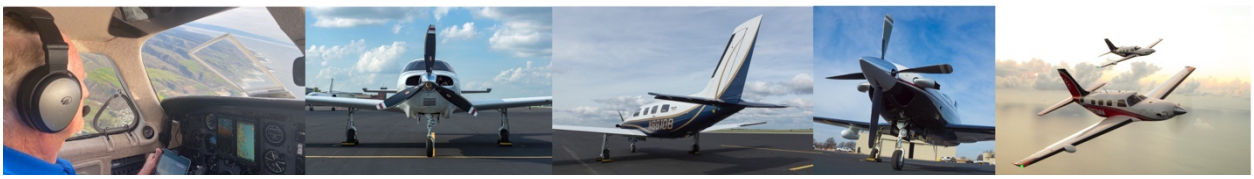
PMOPA™ | SAFETY & EDUCATION FOUNDATION



M-CLASS ELEVATE TRAINING PROGRAM

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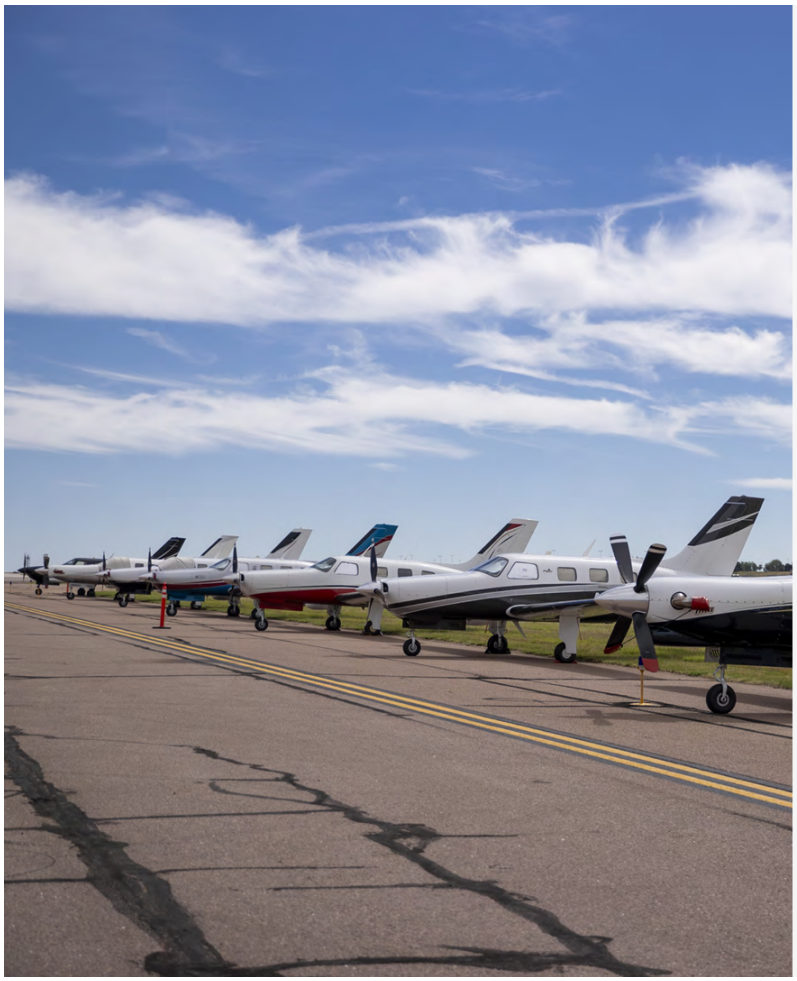
Introduction



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Sharing Our Passion for Flight

We share a deep passion for aviation and a commitment to spreading the freedom of flight with others. The thrill of being airborne, observing varied landscapes from above, experiencing new destinations, and mastering the art of piloting an aircraft is incredibly rewarding. Adventure only adds to this allure. Aircraft are designed for specific purposes such as training, exploration, experimentation, travel, or aerobatics. Each of these purposes requires pilots to develop and refine different sets of skills, knowledge, and judgment, usually progressing from simpler, slower aircraft to more complex, faster ones.

Becoming a safe and proficient pilot of a high-performance, cabin-class aircraft like the Piper M-Class demands not only a comprehensive understanding of advanced technical systems but also the development of skills for flying with higher power, speed, and altitude.

These aircraft often offer superior avionics and performance capabilities, enabling faster and longer travel.

As a result, pilots may suddenly find themselves capable of undertaking long-distance, high-speed, and high-altitude flights—along with the challenges these flights present—without possessing the full knowledge and skills necessary for a safe outcome. Such journeys often span diverse weather systems and varied topography, requiring advanced flight planning and execution. Pilots must be skilled at recognizing and managing unique risks through precise aeronautical decision-making. They must be able to utilize all available tools and resources to plan and execute uneventful flights that may cross the continent and be prepared to address any emergency or unusual situation that arises.

Furthermore, the advanced cockpits and avionics, while generally considered enhancements, demand increased technical knowledge and finely tuned automation skills. Without these, the potential for human-error accidents increases significantly.

Training and Proficiency Elevate Safety

The accident rate in the Piper M-Class community is higher than anyone in the PMOPA community is willing to accept, and we must take decisive, proactive measures to improve it. Enhancing pilot training is necessary to increase safety in our community, similar to the successes other Owner Pilot Associations have achieved through a coordinated, consistent, and intentional approach to training, supported by relevant resources to advance our knowledge and skills.

Additionally, there is a need to bring in new instructors to the M-Class community. This training program, along with the accompanying M-Class Standardized Instructor Pilot (MSIP) Program, will help attract CFIs to the M-Class aircraft while maintaining high standards in training.

Introducing M-Class Elevate

M-Class Elevate was created with cooperation from the Piper M-Class Owners & Pilots Association Safety & Education Foundation (PMOPA SEF) and volunteers from the Piper M-Class Owners & Pilots Association (PMOPA) community to provide a training curriculum, learning resources, and guidance to help pilots-in-training (referred to throughout this document as “pilots”) and instructors enhance their skills, knowledge, and judgment with the M-Class aircraft.

This program includes a comprehensive syllabus, training recommendations, and resources. The program will be further enhanced with an online education and administration system that will be

developed for easy access and use. Instructors who demonstrate proficiency in training in the M-Class will have the opportunity to be recognized as "MSIP Instructors." MSIP Instructors are committed to quality training. Through these efforts, we aim to improve the overall safety, proficiency, and experience within the community.

M-Class Elevate was developed, in part, using a data-driven approach, considering the M-Class accident record and how training can prevent future accidents. The syllabus is based on extensive research of aviation industry best practices for training. M-Class Elevate blends established, tested, and proven syllabi developed by the FAA and the General Aviation Manufacturers Association (GAMA) and adheres to the Piper Pilot's Operating Handbooks (POH) and the FAA Airman Certification Standards (ACS). We also identified how improvements in training, led by other Owner Pilot Associations, has reduced the accident record in their communities. And, most importantly, we relied on the extensive expertise of M-Class instructors who have trained thousands of M-Class pilots.

Using the Syllabus

This syllabus organizes learning elements into four components and thirty-four training units that instructors and training centers can use to develop lesson plans and training events. Each unit contains objectives and states expectations for each training task in order to provide guidance for instructor evaluation and self-assessment by the pilot. The training units include recommendations for instructors, and links to PMOPA and external resources for self-study and instructional support. As M-Class Elevate evolves, many of these materials will be incorporated into the new PMOPA SEF learning management system which, combined with quizzes, will allow the pilot to demonstrate understanding and identify areas for further emphasis before their next training event, thereby improving both time efficiency and learning effectiveness.

Note that the units are not necessarily independent as learning will take advantage of multiple conditions. For example, a pilot can build his/her basic understanding of systems by self-study of articles and videos, but application of that knowledge can only be achieved in a flight training device or in the aircraft, including a scenario during flight. This is particularly true with units the risk management unit and the avionics unit where context and situations are important. Pilot expectations are worded such to orient instructors to the condition most relevant. Thus, "apply", "engage", "manage", and "perform" are relevant to in-flight conditions although some risk management tasks can be taught through scenarios in classroom discussions.

Components

Risk Management and Decision Making

This component covers four key areas of risk management and decision making that are critical to safe flight: (1) single-pilot resource management, (2) threat and error management, (3) cross-country flight planning, and (4) in-flight operations. Self-study materials are available to build awareness and understanding of the foundational concepts and tools. Discussions and scenario illustrations with the instructor and perhaps other pilots can amplify understanding. Observation and engagement with the instructor around situations, threats, and errors during the flight portion of training can demonstrate application of the knowledge. The pilot will demonstrate mastery of this component by effectively managing risks independently.

Aeronautical Knowledge and Systems

This component covers basic knowledge about the M-Class aircraft and its key systems, including abnormal and emergency situations and pilot maintenance responsibilities. The focus is on areas and systems peculiar to the M-Class aircraft flown by the pilot. Self-study materials can be used to build initial awareness and understanding but instructors will need to assess the understanding in discussions and determine whether that knowledge can be applied in the aircraft and in flight.

Avionics and Panel Instruments

This component covers the panel instruments and avionics of the M-Class aircraft flown by the pilot. Panel instruments are included with avionics because many aircraft integrate engine instruments, monitors, crew alerting systems (CAS), and annunciators into their avionics systems. This component focuses on knowledge, programming, monitoring, and practical application of instruments and equipment for primary flight, navigation, communication, flight management and control, and the use of datalink services. Self-study materials, including manufacturer user guides and courses, build foundational awareness and understanding. However, hands-on interaction with the equipment in the aircraft—before, during, and after flight, and across various scenarios—is crucial for deep understanding and the ability to effectively apply that knowledge in practice.

Flight Procedures and Proficiency

This component covers the critical skills required for proficient piloting of the M-Class aircraft through the complete process from pre-flight inspection through the various stages of taxi and flight, to post-flight shutdown. This includes normal maneuvers and situations as well as abnormal and emergency procedures. Most units include risk management tasks and opportunities for applying system and avionics knowledge. Scenarios can be used to develop situations to highlight specific areas. Topical scenarios such as icing encounters are included in the resources. These can be used in flight, if appropriate, or in discussions on the ground. Multiple flights can be used to progress from a basic description of the maneuver or procedure to being able to explain, practice, and perform.

Units

The units under each component are detailed by component in the next section. Each unit includes training tasks, instructional recommendations, and links to available resources for self-study and instructor use. The focus is on areas where the pilot will encounter features or behaviors unique to all variants of the M-Class, and on differences among the specific variants: Malibu/Mirage, Matrix, JetPROP, Meridian, M500, M600, and M700. As safety data from the M-Class fleet identifies new or different threats, errors, risks, and vulnerabilities, new special emphasis scenarios will be created to promote safety by highlighting these areas.

M-Class Elevate does not aim to cover general piloting knowledge or skills applicable to all aircraft; these broader areas should be addressed through other training avenues.

Conditions

Elements of M-Class Elevate can be conducted under one or more specific “conditions” including:

- **Self-study:** Reading materials, videos, online courses, or other content designed to be reviewed in advance of a scheduled training event, or any time the pilot wishes to advance his/her knowledge.

- **Ground School:** Live in-person or web-based training, with the ability to engage in discussions with questions and answers. This includes group and/or one-on-one training.
- **Pre-Flight:** Conducted one-on-one (or small group) at or in the aircraft, or in a classroom setting, typically immediately before a flight.
- **In-flight:** Training conducted during an actual flight. Realistic situations and scenarios provide opportunities for risk management and decision making.
- **Post-Flight:** Debriefing discussions after flight or in subsequent forums.

Training for aeronautical knowledge and systems primarily emphasizes self-study and classroom training, while flight proficiency focuses on in-aircraft experience and practical flight training, supplemented by some preparatory work and profiles. Avionics and panel instruments training can vary; a solid understanding of pilot guides and theoretical concepts is crucial and can be studied in advance, but hands-on use in flight and across various training scenarios is essential, especially given the wide variation in configurations.

Risk management and decision-making require a blend of training methods; foundational concepts and tools are introduced through online materials, but instructors must observe and guide pilots during actual flight conditions across different scenarios. Scenario-based training, whether in-flight, using training devices, or through individual or group discussions, is recommended. Many flight proficiency units include SRM training tasks. The syllabus provides example scenarios for different conditions.

Expectations are detailed for each training task. Risk management tasks progress from describe, perform/engage, to explain/manage. Knowledge and avionics tasks progress from aware, understand, to apply. Flight tasks progress from describe, explain, practice, to perform. While mastery may require all tasks to reach the highest level, lower expectations coupled with personal minimums and training recommendations may be appropriate for initial and recurrent training. Some topics may not be required in a specific training event or for a specific aircraft.

Scenario-based training uses a sequence of scenarios to build knowledge and skills across various training topics, with outcomes progressing from describe, to explain/practice, and then to perform or manage/decide. Maneuver-based approach emphasizes developing motor skills to master individual tasks or elements, leaving risk management and decision-making to final line-oriented flight training (LOFT) or other scenarios. Many flight topics incorporate SRM training tasks along with maneuvers. Either approach can be used to train to expectations.

Expectations

Pilot

The pilot is expected to review all assigned materials prior to in-person instruction; this may include completing specific quizzes to demonstrate their understanding of the topics. The instructor will then assess whether the pilot can effectively apply that knowledge when necessary, providing additional training as needed to ensure that expectations are met.

Each training task lists specific expectations for the pilot. The instructor will determine how those expectations are met, perhaps with suggestions for further training or personal minimums.

