Area of Operation III - Task B

Cross Country IFR Flight Planning

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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 <u>Alternate</u> airports (next slide)
- Fuel Reserves requirements are different [91.167]
 - o Fly to the first airport of intended landings
 - o If Alternate is required, fly from there to the Alternate
 - o Then fly an additional 45min at cruise speed
- Flight Plan is automatically open when picking up clearance, and <u>automatically closed by ATC</u> at the end of the flight (or when IFR is cancelled) → <u>Don't need to open/close with FSS</u>
- Route filled might not be the route flown (ATC will give you one)



2. Regulation

 Pre-Flight Actions [91.103] → <u>NW KRAFT</u> 	Filing Alternate [§91.169]
○ N – NOTAMs	• 0 – Destination airport doesn't have an IAP, or
 W – Weather report and forecasts 	 1 – Within ±1h from ETA, the destination airport has 2 – Ceiling lower than 2,000ft AGL, or
 K – Known Traffic/ATC delays 	• $3 - VISIDILITY IOWER THAN 3SM$
 R – Runway lengths of intended use 	• <u>Precision approach</u> \rightarrow Min 600ft ceiling and 2sm visibility at ETA • Non-precision approach \rightarrow Min 800ft ceiling and 2sm visibility ETA
 A – Alternate airports available 	• <u>Airport with no IAP</u> \rightarrow Ceiling/Visibility at VFR conditions from MEA to landing • NOTE: if approach has a \wedge then the above is not applicable and Alternate
 F – Fuel requirements (91.167) 	Minimums must be used (see <u>Arrival</u> \rightarrow <u>Alternate Minimums</u> in Foreflight)
 T – Takeoff/Landing performance data 	OTHER CONSIDERATIONS [AIM 1-2-3(d) and 1-1-18(c9)] <u>Non-WAAS GPS</u> (TSO 129/196): a GPS approach can be flight-planned at either
 When to File an Alternate [91.169] 	 the destination or alternate, <u>but not both</u> <u>WAAS GPS</u> (TSO 145/146): no restrictions, can use GPS approaches for flight planning at both the destination and alternate.
• Altitudes	
 ○ IFR Cruising Altitudes [91.179] 	IFR Cruising Altitudes [§91.179]
 IFR Minimum Altitudes [91.177] 	 In <u>controlled airspace</u>: maintain the altitude or flight level assigned by ATC In <u>uncontrolled airspace</u>, except while in holding of 2min or less, or turning:
 ✓ If applicable min prescribed on Part 95 (MEA or MOCA) and Part 97 (Approach/TO), must comply with it 	0° → 179° [N/E]: Odd (5000ft, 7000ft, FL190, FL210) Even (4000ft, 6000ft, FL180, FL200)
 ✓ Otherwise: <u>1000ft</u> above the highest obstacle (<u>2000ft if mountainous terrain</u>) within a horizontal distance of <u>4nm from the course</u> 	If FL290 or above an RSVM (Reduced Vertical Separation Minimum), then separation remains 2000ft interval. <u>If Non-RSVM, separation of 4000ft intervals</u> NOTE: All courses magnetic

2. Regulation

- IFR Takeoff Minimums [§91.175] Takeoff and Landing IFR [91.175] Follow minimums prescribed by the airport (if it has a \mathbf{V} in the approach plate) If airport doesn't have minimums: **Operations in Class A** [91.135] - No minimums if Part 91 - Airplane w/ 1-2 engines \rightarrow 1 sm visibility (Part 121, 125, 129, 135) Must be conducted under IFR, Aircraft IFR Equip, Ο - Airplane w/ >2 engines $\rightarrow \frac{1}{2}$ sm visibility (Part 121, 125, 129, 135) ATC clearance received prior to entering Example: **V** (KELN) <u>Rwy</u> 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 **Operations in Class B** [AIM 3-2-3(b)(5)] std takeoff min (e.g. 0ft / 0sm for Part 91) if climbing \geq 320ft/nm to 7800ft MSL VOR or TACAN receiver, or RNAV system is required Ο
- **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
 - o <u>TSO 129/196:</u>
 - ✓ Can fly RNAV(GPS) approaches to LNAV minima (LNAV/VNAV with baro-aided systems).
 - \checkmark <u>Needs to confirm RAIM availability</u> as part of pre-flight.
 - ✓ Under IFR, must be equipped with an alternate means of navigation (if lose RAIM, must revert to VOR navigation)
 - <u>TSO 145/146 (WAAS):</u>
 - ✓ Can fly the approaches above, plus <u>LPV</u>, 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] Non-radar only 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 (A) [§91.183] or any fix if not in airways [AIM 5-3-2(c2)] 500 - Unable to descent/climb at least 500fpm ٠ NOTE: In non-radar environment, pilot must report Call Sign \rightarrow Position \rightarrow Time ٠ \rightarrow Altitude \rightarrow Name + ETA of next reporting fix \rightarrow Name of the fix after that



