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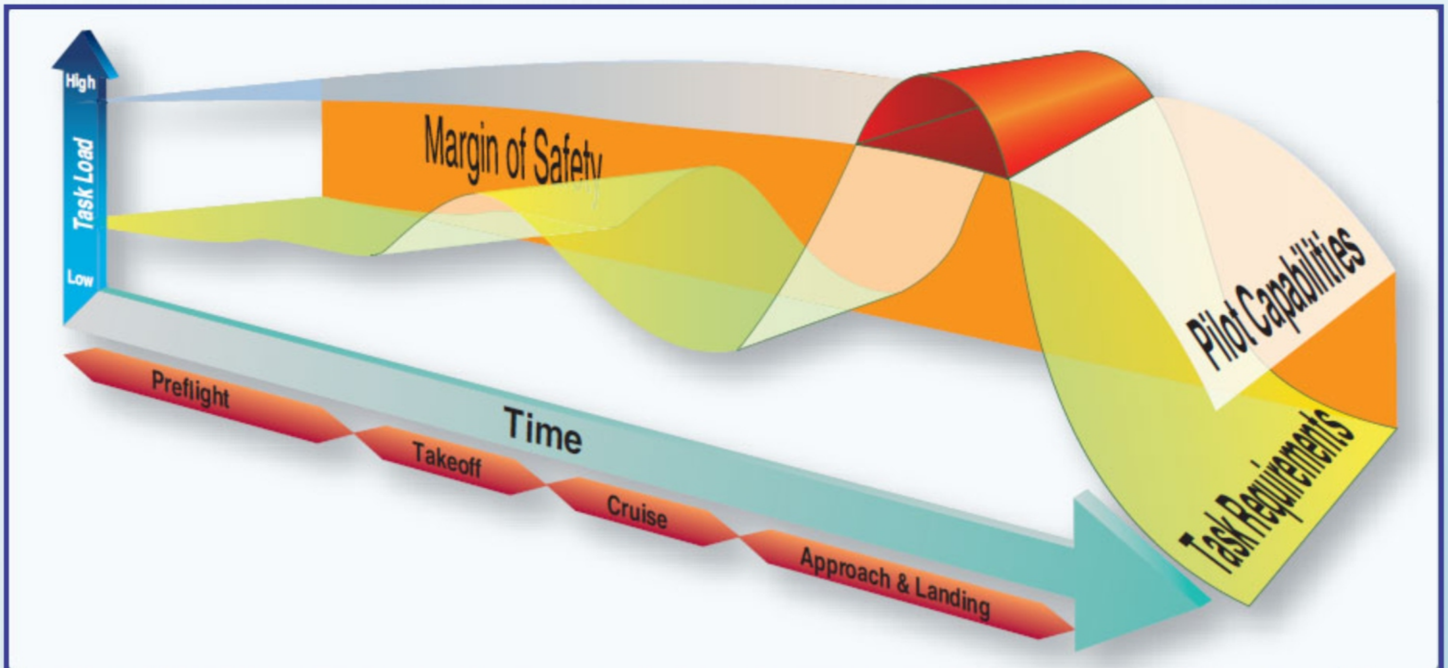
SRM



Single-Pilot Resource Management

Managing the Mission With A Crew Of Just You

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I. Single-Pilot Resource Management

Single-Pilot Resource Management (SRM) is defined as managing all of the resources (both on-board and outside of the aircraft) available to a single-pilot (prior to and during flight) to ensure that the successful outcome of the flight is never in doubt. The single-pilot must learn how to identify problems, analyze the information, and make informed decisions in a timely fashion while performing preflight, flight, and post-flight. Learning how to judge a situation encountered while flying out in the 'real world' is a difficult task. A single person can be more easily overwhelmed when faced with multiple decisions to make. Task management can quickly become serious, even catastrophic, for even the seasoned pilot when things go wrong.

There is no, one right formula, in aeronautical decision making (ADM). Each pilot is expected to analyze each situation taking into account experience level, personal minimums, and current physical and mental readiness to form decisions. Failure of a pilot to effectively analyze a situation increases the risk probability for that pilot. The good news is through SRM, a single-pilot learns to manage workload, mitigate risk, correct errors, and most importantly, make good decisions.

The proper execution of any flight operation demands constant situational awareness. This is especially true in single pilot operations. Training, experience and adherence to standard operating procedures coupled with good situational awareness are the single pilot's only recourse to the absence of a second cockpit crew member. By maintaining a high state of situational awareness and planning as far in advance as flight conditions permit, the single pilot manages the cockpit by exception; anticipation and planning for events rather than reacting to them.

Situational awareness is a function of human factors (fatigue, stress, medication, alcohol and health); personality traits (machismo, invulnerability, impulsiveness, antiauthoritivism, defeatism and a "GO" mentality); and the sum of all external forces. Unfortunately, these same human factors, personality traits and external stressors tend to mask recognition of what is happening. Loss of situational awareness is communicated by indicators that make up a list of exceptions. If certain items on the list are not happening, situational awareness is high; if items begin to manifest themselves, the situation is becoming clouded.

The nine indicators are a means of measuring the level of situational awareness and recognizing when it is beginning to breakdown.

Ambiguity - sources of information disagree.

Case #1: *Disaster was averted in a 1994 incident involving a Cessna 208 on an approach into Salt Lake City, Utah. Though cleared to "descend seven thousand five hundred feet" (7,500 ft), the pilot believed he had heard "five thousand feet" (5,000ft) and began descent through mountainous terrain on ILS 34R. However, that altitude* *was 773 feet above the airport elevation. Fortunately, the aircraft broke out of the clouds in time for the pilot to see the terrain and enter a climb.*

Preoccupation - Fixation on a particular task.

Case #2: *The flight of a Cessna Centurion P-210 approaching Fallon, Nevada, turned fatal when the pilot-in-command was more focused on scheduling a hotel and rental car from the Fallon FBO than on flight parameters while on approach. The existing altimeter setting approximately 40 minutes prior to arrival at Fallon was 29.65 at his cruise altitude of 12,000 ft. As ATC began vectoring the pilot onto the VOR-B approach, the pilot changed radio frequencies and began speaking with the Fallon FBO on securing the hotel and car rental while flying the approach somewhat haphazardly. An ATC radar display of his flight track showed the Centurion S-turning along the approach course.*

One minute prior to the incident, the pilot returned back to ATC only to receive an immediate altitude alert. The pilot attempted to begin a climb when he impacted the ground at 110 KIAS. Post accident review of the incident showed the altimeter setting to be 29.65 when the actual reading was 29.90. The pilot never listened to the AWOS and never adjusted the altimeter which would have shown him that he was 230 ft. low on approach. From the start of the approach until impact, the pilot was speaking with Fallon FBO for 2 ½ minutes.

Not Communicating - Not asking for or offering input and/or speaking without listening.

Case #3: *The pilot of a Cirrus SR-22 enroute from Dubuque, Iowa to Teterboro, New Jersey ended up with a 2-year license suspension for failure to 'see and avoid' and penetration into a non-transgression area. Conditions were VFR, visibility unlimited. Approximately 40 NM prior to TEB, ATC called "Traffic at 11:00, Boeing 737 at 12 miles inbound to Newark same altitude and at 11:00 Boeing 777 at 23 miles inbound Newark, both a same altitude". The Cirrus pilot called "No Joy. But I have them on the 'fish finder'" Traffic in the New York Class Bravo airspace was congested so ATC expected pilots to 'listen up' when navigating in the area. Several minutes passed when ATC issued " Traffic at 10:30, 8 miles 5,300 descending; Traffic 11:00, 17 miles same altitude." The Cirrus pilot again called "No Joy." ATC suggested a heading away from traffic and received no response from the Cirrus. Instead, the Cirrus turned toward TEB and began descent passing through the approach corridor of Newark and in front of the arriving Boeing 737. ATC issued 'Traffic Alert. Turn right heading 120, climb and maintain 3000.' No response from the Cirrus pilot. The arriving Boeing 737 aborted the approach and went around.*

Two miles from TEB, the Cirrus pilot contact the tower. Not only had the Cirrus pilot failed to 'see and avoid'; not only had he forced a Boeing full of passengers to go-around; not only had he failed to monitor communications or ask for assistance of any kind; but he violated the airspace of both Newark and Teterboro.

