ANSWERS TO THE ACS

PRIVATE PILOT

AIRPLANE SINGLE ENGINE LAND

VOLUME II: FLIGHT PORTION

REVISION 0

ADDRESSES FAA-S-ACS-6B (CHANGE 1)

PATRICK MOJSAK

MOJSAK AERO LLC, ARLINGTON, TEXAS

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Dedication

To all those who have lost their lives in general aviation, that we may learn from their mistakes, and others, to forge a safer air transportation system.

ABOUT THE AUTHOR

Patrick Mojsak began learning to fly from his father at the age of 12. He proceeded to then earn his private, instrument, commercial, and flight instructor certificates by the age of 18, which is when he began instructing.

Patrick graduated from the University of Texas at Arlington in 2012 with a Bachelor of Science in Electrical Engineering. He then moved to Wichita, Kansas to pursue a position with Cessna Aircraft Company as an electrical engineer. Patrick began working on Cessna's single engine piston airplanes such as the Cessna TTx (formerly the Columbia 400) by performing avionics testing, supporting production flight test regarding customer training, and drafting certification documentation.

During his time there, in early 2014, the companies of Cessna and Beechcraft merged to form what is now known as Textron Aviation. Patrick was then moved to begin working on the Citation Longitude - the company's first super mid-sized business jet. Duties included FADEC integration of the Honeywell HTF 7000 engine, wire diagram development, and assisting experimental shop with assembling a functional prototype. First flight was achieved on October 8, 2016.

During his time at Textron Aviation, Patrick continued to fly by instructing at the employee's flying club and earning additional certificates and ratings such as airline transport pilot (ATP), commercial airplane single engine sea (ASES), commercial glider, and flight instructor glider.

In late 2016, Patrick left Textron Aviation to return to his home state of Texas and pursue a career with the airlines. Patrick began working for Envoy Air Inc. (formerly known as American Eagle) in 2017 as a first officer on the Embraer 145 regional jet. In 2019, Patrick upgraded to captain on the Embraer 175. In 2022, Patrick began working as an instructor in Envoy's Advanced Qualification Program (AQP) on the Embraer 175. In 2023, Patrick began working for American Airlines as a first officer on the Airbus 320.

Patrick's love for teaching is his inspiration behind this book. With new, more challenging standards being imposed by the FAA, Patrick wishes to reach a wider audience by providing detailed and tangible guidance.

TABLE OF CONTENTS

Frontmatter

Copyright and Dedication ii

About the Author iii

Table of Contents iv

Acknowledgements xiii

Disclaimer xiv

Revisions xv

II. Preflight Preparation

A. Preflight Assessment II-A-4

Overview II-A-4

Airplane Assessment II-A-5

Preflight Inspection II-A-12

Aviation Security Concerns II-A-19

Use of Checklists II-A-21

In-Flight Task II-A-22

References II-A-26

B. Flight Deck Management II-B-2

Seatbelts II-B-3

Navigation Data Requirements II-B-7

Improper Use of Automation and PEDs II-B-9

Flying with Unresolved Discrepancies II-B-16

Secure All Items in the Cockpit and Cabin II-B-18

Pre-Takeoff Briefing II-B-27

Properly Program and Manage Automation .. II-B-33

References II-B-37

C. Engine Starting II-C-2

Overview II-C-2

Starting Under Various Conditions II-C-3

Use of External Power II-C-14

Engine Starting Limitations II-C-19

Risk Factors II-C-22

Positioning the Airplane II-C-24

Engine Starting Procedures II-C-26

References II-C-28

D. Taxiing II-D-2

Overview II-D-2

Taxiing Publications II-D-3

Taxi Instructions/Clearances II-D-7

Airport Signs, Markings, and Lights II-D-14

Visual Indicators For Wind II-D-29

TABLE OF CONTENTS

Aircraft Lighting II-D-33
Flight Deck Activities During Taxi II-D-41
Radio Communications II-D-46
Entering or Crossing Runways II-D-52
Night Taxi Operations II-D-54
Low Visibility Taxi Operations II-D-57
Inappropriate Activities and Distractions II-D-61
Confirmation/Expectation Bias II-D-63
Taxi Route or Departure Runway Change II-D-65
In-Flight Task II-D-67
References II-D-74

F. Before Takeoff Check II-F-2
Overview II-F-2
Purpose of a Before Takeoff Check II-F-3
Division of Attention II-F-9
Unexpected Runway Changes by ATC II-F-11
Complete the Appropriate Checklist II-F-17
Properly Position the Airplane II-F-18
Divide Attention II-F-20
Verify Engine Parameters and Airplane Configuration II-F-21
References II-F-23

III. Airport and Seaplane Base Operations

A. Communications III-A-2
Overview III-A-2
Obtaining Proper Radio Frequencies III-A-3
Proper Radio Communication Procedures III-A-16
ATC Light Signals III-A-45
Appropriate Use of Transponders III-A-50
Lost Communication Procedures III-A-53
NTSB Accident/Incident Reporting III-A-56
Runway Status Lighting Systems III-A-63
Poor Communication III-A-66
Confirmation/Expectation Bias III-A-68
In-Flight Task III-A-70
References III-A-74

B. Traffic Patterns III-B-2
Overview III-B-2
Towered and Nontowered Airport Operations III-B-3
Runway Selection III-B-13
Right-of-Way Rules III-B-16

TABLE OF CONTENTS

Automated Weather and Airport Information III-B-23
Risk Factors III-B-29
In-Flight Task III-B-31
References III-B-36

IV. Takeoffs, Landings, and Go-Arounds

A. Normal Takeoff and Climb IV-A-2
Overview IV-A-2
Effects of Atmospheric Conditions IV-A-4
V_X and V_Y IV-A-8
Appropriate Airplane Configuration IV-A-9
Selection of Takeoff Runway IV-A-10
Crosswind Effects on Takeoff IV-A-17
Windshear Effects on Takeoff IV-A-19
Tailwind Effects on Takeoff IV-A-22
Wake Turbulence Effects on Takeoff IV-A-24
Runway Effects on Takeoff IV-A-26
Rejected Takeoff IV-A-31
Engine Failure During Takeoff IV-A-34
Collision Hazards During Takeoff IV-A-36
In-Flight Task IV-A-38
References IV-A-44

B. Normal Approach and Landing IV-B-2
Overview IV-B-2
Stabilized Approach and Energy Management IV-B-4
Atmospheric Effects on Approach and Landing IV-B-10
Wind Correction Techniques on Approach and Landing IV-B-13
Runway Selection IV-B-15
Crosswind Effects on Landing IV-B-17
Windshear Effects on Landing IV-B-19
Tailwind Effects on Landing IV-B-21
Wake Turbulence Effects on Landing IV-B-23
Runway Surface/Condition IV-B-25
Go-Around and Rejected Landing IV-B-32
Land and Hold Short Operations (LAHSO) .. IV-B-34
Collision Hazards IV-B-36
In-Flight Task IV-B-38
References IV-B-46

C. Soft-Field Takeoff and Climb IV-C-2

TABLE OF CONTENTS

Overview IV-C-2
Appropriate Airplane Configuration IV-C-4
Ground Effect IV-C-5
Importance of Weight Transfer IV-C-7
Left Turning Tendencies IV-C-9
In-Flight Task IV-C-15

D. Soft-Field Approach and Landing IV-D-2
Overview IV-D-2
In-Flight Task IV-D-4

E. Short-Field Takeoff and Climb IV-E-2
Overview IV-E-2
Appropriate Airplane Configuration IV-E-4
In-Flight Task IV-E-5

F. Short-Field Approach and Landing IV-F-2
Overview IV-F-2
Stabilized Approach IV-F-4
In-Flight Task IV-F-8
References IV-F-15

M. Forward Slip to a Landing IV-M-2
Overview IV-M-2
Energy Management Concepts IV-M-3
Wind Correction Techniques IV-M-4
Purpose of a Forward Slip IV-M-5
Risk Factors IV-M-6
In-Flight Task IV-M-8
References IV-M-13