3. IFR Cross-Country

- STEP 1 → Check the <u>airport, runways</u> and <u>procedures</u> 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 <u>route</u>, <u>checkpoints</u> and <u>altitudes</u>
 - o Departure Procedure
 - Preferred IFR Routes, Often/Recent cleared routes, Airways, Direct, TEC, etc
 - Enroute Fixes for each leg + STARs, IAPs, IAFs
 - o Consider terrain, distances, aircraft performance, weather and risk mgnt
- STEP 3 → Identify <u>Alternates</u> 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 N	IAVL	OG							
Aircraft Number	N91	FF	Fuel	53	Fuel le	ft (@100	GPH):	3.	.5h	Mag.	Varia	tion	-16	Ori	gin/Destination	KRNT (Renton) / KBL	I (Bellingham)
This is a RNAV route, trac	king a STAR (MA	ADEE5) which also	flies ov	er V23													
Route ==> KRNT SE	A PAE MADEE M	ADEE5 KBLI															
Expect STAR ==> Joi	n MADEE5 at MA	DEE (lateral cleara	ance, m	aintain 60	>	Descen	ıd via N	MADEE	5 before	GERRD	> Ex	pect V	ectors a	fter YAA	NO		
NAVLOG for DEPARTIN	G 16 - LANDING	16															
	Nav	Other Info			w	ind				Dist.	GS		Time	Fuex Taxi		ATIS/METAR (Current)	
Check Points (Fixes)	VOR Freq			Altitude	Dir.	Vel.		WCA		Leg	Est.			3.0	Departure	Time Taken 17:53Z	Destination
(1 1/00)	or Procedure		MC	(feet)	True		TAS	Mag.	MH	Rem.		GPH	ETE	Fuel	KRNT	Airport Code	KBLI
KONT	RENTN3				Mag	Temp				124	Act.		ATE	Rem.	VFR	ATIS	VFR
KKNI	(Departure)		040	2 000	263	10	74		240	4	66	47	0:04	1.1	OVC 3200', 10SM	Ceiling/Vis	SCT 8500', 10SM
SEA	SEA (116.8)	MEA (V23): 3000	212	3,000	247	13	74	4	216	120		17		48.9	180 @ 11 G 17	Wind	190 @ 14 G 23
SEA	Direct To		247	6.000	263	10	74		220	10	75	45	0:08	2.0	30.10	Altimeter	30.07
1700			347	6,000	247	13	14	-0	339	110		15		46.9	21 / 13	Temp/Dew Point	19 / 14
<100>			247	6 000	259	11	100		244	19	102	_	0:11	1.7	16	Rwy (*RP)	16*
DAE	PAE (110.6)	MEA (V23): 4500	347	6,000	243	6	100	-0	341	91		9		45.2	TAF (at D	eparture / at Arrival) - Clos	sest Station
FAE	Direct To		222	6 000	257	11	100	6	207	26	100	0	0:16	2.3	KBFI (closest)	Station	KBLI
MADEE	MADEE4		333	0,000	241	6	100	-0	-6 327	65		9		42.8	BKN 5000', 6SM+	Ceiling/Vis	OVC 9000', 6SM+
(Exp join the STAR)	(Lateral course)		222	5 000	264	12	100	7	226	18	98	0	0:11	1.6	170 @ 10	Wind	180 @ 11 G 20
GERRD	MADEE4	Cross between	333	5,000	248	6	100	-7	320	47		9		41.2	16	Rwy (*RP)	16*
(Exp descend via STAR)	(Descend Via)	5000' - 7000'	207	4 000	267	15	100	7	300	11	91	0	0:07	1.1		Airport Information	
ПСАКІ	MADEE4	At or above	307	4,000	251	9	100	-7	300	36		9		40.1	1000ft	TPA	1200ft
UCAN	(Descend Via)	4000'	244	2 000	270	16	100	0	225	6	99	0	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
TANIO	(Descend Via)	2000'	25	2 000	270	16	100	7	19	8	110	0	0:04	0.7	1700ft MAX	Take off / Landing Dist	1450ft MAX
SECOG (IAE)	Direct To	At or above	25	2,000	254	14	100	-7	10	22		9		38.9		Airport Frequencies	
SECOG (IAP)	(**)	2000'	164	0	274	17	100	10	174	22	100	0	0:13	2.0	126.95	ATIS/AWOS	134.45
KBU	RNAV (GPS)		104	U	258	14	100	10	174	0		9		36.9	121.6	Ground	127.4
KBEI	Y RYW 16														124.7	Tower/CTAF	124.9
(**) Assumes "Direct	To" and PROCE	EDURE TURN.												36.9	119.2	Dep/App	132.7
If no PT, then reduce	distance by 10r	nm, time -6min						Т	otals »	124			1:18	16.1	122.5	FSS	122.2
KBVS			151	5 000	270	6	100	3	154	20	101	12	0:12	2.4			
(Alternate)				3,000	254	6		Ŭ	104			12		34.5	<== Fuel Remainir	ng after Alternate	
							Tota	ls w/ Alt	ernate »	144			1:30	18.5	<== Fuel Used aft	er Alternate	



