Assumed Safety

There are **risks inherent** to any act of aviation, so how can we best improve our **levels of safety**?

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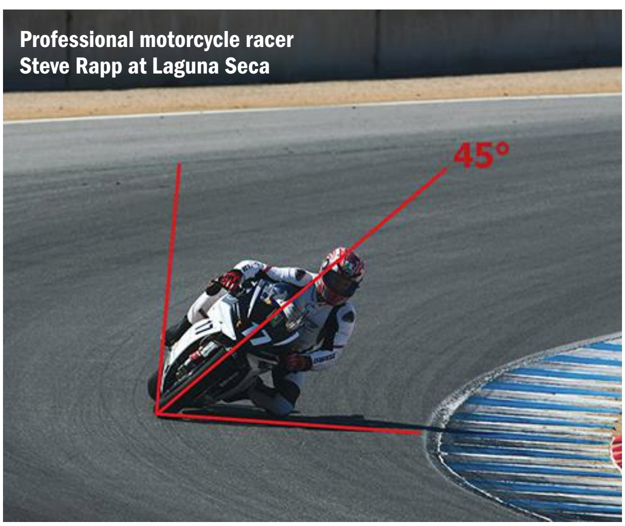
Aviation safety has progressed to such a point that most airline and business aviation passengers simply assume their chance of safely arriving at their desired destination is assured. However, as pilots we understand that no such guarantee is possible since there will always be a level of risk, which we accept, when flying people from Point A to Point B. Our passenger's view can be labeled as blissful ignorance or simply a rounding error in the modern era of aviation safety. It is up to us to justify their assumption of safety by managing the risks.

The concept of risk management has been around for a while. The *Risk Management Handbook* (FAA Handbook 8083-2) was published in 2009 and an Advisory Circular covering Aeronautical Decision Making (AC 60-22) first appeared in 1991. For all the research and training, however, risk management seems a topic for the classroom and not the cockpit. The classic, academic approach to risk management calls for the identification of the hazards involved. The academician then evaluates the likelihood and severity of those hazards and categorizes each into identified, unidentified, acceptable, unacceptable and residual risks. Risks, once identified, are mitigated. Now all we need to do is translate this into pilot-speak!

Perhaps we need to turn the phrase on its head. Rather than talking about managing the ever-present risks, why not address those levels of assumed safety? There are risks inherent to any act of aviation, so how can we best improve our levels of safety? This is a difficult topic to get one's head around because any act of aviation defies gravity. How can we evaluate a cockpit decision when every option itself cannot be said to be completely risk free? Perhaps looking at a terrestrial parallel can help us devise a risk evaluation strategy that makes sense.

A Back-to-Earth Comparison

Motorcycling could be a suitable analog when trying to analyze the safety-versus-risk continuum. As with aviating, it involves a level of physics that requires one to think about turns in three dimensions.



Professional motorcycle racer Steve Rapp at Laguna Seca

BRIAN REYNOLDS

Recreational motorcyclist Grace Albright on New England city streets

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Consider two motorcyclists executing left turns at wildly different speeds: one a professional racer at a California racetrack and the other a commuter on the city streets of a sleepy New England town. Like airplanes, a motorcycle must be banked into the turn to keep the maneuver coordinated; without this lean, the centrifugal force will cause the bike to topple over outside the turn radius. Also as with airplanes, higher speeds and tighter turns require higher angles of lean.

In fact, the professional is leaned over so heavily he needs to drag his left knee on the ground to gauge his "bank angle." To understand and evaluate the risks involved, we can express this rider's current situation in terms of four different criteria.

Equipment: His bike is specially designed for the extreme conditions and he is wearing a leather suit designed to minimize "road rash" in the event of a fall.

Training: He has trained for these speeds and conditions.

Oversight: The racetrack has clearly defined rules governing what can and cannot be done on the course.

Proficiency: He does this for a living and practices regularly.

By contrast, our recreational rider is leaned into the turn but at a much less extreme angle. Her lean is necessary to safely complete the turn, but the difference is striking. Why? Let's compare and contrast the criteria.

Equipment: Her bike is not designed for the high speeds or extreme lean angles and she is wearing denim and a light-duty riding jacket.

Training: She is suitably trained to operate at city speed limits but has never needed to "drag a knee" to gauge her lean angle.

Oversight: She is operating under municipal traffic laws on a city street with other traffic of varying types (and numbers of wheels).

