

Area of Operation **III** - Task **B**

Cross Country IFR Flight Planning

Content

1. Introduction
2. Regulation
3. IFR Cross Country
4. Notice to Air Missions
5. Filling a Flight Plan
6. IFR Control Sequence
7. Icing, De-Icing and Anti-Icing



Key References:

- Instrument Flying Handbook
- AIM
- 14 CFR Part 61, 91

1. Introduction

- **What:** Learn how to plan, file and fly an IFR flight plan
- **Why:** Every IFR flight require the pilot to file a flight plan, and comply with regulations/procedures associated to it
- **Key Differences of an IFR flight plan vs a VFR flight plan**
 - Filling a flight plan and receive ATC clearance are required [\[91.173\]](#)
 - There is regulation about picking Alternate airports (next slide)
 - Fuel Reserves requirements are different [\[91.167\]](#)
 - *Fly to the first airport of intended landings*
 - *If Alternate is required, fly from there to the Alternate*
 - *Then fly an additional 45min at cruise speed*
 - Flight Plan is automatically open when picking up clearance, and automatically closed by ATC at the end of the flight (or when IFR is cancelled) → Don't need to open/close with FSS
 - Route filled might not be the route flown (ATC will give you one)



2. Regulation

- **Pre-Flight Actions [91.103] → NW KRAFT**

- **N** – NOTAMs
- **W** – Weather report and forecasts
- **K** – Known Traffic/ATC delays
- **R** – Runway lengths of intended use
- **A** – Alternate airports available
- **F** – Fuel requirements (91.167)
- **T** – Takeoff/Landing performance data

- **When to File an Alternate [91.169] →**

- **Altitudes**

- IFR Cruising Altitudes [91.179] →
- IFR Minimum Altitudes [91.177]

- ✓ *If applicable min prescribed on Part 95 (MEA or MOCA) and Part 97 (Approach/TO), must comply with it*
- ✓ *Otherwise: 1000ft above the highest obstacle (2000ft if mountainous terrain) within a horizontal distance of 4nm from the course*

Filing Alternate [§91.169]

ALTERNATE IS REQUIRED WHEN: **(0-1-2-3 Rule)**

- **0** – Destination airport doesn't have an IAP, or...
- **1** – Within ±1h from ETA, the destination airport has...
- **2** – Ceiling lower than 2,000ft AGL, or...
- **3** – Visibility lower than 3sm

CONDITIONS FOR AN AIRPORT TO BE ELIGIBLE AS ALTERNATE

- Precision approach → Min 600ft ceiling and 2sm visibility at ETA
- Non-precision approach → Min 800ft ceiling and 2sm visibility ETA
- Airport with no IAP → Ceiling/Visibility at VFR conditions from MEA to landing
- NOTE: if approach has a **A** then the above is not applicable and Alternate Minimums must be used (see Arrival → Alternate Minimums in Foreflight)

OTHER CONSIDERATIONS [AIM 1-2-3(d) and 1-1-18(c9)]

- Non-WAAS GPS (TSO 129/196): a GPS approach can be flight-planned at either the destination or alternate, but not both
- WAAS GPS (TSO 145/146): no restrictions, can use GPS approaches for flight planning at both the destination and alternate.

IFR Cruising Altitudes [§91.179]

- In controlled airspace: maintain the altitude or flight level assigned by ATC
- In uncontrolled airspace, except while in holding of 2min or less, or turning:

0° → 179° [N/E]:
Odd (5000ft, 7000ft, FL190, FL210)

180° → 359° [S/W]:
Even (4000ft, 6000ft, FL180, FL200)

If FL290 or above an RSVM (Reduced Vertical Separation Minimum), then separation remains 2000ft interval. If Non-RSVM, separation of 4000ft intervals
NOTE: All courses magnetic

2. Regulation

- **Takeoff and Landing IFR [91.175]** →
- **Operations in Class A [91.135]**
 - Must be conducted under IFR, Aircraft IFR Equip, ATC clearance received prior to entering
- **Operations in Class B [AIM 3-2-3(b)(5)]**
 - VOR or TACAN receiver, or RNAV system is required

IFR Takeoff Minimums [§91.175]

- Follow minimums prescribed by the airport (if it has a  in the approach plate)
- If airport doesn't have minimums:
 - No minimums if Part 91
 - Airplane w/ 1-2 engines → 1 sm visibility (Part 121, 125, 129, 135)
 - Airplane w/ >2 engines → ½ sm visibility (Part 121, 125, 129, 135)
- **Example:**  (KELN) Rwy 29, 4600-3 or std. w/min. climb of 320' per NM to 7800
Mean min of 4600ft ceiling and 3sm visibility (if standard departure profile), OR
std takeoff min (e.g. 0ft / 0sm for Part 91) if climbing ≥320ft/nm to 7800ft MSL