Confusion - feeling uncertain about a situation. Unsure of what to do next.

Case #4: *A pilot who held an Airline Transport Pilot (ATP) certificate and who was also a CFI with a total of 10,000 hours of flight time, became confused while navigating with an iPAD and failed to realize he had penetrated Class D airspace until he visually sighted the airport. He had a new iPad with scanned sectional chart (not current) and a paper chart (current). The pilot had his VOR radios set correctly and an on-board Garmin 430 which was also programmed and displaying correctly and he should have avoided the airspace without any doubt. But because his iPad was new and, of course, 'State-of-the-Art', he placed his trust in the iPad. That earned him a 6 month suspension.*

Violating Minimums - Exceeding established limits.

Case #5: *A Cessna Caravan pilot with 1700 hours in type and an ATP, was holding on the ground at Arlington, Washington waiting for fog burn-off so as to deliver inbound cargo to Airborne Express at Boeing Field, Washington*. *After 2 hours of waiting, the pilot decided to 'scud run' around Puget Sound to get to Boeing Field. After all, according to the pilot, he had done it many times before without incident.*

Departing Arlington and flying the bay area at 200 AGL, he made his fateful turn toward Boeing Field over Whidbey Island and found the only obstacle that posed a threat – a 317 foot communication tower.

Not Flying the Aircraft - Failure to monitor the auto pilot.

Case #6: *On the afternoon of April 28, 2009, a Cirrus SR22 took off into a 200-foot overcast from Cleveland's Cuyahoga County Airport. It crashed four and a half minutes later, killing both on board. The pilot acknowledged the tower controller's hand-off, but never made contact with departure control.*

The Cirrus was cleared to take off from Runway 6 with instructions to fly runway heading and climb to 3,000 feet msl. Data recovered from its avionics suite showed that it began turning right almost immediately. The right turn continued through about 540 degrees—one and a half complete revolutions—before the airplane finally rolled out on a southerly heading. It then climbed from 1,200 feet msl to 2,700 feet msl in 17 seconds as its airspeed decayed to 50 knots before it fell back to 1,600 feet msl, reversing heading yet again.

During the next two minutes, it climbed and dropped two more times, reaching a peak altitude of 3,200 feet msl. Pitch angle ranged from 50-degrees nose up to 60-degrees nose down and airspeed varied between 50 knots and 172 kt. Bank angles reached 75 degrees. The final data point showed the airplane pitched 30 degrees nose down and partially inverted, banked 120 degrees over the right wing.

The data logger also recorded that the autopilot was engaged about five seconds after takeoff at an altitude of 940 feet msl, just 61 feet above field elevation. However, *instead of altitude preselect mode (already programmed for 3,000 feet with an 850 fpm rate of climb), it was set for altitude hold. This automatically set the altitude bug to 940 feet msl, which the autopilot attempted to recapture as the airplane climbed. The series of inputs recorded during the subsequent oscillations led the NTSB to conclude that "the pilot never adequately regained control of the airplane" while attempting to reset the altitude and heading bugs.*

Failure to Set or Meet Targets - Aircraft performance. Failure to set performance limits and adhere to flight parameters.

Case #7: *On June 30th, 2012 a pilot flying a Stinson 108 crashed shortly after takeoff from the Bruce Meadow's Airport (U63), Idaho. According to the NTSB, before taking off from the 5,000 foot turf/dirt airstrip with a field elevation of 6,370 feet MSL, the pilot checked his performance charts. He calculated that the density altitude was about 9,200 feet.*

Based on the takeoff chart, the maximum field elevation for calculating takeoff is 6,000', 370 feet lower than the actual field elevation. While you can't extrapolate a chart for performance calculations, it's clear the pilot needed nearly all of the 5,000' runway for takeoff in a no-wind situation (it was 81 degrees at the time).

Worse yet, the pilot also noted that at the time of departure, the wind was from 030 degrees at 10 knots, with gusts to 20 knots. This was a nearly direct tailwind for the takeoff from runway 23. In most light aircraft, takeoff distance increases by 10% for each 2 knots of tailwind. The takeoff run for this departure direction would have taken approximately 50% more distance with a sustained 10 knot tailwind. And that doesn't take gust factor into consideration.

Not Addressing Discrepancies - Unresolved confusion. Questions and concerns with no answers.

Case #8: *A pilot of a Pilatus PC-12, with an ATP Certificate and 9,400 hours flight time was terminated and subsequently sued by his parent company for failure to report a propeller strike in Somerville, New Jersey. According to an NTSB interview with the pilot, he reported that while taxiing for takeoff at Somerset airport, he felt what he called a 'bump' just prior to the runway. The pilot performed a lengthy, pre-takeoff check and observed nothing out of the ordinary. The pilot departed and reported no anomalies while enroute to Atlantic City.*

While tied-down at Atlantic City, Boreman Aviation performed a monthly, interim maintenance check and discovered all propeller blade tips of the Pilatus were curled backward by 3 inches and small shards of aluminum were embedded in the blades. Upon further inspection, Boreman found the propeller shaft to be sheared through and the #1 shaft bearing destroyed. This was further confirmed by large shards of metal coating the forward chip detector of the engine. The entire forward half of the turbine engine including the propeller were deemed unrepairable.

Further inquiries were made to Somerset FBO. A ramp worker performed a runway and taxiway check and noticed a lighted, taxiway sign enclosure had one corner sheared away with ripped aluminum pieces splayed across the ground. Comparison of the Somerset aluminum and the shards found in the propeller were identical.

Violating Standard Operating Procedures - Conducting flights using personal, flying rules and procedures rather than following established rules and procedures.
Case #9: *A newly, minted cargo feeder pilot flying a PA31, crashed shortly after takeoff after failing to perform a required weight and balance. The NTSB determined the aircraft to be 670 pounds over-weight with an aft, center-of-gravity 7 inches beyond the aft limit established by the Piper Aircraft Corporation.*

The pilot was flying bank checks from Nashville, TN to Bowling Green, KY. The bank arrived late at the aircraft with 22 large bags of bank checks. The PA31 could only manage 17 bags maximum on any given day and the pilot stated as much. But the bank was adament about getting as many bags as possible on board because they were 'time sensitive'. The bank also pressured the pilot to 'load and go' since they were already behind schedule.

The pilot capitulated and just started throwing as many bags as he could into the aircraft without weighing any of the cargo. The pilot and the van driver had to lean hard into the cargo door just to get it closed and latched. The pilot started the aircraft, taxiied out and took off bound for Bowling Green.

Once the pilot left 'ground effect' and was climbing through approximately 700 ft, the aircraft began a subtle oscillation up and down that got progressively worse with each passing second. The pilot was trying to control the oscillations, but dynamic instabilty continued to progress. The aircraft impacted terrain 1.7 miles from the departure end of the runway.

Accidents are not the result of a single cause. Accidents occur because several indicators, as previously listed, are allowed to go unresolved and continue unchecked. Loss of situational awareness is evident when a accident takes place. Incidents become compounded until events exceed the capabilities of the pilot and/or the aircraft.

