FITS Generic
Private Multi-engine Additional Aircraft Rating Syllabus

October 2008

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SECTION 1 – INTRODUCTION

How to use this generic FITS Syllabus

This syllabus is an FAA Industry Training Standards (FITS) accepted training method. This generic syllabus is a guide for you to use in developing your specific FITS curriculum. This FITS Syllabus is intended as a guide for aircraft manufacturers, training providers, and flight schools to use in developing a specific FITS curriculum for their aircraft, geographic region, and customer base. This syllabus is unique in several ways. First, it is a syllabus that uses real-world scenarios as the foundation of the training. Flight maneuvers are still a vital part of flight training and flight maneuvers are a part of this syllabus, but the use of real-world scenarios is used to also enhance the pilot's decision making skills. The syllabus presents situations and circumstances that pilots face everyday as learning experiences and lessons. The primary tenant of FITS training is that you prepare for the real world of flying, by acting as a pilot while in training. Therefore, throughout the syllabus, the pilot in training (PT) will take on different tasks or jobs just as if they were already certificated pilots. The second important unique feature of this syllabus and of FITS training is that it is all competency based. When the pilot in training (PT) masters a particular skill area in the syllabus, he/she moves on regardless of how much time it takes to reach that point of mastery. This means that each lesson does not necessarily equal one flight. It may take several flights before the PT masters the elements of the lesson and is ready to move on to the next lesson. Consequently, the amount of total flight hours a PT has when the syllabus is completed may be more or less than the minimum times under current aviation regulations. Please note that FITS training is conducted under the current CFAR's. Although philosophically, FITS is competency based, many training organizations must still require their students to meet the FAA minimum training hours. Courses under CFAR Part 142 and section 141.55(d) may be approved to train to competency and not require an hours minimum.

Regulations

This generic syllabus is adaptable to 14 CFR Parts 142, 141, or 61. Please refer to the appropriate regulations for your specific curriculum requirements.

FITS Acceptance

FITS acceptance is achieved by developing your specific curriculum and submitting it to your local Flight Standards District Office for operations under CFAR Part 61, 141, and 142. If you are an OEM (Original Equipment Manufacturer, you should submit your curriculum to the FAA FITS Program Manager, AFS-800, Federal Aviation Administration, 800 Independence Ave. SW, Washington, DC 20591. A cover letter explaining exactly for what courses you are requesting FITS acceptance and under what regulations should accompany the curriculum. *Use of the FITS logo*. Once accepted, you are free to use the FITS Logo on all accepted curriculums and in

advertising about this particular curriculum. The FITS logo cannot be used in relationship to non-FITS products.

There are 4 levels of FITS acceptance:

1. Accepted FITS Flight Syllabus: Will contain all the tenets of FITS and will include flight in an aircraft or at least an Advanced Training Device. Examples of this type of syllabus include initial, transition, and recurrent training syllabi.

2. Accepted FITS Syllabus (No flight): It is not intended to teach the pilot in training (PT) psychomotor pilot skills or full cockpit/aircraft integration in a specific aircraft. It's intended to enhance certain skill sets of the PT. Application of this level of acceptance may be to teach the PT how to use a new glass cockpit display or develop better Single Pilot Resource Management (SRM) skills. A FITS Accepted Syllabus will also contain all the tenets of FITS. A live instructor will lead the training.

3. Accepted FITS Self-Learning Program: This acceptance is between the FITS Accepted Syllabus and FITS Supporting Material. It may be either an interactive CD or on-line course on a specific application or subject. The purpose of this training is to learn a specific piece of equipment or enhance a specific higher order thinking skill. Scenario training and/or testing is required. Since a live instructor is not required, Learner Centered Grading may not be applicable.
    a. If the program is for a piece of equipment (i.e. GPS), the equipment should act like the actual piece of equipment during the interaction with the equipment as much as feasible. After basic training on the equipment, scenarios should be used to demonstrate PT proficiency and knowledge.
    b. For non equipment programs (i.e. ADM development) scenarios with multi-string testing should be used.

4. Accepted FITS Supporting Material: These products do not meet the training tenets of FITS (i.e. may not be scenario based), but the subject is integral to FITS. These products could be accepted on their own technical merit, but only as a part of an Accepted FITS Flight Syllabus or FITS Syllabus. For example, a CBI on risk management could be accepted as and used as a module in a FITS accepted transition syllabus. Original equipment manufacturers (Cessna, Cirrus, Eclipse, etc.) or developers of training materials (Sporty's, Jeppesen, King Schools, etc.) normally develop Accepted FITS Supporting Material.

SECTION 2 – FITS TERMINOLOGY

1. Automation Bias – The relative willingness of the pilot to trust and utilize automated systems.

2. Automation Competence – The demonstrated ability to understand and operate the automated systems installed in the aircraft.

3. Automation Management – The demonstrated ability to control and navigate an aircraft by means of the automated systems installed in the aircraft.

4. Automated Navigation leg – A flight of 30 minutes or more conducted between two airports in which the aircraft is controlled primarily by the autopilot and the on board navigation systems.

5. Automation Surprise – Occurs when the automation behaves in a manner that is different from what the operator is expecting.

6. Candidate Assessment – A system of critical thinking and skill evaluations designed to assess a pilot in training's readiness to begin training at the required level.

7. Critical Safety Tasks/Events – Those mission related tasks/events that if not accomplished quickly and accurately may result in damage to the aircraft or loss of life.

8. Data link Situational Awareness Systems – Systems that feed real-time information to the cockpit on weather, traffic, terrain, and flight planning. This information may be displayed on the PFD, MFD, or on other related cockpit displays.

9. Emergency Escape Maneuver – A maneuver (or series of maneuvers) performed manually or with the aid of the aircraft's automated systems that will allow a pilot to successfully escape from an unanticipated flight into Instrument Meteorological Conditions (IMC) or other life-threatening situations.

10. IFR Automated Navigation Leg – A leg flown on autopilot beginning from 500 ft AGL on departure (unless the limitations of the autopilot require a higher altitude, then from that altitude) until reaching the decision altitude or missed approach point on the instrument approach (unless the limitations of the autopilot require a higher altitude, then from that altitude). If a missed approach is flown, it will also be flown using the autopilot and on-board navigation systems.

11. Light Turbine TAA –is a jet or turboprop Technically Advance Aircraft (TAA) certified for single-pilot operations, weighing 12,500 lbs or less, that may be equipped with cabin pressurization, and may be capable of operating in Class A airspace on normal mission profiles.

12. Mission Related Tasks – Those tasks required for safe and effective operations within the aircraft's certificated performance envelope.

13. Multi-Function Display MFD – Any display that combines primarily navigation, systems, and situational awareness information onto a single electronic display.

14. Primary Flight Display (PFD) – Any display that combines the primary six flight instruments, plus other related navigation and situational awareness information into a single electronic display.

15. Proficiency-Based Qualification – Aviation task qualification based on demonstrated performance rather than other flight time or experience.

16. Scenario Based Training – A training system that uses a highly structured script of real-world experiences to address flight-training objectives in an operational environment. Such training can include initial training, transition training, upgrade training, recurrent training, and special training. The appropriate term should appear with the term "Scenario Based," e.g., "Scenario Based Transition Training," to reflect the specific application.

17. Simulation Training Only – Any use of animation and/or actual representations of aircraft systems to simulate the flight environment. Pilot in training interaction with the simulation and task fidelity for the task to be performed are required for effective simulation.

18. Single Pilot Resource Management (SRM) – The art and science of managing all resources (both on-board the aircraft and from outside sources) available to a single pilot (prior and during flight) to ensure the successful outcome of the flight is never in doubt.

19. Technically Advanced Aircraft (TAA) – A General Aviation aircraft that contains the following design features: Advanced automated cockpit such as MFD or PFD or other variations of a Glass Cockpit, or a traditional cockpit with GPS navigation capability, moving map display and autopilot. It includes aircraft used in both VFR and IFR operations, with systems certified to either VFR or IFR standards. TAA's may also have automated engine and systems management. VFR Automated Navigation Leg – A leg flown on autopilot from 1,000 ft AGL on the departure until entry to the 45-degree leg in the VFR pattern.

SECTION 3 – TRAINING PHILOSOPHY

FITS Training is a scenario-based approach to training pilots. It emphasizes the development of critical thinking and flight management skills, rather than solely on traditional maneuver-based skills. The goal of this training philosophy is the accelerated acquisition of higher-level decision-making skills. Such skills are necessary to prevent pilot-induced accidents.

FITS Training Goals

- Higher Order Thinking Skills
- Aeronautical Decision Making
- Situational Awareness
- Pattern Recognition (Emergency Procedures) and Judgment Skills
- Automation Competence
- Planning and Execution
- Procedural Knowledge
- Psychomotor (Hand-Eye Coordination) Skills
- Risk Management
- Task Management
- Automation Management
- Controlled Flight into Terrain (CFIT) Awareness

Previous training philosophies assumed that newly certified pilots generally remain in the local area until their aviation skills are refined. This is no longer true with the advent of Technically Advanced Aircraft (TAA). Offering superior avionics and performance capabilities, these aircraft travel faster and further than their predecessors. As a result, a growing number of entry-level pilots are suddenly capable of long distance/high speed travel—and its inherent challenges. Flights of this nature routinely span diverse weather systems and topography requiring advanced flight planning and operational skills. Advanced cockpits and avionics, while generally considered enhancements, require increased technical knowledge and finely tuned automation competence. Without these skills, the potential for an increased number of pilot-induced accidents is daunting. A different method of training is required to accelerate the acquisition of these skills during the training process.

Research has proven that learning is enhanced when training is realistic. In addition, the underlying skills needed to make good judgments and decisions are teachable. Both the military and commercial airlines have embraced these principles through the integration of Line Oriented Flight Training (LOFT) and Crew Resource Management (CRM) training into their qualification programs. Both LOFT and CRM lessons mimic real-life scenarios as a means to expose pilots to realistic operations and critical decision-making opportunities. The most significant shift in these programs has been the movement from traditional maneuver-based training to incorporate training that is scenario-based.

Maneuver-based training emphasizes the mastery of individual tasks or elements. Regulations, as well as Practical Test Standards (PTS), drive completion standards. Flight hours and the ability to fly within specified tolerances determine competence. The emphasis is on development of motor skills to satisfactorily accomplish individual maneuvers. Only limited emphasis is placed on decision-making. As a result, when the newly trained pilot flies in the real-world environment, he or she is inadequately prepared to make crucial decisions. Scenario Based Training (SBT) and Single Pilot Resource Management (SRM) are similar to LOFT and CRM training. However, each is tailored to the pilot's training needs. These techniques use the same individual tasks that are found in Maneuver Based Training, but script them into scenarios that mimic real-life cross-country travel. By emphasizing the goal of flying safely, the pilot in training correlates the importance of individual training maneuvers to safe mission accomplishment. In addition, the instructor continuously interjects "What If?" discussions as a means to provide the trainee with increased exposure to proper decision-making. Because the "What If?" discussions are in reference to the scenario, there is a clear connection between decisions made and the final outcome. The "What If?" discussions are designed to accelerate the development of decision-making skills by posing situations for the pilot in training to consider. Once again, research has shown these types of discussions help build judgment and offset low experience.

Questions or situations posed by the instructor must be open-ended (rather than requiring only rote or one-line responses). In addition, the instructor guides the pilot in training through the decision process by: 1) Posing a question or situation that engages the pilot in training in some form of decision-making activity. 2) Examining the decisions made. 3) Exploring other ways to solve the problem. 4) Evaluating which way is best. For example, when the pilot in training is given a simulated engine failure, the instructor might ask questions such as: "What should we do now?" Or, "Why did you pick that place to land?" Alternatively, "Is there a better choice?" Or, "Which place is the safest?" Alternatively, "Why?" These questions force the pilot in training to focus on the decision process. This accelerates the acquisition of improved judgment, which is simply the decision-making process resulting from experience. It is not innate. All of our life experiences mold the judgment tendencies we bring to our flight situations. By introducing decision-making opportunities into routine training lessons, we speed-up acquisition of experience and enhance judgment.

For further information, please reference "Aeronautical Decision Making" in the FAA Aviation Instructor Handbook (FAA-H-8083-9).

SECTION 4 – TEACHING METHODS

Scenario Based Training

For Scenario Based Training (SBT) to be effective there must be a purpose for the flight and consequences if it is not completed as planned. It is vital that the pilot in training and the Instructor communicate the following information well in advance of every training flight:

Purpose of flight
Scenario destination(s)
Desired pilot in training learning outcomes
Desired level of pilot in training performance
Desired level of automation assistance
Possible in-flight scenario changes (during later stages of the program)

With the guidance of the Instructor, the pilot in training should make the flight scenario as realistic as possible. This means the pilot in training will know where they are going and what will transpire during the flight. While the actual flight may deviate from the original plan, it allows the pilot in training to be placed in a realistic scenario.

Scenario Planning – Prior to the flight, the Instructor will brief the scenario to be planned. The Instructor will review the plan and offer guidance on how to make the lesson more effective. Discussion, in part, will reflect ways in which the Instructor can most effectively draw out a pilot in training's knowledge and decision processes. This enables the Instructor to analyze and evaluate the pilot in training's level of understanding. After discussion with the Instructor, the pilot in training will plan the flight to include:

Reason to go flying
Route
Destination(s)
Weather
NOTAMS
Desired pilot in training learning outcomes
Possible alternate scenarios and emergency procedures

Example of Scenario Based Training

Consider the following example: During traditional MBT, the Instructor provides a detailed explanation on how to control for wind drift. The explanation includes a thorough coverage of heading, speed, angle of bank, altitude, terrain, and wind direction plus velocity. The explanation is followed by a demonstration and repeated practice of a specific flight maneuver, such as turns around a point or S turns across the road until the maneuver can be consistently accomplished in a safe and effective manner within a specified limit of heading, altitude, and airspeed**. *At the end of this lesson, the pilot in training is only capable of performing the maneuver.***

Now, consider a different example: The pilot in training is asked to plan for the arrival at a specific uncontrolled airport. The planning should take into consideration the possible wind conditions, arrival paths, airport information and communication procedures, available runways, recommended traffic patterns, courses of action, and preparation for unexpected situations. Upon arrival at the airport the pilot in training makes decisions (with guidance and feedback as necessary) to safely enter and fly the traffic pattern using proper wind drift correction techniques. This is followed by a discussion of what was done, why it was done, the consequences, and other possible courses of action and how it applies to other airports. ***At the end of this lesson the pilot in training is capable of explaining the safe arrival at any uncontrolled airport in any wind condition.***

The first example is one of traditional learning, where the focus is on the maneuver. The second is an example of scenario-based training, where the focus is on real world performance. Many course developers in flight training have built on the former option. Traditional training methods in many instances are giving way to more realistic and fluid forms of learning. The aviation industry is moving from traditional knowledge-related learning outcomes to an emphasis on increased internalized learning in which learners are able to assess situations and appropriately react. Knowledge components are becoming an important side effect of a dynamic learning experience.

Reality is the ultimate learning situation and scenario-based training attempts to get as close as possible to this ideal. In simple terms, scenario-based training addresses learning that occurs in a context or situation. It is based on the concept of situated cognition, which is the idea that knowledge cannot be known and fully understood independent of its context. ***In other words, we learn better, the more realistic the situation is.***

Michael Hebron, a well-known golf instructor, suggests that there is little the expert can do in the way of teaching the learner particular motions of the golf swing. Instead, learning has to be experiential and feedback based; only a handful of basic principles are involved. The same goes, he says, for any and all kinds of learning. ***"It's about learning, not about golf."***

Scenario-based training (SBT) is similar to the experiential model of learning. The adherents of experiential learning are fairly adamant about how people learn. **They would tell us that learning seldom takes place by rote.** Learning occurs because we immerse ourselves in a situation in which we are forced to perform. We get feedback from our environment and adjust our behavior. We do this automatically and with such frequency in a compressed timeframe that we hardly notice we are going through a learning process. Indeed, we may not even be able to recite particular principles or describe how and why we engaged in a specific behavior. Yet, we are still able to replicate the behavior with increasing skill as we practice. If we could ask Mark MacGuire to map out the actions that describe how he hits a home run, he would probable look at us dumbfounded and say, "I just do it." On the other hand, I am sure Mark MacGuire could describe in detail the size and characteristics of every one of the baseball diamonds he was playing in as well as the strengths, weaknesses and common practices of every one of the pitchers he faces.

Developing Scenario-Based Training

Scenario-based training best fits an open philosophy of blended and multiple learning solutions in which change and experience are valued and the lines between training and performance improvement are blurred. For scenario-based training to be effective it must generally follow a performance improvement imperative. The focus is on improved outcomes rather than the acquisition of knowledge and skills. Success requires a blended, performance-based, and reinforced solution.

An athletic exercise such as Basketball might prove to be a very good example. Clearly, the team's objective is to win, which means scoring more points than the other team. That's the performance objective. Each member of the team also has personal performance goals. The coach can stand at a blackboard and explain defensive and offensive diagrams with players, the rules of the game, and so forth. By doing that, he has identified a set of learning subjects (rules and play patterns) that are best delivered in a traditional fashion.

On the other hand, the application of these subjects and the level of proficiency required in their use can only be learned on the court. The scenario in this example is a scrimmage. During a typical scrimmage, experienced players are mixed with non-experienced players and matched against a similarly constituted practice team. The two teams play a game, and the coaches stop the action at appropriate intervals to offer feedback. Learning takes place in a highly iterative fashion often without the player realizing that specific bits of learning are taking place. The scrimmage provides a player with the opportunity to make several decisions, engage in complex and fast-paced behaviors, and immediately see impact. The coach may have some general ideas of basketball in mind and perhaps some specific learning objectives for the day, but in most cases does not know precisely which of them will be addressed during the scrimmage – that depends on the flow of practice.

Similarly, most flight training consists of both kinds of subjects: those amenable to traditional instructional design techniques and those better approached through scenario-based training. Neither is all that useful without the other. Before a learner can engage in a scenario, he or she needs some basic subject knowledge and skill. However, the strongest adherents of the scenario-based approach suggest very little subject knowledge is needed in order to take advantage of SBT. **The main point is that knowledge without application is worth very little.**

The first step in the scenario design process is to engage a number of subject matter experts in a series of discovery sessions and interactive meetings for the purpose of identifying issues and learning objectives including higher-level and performance objectives. With clearly identified learning objectives, appropriate techniques and where to use them can be specified. In the basketball example, players need some rudimentary knowledge of the game and basic skill in order to make the practice session efficient and effective. Consequently, the required knowledge and skill objects need to be integrated into the actual sessions of practice. So, like a train pulling a number of boxcars, a traditional piece of learning precedes or is integrated into a scenario, with the scenario dictating what information is covered in the traditional piece. If, as described in the scrimmage session above, you don't precisely know what will come up in the practice, you shouldn't waste time in the traditional preparation. It's more efficient to share very basic principles and devote your resources to preparing to teach any situation that may arise. What is important, however, is to establish the boundaries of the scenarios. These are done using performance-based learning objectives (Internalized Responses) as opposed to knowledge-based learning objectives, and are worded as performance objectives rather than skill-based behavior objectives.