• **GPS Equipment [AIM 1-1-18(c), AIM 1-1-17(b2a2), AIM 1-1-3(f3b2)]**

- Must be installed in accordance with AC 20-138
- TSO 129/196:
 - ✓ Can fly RNAV(GPS) approaches to LNAV minima (LNAV/VNAV with baro-aided systems).
 - ✓ Needs to confirm RAIM availability as part of pre-flight.
 - ✓ Under IFR, must be equipped with an alternate means of navigation (if lose RAIM, must revert to VOR navigation)
- TSO 145/146 (WAAS):
 - ✓ Can fly the approaches above, plus LPV, LP, and LNAV/VNAV minima w/o baro-aided system.
 - ✓ RAIM is not required, so RAIM prediction is also not required (unless if lose WAAS signal).
 - ✓ WAAS users flying under Part 91 are not required to carry VOR avionics for IFR/GPS operations

RAIM (Receiver Autonomous Integrity Monitoring) [AIM 1-1-17(a3)]

- Required in order to ensure satellite signals meet integrity requirements
- Need at least 5 satellites for RAIM (6, or 5 + baro aid, for fault exclusion)

2. Regulation

- **Course to be Flow** [91.181]
 - On ATS Routes: fly along the centerline of the airway
 - On other routes: fly the direct course between navaids or fixes
- **Reporting Points** [AIM 5-3-3]

Mandatory IFR Reporting Points [AIM 5-3-3]

MARVELOUS VFR C500

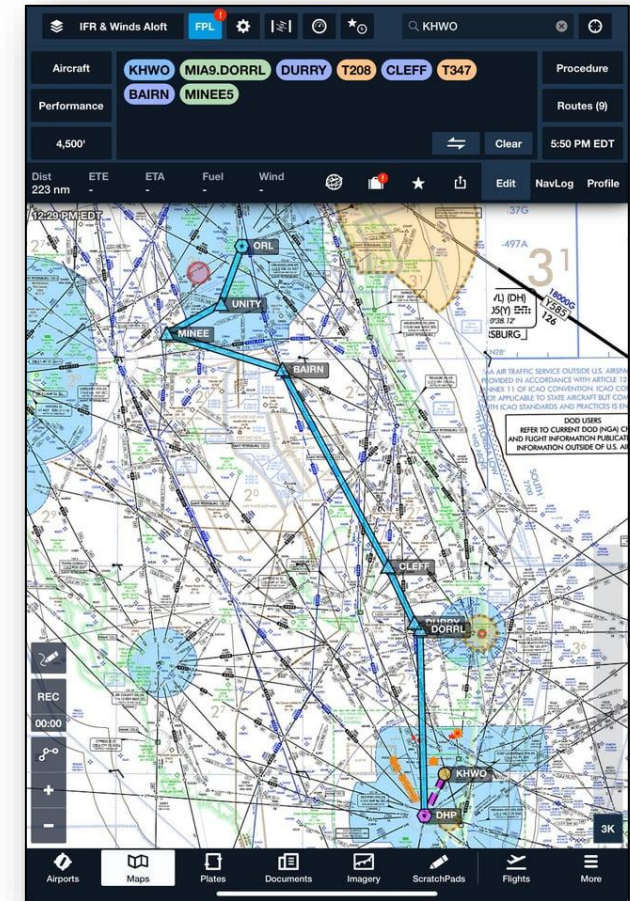
- **M** – Missed approach
- **A** – Airspeed change of 10kts or 5% of filed TAS (whichever is greater)
- **R** – Reaching a holding fix (report time and altitude)
- **V** – VFR on top when changing altitudes
- **E** – ETA changed by more than 2min (or 3min in North Atlantic) ★
- **L** – Leaving a holding fix
- **O** – Outer marker or fix (precision approach) ★
- **U** – Unforecasted weather [§91.183]
- **S** – Safety related [§91.183]
- **V** – Vacating an altitude or flight level
- **F** – Final approach fix (non-precision approach) ★
- **R** – Radio/Nav equipment failure [§91.187]
- **C** – Compulsory points (▲) [§91.183] or any fix if not in airways [AIM 5-3-2(c2)] ★
- **500** – Unable to descent/climb at least 500fpm
- **NOTE:** In non-radar environment, pilot must report Call Sign → Position → Time → Altitude → Name + ETA of next reporting fix → Name of the fix after that