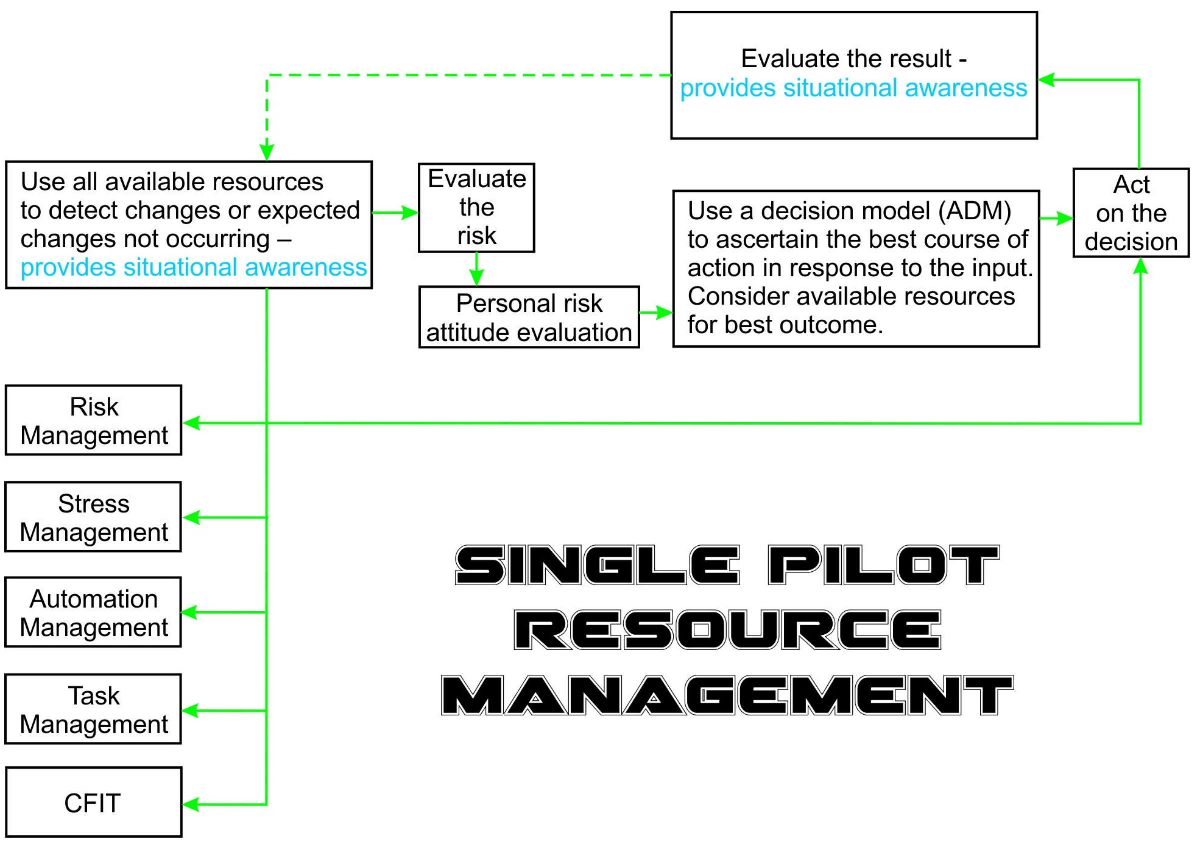
With the detection of one link in the chain-of-judgement, an accident might be avoided.

II. Aeronautical Decision Making (ADM)

SRM training teaches pilots appropriate decision-making strategies and risk-management techniques. Each flight has some level of risk to it and pilots should know how to do a risk assessment; how to reduce risk; and how to make decisions based on all available information.

Tradition held that good judgment was a natural by-product of experience, but as pilots continued to log accident-free flight hours, a corresponding increase of good judgment was assumed. Building upon the foundation of conventional decision-making, ADM enhances the process to decrease the probability of human error and increase the probability of a safe flight. ADM provides a structured, systematic approach to analyzing changes that occur during flight and how these changes might affect the safe outcome of a flight. The ADM process addresses all aspects of decision-making in the cockpit and identifies the steps involved in good decision-making.

1. Identify personal attitudes hazardous to safe flight.
2. Learn behavior modification techniques.
3. Learn how to recognize and cope with stress.
4. Develop risk assessment skills.
5. Use all available resources.
6. Evaluate the effectiveness of one’s ADM skills.



SRM is the art and science of managing all the resources (both inside and outside of the aircraft) to maintain situational awareness. Partial understanding and use of all resources reduces that awareness and increases a pilot's risk factor when operating in the flight environment. For this reason, the Aviation Safety Foundation developed several models and acronyms for those models for pilots to focus their attention.

A helpful way for a pilot to assess his/her situation as a single pilot is to utilize the concept of the 5 P's, which is a practical way to analyze the risks associated with flight elements. It relies on the pilot to adopt a 'scheduled' review of the critical variables at points in the flight where decisions are most likely to be effective.

1. **Plan** 2. **Plane** 3. **Pilot** 4. **Passengers** 5. **Programming**

The Plan: The 'Plan' includes the elements of cross-country planning, weather, route, fuel, publication currency and other related tasks for the flight mission. It should be reviewed and updated accordingly during the course of the flight. A delayed takeoff due to maintenance, weather and late arriving connection flights may radically alter the plan. The 'plan' is not only about the flight plan, but also all the events that surround the flight. The plan is always being updated and modified and is responsive to changes in the four remaining P's.

Weather is the largest chunk of any plan. The addition of datalink weather information gives the advanced avionics pilot a real advantage in inclement weather, but only if the pilot is trained to retrieve and analyze the weather in real time without infringing on situational awareness.

The Plane: The 'Plane' consists of a myriad of mechanical and cosmetic issues that every pilot can identify with. With the advent of advanced avionics, the 'plane' has evolved to include databases, automation, and emergency backup systems that had been absent not that long ago. Much has been written about single-pilot IFR flight with and without an autopilot. While use of this device is a personal decision it is just that – a decision. Low IFR in a non-autopilot equipped aircraft may depend on the other P's.

This focusses on the pilot who purely, refuses to fly in the IFR environment without an autopilot. He or she instinctively knows their proficiency level is low which points to a heightened risk factor that critically affects his or her situational awareness. Couple this with pilot currency level, and fatigue and risk assessment runs off the chart.

The Pilot: The pilot should assess himself with a risk assessment checklist and the I'M SAFE checklist, but should also assess currency and proficiency, as well as, the conditions of the flight in relation to his abilities and personal minimums.

The Passengers: On occasion, Martinaire Aviation does fly with passengers that are approved according to their Operating Specifications and General Operations

Manual. In that instance, the pilot may maintain a much more personal relationship with the individual sitting just two feet away; or be faced with challenges like illness, fear, discomfort, and other distractions. It is best for a pilot to plan for the passenger challenges ahead of time and brief them about what will occur.

The Programming: With the advent of advanced avionics, a new dimension has been added to the way aircraft are flown. Instrument displays, GPS, WAAS, and autopilots can reduce a pilot's workload and increase situational awareness. However, the advanced avionics must be completely understood and programmed correctly. The pilot who decidedly gets by with just a basic understanding increases the risk assessment and lowers the degree of situational awareness.

The advanced avionics also capture a pilot's attention and hold it for long periods of time and promote 'fixation'. To avoid this phenomena, the pilot should plan in advance when and where the programming of a flight plan, the approaches, route changes, and airport information should be accomplished, as well as, times it should not. Pilot familiarity with the equipment, the route, the local ATC environment and personal capabilities with regard to the automation should determine when, where, and how the automation is programmed.

The (3P) Model – Perceive, Process, Perform

The 3P model for ADM provides a simple, practical, and systematic approach that can be used during all phases of flight.

- Perceive the given set of circumstances for a flight.
- Process by evaluating their impact on flight safety.
- Perform by implementing the best course of action.

Use the 3P method as a continuous model for every aeronautical decision that you make. Even though pilots will inevitably make mistakes, anything you can do to minimize potential threats to your safety will make you a better pilot.

Risk Management

The goal of risk management is to proactively identify safety-related hazards and reduce the associated risks. When a pilot follows good decision-making practices, the inherent risk of a flight is reduced or even eliminated. The ability to make good decisions is based upon direct or indirect experience and education. Risk management decision-making involves six steps.

