TRAIN LIKE YOU FLY

A FLIGHT INSTRUCTOR'S GUIDE TO SCENARIO-BASED TRAINING

Second Edition

Arlynn McMahon

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Foreword

Congratulations—by reading this book and following its tenets, you are standing on the leading edge of safety science. But your author, Arlynn McMahon, has been leading the way for some time now. This second edition of *Train Like You Fly* is the product of several decades of work to make flying as safe as possible and therefore as rewarding and fun as possible.

To my fellow flight instructors: Have you ever looked back and said to yourself, "if I knew then what I know now, I would have done things differently." Of course, we have all said that about decisions in life and flying. Well, Arlynn's scenarios help us place our students in decision situations that they will face in the future so that when they encounter those situations, they will know better what to do because they will have previously worked through the situations in the scenarios. Scenario-based training provides the safe hindsight that we otherwise would not have in a crunch. Experience is a great teacher; you can use the scenarios in this book (and tailor-make your own now that you know Arlynn's tricks) so that your flight instruction provides students with experience to draw on when you are not with them.

Flight instructors, aviation researchers and curriculum writers work every day to "train out" the next accident. It is challenging work, and the impact of the work is not always clear. The truth is that the NTSB cannot tally an accident that never happens. When a pilot takes what they have learned from scenarios they faced in training, and uses it to make a safe decision in real life—an accident is avoided. But it is difficult to link back and connect wise aeronautical decision-making to the specific program that produced that decision. It is hard to definitively give credit for the accident avoidance to any one particular teaching strategy—*but we know it when we see it.* We know that Arlynn's teaching strategies and her unique ability to give a voice to those strategies "trains out" accidents and saves lives.

You now have in your hand a powerful tool for safety. *Train Like You Fly* brings several decades of initiatives, research, and safety science together. This book builds on lessons learned from FAA/Industry Training Standards (FITS) and helps us apply safety management systems (SMS) and use the Airman Certification Standards (ACS). Now you are the beneficiary of this effort. You can *Train Like You Fly*.

Dr. Paul A. Craig
Professor of Aerospace and NASA Principal Aviation Investigator

Acknowledgments

It may seem coy to say, but this book truly could not have been written without the efforts of many people.

I dedicate this book to Charlie Monette, the flight instructor who gave me wings and who instilled in me a need to be the best. And who later married me and tolerated a new wife, distracted while completing this book—throughout our honeymoon, Thanksgiving and Christmas holidays.

I'd like to thank the many FAA and NASA scientists whose hard work is seldom recognized or appreciated in general aviation. Some will read this book and feel acknowledged, knowing that flight schools are finally "getting it." Some may read and be shocked to see how I've mutilated their examples in attempts to refashion something intended for airline into something for use in a general aviation flight school environment.

Last, I thank the many flight instructors whom I have had the opportunity to train and work with during my role as a Chief Instructor. They keep me on my toes, thinking forward, staying current and focused on the pilots who trust our school to make them safe.

Arlynn McMahon

A Note from the Author

I use the word "pilot" in lieu of "student" in consideration of the many doctors, lawyers, professionals, business owners and adult men and women who engage in flight training. They are commonly addressed as "sir" or "ma'am" in their office. I believe they deserve the same respect when paying for my service. Somehow, referring to a valued customer as a "student" seems belittling. I also recognize that some people receiving scenario-based training have already earned a pilot certificate. In this book I use "pilot" when referring to the person in training and "instructor" to refer to the person teaching. After all, we are all "students" of aviation in that pilots continue to learn well after the FAA certificate is awarded. The term "him" means "him or her." It's easier to read.

About the Author

Arlynn McMahon began her love of aviation as a youngster. She soloed on her sixteenth birthday; since that time her feet have rarely been on the ground. Arlynn is a graduate of Aero-Tech of Lexington, Kentucky, and of Embry-Riddle Aeronautical University.

Arlynn has helped more than 1,000 students and CFIs fulfill their dreams of flight since she joined Aero-Tech as an instructor in 1984. A career flight instructor, she recently completed a MBA in Strategic Leadership from Amberton University. Today she serves as Aero-Tech's Vice President and Training Centers Manager, responsible for all pilot training and flight activities. She is an active FAA Accident Prevention Counselor, 1991 FAA Regional Flight Instructor of the Year, 2009 CFI of the Year, and 2009 recipient of the NATA Award for Excellence in Pilot Training.