N. Go-Around/Rejected Landing IV-N-2
Overview IV-N-2
Effects of Atmospheric Conditions IV-N-3
Delayed Recognition IV-N-4
Delayed Performance IV-N-6
Improper Application of Power IV-N-8
Improper Airplane Configuration IV-N-10
In-Flight Task IV-N-12
References IV-N-17

V. Performance & Grnd Reference Maneuvers

A. Steep Turns V-A-2
Overview V-A-2
Purpose of Steep Turns V-A-3
Coordinated and Uncoordinated Flight V-A-4

TABLE OF CONTENTS

Overbanking Tendencies....V-A-5

Maneuvering Speed.... V-A-6

Load Factor and Accelerated Stalls....V-A-7

Rate and Radius of Turn V-A-8

Risk Factors V-A-9

In-Flight Task V-A-11

References V-A-15

B. Ground Reference Maneuvers.... V-B-2

Overview V-B-2

Purpose of Ground Reference Maneuvers....V-B-3

Effects of Wind V-B-4

Bank Angle, Groundspeed, and Rate and Radius of Turn V-B-7

Relationship of Rectangular Course to Traffic Pattern V-B-8

Collision Hazards V-B-9

Low Altitude Stall/Spin....V-B-11

In-Flight Task V-B-13

References V-B-26

VI. Navigation

A. Pilotage and Dead Reckoning VI-A-2

Overview VI-A-2

Pilotage and Dead Reckoning VI-A-3

Magnetic Compass Errors.... VI-A-4

Planned Versus Actual Flight Plan Calculations VI-A-10

In-Flight Task VI-A-13

References VI-A-15

B. Navigation Systems and Radar Services VI-B-2

Overview VI-B-2

Ground-Based Navigation....VI-B-3

Satellite Based Navigation VI-B-15

Radar Assistance to VFR Aircraft VI-B-21

Transponders and ADS-B VI-B-29

Risk Factors VI-B-50

In-Flight Task VI-B-52

References VI-B-55

C. Diversion.... VI-C-2

Overview VI-C-2

Situations Requiring Diversion and Alternate

TABLE OF CONTENTS

Selection VI-C-3

Risk Factors VI-C-5

In-Flight Task VI-C-8

References VI-C-11

D. Lost Procedures VI-D-2

Overview VI-D-2

Methods to Determine Position VI-D-3

Assistance Available if Lost VI-D-5

Risk Factors VI-D-11

In-Flight Task VI-D-14

References VI-D-16

VII. Slow Flight and Stalls

A. Maneuvering During Slow Flight VII-A-2

Overview VII-A-2

Aerodynamics Associated with Slow Flight VII-A-3

Inadvertent Slow Flight with a Stall Warning VII-A-7

Range and Limitations of Stall Warning Indicators.... VII-A-8

Effect of Environmental Elements VII-A-11

In-Flight Task VII-A-13

References VII-A-17

B. Power-Off Stall VII-B-2

Overview VII-B-2

Aerodynamics Associated with Stalls VII-B-3

Stall Characteristics and Indications VII-B-11

Fundamentals of Stall Recovery VII-B-24

General Risk Factors VII-B-25

Secondary, Accelerated, and Cross-Control Stalls VII-B-27

Environmental Effects................................. VII-B-31

In-Flight Task VII-B-33

References VII-B-38

C. Power-On Stalls VII-C-2

Overview VII-C-2

Fundamentals of Stall Recovery VII-C-3

General Risk Factors VII-C-4

Types of Power-On Stalls VII-C-6

Environmental Effects.................................. VII-C-10

In-Flight Task VII-C-12

References VII-C-16

D. Spin Awareness VII-D-2

TABLE OF CONTENTS

Overview VII-D-2

Aerodynamics Associated With Spins VII-D-3

Spin Causes and Identification VII-D-9

Spin Recovery Procedure VII-D-13

General Risk Factors VII-D-14

Improper Spin Recovery Procedure VII-D-18

Environmental Effects VII-D-20

References VII-D-22

VIII. Basic Instrument Maneuvers

A. Straight-and-Level Flight VIII-A-4

Overview VIII-A-4

Flight Instruments VIII-A-5

Pitch and Bank Instruments VIII-A-26

Instrument Scanning and Crosscheck VIII-A-27

In-Flight Task VIII-A-29

References VIII-A-30

B. Constant Airspeed Climbs VIII-B-2

Overview VIII-B-2

In-Flight Task VIII-B-3

C. Constant Airspeed Descents VIII-C-2

Overview VIII-C-2

In-Flight Task VIII-C-3

D. Constant Airspeed Descents VIII-D-2

Overview VIII-D-2

In-Flight Task VIII-D-3

E. Recovery From Unusual Attitudes VIII-E-2

Overview VIII-E-2

Risk Factors VIII-E-3

In-Flight Task VIII-E-7

References VIII-E-12

F. Comms, Nav Systems, and Radar Services VIII-F-2

Overview VIII-F-2

Knowledge VIII-F-3

Risk Factors VIII-F-9

In-Flight Task VIII-F-10

References VIII-F-11

IX. Emergency Operations

A. Emergency Descent IX-A-4

Overview IX-A-4

TABLE OF CONTENTS

Situations That Require an Emergency Descent IX-A-5

Emergency Descent Procedures...................... IX-A-6

Risk Factors IX-A-8

In-Flight Task IX-A-11

References IX-A-15

B. Emergency Approach and Landing (Sim) IX-B-2

Overview IX-B-2

Emergency Approach and Landing Procedures IX-B-3

Importance of Best Glide Speed..................... IX-B-10

Difference Between Best Glide and Minimum Sink IX-B-12

Effects of Wind on Glide Distance IX-B-14

Effects of Atmospheric Conditions IX-B-15

Emergency Locator Transmitters IX-B-16

ATC Services to Aircraft in Distress.............. IX-B-23

Collision Hazards IX-B-25

Improper Airplane Configuration IX-B-27

Stall/Spin.. IX-B-30

In-Flight Task IX-B-32

References IX-B-37

C. Systems and Equipment Malfunctions IX-C-2

Overview IX-C-2

Engine Roughness or Overheat....................... IX-C-3

Carburetor or Induction Icing........................ IX-C-8

Loss of Oil Pressure IX-C-11

Fuel Starvation IX-C-13

Electrical Malfunction IX-C-14

Vacuum/Pressure System Malfunction IX-C-17

Pitot/Static System Malfunction.................... IX-C-18

EFIS Malfunction IX-C-21

Landing Gear or Flap Malfunction IX-C-22

Inoperative Trim IX-C-29

Smoke/Fire/Engine Compartment Fire IX-C-30

Airplane-Specific Malfunctions..................... IX-C-36

Inadvertent Door or Window Opening.......... IX-C-43

Risk Factors IX-C-44

In-Flight Task IX-C-46

References IX-C-50

D. Emergency Equipment and Survival Gear IX-D-2

TABLE OF CONTENTS

Overview IX-D-2

Emergency Locator Transmitters IX-D-3

Fire Extinguishers IX-D-7

Types of Emergency Equipment and Survival Gear ... IX-D-9

Risk Factors IX-D-16

Identifying Emergency Equipment and Survival Gear IX-D-18

Briefing Emergency Equipment and Survival Gear.... IX-D-19

References IX-D-20

XI. Night Operations

A. Night Preparation XI-A-2

Overview XI-A-2

Night Vision.. XI-A-3

Lighting Systems XI-A-7

Airplane Night Equipment............................ XI-A-11

Night Navigation XI-A-16

Personal Night Equipment.............................XI-A-17

Risk Factors XI-A-18

References XI-A-20

XII. Postflight Procedures

A. After Landing, Parking, and Securing.XI-A-2

Overview XI-A-2

Shutdown, Securing, and Postflight Inspection XI-A-3

Documenting Discrepancies XI-A-9

Risk Factors XI-A-10

In-Flight Task XI-A-12

References XI-A-19

Appendices and Addenda

1. Risk Assessment Matrix A-4

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DISCLAIMER

This book is intended to be a learning tool for applicants preparing for the practical test towards a pilot certificate and/or rating. The information presented herein is as accurate, complete, and authoritative as possible. However, there may be errors and omissions, both typographical and in content.