Instructor

Pilots new to the M-Class will complete an "initial training" event which will address most, if not all, of the M-Class Elevate curriculum. Subsequent training events -- "recurrent training" and "focused training" -- will allow the pilot and instructor to delve deeper into specific content areas to more fully develop the pilot's knowledge, skills, and abilities. Prior to each training event, the instructor will engage with the pilot to discuss his/her needs and expectations from the training event.

The instructional approach and the lesson planning that apply this syllabus will be determined by the individual training facility and instructor. The MSIP flight instructor will tailor each training event to the pilot's specific needs. The instructor will use his/her judgement to determine which aspects of the training event will require less time or more time for the pilot to grasp the subject matter.

Upon completion of a training event, whether initial, recurrent, or focused, the instructor will discuss with the pilot their strengths and weaknesses, personal minimums, and recommendations for interim training. The instructor will complete the M-Class Elevate Training Record during the final debrief, documenting the elements covered and confirming that objectives and expectations were met. The instructor will sign this record, the pilot shall have the option to sign the record, and it will then become part of the pilot's training transcript. A training certificate from PMOPA SEF will then be issued to the pilot.

PMOPA SEF

PMOPA SEF will support instructors and pilots as they use this training program. Materials, courses, learning, and administrative tools will be added on an on-going basis as instructor experience and needs evolve. In addition, PMOPA SEF will revise the training program when needed to address hot topics based on data reviews, industry shifts, and community feedback.

Acknowledgements

PMOPA SEF is indebted to those who contributed their passion, time, and expertise via in-person meetings, webinars, and independent work to create the M-Class Elevate training program for the Piper M-Class community.

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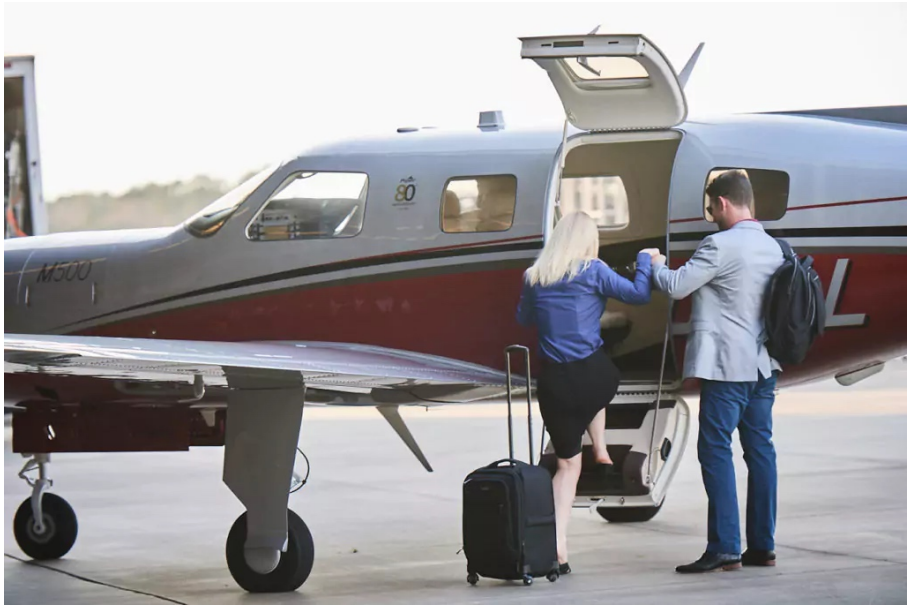
Risk Management and Decision Making



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Risk Management and Decision Making

M-Class R01 - Single Pilot Resource Management (SRM)

Unit Objective: Demonstrate safe and efficient operations by adequately managing all available resources.

Summary: This unit covers the basic elements of single-pilot resource management including effective task and automation management, risk management and decision making, and situation awareness. Controlled flight into terrain is also addressed along with general aircraft and pilot resources and limitations as they related to specific flights and personal minimums. Application of these topics is considered during flight training tasks and scenarios.

Training Topics

1. **Task Management (TM)**
   a. Prioritize and select the most appropriate tasks (or series of tasks) to ensure successful completion of the training scenario

2. **Automation Management (AM)**
   a. Program and utilize the most appropriate and useful modes of cockpit automation to ensure successful completion of the training scenario

3. **Risk Management (RM) and Decision-Making (ADM)**
   a. Consistently make informed decisions in a timely manner based on the task at hand and a thorough knowledge and use of all available resources

4. **Situational Awareness (SA)**
   a. Be aware of all factors such as traffic, weather, fuel status, aircraft mechanical condition, and pilot fatigue level that may have an impact on the successful completion of the training scenario

5. **Controlled Flight into Terrain (CFIT) Awareness**
   a. Understand, describe, and apply techniques to avoid CFIT encounters:
      - During inadvertent encounters with Instrument Meteorological Conditions during VFR flight
      - During system and navigation failures and physiological incidents during IFR flight

6. **Aircraft and Pilot Resources and Limitations**
   a. Review and understand needed and available resources for a specific flight, and consider aircraft and pilot limitations when making decisions

Risk Management and Decision Making

Instructor Recommendations:

- Embed SRM tasks into your lesson plans and evaluate throughout all phases of training
- Provide written materials ahead of time; quiz to ensure read/understood materials

Resources:

- FAA Risk Management Handbook (FAA-H-8083-2A)
    - Chapter 7: Automation and Flight Path Management
    - Chapter 8: Aeronautical Decision Making in Flight

Risk Management and Decision Making

M-Class R02 - Threat and Error Management (TEM)

Unit Objective: Know and apply effective threat and error management in flight operations.

Summary: This unit covers how to identify threats and recognize errors, along with mitigation of threats, trapping of errors, and recovering from abnormal aircraft states. Illustration and application of these topics is considered during flight training tasks and scenarios.

Training Topics

1. **Identify and Recognize Threats**
    - **Operational,**
    - **Environmental,**
    - **Mismanaged Threats**

    a. Use Situational Awareness and deliberate checklists to identify likely and actual threats

2. **Identify and Recognize Errors**
    - **Action or Inaction**
    - **Handling,**
    - **Procedural,**
    - **Communications**

    a. Readily recognize and correct errors before they lead to an undesired aircraft state

3. **Mitigate Threats and Errors**
    - **Act on Threats (Anticipate),**
    - **Trap Errors (Recognize);**
    - **Decision Making on actions**

    a. Anticipate possible threats and have strategies for trapping errors

4. **Prevent and Recover from Abnormal Aircraft States**
    a. Be aware of undesired aircraft states that could result from a threat or error and have strategies for recovering within aircraft and pilot limitations

Note: All tasks under TEM will be embedded into the curriculum and the training will occur selectively during all phases of training. TEM will be graded with SRM as it occurs during the training scenario syllabus.

Risk Management and Decision Making

Instructor Recommendations

- Discuss real and relevant accidents and incidents stemming from inadequate attention to TEM
- Discuss threats and errors identified from PMOPA's Flight Data. Monitoring (FDM) Program data analysis

Resources

- FAA: Risk Management Handbook (FAA-H-8083-2A) (Publication)
    - Chapter 6: Threat and Error Management
- Skybrary: Threat and Error Management (TEM) (Article)
- Skybrary: The Dirty Dozen (Article)
- NTSB: Controlled Flight Into Terrain (CFIT) (Safety Alert)

Risk Management and Decision Making

M-Class R03 - Cross-Country Flight Planning

Unit Objective: Demonstrate ability to acquire and appropriately use all available resources for a long-distance trip.

Summary: This unit covers basic elements of planning long cross-country flights, perhaps into novel areas and airports, traversing multiple weather systems, different geographies, and requiring supplemental fuel stops. This includes big-picture assessment with long-range weather and route planning, as well as identifying risks and challenges to factor into the plan. Methods for risk mitigation and day-of-flight decisions are considered. Training scenarios may be used, either in flight or discussion, to illustrate issues and solutions.

Training Topics

1. **Big Picture Assessment and Building Mental Models**
   a. Be able to build a high-level plan for the proposed flight with optimistic routes, stops, and timing

2. **Long-range Weather**
   a. Use available tools and resources to review and assess weather trends and evaluate alternate plans as needed

3. **Route Planning**
   - **Stops,**
   - **Fuel**

   a. Choose appropriate fuel stops based on planning criteria (e.g., FBO resources, airport limitations, available alternates)

4. **Risks and Challenges**
   a. Carefully identify flight risks and challenges and evaluate possible impact, considering aircraft and pilot limitations

5. **Risk Mitigation,**
   - **Watchpoints**
   - **Checkpoints**
   - **Alternates**
   - **Contingencies**

   a. Develop and include risk mitigation strategies for the identified and possible risks and challenges

Risk Management and Decision Making

6. **Day of Flight Decisions**
    - **FRAT**
    - **PAVE**
    - **Forecast vs. Actual**
    - **Green/Yellow/Red**
    a. Make go/no go decisions using appropriate information, tools, and resources

Instructor Recommendations

- Use real journeys – goal is safe, uneventful, and according to plan (or modified plan based on real-world environment)
- Area to include accident reviews, from poor planning and decision-making

Resources

- FAA: Risk Management Handbook (FAA-H-8083-2A) (Publication)
    - Chapter 3: Identifying Hazards and Associated Risks
    - Chapter 4: Assessing Risk
    - Chapter 5: Mitigating Risk

Risk Management and Decision Making

M-Class R04 - Flight Operations

Unit Objective: Demonstrate safe and efficient operations by monitoring flight progress and plan.

Summary: This unit covers tools and methods for tracking progress and performance during flight. This includes weather tracking and ongoing risk management and decision-making using predictions from the plan, navigation log, and in-flight and datalink data. Application of these topics is considered during flight training and scenarios.

Training Topics

1. **Flight Navigation Log**
    - **Watchpoints**
    - **Checkpoints**
    a. Describe using a paper or electronic flight navigation log to verify times and waypoints

2. **Progress and Performance Monitoring**
    a. Monitor flight progress and performance, including fuel burn monitoring (how much should have used; how much actually used)

3. **Pilot and Passenger Status**
    a. Explain monitoring pilot and passenger status including fatigue, dehydration, and medical, and how to mitigate risks

4. **Risk Management (RM) and Decision-Making (ADM)**
    a. Explain deliberate risk management and decision making for safe and efficient flight operations

5. **Weather Tracking**
    a. Describe in-flight weather resources and how they can be used

Instructor Recommendations

- This unit may be used with flight scenarios intended to cover specific areas, such as icing, radar use

Resources

- FAA Risk Management Handbook (FAA-H-8083-2A)
    - Appendix B: Risk Management Tools
- Malibu Guru Podcast: Episode 140, Transatlantic Trek: Ferrying King Air 260's to Saudi Arabia - Technique for Monitoring Fuel Burn (Podcast)

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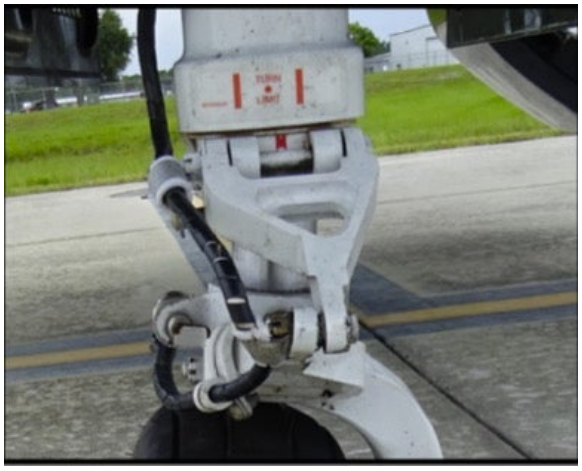
Aeronautical Knowledge and Systems



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Aeronautical Knowledge and Systems

M-CLASS K01 - Airplane Familiarization

Unit Objective: Demonstrate familiarity with the aircraft components and functionality.

Summary: This unit covers familiarization of the airplane exterior and interior, introduction to the basic system and safety components and their location, and general limitations on loading and operations.

Training Topics

1. **Airplane Overview:**
   - **Location of major subsystems and how they relate to each other**
   - **Service limitations of the engine and other time limited parts**
   - **Modifications to original airplane**

   a. Demonstrate a comprehensive pre-flight inspection of their aircraft, as outlined in the POH.
   b. Identify and explain major systems of the aircraft during pre-flight.
   c. Provide examples of potential issues and grounding items relating to the system or part.
   d. Explain the power plant used in their specific model.
   e. Explain the limitations outlined in the POH and the real-world limitations that promote longevity and safety for their aircraft.
   f. Demonstrate where visible parts are on the engine and propeller during pre-flight.
   g. Remove upper cowling and identify systems on the remainder of the engine.
   h. All additional equipment installed must be documented and the documentation must be available (e.g., 337, STC data in POH, logbook entry)

2. **Use of Safety Equipment**
   - **Emergency Exits**
   - **Seat Operations**
   - **Seat Belts and Shoulder Harnesses**
   - **Other**

   a. Locate and explain the emergency exit and give an example briefing to potential passengers
   b. Locate a fire extinguisher, if one is not installed, explain the benefits of having one
   c. Demonstrate adjusting the pilot, co-pilot, and passenger seats
   d. Locate and explain the emergency oxygen system installed in their specific aircraft
   e. JetPROP / Meridian / M500 / M600 / M700: demonstrate the oxygen mask and how to remove and stow
   f. Demonstrate how to access and recharge the oxygen bottle
   g. Matrix: locate oxygen fill port and oxygen mask hookup ports

Aeronautical Knowledge and Systems

3. **Instrument Panel (aircraft specific)**
    a. Explain where the instrument data is generated and demonstrate where it can be displayed
    b. Glass panels need to be able to describe what systems converts information (ADC, AHRS, GEA, etc. Use Garmin architecture diagrams to describe how all systems interconnect and have redundancy)
    c. Describe autopilot integration, limitations, and displays
    d. Describe and explain self-testing systems
    e. Describe and explain the aircraft CAS system and where it is displayed

4. **Cabin**
    a. Describe and demonstrate the main cabin door and how to operate it
    b. Demonstrate a passenger brief on how to operate the door in the most basic terms and how to avoid damaging the aircraft
    c. Demonstrate location of light switches
    d. Demonstrate how to adjust the seats
    e. Demonstrate how to move seats to access the baggage compartment

Instructor Recommendations

- Remember that the most basic things on this aircraft will be new to someone who has never experienced it. Just because we have opened and closed the door, run a before start flow, and flown these aircraft thousands of times doesn't mean your client has. Explain everything as if they have no base knowledge and always cover the important stuff multiple times.

