* SSE Approach Configuration Procedures [FTI 4.11]
	+ At the normal configuration point lower the flaps to approach, set the props full forward, and hold the landing gear until as indicated below:
		- Precision : ½ dot below glide-slope at glide-slope intercept altitude.
		- Non-precision : In safe position to land
		- ASR w/o Recommended Altitudes: safe position to land.
		- ASR w/ Recommended Altitudes: 10 second gear warning
		- Radar Approach PAR : 10 second gear warning
	+ Note: When backing up a PAR with an ILS, you may notice that the ten second gear warning will be given about ½ dot below glide-slope.
* SSE Circling Approach [FTI 4.11]
	+ The approach should be flown as a SSE non-precision approach
	+ When circling during SSE operations, lower the gear when intercepting the appropriate VFR pattern checkpoint. The landing checklist must be complete no later than the 90° position.
	+ Airspeed may be reduced from 130 KIAS only when intercepting a segment of the VFR pattern.
	+ The circling maneuver, especially single-engine, can be one of the most demanding requirements of a pilot (depending on daylight, weather conditions, etc.); it is critical to maintain precise control of airspeed and altitude while visually aligning the aircraft to the landing runway.
	+ SSE Circling Missed Approach [FTI 4.11/NATOPS 15.2/AIM 5.4.21]
		- If upon reaching the MAP the airport environment is not in sight, execute the verbally issued climb-out instructions from the MAP.
		- If the circling maneuver has begun and the airport environment is visually lost, begin an initial climbing turn toward the landing runway to ensure the aircraft remains within the circling obstruction clearance area. Continue the turn until established on the climb out instructions.
		- The decision to wave off must be made as early s possible.
			* \*1. Power – Maximum Continuous. (PF)
			* \*2. Flaps – APPROACH (unless already UP). (PF)
				+ Note
				+ If flaps are full down, it is recommended they be raised in increments; set flaps to APPROACH, allow airspeed to increase to at least VYSE, and ensure a positive rate of climb is established. Single-engine wave off with full flaps will cause a 200 ft. loss in altitude.
				+ Ensure a positive rate of climb is established at the required airspeed. If maximum rate or maximum angle of climb is not required, allow the aircraft to accelerate to normal climb speed.
				+ Electric trim may not be adequate to relieve the high longitudinal control forces associated with the transition from landing attitude to climb attitude.
			* \*3. Gear – UP, once rate of descent has been stopped or there is no possibility of touch down. (PF)
			* \*4. Flaps – UP, minimum of VYSE. (PF)
		- Missed approach obstacle clearance is predicated on beginning the missed approach procedure at the Missed Approach Point (MAP) from MDA or DA and then climbing 200 feet/NM or greater.
		- Initiating the go-around after passing the published MAP may result in total loss of obstacle clearance. To compensate for the possibility of reduced obstacle clearance during a go-around, a pilot should apply procedures used in takeoff planning.
			* Refer to airport obstacle and departure data prior to initiating an instrument approach procedure.
* Emergency Voice Reports [FIH A.1]
	+ If under positive radar control (or in an environment that requires a specific squawk) maintain codes as previously set. In situations other than that, switch to Mode 3/A, code 7700
	+ Transmit the following message to any agency on the air-ground frequency in use at the time. If unable to establish communication, attempt contact on any emergency frequency (ex. 121.5/243.0/etc)
	+ Transmit as many of the following elements as necessary:
		- Distress, MAYDAY (3 times) or Urgency, PAN PAN (3 times)
		- Name of station addressed
		- Aircraft identification and type
		- Nature of distress or urgency
		- Weather
		- Pilot’s intention (bailout, ditch, crash, etc.)
		- Pilot’s request (fix, steer, escort, etc)
		- Present position & heading
		- Altitude or Flight Level
		- Fuel in hours and minutes
		- Numbers of persons (souls) on board
		- Any other information that might be helpful