This book should not be used as the ultimate source of aeronautical information. It is designed to complement other aviation texts and formal flight instruction. For additional reading materials, refer to the extensive references at the end of each section.

The author and publisher shall not be liable or responsible to any person or entity with respect to any loss or damage caused or alleged to be caused directly or indirectly by the information contained in this book. This text is not a substitute for common sense, the exercise of good judgement, or formal flight instruction.

REVISIONS

Revision	0	Date	December 31, 2023	ACS Addressed	FAA-S-ACS-6B (Change 1)
Reason(s) for Revision	NA				

Section	Sub-Section	Change Description
All	All	None - initial issue.

AREA OF OPERATION IV

TASK F

SHORT-FIELD APPROACH AND LANDING

F. SHORT-FIELD APPROACH AND LANDING
OVERVIEW

Task	*F. Short-Field Approach and Landing (ASEL, AMEL)*
References	FAA-H-8083-2, FAA-H-8083-3; POH/AFM; AIM
Objective	To determine that the applicant exhibits satisfactory knowledge, risk management, and skills associated with a short-field approach and landing with emphasis on proper use and coordination of flight controls.
Knowledge	The applicant demonstrates understanding of:
PA.IV.F.K1	A stabilized approach, to include energy management concepts.
PA.IV.F.K2	Effects of atmospheric conditions, including wind, on approach and landing performance. (see ***PA.IV.B.K2***)
PA.IV.F.K3	Wind correction techniques on approach and landing. (see ***PA.IV.B.K3***)
Risk Management	The applicant demonstrates the ability to identify, assess and mitigate risks, encompassing:
PA.IV.F.R1	Selection of runway based on pilot capability, airplane performance and limitations, available distance, and wind. (see ***PA.IV.B.R1***)
PA.IV.F.R2	Effects of:
PA.IV.F.R2a	a. Crosswind (see ***PA.IV.B.R2a***)
PA.IV.F.R2b	b. Windshear (see ***PA.IV.B.R2b***)
PA.IV.F.R2c	c. Tailwind (see ***PA.IV.B.R2c***)
PA.IV.F.R2d	d. Wake turbulence (see ***PA.IV.B.R2d***)
PA.IV.F.R2e	e. Runway surface/condition (see ***PA.IV.B.R2e***)
PA.IV.F.R3	Planning for:
PA.IV.F.R3a	a. Go-around and rejected landing (see ***PA.IV.B.R3a***)
PA.IV.F.R3b	b. Land and hold short operations (LAHSO) (see ***PA.IV.B.R3b***)
PA.IV.F.R4	Collision hazards, to include aircraft, vehicles, persons, wildlife, terrain, obstacles, and wires. (see ***PA.IV.B.R4***)
PA.IV.F.R5	Low altitude maneuvering including, stall, spin, or CFIT. (see ***PA.VII.B.R1***)
PA.IV.F.R6	Distractions, loss of situational awareness, and/or improper task management. (see ***PA.VII.B.R8***)

Skills	The applicant demonstrates the ability to:
PA.IV.F.S1	Complete the appropriate checklist.
PA.IV.F.S2	Make radio calls as appropriate.
PA.IV.F.S3	Ensure the airplane is aligned with the correct/assigned runway.
PA.IV.F.S4	Scan the landing runway and adjoining area for traffic and obstructions.
PA.IV.F.S5	Select and aim for a suitable touchdown point considering the wind, landing surface, and obstructions.
PA.IV.F.S6	Establish the recommended approach and landing configuration and airspeed, and adjust pitch attitude and power as required to maintain a stabilized approach.
PA.IV.F.S7	Maintain manufacturer's published airspeed or in its absence not more than 1.3 V_{SO}, +10/-5 knots with wind gust factor applied.
PA.IV.F.S8	Maintain directional control and appropriate crosswind correction throughout the approach and landing.
PA.IV.F.S9	Make smooth, timely, and correct control application during the round out and touchdown.
PA.IV.F.S10	Touch down at a proper pitch attitude within 200 feet beyond or on the specified point, threshold markings, or runway numbers, with no side drift, minimum float, and with the airplane's longitudinal axis aligned with and over runway centerline.
PA.IV.F.S11	Use manufacturer's recommended procedures for airplane configuration and braking.
PA.IV.F.S12	Execute a timely go-around if the approach cannot be made within the tolerances specified above or for any other condition that may result in an unsafe approach or landing.
PA.IV.F.S13	Utilize runway incursion avoidance procedures.

Similar to a short-field takeoff, a short-field landing is defined as one in which the airplane utilizes a paved runway surface and runway length is limited; that is, runway length is at or just slightly greater than the required landing distance. Touchdown is more restrictive than on a normal approach and landing, being reduced to -0/+200 feet beyond a specified point. As a result, it is crucial to verify the touchdown point with the examiner. Additional items of emphasis include using all available means to bring the airplane to a stop as quickly as possible during the rollout.

STABILIZED APPROACH

K

Knowledge	The applicant demonstrates understanding of:
PA.IV.F.K1	A stabilized approach, to include energy management concepts.

Examiner: *"Explain a stabilized approach and energy management as applied to a short-field approach and landing."*

You: *"If there is an obstacle at the threshold, the approach will have to be flown such that the airplane crosses directly above the obstacle at 1.3 V_{SO} and idle throttle, which is a minimal energy state. If there is no obstacle, the airplane should be flown in this manner directly above the ground just prior to the desired touchdown point."*

Short-Field Landing with an Obstacle

Short-Field Landing with No Obstacle

A short-field landing is unique in that there are two variants: landing on a runway with an obstacle before it and landing on a runway with no obstacle. A short-field landing is often associated with obstacles at the beginning of the runway, since many smaller runways are located in undesirable locations and may be adjacent to trees, powerlines, or rising terrain. This requires a modified approach in which the airplane may have to fly slightly higher to cross the obstacle. However, many runways have no obstacles in front of them thus necessitating a different technique.

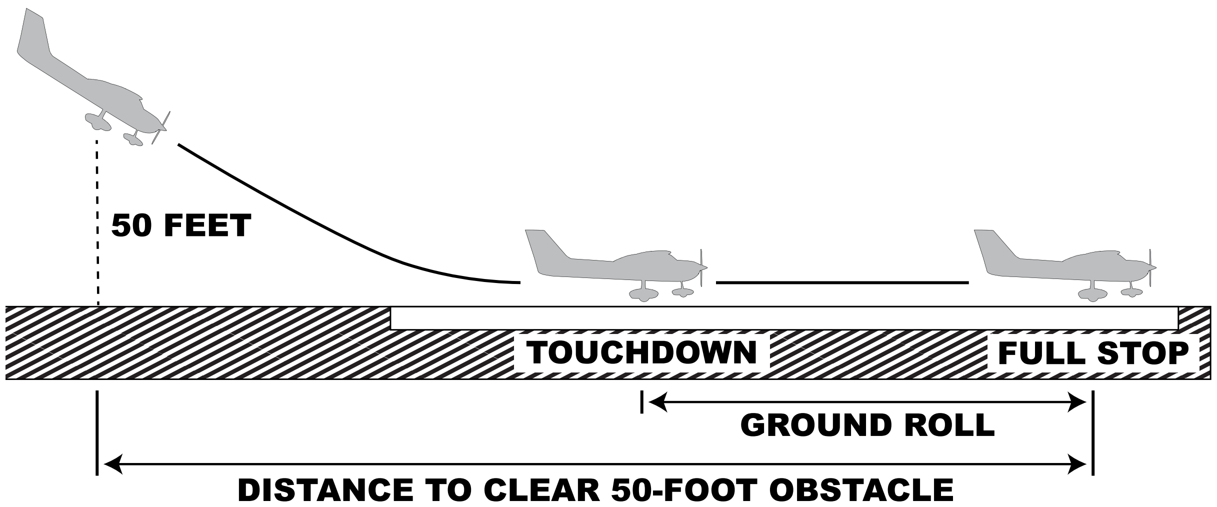
Short-Field Landing with an Obstacle

A short-field landing with an obstacle assumes a 50-foot obstacle located at the runway threshold. This is based on requirements in certification regulations regarding landing performance[1] and is reflected in airplane landing performance data in which a 'distance to clear 50-foot obstacle' is provided. This is the horizontal distance measured from the obstacle until the airplane comes to a complete stop.