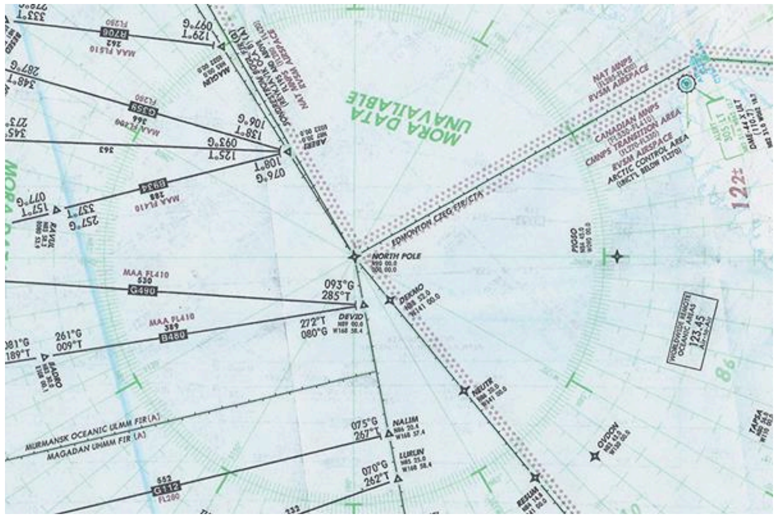
Proficiency: She rides on weekends for fun and can go months without a run on two wheels.

Each motorcyclist has an appropriate level of assumed safety. And each motorcyclist would be well advised to revise their assessment given a change in equipment, training, oversight, environment or proficiency. Although as pilots our risk analysis may not be as clear-cut as those of our motorcyclists, we can still see how this strategy can be useful by examining a few typical operational examples.

Polar Operations Example

Consider a trip from Luton, England (EGGW) near London to Anchorage, Alaska (PANC) in a Global Express BD-700 operating under FAR Part 91. The great circle route of 3,879 nm is comfortably within the airplane's range but takes it well into the Canadian Arctic Control Area, between the magnetic and true north poles. An optimized flight plan adds only 123 nm to the great circle route and can be flown in 8 hr. and 30 min. But this optimized route takes the airplane as high as 80 deg. north latitude.

Since this is a private flight, there are no regulatory restrictions against this polar flight, something more properly classified as a high-latitude operation. The crew would be well advised, however, to consider the mandated requirements placed on their commercial counterparts. Even without FAR Part 135 experience, a search through the **http://www.faa.gov** website using the word "polar" reveals two applicable Advisory Circulars: AC 120-42B Extended Operations (ETOPS and Polar) and AC 135-42 Extended Operations (ETOPS) and Operations in the North Polar Area. A search of Part 135 for the word "polar" would reveal that paragraph 135.98 does indeed contain commercial requirements for an operations specification. Finally, looking through the FAA document covering en route



The North Pole

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Polar operations example notes

London to Anchorage Polar Option

Benefits of Proposal:
Save 420 nm distance, fuel, time

Best Practices:
14 CFR 135.98, AC 135-42, AC 120-42B

Risks	Equipment	Training	Oversight	Proficiency
Polar Navigation				
- FMS	✓	✓	✓	✓
- GPS	✓	✓	✓	✓
Communications				
- HF	✓	✓	✓	✓
- VHF	✓	✓	✓	✓
- Satcom/voice	✓	✓	✓	✓
Diversion				
- Identify airports		✓	✓	✓
- Prior coordination		✓	✓	✓
Forced Landing				
- Survival	✗	✗	✗	✗
- Rescue Operations	✗	✗	✗	✗

Assumed safety is justified because:
We trained with a qualified vendor and hired an auditor to check our preparations. We don't have survival gear and were unable to find a forced landing trainer/auditor, but we believe the chances of a forced landing are remote.


Low-visibility takeoff

JAMES ALBRIGHT

authorizations, FAA Order 8900, Volume 3, the crew would see at least two applicable Operations Specifications: B040, Operations in Areas of Magnetic Unreliability, and Operations Specification B050, Authorized Areas of En Route Operations.

Few Part 135 crews are authorized under either Operations Specification. Getting B040 can be costly and time consuming. Without the necessary authorizations, a Part 135 crew would be wise to bend the flight plan south over Frobay, Canada (CYFB). This route adds 420 nm and an hour to the trip but greatly simplifies worries about true versus magnetic navigation, limited GPS satellite coverage, alternate airport selection, VHF and HF communications, fuel freezing and polar radiation. Since the commercial crew has no choice but to comply with applicable regulations, authorizations and guidance, their route selection is for all intents and purposes made for them.

Our noncommercial crew could legally fly the much shorter high-latitude route without the oversight provided by Part 135 but should at least consider the restrictions placed on commercial crews to understand the risks involved. Of course they are not mandates for the Part 91 flight, but they are "best practices." By cataloging the advice of these best practices, the crew will be able to make more informed decisions about taking the polar shortcut.

