Takeoffs, Approaches, and Landings for the Cessna 172, 182 and 206

Federal Aviation Administration

Presented to: FAA Safety Seminar Attendees

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Date: 2013

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  - The link is case-sensitive.
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- http://williamjdoylejr.net/FAAST/Cessna

Presentation Agenda

- NTSB Cessna 172, 182, and 206 Accident Trends
- Cessna Generations
- Crosswind Landing Procedures
- Carburetor Icing and Carburetor Heat
- IMC and Night Landing Considerations
- Fuel Management
- Mishaps and Gotchas: Takeoffs, Enroute Descents, Approaches, and Landings
- What Are the Risks in Flying a TAA?
- Doing It by the Numbers: Vspeeds, ASI Arcs, and Performance Data
- Cessna 172, 182, and 206 Weight & Balance Scenarios
- How to Query the NTSB Database

Two FARs You Really Need to Understand

14 CFR 91.3

- Responsibility and authority of the pilot in command.

  a) The pilot in command of an aircraft is directly responsible for, and is the **final authority** as to, the operation of that aircraft.

  b) In an **in-flight emergency requiring immediate action**, the pilot in command **may deviate from any rule of this part to the extent required to meet that emergency**.

  c) Each pilot in command who deviates from a rule under paragraph (b) of this section shall, **upon the request of the Administrator**, send a written report of that deviation to the Administrator.

14 CFR 91.103 – Preflight Action

- Each pilot in command shall, before beginning a flight, become familiar with all available information concerning that flight. This information must include—

  a) For a flight under IFR or a flight not in the vicinity of an airport, **weather reports and forecasts**, fuel requirements, **alternatives available if the planned flight cannot be completed**, and any known traffic delays of which the pilot in command has been advised by ATC;

  b) For any flight, **runway lengths at airports of intended use**, and the following takeoff and landing distance information:

     1) For civil aircraft for which an approved Airplane or Rotorcraft Flight Manual containing takeoff and landing distance data is required, the takeoff and landing distance data contained therein; and

     2) For civil aircraft other than those specified in paragraph (b)(1) of this section, other reliable information appropriate to the aircraft, relating to aircraft performance under expected values of airport elevation and runway slope, aircraft gross weight, and wind and temperature.

NTSB Statistics
on
Cessna 172, 182, and 206
General Aviation Accidents
in the
United States
from 1/1/2000 to 12/31/2012

NTSB Cessna 172, 182 and 206 Accident Trends U.S. – 1/1/2000 – 12/31/2012

14% Fatal

14% of Pax/Crew Died

45% Landing

29% Instructional

66% Personal

Cessna 172, 182 and 206 Accidents from 01/01/2000 to 12/31/2012

U.S.	Fatal	Non-Fatal	172	182	206
2807	386	2418	1835	795	175

U. S.	Total Fatal Injuries	Total Serious Injuries	Total Minor Injuries	Total Uninjured	VMC	IMC
172	388	221	441	2097	1760	70
182	259	104	217	984	727	63
206	84	31	70	246	163	12
Total	731	356	728	3327	2650	145

U. S.	TAXI	TAKEOFF	CLIMB	CRUISE	DESCENT	APPROACH	MANEUVERING	LANDING
172	87	297	30	151	37	107	119	724
182	28	109	17	99	32	69	49	286
206	10	30	6	23	6	18	4	56
Total	125	436	53	273	75	194	172	1066

U. S.	Instructional	Personal	Business	Positioning	Aerial Observation
172	707	1042	19	11	20
182	52	605	31	13	10
206	6	107	14	18	3
Total	765	1754	64	42	33

NTSB Cessna 172, 182 and 206 Accident Trends
PA – 1/1/2000 – 12/31/2012

11% Fatal

PA	Total	Fatal	Non-Fatal
172	37	4	33
182	15	2	13
206	1	0	1
Total	53	6	47

8% of Pax/Crew Died

PA	Total Fatal Injuries	Total Serious Injuries	Total Minor Injuries	Total Uninjured	VMC	IMC
172	5	4	7	46	35	2
182	2	0	1	23	15	0
206	0	0	0	3	1	0
Total	7	4	8	72	51	2

55% Landing

PA	TAXI	TAKEOFF	CLIMB	CRUISE	DESCENT	APPROACH	MANEUVERING	LANDING
172	2	3	0	3	0	4	2	15
182	0	3	1	2	0	0	0	8
206	0	0	0	0	0	0	0	1
Total	2	6	1	5	0	4	2	24

28% Instructional

68% Personal

PA	Instructional	Personal	Business	Positioning	Aerial Observation
172	14	22	1	0	0
182	0	11	1	0	0
206	0	1	0	0	0
Total	14	34	2	0	0

NTSB Cessna 172, 182 and 206 Accident Trends
NJ – 1/1/2000 – 12/31/2012

11% Fatal

NJ	Total	Fatal	Non-Fatal
172	41	4	37
182	15	2	13
206	1	0	1
Total	57	6	51

9% of Pax/Crew Died

NJ	Total Fatal Injuries	Total Serious Injuries	Total Minor Injuries	Total Uninjured	VMC	IMC
172	5	6	10	48	39	1
182	3	3	1	17	14	1
206	0	0	0	1	1	0
Total	8	9	11	66	54	2

47% Landing

NJ	TAXI	TAKEOFF	CLIMB	CRUISE	DESCENT	APPROACH	MANEUVERING	LANDING
172	1	9	0	7	0	2	0	16
182	1	4	0	0	0	2	1	7
206	0	0	0	0	0	0	0	1
Total	2	13	0	7	0	4	1	24

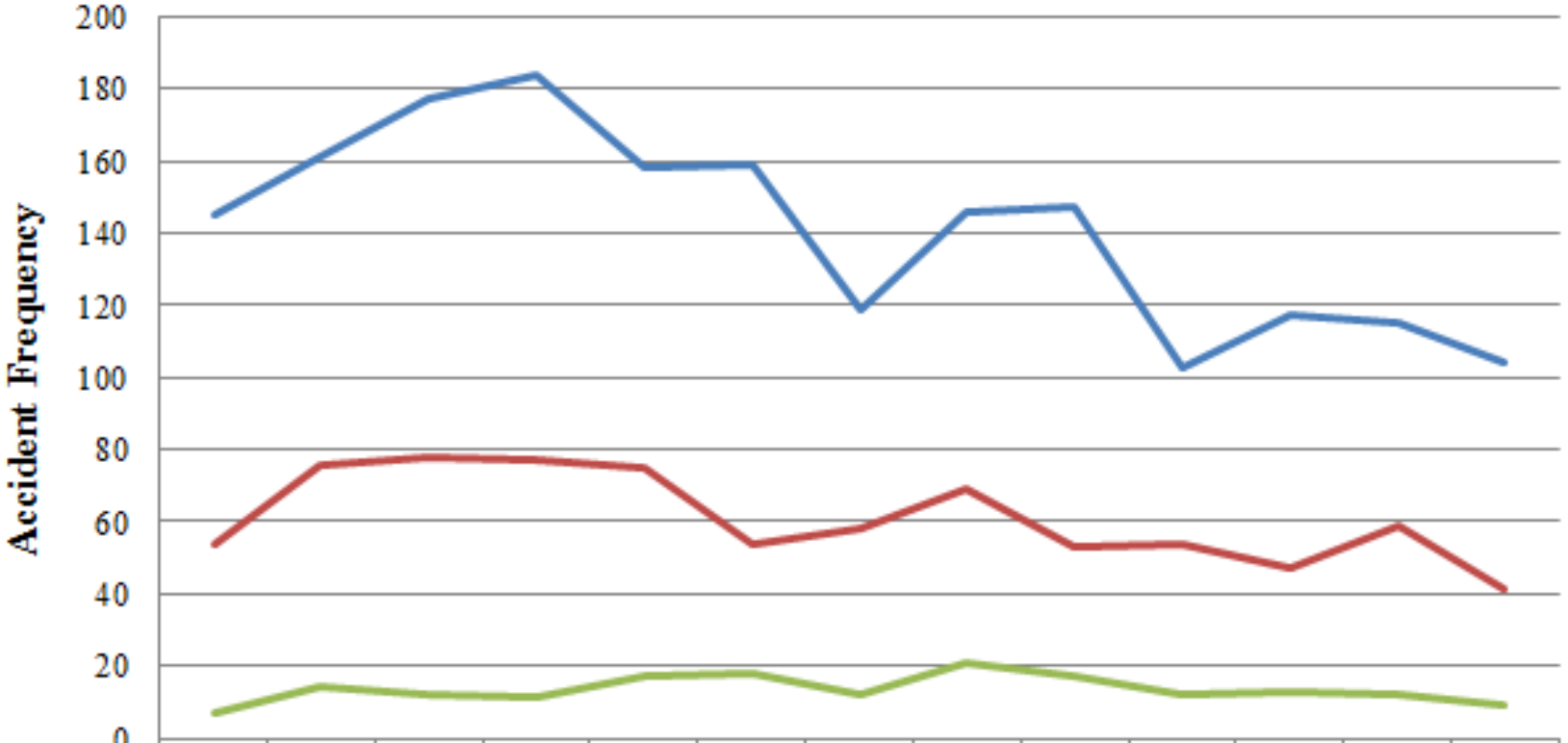
39% Instructional

57% Personal

NJ	Instructional	Personal	Business	Positioning	Aerial Observation
172	19	19	0	2	0
182	2	11	0	0	0
206	0	1	0	0	0
Total	21	31	0	2	0

NTSB Cessna 172, 182 and 206 Accident Trends U.S. – 1/1/2000 – 12/31/2012

Cessna Accident Trends



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
172	145	161	177	184	158	159	119	146	147	103	117	115	104
182	54	76	78	77	75	54	58	69	53	54	47	59	41
206	7	14	12	11	17	18	12	21	17	12	13	12	9

NTSB Statistics
on
Pre-Flight Planning
General Aviation Accidents
in the
United States
from 1/1/2000 to 07/31/2013

NTSB Pre-Flight Planning Accident Trends
U.S. – 1/1/2000 – 7/31/2013

Pre-Flight Planning Accidents from 01/01/2000 to 07/31/2013

U.S.	Fatal	Non-Fatal	Fatalities	Serious	Minor	Uninjured	Total
388	91	297	172	92	167	368	799

Year	Fatal	Non-Fatal	Total
2000	13	40	53
2001	5	27	32
2002	13	22	35
2003	5	32	37
2004	10	33	43
2005	6	33	39
2006	9	26	35
2007	13	18	31
2008	1	22	23
2009	7	12	19
2010	4	12	16
2011	5	13	18
2012	0	6	6
2013	0	1	1
Total	**91**	**297**	**388**

PIC Certificate	Fatal	Non-Fatal	Total
ATP	10	30	40
Commercial	15	94	109
Private	64	163	227
Sport	0	1	1
Student	2	7	9
Non-certificated	0	2	2
Total	**91**	**297**	**388**

PIC Age	
Average	49
Median	51
Mode	56
High	84
Low	17

NTSB Pre-Flight Planning Accident Trends
U.S. – 1/1/2000 – 7/31/2013

Purpose of Flight

U. S.	Instructional	Personal	Business	Executive/ Corporate	Aerial Observation	Banner Tow	Ferry	Flight Test	Glider Tow	Positioning	Public Use	Skydiving	Other Work Use
Fatal	6	70	10	0	0	0	1	0	0	3	0	0	0
Non-Fatal	26	231	13	5	2	1	1	1	1	5	1	2	7
Total	**32**	**301**	**23**	**5**	**2**	**1**	**2**	**1**	**1**	**8**	**1**	**2**	**7**

Weather Conditions of Flight

U. S.	VMC	IMC
Fatal	54	34
Non-Fatal	285	12
Total	**339**	**46**

Broad Phase of Flight

U. S.	Taxi	Takeoff	Climb	Cruise	Descent	Approach	Maneuvering	Landing	Go-Around	Standing
Fatal	2	18	6	24	3	14	12	2	2	0
Non-Fatal	6	85	6	81	18	43	12	26	3	2
Total	**8**	**103**	**12**	**105**	**21**	**57**	**24**	**28**	**5**	**2**

NTSB Pre-Flight Planning Accident Trends
U.S. – 1/1/2000 – 7/31/2013

Probable Cause	Fatal	Non-Fatal	Total	Percent
Airspeed	1	3	4	1.0%
Airworthiness	3	2	5	1.3%
Approach to Landing	0	4	4	1.0%
Carburetor Ice	0	5	5	1.3%
CFIT	**7**	**15**	**22**	**5.7%**
Closed Airport	0	2	2	0.5%
CRM	1	0	1	0.3%
Crosswind	0	8	8	2.1%
Fatigue	1	0	1	0.3%
Forecast Weather	1	0	1	0.3%
Fuel Contamination	0	4	4	1.0%
Fuel Management	**18**	**155**	**173**	**44.6%**
Hand Propping	1	1	2	0.5%
HAZMAT	0	1	1	0.3%
Icing	5	1	6	1.5%
Landing Flare	0	5	5	1.3%
Loss of Control	1	7	8	2.1%
Mechanical Failure	0	1	1	0.3%
Mixture Leaning	1	3	4	1.0%
Night	1	1	2	0.5%
Obstacle Clearance	0	2	2	0.5%
Runway Excursion	**2**	**19**	**21**	**5.4%**
Takeoff Performance	**7**	**34**	**41**	**10.6%**
Thunderstorm	1	1	2	0.5%
VFR into IMC	**24**	**5**	**29**	**7.5%**
Visual Separation	5	4	9	2.3%
Weight & Balance	**11**	**13**	**24**	**6.2%**
Windshear	0	1	1	0.3%
Total	**91**	**297**	**388**	

Cessna Generations

Cessna 182/206 G1000 with GFC 700

Show of hands …

How many fly a Cessna 182 with this?

How many fly a Cessna 206 with this?

Cessna 182/206 G1000 with KAP 140

Show of hands …

How many fly a Cessna 182 with this?

How many fly a Cessna 206 with this?

Cessna 172 G1000 with GFC 700

Show of hands …

How many fly a Cessna 172 with this?

Cessna 182 – "Six Pack"

Show of hands …

How many fly a Cessna 182 with this?

Cessna 172 – "Six Pack"

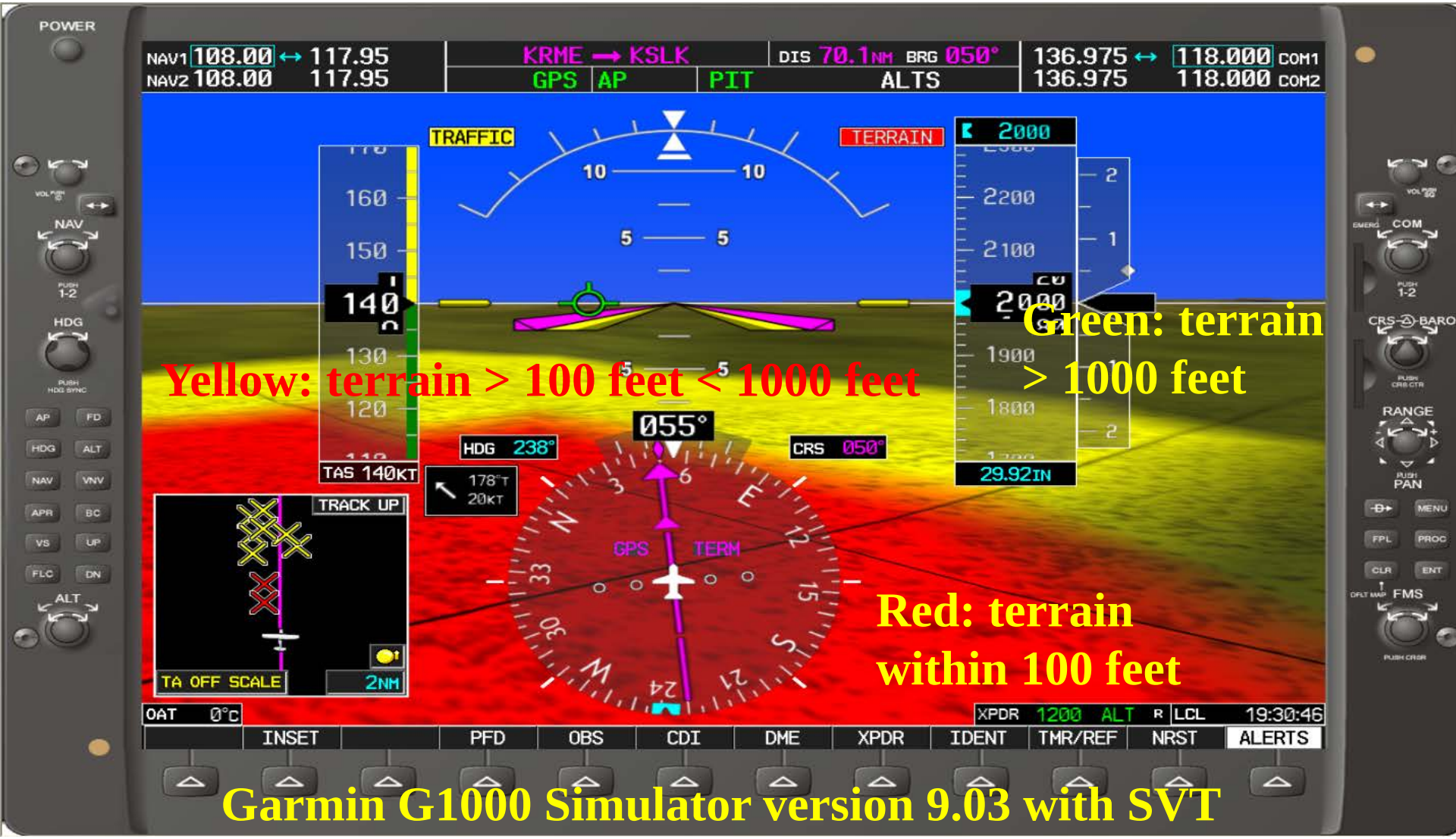
Show of hands …

How many fly a Cessna 172 with this?

