NAVAL AIR TRAINING COMMAND

NAS CORPUS CHRISTI, TEXAS CNATRA P-1301

FLIGHT TRAINING INSTRUCTION

NAVAL INTRODUCTORY FLIGHT EVALUATION

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FLIGHT TRAINING INSTRUCTION

FOR

NAVAL INTRODUCTORY FLIGHT EVALUATION

P-1301

LIST OF EFFECTIVE PAGES

Dates of issue for original and changed pages are:

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 170 CONSISTING OF THE FOLLOWING:

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INTERIM CHANGE SUMMARY

The following Changes have been previously incorporated in this manual:

CHANGE NUMBER	REMARKS/PURPOSE

The following interim Changes have been incorporated in this Change/Revision:

INTERIM CHANGE NUMBER	REMARKS/PURPOSE	ENTERED BY	DATE

INTRODUCTION

COURSE OBJECTIVE:

Upon completion of this course, students will have been introduced to military procedural based aviation training with a light single engine land aircraft, including takeoff and landing phases. This course will assess aeronautical adaptability and prepare students for follow-on aviation training and their future responsibilities as military officers.

STANDARDS:

Conditions and standards are defined in CNATRAINST 1542.178 series.

INSTRUCTIONAL PROCEDURES:

1. This is a flight training course and will be conducted in the aircraft.

2. The student will demonstrate a functional knowledge of the material presented through successful completion of the flight maneuvers.

INSTRUCTIONAL REFERENCES:

1. Pilot Operating Handbook.

2. Local Standard Operating Procedures Instruction.

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CHAPTER ONE
INTRODUCTION TO NAVAL INTRODUCTORY FLIGHT EVALUATION

100. INTRODUCTION

Congratulations on your commencement of NIFE training. Your hard work and determination has earned you the unique opportunity to become part of the most elite team of aviation warriors in the world today. The United States Naval Aviator, Naval Flight Officer, and Air Vehicle Operator are highly trained professionals. The tremendous level of skill demanded by the naval air community can only be obtained through total dedication and sustained maximum effort. It is imperative that every student completely apply themselves. Anything less than your best effort is unacceptable. Best of luck in your endeavor to earn your "Wings of Gold."

This Flight Training Instruction (FTI) is a Naval Air Training Command directive published by Chief of Naval Air Training (CNATRA). The information and instructions are relative to all instructors and students operating aircraft in the Naval Introductory Flight Evaluation (NIFE) Phase of training. It is very important that the factual material contained herein be thoroughly studied and retained.

The process by which a student is transformed into a skilled Naval Aviator, Naval Flight Officer, or Air Vehicle Operator is both complex and demanding. It can be accomplished only by intensive instruction in the air as well as in the classroom. For the most part, success depends upon the student’s attitude, cooperation, and attention to detail. The degree of skill attained by students depends largely upon their ability to understand new material and to work hard. Those students who cannot measure up to the high standards required throughout the various phases of training, due to either their lack of motivation or ability, must and will be attrited.

This FTI does not contain all the information necessary for a student pilot to become a professional aviator. Rather, this instruction provides a focal point and reference manual for all other sources of technical information, outlining and amplifying the flight procedures where necessary. This manual is designed as a training tool and is not meant to establish policy counter to civilian Federal Aviation Administration (FAA) regulations or notices. This FTI is designed as a technical manual to introduce basic pilot skills, knowledge, and procedures that are the essential skills for piloting airplanes during NIFE. The majority of information for this FTI is derived from FAA-H-8083-3B, “The Airplane Flying Handbook” (AFH). For further information on any of the topics covered in the FTI, please refer to the additional information references in each section.

Topics such as navigation and communication, meteorology, use of flight information publications, regulations, and aeronautical decision making are available in other Federal Aviation Administration (FAA) publications as well as limited information in your student guides. FAA publications can be found online at:
http://www.faa.gov/regulations_policies/handbooks_manuals/aviation/

Occasionally the word “must”, “shall”, or similar language is used where the desired action is deemed critical. The use of such language is not intended to add to, interpret, or relieve a duty imposed by Title 14 Code of Federal Regulations (14 CFR).

In addition to 14 CFR Part 61 and Part 91, some specific manuals, handbooks and other documents are referenced in the NIFE FTI including: Aeronautical Information Manual (AIM), Aerodynamics for Naval Aviators (ANA), CNATRA P-764 T-6 FTI (http://www.cnatra.navy.mil/pubs/ppub_t6b.htm), FAA-8083-25A, Pilot's Handbook of Aeronautical Knowledge (PHAK), Runway Incursion Avoidance (PHAK App1), FAA-H-8083-27A Student Pilot Guide (SPG), FAA-AC90-42F Traffic Advisories at Non-towered Airports (Traffic Advisory AC), FAA-AC90-48D Pilot's Role in Collision Avoidance (Collision Avoidance AC), FAA-AC90-66A Traffic Patterns at Non-Towered Airports (Traffic Pattern AC), OPNAV 3710.7 (series) General NATOPS (3710), Pilot Safety Brochures: http://www.faa.gov/pilots/safety/pilotsafetybrochures/

If a conflict exists between this document and Title 14 of the Code of Federal Regulations, the Aeronautical Information Manual, or any FAA document, those sources take precedence over the FTI. Much of the FTI is verbatim from FAA-8083-25A. Where differences in technique/practice are encountered, use sound judgment in order to meet the intent of the training program.

101. SCOPE OF INSTRUCTION

So far as is practical, all information and instructions governing NIFE aircraft procedures and the execution of curriculum maneuvers will be published for inclusion in this manual. Procedures peculiar to Naval Aviation Schools Command (NASC) may be found in the Standard Operating Procedures instruction and/or standardization notes.

Terms that would ordinarily be included in a glossary for NIFE training are defined as they are used throughout the text.

1. **Learning Objectives.** The course objective is broken down into Stage (Terminal) Learning Objectives (TLO). TLOs are further broken down into Enabling Learning Objectives (ELO). These are designed to be smaller, bite-sized chunks of the overall objective.

2. **Enabling Objectives, Maneuvers and Exercises.** Each event in this stage is comprised of various tasks the student will have to perform. Examples include performing a stall on a contact flight, reciting an emergency procedure during a lecture, or answering a test question correctly in an end-of-course exam. The NIFE syllabus and FTI break down each of these tasks in detail.

The maneuvers or other items that you will perform on the events may be graded or nongraded. This means that the particular item may or may not be used to compare you to course training standards. This does not mean that the instructor may not evaluate a nongraded item. The student is just as responsible for a demo (nongraded) item as for a graded item. Lack of preparation for either warrants an unsatisfactory grade. Unsatisfactory grades are cumulative throughout the Naval Aviation training. Any unsat grades earned in NIFE will still be with you in (the more difficult) Advanced phase of training.

3. **Headwork/Situational Awareness.** Headwork can be thought of as the combined effect of perception, comprehension, analysis, and judgment of multiple factors in a given situation. Headwork is often called “good judgment.” Naval aviation defines situational awareness (SA) as “the degree of accuracy by which one’s perception of current environment mirrors reality” (CNAF 1542.7). SA is what can inform a pilot that a bad situation is developing; headwork is the good judgment he or she uses to improve or avoid the situation. However they are explicitly defined, headwork and SA are the two of the most critical skills a pilot must possess. Headwork/SA will be graded on every event in flight training. It is an assessment of the student’s ability to correctly perceive all the factors in a given situation, assess the current and future priority as well as the relevancy of those factors, and then decide the best course of action.

4. **Pilot in Command Responsibilities.** The pilot in command (PIC) is ultimately responsible for all aspects of safely operating and piloting an aircraft, including the lives of the crewmembers and passengers As described in 14 CFR 91.3 and 14 CFR 91.103:

a. The pilot in command of an aircraft is directly responsible for, and is the final authority as to, the operation of that aircraft.

b. In an in-flight emergency requiring immediate action, the pilot in command may deviate from any rule of this part to the extent required to meet that emergency.

c. Each pilot in command shall, before beginning a flight, become familiar with all available information concerning that flight

The PIC is responsible for knowing and doing everything required to safely operate the aircraft, including the safety of the other crewmembers and passengers.

102. CURRICULUM RESOURCES

1. **Naval Introductory Flight Evaluation Master Curriculum Guide (MCG)**

CNATRAINST 1542.178A. This pocket guide is the curriculum outline. It describes what each student will do during the NIFE phase of training. The maneuvers and exercises in the syllabus are described, as well as the standards of performance to be achieved. Each event lists all of the maneuvers to be performed.

2. **Flight and Academic Training Instructions.** These are called "peculiar to aviation training" (PAT) pubs and are produced by CNATRA specifically for each of its curricula. These PAT pubs describe the various maneuvers and exercises the student will be required to perform, and list any additional pubs or study material that the student may need to reference for an event. The student is responsible for all material listed in these training instructions. It is every student’s responsibility to be thoroughly familiar with the contents of this manual. Strict adherence to the manner of execution of maneuvers, patterns, procedures and instructions herein promulgated is mandatory for all instructors and students operating NIFE aircraft.

3. **CNATRAINST 1500.4 (TA Manual) and the Aviation Training Jacket (ATJ).** CNATRAINST 1500.4 is commonly referred to as the Training Administration (TA) manual. The TA manual is Student Control's guide to handling its students. Normally, those areas of the TA manual for which the student is responsible will be outlined to the student upon check in. Such student responsibilities always include obtaining jacket reviews, ensuring Aviation Training Forms (ATF) make their way to the ATJ, and updating the calendar card. These responsibilities should not be taken lightly. The responsibility (or lack thereof) that a student displays with these administrative details can be a direct indication of how seriously a student applies them self to an aviation training program.

4. **Aviation Training Forms.** These are records of the training events that take place for a student. They also record the instructor's evaluation of student performance. These are permanent, official documents that remain in the student's jacket forever. They are never removed or altered by anyone except under very special circumstances listed in the TA manual. Any student who alters or removes an ATF from a jacket will be subject to attrition under the provisions of the TA manual.

103. USE OF FLOWS, CHECKLISTS, AND PROCEDURES

To aid in learning, standardization and safety, NIFE will use a combination of flows, checklists, and procedures to execute ground operations and flight maneuvers. In general, flows backed up by checklists will be utilized for ground operations when the pilot can safely pull out the approved or manufacturer's checklist to ensure all required steps have been accomplished. Memorized procedures will be utilized when the pilot should be primarily focused on control of the aircraft when executing maneuvers or in the traffic pattern where collision avoidance, proximity to terrain, and safe, precise control of the aircraft are paramount. Where an inflight checklist and a procedure exists for a maneuver or evolution, the procedure will be executed and backed up with the checklist at the appropriate time. **With respect to procedures, to "know" is to perform from memory (step by step, though not necessarily verbatim) each action of the procedure.** Some items and many Emergency Procedures (EPs) are listed in **Boldface** or with asterisks next to them. These items are memory items, and **shall be memorized verbatim** with the student able to recall and apply any of these procedures correctly to the appropriate aircraft malfunction.

1. **Checklists.** Checklists have been the foundation of pilot standardization and cockpit safety for years. The checklist is an aid to the memory and helps to ensure that critical items necessary for the safe operation of aircraft are not overlooked nor forgotten. The importance of consistent use of checklists cannot be overstated in aviation training. The student must understand the importance of checklists and their role in aviation safety. Checklists listed below are expected to be executed step-by-step using the checklist (not memorized):

   a. Preflight Inspection

   b. Before Starting Engine

   c. Starting Engine

d. Before Taxi

e. Taxi

f. Run-up

g. Line-up

h. After Landing

i. Securing

Checklists listed below are expected to be executed by memory, then verified correct when the airplane is in a safe position and time allows:

j. Climb

k. Cruise

l. Pre Maneuver

m. Descent

n. Before Landing

2. **Flows.** The purpose and goal of executing a flow is the expeditious and precise execution of tasks in a logical order. A standard visual flow around the aircraft or through the cockpit will be executed from memory. After executing the flow, the appropriate checklist will be expeditiously read “out loud” from the approved or manufacturer’s checklist, confirming that all steps have been completed. Occasional minor omissions/mistakes in executing the flow are acceptable. However, relying on the checklist to execute the flow is below NIFE standards.

3. **Procedures.** Like all phases of flight training, NIFE is a fast-paced program. The use of standard procedures, executed from memory is a key enabler to the successful and safe execution of the NIFE program. If the procedures are successfully committed to memory, the student can then focus on other things while performing high-workload maneuvers, accelerating development of headwork/SA, and mastery of basic piloting skills.

104. ACADEMIC/FLIGHT SUPPORT TRAINING

The terminal objective of flight support training and academics is to provide the student with the basic knowledge and skills directly applicable to satisfactory progression in NIFE aircraft flight training. Upon completion of the academic and flight support activities, the student will be capable of relating these acquired cognitive skills and applying them during flights, thus developing the motor skills and headwork necessary to meet CNATRA standards to complete NIFE training.

105. STANDARDS OF PERFORMANCE

1. **Standardization.** Flight instruction must be highly standardized. The current syllabus is the result of constant evolution, and the procedures taught are from lessons learned over the course of many years. The FTI, Pilot's Operating Handbook (POH) and NIFE Aircraft Checklists define the standard way of executing specific maneuvers. Adherence to these standards will be a part of any instructor's evaluation of student performance. Occasionally, a student may question a particular instructor's technique, or think that an instructor is incorrect. There is no time for protracted discussion or debate in the air. If an instructor's request is unclear to the student, the student must request clarification. If, however, the student feels that the instructor's methods contradict the standardization documents, he should consult the NIFE Director or NIFE Chief Flight Instructor on the appropriate way to address the issue. In any event, when the student feels that flight safety is in jeopardy, he is bound to request a Training Time Out (TTO) to obtain clarification. Training Time Out is defined in section 108 of this publication.

The standard flight procedures employed in the training syllabus are universal to all Navy aircraft, except when slight deviations have been adapted in the interest of flight safety.

Maximum utilization of instructor/aircraft time demands a thorough knowledge of the flight training instructions and referenced publications by both the flight student and instructor. The time designated for the pre-flight briefing is equally limited and demands that both student and instructor have a complete knowledge of the material to be covered in preparation for the flight. Briefing time should be for review of previous difficulties, clarification of misunderstandings, and immediate flight planning. It is essential that the instructor and student have a common understanding of the maneuvers to be flown and employ the same nomenclature in order to take full advantage of the time afforded.

2. **Grades.** The adage is that if you worry about learning, the grades take care of themselves. The truth is that one should be trying to perform to the best of his or her ability at all times. Grades are designed to do two things: compare performance to a set standard or criterion; and contrast performance of individuals within the same curriculum.

There is little to be gained by stressing over grades. The nature of flight training is such that if one misses a step, it is very difficult to catch up. The syllabus is designed to give the average student sufficient time and opportunity to complete the objectives. When it becomes apparent to an instructor that objectives are not being met, or the student is having difficulty, the student's grades will reflect this. The student should not take grades as a personal affront. The instructor should make every effort not only to critique the student, but also to give the student the information required to perform the exercise or maneuver in an acceptable manner. The best instructors are not those who give the best grades, but those who best prepare the students for their next flight. Students should concentrate on correctly performing the maneuvers of the next event, and meeting the stage and phase objectives. Students who are able to do this are successful in the Naval Air Training Command.

3. **Check Flights.** The student should place no special significance on designated check flights and should not anticipate failure if a superlative performance is not demonstrated. The designated check flight is merely a validation by another instructor of the evaluations previous instructors have given to the student. If a student fails to meet the accepted standards of progress, the instructor will grade the student's performance unsatisfactory rather than allow the student to complete the syllabus. The check pilot is obligated to judge the student fairly in comparison with accepted standards.

106. THE FLIGHT INSTRUCTOR

The flight instructor is an experienced aviator, civilian or military, trained to provide the student with a sound foundation in the operation of the aircraft. Civilians are Certified Flight Instructors (CFI) contracted by the Navy to provide flight instruction. They are also responsible for standardization. If you notice a nonstandard maneuver, bring it to the attention of the NIFE Director or NIFE Chief Flight Instructor. Military Flight Instructor pilots are commonly referred to as MFIs or IPs (Instructor Pilots). MFIs have undergone a training course similar to the student's syllabus, which familiarizes them with the curriculum maneuvers and teaches an effective means of presenting them. This training comes under the heading of standardization. The intent of standardization is to provide the instructor with a logical, effective, and consistent foundation upon which to present any maneuver. This in turn ensures that all students can be judged on the same basis, each having been exposed to the same material and afforded an equal opportunity to demonstrate their abilities. No two instructors will be identical in their techniques and each may vary his presentation to fit the needs of the individual student.

In order to teach you to fly NIFE aircraft properly, the instructor must be honest and critical. The comments on your performance of the various maneuvers are intended to improve your understanding. All criticism by the instructor is meant to be constructive in character. The instructor's sole intent is to instill confidence and develop you into a qualified aviator. If you have questions about procedures or concepts, ask them. Knowing procedures, both for normal and emergency operations, cannot be overemphasized! They must be over-learned so that they can be recalled in flight, especially during periods of high cockpit workload and stressful situations.

107. THE STUDENT

The qualifications to become a SNA, SNFO, or SAVO are high. The student has been selected for flight training by a screening process that determines superiority over the average American with respect to physical condition, intelligence, ability to grasp and retain new ideas, and apparent emotional stability. Superior reasoning ability enables the student to combine these talents into experience that will produce a qualified aviator. One critical factor of success, which cannot be accurately evaluated by the normal selection process, is mental attitude. Mental attitude, as much as any other factor, determines the ease or difficulty with which the student progresses through the training syllabus. Under the heading of positive mental attitude come such elements as willingness to conform to military discipline, acceptance of curtailed personal freedom and leisure, and the resiliency to encounter occasional reverses and still maintain enthusiasm and self-confidence.

Flying is a highly physical attribute and, like many other acts of a physical nature, is mostly a matter of coordination of hands, feet, and eyes. As far as controlling the attitude and performance of the aircraft is concerned, the elementary methods of flying are not at all difficult to master. However, as it is performed in an environment to which you will not be accustomed, you may experience some difficulty adapting to the airborne classroom. With your instructor's patience and your own hard work and alertness, the readjustment required will occur naturally and you will find that the NIFE aircraft are one of the most enjoyable classrooms in the world. Every student should remember these guidelines when managing his training program.

- Your flight instructor wants you to learn to be a professional aviator. If in doubt, ask questions and use your flight instructor to help you through problem areas.

- Preparation is key to professionalism. Do not be satisfied with only knowing enough to complete the event. NIFE has a direct transference to all future training.

Remember one important thing for as long as you fly an aircraft: You must be your own most aggressive critic. This does not mean that you become a "mental case" in the cockpit.It does mean that as an aviator beginning the flight training syllabus, you must demonstrate one of the most critical qualities of a professional aviator: self-discipline. Prepare for every hop as if your professional reputation is at stake. Your flights are not contests where someone is keeping score and counting your mistakes. Your flight grades should not be as important as your own honest assessment of your flight performance. You are expected to come well prepared, but expect to make mistakes. Most of these mistakes are forgiven as long as you deal with them professionally and learn from them. That is why it is called this flight training.

108. TRAINING TIME OUT

CNATRAINST 1500.4 (series) defines the conditions under which a Training Time Out (TTO) may be requested. A TTO may be called in any training situation whenever a student or instructor expresses concern for personal safety or a need for clarification of procedures or requirements exists.

The intent of TTO is to give students and instructors the means to stop a flight if they are not "communicating" or if either party feels they are in an unsafe position. It will not be used to terminate a flight just because you are having a bad day or do not know your procedures. Nevertheless, do not be hesitant to use TTO if you feel the flight conditions warrant it.

109. CREW RESOURCE MANAGEMENT

The "Human Error" factor or inadequate Crew Resource Management (CRM) is the single leading causal factor for Class A mishaps in modern naval aviation. Human factors are the sum of all the elements that affect a pilot's aviation decision making. They include external factors and internal factors that directly or indirectly affect the flight. As defined in OPNAVINST 3710.7, CRM describes the use of "specifically defined behavioral skills as an integral part of every flight to improve mission effectiveness by minimizing crew preventable errors, maximizing crew coordination, and optimizing risk management." It includes all crew members, equipment, and external factors involving the flight from before the flight brief to after the flight debrief. The student will receive extensive training on Human Factors, Operational Risk Management (ORM), and CRM during flight training and as a fleet aviator.

During Primary, you will be provided with both ground and flight CRM training. Since research and development began in 1991, the CRM program and its seven skills have become fully integrated into all aspects of naval aviation and are governed by CNAFINST 1542.7 (series). With the instructor/student relationship required by the nature of Primary flight training, it is imperative that both instructors and students actively practice good CRM to ensure that safety is maintained at all times. This should not preclude the instructors from ensuring students are able to perform as single-pilots, but should provide guidance to maintain safety in the cockpit.

Concepts that degrade aircrew coordination:

Sandbag Syndrome. The sandbag syndrome is based on a comforting premise that one or more other crew members have the situation under control and are looking out for your best interest. It is a direct breakdown of CRM skills such as: leadership, assertiveness, and situational awareness. The sandbag syndrome is mainly experienced at certain times when the instructor pilot has assumed flying duties, such as breaks in training, approaches, enroute transits, etc. This effectively results in the student being "along for the ride." It is important to remember that no pilot is above the momentary lapse of judgment or situational awareness that could result in a flight violation or mishap. Do not let this happen to you! As a copilot, your primary responsibility is to support and back up the pilot at the controls.

Stay alert and be assertive when necessary. The instructor/student relationship often fosters reluctance on the part of the student to confront the IP. Remember, do not let misplaced professional courtesies stand in the way of maintaining safe and efficient flying practices.

Excessive Professional Courtesy: In general, we are hesitant to call attention to deficient performance in others, particularly if they are senior to us. Thus, even when one crewmember does point out performance which is outside established parameters, it is typically done with very little emphasis. Instead of stating, "Sir/Ma'am, you're a little fast," or "a little low," use assertive specifics such as "I show our airspeed 15 knots fast" or "I show our altitude 225 feet low."

Strength of an idea/channelized attention: Strength of an idea can be defined as an unconscious attempt to make available evidence fit a preconceived situation. Once a person or group of people gets a certain idea in their head(s), it is difficult or impossible for them to alter the idea no matter how much conflicting information is received. Avoid channelized attention or a closed-minded attitude which might allow a serious threat to the mission without any awareness on the part of the crew. In a highly stressful situation, it is even more important we do not focus our attention or become channelized on only one area.