Proper technique for landing with an obstacle at the threshold includes crossing the obstacle just above it at 1.3 V_{SO} and idle throttle. This allows the airplane to be brought to a minimal energy state consistent with safety once above the obstacle. The airplane should then be allowed to descend at idle throttle past the obstacle, flared, and allowed to touchdown as quickly as practical to minimize the flare distance. Once the airplane has touched down, every effort should be made to bring the airplane to a stop. This may include some or all of the following:

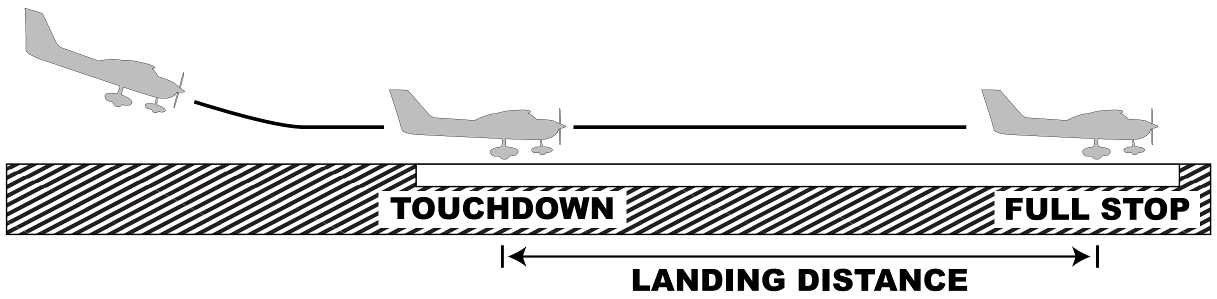
- **Maximum Use of Brakes:** All airplanes should apply maximum braking after touching down during a short-field landing. It should be noted, however, that small airplanes typically have either mechanical drum brakes or hydraulic brakes. As a result, these brakes can "lock up" unlike anti-lock brakes on modern cars. Caution should be used when applying maximum braking to prevent lockup while obtaining maximum effectiveness.
- **Aerodynamic Braking:** Once slow enough, the elevator should be deflected up (yoke aft) to provide aerodynamic braking by increasing the wing's angle of attack and hence drag. However, if the airplane is travelling too fast, the wing may produce enough lift to become airborne again. Pulling the yoke aft also serves to keep the nose raised and the propeller far from the ground during maximum braking, which has the opposite effect.
- **Retracting Flaps:** Retracting flaps is another method that can be used to help stop the airplane. Since flap retraction reduces the wing's lift, this allows more of the airplane's weight to be transferred to the wheels, which then increases friction and brake effectiveness. Normally, this method should only be used on airplanes with mechanical flaps, since the lift reduction will be instantaneous. Airplanes with electric or hydraulic flaps will retract too slowly and be of no benefit, since the airplane will likely be stopped before the flaps have even retracted. However, the airplane's POH/AFM should always be consulted as some airplanes with electric or hydraulic flaps still contain procedures to retract them during the landing rollout.

An important point to note is that the touchdown point is irrelevant when performing a short-field landing over an obstacle. The goal is to cross the obstacle at a minimal but safe energy state and to touch down as soon as possible afterward. It should also be noted that, unlike the short-field takeoff, the ACS makes no mention of clearing an obstacle for a short-field landing at this present time. Instead, a tolerance of -0/+200 feet about a touchdown point is specified. Many examiners still seek to evaluate a short-field landing with an obstacle, however. In order to still satisfy the ACS requirement, a common request is to assume a 50-foot obstacle at the actual runway's threshold, but to consider the aiming point markings as the beginning of the usable runway.



Short-field landing with an obstacle.

Short-Field Landing with No Obstacle



Short-field landing with no obstacle.

A short-field landing with no obstacle before the runway requires touching down as close to the beginning of the runway as possible. Ideally, this would consist of a constant angle descent all the way to the threshold markings, since these are the first markings on the runway. Practically, however, a much more repeatable technique is to fly low and level within ground effect prior to the runway with partial power then reduce the throttle to idle once over the threshold. Once the airplane touches down, all available methods to bring the airplane to a stop should be employed as discussed previously.

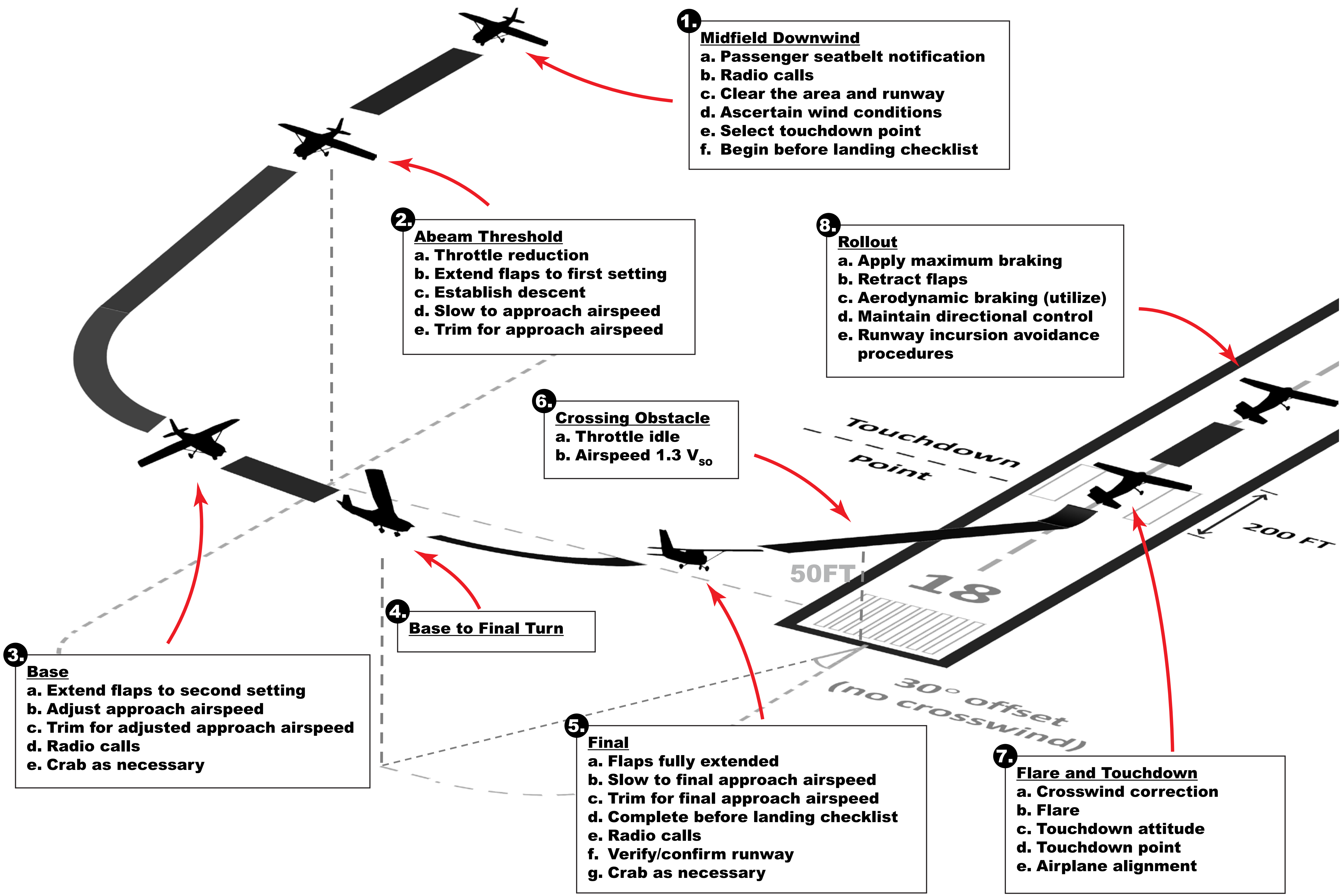
It should be noted that there are risks involved with this technique, namely, striking the threshold lights with the propeller or landing gear. As a result, many examiners will state that they consider the runway to begin at a point beyond the threshold to reduce this risk. Two common examples are the usable runway beginning at the runway numbers or at the aiming point markings, both of which are suggested by Skill Element 10.