	+ When in DISTRESS CONDITION with bailout, crash landing imminent, transmit the above information (time and circumstances permitting) plus:
		- ELT status
		- Landmarks
		- Aircraft Color
		- Emergency equipment available on board
	+ Set radio for continuous transmission for bailout and for crash landing or ditching (if risk of fire is not a consideration)
	+ DISTRESS – Call MAYDAY when you are threatened by serious and or imminent danger and require immediate assistance (ex. Ditching, crash landing or abandoning aircraft).
	+ URGENCY – Call PAN PAN when a condition concerning the safety of an aircraft or other vehicle, or of some person on board or within sight but does not require immediate assistance (ex. Lost, fuel shortage, partial engine failure, etc.)
	+ CANCELLATION – When an aircraft is no longer in distress, a cancellation message shall be immediately transmitted on the same frequency or frequencies used for the distress message.
* Partial Panel Approach [FTI 412.8]
	+ Trouble shoot and transfer the controls to the co-pilot if the system failure affects only the pilots instrument panel.
	+ Remain VMC and land as soon as practical if weather is not a problem and this is an option
	+ Secure all electrical equipment (Big Three) that may influence the wet compass if the malfunction is a heading problem
	+ If the heading indicator should fail, advise the radar controller and request a no-gyro radar approach.
	+ Perform turns during the transition to final by establishing an AOB on the attitude indicator that will approximate a SRT, not to exceed 30° of bank.
	+ If attitude information is also unavailable, a single needle width deflection of the pilot’s turn needle will indicate a SRT.
	+ On final, do not use more than a ½ SRT.
	+ Initiate turns immediately upon hearing the words “Turn Right” or “Turn Left”; likewise, stop turn on receipt of words “Stop Turn”. Acknowledge controller’s commands until advised not to.
	+ Big Four:
		- Windshield heat
		- Windshield wipers
		- Air Conditioning (Forward Vent Blower)
	+ Loss of attitude gyro (Verbiage)
		- *“I’ve lost my attitude system, on the standby gyro. How is yours?”*
		- *“Check circuit breakers and switch to the opposite inverter”*
		- *“Are we able to proceed VMC?”*
		- *“Secure the big three. Are you familiar with wet compass characteristics?”*
		- *“Call out cardinal headings and headings when requested to the nearest 5 degrees. You have the comms, declare an emergency. Get me [an appropriate instrument approach, such as a no-gyro PAR]”*
	+ SSE Full Stop
		- *“Once safely on deck, I will bring both power levers over the detent, reversing with the [left/right] engine, maintaining centerline with opposite rudder and aileron and forward yoke pressure. If rudder effectiveness is lost, I will bring both power levers toward flight idle.”*
* Needle Only VOR & TAC Approach Procedures [FTI 412.5]
	+ VOR
		- Can be flown using the needles on the RMI.
		- Remember the needle will always point to the station, the head of the needle will always “fall” and the tail of the needle will always “rise”.
		- Put another way, you always “push” the head of the needle to the desired course or “pull” the tail to the desired course.
	+ TACAN
		- Can be flown using the bearing pointer on the HIS
		- If you have to fly the TACAN approach without the CDI, you will have to mentally calculate the radial you’re on as there is no needle (just the pointer) in the aircraft
		- Inbound Course Intercept
			* When intercepting a course inbound, put the heading bug on the inbound course; the pointer will “fall” to the heading bug when on an intercept heading.
			* The intercept is completed by turning to put the pointer under the upper lubber line.
		- Outbound Course Intercept
			* When intercepting a course outbound, the heading bug is put on the reciprocal of the outbound course; again the pointer will “fall” to the heading bug when on an intercept heading.
			* Complete the intercept, in this case, by turning away from the pointer so it is on the lower line mark. Maintain course by keeping the pointer centered on the heading bug.
* Approach & Landing Minimums [FAR 91.175 / AIM 5.4.20]

