



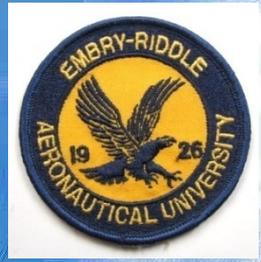
NTSB National Transportation Safety Board

Office of Aviation Safety

General Aviation Weather Related Accidents

Donald Eick (“Ike”)

NTSB Senior Meteorologist



Don Eick
NTSB Senior Meteorologist
eickd@ntsb.gov

Maurice



NTSB Most Wanted List

Critical changes needed to reduce transportation accidents and save lives.

***“The best safety device in
any aircraft is a well
trained pilot”***

***Improve General
Aviation Safety***



National
Transportation
Safety Board

WWW.NTSB.GOV/MOSTWANTED

Topics that will be discussed:

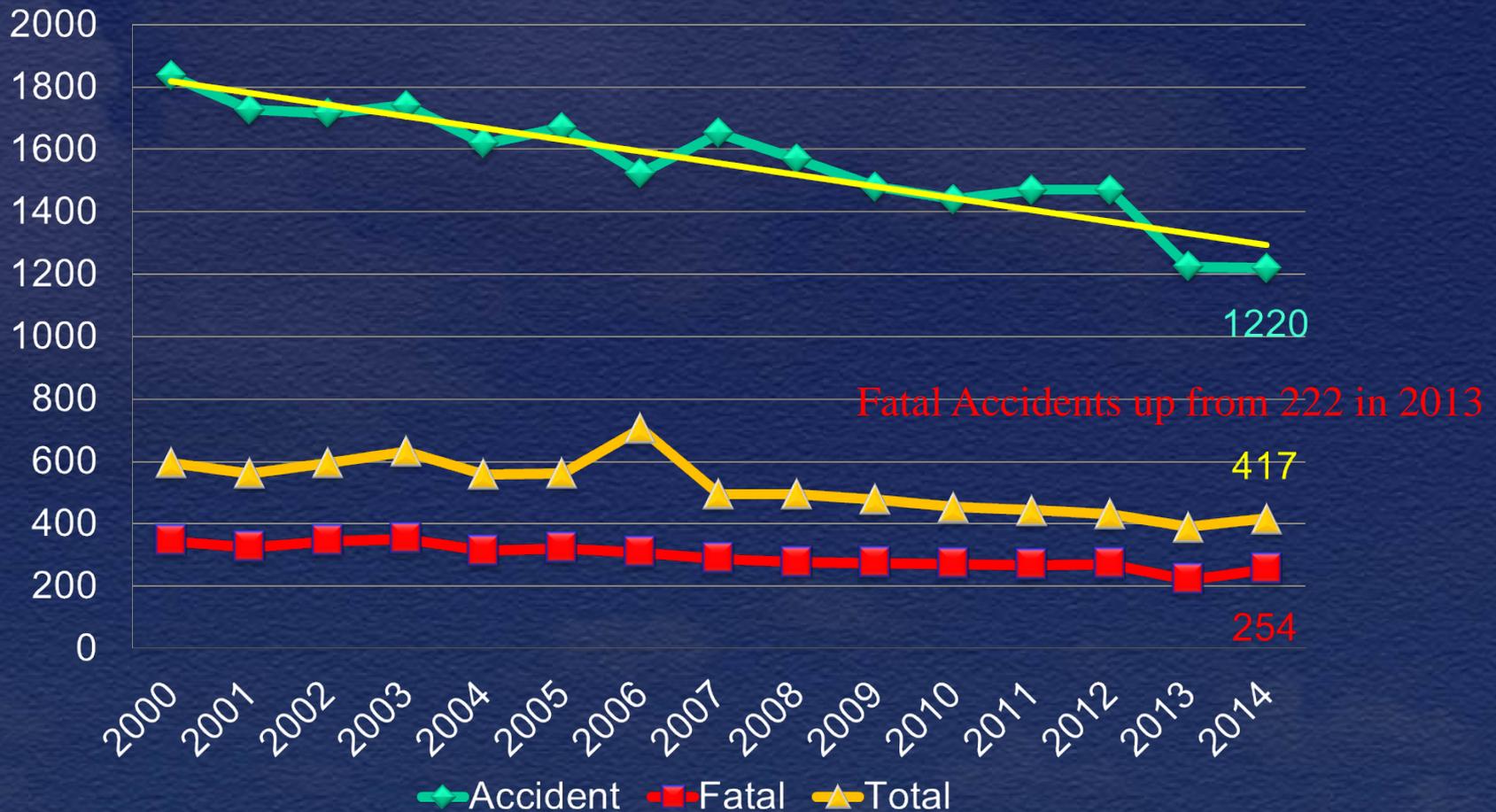
- Review Part 91 accident statistics
 - Main weather threat areas
 - Thunderstorms
 - Making weather wise decisions
 - Preflight weather briefing
 - Obtaining updates
 - Weather in the cockpit
 - Weather related accidents
- 

NTSB 2014 - Part 91 Accident Statistics

- 1,218 accidents
- 252 fatal accidents
- 417 total fatalities
- **Man-Machine-Environment**
- Part 91 accounted for 51% of total flight time and 97% of all fatal accidents
- *Weather related events account for a high percentage of the accidents and one of the highest fatality rate!*

NTSB Part 91 Accident Trends

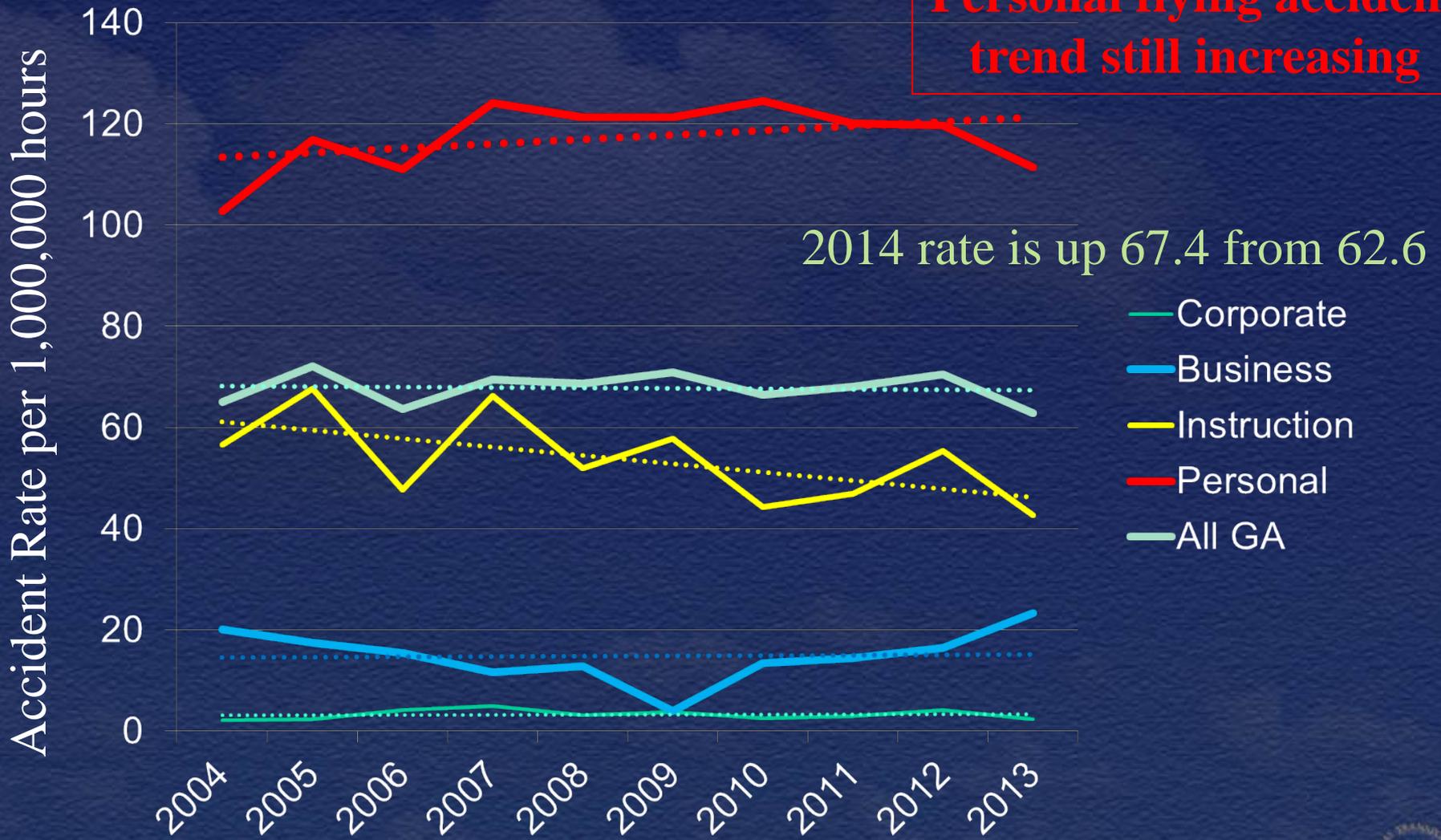
Continued decreasing trend in the number of accidents
2014 lowest rate in 20 years! But...
2000-2014



Part 91 Accident Rates

2004-2013

Personal flying accident trend still increasing



General Aviation on the Most Wanted List

- NTSB investigates approximately 1,500 accidents per year (10 year average)
- **Part 91 – Overall GA accident rate is relatively flat**
 - Part 91 little improvement over the last decade
 - Part 121 air carrier accident rates have declined more than 80% during the period
- **Part 91 – Personal flying accidents**
 - Increased 20% over the last 10 years
 - Fatal rate increased 25% over the period

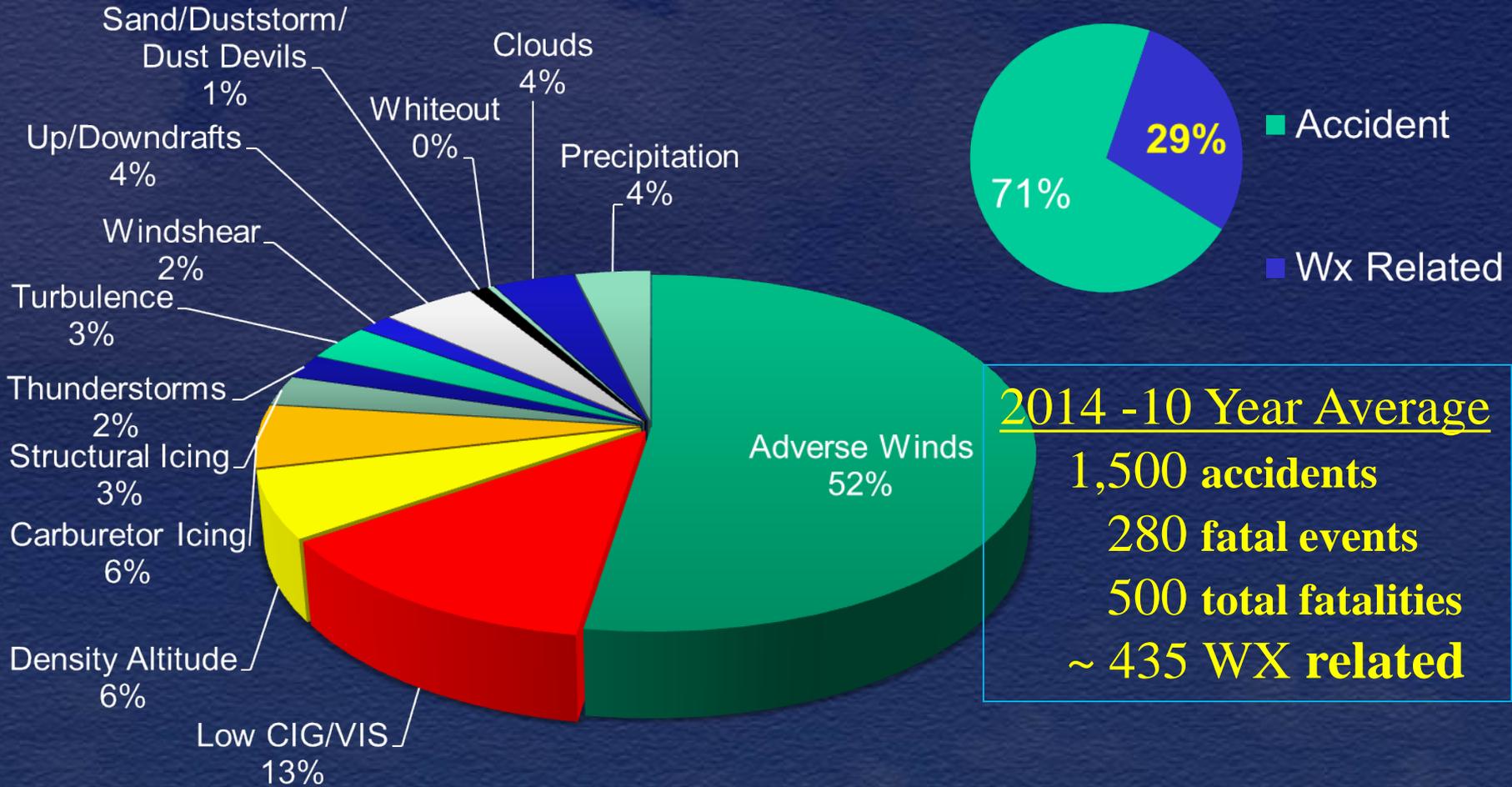
Defining Fatal Accident Events

In 2008 NTSB began using the Commercial Aviation Safety Team (CAST) descriptions for classifying accidents:

- *Loss of Control (LOC) in flight/ground (~38% wx)*
 - *Spatial Disorientation*
 - *Thunderstorms*
 - *In-flight icing*
 - *Adverse winds*
- *System/component failure – Powerplant*
 - *Carburetor icing*
- *Controlled Flight Into Terrain (CFIT)*
- *Collision with terrain/object*
- *VFR encounter with IMC*
- *System/component failure – Non-Powerplant*

Part 91 – Weather As Cause/Factor period 2000-2011

19,441 Accidents



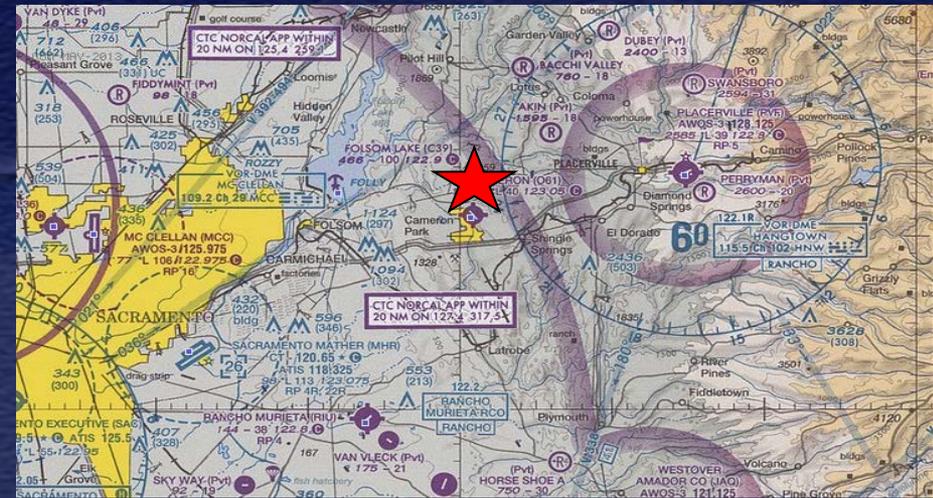
ADVERSE WINDS

#1 ENVIRONMENTAL FACTOR IN WEATHER RELATED ACCIDENTS:

- **VARIABLE WIND**
- **HIGH WIND $\geq 25KT$**
- **CROSSWIND & TAILWIND**
- **WIND GUSTS/SQUALLS**
- **WIND SHIFTS**



LAX07FA258
Cameron Park, CA
Raytheon A36, N1098F
Aug. 30, 2007



- Part 91- personal flight
- Cameron Park (O61) , elevation 1,287 ft
- Runway 13/31 - 4,050 X 50 ft
- 1235 PDT - Weather 96° F & variable wind
- Density altitude 4,125 ft
- Full fuel, Pilot & 3 PAX, baggage
- No formal weight & balance performed
- Takeoff distance 50' required +30% = 4,030 ft

Unfavorable Winds & High Density Altitude LAX07FA258



 Quartering crosswind & tailwind

NTSB



LAX07FA258 - Cameron Park, CA

Aug 30, 2007

Fatal 2
Serious 2



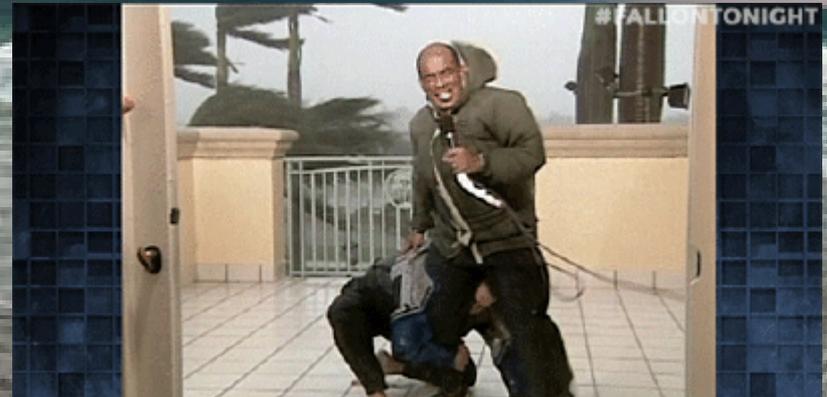
Main Wreckage
Photo 2- Main Wreckage 1

Dislodged Boulder



Welcome to Florida

What do you think is the primary cause of adverse winds in Florida?



ERA12CA521 - Deland, FL

Cessna 152, N49054

Aug. 21, 2012



- Part 91 maintenance flight
- Local flight @ 1510 EDT
- Once airborne noticed storms approaching field
- Abort flight & returned to field
- Became unstable on approach – wind & turbulence
- Attempted go-around, full power, aircraft continued to settle, impacted runway hard & flipped inverted off runway
- Substantial damage
- Pilot unhurt “*shaken by event!*”

ERA12CA521- Deland, FL



KDED 211855Z AUTO 31025G34KT 10SM FEW023 32/22 A3002 RMK A01 TSNO



NTSB Probable Cause - The pilot's failure to maintain airplane control on final approach in gusting wind conditions. Contributing to the accident was the pilot's decision to operate in an environment of thunderstorms and rapidly deteriorating weather.

KMLB WSR-88D base reflectivity
images at 1508 and 1515 EDT

✈️ **A large majority of fatal Part 91 accidents occur in Instrument Meteorological Conditions (IMC)**

✈️ **Loss of control (LOC)**

✈️ **VFR into IMC**

✈️ **Spatial Disorientation (SD)**

✈️ **Icing, turbulence, thunderstorms**

✈️ **Failure to adhering to standard instrument approach procedures**

THE
FOG

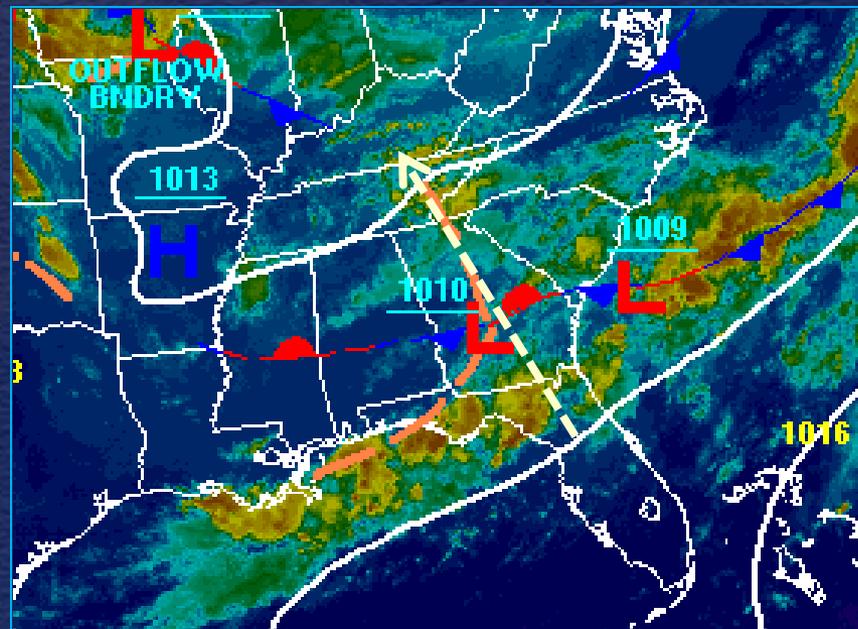
ERA09LA392
Sanderson, FL
RV7A, N774US
July 8, 2009



- Non-instrument rated pilot
- Departed morning VFR cross country to pickup friend in KY and fly back to Sun City, FL
- No flight plan or preflight briefing documented
- Departure/destination – VFR
- Let's go flying!

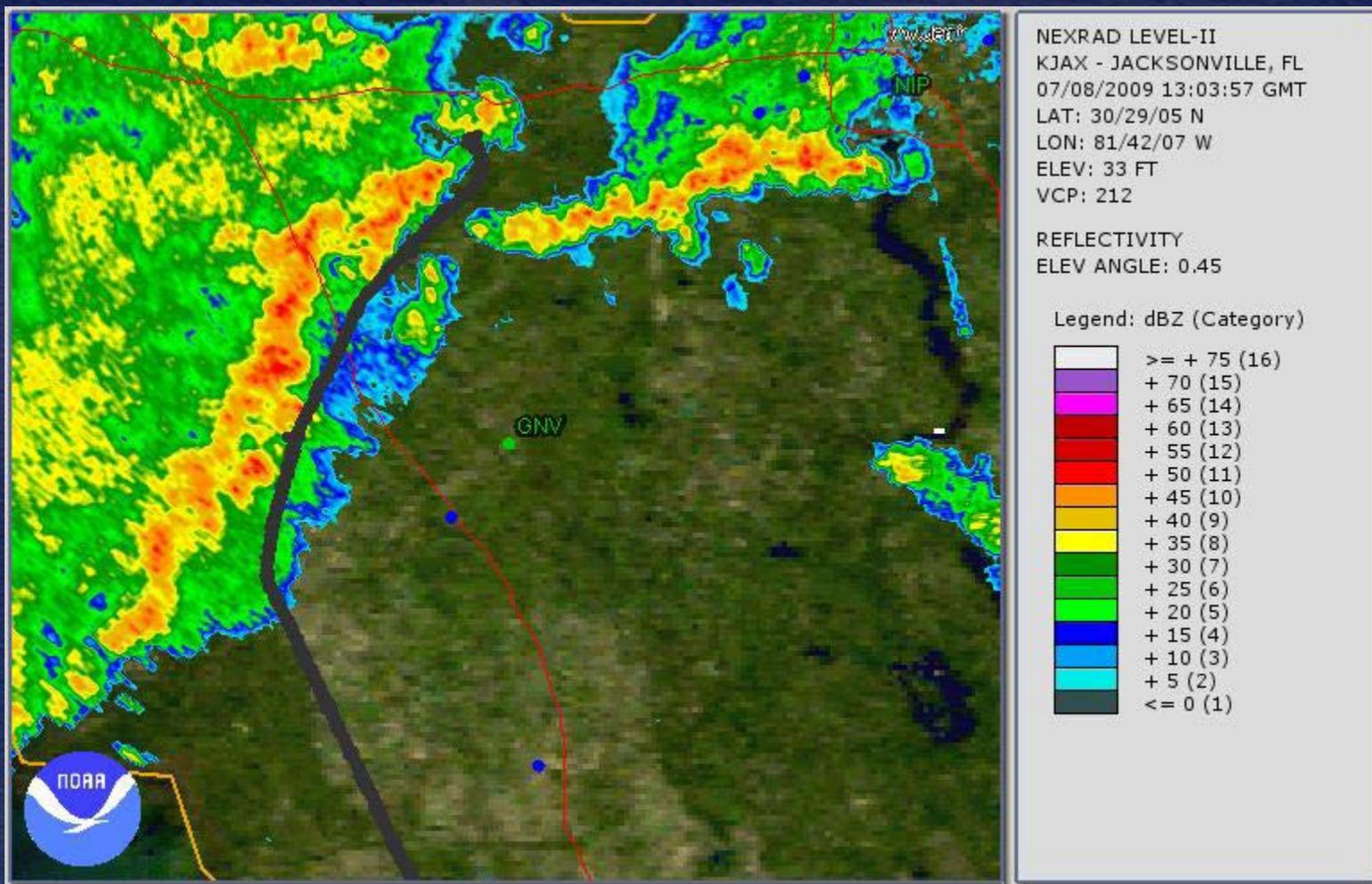
ERA09LA392 – Sanderson, FL

- Current conditions:
 - Stationary front
 - Convective activity
- Encountered area of thunderstorms
- Low overcast ceilings, rain and thunder reported by witness



WX 240° 5KT 2 1/2SM TSRA BKN010 OVC020 23/22
A2990 RMK TSB14 OCNL LTGCG TS S MOV E

ERA09LA39 - Sanderson, FL

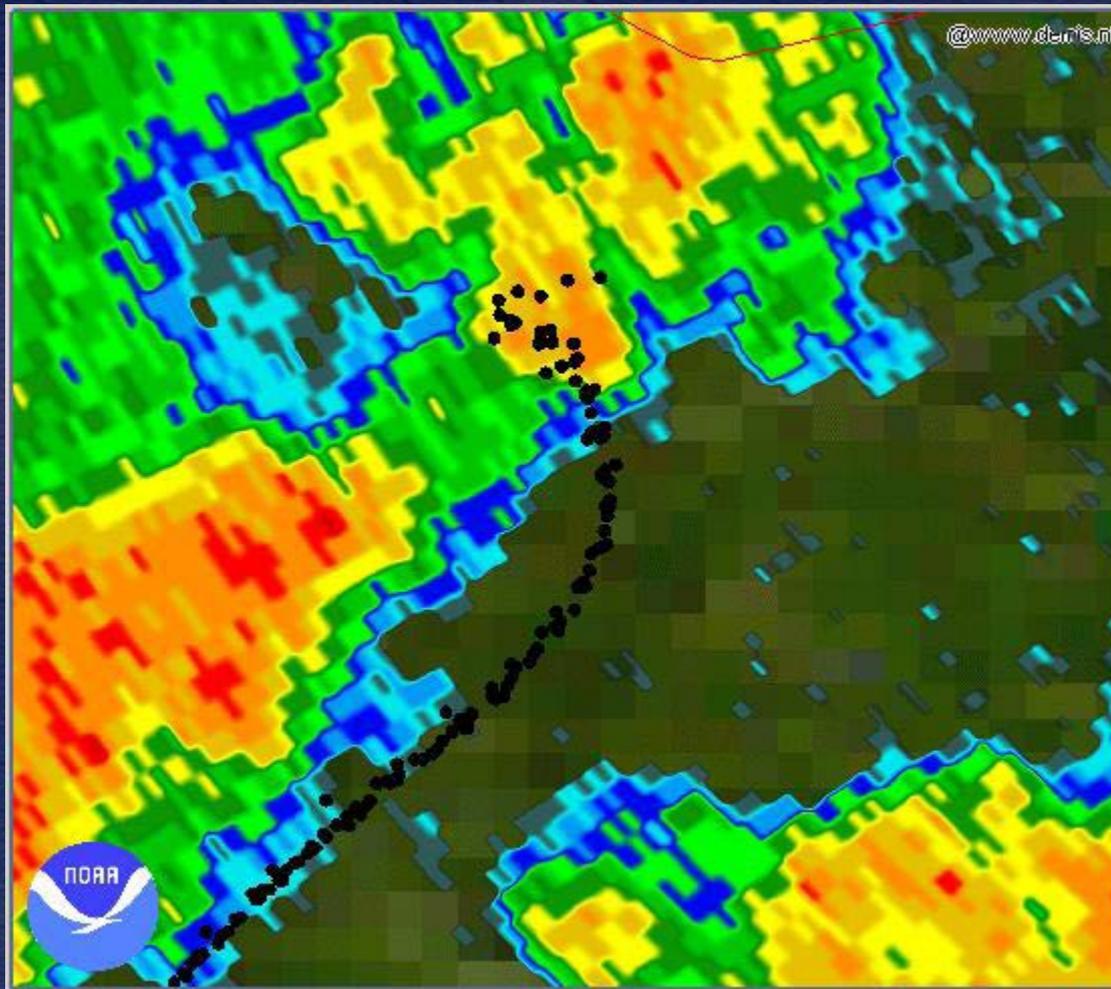


Flight started out OK until....