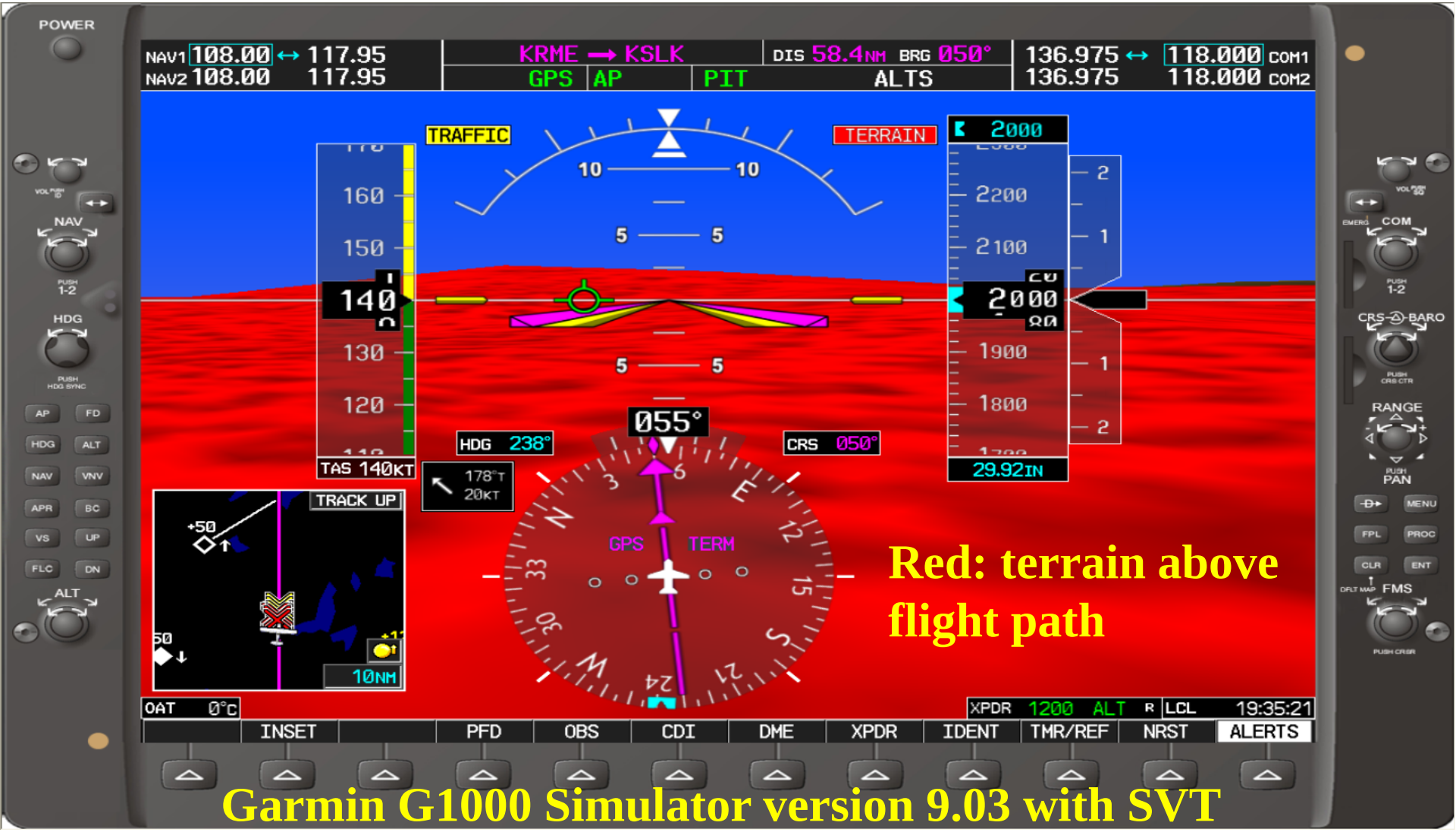
Know Your Airplane

- Study your airplane's POH
  - If non-owner, purchase the information manual(s) for the airplane(s) you regularly fly
- Learn your airplane's limitations and performance capabilities
- Look at the NTSB database (see usage instructions at end)
  - Check accident histories for the airplane(s) you fly
  - Check accident histories for the airports you fly to
  - Could you make mistakes similar to the pilots in those accidents?
- Check inoperative equipment against Kinds of Operational Equipment List (KOEL) in POH Section 2
- Cessna 172 is one of the most docile and forgiving airplanes ever built
  - It can just barely kill you!

Anything Wrong With This Picture?



So What Do You Think? CFIT in the Making?



Garmin G1000 Simulator version 9.03 with SVT

Crosswind Landing Procedures

Crosswind Landing Techniques

- Crab down final
- Transition to sideslip at or just before the thresh hold
- Any risks?
  - Side load on tires

Figure 8-15. Crabbed approach. FAA Airplane Flying Handbook

- Sideslip not recommended all the way down a long final approach leg
- Any risks?
  - Cross control stall if improper pitch, power, airspeed

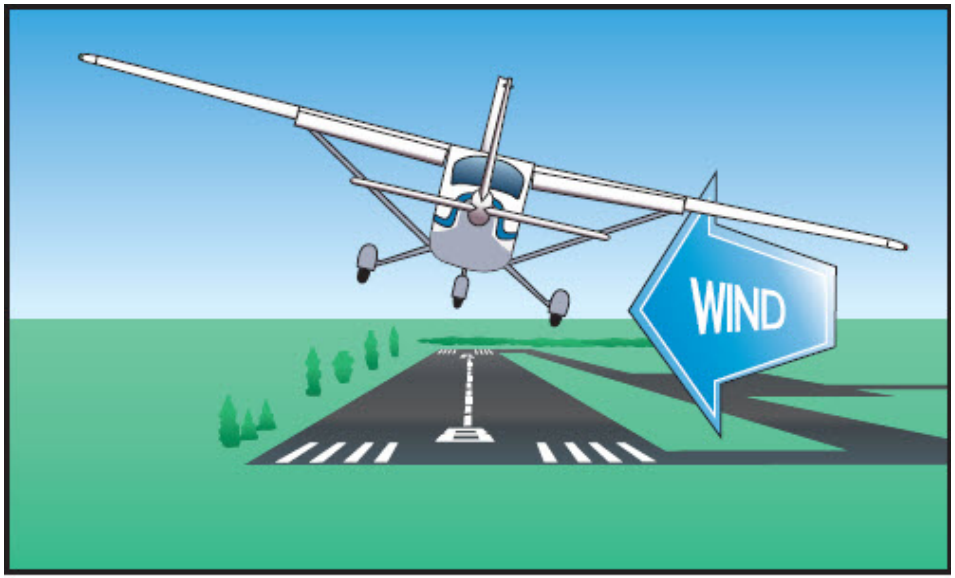


Figure 8-16. Sideslip approach. FAA Airplane Flying Handbook

Crosswind Landing Techniques

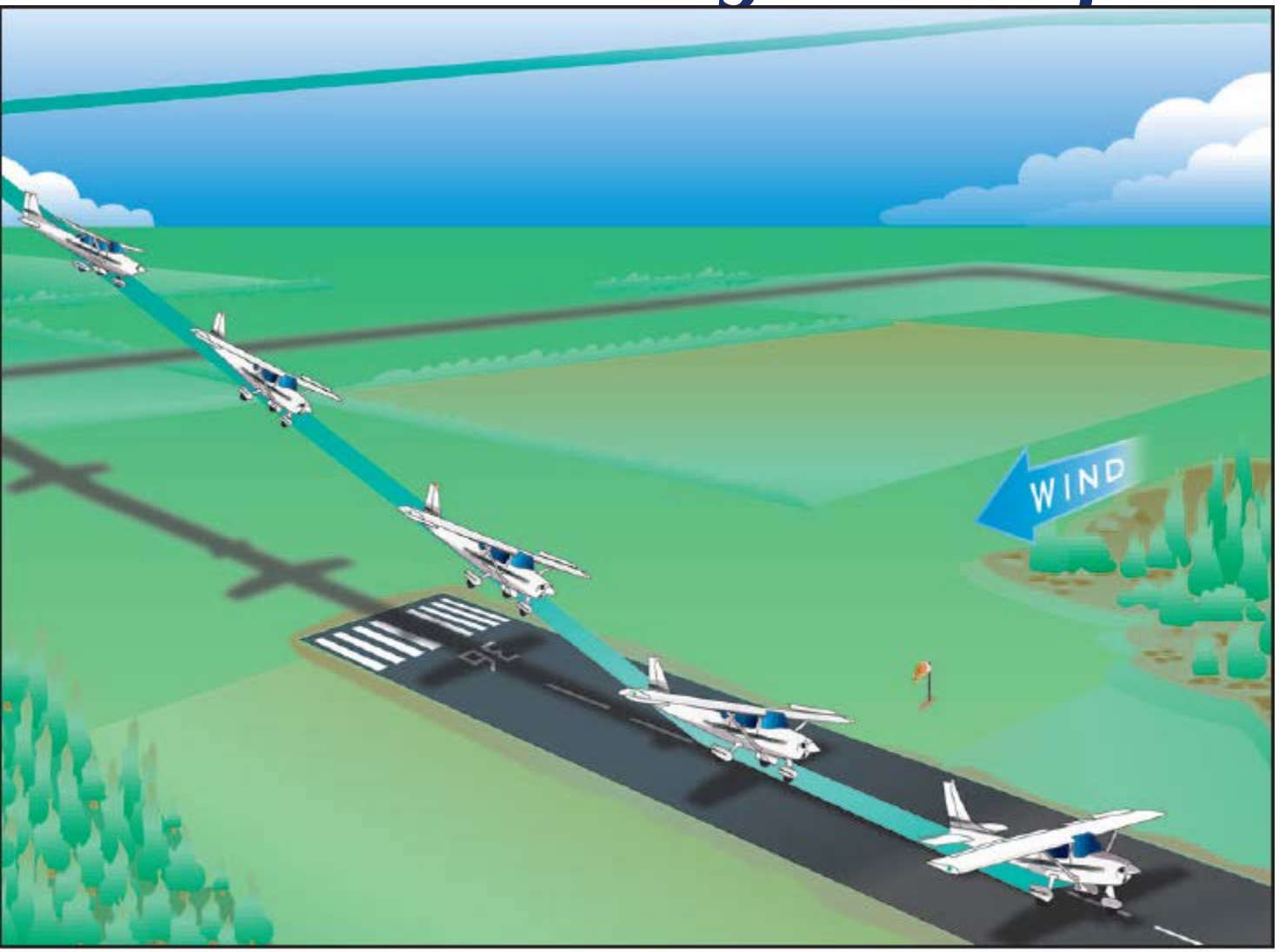


Figure 8-17. Crosswind approach and landing. FAA Airplane Flying Handbook - FAA-H-8083-3A

Hold aileron into wind until parked and shutdown.

Yogi Berra, "It ain't over 'til it's over!"

Crosswind Operations

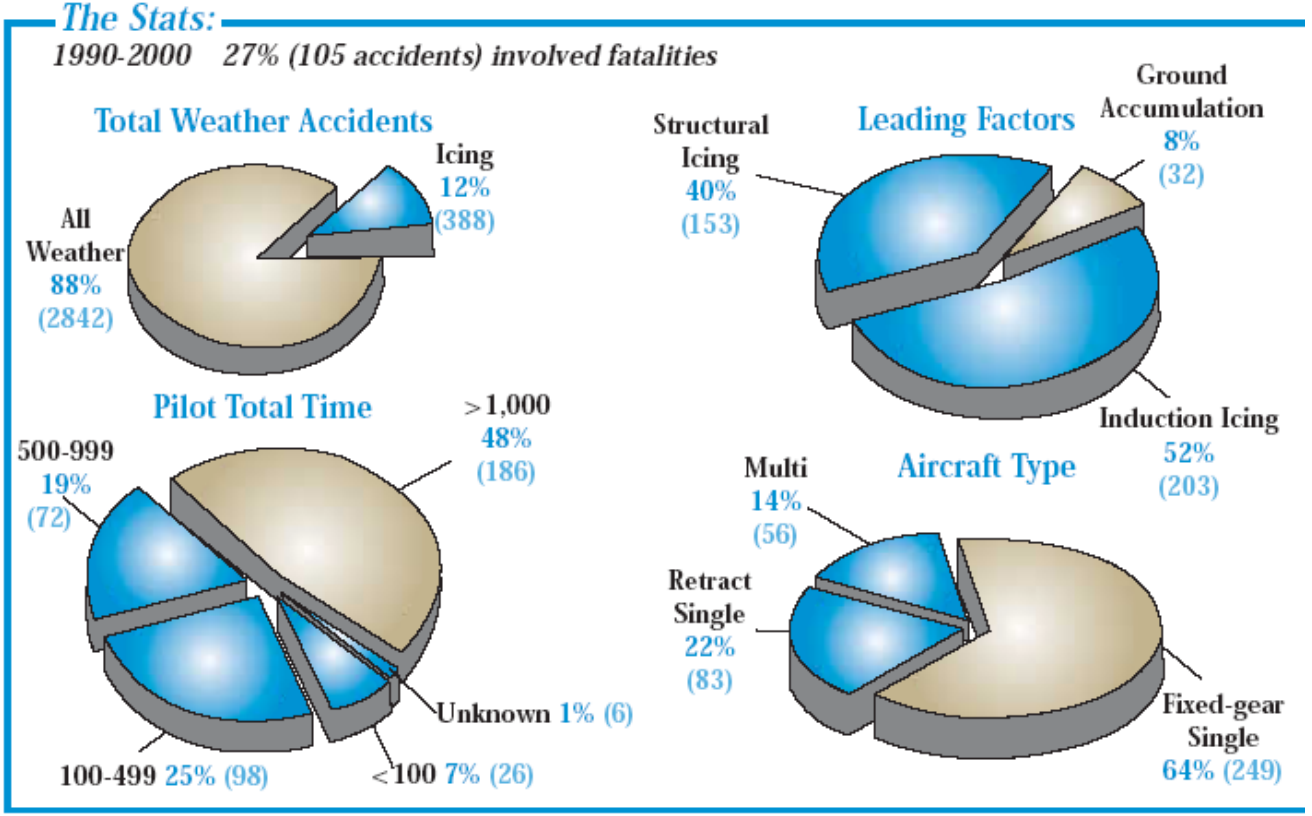
- Please refer to the link below for more information on crosswind operations
  - http://williamjdoylejr.net/FAAST/Crosswind_Operations_at_the_Edge.ppt

Carburetor Icing and Carburetor Heat

AOPA Air Safety Foundation on Carburetor Icing

- **At the first indication of carburetor ice**
  - Apply full carburetor heat
  - ***Leave It On***
- **The engine may run rougher as the ice melts and goes through it**
  - but it will smooth out again
- **When the engine runs smoothly**
  - Turn off the carburetor heat
- **If you shut off the carburetor heat prematurely**
  - the engine will build more ice
  - and probably quit because of air starvation

AOPA Air Safety Foundation Weather Accident Statistics



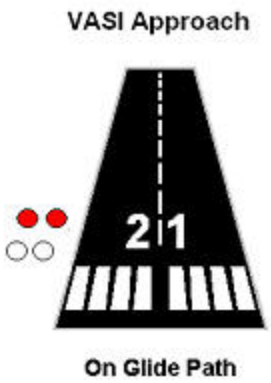
Induction icing (carburetor ice) was a leading factor in 52% of the weather accidents that occurred between 1990 and 2000.

IMC and Night Landing Considerations

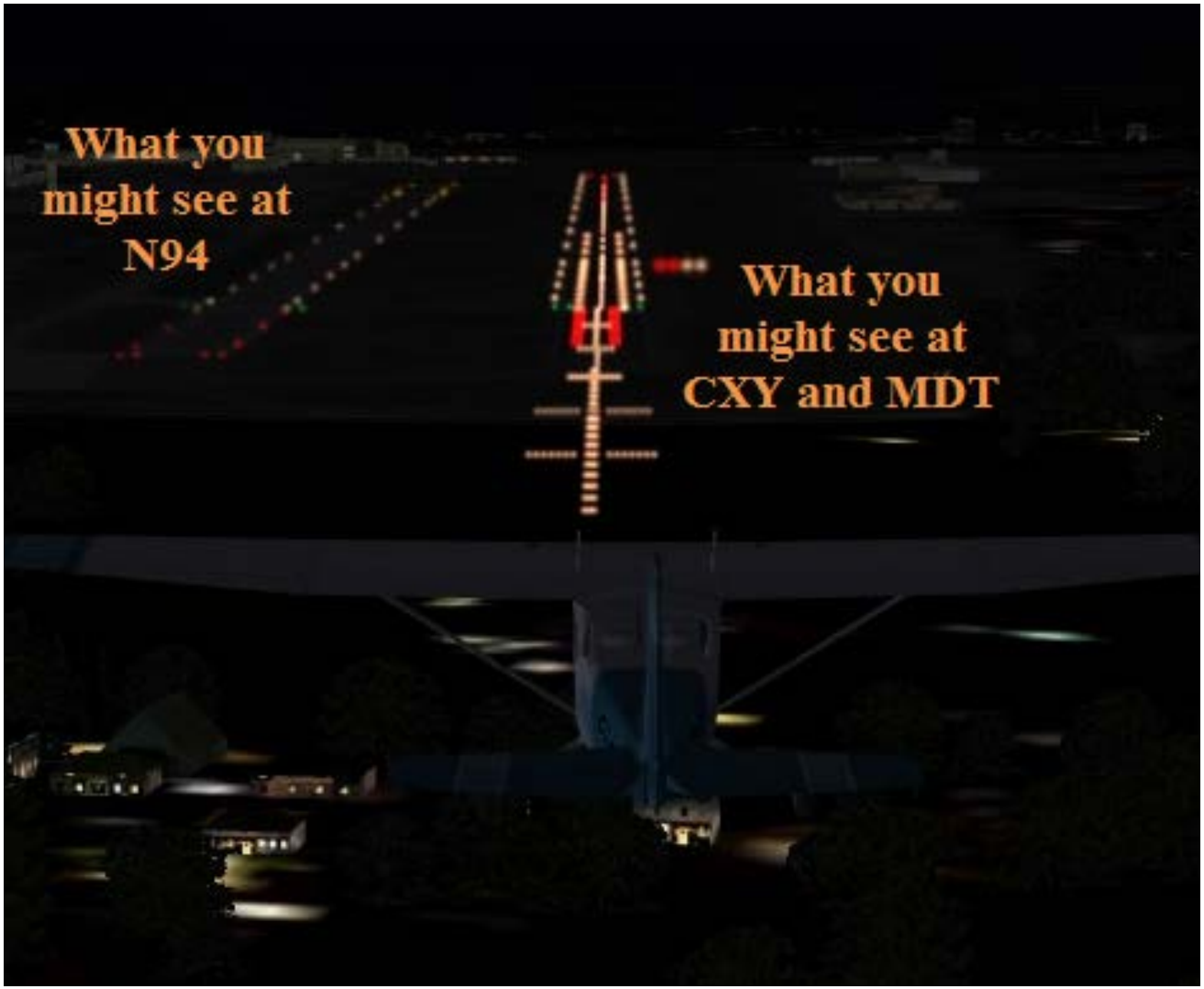
Single Pilot Night IFR

- Please refer to the link below for more information on single pilot night IFR
  - http://williamjdoylejr.net/FAAST/Single_Pilot_Night_IFR.ppt

Approach Lighting Comparison



All You Might Get at N94



Approach Lighting Comparison

Fuel Management

Fuel Management

- Please refer to the links below for more information on fuel management
  - http://williamjdoylejr.net/FAAST/fuel_management.ppt
  - http://williamjdoylejr.net/FAAST/fuel_management_banner_tow.ppt

Federal Aviation Regulations on Fuel Reserve Requirements

- ***FAR 91.151***
  - – Fuel Requirements for Flight in VFR Conditions
- ***FAR 91.167***
  - – Fuel Requirements for Flight in IFR Conditions

FAR 91.151 VFR Fuel Reserves

a) No person may begin a flight in an airplane under VFR conditions unless (considering wind and forecast weather conditions) there is enough fuel to fly to the first point of intended landing and, assuming normal cruising speed –

1. **During the day, to fly after that for at least 30 minutes**; or
2. **At night, to fly after that for at least 45 minutes**.

b) No person may begin a flight in a rotorcraft under VFR conditions unless (considering wind and forecast weather conditions) there is enough fuel to fly to the first point of intended landing and, assuming normal cruising speed to fly after that for at least 30 minutes.