Resources

- Pilot's Operating Handbook
    - Section 7
- Aircraft engine (Lycoming / Continental / Pratt and Whitney) manual and limitations
- Piper Service and Maintenance Manuals

Aeronautical Knowledge and Systems

M-CLASS K02 - Flight Controls

Unit Objective: Develop thorough understanding of the M-Class flight control system.

Summary: This unit covers description, inspection, operation, and maintenance of aircraft flight controls including ailerons, flaps, trim, speed brakes and spoilers (if installed). Abnormal and emergency procedures such as runaway trim are covered.

Training Topics

1. **Description and Limitations**
   a. Describe the aircraft flight controls to the extent the POH describes them:
      - Limitations
      - Inspection, Service, and Maintenance
      - Abnormal and Emergency Procedures

2. **Flight Controls**
   a. Describe the actuating method for the PA-46 Flight control system in accordance with the POH
   b. Perform an acceptable pre-flight inspection of the flight controls
   c. Demonstrate safe and controlled movements of flight controls in flight
   d. Describe Vo/Va and how it relates to flight controls

3. **Flaps**
   a. Describe the flap system according to the POH
   b. Describe flap settings and the associated limitations
   c. Describe the airframe limitations associated with the flaps
   d. Describe actuation methods of the flaps
   e. Identify failure of the flap system
   f. Run appropriate checklists and remedy items for flap system failures

4. **Trim Controls**
   a. Describe the trim system
   b. Demonstrate proper trim usage
   c. Demonstrate proper pre-flight checks of the trim system

5. **Speed brakes and/or spoilers**
   a. Describe the speed brakes and/or spoilers system(s)
   b. Describe limitations of speed brakes and/or spoilers
   c. Describe and identify scenarios and situations where speed brake usage is appropriate
   d. Describe actuating methods for installed equipment

Aeronautical Knowledge and Systems

6. **Abnormal and Emergency Procedures**
   a. Explain dangers associated with failure to retract speed brakes
   b. Describe runaway trim training and trim interrupt methods

Instructor Recommendations

- CFI to understand differences between variants
- New CFIs dealing with hydraulic flaps need to make themselves familiar, by aircraft serial number, of the system.

Resources

- McVinnie Aviation: Malfunctioning Speed Brakes (Video)
- Pilot's Operating Handbook
  - Section 7
- Autopilot manual applicable to the pilot's airplane

Aeronautical Knowledge and Systems

M-CLASS K03 - Panel Instruments

Unit Objective: Understand, configure, and precisely use simple flight and panel instruments.

Summary: This unit covers basic aircraft instruments not part of a "glass cockpit." This includes pitot-static system, six-pack flight instruments, annunciators, and engine instruments not integrated with the avionics.

Training Topics

1. **Description and Limitations**
   a. Explain pitot-static sources, failures, systems associated, and troubleshooting
   b. Explain instrument power systems, gyroscopic principles, and the operating principles of each instrument

2. **"Six pack" Flight instruments**
   a. Explain and perform normal operating flight instruments including power on and test
   b. Explain limitations and common failures
   c. Perform effective scan

3. **Horizontal Situation Indicator (HSI)**
   a. Perform proper setup, use, and operation

4. **Pitot-static System**
   a. Identify the location and explain the function of the static source switch in the cockpit
   b. Identify the location of pitot static drains and the proper usage of them
   c. Identify the external location of pitot and static sources
   d. Explain how a failure or blockage would affect the instrumentation

5. **Cockpit Annunciation Systems**
   a. Explain available indications and their resolution

6. **Engine Indication System (EIS) or Graphic Engine Monitor (GEM)**
   a. Demonstrate proper setup, use, and operation
   b. . Explain the importance of proper calibration

7. **Fuel Computer (Totalizer)**
   a. Demonstrate proper setup, use, and operation

Aeronautical Knowledge and Systems

8. **Failure Modes and Corrective Actions:**
    - **Invalid Sensor Data**
    - **Invalid Heading**
    - **Crosscheck Monitor**
    - **Recoverable Attitude**
    - **Invalid Attitude and Heading**
    - **Complete/Partial Electrical Power Failure**
    - **Loss of Vacuum for Gyro Instruments**

    a. Explain identifying specific failures and their associated cues
    b. Perform the appropriate corrective action for each malfunction

Instructor Recommendations

- Familiarize the pilot with the Alternate static system and where the switch is located
- Legacy 310P and 350P airframes will have gyro driven instrumentation and gyro driven standby instruments (sometimes electrically driven).
- Note all M-Class airframes share a similar Pitot Static system.
    - Main static lines come from the empennage with multiple static ports on the side and belly.
    - Outflow and safety valves have their own static supply lines for differential pressure.
    - All later-model M-Class airframes are equipped with dual heated pitot tubes (one on each wing), and they supply information to the associated ADC.
    - Training should reference the pitot and static drain valves, when to use them, and potential issues using them can introduce.

Resources

- FAA: Pilot's Handbook of Aeronautical Knowledge (2024) - FAA-H-8083-25C (Publication)

Aeronautical Knowledge and Systems

M-CLASS K04 - Performance

Unit Objective: Understand and apply the factors and limitations that affect aircraft performance.

Summary: This unit covers takeoff and landing performance under various runway and environmental conditions. Cruise and leaning procedures (piston aircraft) are covered.

Training Topics

1. **Description and Limitations**
   a. Explain aircraft performance limitations

2. **Takeoff**
   a. Perform accurate use of the takeoff performance chart(s)

3. **Cruise and Leaning Procedures (if applicable)**
   a. Perform accurate use of the cruise performance chart
   b. Explain leaning procedures, including lean of peak vs. rich of peak, to control cylinder and engine temperatures

4. **Turbulence Penetration Speed**
   a. Explain risks associated with encountering turbulence
   b. Explain impact of load factors on penetration speeds
   c. Describe kinds of turbulence and potential impact

5. **Landing**
   - Power Adjusted for Target Airspeeds
     a. Perform accurate use of the landing performance chart(s)
     b. Explain the approximate power settings for target airspeeds
     c. Explain when aircraft will be stabilized on approach
     d. Perform crossing fence at Vref

Instructor Recommendations

- Note Lycoming and Continental manufacturer recommendations regarding leaning
- Discuss high-altitude airport operations, effects on speeds, impact on engine temperatures
- Review accidents stemming from encounters with turbulence

Resources

- Pilot's Operating Handbook
  - Sections 2 and 5
- PMOPA: PMOPA Operating Practices (Publication)

Aeronautical Knowledge and Systems

M-CLASS K05 - Powerplant and Propellers

Unit Objective: Develop a thorough understanding of the powerplant and propeller systems, operations, and procedures.

Summary: This unit covers turbo-charged piston and turbine engines, including starting, operation, shutdown, limitations, inspection, and maintenance. Abnormal and emergency procedures are covered, including turbine rollback and manual turbine operations.

Training Topics

1. **Powerplant Description and Limitations**
   Piston:
   a. Describe piston turbocharged engines, ignition system, and associated limitations

   Turbine:
   a. Describe PT6 turbine engine, fuel flow controller, and ice door (when present), their limitations, and use at low and high altitudes

2. **Propeller Description, Limitations, and Operation**
   a. Describe propeller and governor system, speed limitations, and operation in particular aircraft

3. **Starting Procedures**
   a. Explain pre- and post-start checks, cold- and hot-start procedures, and common issues

   Turbine:
   b. Explain high starting temperature limitations, consequences and avoidance

4. **Before Takeoff Checks**
   a. Describe before takeoff checks of engine and propeller

5. **Powerplant Controls**
   Piston:
   a. Explain use and response of throttle, propeller, mixture, and ignition controls during all phases of flight.
   b. Describe induction system to include the use of the alternate air door

   Turbine:
   c. Explain use and response of power and propeller (if present) controls during all phases of flight

Aeronautical Knowledge and Systems

6. **Shut Down Procedures**
   a. Describe engine and systems shut down procedures and checks

7. **Abnormal Procedures**
   a. Describe identification and mitigation of important abnormal situations (e.g., propeller overspeed, air start procedures, loss of oil pressure, rough running (piston), engine securing)

8. **Emergency Procedures**
   a. Describe identification and mitigation of significant emergency situations (e.g., engine failure (before and after lift-off), fire, engine roll back (turbine))

9. **Inspection, Service, and Maintenance**
   a. Describe ongoing inspection, service, and maintenance of powerplant and propeller

Instructor Recommendations

- Do not shutdown engine and demonstrate air start procedures in flight

Resources

- Piston:
  - Pilot's Operating Handbook
    - Section 7 Diagrams
  - Bold Method: How Does a Piston Engine Work? (Article)
  - Bold Method: How A Turbocharger Works (Article)
  - Bold Method: How Does An Aircraft Engine Start? (Article)
  - Bold Method: How A Constant Speed Propeller Works (Article)
  - Bold Method: How A Propeller Generates Thrust (Article)
- Turbine:
  - Bold Method: How A Turboprop Engine Works (Article)

Aeronautical Knowledge and Systems

M-CLASS K06 - Electrical

Unit Objective: Understand the electrical system components, how indications are presented, and how electrical abnormalities or emergencies are mitigated.

Summary: This unit covers electrical system components and connections, sources, indicators, and lighting, along with abnormal and emergency procedures, and using external power. Normal pre-flight inspection and general servicing are covered.

Training Topics

1. **Description and Limitations**
   a. Become familiar with the system description and limitations, as described in the POH

2. **Inspection, Service, and Maintenance**
   a. Familiarize himself/herself with any recent servicing and/or maintenance of electrical components, per the logbooks
   b. Demonstrate understanding of recommended time limits for overhaul pertaining to turbine generators and alternators

3. **Sources of Electrical Power**
   a. Learn the limitations of each source of electrical power and how to check the operation of each source prior to flight

4. **Battery Starts**
   a. Know minimum voltage limitations for starting
   b. Verify voltage prior to engaging the starter
   c. Turbines: know how to recognize slow acceleration starts and hot starts and how to appropriately respond to each scenario

5. **External Power Starts**
   a. Verify GPU power rating (voltage and amps) are adequate for the start process

6. **Indicators**
   a. Become familiar with the annunciators and indicator lights associated with each source of electrical power and what each indication means

7. **Lighting Systems**
   a. Know when it is appropriate, per regulation and recommendation, to use each lighting system installed on the aircraft

Aeronautical Knowledge and Systems

8. **Abnormal and Emergency Procedures**
    a. Know how to recognize an electrical emergency or abnormal situation and where to find the related checklists and procedures for such an emergency
    b. Understand how to "shed" non-essential items to reduce the electrical load, when required

Instructor Recommendations

- Ensure the pilot has a thorough understanding of the electrical sources, according to their specific variant, including knowing what source is primary/secondary and what the limitations of each are
- Create and talk about scenarios that simulate what will happen if one or both sources of electrical power are lost in various environmental conditions (e.g., nighttime, icing, IMC, VMC)
- Review the difference between "landing as soon as possible" and "landing as soon as practical" as it relates to different electrical emergencies (e.g., an uncontained electrical fire would be a "land as soon as possible" scenario and an alternator failure in VMC would be a "land as soon as practical" scenario)
- Do NOT pull circuit breakers in the aircraft to fail a generator or alternator for training purposes
- Do NOT continue to start a turbine aircraft after an abnormal start and shutdown, without first identifying and correcting the condition that caused the abnormal start

Resources

- Pilot's Operating Handbook
    - Section 7, Basic Electrical Diagrams
- Aircraft Maintenance Manual
    - Detailed Electrical Diagrams
- Covington Aircraft: What is a PT6 "Hot Start?? (Article)
- Casey Aviation: Avoiding A Hot Start (Article)
- Lakefront Aviation: The Meridian PT6A 42A Engine Start Procedure Explained (Video)
- AOPA: In-flight Emergencies (Article)
- AOPA: In flight Electrical Fires (Safety Brief)
- Bold Method: 5 Engine Start Malfunctions You'll Learn About Before Flying Jets (Article + video)

Aeronautical Knowledge and Systems

M-CLASS K07 - Airplane Fuel Systems

Unit Objective: Understand the fuel system of the M-Class aircraft to aid in aircraft familiarization and fuel management.

Summary: This unit covers the fuel system including tanks, pumps, distribution, indicators, and operations. Abnormal and emergency procedures are covered. Specific airframe related components are covered.

