

THE EDGE OF THE ENVELOPE



Navigating the RADAR **RED ZONE**

WITH **COLLINS/GARMIN/HONEYWELL** AND CAPT'N BILL

WELCOME ABOARD

- COMMAND AUTHORITY
- BE A CREATURE OF GOOD HABITS
- SPEAK UP / BE ASSERTIVE
- PROTECT YOUR PASSENGERS
- KEEP THE BLUE SIDE UP AND THE BALL CENTERED !

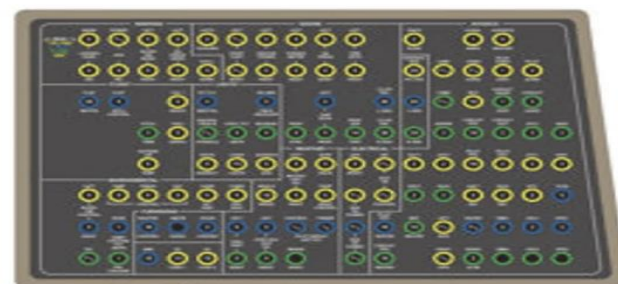
THANK YOU AND GOD BLESS !

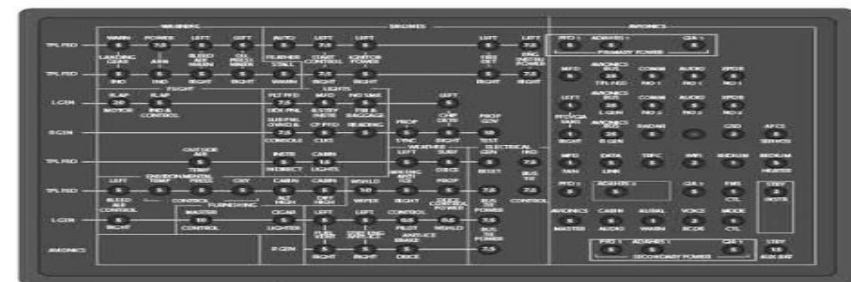
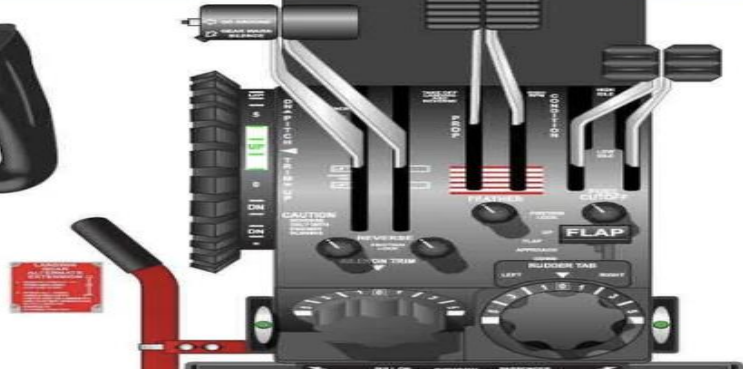
CAPT'N BILL













Weather Radar System (WXR)


- Rockwell Collins TWR-850 Weather Radar

The Rockwell Collins TWR-850 Weather Radar is a four color, 6 range weather radar designed to interface with the EFIS, Primary Flight Display (PFD) and Multi-Function Display (MFD). The radar features ± 15 degrees of antenna tilt (12 in. diameter antenna), 14 scans of 120 degrees per minute. Color weather depictions clearly identify the intensity and level of targets in any mode of operation.




COLLINS RADAR. WX-85D. CONTROL



In the **King Air 260**, the Collins Aerospace MultiScan **RTA-4112** weather radar is integrated directly into the **Pro Line Fusion** flight deck. 

Unlike older radar systems that used a dedicated standalone hardware panel, the controls for the RTA-4112 are typically accessed and managed through the cockpit's **touchscreen Primary Flight Displays (PFD)** or the **Multifunction Keypad (MKP)** located on the center pedestal.

Key Control Features in the King Air 260:


- **Touchscreen Interface:** Pilots can adjust radar settings, such as gain and tilt (though tilt is automated in MultiScan mode), directly on the weather overlay of the Pro Line Fusion displays.
- **Fully Automatic Operation:** The MultiScan system is designed to operate hands-free, automatically scanning from the aircraft nose out to 320 nautical miles while suppressing ground clutter.
- **Center Pedestal:** The physical inputs for navigating the menus (if not using touch) are handled by the cursor control and keypad unit located between the pilot seats. 



Collins Pro Line Fusion for...

Collins Pro Line Fusion for... AIR TEAM Services

Pro Line Fusion Radar Interface Structure

The radar is managed through a **contextual interface** on the Primary Flight Display (PFD) or Multifunction Display (MFD). 

1. Radar Overlay Selection:

1. On the display, you select the **RDR (Radar)** button from the lower menu bar to overlay weather data on the moving map or HSI.


2. Mode Control (Touch Interface):


1. Once active, a dedicated radar control window or "block" appears.
2. **Auto Mode:** The primary setting. The [MultiScan technology](#) handles tilt and gain automatically to identify threats.
3. **Manual Override:** Selecting **MAN** allows you to manually adjust:
 - **Tilt:** Adjust the vertical angle of the antenna.
 - **Gain:** Adjust the sensitivity of the receiver.

3. Specific Feature Toggles:

1. **GCS (Ground Clutter Suppression):** A toggle to filter out ground returns.
2. **USTB (Stabilization):** Turns antenna stabilization on or off.
3. **TRBK (Track):** Used for specific storm tracking features.

4. Display Format:

1. You can toggle between **WX (Weather)** and **MAP (Ground Mapping)** modes via the touch-sensitive mode icons. 

The system is designed so that you "**touch what you want to change.**" To adjust the range, you can simply pinch-to-zoom on the map or use the range knobs on the [Multifunction Keypad \(MKP\)](#) located on the center pedestal. 

NOTE:

DIGITAL TRANSMITTER
PWR **35 WATTS**

MULTIPLE PULSE
LENGTHS FOR BEST
DISTANCE
RESOLUTION

LENGTH:	8.7"	DIAMETER:	14.4" max
WEIGHT:	20.1 lbs.	POWER:	28 VDC at 3.1A Plus, for analog stabilization only: 115 VAC, 400 Hz at 10 mA max or 26 VAC, 400 Hz at 2.3 mA
PERFORMANCE INDEX:	224	AVOIDANCE RANGE:	365 nm
RANGES:	5, 10, 25, 50, 100, 200, 300 nm standard	TRANSMITTER POWER:	35 W nominal
FREQUENCY:	X band (9343.85 ±1.8 MHz transmit and 9338.84 ±1.8 MHz preheat)	PULSE LENGTH:	1.8, 2, 4, 4.8, 9.6, 19.2, or 28.8 micro sec
			Weather, Weather

Gain control

Cal (calibrated - normal gain)
+1, +2, +3 (Three steps of increased gain (6 dB/step))
-1, -2, -3 (Three steps of decreased gain (6 dB/step))