Sudden Loss Of Judgment (SLOJ): SLOJ is a condition in which an individual's decision-making abilities become impaired. Even the most capable and experienced crews are susceptible to this condition. It is generally precipitated by a real or perceived pressure to perform or by

workload or stress-related issues.
Halo Effect: The halo effect comes into play when the aircrew is impressed by the vast experience of a senior person. They tend not to speak up about problems they see, even though they may have more experience on that type of aircraft or particular mission. Sometimes the senior person involved is aware of this effect and even attempts to use it to his/her advantage.

Hidden Agenda: Sometimes a crewmember may make suggestions or decisions based on information or desires the rest of the crew are not aware of, such as a strong desire to make it back to base due to important plans for the evening. We need to communicate all motives involved honestly so decisions can be made rationally and are based on the facts rather than on wishful thinking. Additionally, there may be instances where a crewmember fails to share certain information about his/her intentions regarding the completion of a particular maneuver, task, or mission in order to prevent objections and confrontation from other crewmembers.

<u>Concepts that aid aircrew coordination:</u>

Two-Challenge Rule: The two-challenge rule provides for automatic assumption of duties from any crewmember who fails to respond to two consecutive challenges. This overcomes our natural tendency to believe the pilot flying must know what he/she is doing, even as he/she departs from established parameters.

Most Conservative Response Rule: Occasionally there is a disagreement in the cockpit which cannot be resolved due to lack of information. It is best to agree in advance to take the most conservative action in these situations until additional information is available.

Assertive Statement: The assertive statement is a non-threatening method by which a crewmember can directly communicate concerns about a situation with which he/she is uncomfortable. An example of an assertive statement is “time out,” or “knock it off,” or “this is stupid.” After getting the attention of the other crew member(s), you should state your concern and then offer a solution.

Positive transfer of control of the aircraft: A most important flying safety requirement is a clear, positive understanding at all times of who has control of the aircraft. You must understand the procedures involved in transferring control of an aircraft.

The instructor will tell you over the intercommunications system (ICS), “I have the controls.” When your instructor says, “I have the controls,” you acknowledge by stating over the ICS, “You have the controls.” You then take your hands and feet off the controls. Your instructor will then confirm control by saying, “I have the controls.” Conversely, but in the same manner, when your instructor wants you to fly, he/she will say, “You have the controls,” whereupon you will take control and acknowledge over the ICS, “I have the controls.” The instructor will then complete the exchange with another, “You have the controls.” Understand that unless you and the instructor complete the 3-way exchange of controls, no exchange of control was made. For example, your instructor may coach or aid your flare during a landing. You may feel a presence on the control stick, but you are still flying and should continue to do so. Never be in doubt as to who is flying; if you are not absolutely sure, safety dictates you speak up and ask!

Radio/ICS Communications: Proper radio communication is extremely important to safety. Your communication will be inside the aircraft with your instructor over the Intercom System (ICS), and also outside of the aircraft with controlling agencies like ground, tower, and departure/arrival control. You must read and learn the contact radio procedures in the Voice Communications FTI prior to your first flight.

110. PHYSICAL/PSYCHOLOGICAL FACTORS

"I'm Safe" Checklist. External human factors refer to all the external happenings in a pilot's life that are not directly related to the safe operation of the aircraft. Throughout the course of NIFE, you have the responsibility to examine your personal external human factors and determine if they are affecting your ability to safely operate the aircraft. An example of an external human factor would be the serious illness of a family member. This situation would distract your mental attention from safely operating the aircraft. With experience, you will learn to compartmentalize external human factors, to train your mind to concentrate on safe execution of the task at hand, and then return your mental attention to the external factor once the mission is completed. This takes time and practice. For NIFE, you are required to inform your instructor that you have external factors that will interfere with your ability to focus your full attention on the mission at hand. Your instructor's experience will help the instructor/student team determine if the flight can still be safely executed or if the scheduled event should be postponed. As a rule, good aircrew coordination begins with the individual crew member. Our situational awareness resources might be lacking before we even set foot in the cockpit. Unfortunately, we do not have external readouts telling ourselves when they are diminished; therefore, it is important that every pilot conduct a daily personal preflight prior to each flight. "I'M SAFE" is a simple checklist to determine if we are ready and fit to fly. Do not show up for a brief without first conducting a personal preflight.

I – Illness (Do you feel well?)

M – Medication (Are you feeling any effects of medications taken?)

S – Stress (Are there any adverse stresses in your life to distract you?)

A – Alcohol (Are you free of all effects of alcohol consumed?)

F – Fatigue (Are you well rested?)

E – Eating (Did you eat properly before flying?)

Physical ease and relaxation while flying makes the difference between the pilot flying the plane and the plane flying the pilot. A proper sense of "feel" of the aircraft is essential. Just as a good horseman must be sensitive to the movements of his mount, so must the aviator be sensitive to the movements of the airplane. This innate sense cannot be achieved in any other way than by the proper relaxation of all the body muscles and light touch on the aircraft's controls. The art of being relaxed in an airplane involves an awareness of what your body and mind are doing. A natural reaction to the strange environment or unusual situation is the age-old aviator tendency to "pucker" in a tight situation. Be alert for involuntary tensing of the muscles and you will quickly develop that sought-after "feel" and avoid the hard-to-break habit of mechanical flying. An important aspect of developing this sense of "feel" is knowing what you are going to do at all times and be prepared for the next evolution in your flight training. This is nothing more than knowing your **PROCEDURES**. Remember the panic in your school days when you were handed a test and it suddenly dawned on you that you had not studied, or what you had studied was not on the test?

Confidence in your aircraft, your instructor, and most importantly yourself, is another essential element of flying. The basic ingredient to acquiring the confidence necessary to professionally pilot an aircraft is knowledge and efficient analytical application of that knowledge. The aircraft you are flying has been engineered to provide you with every safety feature known to the industry. The risks beyond the control of the pilot are minimal. Fire is an extremely rare occurrence. Engines are inherently reliable. In-flight collisions are rarities that are completely avoidable if you stay alert. With the above points in mind, it is readily apparent that the chance of an aviation accident caused by anything other than incompetence, disobedience or poor judgment is remote. Remember that most fatal accidents are due to pilot error. With all this going for you, do not let human frailty or overconfidence develop, particularly while your experience is limited. The instant that a pilot begins to lose that feeling of respect due an aircraft, he has reached a stage when anything can happen and usually does. Good pilots are never caught unprepared in an emergency situation. They know and understand emergency procedures ***COLD!*** Humble confidence and perseverance will go a long way in striving for those “Wings of Gold”.

111. FLIGHT PREPARATION

You won’t always have a formal training device at your disposal to prepare for your flights. “Chair flying” or “hangar flying” is an excellent way to prepare at home, preferably with a classmate. Strap your checklist on your knee, grab a simulated control yoke and mentally accomplish each segment of your imaginary flight. Visualize each procedural step of your planned maneuvers and verbalize your radio calls. “Chair flying” is a skill in itself and can reap major rewards in all phases of your training and throughout your career.

Before you climb into the NIFE aircraft for the first time, you will have practiced the use of checklists and some procedures several times during ground training events in a NIFE aircraft. Practice will pay off with better grades, increased self-confidence, and more professional performance.

CHAPTER TWO
FUNDAMENTAL FLIGHT CONCEPTS

200. INTRODUCTION

Prior to your first flight, there are several fundamental topics that you should understand if you are to obtain maximum benefit from your NIFE training. These topics include not only basic aerodynamics, but also certain principles pertaining to safety of flight. Basic aerodynamic theory and fundamentals of flight will be covered during academic ground school, and not replicated here. Concepts such as performance, stability, and control can be explored further by referencing your ground school notes, the AFH, ANA, and other publications.

This section discusses and explains the fundamental flight maneuvers upon which all flying tasks and procedures are based. In learning to fly, as in any learning process, fundamentals must be mastered before the more advanced phases can be learned.

201. STABILITY AND CONTROL

1. **Effects and Use of the Controls**. When the control surfaces are manipulated, the pilot should always consider the center of movement of the airplane, or the reference point from which the movements of the airplane are judged and described.

The following will always be true, regardless of the airplane's attitude in relation to the Earth.

a. When back pressure is applied to the elevator control, the airplane's nose rises in relation to the pilot.

b. When forward pressure is applied to the elevator control, the airplane's nose lowers in relation to the pilot.

c. When right pressure is applied to the aileron control, the airplane's right wing lowers in relation to the pilot.

d. When left pressure is applied to the aileron control, the airplane's left wing lowers in relation to the pilot.

e. When pressure is applied to the right rudder pedal, the airplane's nose moves (yaws) to the right in relation to the pilot.

f. When pressure is applied to the left rudder pedal, the airplane's nose moves (yaws) to the left in relation to the pilot.

The controls will have a natural "live pressure" while in flight in that they will remain in neutral position of their own accord if the airplane is trimmed properly. With this in mind, the pilot should be cautioned never to think of movement of the controls, but of exerting a force on them against this live pressure or resistance. It is the duration and amount of the force exerted on them that maneuvers the airplane.

Since the airspeed will not be the same in all maneuvers, the actual amount the control surfaces are moved is of little importance. Nevertheless, it is important that the pilot maneuver the airplane by applying sufficient control pressure to obtain the desired result, regardless of how far the control surfaces are actually moved.

The controls should be held lightly, with the fingers, not grabbed and squeezed. Pressure should be exerted on the control yoke with the fingers. A common error in beginning pilots is a tendency to "choke the controls." This tendency should be avoided as it prevents the development of "feel," which is an important part of aircraft control.

The pilot's feet should rest comfortably against the rudder pedals. Both heels should support the weight of the feet on the cockpit floor with the ball of each foot touching the individual rudder pedals. The legs and feet should not be tense; they must be relaxed just as when driving an automobile. When using the rudder pedals, pressure should be applied smoothly and evenly by pressing with the ball of one foot. Since the rudder pedals are interconnected, and act in opposite directions, when pressure is applied to one pedal, pressure on the other must be relaxed proportionately. When the rudder pedal must be moved significantly, heavy pressure changes should be made by applying the pressure with the ball of the foot while the heels slide along the cockpit floor.

2. **Trim Control.** The airplane is designed so that the primary flight controls (rudder, aileron, and elevator) are streamlined with the non-movable airplane surfaces when the airplane is cruising straight-and-level at normal weight and loading. If the airplane is flying out of that basic balanced condition, one or more of the control surfaces will have to be held out of its streamlined position by continuous control input. The use of trim tabs relieves the pilot of this requirement. Proper trim technique is a very important and often overlooked basic flying skill. An improperly trimmed airplane requires constant control pressures, produces pilot tension and fatigue, distracts the pilot from scanning, and contributes to abrupt and erratic airplane attitude control.

Because of their relatively low power and speed, not all light airplanes have a complete set of trim tabs. Most have elevator trim and some have rudder trim available to the pilot. The elevator should be trimmed first to relieve the need for control pressure to maintain constant airspeed/pitch attitude. Attempts to trim the rudder at varying airspeed are impractical in propeller driven airplanes because of the change in torque correcting offset of the vertical fin.

A common trim control error is the tendency to over-control the airplane with trim adjustments. To avoid this, the proper attitude should be established with reference to the horizon and then verified by reference to performance indications on the flight instruments. The pilot should then apply trim in the above sequence to relieve control pressures. The pilot must avoid using the trim alone to establish or correct airplane attitude.

202. PERFORMANCE

Remember this simple formula: ***POWER + ATTITUDE = PERFORMANCE***

Most early basic air work problems result from the inability to properly see and control the aircraft's attitude, in correlation to the power applied by the engine. Only after you master proper attitude control will you begin to develop solid basic flying skills.
Coordinated use of all controls is very important in any turn. Applying aileron pressure places the aircraft in the desired angle of bank (AOB), while simultaneous application of rudder pressure is required to counteract the resultant adverse yaw. During a turn, the angle of attack (AOA) must be increased by adding back-stick pressure (increasing elevator deflection) to compensate for the loss of lift due to bank. Thus, the steeper the turn, the more back elevator pressure is needed to maintain level flight, accompanied by a corresponding increase in G load. Varying greatly among different flight regimes, deflection of the control surfaces will allow you to reach the desired result.

203. FUNDAMENTAL FLIGHT MANEUVERS

Maneuvering of the airplane is generally divided into four flight fundamentals:

- Straight and level flight
- Turns
- Climbs
- Descents

All controlled flight consists of any one or a combination of these basic maneuvers. Proper control of an airplane's attitude is the result of the pilot knowing when and how much to change it, and then smoothly making the required correction. When flying by reference to objects outside the airplane, the effects of the pilot's control application on the airplane's flight attitude can be seen by observing the relationship of the position of some portion of the airplane to the outside references.

At first, control of the airplane is a matter of consciously fixing the relationship of a specific reference point on the airplane to the horizon. As basic flight skills are developed through experience and training, the pilot will acquire a continuous awareness of these relationships without conscious effort. The reference points will be used almost subconsciously in varying degrees to determine the attitude of the airplane during all maneuvers.

In establishing the reference points, the airplane should be placed approximately in the desired attitude, and then a specific point should be selected. No two pilots see this relationship exactly the same. The apparent position of reference points will depend on each pilot's seat height and lateral position, and/or the pilot's eye level and line of sight. It is imperative that the student utilize the same seat position on each flight so that the reference points remain the same.

204. INTEGRATED FLIGHT INSTRUCTION

When introducing basic flight maneuvers to a beginning pilot, the "integrated flight instruction" or “composite” method will be used. This means that each flight maneuver will be performed by using both outside visual references and the flight instruments.

When pilots use this method, they achieve a more precise and competent overall piloting ability. Although this method of airplane control may become second nature with experience, the beginning pilot must make a determined effort to master the technique. The basic elements are:

- The airplane’s attitude is established and maintained by positioning the airplane in relation to the natural horizon. At least 90 percent of the pilot’s attention should be devoted to this end, along with scanning for other airplanes. During a recheck of the pitch and/or bank, if either or both are found to be other than desired, an immediate correction is made to return the airplane to the proper attitude. Continuous checks and immediate corrections will allow little chance for the airplane to deviate from the desired heading, altitude, and flightpath.

- The airplane’s attitude is confirmed by referring to flight instruments, and its performance checked. If airplane performance, as indicated by flight instruments, indicates a need for correction, a specific amount of correction must be determined, then applied with reference to the natural horizon. The airplane’s attitude and performance are then rechecked by referring to flight instruments. The pilot then maintains the corrected attitude by reference to the natural horizon.

- The pilot should monitor the airplane’s performance by making numerous quick glances at the flight instruments. No more than 10 percent of the pilot’s attention should be inside the cockpit. The pilot must develop the skill to instantly focus on the appropriate flight instrument, and then immediately return to an outside reference to control the airplane’s attitude.

Although flight instruments are cross-referenced for aircraft performance, integrated flight instruction still relies primarily on pilots knowing the appropriate VFR sight pictures for each phase of flight and desired flight condition. This means the pilot must become familiar with the relationship between outside references to the natural horizon and the corresponding indications on flight instruments inside the cockpit for straight and level flight, turns, climbs and descents in various configurations and at various speeds.

205. ATTITUDE FLYING

Contact flying (i.e. “attitude flying”) means visually establishing the airplane’s attitude with reference to ground references and the natural horizon. Attitude is the angular difference measured between an airplane’s axis and the line of the Earth’s horizon. Pitch attitude is the angle formed by the longitudinal axis, and bank attitude is the angle formed by the lateral axis. Rotation about the airplane’s vertical axis (yaw) is termed an attitude relative to the airplane’s flightpath, but not relative to the natural horizon.

Airplane control is composed of four components:

1. **Pitch control:** Pitch control is the control of the airplane about its lateral axis by applying elevator pressure to raise or lower the nose, usually in relation to the horizon.

2. **Bank control:** Bank control is the control of the airplane about its longitudinal axis by use of the ailerons to attain the desired angle of bank in relation to the horizon.

3. **Yaw control:** Yaw control is the control of the aircraft about its vertical axis by use of the rudder.

4. **Power control:** Power control is the control of power or thrust by use of the throttle to establish or maintain desired airspeeds in coordination with the attitude changes.

206. "SEE AND AVOID" DOCTRINE

Simply stated, the "See and Avoid" Doctrine is a pilot's best defense against a midair collision. The "Big Sky, Little Airplane" theory is the key ingredient in the recipe for a midair collision. The causal factor most often noted in aircraft accident reports involving midair collisions is, "failure of the pilot to see and avoid the other aircraft." In most cases, at least one of the pilots involved could have seen the other in time to avoid contact if he had been executing a proper outside scan.

Studies show that nearly all midair collisions occur during daylight hours, in good weather. Most midairs occur within five miles of an airport, in areas of greatest traffic concentration, and usually on warm, weekend days. Most midairs also involve maneuvers that are classified as crossing or overtaking. Very rarely are head-on collisions reported.

It is important to develop a scan that is both comfortable and workable for your own airplane. In normal flight, the threat of a midair collision is greatly diminished by scanning an area 60º either side of center and 10º up and down. Refer to Figure 3-1. This does not mean that the rest of the area should be ignored.

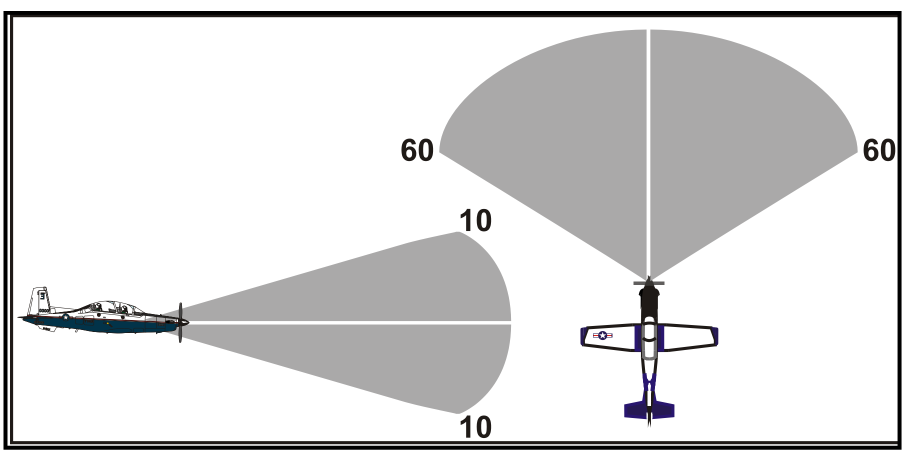

Figure 2-1 Outside Scan

Many times the threat of an impending midair collision is evident early enough for the aircrew to discuss the threat and coordinate a decision regarding deviation from the flight path to avoid it. However, this will not always be the case. Another aircraft may be sighted at a point which will prevent discussion with, or even notification of, the other crewmember. This would require immediate action! In such a situation, students are expected to take the controls and/or initiate a deviation in either bank, pitch or power (or combination of these) to displace the aircraft from its current flight path in order to avoid the collision. This concept holds true even if the deviation involves either high positive or negative "G" loads. Avoiding the collision takes priority over preventing an overstress! This situation should be addressed during the preflight briefing.

207. SCAN PATTERN

The tool that all pilots must employ to guard against midair collisions is an efficient scan pattern. Division of attention, or scanning, is the "awareness" that a pilot must possess in order to fly his/her aircraft effectively. It is quite obvious that you must:

- Look outside the airplane to see where you are going.
- Look at the aircraft with respect to the horizon to check and maintain a desired attitude.
- Look inside the aircraft to check for proper power settings, flight instrument readings and any signs of malfunctions.

Combined with the diversified attention involved in the fundamental control of the aircraft is the concern that must be devoted to flight safety: avoiding other aircraft. Behind the proper division-of-attention methods, which you learn in training, lies the foundation for the mandatory alertness of the military pilot.

A scan pattern is a means, or procedure, by which you can observe everything you need to see by starting at one point, moving visually about the aircraft, checking all applicable items systematically and thoroughly, and completing the pattern at the starting point. A scan pattern may be started anywhere, but it must be complete and continuous.

An integrated scan involves combining contact flying and flight instruments through a systematic pattern. The task of scanning in contact flying involves division of attention between the external and internal environment, setting attitudes with the nose and wings in relation to the horizon and cross-checking them against the instruments in the cockpit. The following scan pattern is a workable example:

1. **Outside the cockpit:**

    a. Attitude and area - Nose in proper relation to horizon and geographical references for heading and position.

    b. Area - Airspace between nose and left wing clear of hazards.

c. Attitude - Left wing in proper relation to horizon.

2. **Inside the cockpit:**

a. Attitude - Check wings level with attitude indicator (AI) and correct nose position with the altimeter and vertical speed indicator (VSI).

b. Performance - Check airspeed indicator and power setting.

3. **Outside the cockpit:**

a. Attitude and area - Nose in proper relation to horizon and geographical references for heading and position.

b. Area - Airspace between nose and right wing clear of hazards.

c. Attitude - Right wing in proper relation to horizon.

As a beginner, you may crosscheck rapidly by "looking" without knowing exactly what you are looking for, but with increasing familiarity with the maneuvers and experience with the support instruments, you will learn:

What to look for,

When to look for it, and

What response is required.

As proficiency increases, you will scan primarily from habit by adjusting your scanning rate and sequence to the demands of the situation. The scan requirements will vary from maneuver to maneuver, so initially the scanning process will seem new and somewhat unnatural. It cannot be overemphasized, however, that your level of success in flight training will vary proportionately to your ability to force yourself to develop and maintain a correct and expeditious scan pattern.

The entire pattern should take very little time and no one item should fix your attention at the exclusion of another. Meanwhile, corrections should be initiated for any errors detected and the next scan over the pattern will enable you to further correct or perfect your condition of flight. You cannot afford to gaze at any one item for a length of time or the pattern will be broken (this is referred to as "fixating"). Instead, scan each position, initiate corrections, and then check those corrections when you return to that position in the scan pattern. Be alert! Look around! Remember that under you is a blind spot. Never assume that others see you!

208. STRAIGHT AND LEVEL FLIGHT

It is impossible to emphasize too strongly the necessity for forming correct habits in flying straight and level. Straight-and-level flight is flight in which a constant heading and altitude are maintained. All other flight maneuvers are in essence a deviation from this fundamental flight maneuver. Many flight instructors and students are prone to believe that perfection in straight-and-level flight will come of itself, but such is not the case. It is not uncommon to find the cause for a pilot who consistently falls just short of minimum expected standards to be the inability to fly straight and level properly.