Training Topics

1. **Description and Limitations**
   a. Describe the fuel system diagram in the applicable POH
   b. Describe the limitations of the fuel system in section 2 of the POH
   c. Describe the required fuel system placards and their purposes

2. **Inspection, Service, and Maintenance**
   a. Confirm the correct fuel type for the aircraft
   b. Identify the correct grounding location for fueling operations
   c. Understand best practices for self-service fuel
   d. Understand best practices for full-service fuel
   e. Identify all fuel components that are visible during pre-flight

3. **Control System**
   a. Describe the fuel pumps and their role in the fuel system
   b. Demonstrate use of fuel selector and best practices for tank changes in piston and JetPROP aircraft
   c. Describe how the fuel system detects and alleviates imbalances in Meridian / M500 / M600 / M700 aircraft

4. **Airframe Related Components**
   a. Describe the location and function of the fuel vents
   b. Describe the operation of the aircraft's fuel caps
   c. Demonstrate the correct procedure for opening and closing the fuel caps
   d. Describe the POH cautions and warnings related to the airframe components
   e. If installed, describe the long-range fuel STC for piston aircraft / JetPROP

5. **Indicating System**
   - **Quantity Indication**
   - **Warning System**

   a. Describe the sending units of the fuel system
   b. Identify the location of the fuel gauges and proper way of verifying and updating the fuel quantity in the fuel computer, if applicable

c. Describe the system indications (CAS messages, warning lights, fuel gauge indications) for low fuel and fuel related emergencies

6. **Abnormal indications, Power Loss, Imbalance**
   a. Describe fuel related emergency and caution indications in the aircraft
   b. Use appropriate checklists and QRH information to identify and respond to abnormal an emergency scenario
   c. Describe the threshold for a fuel imbalance as described in the POH
   d. Describe the correct response to a fuel imbalance situation
   e. Describe aircraft systems that help alleviate fuel imbalances
   f. Describe the flight characteristics of a fuel imbalance (turbines)
   g. Describe flying the aircraft in a reduced power scenario and appropriate actions / checklists to try and restore power

Instructor Recommendations

- Teach the Fuel System Schematics and relate each component to the system and what it provides for normal and abnormal scenarios
- Teach the correct way to fuel and service the aircraft without damaging the boots or the aircraft finish
- Teach the correct way to alternate fuel tanks to actually get full fuel
- Show the appropriate place to ground the aircraft and how to describe it to FBO and service personnel
- Teach limitations and appropriate use of fuel system icing inhibitors (e.g., Prist)

Resources

- Pilot's Operating Handbook
  - Section 7
- Aircraft Maintenance Manual
- AOPA: Fuel Management Safety Spotlight (Article)

Aeronautical Knowledge and Systems

M-CLASS K08 - Landing Gear and Brake System (Hydraulics)

Unit Objective: Understanding the hydraulic system and how it operates the landing gear of the M-Class aircraft.

Summary: This unit covers the landing gear and braking system including hydraulics, indicators, and switches. Normal operations and limitations, along with abnormal and emergency procedures are covered.

Training Topics

1. **Description and Limitations**
   a. Describe the landing gear and hydraulic system
   b. Describe the brake system and potential failure points (right side only, left side only, both sides)
   c. Describe and locate all landing gear components
   d. Describe the limitations associated with the landing gear

2. **Inspection, Service, and Maintenance**
   a. Inspect all landing gear components to check for abnormal wear, leaking, fluid levels, and damage
   b. Describe how to check and service the landing gear fluid reservoir

3. **Indicating Systems**
   a. Describe the indication for gear up / down / and in transit
   b. Describe the gear unsafe indications and describe what can cause them

4. **Normal Operation**
   a. Describe what happens in the hydraulic system when gear is selected up and down
   b. Describe what holds the gear in the up and down position
   c. Demonstrate a gear extension and retraction without exceeding limitations

5. **Abnormal and Emergency Procedures**
   a. Describe the indication of a gear malfunction and what can cause them
   b. Describe what would happen in the event of a full hydraulic pressure loss
   c. Describe the indications of a leaking or low fluid hydraulic system
   d. Describe appropriate actions if you see hydraulic fluid during a pre-flight
   e. Describe and demonstrate an emergency gear extension
   f. Emphasize the speed restriction on the emergency gear extension and why we need to go slow
   g. Describe the issues with the day / night switch and how it relates to the gear indication

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Instructor Recommendations

- Cover how to prevent the cockpit occupants from accidentally introducing pressurized air into the master cylinder (a common failure point of an O ring in the assembly, typically displaced by checking brakes early or resting feet on brakes while the cabin is still pressurized)

Resources

- Pilot's Operating Handbook
    - Section 7

Aeronautical Knowledge and Systems

M-CLASS K09 - Environmental

Unit Objective: Understand the environmental and pressurization systems and their components.

Summary: This unit covers heating, cooling, ventilation, and pressurization systems. Normal operation of the pressurization system and its failure modes are covered along with abnormal and emergency procedures.

Training Topics

1. **Description and Limitations**
   a. Describe the environmental systems for the specific model of aircraft
   b. Describe limitations for the specific model of aircraft

2. **Inspection, Service, and Maintenance**
   a. Locate and describe outflow and safety valve (or both outflow valves on current models)
   b. Understand how to inspect the air conditioning compressor belt
   c. Locate and describe air conditioning charge ports
   d. Locate and describe recirculating blower motors
   e. Locate and describe the vent / defog fan

3. **Normal Operation of Heating, Ventilation, and Cooling**
   a. Describe air conditioning system and control
   b. Describe the difference of heating and cooling vents and sources of conditioned air
   c. MX00 variants: describe the mixing valve, its location, and how air is routed for cooling / heating
   d. MX00 variants: describe auto vs manual modes for mixing valve
   e. Piston models: describe cabin heat knob and function
   f. Explain the typical reason for poor cooling (blocked inlets/clogged evaporator)

4. **Normal Operation of Pressurization**
   - **Except for the Matrix:**
   a. Describe source and routing of pressurized air for the cabin
   b. Describe the proper manual altitude selection for the pressurization controller for takeoff, cruise, and landing
   c. Describe the cabin rate controller and the POH recommended setting
   d. Describe the automatic and manual selection of landing elevation in the G1000 / G3000 (if applicable)
   e. Describe the function and differences between the isobaric outflow valve and the safety valve
   f. Describe the vacuum source for the applicable airframe

Aeronautical Knowledge and Systems

5. **Abnormal and Emergency Procedures**
   - **Except for the Matrix:**

a. Describe common pressurization issues and the causes
b. Use section 3 of the POH and the applicable QRH to diagnose and correct pressurization issues
c. Describe and demonstrate an emergency descent
d. Describe the relation between the pressurization system and other emergencies (smoke in the cockpit, electrical fire, engine fire)
e. Describe CAS and alerts related to the pressurization system
f. Describe and locate the cabin altitude alert mute (if applicable)
g. Describe location of supplemental oxygen
h. Demonstrate use of the oxygen mask for MX00 models

Instructor Recommendations

- Develop scenarios that require higher level thinking and use of checklists to identify problems that may or may not have relation to the pressurization system. For example smoke in the cockpit, describe varying levels of smoke or contamination, odors, etc.
- Open the rear bulkhead and look at the outflow and safety valves. Most owners will never see them unless we show them.

Resources

- Pilot's Operating Handbook
  - Sections 2, 3, 7, and 9
- Casey Aviation: Environmental System – Malibu/Mirage (Video)
- Casey Aviation: Environmental System – Meridian (Video)
- Casey Aviation: Environmental System – JetPROP (Video)

Aeronautical Knowledge and Systems

M-CLASS K10 - Oxygen

Unit Objective: Understand hypoxia risks and the use of hypoxia mitigation tools and procedures available to pilots/passengers.

Summary: *This unit covers high altitude physiology along with oxygen system components and operation. Abnormal and emergency procedures are covered.*

Training Topics

1. **Normal Operation**
   a. Be able to describe how the oxygen system works for both the pilot and passengers, including limitations of the system
   b. Demonstrate how the oxygen system is armed and verify quick don masks are ready for use

2. **High Altitude Physiology**
   a. Have a clear understanding of and be able to describe the ways in which high altitude operations affect physiology
   b. Be able to describe the various impairments a lack of oxygen can have on the body
   c. Be able to talk about how to recognize an oxygen deficiency (outside of a rapid decompression scenario) and when it is appropriate to don an oxygen mask in-flight
   d. Talk about how individual fitness levels affect time of useful consciousness

3. **Abnormal and Emergency Procedures**
   a. Demonstrate the use of the oxygen system in a rapid decompression scenario
   b. Understand the various ways a slow pressurization leak may be identified and mitigated.
   c. Understand when oxygen should be used by the pilot and/or passengers

Instructor Recommendations

- Be sure to check the oxygen bottle pressure, oxygen mask connection points, and mask operation prior to flight. These systems regularly come out of maintenance events not connected and operable after inspections.
- Take the time to teach the pilot how to properly stow the oxygen masks in the MX00 series with the quick-donning masks. Proper stowage will allow the “doors” on the mask cabinet to close correctly and prevent breakage or warping, in addition to ensuring proper placement for quick-donning in an emergency.

Resources

- Casey Aviation: Depressurization in the Flight Levels in a PA46 (Article with video)
- FAA: Introduction to Aviation Physiology (Publication)

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- PMOPA: Hypoxia and High-Altitude Operations for General Aviation Pilots (Webinar)
- Skybrary: Hypoxia (Article)
- FAA: Beware of Hypoxia (Article)
- Skybrary: Aircraft Oxygen Systems (Article)
- FAA: Air Transport Category Slow Depressurization (Case Study)
- HouieLouy: Kalitta 66 hypoxic pilots (YouTube Audio)

Aeronautical Knowledge and Systems

M-CLASS K11 - Ice Protection

Unit Objective: Understand surface, propeller and other ice protection systems, their normal use, and operating practices.

Summary: This unit covers the ice protection system components and their operation, including surface boots, propeller, inlet, and windshield heating. Inspection, servicing, abnormal, and emergency procedures are covered.

Training Topics

1. **Description and Limitations**
   a. Understand icing equipment installed on the aircraft
   b. Understand which systems are required to be operational prior to flight
   c. Understand aircraft's icing limitations (forecast and actual)
   d. Understand autopilot limitations related to icing
   e. Know the minimum icing airspeed

2. **Inspection, Service, and Maintenance**
   a. Ensure proper operation of all installed anti- and de-icing equipment

3. **Normal Operation**
   a. Understand when icing equipment should be deployed

4. **Abnormal and Emergency Procedures**
   a. Understand potential risks and impact of inadvertent encounter with icing
   b. Recognize ice bridging on elevator and stabilizer

Instructor Recommendations

- Review the types of icing, predicting icing, and ways to avoid icing.

Resources

- PMOPA: "Icebergs in the Sky" article by Hank Gibson Jan/Feb 2024 (Magazine Article)
- FAA: Ways to Predict Icing in 57 Seconds (YouTube Video)

Aeronautical Knowledge and Systems

M-CLASS K12 - Weight and Balance

Unit Objective: Apply risk awareness pertaining to Weight and Balance limitations.

Summary: This unit covers calculation of weight and balance, along with limitations and performance implications.

Training Topics

1. **Description and Limitations**
   a. Describe the risks associated with exceeding forward and aft CG and weight limits

2. **Takeoff**
   a. Understand how to use aircraft performance charts for takeoff
   b. Compute distance requirements at low and maximum takeoff weights

3. **Landing**
   a. Understand how to use aircraft performance charts for landing
   b. Explain how landing weight affects approach speeds and landing distances
   c. Compute distance requirements at low and maximum landing weights

4. **Controllability, Center of Gravity, and Stall Speed**
   a. Explain the risks associated with high power/low speed flight operations in an aft CG condition
   b. Understand the risks associated with aircraft operations in an improperly loaded condition

5. **Legal Implications**
   a. Explain the determination of careless and reckless during post-accident investigations relating to operating outside the published weight and balance limitations
   b. Present the completed aircraft Weight and Balance calculation

Instructor Recommendations

- Prepare a weight and balance worksheet/app for the actual aircraft using actual weights/CG data. Review the process for making changes due to equipment installations/removals.

Resources

- Pilot's Operating Handbook
  - Section 6
- FAA: Weight and Balance Handbook - FAA-H-8083-1B (Publication)

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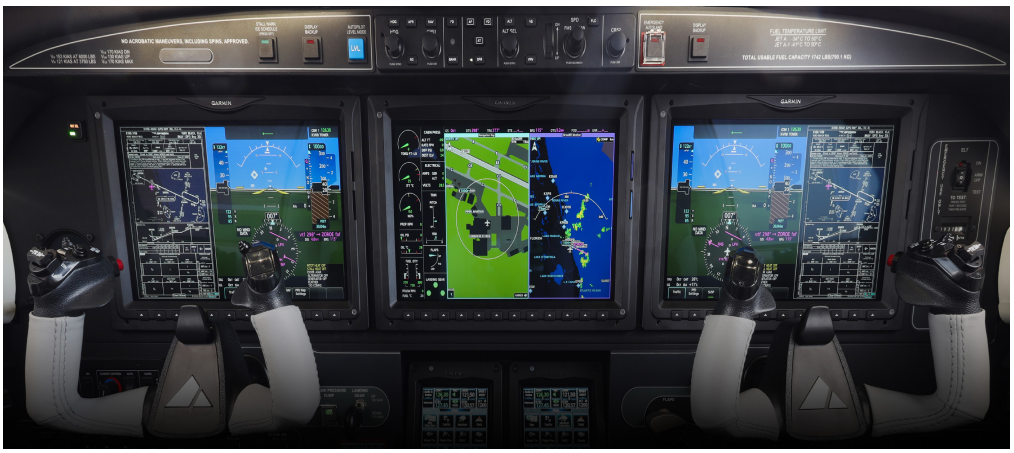
Avionics and Flight Instruments



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Avionics and Flight Instruments

M-CLASS A01 - Primary Glass Panel Instruments

Unit Objective: Understand, configure, and proficiently use glass panel flight and aircraft instruments.