Non-radar only



3. IFR Cross-Country

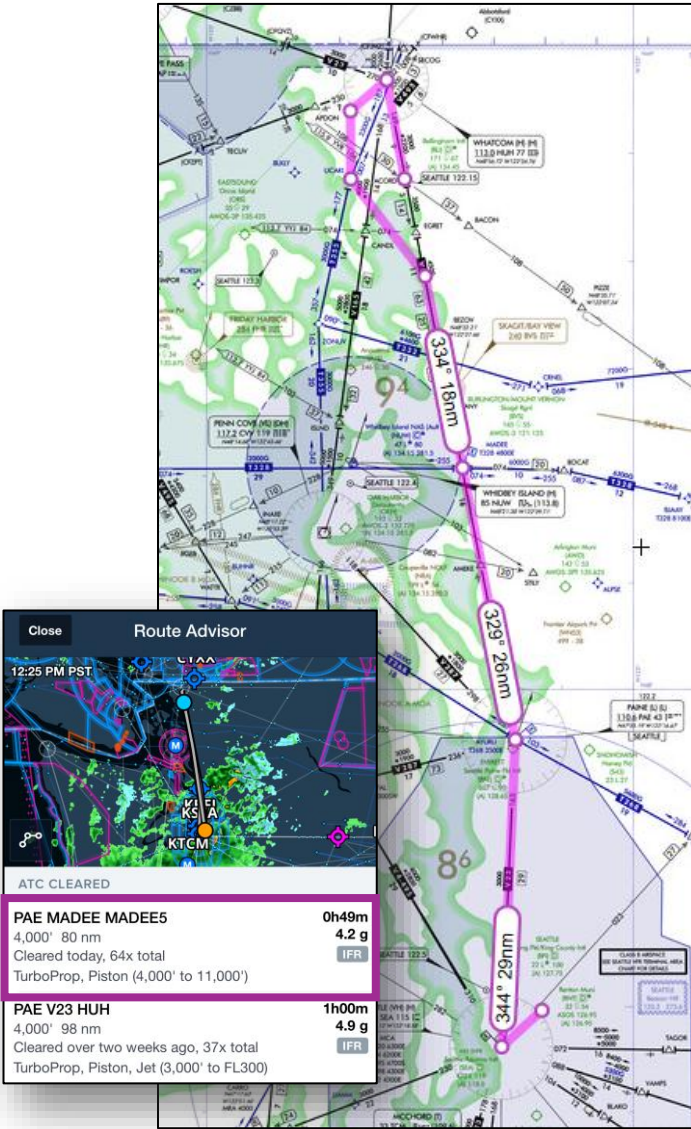
- **STEP 1 →** Check the airport, runways and procedures you want to use
 - Calculate Runway required (takeoff/landing distances)
 - Verify IAPs available and any NOTAMs (+Airport NOTAMs)
 - Verify basic data: TPA, Pattern, Lights, Frequencies, etc
- **STEP 2 →** Select route, checkpoints and altitudes
 - Departure Procedure
 - Preferred IFR Routes, Often/Recent cleared routes, Airways, Direct, TEC, etc
 - Enroute Fixes for each leg + STARs, IAPs, IAFs
 - *Consider terrain, distances, aircraft performance, weather and risk mgnt*
- **STEP 3 →** Identify Alternates and check airport data
- **STEP 4 →** Populate **NAVLOG** (+wind data)
 - Calculate **ETE**, **ETA** and **Fuel Required** with IFR reserves
- **STEP 5 →** Calculate **W&B**
- **STEP 6 →** **Weather briefing** (clouds, winds, icing, metar, turbulence, airmet/sigmet), **NOTAMs**, **ATC delays** → **GO or NO-GO Decision**
- **STEP 7 →** File Flight Plan



