* CRM Seven Skills/Callouts
  + CRM is the responsibility of the Pilot In Command (PIC). The PIC is responsible for the successful completion of any assigned mission. Utilizing each crewmember to his/her full capacity ensures good crew resource management.
  + CRM is intended to improve the mission effectiveness of all aviation communities by enhancing crew coordination through increased awareness of associated behavioral skills. Practicing CRM principles will improve mission effectiveness and reduce mishaps that result from poor crew coordination and human error.
  + The seven CRM Skills:
    - Decision-Making
      * Ability to use logical and sound judgment based on the information available.
    - Assertiveness
      * Willingness to actively participate and the ability to state and maintain your position, until convinced by the facts (not the authority or personality of another) that your position is wrong.
    - Mission Analysis
      * Ability to make long-term and contingency plans and to coordinate, allocate, and monitor crew and aircraft resources.
    - Communication
      * Ability to clearly and accurately send and acknowledge information, instructions, or commands and provide useful feedback.
    - Leadership
      * Ability to direct and coordinate the activities of other crewmembers and to encourage the crew to act together as a team.
    - Adaptability/Flexibility
      * Ability to alter course of action to meet situational demands, to maintain constructive behavior under pressure, and to interact constructively with crewmembers.
    - Situational Awareness
      * Cognizance of what is happening in the cockpit and the in the mission, and knowledge of how that compares with what is suppose to be happening.
  + For Standard CRM callouts reference NATOPS 27.6
* Radio Communications Above FL180
* Preflight Planning
  + Publications Bag
    - A pubs kit for a cross-country is in principle the same as a normal instrument flight pubs bag.
    - Make sure that you have charts (high & Low) and IAP books covering the vicinity of the entire route of flight. Pubs can be found in the duty office or in Base Ops.
    - You should have two copies of each relevant IAP book and one copy of each chart, and your pubs kit should be in order before the morning of your cross-country.
  + Fuel Planning [OPNAV 4.6.5]
    - All aircraft shall carry sufficient usable fuel, considering all meteorological factors and mission requirements as computed below.
      * If alternate is not required, fuel to fly from takeoff to destination airfield, plus a reserve of 10% of planned fuel requirements
      * If alternate is required, fuel to fly from takeoff to the approach fix serving destination and thence to an alternate airfield, plus a reserve of 10 percent of planned fuel requirements.
      * In no case shall the planned fuel reserve after final landing at destination or alternate airfield, if one is required, be less than that needed for 20 minutes of flight, computed as follows
        + Turbine-powered fixed-wing/tilt-rotor aircraft: Compute fuel consumption based on maximum endurance operation at 10,000 feet.
        + See OPNAV for other aircraft requirements
      * Any known or expected traffic delays shall be considered time en route when computing fuel reserves.
      * If route or altitude assigned by air traffic control causes or will cause planned fuel reserves to be inadequate, the pilot shall inform ATC of the circumstances, and, if unable to obtain a satisfactory altitude or routing, alter destination accordingly.
  + Fuel Packet
    - Any off-station flight involves the fuel packet. The fuel packet contains a card for military fuel refueling ops, and a card for civilian fuel purchases, if the field has a military contract for gas. (Refer to the IFR Supplement to see if they do)
    - You should hold on to the fuel packet, and ensure that all fuel receipts are stored in the packet. Also make sure that civilian fields print the fuel receipt in gallons of fuel, not dollars. You need to sign out the fuel packet with the SDO, and return it there following the flights.
  + Weight & Balance Form F [NATOPS 26]
    - Basic Weight is that weight that includes all fixed operating equipment, unusable fuel, and engine oil.
      * The term “basic weight” when qualified with a word indicating the type of mission, such as basic weight for personnel transport, basic weight for ferry, etc., may be used in conjunction with directives stating what the equipment shall be for these missions.
    - Operating Weight is the basic weight of the aircraft, plus the weight of the crew and all equipment required for the mission, excluding the weight of fuel or payload.
    - Gross Weight is the total weight of an aircraft and it’s content.