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)

3. IFR Cross-Country | KRNT-KBLI



4. Notice to Air Missions (NOTAM)

What → Information not know 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:
 - o Aeronautical facility
 - \circ Airspace
 - o Visual & Radio navaid
 - o Communications and Services
 - \circ Hazards
 - Pointer NOTAMs

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

FDC NOTAMs

- Regulatory information
 - $\circ~$ Amendments to published IAPs and Chart
 - o TFRs
 - o ADS-B/GPS availability
 - \circ Special Notices

Military NOTAMs:

• Military or joint use navigational aids/airports

5. Filling a Flight Plan

- Flight plans are <u>filled</u> by calling <u>FSS</u> on the radio, <u>1-800-WX-BRIEF</u> on the phone, or online services such as <u>Leidos</u>, <u>Foreflight</u>, 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 <u>closed by Tower</u> automatically upon landing
 - ✓ Landing at <u>Non-Towered</u>: Pilot resp. for cancelling IFR or closing with FSS
 - ✓ Search & Rescue starts 30min after ETA if not closed (non-towered airp)

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

ICAO Codes FAA FPL Quick Reference Brochure.pdf

RSION 8			SEPT 2022	VERSION 8			SEPT 2022	VERSION 8	SEPT 2022
TS/ Special	Handling Re	asonti		Datacomin	Services (See	AC 90-117 A	ppendix Di	FAA ICAO Flight P	an Quick Guide
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bim 18 PBN	Gapabilities	LUD to I	allowed)	En Route	Item 10a- Z	and appropri-	ate 'J' code	- Other Informatic	(n
to say here a	ey codes in ex	anss of A m	MAY	Services	followed by -	7- Phonty nu each apolicat	mber le service:	100 million (1997)	
1 RNAV 10	RNP 105	01 All			FANSE			Example:	
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2 GNSS		S2 RNI	APCH/Baro VNAV	Key PON R	outre (See All	Appendix 4	table 4-13)	-KPWM1225	COVE DET BUZED
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5 INS or IRI		11 104	AR APCH WHO			PBN	NAVI	CHS EESNT LUNNI1	
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1 AI		D1 All		RF required				DAT/1FANS2PDC SUR	/2608 RSP180
2 GNSS	IRU	D2 GN2 D4 DM	S	PNAV 1 CIO	69	D1 or D2		DOF/220501 REG/N1	23A SEL/BPAM
dotional PE	N capabilitie		18 NAV/	or STAR	010	DI at DA		CODE/MOSED/)	
1 Radius to	Fix (RF)		there is a second se	-	DIA	D1 0r D4		For further information:	
5 Time of A	rival Control	(TOAC)	include Z in	Domestic Q Route	GR	C1 or C2			
1 Helicopter	RNP 0.3		item 10e	0.000006	DIR	C1 or C4		Aeronautical Info. Manua	I (AIM) Append. 4
11 RNP 2 Co	tinental		NAV/	T Route	GR	C1 or C2		Both are available at:	non (AP) Append. 2
