If the Engine Fails-Keeping it Simple
Or is it?

By John Morris

Does title seem familiar? If you have been reading the POPA newsletter since 2007 (winter issue-2008) or have been to my website, then it is familiar except that this time I will discuss the “infamous” after takeoff turn back to the airport after an engine failure. The keeping it simple part is a matter of opinion, in this case.

Barry Schiff, a regular article contributor to AOPA (and a former guest speaker at POPA) recently wrote about the “impossible turn” in the April, 2011 issue of AOPA. I thought it interesting enough to expand on his thoughts into how it could, or couldn’t, work using the performance of PC12.

Highlights of Mr. Schiff’s article included bank angle, direction of turn, climb/glide speed, use of full power at takeoff, and the 5-second (reaction) delay - all classic discussion points when dealing with a single-engine aircraft.

Using those highlights I will incorporate the PC12’s performance into the discussion by choosing to analyze the only two known cases of an engine failure after takeoff/return to the airport by a PC12; Yellowknife, Northwest Territories (Chart 1) and Trenton, New Jersey (Chart 2).
In both cases the aircraft successfully returned to the airport with only one minor injury resulting from the Trenton incident. But will that always be the case? How successful was it, really? Both aircraft had two professional pilots in the cockpit. Did that make a difference?

CHART 1

Yellowknife, NT (CYZF): 9/16/1999

Reference	ALTITUDE	DISTANCE
1: Takeoff Rwy 15	800 AGL (Reported) VMC	7250’: From T/O with 7 kt Headwind
2: Radius point	500 AGL (22 Seconds)	1300’ abeam from #1
3: Over Runway	200 AGL (11 Seconds)	2296’ to 50’ agl
4: Touchdown	Landing Total = 3111’- 7 kt Tailwind	
5: Plane stopped	Pilot used high-speed taxiway to avoid going off end of runway	
A: Total Landing distance: 5407’-using 200’ over runway, tailwind component (7 kts) and Landing Total (POH) flaps 30		

All non-reported numbers are estimated using POH for all performance procedures to 1000 AGL and landing, TABLE 1 and where applicable-based on established glide rate of 114 KIAS/ 800 fpm

CHART 2

Trenton, NJ (KTTN): 10/16/2002

Reference	ALTITUDE	DISTANCE
1: Takeoff Rwy 6	700 AGL (Reported), IMC	6950’: From T/O with 0 kt Headwind
2: Radius point	450 AGL (24 Seconds)*	1500’ abeam from #1
3: Over Runway	75 AGL	625’ to 50’ agl
4: Touchdown	Landing Total = 4026’- 20 kt Tailwind	
5: Plane stopped	Against perimeter fence	
A: Pilot probable squared downwind RWY 6 for RWY 16 landing - VMC		
B: Total Landing distance: 4026’ Landing Total (POH) flaps 30- tailwind component (20 kts) *Note: If 200’ AGL over runway add 2500’ to total landing distance		
C: Pilot choose to exit runway towards the right of runway to avoid railroad berm on other side of perimeter fence		

All non-reported numbers are estimated using POH for all performance procedures to 1000 AGL and landing, TABLE 1 and where applicable-based on established glide rate of 114 KIAS/ 800 fpm

* Engine partial power when initiating left turn to assigned heading 290°

TABLE 1

	Entry speed of 120/140 (KIAS)				114 (116)
Bank angle	26° (FD)	35°	40°	45°	40°
RADIUS at 180° (feet)	2626/3575	1830/2490	1527/2078	1281/1744	1378 (1427)
RADIUS at 180° (time)	41/47 Seconds	28/33 Seconds	24/28 Seconds	20/23 Seconds	23 Seconds
RADIUS at 270° (time)	62/71 Seconds	42/50 Seconds	36/42 Seconds	30/35 Seconds	35 Seconds
STALL SPEED (/47. NG)	96 (98)	101 (103)	104 (106)	108 (111)	104 (106)

Calculated distance/time based on Maximum Gross Weight stall speed-clean configuration and standard day conditions with no wind.
140 KIAS radius does not account for deceleration in turn

I will let the diagrams / charts speak for themselves. Lets look at the factors regarding the decision making process. This is where the "keeping it simple" is not so simple.