The pitch attitude for level flight (constant altitude) is usually obtained by selecting some portion of the airplane's nose as a reference point, and then keeping that point in a fixed position relative to the horizon. Using the principles of attitude flying, that position should be cross-checked occasionally against the altimeter and VSI to determine whether or not the pitch attitude is correct. If altitude is being gained or lost, the pitch attitude should be readjusted in relation to the horizon and then the altimeter rechecked to determine if altitude is now being maintained. The application of forward or back elevator pressure is used to control this attitude.

In controlling level flight, it is important to maintain a light grip on the flight controls, and use just enough to pressure to produce the desired result. The student must learn to associate the apparent movement of the references with the forces which produce it.

Straight flight (laterally level flight) is accomplished by visually checking the relationship of the airplane's wingtips with the horizon. Both wingtips should be equidistant above or below the horizon (depending on whether the airplane is high-wing or low-wing), and any necessary adjustments should be made with the ailerons, noting the relationship of control pressure and the airplane's attitude. Anytime the wings are banked, even though very slightly, the airplane will turn. The objective of straight and level flight is to detect small deviations from laterally level flight as soon as they occur, necessitating only small corrections. Reference to a visually distinct point in the distance, or the heading indicator, should be made to note any change in direction.

For all practical purposes, the airspeed will remain constant in straight and level flight with a constant power setting. Practice of intentional airspeed changes, by increasing or decreasing the power, will provide an excellent means of developing proficiency in maintaining straight-and-level flight at various speeds. Significant changes in airspeed will, of course, require considerable changes in pitch attitude and pitch trim to maintain altitude. Changes in pitch attitude and trim will also be necessary as the flaps are operated.

209. COMMON ERRORS DURING STRAIGHT AND LEVEL FLIGHT

- Attempting to use improper reference points on the airplane to establish attitude.
- Forgetting the location of preselected reference points on subsequent flights.
- Attempting to establish or correct airplane attitude using flight instruments rather than outside visual reference.

- Attempting to maintain direction using only rudder control.

- Habitually flying with one wing low.

- “Chasing” the flight instruments rather than adhering to the principles of attitude flying.

- Too tight a grip on the flight controls resulting in over-control and lack of feel.

- Pushing or pulling on the flight controls rather than exerting pressure against the airstream.

- Improper scanning and/or devoting insufficient time to outside visual reference. (Head in the cockpit.)

- Fixation on the nose (pitch attitude) reference point.

- Unnecessary or inappropriate control inputs.

- Failure to make timely and measured control inputs when deviations from straight-and-level flight are detected.

- Inadequate attention to sensory inputs in developing feel for the airplane.

210. TURNS

The turn is the most complex of all the basic flight maneuvers. A specific angle of bank (AOB) is selected by the pilot, control pressures applied to achieve the desired bank angle, and appropriate control pressures exerted to maintain the desired bank angle once it is established. All four primary controls are used in close coordination when making turns. Their functions are as follows:

- The ailerons bank the wings and so determine the rate of turn at any given airspeed.

- The elevator moves the nose of the airplane up or down in relation to the pilot, and perpendicular to the wings. It both sets the pitch attitude in the turn and “pulls” the nose of the airplane around the turn.

- The throttle provides thrust which may be used for airspeed to tighten the turn.

- The rudder offsets any yaw effects developed by the other controls. **<u>The rudder does not turn the airplane.</u>**

For purposes of this discussion, turns are divided into three classes: shallow turns, medium turns, and steep turns. Shallow turns are those in which the bank (less than approximately 20°) is so shallow that the inherent lateral stability of the airplane is acting to level the wings unless some aileron is applied to maintain the bank. Medium turns are those resulting from a degree of bank (approximately 20° to 45°) at which the airplane remains at a constant bank. Steep turns are those resulting from a degree of bank (45° or more) at which the "overbanking tendency" of an airplane overcomes stability, and the bank increases unless aileron is applied to prevent it.

In all constant altitude, constant airspeed turns, it is necessary to increase the angle of attack of the wing by applying up elevator when rolling into the turn. This is required because part of the vertical lift has been diverted to horizontal lift. Thus, the total lift must be increased to compensate for this loss.

When an airplane is flying straight and level, the total lift acts perpendicular to the wings and to the Earth. As the airplane is banked into a turn, the lift then becomes the resultant of two components. One, the vertical lift component continues to act perpendicular to the Earth and opposes gravity. Second, the horizontal lift component (centripetal) acts parallel to the Earth's surface and opposes the aircraft's inertia (apparent centrifugal force). These two lift components act at right angles to each other, causing the resultant total lifting force to act perpendicular to the banked wing of the airplane. It is the horizontal lift component that actually turns the airplane—not the rudder (Figure 2- 2). When applying aileron to bank the airplane, the lowered aileron (on the rising wing) produces a greater drag than the raised aileron (on the lowering wing). (Figure 2-3) This increased aileron yaws the airplane toward the rising wing, or opposite to the direction of turn. To counteract this adverse yawing moment, rudder pressure must be applied simultaneously with aileron in the desired direction of turn. This action is required to produce a coordinated turn.

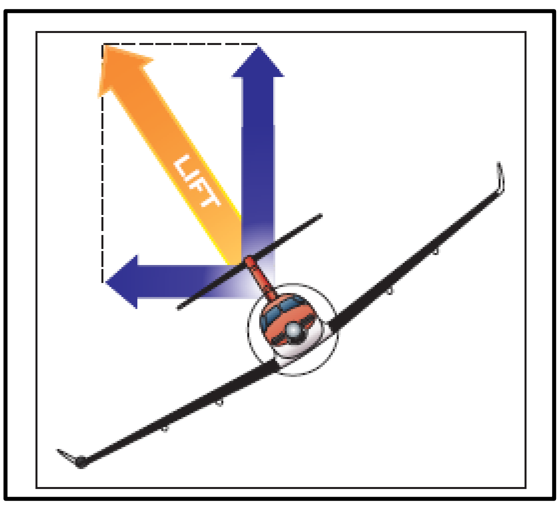

Figure 2-2 Change in lift

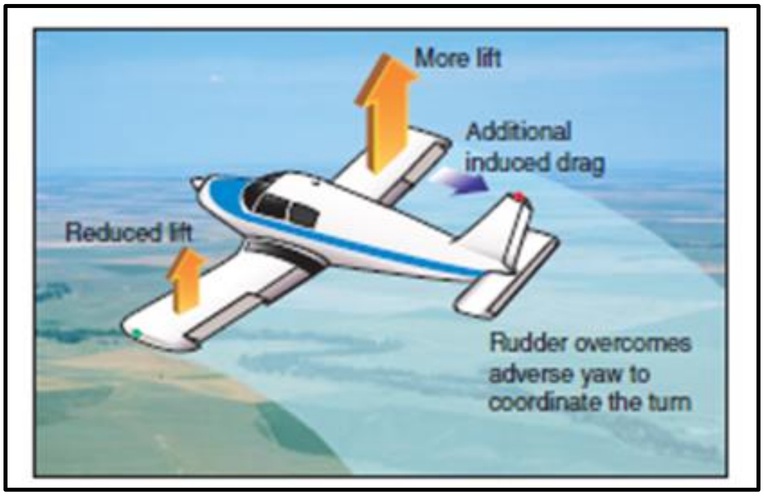

Figure 2-3 Forces during a turn

When learning to use coordinated control inputs, the following variations provide excellent guides:

- If the nose starts to move before the bank starts, rudder is being applied too soon.

- If the bank starts before the nose starts turning, or the nose moves in the opposite direction, the rudder is being applied too late.

- If the nose moves up or down when entering a bank, excessive or insufficient elevator is being applied.

As the desired angle of bank is established, aileron and rudder pressures should be relaxed. This will stop the bank from increasing because the aileron and rudder control surfaces will be neutral in their streamlined position. The up-elevator pressure should not be relaxed, but should be held constant to maintain a constant altitude. Throughout the turn, the pilot should cross-check the airspeed indicator, and if the airspeed has decreased more than 5 knots, additional power should be used. The cross-check should also include outside references, altimeter, and vertical speed indicator (VSI), which can help determine whether or not the pitch attitude is correct. If gaining or losing altitude, the pitch attitude should be adjusted in relation to the horizon, and then the altimeter and VSI rechecked to determine if altitude is being maintained.

During all turns, the ailerons, rudder, and elevator are used to correct minor variations in pitch and bank just as they are in straight and level flight.

The rollout from a turn is similar to the roll-in except the flight controls are applied in the opposite direction. Aileron and rudder are applied in the direction of the rollout or toward the high wing. As the angle of bank (AOB) decreases, the elevator pressure should be relaxed as necessary to maintain altitude.

211. PROCEDURE FOR LEVEL TURNS

1. CLEAR – Scan for traffic and clear the area in the direction of turn.

2. SELECT – Select a reference point on the horizon to which to turn.

3. COORDINATE – Use coordinated aileron and rudder to roll to the desired AOB.

4. PITCH – Increase elevator back pressure as required to maintain level flight.

5. POWER – Adjust power as required to maintain airspeed.

6. ROLL – Use coordinated aileron and rudder during rollout. Lead by 1/3 the AOB.

212. COMMON ERRORS DURING LEVEL TURNS

- Failure to adequately clear the area before the turn.

- Attempting to execute the turn solely by instrument reference.

- Attempting to sit up straight, in relation to the ground, during a turn, rather than riding with the airplane.

- Insufficient feel for the airplane as evidenced by the inability to detect slips/skids without reference to flight instruments.

- Attempting to maintain a constant bank angle by referencing the "cant" of the airplane's nose.

- Fixating on the nose reference while excluding wingtip reference.

- "Ground shyness"—making "flat turns" (skidding) while operating at low altitudes in a conscious or subconscious effort to avoid banking close to the ground.

- Gaining proficiency in turns in only one direction (usually the left).

- Failure to coordinate the use of throttle with other controls.

- Altitude gain/loss during the turn – allowing the nose to drop or rise during entry.

213. SKID

A skid occurs when the aircraft yaws towards the inside of a turn. It is caused by too much rudder pressure in relation to the angle of bank used. In other words, if you try to force the aircraft to turn faster without increasing its degree of bank, the aircraft will skid sideways away from its radius of turn. In a turn, the rudder must follow the flight path of the aircraft. If excessive pressure is maintained on the rudder after the turn is established, a skid will result.

A SKIDDED TURN CAN DEVELOP INTO A DANGEROUS SITUATION WHEN IN CLOSE PROXIMITY TO THE GROUND. ESSENTIALLY, WHAT OCCURS IS THE WING ON THE INSIDE OF A TURN IS MOVING SLOWER THAN THE OUTSIDE WING. SINCE THE SLOWER WING DEVELOPS LESS LIFT DURING A SKID, THIS COMPOUNDS THE REDUCTION IN LIFT, EVENTUALLY DEVELOPING INTO A STALL OF ONE WING. THE RESULT: UNINTENTIONAL INVERTED FLIGHT!

214. SLIP

A slip occurs when the aircraft yaws towards the outside of a turn. It is caused by an insufficient amount of rudder in relation to the amount of aileron and the angle of bank used. If you roll into a turn without using coordinated rudder and aileron, or if you hold rudder against the turn after it has been established, the aircraft will slip. A slip may also occur in straight and level flight if one wing is allowed to drag; that is, flying with one wing low, while holding the nose of the aircraft straight by the use of the rudder pressure. In this case, the aircraft slips downward towards the earth's surface and loses altitude. An intentional slip is not a dangerous maneuver. The slip is an acceptable method to safely dissipate excess altitude under certain conditions discussed later in this manual. Any inadvertent tendency to fly in out-of-balanced flight (either a slip or skid) is ***NOT*** an acceptable practice.

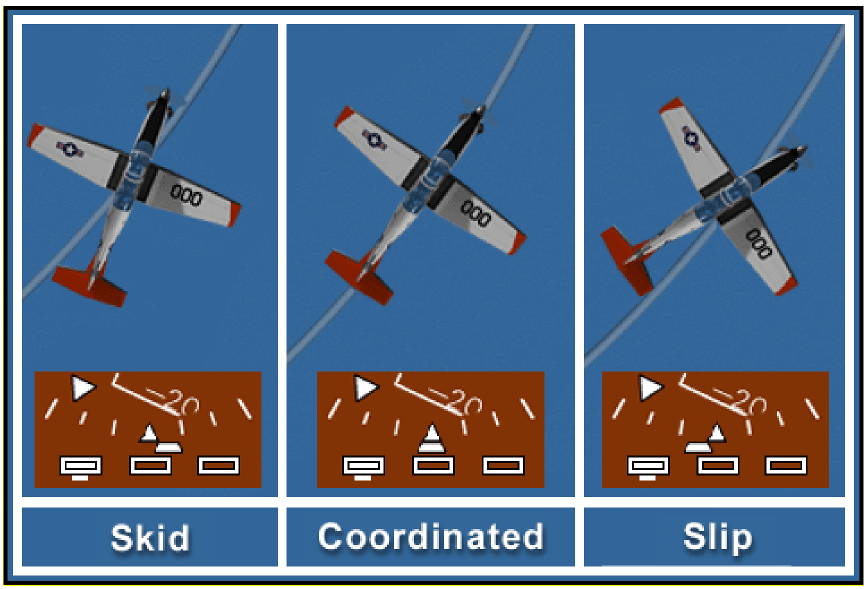

Figure 2-4 Coordinated vs. Uncoordinated Turns

215. WIND EFFECTS AND CRAB CORRECTIONS

As an aircraft flies in an air mass, any movement of the air mass affects the course of the aircraft. In other words, the path of the aircraft over the ground will be determined not only by the direction in which it is headed, but also by the direction and speed of the air mass movement.

Suppose you were flying straight and level and the wind was blowing 30 knots from a direction 90º to your left. Since the aircraft was in the body of air, and moving with it, you and the aircraft would also have drifted 30 miles to your right in one hour. Of course, in relation to the air mass itself, you would have moved forward only, but in relation to the ground, you would have moved forward and 30 miles sideways. This effect of the movement of the air on the track of the aircraft is known as drift. The difference between the actual heading of the aircraft and its track over the ground is called the angle of drift. Drift must be compensated for, in order to cause the aircraft to maintain a desired track over the ground. The proper way to correct the drift when you are flying in straight and level flight and wish to follow a desired ground track, is to make a shallow balanced turn into the wind. When you seem to have the drifting effect neutralized or stopped, return to straight and level flight. The aircraft is now pointed into the wind slightly. This causes the aircraft to fly into the wind at the rate that the wind is trying to move it sideways. Since the effect of drift has now been neutralized, the aircraft will fly a straight and selected ground track. The nose of the aircraft, however, is not pointed in the direction of the ground track. This is known as drift correction, and is usually referred to as "crabbing" because the aircraft is moving sideways in relation to the ground (Figure 2-5).

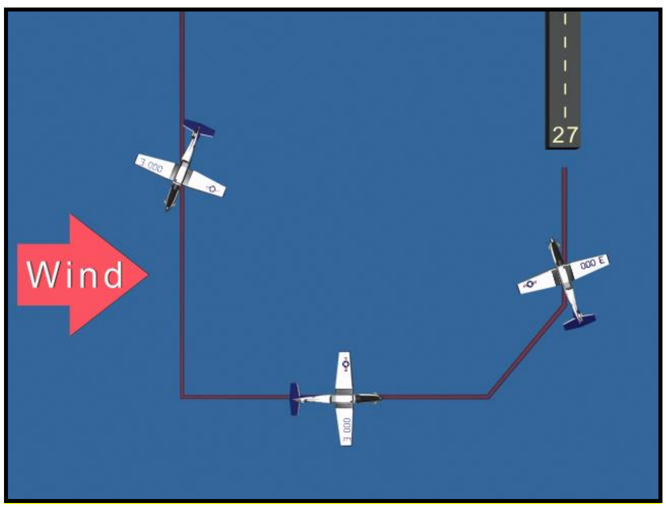

Figure 2-5 "Crabbing" Flight Path

216. THE P.A.T. PRINCIPLE

For corrections and to execute many maneuvers you must:

- Set/reset power
- Adjust the nose attitude
- Trim for the new attitude

The mechanics of the transitions will be performed in a specific sequence:

- ***P***ower
- ***A***ttitude
- ***T***rim

Although power and attitude change are almost simultaneous, lead with THROTTLE movement. For example, consider the transition to a constant airspeed descent. Reduce power from normal cruise to the descent power setting, scanning the nose attitude. As the power is retarded, lower the nose towards a descending attitude. Finally, trim the aircraft. Trim is used to relieve all possible control pressures held after a desired attitude has been attained.

NOTE

> The power may not be the exact descent power setting, since it was initially reduced using peripheral vision. Power is then reset to exactly the descent power setting after completing P.A.T. Remember - Power, Attitude, Trim; reset Power, reset Attitude, reset Trim.

217. CLIMBS AND DESCENTS

Climbs and descents are much like straight-and-level flight except the added motion of up and down. If the aircraft is already in a trimmed and balanced flight condition, climbs and descents can be initiated with adjustments to power and slight forward or back pressure to “influence” the pitch attitude in the correct direction.

When leveling off from a climb or descent, the same is true. The key is to maintain trimmed and balanced flight. It is recommended to lead the level-off by 10% of the climb/descent rate (for 500 foot per minute climb, begin level-off 50 feet prior to desired altitude).

Just as in straight and level flight, climbs and descents should be flown primarily by utilizing visual references to establish correct pitch attitudes. The student must learn the correct pitch attitudes for key climb and descent conditions such as Vx (speed for max angle of climb), Vy (speed for max rate of climb), and approach speed. The following procedures do not preclude climbing or descending at different rates when common sense and the situation warrant. Consideration should be given to climbing at a lower pitch angle after a safe altitude has been obtained in order to facilitate forward visibility.

218. PROCEDURES FOR CLIMBS AND DESCENTS

1. **Procedure to Initiate a Vy Climb from Level Flight**

    a. RICH – Mixture full rich, as required.

    b. POWER – Smooth apply full power.

    c. ATTITUDE – Simultaneously set Vy (73 KIAS) pitch.

    d. TRIM – As required for climb airspeed.

2. **Procedure for Level-off from Climb**

    a. ATTITUDE – 50 feet prior to level-off altitude, begin lowering nose to the level flight attitude.

    b. ACCELERATE – 90 KIAS, trim throughout the acceleration. Five knots prior to cruise speed:

    c. POWER – Smoothly reduce to normal cruise ~2100-2300 RPM.

    d. ATTITUDE – Set pitch for level flight.

    e. TRIM – Adjust for hands free flight

3. **Procedure to Initiate a Constant Airspeed Descent from Level Flight**

    a. RICH – Mixture full rich, as required.

    b. POWER – Reduce to ~1500 RPM.

    c. ATTITUDE – Simultaneously allow pitch attitude to drop to establish airspeed of 90 knots.

    d. TRIM – As required to maintain constant airspeed.

Although 90 knots is directed, students should expect to demonstrate proficiency in descents at other airspeeds as directed by their instructor.

4. **Procedure to Level-off from a Constant Airspeed Descent**

    a. ATTITUDE – ~50 feet prior to level-off altitude pitch to level-flight attitude.

    b. POWER – Increase to cruise setting.

c. ATTITUDE – Adjust to maintain level flight picture.

d. TRIM – As required to maintain straight and level flight.

219. COMMON ERRORS DURING CLIMBS AND DESCENTS

- Initiating level off procedures too early/late.
- Attempting to use improper reference points on the airplane to establish attitude.
- Forgetting the location of preselected reference points on subsequent flights.
- Attempting to establish or correct airplane attitude using flight instruments rather than outside visual reference.
- Attempting to maintain direction using only rudder control.
- Habitually flying with one wing low.
- “Chasing” the flight instruments rather than adhering to the principles of attitude flying.
- Too tight of a grip on the flight controls resulting in over-control and lack of feel.
- Pushing or pulling on the flight controls rather than exerting pressure against the airstream.
- Improper scanning and/or devoting insufficient time to outside visual reference.
- Failure to make timely and measured control inputs when transitioning to/from straight-and-level flight are detected.
- Not using coordinated power and pitch attitude (control pressure) to establish and maintain climbs or descents.

220. CLIMBING TURNS

In developing skills to perform climbing turns, the following factors should be considered:

- With a constant power setting, the same pitch attitude and airspeed cannot be maintained in a bank as in a straight climb, due to the decrease in effective lift during a turn.
- The degree of bank should be neither too steep nor too shallow. Too steep a bank intensifies the effect mentioned above. If too shallow, the angle of bank may be difficult to maintain because of the inherent stability of the airplane.

- A constant airspeed, a constant rate of turn, and a constant angle of bank must be stressed. The coordination of all controls is likewise a primary factor to be stressed and developed.
- The airplane will have a greater tendency towards nose-heaviness than in normal straight climb, due to the decrease in effective lift that is the case in all turns.
- As in all maneuvers, attention should be diverted from the airplane's nose and divided among all references equally.

All of the factors that affect the airplane during level (constant altitude) turns will affect it during climbing turns or any other turning maneuver. It will be noted that because of the low airspeed, aileron drag (adverse yaw) will have a more prominent effect than it did in straight-and-level flight and more rudder pressure will have to be blended with aileron pressure to keep the airplane in coordinated flight during changes in bank angle. Additional elevator deflection and trim will also have to be used to compensate for centrifugal force and loss of vertical lift, and to keep the pitch attitude constant.

During climbing turns, the loss of vertical lift becomes greater as the angle of bank is increased, so shallow turns must be used to maintain a sufficient rate of climb. If a medium or steep banked turn is used, the airplane will not climb sufficiently.

221. ASSUMING CONTROL OF THE AIRCRAFT

A most important flying safety requirement is a clear, positive understanding at all times of who has control of the aircraft. You must understand the procedures involved in transferring control of an aircraft.