NTSB



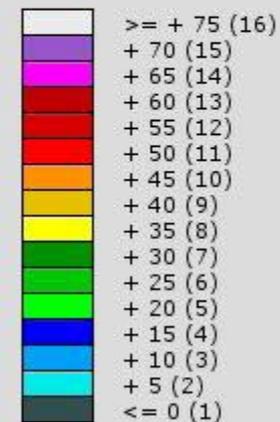
ERA09LA39 - Sanderson, FL



NEXRAD LEVEL-II
KJAX - JACKSONVILLE, FL
07/08/2009 13:03:57 GMT
LAT: 30/29/05 N
LON: 81/42/07 W
ELEV: 33 FT
VCP: 212

REFLECTIVITY
ELEV ANGLE: 0.45

Legend: dBZ (Category)



NTSB



ERA09LA392 – Sanderson, FL

Fatal 1



Preflight Planning

FAR 91.103 - Preflight Action



“But, it’s just a local flight?”

NTSB



Preflight Planning



NTSB study 41% of the weather related accidents the pilot did not obtain or received an adequate weather briefing

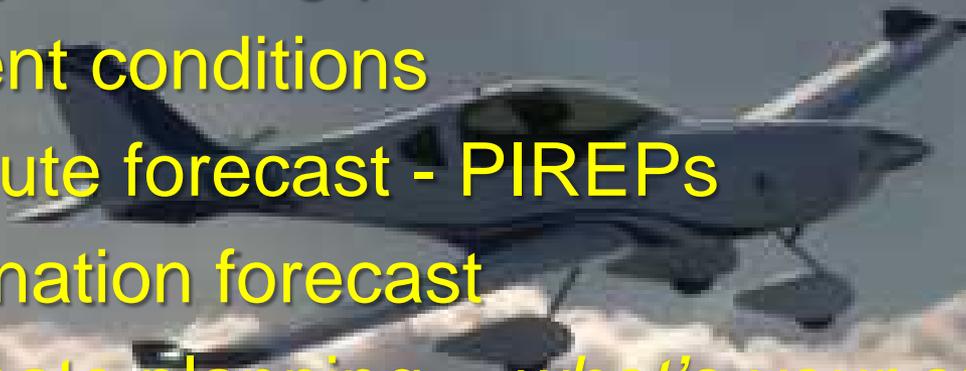
Weather Briefing Sources

- **Automated Flight Service Station (AFSS)**
1-800-WX-BRIEF*
- **Direct User Access Terminal Service (DUATS)***
- Internet sources – NWS ADDS site
- Private Vender - WSI Pilot Brief, Foreflight, FltPlan.com, etc.

- *** Only recognized official briefing sources**



Standard Weather Briefing

- Adverse weather - Hazards
 - Synopsis – “big picture”
 - Current conditions
 - En route forecast - PIREPs
 - Destination forecast
 - Alternate planning – *what's your out?*
 - Winds aloft – freezing level? Strong winds?
 - Notice to Airmen
 - Update – *forecasts are perfect!*
- 
- A small, dark-colored airplane is shown in flight, banking to the right. The aircraft is positioned in the upper-middle section of the frame, flying through a sky filled with numerous white, puffy clouds. The background sky is a clear, pale blue. The overall scene is a typical representation of a flight in a clear but cloudy atmosphere.

Internet Weather

Safety Tip –
get the big picture!



**A picture is
worth a
thousand
words!**



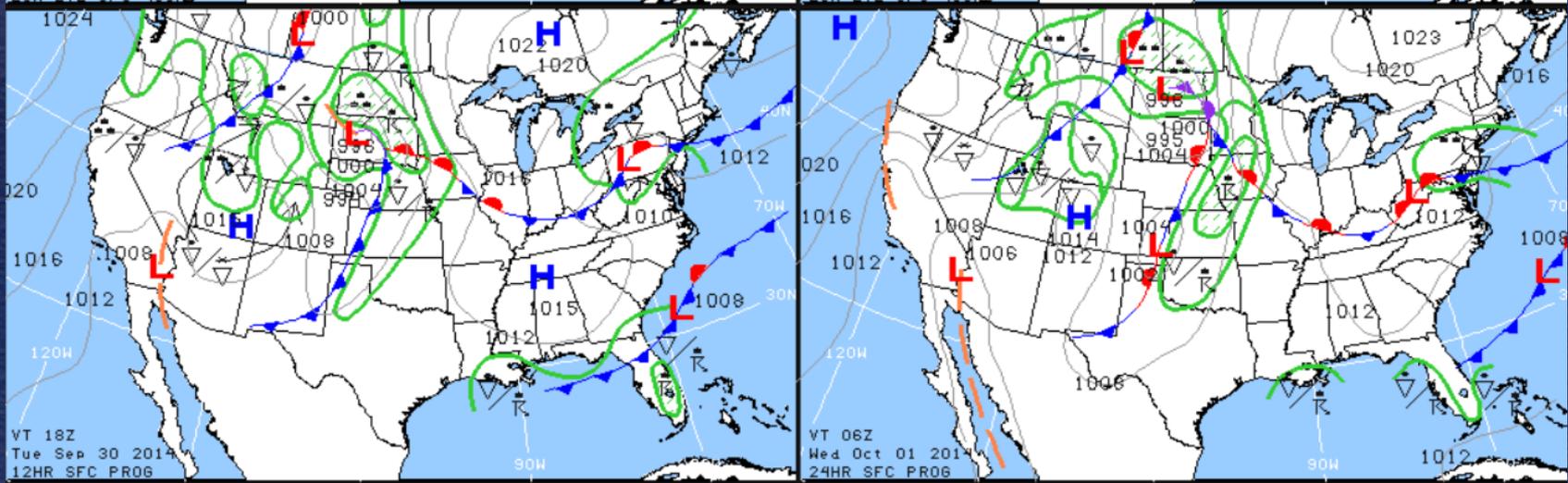
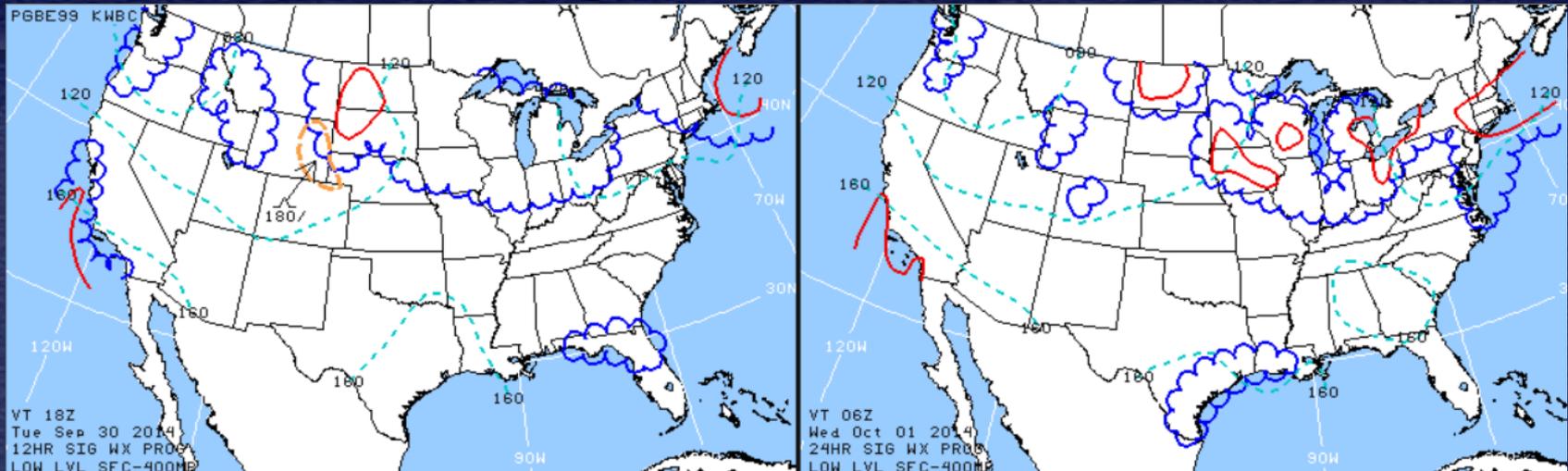
Internet Weather Sources

The screenshot shows the Aviation Weather Center website interface. At the top, there are logos for NOAA and the National Weather Service, followed by the text "AVIATION WEATHER CENTER". Below this is a navigation menu with links: USER, HOME, ADVISORIES, FORECASTS, OBSERVATIONS, USER TOOLS, NEWS, SEARCH, and ABOUT. A note states: "NOTE: For slower internet connections and browsers, it is recommended to turn off the display of the interactive map. You can do this through the settings page under the 'USER' menu." There is a search box for "Local forecast by" with a "Go" button. A "New Web Site Introduction" section has tabs for Overview, What's New, Tutorial, and FAQ. The main content area is titled "Aviation Weather Overview" and includes a map of the United States. A popup window displays details for "Urgent PIREP FA50" with the following text: "Obs Time: 2015-04-23T19:17:00Z", "Hazards: Turbulence", "Intensity: EXTM", "Flight level: 160", and "Urgent PIREP: RSW UUA /OV RSW090025/TM 1917/FL160/TP FA50/TB EXTRM/RM CWSU ZMA". Below the map are various checkboxes for weather products like METARs, TAFs, AIR/PIREPs, SIGMETs, and G-AIRMETS. A legend at the bottom explains symbols for flight categories (MVFR, IFR, LIFR), turbulence (LGT, MOD, SEV), ice (LGT, MOD, SEV), and CWA. A disclaimer at the bottom reads: "Disclaimer: International SIGMET locations approximated. Please refer to SIGMET text for full details".

- Official NWS site recently updated!
- Graphical & text information
- Customize your display
 - Radar
 - Satellite
 - Flt Cat
 - PIREPs

<http://aviationweather.gov/>

Low-Level Significant Weather Chart



Flight planning only. See TAFs for specific terminal forecast.

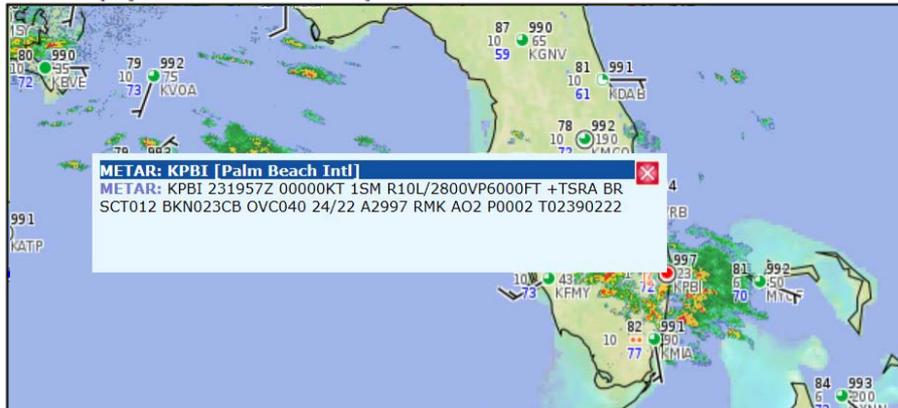
- ceiling less than 1000 ft and/or visibility less than 3 miles
 - ceiling 1000-3000 ft inclusive and/or visibility 3-5 miles incl
 - moderate or greater turbulence
 - freezing level above mean sea level
- freezing level at surface
Tstorms imply possible svr or greater turb, svr icing and LLWS.

ADDS METARs

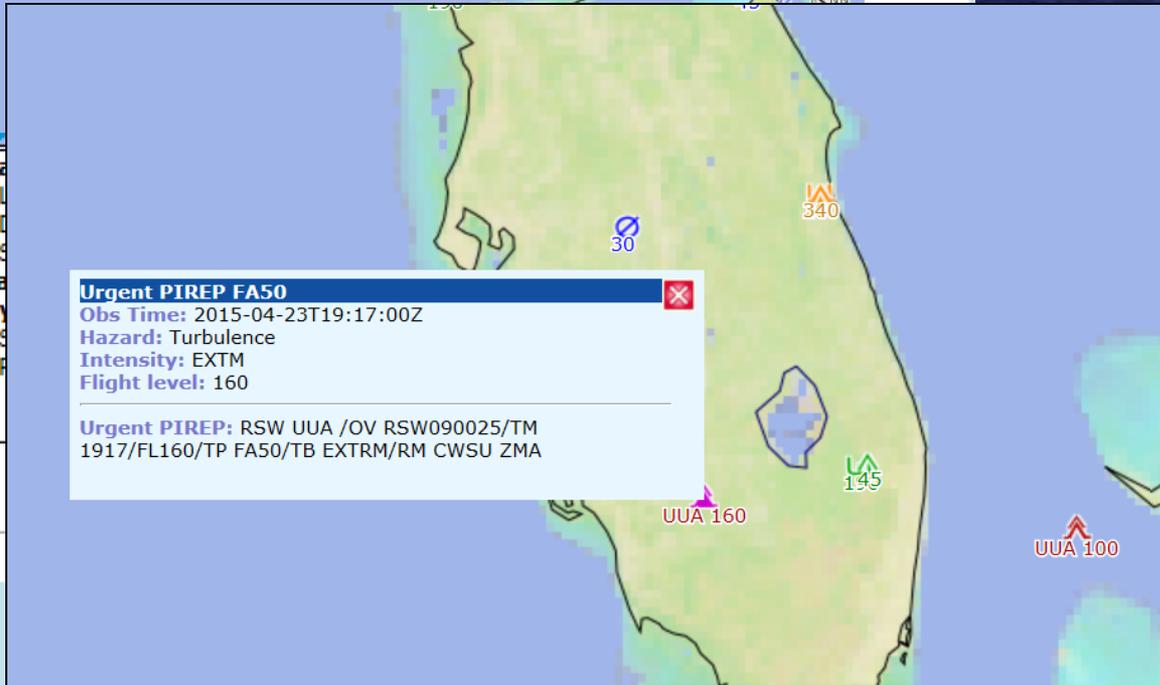
ENFO

METAR Display at valid at 2009 UTC 23 Apr 2015

permalink



METAR: KPBI [Palm Beach Intl]
METAR: KPBI 231957Z 00000KT 1SM R10L/2800VP6000FT +TSRA BR
SCT012 BKN023CB OVC040 24/22 A2997 RMK AO2 P0002 T02390222



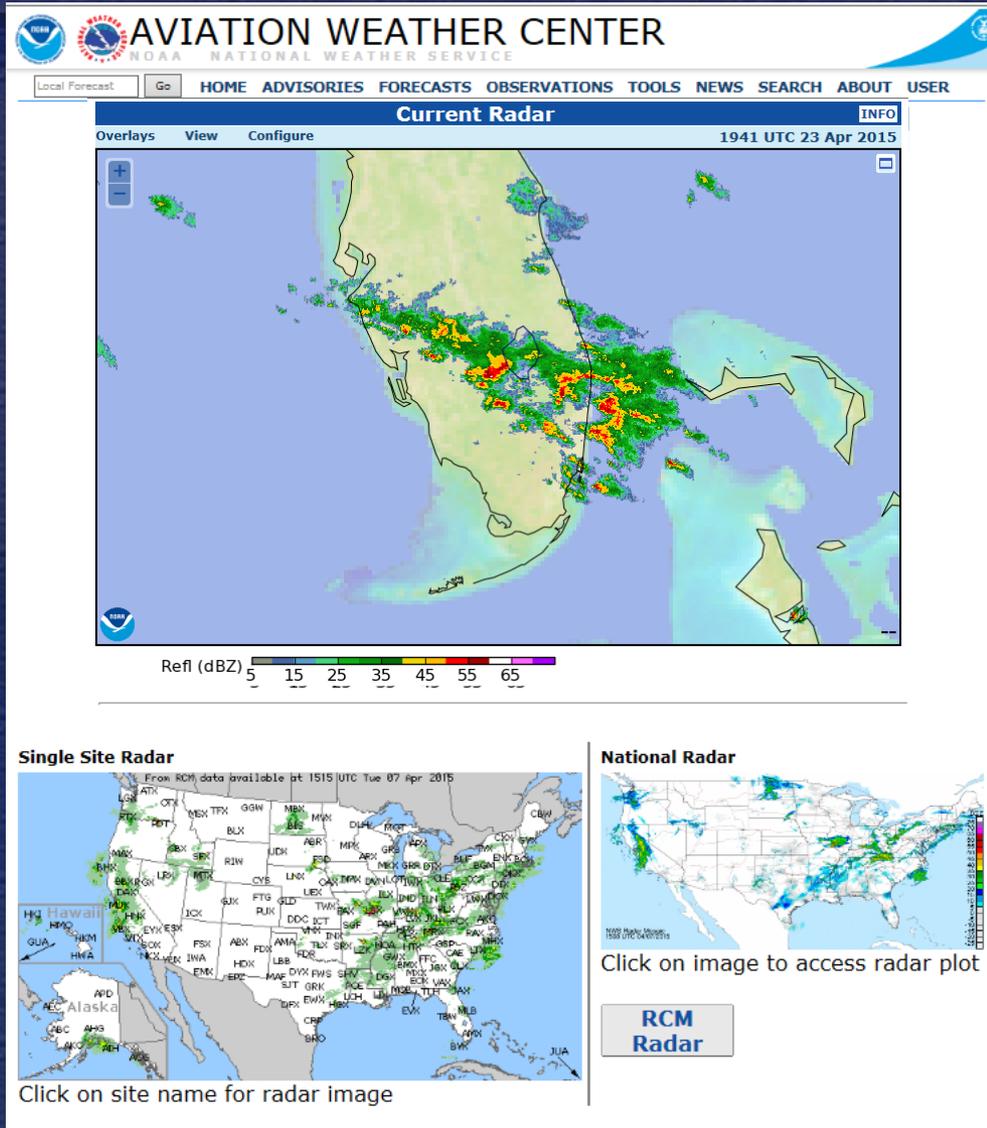
Urgent PIREP FA50
Obs Time: 2015-04-23T19:17:00Z
Hazard: Turbulence
Intensity: EXTM
Flight level: 160

Urgent PIREP: RSW UUA /OV RSW090025/TM
1917/FL160/TP FA50/TB EXTRM/RM CWSU ZMA

Observations

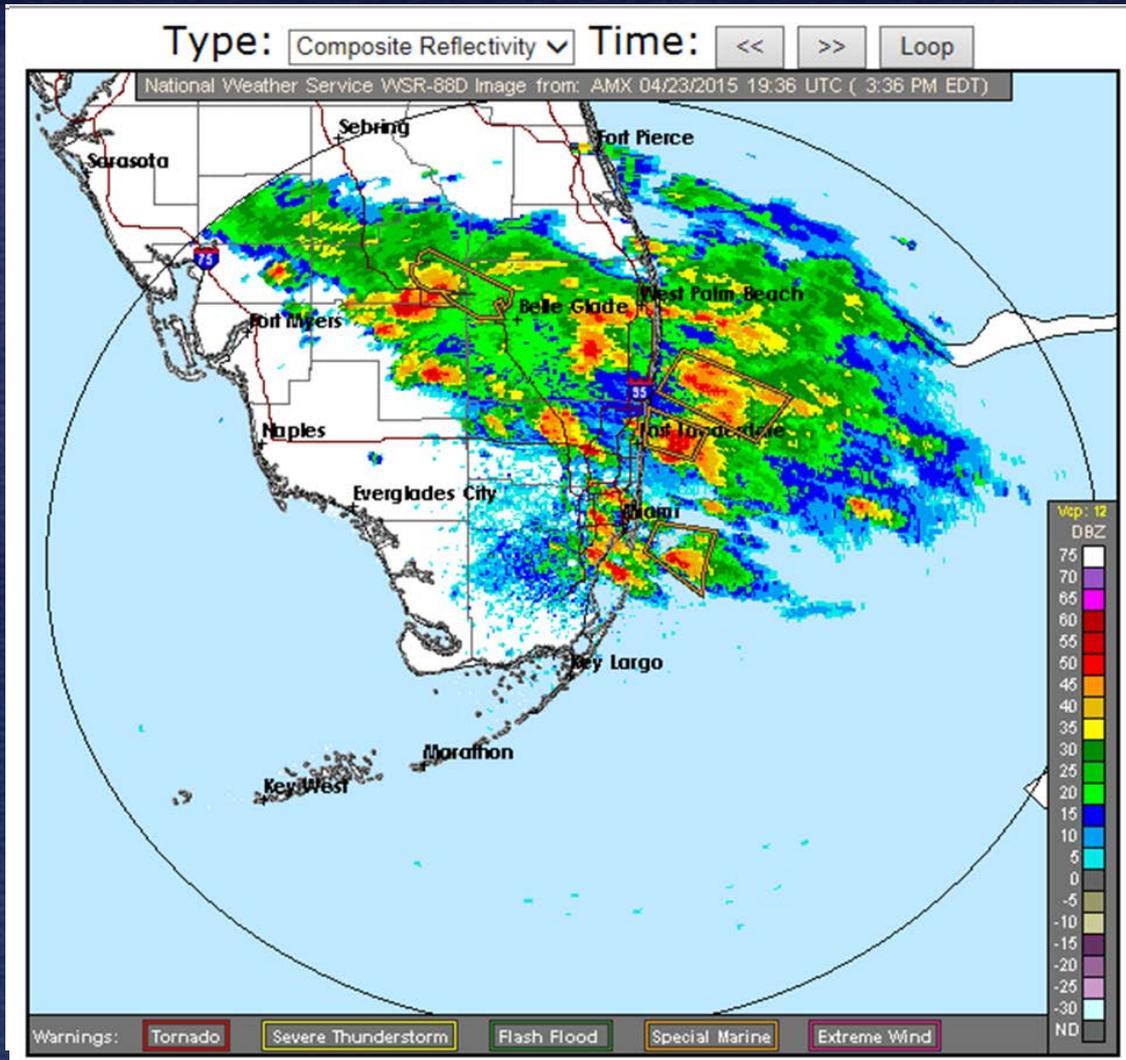
- Aircraft Rep
- METARs
- Ceiling and Vis
- Radar
- Satellite

Observations - Radar



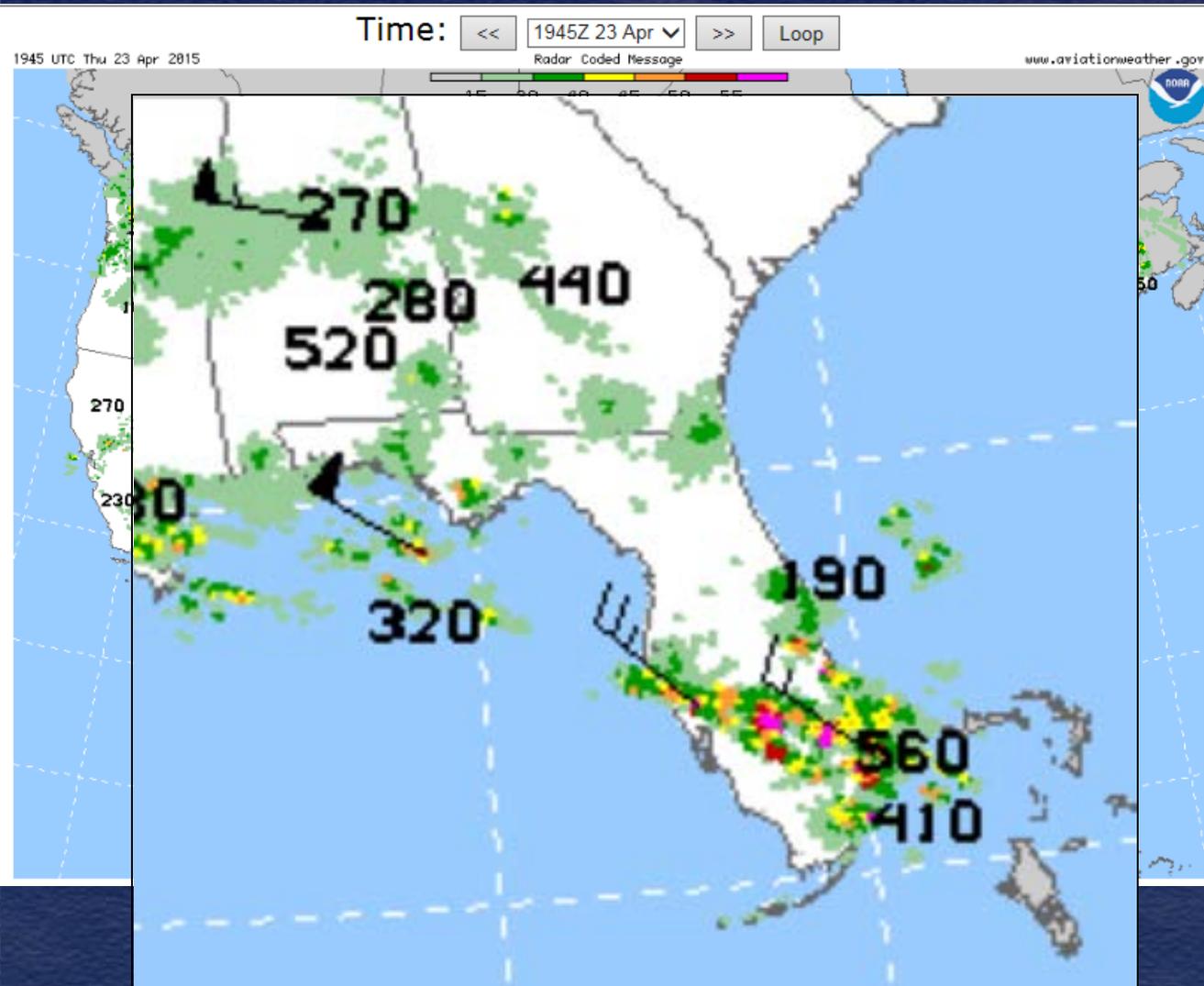
- National Composite Radar Mosaic
 - Updated 10 min
- Regional mosaic
- Individual WSR-88D sites
 - Base & composite reflectivity
- RCM Radar Summary
 - Movement & tops