Map, Test,
Standby,
Off

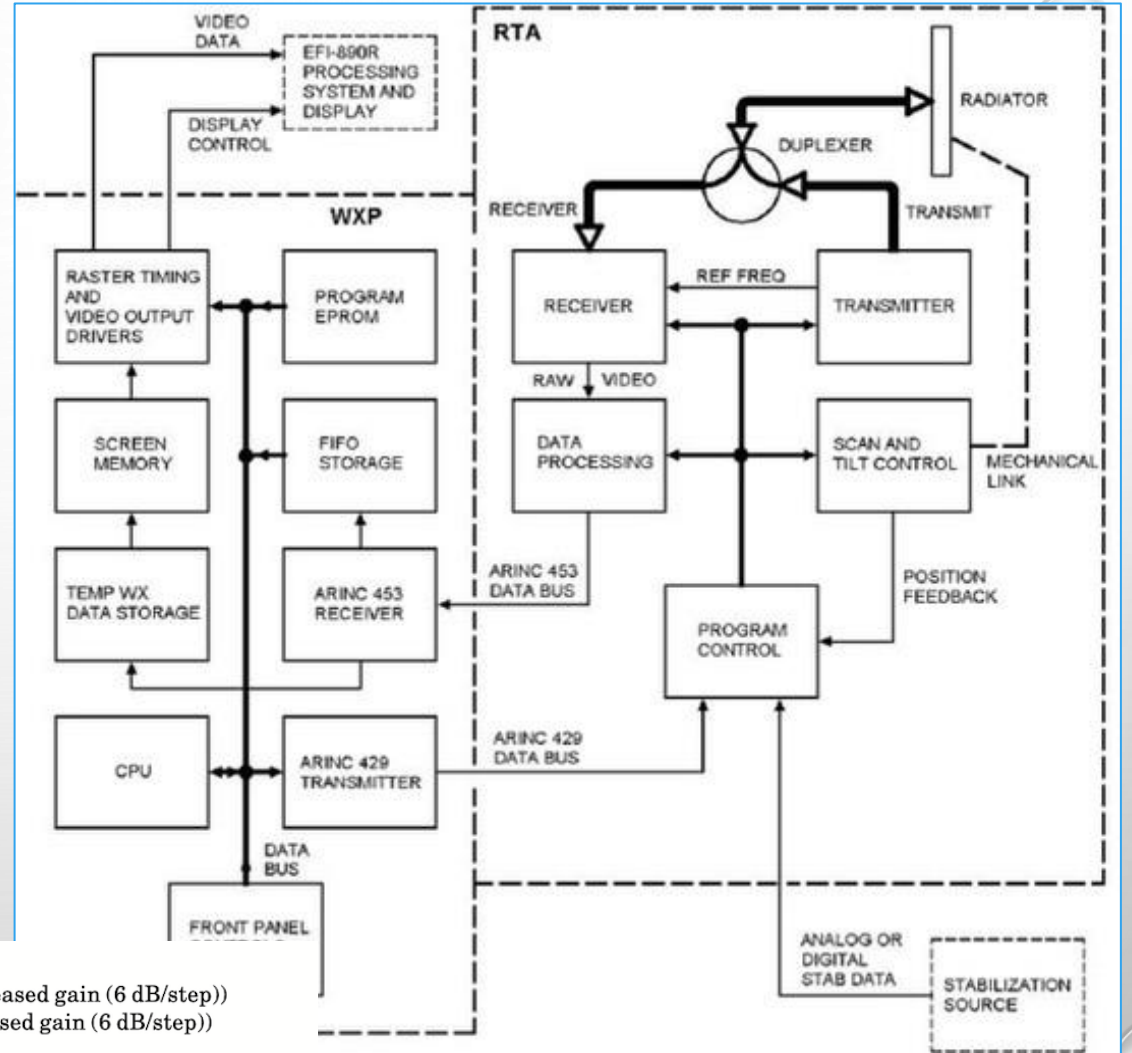


Figure 3-12. TWR-850 Weather RADAR Functional Block Diagram

- **A Significant Advancement in Airborne Weather Radar**

- Includes all features of GWX 70
- System enhancements include:
 - **Multi-core processor** and expanded memory
 - **Advanced waveform technology** with improved sensitivity
 - **Enhanced color palette** for improved weather threat differentiation