The instructor will tell you over the intercommunications system (ICS), "I have the controls." When your instructor says, "I have the controls," you acknowledge by stating over the ICS, "You have the controls." You then take your hands and feet off the controls. Your instructor will then confirm control by saying, "I have the controls." Conversely, but in the same manner, when your instructor wants you to fly, he will say, "You have the controls," whereupon you will take control and acknowledge over the ICS, "I have the controls." The instructor will then complete the exchange with another, "You have the controls." Keep flying the aircraft until you are told to do otherwise. Understand that unless you and the instructor complete the three-way exchange of controls, no exchange of control was made. For example, your instructor may coach or aid your flare during a landing. You may feel a presence on the controls, but you are still flying and should continue to do so. Never be in doubt as to who is flying; if you are not absolutely sure, safety dictates you ***speak up and ask!***

CHAPTER THREE
NIFE AVIATION MAINTENANCE STANDARDS

300. INTRODUCTION

This chapter briefly addresses how to properly handle maintenance discrepancies encountered during preflight and how to ensure the aircraft meets the minimum regulatory requirements to be considered safe for flight. The ultimate decision on whether an aircraft is airworthy resides with the Pilot in Command (PIC). **No pilot in NIFE should feel pressured to fly an aircraft that they are convinced is not airworthy in order to make the flight schedule.**

301. GOVERNING GUIDANCE

The governing guidance as to the minimum standards of airworthiness for general aviation aircraft operated under Part 91 is in accordance with 14 CFR Part 91.213, which clearly states, "...no person may take off an aircraft with inoperative instruments or equipment installed...."

Part 91 makes provision for Minimum Equipment Lists (MELs), however, NIFE aircraft generally do not have approved MELs. In this case, Part 91.213(d) applies and provides some relief from this stringent requirement. Part 91.213(d) is covered in Advisory Circular 91-67 which provides the following flow chart to aid in preflight airworthiness decision making:

During the preflight inspection, the pilot recognizes inoperative instruments or equipment:		
Is the equipment part of the VFR-day type certification instruments and equipment prescribed in the applicable airworthiness regulations under which the aircraft was type certificated? (See list below 303)	YES	The aircraft is not airworthy and maintenance is required.
If **NO**, is the equipment indicated as required on the aircraft's MEL, or on the Kinds of Operations Equipment List for the kind of flight operation being conducted?	YES	The aircraft is not airworthy and maintenance is required. *Note Kinds of Operations Lists are in the POH. For instance, Sec 2.19 for a*
If **NO**, is the equipment required to be operational by an airworthiness directive?	YES	The aircraft is not airworthy and maintenance is required.

Table 3-1 Airworthiness Flow Chart

If all of the above are NO, you may continue flight. Upon return notify maintenance
When an aircraft is due for inspection in accordance with the regulations, the operator should have all of the inoperative items repaired or replaced. If an owner does not want specific inoperative equipment repaired, then the maintenance person must check each item to see if it conforms to the requirements of § 91.213(d). The maintenance person must ensure that each item of inoperative equipment that is to remain inoperative is placarded appropriately.

All aircraft discrepancies will be noted in the aircraft discrepancy log.

Downing discrepancies need to be brought to the attention of the FDO or another NIFE staff member immediately.

302. WORKING DEFINITIONS

Deactivate means to make a piece of equipment or an instrument unusable to the pilot/crew by preventing its operation. This could be as simple as turning the equipment off and securing the circuit breaker.

Inoperative means, that a system and/or component has malfunctioned to the extent that it does not accomplish its intended purpose and/or is not consistently functioning normally within its approved operating limits or tolerances.

Next Required Inspection is the one required under either an FAA- approved inspection program, a 100- hour inspection, or an annual inspection, as appropriate.

Placard is a decal or label with letters at least 1/8 inch high. The operator or mechanic must place the placard on or near inoperative equipment or instruments so that it is visible to the pilot or flightcrew and alerts them to the inoperative equipment.

303. MINIMUM VFR EQUIPMENT

Part 91 lists the minimum equipment that must be installed and operable in order to fly under visual flight rules (VFR). There are a number of acronyms to aid in recall of the minimum equipment for VFR flight. GOOSEACAT:

- **G**as gauge
- **O**il pressure gauge
- **O**il temperature gauge
- **S**eatbelts
- **E**mergency locator transmitter
- **A**irspeed indicator
- **C**ompass
- **A**ltimeter
- **T**achometer

CHAPTER FOUR
GROUND PROCEDURES

400. INTRODUCTION

This chapter discusses the basic procedures essential to the safe operation of the airplane on the ground prior to and after a flight. This includes the major points of ensuring that the airplane is in an airworthy condition, starting and stopping the engine, and taxiing the airplane to and from the line area and the runway.

The propeller is the most dangerous part of the airplane. Under certain light conditions it is difficult to see a rotating propeller. This may give the illusion that it is not there. As a result, the files of aviation safety offices contain many cases that read, "victim walked into a rotating propeller."

401. PREFLIGHT PLANNING AND BRIEFING

Each scheduled event begins with a flight brief and discussion with your instructor. The Certified Flight Instructor as the Pilot in Command is responsible to perform and/or delegate preflight planning for the flight (i.e., weight and balance, fuel planning, obtaining weather brief, and filing a flight plan as necessary). You will assist as directed, reporting results and noting any discrepancies. By the end of the syllabus, you will be responsible for completing all preflight planning and briefing your instructor on the status.

To aid in preflight planning, you will use the standard preflight briefing guide provided in the NIFE syllabus. Although it is the pilot's responsibility to obtain and understand all available information for a given flight, the preflight briefing guide provides a good starting point for the minimum information required.

14 CFR 91.103 states that the information a PIC must become familiar with prior to flight includes:

- **Weather reports and forecasts**
- **Fuel requirements**
- **Alternate airfields**
- **Known traffic delays**
- **Runway lengths at airports of intended use**
- **Takeoff and landing performance at expected environmental conditions for those runways**

402. GRADED PREFLIGHT VS POSTFLIGHT DISCUSSION ITEMS

The FTI description of each concept or maneuver is intended to give the student the minimum knowledge and theory behind each maneuver in the NIFE Flight Syllabus. It is followed by the step-by-step procedure for executing the maneuver. Further detail for many maneuvers is available in FAA-H-8083-3, Airplane Flying Handbook, available as a free downloadable .pdf from the FAA or can it be purchased on line through resellers like Amazon.

Your instructor will expect you to know the procedures for the maneuvers listed on the syllabus event card, along with any "discuss" items listed on the top of the event card With respect to procedures, to “know” is to “memorize” (step by step, though not necessarily verbatim) each action of the procedure. With respect to discussion items, there are two types: graded discussion items and postflight discussion items. Graded preflight discussion means the student has studied the related FTI material and can repeat the major points made in the FTI regarding that material. For instance, Contact Flight One (C4101) has a graded preflight discussion of the IMSAFE checklist. It is expected that at a minimum, the student has read the related section of the FTI, can recite the elements of the IMSAFE checklist and can speak to the relevance and purpose of each element. Postflight discussions are led by CFI and introduce new concepts and topics for the next flight.

403. PREFLIGHT INSPECTION

A safe flight begins with a careful visual inspection of the airplane. The purpose of the preflight visual inspection is twofold: to determine that the airplane is legally airworthy, and that it is in condition for safe flight. **Student preparation for and knowledge of pre-flight inspections and procedures should be based on knowledge of the applicable section of this FTI and the aircraft’s operating handbook.**

The airworthiness of the airplane is determined, in three general ways: compliance with recurrent inspections requirements, ready access to FAA required documentation, and a physical pre-flight.

Compliance with recurrent inspections can be verified by reviewing the aircraft logbooks. Each aircraft has a set of logbooks that serve to document the aircraft’s maintenance history and to record recurrent maintenance requirements. Airplane maintenance logbooks are not required to be kept in the airplane when it is operated.

Recurrent Inspection Requirements.

- At a minimum, there should be an annual inspection within the preceding 12-calendar months. In addition, the aircraft for NIFE will be required to have an inspection after every 100-hours of use.

- If a transponder is to be used, it is required to be inspected within the preceding 24-calendar months. If the airplane is operated under instrument flight rules (IFR) in controlled airspace, the altimeter and pitot-static system is also required to be inspected within the preceding 24- calendar months.

- The emergency locator transmitter (ELT) must be checked every 12-calendar months. The ELT is battery powered, and the battery replacement or recharge date should not be exceeded.

- Maintenance Airworthiness Directives (ADs) are similar to automobile industry recalls where a fault in design or construction has been discovered. In this case, the FAA requires additional periodic, recurrent or one time inspections for specific models of aircraft due to a discovered flaw in the aircraft's design or manufacture. An example is the seat rails in a Cessna 172 have been discovered to wear in a manner that the seat could move during a steep climb or rapid acceleration. Therefore, the seat rails must be inspected periodically (as directed through an AD) by an A&P and that inspection must be documented in the aircraft logs for the aircraft to be airworthy.

- The following certificates and documents must be on board the airplane when operated (**AROW**).

    - Airworthiness certificate.

    - Registration certificate.

    - Operating limitations, which may be in the form of an FAA-approved Airplane Flight Manual and/or Pilot's Operating Handbook (AFM/POH), placards, instrument markings, or any combination thereof.

    - Weight and Balance: This is the current weight and balance document for the specific aircraft/tail number. It is certified and signed by a FAA licensed A&P.

Figure 4-1 Location of aircraft documents

The final determination of whether the airplane is in a condition for safe flight is made by a physical preflight inspection of the airplane and its components. The preflight inspection should be executed by the approved NIFE Checklist.

The preflight inspection of the airplane should begin while approaching the airplane on the ramp. The pilot should make note of the general appearance of the airplane, looking for obvious discrepancies such as a landing gear out of alignment, structural distortion, skin damage, and dripping fuel or oil leaks. Upon reaching the airplane, all tie-downs, control locks, and chocks should be removed.

404. INSIDE THE COCKPIT

The student should execute a flow supplemented by the checklist in accordance with the FTI and other NIFE guidance. The following is a brief synopsis of some major points the student should consider while conducting the preflight inspection. It is by no means complete or exhaustive.

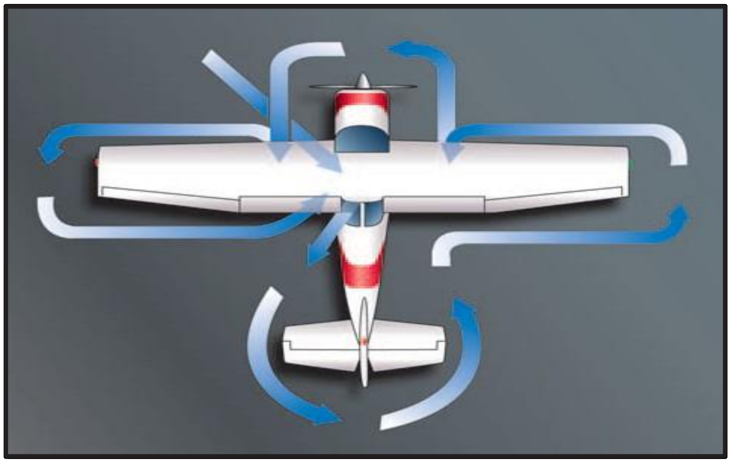

Figure 4-2 Preflight Inspection Flow

The inspection should start with the cabin door. If the door is hard to open or close, or if the carpeting or seats are wet from a recent rain, there is a good chance that the door, fuselage, or both are misaligned. This may be a sign of structural damage.

The windshield and side windows should be examined for cracks and/or crazing. Crazing is the first stage of delamination of the plastic. Crazing decreases visibility, and a severely crazed window can result in near zero visibility due to light refraction at certain angles to the sun.

The pilot should check the seats, seat rails, and seat belt attach points for wear, cracks, and serviceability. The seat rail holes where the seat lock pins fit should also be inspected. The holes should be round and not oval. The pin and seat rail grips should also be checked for wear and serviceability.

Inside the cockpit, two key items to be checked are: (1) battery and ignition switches—off, and (2) control column locks—removed.

The fuel selectors should be checked for proper operation in all positions—including the OFF position. Stiff selectors, or ones where the tank position is hard to find, are unacceptable. The pilot should feel resistance when the primer is both pulled out and pushed in. The primer should also lock securely. Faulty primers can interfere with proper engine operation. The engine controls should also be manipulated by slowly moving each through its full range to check for binding or stiffness. The airspeed indicator (ASI) should be properly marked, and the indicator needle should read zero. If it does not, the instrument may not be calibrated correctly. Similarly, the vertical speed indicator (VSI) should also read zero when the airplane is on the ground.

The magnetic compass is a required instrument for both VFR and IFR flight. It must be securely mounted, with a correction card in place. The instrument face must be clear and the instrument case full of fluid. A cloudy instrument face, bubbles in the fluid, or a partially filled case renders the instrument unusable.

The gyro driven attitude indicator (AI) should be checked before being powered. A white haze on the inside of the glass face may be a sign that the seal has been breached, allowing moisture and dirt to be sucked into the instrument.

The altimeter should be checked against the ramp or field elevation after setting in the barometric pressure. If the variation between the known field elevation and the altimeter indication is more than 75 feet, its accuracy is out of limits.

The pilot should turn on the battery master switch and make note of the fuel quantity gauge indications for comparison with an actual visual inspection of the fuel tanks during the exterior inspection.

405. OUTER WING SURFACES AND TAIL SECTION

The pilot should inspect for any signs of deterioration, distortion, and loose or missing rivets or screws, especially in the area where the outer skin attaches to the airplane structure. The pilot should look along the wing spar rivet line—from the wingtip to the fuselage—for skin distortion. Any ripples and/or waves may be an indication of internal damage or failure.

Loose or sheared aluminum rivets may be identified by the presence of black oxide which forms rapidly when the rivet works free in its hole. Pressure applied to the skin adjacent to the rivet head will help verify the loosened condition of the rivet.

When examining the outer wing surface, it should be remembered that damage, distortion, or malformation of the wing leading edge renders the airplane not airworthy. Serious dents in the leading edge, and disrepair of items such as stall strips, and deicer boots can cause the airplane to be aerodynamically unsound. Also, special care should be taken when examining the wingtips. Airplane wingtips are usually fiberglass. They are easily damaged and subject to cracking. The pilot should look at stop drilled cracks for evidence of crack progression, which can, under some circumstances, lead to in-flight failure of the wingtip.

The pilot should remember that fuel stains anywhere on the wing warrant further investigation—no matter how old the stains appear to be. Fuel stains are a sign of probable fuel leakage. On airplanes equipped with integral fuel tanks, evidence of fuel leakage can be found along rivet lines along the underside of the wing.

406. FUEL AND OIL

Particular attention should be paid to the fuel quantity, type and grade, and quality. Many fuel tanks are very sensitive to airplane attitude when attempting to fuel to maximum capacity. Nosewheel strut extension, both high as well as low, can significantly alter the attitude, and therefore the fuel capacity. The airplane attitude can also be affected laterally by a ramp that slopes, leaving one wing slightly higher than another. Always confirm the fuel quantity indicated on the fuel gauges by visually inspecting the level of each tank.

The type, grade, and color of fuel are critical to safe operation. The only widely available aviation gasoline (AVGAS) grade in the United States is 100-octane low-lead, or 100LL. AVGAS is dyed for easy recognition of its grade and has a familiar gasoline scent. Jet-A, or jet fuel, is a kerosene-based fuel for turbine powered airplanes. It has disastrous consequences when inadvertently introduced into reciprocating airplane engines. The piston engine operating on jet fuel may start, run, and power the airplane, but will fail because the engine has been destroyed from detonation. The pilot should always ensure the fuel caps have been securely replaced following each fueling.

Checking for water and other sediment contamination is a key preflight element. Water tends to accumulate in fuel tanks from condensation, particularly in partially filled tanks. Because water is heavier than fuel, it tends to collect in the low points of the fuel system. Water can also be introduced into the fuel system from deteriorated gas cap seals exposed to rain, or from the supplier's storage tanks and delivery vehicles. Sediment contamination can arise from dust and dirt entering the tanks during refueling, or from deteriorating rubber fuel tanks or tank sealant.

Sufficient fuel should be drained from the fuel strainer quick drain and from each fuel tank sump to check for fuel grade/color, water, dirt, and smell. If water is present, it will usually be in bead-like droplets, different in color (usually clear, sometimes muddy), in the bottom of the sample. In extreme cases, do not overlook the possibility that the entire sample, particularly a small sample, is water. If water is found in the first fuel sample, further samples should be taken until no water appears. Significant and/or consistent water or sediment contamination is grounds for further investigation by qualified maintenance personnel.

The fuel tank vent is an important part of a preflight inspection. Unless outside air is able to enter the tank as fuel is drawn out, the eventual result will be fuel gauge malfunction and/or fuel starvation. During the preflight inspection, the pilot should be alert for any signs of vent tubing damage, as well as vent blockage. A functional check of the fuel vent system can be done simply by opening the fuel cap. If there is a rush of air when the fuel tank cap is cracked, there could be a serious problem with the vent system.

The oil level should be checked during each preflight and rechecked with each refueling. Reciprocating airplane engines can be expected to consume a small amount of oil during normal operation. If the consumption grows or suddenly changes, qualified maintenance personnel should investigate. If line service personnel add oil to the engine, the pilot should ensure that the oil cap has been securely replaced. The "dip stick" represents the amount of oil in the engine oil sump. Oil is circulated through the engine by an oil pump. If the engine is warm from recent operation and the oil level is checked, it can be expected to read low until sufficient time has passed for the oil to return to the sump.

407. LANDING GEAR, TIRES, AND BRAKES

Tires should be inspected for proper inflation, as well as cuts, bruises, wear, bulges, imbedded foreign objects, significant flat spots, and deterioration. In order to adequately check the condition of the tires, the aircraft should be moved as it could be resting on cut or flat spot. As a general rule, tires with cord showing, and those with cracked sidewalls are not considered airworthy.

Brakes and brake systems should be checked for rust and corrosion, loose nuts/bolts, alignment, brake pad wear/cracks, signs of hydraulic fluid leakage, and hydraulic line security/abrasion.

An examination of the nose gear should include the shimmy damper and the torque link for proper servicing and general condition. All landing gear shock struts should also be checked for proper inflation. In general, 3-4 inches of the silver strut should be visible, however, refer to the aircraft POH for proper inspection.

408. ENGINE AND PROPELLER

The pilot should make note of the condition of the engine cowling. If the cowling rivet heads reveal aluminum oxide residue, and chipped paint surrounding and radiating away from the cowling rivet heads, it is a sign that the rivets have been rotating until the holes have been elongated. If allowed to continue, the cowling may eventually separate from the airplane in flight.

Certain engine/propeller combinations require installation of a prop spinner for proper engine cooling. In these cases, the engine should not be operated unless the spinner is present and properly installed. The pilot should inspect the propeller spinner and spinner mounting plate for security of attachment, any signs of chafing of propeller blades, and defects such as cracking. A cracked spinner is not considered airworthy.

The propeller should be checked for nicks, cracks, pitting, corrosion, and security. The propeller hub should be checked for oil leaks, and the alternator/generator drive belt should be checked for proper tension and signs of wear.

When inspecting inside the cowling, the pilot should look for signs of fuel dye which may indicate a fuel leak. The pilot should check oil and brake fluid levels, for oil leaks, deterioration of oil lines, and to make certain that the oil cap, filter, oil cooler and drain plug are secure. The exhaust system should be checked for white stains caused by exhaust leaks at the cylinder head or cracks in the stacks. The heat muffs should also be checked for general condition and signs of cracks or leaks.

The air filter should be checked for condition and secure fit, as well as hydraulic lines for deterioration and/or leaks. The pilot should also check for loose or foreign objects inside the cowling such as bird nests, shop rags, and/or tools. All visible wires and lines should be checked for security and condition. And lastly, when the cowling is closed, the cowling fasteners should be checked for security.

409. COCKPIT MANAGEMENT

After entering the airplane, the pilot should first ensure all necessary equipment, documents, checklists, and navigation charts appropriate for the flight are on board.

Regardless of what materials are to be used, they should be neatly arranged and organized in a manner that makes them readily available. The cockpit and cabin should be checked for articles that might be tossed about if turbulence is encountered. Loose items should be properly secured. All pilots should form the habit of good housekeeping.

The pilot must be able to see inside and outside references. If the range of motion of an adjustable seat is inadequate, cushions should be used to provide the proper seating position.

When the pilot is comfortably seated, the safety belt and shoulder harness (if installed) should be fastened and adjusted to a comfortably snug fit. The shoulder harness must be worn at least for takeoff and landing, unless the pilot cannot reach or operate the controls with it fastened. The safety belt must be worn at all times when the pilot is seated at the controls.

If the seats are adjustable, it is important to ensure the seat is locked in position so that full throw of the rudder is available with a slight flex in the knee. Accidents have occurred as the result of seat movement during acceleration or pitch attitude changes during takeoffs or landings. When the seat suddenly moves too close or too far away from the controls, the pilot may be unable to maintain control of the airplane.

14 CFR part 91 requires the pilot to ensure all passenger’s safety belts/harnesses are secured.

410. GENERAL GROUND PROCEDURES

It is important that a pilot operates an airplane safely on the ground. This includes being familiar with airport ground operations, standard hand signals that are used by ramp personnel, standard airport markings and lighting, current Notices to Airman (NOTAMS), how to safely start and taxi the aircraft, and perform pre-takeoff checks prior to takeoff.

14 CFR 121.542, in general, applies to air carriers and is the FAA’s implementation of what is termed the “sterile cockpit rule.” The FAA rule and the manner in which it is implemented can be summarized as …flight crew member(s) “shall not perform any duties during a critical phase of flight except those duties required for the safe operation of the aircraft.” Additionally, “No flight crew member may engage in, nor may any pilot in command permit, any activity during a critical phase of flight which could distract any flight crew member from the performance of his or her duties or which could interfere in any way with the proper conduct of those duties. Activities such as eating meals, engaging in non-essential conversations within the cockpit and non-essential communications between the cabin and cockpit crews, and reading publications not related to the proper conduct of the flight are not required for the safe operation of the aircraft... critical phase of flight involves all ground operations involving taxi, takeoff and landing, and all other flight operations... except cruise flight.”

In NIFE, discussions during critical phases of flight other than those related to the safe operation of the aircraft or instructional dialog between the student and their instructor are not authorized. Particular attention should be paid to avoid speaking over ATC instructions to your aircraft or other aircraft in the landing pattern.

NOTE

> Taxi is defined as "movement of an airplane under its own power on the surface of an airport."

411. ENGINE STARTING

The specific procedures for engine start will not be discussed here since there are as many different methods as there are different engines, fuel systems, and starting conditions. The before engine start and engine start checklist procedures should be followed. There are, however, certain precautions that apply to all airplanes.