      * The takeoff gross weight is the operating weight plus the variable and expendable load items that vary with the mission.
      * The landing gross weight is the takeoff gross weight minus the expended load items.
    - Reference Datum is an imaginary vertical plane at or forward of the nose of the aircraft from which all horizontal distances are measured for balance purposes.
    - Arm is the horizontal distance in inches from the reference datum to the cg of the item.
    - Moment is the weight of an item multiplied by its arm.
      * Moment divided by a constant is generally used to simplify balance calculations by reducing the number of digits. For the TC-12B, inches and moment/100 have been used.
    - Average Arm is the arm obtained by adding the weights and adding the moments of a number of items and dividing the total moment by the total weight.
    - Basic Moment is the sum of moments of all items making up the basic weights.
    - Center of Gravity (cg) is the point about which and aircraft would balance if suspended.
      * It’s distance from the reference datum is found by dividing the total moment by the gross weight of the aircraft.
    - Cg Limits are the extremes of acceptable forward or aft cg location.
      * The cg of the loaded aircraft must be within these limits at takeoff, in the air, and on landing.
    - Form F [NATOPS 26.8]
      * The summary of the actual disposition of load in the aircraft for a particular flight. It records the weight and balance status of the aircraft step-by-step through out the flight.
      * It serves as a worksheet on which the weight and balance technician records the calculations and an corrections that must be made to ensure the aircraft will be within weight and cg limits throughout the flight.
      * If also serves as the record that weight and balance were determined to be acceptable for the flight. It is necessary to complete Form F prior to flight whenever an aircraft is loaded in a manner for which no previous valid Form F is available.
  + Weather Filing Criteria [OPNAV 3710.7T 4.6.4]
    - Flight plans shall be filed based on all of the following
      * The actual weather at the point of departure at the time of clearance
      * The existing and forecast weather for the entire route of flight
      * Destination and alternate forecasts for a period 1 hour before ETA until 1 hour after ETA.
    - For VFR flight plans, the pilot in command shall ascertain that actual and forecast weather meets the criteria specified in [OPNAV 3710.7T] paragraph 5.2.4 prior to filing a VFR flight plan
    - Regardless of weather, IFR flight plans shall be filed and flown whenever practicable as a means of reducing midair collision potential.
    - Forecast meteorological conditions must meet the weather criteria for filing IFR flight plans and shall be based on the pilot’s best judgment as to the runway that will be in use upon arrival.
    - An IFR flight plan may be filed for a destination at which the forecasted weather is below the appropriate minimums provided a suitable alternate airfield is forecast to have at least 3,000-feet ceiling and 3-statute-mile visibility during the period 1 hour before ETA until 1 hour after ETA.
    - If an alternate airfield is required, it must have published approach compatible with installed operable aircraft navigation equipment that can be flown with out the use of two-way radio communication whenever either one of the following conditions is met:
      * The destination lacks the above described approach
      * The forecasted weather at the alternate is below 3,000-foot ceiling and 3-statute-mile during a period of 1 hour before ETA Until 1 hour after.
    - Flights shall be planned to circumvent areas of forecast atmospheric icing and thunderstorm conditions whenever practicable.
    - The National Weather Service Storm Prediction Center issues unscheduled Weather Watch (WW) bulletins as graphical advisories for the Continental United States whenever a high probability exists for severe weather.
      * Provides estimates of the potential for convective activity for a specific time period, will be provided to pilots or certified crewmembers upon request, and are included with all briefings.
      * Except for operational necessity, emergencies, and flights involving all-weather research projects or weather reconnaissance, pilots shall not file into or through areas for which a WW has been issued unless one of the following exceptions apply:
        + Storm development has not progressed as forecast for the planned route. In such situations:

VFR filing is permitted if existing and forecast weather for the planned route permits such flights

IFR flight may be permitted if aircraft radar is installed and operative, thus permitting detection and avoidance of isolated thunderstorms.

IFR flight is permissible in positive control areas if VMC can be maintained, thus enabling aircraft to detect and avoid isolated thunderstorms.