Arlynn specializes in teaching aeronautical decision-making and cockpit-risk management to the aircraft owner/nonprofessional pilot. She is a guest speaker at many aviation safety seminars and functions. Arlynn holds an Airline Transport Pilot for multi-engine privileges and a Commercial Pilot Certificate for single engine privileges. She is an FAA Gold Seal and NAFI Master Instructor, with CFI, CFII, MEI, AGI, and over 10,000 accident-free hours, including 7,000 hours dual given. She is a Designated Sport Pilot Examiner and a FAAST Representative. In 2006, Arlynn married her flight instructor and best friend, Charlie Monette. When not in a cockpit, they share sailing, scuba diving and all types of fun in the sun.

Arlynn is also the author of *Lesson Plans: to Train Like You Fly* and *The Flight Instructor's Survival Guide*.

Introduction

How did we get to this point in the pursuit of making flying as safe as possible?

Just as aircraft and avionics manufacturers have worked to provide us with safe aircraft and systems, flight instructors, aviation educators, and curriculum writers have been hard at work as well—providing the training methods, concepts and tools for flying in the twenty-first century.

From the time of the Wright Brothers to the 1960s, safety issues in aviation were mainly related to technical problems. Airplanes and their systems did not always work as planned. Accident investigation focused on technical failures of the machine. This was the Technical Era. Eventually, however, our airplanes became more dependable and maintenance-related accidents declined—but total accidents did not decline because humans make mistakes. The focus changed from the machine to pilot error, and the Human Factors Era began. From the 1970s to the mid-1990s, safety initiatives were aimed at the individual. Personal decision checklists such as "PAVE" (Pilot, Aircraft, enVironment, External Pressures) were designed to help pilots help themselves in making wise aeronautical decisions. On airline flight decks, the concept of cockpit resource management was introduced. Communication among crewmembers was emphasized so that, as a team, human error was reduced. But whether flying single pilot in a general aviation airplane or as part of an airline flight crew, the focus of the Human Factors Era was on the people in the airplane.

From the mid-1990s to the present, safety science has taken a broader view. Safety is no longer confined just to the airplane. Today, safety is an encompassing culture that extends outside the airplane, across the flight line and into the front office. We now live in the Organizational Era of safety. This concept of safety is a top-down management perspective. This concept launched the safety management system (SMS) and its pillars of safety policy, risk management, safety assurance, and safety promotion.

Safety has grown up from a concentration on technical failures to individual pilot errors to an entire culture where both technical failures and pilot errors are preempted with proactive strategies. One of those strategies is the scenario-based concepts of this book.

In the early 2000s, a perfect storm hit in general aviation. After decades with no new general aviation aircraft being offered, legal tort reform encouraged new legacy airplanes (Cessna, Piper) to be built and new companies (Diamond, Cirrus) to flourish. GPS moving maps and an affordable laser ring gyro made "glass" cockpits possible in general aviation airplanes. But it was like moving from a Commodore 64 computer (circa 1979) to an iPad in one step. The FAA was not ready for the change. In a February 2003 document, the FAA admitted, "*New small general aviation systems and technologies, that do not fit neatly into the currently approved training programs, are being produced faster than the FAA's resources can react to them.*" Aviation educators were caught off guard as well, but we went to work. Looking back across aviation history, we see that whenever a new technology was introduced into aviation, a spike in accidents followed. Technically Advanced Aircraft (TAA) represented the biggest jump in technology in general aviation history, so would this result in the biggest jump in accidents in aviation history?

To head that possibility off at the pass, the FAA together with aviation researchers began the FAA/Industry Training Standards program (FITS). The FITS initiative was a non-regulatory "proof of concept" program. What was FITS trying to prove? The idea was to enhance pilot training by adding to the curriculum real-world scenarios that pilots will face *after* they pass the checkride. Before FITS, flight training was a series of maneuvers, some of which were unrelated to the actual flight environment. FITS initially drew criticism for being "anti-maneuvers" based, but that was not true. "Stick and rudder" skills will always be a part of excellent flight training; what was added was the realism. For example, pilots will always need the skill to land in a crosswind, but FITS also equipped pilots with the ability to pass on a crosswind landing if it was too dangerous. The first edition of Arlynn's book was the leading voice in this effort. She took what she and other researchers discovered and delivered it to flight schools, instructors, and students.

Then the FAA paid attention: More than ten years now after the introduction of FITS, the concept of scenario-based and competency-based flight training has graduated from a "proof of concept" program to a standard operating procedure (SOP). In the United States, you now cannot become a pilot without being tested using scenarios. The Private Pilot—Airplane Airman Certification Standards (FAA-S-ACS-6B, June 2018) describes how a pilot test will be conducted: "*the evaluator will assess the applicant's understanding by providing a scenario that requires the applicant to appropriately apply and/or correlate*

knowledge, experience, and information to the circumstances of the given scenario. The flight portion of the practical test requires the applicant to demonstrate knowledge, risk management, flight proficiency, and operational skill in accordance with the ACS."