When ready to start the engine, the pilot should look in all directions to be sure that nothing is or will be in the vicinity of the propeller. This includes nearby persons and aircraft that could be struck by the propeller blast or the debris it might pick up from the ground. The anti-collision light should be turned on prior to engine start, even during daytime operations. At night, the position (navigation) lights should also be on.

The pilot should always call "CLEAR" out of the side window and wait for a response from persons who may be nearby before activating the starter.

When activating the starter, one hand should be kept on the throttle. This allows prompt response if the engine falters during start, and allows the pilot to rapidly retard the throttle if revolutions per minute (RPM) are excessive after start. **Set RPM to 1,000 immediately following engine start**. **It is highly undesirable to allow the RPM to race immediately after start, as there will be insufficient lubrication until the oil pressure rises and engine damage could occur.**

Immediately after a successful start, the oil pressure should be checked. If it does not rise to the manufacturer's specified value, the engine may not be receiving proper lubrication and should be shut down immediately to prevent serious damage.

Although quite rare, the starter motor may remain on and engaged after the engine starts. This can be detected by a continuous very high current draw on the ammeter. Some airplanes also have a starter engaged warning light specifically for this purpose. The engine should be shut down immediately should this occur.

Starters are small electric motors designed to draw large amounts of current for short periods of cranking. **Should the engine fail to start readily, avoid continuous starter operation for periods longer than 10 seconds without a cool down period of at least 20 seconds to a minute (some AFM/POH specify even longer)**. **This cycle can be repeated two additional times, followed by a ten minute cool down period before resuming cranking. After cool down, crank the started again, three cycles of 10 seconds followed by 20 seconds of cool down**. Starter service life is drastically shortened from high heat through overuse.

412. TAXIING

Taxiing is the controlled movement of the airplane under its own power while on the ground. Since an airplane is moved under its own power between the parking area and the runway, the pilot must thoroughly understand and be proficient in taxi procedures.

An awareness of other aircraft that are taking off, landing, or taxiing, and consideration for the right-of-way of others is essential to safety. When taxiing, the pilot's eyes should be looking outside the airplane, to the sides, as well as the front. The pilot must be aware of the entire area around the airplane to ensure the airplane will clear all obstructions and other aircraft. If at any time there is doubt about the clearance from an object, the pilot should stop the airplane and have someone check the clearance. It may be necessary to have the airplane towed or physically moved by a ground crew.

It is difficult to set any rule for a single, safe taxiing speed. What is reasonable and prudent under some conditions may be imprudent or hazardous under others. The primary requirements for safe taxiing are positive control, the ability to recognize potential hazards in time to avoid them, and the ability to stop or turn where and when desired without undue reliance on the brakes. Pilots should proceed at a cautious speed on congested or busy ramps. Normally, the speed should be at the rate where movement of the airplane is dependent on the throttle. That is, slow enough so when the throttle is closed, the airplane can be stopped promptly. When yellow taxiway centerline stripes are provided, they should be observed unless necessary to clear airplanes or obstructions.

When taxiing, it is best to slow down before attempting a turn. Sharp, high-speed turns place undesirable side loads on the landing gear and may result in an uncontrollable swerve or a ground loop. This swerve is most likely to occur when turning from a downwind heading toward an upwind heading. In moderate to high-wind conditions, pilots will note the airplane's tendency to weathervane, or turn into the wind when the airplane is proceeding crosswind.

When taxiing at appropriate speeds in no-wind conditions, the aileron and elevator control surfaces have little or no effect on directional control of the airplane. The controls should not be considered steering devices and should be held in a neutral position. Their proper use while taxiing in windy conditions will be discussed later.

Steering is accomplished with rudder pedals and brakes. To turn the airplane on the ground, the pilot should apply rudder in the desired direction of turn and use whatever power or brake that is necessary to control the taxi speed. The rudder pedal should be held in the direction of the turn until just short of the point where the turn is to be stopped. Rudder pressure is then released or opposite pressure is applied as needed.
More engine power may be required to start the airplane moving forward, or to start a turn, than is required to keep it moving in any given direction. When using additional power, the throttle should immediately be retarded once the airplane begins moving, to prevent excessive acceleration.

When first beginning to taxi, the brakes should be tested for proper operation as soon as the airplane is put in motion. Apply power to start the airplane moving forward slowly, then retard the throttle and simultaneously apply pressure smoothly to both brakes. If braking action is unsatisfactory, the engine should be shut down immediately.

The presence of moderate to strong headwinds and/or a strong propeller slipstream makes the use of the elevator necessary to maintain control while taxiing. This becomes apparent when considering the lifting action that may be created on the horizontal tail surfaces by either of those two factors. The elevator control should be held in the neutral position. Downwind taxiing will usually require less engine power after the initial ground roll is begun, since the wind will be pushing the airplane forward. To avoid overheating the brakes when taxiing downwind, keep engine power to a minimum. Rather than continuously riding the brakes to control speed, it is better to apply brakes only occasionally. Other than sharp turns at low speed, **the throttle should always be at idle before the brakes are applied. It is a common student error to taxi with a power setting that requires controlling taxi speed with the brakes. This is the aeronautical equivalent of driving an automobile with both the accelerator and brake pedals depressed.**

When taxiing with a quartering headwind, the wing on the upwind side will tend to be lifted by the wind unless the aileron control is held in that direction (upwind aileron UP). Moving the aileron into the UP position reduces the effect of the wind striking that wing, thus reducing the lifting action. This control movement will also cause the downwind aileron to be placed in the DOWN position, thus a small amount of lift and drag on the downwind wing, further reducing the tendency of the upwind wing to rise.

When taxiing with a quartering tailwind, the elevator should be held in the DOWN position, and the upwind aileron, DOWN. Since the wind is striking the airplane from behind, these control positions reduce the tendency of the wind to get under the tail and the wing and to nose the airplane over.

The application of these crosswind taxi corrections helps to minimize the aircraft's weathervane tendency and ultimately results in making the airplane easier to steer.

An easy way to remember the elevator and aileron control inputs required for crosswind/headwind combinations during taxi:

- Level into a headwind (elevator neutral; upwind aileron up)
- Descend away from a cross-wind (elevator down; upwind aileron down)

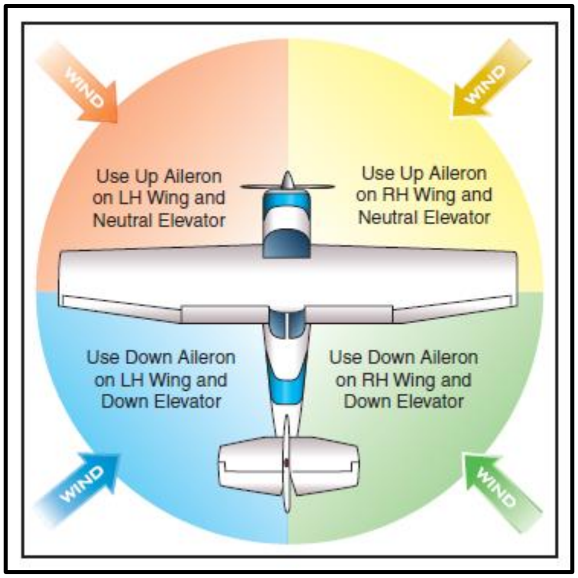

Figure 4-3 Control inputs during crosswind taxi

Normally, all turns should be started using the rudder pedal to steer the nosewheel. To tighten the turn after full pedal deflection is reached, the brake may be applied as needed. Turns can be sharpened by either tapping the brake in the direction of turn or, at low speeds, the brake can be held. By first allowing the aircraft to roll forward, applying full rudder and then holding the respective brake, the aircraft can be made to turn by rotating on the stopped wheel.

When stopping the airplane, it is advisable to always stop with the nosewheel straight ahead to relieve any side load on the nosewheel and to make it easier to start moving ahead.

During crosswind taxiing, the nosewheel linkage from the rudder pedals provides adequate steering control for safe and efficient ground handling, and normally, only rudder pressure is necessary to correct for a cross-wind.

413. ENGINE RUNUP/BEFORE TAKEOFF CHECK

The before takeoff check is the systematic procedure for making a check of the engine, controls, systems, instruments, and avionics prior to flight. Normally, it is performed after taxiing to a position near the takeoff end of the runway. Taxiing to that position usually allows sufficient time for the engine to warm up to at least minimum operating temperatures. This ensures adequate lubrication and internal engine clearances before being operated at high power settings. Many engines require that the oil temperature reach a minimum value as stated in the AFM/POH before high power is applied.

Air-cooled engines generally have very close cowlings and are equipped with pressure baffles that direct the flow of air to the engine in sufficient quantities for cooling in flight. On the ground, however, much less air is forced through the cowling and around the baffling. Prolonged ground operations may cause cylinder overheating long before there is an indication

of rising oil temperature.
Prior to beginning the before takeoff check, the airplane should be positioned clear of other aircraft. There should not be anything behind the airplane that might be damaged by the prop blast. **To minimize overheating during engine run-up, it is recommended that the airplane be headed into the wind as nearly as possible**. **After the airplane is properly positioned for the run-up, it should be allowed to roll forward slightly so the nosewheel will be centered.**

During the engine run-up, the surface under the airplane should be firm (a smooth, paved, or turf surface if possible) and free of debris. Otherwise, the propeller may pick up pebbles, dirt, mud, sand, or other loose objects and hurl them backwards. This damages the propeller and may damage the tail of the airplane. Small chips in the leading edge of the propeller form stress risers, or lines of concentrated high stress. These are highly undesirable and may lead to cracks and possible propeller blade failure.

While performing the engine run-up, the pilot must divide attention inside and outside the airplane. If the parking brake slips, or if application of the toe brakes is inadequate for the amount of power applied, the airplane could move forward unnoticed if attention is fixed inside the airplane.

Each airplane has different features and equipment and the before takeoff checklist provided by the airplane manufacturer or operator should be used to support the memorized execution of the run-up flow.

414. AFTER LANDING

During the landing roll, the airplane should be gradually slowed to normal taxi speed before turning off the landing runway. Any significant degree of turn at faster speeds could result in ground looping and subsequent damage to the airplane.

To give full attention to controlling the airplane during the landing roll, the after-landing check should be performed only after the airplane is brought to a complete stop clear of the active runway. There have been many cases of the pilot mistakenly grasping the wrong handle and retracting the landing gear, instead of the flaps, due to improper division of attention while the airplane was moving. However, this procedure may be modified if the manufacturer recommends that specific after-landing items be accomplished during landing rollout.

Because of different features and equipment in various airplanes, the after-landing checklist provided by the manufacturer should be used. It is important that the pilot taxi clear of the runway environment (past the hold short markings) and stop the aircraft prior to performing after landing checks.

415. PARKING AND ENGINE SHUTDOWN

Unless parking in a designated, supervised area, the pilot should select a location and heading which will prevent the propeller or jet blast of other airplanes from striking the airplane broadside. Whenever possible, the airplane should be parked headed into the existing or forecast wind. After stopping on the desired heading, the airplane should be allowed to roll straight ahead enough to straighten the nosewheel. Finally, the pilot should always use the procedures in the manufacturer's checklist for shutting down the engine and securing the airplane.

416. POSTFLIGHT SECURING AND SERVICING

A flight is not complete until the engine is shut down and the airplane is secured. A pilot should consider this an essential part of any flight. After engine shutdown and deplaning passengers, the pilot should accomplish a postflight inspection. This includes checking the general condition of the aircraft. For a departure, the oil should be checked and fuel added if required. If the aircraft is going to be inactive, it is a good operating practice to fill the tanks to the top to prevent water condensation from forming. When the flight is completed for the day, the aircraft should be tied down and the flight controls secured.

In NIFE, aircraft are often turned around to a subsequent training wave. It is everyone's responsibility to facilitate the execution of the flight schedule. **Postflight is not complete until the aircrew has ensured the aircraft is prepared for the next wave to include ensuring the aircraft is adequately fueled or fuel has been ordered and any downing discrepancies have been reported**.

CHAPTER FIVE
FLIGHT PROCEDURES

500. INTRODUCTION

This chapter discusses the basic procedures that you will practice during your NIFE flight training. These basics will form the foundation of your ability to fly the aircraft and to later perform advanced maneuvers. You will learn to takeoff, fly straight and level, turn, climb and descend. You will even learn to stall the aircraft. While some of these maneuvers, such as Straight-and-Level Flight, may seem simple, they all require strict adherence to the procedures contained in this chapter. In order to successfully learn to accomplish these maneuvers in the small amount of time that you will be airborne, it is essential that you commit these procedures to memory prior to entering the aircraft. If you do not know the procedures on the ground, you will not be able to perform them in the air.

During flight training, there must always be a clear understanding between the student and flight instructor of who has control of the aircraft. Prior to any dual training flight, a briefing should be conducted that includes the procedure for the exchange of flight controls. As stated before, the three-step process for the exchange of flight controls is highly recommended. In Naval Aviation this is referred to as a “positive three-way exchange of controls.”

501. COMMUNICATIONS

Proper radio communication procedures are extremely important to safety when operating in controlled airspace or the vicinity of other aircraft. You should read and learn the basic communication terminology/procedures explained in Appendix B. These procedures will be useful throughout your aviation career.

502. TAKEOFFS

This section discusses takeoffs and departure climbs in tricycle landing gear (nosewheel-type) airplanes under normal conditions, and under conditions which require maximum performance. A thorough knowledge of takeoff principles, both in theory and practice, will often prove of extreme value throughout a pilot’s career. It will often prevent an attempted takeoff that would result in an accident, or during an emergency, make possible a takeoff under critical conditions when a pilot with a less well rounded knowledge and technique would fail.

The takeoff, though relatively simple, often presents the most hazards of any part of a flight. The importance of thorough knowledge and faultless technique and judgment cannot be overemphasized.

It must be remembered that the manufacturer’s recommended procedures, including airplane configuration and airspeeds, and other information relevant to takeoffs and departure climbs in a specific make and model airplane are contained in the FAA-approved Airplane Flight Manual and/or Pilot’s Operating Handbook (AFM/POH) for that airplane. If any of the information in this chapter differs from the airplane manufacturer’s recommendations as contained in the AFM/POH, the airplane manufacturer’s recommendations take precedence.

Although the takeoff and climb is one continuous maneuver, it will be divided into three separate steps for purposes of explanation: (1) the takeoff roll, (2) the lift-off, and (3) the initial climb after becoming airborne.

- Takeoff Roll (ground roll)—the portion of the takeoff procedure during which the airplane is accelerated from a standstill to an airspeed that provides sufficient lift for it to become airborne.

- Lift-off (rotation)—the act of becoming airborne as a result of the wings lifting the airplane off the ground or the pilot rotating the nose up, increasing the angle of attack to start a climb.

- Initial Climb—begins when the airplane leaves the ground and a pitch attitude has been established to climb away from the takeoff area. Normally, it is considered complete when the airplane has reached a safe maneuvering altitude, or an enroute climb has been established.

Before taxiing onto the runway or takeoff area, the pilot should ensure that the engine is operating properly and that all controls, including flaps and trim tabs, are set in accordance with the before takeoff checklist. In addition, the pilot must make certain that the approach and takeoff paths are clear of other aircraft. At uncontrolled airports, pilots should announce their intentions on the common traffic advisory frequency (CTAF) assigned to that airport. When operating from an airport with an operating control tower, pilots must contact the tower operator and receive a takeoff clearance before taxiing onto the active runway.

All prudent wake turbulence avoidance measures should be taken when departing behind larger aircraft either taking off or landing on your runway or another runway that could result in wake turbulence during takeoff roll.

503. TAKEOFF BRIEF

Prior to taking the runway a concise takeoff brief shall be conducted. The takeoff brief ensures the student and instructor have clearly defined roles and have discussed a plan should an emergency occur during this critical phase of flight.

"Rotate at ___ (Vr), climb out at ____ (Vy), departing to the ____ (east, west, etc.). Any malfunction prior to rotate, we'll abort the takeoff. Any malfunction after rotate, we'll climb to 1000 feet, enter the pattern and troubleshoot. If we have an engine failure after rotate with runway remaining – set it back down. If engine failure below 800' AGL – select landing site within 30° of the nose. If engine failure above 800' AGL – enter low key for nearest suitable runway."

While taxiing onto the runway, the pilot can select ground reference points that are aligned with the runway direction as aids to maintaining directional control during the takeoff. These may be runway centerline markings, runway lighting, distant trees, towers, buildings, or mountain peaks. If the aircraft is equipped with an adjustable heading indicator, it should be slewed to runway heading at this time.

504. PROCEDURE PRIOR TO TAKING THE RUNWAY

At the hold short:

1. TALK – Switch to tower and request permission for departure or make appropriate radio call on CTAF.

2. CLEAR – Visually check runway and final approach for other aircraft or obstacles.

3. LINE UP CHECKLIST – Execute the lineup checklist after clearing the runway, while taxiing into position of takeoff.

505. NORMAL TAKEOFF

There are two reasons for making a takeoff as nearly into the wind as possible. First, the airplane’s speed while on the ground (groundspeed) is much less than if the takeoff were made downwind. Second, a shorter ground roll and therefore much less runway length is required to develop the minimum lift necessary for takeoff and climb. Since the airplane depends on airspeed in order to fly, a headwind provides some of that airspeed, even with the airplane motionless, from the wind flowing over the wings.

After taxiing onto the runway, the airplane should be carefully aligned with the intended takeoff direction, and the nosewheel positioned straight, or centered. After releasing the brakes, the throttle should be advanced smoothly and continuously to takeoff power. An abrupt application of power may cause the airplane to yaw sharply to the left because of the torque effects of the engine and propeller. This will be most apparent in high horsepower engines. As the airplane starts to roll forward, the pilot should assure both feet are on the rudder pedals so that the toes or balls of the feet are on the rudder portions, not on the brake portions of the pedals (heels on the deck). Engine instruments should be checked and monitored during the takeoff roll for any malfunctions to include: the engine is creating sufficient RPM, fuel pressure, oil pressure, oil temperature, ammeter are in the green or operating properly and the airspeed indicator is functioning properly.

As speed is gained, the elevator control will tend to assume a neutral position if the airplane is correctly trimmed. At the same time, directional control should be maintained with smooth, prompt, positive rudder corrections throughout the takeoff roll. The effects of engine torque and P-factor at the initial speeds tend to pull the nose to the left. The pilot must use whatever rudder pressure and aileron needed to correct for these effects or for existing wind conditions to keep the nose of the airplane headed straight down the runway. The use of brakes for steering purposes should be avoided, since this will cause slower acceleration of the airplane’s speed, lengthen the takeoff distance, and possibly result in severe swerving and loss of aircraft control. While the speed of the takeoff roll increases, more and more pressure will be felt on the flight controls, particularly the elevator and rudder. If the tail surfaces are affected by the propeller slipstream, they become effective first. As the speed continues to increase, all of the flight controls will gradually become effective enough to maneuver the airplane about its three axes. It is at this point, in the taxi to flight transition, that the airplane is being flown more than taxied.

As this occurs, progressively smaller rudder deflections are needed to maintain direction.

The feel of resistance to the movement of the controls and the airplane's reaction to such movements are the only real indicators of the degree of control attained. This feel of resistance is not a measure of the airplane's speed, but rather of its controllability. The flight instructor should stress the importance of the development of feel. The student pilot should be required to feel lightly for resistance and accomplish the desired results by applying pressure against it. This practice will enable the student pilot, as experience is gained, to achieve a sense of the point when sufficient speed has been acquired for the takeoff, instead of merely guessing, fixating on the airspeed indicator, or trying to force performance from the airplane

When all the flight controls become effective during the takeoff roll, and rotation speed is reached, back- elevator pressure should be gradually applied to raise the nosewheel slightly off the runway, thus establishing the takeoff or lift-off attitude. This is often referred to as "rotating." The wings must be kept level by applying aileron pressure as necessary.

Since a good takeoff depends on the proper takeoff attitude, it is important to know how this attitude appears and how it is attained. **The ideal takeoff attitude requires only minimum pitch adjustments shortly after the airplane lifts off to attain the speed for the best rate of climb (Vy)**. **The pitch attitude necessary for the airplane to accelerate to Vy speed will be demonstrated by the instructor and memorized by the student**. **Initially, the student may have a tendency to hold excessive back-elevator pressure just after lift-off, resulting in an abrupt pitch-up.**

The airplane should be allowed to fly off the ground while in the normal takeoff attitude. Although the airplane can be forced into the air, this is considered an unsafe practice and should be avoided under normal circumstances. If the airplane is forced to leave the ground by using too much back-elevator pressure before adequate flying speed is attained, the wing's angle of attack may be excessive, causing the airplane to settle back to the runway or even to stall. It is important, then, to hold the correct attitude constant after rotation or lift-off.

As the airplane leaves the ground, the pilot must continue to be concerned with maintaining the wings in a level attitude, as well as holding the proper pitch attitude. Outside visual scan to attain/maintain proper airplane pitch and bank attitude must be intensified at this critical point. The flight controls have not yet become fully effective, and the beginning pilot will often have a tendency to fixate on the airplane's pitch attitude and/or the airspeed indicator and neglect the natural tendency of the airplane to roll just after breaking ground.

During takeoffs in a strong, gusty wind, it is advisable that an extra margin of speed be obtained before the airplane is allowed to leave the ground. A takeoff at the normal takeoff speed may result in a lack of positive control, or a stall, when the airplane encounters a sudden lull in strong, gusty wind, or other turbulent air currents. In this case, the pilot should allow the airplane to stay on the ground longer to attain more speed; then make a smooth, positive rotation to leave the ground.

506. INITIAL CLIMB

Upon lift-off, the airplane should be flying at approximately the pitch attitude that will allow it to accelerate to Vy. This is the speed at which the airplane will gain the most altitude in the shortest period of time.

If the airplane has been properly trimmed, some back-elevator pressure may be required to hold this attitude until the proper climb speed is established. On the other hand, relaxation of any back-elevator pressure before this time may result in the airplane settling, even to the extent that it contacts the runway.

The airplane will pick up speed rapidly after it becomes airborne. Once a positive rate of climb is established, the flaps can be progressively retracted (if used for takeoff).