* + - * + Performance characteristics of the aircraft permit an en route flight altitude above existing or developing severe storms.
      * See figure 4-1. IFR Filing Criteria

|  |  |  |  |
| --- | --- | --- | --- |
| Destination Weather  ETA ± 1 hour | Alternate Weather  ETA ± 1 hour | | |
| 0 – 0 up to but not including Published minimums | 3000 – 3 or better | | |
| Published minimums up to but not including 300 – 3  (Single-piloted absolute minimums 200 – 1/2 | **NON-PRECISION** | **ILS** | **PAR** |
| \*Published minimums + 300-1 | Published minimums + 200 – ½ | \*Published minimums + 200 – ½ |
| 3000 – 3 or better | No alternate required | | |
| \*In the case of single-piloted or other aircraft with only one operable UHF/VHF transceiver, radar approach minimums may not be used as the basis for selection of an alternate airfield. | | | |

* + DD-175 [OPNAV 4.4.4.5]
    - Military flight plan, completed in accordance with FLIP General Planning, is used for other than local flights originating from airfields in the United States at which military operations department is located.
    - A flight plan appropriate for the intended operation shall be submitted to the local air traffic control facility for all flights of naval aircraft except the following:
      * Flights of operational necessity
      * Student training flights under the cognizance of CNATRA conducted within authorized training areas. CNATRA shall institute measures to provide adequate flight following service.
    - An FAA flight plan, FAA 7233-1, may be filed in lieu of a DD-175 at airfields in the United States at which a military operations department is not located.
  + DD-175-1
    - Pilots are responsible for being thoroughly familiar with weather conditions for the area in which flight is contemplated.
    - Where available, a flight weather briefing shall be obtained from a qualified meteorological forecaster.
    - If unavailable, an FAA-approved weather briefing from either a Flight Service Station (FSS) or Direct User Access Terminal System (DUATS) may be substituted.
    - Navy and Marine Corps Forecasters are required to provide flight weather briefings using either DD-175-1 forms, or VFR Certification Stamps when VFR flight is an acceptable alternative.
    - A DD-175-1 flight weather briefing form shall be completed whenever an IFR flight plan is filed.
      * Weather briefings may be conducted at any time prior to departure and all will include briefing number and void time. However, briefing-void time cannot exceed 2.5 hours past briefing time or ETD plus one-half hour.
  + Optimum Path Aircraft Routing System (OPARS)
    - The primary purpose of OPARS is to provide a flight planning service to the Naval Aviation community that minimizes time en route and fuel consumption.
    - An OPARS flight plan acts as a preflight planning aid that serves as a supplement to the DD Form 175-1 Military Flight Weather Brief.
    - A computer program that selects the best (optimum) route and altitude for an aircraft to reach a destination.
    - The system combines the latest environmental data with the most fuel efficient flight profile for a specific aircraft, and then produces a customized flight plan for the pilot.
    - Nearly every weather office accepts OPARS requests either over-the-counter or by telephone. Many individual military pilots are frequent users of OPARS, and these pilots may prefer to enter their own OPARS requests. However, most pilots prefer to have the base weather personnel process OPARS requests.
    - The observer normally uses a locally prepared form to ensure that the necessary information is obtained, and then enters the information into the OPARS program. Each request must include information such as aircraft type, point of departure, time of departure, point of arrival, number of different flight routes (legs), fuel weight, and air-routing type.
    - After processing, the information is formatted into a flight plan and transmitted back to the office.
* Unfamiliar Field Operations
* Departure Procedures (DPs) [AIM 5.2.8]
  + Instrument departure procedures are preplanned IFR procedures which provide obstruction clearance from the terminal area to the appropriate en route structure.
  + If an obstacle penetrates what is called the 40:1 obstacle identification surface, then the procedure designer chooses how to establish obstacle clearance. Obstacles that are located within 1 NM of the DER and penetrate the 40:1 OCS are referred to as “low, close-in obstacles”.