The new Airman Certification Standards (ACS) is replacing the Practical Test Standards (PTS) with a more inclusive approach. Previously, knowledge information and flight skills information were scattered across many documents, and many knowledge topics did not line up with flight skills at all. The ACS brings it all together in a much more manageable format. The foundation of the ACS is in safety management systems with a concentration on not just stick and rudder skills but also risk management. And that is where the second edition of *Train Like You Fly* comes in. Arlynn's second edition also graduates from FITS to SMS and ACS. Arlynn is again on the leading edge of safety science.

Dr. Paul A. Craig
Professor of Aerospace & NASA Principal Aviation Investigator

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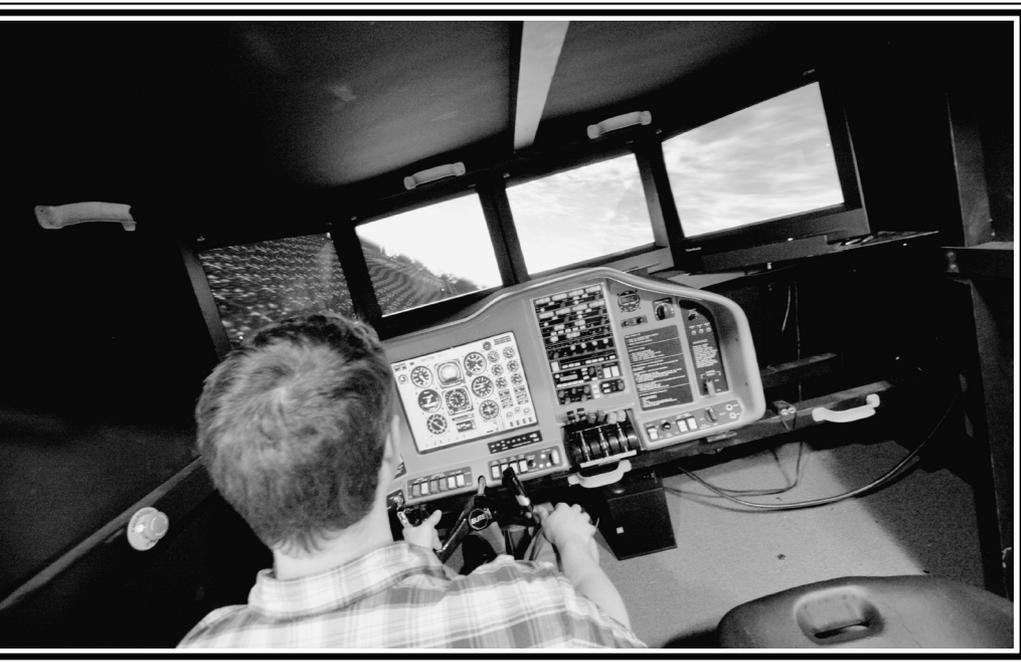
Chapter 1

Concepts

A Lesson

It is a beautiful day. The instructor begins the preflight discussion for Henry's tenth flight. "Henry, today we are flying to Panama City, Florida to look at a piece of property we want to buy near the airport. Take notes: After takeoff, you'll engage the autopilot and take me to Panama City Airport. You choose the altitude. Remember to program the GPS on the ground before takeoff. At Panama City I want you to contact the tower, enter the traffic pattern, disengage the autopilot and give me a crosswind landing. You'll choose if you wish to stop and taxi back or takeoff. We'll stay in the traffic pattern for two more landings before returning home. I'd like to have you handle everything. You decide what needs to be done and do it. Pretend I'm not there, but I am there if you need me."

What kind of a lesson is this? Is Henry's lesson one of navigation or one of takeoffs and landings? Is this a professional instructor who says to a student, you do everything and I'm not going to help you? [1]

What is a Scenario?

The lesson above requires Henry to think and practice making decisions while he is controlling the flying machine. This is a great lesson conducted by a skillful instructor who understands the issues facing today's pilots. "New cockpit technology has tended to place more importance on the pilot as an information processor, decision maker and manager." [2] Consider this an example of scenario-based training (SBT).

The scenario is a viable tool in flight training. In this chapter, the objectives, features and limitations of scenarios present a framework on which the remaining chapters of this book will be built.