F. SHORT-FIELD APPROACH AND LANDING
IN-FLIGHT TASK

S

Skills	The applicant demonstrates the ability to:
PA.IV.F.S1	Complete the appropriate checklist.
PA.IV.F.S2	Make radio calls as appropriate.
PA.IV.F.S3	Ensure the airplane is aligned with the correct/assigned runway.
PA.IV.F.S4	Scan the landing runway and adjoining area for traffic and obstructions.
PA.IV.F.S5	Select and aim for a suitable touchdown point considering the wind, landing surface, and obstructions.
PA.IV.F.S6	Establish the recommended approach and landing configuration and airspeed, and adjust pitch attitude and power as required to maintain a stabilized approach.
PA.IV.F.S7	Maintain manufacturer's published airspeed or in its absence not more than 1.3 V_{SO}, +10/-5 knots with wind gust factor applied.
PA.IV.F.S8	Maintain directional control and appropriate crosswind correction throughout the approach and landing.
PA.IV.F.S9	Make smooth, timely, and correct control application during the round out and touchdown.
PA.IV.F.S10	Touch down at a proper pitch attitude within 200 feet beyond or on the specified point, threshold markings, or runway numbers, with no side drift, minimum float, and with the airplane's longitudinal axis aligned with and over runway centerline.
PA.IV.F.S11	Use manufacturer's recommended procedures for airplane configuration and braking.
PA.IV.F.S12	Execute a timely go-around if the approach cannot be made within the tolerances specified above or for any other condition that may result in an unsafe approach or landing.
PA.IV.F.S13	Utilize runway incursion avoidance procedures.

The following are expanded procedures for how to perform a short-field approach and landing compliant with the ACS. Refer to *Profile IV-F-1* for a pictorial representation.



Profile IV-F-1: Short-Field Approach and Landing

1. **Midfield Downwind:** Accomplish the following items by midfield downwind:

   a. **Passenger Seatbelt Notification:** Notifying all passengers to put on their seatbelts prior to landing is required by Part 91. This can be done by telling the examiner, "*We are about to land, please ensure your seatbelt is fastened.*" For details see ***PA.II.B.K1***.

   b. **Radio Calls (*PA.IV.F.S2*):** Make any necessary radio calls in the downwind. At towered airports this may include a position report, if requested, or soliciting a landing clearance. At non-towered airports this will include a position and intent announcement. For details see ***PA.III.B.K1***.

   c. **Clear the Area and Runway (*PA.IV.F.S4*):** Scan downwind, base, and final for any traffic or obstacles such as antennas or powerlines. Scan the runway itself for aircraft and other things such as mowers, ground vehicles, personnel, construction, etc.

   d. **Ascertain Wind Conditions (*PA.IV.F.S5*):** Locate the wind direction indicator on the airport to determine if a crosswind exists. Modify the crab in the downwind as necessary.

   e. **Select Touchdown Point (*PA.IV.F.S5*):** Verify with the examiner what the desired touchdown point is due to its greater importance relative to a normal landing. Three common examples are the threshold markings, runway numbers, and aiming point markings. Threshold markings are 150 feet in length,[2] runway numbers are 60 feet in length,[3] and the aiming point markings are either 100 or 150 feet in length depending on the runway.

   f. **Begin the Before Landing Checklist (*PA.IV.F.S1*):** Accomplish any items possible on the before landing checklist such as advancing the mixture for best power, turning on the auxiliary fuel pump if applicable, or turning carburetor heat on. This can be done as a flow while entering the downwind leg followed by a review of the checklist. For more information regarding checklist use see ***PA.II.B.K2***.

2. **Abeam Threshold:** Accomplish the following items once abeam the landing runway's threshold:

   a. **Throttle Reduction:** Reduce the throttle to an appropriate setting for a constant power approach. For details see ***PA.IV.B.K1***. A common setting in many simple single engine airplanes is 1,500 RPM.

   b. **Extend Flaps to First Setting (*PA.IV.F.S6*):** Extend flaps to the first setting to begin configuring for landing.

   c. **Establish Descent (*PA.IV.F.S6*):** Allow the airplane to naturally pitch down as a result of the power reduction.

   d. **Slow to Approach Airspeed (*PA.IV.F.S7*):** Adjust the pitch attitude to slow to an appropriate approach speed for the present configuration. With the first flap setting, a common approach speed utilized is 1.7 V_{SO} with wind gust factor applied. Details on how to apply wind gust factor are described in ***PA.IV.B.K1***. As an example, with a V_{SO} of 59 knots and wind reported at 15 knots gusting to 20 knots, the approach speed with the first flap setting would be 104 knots.

   e. **Trim for Approach Airspeed:** Once the approach airspeed has been obtained, trim to relieve control forces to maintain this speed.

3. **Base:** Accomplish the following items once established on the base leg:

   a. **Extend Flaps to the Second Setting (*PA.IV.F.S6*):** Extend flaps to the second setting as part of the iterative process to configure for landing. In some airplanes, the second setting may be full deflection.

   b. **Adjust Approach Airspeed (*PA.IV.F.S7*):** Adjust the pitch attitude to slow to an appropriate approach speed for the present configuration. With the second flap setting, a common approach speed utilized is 1.5 V_{SO} with wind gust factor applied. Details on how to apply wind gust factor are described in ***PA.IV.B.K1***. As an example, with a VSO of 59 knots and wind reported at 15 knots gusting to 20 knots, the approach speed with the second flap setting would be 92 knots.

   c. **Trim for Adjusted Approach Airspeed**: Once the new approach airspeed has been obtained, trim to relieve control forces so as to maintain this speed.

   d. **Radio Calls (*PA.IV.F.S2*):** Make any necessary radio calls on the base leg. This is normally restricted to non-towered airports in which a position report should be made. For details see ***PA.III.B.K1***.

   e. **Crab as Necessary (*PA.IV.F.S8*):** Crab as necessary for wind conditions. On base, this normally consists of pointing the nose slightly toward the runway.

4. **Base to Final Turn:** Accomplish the base to final turn when 30 degrees offset of the runway centerline. If a crosswind exists such that a tailwind is experienced while on base, accomplish this turn sooner. If a headwind is experienced while on base, accomplish it later.

5. **Final:** Accomplish the following items once established on final:

   a. **Flaps Fully Extended (*PA.IV.F.S6*):** Accomplish the final flap extension once established on final. Note that this may not be appropriate in some cases, such as high crosswinds when only partial flap extension would be necessary.

   b. **Slow to Final Approach Airspeed (*PA.IV.F.S7*):** Adjust the pitch attitude to slow to the final approach speed for the present configuration. With the flaps fully extended, a common approach speed utilized is 1.3 V_{SO} with wind gust factor applied. Details on how to apply wind gust factor are described in *PA.IV.B.K1*. As an example, with a V_{SO} of 59 knots and wind reported at 15 knots gusting to 20 knots, the approach speed with full flaps would be 80 knots.

   c. **Trim for Final Approach Airspeed:** Once the final approach speed has been obtained, trim to relieve control forces so as to maintain this speed.

   d. **Complete the Before Landing Checklist (*PA.IV.F.S1*):** Once the final flap setting is in place and the airplane trimmed for the final approach speed, complete the before landing checklist. This normally consists of a quick verification of flap setting.

   e. **Radio Calls (*PA.IV.F.S2*):** Make any necessary radio calls on the final leg. This is normally restricted to non-towered airports in which a position report should be made. For details see *PA.III.B.K1*.

   f. **Verify/Confirm Runway (*PA.IV.F.S3*):** Verify/confirm that you are aligned with the correct runway. This can be accomplished by viewing the runway designation markings (runway number) on the pavement while on final. State *'runway ____ verified'* or *'runway ____ aligned'* to signify accomplishing this to the examiner.

   g. **Crab as Necessary (*PA.IV.F.S8*):** Crab as necessary for wind conditions. On final, this normally consists of pointing the nose into the wind if a crosswind is present.