3. IFR Cross-Country | KRNT-KBLI

STAR
IAP

IFR NAVLOG																				
Aircraft Number	N91FF		Fuel	53	Fuel left (@10GPH):	3.5h	Mag. Variation	-16	Origin/Destination	KRNT (Renton) / KBLI (Bellingham)										
This is a RNAV route, tracking a STAR (MADEE5) which also flies over V23																				
Route ==> KRNT SEA PAE MADEE MADEE5 KBLI																				
Expect STAR ==> Join MADEE5 at MADEE (lateral clearance, maintain 6000') --> Descend via MADEE5 before GERRD --> Expect Vectors after YAANO																				
NAVLOG for DEPARTING 16 - LANDING 16																				
Check Points (Fixes)	Nav	Other Info	MC	Altitude (feet)	Wind		TAS	WCA Mag.	MH	Dist.	GS	GPH	Time	Fuel Taxi	ATIS/METAR (Current)					
	VOR Freq				Dir. True	Vel.				Leg	Est.				Departure	Time Taken	17:53Z	Destination		
	or Procedure				Dir. Mag	Temp				Rem.			ETE	Fuel	KRNT	Airport Code				
KRNT	RENTN3		212	3,000			74	4	216			17		3.0		VFR	ATIS	VFR		
	(Departure)				263	10				124	Act.		0:04	1.1	OVC 3200', 10SM	Ceiling/Vis	SCT 8500', 10SM			
SEA	SEA (116.8)	MEA (V23): 3000	347	6,000	247	13	74	-8	339	120		15		48.9	180 @ 11 G 17	Wind	190 @ 14 G 23			
	Direct To				263	10				110	0:08		2.0	30.10	Altimeter	30.07				
<TOC>			347	6,000	247	13	74	-8	339			15		46.9	21 / 13	Temp/Dew Point	19 / 14			
					259	11				19	102		0:11	1.7	16	Rwy (*RP)	16*			
PAE	PAE (110.6)	MEA (V23): 4500	347	6,000	243	6	100	-6	341	91		9		45.2	TAF (at Departure / at Arrival) - Closest Station					
	Direct To				257	11				26	100		0:16	2.3	KBFI (closest)	Station	KBLI			
MADEE (Exp join the STAR)	MADEE4		333	6,000	241	6	100	-6	327	65		9		42.8	BKN 5000', 6SM+	Ceiling/Vis	OVC 9000', 6SM+			
	(Lateral course)				264	12				18	98		0:11	1.6	170 @ 10	Wind	180 @ 11 G 20			
GERRD (Exp descend via STAR)	MADEE4	Cross between	333	5,000	248	6	100	-7	326	47		9		41.2	16	Rwy (*RP)	16*			
	(Descend Via)	5000' - 7000'			267	15				11	91		0:07	1.1	Airport Information					
UCAKI	MADEE4	At or above	307	4,000	251	9	100	-7	300	36		9		40.1	1000ft	TPA	1200ft			
	(Descend Via)	4000'			270	16				6	99		0:04	0.5	32ft	Field Elev.	171ft			
YAANO	MADEE4	At or above	344	2,000	254	14	100	-9	335	30		9		39.6	5382ft	TODA / LDA	6700ft			
	(Descend Via)	2000'			270	16				8	110		0:04	0.7	1700ft MAX	Take off / Landing Dist	1450ft MAX			
SECOG (IAF)	Direct To	At or above	25	2,000	254	14	100	-7	18	22		9		38.9	Airport Frequencies					
	(**)	2000'			274	17				22	100		0:13	2.0	126.95	ATIS/AWOS	134.45			
KBLI	RNAV (GPS) Y RYW 16		164	0	258	14	100	10	174	0		9		36.9	121.6	Ground	127.4			
														124.7	Tower/CTAF	124.9				
(**) Assumes "Direct To" and PROCEDURE TURN. If no PT, then reduce distance by 10nm, time -6min			Totals »										124		1:18	16.1	119.2	Dep/App	132.7	
																	122.5	FSS	122.2	
KBVS (Alternate)			151	5,000	270	6	100	3	154	20	101	12	0:12	2.4	<== Fuel Remaining after Alternate					
					254	6							34.5	<== Fuel Used after Alternate						
			Totals w/ Alternate »										144		1:30	18.5				



Note: Technically not flying V23 (not filling it), but if I had planned for KRNT-SEA-V23-ACORD-KBLI, fuel required would be less but ATC could still had me fly MADEE5 (actual fuel req higher)

NW-1, 31 OCT 2024 to 28 NOV 2024

NW-1, 31 JUL 2024 10 28 NOV 2024

NW-1. 31 OCT 2024 to 28 NOV 2024

4. Notice to Air Missions (NOTAM)

What → Information not known sufficiently in advance to publicize by other means [\[AIM 5-1-3\(g\)\]](#)

NOTAM (D):

- Contain information concerning the establishment, condition, or change of any:
 - Aeronautical facility
 - Airspace
 - Visual & Radio navaid
 - Communications and Services
 - Hazards
 - Pointer NOTAMs

FDC NOTAMs

- Regulatory information
 - Amendments to published IAPs and Chart
 - TFRs
 - ADS-B/GPS availability
 - Special Notices

International NOTAMs:

- Published in ICAO format and distributed to multiple countries
- Often an international NOTAM issued by the US will be linked to a domestic NOTAM

Military NOTAMs:

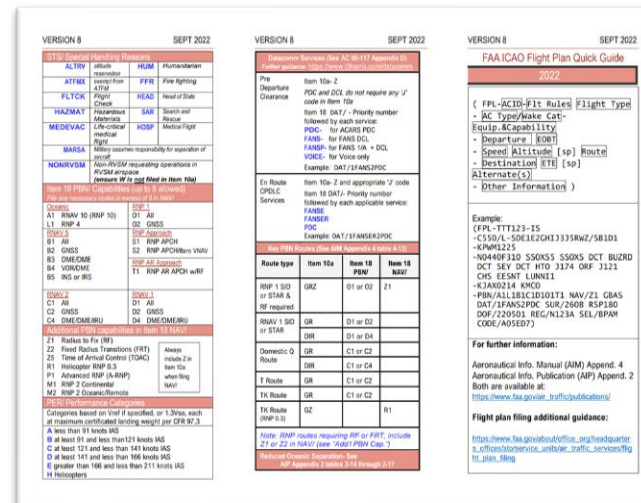
- Military or joint use navigational aids/airports