  + DPs assume normal aircraft performance, and that all engines are operating. Development of contingency procedures, required to cover the case of an engine failure or other emergency in flight that may occur after liftoff, is the responsibility of the operator.
  + Unless specified otherwise, required obstacle clearance for all departures is based on the pilot crossing the departure end of the runway (DER) at least 35 feet above the DER elevation, climbing to 400 feet above the DER elevation before making the initial turn, and maintaining a minimum climb gradient of 200 feet per nautical mile.
  + There are two types of DPs
    - Obstacle Departure Procedures (ODP)
      * Printed either textually or graphically
      * Provide obstruction clearance via the least tasking route from the terminal area to the appropriate en route structure.
      * May be flown without ATC clearance unless an alternate departure procedure has been specifically assigned by ATC.
    - Standard Instrument Department (SID)
      * Always printed graphically
      * ATC procedures printed for pilot/controller use in graphic form to provide obstruction clearance and a transition from the terminal area to the appropriate en route structure.
      * Primarily designed for system enhancement and to reduce pilot/controller workload.
      * ATC clearance must be received prior to flying a SID
  + Diverse Departure
    - If an aircraft may turn in any direction from a runway within the limits of the assessment area and remain clear of obstacles, that runway passes what is called a diverse departure assessment and no ODP will be published.
  + Visual Climb Over the Airport (VCOA)
    - DPs established solely for obstacle avoidance that require a climb in visual conditions to cross the airport or an on-airport NAVAID in a specified direction, at or above a specified altitude.
  + Vectors
    - ATC may assume responsibility for obstacle clearance by vectoring the aircraft prior to reaching the minimum vectoring altitude by using a Diverse Vector Area (DVA).
    - ATC may also vector an aircraft off a previously assigned DP
  + In all cases, the 200 FPNM climb gradient is assumed and obstacle clearance is not provided by ATC until the controller begins to provide navigational guidance in the form of radar vectors.
* Checklist Management
* En Route Charts
* Standard Terminal Arrivals (STARs) [P/C Glossary, AIM 5.4.1]
  + A preplanned IFR air traffic control arrival procedure published for pilot use in graphic and/or textual form, STARs provide transition from the en route structure to an outer fix or an instrument approach fix/arrival waypoint in the terminal area.
* En Route Weather Facilities [AIM 7.1]
  + Pilot-To-Metro Service (PMSV) [FIH C.3 & C.4]
    - USAF
      * The USAF weather units operate a PMSV at selected AFBs and AAFs to provide aircrews a direct contact.
      * “Full Service” facilities are manned by fully qualified personnel.
      * “Limited Service” facilities are manned by individuals not qualified to prepare, issue or interpret forecasts and who will identify themselves as a “weather apprentice”. The apprentice may only relay the following information:
        + Surface observations
        + TAFs for which an amendment capability exists
        + Weather watches, warnings, and advisories
      * The radio call for PMSV is “METRO”. When requesting terminal weather, advise the forecaster/observer of your ETA
    - USN & USMC
      * PMSV are available from all Naval Meteorological and Oceanography Command (NAVMETOCCOM) and USMC aviation weather activities.
      * The primary purpose of PMSV is for communicating various types of weather information to pilots.
      * It is also used to update the Flight Weather Briefing Form (DD-175-1) and to receive pilot weather reports (PIREPS) of significant weather phenomena.
      * The radio call for PMSV is “METRO”. When requesting terminal weather, advise the forecaster/observer of your ETA
  + Automated Flight Service Station (AFSS/FSS) [AIM 7.1.2]
    - The FAA maintains a nationwide network of AFSSs/FSSs to serve the weather needs of pilots.
    - The primary source of preflight weather briefings is an individual briefing obtained from a briefer at the AFSS/FSS; these briefings are tailored to your specific flight and are available 24 hours a day via 1.800.WX.BRIEF
  + Hazardous InFlight Weather Advisory Service (HIWAS) [AIM 7.1.10]
    - A continuous broadcast of inflight weather advisories including summarized AWW, SIGMETs, Convective SIGMETs, CWAs, AIRMETs, and urgent PIREPs.
