and there is no restraint during a forced landing. Whenever possible, ejection airspeed should be limited to a maximum of 400 KCAS when flying with the JHMCS helmet system.

Warning: The JHMCS configuration can contribute to increased neck loads during ejection, particularly at moderate to high speeds. Generally, neck loads increase as ejection airspeeds increase and may cause severe or fatal injury. Aircrews should eject at the lowest possible airspeed to minimize neck and injury loads.

Suspend Procedure:

While on a runway at an airfield, there exists the opportunity to abort the take-off roll. On an aircraft carrier, the analogous procedure is the "Suspend procedure". Whilst you cannot interrupt the launch once the catapult has been fired, you do have the opportunity to stop the launch before the it fires. The suspend is to be used after the run-up and is effective even after giving the salute or turning on the external lights.

Note 1: It is possible that even with a Suspend, you could be launched anyway. This can occur in the situation where you suspend very late and it is immediately prior to the catapult firing.

If for any reason the pilot wishes to abort the launch, he/she shall so indicate by transmitting on the radio the words "Suspend, Suspend, (cat number)" and shake his/her head back and forth in an exaggerated manner *(shaking his head negatively).* If in the heat of the situation you cannot get the cat number out in the transmission, merely saying "Suspend, Suspend" will still work as then all catapults will be suspended. Realize, either the head shaking or the radio transmission by themselves should suffice but doing both would be even better. **It is important that if you have not saluted yet and you wish to suspend, that you do NOT try to use your hands to call for the suspend**. No slashing the throat or thumbs down signals. Keep the hands below the canopy rail. The reason for this is to ensure that the hand signal is not mistaken for a salute. Thus, the exaggerated head shake is the best visual signal. External/navigation lights shall be turned off if already on.

Once the Suspend is received, the Shooter and his team will stand and cross their arms over their head in an "X" shape *(day)* or by initiating a horizontal red wand movement *(night).*
Below deck, personnel shall depress the suspend pushbutton that locks out the catapult from firing. Once that is squared away, the Shooter will walk out in front of you, with the catapult track between his legs, and give the "throttle back" hand signal. He does this as his assurance to you that you are not going anywhere. Once this is complete, you will be reset on the catapult for another try, or you can ask Tower to be spun off the catapult for troubleshooting.

Note 2: It is possible that while nothing is wrong with the airplane, that you will be suspended by the Shooters or the Air Boss. This is usually either related to an issue with the ship's equipment or winds out of limits. The Air Boss will provide time you the reason that you were suspended in this case.

Note 3: Anytime a suspend is initiated, it must be carried out to completion. This includes untensioning of aircraft, reduction of aircraft power to idle, and moving the shuttle forward of the launch bar for all aircraft.

The pattern:

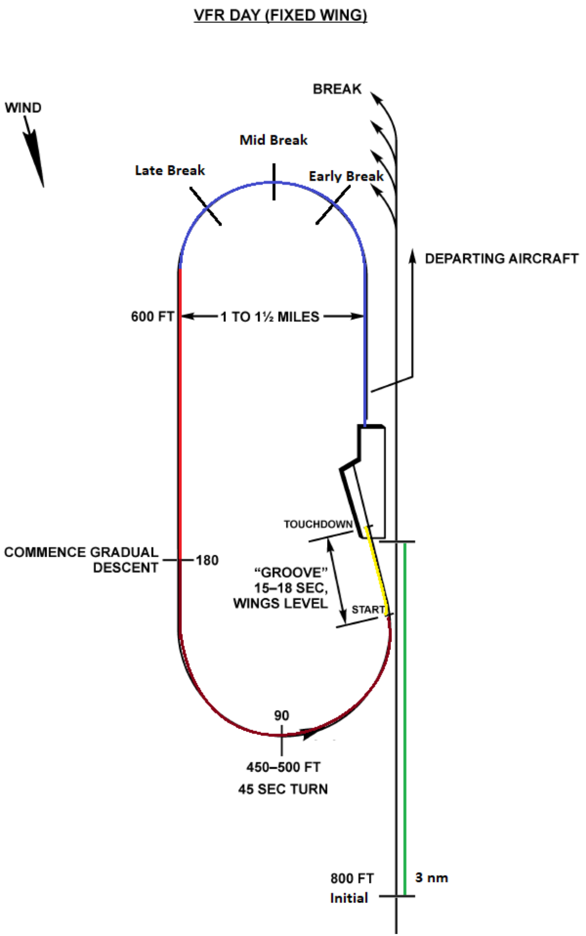
The pattern is as the word describes. It is the pattern that connects the Case I and Case II recovery from the initial to a position behind the ship. While I am very aware that we have not yet covered the arrival part that will lead us to the pattern, it is vital to understand the mechanics and baselines of the pattern before we will discuss the Case I and Case II recoveries that lead us to the initial start of the of the pattern.

Note: **It is wrong to assume 'The Pattern' belongs to a Case I recovery** as 'The Pattern' is not recovery specific. **For Case I and Case II recovery procedures the pattern is the same.** During Case III recovery operations there simply is no pattern because it can be considered an IFR procedure

The VFR DAY *(Fixed Wing)* pattern is shown in the picture on the right-hand side of this slide. We will break down the pattern into different sections to create a better understanding of the pattern, and how it is to be flown.

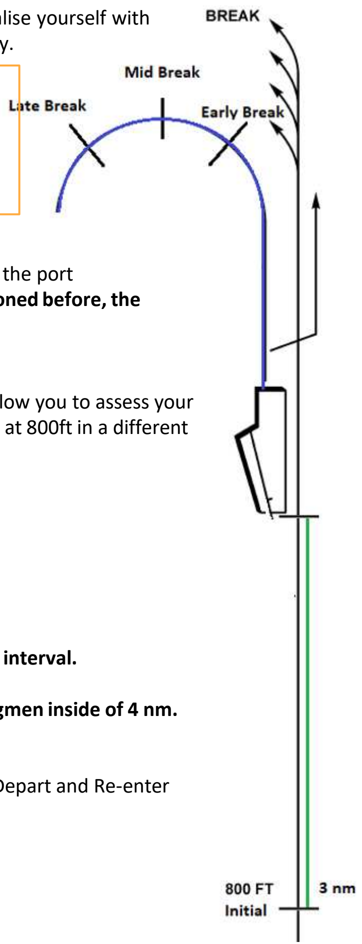
The following sections will be covered:

- Green **Initial:** 3 nm astern of the ship, 800ft AGL , 350 KIAS.
- Blue **Break:** Level turn at 800ft AGL while reducing speed, changing configuration, and bringing the aircraft to an on-speed energy state.
- Red **Downwind:** Descending segment from 800ft AGL to end up at the 180 at 600ft AGL, on-speed, and landing checks complete.
- Brown **Approach Turn:** Descending segment to transition from downwind to the groove.
- Yellow **Groove:** A 15 to 18 seconds final approach segment.



The initial is a fixed position 3 nm astern of the ship. From the initial an aircraft would fly at 800ft AGL , paralleling BRC with a standard speed of 350 knots.
The hook should be down unless doing CQ and the "Boss" requested the hook up. There are different ways to arrive at the initial and those will be covered in the recovery specific sections.
Also important to understand the pattern is flown under VFR conditions and consists of a visual manoeuvre. Whilst approaching or at the initial, use this time to visualise yourself with others in the pattern, the status of the deck, the sea-state etc. Work ahead of the aircraft to create situational awareness and line yourself up correctly for break entry.

When paralleling the BRC at 800ft AGL and 350 knots, 3 options have become available:
- **The Break:** A level turn within 4 nm ahead of the ship at 800ft AGL .
- **Spin:** If there are more than 6 aircraft in the pattern. Spin specific details will be covered in the "Spin section" later on in this manual.
- **Depart and re-enter:** Maintain 800ft AGL and 350 knots until 5 nm ahead of the ship. Then climb to 1,200ft AGL and execute a left-hand arc back to the initial. Tower must be notified of your intentions. The specific details of this manoeuvre will be covered in the "Depart and re-enter" section later.



The Break:
The break is a level turn at 800ft AGL that will allow you to transition your aircraft from a high energy state on the starboard side of the ship to a low energy state on the port side of the ship. The break consists of a 180 degree left hand turn, that shall be flown level at 800ft AGL, whilst reducing speed and changing configuration. **As mentioned before, the break should be executed before reaching 4 nm ahead of the ship.**

Break segments:
The break can be divided in three different segments: early, mid and late break. There is no requirement to divide the break in different segments but doing so will allow you to assess your current position compared to your ideal position. This to help identify and correct deviations at the earliest possible time. If executed correctly, the aircraft should be at 800ft in a different energy state whilst passing each segment.

Note 1: **Early, mid and late break are not official terms** used in any available publications and are listed here purely as technique only.
Note 2: **If not leading a division or performing a SHB (covered later), it is recommended that you continue at least 1 nm upwind prior to breaking.**

Break interval:
When to break is determined by the last aircraft in the landing pattern as they have priority, and the amount of aircraft in the flight.
- If entering the break as a single ship, or as the flight lead, then start the break when your interval passes behind your stabiliser and is out of sight.
- If entering the break as a wingman, start the break 17 seconds after the preceding aircraft. **A 17 second break interval will correspond to a 45-60 second landing interval.**
- If entering the break as a single ship, or as the flight lead, and the pattern is empty, then the break is at your discretion.
- **If you lead a division *(4 aircraft)* into the break you will need to break aft of the bow of the ship. Breaking aft of the ship's bow will be required to keep all wingmen inside of 4 nm.**

Note 3: No breaks shall be performed more than 4 nm ahead of the ship. The flight leader shall either execute a normal break or spin all or a portion of his flight, depending upon the number of aircraft in the landing pattern. If you are unable to break before 4 nm, you will have to depart and re-enter the pattern. Refer to the Depart and Re-enter slide for more information on how this is accomplished.
Note 4: Entry into the break shall be made at 800ft AGL . All breaks shall be level. Ideal distance from the BRC on downwind will be between 1 to 1.5 nm.

Initial and Break:

Break Techniques:

- Reduce thrust to idle and extend the speed brake *(if required).* As the airspeed decreases through 250 knots, lower the landing gear, place the flap lever to full. **250 knots of airspeed is a limit and not a target in this case.**
- Place the velocity vector on the horizon the help you keep the turn level.
- **There is no set procedure on how to execute the break**. It requires constant modulation of pull and bank angle to remain level and end up at the correct abeam distance. This distance is the distance to course line on the HSI indicated at the bottom right. **The correct abeam distance is the ultimate goal coming out of the break.**
- New pilots could use the "1% of airspeed = G" rule for the first half of your turn as a technique. In practise this technique is not commonly used and will tempt you to focus too much on G-force required instead of monitoring the turn.
- **Be a pilot.** If you are too wide, pull more G, or increase bank angle. Equally if you're too tight, then do what is needed to correct, i.e. reduce pull, stow speed brake, "BE A PILOT". Do not delay your reduction in speed to increase your turn radius as this will put you closer to the aircraft in front. If you are not happy with the numbers you are looking at, then do something about it. Play out the turn to end up at the correct distance abeam the course line.
- **Scan, scan and keep scanning**. Adjust your pull, bank angle, speed and configuration as required. Remember the lower your speed the lower your turn radius.
- HSI scale should be 10 with the TACAN course line set to BRC. It is important to have the HSI set up correctly to allow you to use it efficiently.

Note 1: In DCS, if not anticipated correctly, the flaps traveling to the full position may cause a "balloon" effect that does not exist in the real aircraft.

Break exit:

On break exit, take note of your abeam distance, for the following two reasons.

- If you do not end up where you wanted to be after the break i.e. you are much wider or much tighter then you like to be. Then **aggressively** correct it on the downwind. The 180 is approaching quickly and flying a correct approach turn later on requires a proper abeam distance.
- If later in the pattern you notice that your abeam distance will cause you to overshoot or angle then take note of your pattern and make adjustments on the next pass.

Note 2: The idea is that the approach turn should get you to the extended centerline using a 27-30-degrees AOB. Whatever abeam distance is required to get you there with 27-30-degrees AOB, is the correct abeam distance. **Do not fly the same pattern with an increased/decreased bank angle to make the approach turn work, change your abeam distance to make your bank angle work.**

The downwind leg is a course flown parallel to ships course, in a direction opposite to the intended landing direction. After the level break the aircraft should be configured for landing with the hook extended *(unless doing CQ and the "Boss" requested the hook up),* gear down, flaps full and trimmed for on-speed and at the correct distance from the BRC.

Ship procedure: Irrelevant of your type of aircraft the published ideal abeam distance to the ship is 1 to 1.5 nm.
Aircraft Specific procedure: Depending on the airframe you are working with. F/A-18C hornet will require an optimal abeam distance of 1.1 to 1.3 nm from the BRC line within DCS. Again, these numbers are a baseline; they are not required. **Whatever distance works for you with a 27-30 degrees AOB is the correct one**.

Note 1: In real life the F/A-18C hornet would require to be 1.3 to 1.4 nm from the BRC line. The simple reason for this is that, the real life the hornet will fly a higher speed for the same on-speed AOA.

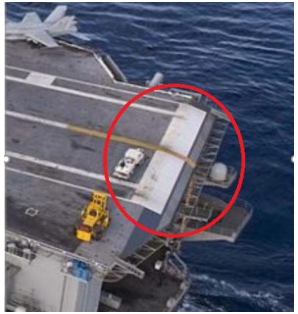
It is important to be on-speed, so you are setup correctly at the 180 to start your approach turn. It will also help you to secure your distance from aircraft ahead and/or behind you. Once all of the above conditions are met, descend to 600ft AGL to intercept the downwind leg of the landing pattern. Descent to 600ft AGL shall be completed before reaching the 180 position. Complete the landing checklist and crosscheck angle-of-attack with proper airspeed.

Optimum Use of HSI:

- Set TACAN course line to BRC.
- Use the reciprocal from the BRC to create awareness for your downwind HDG.
- Use the heading bug to set your downwind heading or as a guide to help on which heading to leave the Marshal Stack.
- With a scale of 10 nm set on the HIS, the aircraft symbol will help you achieve the optimum distance from the BRC on downwind. When the wingtip touches the BRC line, you are roughly 1.2 nm abeam the BRC Line.
- The right bottom corner shows your distance from the BRC line. This will help you create situational awareness during the break.

Note 2: The HSI is used for orientation and abeam distance, not for starting your approach turn.

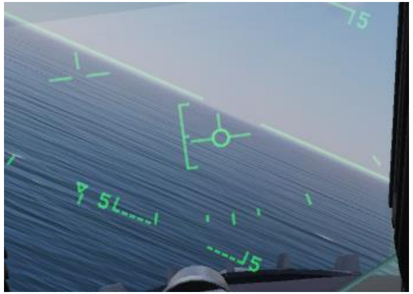
The end of the downwind:
The downwind segment ends at the 180. **The 180 Is defined as the position on downwind where you can see the white of the round down at the stern of the flight deck.** The white of the round down is the white paint of the down slope of the stern of the flight deck as indicated on the photo on the right.



Approach turn:

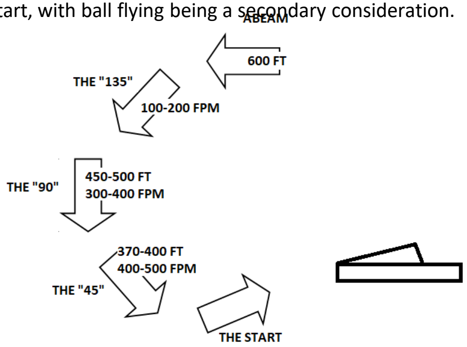
The approach turn will transition you from the end of the downwind segment to the beginning of the groove. The approach turn starts at the 180 and it is therefore important to understand the exact position of the 180. The 180 Is defined as the first position on downwind where you can see the white of the round down at the stern of the flight deck. Once you see the white of the round down, **without delay** begin the approach turn. The first 90 degrees of your turn are **only** based on flying instruments. **Do not get tempted to fixate on the boat too early. Fly the numbers**. At the 90 you can take a peek outside, then back to the instruments. Adjust bank angle slightly if required. At the 45 degree position you now increase your outside scan and take several peeks back and forth, until you approach the groove and are now transitioning to visual flying. While the approach turn from the 180 to the start should take 45 seconds, this fact should not affect how you fly. **If your groove time ends up being longer or shorter than 15-18 seconds, then start your turn earlier or sooner (as required) on the next pass.**

Note 1: It is important to be disciplined and accurate during your approach turn. The setup for your approach turn starts way before the 180. So chase your numbers. If they are not where you want them to be, then do something about it. A good start is imperative. In real life aviators spend their first few hundred passes practicing only to get to a good start, with ball flying being a secondary consideration.



Accurate flying and correct trimming technique are key to achieving on-speed AOA, correct abeam distance and altitude on downwind. Without those parameters you will start a messy approach turn. On the start of your approach turn add a little power to compensate for the increment of bank angle causing your vertical lift to be reduced. If you don't compensate for the loss of vertical lift, increased vertical speed will be the result. The more constant you maintain the correct bank angle during the approach turn, the less you are disturbing your vertical lift component. This means inputs required to maintain a set pitch angle are kept to a minimum.

Note 2: The velocity vector just below the horizon gives you roughly -200 to -300 feet per minute.



Approach turn technique:

- Start the approach turn at the 180. Roll in 27 to 30 degrees angle of bank and a gradual descent of 100 to 200 feet per minute.
- At the 135 degree position you should be descending with 27 to 30 degrees angle of bank and descending 100 to 200 feet per minute.
- At the 90 degree position you should be at 450 to 500ft AGL whilst now descending 300 to 400 feet per minute. 500ft AGL is what is commonly used at the ship so be biased to 500ft AGL.
- **Fly the numbers**, because if you were to look outside you would appear higher and tighter than you think you should be.
- Aim to achieve 370 to 400ft AGL at the 45 Degrees position of the boat, with 400 to 500 feet per minute rate of descent. **The ICLS can only be used as an aid, and not as a primary tool.**
- This will help assess glideslope and altitude trends. For reference: between the 90 and 45, the glideslope needle should be resting on the bottom of the VV circle. Do not rely on it heavily as the correct technique is to use the pattern numbers. Warning: The GS will only give you correct information once established on centerline. Azimuth indications should not be used for line-up behind the ship.
- Cross the wake at 300-350ft AGL. -500ft/min rate of descent.
- **Do not look for the ball too early.**
- Ball Acquisition – Check VSI and Adjust (-500/-600ft per min ROD) Do not fly 3.5 degrees descent path by using the velocity vector. The runway is moving, so fly the ball.

Note 3: During the approach turn, adjust the rate of descent using the throttles only.
Note 4: "Ball flying" will be covered later in this manual.

The groove:

The Groove; This is a 15 to 18 second final approach segment. The aircraft should roll wings level on centerline with a centered ball with a 15 to 18 second groove before touching down on deck. **Groove length is timed from the moment the aircraft crosses the PLAT centerline.** In the case of an angling approach the timing starts once the aircraft is roughly wings level and can be reasonably assumed to be flying the ball. The timer will stop at the instant of touchdown. At touchdown the pilot shall add MIL or MAX power as appropriate and prepare to bolter.

Note 1: Things will be happening very quickly at this point so the correct position from the start is mandatory.

Groove mechanics and technique:

- During CQ, call the ball: Side number, Type, Fuel state, Last name.
- Follow the LSO rules to live by.
- **Scan, scan and keep scanning!** Meatball, line-up, angle of attack.
- **Fly the ball all the way to touchdown. Landing should be a surprise.**
- You will have to hawk lineup very carefully.
- Do **not** spot the Deck.
- **Never** accept a low ball.

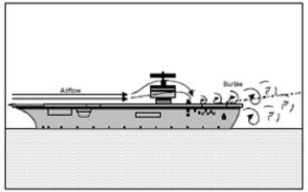
Note 2: Each time you dip the wing for your lineup corrections, you will lose a bit of vertical lift requiring you to compensate with power adjustments .

Difference between the carrier approaches and field approaches (FCLP):

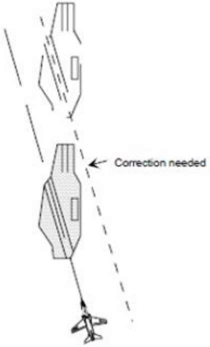
- More power required at the ship to work off a low ball.
- Easier at ship to work off high ball.
- Burble effects on glideslope.
- Harder to correct lineup at the ship.
- At the ship, the 90 degree position looks high and tight due to the angled deck.
- A higher tendency at the ship to spot deck in-close, resulting in excessive sink rate at the ramp and a one-wire.
- A higher tendency at the ship to fixate on a single item, causing a scan breakdown.

Groove time grading:

<9 seconds = <u>NESA</u>
9-11 seconds = NESA
12-14 seconds = (NESA)
15-18 seconds = Normal
19-21 seconds = (LIG)
22-24 seconds = LIG
>24 seconds = <u>LIG</u>



BURBLE



LINEUP DIFFICULTIES

During Cyclic Ops *(which are ZIPLIP),* 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.
If you can see the ball but the visibility makes you unable to see line-up, then call "Clara line-up". This is a regular occurrence when flying the pattern with a difficult sun angle.

Note 3: At any time during ZIPLIP operations, radio calls will only be made for any safety of flight situations.