1. Day/Night, VMC/IMC: How would/should that affect the thought of a return to field?
2. Available runways: length versus favorable winds (see both PC12 incidents)
3. Takeoff/climb power: I have observed over the years some pilots not using maximum available power at takeoff and/or reducing power prior to 1000' AGL! Saving the engine for maintenance costs?
4. Climb speed: Mr. Schiff discusses the best climb speed as between Vx and Vy. For simplicity we should stick with a Vy climb to 1000' AGL. I request this of my students, although it is not adhered to often enough, myself included. So why not climb at a higher initial airspeed? Why Vx/Vy? If we always knew that the minimum altitude before an engine were to fail would be 800-1000' AGL, then why not? I picked 140 KIAS as the other example in Table 1 since in most cases if takeoff is made with the flight director selected to go-around (and the pitch is maintained to the command bars), the aircraft will pass 140 KIAS at about 800'

AGL. 140 KIAS is the most common I see during a standard takeoff when passing 800’ AGL, with/without the flight director.

5. The five (5) second delay: Recognition/Reaction to the “oh sh&t!” moment is the best reason for (at least) Vy since the natural reaction of holding or pulling the yoke, will cause the aircraft to decelerate towards glide speed until realization. Oh, by the way, FEATHER THE PROPELLER!
6. Direction of turn: Obstacle awareness/avoidance of the airport environment and immediate vicinity? Do you plan before arriving at the aircraft for that possibility? First time at airport? Landed at airport at night so did not see potential obstacles?
7. Direction of turn: Wind. Should always turn into the wind, except what about those potential obstacles? Our natural tendency to turn left for better pilot visibility may not be the most favorable.
8. Bank angle: VERY important as it relates to radius of turn & the *time* it takes for a 270° turn back to, and over the runway. Table 1 shows the bank angles, radius and time for the PC12 stall speeds.
9. Bank angle: AIRSPEED. From years of observation once the bank angle turn is initiated the pilot is looking for the runway and not paying enough attention to the airspeed! Bad thing to do, possibly fatal. Of course we want to see what we are aiming for but until at least a 180° turn is performed we should concentrate on flying the aircraft to its best glide speed/bank angle.
10. Wild card: FLAPS. When do you deploy the flaps and how long does it take for them to be at full down? Will you remember to reduce your glide speed (angle of attack) as a factor of the flaps?
11. Wild card: Landing gear. The landing gear extended will increase the rate of descent (angle of attack) as a factor of maintaining best glide speed causing a shorter time airborne.
12. THE wildest card: Human factor. Rest, proficiency, single pilot/dual pilots, training etc… From the many years of being a PC12 instructor and discussing/simulating the “turn back”, at the end of training I always remind the student that the first one (simulated turn back) is the only one that counts. So how was the outcome of your first attempt? Even after you <u>knew</u> it was coming?

Seems like an awful lot of factors that have to be checked before deciding to make “the turn back”. And how much time do we have to make this decision? I am using the best glide of 800 feet per minute for reference. Which means when it starts, if at 800’ AGL, we have 1 minute until ground contact. 1 minute to find a point in front, or to the sides, or turn around (270°) while also configuring the aircraft and maintaining control of the aircraft and ourselves.
Can it be done? Yes. I have shown two known (successful) examples involving the PC12. But consider the circumstances and outcome of those two incidents.
So should you attempt it? As in the AOPA article, it is always up to the PIC to make that final decision. It is a decision I hope to never have to make. One of the reasons for owning/operating a PC12 is the PT6A. It is a very reliable engine that has proven itself repeatedly over the decades. But nothing is perfect and in aviation we must always be prepared. And with a single-engine aircraft we have a select set of factors unique to our type.

So to give us the best opportunity to avoid this decision or to help make the right decision we maintain the engine/airframe to proper standards. We should be aware of the airport environment (runways and buildings) and its immediate surroundings. We should brief, even to ourselves, the engine-out procedure, including wind direction. We should *always* use maximum available power through a minimum of 1000’ AGL and climb at Vy until at least 1000’ AGL.