Standard equipment on a Bombardier Global Express, for example, might satisfy all the commercial requirements except for the survival gear. The crew could consider renting or purchasing the needed equipment. If the crew has never been trained, it might be possible to find a vendor with the appropriate simulator course to address training and proficiency concerns. Hiring a knowledgeable auditor can raise the level of scrutiny to that of the regulatory oversight provided the commercial crew.

On the other hand, they may decide the cost of survival gear is too high and they simply don't have the needed space on the aircraft. At this point the crew may opt for the more southern route. They could also judge that the chances of a forced landing in a remote location are so small as to be justifiably discounted. But in either case they will now be able to make a more informed decision to say their passenger's assumed safety is justified.

Low-Visibility Takeoff Example

There is an old saying among seasoned pilots that is learned through hard experience: "You don't know what you don't know." This lesson must often be learned over and over again because once you've learned something new you might think you finally know all that's necessary. But that is often untrue. A low-visibility takeoff, for example, can stir up heated debates among newer instrument pilots.

How low can the visibility go before you consider the takeoff unsafe? Not only are there several answers to the question, each answer is correct when viewed through the lenses of equipment, training, oversight and proficiency. Let's say, for example, you are planning a takeoff from Indianapolis International Airport, Indiana (KIND). If the fog rolls in, how high must the visibility be to legally take off?

Answer 1 — Zero visibility. It may come as a surprise to many that there are no takeoff weather minimums under Part 91. If the airport or operator does not have minimums, the pilot is free to go. Of course, this would be foolish and the *Instrument Procedures Handbook* (FAA-H-8083-16A) acknowledges this fact: "Legally, a zero/zero departure may be made, but it is never advisable."

Answer 2 — For aircraft operating under Part 121, 125, 129 or 135: 1 sm visibility for aircraft other than helicopters, having two engines or less; 0.5 sm visibility for aircraft having more than two engines; in accordance with Part 91.175(f). Yes, this appears in Part 91. No, it does not apply to Part 91 operations. (The FAA works in mysterious ways.) If we were flying a two-engine airplane under Part 135 in our example, we would be

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TAKE-OFF				
Rwys 5L/R, 23R				
2 operating RVRs are required. All operating RVRs are controlling.		Adequate Vis Ref	STD	
CL & HIRL	CL, or RCLM & HIRL		3 & 4 Eng	1 & 2 Eng
TDZ RVR 5, Mid RVR 5, Rollout RVR 5	TDZ RVR 10, Mid RVR 10, Rollout RVR 10	RVR 16 or 1/4	RVR 24 or 1/2	RVR 50 or 1
Rwy 23L				
Both RVRs are required & controlling.		Adequate Vis Ref	STD	
CL & HIRL	CL, or RCLM & HIRL		3 & 4 Eng	1 & 2 Eng
TDZ RVR 5, Rollout RVR 5	TDZ RVR 10, Rollout RVR 10	RVR 16 or 1/4	RVR 24 or 1/2	RVR 50 or 1
Rwys 14, 32				
Both RVRs are required & controlling.		Adequate Vis Ref	STD	
RCLM & HIRL			3 & 4 Eng	1 & 2 Eng
TDZ RVR 10, Rollout RVR 10		RVR 16 or 1/4	RVR 24 or 1/2	RVR 50 or 1

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Takeoff minimums, Indianapolis, Indiana, extracted from Jeppesen Airways Manual, page KIND 10-9A

required to wait until the visibility lifts to 1 mi. But we might be able to go lower.

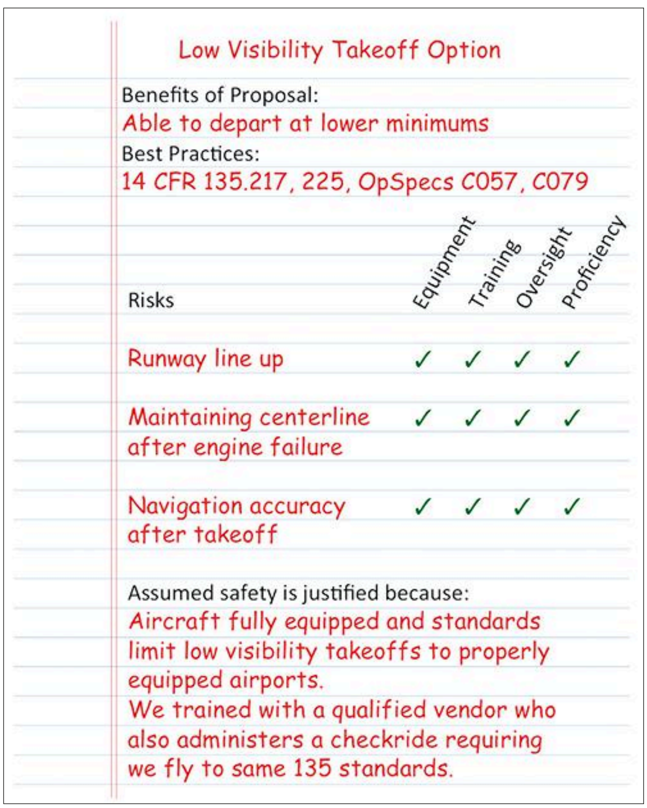
Answer 3 — No lower than the lowest compatible approach minimums. This is conventional wisdom and certainly makes sense. Why take off in weather lower than required for an emergency return? This unwritten guidance, however, ignores the option of landing at a suitable takeoff alternate where the weather is good enough to make an approach and land. In the case of our example airport, the lowest Category I minimums at Indianapolis International would permit an arrival down to a Runway Visual Range (RVR) of 1,800 ft., or 0.75 mi. visibility.