For example, in the traditional, more repetitive, intensive flight training sessions, objectives are knowledge-based and tend to be specific and limited. On the other hand, in scenario-based training we are simply trying to determine whether the learner has the minimum necessary knowledge/skill to qualify for the scenario. With scenario-based objectives, we are looking for performance behaviors and indicators of internalized responses, which are usually situational recognition indicators.

We can see this clearly illustrated in an automobile driver-training example (Table 1). The traditional Behavior (skill) objective is knowledge based and the SBT Performance objective is performance-based (responses which are situational recognition indicators).

Table 1: Driving Learning Objectives

Knowledge		**Behavior (Skill)**
Traditional	Know what a STOP sign and a Railroad crossing sign look like and what they mean. Describe the correct parallel parking procedure	Drive an automatic shift car on a county road over a 2-mile route with one RR crossing and 2 full stops. Maneuver the automobile into a normal parallel parking space between 2 other cars.
Internalized Response		**Performance**
Scenario-Based	Appropriately apply the rules of the road for driving in the local area in moderate traffic. Determine the shortest route and apply the appropriate procedures for driving in heavy and complex traffic conditions.	Drive from your garage to the Shopping Center on the same side of town Drive from your garage to a specified address in another town over 50 miles away on the Interstate and an Expressway system.

Scenario design sessions should resemble focus groups in which participants work through a series of issues, from broad scenario outlines to very specific scenario details. Direct participants to address two general areas: content and style.

Sessions to determine content usually ask participants to:

- Share experiences about the subject event
- Describe desirable outcomes
- Share best practices or known instances of consistent achievement of the desired outcomes
- Create indicators of successful outcomes
- Create strategies expected to lead to successful outcomes
- Establish descriptions of successful and unsuccessful performance behaviors related to these strategies (note that outcome measures and performance behaviors will constitute the evaluative criteria for assessing performance in the scenario).

After the content discussion, ask participants to review the look, feel, and flow of the scenario. This is much like the process used for instructional design. Develop a storyboard with a general beginning and end, using the boundaries established earlier. Talk through the scenario in the session and, through iteration, create a flow script from the results.

With these two elements in place, you can begin the actual construction of the scenario. A subcommittee of Flight Instructors and subject matter experts (SMEs) should review and revise the scenario to fit into the whole course of instruction.

Scenarios are meant to be real situations. In an ideal world, an assessment team would evaluate behavior and agree on several critical performance dimensions. The key indicators should come from the initial SMEs, in which they also create strategies expected to lead to successful outcomes and establish descriptions of successful and unsuccessful performance behaviors. Outcome measures and performance behaviors will constitute the evaluative criteria for assessing performance in the scenario.

Examples of indicators of successful outcomes are whether an airplane arrived and was secured at the destination airport and how safe were all aspects of the flight or were there any regulatory violations. Strategies are clusters of internally consistent behaviors directed toward the achievement of a goal. Performance behaviors are the key behaviors in those strategies. Establishing these dimensions should be a group process and is usually completed in the subject matter expert design session.

Review, obtain learner feedback, and revise**.** All learning, even the most traditional, is iterative. The key to creating a useful scenario is to see it as a learning experience for the designers as well as the learners. This means that results and comments about the learning experience are shared with the SMEs and the designer so that they can review and modify the scenarios as necessary. Obtain open –ended qualitative data from the learner and the Flight Instructor about the experience and review the data with the SME's and the designer.

Based on this kind of feedback, scenarios can be revised to better target the learner population. That process mirrors the original design steps. There are some cautions, however, in the revision process. First, there is an old saying: “It doesn’t take a cannon to blow away a tin can.” Basically, revisions should not needlessly complicate the scenario or the technology needed to employ it. It is crucial to weigh the risks of complication against the genuine learning needs. Before any revision, affirm the original purpose statement and the categorization of learning elements.

Also, do not let principles and main points become diluted by revisions. It is tempting to add more items and nuances in a scenario, but doing so further complicates the learning process. Save complexity for a full-scale “capstone” experience. Remember, adding an item in traditional learning complicates the learning process in a linear fashion. In scenarios, complication grows non-linearly with the addition of learning items. So, beware. A rule of thumb is to reduce rather than increase principles and main points in a revision.

Always review success and failure paths for realism. Remember that any change in a scenario item complicates all items on the path following it. Any time a decision node is altered, chances are that the decision nodes and information items following it must change. With every revision, follow and ensure the consistency of associated paths.

Finally, remember that traditional learning elements should service the scenario-based learning elements, which are situated in a real context and based on the idea that knowledge cannot be known and fully understood independent of its context. It is

essential to place boundaries around scenarios to make the transitions between scenarios and traditional learning as efficient as possible.

Table 2: The Main Points

- Scenario-based training (SBT) is situated in a real context and is based on the idea that knowledge cannot be known and fully understood independent of its context.
- SBT accords with a performance improvement and behavior change philosophy of the learning function.
- SBT is different from traditional instructional design and one must be aware of the differences to successfully employ SBT.
- All learning solutions should employ both traditional and scenario-based training.
- Traditional learning elements should service the scenario-based training elements.
- It is essential to place boundaries around scenarios to make the transitions between scenarios and traditional learning as efficient as possible.
- Use interactive discovery techniques with subject matter experts (SMEs) and designers to establish the purpose and outcomes of scenarios create the scenarios and appropriate strategies and performance behaviors, and develop learner evaluation criteria.
- SBT occurs by following success and failure paths through a realistic situation. Typically, these paths must be limited to stress the main learning objective. Otherwise the scenario can become too complex and unwieldy.
- Open-ended qualitative learner feedback is the key to successful scenario revision, but revisions should not further complicate the scenario unless highly justified.

Kindley, R. (2002). *Scenario-Based E-Learning: A Step Beyond Traditional E-Learning.* Retrieved 02/02/05 from http://www.learningcircuits.org/2002/may2002/kindley.html

Single Pilot Resource Management

Single Pilot Resource Management (SRM) is defined as the art and science of managing all the resources (both on-board the aircraft and from outside sources) available to a single-pilot (prior and during flight) to ensure that the successful outcome of the flight is never in doubt. Most of us remember a favorite Instructor from our past that showed us the best way to solve in-flight problems and unforeseen circumstances. The FITS team has combined much of this collective CFI body of knowledge with some innovative teaching methods to give pilots practical tools to teach aeronautical decision-making and judgment. SRM includes the concepts of Aeronautical Decision Making (ADM), Risk Management (RM), Task Management (TM), Automation Management (AM), Controlled Flight Into Terrain (CFIT) Awareness, and Situational Awareness (SA). SRM training helps the pilot maintain situational awareness by managing the automation and associated aircraft control and navigation tasks. This enables the pilot to accurately assess and manage risk and make accurate and timely decisions. ***This is what SRM is all about, helping pilots learn how to gather information, analyze it, and make decisions.***

Teaching pilots to identify problems, analyze the information, and make informed and timely decisions is one of the most difficult tasks for Instructors. By way of comparison, the training of specific maneuvers is fairly straightforward and reasonably easy to understand. We explain, demonstrate, and practice a maneuver until proficiency is

achieved. We are teaching the pilot in training ***"what to think"*** about each maneuver, and sign them off when they demonstrate proficiency. Teaching judgment is harder. Now we are faced with teaching the pilot in training ***"how to think"*** in the endless variety of situations they may encounter while flying out in the "real world." Often, they learn this by watching Instructors. They observe reactions, and more importantly, actions, during flight situations and they often adapt the styles of the Instructor to their own personalities.

Pilots in training may range from 100-hour VFR-only pilots, all the way to multi-thousand hours ATP's. The strength of this format is that the participants learn not only from their Flight Instructor, but from each other as well. The collective knowledge of many pilots, when guided by an experienced CFI, is much greater than the knowledge of each participant, including the Flight Instructor. In these scenarios, there are no right answers, rather each pilot is expected to analyze each situation in light of their experience level, personal minimums, and current physical and mental readiness level, and make their own decision.

The SRM scenarios, developed by the FITS team, incorporate several maneuvers and flight situations into realistic flight scenarios. The scenarios are much like the Line Oriented Flight Training (LOFT) employed by the major corporate and airline training organizations for years. Table 3 gives an example of the performance, standards and conditions using SRM.

Table 3: Single Pilot Resource Management (SRM)

Performance The training task is:	**Standards** The pilot in training will:	**Conditions** The training is conducted during:
1. Task Management (TM)	Prioritize and select the most appropriate tasks (or series of tasks) to ensure successful completion of the training scenario.	Note: All tasks under SRM will be embedded into the curriculum and the training will occur selectively during all phases of training. SRM will be graded as it occurs during the training scenario syllabus.
2. Automation Management (AM)	Program and utilize the most appropriate and useful modes of cockpit automation to ensure successful completion of the training scenario.	Note: All tasks under SRM will be embedded into the curriculum and the training will occur selectively during all phases of training. SRM will be graded as it occurs during the training scenario syllabus.
3. Risk Management (RM) and Aeronautical Decision-Making (ADM)	Consistently make informed decisions in a timely manner based on the task at hand and a thorough knowledge and use of all available resources.	Note: All tasks under SRM will be embedded into the curriculum and the training will occur selectively during all phases of training. SRM will be graded as it occurs during the training scenario syllabus.
4. Situational Awareness (SA)	Be aware of all factors such as traffic, weather, fuel state, aircraft mechanical condition, and pilot fatigue level that may have an impact on the successful completion of the training scenario.	Note: All tasks under SRM will be embedded into the curriculum and the training will occur selectively during all phases of training. SRM will be graded as it occurs during the training scenario syllabus.
5. Controlled Flight Into Terrain (CFIT) Awareness	Understand, describe, and apply techniques to avoid CFIT encounters: a. During inadvertent encounters with IMC during VFR flight. b. During system and navigation failures and physiological incidents during IFR flight.	Note: All tasks under SRM will be embedded into the curriculum and the training will occur selectively during all phases of training. SRM will be graded as it occurs during the training scenario syllabus.

The “5P” Check

SRM sounds good on paper, however, it requires a way for pilots to understand and deploy it in their daily flights. This practical application is called the “Five P’s (5P’s)” The 5P’s consist of “the Plan, the Plane, the Pilot, the Passengers, and the Programming”. Each of these areas consists of a set of challenges and opportunities that face a single pilot. And each can substantially increase or decrease the risk of successfully completing the flight based on the pilot’s ability to make informed and timely decisions. The 5P’s are used to evaluate the pilot’s current situation at key decision points during the flight, or when an emergency arises. These decision points include, pre-flight, pre-takeoff, hourly or at the midpoint of the flight, pre-descent, and just prior to the final approach fix or for VFR operations, just prior to entering the traffic pattern.

The 5P’s are based on the idea that the pilots have essentially five variables that impact his or her environment and that can cause the pilot to make a single critical decision, or several less critical decisions, that when added together can create a critical outcome. These variables are the Plan, the Plane, the Pilot, the Passengers, and the Programming. The authors of the FITS concept felt that current decision-making models tended to be reactionary in nature. A change has to occur and be detected to drive a risk management decision by the pilot. For instance, many pilots ascribe to the use of risk management sheets that are filled out by the pilot prior to takeoff. These catalog risks that may be encountered that day and turn them into numerical values. If the total exceeds a certain level, the flight is altered or cancelled. Informal research shows that while these are useful documents for teaching risk factors, they are almost never used outside of formal training programs. The number of pilots who use them before each and every flight approaches zero. The 5P concept is an attempt to take the information contained in those sheets and in the other available models and operationalize it.

The 5P concept 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. For instance, the easiest point to cancel a flight due to bad weather is before the pilot and passengers walk out the door and load the aircraft. So the first decision point is Pre-Flight in the flight planning room, where all the information is readily available to make a sound decision, and where communication and FBO services are readily available to make alternate travel plans.

The second easiest point in the flight to make a critical safety decision is just prior to takeoff. Few pilots have ever had to make an “emergency take-off”. While the point of the 5P check is to help you fly, the correct application of the 5P before takeoff is to assist in making a reasoned go-no-go decision based on all the information available. That decision will usually be to “go”, with certain restrictions and changes, but may also be a “no-go”. The key point is that these two points in the process of flying are critical go-no go points on each and every flight.

The third place to review the 5Ps is at the mid point of the flight. Often, pilots may wait until the ATIS is in range to check weather, yet at this point in the flight many good

options have already passed behind the aircraft and pilot. Additionally, fatigue and low altitude hypoxia serve to rob the pilot of much of their energy by the end of a long and tiring flight day. This leads to a transition from a decision-making mode to an acceptance mode on the part of the pilot. If the flight is longer than 2 hours, the 5P check should be conducted hourly.

The last two decision points are just prior to decent into the terminal area and just prior to the final approach fix, or if VFR just prior to entering the traffic pattern, as preparations for landing commence. Most pilots execute approaches with the expectation that they will land out of the approach every time. A healthier approach requires the pilot to assume that changing conditions (the 5Ps again) will cause the pilot to divert or execute the missed approach on every approach. This keeps the pilot alert to all manner of conditions that may increase risk and threaten the safe conduct of the flight. Diverting from cruise altitude saves fuel, allows unhurried use of the autopilot, and is less reactive in nature. Diverting from the final approach fix, while more difficult, still allows the pilot to plan and coordinate better, rather than executing a futile missed approach. Now let us look in detail at each of the “Five P’s.”

The Plan

The “Plan” can also be called the mission or the task. It contains the basic elements of cross country planning, weather, route, fuel, publications currency, etc. Unlike risk management sheets that pilot fill out before a flight, the “Plan” should be reviewed and updated several times during the course of the flight. A delayed takeoff due to maintenance, fast moving weather, and a short notice Temporary Flight Restriction (TFR) may all radically alter the plan. Several excellent flight planning software packages are available that automates this process, allowing the pilot additional time to evaluate and make decisions. Some include real time and graphical TFR depictions. The “plan” is not just about the flight plan, but the entire days events surrounding the flight and allowing the pilot to accomplish the mission. The plan is always being updated and modified and is especially responsive to changes in the other four remaining P’s. If for no other reason, the 5P check reminds the pilot that the day’s flight plan is real life and subject to change at any time.

Obviously the weather is a huge part of any “plan.” The addition of real time data link weather information give the TAA pilot a real advantage in inclement weather, but only if the pilot is trained to retrieve, and evaluate the weather in real time without sacrificing situational awareness. And of course, weather information should drive a decision, even if that decision is to continue on the current “plan.” Pilots of aircraft without datalink weather should get updated weather in-flight through a Flight Service Station and/or Flight Watch.

The Plane

Both the “plan” and the “plane” are fairly familiar to most pilots. The “plane” consists of the usual array of mechanical and cosmetic issues that every aircraft pilot, owner, or

operator can identify. For example, is everything working properly? Is the fuel situation where you expected it to be at that point? Are you using anti-ice equipment? However, with the advent of the Technically Advanced Aircraft (TAA), the “plane” has expanded to include database currency, automation status, and emergency backup systems that were unknown a few years ago. Much has been written about single pilot IFR flight both with, and without, an autopilot. While this is a personal decision, it is just that, a decision. Low IFR in a non-autopilot equipped aircraft may depend on several of the other “P’s” we will discuss. Pilot proficiency, currency, and fatigue are among them. The TAA offers many new capabilities and simplifies the basic flying tasks, but only if the pilot is properly trained and all the equipment is working as advertised.

The Pilot

This is an area all pilots are learning more and more about each day. Flying, especially when used for business transportation, can expose the pilot to high altitude flying, long distance and endurance, and more challenging weather. Technically Advance Aircraft (TAA), simply due to their advanced capabilities can expose a pilot to even more of these stresses. The traditional “IMSAFE” checklist is a good start. However, each of these factors must be taken in consideration of the cumulative effect of all of them together and the insidious effects of low altitude hypoxia. The authors informal survey of TAA pilots show that almost half fly with pulse oxymeters to display the effects of low altitude hypoxia in a graphic manner.

The combination of late night, pilot fatigue, and the effects of sustained flight above 5,000 feet may cause pilots to become less discerning, less critical of information, less decisive and more compliant and accepting. Just as the most critical portion of the flight approaches (for instance a night instrument approach, in the weather, after a four hour flight) the pilot’s guard is down the most. The “5P” process emphasizes that pilot recognize the physiological situation they are placing themselves in at the end of the flight, before they even takeoff, and continue to update their condition as the flight progresses. Once identified, the pilot is in an infinitely better place to make alternate plans that lessen the effect of these factors and provide a safer solution.

The Passengers

One of the key differences between CRM and SRM is the way passengers interact with the pilot. In the airline industry the passengers have entered into a contractual agreement with the pilots company with a clearly defined set of possible outcomes. In corporate aviation, the relationship between crew and passengers is much closer, yet is still governed by a set of operating guidelines and the more formal lines of corporate authority. However, the pilot of a highly capable single engine aircraft has entered into a very personal relationship with the passengers, in fact, they sit within an arms reach all of the time.

It may be easy, especially in business travel, for the desire of the passengers to make airline connections or important business meetings to enter into the pilot’s decision-

making loop. If this is done in a healthy and open way, it is a very positive thing. However, this is not always the case. For instance, imagine a flight to Dulles Airport and the passengers, both close friends and business partners, need to get to Washington D.C. for an important meeting. The weather is VFR all the way to southern Virginia then turns to low IFR as the pilot approaches Dulles. A pilot employing the 5P approach might consider reserving a rental car at an airport in northern North Carolina or southern Virginia to coincide with a refueling stop. Thus, the passengers have a way to get to Washington, and the pilot has an out to avoid being pressured into continuing the flight if the conditions do not improve.

Passengers can also be pilots. The old joke says that when four Certified Flight Instructors (CFI) board a light general aviation, a NOTAM should be posted. There is some truth to this. If no one is designated as pilot in command and unplanned circumstances arise, the decision-making styles of four self confident CFI's may come into conflict. Another situation arises when an owner pilot flies with a former CFI in the right seat on a business trip. Unless a clear relationship is defined and briefed prior to the flight, the owner pilot may feel some pressure to perform for the Individual Learning Manager (possibly beyond his or her capability), and the Individual Learning Manager may feel inhibited from intervening in small decisions until it is clearly evident that the pilot is making poor decisions. This is actually a CRM situation and requires clear pre-flight understanding of roles, responsibilities, and communication. Non-Pilots can also cause the pilot to review the SRM process.