FAR 91.167 IFR Fuel Reserves

a) No person may operate a civil aircraft in IFR conditions unless it carries enough fuel (considering weather reports and forecasts and weather conditions) to –

1) Complete the flight to the first airport of intended landing;

2) Except as provided in paragraph (b) of this section, **fly from that airport to the alternate airport**; and

3) Fly after that for 45 minutes at normal cruising speed or, for helicopters, fly after that for 30 minutes at normal cruising speed.

- **But wait! There's more …**

FAR 91.167 IFR Fuel Reserves (cont'd)

b) Paragraph (a)(2) does not apply if:

1) Part 97 of this chapter prescribes a standard instrument approach procedure to, or a special instrument procedure has been issued by the Administrator to the operator for, the first airport of intended landing and

2) Appropriate weather reports or weather forecasts, or a combination of them, indicate the following the **1-2-3** Rule

   i. For aircraft other than helicopters. For at least **1** hour before and for **1** hour after the estimated time of arrival,

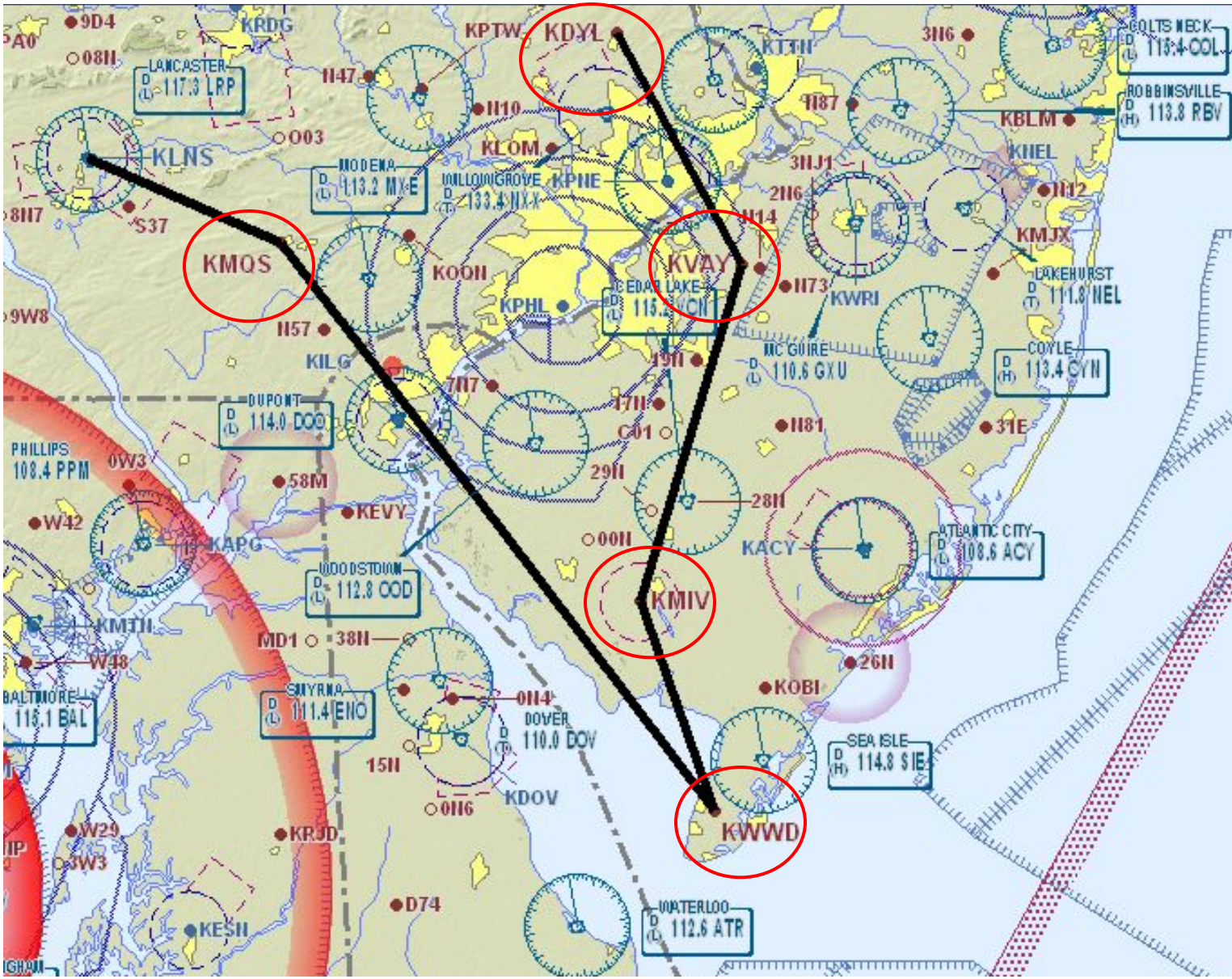
   ii. the ceiling will be at least **2**,000 feet above the airport elevation and

   iii. the visibility will be at least **3** statute miles

Making the FARs Work for You

- **FARs 91.151 & 91.167 all use “at normal cruise”**
- **What is a normal cruise power setting?**
  - 70% -- 75% power
  - What happens at 75% power?
- **What other choices might there be?**
  - What happens at 65% power?
  - What happens at 55% power?

Flight Planning Scenario



Flight Planning Scenario

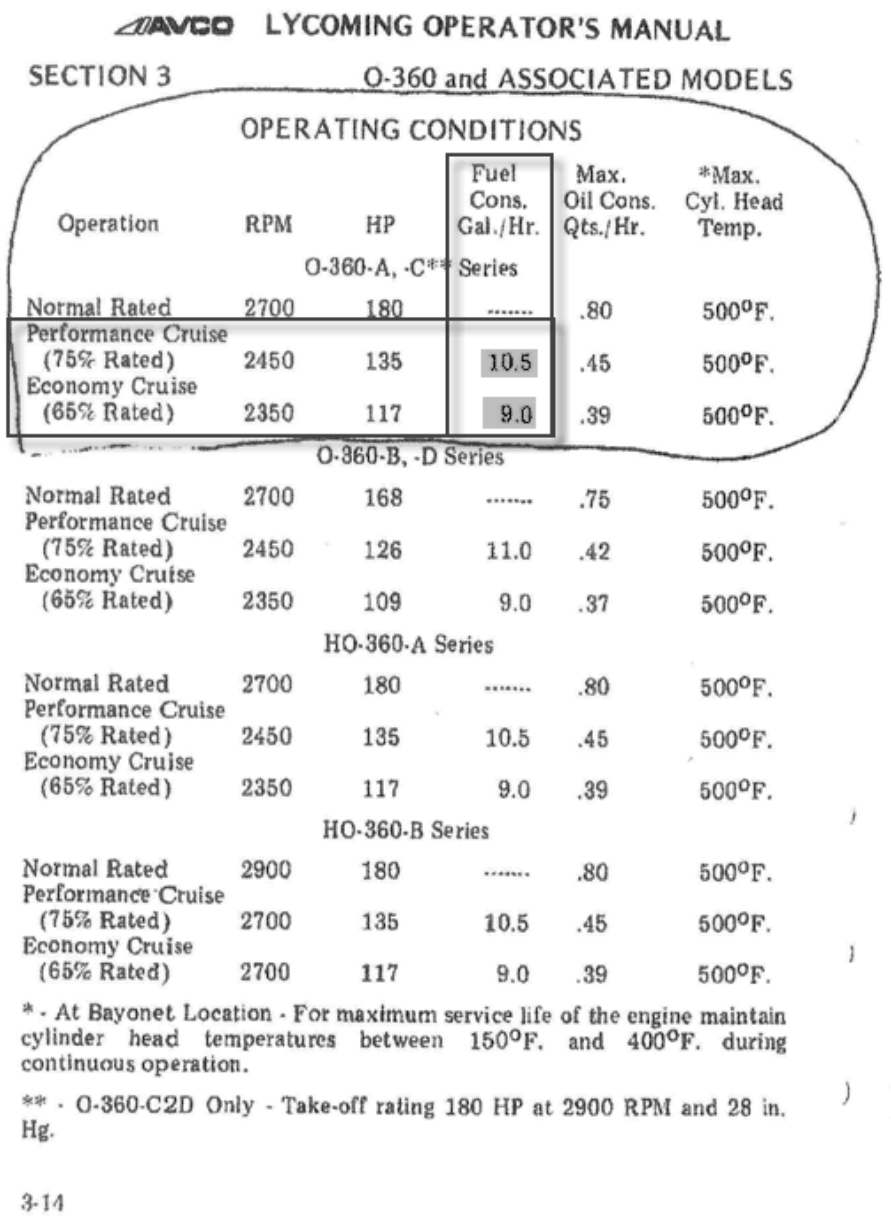
Filed Route
KVAY KMIV KWWD KMQS

Waypoints Fixes	MEA / (MORA) FREQ	Route	MC	Fuel (gal) LEG	Dist (NM) LEG	GS (Kts)	ETE	ATE	WIND
KDYL **DOYLESTOWN** N40° 19.983' W75° 7.340'		ALT	MH	REM	REM	EST	TTE	ATA	OAT
				40	180	ACT			
KVAY **SOUTH JERSEY REGL** N39° 56.573' W74° 50.743'	(4700)		163	3	27	90	**00:18**		127@14
		3000	**160**	37	154		00:18		9°C
KMIV **MILLVILLE MUN** N39° 22.068' W75° 4.333'	(2700)		209	4	36	98	**00:22**		162@14
		3000	**205**	33	118		00:40		10°C
KWWD **CAPE MAY CO** N39° 0.510' W74° 54.496'	(2700)		172	2	23	96	**00:14**		197@17
		3000	**178**	31	95		00:54		12°C
KMQS **CHESTER CO G O CARLS** N39° 58.738' W75° 51.928'	(2700)		334	6	73	123	**00:36**		169@15
		3000	**332**	25	22		01:30		9°C
KLNS **LANCASTER** N40° 7.303' W76° 17.766'	(4700)		305	2	22	115	**00:11**		128@13
		403	**303**	23	0		01:41		8°C
		ROUTE TOTALS		**17**	**180**		**01:41**		

Flight Planning Scenario

- **Will it work at full fuel in Cessna 172P with standard tanks?**
  - If yes, why?
  - If not, why not?
- **Will it work with the tanks down 8 to 10 gallons for a Cessna 172P with standard tanks?**
  - If yes, why?
  - If not, why not?

Flight Planning Scenario



AVCO LYCOMING OPERATOR'S MANUAL

SECTION 3 O-360 and ASSOCIATED MODELS

OPERATING CONDITIONS

Operation	RPM	HP	Fuel Cons. Gal./Hr.	Max. Oil Cons. Qts./Hr.	*Max. Cyl. Head Temp.
O-360-A, -C Series**					
Normal Rated	2700	180	.....	.80	500°F.
Performance Cruise (75% Rated)	2450	135	10.5	.45	500°F.
Economy Cruise (65% Rated)	2350	117	9.0	.39	500°F.
O-360-B, -D Series					
Normal Rated	2700	168	.....	.75	500°F.
Performance Cruise (75% Rated)	2450	126	11.0	.42	500°F.
Economy Cruise (65% Rated)	2350	109	9.0	.37	500°F.
HO-360-A Series					
Normal Rated	2700	180	.....	.80	500°F.
Performance Cruise (75% Rated)	2450	135	10.5	.45	500°F.
Economy Cruise (65% Rated)	2350	117	9.0	.39	500°F.
HO-360-B Series					
Normal Rated	2900	180	.....	.80	500°F.
Performance Cruise (75% Rated)	2700	135	10.5	.45	500°F.
Economy Cruise (65% Rated)	2700	117	9.0	.39	500°F.

* - At Bayonet Location - For maximum service life of the engine maintain cylinder head temperatures between 150°F. and 400°F. during continuous operation.

** - O-360-C2D Only - Take-off rating 180 HP at 2900 RPM and 28 in. Hg.

3-14

Suggestions and Cautions

- **Recognize that your aircraft information manual is not the official aircraft Pilot's Operating Handbook**
- **Know the aircraft you are flying**
  - Is it a Cessna?
    - C-172 / 160 hp?
    - C-172 / 180 hp?
    - C182 / 230 hp?
  - What is its fuel capacity?
    - Standard tanks?
    - Long range tanks?
  - How do you manage tank selection and fuel flow?
  - Know your aircraft's fuel consumption
    - Cessna 182 Skylane – flight plan at 15 gph
    - Cessna 172 Skyhawk (180 hp) – flight plan at 12 gph

Suggestions and Cautions (cont'd)

- Conduct thorough preflight planning (FAR 91.103)
  - Know the Wx for route of flight, especially winds aloft
  - Know airports along the route of flight for refueling options
  - Establish flight legs no longer than 3.0 – 3.5 hours for safety and convenience
  - Incorporate and maintain good judgment on the ground and in the air
  - Always make sure the tanks are topped prior to departure
    - Be sure you conform to weight and balance limitations

Landing Procedures

Landing Procedures

- VFR Pattern for Landing
  - Flaps 10° abeam Base numbers, note $\mathbf{V_{fe}}$
  - Flaps 30° turning Base to Final
- Tips/Suggestions for Final Leg
  - Flaps 30°
  - Power (throttle controls altitude)
    - For 172 set power at 1500 RPM
    - For 182 and 206 set power between 12” and 14” MP
  - Pitch (controls airspeed) for
    - ASI 60-70 KIAS (172 & 182), 65 - 75 KIAS (206) (pitch controls airspeed)
  - Going Around
    - If you need to go around, don’t hesitate to initiate!
    - Flaps 20°
    - ASI 60 KIAS (172); 55 KIAS (182); 75 – 80 KIAS (206)

Landing Procedures

- Sample Pattern Operations for Cessna 172
  - Doylestown Airport (KDYL), Doylestown, PA
    - http://williamjdoylejr.net/FAAST/Cessna/Pattern_Operations_at_Doylestown_Airport_CAP_C172_180HP.pdf
  - R. J. Miller Airpark (KMJX), Toms River, NJ
    - http://williamjdoylejr.net/FAAST/Cessna/Pattern_Operations_at_RJMiller_Airpark_CAP_C172_180HP.pdf
  - Lakehurst NAES/JRB (KNEL), Lakehurst, NJ
    - http://williamjdoylejr.net/FAAST/Cessna/Pattern_Operations_at_Lakehurst_NAES_CAP_C172_180HP.pdf
  - Venango County Regional Airport (KFKL), Franklin, PA
    - http://williamjdoylejr.net/FAAST/Cessna/Pattern_Operations_at_Venango_County_FKL_CAP_C172_180HP.pdf

Taxiing Mishaps and Gotchas

Student Pilot Taxiing Mishap in 172P "Six Pack"

- Student Pilot had just landed after a solo flight and was taxing back to the FBO to pick up his instructor
  - As Student attempted to taxi past a parked fuel truck
    - Right wing clipped the truck's right rear view mirror
    - Airplane pivoted to the right
    - Spinner and propeller collided with the side of the truck
    - Airplane substantially damaged, no injuries
  - Student pilot told FAA that
    - I was taxiing back to the FBO when about 10 people started crossing the taxiway. I stopped, letting the people through. From where I stopped I thought I could clear the fuel truck. I continued after the people passed.
    - I was about 1-foot to the left of the centerline and as I passed the truck I felt the airplane hit and suddenly swing into the side of the truck. After the collision, I shut down the airplane as fast as possible.