5. Filling a Flight Plan

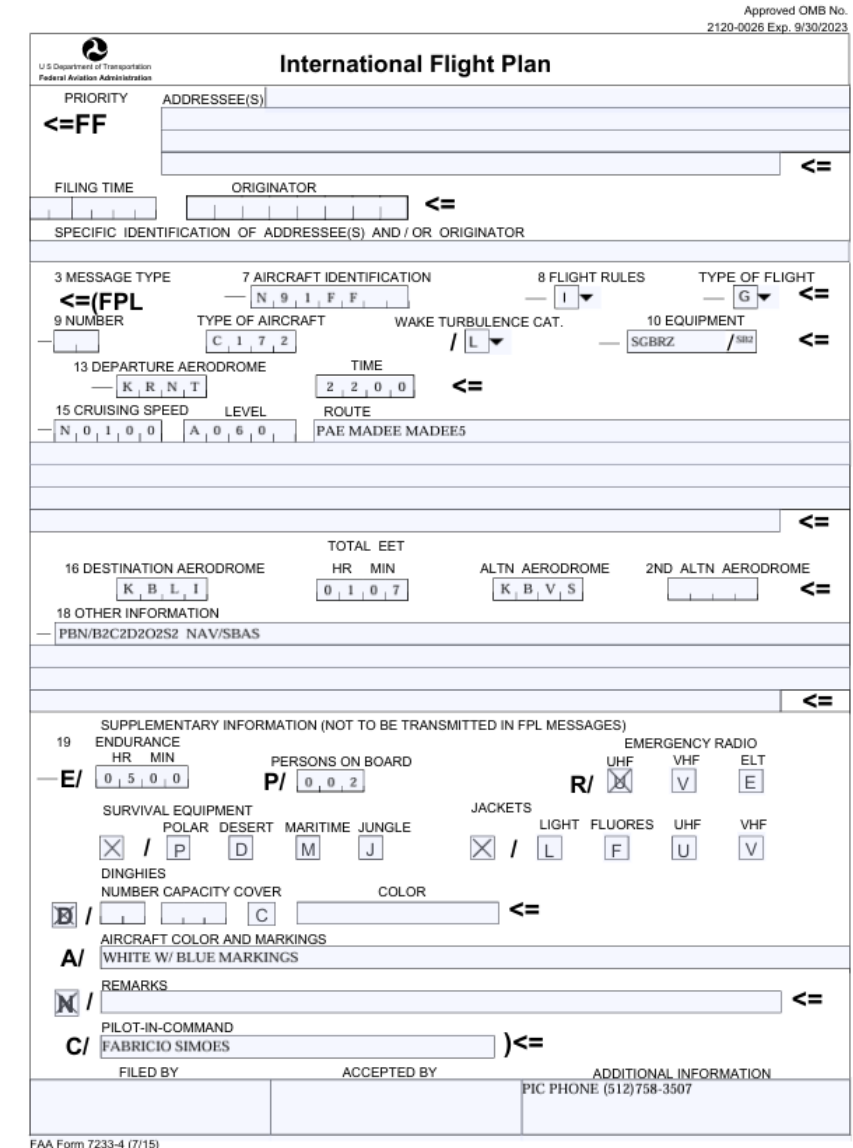
- Flight plans are filled by calling FSS on the radio, 1-800-WX-BRIEF on the phone, or online services such as Leidos, Foreflight, etc
 - ✓ When filling via Leidos (or Foreflight), get Weather Briefing and Notam
- IFR Flight Plans stay in the system for 2h after ETD
- Pilot can cancel IFR anytime (as long as in VFR conditions and not in Class A)
 - ✓ Flight Following can be requested
- IFR Flight Plans are closed by Tower automatically upon landing
 - ✓ Landing at Non-Towered: Pilot resp. for cancelling IFR or closing with FSS
 - ✓ Search & Rescue starts 30min after ETA if not closed (non-towered airp)

- 91.173: ATC Clearance & Flight Plan Required
- AIM 5-1-6: IFR Flight Plan Information
- AIM Appendix 4. International Flight Plan:
Breaks down flight plan information requirements

ICAO Codes
FAA FPL Quick Reference Brochure.pdf



The image shows three versions of the FAA ICAO Flight Plan Quick Guide (2022). The first version shows the 'Special Handling' section with codes for various aircraft types and equipment. The second version shows the 'Pre-Departure' section with codes for various aircraft types and equipment. The third version shows the 'Route/Altitude' section with codes for various aircraft types and equipment.