Summary: This unit covers the primary flight instruments and other glass panel instruments necessary for VFR flight. This may include such items as engine monitor, engine indication system, fuel totalizer, and annunciators integrated with the avionics.

Training Topics

1. **Description and Limitations**
   a. Explain the interface between all the installed avionics systems in the aircraft
   b. Perform proficient operations of the avionics as an integrated system
   c. Explain configuration and setup of avionics
   d. Explain pitot-static sources, failures, systems associated, and troubleshooting
   e. Explain instrument power systems, gyroscopic principles, and the operating principles of each instrument

2. **Basic Operations**
   a. Explain and perform normal operating flight instruments including power on and test
   b. Explain limitations and common failures

3. **Primary Flight Display (PFD)**
   - **Configuration and Setup**
   - **Preflight Procedures**

   a. Explain common PFD modes and features
   b. Perform pre-flight procedures (verify altitude and heading readouts)
   c. Perform effective scan
   d. Explain how the AHRS system receives and displays flight information on the PFD and MFD
   e. Explain failure modes/CAS messages and the associated checklists/QRH/use
   f. Explain instrumentation affected by the AHRS system and what is lost if a failure occurs
   g. Explain the startup / initialization of the PFD and AHRS system.
   h. Explain switching between AHRS 1 and AHRS 2 on both PFD 1 and 2 if so equipped

4. **Backup Instruments**
   a. Explain and perform use of backup instrument(s) including initialization and testing
   b. Explain and perform reversion mode (Garmin integrated panels)
   c. Explain power source, limitations, and capabilities

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5. **Electronic Horizontal Situation Indicator (eHSI)**
   a. Perform proper setup, use, and operation

6. **Air-data Computer**
   a. Explain the ADC and the instrumentation affected by the ADC
   b. Explain switching between ADC 1 and 2 on both PFD 1 and PFD 2 (if equipped)
   c. Explain failures and associated CAS messages

7. **CAS and Annunciation System**
   a. Explain available indications and their resolution
   b. Explain possible CAS messages and their resolution

8. **Integrated Engine Indication System (EIS) or Graphic Engine Monitor (GEM)**
   a. Demonstrate proper setup, use, and operation

9. **Integrated Fuel Computer (Totalizer)**
   a. Demonstrate proper setup, use, and operation

10. **Failure Modes and Corrective Actions**
    - **Invalid Sensor Data**
    - **Invalid Heading**
    - **Crosscheck Monitor**
    - **Recoverable Attitude**
    - **Invalid Attitude and Heading**
    - **Complete/Partial Electrical Power Failure**

    a. Explain identifying specific failures and their associated cues
    b. Perform the appropriate corrective action for each malfunction

11. **Avionics and Instrument Maintenance**
    a. Explain backup batteries and their maintenance

Instructor Recommendations

- CFI's should be knowledgeable in the avionics they are teaching in. When demonstrating buttons to be pushed, make sure that tasks are performed in the correct order.
- For new pilots, use Ground Power to practice on the avionics and give the pilot scenarios
- Ground and flight training is needed when upgrading from steam gauges to glass, from a KFC to a Garmin Autopilot, or 530W to GTN, they need to get training
- Use long (1 hour or so) enroute time for allowing the pilot to get familiar with button pushing
- Emphasize the need to go slow when finding the button or knob to push, then verify that the GPS or autopilot is doing what the pilot expected it to do
- Emphasize the autopilot "scoreboard" on most PFDs to verify correct mode and parameters
- Give the pilot cues to do certain things
  - Garmin Autopilots: When cleared for the approach, engage the APR mode
  - KFC 150 and STEC 55x and STEC 1500 Autopilots: Remain on GPSS until on the FAC before engaging APR mode

    - KFC 225 Autopilots: Wait till the GPS indicates Approach mode, then Engage the APR Output under the GPS MSG page, then engage the autopilot APR mode
- Show pilots what happens with an ADC or AHRS failure, but best to only use a PFD failure for partial panel practice.
- Pre-NXi G1000 avionics: do not give Glidepaths on LP approaches. Teach the pilot to recognize what type of minimums are on the plate (LNAV, LP, or LPV) and know that LNAV and LPV produce a GP, but LP does not. In G1000 NXi aircraft, LP approaches do have advisory glide paths.
- Teach what an advisory glidepath is but emphasize the fact that it is still a non-precision approach to an MDA and the glidepath can't be blindly followed down below the MDA.
- Familiarize the pilot with the Alternate static system and where the switch is located
- IFR ACS Task B Aircraft Flight Systems states standards for knowledge of systems
- Review use of Backup systems
- Current M-class models use Garmin GI275 as backup (standby) system. It has its own databases, internal battery, and AHRS sensors
- Previous glass panels used Aspen 1000 digital displays, STC digital systems, and analog gyro-driven instruments for backup (standby).
- Do NOT simulate any avionics failures in actual IMC, only simulated IMC. The CFI needs to have an outside visual reference while performing partial panel operations.
- Do NOT pull/trip circuit breakers to simulate failures (e.g., partial panel)
- Do NOT teach in Autothrottle equipped airplanes unless given previous training

Resources

- Aviators Academy: Garmin G1000 Proficiency Course
- Sporty's: Garmin Courses
- Garmin: Training Courses
- King Schools: Garmin Courses
- Malibu Aerospace: Radar Reference Guide

Avionics and Flight Instruments

M-CLASS A02 – Communication, Navigation, Surveillance Systems

Unit Objective: Understand, configure, and proficiently use radios, navigators, and surveillance systems in VFR and IFR flight.

Summary: This unit covers configuration, setup, programming, and normal operation of the VHF radios, VHF and GPS navigators, transponders, and ADS-B systems, intercom, and audio panel. Databases, pre-flight checks, and basic navigation are covered.

Training Topics

1. **Description and Limitations**
   a. Explain power source for radios and navigators
   b. Explain ground clearance/emergency bus (as appropriate)
   c. Explain configuration and setup options

2. **Preflight Procedures**
   a. Explain power-on sequence, displays, and tests
   b. Explain pre-flight set-up

3. **VHF Communications**
   a. Explain and perform entering frequencies directly or from a database into active or standby locations
   b. Explain the use of second frequency monitor mode if so equipped
   c. Explain the use of squelch

4. **GPS Operation and Programming**
   a. Explain and perform entering or selecting GPS waypoints
   b. Explain and perform navigation direct to GPS waypoint
   c. Explain and perform entering vertical navigation at a GPS waypoint (if available)
   d. Explain and perform loading and activating a GPS approach
   e. Explain loading holds, departures, arrivals (if available)
   f. Explain method for keeping navigator databases current

5. **NAV Operation and Programming**
   a. Explain and perform entering frequencies directly, or from a database into active or standby locations
   b. Explain and perform setting/skewing VOR radials
   c. Explain the various types of VOR checks to include documentation
   d. Explain and perform selecting a VOR or LOC/ILS approach on activation
   e. Explain identifying NAV station

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6. **Transponder and ADS-B**
   a. Explain available transponder modes and how to select
   b. Explain and perform how to identify to ATC
   c. Explain setting and changing ADS-B identifier (if available)

7. **Audio Panel**
   a. Explain and perform audio panel modes and their selection
   b. Explain how to configure intercom and set volumes
   c. Explain how to set and mute radio volume
   d. Explain how to access alternate sources of audio, such as, music

Instructor Recommendations

- Teach the pilot how to load airways, load holds, load arrivals and departures, load approaches, the difference between loading and activating an approach (emphasizing that Activate Approach just gives a course Direct To the IAF), and how to utilize the Flight Stream and GTX 345 Bluetooth capabilities
- Emphasize on GTN and GNS units that when flying an ILS, LOC, or VOR approach, the frequency only get's loaded to the standby NAV radio and the pilot must switch it to the active frequency in NAV 1
- For Garmin GTN and Avidyne IFD units, download the apps on the iPad to practice on
- Utilize the VNV, VCALC, or other descent planning tools on the airplane GPS
- Do NOT program GPS while taxiing
- Do NOT shut off electrical system in-flight (AHRS and avionics may not reinitialize)
- Do NOT utilize "Activate Approach" once on the Final Approach Course (FAC). Activate Approach gives a Direct To course to the IAF and the airplane will turn off of the FAC direct to the IAF, thus abandoning the approach and possibly getting too close to terrain or other obstacles

Resources

- Aviators Academy: Garmin G1000 Proficiency Course
- Sporty's: Garmin Courses
- Garmin: Training Courses
- King Schools: Garmin Courses
- Malibu Aerospace: Radar Reference Guide

Avionics and Flight Instruments

M-CLASS A03 - Flight Management and Flight Control Systems

Unit Objective: Understand the Flight Management System (FMS), Flight Control System (FCS), and advanced system capabilities.

Summary: This unit covers configuration, programming, testing, and normal, abnormal, and emergency operation of the flight management and flight control systems. Autopilot modes are covered as are standard flight plan and autopilot scenarios. Optional features such as stability protection, smart glide, Autoland, and autothrottle are covered.

Training Topics

1. **Description and Limitations**
   a. Describe what avionics systems are installed, their function and operational limitations

2. **Inspection, Service, and Maintenance**
   a. Understand what inspections are required and what service and maintenance criteria exist (e.g., pitot-static/transponder/altimeter checks)

3. **Preflight Procedures**
   a. Learn what preflight tests and setup procedures are needed for proper function and operation

4. **Normal Operation**
   a. Demonstrate proficient operation of the FMS or avionics installed

5. **FMS Programming**
   - **Routes**
   - **Procedures**
   - **Sequencing**
   - **Direct to**
   - **Missed Approach**
   - **Go Around**

   a. Demonstrate proficient operation of routine programming of FMS and avionics.
   b. Demonstrate basic features and abilities of FMS and avionics.

6. **Autopilot Modes and Operation**
   - **Flight Director Mode (Pitch/Roll)**
   - **Horizontal Modes**
   - **Vertical Modes**
   - **Approach Modes**
   - **Control Wheel Steering**

- **Flight Director**

If Installed:

- **Electronic Stability Protection (ESP)**
- **SmartGlide**
- **Autoland**
- **Autothrottle**

a. Demonstrate proficient operation of routine autopilot operation
b. Demonstrate proficient operation of advanced features (e.g., LVL mode, VNAV, CWS, back course)
c. Know how to couple systems for autopilot Approaches and GPSS and limitations of these systems
d. Demonstrate proficiency in identifying failures and taking swift and correct actions to mitigate consequences of failures, including trim runaways and failures
e. Demonstrate proficiency with advanced safety features such as ESP, SmartGlide, Autoland, and/or Autothrottle

7. **Abnormal and Emergency Procedures**
   a. Know how to operate the FMS and avionics in all failure modes, including failures within the systems themselves, the airframe, or other aircraft systems, and emergency disconnect options

Instructor Recommendations

- Understand what GPSS does on King autopilots and how to properly use GPSS
- Have the pilot hand-fly using the Flight Director
- Ensure the pilot:
  - knows how to use the Level button
  - understands when to engage the APR mode
  - references the autopilot scoreboard to verify the proper mode after the pilot has pushed a button on the autopilot
  - knows how to use the G500 and G500TXi to put it in VS and ALT capture capability with the GAD43e (electric interface)
- G3000 Autothrottle use on M600 and M700; AT must be in Manual mode for approaches
- Have the pilot demonstrate SmartGlide (if installed)
- Do NOT allow overuse the autopilot (e.g., never hand fly)
- Do NOT overpower the envelope protection
- Do NOT use the KFC150 below 100 kias (while not a published limitation, there are known challenges with KFC's capability)
- Do NOT allow the pilot to hand-fly while the autopilot is turned on (don't overpower/override the autopilot)

Resources

- PMOPA Quick Reference Handbooks (Handbooks)
- Foreflight: Foreflight Training
- Garmin: Garmin Pilot Training (YouTube videos)

Avionics and Flight Instruments

M-CLASS A04 - Datalink Situation Awareness and Weather Summary

Unit Objective: Demonstrate knowledge and use of in-cockpit datalink systems, services, and multi-function avionics.

Summary: This unit covers configuration, setup, and operation of the multifunction displays along with specific use of traffic, terrain, weather, and radar components, and integration and use of personal electronic devices such as iPads.