Student Pilot Taxiing Mishap in 172P "Six Pack"

- FAA interviewed CFI
  - FAA compared CFI's logbook against student pilot's logbook, looking for endorsements in accordance with 14 CFR 61.87(d)(1)–(15)
    - FAA found no endorsements for collision avoidance, windshear avoidance, and wake turbulence avoidance per 14 CFR 61.87(d)(7)
    - CFI said these were taught in ground school
    - FAA said it needed to be endorsed as flight instruction
- Lessons Learned
  - CFIs should either use a handheld radio to communicate with students during supervised solos.
    - CFI in this case should have been a wing walker to get the student pilot past the fuel truck or to halt the taxi
  - CFIs should pay close attention to the requirements of 14 CFR 61.87, particularly 14 CFR 61.87(d)(1)–(15)

Takeoff Mishaps and Gotchas

Takeoff Mishap in 172P "Six Pack"

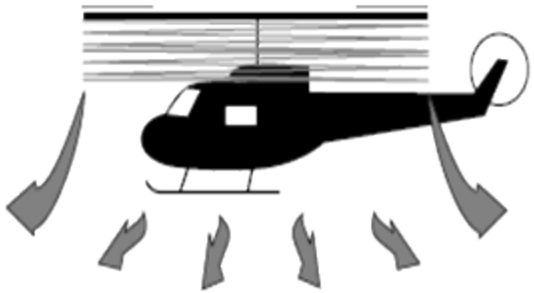
- Cadet orientation flight from Doylestown (KDYL) to Pennridge (KCKZ) and return to Doylestown
  - Orientation flights use a structured (FAA-approved) syllabus
    - Five (5) powered flights
    - PIC must fly from the left seat regardless of ratings
    - Flights must be conducted in Day VMC
  - Flight departs DYL runway 5 (3,000 feet x 60 feet)
    - Cessna 172 is on takeoff roll, ASI about 30 KIAS
    - Passenger suddenly grabs yoke and yanks it full aft
    - What would you have done if you were PIC?
    - PIC/CFI asserts yoke control, pushing it back to the takeoff position
    - Cessna 172 reaches rotation speed
    - Remainder of flight uneventful

Takeoff Mishap in 172P "Six Pack"

- Cadet orientation flight from Doylestown (KDYL) to Pennridge (KCKZ) and return to Doylestown
  - Post flight debrief
    - CFI explains positive exchange of controls to cadet
    - CFI explains ground effect and
      - That leaving ground effect at low speed can result in stall
      - That a stall just above ground effect may not be recoverable and that severe injury or death could be a consequence
  - Lessons Learned
    - Thoroughly brief passengers on "Do's" and "Don'ts"
    - Thoroughly brief passengers on positive exchange of controls
    - Thoroughly brief passengers on sterile cockpit
    - Pilots need to be able to recover from someone else's stall – get training

C182RG Wake Turbulence on Takeoff at Muir AAF

- Muir AAF Tower cleared Cessna 182RG for takeoff at 2100 Local on IFR flight plan MUI to TTN then PVD
- Crew
  - PIC: PAWG/DOV, COM, CFI A&I, 2340 hours TT
  - Pax: PAWG/XD, PVT (not current)
- Weather Conditions: Night, VMC, Wind relatively calm
- Flight activity
  - Tower in operation
  - Several UH-60 Blackhawks nearby for NVG ops
- C182RG climbing through 150 feet AGL
  - Tower flew UH-60 directly over C182RG with about 100 feet of vertical separation
  - C182RG did un-commanded left bank of about 70º with about 15º - 20º of nose down pitch
  - PIC recovered at about 50 feet AGL



CAP C-182RG – PANG Black Hawk – Muir AAF

Night VMC Takeoff Accident in T182T G1000 - CFIT

- **C**ontrolled **F**light **i**nto **T**errain (CFIT) with two fatalities
  - NTSB Factual Report – click link below
    http://dms.ntsb.gov/aviation/AccidentReports/jvz1ki452vc0nk45asmeafyr1/F03232013120000.pdf
  - NTSB Probable Cause – click link below
    http://dms.ntsb.gov/aviation/AccidentReports/5wx5cwed5jlmolr0hldm5n551/S03232013120000.pdf
  - Crew Experience and FAA Certificates
    - Pilot (left seat):
      - ATP AMEL, Commercial ASEL, **25,000 hours total time**, G1000 trained (74.7 hours G1000, 34.2 hours in accident airplane)
    - Pilot (right seat):
      - ATP AMEL, helicopter, CFI, AGI, IGI, **28,000 hours total time**, **not** G1000 trained

Night VMC Takeoff Accident in T182T G1000 - CFIT

- **C**ontrolled **F**light **i**nto **T**errain (CFIT) with two fatalities
  - Events from night of 11/08/2007
    - Departed North Las Vegas Airport (VGT), Las Vegas, NV on a VFR flight plan about 19:05 Local PST bound for Rosamond Skypark Airport (L00), Rosamond, California
    - 19:05:29 Local PST - checked in with ATC at 2,700 feet MSL
    - 19:17:29 Local PST - radar contact lost, airplane impacted 1,000 feet below summit of Mt. Potosi (elevation = 8,514 feet MSL)
    - Fireball from impact witnessed by law enforcement helicopter
  - Interviews with the ATC Controller produced the following
    - Controller stated, "The aircraft looked fine - there was nothing unusual about it."
    - When questioned about where he expected the aircraft to go the controller replied that "...the pilot was on his own navigation."
    - Controller stated that other aircraft he has seen go where the accident aircraft was, and some go further south.
    - Asked when he is required to issue a safety alert, the controller stated, in his opinion, when an aircraft is close to terrain or other aircraft.
      Controller stated that he knew that the height of Mt. Potosi was 8,500 feet.

Night VMC Takeoff Accident in T182T G1000 - CFIT

- **C**ontrolled **F**light **i**nto **T**errain (CFIT) with two fatalities
  - Conditions of Flight
    - Accident occurred during dark night under visual meteorological conditions.
    - No lighted roads or round structures were present in the area to provide ground reference to terrain.
    - 1% of the moon's disk was illuminated.
  - Airplane climb performance over last six minutes of flight per recorded radar data
    - Average groundspeed was 100 knots
    - Average rate of climb was 406 fpm (feet per minute)
    - **Note: an average rate of climb of 600 fpm was required to clear terrain along the flight path**.

Night VMC Takeoff Accident in T182T G1000 - CFIT

- **C**ontrolled **F**light **i**nto **T**errain (CFIT) with two fatalities
  - NTSB Findings
    1. (F) TERRAIN CONDITION - RISING
    2. (F) TERRAIN CONDITION - MOUNTAINOUS/HILLY
    3. (F) LIGHT CONDITION - DARK NIGHT
    4. (C) ALTITUDE/CLEARANCE - NOT MAINTAINED - PILOT IN COMMAND
    5. (F) OTHER PSYCHOLOGICAL CONDITION - PILOT IN COMMAND
       a) Ethanol
       b) Diphenhydramine (Benadryl)
    6. (F) PROCEDURES/DIRECTIVES - NOT FOLLOWED - ATC PERSONNEL (ARTCC)
    7. (F) SAFETY ADVISORY - NOT ISSUED - ATC PERSONNEL (ARTCC)
  - Legend
  - (F) – Factor
  - (C) – Cause

Night VMC Takeoff Accident in T182T G1000 - CFIT

- **C**ontrolled **F**light **i**nto **T**errain (CFIT) with two fatalities
  - Lessons Learned
    - Know necessary climb out rate
      - Conversion formula for Feet Per NM to Feet Per Minute (FPM)
        - Feet Per NM / feet in NM * 100 * ground speed (per G1000)
      - VGT Northtown Three Departure from Runway 30L uses 415 feet per NM
        - 415 / 6076 * 100 * 100 = 683 FPM
      - VGT Boulder City One Departure from Runway 30L uses 367 feet per NM
        - 367 / 6076 * 100 * 100 = 604 FPM
    - Do not depend on ATC for terrain separation
    - File for an instrument departure
    - Know the airplane's equipment
      - See G1000 illustration on terrain avoidance

Night VMC Takeoff Accident in T182T G1000 - CFIT

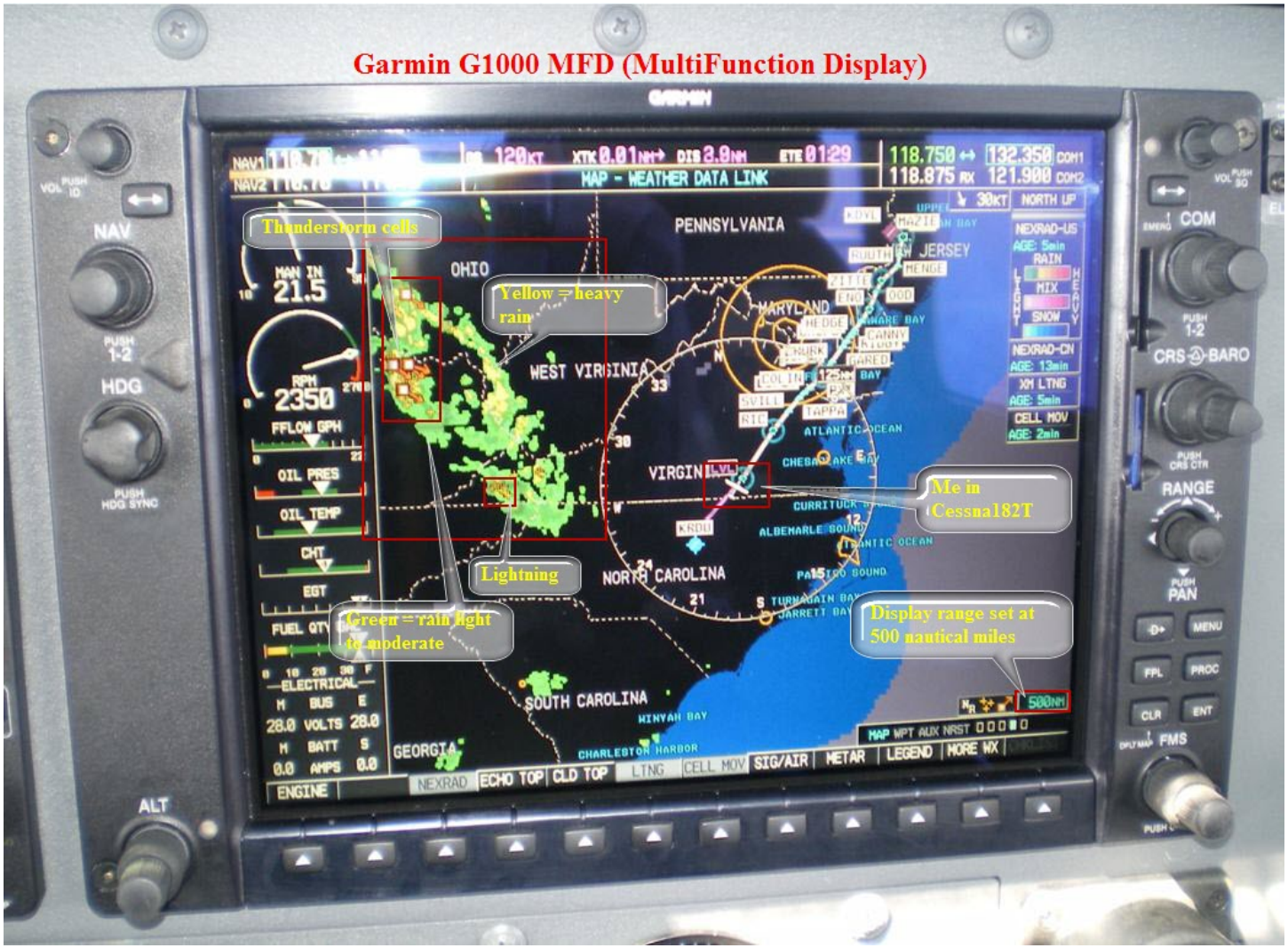
- **C**ontrolled **F**light **i**nto **T**errain (CFIT) with two fatalities
  - G1000 illustration on terrain avoidance
    - PDF inset or MFD
      - Red – 100 feet AGL or less
      - Yellow – more than 100 feet AGL but less than 1000 feet AGL
      - Black – 1000 feet AGL or higher

Enroute Mishaps and Gotchas

Cessna 182T G1000 – Day IFR Flight Plan – Enroute

- IFR flight plan from Columbus, MS (KGTR) to Doylestown (KDYL)
  - Pilot/CFI flew from Doylestown, PA to Columbus, MS to visit former flight student then in USAF undergraduate pilot training (now flying F/A-22 Raptors)
  - Pilot/CFI monitored weather during visit and decided to leave a day early because thunderstorms forecast across the mountainous areas of GA, SC, NC, VA, and WV
    - Route down had been an “inland” across the northern mountains
    - Route home was more of a “coastal” route across the southern plains
- Lessons Learned
  - Keep on top of developing weather
    - If necessary leave early or stay longer
  - Consider your route of flight
    - Mountainous areas have greater thunderstorm risk because of rising terrain
    - MFD on next slide attests to this

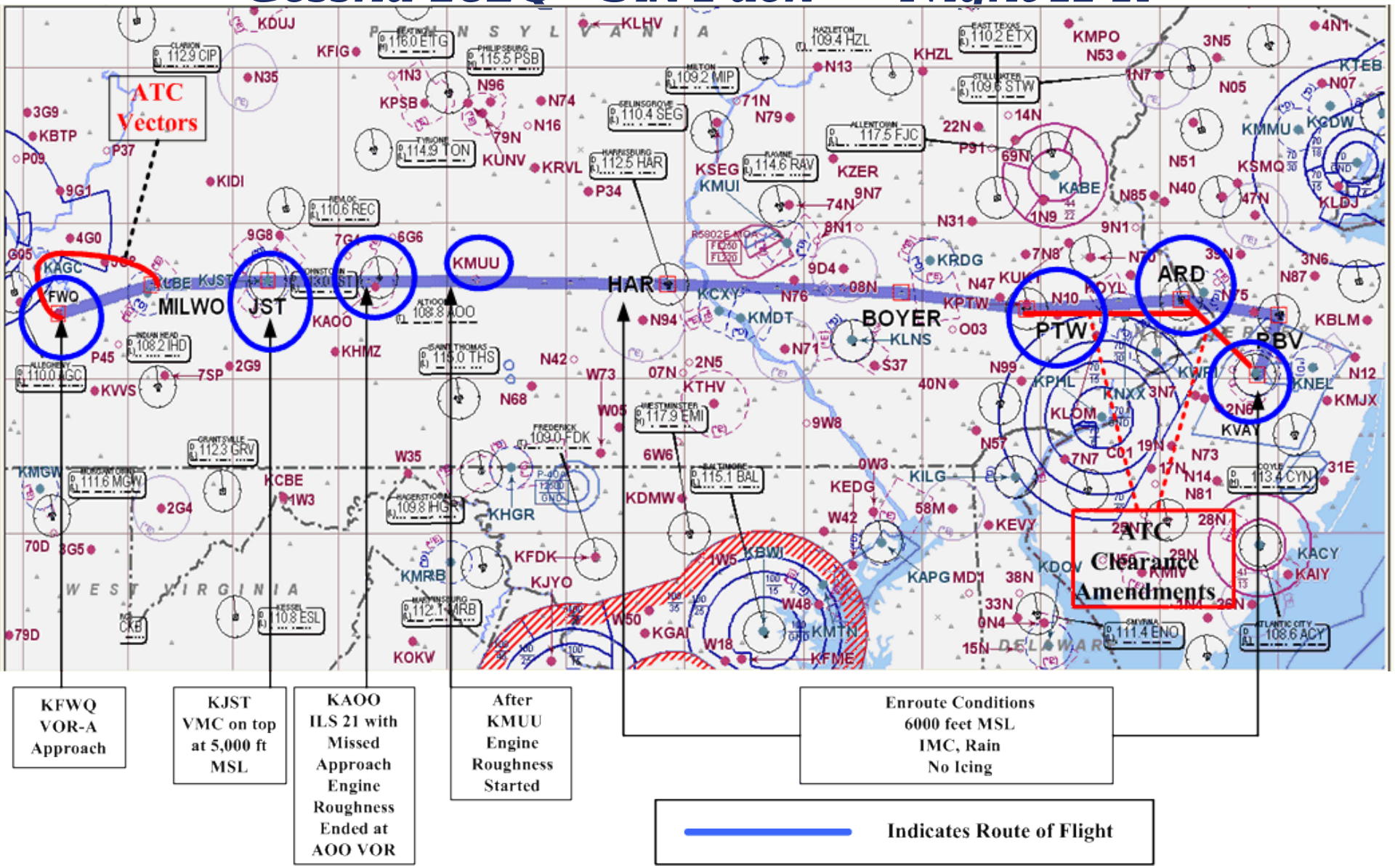
Cessna 182T – Thunderstorm Avoidance



Cessna 182Q "Six Pack" – Night IFR – Enroute

- IFR flight plan from McGuire AFB (KWRI) to Rostraver (KFWQ)
  - Pilot: newly instrument-rated, 400 hours total time, 15 hours actual, 3 hours actual in preceding 90 days
  - Conditions: IMC
  - Assigned altitude: 6,000 feet MSL
  - Route of flight: KWRI → ARD → PTW → HAR → V12 → MILWO → KFWQ
- Flight Events
  - Flight departed KWRI at 5:00 Local, the sun set at 4:46 PM Local
  - Ice forecast for 6,000 feet MSL, but none reported along route of flight
  - Engine roughness occurs (800 – 1000 RPM drop) over KMUU
  - What would you do?
  - Pilot applies carburetor heat but turns it off when roughness worsens
  - What would you do?
  - Pilot reports problem to Cleveland Center
  - Cleveland Center offers precautionary landing at Altoona (KAOO)

Cessna 182Q "Six Pack" – Night IFR



Cessna 182Q "Six Pack" – Night IFR – Approach #1

- Flight Events (continued)
  - Cleveland Center offers precautionary landing at Altoona (KAOO)
  - Pilot accepts (without approach plate) and is vectored for ILS 21 approach
    - Non-pilot passenger roots in back for approach plate
  - Pilot flies approach at cruise power setting, without carburetor heat
    - Fear of more carburetor icing
  - Pilot does not reduce power until crossing threshold
  - Pilot tries to execute a tailwind landing
  - High power setting and tailwind precluded touchdown until two-thirds of the way down the runway
  - Pilot executes a go-around/touch-and-go then executes the missed approach
  - Pilot encounters visual conditions at 5,000 feet MSL with a cloud layer below
  - ATC offers vectors to AGC for ILS 28
  - What would you do?