During ZIPLIP or EMCON conditions, or for a NORDO aircraft, the LSO shall acknowledge control of the aircraft on final approach with a steady (3-second) flash of the cut lights. In doing so, the LSO is also acknowledging that the pilot has meatball acquisition, line-up reference and angle of attack. Subsequent flashes of the cut lights by the LSO command a pilot response of adding power, the degree of which is indicated by the duration of the cut light signal. Waveoff lights mean waveoff. Alternating cut and waveoff lights mean divert.

Execute the approach exactly as a touch and go, flying the ball all the way to touchdown. When the aircraft touches down, advance the throttles to "MIL" or "MAX" as the aircraft touches down. **Do not anticipate an arrested landing.** When forward motion has ceased and the yellow shirt located at the 1 to 2 o'clock position signals for power back. **reduce power to idle and allow the aircraft to roll aft.**

Note 1: During the motion of retarding the throttles back to idle, switch the "Exterior Lights Master Switch" to "OFF" at night.
Note 2: 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. Apply brakes on signal and raise the hook when directed. If the wire does not drop free, drop the hook when directed and allow the aircraft to be pulled aft. Raise the hook again on signal. When the come ahead signal is received, add power, release brakes, and exit the landing area cautiously and expeditiously, raise the flaps to half and then unlock the wings. Do not fold the wings until given the signal. The pilot will then pass a thumbs up or down to the flight deck chief indicating that the jet is either up or down for maintenance. Taxi the aircraft as directed. Do not use excessive power. Once spotted, keep the engines running and follow shutdown procedures and directions given by the plane captain.

After landing:
- **During Cyclic Ops:** When initially told to taxi ahead out of the landing area, raise the flaps to half and then unlock the wings. Do not fold the wings until given the signal.
- **During CQ:** Perform the FTR-D (pronounced "fighter D") checklist if going from trap to cat: Flaps Half, Trim Set, RADALT Reset, Displays Set.

Note 3: More detailed information on taxiing after landing is described earlier in this manual.

Touch and go/bolter procedure: (FOR CASE I AND CASE II ONLY)

Touch and Go/Bolter:

The bolter/waveoff procedures related to Case I and Case II recoveries as described on this page **shall not be confused with the bolter/waveoff pattern related to Case III recoveries.**
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 "MIL" or "MAX" as required and rotate to on-speed AOA. Maintain wings level and verify a positive rate of climb and whilst maintaining on-speed AOA. Do not change configuration. 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 ft AGL)* and turn downwind with proper interval.

Once clear of the ship following a waveoff, touch and go, or bolter, the pilot shall turn to parallel the BRC. Corrections to parallel the BRC shall not be attempted until a definite climb has been established. The climb to 600ft AGL landing (pattern altitude) should normally be completed prior to commencing the turn to the downwind leg. Aircraft continuing in the landing pattern shall take normal interval on other traffic in the pattern.

Hook Up touch and go:

The "Boss" and his team in Pri-Fly keep track of pilot CQ requirements. The "Boss" will direct hook up or hook down in order to manage the pattern as well as pilot requirements. The "Boss" may use phrases such as "hook up for 1", "hook up for 2", and "hook down."

Example:
"Boss" – *"201, Hook down".*
201 – *"201".*
Right after replying with your callsign, move the handle to lower the hook.

Touch and go/bolter mechanics:

- Advance throttles to "MIL" or "MAX" power as required.
- Maintain wings level and verify a positive rate of climb whilst maintaining **on-speed AOA**.
- Do not change configuration.
- Once a definite climb has been established turn to parallel the BRC.
- Climb to 600ft AGL .
- Turn downwind with your interval *(when the interval hits your stabiliser at the 7 o-clock position).*
- Perform landing checklist.

Note 3: **Upwind interval is determined by "first to the bow", whether that is break traffic, waveoff, touch-and-go, or bolter.**
Note 4: **Once upwind, the proper interval to follow traffic on downwind is to wait until they reach your 7 o'clock position, (visually when the traffic reaches your left horizontal stabiliser).**

Waveoff:

The waveoff window is defined as a moving window through which the aircraft passes and is the latest point where normal pilot technique will result in a safe waveoff. Many factors must be considered in determining this point, including aircraft/engine performance, approach dynamics, and environmental conditions *(i.e., sink rate, angle of bank, deck movement, visibility).*

All LSOs have an equal responsibility for not landing an aircraft on a foul deck. Additionally, when in the opinion of the air officer the deck will remain foul throughout an aircraft's approach *(i.e., arresting gear malfunctions, personnel or equipment in the landing area, etc.),* he should advise the LSO via the 5MC, **"No chance Paddles",** The LSO shall immediately initiate the waveoff using the IFLOLS/ MOVLAS waveoff lights and a UHF radio transmission *(EMCON permitting)*.

With an aircraft inside the 180 during Case I/II operations, or with an aircraft approaching 2 DME during Case III operations, the controlling and backup LSOs shall each raise their pickle switch arm above their heads as a visual signal and reminder anytime the deck status is foul *(except for MOVLAS, when the backup LSO is the only LSO to raise his arm).* The LSOs shall lower their arms only upon receipt of a clear deck signal, or upon waving off the approaching aircraft for a foul deck.

During normal recovery operations, the LSO shall initiate a foul deck waveoff such that a normal waveoff response will allow the aircraft to pass no lower than 100ft. For visualisation purposes this should translate to no aircraft will descend below the height of the island unless the deck is clear. If aircraft, personnel, or equipment are in the landing area, the waveoff shall prevent the aircraft from passing within 100ft of the highest obstacle in the landing area.

Note: The 100ft waveoff window is the default.

During CQ:

- All waveoffs are made up the angled deck unless otherwise directed by the LSO or Tower, i.e. waveoff starboard side.
- Pilots will not initiate their own waveoff unless the ball call has not been rogered by the in-the-middle position. Waveoffs are mandatory when directed by Tower or the LSO.

Reasons for waveoffs *(beyond a pilot's control).*

- Foul deck- the landing area is not clear of aircraft, personnel, equipment, or debris.
- Winds out of limits for a safe landing.
- Pitching deck.
- IFLOLS not set correctly.
- Arresting gear not set correctly.

Reasons for waveoffs: *(pilot technique).*

- Overshooting start/angling approach.
- Incorrect configuration.
- Excessive rate of descent in close.
- Excessively long in the groove.
- Excessive drift.
- Excessively high or low on glideslope.

Waveoff:

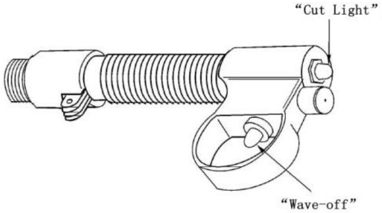
Waveoff window:

The PLAT *(Pilot Landing Aid Television)* is never used for any type of glide slope determination, whether for waving, or the determination of the waveoff window. The 100ft waveoff window exists when the landing area is not physically "sanitized" between the foul lines. This means that a person or object is fouling the landing area. Most commonly during recoveries this will be the preceding aircraft that just landed. When the arresting gear officer raises and lowers his arms 3 times, that means the landing area is clear and the waveoff window is reduced to 10ft. The 10ft waveoff window is for the IFLOLS and arresting gear not yet being set for the type of aircraft in the groove. Again, the 10ft waveoff window is determined visually.

Note 1: The term visually in this case means that a visual assessment is made by the responsible LSO as it is impossible to exactly assess 10ft with the aircraft being this close to the ship.

The waveoff window is such that the airplane needs to waved off and at no point descend below 100ft or 10ft. The gouge for the 100ft waveoff window is projecting the top of the island out into the groove. 10ft feet is more subjective but basically after the in close position the aircraft should be waved off *(Remember, the "on glideslope" sight picture for an aircraft crossing the ramp is at 14.1 feet. That is roughly the hook being at the top of an F/A-18's tails).* The pickle switch is used for the cut lights, the waveoff lights, and held over the LSO's head as a reminder that the deck is foul. The cut lights are a deadman switch that has to be held down. The waveoff lights are click on and they stay on. Click again and they are off. As a fun fact, the AGO's "clear deck" button is also a deadman switch. He has to positively hold it to ensure the deck is clear.

Note 2: The pickle operates the cut lights and waveoff lights. However, CAG Paddles uses the cut lights and waveoff lights buttons on the LSODS. LSODS = LSO display system *(The screens at the LSO platform).*



Waveoff mechanics:

- Advance throttles to "MIL" or "MAX" power as required.
- Maintain wings level and **verify a positive rate of climb whilst maintaining on-speed AOA**.
- **Do not change the aircrafts configuration unless during Case III recovery**.
- During Case I and Case II conditions: Turn to parallel the BRC. During Case III, follow the FB.
- During Case I and Case II conditions: Climb to 600ft AGL and turn downwind with your interval.
- During Case III conditions, climb to 1200ft AGL and follow the controller's instructions.

Note 3: If slow at the time of waveoff initiation then accelerate to on-speed first before climbing away at on-speed AOA. If fast at the time of waveoff initiation, then positively rotate to on-speed and then climb away keeping on-speed AOA.

Note 4: **Upwind interval is determined by "first to the bow", whether that is break traffic, waveoff, touch-and-go, or bolter.**
Note 5: **Once upwind, the proper interval to follow traffic on downwind is to wait until they reach your 7 o'clock position, *(visually when the traffic reaches your left horizontal stabiliser).***

Before it is even worth mentioning any specific details in regards to the SHB, the following will have to be clarified. **The SHB is not in any way a formal term nor is it a formal manoeuvre.** No formal documents will provide any mention of a SHB and it is needless to say that it is not a technique a navy pilot is required to be capable of.

What is a Shit Hot Break?

The SHB consists of a unique technique for the break done under certain circumstances. It is important to understand that it is not a separate manoeuvre. The SHB differs from the normal pattern technique, that when a SHB is executed correctly it combines the break, downwind, and approach turn segments as a continuous manoeuvre, rather than discrete segments as in the normal pattern.
The technique allows a dynamic way to fly the landing pattern with the aircraft being in a higher energy state than the normal technique used to fly the pattern. It is high energy and the dynamic characteristics require a higher level of proficiency than the standard break technique. Thus, the performance of a **SHB is never required**. That said, if you manage to pull it off correctly, it will be probably be some of the most fun and give you the most rewarding feeling you could possibly have. Besides, it will provide a great mini -airshow for the spectator. With regards to what defines a SHB, **there is no clear, agreed upon definition other than "low, fast, and aft of the ship".** It should look like a complete circle when viewed from overhead. A 600-knot break 3 miles upwind is not a SHB, nor is a 350 knot break aft of the ship. Therefore, you need to combine the elements of at least speed and being aft of the ship to qualify. The lower altitude looks better from the ship and makes it easier to dissipate the enormous energy by not requiring as much of a descent as 800ft AGL would require. However, if you break at 800ft AGL , but fast and aft of the ship, you will still qualify. Realize that under normal conditions, if you lead a division *(4 aircraft)* into the break you will need to break aft of the bow of the ship. This is not necessarily a SHB unless you have high speed, but breaking aft of the ship's bow will be required to keep all wingmen inside of 4 nm.

Can all pilots do a Shit Hot Break?

The simple answer to this question is no. The SHB is not performed by pilots unless they feel completely capable and are able to execute the technique proficiently and well. Junior pilots would not dare attempt the SHB until a reasonable amount of carrier operations experience has been achieved. There is not necessarily a strict amount of experience required, but generally by the time the pilot has accumulated at least six months of carrier experience he may be able to try it. This varies from pilot to pilot. Most pilots are not ready at six months; some need multiple deployments. Some never do it. It is not required, and you definitely do not want to screw it up.

When is a Shit Hot Break executed?

The opportunity to perform a SHB depends on several factors.

- **During Cyclic Ops;** the honour and glory belong to the aircraft at 2,000ft AGL in the stack that break the deck. If they time their commence correctly it will create the opportunity to execute a SHB. Needless to say, if they commence early, it is not going to work out. If they commence late, they have the opportunity to do it, but **again it is never required.** A truly glorious SHB will occur when the timing is just right and the aircraft rolls into the groove just as the deck is going clear. A SHB to a perfectly timed clear deck is the pinnacle of Naval Aviation.
- **During CQ;** the SHB is not normally performed as the pilots are not proficient enough. One does not simply perform a SHB at the carrier after not having any traps for the previous month or two *(usually even longer)*. That would be quite bold, and the "Boss" may not be too pleased.

A SHB, executed by a F/A-18 Super hornet.

The shit hot break: "SHB"

Shit Hot Break mechanics:

As far as the mechanics are concerned, it is very important to realize something innate about the SHB: **There is no single way to do this, nor is there any prescribed way in how the technique would have to be correctly executed.** Ask 10 pilots how they do the SHB, and you will likely get 10 answers. The thing they will have in common is they all use "pilot stuff" to successfully execute the SHB within the boundaries of the pattern and safety. If you fear that you will not be able to bleed the energy in time, have faith that you will. Modulate the pull as required to end up with a reasonable approach to the groove with a normal groove length. This is entirely pilot judgment. Continuous adjustments on the fly will have to be made. The most common error seen is related to groove length, either too short or too long. This is one of those things you just need to make happen. Another common error is an overshooting start or angling approach; modulate the pull however necessary to prevent this!

Note: The checkpoints and numbers required of the standard approach turn do not apply.

However, as an aid when first practicing, try to get yourself to a good 90 position as your first goal. This will help to make the turn more familiar. Granted you will be much faster, and have a different angle of bank, but it will get you in the ball park.

SHB Grading:

Grading on the performance of a SHB is different than the normal grading techniques that are described later in this document. If the SHB was impressive enough, and the pass was at least a "fair pass" in terms of safety, then the pass will automatically be an OK. A slight amount of extra leniency is applied to the aircraft that performs the SHB. What would normally be a fair groove length, or initial glideslope or speed deviation, may be forgiven. However, if a SHB leads to a truly ugly pass that is not safe, Paddles will offer no extra generosity. A one-wire is likely *(but not guaranteed)* still going to be a no-grade.

Spin pattern:

The spin pattern:

What exactly is a spin, what does the pattern look like, and when is it normally initiated?
View a "spin" as an expedited way to send you back in the landing pattern without going back into the marshal stack again.

Spin mechanics:

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: **at the bow** the flight will **simultaneously climb** to **1,200ft AGL** and perform a left-hand turn **remaining within 3 nm**. The speed will remain at 350 knots, *(yes this is a sporty turn to remain withing 3 nm).*

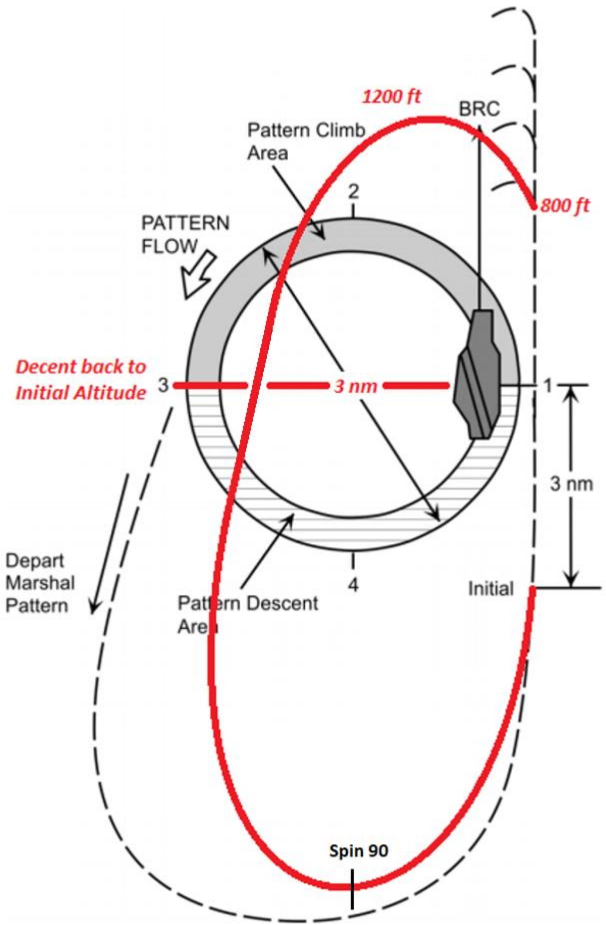
Note 1: The maximum number of 6 aircraft may be modified by the air officer.

Pilots must exercise caution to avoid departing aircraft, **but prior to entering the landing pattern,** aircraft shall climb or descend as required and enter the spin pattern *(1,200ft AGL)* unless specifically directed otherwise.

Aircraft in the landing pattern shall continue to maintain proper interval, flying the landing pattern at 600ft AGL until otherwise directed. Flights directed to spin or re-enter the port holding pattern shall **climb only on the upwind or crosswind** leg ahead of the ship's abeam.

Note 2: Aircraft re-entering the break from the spin pattern have priority over aircraft entering from the port holding pattern.

After 270 degrees of turn *(aft of abeam, or "abaft"),* The flight will descend to 800ft AGL and proceed inbound for the break. Aircraft re-entering 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 traffic. However, caution must be exercised when re-entering the initial so as to avoid conflict with other aircraft inbound for the break. A spin should normally be initiated at the bow.



Depart and re-enter:

It is important to understand that "**depart and re-enter" is not the same as the flying the spin pattern.** Depart and re-enter simply means go away and get back to the initial. An aircraft might be told to depart and re-enter from any position and no specified procedures are provided to describe how it is to be flown. Pilot judgement is required to stay out of the pattern and the stack, and sometimes even the 10-mile bubble around the carrier is left to re-enter along the BRC towards the initial.

Examples:

- During CQ, for the first go of the day, the aircraft needs to depart and re-enter in order to reduce gross weight. As this will take a good amount of fuel burn, the pilot will always go outside 10 nm, do some afterburner turns or dump gas, and then re-enter up BRC.
- Another occasion could be aircraft that are unable to execute the break before 4 nm ahead of the ship *(as we mentioned in "The break" section of this manual).* They will then have to depart and re-enter. Fuel in this case will not be the issue and just a quick turn back towards the initial is required. To accomplish this also any technique is allowed as long as they remain clear of the pattern and the stack *(even right turns would be legal).*

Communications:

If told to depart and re-enter, specific instructions might be given on how to do this. If no instructions given, then notify Tower of your intentions

Note: No pattern can be drawn for a depart and re-enter event as there are endless possibilities.

Delta Procedures:

In the event the deck becomes fouled or an excessive number of aircraft bolter or wave off, the Air Boss shall issue a signal Delta.
The signal Delta shall be accompanied by the number of minutes of delay *(even increments but never less than four)* required to resume recovery operations *(i.e., Delta 4, Delta 6, and so forth).* Delta procedures are often misunderstood and differ up on where you find yourself at the time of the delta start.

Note 1: **Typically during Case I and Case II operations the signal Delta will be transmitted by the "Boss". However During Case III operations, the Delta will be transmitted by Marshal and/or Approach.**

The delta pattern can be flown in 2 different configurations:

- **Delta Clean:** Signal for aircraft in the pattern to raise gear and flaps/slats and hold as directed. This is to conserve fuel.
- **Delta Easy:** The pattern is flown on-speed in the landing configuration with speed brakes retracted

What to do when signal Delta is given:

If a signal Delta is given by Tower whilst 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).*

When cleared from the Delta pattern, the first aircraft to reach the 180 position after "Charlie" is transmitted will be the first aircraft that will resume the normal approach by making the approach turn.

Should a Delta be given after commencing descent from the port holding pattern, but prior to entering the landing pattern, aircraft shall climb or descend as required and enter the spin pattern *(1,200 ft AGL)* unless specifically directed otherwise. Aircraft in the landing pattern shall continue to maintain proper interval, flying the landing pattern at 600ft AGL until otherwise directed. Flights directed to spin or re-enter the port holding pattern shall climb only on the upwind or crosswind leg ahead of the ship's beam. Aircraft re-entering the break from the spin pattern have priority over aircraft entering from the port holding pattern.

Note 2: **When the "Delta" is cancelled, It will be cancelled for all aircraft at once irrelevant of your position.** That does not mean, that "Delta procedures" cannot be active for single aircraft. If an aircraft requires troubleshooting, for whatever reason it could be given an individual delta.
Note 3: The word "Charlie" will used to signal that delta is over. **In this case, "Charlie" is not used to get aircraft to commence from the marshal stack**, it is used to signal that airplanes no longer need to "Delta" in the landing pattern. Aircraft in this case would not be given an individual "Charlie" or "Charlie time".

Arrival:

Arrival in the CCA:

To build our understanding of recovery procedures we will have to start with the basics and recall who controls what areas around the carrier.

Entering the Carrier Control Area:

Inbound flights to the ship shall normally be turned over to Marshal Control for further clearance to the holding area or pattern. Following a mission, aircraft will proceed back to Mother to arrive 10 minutes prior to their scheduled cyclic land time (earlier if Case II or III). After checking out on the mission frequency, contact the CSG air defence 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.

Note 1: In DCS we do not operate with Red Crown or Strike. Instead we will proceed from MBC or AWACS directly to Marshal.

During CQ the setup as above might be slightly different, as you will not arrive at the carrier after having flown a mission. Your mission **is** CQ.