    - In those areas where HIWAS is commissioned, ARTCC, Terminal ATC, and AFSS/FSS facilities have discontinued the broadcast of inflight advisories.
    - HIWAS availability is shown on IFR Enroute Low Altitude Charts and VFR Sectional Charts.
  + Automated Surface Observing System (ASOS)/Automated Weather Observing System (AWOS)
    - Consists of various sensors, a processor, a computer-generated voice subsystem, and a transmitter to broadcast local, minute-by-minute weather data directly to the pilot.
    - The AWOS observations will include he prefix “AUTO” to indicate that the data are derived from an automated system.
    - Some AWOS locations will be augmented by certified observers who will provide weather and obstruction to vision information in the remarks of the report when the reported visibility is less than 7 miles. Augmentation is identified in the observation as “Observer Weather”
    - Transmissions on a discreet VHF radio frequency are engineered to be receivable to a maximum of 25 NM from the AWOS site and a maximum altitude of 10,000 feet AGL.
  + En Route Flight Advisory Service (EFAS) [AIM 7.1.5]
    - Called “Flight Watch”, a service specifically designed to provide en route aircraft with timely and meaningful weather advisories pertinent to the type of flight intended, route of flight, and altitude.
    - In conjunction, also a central collection and distribution point for PIREPs.
    - Provides communication capabilities for aircraft flying at 5,000 feet AGL to 17,500 feet MSL on a common frequency of 122.0 MHz. Discrete frequencies have been established to ensure communications coverage from 18,000 thru 45,000 feet MSL
    - Contact Flight Watch by using the name of the ARTCC facility identification serving the area of your location, followed by your aircraft identification, and the name of the nearest VOR to your position.
    - Not intended to be used for filing or closing flight plans, position reporting, getting complete pre0flight briefings, or obtaining rather weather reports and forecasts.
  + Automatic Terminal Information Service (ATIS) [AIM 4.1.13]
    - The continuous broadcast of recorded non-control information in selected high activity terminal areas.
    - It’s purpose is to improve controller effectiveness and to relieve frequency congestion by automating the repetitive transmission of essential but routine information.
    - Transmissions of a discrete VHF radio frequency are engineered to be receivable to a maximum of 60 NM from the ATIS site and a maximum of 25,000 feet AGL.
  + TWEB (Alaska Only) [AIM 7.1.9]
  + PIREP [AIM 7.1.20]
    - FAA air traffic facilities are required to solicit PIREPs when the following conditions are reported or forecast:
      * Ceilings at or below 5,000 feet;
      * Visibility at or below 5 miles (surface or aloft);
      * Thunderstorms and related phenomena;
      * Icing of light degree or greater;
      * Turbulence of moderate degree or greater;
      * Wind shear; and
      * Reported or forecast volcanic ash clouds
* Airport Diagrams & Symbols
  + See Instrument Approach Plate Legend
* Circling Procedures [FTI 411]
  + Circling to land is a visual flight maneuver. When the instrument approach is completed, it is used to align the aircraft with the landing runway.
  + The TC-12B circles at 130 KIAS for normal and single engine situations, and 140 KIAS with a no-flap configuration.
  + The circling MDA and weather minima published on IAPs are those for the runway to which the instrument approach was flown, and apply to non-radar non-precision approaches.
  + Controllers may issue specific guidance for the circling approach to include a direction on an eight-point compass (N, NE, E, SE…)
  + Circling obstruction clearance areas are determined by aircraft category and the aircraft should be maneuvered to remain within the circling area.
    - Category ‘C’ : 1.7 NM
    - Category ‘D’ : 2.3 NM
  + When requesting circling MDA from the controller for a circling ASR approach, state your aircraft category.
  + Circling minimums provide 300 feet of obstacle clearance within the clearance area for a specified category
  + Additional consideration should be given to high altitudes and high tailwinds, possibly increasing aircraft category.