As you work through the decision making process, it is important to remember the four tenants of risk management.

1. Accept no unnecessary risk. Flying is not possible without risk, but unnecessary risk comes without a corresponding return.

2. Make risk decisions at the appropriate level. Risk decisions should be made by the person who can develop and implement risk controls. As pilot-in-command, never let anyone else – not ATC or passengers – make risk decisions for you.

3. Accept risk decisions when benefits outweigh dangers. A day with VFR conditions is a much better day to fly an unfamiliar airplane for the first time than a day with low IFR.

4. Integrate risk management into planning at all levels. Risk is an unavoidable part of every flight. Safety requires the use of appropriate and effective risk management in all stages of the flight.

Hazards and Risk: Hazard is a real or perceived condition, event, or circumstance that a pilot encounters. When a hazard presents itself, the pilot makes an assessment of that hazard based upon various factors. The pilot assigns a value to the potential impact of the hazard which qualifies the pilot's assessment of the hazard – risk.

Risk is an assessment of the single or cumulative hazard facing a pilot; however, different pilots see hazards differently. For example, during a flight in icing conditions, a seasoned, Caravan pilot muddles through the flight to his destination without incident having encountered intermittent, light to moderate rime ice along the route. He had analyzed all weather data pertaining to the flight and with all deice, anti-ice systems working, he evaluated the risk to be low.

The inexperienced pilot with little or no icing experience may see the risk as high and cancel his flight.

Elements or factors affecting individuals are different and keenly impact decision-making. These are called human factors and can transcend education experience, health, physiological aspects, etc.

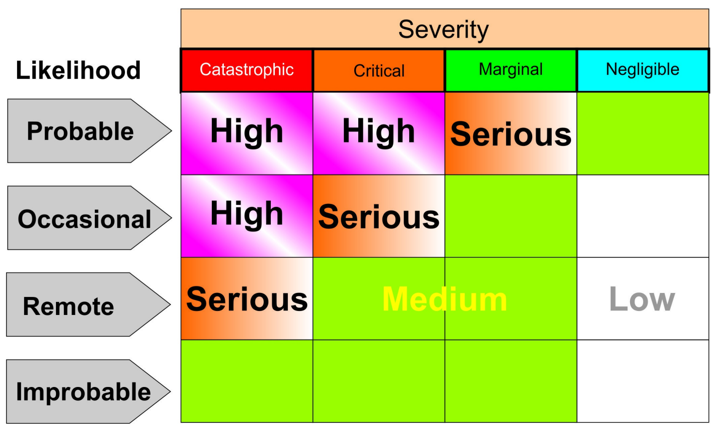
Hazardous Attitudes: Attitude is a motivational predisposition to respond to people, situations, or events in a given manner. Hazardous attitudes contribute to poor pilot judgement but can be counteracted by redirecting the attitude so that correct action can be taken. Recognition of hazardous thoughts is the first step toward neutralizing them. After recognizing the thought, the pilot should label it as hazardous, then state the corresponding antidote. Antidotes should be memorized for each hazardous attitude so they come to the forefront when needed.

Assessing Risk: For the single-pilot, assessing risk is far from simple. The pilot acts as his or her own quality control in making decisions. Most pilots are goal oriented and when asked to accept a flight, there is a tendency to deny personal limitations while adding weight to issues not germane to the mission. The single pilot who has no other crew member for consultation must wrestle with the intangible factors that draw one into a hazardous position.

Examining the National Transportation Safety Board (NTSB) reports and other accident research can help a pilot learn to assess risk more effectively. For example, the accident rate for Commercial, Single-Engine, Fixed Gear was 63.9% in 2017 with 2 of the accidents fatal. The accident rate was highest in Day VMC for Commercial Rated pilots. That statistic dropped off precipitously to 27.8% for pilots ATP rated. The data suggest that commercial pilots had lower personal minimums for the first 500 flight hours. The accident rate continued to decline as pilots gained more experience and crossed the 1000 flight hour mark.

Several risk assessment models are available to assist the process of assessing risk. The models take different approaches, but seek a common goal of assessing risk in an objective manner.

Risk Assessment Matrix



Likelihood is taking a situation and determining the probability of its occurrence. It is rated as probable, occasional, remote or improbable.

Probable - *an event will occur several times.*

Occasional - *an event will probably occur sometime.*

Remote - *an event is unlikely to occur, but is possible.*

Improbable - *an event is highly unlikely to occur.*

The next element is the severity or consequence of a pilot’s action(s). It can relate to injury and/or damage.

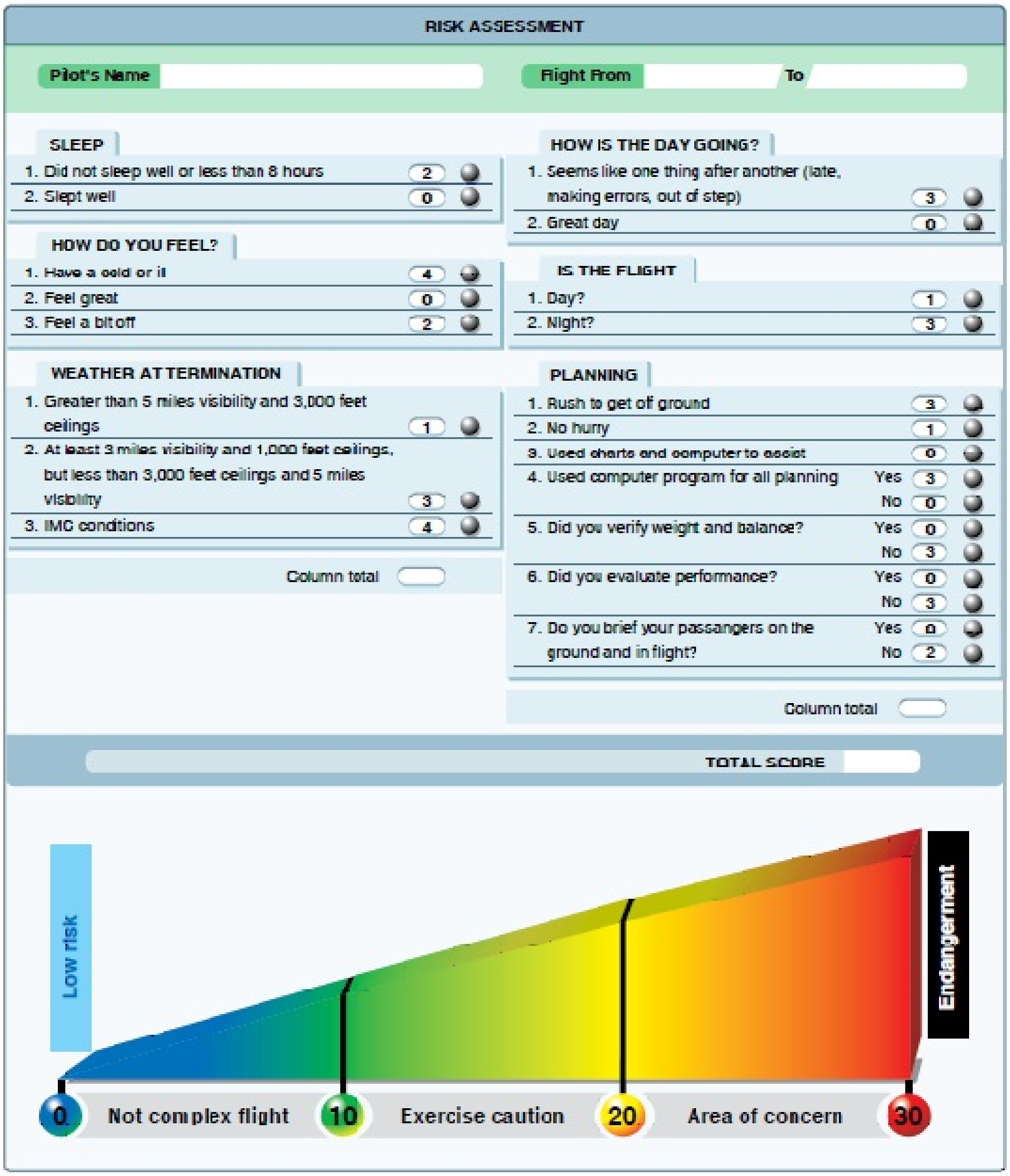
Catastrophic - *results in fatalities, total loss.*

Critical - *severe injury, major damage.*

Marginal - *minor injury, minor damage.*

Negligible - *less than minor injury, less than minor system damage.*

Although this matrix provides a general viewpoint of a generic situation, a more comprehensive program can be made that is tailored to a pilot's flying.