Answer 4 — As published on a departure procedure. In the U.S., if IFR Takeoff Minimums and (Obstacle) Departure Procedures are published, pilots must comply with the stated minimums. This applies to all operators, even Part 91. If you fly IFR, you are operating under Part 97, which "prescribes standard instrument approach procedures to civil airports in the United States and the weather minimums that apply to landings under IFR at those airports." In the case of Indianapolis International, the lowest permitted visibility is an RVR of 500 ft., provided the minimum number of transmissometers are operational for the combination of lighting and visual references required by the airport are present.

Note that our answers — varying from 0 to 1-mi. visibility and back down to 500 ft. — only give us what is legal to do in the U.S. They may not be legal in other parts of the world and they may not be safe, depending on your equipment, training, other oversight considerations or your proficiency. All these factors must be considered before deciding if your level of assumed risk is acceptable.

▶ **Equipment:** While most aircraft capable of instrument flight are suitable for a low-visibility takeoff, some are better equipped than others. Airplanes with synthetic vision and enhanced flight vision systems, for example, provide pilots with additional situational awareness that makes a low-visibility takeoff possible with less risk and higher levels of safety.

Low-visibility takeoff example notes



▶ **Training:** Even if you have the necessary equipment and the airport provides you with low takeoff minimums, have you been adequately trained to take off with visibility lower than your stopping distances? If you lose an engine at the worst possible moment, will you be able to maintain runway centerline while braking to a stop or accelerating to gain enough speed to take off?

▶ **Oversight:** Part 135 commercial operators must contend with Parts 135.217 and 135.225, as well as Operations Specifications C057 and C079. They are also required to demonstrate these maneuvers in a simulator before gaining this privilege. Some Part 91 operators are similarly trained and must also demonstrate low-visibility takeoffs with an engine failure during simulator evaluations. Even if you are properly trained and your aircraft so equipped, you may need to jump through other hoops to satisfy the regulatory requirements when flying outside the U.S. Many international airports, for example, do not permit low-visibility takeoffs for noncommercial crews on the theory they are not as well trained. Your training may be equal to or better than a commercial pilot's, but if the nation forbids it, you cannot do it. Period. (This restriction will be noted on the 10-9A page of your *Jeppesen Airway Manual* airport pages.)

▶ **Proficiency:** But let's say you have met all these requirements and the circumstances for a low-visibility takeoff are at hand. You still have a question remaining: Are you proficient? It takes a novice instrument pilot several tries before mastering the skill needed to keep an airplane pointed down the runway centerline following an engine failure with limited visibility. Even if you've been a master of the science for decades, if you haven't done it recently will you be up to the task on your next flight?

The forgoing example is foreign to many noncommercial operators but is standard practice among many business and commercial aviation pilots, even those flying strictly Part 91.

Their flight operating manuals contain language almost word-for-word from Operations Specification C079 and their simulator evaluation standards could have been copied directly from the Part 135 test standard. A noncommercial operator with the proper equipment, training and this level of oversight need only worry about proficiency. At this point they could be fully confident when saying their passenger's assumed safety is justified.

The Assumed Risk in Aeronautical Decision-Making

Your passengers assume a level of safety that guarantees a safe arrival every time they board an airplane. Your company assumes a level of success within the margins of their insurance policies every time they hand you the aircraft forms and a trip sheet. But you know that you are assuming a level of risk with every decision you have to make.

Some pilots see the variables in these decisions as intangibles and therefore not suitable for analysis. But if you search for the best practices available in an effort to really understand the risks involved, you can better understand the choices available to you. Do you have the right equipment? Are you properly trained? Is there an oversight mechanism to ensure your equipment and training are adequate? Are you proficient? If you can answer yes to each of these questions, you have taken the necessary steps to address the risks and to justify the weight of the assumed safety placed on your shoulders. **BCA**