NWS Individual WSR-88D



- Individual WSR-88D sites
- Base reflectivity
 - Composite
 - local weather watches

RCM Radar Summary



Radar Coded Message (RCM)

- Updated every 30 min
- Movement
- Tops
- Limitation – NWS does not use severe storm indicators (TVS, Hail, Meso, solid line, or add weather watches)



AVIATION WEATHER CENTER

NOAA NATIONAL WEATHER SERVICE

Local Forecast

Go

HOME ADVISORIES FORECASTS OBSERVATIONS TOOLS NEWS SEARCH ABOUT USER

Satellite Imagery

INFO

Overlays View Configure

2005 UTC 23 Apr 2015

Type: Region: Time:

1945 UTC Thu 23 Apr 2015

Visible Satellite

www.aviationweather.gov

0 6 9 12 15 18 21 24 27 30 33 36 39 42 45 48 51 54 57 60 63 66 69 72 75 78 81 84 87 90 93 96 99



US Reg



Click on site na

GOES Vis/Fog
VFR/IFR



- ICAO Area E
- ICAO Area F
- ICAO Area M

satellite imagery
Infrared
Water Vapor
Visible

NTSB



Aviation Weather Services

AVIATION WEATHER SERVICES

Advisory Circular,
AC 00-45G,
Change 1



U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE



U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION



Published July 29, 2010

Photo courtesy of Aaron A. Gistad

AC 00-45G

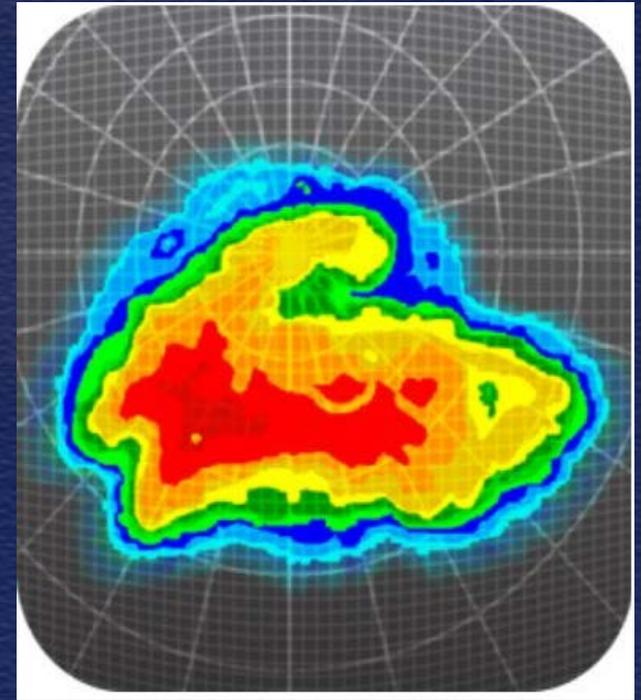
- Basic reference guide how to read and interpret all NWS weather products.
- Listed as required knowledge in almost all FAA Airmen test guides

www.faa.gov/gslac/onlineresources.aspx?categoryId=48&masterId=1

NTSB



Weather in the Cockpit (WTIC)



MyRadar

AC 00-24C *Thunderstorms*

- **Ground based weather radar (WSR-88D)**
 - **Reflectivity & echo intensity (dBZ)**
 - **Clear air & Precip modes**
 - **Base & composite reflectivity images**
 - **Flight planning**
 - **Weather in-cockpit displays**
 - **Not real time – time lag**
- **Airborne avoidance radar**
 - **20 NM avoidance**
 - **Attenuation**
- **Do's & Don'ts rules**

Air Traffic Control
FAA Revised Terms
4 levels

Light

Moderate

Heavy

Heavy

Extreme

Extreme

Boundaries

10-30

>30-40

>40

>45-50

>50-55

>55

Existing Systems and Boundaries

ASR-9 Intensity

NWS VIP Levels

Airborne Radar AC 25-11

NEXRAD Cockpit DO-267

Unisys

DTN

WSI

Lvl 1	>30
Lvl 2	40
Lvl 3	46
Lvl 4	50
Lvl 5	57
Lvl 6	57+

18	Lvl 1	30
40	Lvl 2	40
46	Lvl 3	46
50	Lvl 4	50
56	Lvl 5	56
57+	Lvl 6	57+

20	30	40	50	50+
----	----	----	----	-----

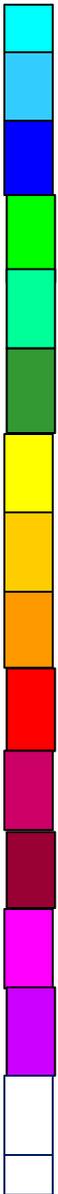
20	30	40	45	50	55	60	60+
----	----	----	----	----	----	----	-----

20	30	40	45	50	55	N
----	----	----	----	----	----	---

N	N
---	---

10	15	20	25	30	35	40	45	50	55	60	65	70	75
----	----	----	----	----	----	----	----	----	----	----	----	----	----

N = National Map
 I = Individual Site
 # = Radar Return in dBZ



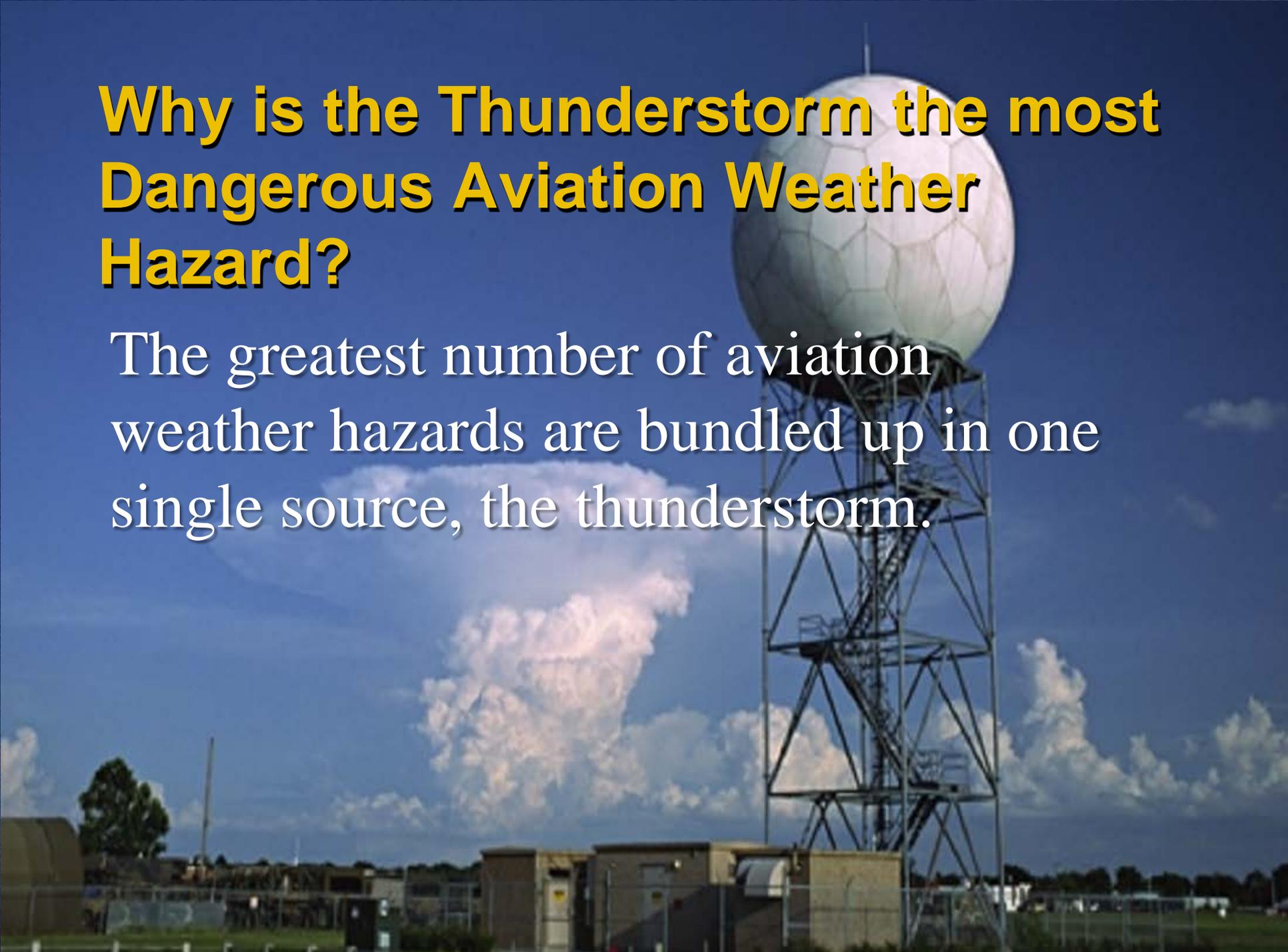


Thunderstorms



Why is the Thunderstorm the most Dangerous Aviation Weather Hazard?

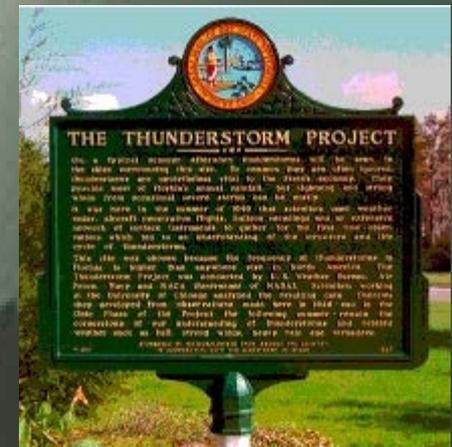
The greatest number of aviation weather hazards are bundled up in one single source, the thunderstorm.

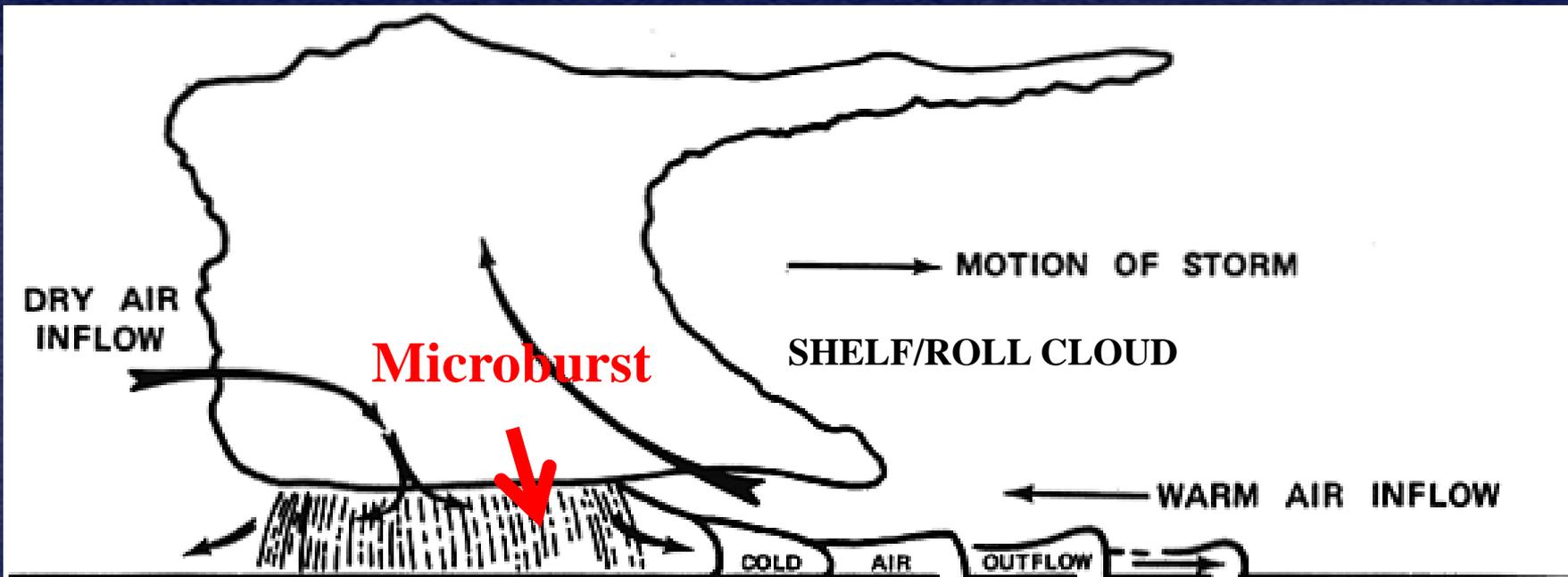


Thunderstorm Hazards AC 00-24C

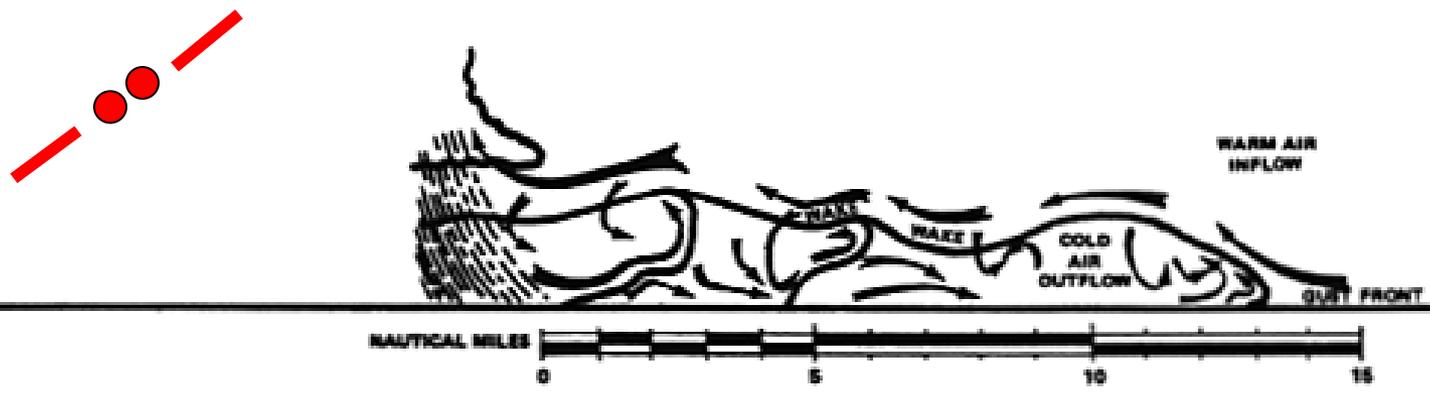
Updated 2013

- ✈️ **Tornadoes**
- ✈️ **Turbulence**
- ✈️ **Gust front**
- ✈️ **Microbursts**
- ✈️ **Icing**
- ✈️ **Hail**
- ✈️ **Low ceilings & visibilities**
- ✈️ **Altimeter errors**
- ✈️ **Lightning**
- ✈️ **Engine water ingestion**





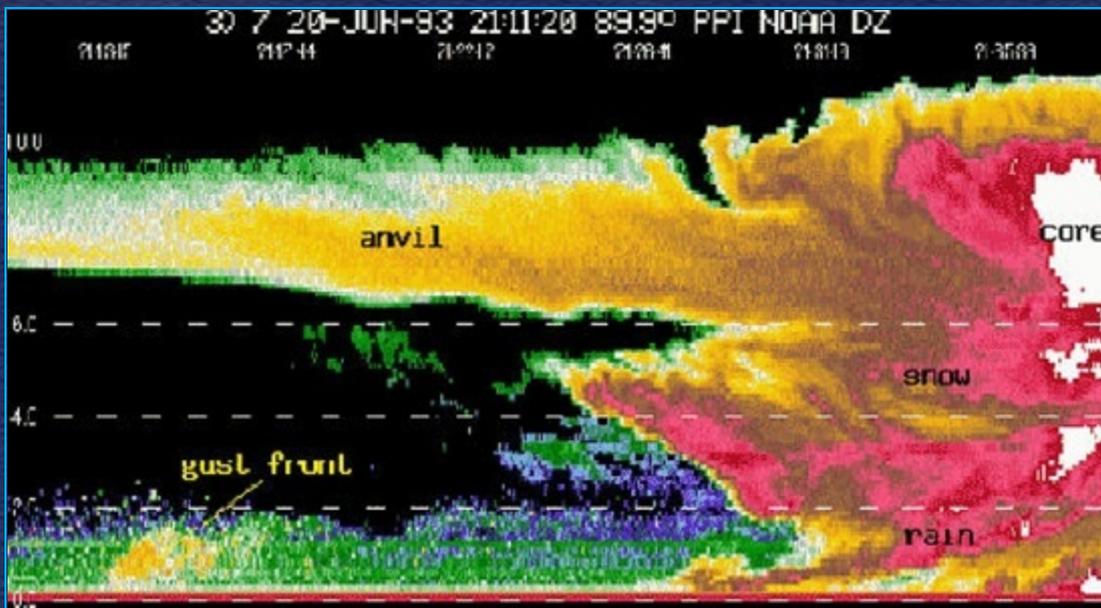
Squall Line - Gust front/Outflow boundary



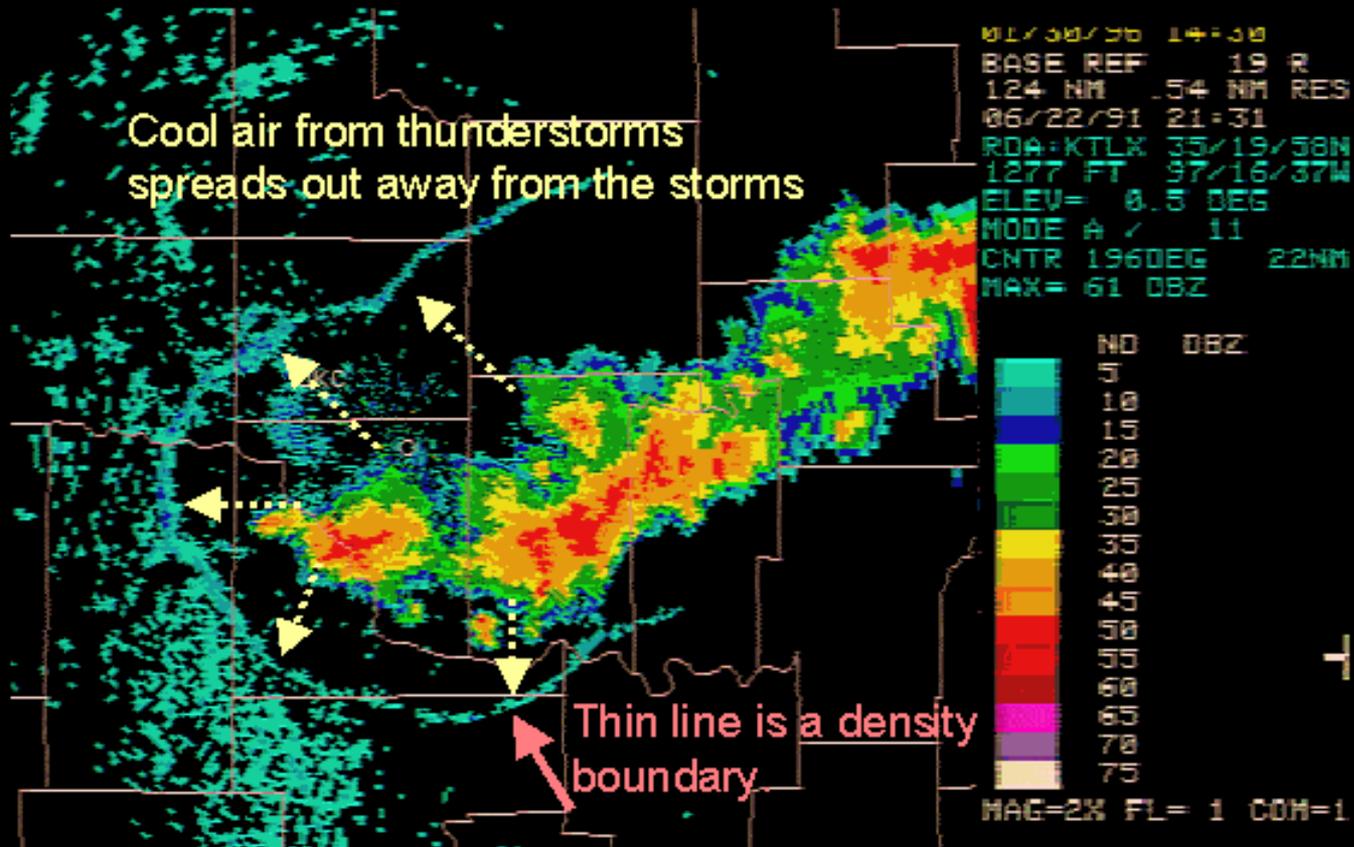
Sign posts in the sky!







Outflow Boundary Example



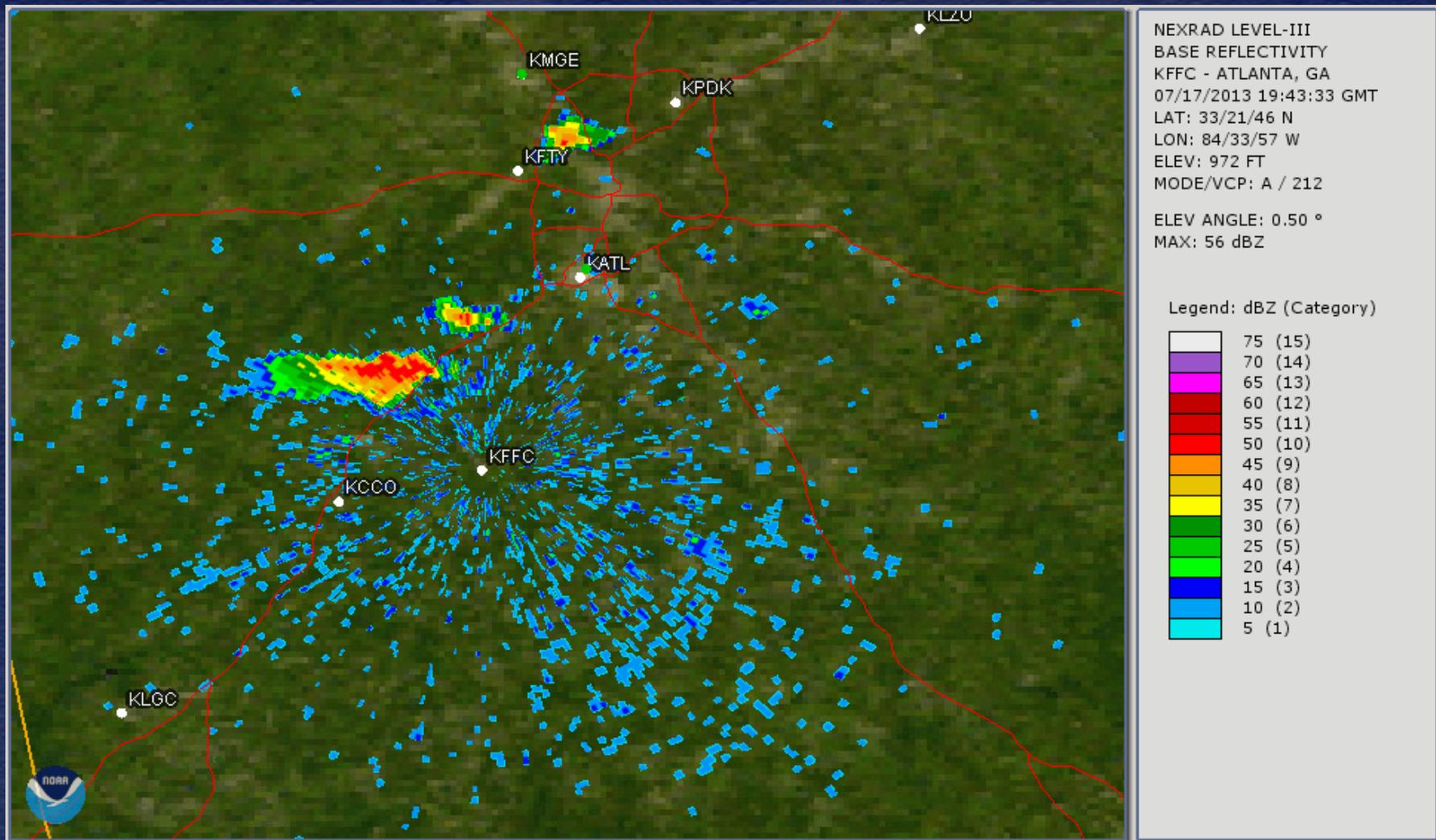
Cool air from the thunderstorms spreads out in all directions away from the storms. These boundaries (separating the cool air from warmer ambient air) can act as focusing mechanisms for additional activity.