Landing Minimums

* + - The rules applicable to landing minimums are contained in the FAR 91.175, however do not apply to US Military aircraft, for the majority.

Approach Minimums

* + - Final approach obstacle clearance is provided from the start of the final segment to the runway or missed approach point, whichever occurs last. Sidestep obstacle protection is provided by increasing the width of the final approach obstacle clearance
		- Circling approach protected areas are defined by the tangential connection of arcs drawn from each runway end. The arc radii distance differs by aircraft approach category.
		- Obstacle clearance is provided at the published minimums (MDA) for the pilot who makes a straight-in, side-steps, or circles. Once below the MDA the pilot must see and avoid obstacles.
		- Straight-In minimums are shown on the IAP when the final approach course is within 30° of the runway alignment (15° for GPS IAPs) and a normal descent can be made from the IFR altitude shown on the IAP to the runway surface.
		- Landing minimums for a side-step maneuver to the adjacent runway will normally be higher than the minimums to the primary runway
		- Approach minimums are published for different aircraft categories and consist of a minimum altitude (DA, DH, MDA) and required visibility.

Definitions

* + - Decision Altitude (DA) is a specified altitude in an instrument approach procedure at which the pilot must decide whether to initiate an immediate missed approach if the pilot does not see the required visual reference, or to continue the approach. Decision Altitude is expressed in feet above mean sea level.
		- Decision height (DH) is a specified height above the ground in an instrument approach procedure at which the pilot must decide whether to initiate an immediate missed approach if the pilot does not see the required visual reference, or to continue the approach. Decision height is expressed in feet above ground level.
		- Minimum Descent Altitude (MDA) is the lowest altitude specified in an instrument approach procedure, expressed in feet above mean sea level, to which descent is authorized on final approach or during circle-to-land maneuvering until the pilot sees the required visual reference for heliport or runway of intended landing.
* Flight Director Malfunctions
	+ If flight director malfunctions, disconnect, pull circuit breaker and do not use.
* Autopilot Malfunctions [NATOPS 14.16]
	+ The following conditions will cause the autopilot to disengage automatically:
		- Any interruption or failure of power
		- Vertical gyro failure
		- Vertical gyro fast erect
		- Compass ‘Increase-Decrease’ switch
		- Flight control system power or circuit breaker failure
		- Directional gyro failure
		- Torque limiter failure
	+ If an engine fails, disengage autopilot and re-trim aircraft; autopilot may be reengaged if desired.
	+ If autopilot is used in conjunction with an instrument approach, maintain 120 KIAS for single-engine approach speed until landing is assured.
* Autopilot Disconnect Procedures [NATOPS 14.16]
	+ The autopilot may be intentionally disengaged by any of the following methods:
		- AP/YD disconnect switch (either control wheel)
		- Push autopilot TEST button on controller panel
		- Actuation of GO-AROUND button (left power lever)
		- Pulling FLT DIR/AP POWER circuit breaker
		- Turning OFF BATT/GENS (gangbar) or AVIONICS MASTER switch
		- Turn off inverter
		- Activation of respective vertical gyro FAST ERECT button
		- Actuation of respective compass INCREASE-DECREASE switch
		- Actuate electric elevator trim
* IAF Procedures [FTI 409.4]
	+ A low altitude IAF is any fix that is labeled as an IAF or any PT/HILO PT fix.
	+ Before reaching the IAF, recheck the weather, review/brief the IAP, obtain clearance for the approach, and complete the Approach Checklist (ABCC: ATIS, Brief, Checklist, Clearance)
	+ Normally cross the IAF at 150 KIAS and maintain for the initial and intermediate segments of the approach, although 170 KIAS or other airspeeds may be flown for extended arcs/segments at pilot’s discretion or as directed by ATC.
	+ At the initial approach fix execute the 6 T’s:
		- **Time.** As Required
		- **Turn.** Turn to intercept course
		- **Time.** As Required
		- **Transition.** Reduce power to initiate descent
		- **Twist.** Set the inbound, teardrop, or front course
		- **Talk.** Refer to NATOPS callouts.
	+ Upon reaching the IAF, you have two choices, whether it is a PT or procedure track:
		- If your heading is within 90° of the procedural course, use normal lead points to intercept the course.
		- If your heading is NOT within 90° of the procedural course, overfly the IAF and turn in the shortest direction to intercept the procedural corse