RISK ASSESSMENT

Pilot's Name | Flight From | To

SLEEP	
1. Did not sleep well or less than 8 hours	2
2. Slept well	0

HOW DO YOU FEEL?	
1. Have a cold or ill	4
2. Feel great	0
3. Feel a bit off	2

WEATHER AT TERMINATION	
1. Greater than 5 miles visibility and 3,000 feet ceilings	1
2. At least 3 miles visibility and 1,000 feet ceilings, but less than 3,000 feet ceilings and 5 miles visibility	3
3. IMC conditions	4

Column total

HOW IS THE DAY GOING?	
1. Seems like one thing after another (late, making errors, out of step)	3
2. Great day	0

IS THE FLIGHT	
1. Day?	1
2. Night?	3

PLANNING		
1. Rush to get off ground		3
2. No hurry		1
3. Used charts and computer to assist		0
4. Used computer program for all planning	Yes	3
	No	0
5. Did you verify weight and balance?	Yes	0
	No	3
6. Did you evaluate performance?	Yes	0
	No	3
7. Do you brief your passangers on the ground and in flight?	Yes	0
	No	2

Column total

TOTAL SCORE

Example of a more comprehensive risk assessment form.

Mitigating Risk - The 'IMSAFE & PAVE' Checklists: Risk assessment is only part of the equation. Once the level of risk is determined, the pilot needs to lessen the degree of risk. One of the best ways to mitigate risk related to physical and mental readiness is to use the IMSAFE checklist.

1. ***I - Illness***

The FAA requires most pilots to possess a valid medical certificate for flight, but the occasional medical exam every five years doesn't cover illness such as colds and flu. In the interest of safety, the FAA does regulate this topic loosely by stating that if a pilot has or develops a known medical condition that would prevent him from obtaining a medical certificate, he is prohibited from flying as a required crewmember (FAR 61.53).

Also, FAR 91.3 states that the pilot in command is directly responsible for the operation of the flight. The pilot alone is responsible for ensuring his health is up to par before taking the controls.

Colds, allergies, and other common illnesses can cause problems for pilots. From sinus pressure to general malaise, pilots can easily become more of a risk to the flight than an asset.

Before flying, pilots should think about recent or current illnesses that might affect flight. After the coughing and sneezing subside, a pilot might feel well enough to fly but could still have trouble performing the Valsalva maneuver, for example, which equalizes the pressure inside of his ears.

2. **M - Medication**

With illness, it's mostly clear when a pilot should or shouldn't fly. But with illness comes medication, and all medications should be scrutinized by both the pilot and his or her doctor before taking it. Many prescription and over-the-counter medications can be dangerous for a pilot to take before flying.

If medication is necessary, pilots should discuss the specific effects of the medication with an aviation medical examiner to determine if it causes mental or physical impairment that would interfere with the safety of flight. Then, pilots need to be aware of residual effects of both short-term and long-term use of medications. Even after the medication has been stopped, the effects of it may remain in the body for some time.

So how long should you wait after taking medication to fly? Well, that depends on the drug itself, but the FAA recommends waiting until at least five dosage periods have passed. If the medication is taken once a day, for example, you would wait five days before flying again.

3. **S - Stress**

There are at least three kinds of stress that pilots should be aware of: Physiological, environmental and psychological stress.

Physiological stress is stress in the physical sense. It comes from fatigue, strenuous exercise, being out of shape or changing time zones, to name a few. Unhealthy eating habits, illness, and other physical ailments are included in this category, too.

Environmental stress comes from the immediate surroundings and includes things such as being too hot or too cold, inadequate oxygen levels or loud noises.

Psychological stress can be more difficult to identify. This category of stress includes anxiety, social and emotional factors and mental fatigue. Psychological stress can occur for many reasons such as divorce, family problems, financial troubles or just a change in schedule.

A small level of stress can be a good thing, as it keeps pilots aware and on their toes. But stress can accumulate and affect performance. Also, everyone handles stress differently. A source of anxiety for one person might be a fun challenge for another person. It's important for pilots to be able to recognize and evaluate their stressors so they can mitigate risk.

4. **A - Alcohol**

There's no doubt that alcohol and flying don't mix. Alcohol abuse affects the brain, eyes, ears, motor skills and judgment, all of which are necessary components to safe flight. Alcohol makes people dizzy and sleepy which decreases reaction time.

The rules surrounding the use of alcohol while flying are clear: FAR 91.17 prohibits the use of alcohol within the 8 hours before flying, while under the influence of alcohol, or with a blood alcohol content of .04% or greater. The FAA recommends that pilots wait at least 24 hours after drinking to get behind the controls.

A pilot should remember, though, that they can follow the "8 hours from bottle to throttle" rule and still not be fit to fly. Hangovers are dangerous in the cockpit, too, with effects similar to being drunk or ill: Nausea, vomiting, extreme fatigue, problems focusing, dizziness, etc.

5. **F - Fatigue**

Pilot fatigue is a difficult problem to address completely, as fatigue affects everyone differently. Some people can function well with little sleep; others don't perform well at all without at least ten hours of sleep per night. There's no medical way to address the sleep issue with pilots -- each pilot must be responsible for knowing his or her limitations.

The effects of fatigue are cumulative, meaning that small sleep deprivations over time can be dangerous for pilots. Pilots should also take into account time changes, jet lag and day/night scheduling options when managing fatigue.

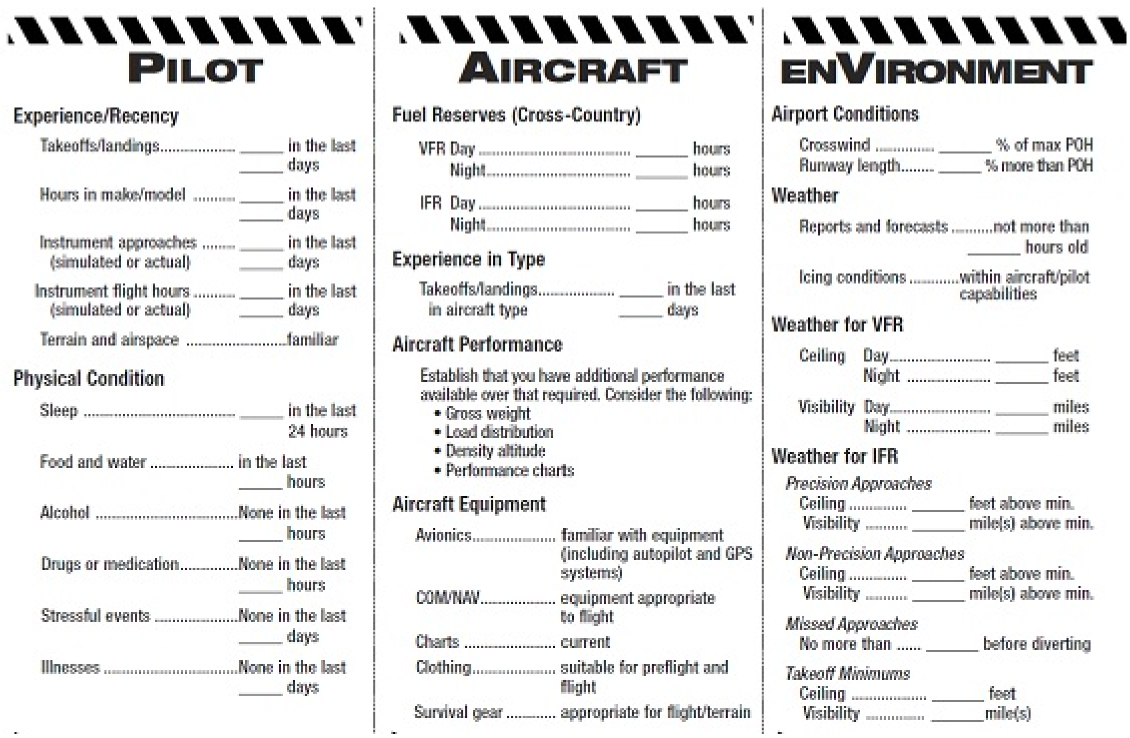
Although there are FAA regulations and company policies for commercial pilots to help manage fatigue, the responsibility for safety lies with the pilot alone.