Pilots need to understand that non-pilots may not understand the level of risk involved in the flight. There is an element of risk in every flight. That's why SRM calls it risk management not risk elimination. While a pilot may feel comfortable with the risk present in a night IFR flight, the passengers may not and may manifest this during the flight. The human reaction to fear and uncertainty is as varied as the shapes of our ears. Some become quiet, some talk incessantly, and in extreme cases anger and fear are strongly manifested. This may be the last thing the pilot needs to deal with while shooting the ILS to 400 feet and a mile visibility at midnight.

.A pilot employing SRM should ensure that the passengers are involved in the decision-making and given tasks and duties to keep them busy and involved. If, upon a factual description of the risks present, the passengers decide to buy an airline ticket or rent a car, then a good decision has generally been made. This discussion also allows the pilot to move past what he or she "thinks" the passengers want to do and find out what they "actually" want to do. This removes a load of self-induced pressure from the pilot.

The Programming

The TAA adds an entirely new dimension to the way General Aviation aircraft are flown. The Glass Cockpit, GPS, and Autopilot are tremendous boons to reduce pilot workload and increase pilot situational awareness. And frankly, the programming and operation of these devises is fairly simple and straightforward. However, unlike the analog

instruments they replace, they tend to capture the pilot's attention and hold it for long periods of time (like a desktop computer). To avoid this phenomenon, the pilot should plan in advance when and where the programming for approaches, route changes, and airport information gathering should be accomplished…as well as times it should not. Pilot familiarity with the equipment, the route, the local air traffic control environment, and their own capabilities vis-à-vis the automation should drive when, where, and how the automation is programmed and used.

The pilot should also consider what his or her capabilities are in response to last minute changes of the approach (and the reprogramming required) and ability to make large-scale changes (a re-route for instance) while hand flying the aircraft. Since formats are not standardized, simply moving from one manufacturer's equipment to another should give the pilot pause and require more conservative planning and decisions.

The SRM Decision Process

The SRM process is simple. At least five times, before and during the flight, the pilot should review and consider the "Plan, the Plane, the Pilot, the Passengers, and the Programming" and make the appropriate decision required by the current situation. It is often said that failure to make a decision is a decision. Under SRM and the 5P's, even the decision to make no changes to the current plan, is made through a careful consideration of all the risk factors present.

Example of Single Pilot Resource Management

The teaching of SRM is best accomplished in a seminar environment. Recently, the authors conducted a set of classroom seminars that presented real time flight scenarios to a room full of qualified pilots of varied experiences. The first scenario presented was a night MVFR/IFR flight from St Augustine Florida to Washington Dulles Airport. The original **"Plan"** called for a non-stop flight with a 45-minute fuel reserve. The **"Plane"** was a well-equipped TAA with a minor navigation light problem that delayed departure by an hour. The **"Passengers"** were one pilot and one non-pilot. The non-pilot seemed nervous about the trip and a little ill. Both passengers needed to get to Washington DC for an important meeting the next day. The **"Pilot"** had spent a full day at a flight refresher clinic, including a two-hour flight and a three-hour class, and felt reasonably refreshed at the 5 PM departure time. And finally, the GPS/MFD, the "**Programming**," combination looked like it would make the flight a snap. However, there were questions about the currency of the database that required the pilot's attention.

The discussion that followed revolved around the reliability of the weather data, the fatigue of the pilot landing at Dulles at 9 PM, alternate ways to get the passengers to their meeting, minimum requirements for aircraft night flight, and a more complete understanding of the benefits and challenges posed by GPS programming and database currency. The 5p's ensured that each pilot looked at the entire picture prior to making the critical decisions that would lay the groundwork for success or failure over four hours later in Washington.

Predictably, the destination weather deteriorated slowly as the flight proceeded northbound. The pilot's fatigue level, low altitude/long duration hypoxia, a succession of minor annoyances caused by the airplane and the passengers, began to become a factor. Again, the pilots applied the 5p's, and many decided to land short of Washington Dulles, check the weather, and secure a rental car as a backup for the Monday morning meeting (in fact many decided this prior to takeoff).

For the purposes of the discussion, this aircraft was equipped with a ballistic parachute system. For those that proceeded to Dulles, the scenario ended with a spatial disorientation incident at 1500 feet, 10 miles short of the airport caused by pilot fatigue, latent hypoxia, and failure to use the autopilot. For many, it was the first time they had considered all the options available, and the criticality of quick and accurate decisions. In the background, another instructor began calling out altitudes and speeds as the aircraft descended to the ground, providing an added dose of realism and pressure. Should the class initiate an unusual attitude recovery, and if it did not work should they attempt another? How much will the passengers help or hinder the pilots thought processes? When, and how, should the ballistic parachute system be deployed, and what are its limitations. This scenario sparked questions about the capabilities and limitations of the autopilot, cockpit automation, and the parachute system. More importantly, it caused the pilots in the room to examine how they should gather critical information, assess the risks inherent in the flight, and take timely action. All agreed that a few accurate decisions before and during the early part of the flight reduced the risk to pilot and passengers.
All these questions were discussed in a lively thirty-minute session following the scenario. In this type of Scenario Based Training, the group discussion is just as important as the actual situation, for it is during the discussion that the pilots are most ready to learn, and begin to develop a mental model of how they might react to situations. Instead of encountering a once in a lifetime, life or death, situation alone on the proverbial dark and stormy night, the participants could examine how the situation had developed, understand the options available to them, and begin to develop a general plan of action well ahead of time.

Learner Centered Grading

The third component of the FITS training method, following each flight scenario, is to use the concept of "learner-centered grading." Learner centered grading includes two parts: learner self assessment and a detailed debrief by the instructor. The purpose of the self assessment is to stimulate growth in the learner's thought processes and, in turn, behaviors. The self-assessment is followed by an in-depth discussion between the instructor and the pilot in training which compares the instructor ratings to the pilot in training's self-assessment.

To improve learning, it is recommended that learners prepare to learn from their experiences both before and after key events. This preparation should increase learning and enhance future performance. Pre-briefs are essential for setting goals. During key

events, especially those that require high levels of attention, there may be little time for learning; most individuals allocate the bulk of their cognitive resources to performing the actual task; however, they may also dedicate some cognitive resources to self-monitoring, learning, and correction.

How facilitation and feedback occur is important to the learning process. In order for feedback to be useful for both informational and motivational purposes, it should be designed systematically. For example, the facilitator (Flight Instructor) should avoid lecturing the learner, and should withhold their observations and opinions of the exercise until the learner has given their opinion. The use of closed-ended questions may stymie the usefulness of the feedback process as well, as they encourage one-word/yes/no types of answers that do not elicit opinions of performance or suggestions for improvement. It is more effective to use open-ended questions that probe the learner to assess their own performance. Allotting enough time for the feedback is also important. Debriefs that are rushed often turn into one-way “lectures” due to time constraints.
Referring to prior pre-briefs when conducting subsequent debriefs provides a sense of continuity, reliability, and consistency, all of which are desirable attributes of a feedback source. Reminding learners of goals and lessons learned from prior exercises helps them plan for future events. Learners may also be more receptive to feedback during the debrief if they were appraised of the goal criteria in a pre-brief.

The FITS approach utilizes scenarios to teach Single Pilot Resource Management (SRM) while simultaneously teaching individual tasks such as landings and takeoffs. The authors quickly realized that this required a new approach to the pilot in training's performance measurement. Traditional grading approaches are generally teacher centered and measure performance against an empirical standard. The following example of a traditional flight syllabus demonstrates.

Table 4: A Traditional Grading Scale

. Excellent - the pilot in training has performed in an excellent manner . Good – the pilot in training has exceeded basic requirements . Satisfactory – the pilot in training has met basic standards . Marginal – the pilot in training has failed to perform the task standards . Unsatisfactory – the pilot in training has demonstrated significant performance difficulties

Table 5: A Traditional Lesson

Lesson Tasks	Lesson Sub Tasks	Lesson Grading
. Flight Planning	. Flight Planning . Weight and Balance and Aircraft Performance Calculations	. U, M, S, G, E . U, M, S, G, E
. Normal Preflight and Cockpit Procedures	. Normal Pre-Takeoff Checklist Procedures . GPS/Avionics Programming . MFD /PFD Setup	. U, M, S, G, E . U, M, S, G, E . U, M, S, G, E

This type of grading scale (See Table 4), or something similar, is in wide use throughout the aviation training industry. While it appears to be based on published standards, in reality it is often used as a tool to determine pilot in training progress and provide motivation. Thus, on the first lesson a pilot in training may receive an "Excellent" grade for attempting to plan the flight and accomplishing the weight and balance with a few minor errors. However, by the third flight, that same performance may only earn a "Satisfactory" grade due to lack of pilot in training progress (***note that while performance remained the same, the grade changed***). Additionally, the Flight Instructor awards the grade based on his or her observation of the pilot in training's performance. This observation, while accurate, may not be based on an understanding of the pilot in training's level of knowledge and understanding of the task. Lastly, the pilot in training has been conditioned since grade school to look at grades as a reward for performance and may feel that there is a link between grades earned and their self-esteem. In reality, none of this aids pilot in training performance in any meaningful way.

The learner centered grading approach addresses the above concerns. First, the grade is now a "Desired Scenario Outcome." These outcomes describe pilot in training-learning behavior in readily identifiable and measurable terms. They reflect the pilot in training's ability to see, understand, and apply the skills and tasks that are learned to the scenario.

For instance, a pilot in training who can "explain" a successful landing has achieved the basic level of competence to begin the learning process. Once the pilot in training can "explain" the effect of crosswind and speed reduction on rudder effectiveness, they have achieved a level of learning that will allow for meaningful "Practice." The "Perform" level denotes unsupervised practice and self-correction of errors. These grades are equally applicable to the first scenario to the last since they are not lesson dependent.

The grade of "Manage/ Decide" is used solely for SRM grading and the grade of "Perform" is used solely for task grading. A pilot in training who is becoming proficient at aeronautical decision-making and risk management would be graded first at the "Explain" level, then at the "Practice", and finally at the "Manage/Decide" level. A Manage/Decide or Perform grade does not describe perfection. Rather, these grades

simply show a proficient pilot who corrects their own errors so that the outcome of the flight is never in doubt. Realistically, this is the performance level we desire. All pilots make mistakes, it is in learning to identify and correct mistakes that they become proficient pilots.

Desired Outcomes

The objective of scenario-based training is a change in the thought processes, habits, and behaviors of the pilot in training during the planning and execution of the scenario. Since the training is learner centered, the success of the training is measured in the following desired pilot in training outcomes.

(a) Maneuver Grades (Tasks)

- Describe – at the completion of the scenario, the PT will be able to describe the physical characteristics and cognitive elements of the scenario activities. *Instructor assistance is required to successfully execute the maneuver.*
- Explain –at the completion of the scenario the PT will be able to describe the scenario activity and understand the underlying concepts, principles, and procedures that comprise the activity. *Significant instructor effort will be required to successfully execute the maneuver.*
- Practice – at the completion of the scenario the pilot in training will be able to plan and execute the scenario. *Coaching, instruction, and/or assistance from the CFI will correct deviations and errors identified by the CFI.*
- Perform – at the completion of the scenario, the PT will be able to perform the activity without assistance from the CFI. *Errors and deviations will be identified and corrected by the PT in an expeditious manner.* At no time will the successful completion of the activity be in doubt. ("Perform" will be used to signify that the PT is satisfactorily demonstrating proficiency in traditional piloting and systems operation skills)
- Not Observed – Any event not accomplished or required

(b) Single Pilot Resource Management (SRM) Grades

- Explain – the pilot in training can verbally identify, describe, and understand the risks inherent in the flight scenario. *The pilot in training will need to be prompted to identify risks and make decisions.*
- Practice –the pilot in training is able to identify, understand, and apply SRM principles to the actual flight situation. *Coaching, instruction, and/or assistance from the CFI will quickly correct minor deviations and errors identified by the CFI.* The pilot in training will be an active decision maker.
- Manage/Decide - the pilot in training can correctly gather the most important data available both within and outside the cockpit, identify possible courses of action, evaluate the risk inherent in each course of action, and make the appropriate decision. *Instructor intervention is not required for the safe completion of the flight.*
- Not Observed – Any event not accomplished or required

Grading will be conducted independently by the pilot in training and the instructor, and then compared during the post flight critique.

Learner centered grading (outcomes assessment) is a vital part of the FITS concept. Previous syllabi and curriculum have depended on a grading scale designed to maximize pilot in training management and ease of instructor use. Thus the traditional: "excellent, good, fair, poor" or "exceeds standards, meets standards, needs more training" often meet the instructor's needs but not the needs of the pilot in training. The learner centered grading described above is a way for the instructor and pilot in training to determine the pilot in training's level of knowledge and understanding. "Perform" is used to describe proficiency in a skill item such as an approach or landing. "Manage-Decide" is used to describe proficiency in the SRM area such as ADM. Describe, explain, and practice are used to describe pilot in training learning levels below proficiency in both.

Grading should be progressive. During each flight, the pilot in training should achieve a new level of learning (e.g. flight one, the automation management area, might be a "describe" item by flight three a "practice" item, and by flight five a "manage-decide" item.

An Example of Learner Centered Grading

Immediately after landing, and before beginning the critique, Flight Instructor Linda asks her pilot in training Brian to grade his performance for the day. Being asked to grade himself is a new experience but he goes along with it. The flight scenario had been a two-leg IFR scenario to a busy class B airport about 60 miles to the east. Brian had felt he had done well in keeping up with programming the GPS and the MFD until he reached the approach phase. He had attempted to program the ILS for runway 7L and had actually flown part of the approach until ATC asked him to execute a missed approach.

When he went to place a grade in that block he noticed that the grades were different. Instead of satisfactory or unsatisfactory he found, "Describe, Explain, Practice, and Perform". He decided he was at the Perform level since he had not made any mistakes.

When Linda returned Brian discovered that she had graded his flight as well, with a similar grade sheet. Most of their grades appeared to match until the item labeled "programming the approach". Here, where he had placed a "Perform" Linda had placed an "Explain." This immediately sparked a discussion. As it turned out, Brian had selected the correct approach, but he had not activated it. Before Linda could intervene, traffic dictated a go around. Her explain grade told Brian that he did not really understand how the GPS worked and he agreed. Now, learning could occur.

In Table 6, the desired outcome table denotes a pilot in training near the beginning of training and the grades reflect proficiency of the pilot in training to an expected level of performance in each of these areas. These grades are not self-esteem related since they do not describe a recognized level of prestige (such as A+ or "Outstanding"), rather a level of performance. You can't flunk a lesson. However, you can fail to demonstrate the required flight and SRM skills. By reflecting on the lesson and grading their own performance, the pilot in training becomes actively involved in the critique process. Pilot

in training participation in the process also reduces the self-esteem issue. But most importantly, this establishes the habit of healthy reflection and self-criticism that marks most competent pilots.

Table 6: Learner Centered Scenario Grading-Desired Outcome Table

Scenario Activities	Scenario Sub Activities	Desired Scenario Outcome
Flight Planning	1. Scenario Planning 2. Weight and Balance and Aircraft Performance Calculations 3. Preflight SRM Briefing 4. Decision making and risk management	1. Perform 2. Perform 3. Perform 4. Explain/Practice
Normal Preflight and Cockpit procedures	1. Normal Pre-Takeoff Checklist Procedures 2. GPS Programming 3. MFD Setup 4. PFD Setup	1. Perform 2. Explain/Practice 3. Practice 4. Explain/Practice
Engine Start and Taxi Procedures	1. Engine Start 2. Taxi 3. SRM/Situational Awareness	1. Perform 2. Perform 3. Explain/Practice
Before Takeoff Checks	1. Normal and Abnormal Indications 2. Aircraft Automation Management 3. Aeronautical Decision Making and Risk management	1. Perform 2. Explain/Practice 3. Manage/Decide

SECTION 5 – FITS PRIVATE MULTI-ENGINE ADDITIONAL RATING SYLLABUS

Introduction

To the Pilot-in-Training (PT) and Instructor

This Private Multi-engine Additional Rating Syllabus is unique in several ways that you should be familiar with as you use the syllabus to acquire the FAA Multi-engine Additional Aircraft Rating Airplane. First, it is a syllabus that uses real-world scenarios as the foundation of the training. This generic syllabus follows the FAA/Industry Training Standards (FITS) accepted training method. It's to be used as a guide for developing your own FITS accepted syllabus that fits your specific flight school, aircraft, and environment. Flight maneuvers are still a vital part of flight training and flight maneuvers are a part of this syllabus, but real-world scenarios are used to enhance the pilot's decision making skills. The syllabus presents situations and circumstances that MEL pilots face every day as learning experiences and lessons. The primary tenet of FITS training is that you prepare for the real world of MEL flight operations, by acting as a MEL pilot while in training. Therefore, throughout the syllabus, the pilot in training (PT) will take on different tasks or jobs just as if they were already a MEL pilot. The second important unique feature of this syllabus, and of FITS training, is that it is all competency based. The times shown in each lesson are target times and should not be considered the minimum or maximum ground/flight time for the lesson. When the PT masters a particular skill area in the syllabus, they move on regardless of how much time it takes to reach that point of mastery. This means that each lesson does not necessarily equal one flight. It may take several flights before the PT masters the elements of the lesson and is ready to move on to the next lesson. Consequently, the amount of total flight hours a PT has when the syllabus is completed may be more or less than the minimum times under current aviation regulations. Please note that FITS is conducted under the current rules. Although philosophically, FITS is competency based, many training organizations must still require their students to meet the FAA minimum training hours. Courses under 14 CFR Parts 142 and 141.55(d) may be approved to train to a standard.

Using of Decision-Making scenarios in flight training

The PT, in this syllabus, is the Private pilot seeking the Multi-engine Additional Aircraft Rating Airplane (MEL). Thus, the PT will be the private pilot learning how to fly a multi-engine airplane using scenario-based learning. The PT will be given assume various situations and asked to perform the multi-engine maneuvers under those conditions. In other words, the PT will be placed in a scenario where he/she will be expected to manage the situation and fly the airplane. The following discussion addresses how the instructor could use the decision-making scenario method to enhance the learning and teach aeronautical decision-making.