The image shows the FAA Form 7233-4 (7/15) International Flight Plan form. The form is divided into several sections: 1. General Information (Priority, Addressee, Filing Time, Originator), 2. Aircraft Identification (Aircraft Type, Wake Turbulence, 10 Equipment), 3. Flight Rules (Type of Flight, 13 Departure Aerodrome, 15 Cruising Speed, Level, Route), 4. Destination (16 Destination Aerodrome, 18 Other Information), 5. Supplementary Information (19 Endurance, Persons on Board, Emergency Radio, Survival Equipment, Dinghies, Aircraft Color and Markings, Remarks, Pilot-in-Command, Filed By, Accepted By, Additional Information).

5. ICAO Codes

Example of an airplane equipped with a **GNC 255** (VOR/ILS Receiver), **GNX 375** (WAAS GPS Navigator) and **coupled Auto-Pilot**

Always consult the AFMS of your equipment to know your ICAO codes

ICAO Group	Code	Description
Equipment (10a)	BGRSZ	B – LPV (SBAS) G – GNSS R – PBN Approved (see ICAO PBN) S – Standard (VOR/ILS) Z – Other information entered
Surveillance (10b)	EB2	B2 – ADSB 1090 OUT+IN E – Mode S transponder, Altitude, ID and Squitter)
PBN (18)	B2C2D2O2S2	B2 – RNAV 5 (GNSS) C2 – RNAV 2 (GNSS) → Q/T Routes D2 – RNAV 1 (GNSS) → Dept, Arrival, Appr until FAF O2 – RNP 1 (GNSS) → Similar to D2, w/ Radius to Fix S2 – RNP Approach, LNAV/VNAV Minima (Baro)
Other (18)	<as needed>	NAV/ SBAS SUR/ 280B <i>(this is for 1090 ADS-B out; if UAT then 282B)</i> CODE/ <enter your code here, look up FAA Registry>

Oceanic such as A1 (RNAV 10) and L1 (RNP 4) requires dual GNSS. If airplane has only 1, then it is usually not capable

Note: some airplane have **1090ES OUT** and **1090/UAT (978) IN**. This allows to capture FIS-B and the ES allows operations above 18,000ft and outside of the US

Item 10b (Surveillance)	
N	No capabilities- include no other entries if filed
Transponder (include no more than one)	
A	Mode A (no Mode C)
C	Modes A and C
S	Mode S- ACID and Altitude
P	Mode S- Altitude, no ACID
I	Mode S- ACID, no Altitude
X	Mode S- no ACID, no Altitude
E	Mode S- ACID, Altitude, Extended Squitter
H	Mode S- ACID, Altitude, Enhanced Surveillance
L	Mode S- ACID, Altitude, Enhanced Surveillance, Extended Squitter

Item 18 PBN/ Capabilities (up to 8 allowed) File any necessary codes in excess of 8 in NAV/	
<u>Oceanic</u>	<u>RNP 1</u>
A1 RNAV 10 (RNP 10)	O1 All
L1 RNP 4	O2 GNSS
<u>RNAV 5</u>	<u>RNP Approach</u>
B1 All	S1 RNP APCH
B2 GNSS	S2 RNP APCH/Baro VNAV
B3 DME/DME	<u>RNP AR Approach</u>
B4 VOR/DME	T1 RNP AR APCH w/RF
B5 INS or IRS	
<u>RNAV 2</u>	<u>RNAV 1</u>
C1 All	D1 All
C2 GNSS	D2 GNSS
C4 DME/DME/IRU	D4 DME/DME/IRU

ADS-B (include up to three)	
- Include aircraft address in Item 18 Code/ - When compliant with 14 CFR 91.227 and AC 20-165, also include in Item 18 SUR/ :	
	260B (for 1090 MHz)
	282B (for UAT)
B1	1090 MHz "out"
B2	1090 MHz "out" and "in"
U1	UAT "out"
U2	UAT "out" and "in"
V1	VDL Mode 4 "out"
V2	VDL Mode 4 "out" and "in"