		- **NOTE:** Do not ask for “maneuvering airspace” as this term is not found in the AIM and maneuvering for better alignment is not necessary. **PRIMARY LIED TO YOU!**
	+ Assuming you are cleared for the approach, do not descend until outbound/abeam and on a parallel or intercept heading the PT course.
		- Do not confuse abeam the PT course with abeam the NAVAID or IAF, this may not necessarily be needle through the wing tip.
* Procedure Track
	+ Arc/Radial Combination [Primary Instrument FTI]
		- Arcing is defined as flying at a constant distance from a TACAN or VOR/DME station by reference to DME
		- In practice you do not actually fly a “perfect arc”, but by varying AOB and heading, a close approximation of an arc can be achieved.
		- When turning onto an arc from a radial, the amount of lead should be 0.5% of the aircrafts groundspeed.
			* At 150 KIAS, this is approximately 0.8 NM
		- Turn to place the TACAN or VOR needle on the 90° benchmark
			* If DME is less than the desired arc distance, maintain heading. If excessively inside the arc, turn away from the NAVAID to place the head of the needle just below the 90° benchmark
			* If the DME is more than the desired arc distance, turn toward the NAVAID to place the head of he needle just above the 90° benchmark.
		- Turn off an arc onto a radial: (60/DME) x (5% Groundspeed)
	+ Teardrop
		- Per Advanced FTI:
			* The advantage of the teardrop is that pilots can proceed outbound using course guidance to achieve the proper offset from the PT course so that one continuous turn will establish you inbound
			* Rules of Thumb
				+ 30° teardrop for 1 minute outbound
				+ 20° teardrop for 2 minutes outbound
				+ 10° teardrop for 3 minutes outbound
		- Per Primary FTI
			* IAF 6 Ts
				+ **Time.** Note time
				+ **Turn.** In the shortest distance to parallel the outbound course
				+ **Time.** Start timing for three minutes outbound when wings level or abeam the station
				+ **Transition.** Airspeed, Altitude, Configuration
				+ **Twist.** Set the outbound course in the CDI and intercept
				+ **Talk.** Brief next segment
			* After 2 ½ minutes twist inbound course into CDI
			* At the three minutes (or timing as appropriate to remain within specified distance) turn to the inbound course and set an intercept.
			* When established inbound (half deflection on the CDI for VOR/TACAN approaches, 5 radials for NDB approaches) and 3 NM from FAF, configure and slow to 130 and continue the approach.
* 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.
* Airfield Diagrams
	+ See Instrument Approach Plate Legend
* 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
* Hazardous Weather
	+ Thunderstorms [API Weather Guide 4]
		- The basic requirements for thunderstorm formation are moisture, unstable air, and some type of lifting action which builds through the freezing layer.
		- The initial stage is always a cumulus cloud
		- The mature stage is reached when the raindrops and ice particles in the cloud have grown too large to be supported by the updrafts and begin to fall. Rain and/or hail falling from the cloud base indicates a downdraft has developed and the cell has entered the mature stages.
		- Thunderstorms begin to dissipate when the updrafts, which are necessary to produce condensation and the resulting release of heat, are no longer present.
		- Some of the following hazards accompany thunderstorms:
			* Extreme turbulence [See Below]
			* Hail
				+ Has been encountered as high as 45,000 feet in completely clear air and may be carried up to 30 miles downwind from the storm core.
			* Microbursts
				+ An intense, highly localized downward atmospheric flow with velocities of 2000 to over 6000 feet per minute.
				+ Downward flow diverges outward, producing wind velocities from 20-200 knots.
				+ More likely to occur in mid-afternoons during the summer months.
			* Severe Icing [See Below]
			* Lightning and Electrostatic Discharge (ESD)
				+ Occurs at all levels in a thunderstorm.
				+ Most lightning strikes occur when the aircraft are operating in one or more of the following conditions

Within 8°C of the freezing layer

Within approximately 5000 feet of the freezing level

In precipitation, including snow

In clouds

In some turbulence

* + - * + Lightning strikes have varied effects on aircraft and aircrews:

Interrupt electrical circuits (damaging systems, instruments, avionics, or radar)

Ignition of fuel or fuel vapors

Aircraft skin perforations

Temporary blindness

Induced error in magnetic compass

* + - * + The larger and faster the aircraft moves, the more particles it impacts, generating a greater static electricity charge on the airframe.