For years, good flight instructors have incorporated some form of scenario-based learning into their flight training. Usually during a flight the CFI would tell the PT that

something has occurred, such as deteriorating weather, an aircraft malfunction, or air traffic delay. The PT is to assume that the occurrence is actually real and to act accordingly. The PT might decide to divert to a different airport after the CFI tells them that the weather at their destination is poor. The PT may decide to change from the original plan and flies to a different airport. The difference between that and FITS is that FITS also incorporates the consequences of the failure to arrive at the originally planned airport. If a PT decides to fly to an alternate airport instead of the original destination because the CFI "makes up" a story that the weather is bad, then that alone does not consider the consequences of that decision. What if, rather than a training flight, the flight to the original destination was to deliver a human organ for transplant – the decision to divert to an alternate airport could have the consequence of the patient dying that was awaiting the transplant. If the pilot understood that their decision has actual life or death consequences, then the decision to divert will be more difficult. In the real world, these are the type of decisions a pilot faces everyday – so in this syllabus we train the pilot to be ready to make those decisions. For these reasons, most of the lessons in this syllabus are actual "missions" that carry with them actual reasons for the flight and actual consequences for the decisions the pilot will make. The lessons are not "scripted" to the point that every outcome is known in advance. The PT and flight instructor must be flexible enough to accept this fact. Different PTs will make different decisions, and these different decisions will alter the outcome of each flight. Using real world scenarios as part of flight training does not in any way diminish the need for pilots to also have good "stick and rudder" skills. Pilots will always need the skills, for instance, to land in a crosswind (although enhanced decision skills will prevent them from attempting a dangerous crosswind landing in the first place!). The lessons in this syllabus therefore are all part "mission" training and part "maneuvers" training on a sliding scale. None of the lessons in this syllabus are 100% mission and none are 100% maneuvers. The amount that any lesson is mission-based or maneuver-based is determined by the completion standards of that lesson.

The Pilot-In-Training Plays a Role in Grading the Lesson

Again, the PT training will learn how to use learner-centered grading through participation in a student-centered grading process during the course of this training.

Learner-centered grading means that after each flight, the PT and instructor will have a discussion of the items that were encountered on the flight and each will evaluate the items. The PT will judge her/his own performance. The instructor, likewise will judge the PT's performance and then the PT and instructor will compare evaluations. There will be items that both the PTs and instructor will agree were performed well and other that both agree could use improvement. Inevitably, the PT and instructor's evaluations will disagree. This will be a great opportunity to discuss alternate methods, solutions and techniques that could have been used by the PT to have produced a more favorable outcome to the lesson. Mission based flight lessons can have multiple outcomes that are "correct." The PT and instructor will discuss if the outcome of the flight was a safe outcome – which is the primary concern of any flight.

Beyond the basic safety of the flight, the PT and instructor will discuss if the outcome could have been even better – optimized. The instructor will use a “rubric” to grade the lessons based on what is an unacceptable outcome, versus a range of possible acceptable outcomes. A “rubric” might be defined as a set of criteria that aids the instructor in evaluating an outcome as objectively as possible when there are multiple correct answers, which is often the true in aeronautical decision-making. This does not mean that some answers are better than others, they just are not incorrect. Learning to choose a good solution or the best solution to an in-flight problem is judgment training. Judgment training is an integral part of FITS training.

The Format of Each Lesson

Each lesson in this syllabus will have the same format. The PT and instructor should read through the format information before the flight and as preparation for the flight. Each lesson will have:

1. Heading
2. Scenario
3. Lesson Objectives
4. Pre Briefing
5. Completion Standards
6. Desire Outcome Grade Sheet
7. Debriefing
8. Notes to the Instructor

Syllabus Shuffle

This FITS Private Multi-engine Aircraft Additional Rating Syllabus has one more unique feature. It contains two “learning strands.” The strands are: Multi-engine Aircraft Systems and Multi-engine Aerodynamics, Performance, and Control. A PT does not have to complete one strand before beginning on another. The syllabus is designed to be “shuffled” and to allow maximum flexibility to meet training requirements. There are some prerequisite lessons that must follow in a particular order, but most lessons can come in any order. If an instructor and PT had previously completed ground lessons 6 and 7 and are scheduled for flight lesson 8 or 9 today, but the weather at the destination prevents that lesson, the instructor could switch and conduct lesson 11 or flight lesson 12.

Private Multi-engine Additional Rating Syllabus

Ground Lesson 1	Ground Lesson 11
Ground Lesson 2	Flight Lesson 12
Flight Lesson 3	Flight Lesson 13
Flight Lesson 4	Flight Lesson 14
Flight Lesson 5	Flight Lesson 15
Ground Lesson 6	Flight Lesson 16
Ground Lesson 7	Flight Lesson 17
Flight Lesson 8	Flight Lesson 18 – FAA Practical Test
Flight Lesson 9	
Flight Lesson 10	
Multi-engine Aircraft Systems	Multi-engine Aerodynamics, Performance, and Control

Ground lessons are Knowledge Acquisition Lessons and must come before the Flight Lesson/s in respective columns. Flight lessons within a column can be completed in any order once the ground lessons for the column are completed. Columns of lessons may be started and/or completed in any order. Lessons 17 is the final training lessons before the FAA Practical Test, lesson 18 (FAA Multi-engine Airplane Practical Test). Typically, the assigned instructor will conduct light lesson 16, a senior flight instructor will conduct flight lesson 17, and a FAA pilot examiner or designed examiner will complete flight lesson 18.

FITS Private Multi-engine Additional Rating Curriculum Outline

Stand 1 – Multi-engines Aircraft Systems

Objectives of lessons 1 through 10: During this strand of training the PT will be provided experience in VFR multi-engine procedures and multi-engine aircraft systems that will meet or exceed the requirements of the Multi-engine Practical Test Standards.

Completion Standards for lessons 1 through 10: At the completion of this strand of training, the PT has the aircraft systems knowledge required for the Multi-engine Practical Test Standards.

Ground Lesson 1
Ground Lesson 2
Flight Lesson 3
Flight Lesson 4
Flight Lesson 5
Ground Lesson 6
Ground Lesson 7
Flight Lesson 8
Flight Lesson 9
Flight Lesson 10

Stand 2 – Multi-engine Aerodynamics, Performance, and Control

Objectives of lessons 11 through 18: During this strand of training the PT will continue to gain the knowledge, skills, and judgment necessary to operate a multi-engine airplane in the National Airspace System.
Completion Standards of Lessons 11 through 18: During this strand of training, when the PT has the knowledge, skills, and judgment to operate a multi-engine airplane with private pilot privileges in the National Airspace System.

Ground Lesson 11
Flight Lesson 12
Flight Lesson 13
Flight Lesson 14
Flight Lesson 15
Flight Lesson 16
Flight Lesson 17
Flight Lesson 18 – FAA Multi-engine Practical Test

Strand 1 – Multi-engine Aircraft Systems

Multi-engine Aircraft Systems – Lesson 1
Review Certificates and Documents Outlined in the Multi-engine Airplane Practical Test – Mission
GND Lesson 1 (Approximate lesson time 1.5 hours)

Scenario:

The PT is a private pilot with a multi-engine land rating and has just bought a twin-engine airplane. The student is asking for a checkout in his airplane. Next week he is planning to take his family from the New England area to the Midwest to visit his wife's Mother.

Lesson Objective:

This ground lesson will be used to introduce the PT to certificates and documents, minimum equipment list, normal operations, preflight, performance charts, weight and balance, and safety policies and procedures. In addition, this ground lesson will introduce the PT to scenario based training, learner centered grading, and single pilot resource management.

Pre Briefing:

The instructor will take the lead in the pre briefing and debriefing.

Completion Standards:

The completion standards for this lesson will have been met when the PT demonstrates a working knowledge of certificates and documents, minimum equipment list, normal operations, preflight, performance charts, weight and balance, and safety policies and procedures. In addition, the PT will understand how judgment and thinking skills will be learned and developed.

Desired Outcome Grade Sheet:

			Task Grades					SRM Grades		
Lesson 01 **Desired Outcome Grade Sheet**			Not Observed	Describe	Explain	Practice	Perform	Explain	Practice	Manage/Decide
Scenario Activities	Task	Desired Performance								
Demonstration of SRM	Effectively managed all resources available related to the lesson	Explain								
	Discussed and demonstrated the proper use of automation management in all phases of flight	Explain								

	Identified and discussed areas of risk and made proper decisions in managing those situation	Explain								
	Discussed and demonstrated proper task management throughout the flight lesson	Explain								
	Exercised proper aeronautical decision making and risk management while maintaining positional and situational awareness	Explain								
	Discussed and demonstrated the avoidance of controlled flight into terrain	Explain								
	Effectively managed the flight as a Private Pilot with a multi-engine rating	Explain								
Scenario-Based Training	Understands the FITS scenario based training concept and learner centered grading	Practice								
	Understands the concept of student led training	Practice								
	Understands the concept of learner centered grading	Practice								
	Understands the completion standards for the course	Practice								
	Understands the role that the Practical Test Standards have in their training	Practice								
	Understands the use of the Practical Test Standards through the application of certification scenarios	Practice								
Introduction	Use of minimum equipment list	Explain								
	Normal operations procedures – two engines									
	Appropriate V speeds for two engine operations	Explain								
	Airplane and operating limitations	Explain								
	Airplane placards	Explain								
	Engine starting procedures: normal, cold, hot, and flooded	Explain								
	Airspeeds and power settings applicable for two engine operations	Explain								
	Performance charts applicable for two engine operations	Explain								
	Airplane weight and balance	Explain								
	Airplane preflight inspection, interior and exterior	Explain								
Safety Policies and Procedures	Understands the role that the Safety Policies and Procedures have in their training	Perform								
	Properly applies the policies and procedures through discussions that include scenarios that may occur in actual multi-engine flight training	Perform								
Aeronautical Decision Making	Discussed and is able to explain aeronautical decision making at a Private Pilot level as outlined in the Aviation Instructor's Handbook	Explain								

	Discussed and is able to explain the use of the PAVE and DECIDE model as well as the 5Ps in multi-engine flight	Explain								
	Discussed and is able to explain assessing the risk of a student and flight lesson	Explain								
	Discussed and is able to explain factors that affect decision making	Explain								
	Discussed and is able to explain incorporating aeronautical decision making scenarios into ground briefings and flight lessons to emphasize risk management and single pilot resource management	Explain								

Debriefing:

Initially the de-briefing will be lead by the instructor using LCG techniques.

Assignment for lesson 2:
1. Airplane POH and checklist
2. Multi-engine airplane systems
3. Emergency procedures

Notes to the Instructor:

The Notes to the Instructor should be on a separate page for easy removal for use by the instructor during the lesson and omission from the PT's package.

For lesson one the instructor sets up the circumstances for the PT.

If the PT has not been trained under a FITS accepted course, it is very likely that the PT will need assistance thinking of alternatives during the first couple of lessons, but should quickly catch on. Once the PT catches on, guided discussion should become more complex and extensive. Remind the PT that the grading sheet will serve as a briefing guide for the PT's de-briefing of the simulated student in the training situation.

Multi-engine Aircraft Systems – Lesson 2
Review for Multi-engine Practical Test – Mission
GND Lesson 2 (Approximate lesson time 3.0 hours)

Scenario:

You and two friends are planning a trip from Minneapolis, MN to Dallas, TX to watch the Vikings pay the Cowboys. One of your friends is apprehensive about flying in a light twin and the other is a very inquisitive type. He constantly asks what is this and how does it work. With one passenger needing reassurance and the other always asking about you airplane, you figure you really need to know your stuff. Fortunately, you will need a flight review before your return flight, so you have set up a ground review and several review flights.

Lesson Objective:

This ground lesson will be used to introduce the PT to multi-engine airplane systems and emergency procedures.

Pre Briefing:

The instructor will lead the discussions using guided discussions and has e-mailed you several system failures and asked you to explain what has happened, how will it effect the flight, and what will you do about it.

Completion Standards:

This lesson is complete when the PT demonstrates a working knowledge of multi-engine airplane systems and emergency procedures. In addition, the PT will discuss several alternatives for handling the emergencies, decide which is best, and explain why he thinks it is the best solution.

Desired Outcome Grade Sheet:

Lesson 02 **Desired Outcome Grade Sheet**			Task Grades					SRM Grades		
Scenario Activities	Task	Desired Performance	Not Observed	Describe	Explain	Practice	Perform	Explain	Practice	Manage/Decide
Demonstration of SRM	Effectively managed all resources available related to the flight lesson	Explain								
	Discussed and demonstrated the proper use of automation management in all phases of flight	Explain								
	Identified and discussed areas of risk and made proper decisions in	Explain								

	managing those situation									
	Discussed and demonstrated proper task management throughout the flight lesson	Explain								
	Exercised proper aeronautical decision making and risk management while maintaining positional and situational awareness	Explain								
	Discussed and demonstrated the avoidance of controlled flight into terrain	Explain								
	Effectively managed the flight as a Private Pilot with a multi-engine rating	Explain								
Multi-engine Airplane Systems	Landing gear systems components, operations and limitations	Explain								
	Brake system components, operations and limitations	Explain								
	Engine components, operations and limitations	Explain								
	Propeller components, operations and limitations	Explain								
	Fuel system components, operations and limitations	Explain								
	Electrical system components, operations and limitations	Explain								
	Avionics system components, operations and limitations	Explain								
	Environmental system components, operations and limitations									
	Heating	Explain								
	Cooling	Explain								
	Pressurization/high altitude	Explain								
	Deice and anti-ice system components, operations and limitations									
	Pitot static	Explain								
	Airframe	Explain								
	Propeller	Explain								
	Windshields	Explain								
	Airplane control surfaces									
	Trim tabs, anti-servo tabs	Explain								
	Flaps	Explain								
	Ailerons	Explain								
Emergency Procedures – all engines operating	Emergency checklist	Explain								
	Engine roughness or overheat	Explain								
	Loss of oil pressure	Explain								
	Engine fire									
	Fire during start	Explain								
	Fire during flight	Explain								
	Electrical fire	Explain								
	Fuel management									
	Engine driven fuel pump failure	Explain								
	Cross feed operations	Explain								
	Landing gear unsafe warnings	Explain								
	Landing gear malfunctions	Explain								

	Electrical system malfunctions									
	Single alternator failure	Explain								
	Dual alternator failure	Explain								
	Spin recovery	Explain								
	Open door	Explain								
	Propeller overspeed	Explain								
	Carburetor icing	Explain								
	Wing flap malfunction (asymmetrical)	Explain								
	Emergency exits and equipment	Explain								
Emergency Landing	Precautionary – with power	Explain								
	Without power procedures	Explain								
Aeronautical Decision Making	Discussed and is able to explain aeronautical decision making at a Private Pilot level as outlined in the Aviation Instructor's Handbook	Explain								
	Discussed and is able to explain the use of the PAVE and DECIDE model as well as the 5Ps in multi-engine flight	Explain								
	Discussed and is able to explain assessing the risk of a student and flight lesson	Explain								
	Discussed and is able to explain factors that affect decision making	Explain								
	Discussed and is able to explain incorporating aeronautical decision making scenarios into ground briefings and flight lessons to emphasize risk management and single pilot resource management	Explain								

Debriefing:

The de-briefing will be lead by the instructor.

Assignment for Lesson 3:
1. Checklist usage – flow patterns
2. Weight and balance, and performance charts
3. Develop lesson plan on stalls

Notes to the Instructor:

The Notes to the Instructor should be on a separate page for easy removal for use by the instructor during the lesson and omission from the PT's package.

Again, this syllabus assumes the PT holds a private pilot certificate, but it does not assume that the PT has received scenario-based instruction and ADM training and been graded under a LCG system. In other words, the syllabus does not assume that the PT has been trained under a FITS accepted syllabus previously. Therefore, it is being suggested the PT be given ADM training.

Multi-engine Aircraft Systems – Lesson 3
Light Twin Demonstration Flight – Mission
FLT Lesson 3 (Approximate lesson time 1.3 hours)

AIRPLANE – MEL

Scenario:

You are doing a local checkout to rent a multi-engine airplane from you local FBO. You have rented from this FBO before and just need to show them you a familiar with this airplane.

Lesson Objective:

The PT shall be introduced to multi-engine airplane operations with an emphasis on flow patterns and operating procedures.

Pre Briefing:

The instructor will lead the discussions.

Aircraft performance, and weight and balance have been covered in previous ground briefing; however, they have not been done in preparation for an actual flight.

Completion Standards:

This lesson is complete when the PT demonstrates a working knowledge of multi-engine airplane operations to include the location and function of all items in the cabin. The PT will also use the checklist. The standards for this lesson are: altitude ±200 ft., heading ±20º, and airspeed ±20 kts. will be maintained where appropriate. Also, the PT will demonstrate an acceptable use of aeronautical decision making, risk management, and single pilot resource management.

Desired Outcome Grade Sheet:

			Task Grades					SRM Grades		
Lesson 03 **Desired Outcome Grade Sheet**			Not Observed	Describe	Explain	Practice	Perform	Explain	Practice	Manage/Decide
Scenario Activities	Task	Desired Performance								
Preflight briefing	Weight and balance	Practice								
	Prior planning and preparation	Practice								
	Airplane performance	Practice								
	Descent planning	Practice								
Demonstration of SRM	Effectively managed all resources available related to the flight lesson	Practice								

	Discussed and demonstrated the proper use of automation management in all phases of flight	Practice								
	Identified and discussed areas of risk and made proper decisions in managing those situation	Practice								
	Discussed and demonstrated proper task management throughout the flight lesson	Practice								
	Exercised proper aeronautical decision making and risk management while maintaining positional and situational awareness	Practice								
	Discussed and demonstrated the avoidance of controlled flight into terrain	Practice								
	Effectively managed the flight as a Private Pilot with a multi-engine rating	Practice								
Introduction	Checklist usage – flow patterns	Explain								
	Ground operations – starting and pre-takeoff checks	Explain								
	Normal takeoff	Explain								
	Climb procedures	Explain								
	Cruise procedures	Explain								
	Maneuvers									
	Stalls									
	Power-off	Explain								
	Power-on	Explain								
	Maneuvering during slow flight	Explain								
	Steep turns	Explain								
	Descent and approach procedures	Explain								
	Traffic pattern operations	Explain								
	Normal landings	Explain								
	Parking – shutdown checks	Explain								
Aeronautical Decision Making	Discussed and is able to explain aeronautical decision making at a Private Pilot level as outlined in the Aviation Instructor's Handbook	Practice								
	Discussed and is able to explain the use of the PAVE and DECIDE model as well as the 5Ps in multi-engine flight	Practice								
	Discussed and is able to explain assessing the risk of a student and flight lesson	Practice								
	Discussed and is able to explain factors that affect decision making	Practice								
	Discussed and is able to explain incorporating aeronautical decision making scenarios into ground briefings and flight lessons to emphasize risk management and single pilot resource management	Practice								
Post-flight discussion	Critique student performance, preview next lesson, and make study assignment	Explain								

Debriefing:

The instructor will lead a debriefing using a LCG approach; that is, jointly the instructor and PT will debrief the performance after individually assessing the PT's it.