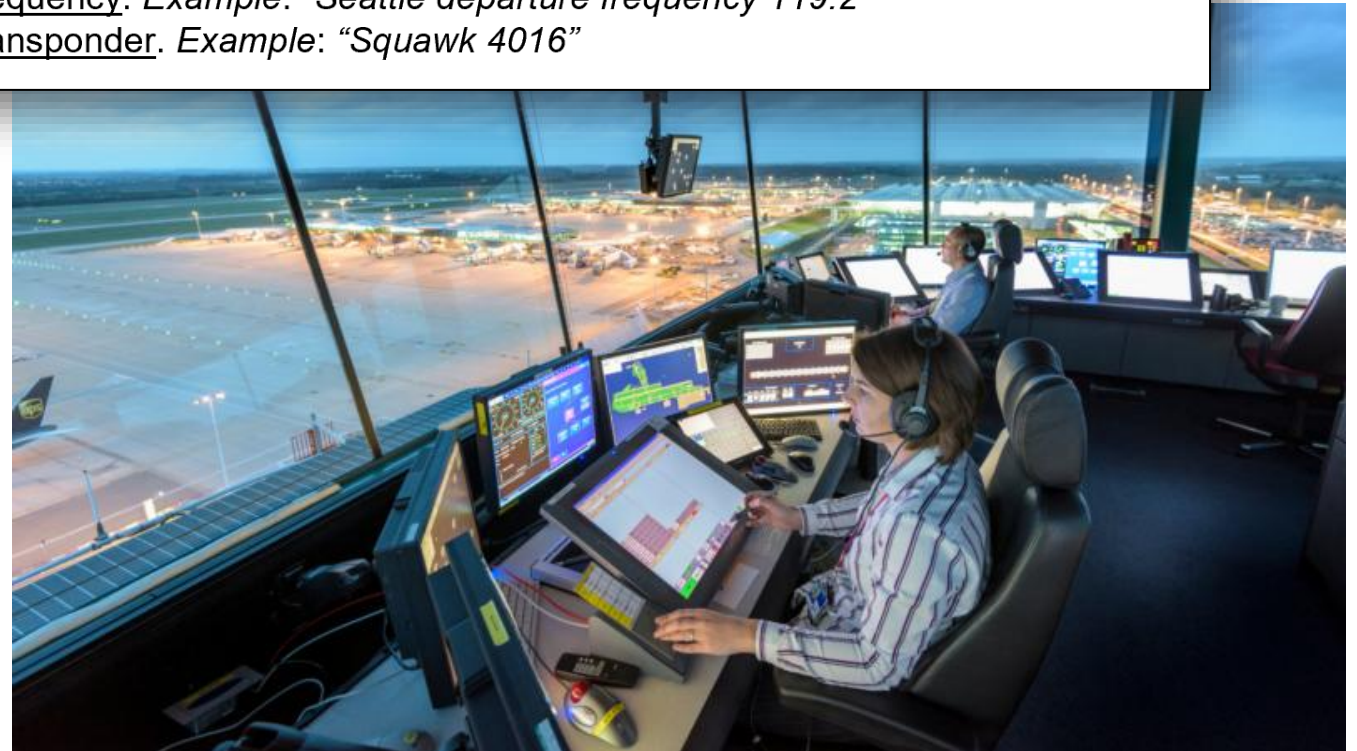
6. IFR Control Sequence

- FSS
- *ATIS*
- Clearance Delivery →
- Ground Control
- Tower
- Departure Control
- Air Route Traffic Control Centers
- Approach Control
- *ATIS*
- Tower
- Ground Control

Departure Clearance

CRAFT

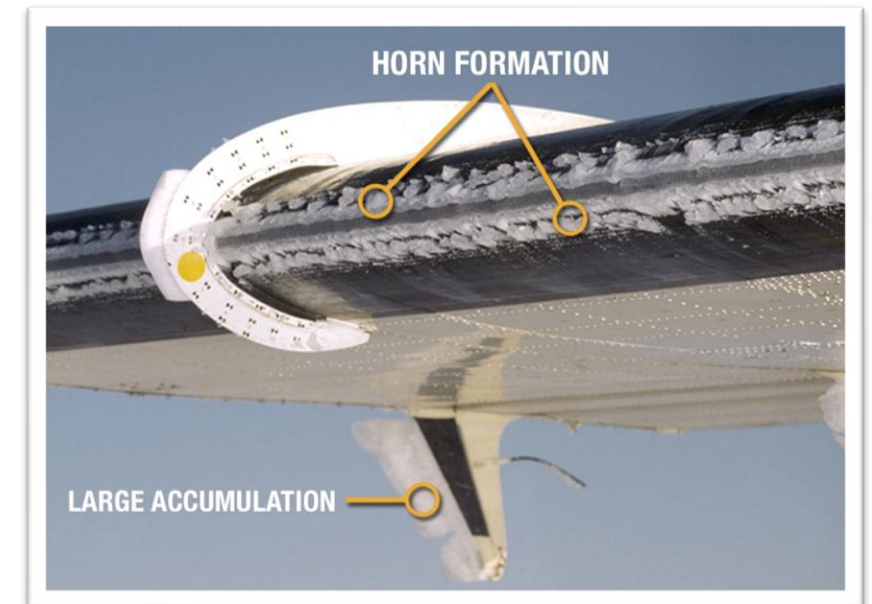
- **C** – Clearance limit (typically the destination airport). Ex: “Clear to Skagit airport”
- **R** – Route (usually “as file” or via a given DP). Ex: “via RENTN3, then as filed”
- **A** – Altitude. Example: “Climb via the SID, Expect 4,000’ 5min after departure”
- **F** – Frequency. Example: “Seattle departure frequency 119.2”
- **T** – Transponder. Example: “Squawk 4016”