  + After breaking out, maneuver the shortest path to the downwind or base leg, considering existing weather conditions. You may make turns in either direction to final, unless
    - Directed otherwise by the controlling agency
    - Required to by the IAP or IFR/VFR Supplement
    - Other aircraft in the pattern
  + If able, fly the circling maneuver at higher than circling minimums (up to pattern altitude) to allow for better site picture and visual cues. Do not descend below MDA or reduce airspeed below 130 KIAS until in a position to place a normal glide path to the runway.
* Circling Missed Approach [FTI 411, AIM 5.4.21]
  + If you lose visual reference while circling to land or there is any doubt whether the aircraft can be safely maneuvered to touchdown, execute a missed approach.
  + The missed approach instruction is designed to return the aircraft to an altitude providing en route obstruction clearance.
  + If visual reference is lost while circling to land from an instrument approach, the missed approach specified for that procedure must be followed.
  + To become established, begin an initial climbing turn toward the landing runway to ensure the aircraft remains within the circling obstruction clearance area, and continue until established on the climb-out instructions.
  + FAA vs. ICAO Procedures
    - ICAO has a wider radius for Circling
    - FAA is more lenient with maneuvering to land
* ICAO vs. FAA Circling
  + FAA
    - The protected area is much smaller in the USA (1.7 mile radius for approach category C and 2.3 mile radius for category D), this is well below ICAO requirements, and makes the circling approach even more difficult and dangerous.
  + ICAO
    - Requires a much larger area. Circling area radius from threshold in ICAO (DOC 8168 OPS/ 611PANS-OPS-4, page 3-26): A: 1.68nm; B: 2.66nm; C: 4.20nm; D: 5.28nm; E: 6.94nm. The maximum speeds are A: 100KIAS; B: 135KIAS; C: 180KIAS; D:205KIAS; E: 240KIAS. The radius is the distance from the threshold used to determine the circling area.
* Securing/RON Procedures [NATOPS 3.11]
  + The proper steps for securing the aircraft must be based on the time the aircraft will be left unattended, the aircraft weight, the expected wind direction and velocity, and the anticipated availability of ground and aircrews for mooring and/or evacuation.
  + When practical, head the aircraft into the wind, especially if strong winds are forecast or if it will be necessary to leave the aircraft overnight. Set the parking brake and chock the wheels securely. Following engine shutdown, position and engage the control lock.
  + Propeller restraints and wheel chocks shall be used whenever the aircraft is moored. At pilot discretion, dust covers may be used for the pitot masts, engine intake and exhaust, and the heat exchanger leading edge intake.
  + If towing is a possibility, release the parking brake after the engines are secured and the chocks are set. Additionally, control locks shall be installed for all aircraft, but not in the rudder (TC-12/T-44) to prevent damage if the aircraft is towed.
  + For remaining securing instructions, see NATOPS 3.11
* FAA Flight Plan
* Automated Flight Service Station (AFSS/FSS) [AIM 7.1.2]
  + The FAA maintains a nationwide network of AFSSs/FSSs to serve the weather needs of pilots.
  + The primary source of preflight weather briefings is an individual briefing obtained from a briefer at the AFSS/FSS; these briefings are tailored to your specific flight and are available 24 hours a day via 1.800.WX.BRIEF
* Performance Data
* Anti-Icing Systems
  + Flights through icing conditions should be avoided if possible. However, if flight in these conditions is necessary, make use of anti-icing and deicing systems to prevent the formation of ice on the pitot tubes, fuel vents, and propeller blades.
  + Deicer boots are provided to remove ice from the wing and tail leading edges.
  + Windshield anti-ice and defrosters are installed to alleviate conditions resulting from frost or light ice.
  + Flight in freezing rain, freezing drizzle, or mixed icing conditions may result in ice buildup on protected surfaces exceeding the capability of the ice protection system or may result in ice forming aft of protected surfaces. This ice may not shed using the ice protection systems and may seriously degrade the performance and controllability of the aircraft. If severe icing conditions are encountered, proceed as follows:
    - Immediately request priority handling from air traffic control to facilitate a route or an altitude change to exit the severe icing condition
    - Avoid abrupt or excessive maneuvering that may aggravate control difficulties.