Checking in with Marshal:

The flight leader shall provide the following information when checking in with Marshal Control:

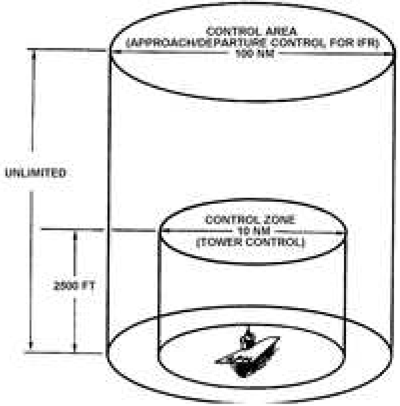
1. Modex "Side Number".
2. Total number of aircraft in flight *(line-up)* "holding hands with".
3. Position.
4. Altitude.
5. Fuel state *(low state in flight).*
6. Other pertinent information such as navigational aid status, hung or unexpended ordnance, weather, etc., that may affect recovery.
7. COD load report. "Only applicable for the C-2 Greyhound".

Marshal will respond with:

Marshal Control shall acknowledge the check-in and provide the following information:

1. Case recovery: Case I, Case II or Case III.
2. Expected BRC/FB.
3. Altimeter.
4. Other instructions if required.

Note 2: During Case I or Case II recoveries aircraft shall normally be switched to Tower Control at 10 DME after reporting the ship in sight *"see you".*



Hook Extension: Common technique for pilots is to marry the actions of putting the hook down with switching to button 16 *(Marshal).* Obviously, HAIL-R checks will be done to verify, but that is the common practice to build muscle memory.

After Speaking to Marshal: There will be 2 options:

- During Case I recovery operations: Marshal will provide instructions to proceed to "Mother" (meaning the ship). Normally you will be instructed to switch to Tower at 10 DME, after reporting the ship in sight with a "see you". Tower will then either provide instructions during CQ, or remain ZIPLIP during Cyclic Ops.
- During Case II or Case III recovery operations: Marshal will provide instructions to proceed to the "Case II or Case III marshal pattern". This marshal is a bearing, distance, and altitude fix designated by CATCC from which pilots will orient holding and from which initial approach will commence.

Note 3: **Altitude changes within 10 nm of the aircraft carrier are prohibited unless permission is given by CATCC/"Boss" or executing a Case procedure.**

Arrival in the CCA:

HAIL-R: Pronounced as "Hail Are", is an acronym used for **every recovery** on the ship. It is therefore wrong to assume this only accounts for recovery from Shore to Ship and vice versa. If flying to the ship, it is important to ensure that the aircraft is setup for the particulars of that recovery. Go through the recovery checklist *(HAIL-R)* to ensure this is done.

Hail-R checklist:

- H: Hook / Heats *(Engine heats if required)*.
- A: Anti-Skid / Box ACL on the HIS if Case III.
- I: Instruments, Box ICLS.
- L: Landing Weight / Lights.
- R: RADALT bug set / RADALT set to the HUD.

Note: "RADALT set to the HUD" is a term used in the US Navy. This means the ALT switch on the HUD control panel is set to RDR.

It is easy to see how missing an item on this checklist could result in a real problem; landing overweight, failing to trap with the hook up, not receiving ICLS or ACLS guidance, etc. Once inside the CCA, Strike will hand the 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 and BRC. BRC is the ship's magnetic heading during the recovery.

IMPORTANT INFORMATION:

Please note the following:

- Altitude changes within 10 nm of the aircraft carrier are prohibited **unless permission is given by CATCC/"Boss" or executing a Case procedure.**
- **During Case I and Case II recoveries, references will be made to the BRC not FB.**
- **During Case III recoveries, references will be made to the FB not the BRC.**
- **CQ: Squadrons do not have their own altitudes.** Aircraft go where the "Boss" tells them to go. **It is not ZIPLIP**. Aircraft are given a Charlie or Charlie time.
- **Cyclic Ops: Each squadron has an altitude assigned to them**, with each altitude being assigned to two squadrons. **It is ZIPLIP. There is no Charlie or Charlie Time.** The stack is collapsed completely visually, with the aircraft commencing when they see the launch will be complete, and aircraft above them coming down as lower altitudes are vacated. "Breaking the deck" is the appropriate phrase for Cyclic Ops.
- The smaller the fuel tank, the lower your squadron altitude will be. F/A-18C ath the bottom, F-14B above them, etc.

Case I recovery:

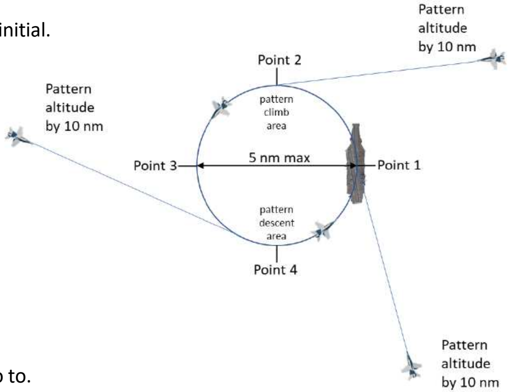
Case I weather conditions:

A Case I recovery may be utilized when it can be anticipated that flights will not encounter instrument conditions at any time during the descent, break, and final approach. A ceiling of 3,000ft AGL and 5 miles visibility within the carrier control zone is required. The flight leader retains full responsibility for proper navigation and separation from other aircraft. All returning flights will check in with Marshal Control when entering the carrier control area as described in the "Arrival" section of this manual.

Case I recovery:

When visual with the ship report "see you" to Marshal. In real life Marshal will request you to update fuel state and will tell you to go to Tower frequency by saying: "Update state, Go button 1". In DCS this call is automated as "Update state, Switch Tower".

- **During Cyclic Ops: There is no requirement to check in with Tower.** Proceed directly to the marshal stack at your squadron assigned altitude and hold in the marshal stack. The marshal stack is shown at the right side of this page.
- **During CQ :** Check in with Tower and follow the instructions given by the "Boss". This might be instructions to hold, or to proceed directly to the initial.



The marshal stack:

The marshal stack (also known in Case I as "low holding" or "port holding" is a left-hand holding pattern with a 5 nm diameter on the port side of the ship. The pattern will normally be flown at max conserve fuel flow or holding airspeed of 250 knots for the F/A-18C Hornet. Within the DCS community there are a lot of misunderstandings on how and when the Marshal stack is to be flown and even more so on when to leave the marshal stack. Good knowledge of the difference between Cyclic Ops and CQ is required to understand this section.

Entering the marshal stack:

Entering the marshal stack is commonly done at point 1 or 3 but can be entered from any point tangentially on the circle.

- **During Cyclic Ops: Hold at squadron altitude.** The lowest altitude is 2,000ft AGL. These assigned altitudes are separated vertically by a minimum of 1,000 feet and are assigned by the CVW SOP.
- **During CQ: Hold at Tower assigned altitude.**

Note 1: It is important to understand squadron altitudes are only applicable during Cyclic Ops. During CQ you go where the "Boss" instructs you to go to.
Note 2: Up to two flights can operate at the same altitude in the stack, across circle from each other. During Cyclic Ops, this will almost always be the case. During CQ this is a less common occurrence.

Changing altitude in the marshal stack:

Once established in holding, any altitude changes within the pattern are accomplished as follows:

- **Climbs:** Performed between points 1 and 3.
- **Descents:** Performed between points 3 and 1.

Note 3: During Cyclic Ops: The lowest aircraft in the stack must monitor the launch to arrive in the groove at the expected ramp time. As the lowest aircraft breaks the deck, aircraft at the next highest altitude will descend to the next lower vacated altitude and the stack starts to collapse.
Note 4: During CQ: if a lower stack altitude is vacated, aircraft are to stay at their respective stack altitude unless the "Boss" instructs them to change altitude.

When to leave the marshal stack:

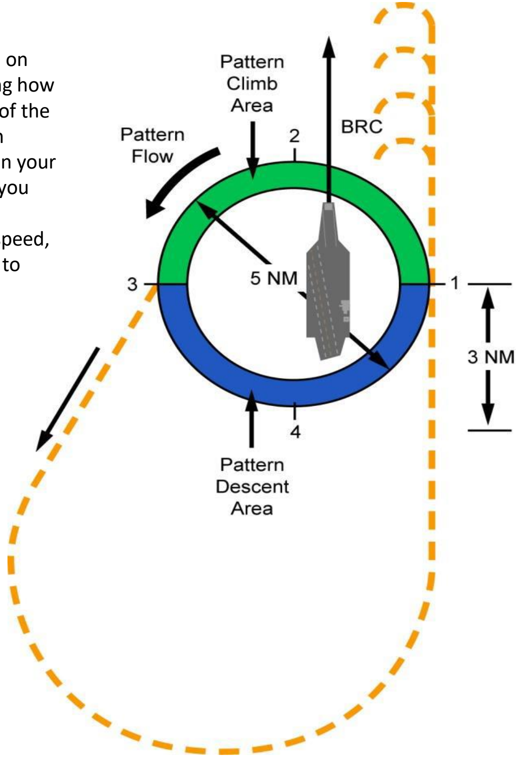
- **During Cyclic Ops:** The goal is to arrive in the groove just as the flight deck is made ready for recovery operations *(ready deck).* This is called "breaking the deck" and is a skill that must be mastered in order to maximize the efficiency of recovery operations.
- **During CQ:** Tower will instruct aircraft on when to leave the marshal stack by giving a "Charlie". 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 landing pattern now. "Charlie five" means be at the ramp in five minutes.

Note 1: During Cyclic Ops no "SIGNAL CHARLIE " is given. You break the deck as a visual manoeuvre. Signal Charlie Is only applicable during CQ.

Note 2: It is good practice to note the ship's BRC every time you pass the ship in holding. It may have changed from what was reported by Marshal before, as the ship needs to turn. Build your SA by continuing to update it.

Note 3: The reason "Charlie" is the code word is because the ship turns to align into the wind before recovery, with the wake making a "C" shape.

- **During Cyclic Ops:** You will have to use your judgement on when to commence based on what point you're at in the circle, how many jets are on the cat, and how many in line behind. Play out your turn's speed and geometry to adjust if the launch is faster or slower than expected. Timing how far upwind to break may also be required. You even have to take into account the time for the green shirts to "wrap the waist" and run clear of the foul lines after the last launch from the waist. The idea is to minimize "open deck time". Show up in the groove exactly as the deck goes green *(clear). W*hen it's done properly, it's beautiful. When it's done properly with a SHB, it's eye watering. If you are late, you are allowed to tighten your turn and increase your speed *(diameter smaller than 5 nm).* Cut the corner after you commence and haul ass to the initial. On the flip side, if you are early, float your turn, slow down, break further upwind, etc
- **During CQ:** You will commence based on when you recieve a Charlie. When given a signal Charlie, just do a standard commence at standard speed, and break with your interval as previously discussed. During CQ there is no need to arrive at a certain time after the "Boss" radios the Charlie to you.



Now we have seen how to arrive in the marshal stack, how to change altitude in the marshal stack, and when to leave the marshal stack, let's have a look at *how* to leave the marshal stack.

How to leave the marshal stack:

You will leave the marshal stack outside of point "3" and have to do what is necessary to arrive at the initial - 3 nm astern of the ship at 800ft AGL, with the hook extended unless doing CQ and the "Boss" requested the hook up.

- **During Cyclic Ops:** Leaving the marshal stack is the moment you can use to your advantage when it comes to correct your timing. There is no definitive course or heading relative to the BRC to leave the marshal stack, neither is there a set way to descend or accelerate to your required parameters at the initial. If you think you may be early to break the deck, float the turn and delay accelerating, or if you believe you are late, tighten the turn and accelerate faster. There are no set requirements on how far you are allowed to go from the carrier, but normal practice shows that during the commence aircraft stay within 5 nm.
- **During CQ:** There is also no definitive course or heading relative to the BRC to leave the marshal stack, neither is there a set way to descent or accelerate to your required parameters at the initial. Be a pilot and make it work. Timing in this case is not an issue.

At the initial, your speed should be 350 knots and the flight will continue inbound and fly just outboard the starboard side of the ship at 800ft AGL to get ready for the break. From the initial, follow the landing pattern as described in "The pattern" section of this manual.

To adjust your timing, you are allowed to play out your turn's speed and geometry to adjust if the launch is faster or slower than expected. Break further upwind to adjust your timing if you are late. You have to take into account the time for the green shirts to "wrap the waist" and run clear of the foul lines after the last launch from the waist. The idea is to commence and break and show up in the groove with minimal open deck time. Show up in the groove exactly as the deck goes green *(clear).*

Misinterpretations:

At this stage again I want to emphasize that to have to "be a pilot". Not only during the flying of the pattern, but also in the stack and when you commence. Take note that the pattern starts at the initial and not at the departure of the marshal stack. CV NATOPS gives a great amount of information and many other different guides will give additional help. Bear in mind it is impossible to cover all available techniques and scenarios in the NATOPS manuals. As previously mentioned, the pattern related to the Case I recovery is a VISUAL procedure and pilot judgment is required to adjust timing. It is a huge misinterpretation to think that everything must be done super precise according to exact parameters, where in the real world things are played out to just make it happen.

- If you are late, it is perfectly allowed to tighten your turn *(diameter smaller than 5 nm),* and increase your speed cut the corner after you commence and haul ass to the initial.
- If you are early, it is completely legal to float your turn, slow down, break further upwind, etc.
- There is no required or recommended AOB, VSI, G, etc. for how to get from the stack to the initial. Just make it happen.
- Again, these discussions on timing are only related to Cyclic Ops.

The framework for these procedures are in CV NATOPS and they are a baseline.

The important part is being safe and expeditious. How safely and efficiently you perform these procedures will be the measure of your performance.

Recap:
As this was probably a lot of information to take in, and because there are so many variables, let's have a recap of the Case I recovery.

During Cyclic Ops:
- No need to check-in with Tower.
- ZIPLIP, unless low-vis or safety requires otherwise.
- Hold at squadron assigned altitude.
- As the lowest altitude aircraft breaks the deck, aircraft at the next highest altitude will descend to the next lower vacated altitude.
- Leave the marshal stack with the goal to arrive in the groove just as the flight deck is made ready for recovery operations *(ready deck).*
- There is no definitive course or heading relative to the BRC to leave the marshal stack, neither is there a set way to descend or accelerate to your required parameters at "the initial".

- **During CQ:**
- Check-in with Tower.
- NON-ZIPLIP.
- Follow the instructions given by the "Boss". This might be instructions to hold, or to proceed directly to the initial.
- Stay at your respective stack altitude unless the "Boss" instructs you change altitude.
- If in the marshal stack, leave the marshal stack when given a signal Charlie, or Charlie time.
- There is no need to arrive at a certain time after the "Boss" radios the Charlie to you.
- There is no definitive course or heading relative to the BRC to leave the marshal stack, neither is there a set way to descend or accelerate to your required parameters at "the initial".

Communications:
So what communications do you expect on button 1 during ZIPLIP conditions? **In theory there could be zero calls during ZIPLIP.**
Absolutely zero. In practice, during every Cyclic Ops Case I recovery, the only calls heard are "Tower, Paddles, Radio check" and LSO required calls to aircraft in the groove. Here is how that goes:

Primary LSO: *"Tower, Paddles, Radio check".*
Air Boss: *"Paddles, Tower, Loud and Clear".*
Backup LSO: *"Loud and clear on Backup".*
CAG Paddles: *"CAG Paddles, we're working 29 knots" (wind over the deck).*

Also realize this radio check happens during CQ as well at the start of the day. Again, in theory, during ZIPLIP that exchange should be the only thing heard whatsoever on "Button 1".

Bolter and waveoff procedures:
Bolter and waveoff procedures will be executed as described in the "Bolter" and "waveoff" section of this manual.

Case I communications example:

Check in with Marshal:
201 - *"Marshal, 201, marking Mom's 250 for 52, angels 9, State 7.2".*
Marshal - *"201, mother is VFR, altimeter 29.93, Case I recovery. BRC is 015, Report a see me".*
201 - *"201".*

Note 1: If in a flight "holding hands" will be used. Individual readbacks are not required during case I recoveries. Only the flight lead will read back instructions.

At 10 DME and when visual with the carrier:
201 - *"201 see you at 10".*
Marshal - *"201, Update state, Go Button 1".*
201 - *"201, 5.6".*

Note 2: DCS standard reply will be: *"201, Update state, Switch Tower"*

Check-in with Tower: *(Only required during CQ)*
201 *– "Tower 201, angels ..".*
Tower – "201, roger" or "201, take angels .." or "201, Charlie".

Note 3: Check-in with Tower is not required during Cyclic Ops.

ZIPLIP will start here, unless:
- Carrier Qualifications.
- Low-vis calls are being used.
- Safety of flight demands otherwise.

Note 4: During Cyclic Ops which are ZIPLIP 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.
Note 5: Corrective calls by the LSO during ZIPLIP operations can be made.

Carrier Qualifications "CQ":
201 – *"201, Hornet ball, 4.3, last name".*
Paddles – *"Roger Ball" (No wind is mentioned during Case I and Case II recoveries).*

Note 6: Paddles does not mention wind during Case I and Case II recoveries.
Note 7: During CQ low-vis calls will not be made unless low-vis calls are directed.
Note 8: During CQ, Paddles will always answer with a verbal *"Roger Ball"*

During Low-Vis operations, the following "Low-Vis Calls" will be used:
201 - *"201, Commencing".*
201 - *"201, Initial".*
201 - *"201, Breaking at ..DME".*
201 - *"201, Hornet Ball, 5.6".*
201 - *"201, Departing at ..DME".*
201 - *"201, Spin 90".*

Note 9: Low-Vis calls can be requested during Cyclic Ops as well as CQ.

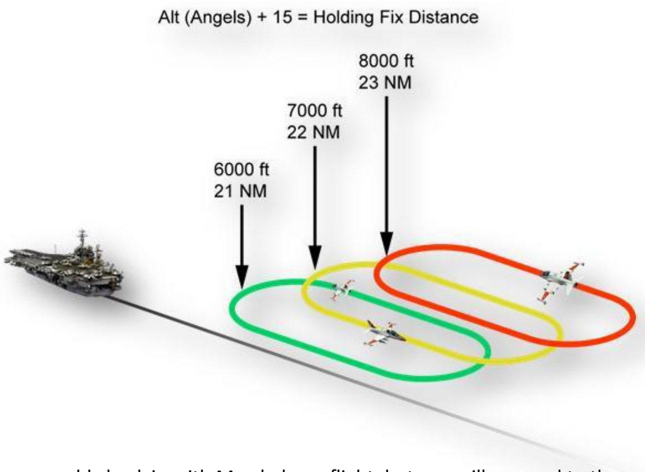
Case III recovery:

As a Case II recovery is a mix of Case I and Case III procedures, Case III recovery procedures will be covered first to create a better understanding when it comes to Case II recovery procedures.

Case III weather conditions:

Case III weather is any ceiling below 1,000ft AGL or a visibility less than 5 nm. All night operations are conducted under Case III, even with CAVU weather. For the purpose of determining Case III operations, night is defined as 30 minutes prior to sunset until 30 minutes after sunrise. **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.

Note 1: Case III recoveries may be conducted concurrently with Case I and II launches.



Communications:

For Case III recoveries, Marshal will provide the following information upon check in:

- Current weather and altimeter.
- Case recovery.
- Marshal instructions.
- Expected final approach button *(frequency).*
- Expected approach time *(EAT)* **Not a Charlie time.**
- Expected final bearing. **Not the BRC.**
- Additional information such as divert field, fuel data and bingo information.

Note 2: Further communication examples will be given at the “Case III communications” chapter.
Note 3: Check in with Marshal in a formation no bigger than 2. If previously in a formation of 3 or 4, split into elements of no greater than 2 aircraft before contacting Marshal.

The Case III recovery:

If Marshal directs a Case III recovery, the aircraft will proceed to the Case III marshal pattern holding fix. It is worth mentioning that you could check in with Marshal as a flight, but you will proceed to the marshal holding as a single. Ideally, the holding fix will be on the reciprocal radial of the final bearing, but in real life this is rarely the case. A huge advantage from a controller’s perspective for not having the marshal on the reciprocal of the final bearing is that it allows controllers to use geometry to build or reduce spacing if needed. Generally, the holding radial will be within 30 degrees of the reciprocal of the final bearing. 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.

Marshal distance and altitude:

The marshal distance from the carrier is depending on the allocated altitude by Marshal. **Distance = Angels + 15.** Thus, if instructed to marshal at angels 8, *then 8+15 =* ***23 nm***. Therefore, hold on the 220 radial at 23 nm at angels 8

Note 4: The lowest altitude for assignment is 6,000ft AGL for turboprop and jet aircraft.

Approaching the marshal:

After receiving your marshal instructions, **you do not have to proceed in a direct line to the Marshal fix**.
In rea life, each aircraft will receive their holding instructions. After that, they can split up immediately, but more often the formation will stay together and later split up as follows: the low state aircraft will just level off early at his altitude (if climbing from below) or late *(if descending from above).* For example, suppose a fligth of 2 is at angels 12 and the wingman has the low state. Lead is assigned angels 7 and the wingman is assigned angels 6. They will descend together and once they hit angels 7, the flight lead will level off and the wingman will continue to angels 6. Once one of them levels off, they are completely split. After instructions are passed, pilots draw their holding profile, and then they do whatever they need to do in terms of flight path and speed to try to join that profile.

Marshal entry:

Once you know the Marshal radial, set that into your TACAN courseline. As a technique, you can set the reciprocal of the Marshal radial into the courseline, so the arrow always points TO the ship. Civilian type holding entries *(direct, teardrop, parallel)* are not required nor expected. Proceed to wherever you need to go to intercept your profile; this often gives great opportunity to make life easier.