“A safe pilot is always learning”

John Morris - ACFT Services
www.acftservices.com

John Morris – Formerly with Simcom Training Centers-Orlando for 14 years with 1999 being the first year teaching the PC12 followed by PC12 Program Coordinator from 2000 until resigning in 2007 to start ACFT Services

ACFT Services provides training ONLY for all PC12’s, no other aircraft.

CHART 1

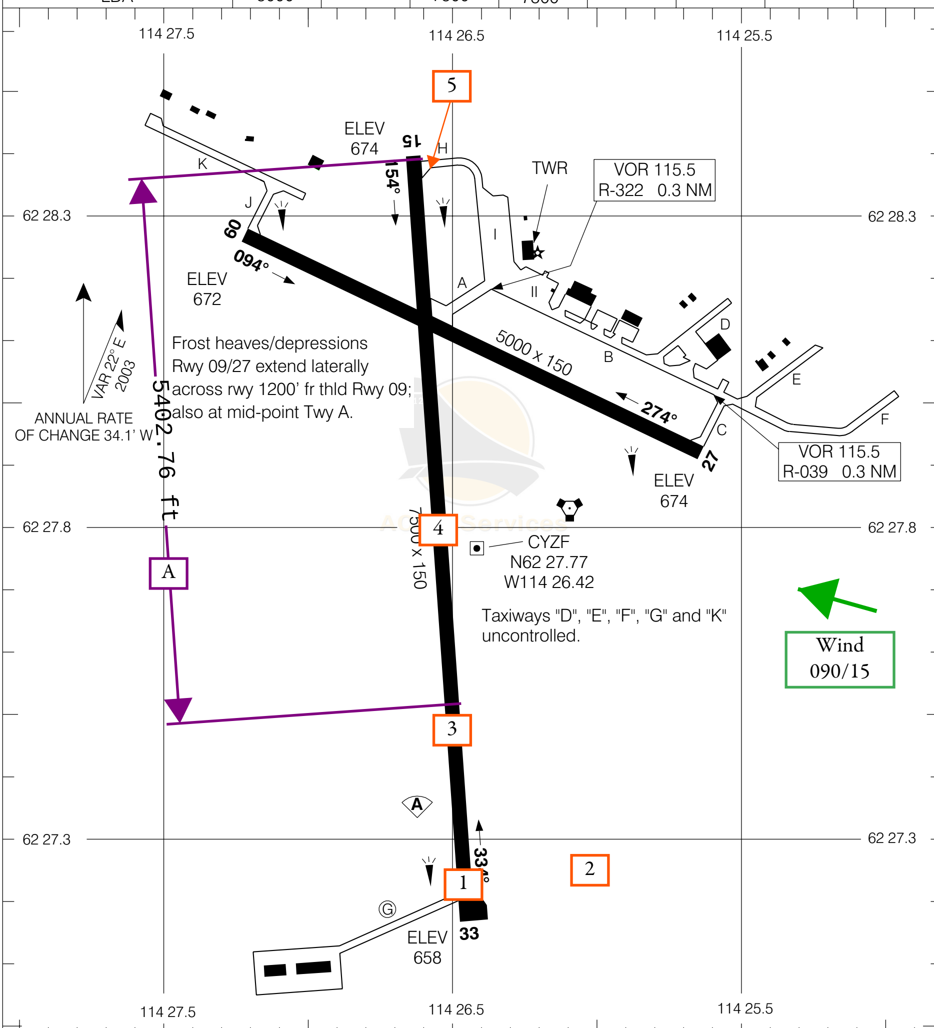
AERODROME CHART

Geomatics Canada

YELLOWKNIFE
YELLOWKNIFE NT

ATIS	GND	TWR	RADIO
128.4	121.9	118.5 340.8 O/T RADIO 118.5 (MF 5 NM)	122.5 262.0

DECLARED DISTANCES	09	27	15	33				
TORA	5000	5000	7500	7500				
TODA	6000	6000	8500	8500				
ASDA	5000	5000	7500	7500				
LDA	5000	5000	7500	7500				