6. **Crossing Obstacle:** Accomplish the following if/when crossing the simulated or actual obstacle:

a. **Throttle Idle:** Reduce the throttle to idle as this is often a required condition for short-field landing performance.

b. **Airspeed 1.3 V_{SO}:** Ensure that the airspeed is at 1.3 V_{SO} as this is often a required condition for short-field landing performance.

7. **Flare and Touchdown:** Accomplish the following during the landing flare and touchdown:

a. **Crosswind Correction (*PA.IV.F.S8*):** Apply any sideslip as necessary if a crosswind is present by banking into the wind and applying opposite rudder.

b. **Flare (*PA.IV.F.S9*):** Ensure the throttle is idle and increase aft elevator pressure to initiate the landing flare. Note that in high crosswind situations, partial power and a reduced flare may be necessary. In order to achieve the selected touchdown point, fly low and level a few hundred feet prior to the runway (if touching down on the threshold markings or runway numbers) before reducing the throttle to idle for touchdown.

c. **Touchdown Attitude (*PA.IV.F.S10*):** Touch down at a nose up pitch attitude on the main landing gear.

d. **Touchdown Point (*PA.IV.F.S10*):** Touch down within 200 feet beyond the selected touchdown point. Identifying whether touchdown occurred at 200 feet beyond the touchdown point is subjective. As mentioned previously, threshold markings are 150 feet in length, runway numbers are 60 feet in length, and the aiming point markings are either 100 or 150 feet in length depending on the runway. Due to each of these markings being just under 200 feet in length, most examiners will consider touching down within or slightly beyond any of these markings as satisfying this requirement.

e. **Airplane Alignment (*PA.IV.F.S10*):** During touchdown, ensure that the airplane's longitudinal axis (in other words the fuselage) is parallel with and directly over the runway's centerline. Ideally, the airplane's nosewheel should roll on the runway centerline. If a crosswind is present, this will require the airplane to be banked into the wind with the use of ailerons and opposite rudder to keep the longitudinal axis aligned with the runway centerline.

8. **Rollout:** Accomplish the following during the landing rollout:

a. **Apply Maximum Braking (*PA.IV.F.S11*):** Begin applying maximum braking immediately after touchdown. Keep in mind that small airplanes are typically equipped with hydraulic or mechanical drum brakes which can "lock up" unlike anti-lock brakes on cars. As a result, caution should be used so as to not lock up the brakes. This can be accomplished by gradually but deliberately increasing pressure on the brakes as the airplane slows. Do not slam on the brakes.

b. Retract Flaps (*PA.IV.F.S11*): If the airplane is equipped with mechanical flaps, retract the flaps completely immediately after touchdown to increase braking effectiveness. If the airplane is equipped with electric or hydraulic flaps, refer to the airplane's POH/AFM for instructions regarding flap use on the rollout, since retraction may be too slow to be beneficial.

c. Aerodynamic Braking: Apply aft elevator pressure once slow enough to further assist in slowing the airplane by utilizing aerodynamic braking.

d. Maintain Directional Control (*PA.IV.F.S8*): Utilize rudder to maintain the nosewheel on the runway centerline during the rollout.

e. Runway Incursion Avoidance Procedures (*PA.IV.F.S13*): Use of runway incursion avoidance procedures during landing includes exiting the runway as quickly and safely as practical. Turn off at the first available taxiway once you are slow enough to make the turn. If performing a touch-and-go, reconfigure the airplane as necessary and advance throttle(s) for takeoff. Do not loiter on the runway.

F. SHORT-FIELD APPROACH AND LANDING
REFERENCES

1 FAA. *Landing distance*. 14 CFR §23.75 Amdt. 23-50. (Washington, DC: U.S. Government Publishing Office, 9 February 1996).

2 FAA. "Standards for Airport Markings." AC 150/5340-1L. (Washington, DC: U.S. Government Publishing Office, 27 September 2013). 81.

3 FAA. "Standards for Airport Markings." AC 150/5340-1L. 18.

AREA OF OPERATION IX

EMERGENCY OPERATIONS

IX. Emergency Operations

A. Emergency Descent

B. Emergency Approach and Landing (Simulated) (ASEL, ASES)

C. Systems and Equipment Malfunctions

D. Emergency Equipment and Survival Gear

This area of operation consists of a set of tasks relating to emergency procedures. Task D is normally evaluated during the preflight inspection while all other tasks are evaluated in flight.

AREA OF OPERATION IX

TASK A

EMERGENCY DESCENT

A. EMERGENCY DESCENT
OVERVIEW

An emergency descent is a maximum rate descent intended to lose altitude as fast as possible at a high airspeed. This will typically be performed once the maneuvers at altitude have been completed as a way to transition to a lower altitude.

Task	***A. Emergency Descent***
References	FAA-H-8083-2, FAA-H-8083-3; POH/AFM
Objective	To determine that the applicant exhibits satisfactory knowledge, skills and risk management associated with an emergency descent. ***Note:*** *See Appendix 6: Safety of Flight.*
Knowledge	The applicant demonstrates understanding of:
PA.IX.A.K1	Situations that require an emergency descent (e.g., depressurization, smoke, and/or engine fire).
PA.IX.A.K2	Immediate action items and emergency procedures.
PA.IX.A.K3	Airspeed, to include airspeed limitations.
Risk Management	The applicant demonstrates the ability to identify, assess and mitigate risks, encompassing:
PA.IX.A.R1	Failure to consider altitude, wind, terrain, obstructions, and available glide distance.
PA.IX.A.R2	Collision hazards, to include aircraft, terrain, obstacles, and wires.
PA.IX.A.R3	Improper aircraft configuration.
PA.IX.A.R4	Distractions, loss of situational awareness, and/or improper task management.
Skills	The applicant demonstrates the ability to:
PA.IX.A.S1	Clear the area.
PA.IX.A.S2	Establish and maintain the appropriate airspeed and configuration appropriate to the scenario specified by the evaluator and as covered in POH/AFM for the emergency descent.
PA.IX.A.S3	Demonstrate orientation, division of attention and proper planning.
PA.IX.A.S4	Use bank angle between 30° and 45° to maintain positive load factors during the descent.
PA.IX.A.S5	Maintain appropriate airspeed +0/-10 knots, and level off at specified altitude, +/- 100 feet.
PA.IX.A.S6	Complete the appropriate checklist.

SITUATIONS THAT REQUIRE AN EMERGENCY DESCENT

K

Knowledge	The applicant demonstrates understanding of:
PA.IX.A.K1	Situations that require an emergency descent (e.g., depressurization, smoke, and/or engine fire).

Examiner: *"What are situations that would require an emergency descent in your airplane?"*

You: *"An in-flight fire."*

The number one situation by far that requires an emergency descent for small general aviation airplanes is an in-flight fire. Although an emergency descent is traditionally associated with depressurization, so few reciprocating general aviation airplanes are pressurized that this is largely only relevant to jets. However, for airplanes equipped with oxygen flying at high enough altitudes, a failure of the oxygen system is another possibility.

A fire requires an emergency descent since time is of the essence. One of three things can occur if the airplane is not landed as soon as possible: structural failure, loss of control, or pilot incapacitation. The high airspeed of an emergency descent also helps to put out an engine or structural fire. For more information regarding in-flight fires see ***PA.IX.C.K3***.

Knowledge	The applicant demonstrates understanding of:
PA.IX.A.K2	Immediate action items and emergency procedures.
PA.IX.A.K3	Airspeed, to include airspeed limitations.