Warning – not identifiable in WARP and some radar displays

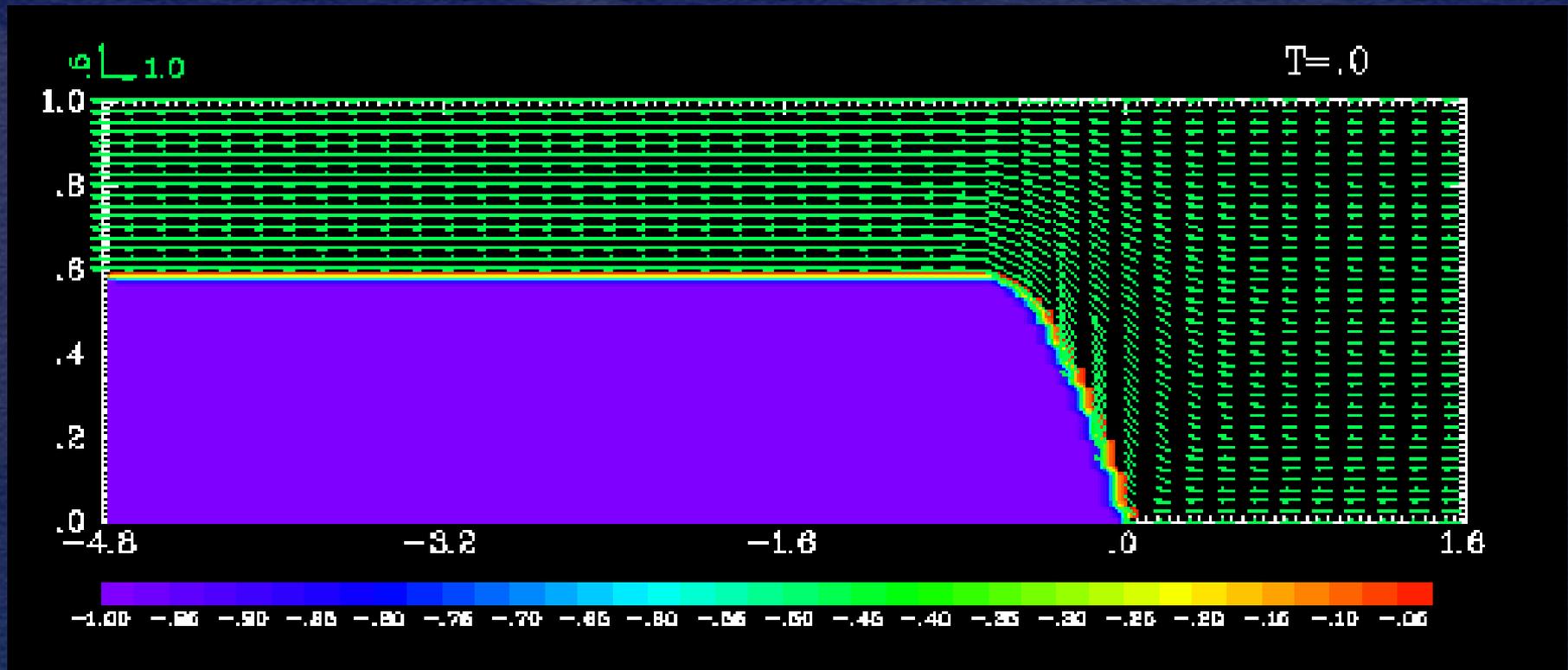


Atlanta, GA - Outflow boundary example

July 17, 2013



Gust Front Hazard – takeoff & landing



LAX08LA105

Tuscaloosa, AL

King Air, N900WP

April 4, 2008



- Approaching airport at 3,000 feet flew under shelf cloud and encountered severe turbulence and lost several hundred feet before regaining control.
- Structural damage to wing spar
- Squall line west of airport
- Fine line echoes 5-10 dBZ

**KTCL 04145 CDT 32025G33KT 2SM -TSRA
SCT029 BKN040 OVC075 20/14 A2986 RMK A02
PK WND 31033/1952 LTG DSNT SW AND W
TSB1950RAB52 PRESRR P0006**



NTSB



CEN09FA369

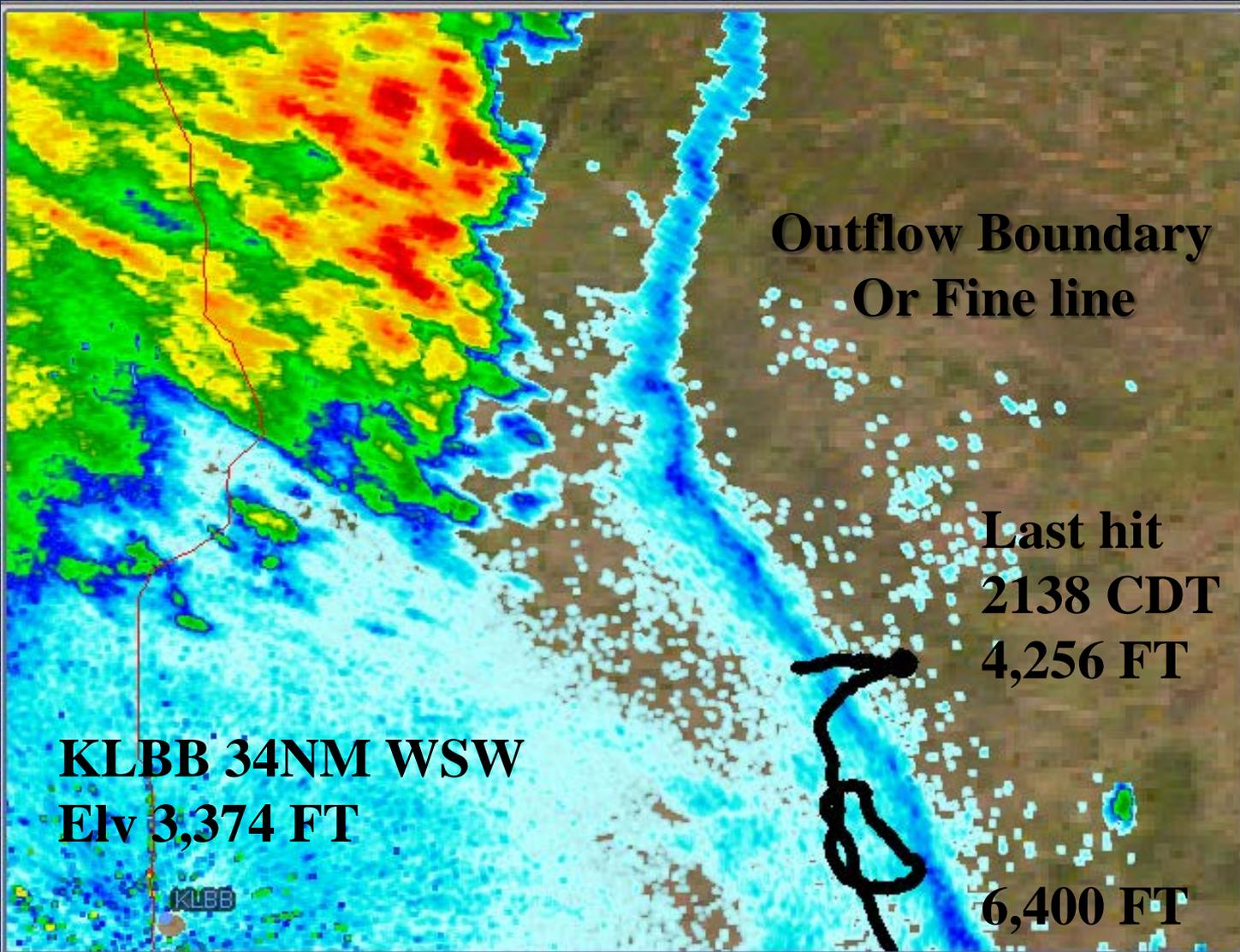
Dougherty, TX

Cessna 182, N1826GT

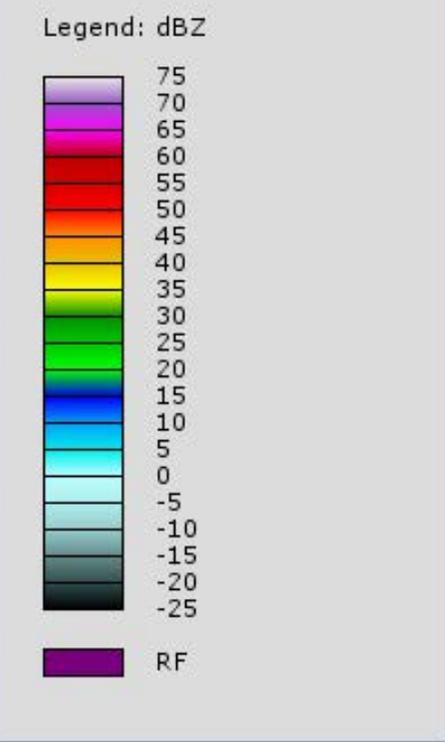
June 18, 2009



- Part 91 personal VFR flight
- Couple both private pilots
- Houston Southwest (KAXH) to Plainview (KPVX), TX
- No weather briefing/flight plan filed
- Female voice calls UNICOM 2140 CDT weather
 - KPVW 0225Z 27018G33KT 2 1/2SM +RA SCT008 BKN050 OVC065
19/17 A2997 RMK A02 SFC VIS 1 3/4V5
- Aircraft found 2 days later in field
- Fatal 2
- Witnesses reported winds gusting 60 KT, blowing dust & sand



NEXRAD LEVEL-II
 KLBB - LUBBOCK, TX
 06/19/2009 02:40:33 GMT
 LAT: 33/39/14 N
 LON: 101/48/50 W
 ELEV: 3259 FT
 VCP: 12
 REFLECTIVITY
 ELEV ANGLE: 0.54



Flight path and “Outflow Boundary/Fine Line” location
 KLBB 26037G51KT 3/4SM BLDU SCT030 BKN070 24/14 A2990
 55 RMK CB DSNT W-NW





Daytime image of gust front – Haboob blowing dust/sand

Astronomical conditions:

Sunset 2100 CDT

End civil twilight 2129 Nighttime condition

Accident 2138

"I Love Haboobs!"



- **NTSB Probable Cause** - *The pilot's improper decision to continue flight into known adverse weather conditions resulting in his inability to maintain aircraft control after penetrating the thunderstorm gust front.*
- *Contributing to the accident was the pilot's lack of preflight planning, failure to obtain a weather briefing, and the severe to extreme turbulence, blowing dust which produced brownout conditions associated with thunderstorm activity.*



CEN11FA500

Rantoul, IL

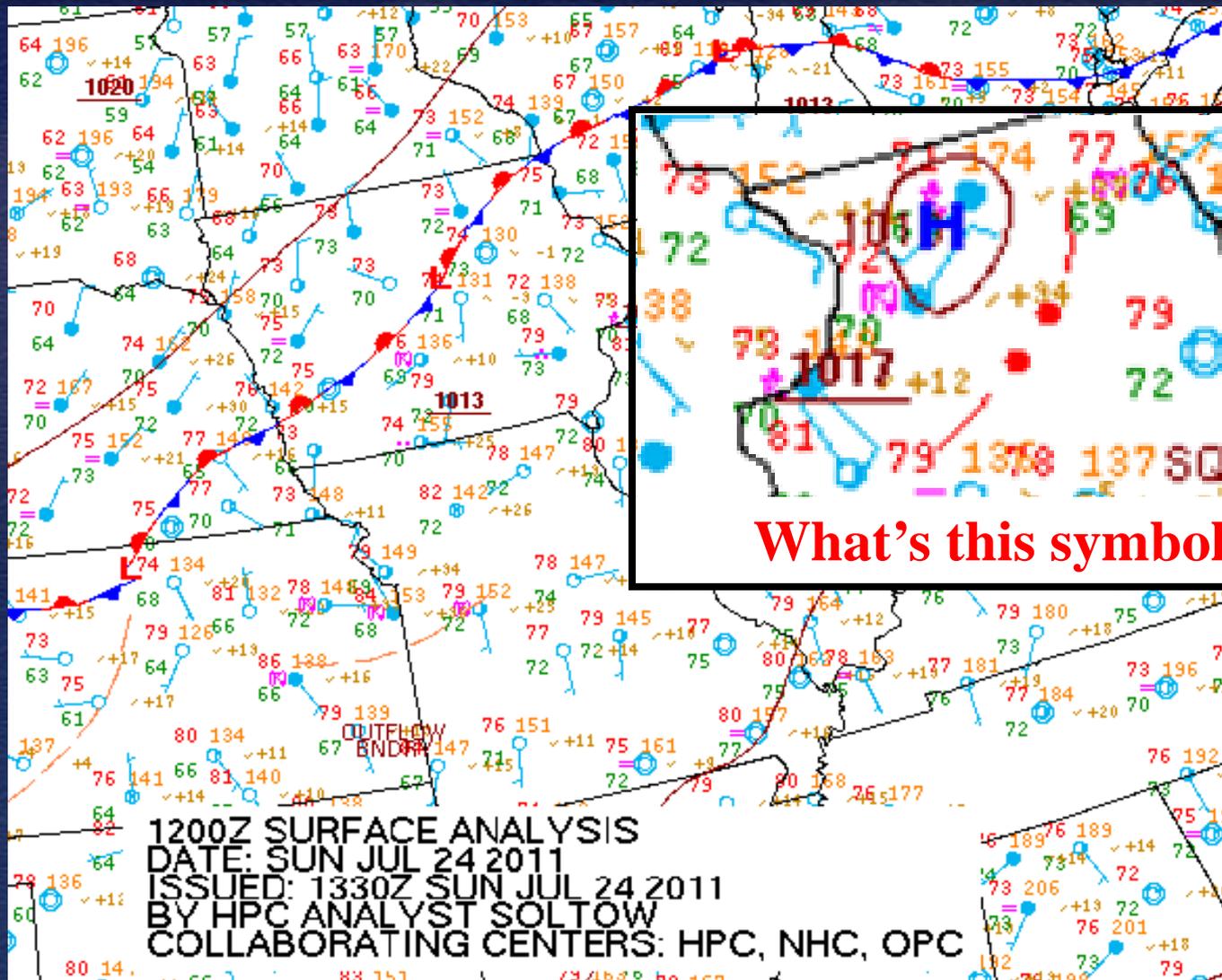
Piper Malibu PA-46, N46TW

July 24, 2011



- Featured in **Flying Magazine Jan. 2013**
- Part 91 personal - IFR flight plan
- Rantoul (KTIP) to Sarasota (KSRQ)
- Internet weather briefing
- Advised FBO “In hurry to beat the weather moving through the area!”
- Loss of control on takeoff
- Fatal to family of 3

Surface Analysis



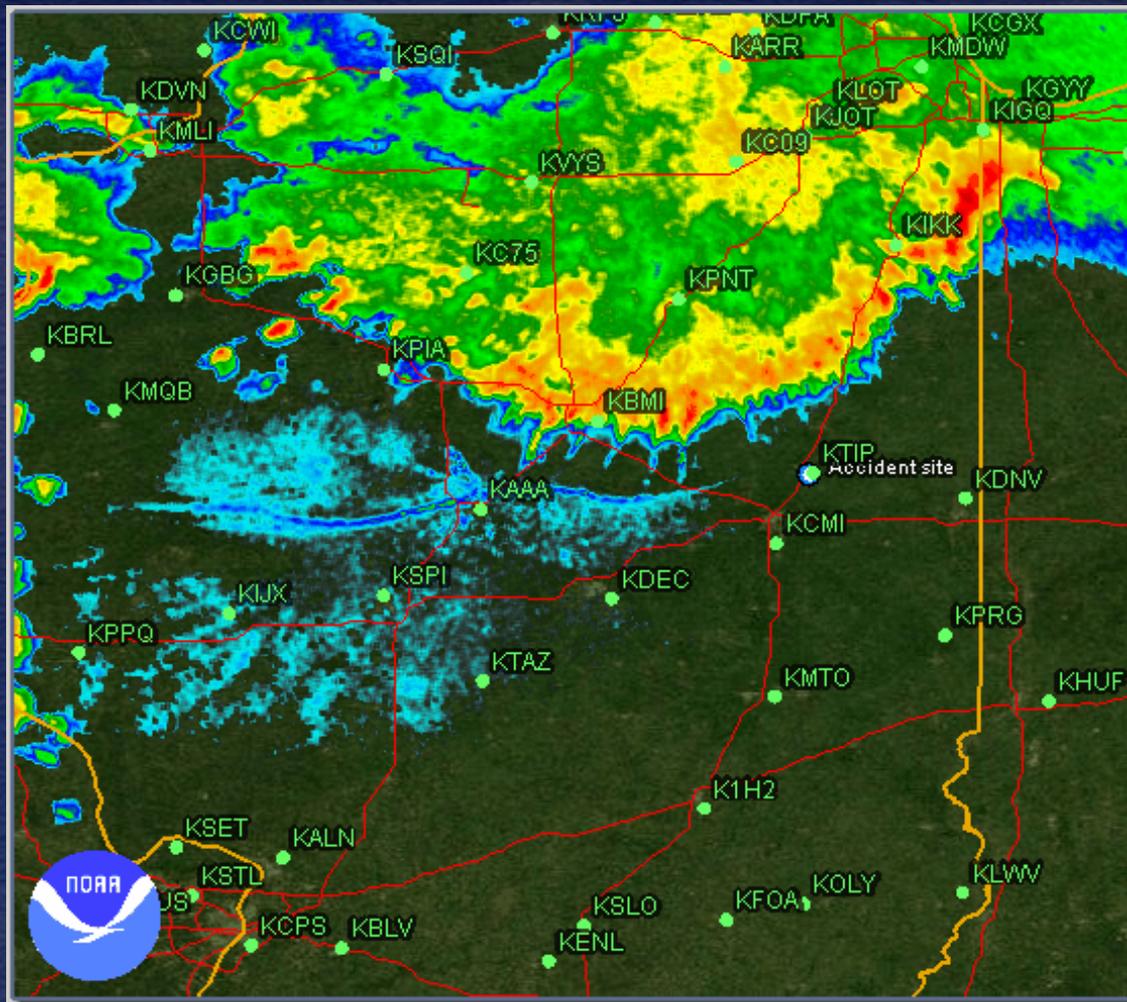
What's this symbol?

CEN11FA500 - Rantoul, IL



Photo's taken by passenger on board accident airplane

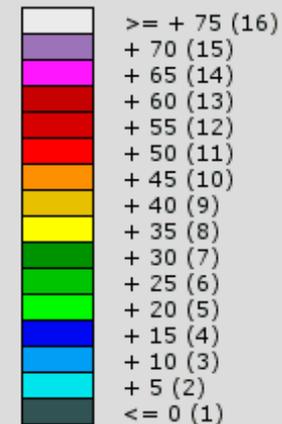
CEN11FA500 - Rantoul, IL



NEXRAD LEVEL-II
KILX - LINCOLN, IL
07/24/2011 14:02:51 GMT
LAT: 40/09/02 N
LON: 89/20/12 W
ELEV: 581 FT
VCP: 212

REFLECTIVITY
ELEV ANGLE: 0.47

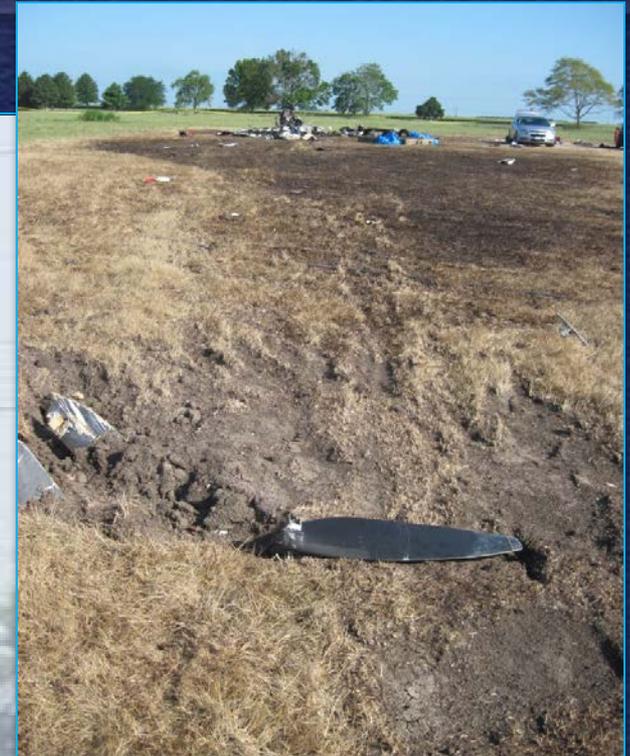
Legend: dBZ (Category)



1,163 lightning strikes within 30NM and 15-min of accident



CEN11FA500 - Rantoul, IL



Probable Cause - The pilot did not maintain airplane control during takeoff with approaching thunderstorms. Contributing factor was the pilot's decision to depart into adverse weather conditions.



ERA13CA181 -Titusville, FL
Cessna 172, N7113G
March 24, 2013



- Part 91 personal flight
- Tamiami – DeLand, FL
- Diverted due to solid line of TSTMS
- Landed/taxiing in when airport hit with strong winds gust 52KT **5-min before rain**
- Substantial damage
- Winds blew hangar door off on field
- **NTSB PC**: The pilot's loss of airplane control while taxiing in gusting wind conditions associated with nearby thunderstorm activity.

CEN15FA245 – Plainview, TX

Beech 36 Bonanza, N221D

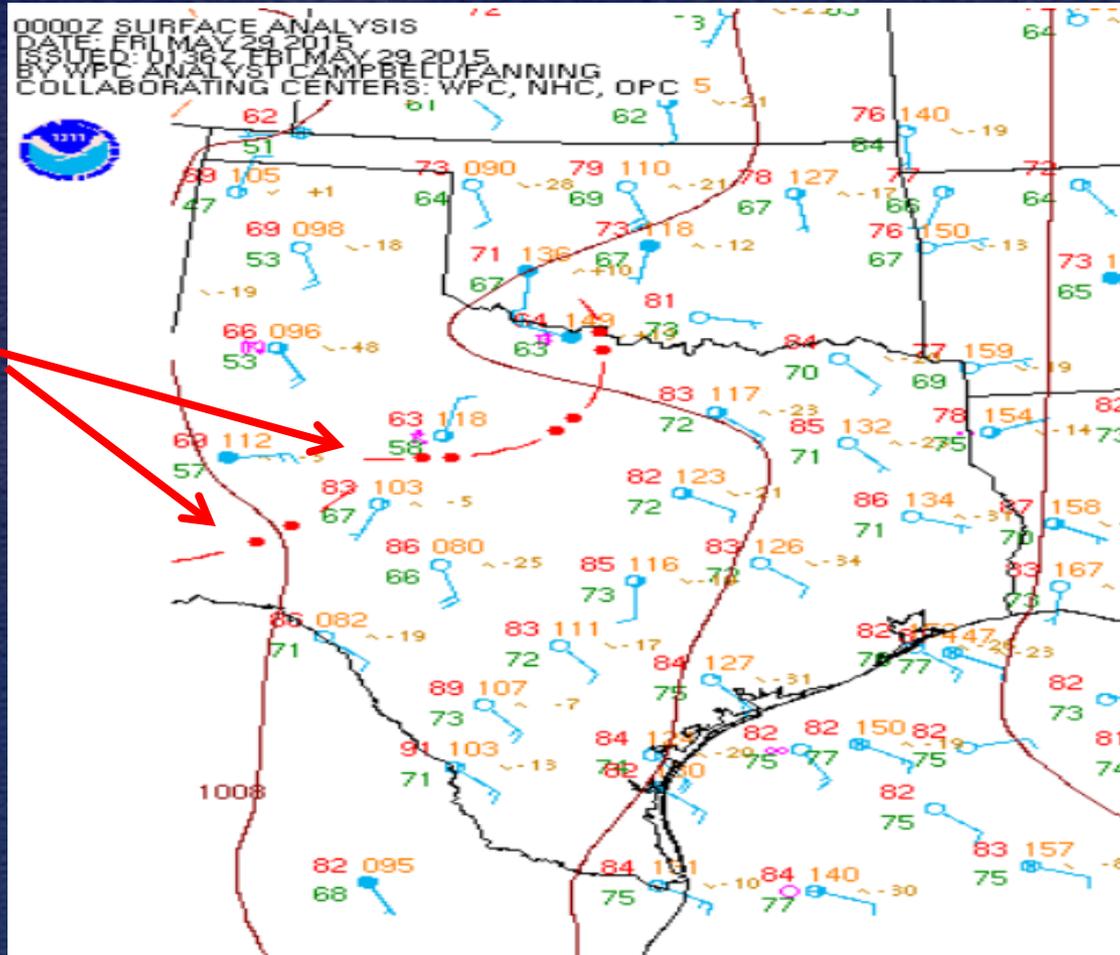
May 29, 2015

- Part 91 personal flight
- Plainview – San Antonio, TX
- On takeoff at ~2116 CDT aircraft lost control and impacted ground
- Line of thunderstorms approaching from the west
- Fatal family of 3



Recent - on going investigation

CEN15FA245 – Plainview, TX Synoptic Conditions



What's this
symbol?