Since the power on the initial climb is fixed at the takeoff power setting, the airspeed must be controlled by making slight pitch adjustments using the elevators. However, the pilot should not fixate on the airspeed indicator when making these pitch changes, but should, instead, continue to scan outside to adjust the airplane's attitude in relation to the horizon. In accordance with the principles of attitude flying, the pilot should first make the necessary pitch change with reference to the natural horizon and hold the new attitude momentarily, and then glance at the airspeed indicator as a check to see if the new attitude is correct. Due to inertia, the airplane will not accelerate or decelerate immediately as the pitch is changed. It takes a little time for the airspeed to change. If the pitch attitude has been over or under corrected, the airspeed indicator will show a speed that is more or less than that desired. When this occurs, the cross-checking and appropriate pitch-changing process must be repeated until the desired climbing attitude is established. When the correct pitch attitude has been attained, it should be held constant while cross-checking it against the horizon and other outside visual references. The airspeed indicator should be used only as a check to determine if the attitude is correct.

After the recommended climb airspeed has been established, and a safe maneuvering altitude has been reached, the power should be adjusted to the recommended climb setting and the airplane trimmed to relieve the control pressures. This will make it easier to hold a constant attitude and airspeed.

During initial climb, it is important that the aircraft course remains aligned with the extended runway centerline to avoid drifting into obstructions, or the path of another aircraft that may be taking off from a parallel runway. Proper scanning techniques are essential to a safe takeoff and climb, not only for maintaining attitude and direction, but also for collision avoidance in the airport area.

507. PROCEDURE FOR NORMAL TAKEOFF

1. SELECT – Reference point to maintain runway extended centerline after takeoff.

2. POWER – Set 2000 RPM.

3. INSTRUMENTS – Check engine instruments and announce “Instruments in the green.”

4. POWER – Smoothly advance to full – heals to the deck.

5. MAINTAIN – Directional control using the rudders.

6. AIRSPEED – Check and announce “Airspeed alive.”

7. ROTATE – Rotate at Vr (55 KIAS).

8. ACCERLATE – Accelerate to Vy (73 KIAS)

9. PITCH –Set attitude for Vy.

508. COMMON ERRORS DURING NORMAL TAKEOFFS

- Failure to adequately clear the area prior to taxiing into position on the active runway.
- Abrupt use of the throttle.
- Failure to check engine instruments for signs of malfunction after applying takeoff power.
- Failure to anticipate the airplane’s left turning tendency on initial acceleration.
- Overcorrecting for left turning tendency.
- Failure to maintain center line.
- Relying solely on the airspeed indicator rather than developed feel for indications of speed and airplane controllability during acceleration and lift-off.
- Failure to attain proper lift-off attitude.
- Inadequate compensation for torque/P-factor during initial climb resulting in a sideslip.
- Over-control of elevators during initial climb- out.
- Limiting scan to areas directly ahead of the air- plane (pitch attitude and direction), resulting in allowing a wing (usually the left) to drop immediately after lift-off.
- Failure to attain/maintain best rate-of-climb air- speed (Vy).
- Failure to employ the principles of attitude flying during climb-out, resulting in “chasing” the air- speed indicator.

509. CROSSWIND TAKEOFF

While it is usually preferable to takeoff directly into the wind whenever possible or practical, there will be many instances when circumstances or judgment will indicate otherwise. Therefore, the pilot must be familiar with the principles and techniques involved in cross-wind takeoffs, as well as those for normal takeoffs. A cross-wind will affect the airplane during takeoff much as it does in taxiing. With this in mind, it can be seen that the technique for cross-wind correction during takeoffs closely parallels the cross-wind correction techniques used in taxiing.

The technique used during the initial takeoff roll in a cross-wind is generally the same as used in a normal takeoff, except that aileron control must be held INTO the cross-wind. This raises the aileron on the upwind wing to impose a downward force on the wing to counteract the lifting force of the cross-wind and prevents the wing from rising.

As the airplane is taxied into takeoff position, it is essential that the windsock and other wind direction indicators be checked so that the presence of a cross-wind may be recognized and anticipated. If a crosswind is indicated, FULL aileron should be held into the wind as the takeoff roll is started. This control position should be maintained while the airplane is accelerating and until the ailerons start becoming sufficiently effective for maneuvering the airplane about its longitudinal axis.

With the aileron held into the wind, the takeoff path must be held straight with the rudder. Normally, this will require applying downwind rudder pressure, since on the ground the airplane will tend to weathervane into the wind. When takeoff power is applied, rudder must now be used to compensate for torque or P-factor, as well as, a crosswind. In any case, apply whatever rudder pressure is required to keep the airplane rolling straight down the runway.

If the upwind wing rises from insufficient aileron control, thus exposing more surface to the cross-wind, a “skipping” action may result. This is usually indicated by a series of very small bounces, caused by the airplane attempting to fly and then settling back onto the runway. During these bounces, the cross-wind also tends to move the airplane sideways, and these bounces will develop into side-skipping. This side-skipping imposes severe side stresses on the landing gear and could result in structural failure.

Figure 5-1 Skipping on Takeoff

As the nosewheel is being raised off the runway, the holding of aileron control into the wind may result in the downwind wing rising and the downwind main wheel lifting off the runway first, with the remainder of the takeoff roll being made on that one main wheel. This is acceptable and is preferable to side-skipping.

It is important to establish and maintain the proper amount of cross-wind correction prior to lift-off by applying aileron pressure toward the wind to keep the upwind wing from rising and applying rudder pressure as needed to prevent weather vaning. If proper crosswind correction is being applied, as soon as the airplane is airborne, it will be side slipping into the wind sufficiently to counteract the drifting effect of the wind. This side slipping should be continued until the airplane has a positive rate of climb. At that time, the airplane should be crabbed into the wind to establish sufficient wind correction angle to maintain extended runway centerline. The remainder of the climb technique is the same used for normal takeoffs and climbs.

510. PROCEDURE FOR CROSSWIND TAKEOFF

1. SELECT - Reference point to maintain runway extended centerline after takeoff.

2. AILERON – Full into wind.

3. POWER – Set 2000 RPM.

4. INSTRUMENTS – Check engine instruments and announce “Instruments in the green.”

With Brakes Released (on the roll):

5. POWER – Smoothly advance to full – heals to the deck.

6. MAINTAIN – Directional control using the rudders.

7. AIRSPEED – Check and announce “Airspeed alive.”

8. AILERON – Gradually reduce aileron as airspeed increases and controls become effective.

9. ROTATE – Rotate at Vr (55 KIAS).

After Liftoff:

10. CRAB – Crab into wind to maintain runway centerline.

11. ACCELERATE - Accelerate to Vy (73 KIAS).

12. . ATTITUDE – Set attitude for Vy.

511. COMMON ERRORS DURING CROSSWIND TAKEOFF

- Failure to adequately clear the area prior to taxiing onto the active runway.
- Using less than full aileron pressure into the wind initially on the takeoff roll.
- Mechanical use of aileron control rather than sensing the need for varying aileron control input through feel for the airplane.
- Premature lift-off resulting in side-skipping.
- Excessive aileron input in the latter stage of the takeoff roll resulting in a steep bank into the wind at lift-off.
- Inadequate drift correction after lift-off

512. GROUND EFFECT

Ground effect is a condition of improved performance encountered when the airplane is operating very close to the ground due to a decrease in total drag. Ground effect can be detected and measured up to an altitude equal to one wingspan above the surface. However, ground effect is most significant when the airplane is maintaining a constant attitude at low airspeed at low altitude (for example, during takeoff when the airplane lifts off and accelerates to climb speed, and during the landing flare before touchdown).

Ground effect is important to normal flight operations. If the runway is long enough, or if no obstacles exist, ground effect can be used to an advantage by using the reduced drag to improve initial acceleration. During landing, ground effect without a power reduction can lead to floating and extended landing distances.

513. ABORTED/REJECTED TAKEOFF

A takeoff is aborted when an emergency or abnormal situations occurs during the takeoff roll that will require a pilot to abort the takeoff. Circumstances such as a malfunctioning powerplant, inadequate acceleration, runway incursion, or air traffic conflict may be reasons for an aborted takeoff.

Prior to takeoff, the pilot should determine a point along the runway at which the airplane should be airborne. If that point is reached and the airplane is not airborne, immediate action should be taken to discontinue the takeoff. Properly planned and executed, chances are excellent the airplane can be stopped on the remaining runway without using extraordinary measures, such as excessive braking that may result in loss of directional control, airplane damage, and/or personal injury.

In the event a takeoff is aborted, the power should be reduced to idle and sufficient braking applied to stop on the runway while also maintaining directional control. If it is necessary to shut down the engine due to a fire, the mixture control should be brought to the idle cutoff position and the magnetos and master turned off. In all cases, the manufacturer’s emergency procedure should be followed.

514. PROCEDURES FOR ABORTING A TAKEOFF

1. POWER – Reduce to idle.

2. MAINTAIN – Directional control using the rudders.

3. BRAKES – Brake as required to stop aircraft on remaining runway.

If leaving paved portion of runway:

4. MIXTURE – Idle cutoff.

5. MAGNETOS – Off.

6. MASTER – Off.

7. DOOR – Open.

515. CLEARING TURNS

Clearing turns are mandatory prior to any stall training maneuvers. Clearing turns are simply a set of turns to scan the surrounding airspace for traffic. A method for clearing turns is to use 15° of bank for 90° of turn either side of present heading or simply a 180° turn. Don’t focus on flying perfect clearing turns at the expense of actually clearing traffic around you. When conducting successive flight maneuvers, clearing turns are not required prior to each maneuver, but instead should be executed prior to the start of the combined maneuvers and then at a sensible periodicity while maneuvering. Regardless of whether the airspace has been cleared, continual awareness of and scanning for traffic should be maintained.

516. LEVEL SPEED CHANGE

The maintenance of lift and control of an airplane in flight requires a certain minimum airspeed. This critical airspeed depends on certain factors, such as gross weight, load factors, and existing density altitude. An important feature of pilot training is the development of the ability to estimate the margin of safety above the stalling speed. Also, the ability to determine the characteristic responses of any airplane at different airspeeds is of great importance to the pilot. The student pilot, therefore, must develop this awareness in order to safely avoid stalls and to operate an airplane correctly and safely at slow airspeeds.

Maneuvering during slow flight demonstrates the flight characteristics and degree of controllability of an airplane at less than cruise speeds. The ability to determine the characteristic control responses at the lower airspeeds appropriate to takeoffs, departures, and landing approaches is a critical factor in stall awareness.

As airspeed decreases, control effectiveness decreases disproportionately. For instance, there may be a certain loss of effectiveness when the airspeed is reduced from 30 to 20 knots above the stalling speed, but there will normally be a much greater loss as the airspeed is further reduced to 10 knots above stalling. The objective of maneuvering during slow flight is to develop the pilot’s sense of feel and ability to use the controls correctly, and to improve proficiency in performing maneuvers that require slow airspeeds.

Maneuvering during slow flight should be performed using both instrument indications and outside visual reference. Your instructor will require you to fly the aircraft at various angles of bank in approach configuration to experience the way in which the aircraft handles at these slower airspeeds. During these turns, additional power must be applied to maintain airspeed, with attitude adjustment to maintain altitude.

517. PROCEDURE FOR LEVEL SPEED CHANGE

1. Establish the aircraft at 90 KIAS and any numbered heading.

2. CARB HEAT – On

3. POWER – Reduce to ~1500 RPM.

4. ATTITUDE – Continually increase pitch to maintain altitude as airspeed decreases.

5. FLAPS – In the White Arc extend flaps (can be added incrementally or all at once).

6. TRIM – As required.

Approaching V_{SO}+10 KIAS:

7. POWER – Increase power to ~2100 RPM in order to maintain level flight.

8. ATTITUDE

    a. Pitch for airspeed - No greater than Vso + 10 knots.

    b. Power for altitude - +/- 100 feet of entry altitude.

9. TRIM – Trim as required to maintain hands off stable flight.

10. CLEAR – Clear the airspace in direction of turn.

11. TURN – Turn 90° and then reverse turn back to initial heading (~10-15° AOB) if directed by the instructor.

Recovery

12. POWER – Increase to cruise flight setting ~2200-2300 RPM.

13. CARB HEAT – Off.

14. FLAPS – Retract flaps incrementally.

15. ATTITUDE – Simultaneously reduce to maintain level flight.

16. ACCELERATE – 90 KIAS.

17. TRIM – Trim to hands off level flight.

518. COMMON ERRORS DURING LEVEL SPEED CHANGE

- Inadequate back-elevator pressure as power is reduced, resulting in altitude loss.
- Excessive back-elevator pressure as power is reduced, resulting in a climb, followed by a rapid reduction in airspeed and "mushing."
- Inadequate compensation for adverse yaw during turns.
- Fixation on the airspeed indicator.
- Failure to anticipate changes in lift as flaps are extended or retracted.
- Inadequate power management.
- Inability to adequately divide attention between airplane control and orientation.

519. TURN PATTERN

The objective of the maneuver is to develop the smoothness, coordination, orientation, and division of attention. Smoothness of control use, coordination, and accuracy of execution are the important features of this maneuver.

The TP is started at 100 KIAS on any cardinal heading. The TP consists of two 15° AOB turns in opposite directions for 30° of heading change, two 30º AOB turns in opposite directions for 90º of heading change, and two 45º AOB turns in opposite directions for 180º of heading change. A smooth reversal is made using the one third rule going from one turn into another, eliminating a straight and level leg. Your IP may adjust the TP as needed to remain within the working airspace.

During the turns, continue to check the area clear. Check the aircraft attitude with the horizon, crosscheck the attitude indicator for nose attitude and AOB, with the altimeter and VSI. Correct the visual attitude as necessary, while periodically cross-checking the heading indicator for turn progress and the airspeed for power required.

The 30º AOB turns will require little back-stick pressure and/or additional power. For the 45º AOB turns, it will be necessary to raise the nose slightly higher yet to increase the AOA in order to compensate for the loss of vertical lift as the bank steepens. Additional power will be required to maintain airspeed. To avoid overshooting the rollout headings, lead the rollout heading by the one-third rule. Strive for smooth reversals between turns.

Trim the aircraft as necessary throughout the pattern. Remember, as the reversal or rollout occurs, the nose must be lowered back to the level attitude, and since it has been trimmed "up" during the turn, the nose will require forward stick pressure to lower it. Remember to use the P.A.T. principle.

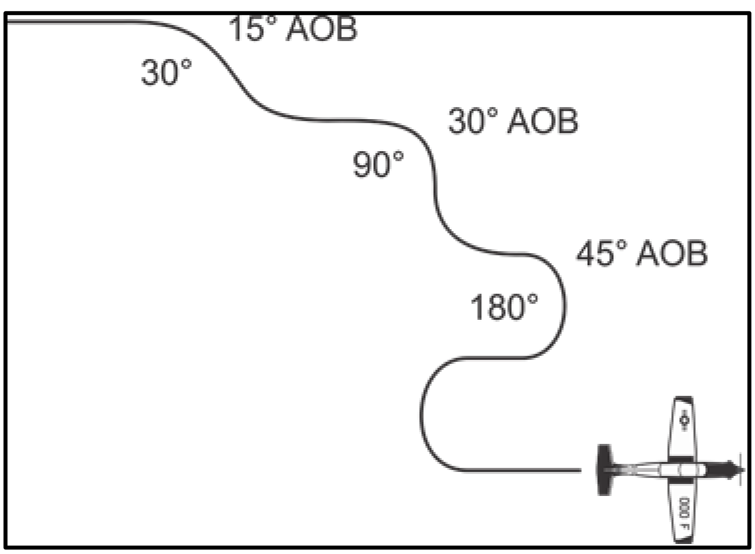

Figure 5-2 Turn Pattern

520. PROCEDURE FOR TURN PATTERN

1. Establish the aircraft straight and level on any cardinal heading, base altitude and 90 KIAS.

2. Clear the area. Turn either direction for 30º of heading change using a 15º AOB. Clear the area (in the other direction), then reverse the turn, leading by the one- third rule for 30º of heading change using a 15º AOB.

3. Clear the area. With no delay, reverse the turn leading by the one-third rule and turn for 90º of heading change using a 30º AOB. Maintain altitude and airspeed with power and nose attitude; trim. Clear the area (other direction), then reverse the turn with no delay using the one-third rule for 90º of heading change using a 30º angle of bank. Remember, adjust nose attitude as necessary to maintain airspeed and altitude while rolling through wings level.

4. Clear the area. With no delay, reverse the turn leading by the one-third rule and turn for 180º of heading change using a 45º AOB. Maintain altitude and airspeed with power and nose attitude; trim. Clear the area (other direction), then reverse the turn with no delay using the one-third rule for 180º of heading change using a 45º angle of bank. Remember, adjust nose attitude as necessary to maintain airspeed and altitude while rolling through wings level.

5. Roll out on the original heading using the one-third rule and holding slight forward stick pressure to prevent ballooning.

6. Reset power to the normal/slow cruise power setting (as required), reset attitude and re-trim for straight and level flight.

521. COMMON ERRORS DURING TURN PATTERN

- Applying the control pressures too rapidly and abruptly, or using too much back-stick pressure before it is actually needed. Remember the aircraft is flown through a medium-banked turn before it reaches a steeper turn.

- Not holding the nose attitude steady. In order to determine the appropriate corrections, you must first establish a steady attitude and allow the instruments to stabilize. Attempts to start recovery prematurely.

- Staring at the nose and consequently applying control corrections too late. Divide your attention. Scan your instruments, never fixating on any one instrument. Anticipate the need for additional power and nose up. Do not wait until you are low or slow.

- Gaining altitude in reversals. Not lowering nose as the wings pass the level flight attitude, usually due to fixating on the attitude indicator instead of scanning the horizon.

- Not clearing the area before and during all turns.

- Not flying in balanced flight.

522. STALL AWARENESS

A stall occurs when the smooth airflow over the airplane's wing is disrupted, and the lift degenerates rapidly. This is caused when the wing exceeds its critical angle of attack. This can occur at any airspeed, in any attitude, with any power setting.

The direct cause of every stall is an excessive angle of attack. The student pilot should fully understand that there are any number of flight maneuvers which may produce an increase in the wing's angle of attack, but the stall does not occur until the angle of attack becomes excessive. This "critical" angle of attack varies from 16 to 20° depending on the airplane design.

The student must understand that low speed is not necessary to produce a stall. The critical AOA can be exceeded at any speed. High pitch attitude is not an absolute indication of proximity to a stall. Most airplanes are quite capable of stalling at a level or near level pitch attitude.

The key to stall awareness is the pilot's ability to visualize the wing's AOA in any particular circumstance, and thereby be able to estimate his/her margin of safety above stall.

The practice of stall recovery and the development of awareness of stalls are of primary importance in pilot training. The objectives in performing intentional stalls are to familiarize the pilot with the conditions that produce stalls, to assist in recognizing an approaching stall, and to develop the habit of taking prompt preventive or corrective action.

Intentional stalls should be performed at an altitude that will provide adequate height above the ground for recovery and return to normal level flight. Though it depends on the degree to which a stall has progressed, most stalls require some loss of altitude during recovery. The longer it takes to recognize the approaching stall, the more complete the stall is likely to become, and the greater the loss of altitude to be expected. **For NIFE, all stalls will be initiated at an altitude that will allow recovery by 1500 ft AGL.**

523. RECOGNITION OF STALLS

Pilots must recognize the flight conditions that are conducive to stalls and know how to apply the necessary corrective action. They should learn to recognize an approaching stall by sight, sound, and feel. The following cues may be useful in recognizing the approaching stall.

- Vision is useful in detecting a stall condition by noting the attitude of the airplane. This sense can only be relied on when the stall is the result of an unusual attitude of the airplane. Since the airplane can also be stalled from a normal attitude, vision in this instance would be of little help in detecting the approaching stall.

- Hearing is also helpful in sensing a stall condition. In the case of fixed-pitch propeller airplanes in a power-on condition, a change in sound due to loss of revolutions per minute (RPM) is particularly noticeable. The lessening of the noise made by the air flowing along the airplane structure as airspeed decreases is also quite noticeable, and when the stall is almost complete, vibration and incident noises often increase greatly.

- Kinesthesia, or the sensing of changes in direction or speed of motion, is probably the most important and the best indicator to the trained and experienced pilot. This is "seat of the pants" flying. If this sensitivity is properly developed, it will warn of a decrease in speed or the beginning of a settling or mushing of the airplane.

- Feel is an important sense in recognizing the onset of a stall. The feeling of control pressures is very important. As speed is reduced, the resistance to pressures on the controls becomes progressively less. Pressures exerted on the controls tend to become movements of the control surfaces. The lag between these movements and the response of the airplane becomes greater, until in a complete stall all controls can be moved with almost no resistance, and with little immediate effect on the airplane. Just before the stall occurs, buffeting, uncontrollable pitching, or vibrations may begin.

Several types of stall warning indicators have been developed to warn pilots of an approaching stall. The use of such indicators is valuable and desirable, but the reason for practicing stalls is to learn to recognize stalls without the benefit of warning devices.

524. FUNDAMENTALS OF STALL RECOVERY

During the practice of intentional stalls, the real objective is not to learn how to stall an airplane, but to learn how to recognize an approaching stall and take prompt corrective action. Though the recovery actions must be taken in a coordinated manner, they are broken down into three actions here for explanation purposes.

First, at the indication of a stall, the pitch attitude and angle of attack must be decreased positively and immediately. Since the basic cause of a stall is always an excessive angle of attack, the cause must first be eliminated by releasing the back-elevator pressure that was necessary to attain that angle of attack or by moving the elevator control forward. This lowers the nose and returns the wing to an effective angle of attack. In NIFE aircraft, relaxing back pressure or pushing elevator control slightly forward of neutral is enough to recover. An excessive negative load on the wings caused by excessive forward movement of the elevator may impede, rather than hasten, the stall recovery. The object is to reduce the angle of attack but only enough to allow the wing to regain lift.

Second, the maximum allowable power should be applied to increase the airplane's airspeed and assist in reducing the wing's angle of attack. The throttle should be promptly, but smoothly, advanced to the maximum allowable power. The flight instructor should emphasize, however, that power is not essential for a safe stall recovery if sufficient altitude is available. Reducing the angle of attack is the only way of recovering from a stall regardless of the amount of power used. In most actual stalls the application of more power, if available, is an integral part of the stall recovery. Usually, the greater the power applied, the less the loss of altitude. The NIFE stall recovery procedure includes the addition of power for this reason. However, stall recoveries should also be demonstrated / practiced without addition of power for the student to understand power is not required for recovery; decreasing AOA below critical is the basis of stall recovery.