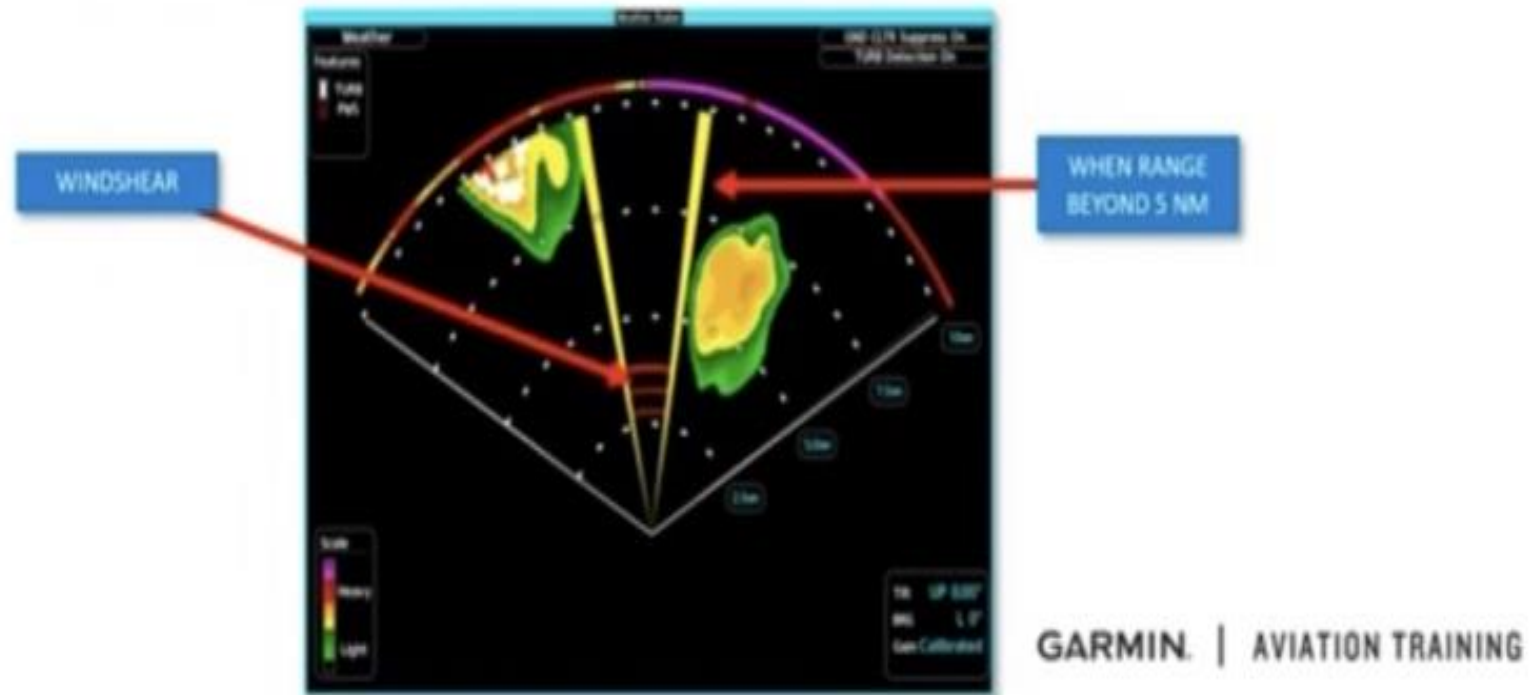


- **State of the Art System with *Automatic Mode***
 - Includes all features of GWX 75
 - A **major advancement** in both threat identification and ease of use
 - **Automatic Mode** greatly reduces pilot workload
 - Automatic **3D Volumetric Scanning** makes threat identification much easier
 - **Predictive lightning and hail region depictions**
 - OPTIONAL: Predictive windshear alerting



• Predictive Windshear Alerting

- Detects potential hazardous performance loss associated with wind changes
- Will alert only below 1200 ft. AGL and +/- 25 degrees of ground track
- Monitors area from 0-5 NM for windshear associated with particulates



OPERATIONAL OBJECTIVES



- 1. **TURN IT ON !! SET UP THE TILT AND RANGE**
- 2. **WHERE IS MY BEAM ? HOW WIDE IS IT?**
- 3. HOW DO I USE THE GAIN CONTROL ? MAP MODE ?
- 4. WHY DO I NEED TO TILT THE RADAR ?
- 5. **WHY NOT JUST USE NEXRAD OR ADS-B ?**

**ROCKWELL COLLINS, A PART OF COLLINS AEROSPACE
PILOT GUIDE**

RTA-4100 Series MultiScan™ Automatic Weather Radar

ANTENNA TILT CONTROL

During manual operation, the antenna tilt control is the most useful control of the MultiScan™ Radar. By changing the angle of the antenna relative to the horizon, the crew can detect close range weather or ground returns (negative tilt angles), or direct the beam farther out to paint distant weather (positive or zero angle).

The tilt range is ± 15 degrees. Proper use of the tilt control allows the operator to achieve the best picture of storm cell size, height, and relative direction of movement. The best tilt setting will vary depending on the aircraft altitude. Procedures for adjusting the tilt control vary depending upon user requirements. It is best used when each change of tilt angle displays several sweeps of the radar to analyze the returns. Proper use can only be achieved through experience and regular practice.

Tactical inside 40 nm

OUR NEW RADAR DATUM IS 15,000' FOR THE FRZL

TILT SHOULD BE ZERO as we Pass thru or Level off at
15,000'



**Below 15,000' Tilt will be Plus and above Minus
when 40 nm and closer**

To get best Reflective Value of Moisture.

Note: Tilts will be Adjusted Positive 40 nm and Up using the Strategic Tilt Procedure **GWX 70 +**

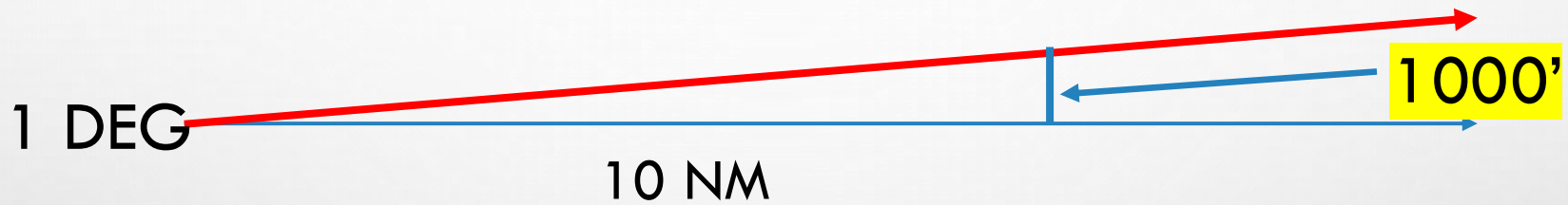


RULE OF 60



1 DEG OF Tilt Angle Change

TBM PRO TRAINING
781-520-9778



Moves the Center of the Beam 1000' AT 10 NM

1 DEG AT 20NM = 2000'. ECT. ECT.

SECRET FORMULA- TO POSITION THE BEAM CENTERLINE
ON THE SWEET SPOT



TILT X RANGE OF CELL = (X)000'

ADD or SUBTRACT (X)000' FROM YOUR ALTITUDE

EQUALS THE BEAM CENTERLINE POSITION AT THE
CELL RANGE



TILT X RANGE (DROP THE ZERO ON RANGE NO.)

)

Cell at 10 NM IS 1..... 20 NM IS 2 ECT. ECT.