CEN15FA245 – Plainview, TX

Observations: AWOS reports every 20-minutes

- METAR KPVW 300215Z **AUTO 00000KT 10SM CLR** 21/16 A3009
RMK AO2 **LTG DSNT W AND NW** T02110160=

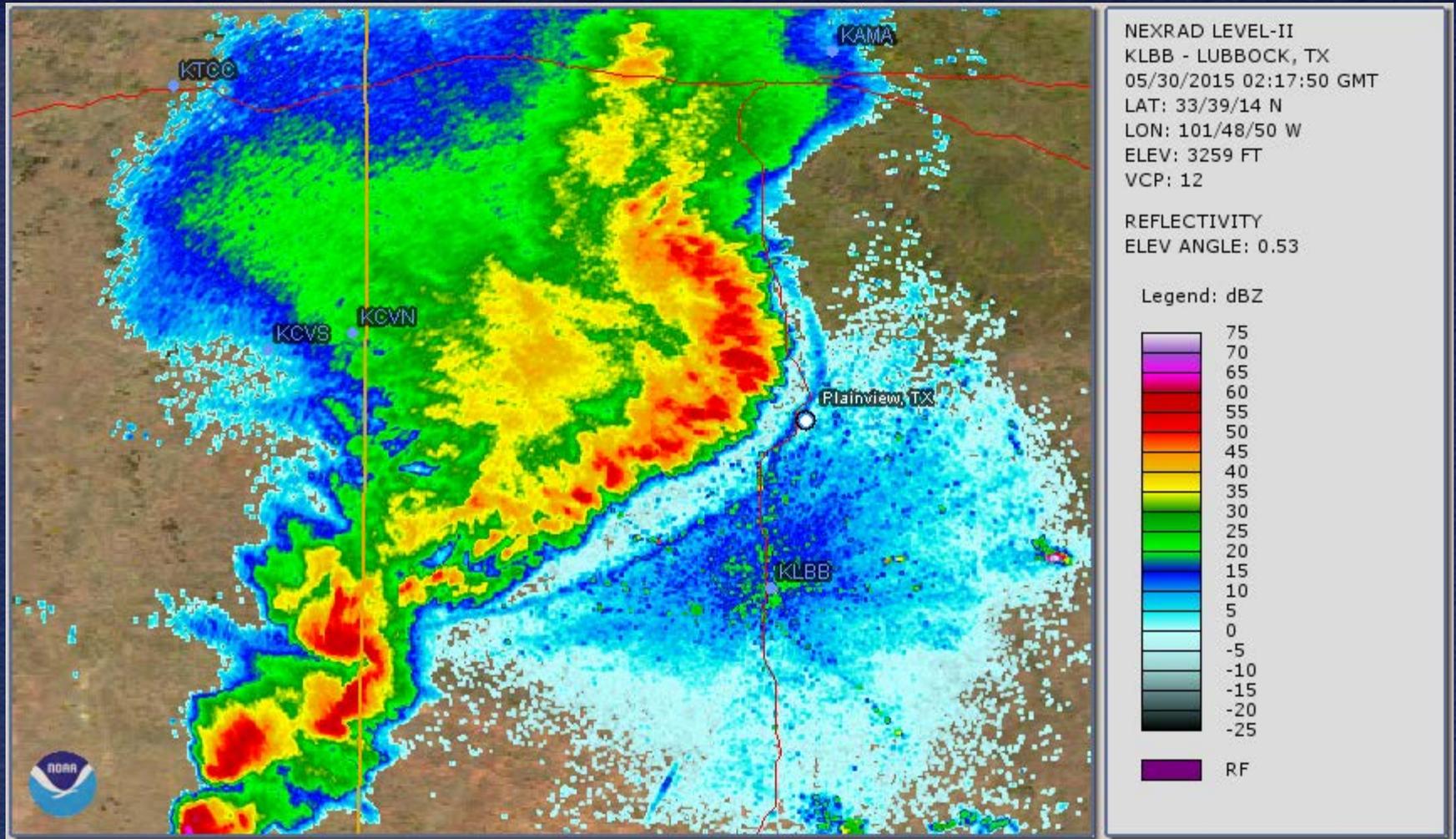
Accident 0216Z (2116 CDT)

- METAR KPVW 300235Z AUTO **30026G36KT 10SM -RA** SCT045
SCT060 BKN065 16/11 A3017 RMK AO2 **LTG DSNT SW**
THRU NW T01550110=
- METAR KPVW 300255Z AUTO **31022G28KT 5SM +TSRA** SCT024
BKN029 OVC065 14/13 A3016 RMK AO2 LTG DSNT
ALQS P0012 60012 T01410130=
- TAF KPVW 292320Z 3000/3024 06010KT P6SM SCT050 BKN250
TEMPO 3002/3006 VRB25G45KT 2SM +TSRA BKN030CB
FM300600 02011KT P6SM SCT025 BKN035 OVC080=

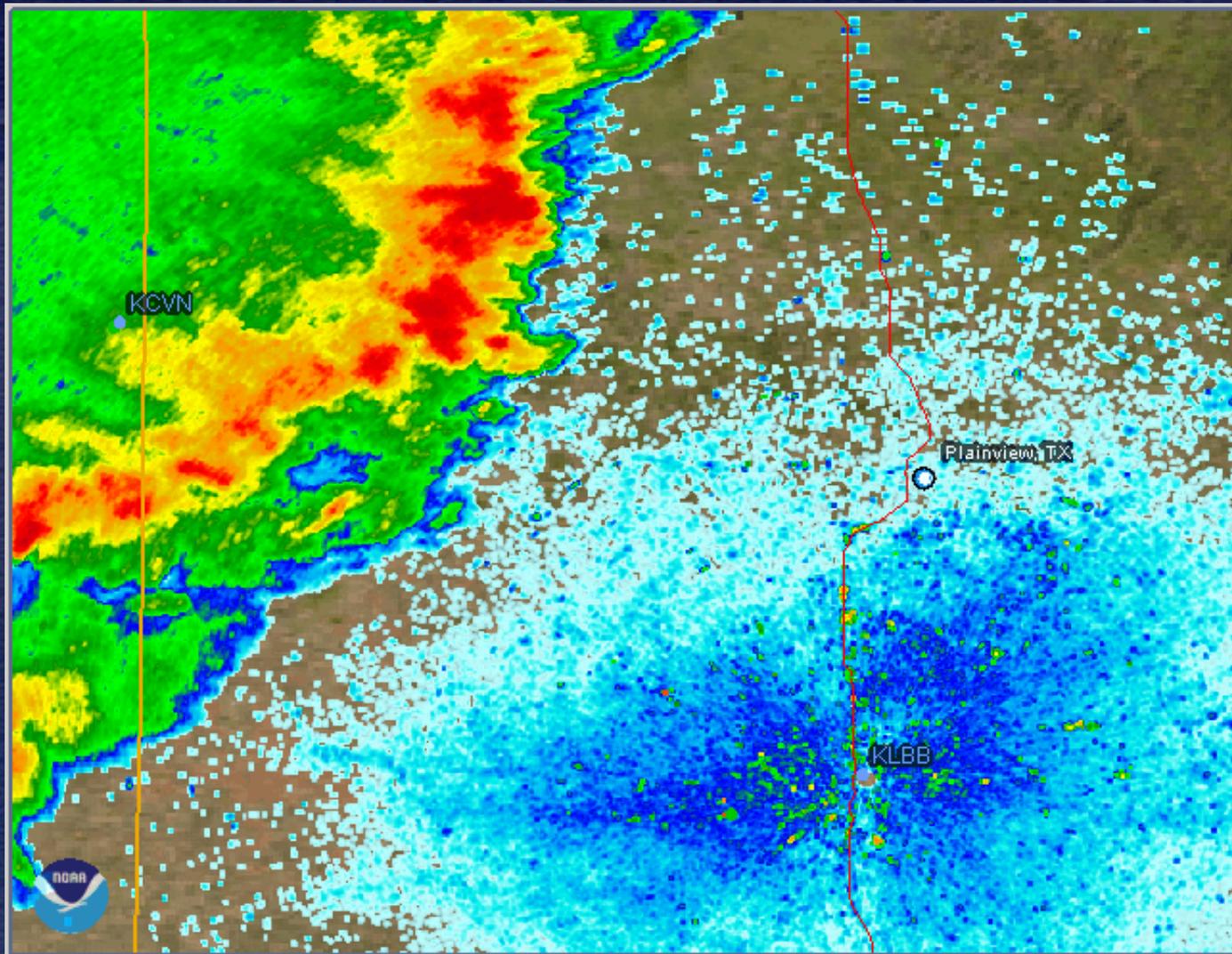
NTSB



CEN15FA245 – Plainview, TX



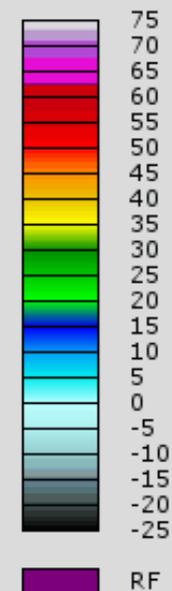
- KLBB WSR-88D 0.5° base reflectivity image at 0217Z



NEXRAD LEVEL-II
KLBB - LUBBOCK, TX
05/30/2015 01:18:05 GMT
LAT: 33/39/14 N
LON: 101/48/50 W
ELEV: 3259 FT
VCP: 12

REFLECTIVITY
ELEV ANGLE: 0.53

Legend: dBZ



- KLBB WSR-88B base reflectivity animation

NTSB



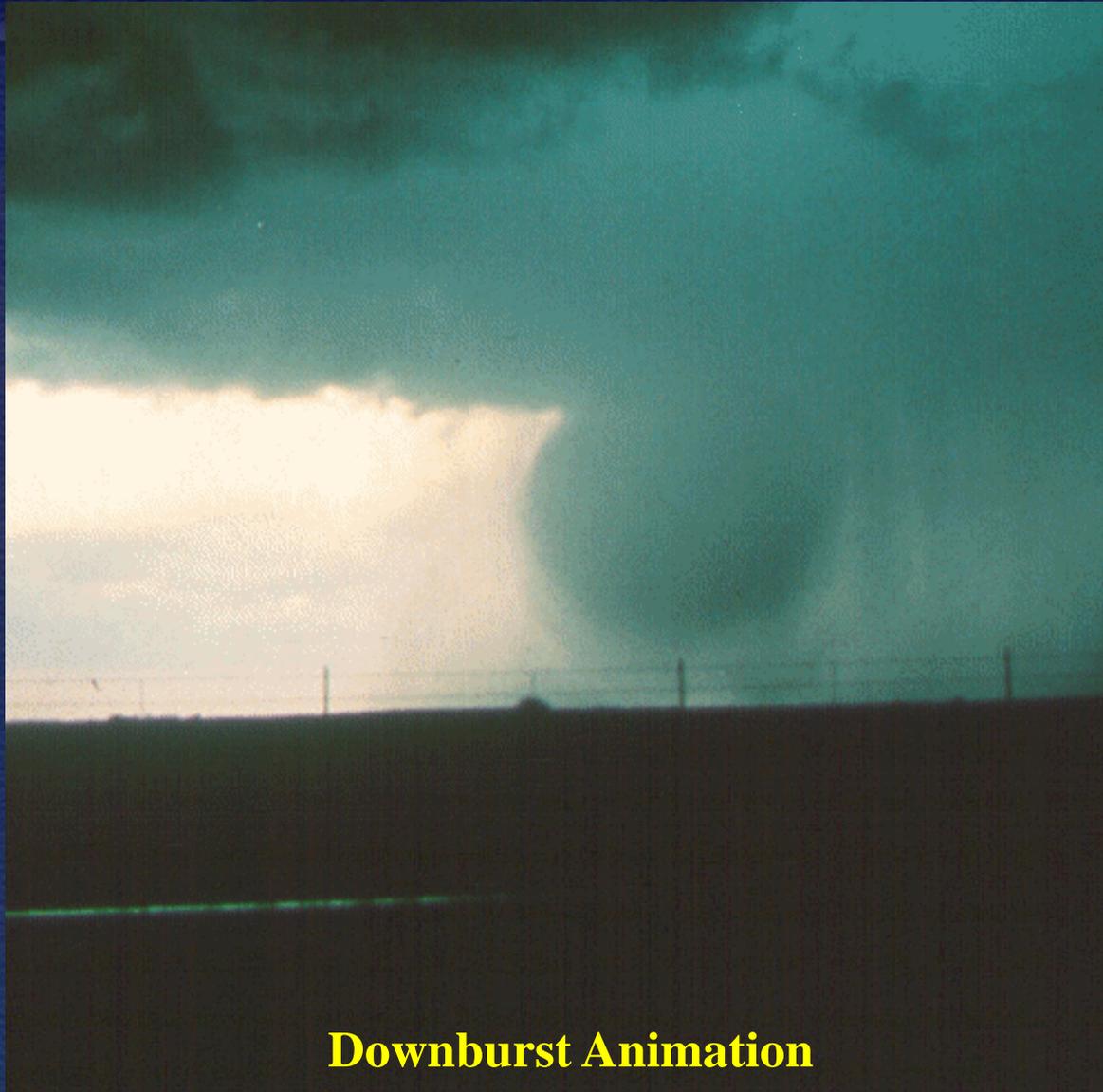
Microbursts



NTSB

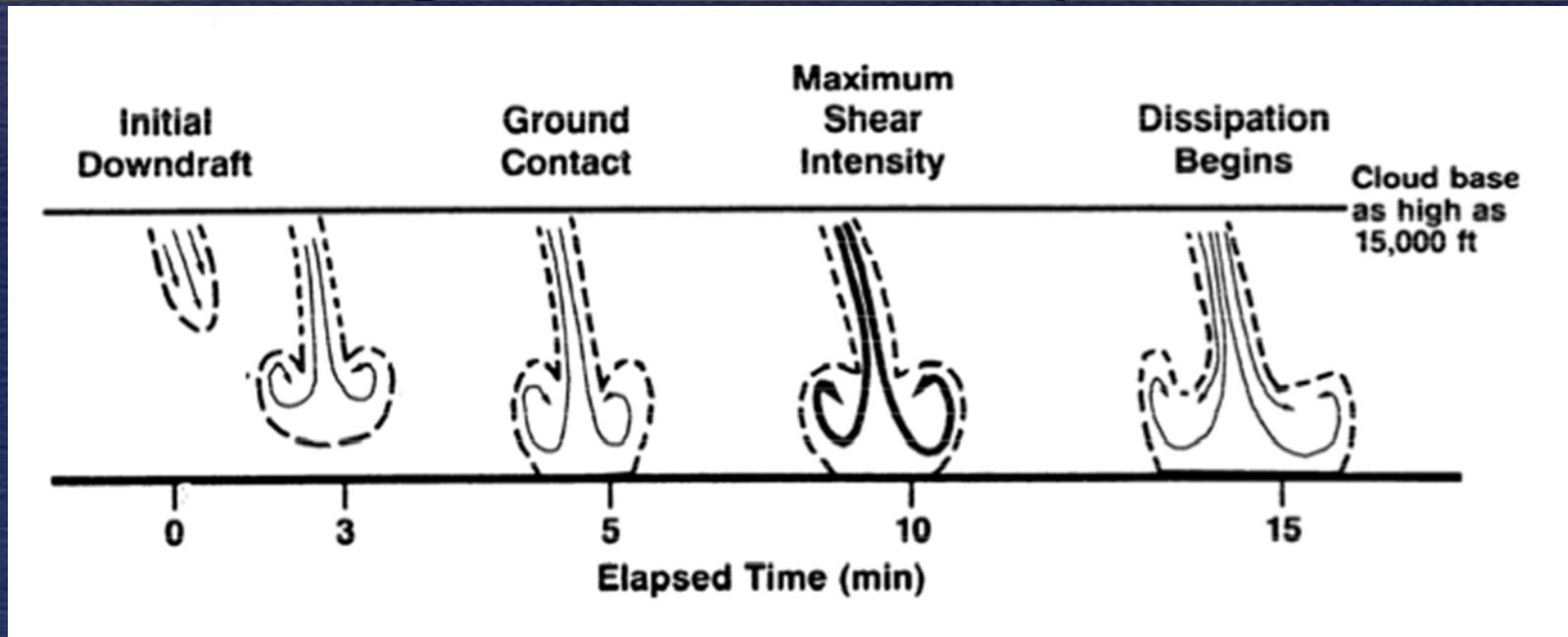


The Microburst



Downburst Animation





Downdrafts can exceed 6,000 FPM

Microbursts



NTSB



Typically form in families of 3 to 4





**GUST FRONT
HERE**

Sign posts in the sky!

ERA14CA184

Daytona Beach, FL

Cessna 172, N2630B

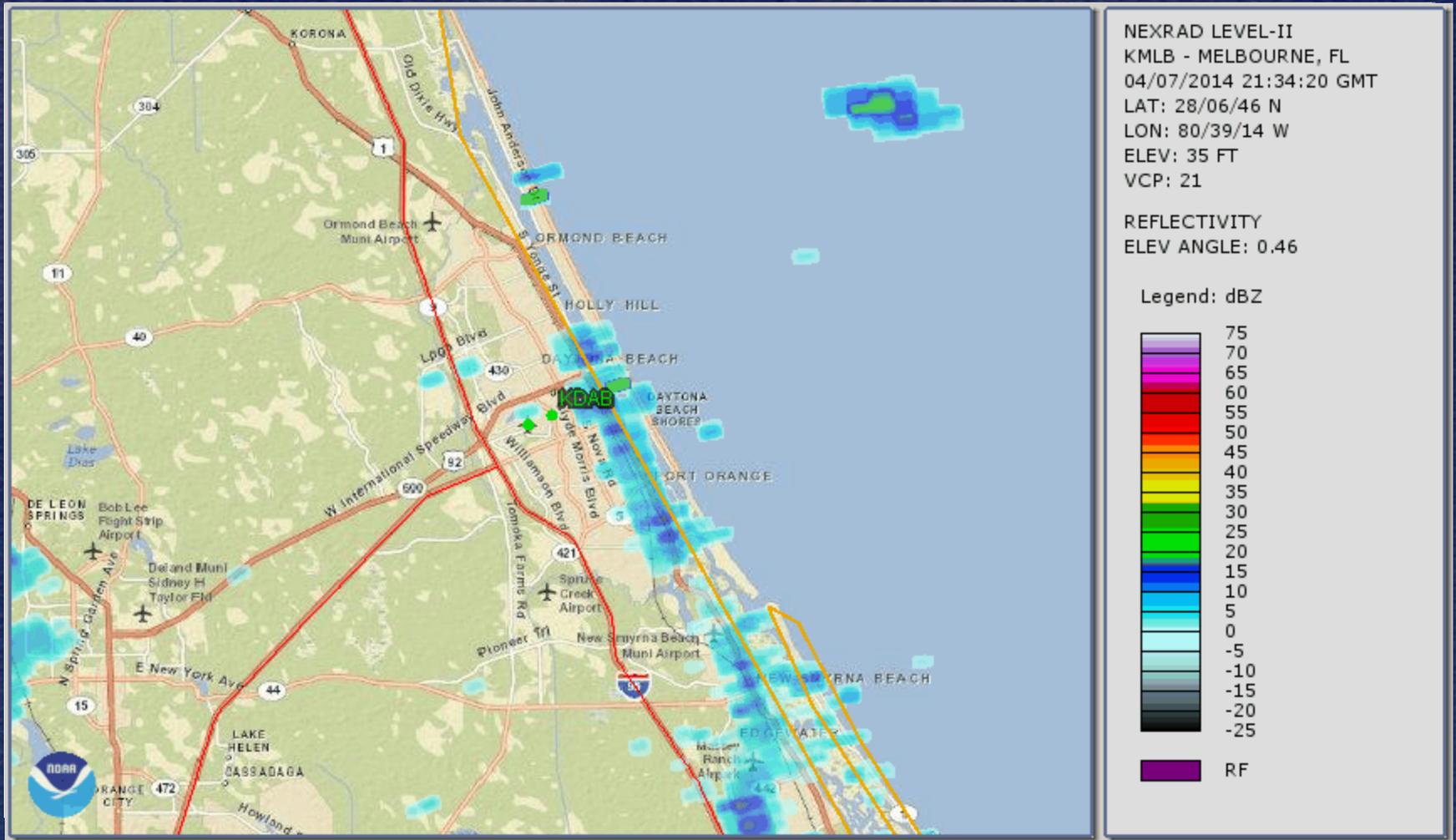
April 7, 2014



- Part 91 instructional flight
- Aircraft just landed, clearing active runway when thunderstorm impacted the field
- Aircraft flipped over inverted, substantial damage
- ATC indicated **microburst alert** with winds surges at 48 knots gusts 64 knots
- Substantial damage
- 2 shaken but uninjured pilots
- NTSB limited investigation



ERA14CA184 – Daytona Beach, FL WSR-88D Radar Animation



81 Steady-state multicellular/supercell type thunderstorm

ADVERSE WINDS

ERA14CA317

Orlando, FL

Cessna 172S, N775SP

June 29, 2014

- Part 141 instructional flight
- Day VFR
- After landing, taxiing to ramp when TSTM moved in
- Aircraft violently weathervaned, lifted, and flipped inverted
- Substantial damage to aircraft
- Student/instructor minor injuries
- NTSB limited investigation by phone



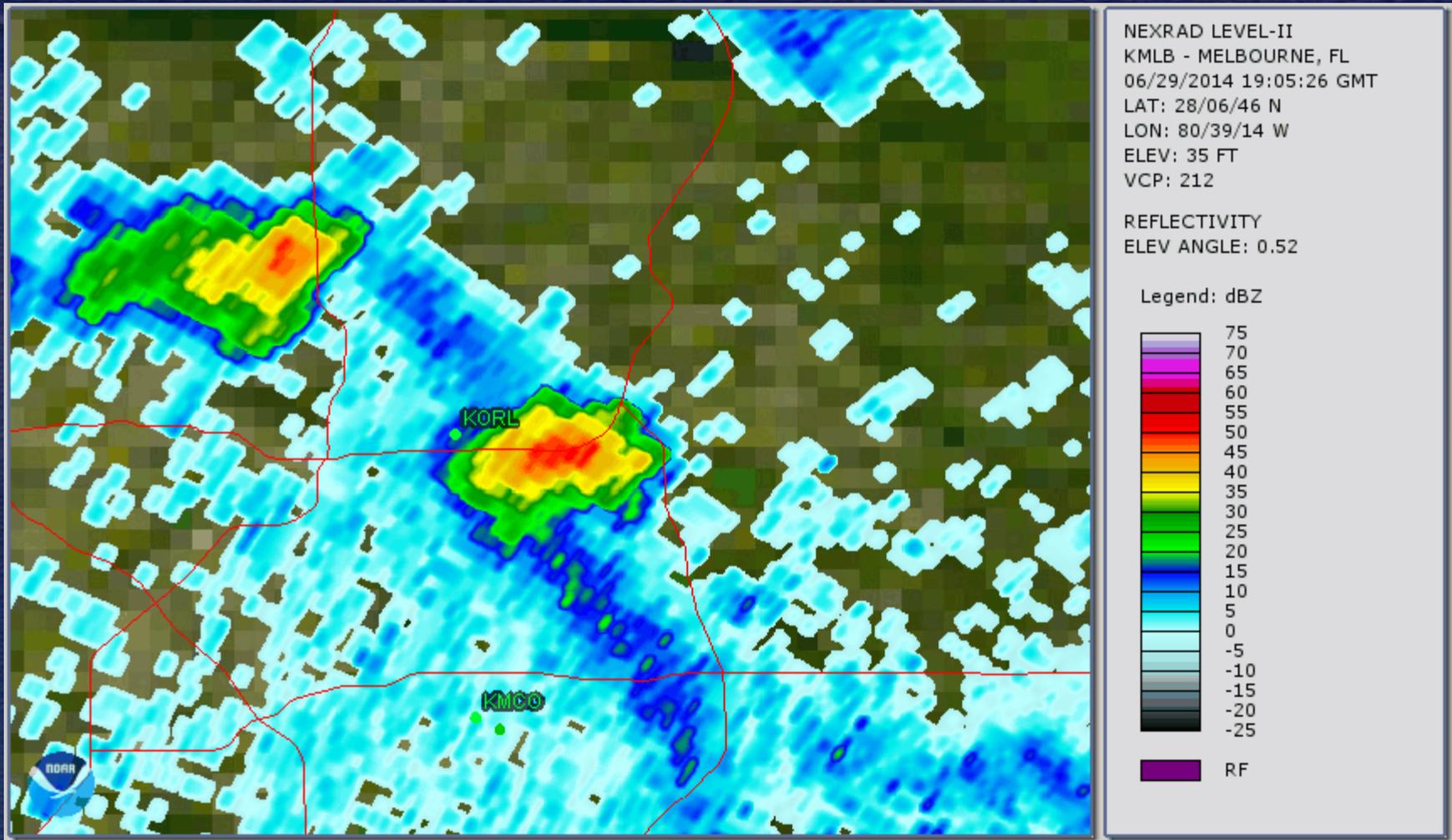
ADVERSE WINDS



NTSB Probable Cause: Flight instructor's failure to maintain control while taxiing in a strong gusty wind

KORL 291925Z 03028G47KT 1 1/2SM +TSRA FEW009 BKN035CB 31/22
A3014 RMK PK WND 04047KT/1924 LTG DSNT NW RAB25 TSB19
PRESRR P0003

ERA14CA317 – Orlando, FL



- KMLB WSR-88D base reflectivity image at 1527 EDT
- Pulse thunderstorm – short lived microburst storm

In-flight Encounters

Convectively Induced Turbulence (CIT)

All thunderstorms imply severe or greater turbulence..