The Marshal pattern:

You do not have to use any particular profile or pattern. <u>**However, you must stay on your altitude.**</u> Draw figure 8s. Draw the alphabet. It’s all legally allowed if you stay on your altitude. **However, you should bias to stay on the port side *(when facing the carrier)* of the radial where possible.** Left hand turns should have priority to stay on the side where the racetrack should be. However, it is not illegal to make temporary right turns, or go to the other side of the radial. Do what you need to do to get the job done, just make sure you are on your altitude.

In real life, the most common technique is to fly the pattern at 300 knots groundspeed and as depicted in the diagram on the next page. This is for the simple reason that it will equate to 5 nm a minute, which will help your timing. Also, worth saying 300 knots groundspeed will be close to 250 knots indicated airspeed. **However, endeavour to correct your speed to 250 right as you cross the fix to commence.**

Note: The most important aspect while in the marshal stack is that you are on your altitude.

Emergency marshal pattern:

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 6,000ft AGL for turboprop and jet aircraft.** The holding sequence is jets, then turboprops. The emergency holding pattern is a right-hand, 6-minute racetrack patterns.

Case III recovery: “Marshal”

Changing altitude in the marshal pattern:

Unless permission is given by Marshal, aircraft are not allowed to change altitude within 30 degrees of marshal radial on the “hot side” or within 10 degrees of the “cold side” of the marshal radial.

For a holding example: suppose you are arriving in holding at time 16 with a push time of 27. You can use a number of different techniques or patterns, including the commonly used one below. But regardless of how the pattern is managed**, aircraft must arrive at the holding fix on airspeed *(250 knots)* 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.

Departing marshal:

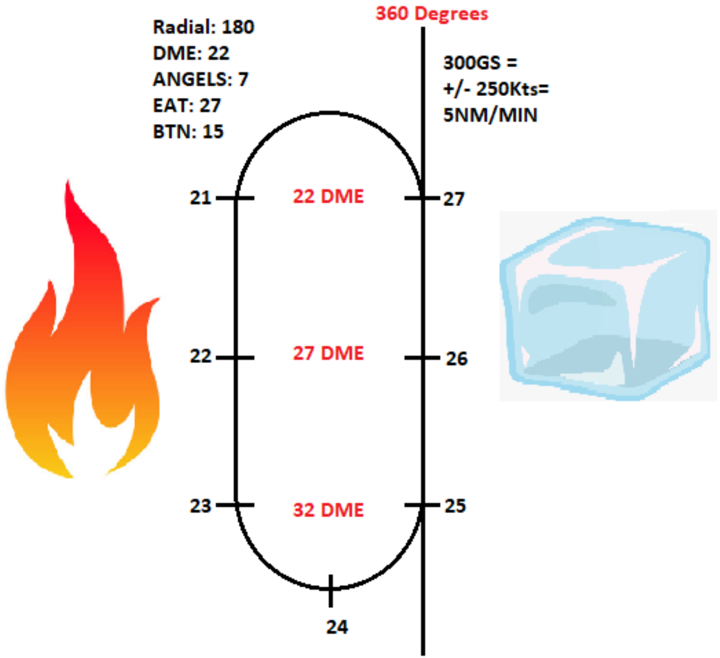
Each pilot shall adjust his holding pattern to depart marshal at the assigned EAT.

Note 1: If you do not manage to make your push time within +/- 10 seconds you are required to inform Marshal about the situation. Within 10 seconds of your push time, no call is not required.

Note 2: It is imperative to stay ahead of the jet. Just prior to commencing, reset the TACAN courseline from the Marshal radial to the Final bearing. Continue to fly the same inbound heading, but have the courseline reflect the Final Bearing.

Initial Separation:

Unless weather or operating circumstances dictate otherwise, aircraft departing marshal will normally be separated by 1 minute. Adjustments may be directed by CATCC, if required, to ensure proper separation.



It is "not" allowed to change altitude by the marshal stack within 30 degrees of the “Hot side” of the marshal radial or 10 degrees of the “Cold side”. Unless specific permission is given from Marshal.

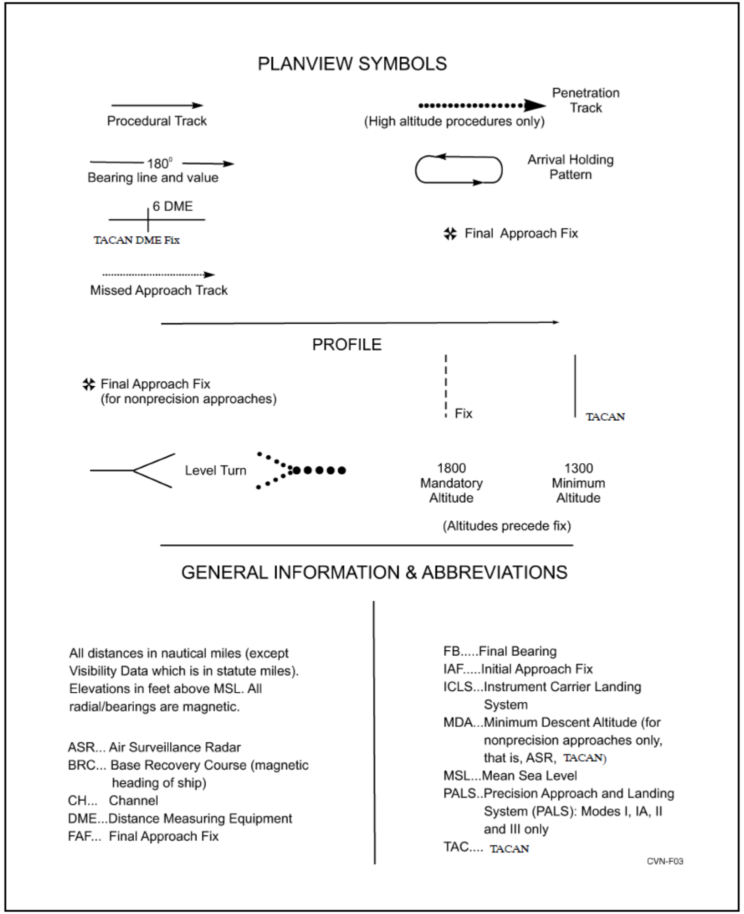
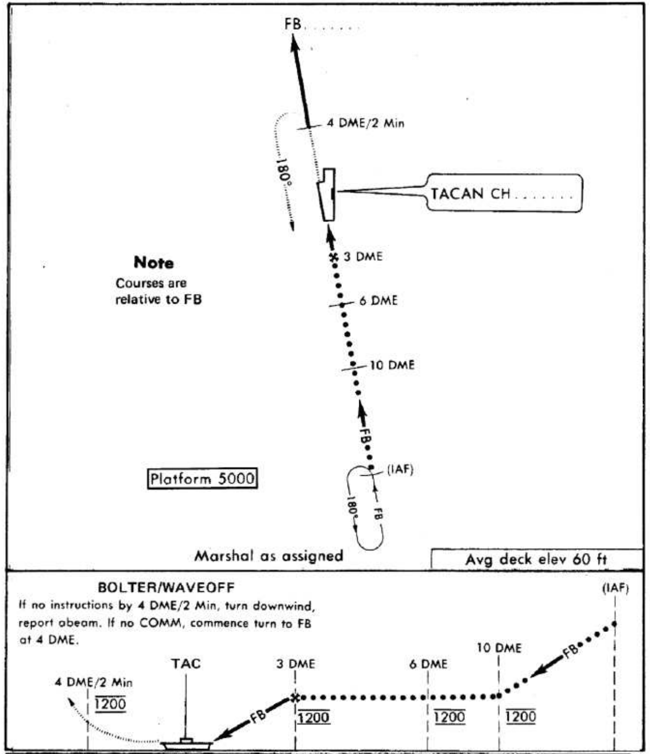


Figure 6-2. Legend Chart for Aircraft Carrier Instrument Approach Procedures



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

CVN-F04

Figure 6-3. Approach Chart CV-1 TACAN (Jet and Turboprop)

Different approach guidance types:

Before we can have a look at the approach section of the recovery, it is important to understand the following 2 types of approach guidance:

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".**

Note 1: Currently in DCS ,ACLS is not Implemented for the F/A-18 Hornet. Our focus will be on the ICLS for now.

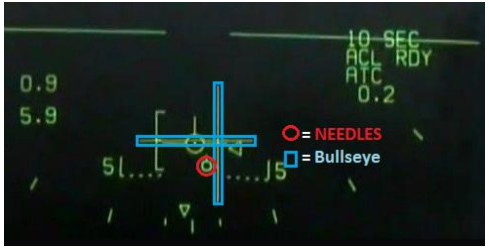
Automated Carrier Landing System *(ACLS).* The ACLS is similar to the ICLS and is also known as "needles". **However, It is <u>not</u> indicated with needles shaped symbology in the HUD; rather it is a little circle in the HUD that you fit into the velocity vector.** The ACLS is powered by a datalink with the ship, and can give predictive guidance similar to a flight director, that provides approach guidance information to the pilot. The ACLS uses the AN/SPN-46(V)3 (*"spin 46"*). 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. This is one of the reasons that aircraft approach the aircraft carrier on different approach frequencies in leapfrog fashion: Button 15 (known as "A") and Button 17 (known as "B").

Time for some confusion:

- ICLS will display needles, but the name for ICLS symbology is "Bullseye".
- ACLS will display a little circle in the HUD that you fit into the velocity vector, but the name for this symbology is "Needles".

Not that difficult right?

So when Approach says: "ACLS lock on, say needles". They're talking about the circular symbol. In the image shown right the pilot would respond with "Down and Right", even though ICLS indications disagree. **"Say needles" only refers to ACLS. In DCS, "say needles" refers to ICLS even though that is technically inaccurate. This is artificial until ACLS is implemented in DCS,**



Note 2: ACLS does not automatically mean Autoland. ACLS is used when the system is operative but 99% of the landings are manually executed.

The ACLS has three main modes for approach:

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. This is a true autoland, used in conjunction with autothrottles.

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. This is a Mode 1 until the pilot takes over at the ball call.

Mode II: Is a manual approach. You are using the ACLS guidance and symbology; just not using the autopilot. Error signals are transmitted to the aircraft. Mode II is the type of approach that will be executed 99% of the time in real life operations.

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

Note 3: For DCS purpose we will focus on the CV-1 Approach as published on the previous page for now.

Note 4: When flying a Mode I approach the ball call changes to "304, hornet ball, 4.9, coupled" and the LSO response is "roger ball, coupled, 31 knots".

Commencing:

Now we have seen how to receive marshal instructions and enter the marshal stack, let's have a look at what happens when we leave marshal. Upon commencing the approach, aircraft will establish a 4,000 foot per minute rate of descent at 250 KIAS.

Note 1: **Certain amount of speedbrake will be required to prevent acceleration**. Full use of speedbrake will not necessarily be needed.

Platform:

At 5,000ft AGL ("platform"), the rate of descent will be reduced to 2,000 feet per minute and speedbrake will no longer be required and shall therefore be retracted. This will be maintained until reaching the level-off altitude of 1,200ft AGL. **Below 2,000ft AGL, for safety reasons, most pilots will use the "minute to live rule" until hitting 1,200ft AGL.** This means the vertical speed indicator will equal the altimeter. For example: At 1,800ft AGL the VSI will read 1,800FPM and at 1,400ft AGL the VSI will read max 1,400FPM. At some point during the penetration, Marshal will switch the aircrew to the approach control frequency and they will check in with DME.

Note 2: Speedbrake will no longer be required at "platform" and should be retracted.

Intercepting the Final Bearing:

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:

- **Final Bearing is < 10 degrees of the reciprocal of the marshal radial:** A gradual correction shall be made.
- **Final Bearing is > 10 degrees of the reciprocal of the marshal radial:** A 30° correction at 20 DME will be used.

If not established on the final bearing by 12 miles, fly the 12-mile DME arc until intercepting final bearing. Usually the offset isn't big enough to cause an arc, but it could happen. Beware: Murphy's Law kicks in at 20 DME. Usually here, your RADALT set at 5k is going off, as you call platform, as you get handed off to approach, as you correct to final bearing. It is indeed a very busy time.

8 DME:

At 8 DME exactly, dirty up the aircraft, meaning: Throttle Idle, Gear down, Flaps Full. Fly exact courses. This is to ensure spacing is accurate and to avoid costly foul deck waveoffs, slowdowns in the recovery, vectors, or other such shenanigans. If executed correctly you should be configured and on-speed just before 6 DME. Make sure you trim to on-speed! ACLS lock-on will occur sometime between 8 DME and 4 DME. Approach will ask the pilot to "say needles". The pilot will reply with the relative position of the ACLS indications, by saying: *"Up and On" or "Fly up, Fly on"* If this concurs with the approach controller's readout, the controller will reply, "Concur, fly mode ..". This instructs the pilot to follow the ACLS indications. If there is a disagreement, the controller will break lock and attempt a new lock. In the case that this also fails, he will instruct the pilot to follow ICLS indications by instructing the pilot to "fly bullseye".

If the aircraft is not ACLS equipped or the ACLS is inoperative, the appropriate reply to approach would be: **201** – *"201, negative needles".* Approach will respond: **Approach** – *"201, roger, Fly Bullseye"* What this means is that you should use the ICLS for approach guidance.

Note 3: As a reply on the relative ACLS indications "*Up and On" or "Fly up, Fly on",* correct phraseology would be "Concur, Fly mode 2", unless a Mode I or Mode IA has been requested.
Note 4: "Say needles" is in no way the ICLS. "Say needles" means: report the relative position of the ACLS indications (the "circular symbol").

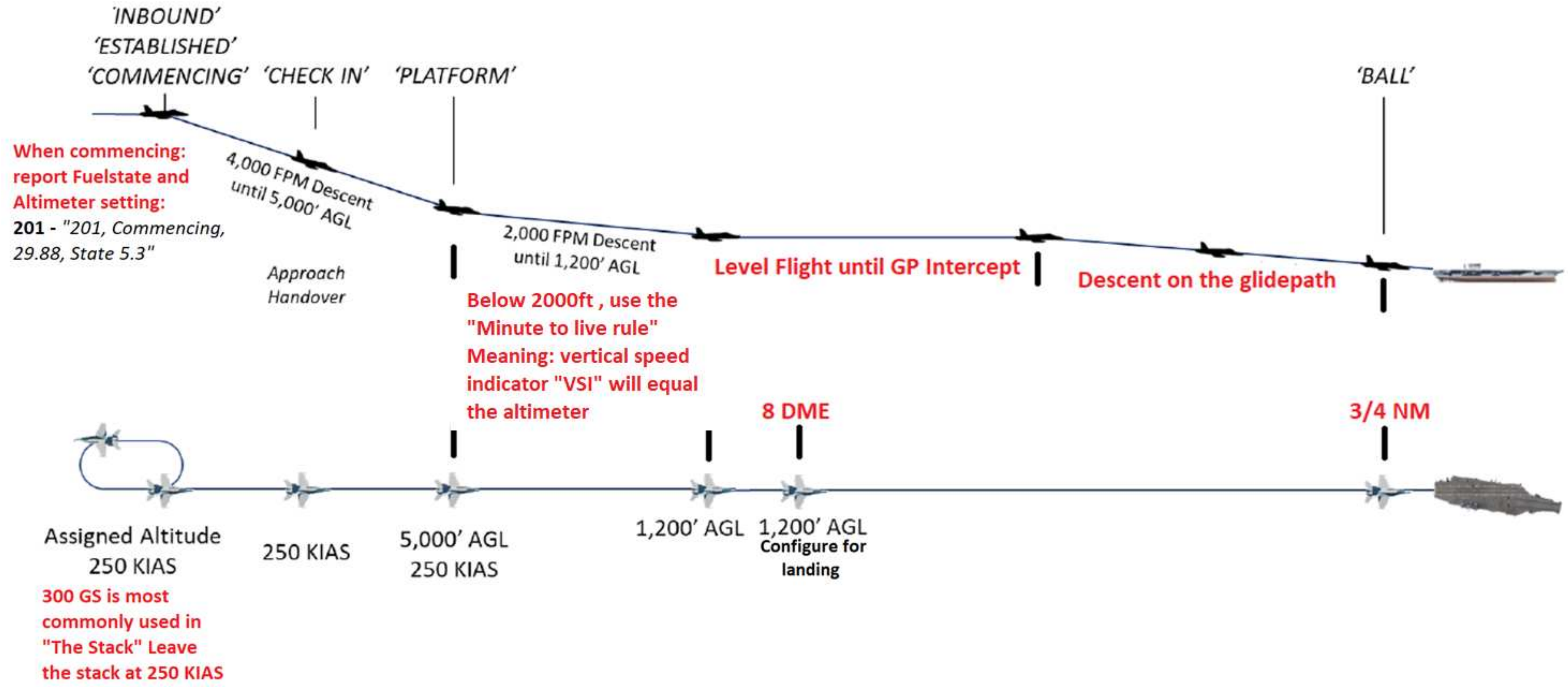
CATCC will maintain proper sequencing. They have decades worth of experience and corporate knowledge on this. The dog leg allows controllers to use geometry to build or reduce spacing. CATCC also can tell an aircraft to "take speed 225" or to "dirty up" sooner than 8 miles, provide vectors, or use a number of other techniques. There's much more to a Case III recovery than simply the approach procedure. There's all kinds of scenarios to account for. Bolter/waveoff pattern, an emergency inbound being dropped off by a wingman on the ball, somebody being sent to the tanker, etc. Many other procedures are required, and thankfully, those exist.

Three quarters of a mile:

At three quartesr of a nautical mile the controller will give you your position and instruct you to call the ball. The ball call is made on the approach frequency, as this frequency is also monitored by the Landing Signal Officers ("LSOs") and the "Boss". The LSO will reply with "Roger Ball" and will add wind information.

If the visibility allows you to see the ball *(because the IFLOLS shines through),* but you cannot see line-up, call "Clara, Line-up". If you cannot see the ship at all, call "Clara ship". In the case of clara ship, the LSO will reply with "Paddles Contact" if he can see the aircraft (or it's taxi light) and will provide a Paddles talk down. If Paddles is unable to see the aircraft, Paddles will say "continue". This will instruct the pilot to continue to approach minimums *(Page 60).* If at minimums the ship is not in sight, or no "Paddles Contact" has been given, the pilot will waveoff.

Note 1: Three quarters of a mile is only connected to Case III recoveries. Case I and II only care about 15-18 seconds in the groove (no distance).
Note 2: Wind information is only added by the LSO during Case III recoveries.



Case III recovery: “Self contained CCA”

Self contained CCA:

It is recommended to backup the information received from:

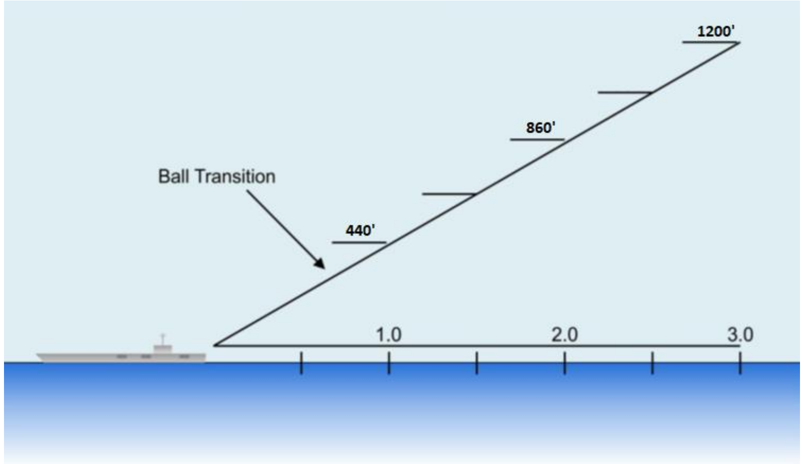
- **CATCC**
- **ICLS**
- **ACLS**

During IMC conditions this will help to spot early incorrect transmitted information, due to malfunction or miscalibration.

Compare actual altitude with expected altitude as follows:

- **3 DME - 1,200ft AGL**
- **2 DME - 860ft AGL**
- **1 DME - 440ft AGL**

Always back up your approach with these numbers!



Case III Bolter/wavoff pattern:

When speaking of the bolter/waveoff pattern, **the bolter/waveoff pattern shall not be confused with the bolter and waveoff procedures related to Case I and Case II recoveries.**

The bolter/waveoff pattern:
Jet and turboprop aircraft shall climb straight ahead on the extended final bearing to 1,200ft AGL and wait for instructions from approach control. All bolter/waveoff pattern turns shall be level.

Waveoff or Bolter technique:
- Advance throttles to "MIL" or "MAX" power as required.
- Maintain wings level and verify a positive rate of climb whilst maintaining **on-speed AOA**.
- Fly final bearing. *(not BRC)*
- Gear up.
- Flaps half *(F/A-18C).*
- Speed 150 knots.
- Climb to 1200ft AGL and await ATC instructions.

Note 1: If slow at the time of waveoff initiation then accelerate to on-speed first before climbing away at on-speed AOA. If fast at the time of waveoff initiation then positively rotate to on-speed and then climb away keeping on-speed AOA.

Configuration after Bolter or waveoff:
- 150 knots, Flaps half (F/A-18C), Gear up.

Configuration for landing:
Depends on how you are being vectored to the final bearing. If assigned the approach turn at:
- **4 DME**, Dirty up at the start of the turn.
- **6 DME**, Dirty up halfway through the turn.
- **8 DME**, Dirty up once back on the final bearing.