42 RNP 2 Oc	eanic/Remote	the second second		TK Route	GR	C1 or C2		https://www.faa.gov/air_tra	fic/publications/
Categories bas	ed on Veef if	upecified.	or 1.3Vap. each	TK Route	GZ	1	R1		
maximum ci	rtificated lane	ling weigt	t per CFR 97.3	(RMP 0.3)				Flight plan filing additio	nal guidance:
less than 91 at least 91 a	knots MS ref. less than 1	21 knots i	45	Note: RMP	outes requiri	ng RF or FF	RT, include	https://www.faa.gov/about/	office org/headquarter
at least 121	and less than	141 knot	IAS	Z1 or Z2 in	NAV/ (see "A	dd'i PBN Ci	NP. 7	s_offices/ato/service_units/	air_traffic_services/flig
at least 141	and less than	166 knots	IAS	Reduced Oce	arnic Dityleratio) steintin 2 katelo	5-240 5 2-14 through	0.2.17	ht_plan_filiog	

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K, B S OTHER INFO BN/B2C2D202 ENDURAN HR M SUPPLEN ENDURAN HR M SURVIVA MUMBER A ARCRAF MUMBER A REMARK	INTELECTION COME I, 1 MATION IS2 NAV/SBAS IENTARY INFORMAT CE IN PEF IO P/ LEQUIPMENT POLAR DESERT M P D S CAPACITY COVER I COLOR AND MARK VI BLUE MARKINGS S			FPL MESSAG	ES) EMERGE UHF V UORES U F	NCY RADIO HF ELT IE HF VHF	<pre></pre>
K, B OTHER INFO BN/B2C2D202 ENDURAN HR N C / DINGHIE NUMBER A ARCRAF A ARCRAF	IENTARY INFORMATI SZ NAV/SBAS IENTARY INFORMATI CE IN PEF 0 P/ L EQUIPMENT POLAR DESERT M P D CAPACITY COVER CAPACITY COVER CAPACITY COVER COMMAND O SIMOES				ES) EMERGE UHF V UORES U F	NCY RADIO HF ELT HF VHF	<pre></pre>
K, B B OTHER INFO BN/B2C2D200 BN/B2C2D20 BN/B2C2D200 BN/B2C2D200 BN/B2C2D200 BN/B2C2D200 BN/B2C2D200	IENTARY INFORMAT IS2 NAV/SBAS IENTARY INFORMAT CE IN PEF 0 P/ LEQUIPMENT POLAR DESERT M CAPACITY COVER COLOR AND MARK V BLUE MARKINGS S COMMAND O SIMOES BV		SMITTED IN F	AERODROME BV_S FPL MESSAG R/ S LIGHT FL L :=	ES) EMERGE UHF V UORES U F		
K B SOTHER INFO BN/B2C2D200 BN/B2C2D200 BN/B2C2D200 BN/B2C2D200 BN/B2C2D200 BN/B2C2D200 BN/B2C2D200 BN/B2C2D200 BN/B2C2D200 SUPPLEN SUP	IENTARY INFORMAT IS2 NAV/SBAS IENTARY INFORMAT CE IN PEF 0 P/ LEQUIPMENT POLAR DESERT M CAPACITY COVER CAPACITY COVER COLOR AND MARK S COMMAND O SIMOES BY	INC MIN 0, 1, 0, 7 ION (NOT TO BE TRANS RSONS ON BOARD 0, 0, 2 ARITIME JUNGLE M J COLOR COLOR ACCEPTED BY	ALTN K	AERODROME B,V,S FPL MESSAG R/ S LIGHT FL L :=	ES) EMERGE UHF V UORES U F L DOTTIONAL II	NCY RADIO HF ELT / E HF VHF J V NFORMATION	<pre></pre>

tem 10b (Surveillance

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=""></as>	NAV/ SBAS SUR/ 280B <i>(this is for 1090 ADS-B out; if UAT then 282B)</i> CODE/ <enter code="" faa="" here,="" look="" registry="" up="" your=""></enter>