Third, straight-and-level flight should be regained with coordinated use of all controls. Practice in both power-on and power-off stalls is important because it simulates stall conditions that could occur during normal flight maneuvers. For example, the power-on stalls are practiced to show what could happen if the airplane were climbing at an excessively nose-high attitude immediately after takeoff or during a climbing turn. The power-off turning stalls are practiced to show what could happen if the controls are improperly used during a turn from the base leg to the final approach. The practice of power- off stalls is usually performed with normal landing approach conditions in simulation of an accidental stall occurring during landing approaches.

525. USE OF AILERONS/RUDDER DURING STALL RECOVERY

Exceeding the critical angle of attack causes a stall; NIFE aircraft are designed such that the wing roots of an airplane will exceed the critical angle before the wingtips, and the wing roots will stall first. The wings are designed in this manner so that aileron control will be available at high angles of attack (slow airspeed) and give the airplane more stable stalling characteristics.

When the airplane is in a stalled condition, the wingtips continue to provide some degree of lift, and the ailerons still have some control effect. During recovery from a stall, the return of lift begins at the tips and progresses toward the roots. Thus, the ailerons can be used to level the wings.

Using the ailerons requires finesse to avoid an aggravated stall condition. For example, if the right wing dropped during the stall and excessive aileron control were applied to the left to raise the wing, the aileron deflected downward (right wing) would produce a greater angle of attack (and drag), and possibly a more complete stall at the tip as the critical angle of attack is exceeded. The increase in drag created by the high angle of attack on that wing might cause the airplane to yaw in that direction. This adverse yaw could result in a spin unless directional control was maintained by rudder, and/or the aileron control sufficiently reduced.

Even though excessive aileron pressure may have been applied, a spin will not occur if directional (yaw) control is maintained by timely application of coordinated rudder pressure. Therefore, it is important that the rudder be used properly during both the entry and the recovery from a stall. The primary use of the rudder in stall recoveries is to counteract any tendency of the airplane to yaw or slip.

The correct recovery technique would be to decrease the pitch attitude by applying forward-elevator pressure to break the stall, advancing the throttle to increase airspeed, and simultaneously maintaining directional control with coordinated use of the aileron and rudder.

526. POWER OFF STALLS

The practice of power-off stalls is usually performed in the landing configuration simulating an accidental stall occurring during landing approaches. Before executing these practice stalls, the pilot must be sure the area is clear of other air traffic.

After configuring for landing, the airplane should be held at a constant altitude in level flight while the airspeed decelerates and induces a stall. Directional control should be maintained with the rudder, the wings held level by use of the ailerons. The stall will be recognized by clues, such as full up-elevator, high descent rate, uncontrollable nose down pitching, and possible buffeting.

Recovering from the stall should be accomplished by reducing the angle of attack (releasing back-elevator pressure), and advancing the throttle to maximum allowable power. Maintain directional control by leveling the wings with rudder and maintaining coordinated flight as indicated by the ball of the turn and ball coordinator being centered. Right rudder pressure is necessary to overcome the engine torque effects as power is advanced and the nose is being lowered.

After establishing a positive rate of climb, the flaps and are retracted in increments ensuring a positive rate of climb is maintained throughout.

527. PROCEDURE FOR POWER OFF STALL

Entry with airspeed 90 KIAS on a numbered heading.

1. CLEAR – Clearing turns executed as required.

2. CARB HEAT – On.

3. POWER – Retard power smoothly to idle.

4. FLAPS – Extend flaps incrementally.

5. AIRSPEED – Establish a 65 KIAS descent.

6. PITCH – Raise the nose 5-10°.

At stall warning horn, buffet, or loss of controllability - simultaneously:

7. RELAX – Relax back pressure to set attitude just below the horizon.

8. MAX – Smoothly advance the throttle to full power.

9. CARB HEAT – Off.

10. LEVEL – Level wings (primarily use ailerons).

11. BALL – Apply right rudder to center the ball.

As aircraft recovers:

12. FLAPS – Raise to 20°.

13. PITCH – Pitch smoothly to set climb attitude.

14. FLAPS – Establishing a positive rate of climb, retract remaining flaps, level off at the next 500' increment and transition back to 90 KIAS

528. POWER ON STALLS

Power-on stall recoveries are practiced from straight climbs to simulate an accidental stall occurring during takeoff climbs and departure climbs. Power-on stalls will be practiced with the airplane in a clean configuration as in departure and normal climbs.

After the climb is established, the pitch attitude is smoothly increased to a point obviously impossible for the airplane to maintain and is held at that attitude until the full stall occurs.

Recovery from the stall should be accomplished by immediately reducing the angle of attack by positively releasing back-elevator pressure and, verifying throttle at maximum allowable power. Reduce the pitch attitude just enough to break the stall, then maintain altitude as the aircraft regains climb airspeed, then increase to intercept Vy.

529. PROCEDURE FOR POWER ON STALL

Enter with airspeed 90 KIAS on a numbered heading:

1. CLEAR – Clearing turns executed as required.

2. CARB HEAT – ON.

3. POWER – 1000 RPM.

4. AIRSPEED – Slow to 65 KIAS.

5. POWER – Advance throttle to 2000 RPM.

6. CARB HEAT – Off.

7. PITCH – Raise the nose 15-20°.

At stall warning horn, buffet, or loss of controllability - simultaneously:

8. RELAX – Relax back pressure to set attitude just below the horizon.

9. MAX – Verify full power.

10. LEVEL – Level wings (primarily use ailerons).

11. BALL – Apply rudder to center ball.

As aircraft recovers:

12. PITCH – Pitch smoothly for climb attitude, level off at the next 500’ increment and transition to 90 KIAS.

530. COMMON ERRORS DURING STALLS

- Failure to adequately clear the area.
- Inability to recognize an approaching stall condition through feel for the airplane.
- Premature recovery.
- Over-reliance on the airspeed indicator while excluding other cues.
- Inadequate scanning resulting in an unintentional wing-low condition during entry.
- Excessive back-elevator pressure resulting in an exaggerated nose-up attitude during entry.
- Inadequate rudder control.
- Inadvertent secondary stall during recovery.
- Failure to maintain specified heading within 10 degrees.
- Excessive forward-elevator pressure during recovery resulting in negative wing loads.
- Excessive airspeed buildup during recovery.
- Failure to select an entry altitude ensuring recovery no lower than 1,500 feet.

CHAPTER SIX
LANDING PROCEDURES

600. INTRODUCTION

This chapter discusses the procedures and operations required to use a military landing pattern.

601. LANDING PATTERN

The landing pattern is a geometric racetrack-shaped course flown so that an approach and landing may be executed in a systematic sequence. The landing line, the upwind leg, and the parallel downwind leg form the sides of the racetrack pattern. These lines are joined together by the crosswind turn and by the approach turn at the downwind end of the pattern. For purposes of clarity in this instruction, the landing pattern will be subdivided into three parts: the pattern, approach, and landing.

The aircraft manufacturer's recommended procedures, including airplane configuration, airspeeds, and other information relevant to approaches and landings are contained in the FAA-approved Airplane Flight Manual and/or Pilot's Operating Handbook (AFM/POH). A great deal of care has been taken to ensure that NIFE procedures are aligned with the recommendations contained in the AFM/POH. In general, they contain greater detail than those in the AFM/POH.

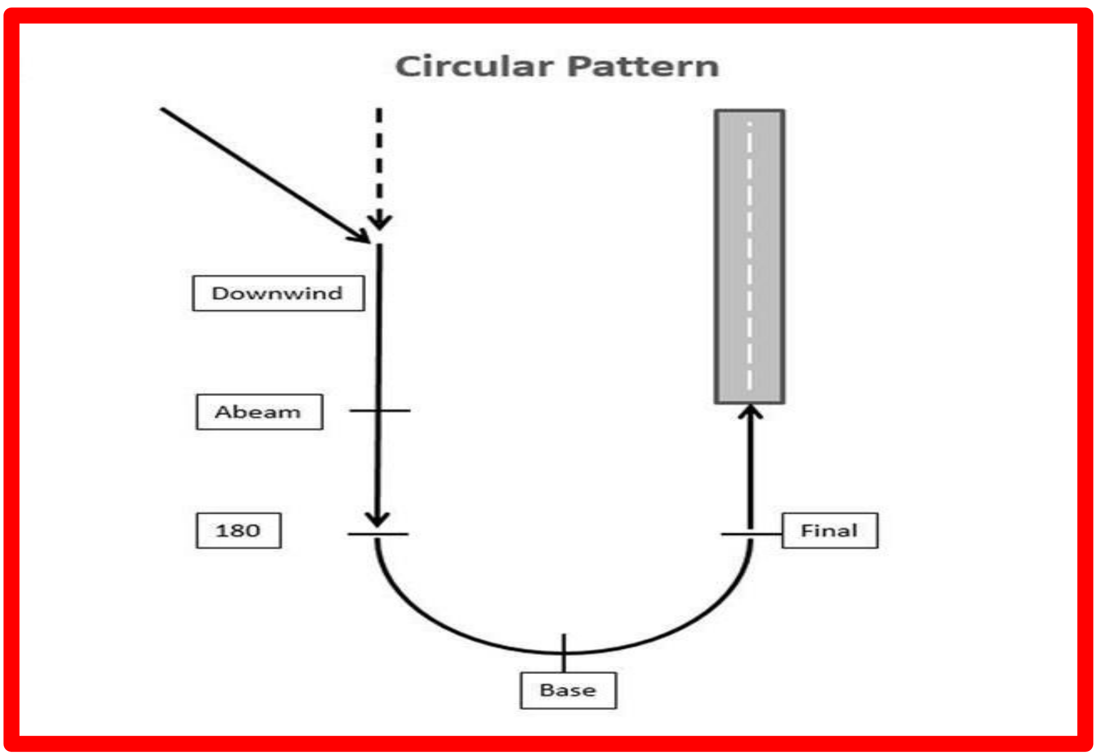

Figure 6-1 Racetrack Pattern

The racetrack pattern is a military style pattern, while most civilians fly a rectangular (box) pattern. Working at civilian fields with other civilian aircraft could have potential conflicts while flying two different style of patterns. Military still try to fly a racetrack to the most extent practicable while maintaining proper safe distances from other aircraft. Ensuring a proper and safe distance can be done two different ways in two different environments: Extending you upwind before making a crosswind turn (for both sea and shore-based aircraft), or extending downwind before starting your abeam procedures (shore based only). Proper spacing requirements will come with time and experience. A box pattern should be demonstrated on the first flight event in order to experience the difference in time considering both patterns. Changing of airspeeds to accommodate the spacing is not recommended due to multiple other aircraft possibly in the pattern. Other aircraft should be adjusting their spacing as well by extending the legs and delaying their turns. Delaying or extending interval turns without reason, causing others in the pattern to delay their timing, is considered bad form. Pattern work and interval timing should continually be trained to in flight school to meet fleet expectations.

602. LANDING PATTERN TERMINOLOGY

1. **Pattern Interval**. Determine the number of aircraft and visually acquire each aircraft to determine the proper interval. You have "Interval" when any of the following conditions occur:

   a. The aircraft ahead of you is Abeam or behind your wingtip AND has completed at least 90º of turn.

   b. The aircraft ahead has departed in accordance with local SOP or course rules.

   c. At a tower-controlled field, the above conditions are met, AND you are cleared by the controller.

2. **Upwind**. The extended runway centerline past the departure end.

3. **Downwind**. Leg flown parallel to the landing runway at the reciprocal heading +/- crab necessary to compensate for wind.

4. **Crosswind Turn**. The turn between upwind and downwind.

5. **Abeam**. The position opposite the Intended Point of Landing at pattern altitude.

6. **Transition**. The actual position where the Transition is initiated and power settings utilized will vary based on conditions such as winds, weight and aircraft configuration in order to maintain airspeed. Initiate the Transition no sooner than when Abeam the Intended Point of Landing, but early enough to arrive at the 180 with the proper approach speed and the aircraft in a trimmed condition.

7. **180º Position**. The position on Downwind from which the approach turn is commenced, opposite the intended rollout point.

8. **90º Position**. The bisector between the 180 and intended rollout point, typically referred to as “the 90.” The 90 is a fixed position at the midpoint of the approach turn at which the aircraft’s heading is 90º from the runway heading. (Civilian equivalent: Base Leg).

9. **Final**. The extended centerline of the runway with 1200-1500 feet of straightaway from the rollout point to the runway threshold at an altitude between 100-150 feet AGL in NIFE aircraft. “The Groove” is similar at the carrier. It is defined as the point the wings roll level until touchdown.

10. **Intended Point of Landing**. This is the point on the runway where you intend for the aircraft to touch down and allows you to stop the aircraft within the remaining length of the runway. Intended Point of Landing is normally 500 feet past the runway threshold, or as defined by local SOP. The Intended Point of Landing may be changed as needed to account for unusual runway conditions such as a raised barrier or a Displaced Threshold.

11. **Touchdown Zone**. This is an area from the Intended Point of Landing extending to 500 feet beyond that point. Strive to make all landings in the Touchdown Zone. If unable to execute a safe landing (within the first 1/3 of the runway or as determined by local SOP), WAVE OFF.

12. **Aimpoint**. The Aimpoint is a reference point at the approach end of the runway (usually the runway threshold) used to fly the aircraft down final approach. It is the point at the end of the aircraft’s glidepath where the transition to landing should commence. It is not the Intended Point of Landing. The Aimpoint should remain fixed in the windscreen on final approach when the aircraft is on speed and altitude. Stable airspeed, proper glide path, and a fixed aimpoint provide the consistency required for successful landing.

13. **The Extended Runway Centerline**. The extended runway centerline is the line over which the aircraft should track while on the final approach to landing.

14. **Departure Interval**. You are number one for departure when past the departure end of the runway (or as defined by local SOP), flaps up, and the aircraft upwind has either initiated the crosswind turn or called departing.

603. DOWNWIND TO THE 180° POSITION

A great landing begins on the downwind leg. If the pilot gets the aircraft to the correct position and energy state on Downwind, the rest of the pattern will go much smoother. All good carrier landings begin here. Consistency is the key.

Enter Downwind at midfield, trimmed for 85 KIAS, in level flight at pattern altitude. Fly the reciprocal of the runway heading +/- crab to compensate for wind in order to arrive to an Abeam distance of 0.7 to 0.8 nm. This distance can be determined using visual cues on your aircraft. The instructor will cover the various visual cues for right and left patterns for the type of aircraft to be flown. In particular, choose a prominent object in the distance to visually aid in maintaining the proper ground track. Apply appropriate wind drift corrections to maintain a track parallel to the runway. Failure to maintain proper ground track will result in starting the landing procedure from the 180° that is either too close (resulting in an over-shooting or high approach) or too far (resulting in an under-shooting or low approach).

604. PROCEDURE FOR DOWNWIND

1. AIRSPEED – 85 KIAS.

2. ALTITUDE – 1000' AGL.

3. SPACING – Spacing from the runway is half way up the wing strut.

4. REPORT – Report "*call sign*, established mid-field downwind" as required.

5. CHECKLIST – Execute before landing checklist.

6. MAINTAIN – Maintain ground track. Crab as required to parallel the runway.

605. ABEAM AND THE 180° POSITION

The approach to landing begins at the Abeam position. If the Downwind was flown correctly, the following procedures will work well. If the aircraft is too close/far, too high/low, or too slow/fast, then the student will have to adjust as necessary to get back on normal parameters. The goal is to arrive at a correct 90° position and energy state. Prior to turning to the 90, the pilot should select a prominent ground visual point 90° from current heading. This will allow the pilot to make the turn to the 90 while looking primarily outside the aircraft, enable better control of pitch, and allow for any wind correction to be applied, as necessary. Remember, if there is a wind component down the runway, the aircraft will need to be placed in a crab towards the runway to adjust. Abeam the Intended Point of Landing, the power is reduced to begin the process of descending to land. After verifying the aircraft is in the flap operating range (white arc), select 30° flap setting and trim the aircraft for 65 KIAS.

During the no-flap approach (in case of flap malfunction), the pilot should expect:

- Higher than normal approach speeds
- Shallower glidepath
- Higher than normal pitch attitude
- Reduced power settings

When the aircraft is positioned 1200-1500ft from the approach end of the runway (180° position), begin a coordinated turn to final. At a non-towered field, the pilot shall announce their base turn. This alerts other aircraft to the pilot's intentions and position. The aircraft is far more visible "wings up" while turning. There is a student tendency to increase pitch during this turn due to "ground shyness." The turn should be a descending turn at 15° AOB. **NOTE: Do not overbank beyond 30° AOB and load the aircraft, a stall speed increases rapidly with the increased load factor of high AOB turns.**

If extending the downwind leg due to spacing requirements, the abeam procedures (4T's) still apply but may be delayed past abeam. Start your abeam procedures when you have proper spacing (traffic at least behind the wingtip). Power/attitude will have to be adjusted to accommodate a proper glideslope due to a longer final.

606. TRANSITION PROCEDURE (4T'S)

1. TRANSITION

    a. CARB HEAT – On.

    b. POWER – Reduce power to 1000 RPM or idle if necessary.

    c. FLAPS - Full.

2. TRIM – Trim for a hands off descent of a pitch attitude for 65 KIAS.

3. TURN – 1200-1500 feet past the runway threshold (180° position) turn towards the 90° position (15° AOB).

4. TALK – Announce turn to Base leg at non-towered fields.

At a towered field, expect tower to clear you for landing before the Abeam position, which will take care of the fourth "T."

607. 90° POSITION (BASE LEG)

The placement of the 90° position is one of the more important judgments made by the pilot in any landing approach. The pilot must accurately judge the altitude and distance from which a gradual descent will result in landing at the desired spot.

Drift correction should be established and maintained to follow a ground track perpendicular to the extension of the centerline of the runway on which the landing is to be made. Since the approach and landing will normally be made into the wind, there will likely be somewhat of a crosswind during the Base leg. This requires that the airplane be angled (crabbed) sufficiently into the wind to prevent drifting farther away from the Intended Point of Landing.

This descending turn should be completed at a safe altitude that will be dependent upon the height of the terrain and any obstructions along the ground track. **The turn should be 15° AOB. Do not exceed 30° AOB**. If an extremely steep bank is needed to prevent overshooting the proper final approach path, discontinue the approach, waveoff, and plan to start the turn earlier on the next approach rather than risk a hazardous situation.

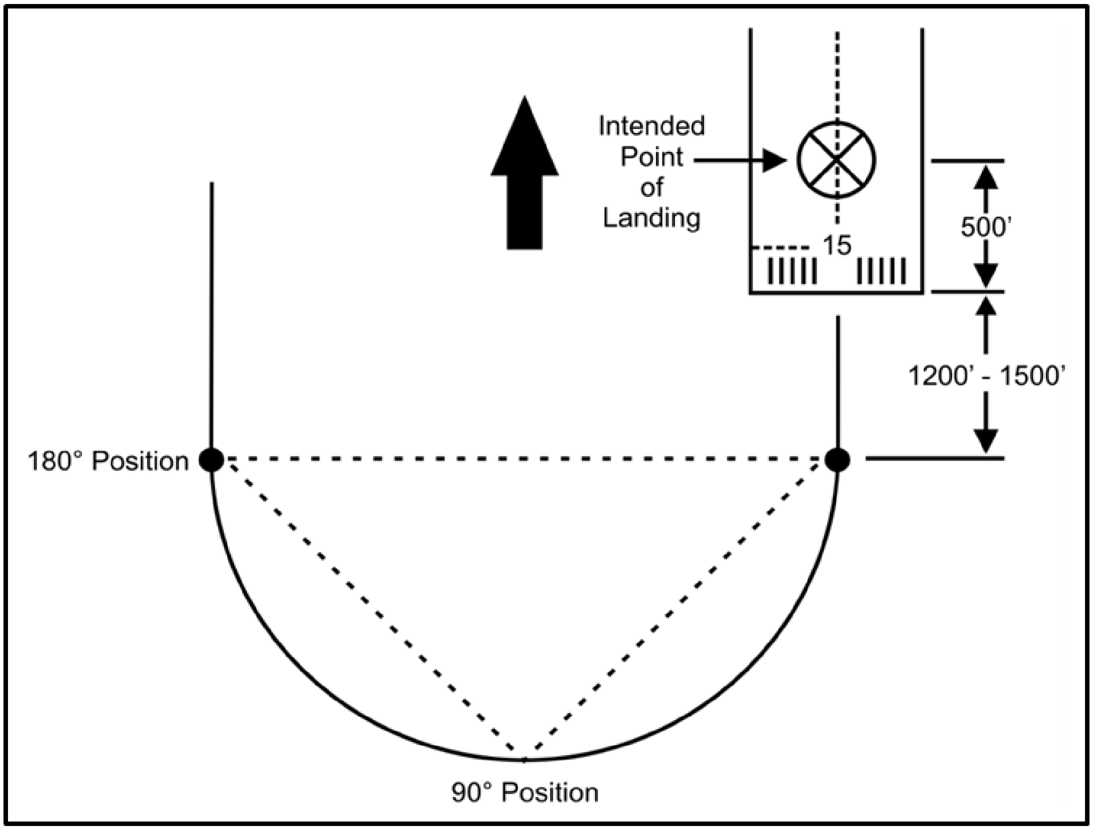

Figure 6-2 90° Position

608. PROCEDURE AT THE 90°POSITION (BASE LEG)

1. ALTITUDE – Check altitude ~500' AGL.

2. AIRSPEED – Check airspeed 65 KIAS.

3. POWER – Adjust power to correct descent rate/altitude to intercept a 3° glidepath.

4. CLEAR – Visually clear final approach leg.

5. TURN – Adjust AOB as needed to intercept the extended runway centerline

609. THE GROOVE (FINAL APPROACH)

The "groove", or "final," is that final portion of the landing approach. In NIFE aircraft, the beginning at a point 1200-1500 feet from the runway threshold at an altitude of 100-150 feet AGL where the aircraft is first aligned, wings-level, and concludes with the landing transition.

The entire pattern to this point is designed to position the aircraft to intercept the glideslope in the "groove" in the proper configuration and the proper speed and attitude. The power and/or attitude must be adjusted and readjusted in order to achieve and maintain a constant rate of descent, and also to stabilize the glideslope "picture."