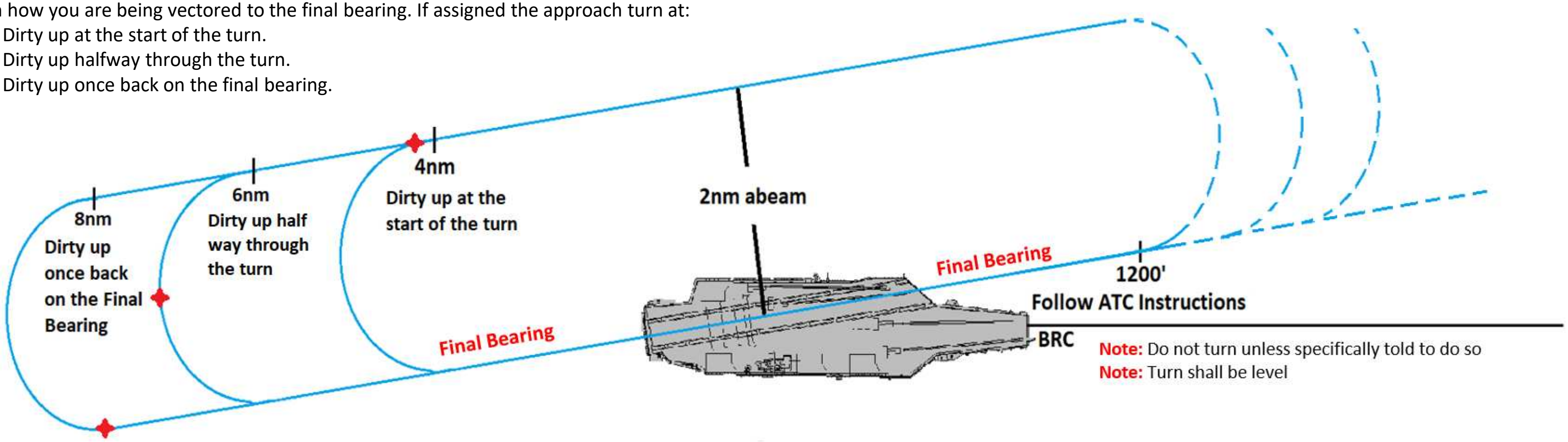
Bolter/waveoff communications:

After a bolter/waveoff, once established climbing away:
201 - *"201, airborne".*
Approach: *"201, take angels 1.2, when level turn left to the downwind, heading 340"*, or
Approach: *"201, take angels 1.2, straight ahead".*

Note 1: In that case you continue straight ahead until instructed to turn.

When abeam the ship (2 nm) on downwind:
201 – *"201, abeam, state 5.2".*
Approach – *"201, at "X" DME turn left to the final bearing, 060".*
201 – *"201".*

Note 2: Communications will now continue as Case III Recovery procedures.



Case III Bolter/wavoff pattern:

Loss of communications during Bolter/waveoff pattern: "NORDO".
If no instructions are received prior to reaching 4 miles or 2 minutes ahead of the ship, the pilot will attempt to make contact with the ship, giving identification and position. If instructions are not received, he will assume communication failure and execute a turn downwind reporting downwind abeam.

On downwind:
If radio contact is **not re-established**, he/she will proceed downwind and re-enter as follows:

- Aircraft commence turn to final at the 4 DME or 2 minutes past abeam position.

If radio contact is re-established, Follow ATC instructions and refer to previous slide.

Bolter or waveoff technique: "**NORDO**"

- Advance throttles to "MIL" or "MAX" power as required.
- Maintain wings level and verify a positive rate of climb whilst maintaining **on-speed AOA**.
- Fly final bearing. *(not BRC)*
- Gear up.
- Flaps half *(F/A-18C).*
- Speed 150 knots.
- Climb to 1200ft AGL.

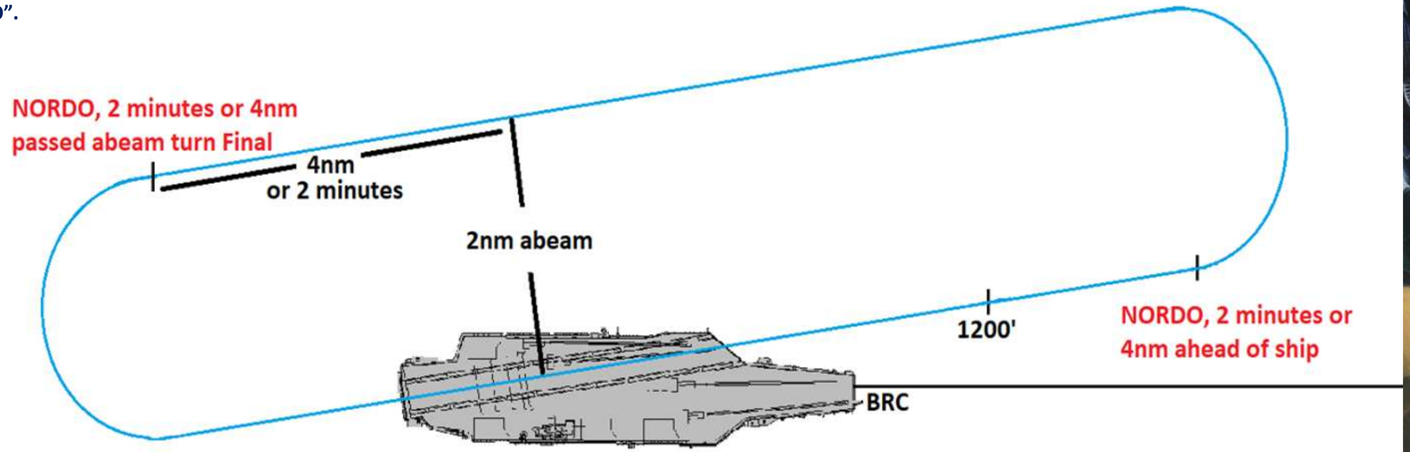
Note 1: If slow at the time of waveoff initiation then accelerate to on-speed first before climbing away at on-speed AOA. If fast at the time of waveoff initiation then positively rotate to on-speed and then climb away keeping on-speed AOA.

Configuration after Bolter or waveoff: "NORDO".

- 150 knots, Flaps half (F/A-18C), Gear up.

Configuration for landing: "NORDO".

- **4 DME**, Dirty up at the start of the turn.



Delta Procedures:
In the event the deck becomes fouled or an excessive number of aircraft bolter or wave off, the CCA Officer shall issue via Marshal Control a signal Delta. The signal Delta shall be accompanied by the number of minutes of delay *(even increments but never less than four)* required to resume recovery operations *(i.e., Delta 4, Delta 6, and so forth).*

In marshal: Aircraft shall continue holding and await assignment of a new EAT.

Commenced aircraft: Commenced aircraft above 7,000ft AGL shall level off at the next lower odd altitude and hold on the inbound bearing at a range in nm equal to holding altitude in thousands of feet plus base distance *(angels + 15).* The holding pattern shall be the same as the original marshal pattern. Pilots shall report established in holding with the new altitude and await assignment of a new EAT. Aircraft at or below 7,000ft AGL will continue the approach and await further instructions.

Issuance of EATs: Marshal Control shall issue new EATs as soon as possible. To preclude two aircraft having the same EAT, new EATs shall be issued from the latest to the earliest (i.e., top of the holding pattern to the bottom). Aircrews shall acknowledge receipt of the new EAT.

Lost communications: Aircraft in marshal shall commence approach at the last acknowledged EAT. Aircraft between marshal and 7,000ft AGL that have established Delta holding and subsequently realize lost communications prior to acknowledging new EAT shall commence approach immediately. All lost communication aircraft shall squawk the appropriate Mode I *(HEFOE)* and III codes. Pilots shall take a 30 cut to the right to intercept a track 10 to the right of the inbound bearing and continue inbound to the ship. Be alert for possible aircraft in Delta holding at lower altitudes.

Note: Due to the possibility of being told to Delta, aircraft should not dump fuel until below 7000ft AGL.

Case III communications example:

Check in with Marshal:
201 - *"Marshal, 201, marking Mom's 250 for 42, angels 14, state 6.4".*
Marshal - *"201, Mother's weather is 600 overcast, Visibility 3 miles, Altimeter 29.87, Case III recovery, CV-1 approach. Expected final bearing 015"."201, Marshal on the 160, 22, Angels 7, expected approach time 28. Approach button 15".*
201 - *"201, Marshal on the 160, 22, angels 7. Expected approach time 28, button 15".*

Note 1: With a wingman, "holding hands" will be used. Individual readbacks are required The side number that is first used will be given the earlier approach time. Normally this will be the aircraft with the lowest fuel state. Example: Assume as the lead that you are in 201 and your wingman is in 203, but you want your wingman to land first. Check in as follows: "Marshal, 203, holding hands with 201, marking mom's...". Marshal will read instructions to 203 first, and your wingman will read it back. Then 201's instructions will come, and you will read that back.

Note 2: Altimeter does not require readback. Approach buttons are 15 or 17 In real life.

When established in holding:
201 - *"201, established angels 7. State 6.0".*

Example "99" Calls:
Marshal - *"99, Altimeter 29.88. New final bearing 020".*
Marshal - *"99, Case III recovery, CV1 approach, expected Final bearing 301".*
Marshal - *"99, Stand by for time hack".*
Marshal - *"99, Time in .. seconds, 26".*
Marshal - *"99, 5,4,3,2,1, Mark, Time 26".*

When beginning the penetration:
201 - *"201 commencing, 29.88, state 5.8".*
Marshal - *"201, radar contact, final bearing 020".*

Handoff to approach:
Marshal - *"201, switch Approach, button 15".*
201 - *"201".*

Check in with Approach:
201 - *"201 checking in, 20 Miles".*
Approach - *"201, final bearing 017".*

At platform:
201 - *"201 platform".*
Approach - *"201, roger".*

At ACLS lock-on:
Approach - *"201, ACLS lock on X Miles, say needles".*
201 -*"201, up and on" or "fly up, fly on" (almost everyone uses the former).*
Approach - *"201, concur fly mode ..".*

Note 3: If "negative needles" is reported by the pilot, or indications are in disagreement with the readout on the approach controller's radar scope, Approach might instruct:
Approach -*"201, roger, Fly bullseye".*

Note 4: Most commonly flown mode will be "Mode II" unless a "Mode I" or "Mode IA" was requested and available.

At ¾ mile: ***(****the controller will give your position and then say call the ball).*
Approach - *"201, slightly above glidepath, right of course, ¾ mile, call the ball".*
201 - *"201, Hornet ball, 5.2".*
LSO - *"Roger ball, X knots" or "Roger ball, X knots, Starboard/Axial/Port".*

Note 5: Wind is only added during Case III Recoveries.

After Bolter/waveoff, once established climbing away:
201 - *"201, airborne".*
Approach: *"201, take angels 1.2, when level turn left to the downwind, heading 340"* Or
Approach: *"201, take angels 1.2, straight ahead".*

Abeam after bolter/waveoff:
201 - *"201 abeam, state 4.5".*
Approach – *"201, at "X" DME turn left to final bearing, 060".*
201 – *"201".*

Additional calls from approach may be added:
Approach - *"201, take speed 225".*
Approach - *"201, 9 miles stay clean".*
Approach - *"201, 13 miles dirty up".*
Approach - *"201, left of course, right Five".*

Case II recovery:

Case II Recovery:

This approach shall be utilized when weather conditions are such that the flight may encounter instrument conditions during the descent, but visual conditions of at least 1,000ft AGL ceiling and 5 miles visibility exist at the ship. Positive control shall be utilized until the pilot reports the ship in sight. This should happen before entering the 5 nautical mile bubble from the carrier. During Case II recoveries, CATCC shall be manned and prepared to assume control of a Case III recovery in the event weather conditions deteriorate. The maximum number of aircraft in the landing pattern is limited to six.

It is fair to say that during a Case II Recovery, the penetration will be under instrument conditions ("IFR") whilst the landing pattern will be flown in visual ("VFR") conditions. To make this a little easier to understand, the first segments of the Case II recovery will be flown exactly as a Case III recovery to allow a safe penetration through the clouds. When below the clouds and visual with the ship, report "see you" to approach. *"201, see you at 10"* Approach will reply with *"201, update state, go button 1"* or "*201, and flight, update state, go button 1".* Once at the initial, the Case II recovery will transition to a Case I recovery and the pattern will be flown exactly as published in "The pattern" section of this manual.

Note 1: The "see you at 10" call in this case is made to Approach and not to Marshal as during Case I recoveries.
Note 2: Case II recoveries shall not be conducted concurrently with Case III departures. Should doubt exist regarding the ability to maintain VMC, Case III recoveries shall be utilized.

Penetrations in actual instrument conditions by formation flights of more than two aircraft are not authorized. Flight leaders shall follow Case III approach procedures. When the ship in sight, flights will be shifted to Tower and proceed as in Case I. If the flight does not have the ship in sight at 10 nm, the flight may descend to not less than 800ft AGL. If a flight does not have the ship in sight at 5 miles, both aircraft shall be vectored into the bolter/waveoff pattern and action taken to conduct a Case III recovery for the remaining flights.

Communications:

Apart from minor differences, communications during the Case II recovery will be as explained during Case I and Case III recovery procedures. The differences however are:
- Marshal will report expected BRC instead of final bearing.
- When instructions are given, the term "and flight" will be used when not operating as a single ship.
- "See you" call will be made to Approach instead of Marshal.

Note2: Case II recoveries can be flown with a maximum number of 2 aircraft in the formation.

Example:

201 - *"Marshal, 201, holding hands with 203, marking Mom's 250 for 42, angels 14, State 6.4".*
Marshal - *"201 and flight , Mother's weather is 600 overcast, Visibility 3 miles, Altimeter 29.87. Case II recovery, CV-1 approach. Expected BRC 015. 201 and flight, Marshal on the 160, 22, Angels 7, expected approach time 28. Approach button 15".*
201 - *"201, Marshal on the 160, 22, angels 7. Expected approach time 28, button 15".*

Note 3: All communications will be done by the flight lead.
Note 4: On switch to Tower, ZIPLIP commences unless CQ, low-vis calls are in use, or required for safety of flight.

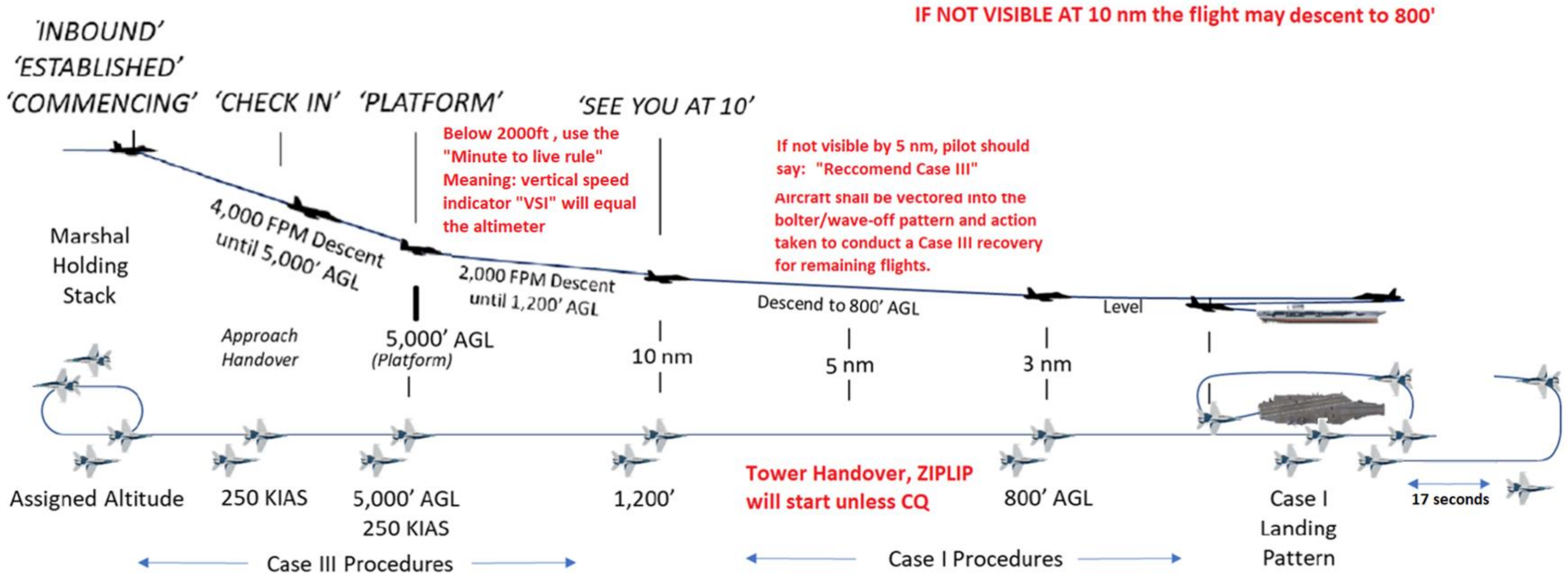
Bolter/waveoff procedures:

Bolter/ waveoff procedures will be executed as described in "Bolter" and "Waveoff" section of this manual.

Delta procedures:

Delta procedures will depend on where you find yourself in the approach.

- Before reaching the initial: Follow delta procedures as described in the "Case III recovery" section of this manual
- After passing the initial: Follow delta procedures as described in "The Pattern" section of this manual.



Techniques and additional information:

Trim and on-speed AOA:

Within the community, I have noticed great confusion regarding on-speed AOA. This is not a speed, **but an angle of attack**. AOA is a measure of the difference between the relative wind crossing the wing and the wing's mean chord line. Isn't that just simple?

AOA, when combined with your *(continuously adjusted)* throttle settings, equals vertical performance, or rate of descent. The F/A-18C lands at a rate of descent of about 750 feet per minute. Navy landing gear are stressed to take this shock, which would certainly fold the undercarriage of lesser aircraft. It is mandatory to understand the principles of on-speed AOA and trim to be able to fly any related carrier procedures accurately and correctly.

How to achieve "On-speed AOA":

On-speed AOA is achieved by manually trimming the aircraft, so the velocity vector displays within the center of the E-bracket. Before we continue it is important to understand and embrace the following concepts:

- A trimmed aircraft naturally seeks a plane of symmetry along the "lateral axis" *(the axis along the wingspan)* regardless of power, attitude, control type, etc. This is called "positive longitudinal stability" also known as pitch stability. Trim in this case can be done by either the pilot or the autopilot.
- If the aircraft is properly trimmed for on-speed AOA, the aircraft will seek a plane of symmetry for this condition. What it is trying to achieve is an equilibrium between the 4 main aerodynamic forces: Thrust, Drag, Lift and Weight. While doing so, the aircraft will go through a series of oscillations *(trading kinetic energy for potential energy and vice versa).* Basically, the nose pitching up and down. If left to its own devices, those oscillation will eventually dampen out and reach an equilibrium *(on-speed if that is in fact what you are trimmed for).* It is possible to expedite the finding of this equilibrium by helping dampen out those oscillation with your right hand. This is the "influencing the nose" concept.
- Do not over pitch the nose and exacerbate those oscillation and do not change the trim, as this will disrupt the aircraft from seeking on-speed, to something other than keeping a constant AOA. Again, this assumes you are trimmed for what you want: on-speed AOA.
- Whilst flying a glideslope, the aim is to keep a constant AOA. The way this translates to the pilot is: The E bracket and velocity vector moving together. Throttle is used to control your vertical performance in this case.
- If the the E bracket and velocity vector move independently from each other, you are controlling the vertical performance of the aircraft with the stick, and are disturbing and overruling the natural tendency of the aircraft causing the aircraft to be in other body angles than desired.

Why on-speed AOA is so important:

- Maintaining a constant AOA will keep the angle along the "lateral axis" *(The axis along the wingspan)* of the aircraft constant. This in effect will keep the hook angle relative to the deck constant. On-speed AOA will place the hook at the most optimal angle to grab a wire.
- On-speed AOA will give the correct Hook-to-Eye value the IFLOLS is set to. If the aircraft is not on-speed *(whether fast or slow),* you will receive inaccurate glideslope information from the IFLOLS.
- If you are slow, (green symbol in the AOA indexer) This will place the aircraft behind the power curve. It will lower the aircrafts energy state and cause it to require more energy to waveoff. Further, the cocked up attitude of a slow aircraft can cause a highly dangerous situation called an in-flight engagement. This is when the hook snags a wire while the jet is airborne and slams the aircraft to the deck.
- If you are fast *(red symbol on the AOA indexer),* you run the risk of a 3 point landing or a hard landing. This in real life will cause a hard landing MSP code to pop up, not allowing the jet to get airborne again before the aircraft has been Inspected. Possible permanent damage could occur.