Training Topics

1. **Description and Limitations**
   a. Describe installed systems, their function and operational limitations

2. **Multi-Function Display**
   - **Normal Operation**
   - **Setup**
   - **Pages**
   - **Navigation Modes**
   - **Traffic Mode**
   - **Weather Modes**
   - **Checklist Modes**

   a. Demonstrate proper use of the avionics interface during normal operations including setup, navigation, traffic, weather, and checklist

3. **Data Link Weather / Data Link Setup and Operation**
   a. Demonstrate the proper setup of the information and related displays
   b. Demonstrate the proper decision-making skills based on the information presented

4. **Terrain Display and Avoidance Systems Setup and Operation**
   a. Demonstrate the proper setup of the information and related displays.
   b. Demonstrate the proper decision-making skills based on the information presented

5. **Radar Systems Setup and Operation**
   a. Demonstrate the proper setup of the information and related displays.
   b. Demonstrate the proper decision-making skills based on the information presented

6. **Personal Electronic Device Apps and Connectivity**
   a. Demonstrate proper setup, use, interface with installed avionics, and operation
   b. Demonstrate transfer of flight plan information (if available)

Avionics and Flight Instruments

Instructor Recommendations

- Utilize the radar to avoid weather, not penetrate a hole
- Utilize NEXRAD as a weather reference, not to actively penetrate
- Do NOT rely upon weather sources in real-time

Resources

- Malibu Aerospace: Radar Reference Guide
- Bold Method: The Difference Between ASOS And ADS-B Weather (article)

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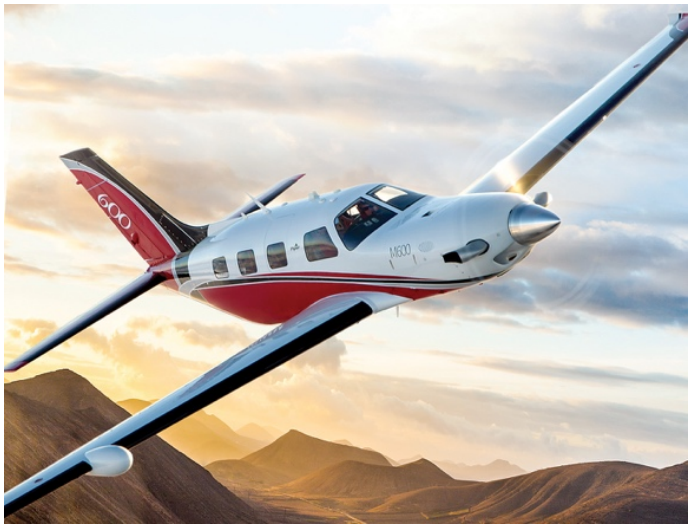
Flight Procedures



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Flight Procedures

M-CLASS F01 - Flight Planning

Unit Objective: Exhibit satisfactory knowledge, risk management, and skills associated with preparation for a safe flight.

Summary: This unit covers basic flight planning, preparation, and briefing activities, including key risk management and decision making prior to each flight.

Training Topics

1. **Flight Training Scenario Planning**
   a. Review the required elements of the appropriate flight training scenario
   b. Decide on the optimum route and sequence of events to accomplish all required tasks
   c. Obtain all required charts and documents
   d. Obtain and analyze an FAA- approved weather briefing appropriate to the scenario to be flown
   e. File a flight plan (VFR/IFR) for the scenario to be flown

2. **Weight and Balance and Aircraft Performance Computation**
   a. Perform accurate weight and balance and performance computations for the specific training scenario

3. **Preflight SRM Briefing**
   a. Orally review in specific terms all aspects of the flight scenario
   b. Identify possible emergency and abnormal procedures relevant to the scenario and describe successful SRM strategies to deal with them
   c. Evaluate risk (e.g., FRAT, PAVE)

4. **Decision Making and Risk Management**
   a. Make sound decisions based on a logical analysis of factual information, aircraft capability, and pilot experience and skill
   b. Continuously critique the success of the flight scenario
   c. Adjust the training scenario to maintain flight safety at all times

Instructor Recommendations

- Provide a real-life scenario for a flight to be conducted in an M-Class aircraft. Have the pilot complete a weight and balance calculation for the specific flight. CFI and pilot discuss how weight and balance affects aircraft performance.

Resources

- Piper ProFlight: Weight and Balance (App)
- PMOPA: FRAT for SRM (App)

Flight Procedures

M-CLASS F02 - Normal Preflight and Cockpit Procedures

Unit Objective: Demonstrate proper pre-flight and effective use of checklists, cockpit procedures, PFD/GPS/MFD, and autopilot operation.

Summary: This unit covers normal preflight and pre-takeoff inspections, setups, and cockpit procedures including checklists.

Training Topics

1. **Normal Pre-takeoff Checklist Procedures**
   a. Perform normal exterior inspection by reference to the written checklist
   b. Perform normal interior preflight inspection, engine start, taxi, before takeoff checklists
   c. Perform all checklists in the proper sequence

2. **PFD/MFD/GPS Autopilot Programming**
   a. Perform PFD/AHRS initialization
   b. Perform autopilot pre-flight checks
   c. Program GPS and MFD (as applicable) for the specific training scenario to be flown

Instructor Recommendations

- Checklist interrupted? Ensure the pilot starts again from the top
- Identify opportunity to create Memory items
- Runaway Trim
  - Press Red button
  - Pull Circuit Breaker
- Demonstrate donning O2 Mask
- Discuss Power Loss on Takeoff

Resources

- PMOPA Quick Reference Handbooks (Handbooks)

Flight Procedures

M-CLASS F03 - Engine Start and Taxi Procedures

Unit Objective: Exhibit satisfactory knowledge, risk management, and skills associated with engine start and taxi operations including runway incursion avoidance.

Summary: This unit covers engine starting (piston or turbine) and taxi procedures including ground situation awareness and attention to wrong surface incursions.

Training Topics

1. **Engine Start**
   a. Demonstrate the correct procedures for engine start under all conditions
   b. Demonstrate the correct emergency procedures associated with engine start
   c. Successfully start the engine

2. **Taxi**
   a. Understand the proper technique to control the aircraft on the ground
   b. Successfully taxi the aircraft, avoiding distrations

3. **SRM/Situational Awareness (SA)**
   a. Understand the capability of the MFD/GPS to aid in low visibility/congested airport taxi situations
   b. Demonstrate the proper visual clearing techniques during all taxi operations

Instructor Recommendations

- What not to do:
  - Hot starts – know the difference between the use of the term when referring to pistons vs turbines and pilots transitioning between the two
  - Inappropriate use of reverse (turbines) – do monitor torque limitations
  - Taking off with MOR Lever
  - No heads-down work while the aircraft is under movement on the ground (e.g., use of phones or other devices, programming of GPS, running checklists)
- What to do:
  - Understand the relationship between rudder input, braking, power settings, and use of beta (if turbine) when taxiing
  - If so equipped, verify proper position of alternate air source or ice doors for the field conditions while taxiing
  - Properly brief the taxi prior to movement – i.e., note the route, identify “hot spots” and potential conflicts, note any “hold short” areas and acknowledge runway crossings, whether at a towered or uncontrolled field

    - Stay situationally aware of other traffic moving on the ground, parked aircraft, movement areas, etc.
- Starting Procedures Notes
    - Piston Variants
        - The amount of prime required depends on engine temperature. Familiarity and practice will enable the operator to estimate accurately the amount of prime to use. If the engine is hot, use prime pump only long enough to purge fuel system of accumulative vapor.
        - The STARTER ENGAGED annunciator will illuminate during engine cranking. If the annunciator remains lit after the engine is running, stop the engine and determine the cause.
        - Care should be exercised because if the ship's battery has been depleted, the external power supply can be reduced to the level of the ship's battery. This can be tested by turning the battery switch ON momentarily while the starter is engaged. If cranking speed increases, the ship's battery is at a higher level than the external power supply.
    - Additional Notes for PA-46-350P
        - Do not attempt flight if there is no indication of alternator output.
        - For all normal operations using an external power source, the battery master switch should be OFF, but it is possible to use the ship's battery in parallel by turning the battery master switch ON. This will give longer cranking capabilities, but will not increase amperage
        - If a positive oil pressure is not indicated within 30 seconds following an engine start, stop the engine and determine the trouble. In cold weather it will take a few seconds longer to get a positive oil pressure indication.
    - Turbine Variants
        - Do not attempt flight if all four-door pin indicators are not green and/or the DOOR AJAR annunciator is active
        - Do not exceed starter time limits (30 seconds ON, 1 minute OFF, 30 seconds ON, 1 minute OFF, 30 seconds ON, 30 minutes OFF
        - If one battery is dead (<15v), select only the good battery for start. Do not select BOTH nor engage DUAL BATT (depending on configuration)
        - Activate the transfer pump in the manual mode and listen for pump activation with the Fuel Selector Lever in both left and right positions
        - Perform engine starts with the Ignition Switch only in the "ON" position. Do not perform normal starts in the "AUTO" position (if so equipped)
        - Flight should not be conducted unless both fuel boost pumps are operational. One must be on the entire flight. Dual Battery Momentary Switch (If equipped)-PRESS and HOLD
        - To allow the PFD to maintain maximum brightness during engine starting with high levels of ambient light present, run the AVIONICS dimmer to its minimum setting (photocell mode)
        - JetPROP: Voltage after starter engage should be > 17 v. Hot start could occur if voltage drops below 17 v. ABORT start if below 14 v
        - Meridian: Observe the engine start ITT limitation, Ng minimum speed of 13% and ensure combustion occurs within 10 seconds after moving the

condition lever to run. Failure to observe these limitations can result in damage to the engine.

Resources

- Skybrary: Taxiing (Article)
- FAA: Anatomy of a Wrong Surface Event Part 1: Pilot (YouTube Video)
- FAA: Anatomy of a Wrong Surface Event Part 2: Environment (YouTube Video)
- FAA: Anatomy of a Wrong Surface Event Part 3: Training (YouTube Video)

Flight Procedures

M-CLASS F04 - Before Takeoff Checks & Briefings

Unit Objective: Demonstrate the proper pre-takeoff checks, checklist, and briefing procedures.

Summary: This unit covers aircraft and avionics settings, final checks, crew and passenger briefings, and decisions before taking the runway for takeoff.

Training Topics

1. **Normal and Abnormal Indications**
   a. Complete all pre-takeoff checklist items in the proper sequence
   b. Identify normal and abnormal systems indications/annunciations using the aircraft annunciation panel or PFD/MFD as equipped

2. **Aircraft Automation Management**
   a. Correctly configure and program the PFD /MFD /HIS /GPS/ Autopilot for the departure

3. **Decision Management and Risk Management**
   a. Make a correct go / no-go decision based on the status of the aircraft, pilot, and environmental factors
   b. Brief expected takeoff and climb performance
   c. Brief Abort/Rejected Takeoff Actions

4. **Pilot Briefing**
   - **Self-briefing (SRM)**
   - **or CRM:**
     - **With CFI**
     - **With another pilot**

   a. Assign responsibility for Communications and Navigation Programming Clarify who will respond to respond to ATC inquiries/instructions

5. **Passenger Briefing**
   a. Brief emergency exit, egress, emergency descent, sterile cockpit practices, Personal Electronic Device use, environmental considerations

Instructor Recommendations

- What not to do:
  - Interrupt checklists, without starting again from the top of the checklist
  - Unnecessarily extend duration of engine run-up which can cause damage to boots, etc. (check mags and Manifold Pressure at 2,000 RPM); other items can be checked at lower power setting
  - Use FLOWs without backing them up with the checklist

Flight Procedures

Resources

- Departure Briefing
  - Bold Method: 7 Tips For A Perfect Departure Briefing (Article)
  - AirBoyd: Pre-Departure Briefing (Video)
  - Martin Pauly: Departure Briefing-How and Why (Video)
  - Avion: 4 Tips for an Effective Departure Briefing (Article)
- Passenger Briefings
  - AOPA Air Safety Institute: Critical Information - The Passenger Safety Briefing (Video)
  - Brodie Brazil Aviation: The ultimate airplane passenger briefing (Video)

Flight Procedures

M-CLASS F05 - Takeoffs

Unit Objective: Demonstrate the proper pre-takeoff, takeoff and initial climb procedures.

Summary: This unit covers normal and high-performance takeoffs under various environmental and runway conditions including attendant risk management and decision making. Abnormal and emergency procedures are included.

Training Topics

1. **Takeoff Conditions and Configurations**
   a. Demonstrate understanding of dynamic factors that may change takeoff assumptions

2. **Normal Takeoff**
   a. Ensure engine is developing full power
   b. Perform a normal takeoff
   c. Utilize call outs to enhance situational awareness

3. **Crosswind Takeoff**
   a. Perform a crosswind takeoff

4. **Aborted Takeoff**
   a. Perform an aborted takeoff
   b. Describe abnormal conditions and applicable procedures to rectify:
      i. Engine Power Loss After Takeoff
      ii. Loss of Oil Pressure
      iii. Loss of Fuel Flow
      iv. High/Low Oil Temperature
      v. Propeller Overspeed
      vi. Engine Roughness
      vii. Flap system malfunction (fails to retract after takeoff)
      viii. Air restart (if altitude allows)

5. **Maximum Performance Takeoff**
   a. Perform a Maximum Performance Takeoff

6. **Unpaved Field**
   a. Understand prohibitions or limitations for unpaved and/or soft field operations

Flight Procedures

7. **Initial Climb**
   a. Demonstrate the use of Vr, Vx, Vy, and Cruise Climb
   b. Clean up flaps and gear
   c. Perform IMC initial climb for IFR rated pilots

8. **Situational Awareness**
   a. Maintain SA with aircraft, performance, obstacles, traffic, weather and ATC
   b. Identify traffic, systems failures, and other developing situations that might prompt the performance of an aborted takeoff
   c. Verbalize and prioritize those situations present during any given takeoff

9. **Task Management**
   a. Establish sterile cockpit
   b. Properly prioritize tasks
   c. Accurately complete checklists

10. **Decision Making**
    a. Decide to continue or abort any given takeoff based on the actual situation or a simulated scenario created by the instructor
    b. Understand impact of runway condition reports

11. **Resource Management**
    a. Effectively employ all resources available for proper decision making before, during and after takeoff

12. **Threat and Error Management**
    a. Identify and discuss possible threats and errors and ways to mitigate these before they progress to an unsafe situation

Instructor Recommendations

- To the maximum extent possible, pilots in training should handle their own communications
- Emphasize Runway Incursion prevention
- Takeoff, initial climb, and abort should be “first look” maneuvers for pilots in recurrent training thus not require prompting by the instructor
- Instrument rated pilots should accomplish both VMC and IMC takeoff and initial climb
- Set the example: takeoff and initial climb are critical phases of flight; do not violate sterile cockpit by discussing topics not related to the tasks being accomplished
- Do NOT do all of the COMM work as the CFI
- Do NOT violate sterile cockpit, discussing topics not related to the flight

Flight Procedures

Resources

- FAA: Private Pilot for Airplane Category Airman Certification Standards (FAA-S-ACS-6C) (Publication)
    - Area of Operation IV. Takeoffs, Landings, and Go-Arounds
- Pilot's Operating Handbook
    - Sections 2 and 4
- FAA: Airplane Flying Handbook - FAA-H-8083-3C (Publication)
    - Chapters 2, 5 and 6
- FAA: Pilot's Handbook of Aeronautical Knowledge - FAA-H-8083-25C (Publication)
    - Chapter 11

Flight Procedures

M-CLASS F06 - Climb Procedures

Unit Objective: Demonstrate the proper climb procedures.