    - Do not engage autopilot. If auto pilot is engaged, hold the controls firmly and disengage the autopilot
    - If an unusual roll response or uncommanded roll control movement is observed, reduce angle of attack.
    - Do not extend flaps during extended operation in icing conditions. Operations with the flaps extended can result in reduced wing angle of attack with the possibility of ice forming in the upper surface farther aft on the wing than normal, possibly end of protected area.
    - If flaps are extended, do not retract them until the aircraft is clear of ice.
  + Stalling Airspeeds
    - Ice accumulations will increase aircraft weight and change aerodynamic characteristics because of wing surface airflow changes. Airspeed should be held to a comfortable margin above the normal stall speed to avert a stall not preceded by warning alarms.
    - A minimum of 140 KIAS should be maintained to prevent or minimize ice accumulation on unprotected wing and empennage surfaces.
    - Continuous flight in severe icing conditions **shall** be avoided.
    - **NOTE**: Stall warning in the form of buffet will occur at higher airspeeds when the aircraft is weighted by ice accumulations, which also increase drag and distorts airflow over the wing and tail surfaces. The buffet warning zone will be narrower than in normal conditions – closer to the onset of stall. Govern approach and landing speed accordingly.
  + Engine Ice Vanes
    - The engine ice vanes **shall** be extended when the indicated OAT is 5°C (41°F) or below in visible moisture. Visible moisture includes clouds, ice crystals, snow, rain, sleet, hail, or any combination of these.
    - **WARN:** If ice formation on the intake screen progresses to a critical point, the engine my flame out.
    - **CAUT:** If the ice vanes are not deployed, the probability exists that moisture will collect on the intake screen and freeze or snow will melt and refreeze on the screen. When ice separates from the screen, the engine could sustain Foreign Object Damage (FOD).
    - **NOTE:**
      * The OAT may be up to 8°C less than indicated.
      * To avoid exceeding the oil temperature limitations, retract the engine ice vanes when operating in ambient temperatures above 15°C (59°F).
      * Ice vane deployment increases fuel consumption by approximately 15 percent.
      * With ice vanes extended, oil temperature may rise to limits with an accompanying drop in oil pressure and/or oil pressure fluctuations. If approaching temperature limits, reduce power or depart icing conditions.
  + Surface Deice
    - When activated, the deicer boots will dislodge ice accumulations from the leading edges of the wings and tail surfaces.
    - Before takeoff on flights in which icing conditions are expected, verify correct pressure reading on the pneumatic pressure gauge, activate both the SINGLE and MANUAL settings of the deice switch, and visually check the boots for inflation and hold down.
    - During icing conditions, monitor ice buildup on aircraft. When ice accumulation is ½ to 1 inch thick, activate the SINGLE mode of deice cycle switch to dislodge leading edge accumulation. Repeat as required.
    - **WARN**: Do not operate boots continuously. Continuous operation tends to balloon ice over the boots.
    - **CAUT**:Operation of the deicer boots in OAT of -40°F or less may crack the boots.
    - **NOTE:** Either engine will supply sufficient air for deice system operation. If the SINGLE mode of the deice cycle switch is ineffective, use the MANUAL mode.
  + Windshield Anti-Ice
    - Before flight into icing conditions, the PILOT and COPILOT WSHLD ANTI-ICE switches should be set at NORMAL position
    - **CAUT:** At low ambient OAT, whether icing conditions exists or not, moving the windshield anti-ice switch from OFF to HI may cause a crack in the windshield. If windshield heat is desired, place the switch first in the normal position for at least 2 minutes prior to selecting HI, if desired.
    - **NOTE:** Select NORMAL if actual or anticipated IOAT is at or below 5°C.
  + Propeller Deice
    - Before flight into icing conditions, the PROP heat switch should be set at AUTO position. This system functions automatically until switched OFF.
    - Propeller imbalance (because of ice loads) should be relieved by increasing propeller rpm briefly, then returning rpm to the desired setting. Repeat as necessary.