6. **E - Emotion**

For some people, emotions can get in the way of behaving in a safe, productive manner. Pilots should ask themselves if they are in an emotionally stable state of mind before departing. Emotions can be subdued and managed most of the time, but they can also resurface easily, especially when faced with a stressful situation.

Most of the time, this type of self-assessment is hard, but pilots need to try to maintain an objective view of themselves to assess their behavior and emotions in a safe way. For example, if a pilot notices that he is unusually angry or impatient while preparing for a flight, he may want to reconsider flying.

Another way to lower risk potential is to perceive hazards. By incorporating the '**P**ilot, **A**ircraft, en**V**ironment, and **E**xternal pressures' checklist into preflight planning, the pilot can decide whether the risk, or combination of risks can be managed safely and successfully.



PILOT

Experience/Recency
- Takeoffs/landings .... _____ in the last _____ days
- Hours in make/model .... _____ in the last _____ days
- Instrument approaches (simulated or actual) .... _____ in the last _____ days
- Instrument flight hours (simulated or actual) .... _____ in the last _____ days
- Terrain and airspace .... familiar

Physical Condition
- Sleep .... _____ in the last 24 hours
- Food and water .... in the last _____ hours
- Alcohol .... None in the last _____ hours
- Drugs or medication .... None in the last _____ hours
- Stressful events .... None in the last _____ days
- Illnesses .... None in the last _____ days

AIRCRAFT

Fuel Reserves (Cross-Country)
- VFR Day .... _____ hours
- Night .... _____ hours
- IFR Day .... _____ hours
- Night .... _____ hours

Experience in Type
- Takeoffs/landings in aircraft type .... _____ in the last _____ days

Aircraft Performance

Establish that you have additional performance available over that required. Consider the following:
- Gross weight
- Load distribution
- Density altitude
- Performance charts

Aircraft Equipment
- Avionics .... familiar with equipment (including autopilot and GPS systems)
- COM/NAV .... equipment appropriate to flight
- Charts .... current
- Clothing .... suitable for preflight and flight
- Survival gear .... appropriate for flight/terrain

ENVIRONMENT

Airport Conditions
- Crosswind .... _____ % of max POH
- Runway length .... _____ % more than POH

Weather
- Reports and forecasts .... not more than _____ hours old
- Icing conditions .... within aircraft/pilot capabilities

Weather for VFR
- Ceiling Day .... _____ feet
- Night .... _____ feet
- Visibility Day .... _____ miles
- Night .... _____ miles

Weather for IFR

Precision Approaches
- Ceiling .... _____ feet above min.
- Visibility .... _____ mile(s) above min.

Non-Precision Approaches
- Ceiling .... _____ feet above min.
- Visibility .... _____ mile(s) above min.

Missed Approaches
- No more than .... _____ before diverting

Takeoff Minimums
- Ceiling .... _____ feet
- Visibility .... _____ mile(s)

The '**E**', external pressures, are influences external to the flight that create a sense of pressure to complete a flight and often at the expense of safety. Factors that can be deemed external include:

- Someone waiting for the flight's arrival.
- Desire to demonstrate pilot qualifications.
- Desire to impress someone.
- Desire to satisfy a specific, personal goal (e.g. 'Get-there-itis')
- Pilot's general goal-completion orientation.

Develop a clear and comprehensive awareness of your particular situation. For each element, as 'what could hurt me, myself or my aircraft'.

Human Behavior: Studies of human behavior have tried to determine an individual's predisposition to taking risks and the individual's involvement in accidents. In 1951, a study regarding injury-prone children was published by the University of Minnesota. The study comprised two, separate groups of second grade students. 55 students were considered accident repeaters and 48 students had no accidents.

The accident-free group showed a superior knowledge of safety, was considered industrious and cooperative with others, but were not considered physically inclined. The accident-repeater group had better gymnastic skills, were considered aggressive and impulsive, demonstrated rebellious behavior when under stress, were poor losers, and liked to be the center of attention.

This is clearly an inaccurate inference. Pilots are drawn from the general population and exhibit a myriad of personality traits. Thus, it is important that good decision-making skills be taught to all pilots.

The successful pilot possesses the ability to concentrate, manage workloads, and monitor and perform several tasks simultaneously. The successful pilot also does not stop learning and improving. Some of the latest psychological screenings used in aviation test applicants for their ability to multitask, measuring both accuracy, as well as the individual's ability to focus attention on several subjects simultaneously. The FAA oversaw an extensive research study on the similarities and dissimilarities of accident-free pilots and those who were not. The project surveyed over 4,000 pilots, half of whom had "clean" records while the other half had been involved in an accident.

Five traits were discovered in pilots prone to having accidents. These pilots:

- Have disdain toward rules

- Have very high correlation between accidents on their flying records and safety violations on their driving records

• Frequently fall into the “thrill and adventure seeking” personality category

• Are impulsive rather than methodical and disciplined, both in their information gathering and in the speed and selection of actions to be taken

• Have a disregard for or tend to under utilize outside sources of information, including copilots, flight attendants, flight service personnel, flight instructors, and ATC

III. Task Management

Effective workload management ensures essential operations are accomplished by planning, prioritizing, and sequencing tasks to avoid work overload. As experience is gained, a pilot learns to recognize future workload requirements and can prepare for high workload periods during times of low workload. Reviewing the appropriate chart and setting radio frequencies well in advance of when they are needed helps reduce workload as the flight nears the airport. In addition, a pilot should listen to ATIS, Automated Surface Observing System (ASOS), or Automated Weather Observing System (AWOS), if available, and then monitor the tower frequency or Common Traffic Advisory Frequency (CTAF) to get a good idea of what traffic conditions to expect. Checklists should be performed well in advance so there is time to focus on traffic and ATC instructions. These procedures are especially important prior to entering a highdensity traffic area, such as Class B airspace.

Recognizing a work overload situation is also an important component of managing workload. The first effect of high workload is that the pilot may be working harder but accomplishing less. As workload increases, attention cannot be devoted to several tasks at one time, and the pilot may begin to focus on one item. When a pilot becomes task saturated, there is no awareness of input from various sources, so decisions may be made on incomplete information and the possibility of error increases.

When a work overload situation exists, a pilot needs to stop, think, slow down, and prioritize. It is important to understand how to decrease workload. For example, in the case of the cabin door that opened in VFR flight, the impact on workload should be insignificant. If the cabin door opens under IFR different conditions, its impact on workload changes. Therefore, placing a situation in the proper perspective, remaining calm, and thinking rationally are key elements in reducing stress and increasing the capacity to fly safely. This ability depends upon experience, discipline, and training.