Examiner: *"What is the emergency descent procedure for your airplane?"*

You: *"Throttle idle, bank 45 degrees, and pitch for V_{NE} in smooth air or V_{NO} if it is turbulent. For training purposes, I maintain V_{NO} even if the air is smooth."*

-Cessna 172S

Not all airplanes have emergency descent procedures published in their POH/AFM. This is especially true for airplanes with fixed landing gear. In the absence of published procedures, the following factors should be considered:

1. **Throttle(s) – IDLE:** The throttles should be reduced to idle for a maximum rate descent.
2. **Carburetor Heat – ON:** Carburetor heat should be turned for airplanes with carbureted engines since the throttle will be at idle for a prolonged period of time.
3. **Propeller(s) – MAX RPM:** Airplanes with constant speed propellers should be set to maximum RPM as this will increase drag to help increase the rate of descent.
4. **Speedbrakes – EXTEND:** If the airplane is equipped with speedbrakes, they should be extended to increase the rate of descent.
5. **Landing Gear – AS REQUIRED:** Airplanes with retractable landing gear generally call for extending the landing gear for an emergency descent since this greatly increases drag and therefore the rate of descent without excessively limiting airspeed. Some manufacturers, like Mooney with the M20TN, may even publish the option of performing an emergency descent with the gear extended or retracted. If the airplane is equipped with retractable landing gear but does not have emergency descent procedures published, it is recommended to extend the landing gear and fly V_{LE}.
6. **Flaps – AS REQUIRED:** Some airplanes call for flaps to be partially extended for an emergency descent since flight testing and procedure development by the manufacturer shows that this increases the rate of descent. However, this should only be done if the POH/AFM calls for it, as flaps may limit the maximum airspeed excessively and therefore limit the rate of descent for these purposes. The limiting of airspeed by flaps also hinders the ability to put out an engine or structural fire.

7. **Airspeed – AS REQUIRED:** Fly the airspeed called for in the POH/AFM. In the absence of published emergency descent procedures, the following airspeeds should be considered:

    a. **Never Exceed Speed (V_{NE}):** If the air is smooth and the airplane not limited by configuration (gear or flaps extended), an airspeed up to V_{NE} should be flown.

    b. **Maximum Structural Cruising Speed (V_{NO}):** If it is turbulent and the airplane not limited by configuration (gear or flaps extended), an airspeed up to V_{NO} should be flown.

    c. **Other Airspeed Limited by Configuration:** If the airplane has retractable landing gear and the landing gear is extended, or if the flaps are partially extended, the appropriate V_{LE} or V_{FE} should be flown.

8. **Bank Angle – 30 TO 45 DEGREES:** A bank angle of 30 to 45 degrees helps to maintain positive load factors during the descent as well as to maximize the rate of descent. This is especially true for airplanes with fixed landing gear. It also increases visibility of the ground below to locate a landing spot.

Due to the urgency of an emergency descent, all of the above items should be considered immediate action items and performed from memory. When established in the emergency descent, the checklist can then be referenced to ensure that none of these were missed as well as to accomplish any follow-up items.

Risk Management	The applicant demonstrates the ability to identify, assess and mitigate risks, encompassing:
PA.IX.A.R1	Failure to consider altitude, wind, terrain, obstructions, and available glide distance.
PA.IX.A.R2	Collision hazards, to include aircraft, terrain, obstacles, and wires.
PA.IX.A.R3	Improper aircraft configuration.
PA.IX.A.R4	Distractions, loss of situational awareness, and/or improper task management.

Identifying Risks

Situations necessitating an emergency descent, like a fire, present tremendous distractions that can easily result in a botched forced landing. This can be due to failing to consider altitude, wind, terrain, obstructions, and available glide distance causing a landing in an unsuitable area which results in a collision with terrain, obstacles, or wires. This can also result in the pilot failing to configure the airplane for the final landing, namely extending full flaps to minimize airspeed and therefore crash energy.

In 2013, the pilot and passenger of a Lancair 360 began to smell an electrical burning odor in cruise flight.[1] Smoke then began to stream from the lower center console to the right of the pilot's footwell. The passenger attempted to locate the source of the smoke while the pilot initiated an emergency descent. Shortly before landing, the footwell became engulfed in flames. During the landing flare, the airplane struck a group of trees and collided with a berm. Both occupants were seriously injured. Post-accident investigation determined the cause of the fire to be an exposed wire that came into contact with the airframe resulting in arcing fed by fuel.

In 2020, the pilot and passenger of a Piper PA-46-350P observed the AVIFAN FAIL CAS message followed by smoke in the cockpit.[2] The pilot followed the Electrical Fire checklist including dumping the cabin and turning off the master switch followed by the Emergency Descent checklist which included extending the landing gear. The pilot attempted to land at a nearby airport, but smoke became excessive necessitating an off-airport landing. The airplane ended up landing on an adjacent roadway. Upon landing, the airplane hit a roadway signpost with the right wing and the airplane spun 90 degrees to the right and came to rest with the nose against a roadway guardrail. The occupants were uninjured.

Accidents also occur because the pilot was unable to get on the ground fast enough. In the case of a fire, this can result in structural failure, incapacitation, and loss of control.

In 2019, a pilot was ferrying a Beech 60 that had just undergone an extensive avionics upgrade from KBJC to KFNL.[3] As the pilot neared the destination airport, he reported over the common traffic advisory frequency that he had "an engine out [and] smoke in the cockpit." Witnesses and airport surveillance video showed fire emanating from the right wing. As the airplane turned towards the runway, it entered an uncontrolled rolling descent and impacted the ground near the airport's perimeter fence, killing the pilot. Post-accident investigation found that a fuel line from the fuel pump to a newly installed fuel flow transducer was loose. It is likely that fuel sprayed from the hose onto the turbocharger and ignited. Based on this cause and the fact that the pilot almost made it to the destination airport, it is possible that the pilot tried to stretch the flight to the destination instead of immediately initiating an emergency descent and landing as soon as possible.

Assessing Risks

- **Severity (Catastrophic):** As demonstrated by one of the example accidents, fires or other emergencies necessitating an emergency descent can easily result in fatal accidents.
- **Likelihood:** Whether the pilot initiates an emergency descent and attempts to land as soon as possible for such an emergency, as opposed to loitering, is dependent on pilot training and knowledge of the criticality of such a situation. However, the ability to successfully land out of an emergency descent is also dependent on factors such as the environment and state of the emergency, which is beyond the pilot's control.
- **Example:** For the proposed flight, the pilot has recently completed flight training in advance of their practical test and as a result is aware of the urgency needed to land as soon as possible in the case of a fire, and is familiar with all of the airplane's emergency procedures including memory items. However, since it cannot be known how severe an emergency driving an emergency descent is, likelihood of such as accident is elevated to **remote**. Using the ***Risk Assessment Matrix***, this makes an accident associated with an emergency descent a **serious**-risk item.

Mitigating Risks

The following are risk mitigation measures pertaining to emergency descents:

- If a fire occurs in flight, it must be understood that landing as soon as possible is necessary since structural failure, loss of control, or pilot incapacitation can result. Do not attempt to reach a desired airport that would cost more time.
- Know that emergencies such as a fire present tremendous distractions that make maintaining situational awareness and airplane control extremely difficult. Heightened awareness must be maintained during the descent to locate a suitable landing area, which a bank angle facilitates. Remember to extend full flaps for the final landing to minimize airspeed and therefore crash energy especially if the landing area is unsuitable.
- Be thoroughly familiar with your airplane's emergency procedures associated with an emergency descent. This includes which checklists to follow and any associated memory items.