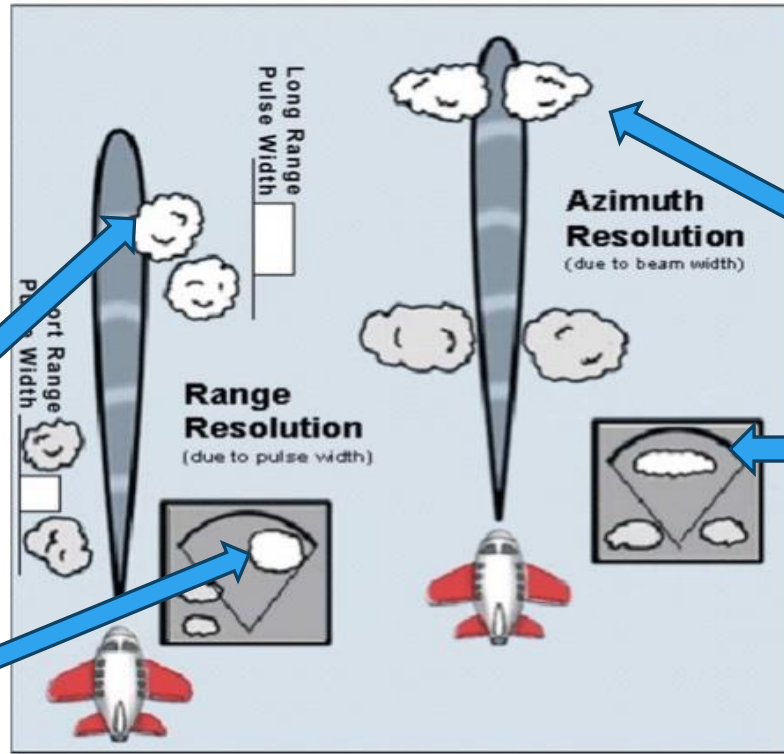
Interpolate the Zero's

EX: TILT MINUS 4 X 2 = -8. (8000' BELOW IS THE **CENTER OF THE BEAM** at 20 NM

TILT MINUS 5 X 3 = -15 (15,000' BELOW YOU is the C/L at 30 NM

Tilt Plus 10 X 1 = 10 (Beam Centerline is 10,000' Above 10 nm Ahead) T.O. Tilt

Figure 6-22 Range Resolution versus Azimuth Resolution



INHERENT ERROR DUE TO BEAM WIDTH SMEAR. TWO TARGETS APPEAR AS ONE

INHERENT ERROR DUE TO BEAM WIDTH SMEAR. TWO TARGETS APPEAR AS ONE

TPF9615_67

In a similar manner, long-range weather targets can be merged into a single target due to the large beam width diameter at extended ranges. In this case, the leading edge of the beam comes in contact with a new target before the trailing edge of the beam leaves the previous target (see figure 6-29). As the aircraft nears the weather targets, the beam narrows and the leading edge of the beam will not contact the next target until the trailing edge has left the previous target. Thus it is not unusual to see a storm cell separate into two cells as it nears the aircraft and the beam becomes narrow enough to distinguish between them.

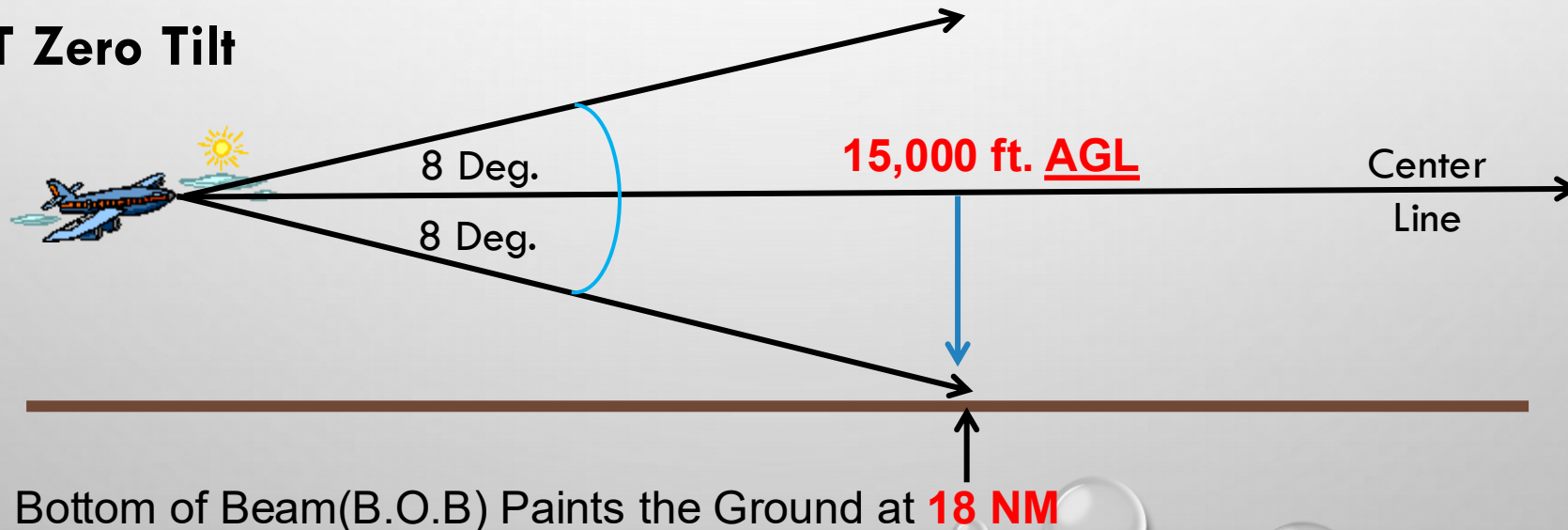
Checking RADAR Pitch Trim



Set **Tilt at Zero**

Note the distance painted by Bottom of Beam (B.O.B)

SET Zero Tilt



Collins Radar

Video output from the processor prints a 22 DBZ return as Black. When reducing gain from Calibrated, each minus click of the three is 6 dbz each for a total of 18 dbz that can be reduced. If you reduce 3 clicks or 16 dbz's and the screen sweeps black, that removed level 1 and 2 returns or light and moderate WX. Maneuver upwind around remaining with proper clearance relative to strength.

Display Level For Radar COLOR	MFD SCREEN COLORS , DBZ REFLECTIVITY		Video Integrated Processor (VIP) Categorizations			DOPPLER WSR-88D Approach Control "Precip" New Terminology
	RDR 2000 MAP	GWX Collins WX	Storm CAT Returns	VIP Level	NWS WSR-57 + 74 Phase out	
					DBZ	
5 Magenta	Greater Than 50	50+	Extreme	6	57+	53 or > Extreme
			Intense	5	50-57	
4 Red	40-49	42-50	Very HEAVY	4	44-50	40 – 53 Heavy
			HEAVY	3	38-44	
3 Yellow	30-39	33-41	MOD	2	30-38	30-39 Moderate
2 Green	20-29	23-32	LIGHT	1	20-30	< 30 Light
1 Black	20 OR LESS	22 OR LESS	50% GAIN REDUCTION REMOVES LEVEL 1 AND 2 RETURNS			

Cal (calibrated - normal gain)
 +1, +2, +3 (Three steps of increased gain (6 dB/step))
 -1, -2, -3 (Three steps of decreased gain (6 dB/step))

2.

SECRET FORMULA - FOR IDENTIFYING POSITIONALLY

**RANGE OF CELL X 1000' X NUMBER OF DEG LEFT OR RIGHT DIVIDED BY 6 =
NM**

1. IDENTIFY POSITIONALLY. Clearance On Cell If You Flew Straight Ahead

10nm/10L/R=2nm – 10nm/20L/R=3nm – 10nm/30L/R=5nm

20nm/10L/R=3nm – 20nm/20L/R=7nm - 20nm/30L/R=10nm

30nm/10L/R=5nm -- 30nm/20L/R=10nm – 30nm/30L/R=15nm

40nm/10L/R=6nm – 40nm/20L/R=13nm – 40nm/30/L/R=20nm

IN THE NEXT SLIDE, THE CELL IS 30NM OUT AND 30 DEG RIGHT

IF 1 DEG OF ANGLE AT 10 NM = 1000' WIDE

THEN 1 DEG OF ANGLE AT 30 NM = 3000' WIDE

3000'X 30 DEG = 90,000 / 6000'/NM = 15 NM RIGHT

INTERPOLATE THE ZERO'S TO GET 90 / 6 = 15 NM

Weather Approaches 40 NM – Use Tactical Procedure - Beam C/L at 15,000'

ALL RADAR MODELS ARE TO USE THE TACTICAL MODE INSIDE 40NM

CRUISING AT FL300
WHAT IS THE TILT SETTING FOR 40 NM?