Remember the basic tenant – AVIATE, NAVIGATE, COMMUNICATE (ANC) – in that order! A break, interruption, distraction and/or performing ANC out-of-order greatly affects workload management and increases risk.

Avoid task fixation / tunneling – ‘the allocation of attention to a particular channel of information, diagnostic hypotheses, or task goal, for a duration that is longer than optimal, given the expected cost of neglecting events on other channels, failing to consider other hypotheses, or failing to perform other tasks.’ Part of workload management is to determine how best to use resources, such as automation, to help complete flight tasks.

IV. Controlled Flight Into Terrain (CFIT)

The Federal Aviation Administration and Department of Transportation go to great lengths to provide topographic and obstacle information on chart publications, approach charts and terminal information to prevent aircraft from inadvertently encountering the earth, towers, and city infrastructures. Yet, controlled flight into terrain still occurs and in most situations, it is the fault of the pilot not managing resources, being situationally unaware, and relying on automation with limited knowledge.

Aeronautical charts and terminal procedures are to be reviewed during the planning of a flight to ensure the intended flight path avoids terrain and obstacles. On departures that encounter terrain and obstacles, alternate takeoff procedures, climb rates and aircraft performance guidelines must be reviewed and calculated to avoid the hazards. If aircraft automation allows for terrain displays, terrain awareness and warning systems (TAWS), and/or ground proximity warning systems (GPWS), the pilot must be thoroughly familiar with their function to maintain appropriate awareness and avoid terrain and obstacles.

A statistical review of TAWS accidents by the FAA and NTSB revealed alarming reasons behind flight into terrain by pilots of all grades and certificates. Many of the accidents can be attributed to human behavior and human factors. TAWS factors include:

- Failure to thoroughly review approach procedures in hazardous terrain.
- Failure to calculate aircraft performance, climb rates in hazardous terrain.
- Failure to set proper pressure settings.
- Extremely basic knowledge and understanding of on-board systems.
- Exceeding aircraft’s capabilities in high terrain, high density conditions.

The FAA creates obstacle departure procedures if obstacles require that a climb of more than 200 feet/nm be maintained for terrain separation. These procedures often will require that the aircraft be able to maintain a specified climb gradient steeper that the standard 200 feet/nm. Pilots are directed to consider the terrain in the vicinity of an airport and if a procedure is available, determine if it should be flown or if visual obstacle avoidance is possible.

Obstacle departure procedures may be flown without ATC clearance unless an alternate departure procedure or radar vectors specifically have been assigned. Obstacle clearance is not provided by ATC until the controller begins to provide navigational guidance in the form of radar vectors. Obstacle departure procedures are depicted in text, not graphic, format and are located in the front of Instrument Approach Plates; U.S. Terminal Procedures.

CFIT is often associated with low visibility, a low cloud deck, or nights in mountainous terrain. Downdrafts near mountains have also caused their fair share of CFIT. Approach these conditions with caution. Maintain a higher altitude than normal when flying at night. Flying over unlit areas at night should be avoided when possible. Thorough planning and weather briefings before flights can prevent encountering hazardous, low visibility conditions, day or night. Good situational awareness is key in these conditions.

V. Automation Management

Automation is the single most important advance in aviation technologies. Electronic flight displays (EFDs) have made vast improvements in how information is displayed and what information is available to the pilot. Pilots can access electronic databases that contain all of the information traditionally contained in multiple handbooks, reducing clutter in the flight deck.

Although automation has made flying safer, automated systems can make some errors more evident and sometimes hide other errors or make them less evident. This reliance on automation translates into a lack of basic flying skills that may affect the pilot’s ability to cope with an in-flight emergency, such as sudden mechanical failure. The worry that pilots are becoming too reliant on automated systems and are not being encouraged or trained to fly manually has grown with the increase in the number of MFD flight decks.

As automated flight decks began entering everyday line operations, instructors and check airmen grew concerned about some of the unanticipated side effects. Despite the promise of reducing human mistakes, the flight managers reported the automation actually created much larger errors at times. In the terminal environment, the workload in an automated flight deck actually seemed higher than in the older analog flight decks. At other times, the automation seemed to lull the flight crews into complacency. Over time, concern surfaced that the manual flying skills of the automated flight crews deteriorated due to over-reliance on computers. The flight crew managers said they worried that pilots would have less “stick-and-rudder” proficiency when those skills were needed to manually resume direct control of the aircraft.

A major study was conducted to evaluate the performance of two groups of pilots. The control group was composed of pilots who flew an older version of a common twin-jet airliner equipped with analog instrumentation and the experimental group was composed of pilots who flew the same aircraft, but newer models equipped with an electronic flight instrument system (EFIS) and a flight management system (FMS). The pilots were evaluated in maintaining aircraft parameters, such as heading, altitude, airspeed, glideslope, and localizer deviations, as well as pilot control inputs. These were recorded during a variety of normal, abnormal, and emergency maneuvers during 4 hours of simulator sessions.

Results: When pilots who had flown EFIS for several years were required to fly various maneuvers manually, the aircraft parameters and flight control inputs clearly showed some erosion of flying skills. During normal maneuvers, such as turns to headings without a flight director, the EFIS group exhibited somewhat greater deviations than the analog group. Most of the time, the deviations were within the practical test standards (PTS), but the pilots definitely did not keep on the localizer and glideslope as smoothly as the analog group.

The differences in hand-flying skills between the two groups became more significant during abnormal maneuvers, such as accelerated descent profiles known as "slam-dunks." When given close crossing restrictions, the analog crews were more adept at the mental math and usually maneuvered the aircraft in a smoother manner to make the restriction. On the other hand, the EFIS crews tended to go "heads down" and tried to solve the crossing restriction on the FMS. [Figure 2-22]
Another situation used in the simulator experiment reflected real world changes in approach that are common and can be assigned on short notice. Once again, the analog crews transitioned more easily to the parallel runway's localizer, whereas the EFIS crews had a much more difficult time with the pilot going head down for a significant amount of time trying to program the new approach into the FMS.
While a pilot's lack of familiarity with the EFIS is often an issue, the approach would have been made easier by disengaging the automated system and manually flying the approach. At the time of this study, the general guidelines in the industry were to let the automated system do as much of the flying as possible. That view has since changed and it is recommended that pilots use their best judgment when choosing which level of automation will most efficiently do the task considering the workload and situational awareness.

Emergency maneuvers clearly broadened the difference in manual flying skills between the two groups. In general, the analog pilots tended to fly raw data, so when they were given an emergency, such as an engine failure, and were instructed to fly the maneuver without a flight director, they performed it expertly. By contrast, SOP for EFIS operations at the time was to use the flight director. When EFIS crews had their flight directors disabled, their eye scan again began a more erratic searching pattern and their manual flying subsequently suffered.