7. Icing, De-Icing and Anti-Icing

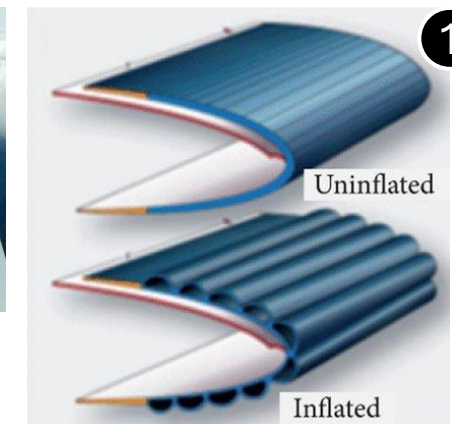
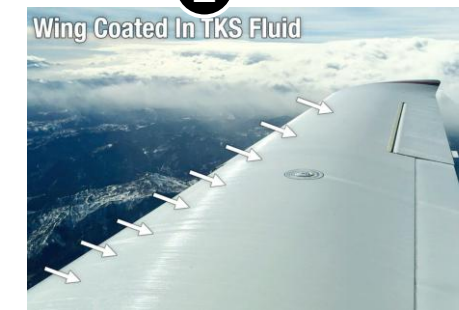
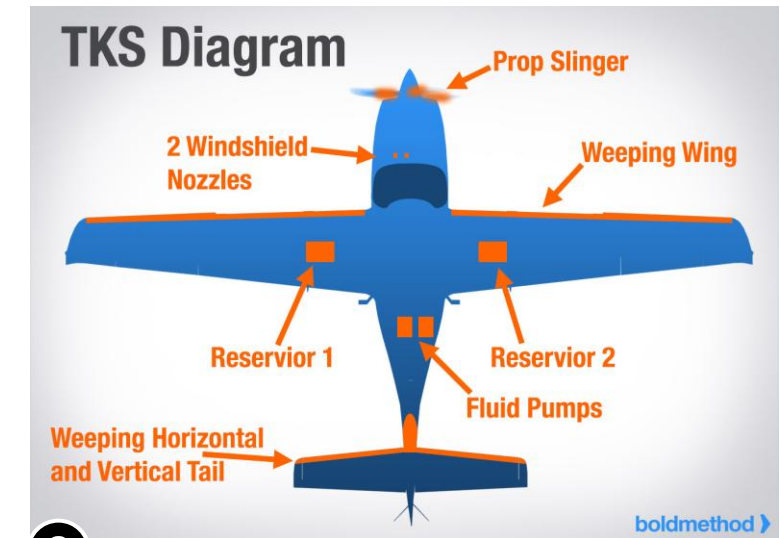
Icing

- Causes Induction icing (blocked air intake), Carburetor icing (type of induction icing, possible from 10°F to 100°F), instrument icing (pitot-static) and structural icing (*temperature <0°C and visible moisture*).
- Types of structural icing:
 - Clear**: large supercooled droplets (cumuliform clouds or freezing rain) spreads out, freeze slowly. Heavy, forms horns. (0°C to -10°C)
 - Rime**: most common. Freezes instantaneously (trap air inside). Typically from stratus clouds. Lighter than clear ice. (-10°C to -20°C)
 - Mixed**: characteristics of both above. Harder to remove. (-10°C to -15°C)
 - Frost**: surface below dewpoint, and dewpoint below freezing
- Intensity of Ice
 - Trace**: usually not hazardous even if de-icing/anti-icing is not used
 - Light**: occasional use of de/anti-icing removes/prevents accumulation
 - Moderate**: even short encounters become potentially hazardous
Action → *use of de-icing/anti-icing required, and/or flight diversion*
 - Severe**: de-icing/anti-icing not enough to reduce the hazard → *Divert immediately*



7. Icing, De-Icing and Anti-Icing

- **Anti-ice** prevents ice, **De-ice** removes ice
- **Airfoil**
 - ① **Deice Boots** → Inflatable rubber boots bonded to the leading edge of the wing
 - **Thermal Anti-Ice** → Hot air from the engine compressor
 - **Weeping Wing** → Antifreeze weeps through small holes in the leading edge
- **Windscreen and Propeller**
 - **Alcohol** – Used to prevent ice build up on windscreen / propeller
 - **Electric Heat** – Wires imbedded in the windscreen / propeller anti-ice
- **TKS System** (Tecalemit-Kilfrost-Sheepbridge Stokes)
 - ② “Weeping wing”, but a system that covers way more than the wing
- **C172S**
 - Flying into **known icing condition is prohibited** in the C172 by the POH
 - C172 does not have deicing, only **minimal anti-icing**
 - **Pitot heat** → electrical heating element. Must be on if OAT <40°F (4.4°C)
 - **Windshield defrost** → heated air routed to the top of the panel



Questions?