We all face decisions that prove to be turning points in our lives. Sometimes we look back at that moment and feel pleased because we chose what proved to be a good decision. Other times, we later find that we missed something that, if we had only known at the time, might have yielded a different decision—and improved our future. Such is the case for too many pilots.

The scenario attempts to place the pilot in a training environment that closely reflects real flying. A scenario is "a situation." It begs the question, "You are here and this happens. How will you handle it?" In practice, scenarios resemble a set of stories, written or spoken, built around constructed plots. They apply knowledge. They allow assessment of flight skills and judgment.

Scenario-based training stems from research proving that good judgment and decision-making are teachable. Teaching pilots to think and advancing those "thinking" skills such as risk management and situational awareness are important to teaching safe piloting. Unfortunately, learning how to think is not taught in a typical course that emphasizes perfecting maneuvers. "It is assumed that they [pilots] will learn judgment through experience." [3]

Learning to operate an aircraft requires more than the ability to recite information or perform individual maneuvers. Generally pilots must use knowledge and skill together. This ability to orchestrate both knowledge and skill is a separate skill in its own right. It's the ability to think—and to think about several tasks at once—while dealing with distractions and interruptions. Thinking-skill is a skill that must be developed in every pilot.

The development of thinking-skills requires problem-solving practice. Scenarios allow the pilot to experience events, explore options and decide how to deal with the situation under the direction of an instructor. "Safety is not a natural mentality. It is one that must be developed and learned through multiple and varying experiences." [4]

The scenario may be a situation introduced in a ground briefing. For example, "What will you do after suddenly becoming aware that you haven't heard any chatter on the radio for a long while?" It may be a flight programmed into an aviation training device or it could also be a flight mission in the airplane.

Scenarios are powerful training tools precisely because the future is unpredictable. There is simply no way to train a pilot for every conceivable event that may happen in his flying future. Instructors can't foresee and

orchestrate the multitude of variables that, at times, come together to create a bad day. Consequently, scenario training can be used to:

- Point to voids in understanding
- Show potential problems
- Provoke debate
- Expand the range of options that a pilot is to consider
- Apply practical application of knowledge
- Identify choices and make decisions

A scenario may represent a simple, sequential string of events. On the other hand, it may be a complex set of events, branching into new solutions. The pilot could make a decision that leads to a new and unexpected direction, perhaps diverting to another airport. Nevertheless, a good scenario is a realistic event requiring practical application of various bits of knowledge.

Features of Scenarios

The scenario presents seemingly unrelated bits of knowledge and requires the pilot to form a bigger picture. Seldom has a single event caused an aviation accident. When a situation arises, there is no flashing banner announcing "This is a weather problem" allowing the pilot to recognize it and pull the solution from a predetermined set of choices.

While instructors preach "stop the accident chain," the average pilot is not taught to recognize how multiple factors combine during flight, leading to an accident. In the real world, seemingly small problems are interlaced. Perhaps weather, terrain, regulatory, and operational considerations are involved. Thus, finding a solution to a "weather problem" with only weather-related information, without considering terrain, could result in a situation of Controlled Flight into Terrain.

A good scenario begins with a need to fly. Many times, the decisions a pilot makes are influenced by the need to fly. For example, if the pilot were delivering an organ to be transplanted into a sick child, he may take a risky flight when he otherwise would not. The scenario implies consequences — if the organ does not arrive by a certain time the child may die. This gives the pilot practice in facing challenging, real life situations that affect decisions in flight.

The construct of a scenario should not be simply "a weather scenario" or "a regulation scenario" but should be realistic in its complexity of variables. For instance:

- A good scenario is much more than an hour of flight time, it's a learning experience. Imagine experiencing the John F. Kennedy flight of reduced visibility while flying over water at night.

- A good scenario might not have one, correct answer and a good scenario does not offer the obvious answer.
- A good scenario uses all available resources: Cockpit technology, ATC, FSS, passengers, etc.
- When pilot error occurs, the pilot still must carry on, dealing with the situation as it unfolds. A good scenario does not promote errors, but should promote judgment in handling errors.
- A good scenario requires the pilot to be "in command" and to be in control of the total situation. During a scenario, the instructor is not in the role of brain-dumping knowledge onto the pilot. The instructor does not teach or coach the pilot any more than what is absolutely necessary to continue.
- Beginning with simple scenarios and moving into more complex situations, they provide a building-block manner in developing the skills of putting it all together. Some pilots may even need remedial thinking-skills training while others may be ready for complex problems.