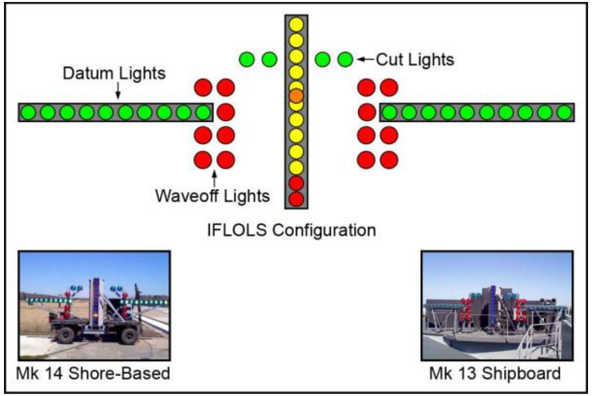
SYMBOL	AIRSPEED	AOA
	Slow	9.3° to 90.00°
	Slightly slow	8.8° to 9.3°
	On speed	7.4° to 8.8°
	Slightly fast	6.9° to 7.4°
	Fast	0° to 6.9°

Improved fresnel lens optical landing system ("IFLOLS") and ball Flying:

In previous slides we have seen "Fly the Ball" being mentioned numerous times. It is important to understand the interpretations of "The Meatball" or "Ball". On the carrier an optical landing system *(OLS)* provides the pilot with glidepath information during the final phase of the approach. All Nimitz class carriers are equipped with an IFLOLS. The IFLOLS consists of a lens assembly, cut lights, waveoff lights, and datum lights. 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 are aligned horizontally, the aircraft is on glidepath.

IFLOLS components:

Lens Assembly: The lens assembly is a box that contains 12 vertical cells through which fibre optic light is projected. The upper cells are amber in colour 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 ZIPLIP 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. ZIPLIP 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 signalled 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.



IFLOLS modes:
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 2500ft AGL 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 models.

Improved fresnel lens optical landing system “IFLOLS” and ball Flying:

On the previous page we have had a look at the mechanization of the IFLOLS. Now let’s have a look at the interpretation of the provided information and how to use it as an aid to achieve a safe and controlled landing.

Basic Angle and Target Wire:

The optical glideslope the IFLOLS sends out is called the basic angle. Normally the basic angle is 3.5 degrees, but this can be changed if required. For example, during very high winds it can be increased to 3.75 or 4.0 degrees. With a 3.5-degree basic angle and 25 to 30 knots of wind over the flight deck, the aircraft will fly an effective glideslope of 2.8 degrees.
The IFLOLS can also target certain wires. The standard target is 230 feet forward of the stern, which is a hook touchdown point of exactly between the 2 and 3 wires. However, this can be adjusted for a number of nonstandard scenarios if required.

Hook to Eye:

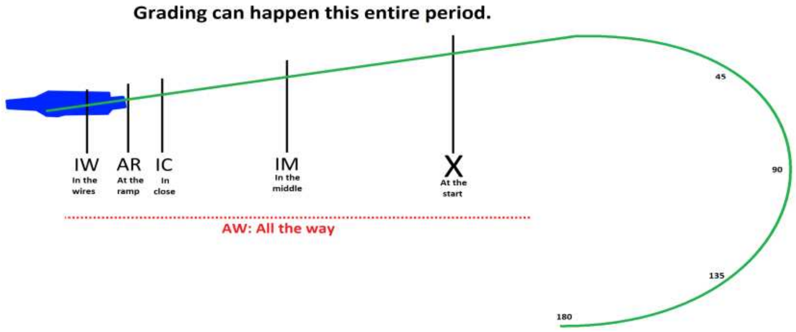
In order to maintain a constant hook touchdown point, the IFOLS has to adjust for the various hook to eye values of certain aircraft. The H/E value is the vertical distance between the eye path and hook path while on-speed. In order to accomplish this, the IFLOLS uses a roll angle and rolls the plane of light as required for each type of airplane. This is normally verified by the LSOs and is significant because a roll angle means the ball is not accurate unless in the groove. If the roll angle did not exist, each type of aircraft would touchdown on a different part of the flight deck with a centered ball.

IFLOLS sensitivity:

The IFLOLS is a very sensitive indicator and the aircraft carrier is a moving runway. As probably expected, this creates special considerations and mechanics for flying the ball. At all times, the following scan must be continuously in action: **Meatball, line-up, AOA. Do not try to fly a centered ball the entire pass.** This simply cannot be achieved and if you have done so, it was a fluke and it cannot be repeated consistently. The goal is to be a **proactive** ball flyer. This means positively moving the ball around *(even away from center)* so the ball is predictable, rather than you react to what it does. This is called proactive ball flying instead of reactive ball flying.

Note: IFLOLS individual cells cover the following vertical width. Each cell is about 8 feet wide *(vertically)* at half a mile reduced to only 18 inches wide *(vertically)* at touchdown. Flying on or near the correct glideslope, as well as touching down on deck in the correct location requires a considerable degree of precision.

DISTANCE FROM TOUCHDOWN	VERTICAL BEAM HEIGHT OF ALL 12 CELLS (FT)	VERTICAL BEAM HEIGHT OF A YELLOW SOURCE CELL (FT)	VERTICAL BEAM HEIGHT OF A RED LOW CELL (FT)
TOUCHDOWN	13.6	1.1	1.4
RAMP (230 FT)	20.4	1.6	2.2
1/4 nm	58.6	4.5	6.7
1/2 nm	103.6	8.0	12.0
3/4 nm	148.7	11.4	17.3
1 nm	193.9	14.9	22.6
2 nm	374.3	28.7	43.8



Improved fresnel lens optical landing system “IFLOLS” and ball Flying:

A good start:

The most important part of ball flying mechanics is: Get a good start. If you finish your approach turn on glideslope, on centerline, on-speed, 15-18 seconds from touchdown, life will be MUCH easier. Getting to a good start cannot be emphasized enough and does not start at “the start”. A good start starts at the break. If all parameters are correct by the end of the break, the downwind focus can be on hitting the 180 at the correct altitude and abeam distance, whilst being trimmed for on-speed AOA. This will allows you to focus on flying a proper approach turn, rather than having to use brain cells to try to catch up from your poor parameters on downwind. Your focus should be to arrive at the correct position at the end of the approach turn. During Case III recoveries, there is no excuse not to get to a good start, as there is no approach turn. Work as hard as you can to get to a perfect start.

Ball flying mechanics:

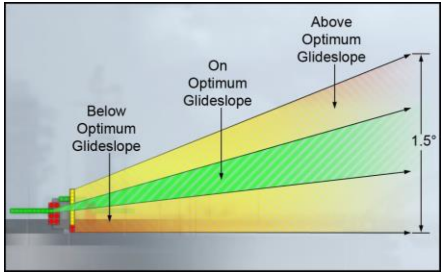
So here is the game plan. Assuming you got to a good start, push the ball up a little by adding power. Then gradually work to bring it back to center by making corrections in power. Repeat this process. The idea here is that you are proactive. You determine where the ball is going to go and there are no surprises. Obviously, we want the ball on the "happy side" of the datums, so we push it up rather than bring it down. When this is initially practiced, it is ok if the ball rises quite a bit as you add power. With more and more practice, this technique will become smoother, and the ball will go up a smaller amount. Do not push the ball up too high; only push it up a ball or two. Keep the ball on the happy side! Paddles *(and you)* do not want to see the ball go low.

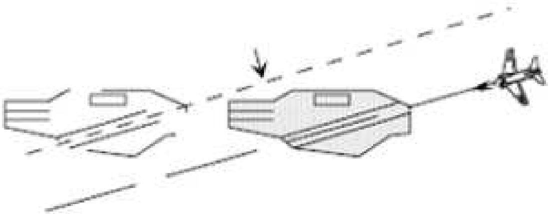
Paddles will be most satisfied if they see *(TMPIM) (HIC) (HCDAR).* This shows the ball was bumped up and worked down. Even though *(HCDAW)* sounds like a pretty pass, it is not as good as the first one, as this one does now show the pilot following the game plan. Glideslope corrections in the pass should be made primarily with throttles. If required, a small nudge of the stick to "influence" the nose can be used. However, that is used only if the inertia needs to be overcome. Again, POWER is the glideslope correction. The mechanics for power corrections are 3-part corrections. Always make 3-part power corrections. A 3-part power corrections means:
- make the power correction,
- make the counter correction,
- reset to the new and improved neutral power point.

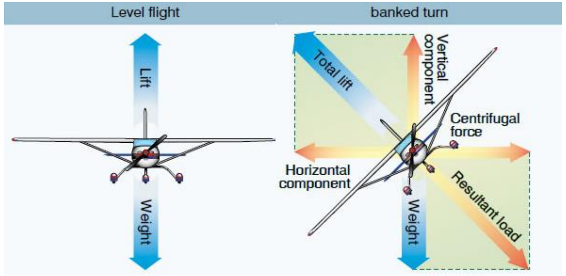
As you get experience, you will do this hundreds of times in a pass. Throttles will constantly be moving as you follow the game plan and make 3 part power corrections. Videos of pilot’s hands in the groove will testify for this. While DCS does not give the physical feedback ("seat of the pants") that you would experience in real life flying, it can still be practiced.

Line up corrections:

Line-up corrections are important to discuss. Dipping a wing to make a line-up correction will cause a loss of the vertical component of lift, and thus an increased negative VSI. This is much more significant at the ship than at an airfield because of the narrow glideslope window and high sensitivity of the IFLOLS. When making a line-up correction, anticipate this and compensate by adding a little extra power. Combine these techniques with the Rules To Live By and you will start flying like a Naval Aviator after some practice!







Use of Automatic Throttle Control: "ATC"

The ATC (Automatic Throttle Control) system is a two-mode auto-throttle system that automatically maintains angle of attack (approach mode) or airspeed (cruise mode) by modulating engine thrust in the range of FLIGHT IDLE through MILITARY power. The ATC is available for use as an aid for carrier landings. However, there are unique characteristics that require attention before use. It is not simply "turn it on and fly the ball".

Use of Automatic Throttle Control:

Aviators are not allowed to use ATC until they have some experience under their belt. A certain number of manual landings must be accomplished prior to being granted permission to use the system. While different airwings put out their own requirements, a common minimum is 50 night traps. With that milestone achieved, the pilot has the option to use ATC if he so chooses. There are no minimum requirements for FCLP prior to using ATC, however, it should be practiced during FCLP if possible prior to using it at the boat. Many eligible pilots use ATC whilst many others do not. Some use it during Case III but not during Case I and II. It is entirely up to personal pilot preference.

ATC Approach Mode:

ATC enters approach mode with the flap switch in HALF or FULL and the trailing edge flaps extended at least 27 degrees. After lowering the landing gear and flaps, engage the ATC button with a single click when you are at or near on-speed. This will allow the jet to capture on-speed AOA. **ALWAYS confirm that "ATC" is displayed in the HUD after clicking the ATC button**. Another single click will disengage ATC. If a force of approximately 12 pounds is applied to either throttle the system will automatically disengage ATC, an important feature for waveoffs.

Note: If either mode does not engage when selected, or automatically disengages after engagement, the ATC display flashes for 10 seconds and is then removed from the HUD.

ATC Mechanics:

As far the mechanics are concerned, the mindset is very different than manual ball flying. You basically have to violate one of the core principles of manual ball flying: **with ATC you fly glideslope with the nose.** For the ATC to perform satisfactorily, smooth attitude control is essential. Large attitude changes result in divergent glideslope oscillations or overcontrolling power response. Close-in corrections are very critical. If a large attitude correction for a high-in-close situation develops, the recommended procedure is to stop ball motion and do not attempt to recenter it *(as in the Rules To Live By).* A low-in-close condition is difficult to correct with ATC and usually results in an over-the-top bolter. **It may be necessary to manually override ATC in order to safely recover from a low-in-close condition.** Throughout the approach the pilot should keep his hand on the throttles in the event it is necessary to manually disconnect/override the ATC. Again, small, smooth corrections with the stick to change aircraft attitude should be applied. **The ball flying gameplan does not change** *(bump the ball up from center, work it back down).* If you deviate more than one ball away from center, "click out" of ATC and fly the rest of the pass manually. **Upon landing, the weight on wheels switch will disengage ATC and you still advance the throttles forward as you would on a manual trap.**

Communication differences:

Since you are no longer adding power to rise on the glideslope, the LSO call will now be "attitude" instead of "power." This phraseology will be used when a small deviation requires correcting, and the pilot should respond with an aft stick input. **For a larger power correction, "power" will be used, and the pilot will then click out of ATC**, apply the power correction, and fly manually for the rest of the pass. Furthermore, Paddles reserves the right to call "go manual" during the pass, at which point the pilot will immediately click out of ATC and fly manually. **Once manual, ATC is not to be reengaged.** When not under ZIPLIP, the ball call shall be made as follows: "402, Hornet ball, 5.2, Auto, *(last name if during CQ)"*. The LSO will respond with "Roger ball, Auto" during Case I and II, or "Roger ball, Auto, 26 knots" during Case III. Because the pilot does not call "Auto" during ZIPLIP conditions, Paddles will defer to the respective squadron representative on the wave team to ask if that particular pilot flies auto passes. The Writer will denote an auto pass with an "A" inside of a circle before the first comment. When an auto pass is flown, the use of "attitude" will be used in the LSO comments instead of "power." For example, instead of *(TMPIM),* it will be *(TMAIM).* The LSO will read an auto pass to the pilot as follows: "Maverick, Side number 402, auto pass, a little too much attitude in the middle.....".

Waveoff with ATC engaged:

For waveoff mechanics, execute the same mechanics as when flying manually. However, the initial step of going to MIL or MAX should be done with a click of the ATC button or with such deliberate force that ATC disengages. **ALWAYS confirm in the HUD that "ATC" has disappeared.**

Rules to live by:

Paddles always briefs the "rules to live by" and they have been unchanged for decades. These rules to live by are no joke. Paddles enforces them, and pilots put out their best efforts to adhere to them. Nobody is going rogue and deviating from them.

Here they are:

Never lead a low or slow: This means that if the ball is low, add power until the ball rises above the datums, THEN reduce the power. Never reduce the power before that point in anticipation of the ball rising above the datums. The same is applied to on-speed. If slow and adding power, do not take it out until you are fully on speed in anticipation.

Always lead a high or fast: This is basically the opposite of the above. With a high ball, add your counter-correction early in anticipation of the ball coming down. Same for correcting from a fast back to on-speed.

When low and slow: Fix the low, then the slow: If you find yourself in the combined condition of simultaneously low AND slow, the priority is to fix the low before fixing the slow. Get the ball above the datums, then accelerate to on-speed.

When high and fast: *Fix the fast, then the high*: Opposite of above. In this combined condition, fixing the fast gets the priority over fixing the glideslope

Never re-center a high ball in close, but stop the rising ball: This is in my opinion the one that needs the most emphasis. Note the words "in close" in there. That refers to the in-close position, which is a few seconds prior to crossing the stern of the ship. At this point, if the ball is high, **do not try to get it back to center!** You will scare yourself, and Paddles, and either earn a no-grade, or worse, a waveoff. Reduce power such that you stop the ball from rising any further. However, TOO MANY people are so focused on trying to get the ball back to center. The IRL expression that is famous in Naval Aviation is "take your bolter like a man". If the ball is high while you are in-close, it is FAR better to bolter, than to make a large power-off correction to try to salvage it. Paddles will be much angrier if you try to recenter the ball to avoid a bolter. I cannot emphasize this enough: boltering is vastly preferable to catching a wire if catching a wire means making a big play for the ramp.

Fly the ball all the way to touchdown: The difference between a 3 wire and something else is often due to a pilot "giving up" in the last two seconds of the pass. This rule to live by is self-explanatory: Fly the ball. ALL THE WAY. To touchdown. There is still more ball flying to be done in the last moments prior to trap. If you just make that last little correction, you can end up with a better pass. Do not give up. Ball flying does not stop until you are literally weight on wheels.

Some additional points:

- The LSO's voice overrides what you see on the Ball.
- LSO commands must be followed without delay.
- The LSO does not grade based on what wire you caught. The grade is based on the whole pass. Safe passes award higher grades than unsafe passes.
- An unsafe 3-wire pass can be "No Grade".
- Safe 2 and 4 wire passes can be "OK Grade".
- 1 wires are frowned upon for safety reasons and are typically a "No Grade".

Manually Operated Visual Landing Aid System: “MOVLAS” (not yet implemented in DCS)

The MOVLAS simply is an optical landing system that is manually controlled by the LSO. MOVLAS is used in the event of an IFLOLS casualty, pitching deck, or during normal conditions for LSO and pilot training. The LSO physically moves a lever nicknamed the “stick” at the LSO station up and down, which in turn moves the lights of the MOVLAS up and down. The MOVLAS can be rigged in 3 possible locations known as "stations“. This allows landing guidance to the pilots whenever the IFLOLS becomes unserviceable, on in case of damage to the ship.

Station 1: Is by far the most common location; it is directly overlaid over the normal IFLOLS cells, and utilizes the normal IFLOLS waveoff, datum lights and cut lights.

Station 2: Is located further aft on the flight deck than the IFLOLS, but still on the port side of the carrier as can be seen in the photo above. For stations 2, the installation is completely independent of the IFLOLS.

Station 3: Is approximately located aft of the island and outboard of the safe parking line. For stations 3, the installation is also completely independent of the IFLOLS. Unfortunately, I have not been able to locate a photo representing the Starboard position of the MOVLAS. This is used if there was damage to the port side of the ship.

The MOVLAS light box contains 23 vertically mounted lights that provide the meatball display, but it does not have the same high resolution as the IFLOLS. Paddles can only effectively show 5 positions: full low, low, center, high, and full high. A big difference between the MOVLAS and the IFLOLS is that the pilot will always see a ball, regardless of how high or low he/she is, even if the condition would be “Clara” with the IFLOLS. Despite these limitations, a proficient LSO and pilot can use the MOVLAS to its advantages, particularly when an IFLOLS would not be sufficient *(heavy pitching deck, for example).*

When using MOVLAS, the LSO is attempting to control the pilot's energy state with the stick. It is important to understand that the **LSO will show the pilot what he wants the pilot to do, not necessarily where the pilot is on glideslope**. For example, if a pilot is on glideslope, but he wants the pilot to rise above glideslope, he will show the pilot a low ball.

MOVLAS flying technique:

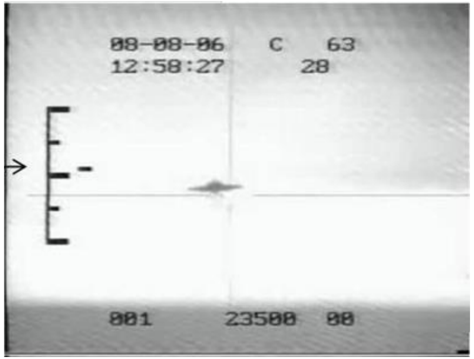
The ball flying game plan is different during MOVLAS. Instead of the standard proactive ball flying game plan, it is now a reactive ball flying game plan. Because the ball does not necessarily reflect true glideslope position, the pilot should not try to push the ball up and then work it down. Rather, the pilot should reactively respond to what they see. I.e., with a centered ball, the pilot should continue with his current energy state. With a high ball, the pilot should make a power off correction and hold the higher rate of descent until the ball centers. This game plan should occur all the way to touchdown. The contract from the LSO is the same as it is with the IFLOLS: ensure the aircraft maintains a minimum of 10 feet of hook-to-ramp distance. However, the contract from the pilot changes from proactively flying the ball and keeping it on the "happy side", to responding immediately to the LSOs signals on the MOVLAS. For this reason, a one wire may not be as frowned upon so long as the pilot was responding appropriately.

Grading differences:

With regard to grading, the LSO takes notes differently. Normally with the IFLOLS, the glideslope comments reflect the aircraft's actual position in the sky. Instead, with the MOVLAS the comments will reflect what the LSO showed the pilot. For instance, if the aircraft was slightly above glideslope at the start, and the LSO showed a low ball, the comment would be LOX instead of *(HX).* The MOVLAS is known as the "green machine" because it tends to give out a high proportion of OK passes. Again, this is so long as the pilot responds in a timely and correct fashion to the LSO. If this is the case, the pilot will get an OK even with a one wire, and a bolter will likely be no-counted. However, during the Case I or II pattern, pattern discrepancies can still ruin the OK pass *(LIG, NESA, OSX, AA, etc.).*

Note: The arrow on the left side shows the MOVLAS indicator scale. This symbol only appears when the MOVLAS is in use.

The tick mark on the right-hand side shows where the manual ball is currently illuminated on the MOVLAS.



Communications differences when the MOVLAS is in use: When MOVLAS is in use and not under ZIPLIP, the LSO will say "Roger Ball, MOVLAS" During Case I and Case II recoveries, or "Roger Ball, 29 knots MOVLAS", during Case III recovery operations.

MOVLAS Limitations: Maximum landing weight for the F/A-18C Hornet is 33k when MOVLAS is in use.

The Landing Safety Officer: “LSO”

A Landing Signal Officer *(LSO)* is a naval aviator with additional specialized training to better facilitate recovery operations on the ship. His job is to guarantee the safe and expeditious recovery of aircraft. LSOs monitor the approach of each aircraft and remain in contact with the pilot during the approach by radio and light signals. LSOs are nicknamed and frequently referred to as “Paddles”.
Well trained LSOs can quickly dissect problems with the approach and alert the pilot to correct deviations prior to the pilot even becoming aware that there is a problem developing. Particularly insidious errors like settling in the groove can be spotted by the LSO before the pilot even realizes it's happening. In addition to ensuring the safe and expeditious recovery of aircraft, the LSOs grade each pass.