Cessna 182Q "Six Pack" – Night IFR – Approach #2

- Flight Events (continued)
  - ATC offers vectors to KAGC for ILS 28 approach
    - Runway 28 6,501 feet by 150 feet with operating control tower
  - Pilot declines and elects to continue to KFWQ for VOR-A approach
    - Decision driven by conference at KWFQ
    - Runway 26 4,001 feet by 75 feet with no control tower
  - Pilot successfully completes VOR-A approach at KFWQ
    - Engine dies in landing roll
- Lessons Learned
  - All pilots should recognize carburetor icing and use of carburetor heat
  - Instrument pilots should become proficient in circle-to-land procedures
  - All pilots need to understand risks of "get-there-itis"
  - Instrument pilots should recognize that in an emergency an ILS is preferable to a VOR-A, especially if "nearest" is not a factor
  - All pilots should recognize that in an emergency a towered field is preferable to a non-towered field, especially if "nearest" is not a factor

Approach Mishaps and Gotchas

Daytime Icing Encounter in Cessna 182R "Six Pack"

- Pilot completing VFR transition to high performance airplane
  - CFI suggested a cross country flight with an ILS 8 approach into LNS
  - With the round trip flight time this would complete Pilot's checkout
- ATC assigns Cessna 182R 3,000 feet MSL with radar vectors to ILS 8
  - Pilot puts on Foggles
  - CFI turns on heater-defrost; Pilot turns off heater-defrost
  - Over the Susquehanna River windshield becomes obscured by clear ice
  - CFI sees ⅛ to ¼ inch of clear ice on leading edge of the wing strut
  - CFI turns heater-defrost back on, but with no effect on the windshield ice
  - What would you do?
  - On final turn to the approach, Pilot sees ice and tells CFI that he can't do it
  - If you were the CFI, what would you do?

Daytime Icing Encounter in Cessna 182R "Six Pack"

- The approach continues …
  - CFI does the following
    - Flies "the needles" down to 40 feet AGL, gets good visibility out right side window
    - Lands to right of the center line
    - Keeps landing roll straight and taxies parallel to the grass
    - Turn off and taxi to the ramp was uneventful
- Lessons Learned
  - This was one of FAA's Five Hazardous Attitudes: Resignation
    - Pilot saw the ice and gave up
    - What the would Pilot have done if he was by himself?
  - Weather-wise there was no ice in the forecast
  - What would you have done?

Fuel Management Mishaps and Gotchas

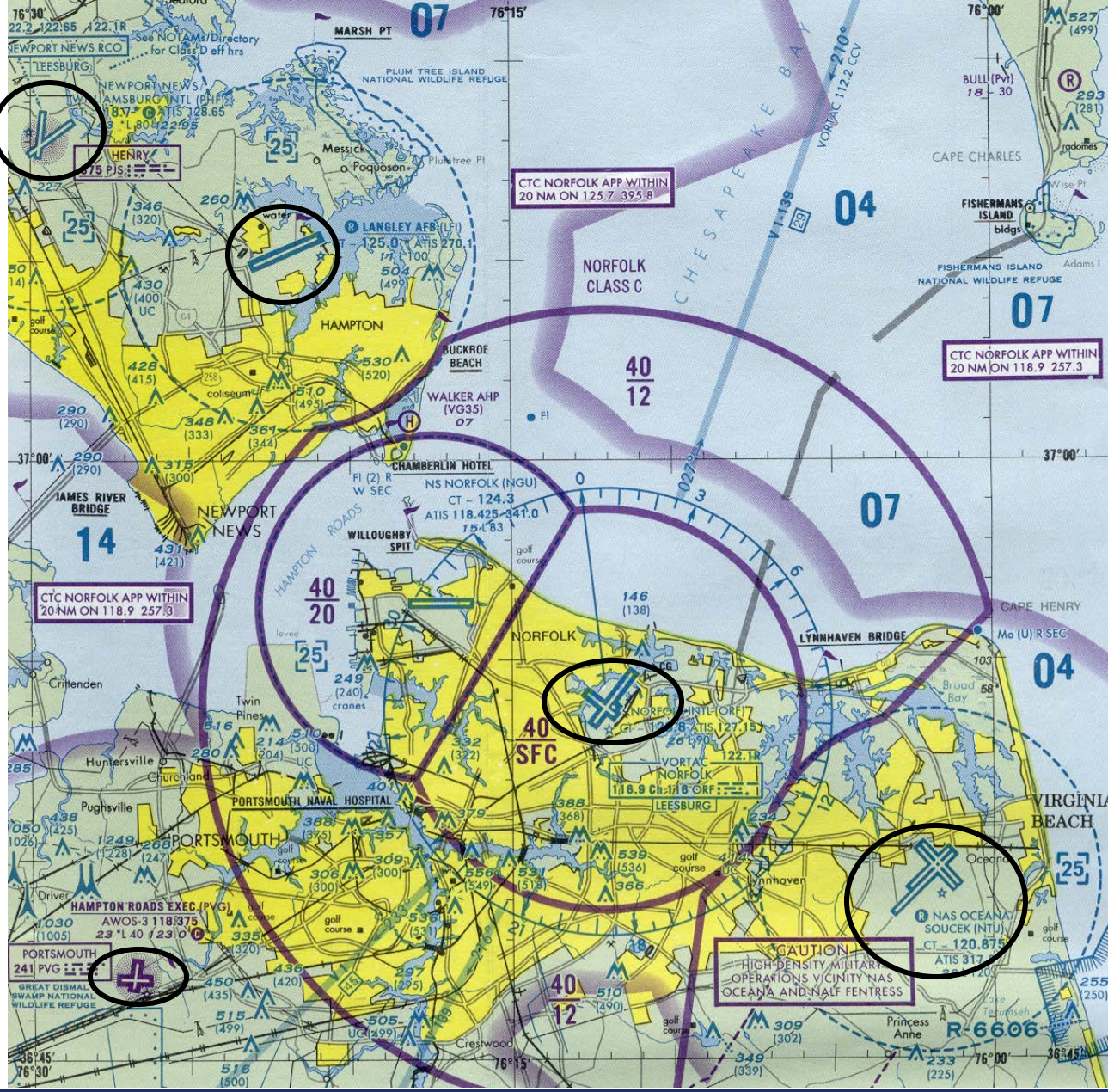
Navy Flying Club Cessna 172 - Mishap

- ***Mishap Highlights***
  - ***Aircraft flying from Myrtle Beach, SC (KMYR) to Patuxent River, MD (KNHK), 3.7 hours Hobbs***
  - ***Excerpts from NTSB Factual Report #IAD02LA080***
    - The pilot performed several ground speed calculations during the flight, indicating a consistent groundspeed of 100-110 mph. The pilot did not perform any fuel burn calculations during the flight.
    - When the pilot was about 10 miles from the airport, he was instructed by the tower controller to expect a left base entry for a full-stop landing on runway 02.
    - About 3 miles from the airport, the pilot was instructed to perform a 360-degree turn for spacing and to change to a straight-in approach for runway 06. As the pilot was leveling the airplane from the turn, the airplane's engine "stopped producing power." The pilot initiated a 90-degree turn and held a nose-high attitude to clear trees in the flight path. Once over the tree line, the pilot lowered the nose and performed a forced landing to a field.
    - The airplane impacted the ground approximately 1/2 mile short of runway 06.
    - The weather reported at Patuxent River, at 1355, included winds from 040 degrees at 9 knots, visibility 7 miles, few clouds at 3,000 feet, temperature 34 degrees, and dew point 19 degrees.
    - Pilot seriously injured and aircraft substantially damaged

Navy Flying Club Cessna 172 - Mishap

- ***Pilot Profile***
  - COM ASEL HELICOPTER IA IH
    - Total Time: 815 hours
    - ASEL: 99 hours
    - Make/Model: 9 hours
    - AMEL: 25 hours
    - Helicopter: 691 hours
- ***NTSB Finding of Probable Cause***
  - The pilot's inadequate fuel calculations, which resulted in fuel exhaustion and a subsequent loss of engine power.
- ***Discussion and dissection***
  - What can we learn from this?

Navy Flying Club C-172 – Lost Fuel Opportunities – Start of Accident Chain



Navy Flying Club C-172 – End of Chain

“ … money is the root of all evil …”

- In this mishap scenario the pilot based his fueling decision on
  - Organizational policies that capped reimbursement amounts
    - Pilot purchased 10 gallons at Myrtle Beach, SC
    - Fuel at Myrtle Beach cost $2.40 per gallon
    - Navy Flying Club only reimbursed at their bulk rate cost of $1.40 per gallon

"Confess" Your Problem

- In this mishap scenario there was no radio broadcast to the tower indicating
  - That airplane was fuel critical when entering the pattern
  - That airplane had fuel exhaustion (engine stopped) on final

Landing Mishaps and Gotchas

Cessna T206H – Landed at Closed Airport

- Pilot Profile:
  - PVT ASEL, Total Time: 600 hours; Make/Model Time: 450 hours
- Flight from KMIV (NJ) to 25N (NJ)
  - PIC diverted to 25N (Rudy's in Vineland) in Day VMC
  - PIC used Nearest function on GPS to choose 25N
  - Landed in sand, substantially damaged aircraft
- NTSB Findings:
  - Airport closed 3 months prior and properly NOTAM-ed
  - Inadequate preflight planning and preparation
- Other Information
  - T206H = Turbo Stationair
- Anything come to mind?

Cessna 172P – Porpoising at Lakehurst NAES (KNEL)

- Student Pilot on first supervised solo
  - First solo takeoff and landing completed successfully
  - Second takeoff completed successfully
  - Four other Cessna 172's are now in the pattern
  - Lakehurst Tower is having difficulty handling the traffic volume
    - KNEL Tower is used to only one or two departures and arrivals per day
    - 4 Cessna 172's doing takeoffs & landings, touch & go's, plus a supervised solo overwhelms KNEL Tower
    - KNEL Tower tries to resolve the problem by increasing the separation between aircraft
    - KNEL Tower extends the downwind for each airplane
  - Student Pilot's downwind is extended close to R. J. Miller
    - Student Pilot gets cleared to land and turns onto a 3 mile Final
    - Student Pilot's timing and perception disrupted by extended downwind
    - Student Pilot lands "hot" and begins to porpoise badly

Cessna 172P – Porpoising at Lakehurst NAES (KNEL)

- Student Pilot on first supervised solo (continued)
  - Student Pilot's downwind is extended close to R. J. Miller
    - Student Pilot lands "hot" and begins to porpoise badly
    - With each bounce, the airplane arcs up higher
    - After second bounce Supervising CFI sees that the airplane will probably come down on its nose wheel
    - Supervising CFI uses hand-held to transmit "Power! Power! Power!"
    - Student Pilot applies full power, retracts flaps a notch, and executes a go around
    - Student Pilot's landing is successful
- Lessons Learned
  - Maintain situational awareness and proper pitch/power
  - Porpoising will not stop without pilot intervention
  - Practice go around procedures
  - Do not hesitate to initiate a go around, even at a towered field

Cessna 172P – Runway Excursion

- Pilot Profiles:
  - Right Seat Pilot Total Time: 279 hours; Time in Type: 106 hours; Dual Time in Right Seat: 2 hours
  - Left Seat Pilot Total Time: 132 hours; Time in Type: 7 hours
- Landing at 26N (runway 24) on cross country from KDYL
  - KACY winds out of 220° at 10 knots gusting to 20 knots
  - Right Seat Pilot said the crosswind component was more severe than what was reported, and was between 45° and 60° off the runway heading.
    - NTSB reported this but did not challenge it in any way

Cessna 172P – Runway Excursion

- Cessna 172 positioning to enter pattern for right downwind runway 24. Left Seat Pilot is flying and loses sight of the airport
  - Right Seat Pilot takes control and positions Cessna 172 for right downwind on runway 24 then returns control to Left Seat Pilot
  - Left Seat Pilot flies downwind, base and onto final leg
  - Right Seat Pilot does the following
    - Sees that Cessna 172 is above glideslope as airplane establishes on final
    - Takes control of the airplane, flies the approach, and lands on runway 24
  - When Cessna 172 touches down, it swerves off the right side of the runway and goes into a marsh.

Cessna 172P – Runway Excursion

Cessna 172P – Runway Excursion

- NTSB Findings
  - NTSB Factual Report
    - http://www.ntsb.gov/ntsb/GenPDF.asp?id=IAD02LA038&rpt=fa
  - Probable Cause
    - http://www.ntsb.gov/ntsb/GenPDF.asp?id=IAD02LA038&rpt=fi

IAD02LA038
File No. 13802 | 03/24/2002 | OCEAN CITY, NJ | Aircraft Reg No. N9847L | Time (Local): 13:50 EST

Occurrence #1: LOSS OF CONTROL - ON GROUND/WATER
Phase of Operation: LANDING - FLARE/TOUCHDOWN

Findings
1. (F) WEATHER CONDITION - CROSSWIND
2. (C) COMPENSATION FOR WIND CONDITIONS - INADEQUATE - PILOT IN COMMAND
3. (C) DIRECTIONAL CONTROL - NOT MAINTAINED - PILOT IN COMMAND

Findings Legend: (C) = Cause, (F) = Factor

The National Transportation Safety Board determines the probable cause(s) of this accident as follows.
The pilot's inadequate compensation for wind and his failure to maintain directional control.

- What would you do differently?

Cessna 172P – Runway Excursion at Doylestown (KDYL)

- Pilot Ferrying C172 from KPNE to KDYL
  - Local Conditions
    - Runways 5-23 – 3,000 feet x 60 feet
    - Runway 23 VASI out of service
    - Crosswind which shifts to a tailwind during runway 23 landing
  - Events
    - Unknown if pilot listened to ASOS on 118.875
    - C172 lands on Runway 23
    - Touchdown occurs at or after mid-field
    - No go around attempted
    - C172 runs off end of runway
    - C172 comes to a stop after impacting chain link fence

Cessna 172P – Runway Excursion at Doylestown (KDYL)

- Pilot Ferrying C172 from KPNE to KDYL (continued)
- Lessons Learned
  - Determine wind conditions before entering pattern
  - Establish proper landing configuration
    - Pitch, power, flaps
  - Practice go around procedures
  - Do not hesitate to initiate a go around, even at a towered field
  - Do not hesitate to divert
    - In this case it may have been better to return to KPNE
      - Control tower
      - Intersecting runways

Night Landing Mishap in Cessna 172P – Student Pilot

- Cessna 172P departed Doylestown (DYL) for a dual flight
  - CFI vectored Student Pilot out of the traffic pattern then re-entered pattern for mid-field 45° downwind for runway 5 (3000 ft x 60 ft)
    - Student Pilot's procedures on downwind and base were perfect
    - On final, about ¼ mile from threshold, after Student Pilot pulled throttle to the Idle, airspeed began to bleed off
      - At 60 KIAS CFI says "Pitch for 65 knots"
      - Student applies back pressure, threshold crossed at 50 feet AGL
      - At 50 KIAS CFI says "Pitch for 65 knots"
      - Student applies back pressure, ASI indicates 40 KIAS, going below white arc
      - CFI shoves yoke forward for three-count then applies slight back pressure
      - As CFI eases back pressure the mains touch down

Night Landing Mishap in Cessna 172P – Student Pilot

- Cessna 172P departed Doylestown (DYL) for a dual flight
  - Lessons Learned
    - CFIs need to recognize the Law of Primacy,
      - Deals with things first learned and how it is often difficult to over-ride them with new learning
      - CFIs need to figure out what needs to be undone and out how to undo it
    - Student Pilot attended a flight training encampment the previous summer
      - Tended to fly faster than 65 KIAS on final
      - When told to “Pitch for 65 knots,” the student always applied back pressure
      - Student “learned” back then that “pitch” meant apply back pressure

What Are the Risks in Flying a Technologically Advanced Aircraft (TAA)?

Technologically Advanced Aircraft (TAA)

- Please refer to the links below for more information on technologically advanced aircraft
  - http://williamjdoylejr.net/FAAST/TAA.ppt
  - http://williamjdoylejr.net/FAAST/gps.ppt
  - http://williamjdoylejr.net/FAAST/TAA-GPS_CFI_Workshop_12-13-2010_R1.ppt

What Are the Risks with Flying TAA?

- **Risk: Lack of Pilot Proficiency**
  - **Mitigation: study, study, study then practice, practice, practice**
    - Get the simulator for whatever GPS you have
      - Garmin GNS 430, Garmin GNS 530, Garmin G1000 for Cessna NAV III, Apollo GX55
      - See reference section for links
    - Download training videos, manuals (PDF), flight planning lessons
    - Get some ground instruction and flight instruction from your CFI

What Are the Risks with Flying TAA?

- **Risk: Head in the Cockpit Instead of Outside**
  - **Mitigation: Set up as much as possible on the ground**
    - Do your flight planning at home before coming to the airport
      - File an FAA flight plan (consider filing IFR even if VMC)
      - Print a navigation log (consider AOPA Internet Flight Planner)
    - Set up flight plan in GPS after preflight but before engine start
      - Contact Clearance Delivery on radio or cell phone
      - Set up clearance route in your GPS

What Are the Risks with Flying TAA?

- **Risk: Single Pilot IFR**
  - **Mitigation: Take an experienced pilot or CFI**
    - Establish personal minimums, don't deviate from them
      - Consider establishing a risk management matrix
      - Refer to next section on personal minimums
    - Build experience
      - ***When appropriate***, revise your personal minimums

What Are the Risks with Flying TAA?

- **Risk: Thunderstorm Penetration**
  - **Mitigation: Avoid thunderstorms**
    - Do ***not*** use NexRad or Strike Finder features to penetrate thunder Storms
    - Use NexRad or Strike Finder features to avoid thunder Storms
      - Preferably by putting the T-Storms at your six o'clock

What Are the Risks with Flying TAA?

- **Other Things You Should Consider**
  - If possible, upgrade your GPS to WAAS
  - If possible, upgrade/subscribe to NexRad
    - Near real-time weather
    - Near real-time TFR
  - Keep your databases up to date
    - Subscriptions are available for downloads from the Internet

What Are the Risks with Flying TAA?