Summary: This unit covers normal manual and autopilot climb procedures and techniques including power control and risk management. Abnormal and emergency procedures are included.

Training Topics

1. **Manual Climb**
   a. Perform a hand-flown climb and level off within the ACS parameters
   b. Maintain the appropriate airspeeds for each segment of the climb, within the ACS parameters

2. **Autopilot Climb**
   a. Understand limitations of auto-pilot usage
   b. Perform an autopilot-flown climb and level off within the ACS parameters
   c. Maintain the appropriate airspeeds for each segment of the climb, within the ACS parameters
   d. Exhibit understanding of autopilot vertical modes (e.g., TOGA, IAS, VS, Pitch)

3. **Navigation Programming**
   a. Program the GPS/MFD to comply with the flight-planned
   b. course and all ATC clearances

4. **Power Management**
   a. Set appropriate power/engine leaning settings by reference to the engine instruments

5. **Abnormal and Emergency Procedures**
   a. Describe abnormal conditions and applicable procedures to rectify:
      i. Flap system malfunction
      ii. Failure of the gear to retract
      iii. Failure of aircraft to pressurize
      iv. Runaway trim
      v. High cylinder head temps
      vi. TIT indicator failure

6. **Situational Awareness, Task Management, and Decision Making**
   a. Identify traffic, hazardous terrain, and potentially hazardous situations as they occur by reference to visual clearing and the MFD (if available and optioned)
   b. Perform all required in- cockpit tasks in such a manner that visual clearing is not negatively impacted

c. Make timely decisions based on information obtained visually, by radio, or by aircraft automation equipment/systems

Instructor Recommendations

- Ensure the pilot performs maneuvers using proper power settings, airspeeds and configuration to achieve best angle, best rate and recommended cruise climb.
- Recognize climb profiles go beyond "Vx" and "Vy"
- Demonstrate autopilot coupled climb modes for the installed equipment and understand when to engage and use each of them
- Transition in a timely & appropriate manner through the aircraft configurations and climb profiles.
- Be aware of climb profiles in relation to density altitude, weight, available power, and engine limitations. The CFI should discuss the possibility or practicality of "step climbs" across a route.
- Take the time to set up, tweak, and utilize performance profiles for climb and fuel burn in preferred flight planning apps, such as Foreflight or Garmin Pilot.
- Do NOT climb less than best rate of climb (relative to air temperature)

Resources

- Applicable avionics manual(s)
- Engineering Pilot: How to Climb - and Why (Article)
- Foreflight: Set Up Aircraft Performance Profiles for Existing Aircraft (Video)
- Foreflight: Bias Climb and Descent Performance Profiles (Video)

Flight Procedures

M-CLASS F07 - Cruise Procedures

Unit Objective: Demonstrate the proper cruise procedures.

Summary: This unit covers cruise engine management (piston engine leaning; turbine temperatures; fuel temperature), power settings, use of the autopilot and navigators, and risk management.

Training Topics

1. **Lean Assist Multi-Function Display (MFD) (Piston Only)**
   a. Lean the engine by reference to the installed engine management system
   b. Demonstrate Lean Assist, if available

2. **Best Power vs. Best Economy**
   a. Lean the engine using the Lean Assist procedures and the MFD (piston only)

3. **Manual Cruise**
   a. Perform hand flown manual cruise within the ACS parameters
   b. Maintains altitude, within the ACS parameters

4. **Autopilot Cruise**
   a. Perform an autopilot assisted cruise within the ACS standards (for manual cruise)
   b. Maintains altitude within the ACS parameters.
   c. Demonstrate the aircraft reaction to course changes programmed into the GPS/MFD

5. **Navigation Programming**
   a. Program flight plan changes into the Flight Management System (FMS)

6. **Automated Navigation Leg**
   a. In VMC conditions, conduct a navigation leg of 30 minutes or more to a different airfield by use of the autopilot beginning at 1,000 ft AGL on departure and terminating autopilot use just prior to entry to the VFR pattern
   b. Conduct an IFR navigation leg of 30 minutes or more to a different airfield using the autopilot beginning at 1,000’ on departure and terminating autopilot use at the decision altitude, minimum descent altitude, or missed approach point as applicable. If a missed approach is flown, it will be flown by use of the autopilot
   c. Conduct a coupled missed approach if the aircraft is equipped and authorized to do so

Flight Procedures

7. **Task Management, Situational Awareness, and Decision-making**
   a. Maintain situational awareness to include traffic, terrain, special use airspace, and potentially hazardous weather situations (including turbulence)
   b. Perform in- cockpit tasks in such a manner that visual clearing is not impacted negatively
   c. Make timely decisions based on information obtained, visually, by radio, or by aircraft automation equipment

Instructor Recommendations

- Become familiar with recommended power settings and airspeeds

Resources

- Aircraft Engine Manual
- Engine manufacturer's recommendations (Lycoming vs. Continental)
- Autopilot Manual
- GARMIN courses
- Other Autopilot courses

Flight Procedures

M-CLASS F08 - Instrument/Visual Cross Check

Unit Objective: Demonstrate the proper use of flight controls in visual and instrument/simulated instrument conditions to perform basic flight maneuvers within ACS tolerances.

Summary: This unit covers manual control of flight including standard and steep turns, and while level, climbing, and descending.

Training Topics

1. **Straight and Level**
   a. Perform the maneuver using outside visual references
   b. Perform the maneuver by sole reference to the primary flight instruments

2. **Normal (Standard Rate) Turns**
   a. Perform the maneuver using outside visual references
   b. Perform the maneuver by sole reference to the primary flight instruments

3. **Climbing and Descending Turns**
   a. Perform the maneuver using outside visual references
   b. Perform the maneuver by sole reference to the primary flight instruments

4. **Steep Turns (45 degree)**

Perform the maneuver using outside visual references

5. **Slow Flight**
   a. Perform the maneuver using outside visual references
   b. Perform the maneuver by sole reference to the primary flight instruments

6. **Unusual Attitude Recovery**
   a. Perform the maneuver using outside visual references
   b. Perform the maneuver by sole reference to the primary flight instruments
   c. Perform the maneuver by sole reference to the standby flight instruments

Instructor Recommendations

- With a new M-Class pilot, the pilot will want to utilize the autopilot as much as possible, but start the pilot off hand flying initially to practice getting a feel for the airplane and controls, practicing the IFR scan and visual cross check outside, and getting a feel for the trim. This also helps with the outside sight picture to see what the climb and descent attitudes and level looks like outside.
- Practice Straight and Level using different power settings to see what pitch attitudes are needed at lower power settings to maintain altitude

Flight Procedures

- Introduce the Flight Path Marker on Glass Panel equipped airplanes to assist with setting pitch attitude to maintain altitude
- Utilize the autopilot to introduce a pilot who is new to a glass panel the instrument scan, plus it gives them practice pushing buttons
- Initiate Steep Turns between below Va/Vo, utilize the flight path marker and CFI should demonstrate steep turns first so pilot sees what they are supposed to look like. This leads to better success for the pilot. Emphasize the need to roll into a level turn until passing 30 degrees of bank, then add back pressure to 3-5 degrees pitch up and add 2-3" MP or 100-200 TQ, then trim to help hold the pitch attitude and utilize Flight Path Marker while scanning altitude, bank angle, and vertical speed. Use outside reference to the visual horizon if not obscured. ACS standards of +/- 100 feet on altitude
- Stall Recoveries: For primacy, teach pilot to recover at the first sign of stall since that is when they need to be recovering if they get into a stall in real life. Landing stall recoveries work very nicely at the end of slow flight as outlined above. Teach pilots to recover at the first sign of stall (horn or buffet since the horn doesn't work all the time in the older PA46s) and simulate how close the plane is to the ground on a landing stall. Give the pilot an altitude that they must be recovered by or they will "hit the ground" (typically 100 feet below the stall entry altitude) to make the maneuver realistic. Takeoff stalls and climbing stalls typically should be done at 65% power, takeoff stall with gear down and flaps in the takeoff position and climbing stall in a clean configuration. In all PA46 aircraft, at 65% power, the pitch attitude needs to be about 15 degrees up in order for the angle of attack to get close to the critical angle of attack. Utilize AOA if so equipped and teach the pilot .85 AOA is where the stall warning horn sounds. If recovery is not initiated promptly at the stall horn or buffet, emphasize the likely wing drop at the stall break and the need to utilize opposite rudder while pitching down. Accelerated stalls may be performed in a clean configuration, not more than 30 degrees of bank, and 65% power or less. If stall warning horn does not sound, watch vertical speed and recover at a negative vertical speed or when the buffet is felt
- Do NOT perform low altitude stall and unusual attitude recoveries (below 3,000' AGL)
- Do NOT teach the falling leaf stall
- Do NOT conduct maneuvers not approved by the POH
- New CFIs - Do NOT conduct commercial maneuvers an M-Class until you have experience instructing and have received a "sign-off" from mentor/experienced M-Class CFI
- Do NOT fly extreme bank angles, inverted, or aerobatic maneuvers
    - 45 degrees of bank (private pilots) and 50 degrees of bank (commercial pilots) is needed for steep turns, but no more than that and never past that for any other maneuvers

Resources

- FAA: Airplane Flying Handbook (Publication)
    - Chapter 3, 4, 5 (pages 10-1 to 10-3)

Flight Procedures

M-CLASS F09 - Low-Speed Envelope

Unit Objective: Recognize the onset of low-speed flight regimes and demonstrate the proper use of flight controls and Visual or flight instrument derived cues to perform basic low speed flight maneuvers.

Summary: This unit covers slow flight and stall recognition and recovery, under different configurations and flight regimes.

Training Topics

1. **Aerodynamics**
   a. Demonstrate understanding of slow flight aerodynamics
   b. Demonstrate knowledge of the situations and factors leading to stall
   c. Understand the effect of flap configuration, bank, weight and CG on stall
   d. Understand the importance of preventing low altitude stalls and spins from occurring

2. **Slow Flight**
   a. Demonstrate slow flight within the ACS parameters with the flaps in all possible flap positions and detents

3. **Configuration Changes**
   a. Demonstrate slow flight at various flap settings
   b. Conduct a drag demonstration

4. **Recognition of Impending Stall, Recovery, and Prevention:**
   - **Power On**
   - **Power Off**
   - **Accelerated/Turning**

   a. State the stall warning indications
   b. Demonstrate stall recovery after first indication of an impending stall
   c. Demonstrate the relationship between increased stall speed, load factor and bank angle
   d. Understand aircraft performance differences for stalls at high altitude vs. low altitude

5. **Secondary Stalls**
   a. Recognize and recover safely

6. **Autopilot Induced Stall**
   a. Demonstrate a recovery from an autopilot induced stall with minimum altitude loss

Flight Procedures

7. **Trim Stalls**
   a. Understand and demonstrate impact of using excessive trim late in the approach or during the landing flare

8. **Situational Awareness**
   a. Clear area and maintain SA with aircraft, traffic, performance, obstacles, weather and ATC
   b. Maintain SA with regard to airspeed and angle of attack and relation to margin above stall

9. **Task Management**
   a. Properly prioritize tasks during stall recovery

10. **Energy Management**
    a. Manage energy and flight path such that stalls and unusual attitude risks are minimized

11. **Decision Making**
    a. Plan flight such that safe and appropriate airspeeds can be maintained

Instructor Recommendations

- Emphasis should be placed on identification of impending stall and recovery before stall occurs during normal operations
- Practice slow flight for sufficient time for pilot in training to be comfortable with the difference in flight control response during slow flight
- Include discussion of Upset Recovery procedures
- High altitude stalls if not demonstrated, should be discussed with pilots in training of aircraft that are certified to fly above FL250
- Unusual attitudes should be thoroughly discussed in the classroom, then instructor demonstrated in the airplane prior to PITs attempting if they have not been trained in this before
- Brief procedures for and demonstrate Electronic Stability Protection (ESP)
- Do NOT demonstrate a power-on stall demonstration using full power
- Do NOT demonstrate a skidding stall
- Do NOT recover abruptly from a descent or overload the airplane in any way
- SPINS ARE PROHIBITED

Resources

- Pilot's Operating Handbook
  - Sections 2 and 3
- FAA: Private Pilot for Airplane Category Airman Certification Standards (FAA-S-ACS-6C) (Publication)
  - Area of Operation VII. Slow Flight and Stalls
- FAA: Airplane Flying Handbook - FAA-H-8083-3C (Publication)
  - Chapters 3, 4, 5
- FAA: Pilot's Handbook of Aeronautical Knowledge - FAA-H-8083-25C (Publication)

    - Chapter 5
- In the Hangar: Best Slips vs Skids Explanation for Flight Training or Learning to Fly (YouTube Video)
- Specific autopilot manuals

Flight Procedures

M-CLASS F10 - Descent Planning and Execution

Unit Objective: Demonstrate the proper descent procedures.