Different LSOs:

- **CAG Paddles:** At all times, one of the airwing's CAG Paddles is on the platform as the overall authority. CAG paddles waves glideslope and line-up and has a direct line to the “Boss” to discuss items relevant to the recovery and any issues that may arise. CAG Paddles also teaches and mentors the junior LSOs.
- **Controlling LSO:** Known as: "Primary“. This LSO is primarily responsible for glideslope. He also "calls the pass" by telling the writer the comments for the pass, as well as issues grades.
- **Backup LSO:** Known as: "Backup“. This LSO is responsible for line-up by using the PLAT cam centerline, however can also back up glideslope as well. Typically, this is a more senior/experienced LSO.
  Deck Caller: Responsible for facing forward and works with the Arresting Gear Officer to visually scan that the deck is clear. He also shouts out "One Hundred" during the 100-foot waveoff window, and notifies Primary when the waveoff window is down to 10 feet.
- **Writer:** Responsible for writing down comments from Primary after each landing and taking notes as required.
- **Groove Timer:** Responsible for timing groove length, and then passing that to the writer.
- **Interval Timer:** Responsible for timing interval *(time from one trap until another trap),* and then passing that to the writer.

Paddles experience levels:

New LSOs often start doing jobs such as groove timer, or writer, to allow the opportunity to watch many passes, hear how they are graded, and calibrate his/her eye. As Paddles gets more experience they can begin to wave as Primary during the day, and then with more experience expand that to night time. Finally, when this LSO is "salty" *(experienced),* he will graduate to backup, the most senior position besides CAG Paddles. If manning is short for whatever reason, some jobs can be combined. For instance, Groove Timer and Writer can be combined, as can Interval Timer and Deck Caller. During Case III, there is no timing of groove or interval. Primary, Backup, and CAG Paddles all stand next to each other on the platform. Primary is the most inboard, and then moving right is Backup, then CAG Paddles. Primary and Backup each have a handset radio, while CAG Paddles uses a headset. If Backup keys the handset while Primary is transmitting, Primary will be cut out and only Backup will transmit. If CAG Paddles transmits, that radio will cut out both Backup and Primary if transmitting.

Pilot or LSO:

In a squadron, the majority of pilots are in their first operational tour out of training. These pilots are known as Junior Officers *(JOs)* and their "JO tour" is 3 years long. A squadron will have 4 LSOs, and each will have varying degrees of experience. Usually, one is new to the squadron, one is ready to leave the squadron, and the other two are in between. There are various levels of LSO qualification that these pilots work up to within their JO tour. The practice of what the LSO does on the platform is known as "waving". While underway, an LSO will wave with his or her wave team every fourth day. On all the other days, the LSO is a squadron pilot like anybody else, but on a wave day the LSO will do nothing but wave. Once done with the JO tour, the LSO may continue to wave in their next tour if that tour is at a training squadron *(either fleet aircraft or T-45)*. It is from these instructional LSOs that the CAG Paddles are chosen. Only a few get chosen to become CAG Paddles, and those that do not get chosen generally do not wave again in their careers. CAG Paddles are usually the only LSOs in the airwing that are not JOs.

Misconception about LSO communications:

Paddles does not actually talk a lot while aircraft are landing. Unless doing a Paddles talk down, he/she is not mentioning every little thing. Calls such as "You're a little high" are usually not necessary. **A little high is ok and the pilot will be aware, so there is no need to make that call.** Calls are only made when needed. **At the start of the pass, if the deviation is not severe, give the pilot a chance to fix it first**. Most passes nothing is said, even with jets that end up a little low. If anything is said, it is "Power" or "Right for lineup". Those calls are the most common and probably make up about 80% of all LSO radio calls. Usually a recovery is silent. There's no constant chat of: "you're on glideslope, you're a little high, you're drifting a little right, you're on glideslope" **Talk only if really needed**, but **if there is doubt,** better to say something rather than nothing.

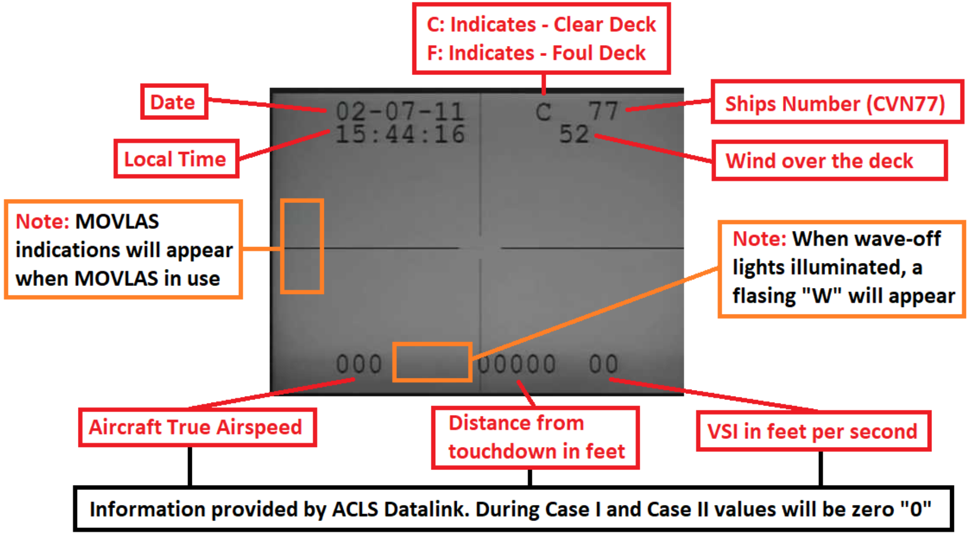
Note 1 : **"**Paddles contact", means the LSO is taking over for a talk down at that time. Usually this happens prior to the ball call, and the approach controller is overridden by Paddles. The LSO will talk the aircraft all the way to touchdown. Paddles Contact does not exist in the normal Case 1/2 pattern. Usually a "Paddles contact" occurs during Case III in low visibility conditions when Paddles is seeing the taxi light.

Note 2 : A Paddles Talk Down is when the aircraft is being talked down the entire pass. This can occur during any Case, and usually occurs when there is an aircraft emergency, pitching deck, or a pilot that is having a difficult time getting aboard. Primary and Backup will speak in rhythm to give a smooth talkdown ("You're on glideslope, you're on centerline...)

Pilot Landing Aid Television: "PLAT"

To support the pilot during the landing, the LSO station is equipped with at least 1 PLAT Camera. The PLAT cam is a TV display that is always on. It is broadcast throughout the ship and is viewed by pilots in the Ready Room, maintenance chiefs in Maintenance Control, Air Ops, and on any other TV if the correct channel is selected. It maintains recordings for a period of time in case any event of note needs to be reviewed.

On the flight deck, there are two PLAT cameras. A primary and a backup, located at different distances embedded into the landing area centerline. The PLAT is predominately used by the Back-up LSO and by CAG Paddles and is **not** used for waving glideslope. It is often not perfectly calibrated to glideslope and does not have the same resolution as a visual observation by the LSO. Another reason is that the Primary and Backup Plat cameras are located at differently as mentioned before. Therefore, it simply cannot be trusted for glideslope, and if it could it would never be able to compare to a human visual observation. However, due to the LSO being unable to discern lineup visually, the Backup LSO will use the centerline crosshair of the PLAT to wave lineup, while scanning his/her eyes up to visually wave glideslope. Before each recovery, an LSO will verify that lineup is calibrated correctly by standing on the centerline while another LSO checks the PLAT



Landing Signal Officer Display System: "LSODS"

As we have seen multiple times in this manual, safety is one of the US Navy's main priorities. US Navy carrier recovery operations are executed under any conditions and there is little margin for error, as operating in a dangerous environment could lead to catastrophic consequences. LSOs require their workstations to be equipped with vital information that is required to keep the operations safe. This workstation is called the Landing Signal Officer Display System: know as "LSODS", and pronounced as "El-Sods". We have had a look at the PLAT system used to enhance this safety but the PLAT is only a small part of the LSODS. The LSODS gives instant information regarding both ship and aircraft status.

Deck Status: If the deck is foul due to either an obstacle in the landing area, or the recovery equipment isn't set yet, this will display FOUL. If the area is clear and the quipment is set, it will display CLEAR.
Ship Heading: This shows the ships magnetic heading which is the same as the Base Recovery Course *(BRC)* value in degrees.
Ship Symbol: In the center of the ship symbol is the wind over deck speed in knots. If the wind is from the left, P will be displayed to the left of the symbol it will indicate the wind speed and P (port). If the wind is from the right, S will be displayed to the right of the symbol and it will indicate wind speed and S *(starboard).* If there is no crosswind, then that value will be blanked.
ACLS Closure: If the active aircraft is using ACLS to land, this will display the closure of the aircraft to the ship in knots.
Ship List and Trim: The top indication displays the real time list (roll) of the ship in degrees. Right of the X.X value, it will display either STBD UP or STBD DOWN (starboard up and down). Trim works the same except the real time trim *(pitch)* of the ship is displayed.
Aircraft Type: The aircraft next for landing is listed here. The **H/E** (hook to eye) distance is the number of feet above the tailhook the pilot's eyes are. This is used to calibrate the IFLOLS ball to be accurate for each aircraft type. The **B/A** *(basic angle)* is the glidepath angle the IFLOLS is set to.
Landing Queue: The next three aircraft in queue to land are listed here, with the next aircraft to land in the top box. Each aircraft is listed by side number. This is only used during Case III.
Hook to Ramp: This vertical scale illustrates the desired height the bottom of the arresting hook should be when it crosses over the stern of the ship. For a 3-wire, it should be 14.1 feet. The thick tick mark indicates the desired hook over ramp height and the caret is the dynamic indication of hook to ramp based on the ship pitching up and down.
Hook Touch Down: This indicates the distance from the stern of the ship at which the IFLOLS landing system directs the pilot to fly such that the hook will strike the indicated location. For a 3-wire, it should be 230 feet. The four dots indicate the four arresting wires. The selected wire to capture is solid. The thick tick mark indicates the exact, desired hook touch down point and the caret above is the dynamic point based on pitch up and down. As the ship's bow moves up and down, so will this caret.

Note: Do not confuse the LSODS for the PLAT camera. The PLAT camera is displayed within the LSODS.

Grading:

Grading is a lot like umpiring in American baseball. There is subjectivity, but the grades are usually right. There are some rare human errors, but what Paddles says, goes.

Why does grading exist?

There is of course the important purpose of measuring a pilot's performance and monitoring trends so he or she can improve. However, the primary reason for grading is to enhance safety.
It achieves this purpose in two ways:

- The competitive nature of the Naval Aviator *(or any aviator really)* is driven to achieve excellence, as well as avoid embarrassment. There is a huge incentive to fly the best pass possible.
- Behaviour reinforcement. This is basic psychology. Let's suppose there is a struggling pilot that consistently shows up to low at "the start". This is something that needs to be fixed, and the pilot has had a hard time with his approach turn. Paddles is displeased that this pilot gets to a bad start and worse, the ball isn't on the happy side. His grades reflect this. If he then shows up one day to a full high start, and flies a safe fair pass, Paddles may give him the OK as a reward even though there was a full deviation. His next full high pass will not get receive the same treatment of course. However, the grades were used as positive reinforcement, and in the aggregate across all pilots this increases safety.

The grading scale is seen on this page. Generally speaking, if a pass has only *(little)* deviations, it will be an OK. If it has at least one full deviation, it will be a Fair. If it has at least one underline deviation, it will be a no grade, or worse. These are not absolutes! The LSO is charged with taking into account the full context of the recovery and the pass in making his judgments. Paddles will generally bias towards punishing low glideslope deviations more harshly than high deviations. The LSO comments should tell a story of the pass. They should be logical. For example, TMPIM HIC-AR makes sense: the pilot added too much power in the middle, and thus was high from then on. What would not make sense is TMPIM LOIC-AR. The pilot should not be low if he was on glideslope and added too much power. LSO grades are much more art than science! After each recovery, the LSO "wave team" that was on the platform will discuss each pass to ensure the passes make sense, correct any errors, and resolve any disagreements on what they have seen. Ultimately, CAG Paddles has the final call in these deliberations. The controlling LSO *("Primary")* is responsible for debriefing the pilots that he waved on that recovery.

Grading Example:

Let's take a look at a fictional pilot *(LT "Maverick" Mitchell)* that flew the following pass: *[55/19 (LIG) (OSX) TMP.CBIM HIC \AR].*

The way the LSO would read this pass would be as follows "Maverick, Aircraft 403, 55 second interval, 19 seconds in the groove, little long in the groove, little overshooting start, too much power on the comeback in the middle, high in close, fly through down at the ramp, Fair 2 wire." If this were Case III, interval and groove length would not be recorded, nor would there be any pattern related comments such as "overshooting start".

If the pilot requires further debrief, that will be handled appropriately. "Maverick" in this case shall not argue, even if he truly believes that isn't what he remembers happening. There is only one correct reply: "Thanks, Paddles"!

Groove time Grading:

<9 sec = <u>NESA</u>
9-11 sec = NESA
12-14 sec = (NESA)
15-18 sec = Normal
19-21 sec = (LIG)
22-24 sec = LIG
>24 sec = <u>LIG</u>

Grading Scales:

<u>OK</u> or **"Oh-kay, underline":** A 5.0 grade. Only awarded for good passes under emergency conditions, or a pilot's final pass of his tour or career.
OK or **"Oh-kay":** A 4.0 grade. Pretty much the best that you can do. "Above average".
(OK) or "Fair pass": A 3.0 grade. Fleet average.
B or Bolter:** A 2.5 grade. Better than the worst normal pass.
No-Grade: A 2.0 grade. Defined as "below average".
No-Grade Bolter **: A 2.0 grade. A bolter that was ugly enough to be a no-grade.
Pattern Waveoff **: A 2.0 grade
Technique Waveoff **: A 1.0 grade, defined as "unsettled dynamics, potentially unsafe".
Cut Pass: A 0.0 grade. Defined as "unsafe deviations inside the waveoff window".
No Count: No points/Neutral
Foul Deck Waveoff: No Points/Neutral

Note 1: The parentheses "( )" are used in LSO shorthand to indicate "a little".
Note 2: **Grades with the double asterisk count against boarding rate percentage.

Paddles can make an error while waving. For example, a power call that was not needed does ocassionally happen and can be annotated in the comments. This can be written as "TMP.LSOAR" or "too much power on LSO at the ramp." Paddles is basically saying that power call was his fault. If you bolter, it will be a no-count. If you went full high but trapped, it may be upgraded from a fair.

Grading symbology:

Here an overview of symbols and abbreviations used by the LSO for grading:

SYMBOL	APARTS SYMBOL	MEANING
________	_Comment_	Underline For emphasis
PATT	PATT	Pattern
A	(A)	APC/Auto
		APC/Auto downgraded to manual
I	M1	Mode I ACLS (record in grade column)
		Mode I ACLS, uncoupled after the ball call
•	•	A dot between two symbols indicates "on" (e.g., S• LUIC)
—	–	A dash between two symbols indicates "to" (e.g., HIM-IC)
SQUARE	Comment [ ]	A square around any symbol indicates that a signal was not answered
CIRCLE	Comment ( )	A circle around any symbol indicates that a signal was answered too slowly
	OC	When used as a prefix to any symbol, " " indicates "over controlled"
AA	AA	Angling approach
ACC	ACC	Accelerate
AFU	AFU	All "fouled" up
B	B	Flat glideslope
	C	Climbing
CB	CB	Coming back to lineup
CD	CD	Coming down
CH	CH	Chased
CO	CO	Come-on
CU	CU	Cocked up
DD	DD	Deck down
DEC	DEC	Decelerate
DL	DL	Drifted left
DN	DN	Dropped nose
DR	DR	Drifted right
DU	DU	Deck up
EG	EG	Eased gun
F	F	Fast
FD	FD	Fouled deck
GLI	GLI	Gliding approach
H	H	High
HO	HO	Hold off
LIG	LIG	Long in the groove
LL	LL	Landed left
LLU	LLU	Late lineup
LO	LO	Low
LR	LR	Landed right
LTR	LTR	Left to right
LU	LU	Lineup
LUL	LUL	Lined up left
LUR	LUR	Lined up right
LWD	DLW	Left wing down
N	N	Nose
NC	NC	Nice correction
ND	ND	Nose down
NEA	NEA	Not enough attitude
NEP	NEP	Not enough power
NERD	NERD	Not enough rate of descent
NERR	NERR	Not enough right rudder
NESA	NESA	Not enough straight away
NH	NH	No hook
NSU	NSU	Not set up
OR	OR	Overrotate
OS	OS	Overshoot
OSCB	OSCB	Overshot coming back
P	P	Power
PD	PD	Pitching deck
PNU	PNU	Pulled nose up
ROT	ROT	Rotate
RUD	RUD	Rudder
RUF or	RUF	Rough
RWD	DRW	Right wing down
RR	RR	Right rudder
RTL	RTL	Right to left
S	S	Settle
SD	SD	Spotted deck
SHT	SHT	Ship's turn
SKD	SKD	Skid
SLO	SLO	Slow
SRD	SRD	Stopped rate of descent
ST	ST	Steep turn
TCA	TCA	Too close abeam
TMA	TMA	Too much attitude
TMP	TMP	Too much power
TMRD	TMRD	Too much rate of descent
TMRR	TMRR	Too much right rudder
TTL	TTL	Turned too late
TTS	TTS	Turned too soon
TWA	TWA	Too wide abeam
W	W	Wings
WU	WU	Wrapped up
XCTL	XCTL	Cross control
	^	Over the top
	LLWD	Landed left wing down
	LRWD	Landed right wing down
	LNF	Landed nose
	3PTS	Landed 3 points
	/	Fly through the glideslope (going up)
	\	Fly through the glideslope (going down)

The burble and the effects of wind:

What is "the burble":

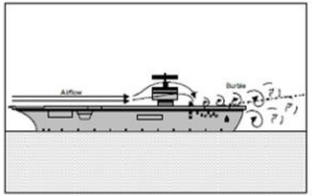
The burble or "burble effect" is the name given by navy pilots to the velocity deficit and downwash field immediately aft of an aircraft carrier. The burble is caused by a disturbance in the wind pattern and velocity as it passes over the flight deck and can have a significant influence on the pilot's ability to make a precise approach and landing. The burble is primarily a result of a disturbance in the airflow as it moves upward over the angled bow, along the landing area, and down at the ramp. Primary factors causing this disturbance in airflow are the superstructure, deck/hull structures as raised jet blast deflectors and flight deck traffic, crosswinds, and sea state. After leaving the ramp, the burble deflects off the water and causes an updraft, or "rooster tail", aft of the ship. The effect of the burble is dependent on the direction and velocity of the wind.

Note 1: Generally, the burble is located near the approach centerline and has the greatest adverse effects when the ship is required to make its own wind.

Hazards of the burble:

The burble can be extremely dangerous to the unsuspecting pilot because it combines two separate but equally hazardous, components.

- Aircraft approaching a carrier are on the verge of a stall due to the low speed and high angle of attack required by the approach, so when the aircraft pass through this region of lower air velocity produced by the superstructure wake, the lift over the wings is reduced, thus causing the aircraft to experience an increased descent rate.
- In addition to this negative effect, the aircraft also fly through a region where the flow is moving downward toward the water, typically 3 to 6 fps. This region of down f lower flow velocity caused by the superstructure; therefore, the two effects combine to produce the sinking effect of the "burble" that pilots describe.



Because of the downdrafts and updrafts associated with the burble, it can significantly affect the pilot's ability to remain on glideslope. When the aircraft reaches the updraft portion of the burble, pilots will reduce power in response to a rising ball. Shortly thereafter, as the aircraft gets to the in-close position, the downdraft part of the burble takes, and effect and the aircraft picks up an increased rate of descent.

> **Most important takeaway regarding the burble:** At the in-close position with a neutral energy state, the burble will cause an increased rate of descent if no compensation is made. It will behave like ground-effect in reverse, at one of the most critical points in the approach.

In response to the increased rate of descent, the pilots may overestimate or underestimate the associated power requirements, which may result in an early wire or bolter. The burble may also affect the ability of the pilot to maintain lineup control. This often results when the pilot is preoccupied with glideslope. The pilot may be working so hard on maintaining optimum glideslope that he drops lineup out of his scan. The burble can have a minor effect on AOA. As the relative wind changes due to the burble, the aircraft may accelerate or decelerate slightly. This condition may be aggravated if autothrottles are used. The LSO must be aware of the effects of the burble and anticipate the pilot's response and make the necessary calls. If the pilots are not adequately responding to the effects of the burble, the LSO should move the waveoff window out and make more calls.

Effects of wind and optimal conditions:

- Optimum wind over the deck is 25-30 knots.
- Maximum crosswind component for recovery is 7 knots and can be increased to 10 knots by the Captain's approval.
- Usually high winds will make the ball heavier. This will cause a small "power off" correction to make the ball fall much more significantly compared to normal winds conditions.
- Unusually low winds will make the ball lighter, and lend to floating to a later wire, and increasing bolters when compared to normal winds conditions.

Note 2: 25-30 knots of wind allows the aircraft to fly the 3.5 degree optical glideslope at an effective glideslope of 2.8 degrees. It is able to be achieved a large percentage of the time to minimize variation in carrier landing conditions. Additionally, 25-30 knots balances pilot response time, LSO response time, engine spool up time, wire engagement speed, approach speed, waveoff capability and pilot's field of view.