- **Other Things You Should Consider**
  - Foster/practice continuing pilot education
    - Get an IPC every 6 – 12 months whether you need it or not
    - Engage in self-study
      - FAA Advanced Avionics Handbook
        - » http://www.faa.gov/library/manuals/aviation/media/FAA-H-8083-6.pdf
      - FAA Risk Management Handbook - See Appendix A for Personal Minimums
        - » http://www.faa.gov/library/manuals/aviation/media/FAA-H-8083-2.pdf
      - AOPA Air Safety Foundation - Technologically Advanced Aircraft Safety and Training
        - » http://www.aopa.org/asf/publications/topics/TAA2007.pdf

Doing It by the Numbers:
Vspeeds
ASI Arcs
and
Performance Data

V_{Speeds} – Cessna 172

For information purposes only. Do not use for flight planning. Use the actual POH.

V_{Speed}	Cessna 172S NAV III	Cessna 172P 180 HP
V_x	62 KIAS	60 KIAS
V_y	74 KIAS	76 KIAS
V_{fe}	0° - 10° @ 110 KIAS	0° - 10° @ 110 KIAS
	10° - Full @ 85 KIAS	10° - Full @ 85 KIAS
Vs	48 KIAS	50 KIAS
V_{so}	40 KIAS	40 KIAS
V_a	105 KIAS @ 2550 lb	105 KIAS @ 2550 lb
	98 KIAS @ 2200 lb	95 KIAS @ 2150 lb
	90 KIAS @ 1900 lb	85 KIAS @ 1750 lb
V_{no}	126 KIAS	127 KIAS
V_{ne}	163 KIAS	158 KIAS
V_{rotate}	55 KIAS	55 KIAS
V_{glide}	68 KIAS	65 KIAS
V_{xwind}	15 Knots	15 Knots
$V_{goaround}$	60 KIAS	60 KIAS
	Flaps 20°	Flaps 20°
$V_{landing}$	65 - 75 KIAS - flaps up	65 - 75 KIAS - flaps up
	60 - 70 KIAS - flaps down	60 - 70 KIAS - flaps down

V_{Speeds} – Cessna 182 and Cessna 206

For information purposes only. Do not use for flight planning. Use the actual POH.

V_{Speed}	Cessna 182T NAV III	Cessna 182R	Cessna U206H NAV III	Cessna U206G
V_x	65 KIAS	59 KIAS	70 KIAS	66 KIAS
V_y	80 KIAS	81 KIAS	86 KIAS	84 KIAS
V_{fe}	0° - 10° @ 140 KIAS	0° - 10° @ 140 KIAS	0° - 10° @ 140 KIAS	0° - 10° @ 140 KIAS
	10° - 20° @ 120 KIAS	10° - 20° @ 120 KIAS	10° - 20° @ 120 KIAS	10° - Full @ 100 KIAS
	20° - Full @ 100 KIAS	20° - Full @ 95 KIAS	20° - Full @ 100 KIAS	
Vs	51 KIAS	50 KIAS	54 KIAS	55 KIAS
V_{so}	41 KIAS	40 KIAS	44 KIAS	46 KIAS
V_a	110 KIAS @ 3100 lb	111 KIAS @ 3100 lb	125 KIAS @ 3600 lb	120 KIAS @ 3600 lb
	101 KIAS @ 2600 lb	102 KIAS @ 2600 lb	112 KIAS @ 2900 lb	106 KIAS @ 2900 lb
	91 KIAS @ 2200 lb	88 KIAS @ 2000 lb	98 KIAS @ 2200 lb	93 KIAS @ 2200 lb
V_{no}	140 KIAS	143 KIAS	149 KIAS	149 KIAS
V_{ne}	175 KIAS	179 KIAS	182 KIAS	183 KIAS
V_{rotate}	50 - 60 KIAS	50 KIAS	56 KIAS	50 KIAS
V_{glide}	76 KIAS	75 KIAS	75 KIAS	75 KIAS
V_{xwind}	15 Knots	15 Knots	20 Knots	20 Knots
$V_{goaround}$	55 KIAS	55 KIAS	75 - 80 KIAS	80 KIAS
	Flaps 20°	Flaps 20°	Flaps 20°	Flaps 20°
$V_{landing}$	70 - 80 KIAS - flaps up	70 - 80 KIAS - flaps up	75 - 85 KIAS - flaps up	75 - 85 KIAS - flaps up
	60 - 70 KIAS - flaps down	60 - 70 KIAS - flaps down	65 - 75 KIAS - flaps down	65 - 75 KIAS - flaps down

ASI Arcs – Cessna 172, 182, 206

Arcs	Cessna 172S NAV III	Cessna 172P 180 HP	Cessna 182T NAV III	Cessna 182R	Cessna U206H NAV III	Cessna U206G
Red Arc	20 - 40	N/A	21 - 41	N/A	20 - 44	N/A
White Arc	40 - 85	40 - 85	41 - 100	40 - 95	44 - 100	46 - 100
Green Arc	48 - 129	50 - 127	51 - 140	50 - 143	54 - 149	55 - 149
Yellow Arc	129 - 163	127 - 158	140 - 175	143 - 179	149 - 182	149 - 183
Red Line	163	158	175	179	182	183

For information purposes only.
Do not use for flight planning. Use the actual POH.

Performance Data – Cessna 172

Weight, Fuel, GPH, Endurance, and Power Rating	Cessna 172S NAV III	Cessna 172P 180 HP 50 gallon tanks	Cessna 172P 180 HP 40 gallon tanks
Maximum Gross for Takeoff	2550	2550	2550
Maximum Gross for Landing	2550	2550	2550
Standard Empty Weight	1663	1539	1539
Maximum Useful Load	887	1011	1011
Usable Fuel - Full	53	50	40
Usable Fuel - Tabs	35	N/A	N/A
Payload with Full Fuel	569	587	647
Payload with Fuel to the Tabs	677	N/A	N/A
GPH @ 75% Power	10.0	10.0	10.0
Endurance - Full Fuel (Hours)	5.3	5.0	4.0
Endurance - Fuel to Tabs (Hours)	3.5	N/A	N/A
Power Rating	180 HP	180 HP	180 HP

For information purposes only.
Do not use for flight planning. Use the actual POH.

Performance Data – Cessna 182 and 206

Weight, Fuel, GPH, Endurance, and Power Rating	Cessna 182T NAV III	Cessna 182R	Cessna U206H NAV III	Cessna U206G
Maximum Gross for Takeoff	3100	3100	3600	3600
Maximum Gross for Landing	2950	2950	3600	3600
Standard Empty Weight	1924	1733	2317	1987
Maximum Useful Load	1176	1367	1283	1613
Usable Fuel - Full	87	88	87	88
Usable Fuel - Tabs	64	64	64	64
Payload with Full Fuel	365	359	365	359
Payload with Fuel to the Tabs	503	503	503	503
GPH @ 75% Power	12.5	12.5	15.7	15.7
Endurance - Full Fuel (Hours)	7.0	7.0	5.5	5.6
Endurance - Fuel to Tabs (Hours)	5.1	5.1	4.1	4.1
Power Rating	230 HP	230 HP	300 HP	300 HP

For information purposes only.
Do not use for flight planning. Use the actual POH.

Weight & Balance Scenarios for Cessna 172, 182, and 206

Weight & Balance

- Please refer to the link below for more information on weight and balance
  - http://williamjdoylejr.net/FAAST/W&B/

Weight & Balance Scenarios

- Airplanes to be used for a cross country flight from Doylestown (KDYL) to Cape May (KWWD) and back

Airplanes					
Make	**Model**	**Gross Weight**	**Fuel - Full**	**Fuel - Tabs**	**Tabs + 7**
Cessna	C172S	2,550	53	35	N/A
Cessna	C182T	3,100	87	64	N/A
Cessna	U206H	3,600	87	64	N/A
Cirrus	SR20	3,000	56	26	40

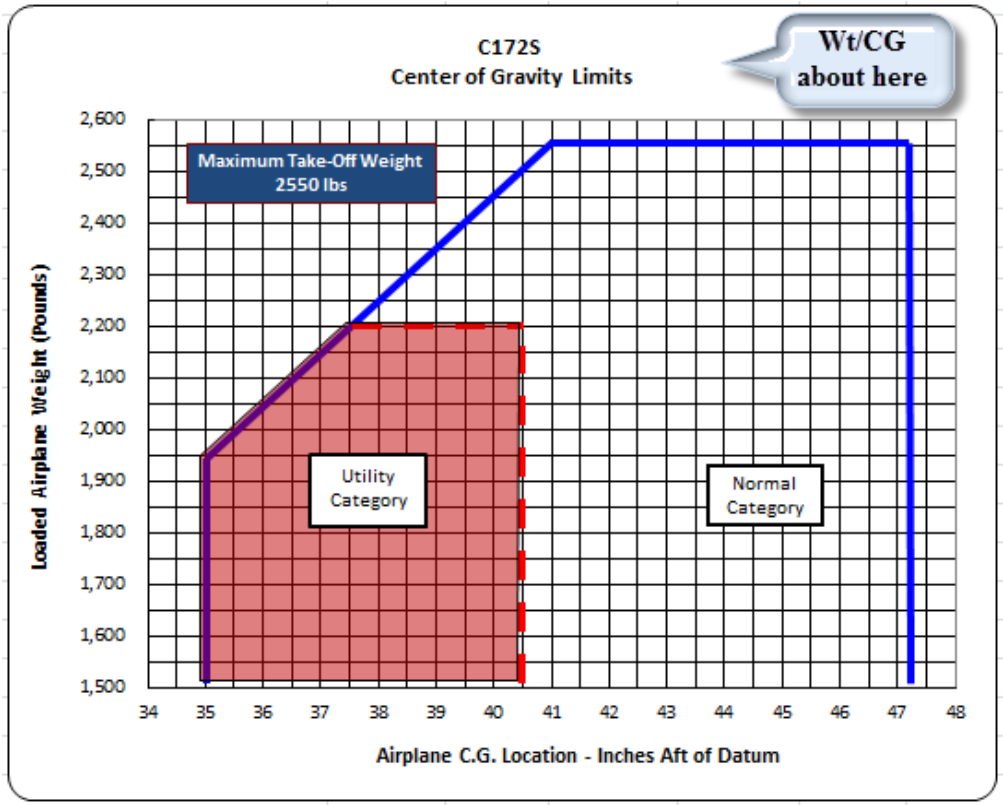
- Crew weights and positions

Crew Weights	
Position	**Weight**
Front - Left	280
Front - Right	200
Rear - Right	175
Rear - Left	20

- Will each airplane be within weight and CG limits?

Weight & Balance Scenario – C-172S – Full Fuel

2006 C-172S Skyhawk Weight & Balance				
Item	Input Data	Weight	Arm	Moment
Basic Empty Weight	1,755	1,755	41.67	73.14
Crew: Pilot	280	280	37.80	10.58
Co-pilot	200	200	37.80	7.56
Passengers: Left Rear	20	20	72.94	1.46
Right Rear	175	175	72.94	12.76
Baggage	0	0	95.00	0.00
Cargo Area	0	0	123.00	0.00
Fuel (Gallons)	53	318	48.00	15.26
Gross Weight		**2,748**	**43.94**	**120.76**
Less Runup Fuel		-7	48.00	-0.34
Total Take Off Weight		**2,741**	**43.93**	**120.42**
Maximum Gross Weight	**2,550**	**191**	**Over Gross**	
Maximum Useful Load	**795**			
Useful Load on this Flight	**986**			
Available Useful Load	**-191**			



Take Off Weight:	2741	Arm:	43.94

Airplane 191 pounds overweight

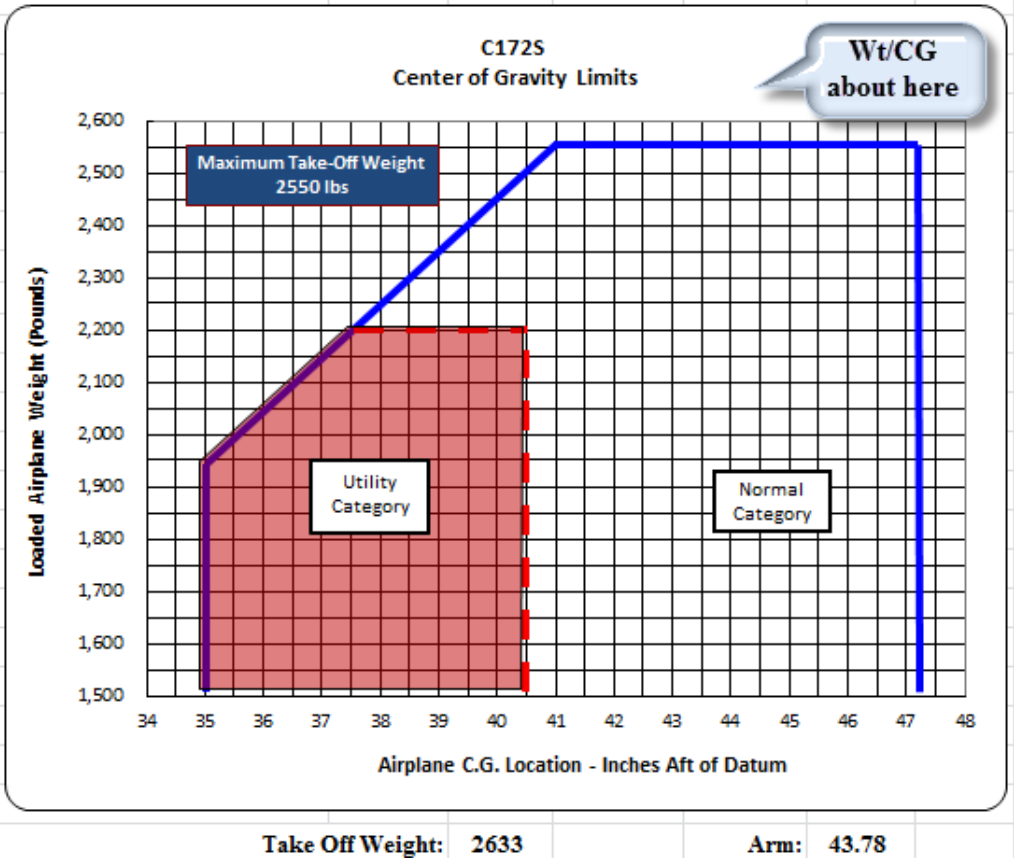
CG above the envelope

Airplane not legal to fly

http://williamjdoylejr.net/FAAST/W&B/Weight_Balance_Cessna_172S.xls

Weight & Balance Scenario – C-172S – Fuel to Tabs

2006 C-172S Skyhawk Weight & Balance				
Item	Input Data	Weight	Arm	Moment
Basic Empty Weight	1,755	1,755	41.67	73.14
Crew: Pilot	280	280	37.80	10.58
Co-pilot	200	200	37.80	7.56
Passengers: Left Rear	20	20	72.94	1.46
Right Rear	175	175	72.94	12.76
Baggage	0	0	95.00	0.00
Cargo Area	0	0	123.00	0.00
Fuel (Gallons)	35	210	48.00	10.08
Gross Weight		**2,640**	**43.78**	**115.58**
Less Runup Fuel		-7	48.00	-0.34
Total Take Off Weight		**2,633**	**43.77**	**115.24**
Maximum Gross Weight	**2,550**	**83**	**Over Gross**	
Maximum Useful Load	**795**			
Useful Load on this Flight	**878**			
Available Useful Load	**-83**			



Airplane 83 pounds overweight

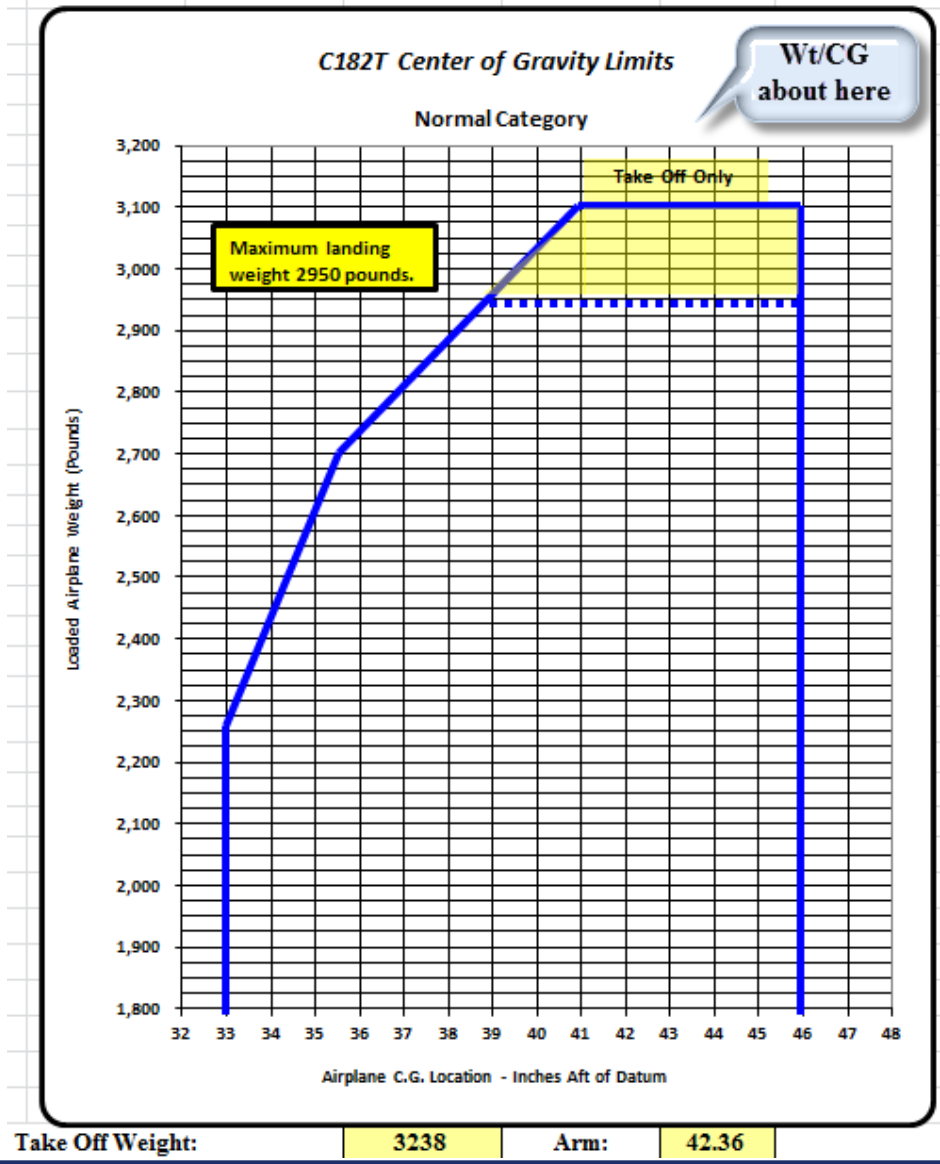
CG above the envelope

Airplane not legal to fly

http://williamjdoylejr.net/FAAST/W&B/Weight_Balance_Cessna_172S.xls

Weight & Balance Scenario – C-182T – Full Fuel

2005 C182T Skylane Weight & Balance				
Item	Input Data	Weight	Arm	Moment
Basic Empty Weight	2,018	2,018	38.84	78.37
Crew: Pilot	280	280	37.00	10.36
Co-pilot	200	200	37.00	7.40
Passengers: Left Rear	20	20	74.00	1.48
Right Rear	175	175	74.00	12.95
Baggage	30	30	97.00	2.91
Rear Baggage Area	0	0	116.00	0.00
Fuel in gallons (Max 87 gallons	87	522	46.00	24.01
Total Ramp Weight		**3,245**	**42.37**	**137.48**
Minus Runup Fuel		-7	46.00	-0.32
Total Take Off Weight		**3,238**	**42.36**	**137.16**
Maximum Gross Weight	3,100	138	Over Gross	
Maximum Useful Load	1082.2			
Useful Load on this Flight	1220.2			
Available Useful Load	-138			