Assignment for Lesson 4:
1. Airplane POH and checklist
2. Two engine emergency procedures

Notes to the Instructor:

The learning experience will be enhanced if the PT is reminded that this is a checkout flight that he/she wants to do to rent a twin. In other words, remind the PT about the scenario and the consequences.

Multi-engine Aircraft Systems – Lesson 4
Private Pilot Multi-engine Training Lesson – Mission
FLT Lesson 4 (Approximate lesson time 1.2 hours)

Visual Flight Training Device/Multi-engine Aircraft (if FTD is not available)

Scenario:

You are taking a date in your dad's new twin to a great restaurant in a town about 200 miles away for a romantic lunch. You are planning to leave mid-morning and return early afternoon. The weather is good and forecasted to remain good. The route of flight will take you date's lake home. You have had an excellent checkout in the airplane with the last three months, but have less than 20 hours in make and model.

Lesson Objective:

The PT will review previously learned maneuvers to gain additional knowledge and proficiency. The PT will also be introduced to all engines operating emergency procedures covered in ground lesson 2. The instruction will correlate decision making into the tasks by discussing task, risk, and automation management as it applies to actual multi-engine flight.

Pre Briefing:

The instruction in this case is one of a series of lessons that will lead the pilot to obtaining a multi-engine airplane rating. You should emphasize aeronautical decision-making and judgment development during the discussions of the system and equipment malfunctions.

Completion Standards:

This lesson is complete when the PT demonstrates a working knowledge of multi-engine airplane operations to include the location and function of all items in the cabin. The PT will also use the checklist. The standards for this lesson are: altitude ±200 ft., heading ±20º, and airspeed ±20 kts. will be maintained where appropriate. The PT will also demonstrate the ability of presenting aeronautical decision making scenarios that may occur in actual multi-engine flight when presenting aircraft flight multi-engines and the multi-engine cockpit check.

Desired Outcome Grade Sheet:

Lesson 04 **Desired Outcome Grade Sheet**			Task Grades					SRM Grades		
			Not Observed	Describe	Explain	Practice	Perform	Explain	Practice	Manage/Decide
Scenario Activities	Task	Desired Performance								
Preflight briefing	Discuss lesson objective	Practice								
	Preflight planning and preparation	Practice								
	Two engine emergency procedures	Practice								
Demonstration of SRM	Effectively managed all resources available related to the flight lesson	Practice								
	Discussed and demonstrated the proper use of automation management in all phases of flight	Practice								
	Identified and discussed areas of risk and made proper decisions in managing those situation	Practice								
	Discussed and demonstrated proper task management throughout the flight lesson	Practice								
	Exercised proper aeronautical decision making and risk management while maintaining positional and situational awareness	Practice								
	Discussed and demonstrated the avoidance of controlled flight into terrain	Practice								
	Effectively managed the flight as a Private Pilot with a multi-engine rating	Practice								
Introduction	Two engine emergency procedures									
	Emergency checklist	Explain								
	Engine roughness or overheat	Explain								
	Loss of oil pressure	Explain								
	Engine fire									
	Fire during start	Explain								
	Fire during flight	Explain								
	Electrical fire	Explain								
	Fuel management									
	Engine driven fuel pump failure	Explain								
	Cross feed operations	Explain								
	Landing gear unsafe warnings	Explain								
	Landing gear malfunctions	Explain								
	Electrical system malfunctions									
	Single alternator failure	Explain								
	Dual alternator failure	Explain								
	Spin recovery	Explain								
	Open door	Explain								
	Propeller overspeed	Explain								
	Carburetor icing	Explain								
	Wing flap malfunction (asymmetrical)	Explain								

	Emergency exits and equipment	Explain								
Review	Checklist usage – flow patterns	Practice								
	Ground operations – starting and pre-takeoff checks	Practice								
	Normal takeoff	Practice								
	Climb procedures	Practice								
	Cruise procedures	Practice								
	Maneuvers									
	Stalls									
	Power-off	Practice								
	Power-on	Practice								
	Maneuvering during slow flight	Practice								
	Steep turns	Practice								
	Descent and approach procedures	Practice								
	Traffic pattern operations	Practice								
	Normal landings	Practice								
	Parking – shutdown checks	Practice								
	Checklist usage – flow patterns	Practice								
Aeronautical Decision Making	Discussed and is able to explain aeronautical decision making at a Private Pilot level as outlined in the Aviation Instructor's Handbook	Practice								
	Discussed and is able to explain the use of the PAVE and DECIDE model as well as the 5Ps in multi-engine flight	Practice								
	Discussed and is able to explain assessing the risk of a student and flight lesson	Practice								
	Discussed and is able to explain factors that affect decision making	Practice								
	Discussed and is able to explain incorporating aeronautical decision making scenarios into ground briefings and flight lessons to emphasize risk management and single pilot resource management	Practice								
Post-flight Discussion	Critique student performance, preview next lesson, and make study assignment	Practice								

Debriefing:

Use LCG techniques to emphasize critical thinking skills development and capture learning opportunities. Learning opportunities occur when the PT is given a chance to gain insight about a point, topic, concept, or theory.

Assignment for Lesson 5
1. Airplane POH and checklist
2. Short-field takeoff and maximum performance climb
3. Short-field landing

Notes to the Instructor:

The scenario sets up a nice flight for an enjoyable lunch with lots of incentive. The over-flight of the date's lake home allows an opportunity to set up maneuvering for sightseeing where the slow flight, stalls, and malfunctions can be done. Selecting an over-flight location close to the departure airport should simplify the division choices and lead the PT to returning. This will allow the flight to be taken to a logical conclusion with a recovery back at your home station. You should select an emergency that will allow you to do all or most of the items listed on the Desired Outcomes Grading Sheet. The specific malfunction or emergency will depend on the aircraft being flown and/or other factors unique to your location. The postflight debriefing should include other options, possible diversions, and solutions to the problem/s.

Multi-engine Aircraft Systems – Lesson 5
Practice Multi-engine Operations – Mission
FLT Lesson 5 (Approximate lesson time 1.0 hour)

Scenario:

You are working for a construction firm near you home and your boss wants you to fly to town about 300 miles away to pick up pictures of an Interstate bridge that collapsed two days earlier. You will leave in time to have lunch there and return before dark.

Lesson Objective:

The PT will review previously learned maneuvers to gain additional knowledge and proficiency. The PT will also be introduced to maximum performance takeoffs and landings, and two engine emergency procedures.

Pre Briefing:

Use actual weather for planning purposes.

Completion Standards:

This lesson is complete when the PT demonstrates a working knowledge of short-field takeoffs, maximum performance climb, and landings as well as the previously learned maneuvers and two engine emergency procedures. The PT will maintain altitude ±150 ft., heading ±15º, and airspeed ±15 kts. where appropriate. Also, the PT will demonstrate the ability to use good critical thinking skills.

Desired Outcome Grade Sheet:

Lesson 05 **Desired Outcome Grade Sheet**			Task Grades					SRM Grades		
Scenario Activities	Task	Desired Performance	Not Observed	Describe	Explain	Practice	Perform	Explain	Practice	Manage/Decide
Preflight Discussion	Discuss lesson objective	Practice								
	Preflight planning and preparation	Practice								
	Airplane weight and balance considerations	Practice								
Demonstration of SRM	Effectively managed all resources available related to the flight lesson	Practice								
	Discussed and demonstrated the proper use of automation management in all phases of flight	Practice								
	Identified and discussed areas of risk and made proper decisions in managing those situation	Practice								

	Discussed and demonstrated proper task management throughout the flight lesson	Practice								
	Exercised proper aeronautical decision making and risk management while maintaining positional and situational awareness	Practice								
	Discussed and demonstrated the avoidance of controlled flight into terrain	Practice								
	Effectively managed the flight as a Private Pilot with a multi-engine rating	Practice								
Introduction	Short-field takeoff and maximum performance climb	Practice								
	Short-field landing	Practice								
Review	Checklist usage – flow patterns	Practice								
	Preflight inspection – emergency equipment and survival gear	Practice								
	Cockpit management	Practice								
	Starting and pre-takeoff checks	Practice								
	taxiing	Practice								
	Ground operations									
	Preflight inspection - emergency equipment and survival gear	Practice								
	Cockpit management	Practice								
	Starting and pre-takeoff checks	Practice								
	taxiing	Practice								
	Normal takeoff	Practice								
	Climb procedures	Practice								
	Cruise procedures	Practice								
	Maneuvers									
	Stalls									
	Power-off	Practice								
	Power-on	Practice								
	Maneuvering during slow flight	Practice								
	Steep turns	Practice								
	Emergency descent	Practice								
	Descent and approach procedures	Practice								
	Airport and traffic pattern operations	Practice								
	Normal/crosswind landings	Practice								
	Go-arounds/rejected landing	Practice								
	Parking – shutdown checks	Practice								
	Two engine emergency procedures									
	Emergency checklist	Explain								
	Engine roughness or overheat	Explain								
	Loss of oil pressure	Explain								
	Engine fire									
	Fire during start	Explain								
	Fire during flight	Explain								
	Electrical fire	Explain								
	Fuel management									
	Engine driven fuel pump failure	Explain								
	Cross feed operations	Explain								
	Landing gear unsafe warnings	Explain								

	Landing gear malfunctions	Explain								
	Electrical system malfunctions									
	Single alternator failure	Explain								
	Dual alternator failure	Explain								
	Spin recovery	Explain								
	Open door	Explain								
	Propeller overspeed	Explain								
	Carburetor icing	Explain								
	Wing flap malfunction (asymmetrical)	Explain								
	Emergency exits and equipment	Explain								
Aeronautical Decision Making	Discussed and is able to explain aeronautical decision making at a Private Pilot level as outlined in the Aviation Instructor's Handbook	Practice								
	Discussed and is able to explain the use of the PAVE and DECIDE model as well as the 5Ps in multi-engine flight	Practice								
	Discussed and is able to explain assessing the risk of a student and flight lesson	Practice								
	Discussed and is able to explain factors that affect decision making	Practice								
	Discussed and is able to explain incorporating aeronautical decision making scenarios into ground briefings and flight lessons to emphasize risk management and single pilot resource management	Practice								

Debriefing:

LCG techniques should be used during the debriefing to practice their use and to enhance learning. The PT should be able to accurately assess his/her own performance.

Assignment for Lesson 6

1. Airplane POH and checklist
2. Significance of V-speeds for single engine operations
3. Directional control with one engine inoperative
4. Factors effecting V_{MC}
5. Identification of an inoperative engine
6. Verification of an inoperative engine
7. Feathering and securing an inoperative engine

Notes to the Instructor:

The scenario for this lesson calls for a cross-country flight to a nearby town to pickup pictures of a bridge that had collapsed several days earlier. The flight could be in a company or privately owned twine to do company business. The scenario provides an important reason for the flight but does not place a lot of demands on the pilot. The flight

does introduce short-field takeoffs and landings. You can pick an appropriate departure runway where short-field takeoffs and landings can be practiced. Additionally, you could ask the PT to overfly the collapsed bridge for some sightseeing and during the sightseeing review stalls, steep turns, and slow flight. At the completion of the sightseeing, you could simulate an engine emergency requiring an emergency descent. It is recommended that you take the emergency to a logical conclusion. That means that you should allow the PT to divert, if a diversion needed, and land the airplane at the diversion airport. Use the review items from the Desired Outcomes Grading Sheet as the trigger event. Cover as many emergency procedures as reasonable in flight. Remember that additional emergencies can be used during the return leg if the diversion is not back to the departure airport. Setting up the trigger event to cause the diversion to go to some other airport will give you the opportunity to practice normal/crosswind landings in addition to the short-field takeoffs and landings. These suggestions are not meant to dictate how to do this lesson but rather to suggest some ideas on how you might do all of items required during this lesson. It would likely be just as easy to normal/crosswind takeoffs and landings at the departure airport and short-field takeoffs and landings at the destination/diversion airport.

A word about diversions, introducing a trigger event in the vicinity of an airport that you would like to divert to may or may not lead to that airport being used. The PT may take longer to recognize the event than you planned and/or the PT may simply pick a different airport. This could be a problem for you if the training items you want to practice at the diversion airport are not appropriate for the actual airport. For example, it is a busy airport where you can use the short-field due to traffic or it just does not have a short runway. Consider planning several trigger events that can be done and then do the event that leads to the desired results. For example, you may start with carburetor icing, if the PT handles the situation promptly and correctly, you may want to have a plug fouling as a result of the icing, which could lead to an engine failure or just a rough running engine. Otherwise, you could have the engine back fire during the recovery for icing procedure that starts an engine fire. If the carburetor icing is not handled promptly, you could simply loss the engine heat and be unable to keep the engine running or to restart the engine. Note that this is not an engine failure lesson so you should not be failing an engine on this lesson. Remember that the problems should be realistic.

Multi-engine Aircraft Systems – Lesson 6
Introduce Multi-engine Emergencies – Mission
GND Lesson 6 (Approximate lesson time 2.0 hours)

Scenario:

During a recent trip, you had an engine that began to run rough and you decide that you need to review one engine inoperative procedures and operations. Your local flying club is conducting a training session on the subject at it next meeting.

Lesson Objective:

This ground lesson will be used to introduce the PT to V speeds pertaining to single engine operations, directional control with one-engine inoperative, factors affecting V_{MC}, identification and verification of an inoperative engine and feathering and securing an inoperative engine.

Pre Briefing:

The instructor will lead a guided discussion on the one engine inoperative procedures and operations.

Completion Standards:

This lesson is complete when the PT demonstrates a working knowledge of V-speeds, directional control with one-engine inoperative, factors affecting V_{MC}, identification and verification of an inoperative engine, and feathering and securing an inoperative engine.

Desired Outcome Grade Sheet:

			Task Grades					SRM Grades		
Lesson 06 Desired Outcome Grade Sheet			Not Observed	Describe	Explain	Practice	Perform	Explain	Practice	Manage/Decide
Scenario Activities	Task	Desired Performance								
Demonstration of SRM	Effectively managed all resources available related to the flight lesson	Practice								
	Discussed and demonstrated the proper use of automation management in all phases of flight	Practice								
	Identified and discussed areas of risk and made proper decisions in managing those situation	Practice								
	Discussed and demonstrated proper task management throughout the flight lesson	Practice								

	Exercised proper aeronautical decision making and risk management while maintaining positional and situational awareness	Practice								
	Discussed and demonstrated the avoidance of controlled flight into terrain	Practice								
	Effectively managed the flight as a Private Pilot with a multi-engine rating	Practice								
Introduction	Significance of V-speeds for engine inoperative operations	Explain								
	Directional control with one engine inoperative									
	Reasons for loss of directional control	Explain								
	Indications of V_{MC}	Explain								
	Safe recovery from V_{MC}	Explain								
	V_{MC} and stall speed relationship	Explain								
	Factors Affecting V_{MC}									
	Altitude	Explain								
	Weight and CG location	Explain								
	Airplane configuration	Explain								
	Windmilling propeller	Explain								
	Power on the operative engine	Explain								
	Counter rotating vs. conventional twin engine airplane (critical engine)	Explain								
	p-factor	Explain								
	Spiraling slipstream	Explain								
	Accelerated slipstream	Explain								
	torque	Explain								
	Identification of an inoperative engine									
	Yaw and roll toward dead engine	Explain								
	Required rudder to maintain heading	Explain								
	Exhaust gas temperature gauge	Explain								
	Inclinometer	Explain								
	Feathering and securing an inoperative engine									
	Memory items	Explain								
	Checklist items	Explain								
Aeronautical Decision Making	Discussed and is able to explain aeronautical decision making at a Private Pilot level as outlined in the Aviation Instructor's Handbook	Perform								
	Discussed and is able to explain the use of the PAVE and DECIDE model as well as the 5Ps in multi-engine flight	Perform								
	Discussed and is able to explain assessing the risk of a student and flight lesson	Perform								
	Discussed and is able to explain factors that affect decision making	Perform								

	Discussed and is able to explain incorporating aeronautical decision making scenarios into ground briefings and flight lessons to emphasize risk management and single pilot resource management	Perform								

Debriefing:

Use LCG techniques during the debriefing to practice their use, to practice and rehires critical thinking skills, and to enhance learning. The PT should be able to accurately assess his/her own performance.

Assignment for Lesson 7
1. Airplane POH and checklist
2. Maneuvering with one engine inoperative
3. Effect of drag on single engine performance
4. Performance charts applicable to single engine operations
5. Partial power loss considerations
6. Takeoff emergencies
7. Engine failures in flight
8. In-flight engine restart procedures
9. Approach and landings with an engine inoperative

Notes to the Instructor:

The scenario provides a reason for reviewing one engine inoperative operations and procedures. Encourage the student to look for the information he/she needs and teach the student how to find the information. You should stress the importance of timely reviews and continuous learning. The engine problems on the recent flight should provide good motivation for this lesson. It is likely the student will be looking for specific information related to the incident but the incident provides a good opportunity to practice critical thinking skills/judgment training. Discuss the actions taken by the student during the incident, why these actions were taken, what other actions could have been taken, and which of the actions would have been best. Discuss this incident in other settings and have the student choose which action would be best in the new setting. These discussions develop judgment and allow a single incident to be used to teach the student appropriate responses in various situations.

Discussions of the type mentioned above could show why the items introduced in this lesson, such as V-speeds and V_{MC}, could be important for the student to know. Information taught, in the context it is used, is easier for the student to recall when the student needs the information. In other words, teaching information in context improves learning.

Multi-engine Aircraft Systems – Lesson 7
Introduce Multi-engine Emergencies – Mission
GND Lesson 7 (Approximate lesson time 1.5 hours)

Scenario:

You are checking out in the flying club's twin. After completing the check out, you want to make a trip into a wilderness area, which is located in rolling hills in a neighboring state. For your trip, it will be a nice summer day but you will have various field elevations. You have little twin time and no time in this make and model airplane.

Lesson Objective:

The purpose of this lesson is to introduce maneuvering with one engine inoperative, effect of drag on single engine performance, performance charts applicable to singe engine operations, and single engine emergencies.

Pre Briefing:

The PT will lead the lesson presentation.

Completion Standards:

This lesson is complete when the PT demonstrates a working knowledge of maneuvering with one engine inoperative, effects of drag on single engine performance, performance charts applicable to single engine operations, and single engine emergencies.