    - **CAUT:**
      * If the propeller ammeter reads above 18 amperes or below 14 amperes, refer to the ELECTROTHERMAL PROPELLER DEICE MALFUNCTION procedures in Chapter 14.
      * Propeller deice should not be operated when propellers are not turning. Static operation may damage brushes and slipring
  + Pitot Heat **shall** be used any time icing or visible moisture is encountered or anticipated
  + Fuel Vent Heat switches **shall** be ON before flight into icing conditions
  + Stall Warning heat switches **shall** be ON before flight into icing conditions.
  + Alternate Static Air Source
    - The alternate (emergency) static air source should be used for conditions where the normal static air source has been obstructed.
    - When the aircraft has bee exposed to moisture and/or icing conditions (especially on the ground), and the possibility of obstructed static ports exists, partial obstructions will result in the rate-of-climb indication being sluggish during a climb or descent.
    - Verification of obstruction is checked by switching to the ALTERNATE system and noting sudden sustained change in rate of indication. This may be accompanied by abnormal airspeed and altitude indication beyond normal calibration differences.
    - For airspeed calibration and altimeter corrections, refer to the respective correction charts in Part XI.
  + Wing Ice Lights
    - Used to illuminate the outboard wing leading edges.
    - The lights circuit is protected and controlled by a circuit breaker-type switch placarded ICE, located on the pilot inboard subpanel
    - **CAUT:** Prolonged use of the ice light during ground operations will generate enough heat to damage the light cover.
* Heat Rise
* Lost Communications
  + En Route
  + VMC vs. IMC
* Filing In Flight
* SSE En Route
* FMS En Route Navigation
* Wake Turbulence [AIM 7.3]
  + Every aircraft generates a wake while in flight. This disturbance is caused by a pair of counter-rotating vortices trailing from the wing tips.
  + The vortices of larger aircraft pose problems to encountering aircraft, for instance, the wake can impose rolling moments exceeding the roll-control authority of the encountering aircraft.
  + Vortex Generation
    - The pressure differential [above and below the wing] triggers the roll up of the airflow aft of the wing resulting in swirling air masses trailing downstream of the wing tips.
    - Most of the energy is within a few feet of the center of each vortex, but pilots should avoid a region within about 100 feet of the vortex core.
  + Vortex Strength
    - The strength of the vortex is governed by the weight, speed, and shape of the wing.
    - The vortex characteristics of any given aircraft can also be changed by extension of flaps or other wing configuring devices, as well as by change in airspeed.
    - However, as the basic facto is weight, the vortex strength increases proportionately.
    - The greatest vortex strength occurs when the generating aircraft is HEAVY, CLEAN, and SLOW.
  + Vortex Behavior
    - Vortices are generated from the moment aircraft leave the ground.
    - Vortex circulations is outward, upward around the wing tips when viewed from either ahead or behind the aircraft.
    - Vortices remain spaced a bit less than a wingspan apart, drifting with the wind, at altitudes greater than a wingspan from the ground.
    - Vortices of larger aircraft sink at a rate of several hundred feet per minute, slowing their descent and diminishing in strength with time and distance behind the generating aircraft.
    - When vortices of larger aircraft sink close to the ground, they tend to move laterally over the ground at a speed of 2 or 3 knots.
  + Vortex Avoidance
    - Landing behind a larger aircraft – same runway
      * Stay at or above the larger aircraft’s final approach flight path – note it’s touchdown point and land beyond it.
    - Landing behind a larger aircraft – when parallel runway is closer than 2,500 feet
      * Consider possible drift to your runway. Stay at or above the larger aircraft’s final approach flight path and note it’s touch down point.
    - Landing behind a larger aircraft – crossing runway
      * Cross above the larger aircraft’s flight path
    - Landing behind a departing larger aircraft – same runway
      * Note the larger aircraft’s rotation point – land well prior to rotation point
    - See AIM for other scenarios
* Arrival Transition
* Procedure Turn (Holding Technique)