Airplane 118 pounds overweight

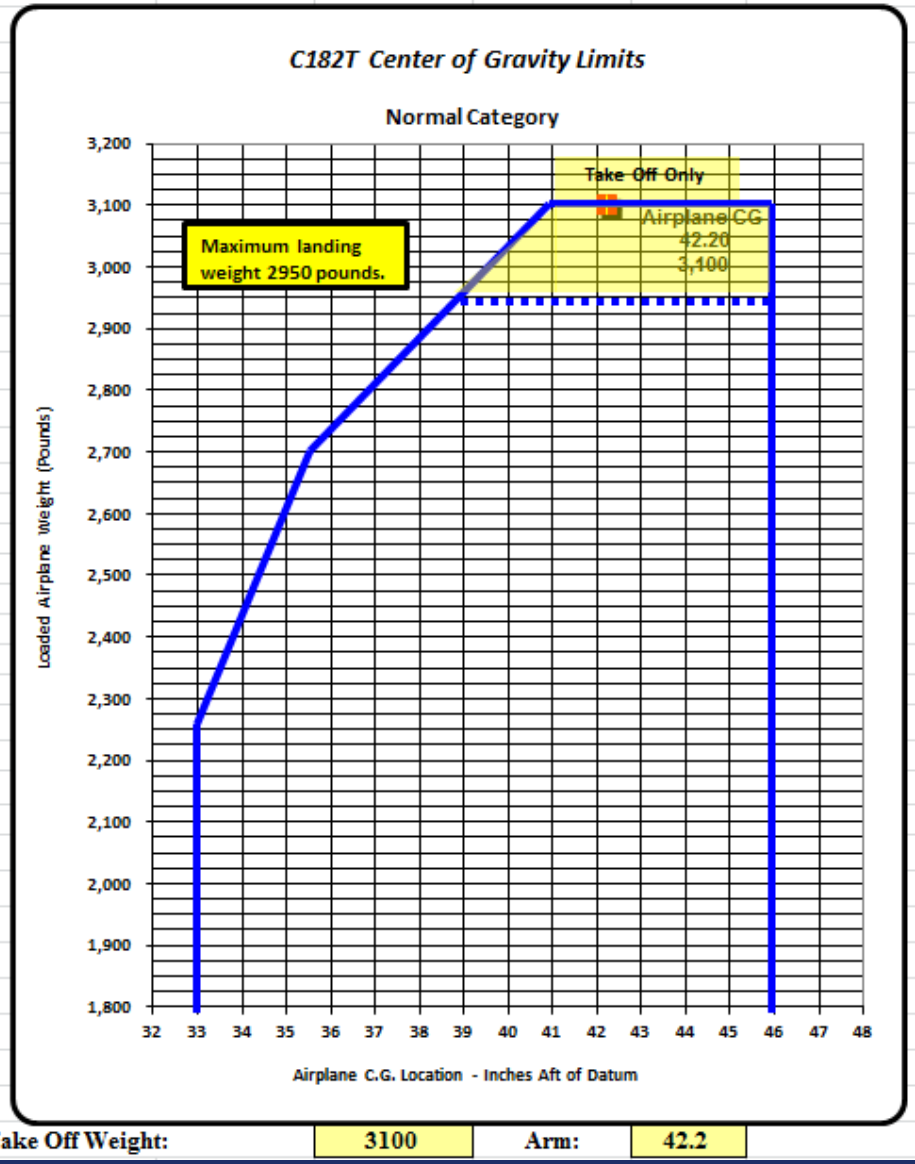
CG above the envelope

Airplane not legal to fly

http://williamjdoylejr.net/FAAST/W&B/Weight_and_Balance_Cessna_182T.xls

Weight & Balance Scenario – C-182T – Fuel to Tabs

2005 C182T Skylane Weight & Balance				
Item	Input Data	Weight	Arm	Moment
Basic Empty Weight	2,018	2,018	38.84	78.37
Crew: Pilot	280	280	37.00	10.36
Co-pilot	200	200	37.00	7.40
Passengers: Left Rear	20	20	74.00	1.48
Right Rear	175	175	74.00	12.95
Baggage	30	30	97.00	2.91
Rear Baggage Area	0	0	116.00	0.00
Fuel in gallons (Max 87 gallons	64	384	46.00	17.66
Total Ramp Weight		**3,107**	**42.21**	**131.14**
Minus Runup Fuel		-7	46.00	-0.32
Total Take Off Weight		**3,100**	**42.20**	**130.82**
Maximum Gross Weight	3,100	Ok		
Maximum Useful Load	1082.2			
Useful Load on this Flight	1082.2			
Available Useful Load	0			



Airplane within weight limit

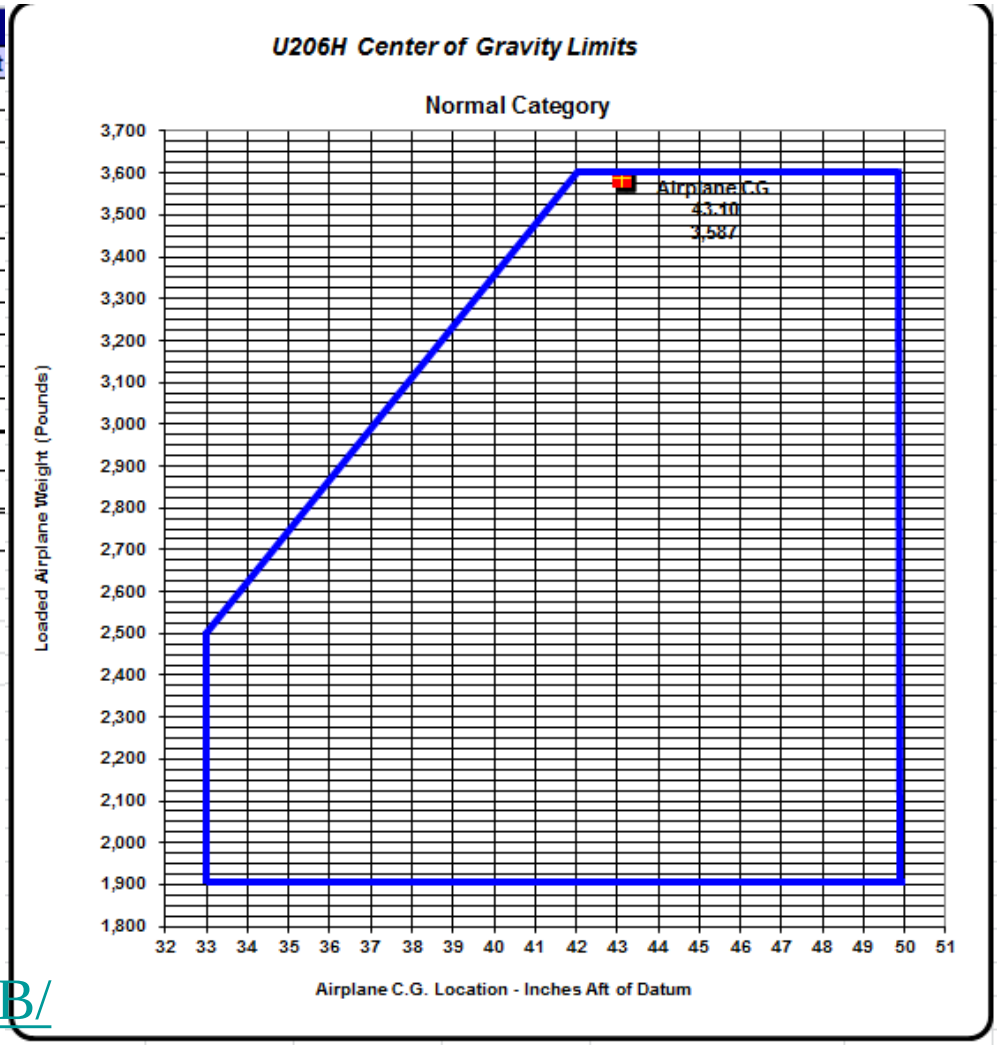
CG within the envelope

Airplane is legal to fly

http://williamjdoylejr.net/FAAST/W&B/Weight_and_Balance_Cessna_182T.xls

Weight & Balance Scenario – U-206H – Full Fuel

2005 U206 Stationair Weight & Balance				
Item	Input Data	Weight	Arm	Moment
Basic Empty Weight	2,317	2,317	39.00	90.36
Crew: Pilot	280	280	37.00	10.36
Co-pilot	200	200	37.00	7.40
Passengers (Row 2): Seat 3	20	20	70.00	1.40
Seat 4	175	175	70.00	12.25
Passengers (Row 3): Seat 5	0	0	100.00	0.00
Seat 6	0	0	100.00	0.00
Baggage Area A	50	50	96.00	4.80
Baggage Area B		0	127.00	0.00
Baggage Area C	30	30	136.00	4.08
Fuel in gallons	87	522	46.50	24.27
Total Ramp Weight		**3,594**	**43.11**	**154.93**
Minus Runup Fuel		-7	46.50	-0.33
Total Take Off Weight		**3,587**	**43.10**	**154.60**
Maximum Gross Weight	3,600	Ok		
Maximum Useful Load	1283			
Useful Load on this Flight	1270			
Available Useful Load	13			



Airplane within weight and CG limits

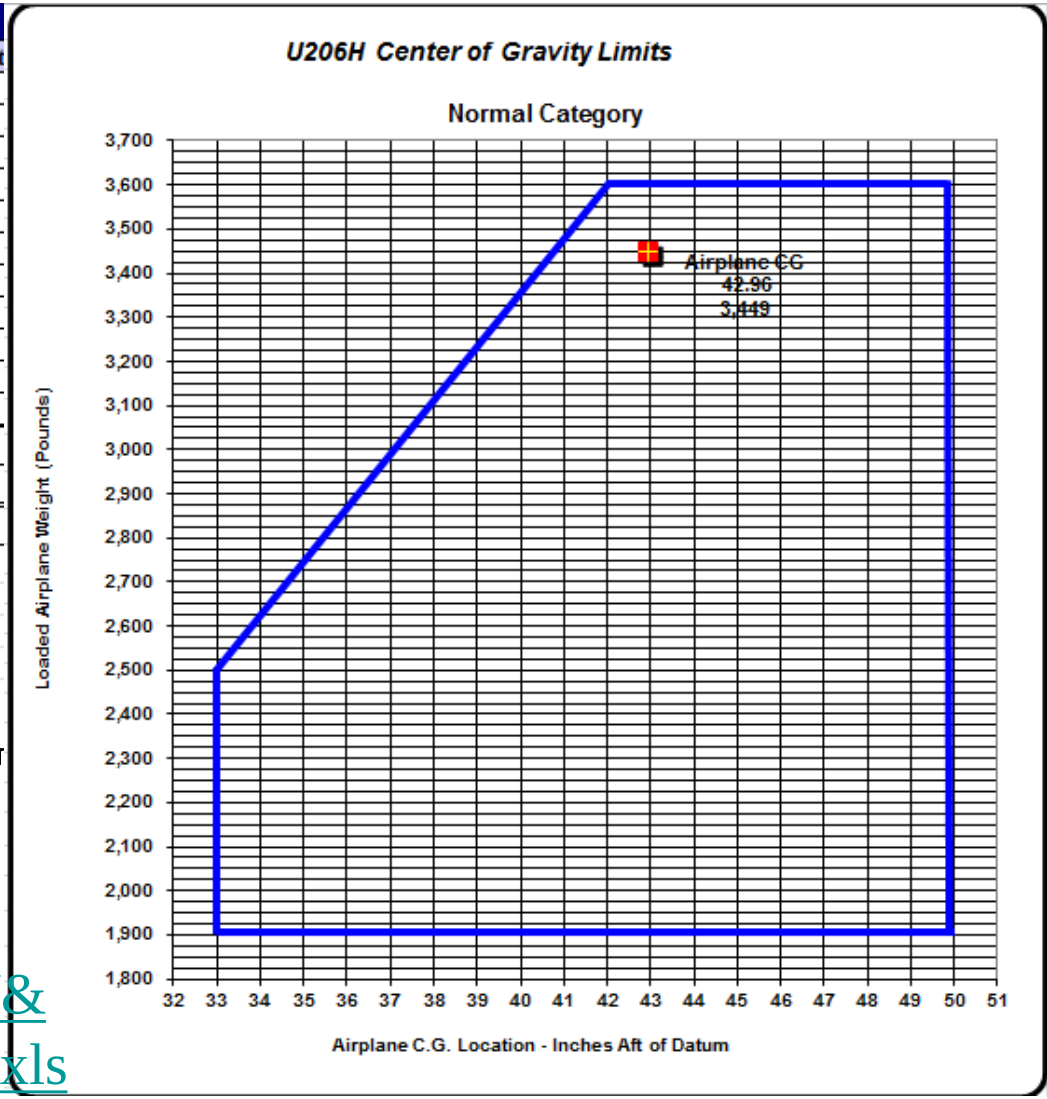
Airplane is legal to fly

http://williamjdoylejr.net/FAAST/W&B/Weight_Balance_Cessna_U206H.xls

Take Off Weight:	3587	Arm:	43.1

Weight & Balance Scenario – U-206H – Fuel to Tabs

2005 U206 Stationair Weight & Balance				
Item	Input Data	Weight	Arm	Moment
Basic Empty Weight	2,317	2,317	39.00	90.36
Crew: Pilot	280	280	37.00	10.36
Co-pilot	200	200	37.00	7.40
Passengers (Row 2): Seat 3	20	20	70.00	1.40
Seat 4	175	175	70.00	12.25
Passengers (Row 3): Seat 5	0	0	100.00	0.00
Seat 6	0	0	100.00	0.00
Baggage Area A	50	50	96.00	4.80
Baggage Area B		0	127.00	0.00
Baggage Area C	30	30	136.00	4.08
Fuel in gallons	64	384	46.50	17.86
Total Ramp Weight		**3,456**	**42.97**	**148.51**
Minus Runup Fuel		-7	46.50	-0.33
Total Take Off Weight		**3,449**	**42.96**	**148.18**
Maximum Gross Weight	3,600	Ok		
Maximum Useful Load	1283			
Useful Load on this Flight	1132			
Available Useful Load	151			



Airplane within weight and CG limits

Airplane is legal to fly

http://williamjdoylejr.net/FAAST/W&B/Weight_Balance_Cessna_U206H.xls

How to Query the NTSB Database

Accessing the NTSB Database

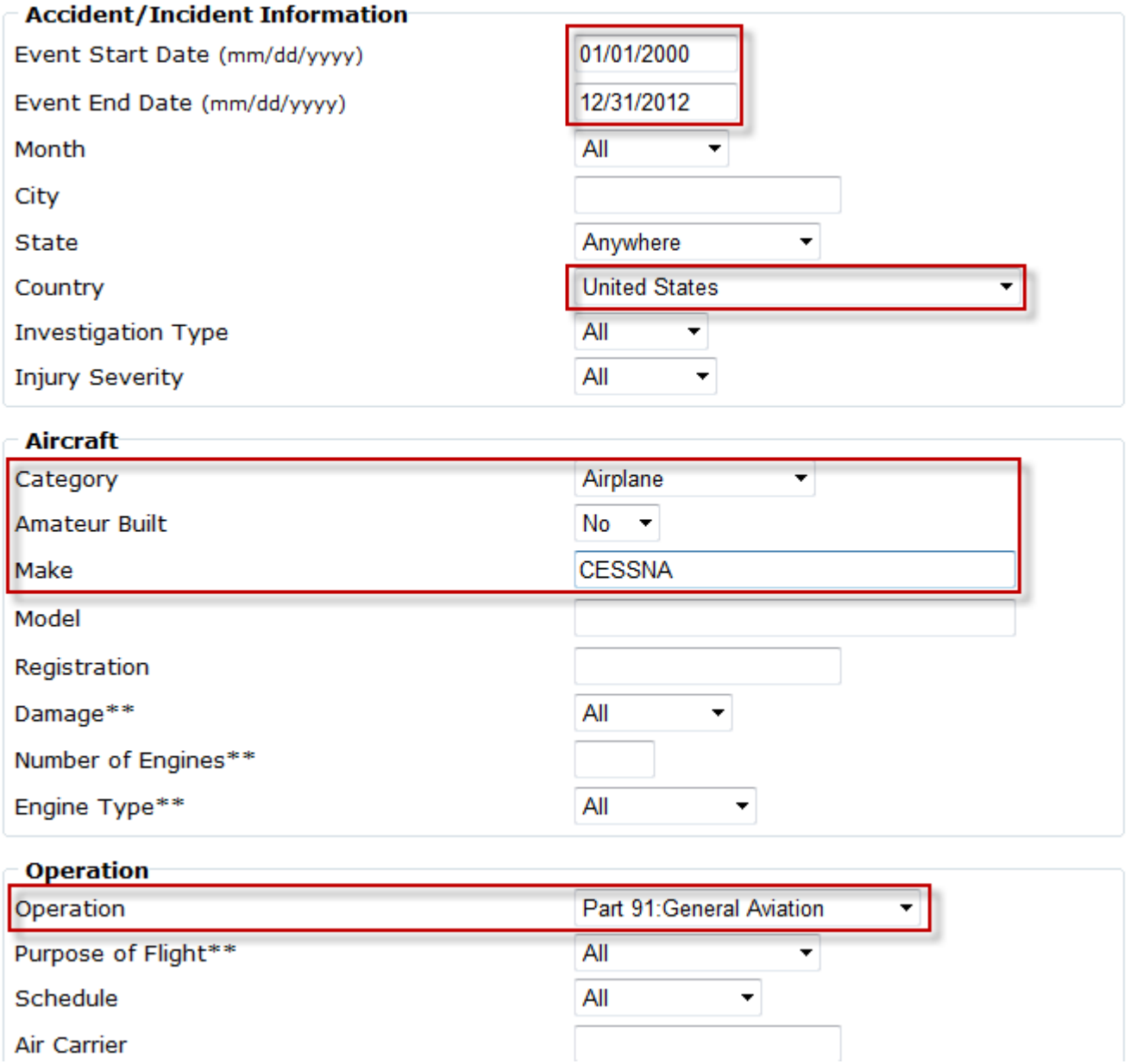
- Use your web browser to access the NTSB Database
  - http://www.ntsb.gov/aviationquery/index.aspx

The NTSB aviation accident database contains information from 1962 and later about civil aviation *accidents* and selected *incidents* within the United States, its territories and possessions, and in international waters. Generally, a **preliminary** report is available online within a few days of an accident. **Factual** information is added when available, and when the investigation is completed, the preliminary report is replaced with a **final** description of the accident and its probable cause. Full narrative descriptions may not be available for dates before 1993, cases under revision, or where NTSB did not have primary investigative responsibility.