Desired Outcome Grade Sheet:

			Task Grades					SRM Grades		
Lesson 07 **Desired Outcome Grade Sheet**			Not Observed	Describe	Explain	Practice	Perform	Explain	Practice	Manage/Decide
Scenario Activities	Task	Desired Performance								
Demonstration of SRM	Effectively managed all resources available related to the flight lesson	Practice								
	Discussed and demonstrated the proper use of automation management in all phases of flight	Practice								
	Identified and discussed areas of risk and made proper decisions in managing those situation	Practice								
	Discussed and demonstrated proper task management throughout the flight lesson	Practice								

	Exercised proper aeronautical decision making and risk management while maintaining positional and situational awareness	Practice								
	Discussed and demonstrated the avoidance of controlled flight into terrain	Practice								
	Effectively managed the flight as a Private Pilot with a multi-engine rating	Practice								
Introduction	Maneuvering with one engine inoperative									
	Zero thrust versus feathering	Explain								
	Airspeed and power setting considerations	Explain								
	Straight and level flight	Explain								
	Turns into and away from the inoperative engine	Explain								
	Climbs and descents	Explain								
	Bank angle for best performance	Explain								
	Effect of Drag on single engine performance									
	Airspeed	Explain								
	Gear	Explain								
	Flaps	Explain								
	Propeller	Explain								
	Performance charts applicable to single engine operations	Explain								
	Partial power loss considerations	Explain								
	Takeoff emergencies									
	Proper takeoff planning	Explain								
	Engine failure on takeoff before V_{MC}	Explain								
	Engine failure in flight									
	Engine failure immediately after lift-off	Explain								
	Engine failure on climb out	Explain								
	Engine failure enroute – drift down	Explain								
	In-flight engine restart procedures	Practice								
	Approach and landing with an engine inoperative									
	Airplane configurations	Practice								
	Go-around possibilities	Practice								
	Instrument approaches and landing with an engine inoperative (if instrument rated)	Practice								
	Go-around procedures	Practice								
	Engine failure landing	Practice								
Aeronautical Decision Making	Discussed and is able to explain aeronautical decision making at a Private Pilot level as outlined in the Aviation Instructor's Handbook	Perform								
	Discussed and is able to explain the use of the PAVE and DECIDE model as well as the 5Ps in multi-engine flight	Perform								

	Discussed and is able to explain assessing the risk of a student and flight lesson	Perform								
	Discussed and is able to explain factors that affect decision making	Perform								
	Discussed and is able to explain incorporating aeronautical decision making scenarios into ground briefings and flight lessons to emphasize risk management and single pilot resource management	Perform								

Debriefing:

The debriefing should continue to emphasize learning opportunities that will enhance the student's knowledge of various situations. The instructor should help the student to become a self-learner who can identify his/her own weak areas and find the information that is needed. The instructor should also correct misunderstanding and weak areas the student has.

Assignment for Lesson 8

1. Airplane POH and checklist
2. Single engine maneuvering
    a. Engine failure during takeoff roll
    b. Engine failure after lift-off
3. V_{MC} demonstration
4. Configuration demonstration
5. Approach and landing with an engine inoperative

Notes to the Instructor:

The scenario is suggestion that the student already has a multi-engine rating; therefore, one engine inoperative operations should be reviewing. This scenario is used to motivate the student and to reduce the perception that it is just another training flight. The information covered in this lesson is needed to make the flight the student is planning to make. If the student does not see a clear connection between the information and the knowledge required to operate the airplane safely, you will need to make this connection. Use "what if" situation to make the connection.

Multi-engine Aircraft Systems – Lesson 8
Practice Multi-engine Emergencies – Mission
FLT Lesson 8 (Approximate lesson time 1.5 hours)

Visual Flight Training Device/Multi-engine Aircraft (if FTD is not available)

Scenario:

You and two other people from the office are taking the company twin to a neighboring state to get an aerial look at a piece of land the company wants to buy. After the flyover, you are landing at the county seat, about 100 miles away, to pick up a copy of the property description and title search. The weather is forecasted to be good for the flight to the property and destination, but it is forecasted to become marginal VFR shortly after your return home. A decision will be made on the property at an 8:00 am business meeting tomorrow morning. Your company also has a news conference set up at 10:00 am to announce the company's expansion plan.

Lesson Objective:

The purpose of this lesson is to introduce single engine maneuvers, V_{MC} demonstration, configuration demonstration, and single engine emergencies.

Pre Briefing:

The PT will lead the briefings for this lesson with assistance as required from the instructor. The PT's briefing should include the planned flight and a mock passenger briefing. The PT should include a good briefing of engine emergencies and engine inoperative operations as covered by the instructor in previous ground lesson. These briefings should include appropriate plans of action for the route of flight. The instructor should revisit these plans of action during the postflight debriefings.

Completion Standards:

This lesson is complete when the PT demonstrates a working knowledge of single engine maneuvering, VMC demonstration, configuration demonstration, and single engine emergencies with instructor assistance. The student will also maintain altitude ±100 ft., heading ±10º, and airspeed ±10 kts. The V_{MC} demonstration heading will be within 30º. In addition, the PT will demonstrate the ability to safely manage the flight lesson through an acceptable use of aeronautical decision-making, risk management, and single pilot resource management.

Desired Outcome Grade Sheet:

Lesson 08 **Desired Outcome Grade Sheet**			Task Grades					SRM Grades		
			Not Observed	Describe	Explain	Practice	Perform	Explain	Practice	Manage/Decide
Scenario Activities	Task	Desired Performance								
Preflight Discussion	Discuss lesson objective	Practice								
	Preflight planning and preparation	Perform								
	Single-engine maneuvering	Practice								
	VMC demonstration	Practice								
	Configuration demonstration	Practice								
	Approach and landing with an engine inoperative	Practice								
Demonstration of SRM	Effectively managed all resources available related to the flight lesson	Practice								
	Discussed and demonstrated the proper use of automation management in all phases of flight	Practice								
	Identified and discussed areas of risk and made proper decisions in managing those situation	Practice								
	Discussed and demonstrated proper task management throughout the flight lesson	Practice								
	Exercised proper aeronautical decision making and risk management while maintaining positional and situational awareness	Practice								
	Discussed and demonstrated the avoidance of controlled flight into terrain	Practice								
	Effectively managed the flight as a Private Pilot with a multi-engine rating	Practice								
Review	Checklist usage – flow patterns	Perform								
Introduction	Feathering and securing an inoperative engine	Practice								
	In-flight engine restart procedures	Practice								
	Maneuvers									
	Single engine maneuvering									
	Engine failure during takeoff roll	Explain								
	Engine failure after lift-off	Explain								
	V_{MC} demonstration	Explain								
	Configuration demonstrations	Explain								
	Approach and landing with an engine inoperative	Explain								
	Instrument approaches and landing with an engine inoperative (if instrument rated)	Practice								
	Missed approach procedures	Practice								
	Engine failure landing	Practice								
Aeronautical Decision	Discussed and is able to explain aeronautical decision making at a	Perform								

Making	Private Pilot level as outlined in the Aviation Instructor's Handbook									
	Discussed and is able to explain the use of the PAVE and DECIDE model as well as the 5Ps in multi-engine flight	Perform								
	Discussed and is able to explain assessing the risk of a student and flight lesson	Perform								
	Discussed and is able to explain factors that affect decision making	Perform								
	Discussed and is able to explain incorporating aeronautical decision making scenarios into ground briefings and flight lessons to emphasize risk management and single pilot resource management	Perform								
Postflight Discussion	Critique student performance, preview next lesson, and make study assignment	Perform								

Debriefing:

Emphasize learning opportunities that will enhance the student's knowledge of various situations and allow the PT to practice decision-making skills. The instructor should help the student determine possible solutions to the problems that occur in flight, then have the PT select course of action, and finally has PT discuss which solution is best and why he/she thinks it is best. The instructor should also correct misunderstanding and weak areas the student has.

Assignment for Lesson 9

1. Review maneuvers and procedures appropriate for engine inoperative operations.

Notes to the Instructor:

Tailor the scenario to the FTD or airplane as appropriate. A FTD allows training flight anywhere while an actual airplane will be limited to a flight in the local area. Furthermore, you may want to plan the flight within the state rather than to a neighbor state if a good cross-country can be done within the state. The destinations, the location of the property and the county seat should be selected to cause the route of flight to pass through or go near the area you want to conduct the engine failure practice and V_{MC}. Other considerations should include possible diversion airports and airspace considerations, if available. Plan the scenario out as much as you can. For example, if the engine problem can be repaired at the diversion airport, let the PT decide if the flight will be continued to the original destination. The subsequent takeoff will allow the student to practice takeoff emergencies.

Multi-engine Aircraft Systems – Lesson 9
Practice Multi-engine Emergencies – Mission
FLT Lesson 9 (Approximate lesson time 1.2 hours)

Visual Flight Training Device/Multi-engine Aircraft (if FTD is not available)

Scenario:

You are due for a flight review within the next two weeks. Your instructor has agreed to conduct part of the flight review a visual flight training device so you can practice engine failures.

Lesson Objective:

The PT will review previously learned maneuvers to gain additional understanding and proficiency with engine failure and engine inoperative operations.

Pre Briefing:

The PT should brief engine failure and engine inoperative operations as well as all normal preflight and flight procedures.

Completion Standards:

This lesson is complete when the PT demonstrates a working knowledge of previously learned maneuvers. The standards for performance are: altitude of ±100 ft., heading ±10º, and airspeed ±10 kts., when appropriate. The V_{MC} demonstration heading will be within 30º.

Desired Outcome Grade Sheet:

Lesson 09 **Desired Outcome Grade Sheet**			Task Grades					SRM Grades		
Scenario Activities	Task	Desired Performance	Not Observed	Describe	Explain	Practice	Perform	Explain	Practice	Manage/Decide
Preflight Discussion	Discuss lesson objective	Practice								
	Preflight planning and preparation	Practice								
Demonstration of SRM	Effectively managed all resources available related to the flight lesson	Perform								
	Discussed and demonstrated the proper use of automation management in all phases of flight	Perform								
	Identified and discussed areas of risk and made proper decisions in managing those situation	Perform								

	Discussed and demonstrated proper task management throughout the flight lesson	Perform								
	Exercised proper aeronautical decision making and risk management while maintaining positional and situational awareness	Perform								
	Discussed and demonstrated the avoidance of controlled flight into terrain	Perform								
	Effectively managed the flight as a Private Pilot with a multi-engine rating	Perform								
Review	Checklist usage – flow patterns	Perform								
	Maneuvers									
	Single engine maneuvering									
	Engine failure during takeoff roll	Practice								
	Engine failure after lift-off	Practice								
	VMC demonstration	Practice								
	Configuration demonstration	Practice								
	Approach and landing with an engine inoperative	Practice								
Aeronautical Decision Making	Discussed and is able to explain aeronautical decision making at a Private Pilot level as outlined in the Aviation Instructor's Handbook	Perform								
	Discussed and is able to explain the use of the PAVE and DECIDE model as well as the 5Ps in multi-engine flight	Perform								
	Discussed and is able to explain assessing the risk of a student and flight lesson	Perform								
	Discussed and is able to explain factors that affect decision making	Perform								
	Discussed and is able to explain incorporating aeronautical decision making scenarios into ground briefings and flight lessons to emphasize risk management and single pilot resource management	Perform								
Postflight Discussion	Critique student performance, preview next lesson, and make study assignment	Perform								

Debriefing:

The debriefing should be lead by the PT using LCG techniques. The debriefing should include an initial self analysis of the PT flight performance. The instructor should lead a guided discussion of other solutions to the in flight problems or other courses of action as well as a practice decision-making session. As the PT progresses through the training program, the instructor should provide feedback to the PT on the quantity and quality of options considered during flight and during the briefings as well as the quality of the PT's decision-making.

Assignment for Lesson 10

1. Review key elements of the maneuvers and procedures of the current Private Multi-engine PTS as assigned by the instructor.

Notes to the Instructor:

Both the pre- and post-flight briefings should give your opportunities to build better understands of the engine inoperative operations and related emergencies. These opportunities should be used to practice and rehires decision- making. This does not mean that every item in the briefings should be discussed at lengths. You will need to select which opportunities will be discussed to limit the briefings to a reasonable length.

It is likely that the flight will be very different if an aircraft is used rather than a flight training device. Flight safety should not be compromised in an effort to provide a better emergency situation and practice. Additionally, when the local area does not require special departure procedures, you should add departure considerations for training purposes.

Multi-engine Airplane Systems – Lesson 10
Practice One Engine Inoperative Procedures – Mission
FLT Lesson 10 (Approximate lesson time 1.5 hours)

AIRPLANE – MEL

Scenario:

You are evaluating a used airplane your flying club is considering buying. The airplane has just completed its annual inspection at your local airport from the same mechanic that maintains the other flying club's airplanes. You and the club instructor will fly to the local practice area to put the airplane through a shake-down flight. This should be an exciting flight, a chance to practice your engine inoperative procedures, and an opportunity to demonstrate your flight skills to the club instructor. The weather is forecasted to be ideal for the flight.

Lesson Objective:

Is to review and perform engine failure, engine inoperative procedures, and other light twin aircraft systems. The PT will also continue to enhance and develop critical thinking and decision-making skills as well as other single-pilot resource management skills.

Preflight Briefing:

The PT will brief the plan of action including the preflight planning and flight plan, and brief engine emergencies and engine inoperative procedures. The PT will also brief single-pilot resource management and aeronautical decision-making considerations.

Completion Standards:

This lesson is complete when the PT demonstrates a working knowledge of previously learned maneuvers. The standards for performance are: altitude of ±100 ft., heading ±10º, and airspeed ±10 kts. when appropriate. The V_{MC} demonstration heading will be within 20º. The PT will also demonstrate the ability to safely manage the flight lesson through an acceptable use of aeronautical decision making, risk management, and single pilot resource management.

Desired Outcome Grade Sheet:

Lesson 10 **Desired Outcome Grade Sheet**			Task Grades					SRM Grades		
			Not Observed	Describe	Explain	Practice	Perform	Explain	Practice	Manage/Decide
Scenario Activities	Task	Desired Performance								
Preflight Discussion	Discuss lesson objective	Perform								
	Preflight planning and preparation	Perform								
	Airplane weight and balance considerations	Perform								
Demonstration of SRM	Effectively managed all resources available related to the flight lesson	Perform								
	Discussed and demonstrated the proper use of automation management in all phases of flight	Perform								
	Identified and discussed areas of risk and made proper decisions in managing those situation	Perform								
	Discussed and demonstrated proper task management throughout the flight lesson	Perform								
	Exercised proper aeronautical decision making and risk management while maintaining positional and situational awareness	Perform								
	Discussed and demonstrated the avoidance of controlled flight into terrain	Perform								
	Effectively managed the flight as a Private Pilot with a multi-engine rating	Perform								
Review	Checklist usage – flow patterns	Perform								
	Maneuvers	Practice								
	Engine inoperative maneuvering									
	Engine failure during takeoff roll (slower than 50% of V_{MC})	Practice								
	Engine failure after lift-off (no lower than 600' AGL)	Practice								
	VMC demonstration	Practice								
	Configuration demonstration	Practice								
	Approach and landing with an engine inoperative	Practice								
Aeronautical Decision Making	Discussed and is able to explain aeronautical decision making at a Private Pilot level as outlined in the Aviation Instructor's Handbook	Perform								
	Discussed and is able to explain the use of the PAVE and DECIDE model as well as the 5Ps in multi-engine flight	Perform								
	Discussed and is able to explain assessing the risk of a student and flight lesson	Perform								

	Discussed and is able to explain factors that affect decision making	Perform								
	Discussed and is able to explain incorporating aeronautical decision making scenarios into ground briefings and flight lessons to emphasize risk management and single pilot resource management	Perform								
Postflight Discussion	Critique student performance, preview next lesson, and make study assignment	Perform								

Debriefing:

The PT will lead the debriefing using LCG techniques. The PT should identify both strengths and weakness in his/her performance, aeronautical decision-making, and single-pilot resource management. The instructor should select several items to lead a guided discussion to practice problem solving and to develop judgment skills.

Assignment for Lesson 11
1. Read about cross-country flights including requirements and planning.
2. Assign route for lesson 12.

Notes to the Instructor:

Lesson 10 completes Strand 1, Multi-engine Aircraft Systems, the next lesson will start the Multi-engine Aerodynamics, Performance, and Control strand. During this strand of training the PT will continue to develop the knowledge, skills, and judgment to operate a multi-engine airplane with private pilot privileges in the National Airspace System.

During this lesson the PT is reviewing engine inoperative maneuvering including approaches and landings. The PT should be performing the engine inoperative maneuvering at the practice level. Proficiency should increase during the second strand; so that, PTS standards are being meet.

The scenario provides an opportunity to practice several engine inoperative maneuvers without having to land; that is, the PT is demonstrating the flight characteristics using simulated engine failures. After the demonstrations, you should give the PT an engine failure that the PT is challenged to deal with an engine failure and carry the failure to a logical conclusion. Most often this includes picking a suitable landing spot, navigating to that spot, and executing an appropriate approach and landing. Again, this in flight problem (an engine failure or power loss) creates an opportunity to use single-pilot resource management and aeronautical decision making which can subsequently be analyzed during the debriefing for additional judgment and decision-making practice.

Strand 2 – Multi-engine Aerodynamics, Performance, and Control

Multi-engine Aerodynamics, Performance, and Control – Lesson 11
Multi-engine Cross-country Planning– Mission
GND Lesson 11 (Approximate lesson time 2.5 hours)

Scenario:

You and a friend are planning to make 200 mile trip to a professional baseball game. You boss has asked you to drop off a business proposal at the branch office there and has given you the company twin to use for the trip. The weather is forecasted to be VFR for the flight to and from the ball game.

Lesson Objective:

During this lesson, the PT will learn to effectively plan VFR cross-country flights in multi-engine airplanes. The PT will also be introduced to the procurement and analysis of aviation weather reports and forecasts necessary for multi-engine cross-country flights.

Pre Briefing:

The instructor will lead the briefing for this lesson. The PT will discuss task, risk, and automation management as it pertains to takeoffs and climbs, cruise, approaches and landings in multi-engine cross-country flight operations.

Completion Standards:

This lesson is complete when the PT demonstrates a thorough understanding and working knowledge of weather, the National Airspace System, and flight planning for multi-engine cross-country flights.