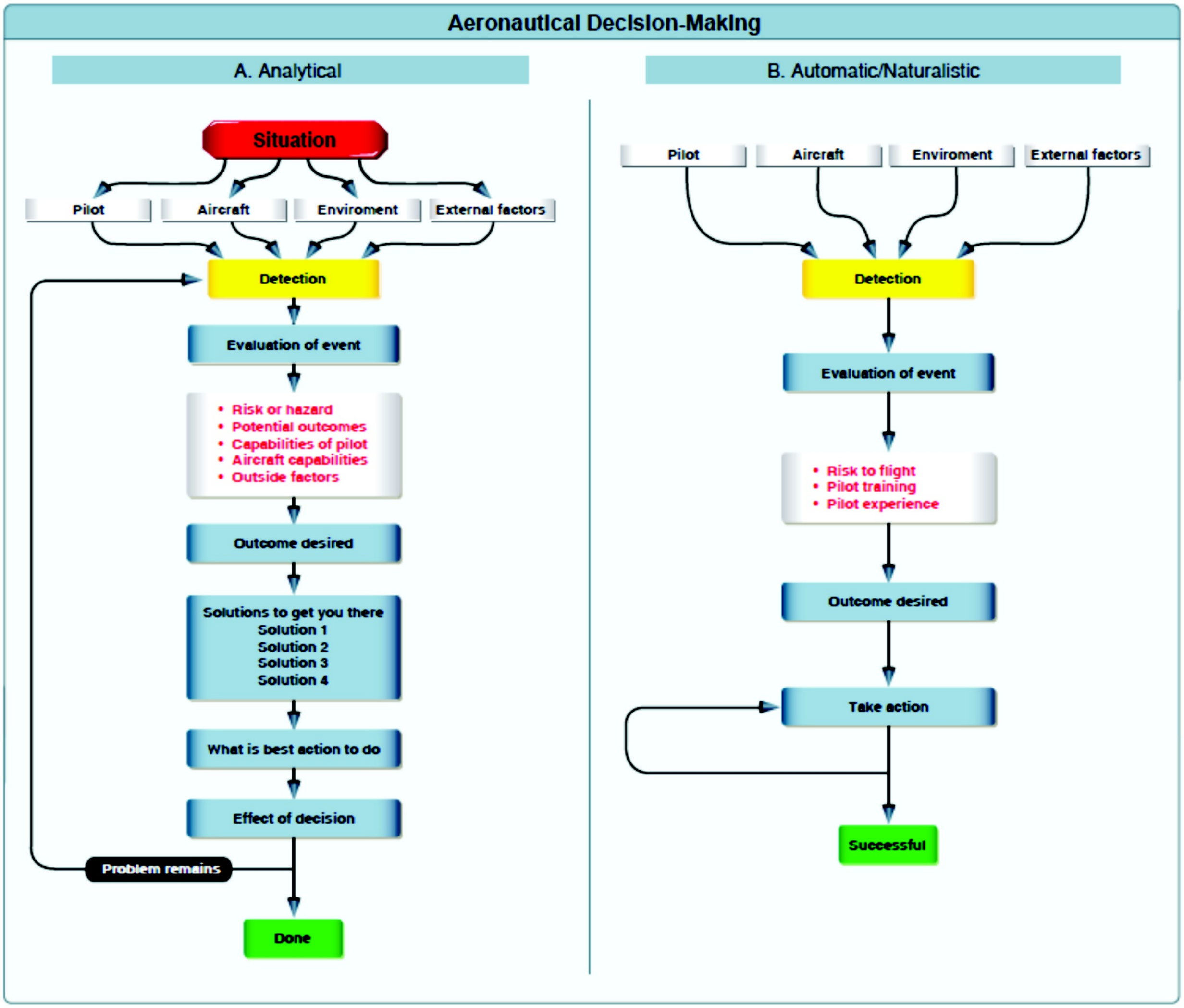
Those who reviewed the data saw that the EFIS pilots who better managed the automation also had better flying skills. While the data did not reveal whether those skills preceded or followed automation, it did indicate that automation management needed to be improved. Recommended "best practices" and procedures have remedied some of the earlier problems with automation.

Pilots must maintain their flight skills and ability to maneuver aircraft manually within the standards set forth in the PTS. It is recommended that pilots of automated aircraft occasionally disengage the automation and manually fly the aircraft to maintain stick-and-rudder proficiency. It is imperative that the pilots understand that the EFD adds to the overall quality of the flight experience, but it can also lead to catastrophe if not utilized properly. At no time is the moving map meant to substitute for a VFR sectional or low altitude en route chart.

Autopilot Systems: In a single-pilot environment, an autopilot system can greatly reduce workload. As a result, the pilot is free to focus his or her attention on other flight deck duties. This can improve situational awareness and reduce the possibility of a CFIT accident. While the addition of an autopilot may certainly be considered a risk control measure, the real challenge comes in determining the impact of an inoperative unit. If the autopilot is known to be inoperative prior to departure, this may factor into the evaluation of other risks.

For example, the pilot may be planning for a VHF omnidirectional range (VOR) approach down to minimums on a dark night into an unfamiliar airport. In such a case, the pilot may have been relying heavily on a functioning autopilot capable of flying a coupled approach. This would free the pilot to monitor aircraft performance. A malfunctioning autopilot could be the single factor that takes this from a medium to a serious risk. At this point, an alternative needs to be considered. On the other hand, if the autopilot were to fail at a critical (high workload) portion of this same flight, the pilot must be prepared to take action. Instead of simply being an inconvenience, this could quickly turn into an emergency if not properly handled. The best way to ensure a pilot is prepared for such an event is to carefully study the issue prior to departure and determine well in advance how an autopilot failure is to be handled.

Equipment Use: Pilot familiarity with all equipment is critical in optimizing both safety and efficiency. If a pilot is unfamiliar with any aircraft systems, this will add to workload and may contribute to a loss of situational awareness. This level of proficiency is critical and should be looked upon as a requirement, not unlike carrying an adequate supply of fuel. As a result, pilots should not look upon unfamiliarity with the aircraft and its systems as a risk control measure, but instead as a hazard with high risk potential. Discipline is key to success.



The DECIDE model

1. **Detect.** The decision maker detects the fact that change has occurred.
2. **Estimate.** The decision maker estimates the need to counter or react to the change.
3. **Choose.** The decision maker chooses a desirable outcome (in terms of success) for the flight.
4 **Identify.** The decision maker identifies actions which could successfully control the change.
5. **Do.** The decision maker takes the necessary action.
6. **Evaluate.** The decision maker evaluates the effect(s) of his/her action countering the change.

Operational Pitfalls
Peer pressure Poor decision-making may be based upon an emotional response to peers, rather than evaluating a situation objectively.
Mindset A pilot displays mind set through an inability to recognize and cope with changes in a given situation.
Get-there-itis This disposition impairs pilot judgment through a fixation on the original goal or destination, combined with a disregard for any alternative course of action.
Duck-under syndrome A pilot may be tempted to make it into an airport by descending below minimums during an approach. There may be a belief that there is a built-in margin of error in every approach procedure, or a pilot may want to admit that the landing cannot be completed and a missed approach must be initiated.
Scud running This occurs when a pilot tries to maintain visual contact with the terrain at low altitudes while instrument conditions exist.
Continuing visual flight rules (VFR) into instrument conditions Spatial disorientation or collision with ground/obstacles may occur when a pilot continues VFR into instrument conditions. This can be even more dangerous if the pilot is not instrument rated or current.
Getting behind the aircraft This pitfall can be caused by allowing events or the situation to control pilot actions. A constant state of surprise at what happens next may be exhibited when the pilot is getting behind the aircraft.
Loss of positional or situational awareness In extreme cases, when a pilot gets behind the aircraft, a loss of positional or situational awareness may result. The pilot may not know the aircraft's geographical location or may be unable to recognize deteriorating circumstances.
Operating without adequate fuel reserves Ignoring minimum fuel reserve requirements is generally the result of overconfidence, lack of flight planning, or disregarding applicable regulations.
Descent below the minimum en route altitude The duck-under syndrome, as mentioned above, can also occur during the en route portion of an IFR flight.
Flying outside the envelope The assumed high performance capability of a particular aircraft may cause a mistaken belief that it can meet the demands imposed by a pilot's overestimated flying skills.
Neglect of flight planning, preflight inspections, and checklists A pilot may rely on short- and long-term memory, regular flying skills, and familiar routes instead of established procedures and published checklists. This can be particularly true of experienced pilots.

Stressors
Environmental Conditions associated with the environment, such as temperature and humidity extremes, noise, vibration, and lack of oxygen.
Physiological stress Physical conditions, such as fatigue, lack of physical fitness, sleep loss, missed meals (leading to low blood sugar levels), and illness.
Psychological stress Social or emotional factors, such as a death in the family, a divorce, a sick child, or a demotion at work. This type of stress may also be related to mental workload, such as analyzing a problem, navigating an aircraft, or making decisions.