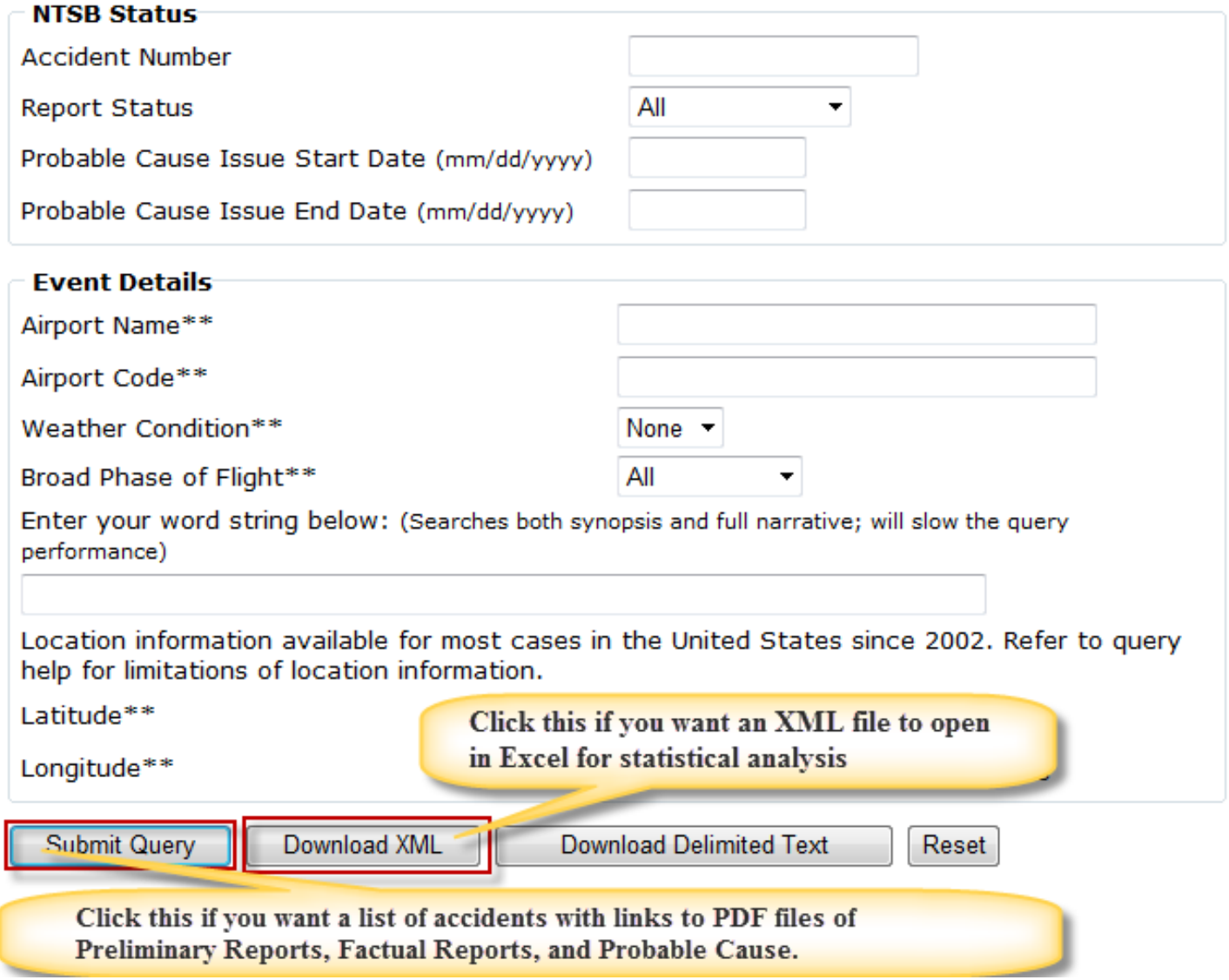
- Monthly lists - accidents sorted by date, updated daily.
- Investigations Nearing Completion - List of investigations with estimated dates of publishing probable cause.
- Downloadable datasets - one complete dataset for each year beginning from 1982, updated monthly in Microsoft Access 2000 MDB format; this site also provides weekly "change" updates and complete documentation.
- GILS record - complete description of the accident database, including definition of "accident" and "incident".
- FAA incident database - complete information about incidents, including those not investigated by NTSB, is provided by the Federal Aviation Administration.
- Data & Information Products - lists other sources of information about aviation accidents, including publications, dockets, and press releases

This interactive search capability for the NTSB database, updated daily; see the and **data dictionary** before using the form for the first time.

Accessing the NTSB Database



Creating an NTSB Database Query



Database Query Results (Partial)

179 records meet your search criteria.

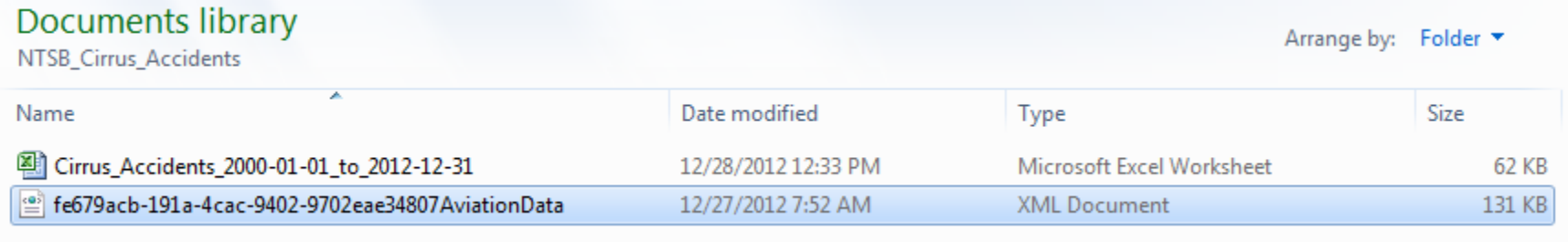
A docket of supporting materials may exist for factual and probable cause reports. Please contact Records Management Division. Dockets are not available for preliminary reports.

Accident Database & Synopses Download XML Download Delimited Text

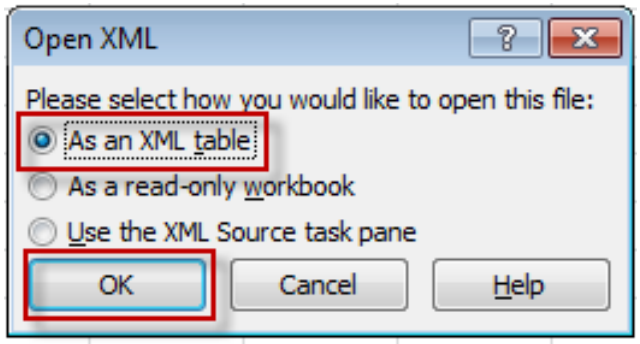
Current Synopsis	PDF Report(s) (Published)	Event Date	Estimated Release	Location	Make/Model	Regist. Number	NTSB No.	Event Severity
Preliminary	Preliminary (11/20/2012)	11/16/2012		Show Low, AZ	CIRRUS SR22	N800RW	WPR13LA043	Nonfatal
Preliminary	Preliminary (11/13/2012)	10/21/2012		Pahokee, FL	CIRRUS DESIGN CORP SR22	N6839R	ERA13LA048	Nonfatal
Preliminary	Preliminary (10/31/2012)	10/15/2012		Parker, AZ	CIRRUS DESIGN CORP SR20	N499SF	WPR13LA011	Nonfatal
Preliminary	Preliminary (10/16/2012)	10/6/2012		Birmingham, AL	CIRRUS DESIGN CORP SR22	N80KW	ERA13LA012	Nonfatal
Preliminary	Preliminary (10/11/2012)	10/3/2012		Gary, IN	CIRRUS DESIGN CORP SR22	N308PJ	CEN13FA002	Fatal(2)
Probable Cause	Factual (11/01/2012) Probable Cause (12/19/2012)	10/2/2012	12/19/2012	Eden Prairie, MN	CIRRUS DESIGN CORP SR20	N750SR	CEN13CA007	Nonfatal
Preliminary	Preliminary (09/20/2012)	9/15/2012		Willard, MO	CIRRUS DESIGN CORP SR22	N436KS	CEN12FA633	Fatal(5)
Preliminary	Preliminary (09/12/2012)	9/1/2012		Falmouth, MA	CIRRUS DESIGN CORP SR22	N221DV	ERA12FA540	Fatal(1)

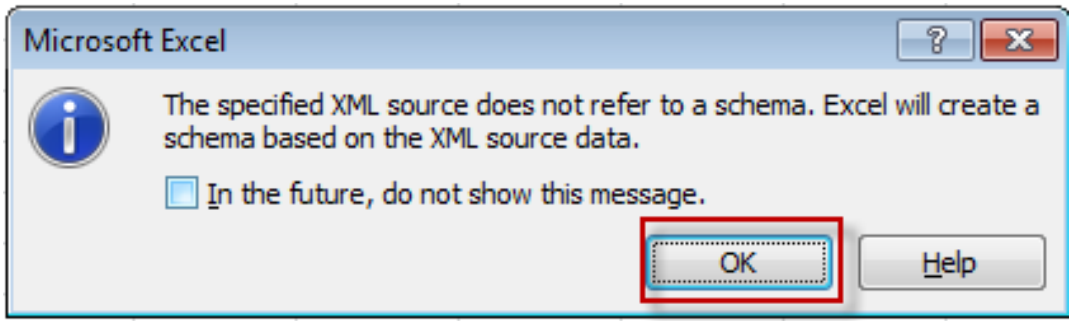
Download of Accidents in XML Format (1 of 2)

- Download the XML file



- After you download the XML file, launch Excel and open the XML file





Download of Accidents in XML Format (2 of 2)

- Your XML file will look similar to the screen shown below.
- You can save your XML file as an Excel workbook.

	A	B	C	D	E	F	G	H	I	J	K	L
1	EventId	InvestigationType	AccidentNumber	EventDate	Location	Country	Latitude	Longitude	AirportCode	AirportName	InjurySeverity	AircraftDama
2	20121116X62231	Accident	WPR13LA043	11/16/2012	Show Low, AZ	United States	34.218889	-109.873889			Non-Fatal	Substantial
3	20121106X04117	Accident	ERA13LA048	10/21/2012	Pahokee, FL	United States	26.784444	-80.689444	PHK	Palm Beach County Glades Airpo	Non-Fatal	Substantial
4	20121015X75934	Accident	WPR13LA011	10/15/2012	Parker, AZ	United States	34.110556	-114.627500	P20	Parker	Non-Fatal	Substantial
5	20121007X94725	Accident	ERA13LA012	10/06/2012	Birmingham, AL	United States	33.563889	-86.752222	BHM	Birmingham International	Non-Fatal	Substantial
6	20121003X24635	Accident	CEN13FA002	10/03/2012	Gary, IN	United States	41.616111	-87.412778	KGYY	Gary/Chicago Int'l Arp	Fatal(2)	Substantial
7	20121007X75550	Accident	CEN13CA007	10/02/2012	Eden Prairie, MN	United States	44.823056	-93.455278	KFCM	Flying Cloud	Non-Fatal	Substantial
8	20120915X35028	Accident	CEN12FA633	09/15/2012	Willard, MO	United States	37.305278	-93.428334	SGF	Springfield-Branson National	Fatal(5)	Substantial
9	20120901X42234	Accident	ERA12FA540	09/01/2012	Falmouth, MA	United States	41.584722	-70.542777	5B6	Falmouth Airpark	Fatal(1)	Substantial
10	20120828X83828	Accident	CEN12CA576	08/25/2012	Watkins, CO	United States	39.766667	-104.525000	KFTG	Front Range Airport	Non-Fatal	Substantial
11	20120731X35733	Accident	CEN12LA495	07/29/2012	Lakeview, AR	United States			3MO	Gastons Airport	Non-Fatal	Substantial
12	20120723X43615	Accident	ERA12LA473	07/22/2012	Pickens, SC	United States	34.810000	-82.702778			Non-Fatal	Substantial
13	20120715X25131	Accident	WPR12FA305	07/14/2012	Salina, UT	United States	38.819723	-111.432223			Fatal(2)	Substantial
14	20120711X12055	Accident	ERA12FA438	07/11/2012	Moscow, TN	United States	35.056389	-89.386389			Fatal(1)	Substantial
15	20120706X65711	Incident	WPR12IA296	06/17/2012	Deer Valley, AZ	United States	33.686111	-112.076111	DVT	Deer Valley	Incident	Minor
16	20120530X50747	Accident	WPR12FA235	05/29/2012	Duck Creek Village, UT	United States	37.435000	-112.765000			Fatal(4)	Substantial
17	20120427X35846	Accident	ERA12FA303	04/27/2012	Anderson, SC	United States	34.493889	-82.707778	KAND	Anderson Regional Airport	Fatal(1)	Substantial

Parting Thoughts

The Three Most Useless Things to a Pilot

- **The runway behind you**
  - **Moral: know your aircraft's take-off minimums and calculate the weight and balance for your flight, your airport's runway length, density altitude, any obstacles to be cleared**
- **The altitude above you**
  - **Moral: know your aircraft's power settings for climb, cruise, and descent**
- **The fuel on the ground below you**
  - **Moral: know your aircraft's fuel capacity, fuel system, GPH burn rate, and winds aloft for the route of flight.**
- **Utilize superior judgment to avoid needing to use superior skill**
  - **Moral: know your aircraft's systems and how to use them**

Just a Real Nice Picture of a Cessna 172S

Credits and Information

References and Information

- **Author of Presentation**
  - William J. Doyle, Jr., CFI A&I, AGI, IGI, Cessna CFAI
    - FAA FAAST Team Representative, PHL FSDO
- **Downloading This Presentation**
  - Uses PowerPoint 2003 and later
  - Password-protected, so click on the “Read Only” button
  - http://williamjdoylejr.net/FAAST - all of my FAAST Team presentations
  - http://williamjdoylejr.net/FAAST/Cessna/ - all Cessna presentation files
  - http://williamjdoylejr.net/FAAST/Cessna/Cessna_172_182_and_206.ppt
  - http://williamjdoylejr.net/FAAST/Cessna/Cessna_172_182_and_206.pdf
  - http://williamjdoylejr.net/FAAST/Cessna/Cessna_Accidents_2000-01-01_to_2012-12-31.xlsx
- **Maj Tom Woods, FAAST Rep PHL FSDO and NJWG/LGM**
  - for creating the W&B spreadsheets for Cessna 172S, 182T, and U206H

References and Information

- **Garmin G1000 PC Trainer for Cessna NAV III, Version 12.0**
  - $24.95 plus $8.00 shipping
  - https://buy.garmin.com/shop/shop.do?pID=113763
- **Garmin GNS 430 and 530 (discontinued products)**
  - Download GNS 430 Simulator (free)
  - http://www8.garmin.com/support/download_details.jsp?id=3527
  - Download GNS 530 Simulator (free)
  - http://www8.garmin.com/support/download_details.jsp?id=3530
  - Download GNS 400W/500W WAAS Simulator (free)
  - http://www8.garmin.com/support/download_details.jsp?id=3532
- **Garmin Apollo GX55 (discontinued product)**
  - Apollo GX55 Simulator (free)
  - https://buy.garmin.com/shop/shop.do?cID=169&pID=6429

References and Information

- **NTSB Accident Database**
  - http://www.ntsb.gov/aviationquery/index.aspx
- **Electronic Code of Federal Regulations – Title 14 Aeronautics and Space**
  - http://www.ecfr.gov/cgi-bin/text-idx?sid=fd0d4ed9821626f95caf8cad8372ce03&c=ecfr&tpl=/ecfrbrowse/Title14/14tab_02.tpl
- **Electronic Code of Federal Regulations – Title 14 Chapter I-- Federal Aviation Administration, Department of Transportation, Subchapter D – Airmen**
  - http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?sid=fd0d4ed9821626f95caf8cad8372ce03&c=ecfr&tpl=/ecfrbrowse/Title14/14cfrv2_02.tpl

Just a Real Nice Picture of a Cessna 182T

FAASTeam
on
Takeoffs, Approaches, and Landings for the Cessna 172, 182, and 206

Questions?
Comments?
Ideas?

This Completes

Takeoffs, Approaches, and Landings for the Cessna 172, 182, and 206

Be sure to sign in so your attendance is record validated!