Objectives in Scenarios

Scenarios include traditional flight maneuvers; however, the objective of the scenario is to put the flight maneuver in a practical setting — as the pilot may see it used in a real flight. Instead of simply presenting a turn-around-a-point, the instructor might, for instance, introduce a scenario where the pilot is employed in aerial photography, photographing points on the ground.

In addition to flight maneuvers, a good scenario strives to play up four key components:

1. Situational Awareness — the Big Picture.
2. In Command — the concept of being "in command" is not just a regulatory issue. Being in command must be introduced as the pilot's responsibility for everything associated with the flight and its safe conclusion. A pilot is in command during the planning phase of flight as well as its execution. SBT focuses on Single Pilot Resource Management.
3. Aeronautical Decision Making — evaluating all information, considering all options and choosing the best one.
4. Managing the risks inherent in every flight.

These are the higher-thinking skills. They allow the pilot to see the accident chain develop before it's too late to recognize the alternatives, and to make the best choice in dealing with his situation.

Limitations of Scenarios

Early in training, the pilot should be told that training will be practical in nature and that training exercises will be as realistic as possible. Mistakes in judgment are expected and are a part of training. The instructor must alert the pilot that he will be expected to handle simulated situations as if he were the sole pilot on board. A pilot will likely be confused and irritated if suddenly thrust into an unexpected, simulated situation and not given the benefit of instructor guidance.

Pilots in general don't like to "fail." When a mistake is made in decision making that affects the flight, it's a much different experience than when altitude was allowed to slide during a maneuver. Learning how to recognize "pilot error" and to manage mistakes is part of the learning process. After the scenario, the instructor leads a debrief so that the pilot discusses with the instructor the problem-solving skills that were used.

Basic knowledge and proficiency in aircraft control is required before introducing a scenario. The pilot should have some understanding of the tasks involved in the scenario. It's difficult to make decisions and to practice being in command if the pilot can't associate the individual tasks. A scenario is a tool best used to "pull it together."

Early scenarios are simple and introduced after basic skills have been achieved. After the pilot has gained more proficiency, then the bar is raised to include more complex situations in higher-thinking skills, completing an effective total training program.

One challenge of a scenario is in keeping the pilot in the mindset of making decisions and in conducting the flight as though the situation were real. If the scenario is conducted on the ground, resist the pilot's recital of "I'd never do that." One way to alleviate "I'd never do that" is to present the situation as if the pilot had been a sleeping passenger who suddenly awoke to find that his pilot-friend put him in this situation. If the scenario is performed in an aviation training device, make it real by engaging in startup and ground maneuvering tasks, just as he would in a real airplane. Make it as real as possible within the limits of the training device.

To be effective, a scenario must be specific to the pilot, the plane and the local flying environment. Specific scenarios that any instructor can use are included in this book. However for maximum benefit, many will need to be revised to relate to the unique needs of the pilot's learning goals.

A Scenario Library

Instructors should have access to a library of scenarios. If the scenario is complex, it will be most effective with a pre-written script to help the instructor manage scenario details. A collection of pre-written and tested scenarios will give the instructor an assortment of tools to use. The library should contain scenarios that offer a range in complexity. Some should feature basic, simple problems. Others should present advanced complex problems to be solved. But the goal of the scenario must be clear and the decision-making opportunities identified to provide a building block approach in developing thinking skills.

Using the scenario library as a "tool box," the instructor can choose from the collection to keep pilots engaged and interested throughout training. Just be sure to choose a scenario appropriate for the pilot's training objectives and skill level.

Conclusions

This chapter introduced scenario concepts, objectives, features and limitations and introduced the instructor's role in joining proficiency in maneuvers with aeronautical decision-making in the certification of pilots. The greater this understanding, the better likelihood that the industry will enjoy increasing numbers of well-trained pilots and safety statistics.

Exercises

1. Think of a time when you imagined different future possibilities to help you solve a problem in your everyday life. For example, a situation at work, with friends or family, or maybe a pet obedience issue. Write a brief summary of:
   - The situation
   - The information you needed
   - The information you wished you could have access to
   - The information you used
   - How you thought about the problem
   - Whether the exercise helped you solve the problem
   - How as a result of finding that solution, you were better equipped to resolve a similar future problem
2. Consider the scenario "Your radios fail. What will you do?"
   - List the implications that the pilot must consider.
   - What situational awareness must the pilot possess?
   - What judgments must be made?
   - What decisions are required by the pilot?
   - What must the pilot do to remain in command of the situation from beginning to end?
   - What underlying concepts must the pilot have knowledge of?
   - How can the instructor help the pilot develop "command mentality"?