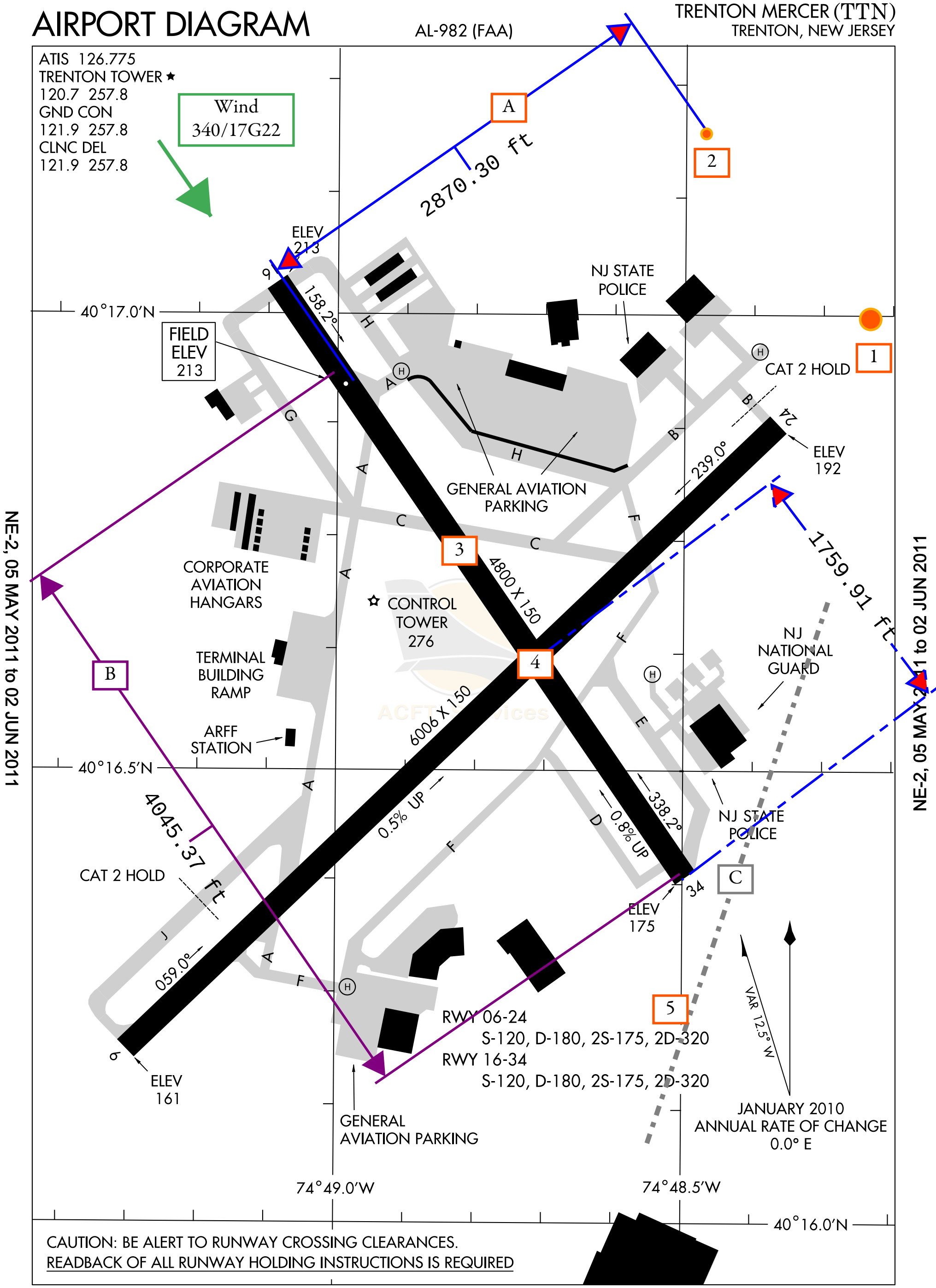
TAKE-OFF MINIMA	SCALE IN FEET
All Rwys: ½	1000 0 1000 2000

CHART 2

AIRPORT DIAGRAM

AL-982 (FAA)

TRENTON MERCER (TTN)
TRENTON, NEW JERSEY



AIRPORT DIAGRAM

10210

TRENTON, NEW JERSEY
TRENTON MERCER (TTN)