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

Iten	n 18 PBN/ Capabilities	s (up to 8 allowed)
File	any necessary codes in ex	cess of 8 in NAV/
Oce	anic	<u>RNP 1</u>
A1	RNAV 10 (RNP 10)	O1 All
L1	RNP 4	O2 GNSS
RNA	<u>V 5</u>	RNP Approach
B1	All	S1 RNP APCH
B2	GNSS	S2 RNP APCH/Baro VNAV
B3	DME/DME	RNP AR Approach
Β4	VOR/DME	T1 RNP AR APCH w/RE
B5	INS or IRS	
RNA	<u>V 2</u>	RNAV 1
C1	All	D1 All
C2	GNSS	D2 GNSS
C4	DME/DME/IRU	D4 DME/DME/IRU

Ν	No capabilities- include no other entries if filed
	Transponder (include no more than one)
Α	Mode A (no Mode C)
С	Modes A and C
S	Mode S- ACID and Altitude
Ρ	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
н	Mode S- ACID, Altitude, Enhanced Surveillance
L	Mode S- ACID, Altitude, Enhanced Surveillance, Extended Squitter
	ADS-B (include up to three)
:	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) 292P (for 1090 MHz)
	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	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) 1090 MHz "out"
• • B1 B2	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) 1090 MHz "out" 1090 MHz "out" and "in"
• • B1 B2 U1	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) 1090 MHz "out" 1090 MHz "out" and "in" UAT "out"
• • B1 B2 U1 U2	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) 1090 MHz "out" 1090 MHz "out" UAT "out" UAT "out" and "in"
• • B11 B22 U11 U22 V11	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) 1090 MHz "out" 1090 MHz "out" UAT "out" UAT "out" UAT "out" and "in" VDL Mode 4 "out"

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

<u>CRAFT</u>

- **C** <u>Clearance</u> limit (typically the destination airport). *Ex: "Clear to Skagit airport"*
- **R** <u>Route</u> (usually "as file" or via a given DP). *Ex: "via RENTN3, then as filed"*
- **A** <u>Altitude</u>. Example: "Climb via the SID, Expect 4,000' 5min after departure"
- **F** <u>Frequency</u>. *Example*: "Seattle departure frequency 119.2"
- T <u>Transponder</u>. 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).
- <u>Types of structural icing</u>:
 - **Clear**: large <u>supercooled droplets</u> (cumuliform clouds or freezing rain) <u>spreads out</u>, freeze slowly. <u>Heavy</u>, forms horns. (0°C to -10°C)
 - **Rime**: most common. <u>Freezes instantaneously</u> (trap air inside). Typically from <u>stratus clouds</u>. 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 <u>dewpoint below freezing</u>
- Intensity of Ice
 - **Trace**: <u>usually not hazardous</u> 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: <u>de-icing/anti-icing not enough</u> to reduce the hazard → *Divert immediately*



7. Icing, De-Icing and Anti-Icing

- Anti-ice prevents ice, De-ice removes ice
- Airfoil
 - 1 <u>Deice Boots</u> → Inflatable rubber boots bonded to the leading edge of the wing
 - <u>Thermal Anti-Ice</u> \rightarrow Hot air from the engine compressor
 - <u>Weeping Wing</u> → Antifreeze weeps through small holes in the leading edge
- Windscreen and Propeller
 - <u>Alcohol</u> Used to prevent ice build up on windscreen / propeller
 - <u>Electric Heat</u> Wires imbedded in the windscreen / propeller anti-ice
- **TKS System** (Tecalemit-Kilfrost-Sheepbridge Stokes)

"Weeping wing", but a system that covers way more than the wing

• C172S

(2)

- Flying into known icing condition is prohibited in the C172 by the POH
- o <u>C172 does not have deicing</u>, only <u>minimal anti-icing</u>
- **Pitot heat** \rightarrow 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?