What is the Difference Between Tactical and Strategic Procedures?



CONUS Atlantic Mexico/Caribbean South America Pacific Canada Alaska Single Site Radar/VAD Winds

▼ Current Weather

Surface Analysis
CONUS

Wx Depiction
CONUS

Freezing Levels
CONUS

Avg Relative Humidity
CONUS

Precipitable Water
CONUS

Lifted / K Index
CONUS

National Center for Atmospheric Research

- [Skew-T/Log P diagrams from rawinsonde data](#)

▶ Adverse Weather Conditions

▶ Prog and Forecast Charts

▶ Winds

▶ Barotropic Level Products (MB Charts)

▶ Thunderstorm & Severe Weather Forecast

▶ Temperature

▶ Radar Summary Charts

▶ Radar

▶ Satellite

▶ Sectionals

▶ UAS Operating Areas

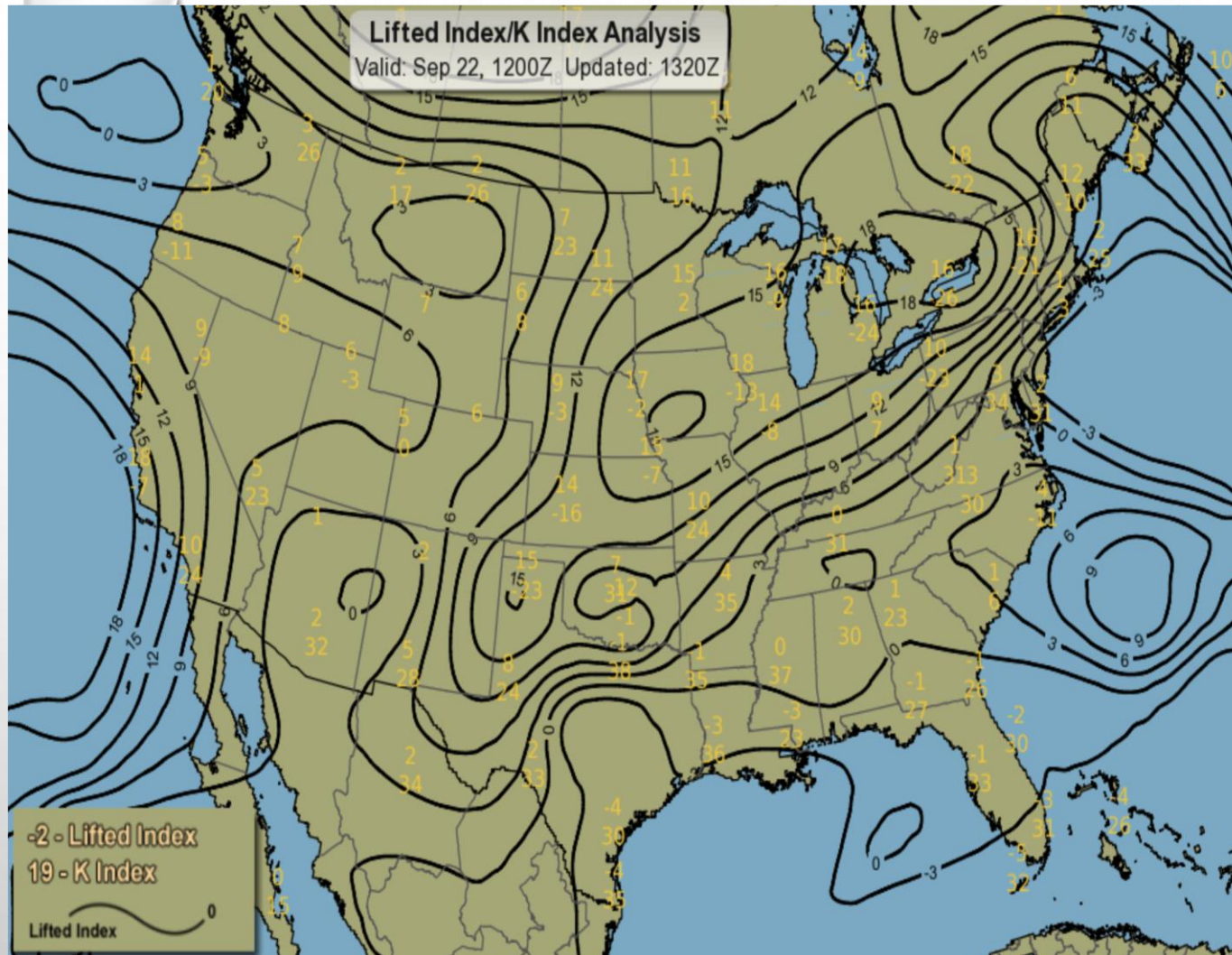
Google 1800wxbrief

1. Weather
2. Lifted / K index
3. ADD to Home screen

Use only the Top/Lifted Number

Chart for air stability at FL180

-6 BAD Zero Stab + Best



Google 1800WXBRIEF

1. SELECT **WEATHER** FROM TASKBAR
2. UNDER PRODUCT CATEGORIES DOWN LIST TO SELECT **MORE**
3. UNDER **CONUS** SELECT **LIFTED / K INDEX**
4. USE **ONLY THE LIFTED TOP NUMBER.**