NTSB



NYC08FA260 – Highland, NC

Piper PA-23 “Geronimo”, N1180P

July 29, 2008



- Part 91 IFR personal cross country
- Louisville, KY – Hazlehurst, GA
- Weather briefing prior to departure at 1000 EDT (1400Z)
 - “I know it’s going to be storming so..”
- Pilot – ATP air carrier pilot & son
 - Bought A/C for son to build flight time
- Stormscope on board
- Level 9,000 feet deviating around weather
- Radio contact lost at 1452 EDT (1852Z)
- In-flight breakup
- Fatal 2

NYC08FA260 – Highland, NC

July 29, 2008

PA-23, N1180P



NYC08FA260 – Highland, NC
July 29, 2008
PA-23, N1180P



NYC08FA260 – Highland, NC
July 29, 2008
PA-23, N1180P



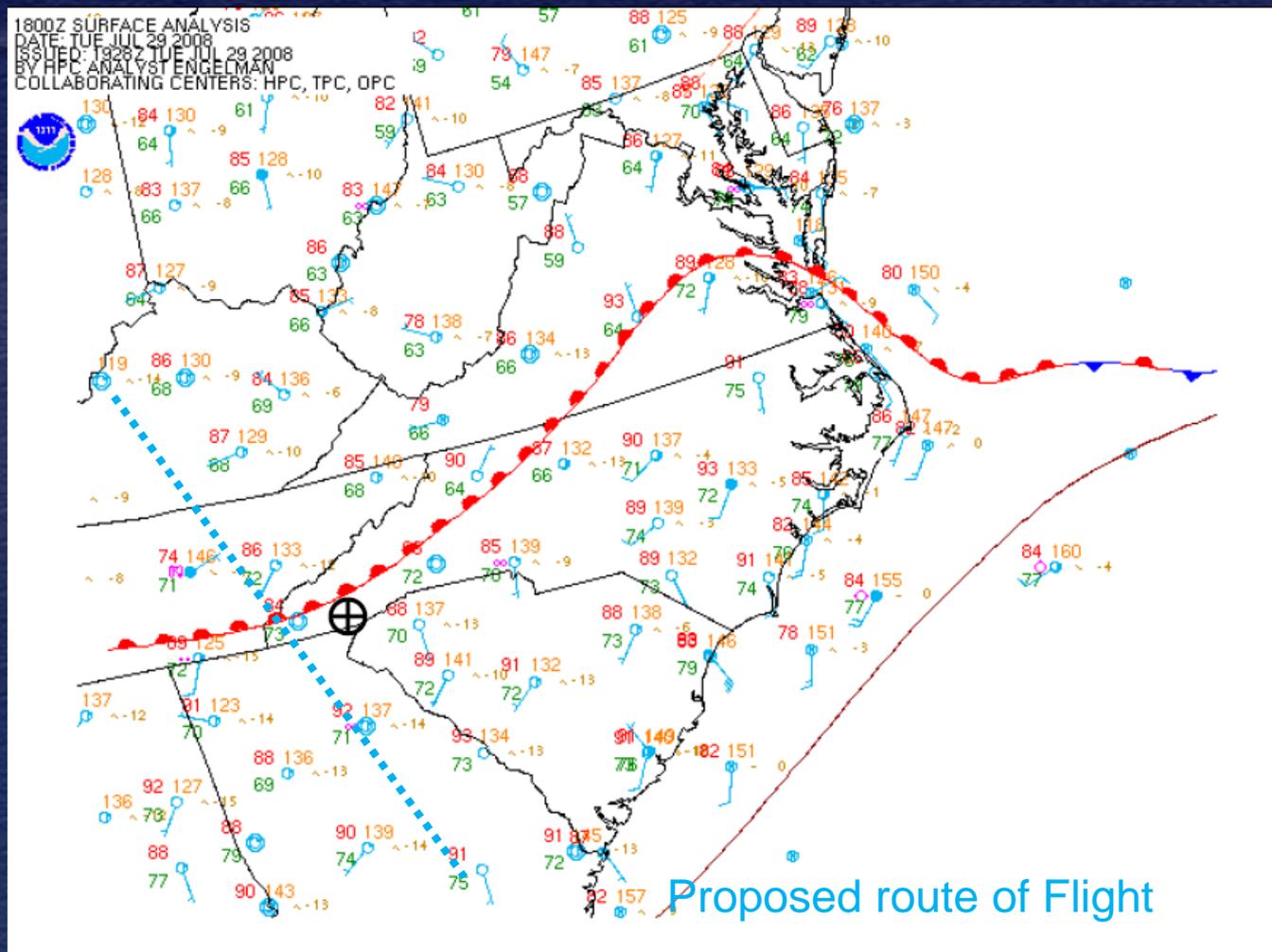
Left wing



Inboard section of left wing

Overstress loading on wings and tail, no indications of fatigue

NYC08FA260 – Highland, NC



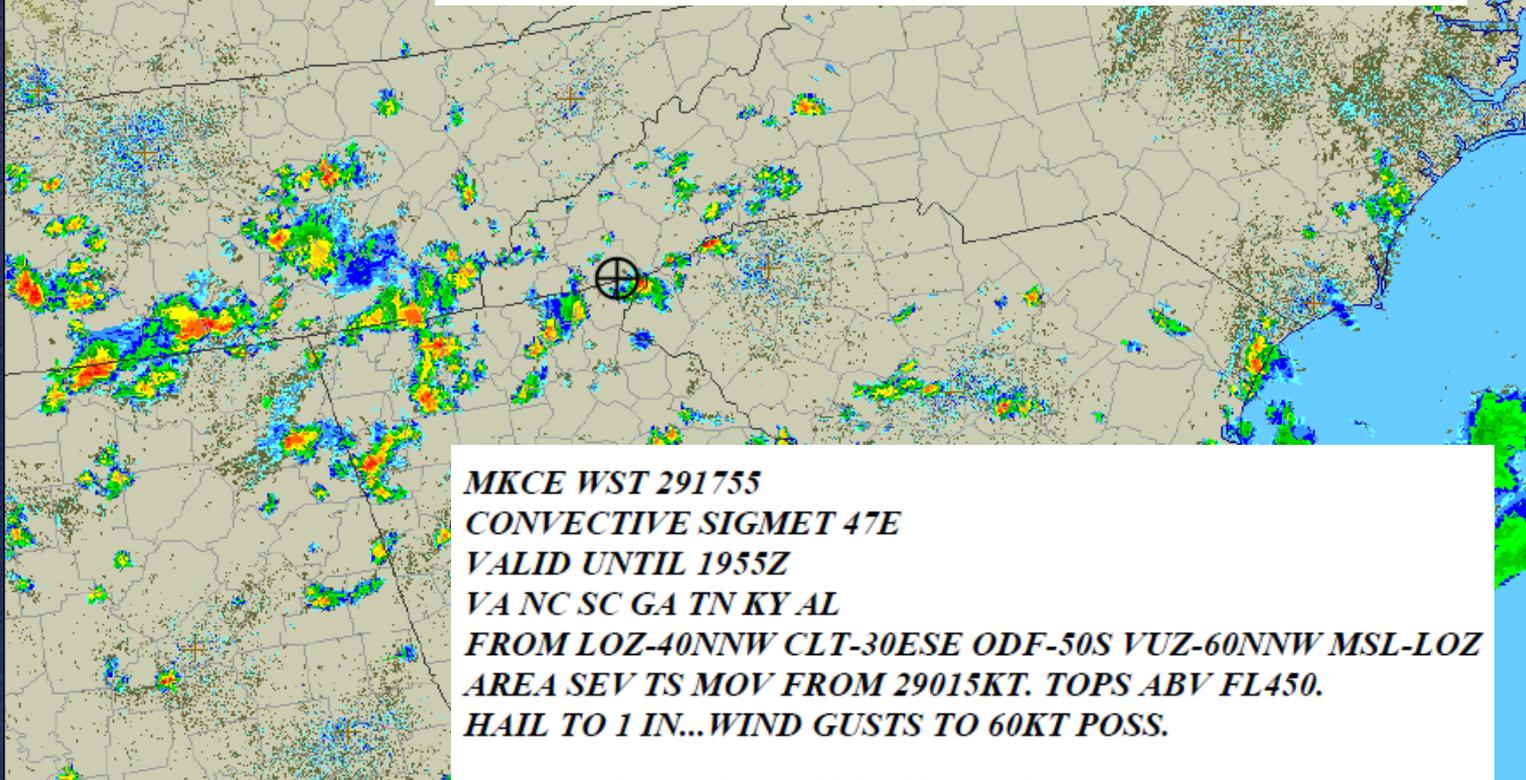
1800Z NWS Surface Analysis Chart warm front in the immediate vicinity

NYC08FA260 – Highland, NC

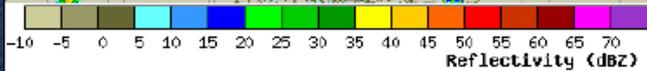
1856 UTC Tue 29 Jul 2008 (c) UCAR <http://www.nap.ucar.edu/weather/radar/>

1856Z

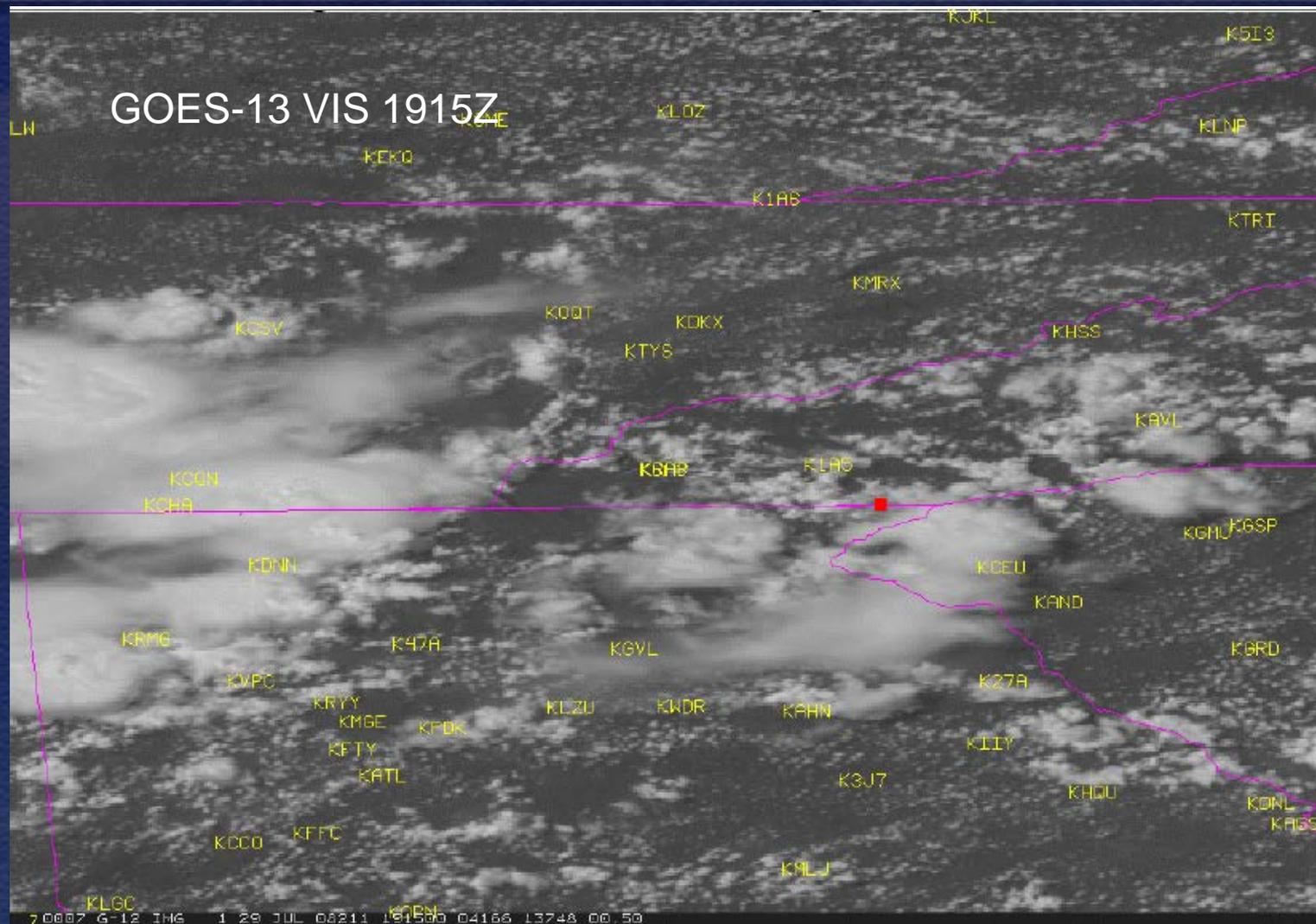
*ZTL2 CWA 291641
ZTL CWA 201 VALID UNTIL 291741
FROM 35SSE VXV TO 10ESE ODF TO 40SW GQO TO GQO TO 35SSE VXV
DVLPG AREA WDLY SCT TSRA/SHRA WITH MOD-HVY PCPN. CNVTN
MOVG FM 270-28010KT WITH MAX TS TOPS TO FL350. PRD*



*MKCE WST 291755
CONVECTIVE SIGMET 47E
VALID UNTIL 1955Z
VA NC SC GA TN KY AL
FROM LOZ-40NNW CLT-30ESE ODF-50S VUZ-60NNW MSL-LOZ
AREA SEV TS MOV FROM 29015KT. TOPS ABV FL450.
HAIL TO 1 IN...WIND GUSTS TO 60KT POSS.*



NYC08FA260 – Highland, NC



NYC08FA260 – Highland, NC

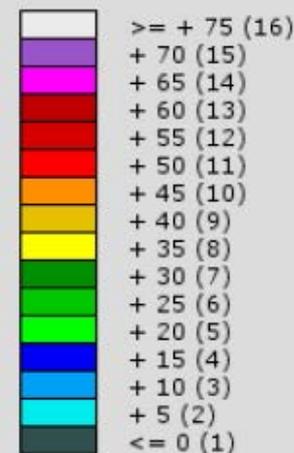
WSR-88D Base Reflectivity Imagery



NEXRAD LEVEL-II
KGSP - GREER, SC
07/29/2008 18:48:53 GMT
LAT: 34/52/59 N
LON: 82/13/11 W
ELEV: 942 FT
VCP: 12

REFLECTIVITY
ELEV ANGLE: 1.37

Legend: dBZ (Category)



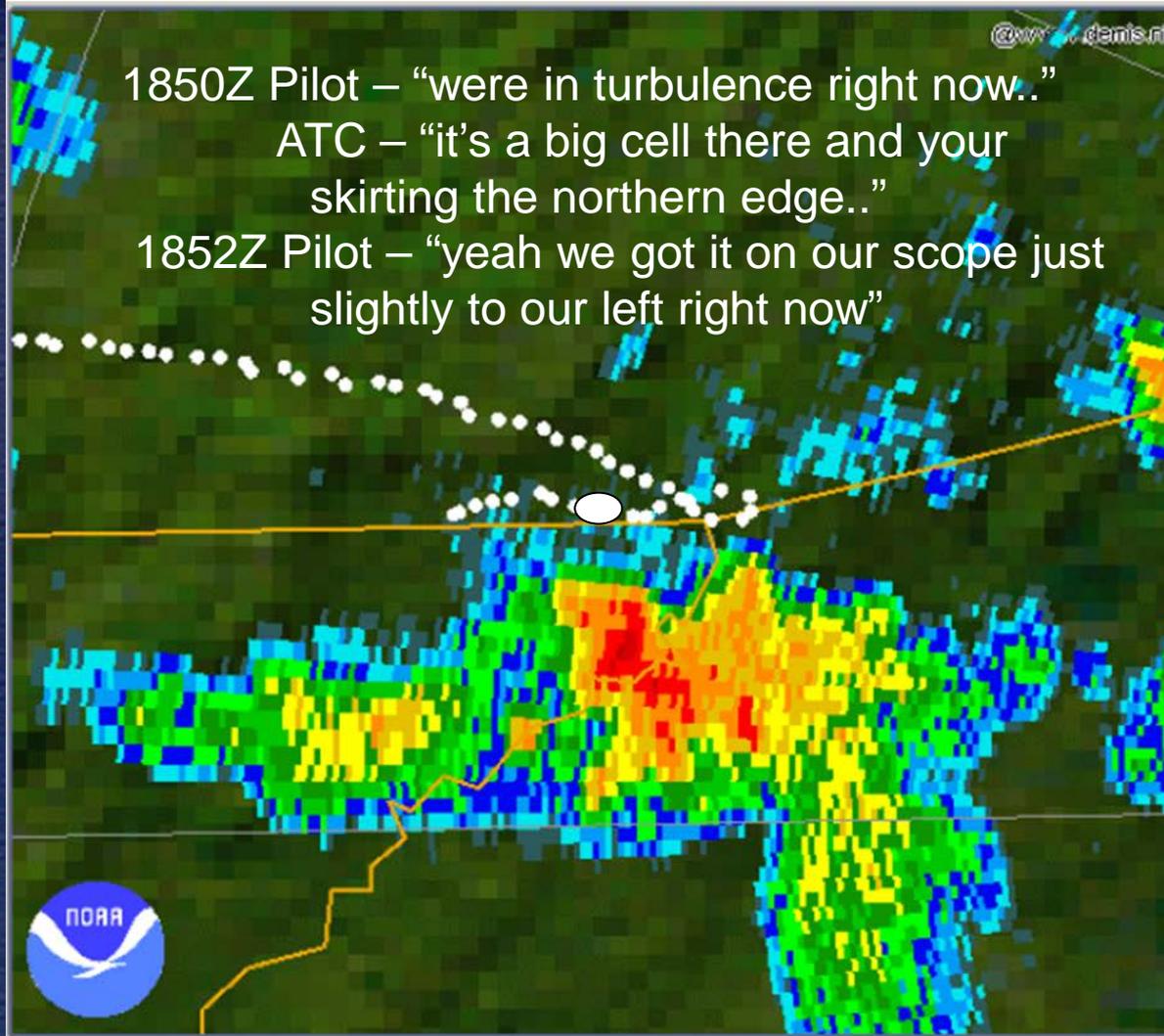
Lightning 177 cloud-to-ground strikes between 1832-1902Z
Closest was 3 miles SE of accident site

NYC08FA260 – Highland, NC

1850Z Pilot – “were in turbulence right now..”

ATC – “it’s a big cell there and your skirting the northern edge..”

1852Z Pilot – “yeah we got it on our scope just slightly to our left right now”



@wv...damis.nl

NEXRAD LEVEL-II
KGSP - GREER, SC
07/29/2008 18:53:14 GMT
LAT: 34/52/59 N
LON: 82/13/11 W
ELEV: 942 FT
VCP: 12

REFLECTIVITY
ELEV ANGLE: 1.37

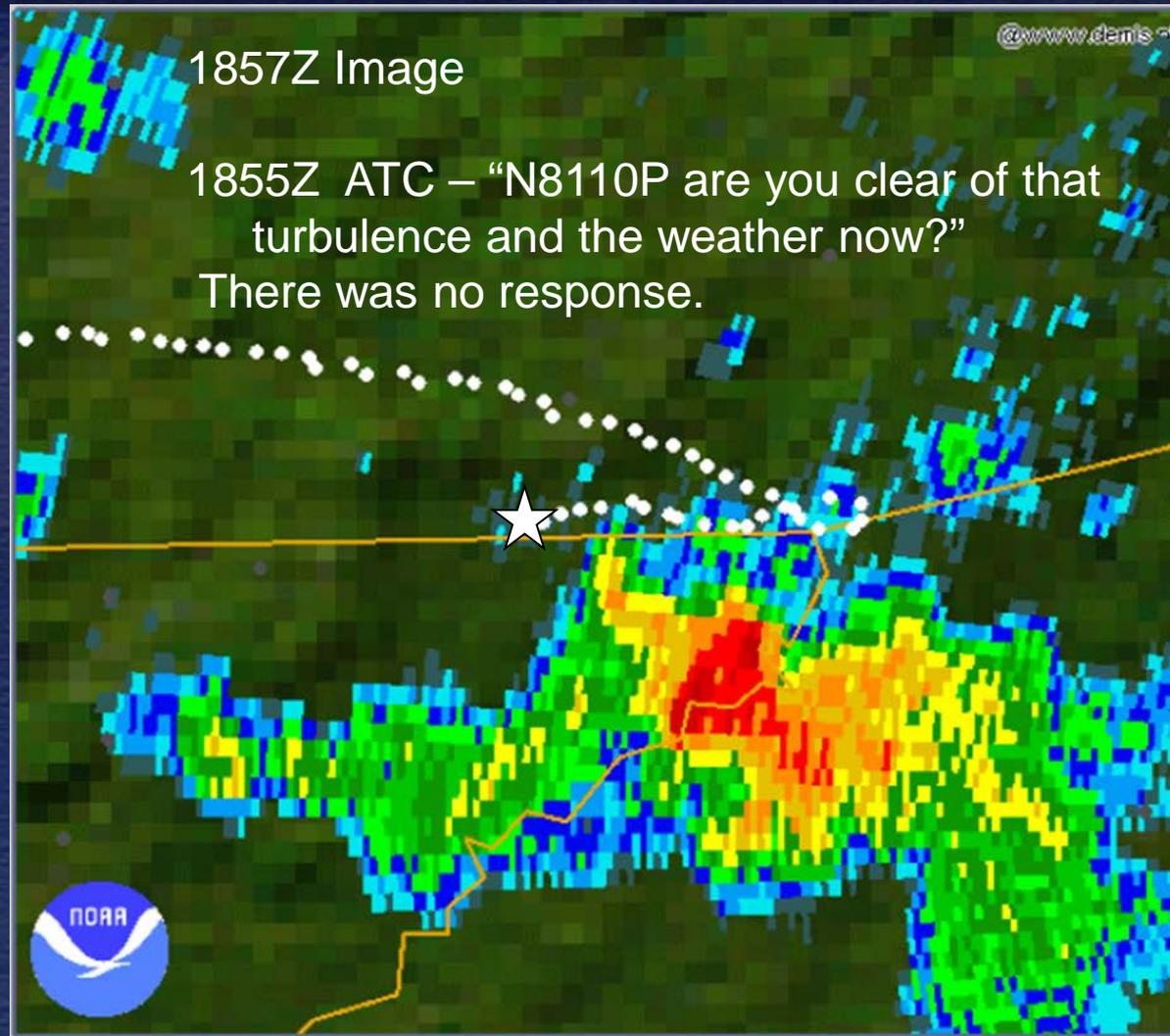
Legend: dBZ (Category)

>= + 75	(16)
+ 70	(15)
+ 65	(14)
+ 60	(13)
+ 55	(12)
+ 50	(11)
+ 45	(10)
+ 40	(9)
+ 35	(8)
+ 30	(7)
+ 25	(6)
+ 20	(5)
+ 15	(4)
+ 10	(3)
+ 5	(2)
<= 0	(1)

NTSB



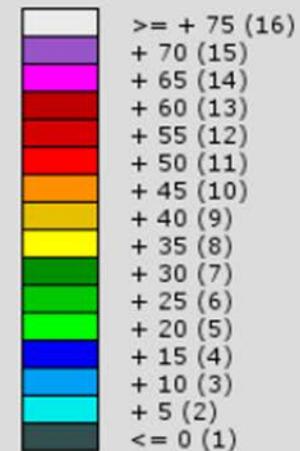
NYC08FA260 – Highland, NC



NEXRAD LEVEL-II
KGSP - GREER, SC
07/29/2008 18:57:33 GMT
LAT: 34/52/59 N
LON: 82/13/11 W
ELEV: 942 FT
VCP: 12

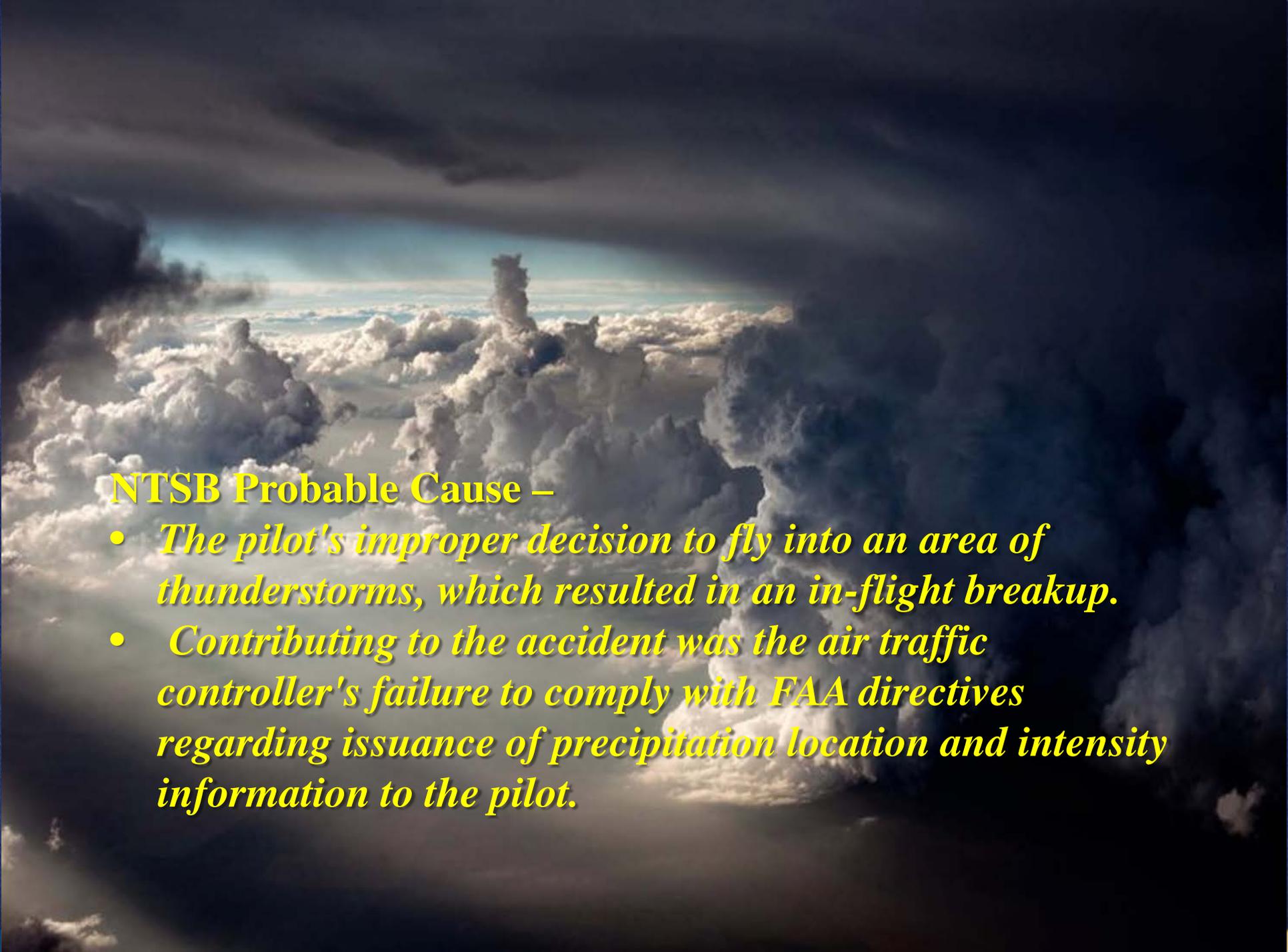
REFLECTIVITY
ELEV ANGLE: 1.37

Legend: dBZ (Category)



NTSB





NTSB Probable Cause –

- *The pilot's improper decision to fly into an area of thunderstorms, which resulted in an in-flight breakup.*
- *Contributing to the accident was the air traffic controller's failure to comply with FAA directives regarding issuance of precipitation location and intensity information to the pilot.*