A. EMERGENCY DESCENT
IN-FLIGHT TASK

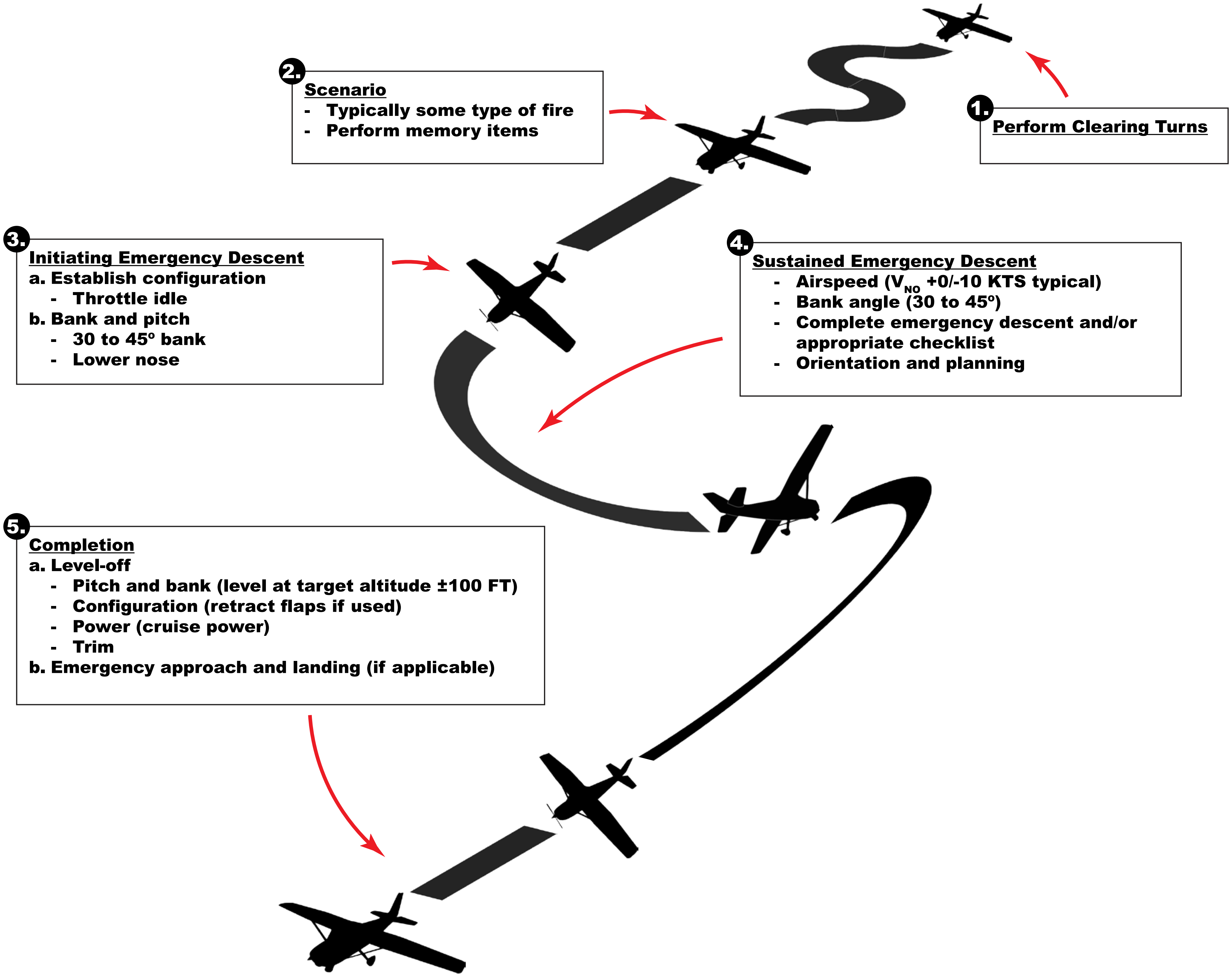
S

Skills	The applicant demonstrates the ability to:
PA.IX.A.S1	Clear the area.
PA.IX.A.S2	Establish and maintain the appropriate airspeed and configuration appropriate to the scenario specified by the evaluator and as covered in POH/AFM for the emergency descent.
PA.IX.A.S3	Demonstrate orientation, division of attention and proper planning.
PA.IX.A.S4	Use bank angle between 30° and 45° to maintain positive load factors during the descent.
PA.IX.A.S5	Maintain appropriate airspeed +0/-10 knots, and level off at specified altitude, +/- 100 feet.
PA.IX.A.S6	Complete the appropriate checklist.

The following are expanded procedures for how to perform an emergency descent compliant with the ACS. Refer to ***Profile IX-A-1*** for a graphical depiction:

A. EMERGENCY DESCENT
IN-FLIGHT TASK

S



Profile IX-A-1: Emergency Descent

A. EMERGENCY DESCENT
IN-FLIGHT TASK

S

1. **Perform Clearing Turns (*PA.IX.A.S1*):** Note that there may not be an opportunity to perform clearing turns if the examiner presents the scenario unexpectedly.
2. **Scenario (*PA.IX.A.S2*):** The examiner will advise of a scenario driving the emergency descent, like a fire. As a result, the checklist for that emergency (i.e. Engine Fire In Flight) should be completed first. See ***Task C*** for details on how to perform this.
3. **Initiating Emergency Descent:** Initiate the emergency descent as follows:
    a. **Establish Configuration (*PA.IX.A.S2*):** Establish the configuration for the emergency descent per manufacturer instructions, or in the absence of manufacturer instructions, a self-developed procedure. See ***Knowledge Element 2***. This will include bringing the throttle to idle at a minimum, but also possibly extending the flaps.

    b. **Bank and Pitch (*PA.IX.A.S4*):** Roll into a 30 to 45 degree bank while lowering the nose to establish the appropriate airspeed in order to maintain positive load factors. A left turn is recommended for improved visibility of the ground.
4. **Sustained Emergency Descent:** While in a sustained emergency descent complete the following:
    a. **Airspeed (*PA.IX.A.S5*):** Maintain the appropriate airspeed (V_{NE}, V_{NO}, or V_{FE}) +0/-10 knots with pitch. For training purposes, V_{NO} should be the maximum speed utilized.

    b. **Bank Angle (*PA.IX.A.S4*):** Maintain a bank angle throughout the descent of 30 to 45 degrees. 45 degrees is preferred, if possible, since a steeper bank angle will result in a higher rate of descent.

    c. **Complete Emergency Descent Checklist (*PA.IX.A.S6*):** If the airplane has an emergency descent checklist, complete it at this time. This will largely be a verification of items already performed.

    d. **Orientation and Planning (*PA.IX.A.S3*):** The majority of the pilot's scan should be outside, looking at the horizon as a pitch reference and the ground for a suitable landing area. Glance briefly at the flight instruments to maintain airspeed and bank angle. Bank angle should be adjusted between 30 and 45 degrees to orient the airplane to a suitable landing area. Note that many examiners have the applicant perform an emergency approach and landing right after this maneuver especially if the engine was shut down due to a fire. This is discussed in step 5.

5. **Completion:** The emergency descent can be completed in one of two ways, a normal level-off or an emergency approach and landing:

   a. **Level-Off (*PA.IX.A.S5*):** Perform a level-off if advised by the examiner:

      i. **Pitch and Bank:** Roll out and pitch up to maintain the target altitude specified by the examiner ±100 feet.

      ii. **Configuration:** If flaps were used, retract them while pitching for straight-and-level flight.

      iii. **Power:** As airspeed decelerates to cruise, advance the throttle to the cruise power setting.

      iv. **Trim:** Trim for straight-and-level flight.

   b. **Emergency Approach and Landing:** Since the scenario driving the emergency descent is often a fire (namely an engine fire requiring the engine to be shut down), many examiners will advise when the fire has been put out as a trigger to proceed with an emergency approach and landing. See ***Task B*** for how to proceed with this.

A. EMERGENCY DESCENT
REFERENCES

1 NTSB. Aviation Accident Final Report. Accident No. WPR13LA122. 29 August 2013.
2 NTSB. Aviation Accident Final Report. Accident No. CEN20LA058. 9 March 2022.
3 NTSB. Aviation Accident Final Report. Accident No. CEN19FA143. 19 May 2020.

APPENDICES AND ADDENDA

APPENDICES AND ADDENDA

Appendices expand on pertinent information referenced throughout this book. Addenda contain information that has recently changed, which permits for rapid deployment of revisions. Over time addenda will be integrated back into the main body of the book in the appropriate location.

1. Risk Assessment Matrix

APPENDIX 1

RISK ASSESSMENT MATRIX

1. RISK ASSESSMENT MATRIX

The following risk assessment matrix is referenced in all risk elements throughout this book:

Likelihood	Severity			
	Catastrophic	Critical	Marginal	Negligible
Probable	High	High	Serious	Medium
Likely	High	Serious	Medium	Low
Remote	Serious	Medium	Low	Low
Improbable	Low	Low	Low	Low