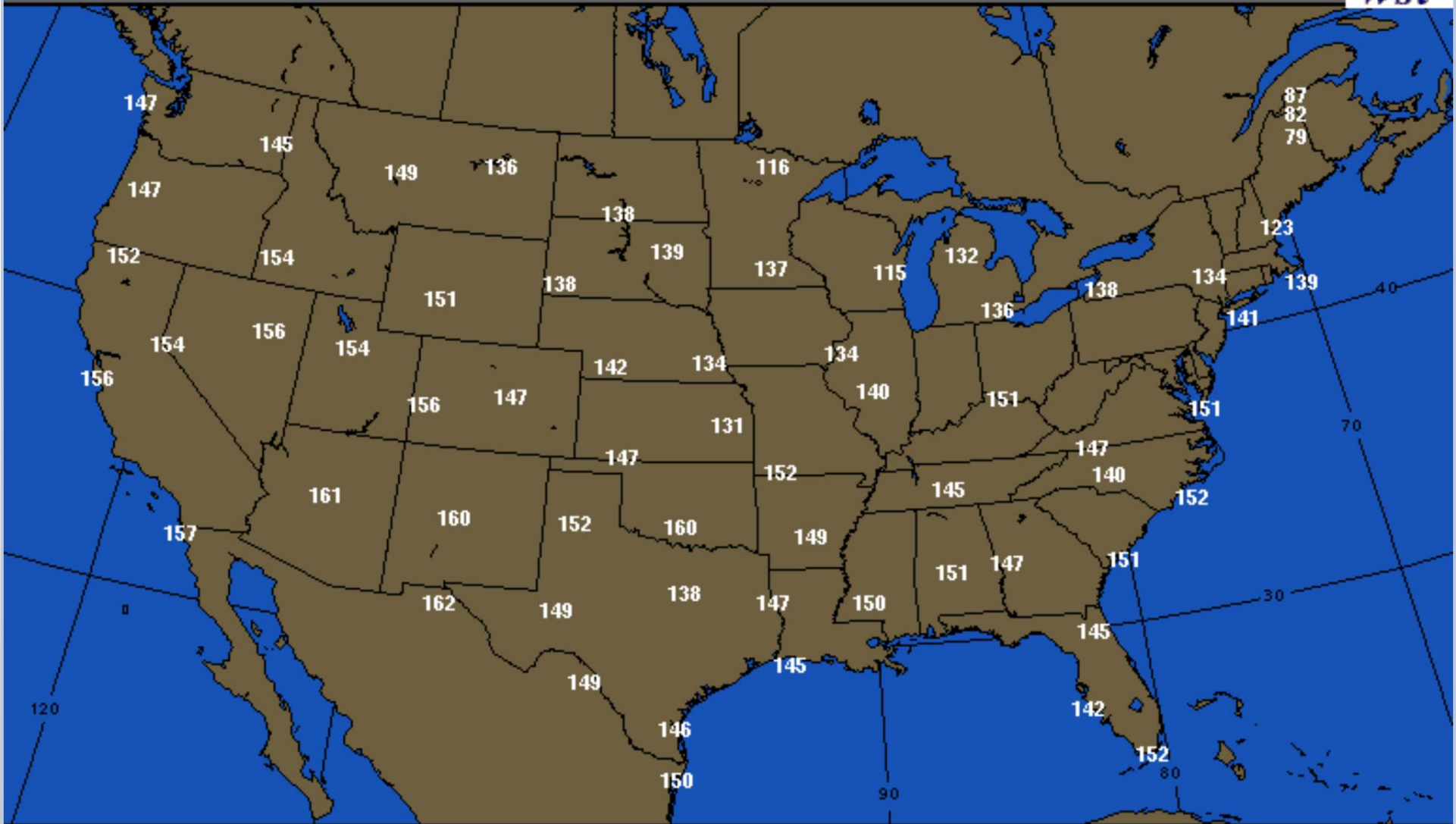
WORKS BEST IN SUMMER

5. - 5 BAD/ 0 STABLE/ + BEST
6. AIR MEASURED AT FL180

Twice a Day 12Z and 00Z. Not a Forecast. **Stability at 18,000'**

Use the Top Number Only / Lifted Print a copy or load photo on Ipad

WORKS BEST IN THE SUMMER ISA +10 TO ISA +20



Surface Below Freezing = Dark Blue

Freezing Levels plotted in 100's of FT MSL

Updated 2X daily at 02 and 14 UTC.

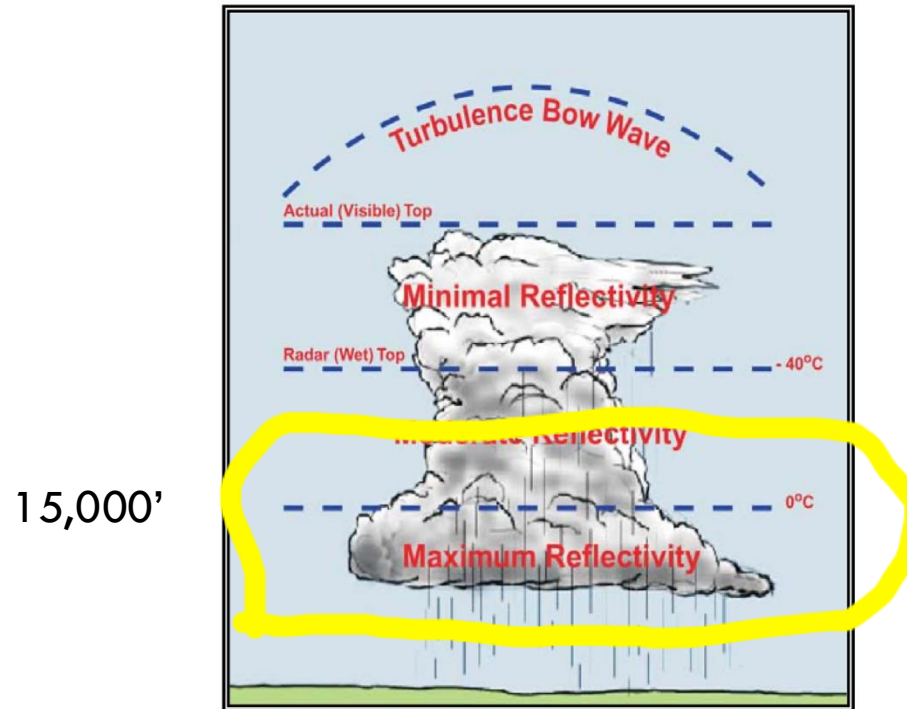
WSI° Downloads Map Airports Wx Charts Preferences

ISA TEMP = ALTITUDE X 2 MINUS 15 THEN CHANGE THE SIGN / COMPARE TO OAT
 USE 15,000' AS THE FREEZING LEVEL / BEST RELECTIVE VALUE / BEAM CENTER

THUNDERSTORM REFLECTIVITY

Understanding thunderstorm reflectivity is the key to understanding how MultiScan works. In general, thunderstorm reflectivity can be divided into three parts (see figure 3-1).

Figure 3-1 Thunderstorm Reflectivity Levels



TPF9615_03

The bottom third of the storm below the freezing level is composed entirely of water and is the part of the storm that most efficiently reflects radar energy. The middle third of the storm is composed of a combination of supercooled water and ice crystals. Reflectivity in this part of the storm begins to diminish due to the fact that ice crystals

ASSOCIATED READING MATERIAL



WWW.AVIATIONWEATHER.GOV

FAA NEW AVIATION WX HANDBOOK H-8083-28 500 pages

Chapter 9-10 Global Circulations and Jet Streams / WINDS

Chapter 11-12 Fronts and Clouds

Chapter 13. Atmospheric Stability 13.5.1-2 Lifted Index/Cape

Chapter 14-15 Precipitation and Radar

Chapter 16. Mountain weather

Chapter 19-20 Turbulence 19.2.3.2. CAT / Icing



Chapter 22 Thunderstorms / Windshear

Chapter 24.6. Radar Observations / WSR-88D

Chapter 25-26 Analysis / Advisories / How to read the Charts

Chapter 27-28 Forecasts / Tools / Feedback Form at THE END !!