ERA11LA344 – Gray, TN

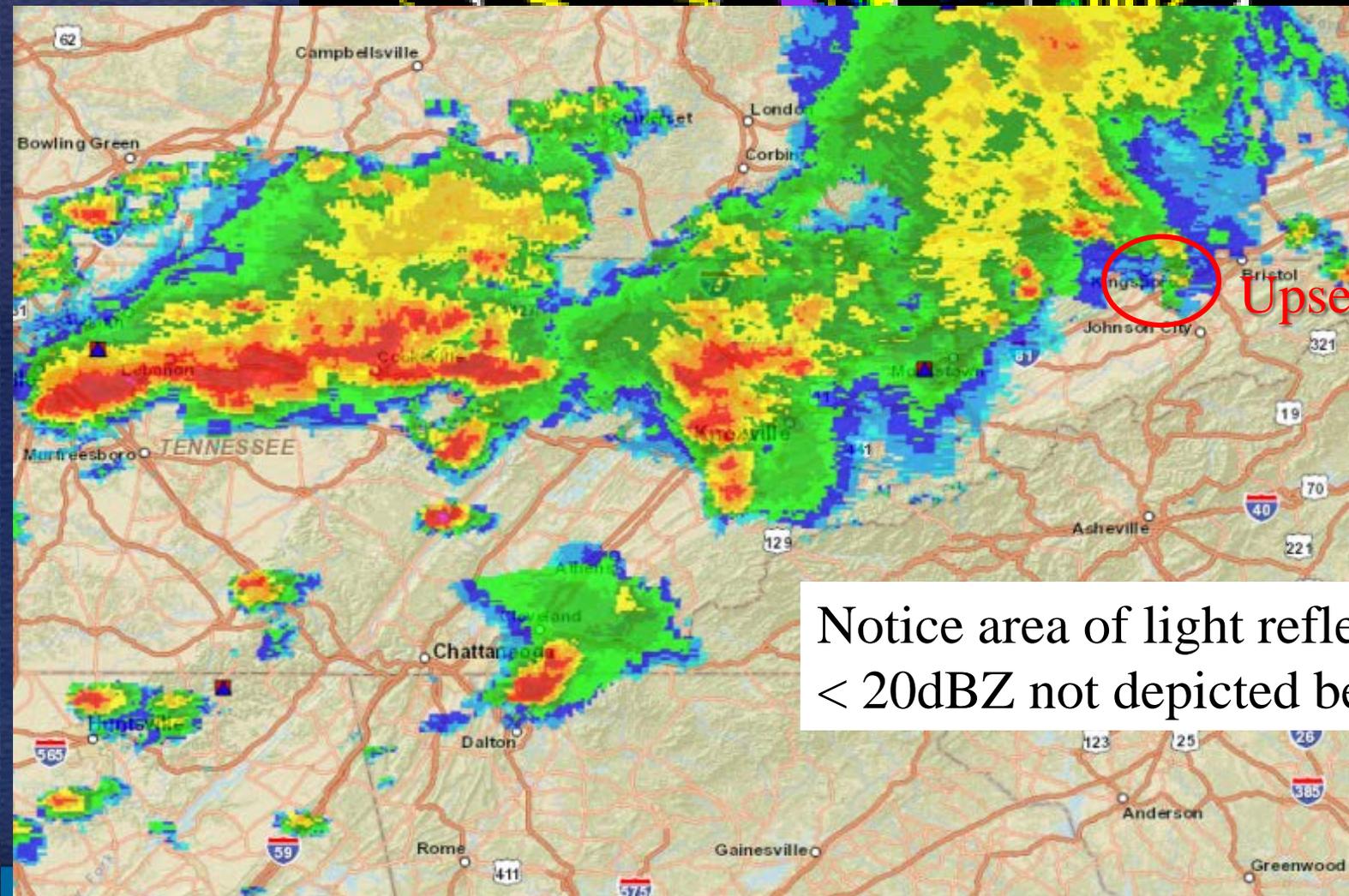
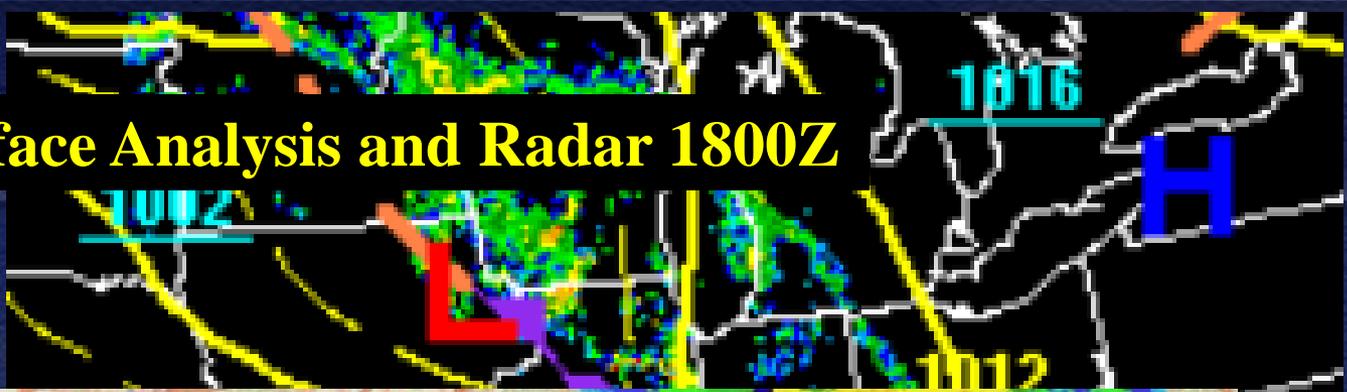
Beech King Air, N15L

June 15, 2011



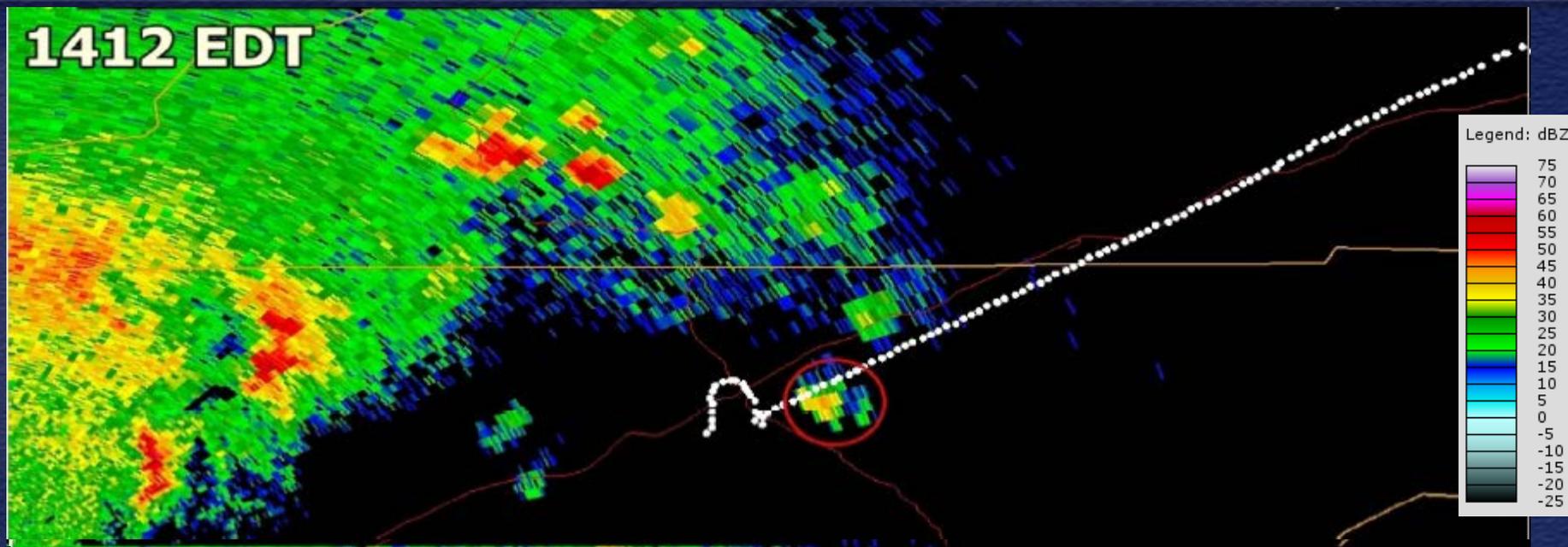
- Part 91 repositioning IFR flight
- Bridgewater, VA – Wichita, KS
- Airborne X-band radar
- IMC at FL200 deviating south of an area of thunderstorms
- Flight upset - uncommanded roll & dive
- Recovered at 8,000 ft (loss 12,000 ft)
- Flight control problems – diverts Tri City Airport, TN
- Substantial damage to aircraft
- 2 uninjured *but shaken pilots*

Surface Analysis and Radar 1800Z



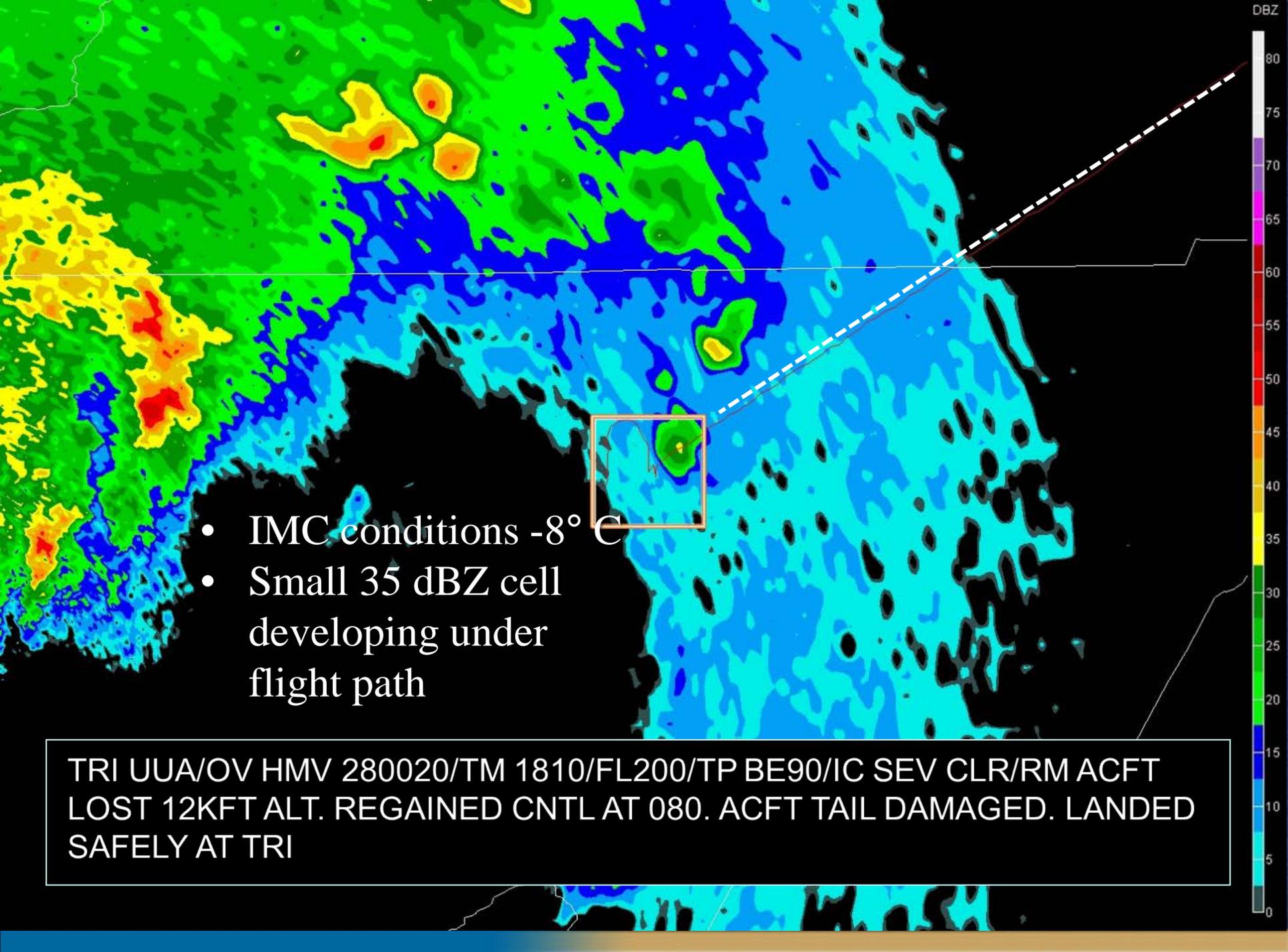
Notice area of light reflectivity's < 20dBZ not depicted before

ERA11LA344 – Gray, TN



Echoes at 3.4° scan aircrafts altitude; echoes <15 dBZ not shown
FL200 -8° C

- 1400:00 – N15L reports in FL200 IMC painting cell off 1 o'clock position
- 1405:50 – N15L “going down, going down..”
- 1406:01 – N15L “un control..,we had, a we had emergency..”
- 1407:26 – N15L “we just had some major issues there, we got to deviate, we may have control issues” 8,000 ft



- IMC conditions -8°C
- Small 35 dBZ cell developing under flight path

TRI UUA/OV HMV 280020/TM 1810/FL200/TP BE90/IC SEV CLR/RM ACFT
LOST 12KFT ALT. REGAINED CNTL AT 080. ACFT TAIL DAMAGED. LANDED
SAFELY AT TRI



**Missing
elevator**

Damage



Outboard 1/3 of left elevator separated in-flight
Right elevator deformed downward



Horizontal stabilizer bulkhead frame fractured
and aft airframe deformed in several areas

NTSB



NTSB Safety Alert - Thunderstorms



NTSB

SAFETY ALERT

National Transportation Safety Board

★ Thunderstorm Encounters

IFR pilots need to actively maintain awareness of severe weather along their route of flight

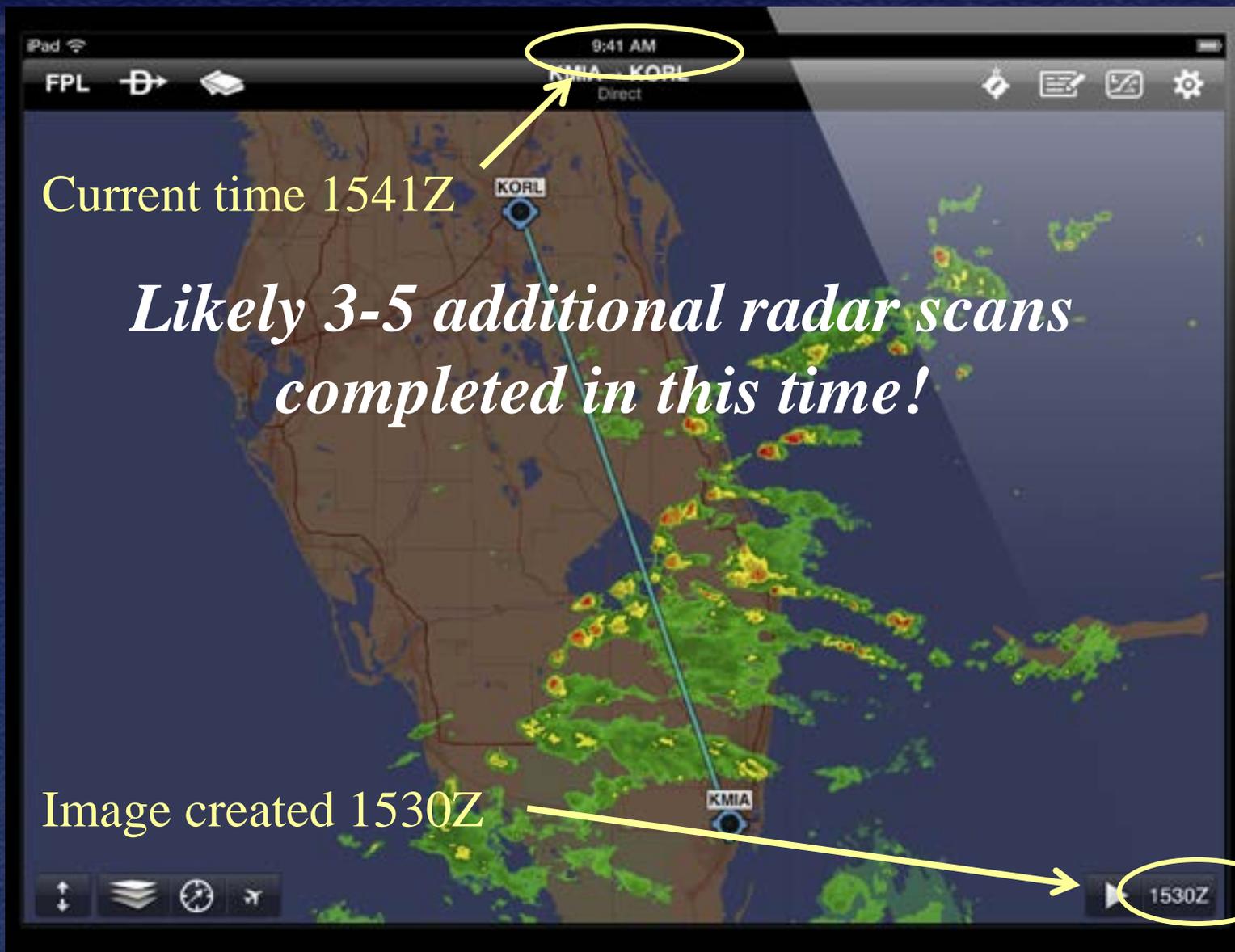
The problem

- Recent NTSB investigations have identified several accidents that appear to be wholly or partly attributable to in-flight encounters with severe weather.
- These accidents have all involved aircraft operating under instrument flight rules and in contact with air traffic controllers.
- Investigations show that pilots were either not advised about areas of severe weather ahead or were given incomplete information.
- Each pilot had readily available alternatives that, if utilized, would have likely prevented the accident.
- ATC training and briefings to controllers have not been sufficient to ensure that pilots receive the weather advisories needed to support good in-flight weather avoidance decisions.
- Recent examples:

NTSB



Weather in the Cockpit

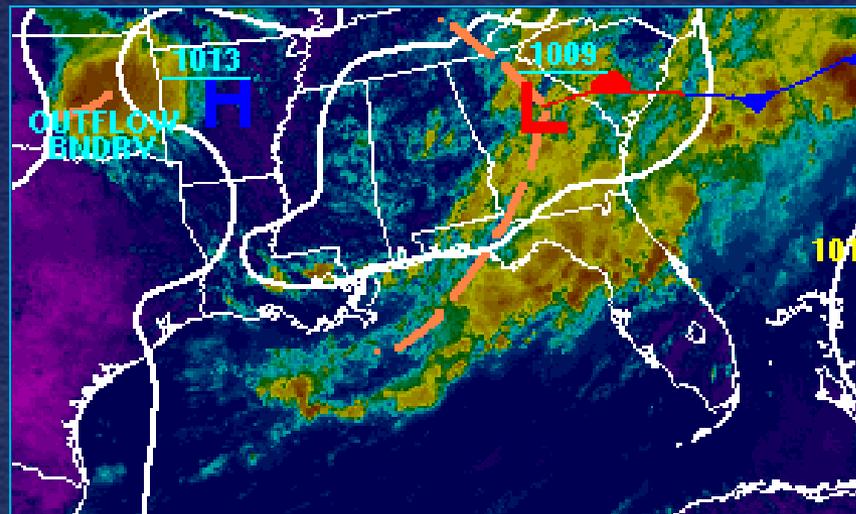


ERA09FA389 – Gulf of Mexico

Cessna 421C, N4467D

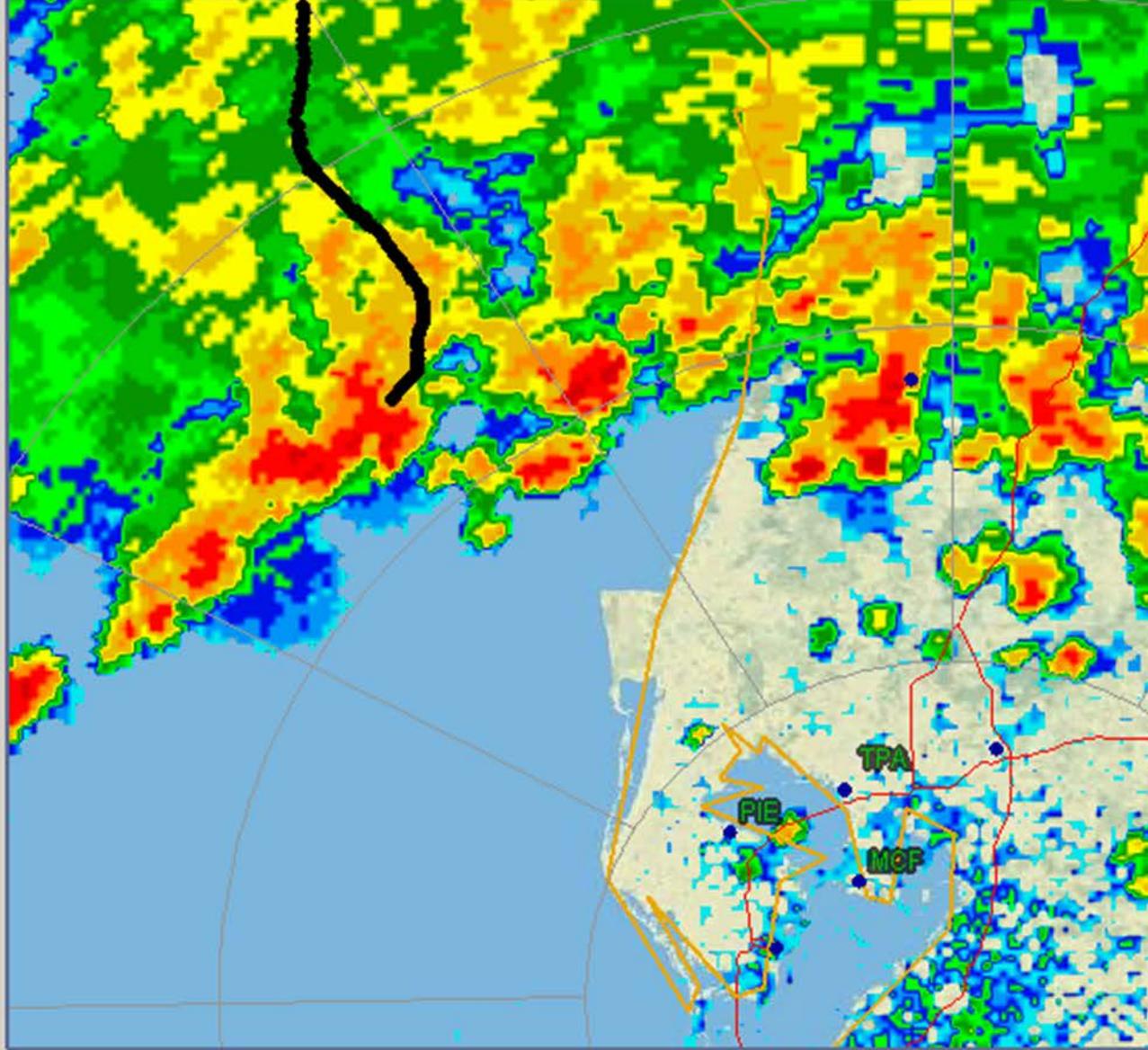
July 8, 2009

- IFR Part 135 flight
- McKinney, TX (TKI) to Tampa, FL (TPA)
- Equipped with airborne weather radar, StormScope, XM satellite
- Multiple Weather briefings
- Anticipated deviating around weather
- Fatal 5



- Advises ATC he **has** XM Weather onboard
- ATC clears to deviated as necessary
- ATC broadcasts Convective SIGMET 63E current tune to HIWAS for more info..

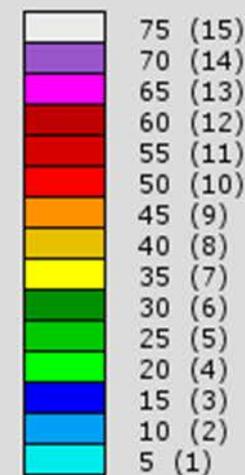
*MKCE WST 081755
CONVECTIVE SIGMET 63E
VALID UNTIL 1955Z
FL CSTL WTRS
FROM 40WNW CTY-40NNW PIE-80WSW PIE-150ESE LEV-110S CEW-40WNW CTY
AREA TS MOV FROM 27025KT. TOPS ABV FL450.*



NEXRAD LEVEL-III
COMPOSITE REF. 124NM
KTBW - TAMPA, FL
07/08/2009 18:48:18 GMT
LAT: 27/42/17 N
LON: 82/24/07 W
ELEV: 122 FT
MODE/VCP: A / 211

MAX: 59 dBZ
BOT: 0 KFT
TOP: 0 KFT

Legend: dBZ (Category)



C421 - N4467D Radar & ATC recording

NTSB



Enroute update your briefing !