Desire Outcome Grade Sheet:

Lesson 11 **Desired Outcome Grade Sheet**			Task Grades					SRM Grades		
Scenario Activities	Task	Desired Performance	Not Observed	Describe	Explain	Practice	Perform	Explain	Practice	Manage/Decide
Preflight Discussion	Preflight planning and preparation	Practice								
	Using aircraft performance charts as they pertain to cross-country flights	Practice								
	Diversions	Practice								
	Lost procedures	Practice								
Demonstration of SRM	Effectively managed all resources available related to the flight lesson	Perform								

	Discussed and demonstrated the proper use of automation management in all phases of flight	Perform								
	Identified and discussed areas of risk and made proper decisions in managing those situation	Perform								
	Discussed and demonstrated proper task management throughout the flight lesson	Perform								
	Exercised proper aeronautical decision making and risk management while maintaining positional and situational awareness	Perform								
	Discussed and demonstrated the avoidance of controlled flight into terrain	Perform								
	Effectively managed the flight as a Private Pilot with a multi-engine rating	Perform								
Introduction	Weather									
	Metars	Practice								
	TAFs	Practice								
	Area Forecasts	Practice								
	Winds Aloft	Practice								
	Winds and temperature aloft chart	Practice								
	Radar summary chart	Practice								
	Weather depiction chart	Practice								
	Significant weather prognostic chart	Practice								
	Surface analysis chart	Practice								
	Convective outlook chart	Practice								
	PIREP's	Practice								
	SIGMET's and AIRMET's	Practice								
	AWOS, ASOS, and ATIS reports	Practice								
	Wind shear reports	Practice								
	National Airspace System	Practice								
	VFR cross-country planning	Practice								
	Performance calculations	Practice								
	MELs	Practice								
	Fuel requirements	Practice								
	Weight and balance	Practice								
	Flight plans	Practice								
	VFR Charts	Practice								
	IFR Charts (If instrument rated)									
	NOTAMS	Practice								
	Certificates and documents	Practice								
Aeronautical Decision Making	Discussed and is able to explain aeronautical decision making at a Private Pilot level as outlined in the Aviation Instructor's Handbook	Perform								
	Discussed and is able to explain the use of the PAVE and DECIDE model as well as the 5Ps in multi-engine flight	Perform								
	Discussed and is able to explain assessing the risk of a student and flight lesson	Perform								

	Discussed and is able to explain factors that affect decision making	Perform								
	Discussed and is able to explain incorporating aeronautical decision making scenarios into ground briefings and flight lessons to emphasize risk management and single pilot resource management	Perform								

Debriefing:

The PT will lead the debriefing using LCG techniques. The PT should identify both strengths and weakness in his/her knowledge of weather and cross-country planning, aeronautical decision-making, and single-pilot resource management. The instructor should select several cross-country planning items to lead a guided discussion to practice problem solving and to develop judgment skills.

Assignment for Lesson 12

1. Assign cross-country for lesson 12.
2. Have the PT plan the cross-country with two contingency plans for unplanned occurrences.
3. Have the PT obtain weather for the flight and bring a copy to the Lesson 12 briefing.

Notes to the Instructor:

You should consider teaching at least two methods for getting aviation weather. Discuss the appropriateness of each method and any other methods that may be used. Choosing the best method for obtaining the weather, provides another opportunity to practice judgment and decision-making skills.

Contingency planning can provide a measure of safety and it can provide an additional opportunity to practice decision-making skills. Factors that could be discussed include how many contingencies should be preplanned, what type of contingencies should planned, what can cause a contingency plan to be used, and how detailed does the contingency plan need to be. Having the PT talk through a contingency plan could help the PT understand the value of contingency planning rather than just having to accept that contingency planning is helpful. Thought question: “when is it unnecessary to develop and have a contingency plan?”

Establishing, practicing, and maintaining good cross-country planning practices are important to aviation safety. Are these good habits being practiced for every flight including training flights? If good habits were being used in the previous lessons, the topics introduced in the lesson are not new but rather they are being shifted from you to the PT.

Multi-engine Aerodynamics, Performance, and Control– Lesson 12
Practice Multi-engine Cross-country – Mission
FLT Lesson 12 (Approximate lesson time 1.5 hours)

Flight Training Device/Multi-engine Airplane (if FTD is not available)

Scenario:

You and a friend are planning to fly from your hometown to a town about 200 miles away to go to a baseball game. You are will drop off the business proposal at the branch office and meet two companions for dinner and the game. The game starts at 7:00 pm, so you are planning a 2:00 pm takeoff. The weather for the flight is good and you are flying the company twin.

Lesson Objective:

During this lesson, the PT will review procedures and maneuvers as listed increasing his/her ability to apply what has been learned. The PT should be able to determine groundspeeds within ±10 kts., ETA's accurate to within 10 minutes. The PT should be able to conduct the flight expeditiously, and display the ability to use radio navigation, pilotage, and dead reckoning procedures

Pre Briefing:

The PT will lead the briefings including the weather, flight, aeronautical decision-making, and single-pilot resource management considerations.

Completion Standards:

This lesson is complete when the PT demonstrates a working knowledge of VFR cross-country procedures. The PT will follow correct procedures during all phases of the flight and be able to determine ground speeds within ±10 kts., ETA's accurate to within 10 minutes. The PT will be able to conduct the flight expeditiously, and display the ability to use radio navigation, pilotage, and dead reckoning procedures. The PT will also demonstrate the ability to safely manage the flight lesson through an acceptable use of aeronautical decision making, risk management, and single pilot resource management.

Desire Outcome Grade Sheet:

Lesson 12 **Desired Outcome Grade Sheet**			Task Grades					SRM Grades		
			Not Observed	Describe	Explain	Practice	Perform	Explain	Practice	Manage/Decide
Scenario Activities	Task	Desired Performance								
Preflight Discussion	Discuss lesson objective	Practice								
	Preflight planning and preparation	Practice								
	Required aircraft equipment	Practice								
	Use of aircraft performance charts	Practice								
	Aircraft weight and balance	Practice								
	Airport facility directory	Practice								
	Notice to airman	Practice								
	Filing a VFR flight plan	Practice								
	Recognition, avoidance, and operational restrictions of hazardous terrain (CFIT)	Practice								
	Diversion	Practice								
	Lost procedures	Practice								
Demonstration of SRM	Effectively managed all resources available related to the flight lesson	Perform								
	Discussed and demonstrated the proper use of automation management in all phases of flight	Perform								
	Identified and discussed areas of risk and made proper decisions in managing those situation	Perform								
	Discussed and demonstrated proper task management throughout the flight lesson	Perform								
	Exercised proper aeronautical decision making and risk management while maintaining positional and situational awareness	Perform								
	Discussed and demonstrated the avoidance of controlled flight into terrain	Perform								
	Effectively managed the flight as a Private Pilot with a multi-engine rating	Perform								
Review	Checklist usage – flow patterns	Perform								
	Control and maneuvering solely by reference to flight instruments	Practice								
	Takeoff, approach, and landing procedures	Practice								
	Climbs at best angle and best rate	Practice								
	Ground speed and ETA calculations									
	Pilotage									
	Dead Reckoning									
	Radio navigation									

Aeronautical Decision Making	Discussed and is able to explain aeronautical decision making at a Private Pilot level as outlined in the Aviation Instructor's Handbook	Perform								
	Discussed and is able to explain the use of the PAVE and DECIDE model as well as the 5Ps in multi-engine flight	Perform								
	Discussed and is able to explain assessing the risk of a student and flight lesson	Perform								
	Discussed and is able to explain factors that affect decision making	Perform								
	Discussed and is able to explain incorporating aeronautical decision making scenarios into ground briefings and flight lessons to emphasize risk management and single pilot resource management	Perform								
Postflight Discussion	Critique student performance, preview next lesson, and make study assignment	Perform								

Debriefing:

The PT will lead the debriefing using LCG techniques. The PT should identify both strengths and weakness in his/her performance, aeronautical decision-making, and single-pilot resource management. The instructor should select several cross-country planning and navigation problems to lead a guided discussion to practice problem solving and to develop judgment skills.

Assignment for Lesson 13
1. Assign cross-country for lesson 13

Notes to the Instructor:

Lesson 12 is a learning and practice session for lesson 13 and applies the material learned in lesson 11. The PT should be given the opportunity to try different techniques during the course of this lesson. At the completion of the lesson, alternative techniques should be discussed. Finally, the PT should determine which technique is best practice and explain why.

If a Flight Training Device (FTD) is used, fly the flight with as few interruptions as possible. Frequent interruptions will likely reduce the FTD to being a task trainer and disrupt the flow and timing of a normal cross-country. That being said, a FTD does provide opportunities to stop the flight and correct errors and/or try different solutions to the problems encountered during the cross-country. Trying different solutions allows the PT a chance to see how the alternate solution would work. You should engage the PT in a post-flight discussion for judgment and decision-making practice.

Multi-engine Aerodynamics, Performance, and Control– Lesson 13
Day Cross-country – Mission
FLT Lesson 13 (Approximate lesson time 1.5 hours)

AIRPLANE – MEL

Scenario:

You are scheduled to attend a business meeting in a town about 115 miles away and you are picking up one of the other company employees in a town about 110 miles from your home and 80 miles away from the location of the meeting on your way. The meeting starts at 10:30 am, so you are planning to depart home at 7:30 am. It is summer time and there is a slight chance of rain showers in the late afternoon. However, there doesn't appear to be any other problems for the flight.

Lesson Objective:

During this lesson, the PT will review procedures and maneuvers as listed increasing his/her ability to apply what has been learned. The PT will follow correct procedures during all phases of the flight and be able to conduct the flight expeditiously, and display the ability to use radio navigation, pilotage, and dead reckoning procedures. The PT will also make proper decisions in managing the flight lesson and safety of flight.

Pre Briefing:

The instructor will lead the briefings.

Completion Standards:

This lesson is complete when a working knowledge of VFR cross-country procedures is displayed. The PT will prepare for a day VFR cross-country flight. The PT will follow correct procedures during all phases of the flight and be able to conduct the flight expeditiously, and display the ability to use radio navigation, pilotage, and dead reckoning procedures. Additionally, the PT will demonstrate the ability to safely manage the flight lesson through an acceptable use of aeronautical decision making, risk management, and single pilot resource management.

Desired Outcome Grade Sheet:

Lesson 13 **Desired Outcome Grade Sheet**			Task Grades					SRM Grades		
			Not Observed	Describe	Explain	Practice	Perform	Explain	Practice	Manage/Decide
Scenario Activities	Task	Desired Performance								
Preflight Discussion	Review areas as necessary	Practice								

	Preflight planning and preparation	Practice								
	Airplane weight and balance	Practice								
	Discuss weather and make a GO/NO GO decision	Practice								
	Airport Facility Directory	Practice								
	Notices to Airman	Practice								
Demonstration of SRM	Effectively managed all resources available related to the flight lesson	Perform								
	Discussed and demonstrated the proper use of automation management in all phases of flight	Perform								
	Identified and discussed areas of risk and made proper decisions in managing those situation	Perform								
	Discussed and demonstrated proper task management throughout the flight lesson	Perform								
	Exercised proper aeronautical decision making and risk management while maintaining positional and situational awareness	Perform								
	Discussed and demonstrated the avoidance of controlled flight into terrain	Perform								
	Effectively managed the flight as a Private Pilot with a multi-engine rating	Perform								
Review	Checklist usage – flow patterns	Perform								
	Short-field takeoff and maximum performance climb	Perform								
	Maneuvers									
	Single engine maneuvering									
	Engine failure during takeoff roll (slower than 50% of V_{MC})	Perform								
	Engine failure after lift-off (no lower than 600' AGL)	Perform								
	Short-field landing	Perform								
	Approach and landing with an engine inoperative	Perform								
	Day cross-country	Practice								
	Pilotage and dead reckoning	Practice								
	Navigation systems and radar services	Practice								
	Diversion	Practice								
	Lost procedures	Practice								
Aeronautical Decision Making	Discussed and is able to explain aeronautical decision making at a Private Pilot level as outlined in the Aviation Instructor's Handbook	Perform								
	Discussed and is able to explain the use of the PAVE and DECIDE model as well as the 5Ps in multi-engine flight	Perform								
	Discussed and is able to explain assessing the risk of a student and flight lesson	Perform								
	Discussed and is able to explain factors that affect decision making	Perform								

	Discussed and is able to explain incorporating aeronautical decision making scenarios into ground briefings and flight lessons to emphasize risk management and single pilot resource management	Perform								
Postflight Discussion	Critique student performance, preview next lesson, and make study assignment	Perform								

Debriefing:

The PT will lead the debriefing using LCG techniques. The PT should identify both strengths and weakness in his/her performance, aeronautical decision-making, and single-pilot resource management. The instructor should select several cross-country planning, navigation, and/or other flight problems to lead a guided discussion to practice problem solving and to develop judgment skills.

Assignment for Lesson 14
1. FAR 61 and 91
2. AIM
3. Night Operations
4. Assign route for lesson 14

Notes to the Instructor:

The debriefing should use a LCG process. The PT should be practicing offering meaningful alternatives to the problems and tasks involved in cross-country flight planning and flight. The flight offers one set of circumstances for the PT to pilot through. Guided-discussions of the problems to be solved during the flight can enrich the experience and learning as well as provide judgment and decision-making practice.

A number of specific training tasks are listed in the Desired Outcomes Grading Sheet; to complete these tasks, you will need to think through the flight and assign a route of flight that allows these learning activities. Of course, this process begins with the scenario, if the scenario does not accommodate the route of flight and learning activities you need, adjust the scenario. This process becomes more challenging when “trigger events” are interjected during the flight. Trigger events often lead to a diversion or a change to the planned route of flight. So, consider the training tasks you want to complete when developing the scenario and subsequent route of flight.

Multi-engine Aerodynamics, Performance, and Control– Lesson 14
Night Multi-engine Cross-country – Mission
FLT Lesson 14 (Approximate lesson time 2.0 hours)

AIRPLANE – MEL

Scenario:

Your boss has asked you to pickup the company President at the Downtown airport at a large city about 300 miles away, take him to a town about 100 miles away, and return the company twin to another town about 70 miles south of the drop off point before morning. You are to pick up the President at the FBO at 10:45 pm, but the airplane will not ready to leave its current location, due to maintenance, until 9:30 pm.

Lesson Objective:

During this lesson, the PT will review night VFR cross-country procedures. In addition, the PT will demonstrate the ability to safely manage the flight lesson through an acceptable use of aeronautical decision making, risk management, and single pilot resource management.

Pre Briefing:

The instructor will brief the lesson requirements; however, the PT should be asked to lead a discussion on night flying requirements. The PT will make proper decisions in managing the flight lesson and safety of flight.

Completion Standards:

At the completion of this lesson, the PT will display a working knowledge of night VFR cross-country procedures. The PT will prepare a night VFR cross-country flight. The PT will follow correct procedures during all phases of the flight and be able to conduct the flight expeditiously, and display the ability to use radio navigation, pilotage, and dead reckoning procedures. In addition, the PT will demonstrate the ability to safely manage the flight lesson through an acceptable use of aeronautical decision making, risk management, and single pilot resource management.

Desired Outcome Grade Sheet:

Lesson 14 **Desired Outcome Grade Sheet**			Task Grades					SRM Grades		
Scenario Activities	Task	Desired Performance	Not Observed	Describe	Explain	Practice	Perform	Explain	Practice	Manage/Decide
Preflight Discussion	Review areas as necessary	Practice								
	Preflight planning and preparation	Practice								
	Airplane weight and balance	Practice								
	Discuss weather and make a GO/NO GO decision	Practice								
	Night Operations	Practice								
	Night weather considerations	Practice								
	Night physiology	Practice								
Demonstration of SRM	Effectively managed all resources available related to the flight lesson	Perform								
	Discussed and demonstrated the proper use of automation management in all phases of flight	Perform								
	Identified and discussed areas of risk and made proper decisions in managing those situation	Perform								
	Discussed and demonstrated proper task management throughout the flight lesson	Perform								
	Exercised proper aeronautical decision making and risk management while maintaining positional and situational awareness	Perform								
	Discussed and demonstrated the avoidance of controlled flight into terrain	Perform								
	Effectively managed the flight as a Private Pilot with a multi-engine rating	Perform								
Review	Checklist usage – flow patterns	Perform								
	Short-field takeoff and maximum performance climb	Perform								
	Maneuvers									
	Single engine maneuvering									
	Engine failure during takeoff roll (slower than 50% of V_{MC})	Perform								
	Engine failure after lift-off (no lower than 600' AGL)	Perform								
	Short-field landing	Perform								
	Approach and landing with an engine inoperative	Perform								
Introduction	Night cross-country	Practice								
	Pilotage and dead reckoning	Practice								
	Navigation systems and radar services	Practice								

Aeronautical Decision Making	Discussed and is able to explain aeronautical decision making at a Private Pilot level as outlined in the Aviation Instructor's Handbook	Perform								
	Discussed and is able to explain the use of the PAVE and DECIDE model as well as the 5Ps in multi-engine flight	Perform								
	Discussed and is able to explain assessing the risk of a student and flight lesson	Perform								
	Discussed and is able to explain factors that affect decision making	Perform								
	Discussed and is able to explain incorporating aeronautical decision making scenarios into ground briefings and flight lessons to emphasize risk management and single pilot resource management	Perform								
Postflight Discussion	Critique student performance, preview next lesson, and make study assignment	Perform								

Debriefing:

The PT will lead the debriefing using LCG techniques. The PT should identify both strengths and weakness in his/her performance, aeronautical decision-making, and single-pilot resource management. The instructor should select several night cross-country planning, navigation, and/or other flight problems to lead a guided discussion to practice problem solving and to develop judgment skills.

Assignment for Lesson 15:

1. As determined by the flight instructor (the instructor should use lesson 15 to review any items needing additional work to meet PTS standards).

Notes to the Instructor:

The instructor should adjust the scenario as required to complete the tasks listed in the Desired Outcomes Grading Sheet. The scenario calls for a night cross-country and the grading sheet calls for engine failures. Completing both objectives will require careful planning since the PT will need to carry the engine failure to a logical conclusion; that is, make an engine inoperative landing and attend to getting the airplane returned to service. A diversion to an unplanned airport could make it difficult to complete the cross-country requirements, depending on where the engine failures are given. A possible solution to this training problem could be to fail the engine at an airport when the engine could be repaired and simply continue the flight after the repairs. Avoid doing in-flight repairs that do not give the PT the opportunity to work all the way through the problem. That is, only let the PT do the immediate action items in the POH and then terminating the emergency without letting the PT complete the problem. The PT needs to be taught how to divert safely.

Multi-engine Aerodynamics, Performance, and Control– Lesson 15
Multi-engine VFR Night Flight – Mission
FLT Lesson 15 (Approximate lesson time 1.0 hours)

AIRPLANE - MEL

Scenario:

You are planning to take you spouse to dinner tomorrow night in a new restaurant in a neighboring state. Your night currency has run out, so you plan to do at least three takeoffs and landings at you local airport tonight. You believe that three takeoffs and landings will be adequate, but you want to get in as many landings as you can in a 1-hour flight. There is little traffic in the evening and the tower is very helpful. This should be fun.