FSF A Practical Guide for Improving F.P.M 65 pages

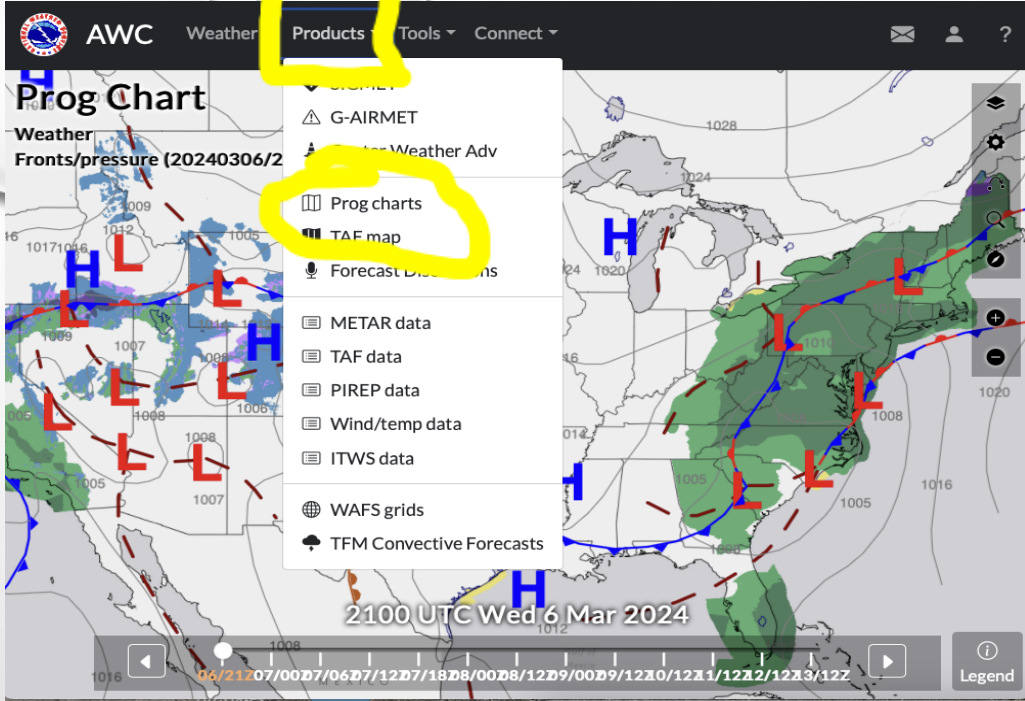
G.A J.S.C. Single Pilot Resource Management. 5 P's