Note 3: Each aircraft type has a minimum recovery headwind *(18 knots for the F/A-18C hornet).*

Pitching deck:

Landing on an aircraft carrier is challenging. This challenge is maximized when the deck oscillates in pitch and/or roll due to more severe sea states. Mild pitching deck is easily managed by following standard procedures. When the sea states cause the deck to pitch more severely is when more consideration and special procedures are required. It is not necessarily the magnitude of the oscillations that is the most dangerous; often it is the period of each cycle. The worst oscillation is a nasty Dutch-roll *(a type motion, consisting of an out-of-phase combination of yaw/roll)* that the ship can encounter that will not only mess with the glide slope but also lineup behind the ship.

Different techniques required:

There are two main scenarios for a pitching deck:

- **The first scenario:** The pitching is moderate enough that the IFLOLS *is able* to keep up with the motion at least 50% of the time. In this case, the IFLOLS will be used and LSO radio talk downs will be the primary landing aid.
- **The second scenario:** The IFLOLS is *not able* to keep up at least 50% of the time. In this case, the MOVLAS should be rigged and LSO talk downs shall be used as required.

Pilot responsibilities:

The pilots' first responsibility is first and foremost is not to spot and chase the deck! Often the pilot will be unsure if it is the deck or himself, and trust in Paddles is required to help get you down safe. The pilot's next responsibility is to fly a smooth approach and stable VSI *(this naturally results from not chasing the deck).* If the pilot can "average" out the ball and VSI, the difficulty of the challenge will be reduced.

Paddles responsibilities and talk down techniques:

If the deck is moving severely enough, Paddles will give an LSO talk down. This is once again the primary landing aid. Expect a rhythm of glideslope callouts and instructions. In the absence of these instructions, fly a smooth pass and fly the proactive IFLOLS game plan or reactive MOVLAS game plan, as appropriate. Paddles' responsibility is, as always, to ensure safe hook-to-ramp clearance for all aircraft. Regarding the talk downs, there are three techniques.

- The first is to make calls with deck position *("Deck is up, you're on glideslope...").*
- The second is to make calls with generic deck motion *("Deck is moving, you're on glideslope...").*
- The third is to only give glideslope deviations *("You're on glideslope, You're going a little high...).*

While different Paddles will have different preferences and opinions on these techniques, it is important to understand their unique features. For example, the second technique does not get into the head of the pilot as much as the first, as the pilot does not focus on the position of the deck.

"Waveoff, waveoff, deck":

Occasionally, through no fault of either the pilot or Paddles, the aircraft can find itself out of sync with the deck. This is an unfortunate coincidence of timing, and even though both parties may be doing their jobs perfectly well, the aircraft will need to be waved off. In this case "waveoff, waveoff, deck" is the call from Paddles to indicate the pilot should waveoff, but it was not due to a foul deck, poor pattern, or poor technique. It was just unfortunate timing where the aircraft and deck were out of sync. Realize that the LSO has great latitude to waveoff an aircraft during pitching deck conditions. If there is any doubt that the aircraft will be out of sync, or that an up deck may cause a loss of minimum hook-to-ramp clearance, waveoff. For the LSO, the waveoff window will be moved further out during pitching deck. For grading, frequent comments of DU or DD will be used. For example, \.DUIC *(fly through down on deck up in close)* means that while an aircraft may have been holding a little above glideslope, the deck pitching up caused a fly through down to below glideslope. If the pilot is following the above procedures and bolters due to the pitching deck, the bolter will typically be no counted. Along the same lines, if the pilot catches an early wire, or is otherwise low at the ramp due to the deck beyond his control, he would not be penalized for that in the same way as if the deck were steady. If a pilot were not responding to Paddles instructions properly, then the grade should be as appropriate to reflect that.

Note: A "waveoff deck" does not count again the pilot GPA or boarding rate, just like a "waveoff foul deck" does not count.

Summary: In pitching deck conditions, do not spot or chase the deck, fly a smooth approach, smooth out the IFLOLS or react to the MOVLAS, and above all listen to Paddles. The LSOs' voice overrides the ball.

Fuel management:

Between Cyclic Ops and CQ there are fundamental different mentalities with regards to fuel management.

- Cyclic Ops uses tankers and may or may not have a divert available *(no divert available uses the term "blue water ops").*
- CQ does not use tankers, and always has a divert field available.

In both cases, it is very important to conserve fuel as the carrier environment is unforgiving.

Cyclic Operations:

During Cyclic Ops, the ship is not continuously open like most airfields or as during CQ. The fuel therefore is not only related to distance but also to time. This issue will be mitigated by a fuel ladder which will be discussed shortly. Additionally, tankers are used and thus "tank states" will be used. CAG will put out guidance as what fuel state is the minimum fuel state to arrive on the ball with. In each air wing, CAG will demand a minimum amount of fuel to show up in the groove with. During Cyclic Ops this is usually a function of number of passes prior to "tank state".

Let's assume the following:	**Case I & Case II Ops:**	**Case III Ops:**
CAG determines that the Hornet tank state is 3.0 *(it is different per aircraft type).*	3000lbs	3000lbs
CAG says that the minimum fuel to show up in the groove with is Tank State plus 2 additional passes *(written as T+2).*	T+2	T+2
Fuel required for the F/A-18C to go around the pattern once.	500lbs	1000lbs
In this example T+2 would be:	4000 lbs	5000lbs

4000 and 5000 represent this example's minimum fuel state to show up with "on the ball" *(slang for in the groove).* If you bolter or waveoff after your first pass you are now considered T+1. If you do so again then you are now considered TOB *(tank on the ball).* If you do so again you will now go to the tanker. Usually after you bolter or waveoff after your T+1 pass the tanker will be instructed to "hawk" you and be in a position for you to easily and quickly join up if you go around again.

The fuel ladder is built on the assumption that the hornet will burn 1200 pounds every 15 minutes AT MAX ENDURANCE. *(roughly 250 KIAS, but it is better to use 5.6 AOA or the FPAS page)*. Again, this burn rate is different for each aircraft.

Let's assume the following:	Fuel Required:	T+3 at 12:30:	4500 lbs
CAG determines that the Hornet tank state is 3.0 *(it is different per aircraft type).*	3000 lbs	T+3 at 12:15	5700 lbs
		T+3 at 12:00	6900 lbs
CAG says that the minimum fuel to show up in the groove with is: Tank State plus 3 additional passes *(written as T+3).*	3 x 500 lbs = 1500 lbs	T+3 at 11:45:	8100 lbs
Case I conditions and you will be on a 1+15 cycle and launch in event 1 at time 11:00		T+3 at 11:30:	9300 lbs
Note: Do not assume you will be landing at 12:15 because it is a 1+15 cycle. Remember: Landings occur after launch. Therefore,		T+3 at 11:15:	10500 lbs
you will be landing after 1215. A good and conservative number is 15 minutes for the launch. So let say 12:30		T+3 at 11:00	11700 lbs

Now we have had a look at the Fuel ladder, lets build fuel management a little more.

Assume on deck you have two fuel tanks on board, and you fire up the APU with 15.0 lbs of total fuel. After start-up and taxi the total amount of fuel will have reduced to roughly 14.5.
If you take 14.5 and subtract 11.7 required as we calculated in our fuel ladder it leaves you with 2.8 to play with before you are forced to max endurance airspeed *(aka Max E).* 2.8 is far from a generous number and this would be even less during Case III as T+3 would be higher. Of course, this is all based on local flying around the carrier; long missions in country have different fuel planning considerations but the later stages of those flights boil back down to the same ladder logic as before.

If you have the luxury to be fragged for gas from a Mission Tanker on the airplan for your flight, you will take-off and spend some time getting gas *(usually between 1000 and 2000 pounds).* This should place you in a more comfortable position. Other scenarios that could free up some gas is if CAG now says he requires T+2, or you now happen to be on a shorter cycle. Hopefully this explains why carrier aviators are obsessed with their fuel state *(especially during blue water ops).* Remember, the fuel ladder is based on 15 minute intervals. You will need to check more often than every15 minutes and interpolate as required.

Note: If you intercept your ladder, fly at max endurance for the rest of the flight except for the break and the pattern. This will definitely put a damper on your tactical flying, so planning is KEY!

Fuel Dumping:
During Case I: If required, dump once commencing from the overhead stack. Do not dump directly overhead the ship, but dumping can be resumed once upwind. Manage the dumping *(and the bingo bug)* to ensure that you end up at max trap on the Ball!
During Case II and Case III: Do not dump until below 7,000ft AGL after commencing in case a Delta situation arises.

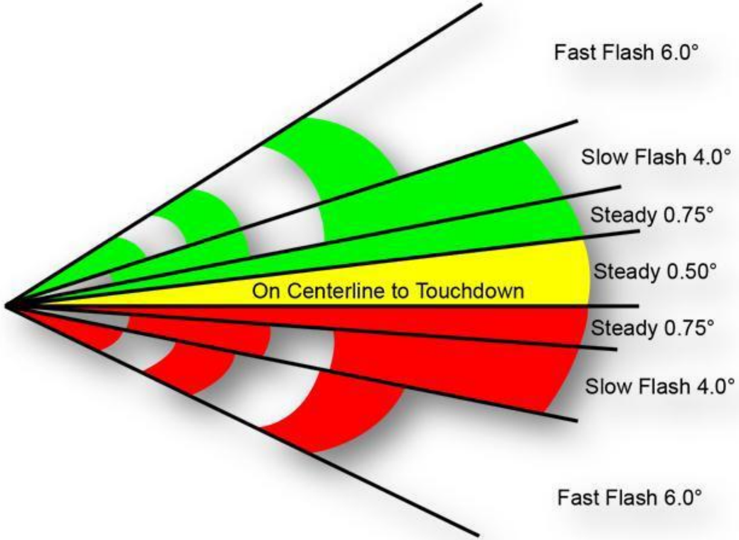
Carrier Qualifications "CQ":
Fuel is conserved by flying efficiently and not dumping unless required, The aim is to show up on the ball for your first trap at exactly max trap weight. During CQ, tankers are not used, so "tank states" do not exist. Because a divert field exists that you use a bingo profile to get to, "bingo states" are used instead. The bingo fuel calculated is based on the NATOPS bingo charts and are derived from the distance to the divert field. The bingo state may be artificially raised from that if the divert field will require an instrument approach. The ship will pass a Bingo/hold-down for each type of aircraft, and update this as the distance to the divert changes over time. The bingo state will require that the aircraft executes a NATOPS bingo profile and fly direct to the divert field. The hold-down fuel state is 2 passes over bingo. A hornet pass assumes 500 pounds per pass during Case I and II, and 1000 pounds per pass during Case III.
If an aircraft reaches hold-down fuel, they shall not launch again until refuelled. Refuel to roughly 1000 pounds above max trap weight to allow for taxi, launch, and pattern execution. If an aircraft reaches bingo, they will fly from present position, no matter where they are, direct to the divert field on a bingo profile. A bingo profile is an emergency, and as such an emergency will be declared with ATC and 7700 will be squawked.

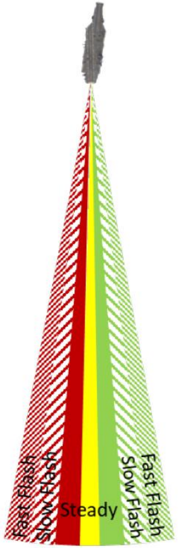
Fuel Dumping:
Fuel dumping during CQ is as described in the Cyclic Ops section of this page.

Long-range Laser line-up System: "LLS"

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.

The unit provides a light source appearing to the pilot as a single point of light emanating from below the landing area threshold *(ramp of the ship).* The system is designed such that the pilot sees a yellow light when on the proper centerline approach. A slight misalignment to the right of centerline will be indicated by a steady green light. A further right misalignment will be indicated by a slow flashing green light. An extreme right misalignment will be indicated by a fast flashing green light. Likewise, a slight misalignment to the left of centerline will be indicated by a steady red light. A further left misalignment will be indicated by a slow flashing red light. An extreme left misalignment will be indicated by a fast flashing red light.





Display management:

Good display management will allow the pilot to actively monitor aircraft status, flight path and other relevant information. The following display setups are specifically for the F/A-18C Hornet. These are the display settings taught to pilots in the FRS *(initial F/A-18 training squadron)* but they are not standard operating procedure. Therefore, use them as guidance to improve SA, but freedom is given to deviate as required.

For launch:
Left DDI: HUD
Right DDI: FCS
MPCD: HSI

In marshal: *(any case)*
Left DDI: HUD
Right DDI: Radar *(For SA)*
MPCD: HSI

Just prior to leaving marshal until touchdown:
Left DDI: HUD
Right DDI: Checklist
MPCD: HSI

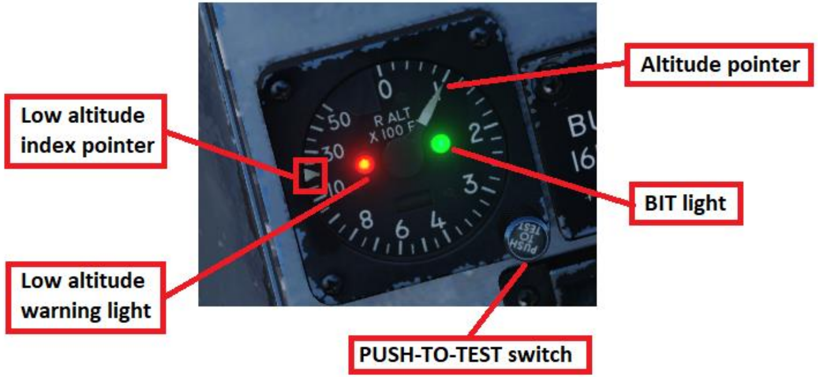
Note 1: The checklist page is used for the landing checklist and gross weight.
Note 2: DCS limitations will allow the HSI to be placed on the right DDI

Use of radar altimeter: “RADALT”

The F/A-18 is equipped with a radar altimeter, also known as RADALT. The radar altimeter is a vital to enhance pilot awareness and improve safety during carrier operations.

What is a radar altimeter?

The radar altimeter indicates clearance over land or water from 0 to 5,000 feet. Operation is based on precise measurement of time required for an electromagnetic energy pulse to travel from the aircraft to the ground terrain and return. Voice alert and/or warning tone and visual warnings are activated when the aircraft is at or below a selectable low altitude limit. The height indicator, on the instrument panel, consists of a calibrated scale from 0 to 5,000 feet, a push-to-test switch, a low altitude index pointer, an altitude pointer, an OFF flag, a low altitude warning light, and a BIT light.



Altitude on the HUD:
The HUD shows Barometric or RADAR altitude in feet as set by the ALT switch on the HUD control panel. When RADAR altitude is selected, an “R” is displayed next to the altitude box. If however the RADAR altitude is invalid, a flashing “B” is displayed to indicate that barometric altitude is being used instead.

Use of Radar altimeter during Carrier operations:

In real life the “RADALT is set to HUD” the entire time the aircraft is at sea. The switch on the HUD control panel does not move all deployment. The Flashing B that will appear on the right side of the altimeter above 5,000 ft is accepted.

Note 1: “RADALT is set to HUD” is a term used in the US Navy. This means the ALT switch on the HUD control panel is set to RDR.

Launch: For launch the RADALT is set to 40 feet. If during a cold cat shot, you hear the RADALT and your trend has not improved, EJECT!
In the Pattern: In the pattern set the radar altimeter either to 450 or 500 at the 90 *(depending on personal preference),* or 370 at the 45.

Note 2: Only pick one of the following options as you should not change the radar altimeter during the approach turn: 450/500 or 370.

Above 5000ft AGL: At any time above 5000 RADALT is set to 5000 for Platform.
Case III recovery: During Case III, below 5000 ft it is set to 500 feet. 500 feet is an arbitrary number selected for safety.

Use of Night Vision Goggles: "NVG"

Naval Aviators operate at night using AN/AVS-9 goggles. The Aviator's Night Vision Imaging System is also known as "ANVIS". The AN/AVS-9 is a lightweight, self-contained, helmet-mounted, direct-view binocular image intensification device. The AN/AVS-9 is powered by one 1/2 AA lithium battery. It is a passive detection device designed for use with military fixed-wing aircraft as a pilot aid during night-time operations. Used on F/A-18C/D/E/F, F-14A/B/D, AV-8B, and F/A-18A/B *(Pre-Lot 12 w/NVG Kits).*

Goggles restrictions:

In the navy it is not allowed to put on or off the night vision goggles below 3000ft. The navy also requires goggles to be off 10 minutes before landing. The reason for this is to create the opportunity for the human eye to adjust to a dark environment. The adjustment time is directly depended on the amount of light in the environment that you are in. Moving from a bright environment into a dark one takes longer than moving from a dim environment and going into a dark one. While the cones in the eyes adapt rapidly to changes in light intensities, the rods take much longer. The rods can take as long as 30 minutes to fully adapt to darkness. A bright light, however, can completely destroy night adaptation, leaving night vision severely compromised while the adaptation process is repeated.

Do goggles have to be worn?

There is no written requirement to wear the goggles, but real-life operations show that it is common practice within the F/A-18 community to wear goggles when it is dark. Flying dark without goggles is considered crazy although not everyone wears the goggles while aerial refuelling. In the initial training on the F/A-18, goggles were only used on the NVG orientation flight, but once graduated to the fleet the common practice was as shown above.

For landing, NVG's simply are not worn for the following reasons:

- The rules do not approve wearing goggles for landing.
- The ships lighting would not necessarily be NVG compatible.
- The trap would most likely send the goggles straight through the HUD.

Note: It is worth mentioning that NVGs are not used to see inside the cockpit; you would have to look under the goggles to see inside. Needless to say,, the goggles have a specific filter to allow light at the wavelength of the HUD to pass through normally

DCS: F/A-18C HORNET

Sources used:

Publications:

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https://info.publicintelligence.net/CV-NATOPS-JUL09.pdf

U.S. Navy Carrier Vessel NATOPS Landing Signal Officer Manual:
https://publicintelligence.net/u-s-navy-carrier-vessel-natops-landing-signal-officer-manual/

NATOPS FLIGHT MANUAL NAVY MODEL F/A-18A/B/C/D 161353 AND UP AIRCRAFT:
https://info.publicintelligence.net/F18-ABCD-000.pdf

CVN FLIGHT/HANGAR DECK NATOPS MANUAL:
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https://www.cnatra.navy.mil/local/docs/pat-pubs/P-816.pdf

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https://www.flyingmag.com/pilot-reports/jets/night-carrier-qualifications/

Carrier Qualifications flight procedures:
https://www.cnatra.navy.mil/pubs/folder5/T45/P-1238.PDF

The Burble Effect: Superstructure and Flight Deck Effects on Carrier Air Wake:
https://pdfs.semanticscholar.org/5433/b9628e9b547ff685a2e22fb218d9fd62d40e.pdf

Video material:

USS Reagan Marshal, Approach and Paddles. Carrier Radio:
https://www.youtube.com/watch?v=rDrVkbYlsLM&t=436s

Aircraft Carrier Communications - Military Aviation Scanner Audio:
https://www.youtube.com/watch?v=8XIsRQ1q_HA&t=4851s

Carrier Qualification DAY 1 PART 1 - my call sign is "golf 12 (one-two)":
https://www.youtube.com/watch?v=nPTcaiNWZIc&t=289s

The Fighter Pilot Podcast:
https://www.youtube.com/channel/UCl_mZTC4UmH2ICN5MBbrDrQ

Pitching Decks US NAVY:
https://www.youtube.com/watch?v=SoPBLLdzjNA

Speed & Angels YouTube links:
https://youtu.be/LvGQS-3AzMc
https://youtu.be/bN44wvtRsw0
https://youtu.be/Xso1mMo_1Mg

Hornet Vids YouTube:
https://m.youtube.com/channel/UC9up8Psjy3Sv6Wu1SZ6yGOw

Discord:

Navy pilot: GB
US Marine Corps pilot: Lex Tallionis.

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Glossary:

ACL: Automated carrier landing
AUX: Auxiliary radio
AGL: Above ground level
AOA: Angle of attack
AOB: Angle of bank
ATC: Automatic Throttle Control
BRC: Base Recovery Course
Boss: Short for "Airboss"
CATCC: Carrier, Air Traffic Control Center
CARQUAL: Carrier Qualifications
Catobar: Catapult assisted take-off, but arrested recovery
CCA: Carrier Control Area
CCA: Carrier Controlled Approach
CCZ: Carrier Control zone
CV NATOPS: Carrier Vessel -Naval Air Training and Operating Procedures Standardisation
CVN: Carrier Vessel with Nuclear propulsion
CQ: Carrier Qualification
DME: Distance measuring equipment
El: Elevator
Emcon: Emissions Control
FCLP: Field Carrier Landing Practice
HUD: Head's up display
ICLS: Instrument carrier landing system
IMC: Instrument meteorological conditions
IRL: In Real Life
Jbd: Jet blast deflector
KIAS: Knots Indicated airspeed
LSO: Landing Signal Officer
LSODS: Landing Signal Officer Display System
Mini-Boss: short for "Airboss assistant"
MIL: Military power
NVG: Night Vision Goggles:
NWS: Nose Wheel Steering
PLAT: Pilot Landing Aid Television
PRI: Primary radio
Pri-Fly: Primary Flight Control
RADALT: Radar Altimeter
RPM: Revolution per minute
SLP: Launch Sequence Plan
TACAN: Tactical air navigation system
VMC: Visual meteorological condition
ZIPLIP: Indication of radio silence.

To P.Ras , the creator of this document,

Understanding this is the culmination of countless hours of hard work and an adherence to accuracy, we cannot thank you enough for the time and effort you have invested in this resource.

Thank you P.Ras!

GB, Lex, S&A, The virtual aviation community.