Lesson Objective:
During this lesson, the PT will function as pilot in command, practice normal and crosswind takeoffs and landings, and procedures, listed in review, to increase his/her understanding and proficiency. In addition, the PT will demonstrate the ability to safely manage the flight lesson through an acceptable use of aeronautical decision making, risk management, and single pilot resource management.

Pre Briefing:

The PT will conduct the briefing for this lesson.

Completion Standards:

At the completion of this lesson, when the PT safely executes the designated maneuvers. In addition, the PT will demonstrate the ability to safely manage the flight lesson through an acceptable use of aeronautical decision making, risk management, and single pilot resource management.

Desired Outcome Grade Sheet:

			Task Grades					SRM Grades		
Lesson 15 Desired Outcome Grade Sheet			Not Observed	Describe	Explain	Practice	Perform	Explain	Practice	Manage/Decide
Scenario Activities	Task	Desired Performance								
Preflight Discussion	Preflight planning and preparation	Perform								
	Airplane weight and balance	Perform								
Demonstration of SRM	Effectively managed all resources available related to the flight lesson	Perform								

	Discussed and demonstrated the proper use of automation management in all phases of flight	Perform								
	Identified and discussed areas of risk and made proper decisions in managing those situation	Perform								
	Discussed and demonstrated proper task management throughout the flight lesson	Perform								
	Exercised proper aeronautical decision making and risk management while maintaining positional and situational awareness	Perform								
	Discussed and demonstrated the avoidance of controlled flight into terrain	Perform								
	Effectively managed the flight as a Private Pilot with a multi-engine rating	Perform								
Review	Checklist usage – flow patterns	Perform								
	Normal/crosswind takeoffs and landings	Perform								
Aeronautical Decision Making	Discussed and is able to explain aeronautical decision making at a Private Pilot level as outlined in the Aviation Instructor's Handbook	Perform								
	Discussed and is able to explain the use of the PAVE and DECIDE model as well as the 5Ps in multi-engine flight	Perform								
	Discussed and is able to explain assessing the risk of a student and flight lesson	Perform								
	Discussed and is able to explain factors that affect decision making	Perform								
	Discussed and is able to explain incorporating aeronautical decision making scenarios into ground briefings and flight lessons to emphasize risk management and single pilot resource management	Perform								
Postflight Discussion	Critique student performance, preview next lesson, and make study assignment	Perform								

Debriefing:

The PT will lead the debriefing using LCG techniques. The PT should identify both strengths and weakness in his/her performance, aeronautical decision-making, and single-pilot resource management. The instructor should select several night cross-country planning, navigation, and/or other flight problems to lead a guided discussion to practice problem solving and to develop judgment skills.

Assignment for Lesson 16:

1. As determined by the flight instructor to prepare the PT for the practical test. The PT should actively participate in the selection of the lesson plans to be assigned for the lesson 16.

Notes to the Instructor:

You must have a total of 5 hours and 10 takeoffs and landings in VFR conditions at night at an airport with an operating control tower between lessons 15, 16, and 17.

The is asked to actively participate in the selection of the assignments for lesson 16 to engage the PT in the learning process (to improve learning) and to further develop the PT's self learning skills. Both of these reasons should cause the PT to be a safer pilot.

Once you and the PT have determined what should be accomplished during this lesson, you will need to develop a plan of action that will accommodate. However, consider building in flexibility that will allow items to be re-flown as necessary or changed in some other way. This will allow you to take advantage of the actual situations or problems that occur during the flight. Situations that cannot be fully explored during the flight can be discussed during the debriefing. Often these events are good judgment and decision-making items. That is, additional solutions can be offered and considered and then the PT can be asked to choose the best solution (practice decision-making). Many "what if" questions can be asked to show the PT how the best solution can be different under slightly different situations. This will enhance the learning experience and the PT will get more from the lesson.

Multi-engine Aerodynamics, Performance, and Control– Lesson 16
Night VFR Multi-engine Flight – Mission
FLT Lesson 16 (Approximate lesson time 1.0 hours)

AIRPLANE – MEL

Scenario:

You are scheduled to fly the company President in a couple of days. The flight will be at night and you want to impress the President, so you are spending tonight practicing your night takeoffs and landings. You have asked a CFI friend of yours to come along and give you engine failure work.

Lesson Objective:
During this lesson, the PT will function as Pilot in Command and practice maneuvers and procedures, listed in the review section, to increase his/her understanding and proficiency. In addition, the PT will demonstrate the ability to safely manage the flight lesson through an acceptable use of aeronautical decision making, risk management, and single pilot resource management.

Pre Briefing:

The PT will conduct the briefing for this lesson.

Completion Standards:

The lesson will be complete when the PT safely executes the designated maneuvers. In addition, the PT will demonstrate the ability to safely manage the flight lesson through an acceptable use of aeronautical decision making, risk management, and single pilot resource management.

Desired Outcome Grade Sheet:

Lesson 16 **Desired Outcome Grade Sheet**			Task Grades					SRM Grades		
			Not Observed	Describe	Explain	Practice	Perform	Explain	Practice	Manage/Decide
Scenario Activities	Task	Desired Performance								
Preflight Discussion	Discuss lesson objective	Perform								
	Preflight planning and preparation	Perform								
	Airplane weight and balance consideration	Perform								
Demonstration of SRM	Effectively managed all resources available related to the flight lesson	Perform								
	Discussed and demonstrated the proper use of automation management in all phases of flight	Perform								

	Identified and discussed areas of risk and made proper decisions in managing those situation	Perform								
	Discussed and demonstrated proper task management throughout the flight lesson	Perform								
	Exercised proper aeronautical decision making and risk management while maintaining positional and situational awareness	Perform								
	Discussed and demonstrated the avoidance of controlled flight into terrain	Perform								
	Effectively managed the flight as a Private Pilot with a multi-engine rating	Perform								
Review	Checklist usage – flow patterns	Perform								
	Short-field takeoffs and maximum performance climb	Perform								
	Maneuvers	Perform								
	Single engine maneuvering	Perform								
	Engine failure during takeoff roll (slower than 50% of V_{MC})	Perform								
	Engine failure after lift-off (no lower than 600' AGL)	Perform								
	Steep turn	Perform								
	Stall – power-on	Perform								
	Stall – power-off	Perform								
	Maneuvering during slow flight	Perform								
	Approach and landing with one engine inoperative	Practice								
Aeronautical Decision Making	Discussed and is able to explain aeronautical decision making at a Private Pilot level as outlined in the Aviation Instructor's Handbook	Perform								
	Discussed and is able to explain the use of the PAVE and DECIDE model as well as the 5Ps in multi-engine flight	Perform								
	Discussed and is able to explain assessing the risk of a student and flight lesson	Perform								
	Discussed and is able to explain factors that affect decision making	Perform								
	Discussed and is able to explain incorporating aeronautical decision making scenarios into ground briefings and flight lessons to emphasize risk management and single pilot resource management	Perform								
Postflight Discussion	Critique student performance, preview next lesson, and make study assignment	Perform								

Debriefing:

The PT will lead the debriefing using LCG techniques. The PT should identify both strengths and weakness in his/her performance, aeronautical decision-making, and single-pilot resource management. The instructor should select several night cross-country planning, navigation, and/or other flight problems to lead a guided discussion to practice problem solving and to develop judgment skills.

Assignment for Lesson 17

1. Assign route for lesson 17. The PT should actively participate in the selection of the lesson plans to be assigned for the lesson 17.

Notes to the Instructor:

You must have a total of 5 hours and 10 takeoffs and landings in VFR conditions at night at an airport with an operating control tower between lessons 15, 16, and 17.

The PT's involvement in selecting the activities to be included in this lesson will likely be limited to practicing items that he/she feels need practice; therefore, it is your job to ensure that the PT has the total hours, takeoffs, and landings required. Ensure that the scenario and route of flight allows all of the training items to be accomplished. Adjust the scenario and route of flight as necessary.

Multi-engine Aerodynamics, Performance, and Control– Lesson 17
Night VFR Multi-engine Cross-country – Mission
FLT Lesson 17 (Approximate lesson time 4.5 hours)

AIRPLANE – MEL

Scenario:

You are taking you new spouse to visit her Mother several states away. You will also be picking up the mother's brother on the way in a neighboring state and returning home, in a mountainous area. The three of them have not been together in five years and this has become a big deal to your spouse. Good luck.

Lesson Objective:

During this lesson, the PT will function as Pilot in Command, practice maneuvering and landing with an engine inoperative, and cross-country procedures, as listed in the review section, to increase his/her understanding and proficiency. In addition, the PT will demonstrate the ability to safely manage the flight lesson through an acceptable use of aeronautical decision making, risk management, and single pilot resource management.

Pre Briefing:

The PT will lead all briefings for this lesson. The instructor should also cover others area he/she feels are appropriate from earlier lessons.

Completion Standards:

This lesson is complete when the cross-country is completed as planned and when the PT safely executes the designated maneuvers. In addition, the PT will demonstrate the ability to safely manage the flight lesson through an acceptable use of aeronautical decision making, risk management, and single pilot resource management.

Desired Outcome Grade Sheet:

Lesson 17 **Desired Outcome Grade Sheet**			Task Grades					SRM Grades		
			Not Observed	Describe	Explain	Practice	Perform	Explain	Practice	Manage/Decide
Scenario Activities	Task	Desired Performance								
Preflight briefing	Discuss lesson objective	Perform								
	Preflight planning and preparation	Perform								
	Airplane weight and balance computation	Perform								

Demonstration of SRM	Effectively managed all resources available related to the flight lesson	Perform								
	Discussed and demonstrated the proper use of automation management in all phases of flight	Perform								
	Identified and discussed areas of risk and made proper decisions in managing those situation	Perform								
	Discussed and demonstrated proper task management throughout the flight lesson	Perform								
	Exercised proper aeronautical decision making and risk management while maintaining positional and situational awareness	Perform								
	Discussed and demonstrated the avoidance of controlled flight into terrain	Perform								
	Effectively managed the flight as a Private Pilot with a multi-engine rating	Perform								
Review	Checklist usage – flow patterns	Perform								
	Maneuvers	Perform								
	Single engine maneuvering	Perform								
	Engine failure during takeoff roll (slower than 50% of VMC)	Perform								
	Engine failure after lift-off (no lower than 600' AGL)	Perform								
	Approach and landing with an engine inoperative	Perform								
	Cross-country flight with landings at three different airports	Perform								
	Pilotage navigation all legs	Perform								
	Dead reckoning navigation all legs	Perform								
	Radio navigation one leg	Perform								
Aeronautical Decision Making	Discussed and is able to explain aeronautical decision making at a Private Pilot level as outlined in the Aviation Instructor's Handbook	Perform								
	Discussed and is able to explain the use of the PAVE and DECIDE model as well as the 5Ps in multi-engine flight	Perform								
	Discussed and is able to explain assessing the risk of a student and flight lesson	Perform								
	Discussed and is able to explain factors that affect decision making	Perform								
	Discussed and is able to explain incorporating aeronautical decision making scenarios into ground briefings and flight lessons to emphasize risk management and single pilot resource management	Perform								
Postflight Discussion	Critique student performance, preview next lesson, and make study assignment	Perform								

Debriefing:

The PT will lead the debriefing using LCG techniques. The PT should identify both strengths and weakness in his/her performance, aeronautical decision-making, and single-pilot resource management. The instructor should select several night cross-country planning, navigation, and/or other flight problems to lead a guided discussion to practice problem solving and to develop judgment skills.

Assignment for Lesson 18
1. Certificates and documents
2. AIM, FAR 61, and 91
3. Systems and equipment malfunctions in VFR conditions
4. Approach and arrival procedures
5. In-flight emergencies appropriate for multi-engines operations
6. AIM
7. Private Multi-engine Practical Test Standards
8. Other areas that the instructor feels are necessary.

Notes to the Instructor:

Continue to work on areas that need improvement before the FAA Practical Test. That is, this is a proficiency flight to get the PT ready for the practical test. Adjust the scenario as needed to meet the training needs of the PT. Ask the PT for his/her input on what needs to be worked on to meet PTS standards. This may include items that the PT can do within standards but just wants to do it again and all items the PT is not sure about being able to do well.

You must have a total of 5 hours and 10 takeoffs and landings in VFR conditions at night at an airport with an operating control tower between lessons 15, 16, and 17. Again, meeting total time as well as takeoff and landing numbers is your responsibility.

Multi-engine Aerodynamics, Performance, and Control – Lesson 18
Multi-engine Additional Rating Practical Test – Mission
FLT Lesson 18 (Approximate lesson time - Oral 2.0 hours – Flight 1.5 hours)

MULTI-ENGINE ADDITIONAL RATING PRACTICAL TEST – AIRPLANE – MEL

Scenario:

Scenario assigned by check pilot.

Lesson Objective:

The PT will manage all phases of the flight lesson. During the flight portion, the stage check pilot may deviate from the original scenario during the flight portion for the PT to manage and perform make proper decisions in managing the flight and safety of flight.

Pre Briefing:

Note: this is a guide to help prepare the applicant with the proper paperwork and necessary items for the FAA practical test: however, the applicant should always consult current PTS and Advisory Circulars when preparing for the practical test.

1. Personal records
    a. Pilot Certificate
    b. Medical Certificate
    c. Picture Id
    d. Completed 8710 Form
    e. Log book showing appropriate flight training and a minimum of 15 hours of pilot in command time.
    f. Appropriate log book endorsement for the addition of a multi-engine rating to a flight instructor certificate.
    g. If applicable
        i. A letter of discontinuance
        ii. A notice of disapproval
        iii. Approved school graduation certificate
        iv. Examiners fee
2. Equipment
    a. Current Private Multi-engine PTS
    b. Current FAR/AIM
    c. Current Checklist
    d. Other reference materials such as
        i. Airplane Flying Handbook
        ii. A multi-engine reference book
    e. Current Aeronautical Charts
    f. Flight Computer and Plotter
    g. Flight Plan Form and Flight Log

h. Current Airport Facility Directory
i. View Limiting Device

3. Review the Applicant's Practical Test Checklist in the Private Pilot Multi-engine PTS

Completion Standards:

This stage check is complete when the PT is able to complete the tasks required in the Private Pilot Multi-engine Practical Test Standards. The PT will demonstrate the ability to safely manage the flight lesson through an acceptable use of aeronautical decision making, risk management, and single pilot resource management.

Evaluation – Oral Portion

The student must be able to manage and perform the tasks required by the Private Pilot Multi-engine Practical Test Standards. See a current version of the Private Pilot Multi-engine Practical Test Standards for specific oral tasks that must be covered on a practical test.

Desire Outcome Grade Sheet:

Lesson 18 **Desired Outcome Grade Sheet**			Task Grades					SRM Grades		
			Not Observed	Describe	Explain	Practice	Perform	Explain	Practice	Manage/Decide
Scenario Activities	Task	Desired Performance								
Demonstration of SRM	Effectively managed all resources available related to the flight lesson	Manage/ Decide								
	Discussed and demonstrated the proper use of automation management in all phases of flight	Manage/ Decide								
	Identified and discussed areas of risk and made proper decisions in managing those situation	Manage/ Decide								
	Discussed and demonstrated proper task management throughout the flight lesson	Manage/ Decide								
	Exercised proper aeronautical decision making and risk management while maintaining positional and situational awareness	Manage/ Decide								
	Discussed and demonstrated the avoidance of controlled flight into terrain	Manage/ Decide								
	Effectively managed the flight as a Private Pilot with a multi-engine rating	Manage/ Decide								
Oral Examination	Discuss tasks outlined in the Private Multi-engine PTSs	Perform								

Aeronautical Decision Making	Discussed and is able to explain aeronautical decision making at a Private Pilot level as outlined in the Aviation Instructor's Handbook	Manage/ Decide								
	Discussed and is able to explain the use of the PAVE and DECIDE model as well as the 5Ps in multi-engine flight	Manage/ Decide								
	Discussed and is able to explain assessing the risk of a student and flight lesson	Manage/ Decide								
	Discussed and is able to explain factors that affect decision making	Manage/ Decide								
	Discussed and is able to explain incorporating aeronautical decision making scenarios into ground briefings and flight lessons to emphasize risk management and single pilot resource management	Manage/ Decide								

Evaluation – Flight Portion

The student must be able to explain, manage, and perform the tasks required by the Private Pilot Multi-engine Practical Test Standards. See a current version of the Private Pilot Multi-engine Practical Test Standards for specific flight tasks that must be covered on a practical test.

Desire Outcome Grade Sheet:

Lesson 18 **Desired Outcome Grade Sheet**			Task Grades					SRM Grades		
			Not Observed	Describe	Explain	Practice	Perform	Explain	Practice	Manage/Decide
Scenario Activities	Task	Desired Performance								
Preflight briefing	Preflight planning and preparation	Perform								
Demonstration of SRM	Effectively managed all resources available related to the flight	Manage/ Decide								
	Discussed and demonstrated the proper use of automation management in all phases of flight	Manage/ Decide								
	Identified and discussed areas of risk and made proper decisions in managing those situation	Manage/ Decide								
	Discussed and demonstrated proper task management throughout the flight	Manage/ Decide								
	Exercised proper aeronautical decision making and risk management while maintaining positional and situational awareness	Manage/ Decide								

	Discussed and demonstrated the avoidance of controlled flight into terrain	Manage/ Decide								
	Effectively managed the flight as a Private Pilot with a multi-engine rating	Manage/ Decide								
Evaluation flight	Perform areas outlined in the Multi-engine PTS									
	Preflight preparation	Perform								
	Preflight procedures	Perform								
	Takeoffs, landings, and go-arounds	Perform								
	Performance maneuver	Perform								
	Slow flight and stalls	Perform								
	Emergency operations	Perform								
	Multi-engine operations (including engine failure during flight [by reference to instruments] and instrument approach-one engine inoperative [by reference to instruments], if instrument rated and instrument proficiency has not previously been demonstrated in a multi-engine airplane.)	Perform								
Aeronautical Decision Making	Discussed and is able to explain aeronautical decision making at a Private Pilot level as outlined in the Aviation Instructor's Handbook	Manage/ Decide								
	Discussed and is able to explain the use of the PAVE and DECIDE model as well as the 5Ps in multi-engine flight	Manage/ Decide								
	Discussed and is able to explain assessing the risk of a student and flight lesson	Manage/ Decide								
	Discussed and is able to explain factors that affect decision making	Manage/ Decide								
	Discussed and is able to explain incorporating aeronautical decision making scenarios into ground briefings and flight lessons to emphasize risk management and single pilot resource management	Manage/ Decide								
Postflight Discussion	The check pilot, FAA Examiner or Designated Examiner, will debrief the PT	Perform								

Debriefing:

Check pilot should debrief the PT as required.