1800WXBrief Weather Lifted/K index. LOAD ON DESKTOP

TBM PRO TRAINING

03-2023

bill@tbmprotraining.com 781-520-9778

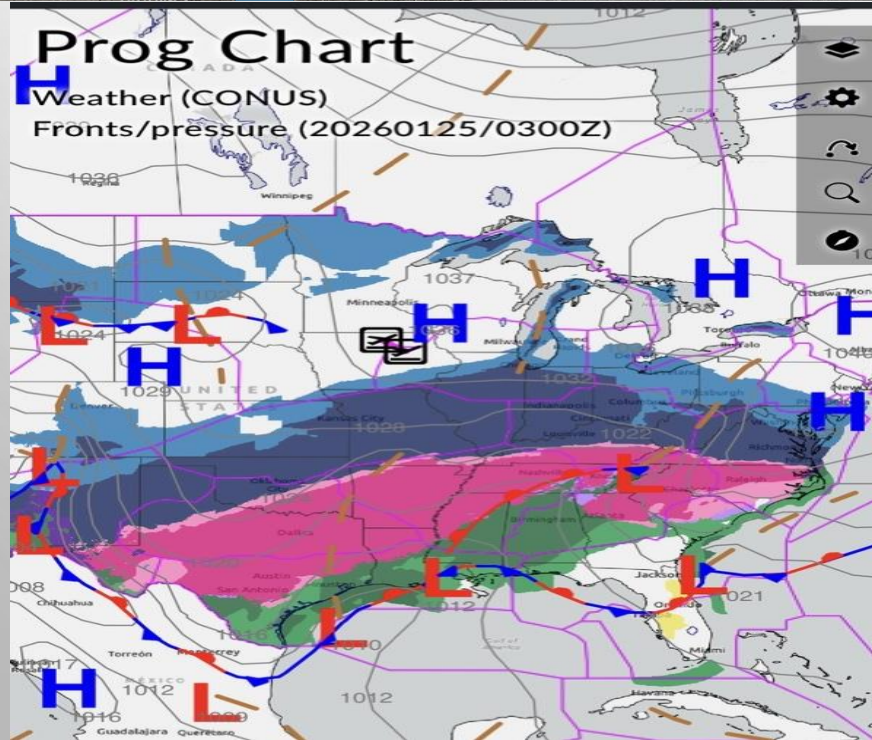


BIG PICTURE

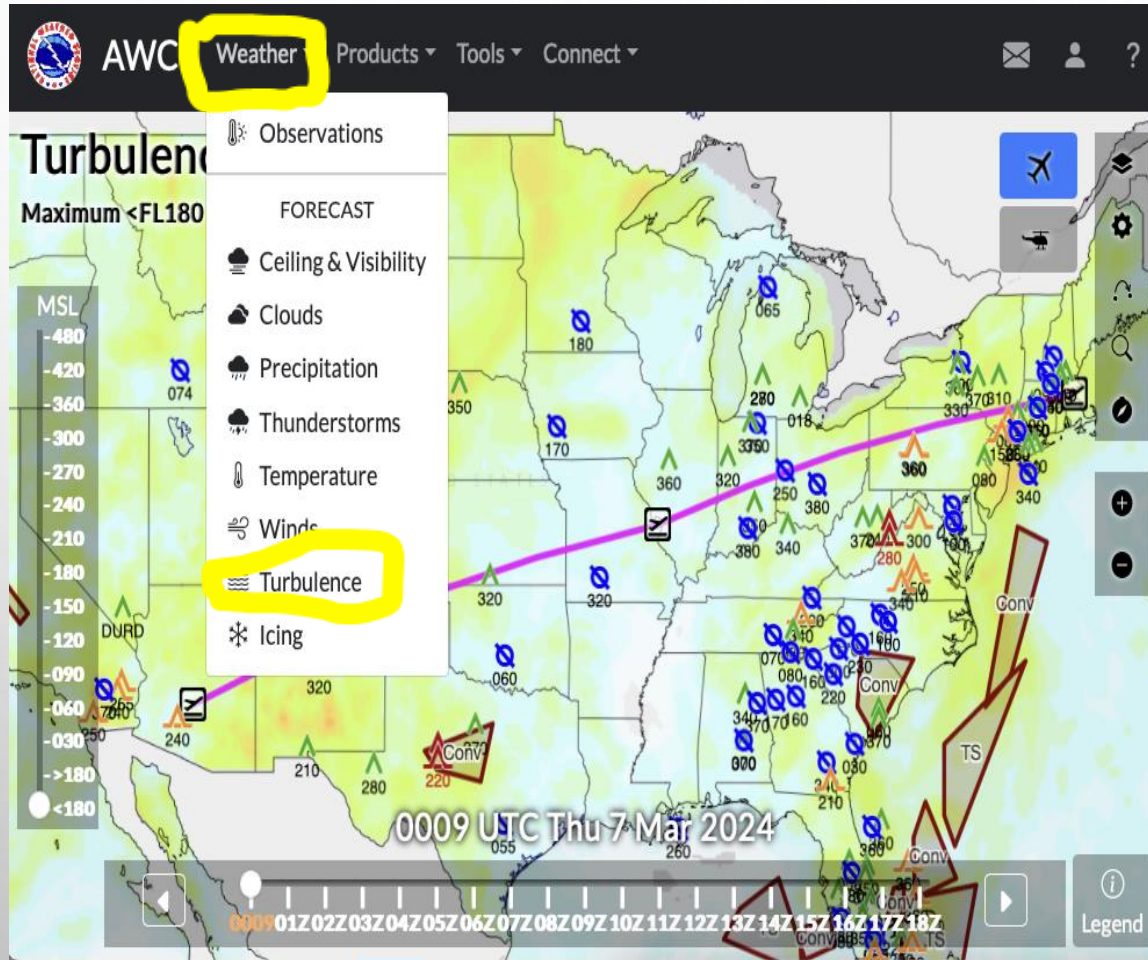


PRODUCTS

1. PROG CHARTS
2. Use the Arrow to move every 6 hours for 7 days
3. Note the Isobars and Troughs



CLEAR AIR TURBULENCE



WEATHER

1. Turbulence
2. Use Side Bar Cross Section Tool to Add your Route.
3. **Vert. level** select 3000' AGL for a look at Turb above your airports.
4. **Vert. level** select your planned cruise altitude.
5. Move Time to move Turbulence

6.1 DATA LINK WEATHER



WARNING: Do not use data link weather information for maneuvering in, near, or around areas of hazardous weather. Information contained within data link weather products may not accurately depict current weather conditions.



WARNING: Do not use the indicated data link weather product age to determine the age of the weather information shown by the data link weather product. Due to time delays inherent in gathering and processing weather data for data link transmission, the weather information shown by the data link weather product may be older than the indicated weather product age.

STARTER	CAB PRESS	STALL HTR	MAIN GEN	AUX BP ON
IGNITION	DOOR	INERT SEP	LO VOLT	FUEL L.LO
PARK BRAKE	FLAPS	VACUUM LO	G P U	FUEL R.LO
	OXYGEN	CHIP		AUTO SEL

TEST 1
TEST 2

MAN

US GAL FUEL QTY 150

FUEL PSI

SHIFT

N 316AH

GARMIN HOME

COM 122.80 X51 UNI
STBY 135.52 KMTH ASOS

Audio Panel Intercom

MIC 2 MON 2

BRG 010° ETE 33:45

NAV ZBV 116.70 ZBV VOR STBY 114.70

VSR FPM

TRK UP

ETE to Dest 4+58

SiriusXM NEXRAD:US Age: 3min
Cell MVMT Age: 1min
TFR Age: 9min
Lightning Age: 3min

Wind 58 KT →

DIS to Dest 975 NM

Back Menu CDI OBS In Out

ENR GPS Com Freq / Psh Nav

BENDIX/KING

STAB ON

WX

MAP WX TRFC TERR AUX

GARMIN

IDENT ON VFR STBY ALT OFF

3575 PRESSURE ALT 20360' ↑

0 1 2 3 4 5 6 7

MODE S XPDR 1 XPDR 2

GARMIN HOME

COM 132.20 MIAMI ACC
STBY 133.50 MIAMI ACC

DIS 110 NM GS 196 KT

DTK 010° TRK 009°

BRG 010° ETE 33:44

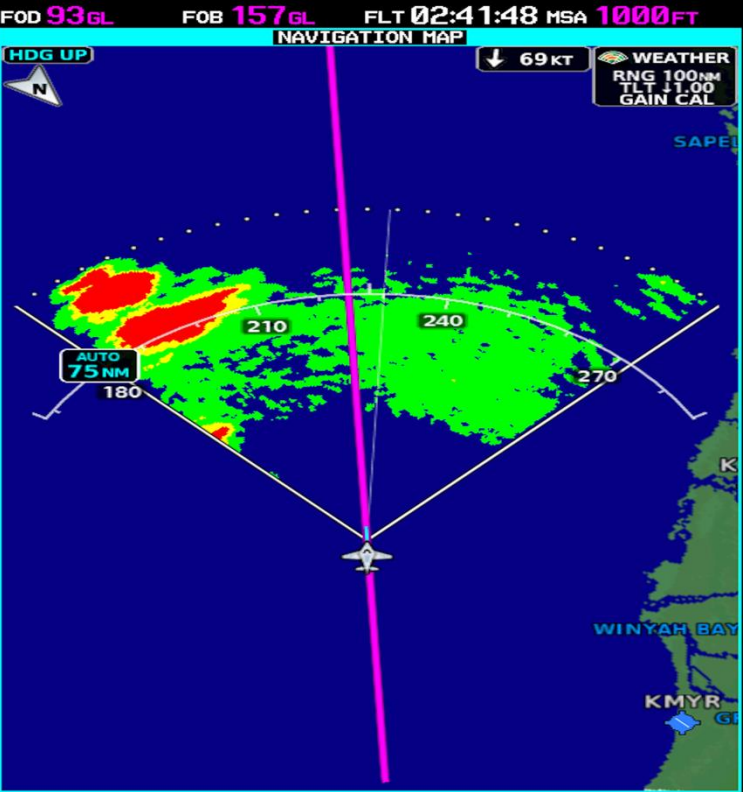
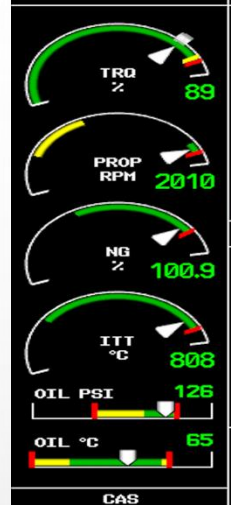
NAV 114.70 STBY 111.75 IFLI ILS

Active Flight Plan

KMTH / KMJX	DTK	CUM	ETE
KMTH Florida Keys Marath			

COM1 135.05 RX
STBY 124.02

COM2 121.50
STBY 123.00



BIRTH OF RADAR MEMORIAL

ON 26th FEBRUARY 1935, IN THE FIELD OPPOSITE

ROBERT WATSON WATT AND ARNOLD WILKINS

SHOWED FOR THE FIRST TIME IN BRITAIN THAT
AIRCRAFT COULD BE DETECTED BY BOUNCING
RADIO WAVES OFF THEM. BY 1939 THERE WERE
20 STATIONS TRACKING AIRCRAFT AT DISTANCES
UP TO MORE THAN 100 MILES. LATER KNOWN
AS RADAR, IT WAS THIS INVENTION, MORE
THAN ANY OTHER, THAT SAVED THE RAF
FROM DEFEAT IN THE 1940 BATTLE OF BRITAIN.





COFFEE



BREAK