The release if static electricity is frequently called St. Elmo’s fire.

* + - * Tornadoes
				+ A violent, intense, rotating column of air that descends from cumulonimbus clouds in funnel-like or tube-like shapes.
				+ If the circulation does not reach the surface, it is called a funnel cloud.
				+ If it touches down over the water, it is called a water spout.
				+ Sometimes forming as far as 20 miles from the lightning and precipitations areas, the vortex is normally several hundred yards wide with wind speeds measured over 300 knots and moving at 30-40 knots.
	+ Turbulence [NATOPS 17.3, API Weather Guide 504]
		- Turbulence is any irregular or disturbed flow in the atmosphere producing gusts and/or eddies. Occurrences are local in extent and transient in character.
		- The different types of turbulence can be divided according to the causative factors:
			* Thermal
				+ Forms as a result of heating from below. Vertical convective currents resulting from surface heating or cold air moving over warmer ground cause thermal lifting (turbulence)
			* Mechanical
				+ Results from wind flowing over or around irregular terrain or man-made obstructions.
				+ When the air near the surface of the Earth flows over obstructions, the normal horizontal wind flow is disturbed and transformed into a complicated pattern of eddies and other irregular movements.
			* Frontal
				+ Caused by lifting of warm air, a frontal surface leading to instability, or the abrupt wind shift between the warm and cold air masses.
				+ Most severe cases of frontal turbulence are generally associated with fast-moving cold fronts.
			* Large-Scale Wind Shear
				+ Results from a relatively steep gradient in wind velocity or direction producing eddy currents that result in turbulence.
		- Turbulence in the absence of or outside of clouds in referred to as Clear Air Turbulence (CAT)
			* Normally occurs outside of clouds and usually at altitudes above 15,000 feet MSL, due to strong wind shears in the jet stream.
		- Even though flight into severe turbulence is to be avoided, turbulent air may be encountered under certain conditions.
		- During night or instrument flight conditions, it is not always possible to detect individual storm areas or find the in-between areas of low turbulence or calm conditions.
		- When areas of expected turbulence must be penetrated, be ready to counter rapid changes in attitude and to accept major indicated altitude variation.
		- Flight through turbulent area presents two basic airspeed problems:
			* If excessive airspeed is maintained, structural damage may be incurred.
			* If airspeed is too low, the aircraft may stall.
		- If turbulence encountered in cruise or descent become uncomfortable, reduce speed to turbulent air penetration speed (170 KIAS). This speed gives the best assurance of avoiding excessive stress loads, and at the same time provides margin against inadvertent stalls caused by gusts.
		- **WARN:**
			* Because of the comparatively light wing loading, airspeed control in severe turbulence and thunderstorms is critical
			* Since turbulence imposes heavy loads on the aircraft structure, make all necessary changes in aircraft attitude with the least amount of control pressures to avoid excessive loads on the aircraft structure.
		- Over-controlling in attempting to correct for changes in altitude by applying control pressure abruptly will build up g-forces rapidly and could cause damaging structural stress loads.
		- Watch particularly the angle of bank, making necessary turns as wide and shallow as possible. Be cautious in applying pressures to keep the aircraft level.
		- Maintain straight and level attitude in either up or down drafts.
		Use trim sparingly to avoid being mistrimmed as the vertical air columns change in velocity and direction.
	+ Icing [NATOPS 17.1, API Weather Guide 505]
		- Icing occurs because of super cooled water vapor such as fog, clouds, or rain. The most severe formation will generally occur at temperature of approximately 23 °F (-5 °C).
		- Types of Icing
			* Clear icing normally occurs at temperatures between 0 and -10°C, where water droplets are large because of unstable air, such as in cumulus clouds.
				+ These large water droplets move along with the airflow, freeze gradually, and form a solid layer of ice
			* Rime icing is rough, opaque, milky white in appearance and most likely to occur at temperatures of -10°C to-20°C.
				+ It is more dense and harder than frost, but lighter, softer, and less transparent than clear ice
				+ Occurs in stable conditions where water droplets are small and freeze instantly, such as stratiform clouds and upper cumulous.
			* Mixed icing is a combination of clear and rime ice, occurring normally at temperatures of -8°C to -15°C
				+ It’s the most frequent type of icing encountered and takes on characteristics of both clear and rime.
				+ Lumpy like rime ice, but also hard and dense like clear ice.
		- Effects of structural icing include
			* Increase in stall speed
			* Increase in drag &fuel consumption
			* Increase in weight
			* Decrease in lift
			* Decrease in thrust & range
		- Preflight
			* Remove frost or ice accumulations from aircraft surfaces by spraying with diluted anti-icing, deicing, and defrosting fluid.
			* Test fuel flow drains for free flow
			* Remove all covers and pre-heaters
		- Taxiing
			* If it is necessary to taxi on ice, snow, slush, or water, allow greater distance for braking action. Skidding may occur when sharp turns are made, or if an extremely strong crosswind condition exists. Taxiing in deep snow is difficult and may also cause freezing of brakes and gear after takeoff.
			* Avoid taxiing through melted snow or slush to prevent icing accumulation on the aircraft surfaces or propellers.
			* Use caution when taxiing in the vicinity of other aircraft. Increase the space between other aircraft to ensure a safe stopping distance. Jet or propeller blast can impair visibility by blowing clouds of dry snow over a large area.
		- In Flight
			* 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.
* 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 WeatherETA ± 1 hour | Alternate WeatherETA ± 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. |