Summary: This unit covers procedures and techniques for normal descent with and without autopilot and navigator support. Vertical navigation (VNAV) is addressed. Risk management and CFIT avoidance are covered.

Training Topics

1. **Automation Management**
   a. Decide which automated features will be used during the descent and program them prior to beginning the descent
   b. Monitor and update the automated features during the descent

2. **Vertical Navigation (VNAV) Planning**
   a. Use the descent features of the GPS and the map features of the MFD, and autopilot (if capable) to plan a fuel
   b. efficient descent that avoids known obstacles and terrain

3. **Navigation Programming**
   a. VFR: Program the entire descent and go-around
   b. IFR: program and activate the desired approach and missed approach

4. **Manual Descent**
   a. Perform a manual descent within ACS parameters

5. **Autopilot Descent**
   a. Perform an autopilot descent
   b. within ACS parameters (for a manual descent)

6. **Task Management, Situational Awareness, CFIT Avoidance**
   a. Identify the most important data available

Instructor Recommendations

- Become familiar with recommended power settings, airspeeds and configurations
- New CFI – Do NOT fly in the yellow arc

Resources

- To be created/identified in the future

Flight Procedures

M-CLASS F11 - Stabilized Approaches and Landings

Unit Objective: Demonstrate stabilized approaches and landing procedures.

Summary: This unit covers normal and high-performance landings under various aircraft configurations and environmental and runway conditions including attendant risk management and decision making. Abnormal and emergency procedures are included.

Training Topics

1. **Before Landing Procedures**
   a. Perform all pre-landing checklist items correctly and in sequence

2. **IFR Landing Transition (Autopilot to manual and manual to Manual)**
   a. Perform the proper transition from instrument reference to visual reference
   b. Perform the proper procedures for autopilot disengagement and transition to landing

3. **Calculate Landing Speed**
   a. Perform landing speed calculations correctly based on POH

4. **Stabilized Approach**
   a. Explain a stabilized approach
   b. Perform a stabilized approach

5. **Normal Landing**
   a. Perform a normal full flap landing within the ACS parameters

6. **Short Field Landing**
   a. Perform Short field landing within the ACS parameters

7. **Partial Flap Landing**
   a. Perform a partial flap landing within the ACS parameters

8. **Zero Flap Landing**
   a. Perform a zero-flap landing within the ACS parameters

9. **Crosswind Landing**
   a. Perform a crosswind landing within the ACS parameters
   b. Perform crosswind component calculation
   c. Understand max demonstrated crosswind component

Flight Procedures

10. **Balked (rejected) Landing and Go- Around**
    a. Make a timely decision to go-around either in flight or after initial touchdown if the landing cannot be accomplished safely
    b. Perform the balked landing procedure within the ACS parameters

11. **Abnormal and Emergency Procedures**
    a. Explain how/when to decline abnormal ATC approach requests
    b. Explain failure of gear to extend
    c. Explain gear up landing technique
    d. Explain and/or perform balked landing (go-around runway obstruction)
    e. Explain failure of flaps to extend (landing) or retract (balked landing)

12. **Decision-making and Situational Awareness**
    a. Demonstrate awareness of all potential weather, traffic, and airfield factors that might impact the approach and landing
    b. Make timely decisions to mitigate risks and ensure a successful approach and landing
    c. Understanding of when to use full flaps, partial flaps, no flaps

13. **Contaminated Runways**
    a. Recognize risks and changes in landing performance data when landing on a runway contaminated with rain, ice, snow, slush, etc.
    b. Understand FAA Runway Condition Codes and Braking Codes

Instructor Recommendations

- Do NOT violate sterile cockpit, discussing topics not related to the flight
- Do NOT proceed with a landing if approach was not stabilized
- Do NOT demonstrate a landing in excess of max demonstrated crosswind component
- Do NOT unnecessarily utilize excessive braking (e.g, to achieve early turn-off to taxiway)
- Do NOT use aerodynamic braking in an M-Class aircraft
- Do NOT debrief flight on taxi in; must wait until on ramp and aircraft shut down
- Do NOT clean up the airplane (e.g., retract flaps) until exited runway and come to a full stop and use checklist
- Do NOT perform touch and goes

Resources

- PMOPA: Standard for Stabilized Approach (Article)
- PMOPA: Operating Practices (Article)
- Pilot's Operating Handbook
    - Balked Landing Performance Chart
- FAA: AC 91-79B Aircraft Landing Performance and Runway Excursion Mitigation (Advisory Circular)
- Flight Safety Foundation: Stabilized Approach (Toolkit)
- FAA: Stabilized Approaches (Article)
- Skybrary: Stabilised Approach (Article)
- Skybrary: Non-stabilized Approach After ATC-Requested Runway Change (Article)

Flight Procedures

- Skybrary: Go Around Decision Making (Article)
- Skybrary: Missed Approach (Article)
- MZeroA Stabilized Approach and when to Go Around (Video)
- Casey Aviation: Go Around in a PA46 (Article)
- NBAA: Pilot's Runway Condition Assessment Matrix (Resource)
- FAA: 7110.65AA Air Traffic Control Procedures and Phraseology (Order)
    - Section 3-3-4 Braking Action Codes
- Bold Method: The FAA's Braking Action Reports Have Changed, Here's What You Need To Know (Article)

Flight Procedures

M-CLASS F12 - Aircraft Shutdown and Securing Procedures

Unit Objective: Demonstrate proficiency shutting down and securing the aircraft.

Summary: This unit covers engine and aircraft shutdown procedures (piston and turbine) and post-flight inspection and handling activities.

Training Topics

1. **Aircraft Shutdown & Securing Checklist**
    a. Demonstrate proficiency properly concluding a flight including engine shutdown and securing
    b. Demonstrate proper use of the Shutdown Checklist
    c. Piston: Demonstrate correct engine cooldown procedure.
    d. Turbine: Describe proper procedure if there is evidence of fire within the engine after shutdown
    e. Turbine: Describe indications of a feathering system failure

2. **Aircraft Towing, Ground Handling, and Tiedown**
    a. Demonstrate proficiency properly concluding a flight including aircraft storage

Instructor Recommendations

- How long let engine (piston) idle before shutting down? (Is there a Savvy article on this?)
- Demonstrate correct use of fuel pump during shutdown.
- What not to do:
    - Shut battery master off before turbine propeller spins down

Resources

- McVinnie Aviation: Piston Cool-down Procedures (Video)

Flight Procedures

M-CLASS F13 - Emergency Escape Maneuvers / Recovery from Unusual Attitudes

Unit Objective: Demonstrate unusual attitude/upset recovery.

Summary: This unit covers emergency and basic upset prevention and recovery procedures and maneuvers, with and without autopilot support. These may include engine, trim, pressurization, autopilot, and fire emergency and abnormal conditions.

Training Topics

1. **Primary Flight Instruments**
   a. Demonstrate unusual attitude recovery using the primary flight instruments to ACS parameters

2. **Backup Instruments**
   a. Demonstrate unusual attitude recovery using the backup instruments to ACS parameters

3. **Autopilot – Limitations of it use for recovery**
   a. Demonstrate unusual attitude recovery using the autopilot to ACS parameters
   b. Explain the Envelope Protection System(s)

4. **Unusual Attitudes Training**
   a. Demonstrate recovery from unusual attitudes using the flight instruments

5. **Engine Failure/ Emergency Descent**
   a. Demonstrate procedures to be used during engine failure or situations requiring an emergency descent

6. **Emergency Maneuvers, Risk Management, and Decision Making**
   a. Understand the capabilities of the flight instruments, and Autopilot
   b. Develop a problem-solving matrix for use of all these systems when faced with IFR/VFR emergency procedures
   c. Demonstrate the ability to make correct decisions when faced with IFR/VFR emergency conditions

7. **Runaway Trim**
   a. Recognize and respond to a runaway trim situation

Flight Procedures

8. **Simulated Engine Out**
   a. Demonstrate best glide speed
   b. Identify a suitable landing spot
   c. Employ energy management techniques to safely maneuver to the suitable landing spot

9. **Loss of Manifold Pressure**
   a. Identify the condition
   b. Safely maneuver to a suitable landing spot to land as soon as possible

10. **Power Rollback (Turbine)**
    a. Identify the condition
    b. Deploy the Manual Override
    c. Safely maneuver to a suitable landing spot to land as soon as practicable

11. **Emergency Gear Extension**
    a. Identify the condition and utilize appropriate checklist(s)
    b. Demonstrate an emergency gear extension (except on aircraft with Gar Kenyon)

12. **Simulated Loss of Pressurization (pressurized airplane)**
    a. Identify the condition and utilize appropriate checklist(s)
    b. Initiate an emergency descent

13. **Emergency Descent**
    a. Utilize appropriate checklist(s)
    b. Demonstrate emergency descent utilizing energy management techniques

14. **Recovery from Unusual Attitudes by Instrument Reference**
    a. Demonstrate ability to recover from high pitch, low pitch and steep turns in a safe manner
    b. Understand the necessity to not overload the airplane to protect the structural integrity

15. **Smoke or Fire -Electrical and Engine**
    a. Identify the source of the fire
    b. Demonstrate ability to take appropriate action
    c. Demonstrate use of oxygen mask in simulated smoke or fire situation

16. **Emergency Exits**
    a. Brief emergency egress
    b. Identify appropriate exit to use in the specific emergency situation
    c. Demonstrate knowledge of how to open emergency exit(s)

Instructor Recommendations

- Complete full Upset Prevention and Recovery Training course.
- Do NOT terminate an emergency descent lower than 3,000’ AGL.
- Do NOT let a simulated emergency turn into a real emergency.

Flight Procedures

- Do NOT surprise pilot with emergency procedures; ensure it has been pre-briefed.
- Do NOT conduct cabin depressurization if client (or CFI) has sinus congestion or related issues.
- Pistons – Do NOT pull power to idle at altitude (concern of shock cooling)
- Pistons – Do NOT conduct a power-off landing without clearing the engine (every 500-1,000' bring RPM to 1,500 RPM to clear lead deposits then bring back to idle)
- Minimum altitude for engine out procedures
    - For new CFIs, standard is to demonstrate not below 500'
    - MSIP Gold or MSIP Platinum CFI, may demonstrate below 500' if safe landing is assured
- Unusual Attitude Recoveries: For primacy, turn off autopilot and hand fly the airplane
    - Nose High Recovery: Pitch down, add power, level ailerons. Emphasize the ill effects of leveling the ailerons prior to pitching down and how that can make the situation worse.
    - Nose Low Recovery: Power Back, level ailerons, pitch up, add power to prevent getting slow at level pitch attitude
    - Note: The Level button will level ailerons and pitch down simultaneously. Emphasize the need to recognize airspeed and if airspeed is decelerating below 100 KIAS, perform a manual recovery.
    - Secondary - if the airplane is equipped with a Level button, have the pilot utilize the Level button for unusual attitude recovery; if spatially disoriented, the Level button could be a life saver. Emphasize the need to recognize what the airplane is doing before initiating a recovery. Focus on airspeed (accelerating means nose low, decelerating means nose high) and have the pilot voice out loud "nose high" or "nose low". This allows the pilot to process properly what is taking place and do the correct inputs. If the aircraft is equipped with a PFD, utilize the attitude indicator to recognize the unusual attitude as it will not tumble.

Resources

- McVinnie Aviation: Extension Bar Short Pull vs. Long Pull (Video)
- FAA: Power Settings During a Power-off 180° Accuracy Approach and Landing or During a Simulated Emergency Approach and Landing Conducted in Single-engine Turboprop Airplanes (InFO)

Flight Procedures

M-CLASS F14 - Approach Procedures

Unit Objective: Demonstrate VFR and IFR (as appropriate) approach procedures.

Summary: This unit covers using avionics to perform precision, non-precision, and assisted visual approach procedures, go-arounds, turns and holds. Risk management is included.

Training Topics

1. **Manual and Coupled Precision Approach and Non-precision Approach**
   a. Perform the approach within the ACS parameters

2. **GPS Augmented Visual Approach**
   a. Utilize supplemental instrumentation to achieve a stabilized approach

3. **Circling Approach**
   a. Perform the circling approach within the ACS parameters

4. **Manual Missed Approach**
   a. Perform the missed approach within the ACS parameters

5. **Autopilot Flown Missed Approach**
   a. Perform the missed approach within the ACS parameters

6. **Procedure Turn**
   a. Demonstrate Procedure Turn to ACS parameters

7. **Holding**
   a. Demonstrate Instrument Holding to ACS parameters

8. **Partial Panel**
   a. Demonstrate partial panel proficiency

9. **Task Management and Decision-making**
   a. Demonstrate proper planning and prioritization of time between avionics programming and execution of IFR procedures

10. **Situational Awareness**
    a. Demonstrate proper use of the flight instruments to maintain situational awareness

Flight Procedures

Instructor Recommendations

- Use VFR visual approach / course guidance in VFR conditions
- Avionics training
- What not to do:
    - Complete instrument training without talking to ATC, which allows CFI to observe client's interactions with ATC
    - Arm a glide path until hear "Cleared for the Approach"

Resources

- FAA: Instrument Flying Handbook (2012) (Publication)
- Avionics training applicable to installed avionics

1800 M Street, NW
Suite 400S
Washington, DC 20036