***Safety, better to think about it
down here than worry about it
up there!***

CEN12FA108 - Bryan, TX

Piper PA-32 Saratoga, N3590T

Dec. 19, 2011

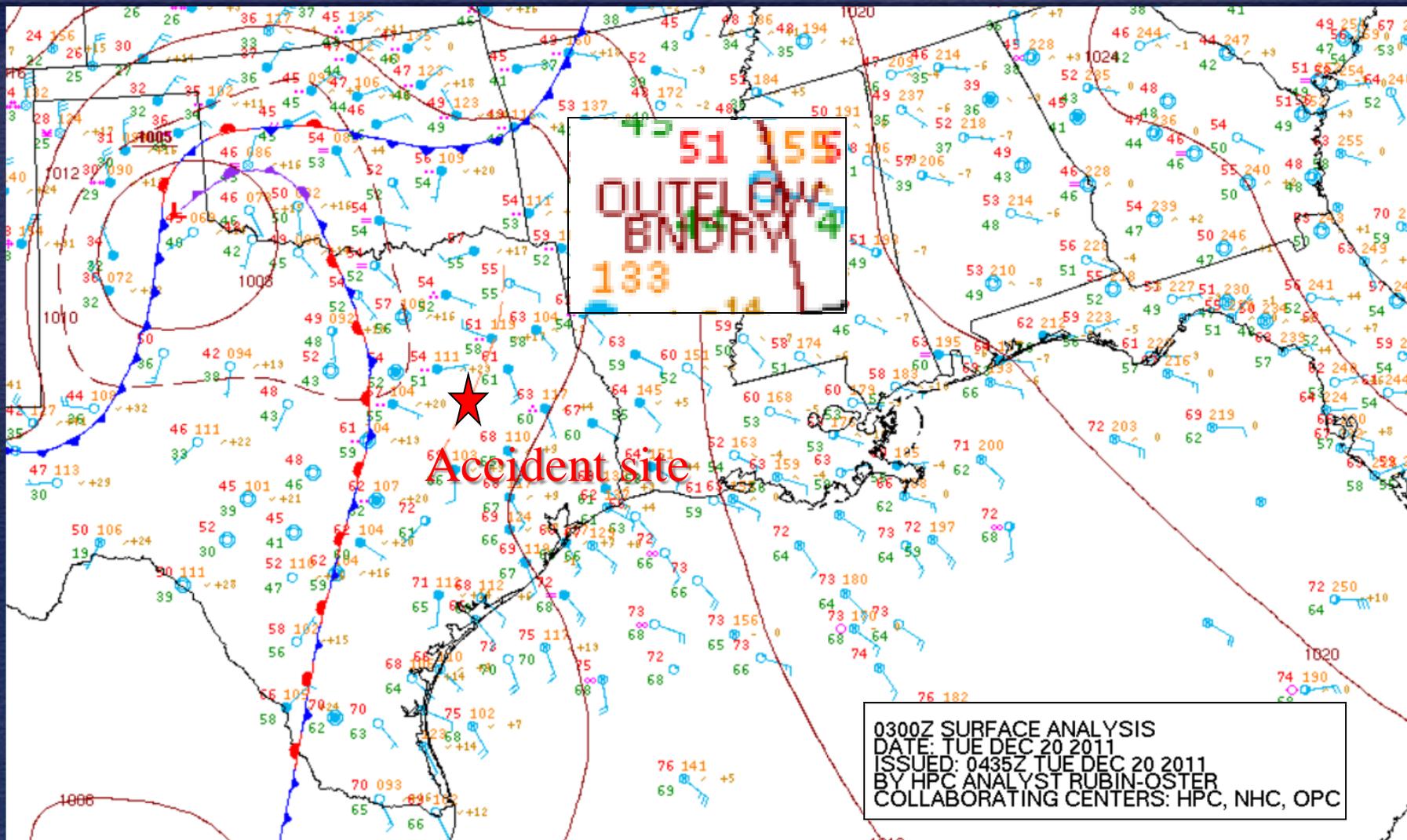
- Featured in AOPA Air Safety Foundation
- Private – instrument rated, total time 392 hr
 - 14 hours actual instrument time
- Night IFR cross country flight from Hampton, GA to Waco, TX
- No documented Wx briefing
- Equipped with Garmin 696 with **XM Satellite NEXRAD**
- Enroute 8,000 ft requests deviations around weather, looking for a “hole” in weather
- ATC provides advisories *“I show you headed right into heavy weather, now..suggest you turn back right..to 220 heading.”*

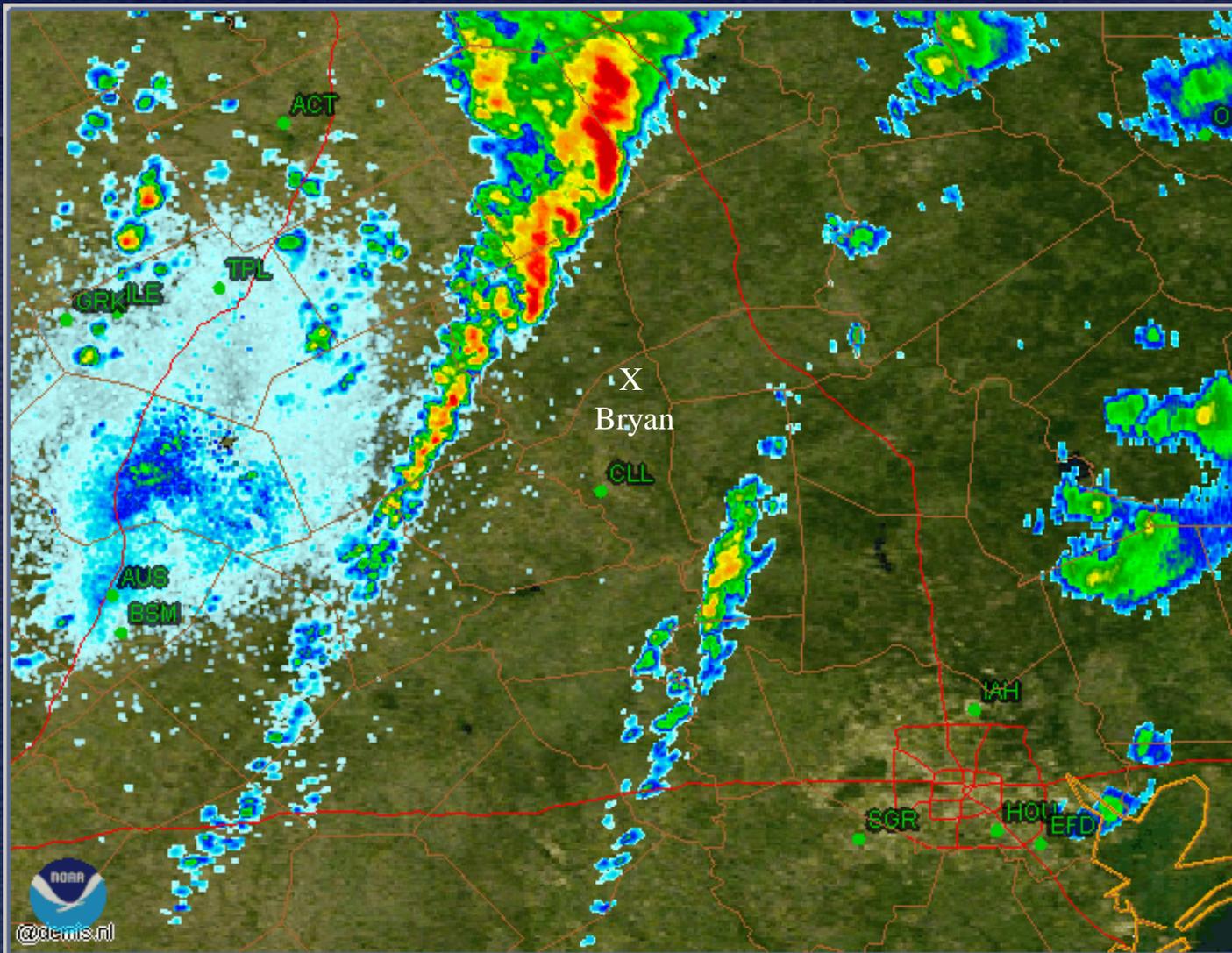


- At 2134 CST pilot responds *“Okay, yea, we’re turning right. We’re in some bad weather here. I’m going to try to get out of it.”*
- Followed by loss of control of aircraft
- In-flight breakup
- Fatal to family of 5



Synoptic Conditions – Surface Analysis for 2200 CST

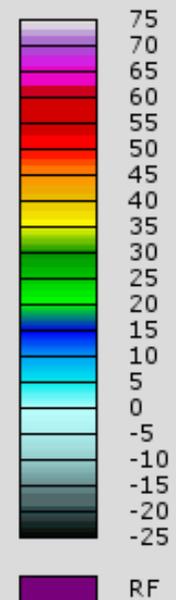




NEXRAD LEVEL-II
KGRK - FORT HOOD, TX
12/20/2011 02:00:45 GMT
LAT: 30/43/19 N
LON: 97/22/58 W
ELEV: 538 FT
VCP: 12

REFLECTIVITY
ELEV ANGLE: 0.98

Legend: dBZ



Fort Hood WSR-88D NEXRAD animation



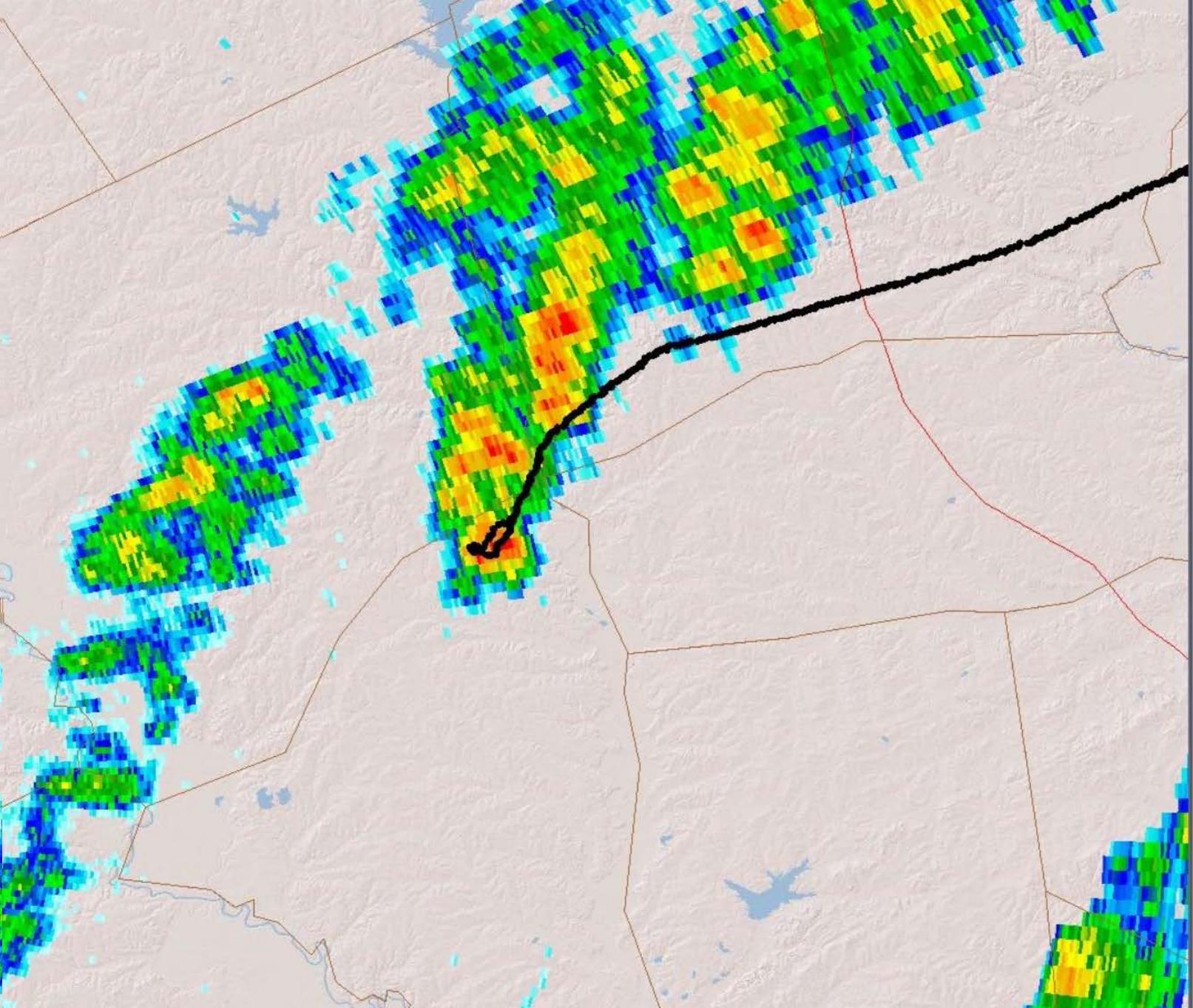
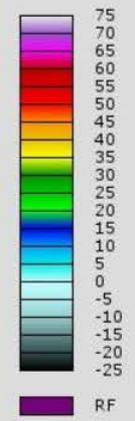


XM Satellite images 2130-2145 CST

NEXRAD LEVEL-II
KGRK - FORT HOOD, TX
12/20/2011 03:45:20 GMT
LAT: 30/43/19 N
LON: 97/22/58 W
ELEV: 538 FT
VCP: 12

REFLECTIVITY
ELEV ANGLE: 0.98

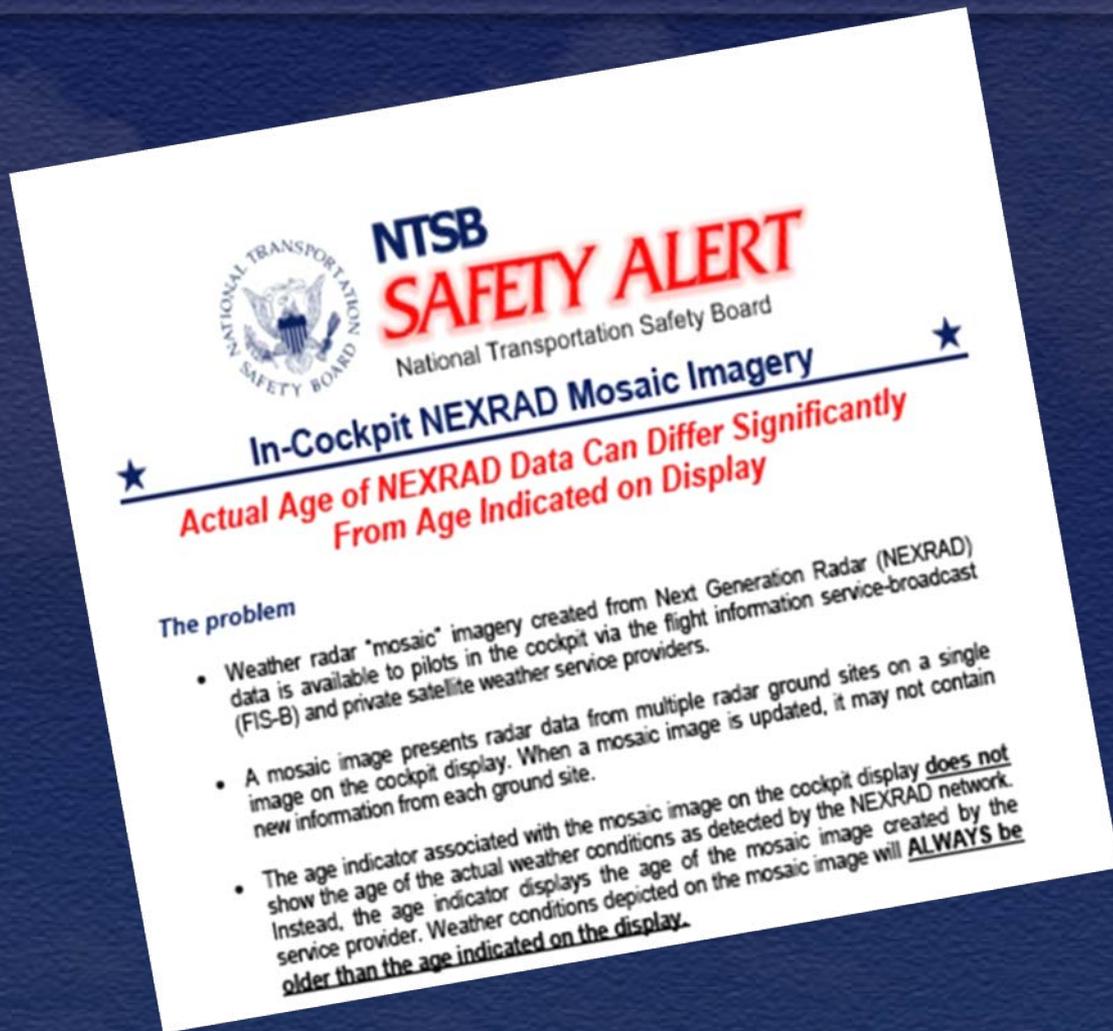
Legend: dBZ



NTSB Probable Cause

- *The pilot's inadvertent encounter with severe weather, which resulted in the airplane's left wing failing in positive overload.*
- *Contributing to the accident was the pilot's reliance on outdated weather information that he received on his in-cockpit Next-Generation Radar (NEXRAD).*

NTSB Safety Alert - NEXRAD



The actual age of the NEXRAD image in the mosaic can exceed the age indicated in the cockpit by 15-20 minutes.

Available on:
www.nts.gov

NEXRAD mosaic shows where weather was, not where it is!

Weather in the Cockpit



- Access to updated weather en route
- Increased situational awareness
- **NEXRAD “Not real time” data**
- **Caution with data lag**
- Spatial resolution of data



Weather in the Cockpit

- The time between when the radar gathered the data and the time stamp can be up to 20 minutes in extreme situations – **not real time!**
- The time stamp only says the time from which the radar mosaic graphic was created...NOT how old the radar data actual is!
- Unless you have Airborne Weather radar and/or Stormscope – assume your display is old or lags multiple scans

ERA12FA376 - Macon, MS

Beechcraft A36, N976S

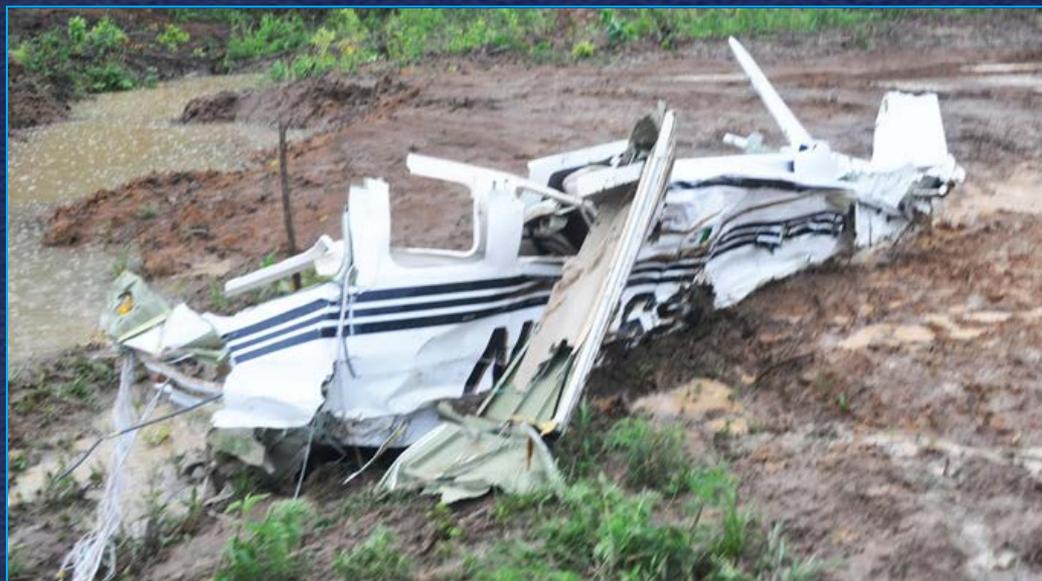
May 31, 2012

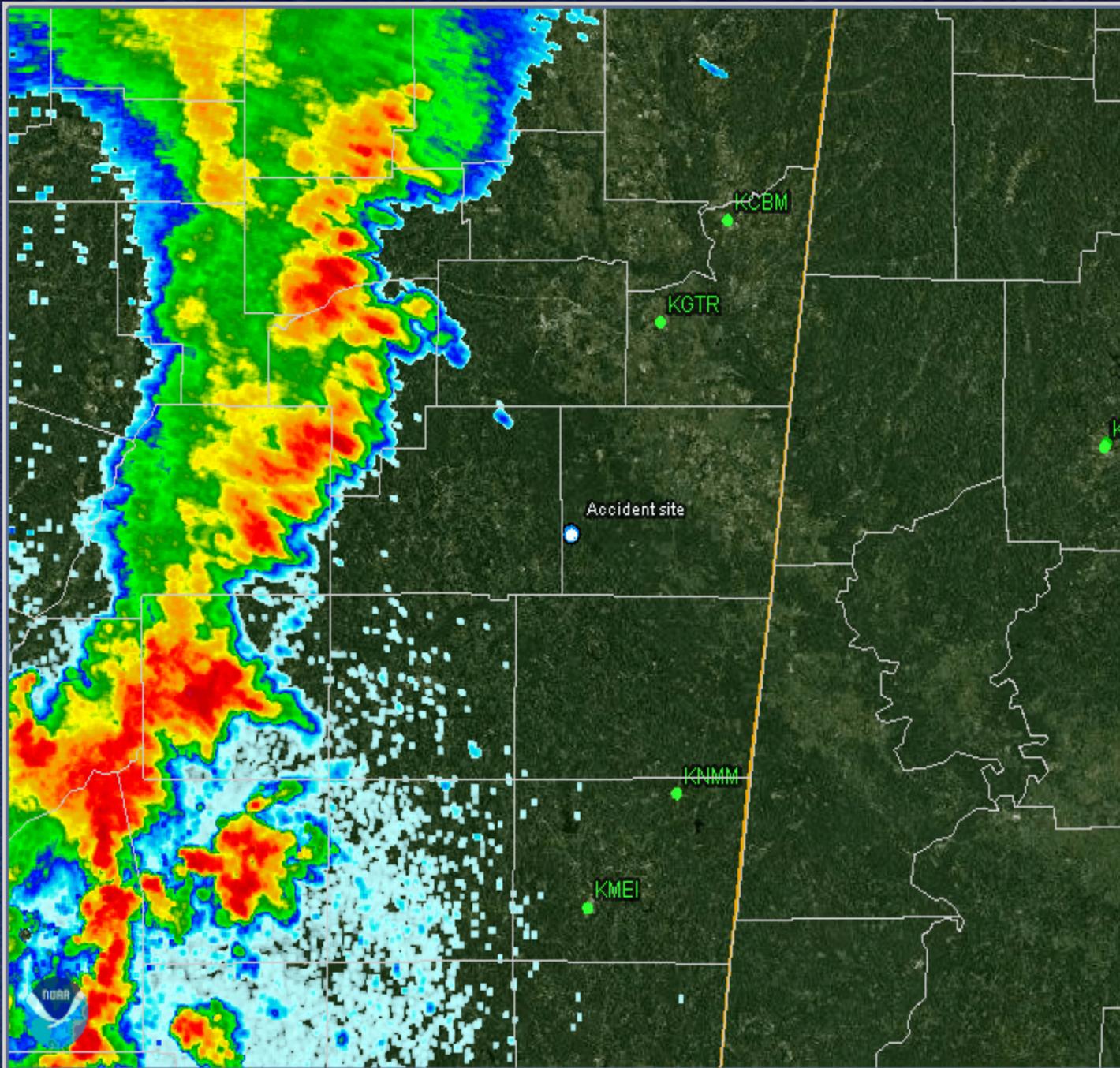
- Flying Magazine Feb 2014
- IFR Part 91 cross country flight
- St. Petersburg, FL (KPIE) to Norman, OK (KOUN)
- Aircraft equipped with StormScope, XM WX Satellite - NEXRAD
- No record of any formal weather briefing
- PIC total time 352 hours, 32 actual instrument



ERA12FA376 – Macon, MS

- While attempting to deviate around an area of extreme precipitation at FL120, aircraft experienced an in-flight breakup and crashed 15NM SW of Macon, MS.
- Witnesses reported high winds and lightning present at the time of the accident
- Convective SIGMET for AREA SEV TS, tops FL450, Hail 2”, Wind gusts 60KT

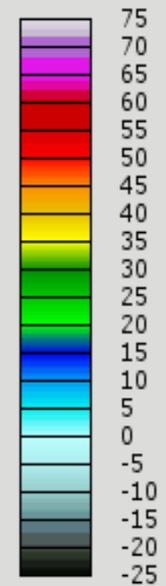




NEXRAD LEVEL-II
KDGX - JACKSON/BRAN., MS
05/31/2012 21:04:24 GMT
LAT: 32/16/48 N
LON: 89/59/02 W
ELEV: 609 FT
VCP: 212

REFLECTIVITY
ELEV ANGLE: 0.50

Legend: dBZ



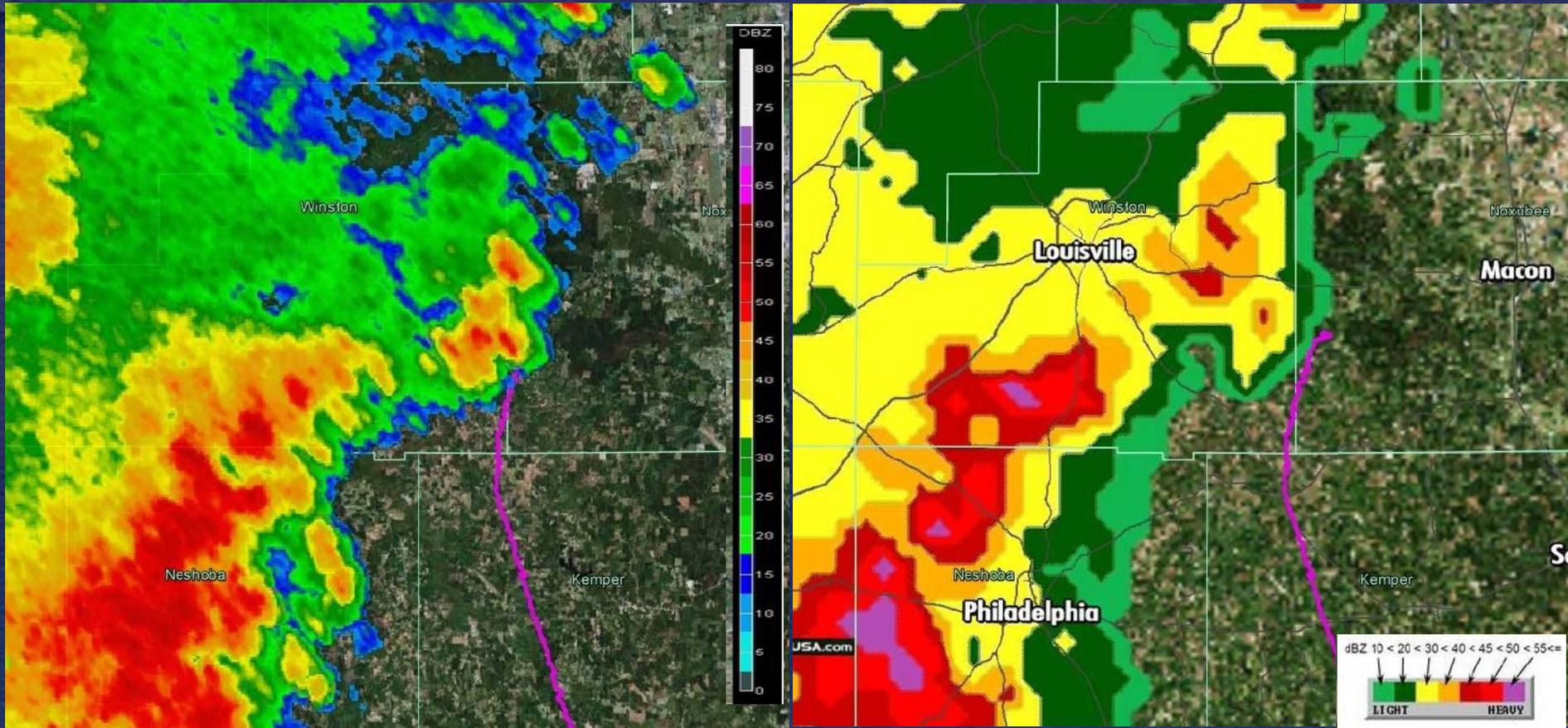
RF

LI -6.5

K-index 39

Tops FL520

ERA12FA376 – Macon, MS



Comparison of NWS WSR-88D and XM WX Satellite Radar images at 1655 CDT
Note different color scales

Don't push a bad situation!

- Obtain a preflight briefing
- Get regular updates on the weather
- Conditions worst than expected?
 - Utilize ATC sources
 - Make a command decision – alter plan, divert, turn back
 - Wait it out & take a break
- Remember time lag in NEXRAD images, what was there...not real time
- Respect *thunderstorms!*

Natures sign post in the sky!



*MOST WEATHER RELATED ACCIDENTS
AND INCIDENTS ARE PREVENTABLE!*

Questions?



eickd@ntsb.gov





NTSB