* 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.
* Cross-country Oxygen Requirements [VT35INST 3710.1D (SOP) 203]
	+ When scheduled for an actual cross-country event, requirement is 1500 psi regardless of destination (this would apply to San Antonio, Houston, etc.)
* 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.
* 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
* Windshear [NATOPS 15.3]
	+ Any rapid change in wind direction or velocity. Severe windshear is defined as a rapid change in wind direction or velocity causing airspeed changes greater than 15 knots or vertical speed changes greater than 500 fpm. The best way to escape severe windshear is avoid it.
	+ Potential windshear notification sources include
		- Hourly Sequence Reports
		- Pilot Reports (PIREPS)
		- Severe Weather Watch Reports
		- Convective Activity
		- Low Level Windshear Alert Systems (LLWAS)
	+ Do not operate in areas of severe windshear
	+ Windshear indications include:
		- ±15 KIAS
		- ±500 fpm of vertical speed
		- ±5° of pitch attitude
		- ±1 dot glide-slope displacement (approach only)
		- Unusual throttle position or a significant period of time (approach only)
	+ A microburst is beyond the performance capability of transport category airplanes
	+ Do not land or takeoff when tower broadcasts words such as “Microburst Alert”, “Microburst”, “Shear of 30 Knots” or greater.
	+ Procedures:
		- \*Power – Maximum. (PF)
		- \*Propeller levers – Full forward. (PF)
		- \*Autopilot – DISENGAGE. (PF)
		- \*Pitch attitude/wings – Rotate toward 15°/gently roll wings level. (PF)
		- Configuration – Do not change. (PF)
	+ When clear of the windshear emergency event:
		- Waveoff Procedure (normal) – Execute. (PF)
	+ Do not stop or delay for analysis. Rotate smoothly at 3°/second until reaching 15° nose up. Stop rotation if stall warning sounds or stall buffet occurs.
	+ If ground contact is imminent, rotate past the 15° target attitude and increase pitch to the lower limit of the stall warning threshold. Use intermittent stall warning as the upper limit for the pitch attitude until terrain clearance is ensured. The warning provides 4 to 12 knots of stall protection.
	+ Do not change landing gear, flap or trim configuration until terrain clearance is ensured
	+ PM call out continuous radio altitude and altitude trend (ie. “Climbing … 200 Feet … Descending … 150 Feet …”)
	+ Advise ATC of any windshear encounter
* 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.