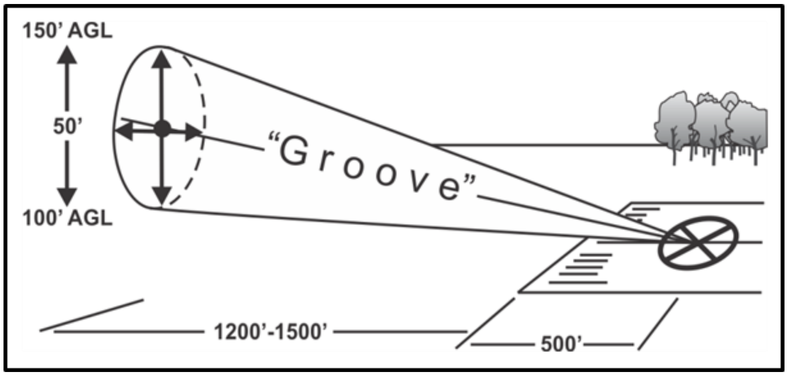

Figure 6-3 The "Groove"

In order to fly a good approach, it is important to solve lineup problems early. After rolling out on straightaway, if the centerline is not between your legs, correct immediately and positively. Implement any required crosswind corrections to maintain centerline using the wing-low, top rudder method described in the crosswind section of this chapter. Following this correction, continue to scan lineup, making small corrections as necessary. Do not ease yourself to centerline, or a counter-correction will have to be made close to the touchdown point of the runway.

The objective of a good final approach is to descend at an angle and airspeed that will permit the airplane to reach the desired touchdown point at an airspeed which will result in minimum floating just before touchdown; in essence, a semi-stalled condition. To accomplish this, it is essential that both the glidepath and the airspeed be accurately controlled. Since on a normal approach the power setting is not fixed as in a power-off approach, the power and pitch attitude should be adjusted simultaneously, as necessary, to control the airspeed and the glidepath, or to attain the desired altitudes along the approach path. By lowering the nose and reducing power to keep approach airspeed constant, a descent at a higher rate can be made to correct for being too high in the approach. This is one reason for performing approaches with partial power; if the approach is too high, merely lower the nose and reduce the power. When the approach is too low, add power and raise the nose.

Lastly, pilots shall ensure their heels are on the floorboards and toes are off the brakes. Inadvertent application of the brakes at touch down or during initial landing roll could result in loss of control of the aircraft or a locked brake and burst tire at high speed.

610. GROOVE PROCEDURES

NOTE

This procedure is executed immediately after rolling wings level on Final.

1. CENTERLINE – Intercept extended runway centerline.

2. GLIDEPATH – Adjust sight picture to ensure Groove parameters.

3. VERIFY – Checklist and landing clearance, announce “Landing Checks Complete, Cleared to Land.”

4. ADJUST – Continually:

   a. Pitch for airspeed.

   b. Power for glidepath.

   c. Alignment to runway centerline.

5. HEELS – Heels on floorboards.
6. FLARE – Establish a nose up attitude to ensure main wheels touch first.

611. USE OF FLAPS

The lift/drag factors may also be varied by the pilot to adjust the descent through the use of landing flaps. Flap extension during landings provides several advantages by:

- Producing greater lift and, thus, permitting lower landing speed.
- Producing greater drag and, thus, permitting a steep descent angle without a corresponding airspeed increase.
- Reducing the length of the landing roll.

When the flaps are lowered, the airspeed will decrease unless the power is increased or the pitch attitude lowered. On final approach, therefore, the pilot must estimate where the airplane will land through discerning judgment of the descent angle. If it appears that the airplane is going to overshoot the desired Intended Point of Landing, more flaps may be used if not fully extended or the power reduced further, and the pitch attitude lowered. This will result in a steeper approach. If the desired Intended Point of Landing is being undershot and a shallower approach is needed, both power and pitch attitude should be increased to readjust the descent angle.

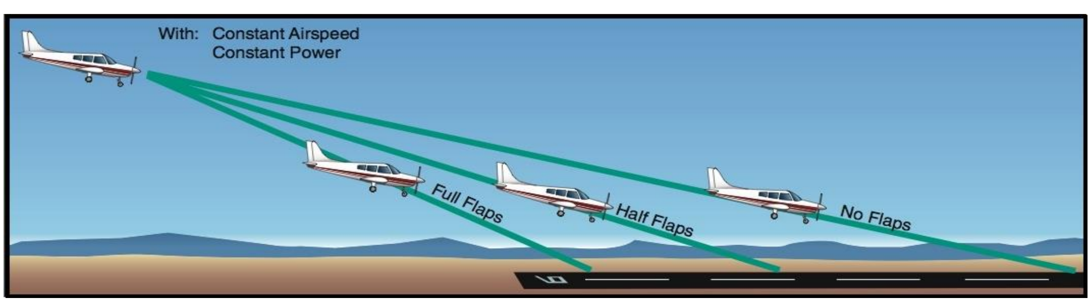

Figure 6-4. Effect of flaps on glideslope

Never retract the flaps to correct for undershooting since that will suddenly decrease the lift and cause the airplane to sink even more rapidly.
The airplane must be re-trimmed on the final approach to compensate for the change in aerodynamic forces. With reduced power and a slower airspeed, the airflow produces less lift on the wings and less downward force on the horizontal stabilizer, resulting in a significant nose down tendency. The elevator must then be trimmed more nose up. The roundout/flare, touchdown and after-landing roll are much easier to accomplish from the stabilized glidepath of a proper final approach.

612. ESTIMATING HEIGHT DURING THE FLARE

During the approach, roundout/flare, and touchdown, vision is of prime importance. To provide a wide scope of vision and to foster good judgment of height and movement, the pilot's head should assume a natural, straight-ahead position. The pilot's visual focus should not be fixed on any one side or any one spot ahead of the airplane, but should alternate slowly from a point just over the airplane's nose to the desired touchdown zone and back again, while maintaining a deliberate awareness of distance from either side of the runway using the pilot's peripheral field of vision.

Accurate estimation of distance is dependent upon how clearly objects are seen and requires that one's vision be properly focused such that important objects stand out as clearly as possible. Speed blurs objects at close range. For example, most everyone has noted this phenomena in an automobile moving at high speed. Nearby objects seem to merge together in a blur, while objects further away stand out clearly. Subconsciously, we focus our eyes sufficiently far ahead of, for example, our automobile that objects can be viewed distinctly.

The distance at which the pilot's vision is focused should be proportionate to the speed at which the airplane is traveling over the ground. Thus, as speed is reduced during the roundout, the distance ahead of the airplane at which it is possible to focus should be brought closer.

If the pilot attempts to focus on a reference that is too close or looks directly down, the reference will become blurred, and the reaction will be either too abrupt or too late. In this case, the pilot's tendency will be to over control, roundout high, and make full-stall, drop-in landings.

Figure 6-5 Focusing on reference that is too close

When the pilot focuses too far ahead, accuracy in judging the closeness of the ground is lost and the consequent reaction will be too slow since there will not appear to be a necessity for action. This will result in the airplane flying into the ground nose first. The change of visual focus from a long distance to a short distance requires a definite time interval and even though the time is brief, the airplane's speed during this interval is such that the airplane travels an appreciable distance, both forward and downward toward the ground.

If the focus is changed gradually, being brought progressively closer as speed is reduced, the time interval and the pilot's reaction will be reduced, and the whole landing process smoothed out.

613. ROUNDOUT (FLARE)

The flare is a **slow, smooth and coordinated** transition from a normal approach attitude to a landing attitude, gradually rounding out the flightpath to one that is parallel with, and within a very few inches above, the runway. Following a normal descent, the flare, or roundout, should be started approximately 15 feet above the ground, and once started should be a continuous process until the airplane touches down on the ground. If done properly, the aircraft will level-off in ground effect approximately three feet above the runway.

During the flare, back-elevator pressure should be gradually applied to slowly increase the pitch attitude and angle of attack. This will cause the airplane's nose to gradually rise toward the desired landing attitude. The angle of attack should be increased at a rate that will allow the airplane to continue settling slowly as forward speed decreases. The goal is to let the aircraft slowly settle from three feet to three inches during the flare.

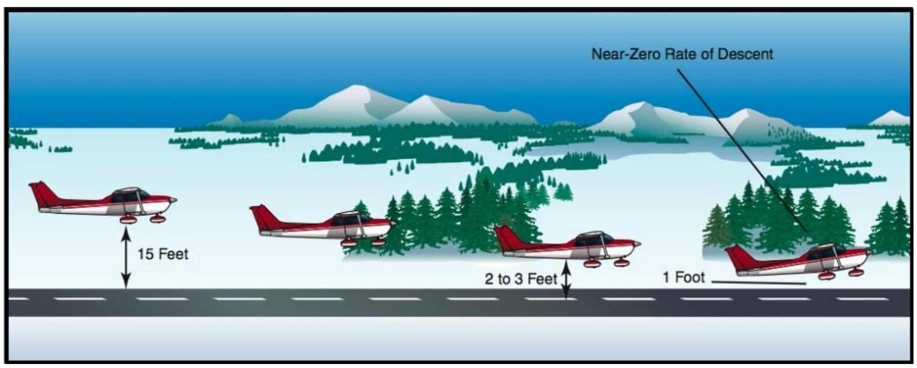

Figure 6-6 Example height during flare

When angle of attack is increased, lift is momentarily increased, which decreases the rate of descent. Since power normally is reduced to idle during the flare, the airspeed will also gradually decrease. This will cause lift to decrease again, and it must be controlled by raising the nose and further increasing the angle of attack. During the flare, airspeed is being decreased to touchdown speed while lift is being controlled so the airplane will settle gently onto the landing surface. The flare should be executed at a rate that a proper landing attitude and a proper touchdown airspeed are attained simultaneously just as the wheels contact the landing surface. The rate at which the flare is executed depends on the airplane's height above the ground, the rate of descent, and the pitch attitude. A flare started excessively high must be executed more slowly than one from a lower height to allow the airplane to descend to the ground while the proper landing attitude is being established. The rate of rounding out must also be proportionate to the rate of closure with the ground. When the airplane appears to be descending very slowly, an increase in pitch attitude must be made at a correspondingly slow rate.

The pitch attitude of the airplane in a full-flap approach is considerably lower than in a no-flap approach. To attain the proper landing attitude before touching down, the nose must travel through a greater pitch change when flaps are fully extended. Since the roundout is usually started at approximately the same height above the ground regardless of the degree of flaps used, the pitch attitude must be increased at a faster rate when full flaps are used; however, the flare should still be executed at a rate proportionate to the airplane's downward motion.

Once the actual process of rounding out is started, elevator control should not be pushed forward. If too much back-elevator pressure has been exerted, this pressure should either be slightly relaxed or held constant, depending on the degree of the error. In some cases, it may be necessary to advance the throttle slightly to prevent an excessive sink rate, or stall, all of which would result in a hard, drop-in type landing.

The student must form the habit of keeping one hand on the throttle throughout the approach and landing, should a sudden and unexpected hazardous situation require an immediate application of power.

614. PROCEDURE FOR NORMAL FLARE

NOTE

> The transition from the roundout to the flare to touchdown is a continuous process.

<u>At 10-15 ft above the runway:</u>

1. LOOK – Look to far the end of the runway in order to better sense aircraft sink rate.

2. POWER – Smoothly and steadily reduce power to idle.

3. ATTITUDE – Increase pitch to smoothly transition to level-off 3 to 5 ft above the runway.

4. CENTERLINE – Maintain.

    a. Rudder to align nose with runway.

    b. Ailerons to stop drift.

<u>As the aircraft begins to settle to the runway:</u>

5. ATTITUDE – Adjust pitch smoothly to place the top of the cowling on the distant horizon (flare) and keep it there.

<u>After touchdown:</u>

6. BRAKES – As required to gradually slow the aircraft in a safe and controlled manner.

615. TOUCHDOWN

The touchdown is the gentle settling of the airplane onto the landing surface. The flare and touchdown should be made with the engine idling and the airplane at minimum controllable airspeed so that the airplane will touch down on the main gear at approximately stalling speed. As the airplane settles, the proper landing attitude is attained by application of whatever back-elevator pressure is necessary.

Some pilots may try to force or fly the airplane onto the ground without establishing the proper landing attitude. The airplane should never be flown onto the runway with excessive speed. It is paradoxical that the way to make an ideal landing is to try to hold the airplane's wheels a few inches off the ground as long as possible with the elevators. In most cases, when the wheels are within 2 or 3 feet from the ground, the airplane will still be settling too fast for a gentle touchdown; therefore, this descent must be retarded by further back-elevator pressure. Since the airplane is already close to its stalling speed and is settling, this added back-elevator pressure will only slow up the settling instead of stopping it. At the same time, it will result in the airplane touching the ground in the proper landing attitude and the main wheels touching down first so that little or no weight is on the nosewheel.

After the main wheels make initial contact with the ground, back-elevator pressure should be held to maintain a positive angle of attack for aerodynamic braking and to hold the nosewheel off the ground until the airplane decelerates. As the airplane's momentum decreases, back-elevator pressure may be gradually relaxed to allow the nosewheel to gently settle onto the runway. This will permit steering with the nosewheel. At the same time, it will cause a low angle of attack and negative lift on the wings to prevent floating or skipping, and will allow the full weight of the airplane to rest on the wheels for better braking action.

It is extremely important that the touchdown occur with the airplane's longitudinal axis exactly parallel to the direction in which the airplane is moving along the runway. Failure to accomplish this imposes severe side loads on the landing gear. To avoid these side stresses, the pilot should not allow the airplane to touch down while turned into the wind or drifting.

If executing a touch and go landing, the takeoff should be initiated only after a controlled touchdown has been successfully executed. Additionally, prior to executing touch and go landings, a pre-flight or, at a minimum, a deliberate in-flight assessment shall be made to determine the touchdown point at which the approach will be aborted and a go around executed. Shorter runways require skilled, precise and expeditious execution of landing and touch and go procedures to ensure the appropriate margin of safety and sufficient runway distance is remaining for the aircraft to achieve the airspeed required to fly. In these cases, consideration should be given to briefing and executing short field takeoff procedures in accordance with the manufacture's guidance in the POH. Remember, a full stop landing is always an option.

616. PROCEDURE FOR TOUCH AND GO LANDING

After touchdown:

1. RUDDER – Maintain runway centerline with rudder, not brakes.

2. AILERON – Into crosswind as required.

3. FLAPS – Up.

4. CARB HEAT – Off.

5. POWER – Smoothly apply full power.

6. TAKEOFF – Execute normal takeoff procedures.

7. CROSSWIND – Execute crosswind turn 400’ AGL (with interval and clearance as required).

617. AFTER LANDING ROLL

The landing process must never be considered complete until the airplane decelerates to the normal taxi speed during the landing roll or has been brought to a complete stop when clear of the landing area. Many accidents have occurred as a result of pilots abandoning their vigilance and positive control after getting the airplane on the ground.

The pilot must be alert for directional control difficulties immediately upon and after touchdown due to the ground friction on the wheels. The friction creates a pivot point on which a moment arm can act. Loss of directional control may lead to an aggravated, uncontrolled, tight turn on the ground, or a ground loop. The combination of the aircraft’s inertia acting on the center of gravity (CG) and ground friction of the main wheels resisting it during the ground loop may cause the airplane to tip or lean enough for the outside wingtip to contact the ground. This may even impose a sideward force, which could collapse the landing gear.

The rudder serves the same purpose on the ground as it does in the air—it controls the yawing of the airplane. The effectiveness of the rudder is dependent on airflow, which depends on the speed of the airplane. As the speed decreases and the nosewheel has been lowered to the ground, the steerable nose provides more positive directional control.

The brakes of an airplane serve the same primary purpose as the brakes of an automobile—to reduce speed on the ground. In airplanes, they may also be used as an aid in directional control when more positive control is required than can be obtained with rudder or nosewheel steering alone.

To use brakes on an airplane equipped with toe brakes, the pilot should slide the toes or feet up from the rudder pedals to the brake pedals. If rudder pressure is being held at the time braking action is needed, that pressure should not be released as the feet or toes are being slid up to the brake pedals, because control may be lost before brakes can be applied.

Putting maximum weight on the main landing gear after touchdown is an important factor in obtaining optimum braking performance. During the early part of rollout, some lift may continue to be generated by the wing. After touchdown, the nosewheel should be lowered to the runway to maintain directional control. During deceleration, the nose may pitch down by braking and the weight transferred to the nosewheel from the main landing gear. This does not aid in braking action, so back pressure should be applied to the controls without lifting the nosewheel off the runway. This will enable the pilot to maintain directional control while keeping weight on the main landing gear.

Careful application of the brakes can be initiated after the nosewheel is on the ground and directional control is established. Maximum brake effectiveness is just short of the point where skidding occurs. If the brakes are applied so hard that skidding takes place, braking becomes ineffective. Skidding can be stopped by releasing the brake pressure. Also, braking effectiveness is not enhanced by alternately applying and reapplying brake pressure. The brakes should be applied firmly and smoothly as necessary.

During the ground roll, the airplane's direction of movement can be changed by carefully applying pressure on one brake or uneven pressures on each brake in the desired direction.

CAUTION

When applying the brakes during the high speeds of a landing roll, exercise cautionas locked brakes could result in rapid yawing, a blown tire, or loss of directional control..

The ailerons serve the same purpose on the ground as they do in the air—they change the lift and drag components of the wings. During the after-landing roll, they should be used to keep the wings level in much the same way they were used in flight. If a wing starts to rise, aileron control should be applied toward that wing to lower it. The amount required will depend on speed because as the forward speed of the airplane decreases, the ailerons will become less effective. Procedures for using ailerons in crosswind conditions are explained further in this chapter in the Crosswind Approach and Landing section.

After the airplane is on the ground, back-elevator pressure may be gradually relaxed to place normal weight on the nosewheel to aid in steering. If available runway permits, the speed of the airplane should be allowed to dissipate in a normal manner. Once the airplane has slowed sufficiently and has turned on to the taxiway and stopped, the pilot should retract the flaps.

618. COMMON ERRORS DURING NORMAL APPROACH AND LANDING

- Inadequate wind drift correction on the base leg.
- Over or undershooting the turn on to final approach.

- Flat or skidding turns from Base leg to final approach as a result of overshooting/inadequate wind drift correction.
- Poor coordination during turn from base to final approach.
- Failure to complete the Landing Checklist in a timely manner.
- Unstable approach.
- Failure to adequately compensate for flap extension.
- Poor trim technique on final approach.
- Attempting to maintain altitude or reach the runway using elevator alone.
- Focusing too close to the airplane resulting in a high roundout.
- Focusing too far from the airplane resulting in a low roundout.
- Touching down prior to attaining proper landing attitude.
- Failure to hold sufficient back-elevator pressure after touchdown.
- Excessive braking after touchdown.

619. INTENTIONAL SLIPS

Intentional slips are used to dissipate altitude without increasing airspeed, and/or to adjust airplane ground track during a crosswind. Intentional slips are especially useful in forced landings. A slip can also be used as an emergency means of rapidly reducing airspeed in situations where wing flaps are inoperative or not installed.

Before executing a slip, consult the Aircraft Flight Manual/Pilot's Operating Handbook to determine if the manufacture has any limitations on the use of slips.

Always announce the slip, "(Left/Right) wing down, (Left/Right) top rudder."

An intentional slip requires deliberate cross-controlling ailerons and rudder throughout the maneuver. A "sideslip" (commonly called "wing down, top rudder") is entered by lowering a wing and applying just enough opposite rudder to prevent a turn. In a sideslip, the airplane's longitudinal axis remains parallel to the original flightpath, but the airplane no longer flies straight ahead. Instead, the horizontal component of wing lift forces the airplane also to move somewhat sideways toward the low wing. The amount of slip and, therefore, the rate of sideward movement is determined by the bank angle. The steeper the bank, the greater the degree of slip. As bank angle is increased, additional opposite rudder is required to prevent turning.

A "forward slip" is one in which the airplane's direction of motion continues the same as before the slip was begun. Assuming the airplane is originally in straight flight, the wing on the side toward which the slip is to be made should be lowered by use of the ailerons. Simultaneously, the airplane's nose must be yawed in the opposite direction by applying opposite rudder so that the airplane's longitudinal axis is at an angle to its original flightpath. The degree to which the nose is yawed in the opposite direction from the bank should be such that the original ground track is maintained. In a forward slip, the amount of slip, and therefore the sink rate, is determined by the bank angle. The steeper the bank, the steeper the descent.

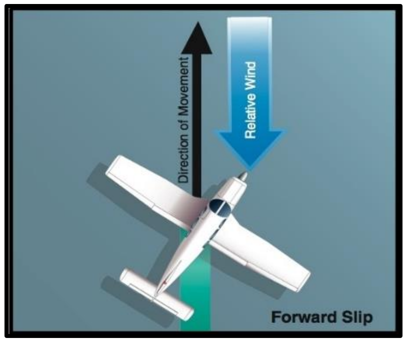

Figure 6-7 Forward slip

Discontinuing a slip is accomplished by leveling the wings and simultaneously releasing the rudder pressure while readjusting the pitch attitude to the normal glide attitude. If the pressure on the rudder is released abruptly, the nose will swing too quickly into line and the airplane will tend to acquire excess speed.

Because of the location of the pitot tube and static vents, airspeed indicators in some airplanes may have considerable error when the airplane is in a slip. The pilot must be aware of this possibility and recognize a properly performed slip by the attitude of the airplane, the sound of the airflow, and the feel of the flight controls. If an airplane in a slip is made to stall, it may do little more than tend to roll into a wings level attitude. In fact, in some airplanes stall characteristics may even be improved.

620. WAVEOFFS (GO AROUNDS/REJECTED LANDINGS)

Whenever landing conditions are not satisfactory, a waveoff is warranted. There are many factors that can contribute to unsatisfactory landing conditions. Situations such as air traffic control requirements, unexpected appearance of hazards on the runway, overtaking another airplane, wind shear, wake turbulence, mechanical failure and/or an unstabilized approach are all examples of reasons to discontinue a landing approach and make another approach under more favorable conditions. The assumption that an aborted landing is invariably the consequence of a poor approach, which in turn is due to insufficient experience or skill, is a fallacy. The waveoff is not strictly an emergency procedure. It is a normal maneuver that may at times be used in an emergency situation. Like any other normal maneuver, the waveoff must be practiced and perfected. The flight instructor should emphasize early on, and the student pilot should be made to understand, that the waveoff maneuver is an alternative to any approach and/or landing.

Although the need to discontinue a landing may arise at any point in the landing process, the most critical waveoff will be one started when very close to the ground. Therefore, the earlier a condition that warrants a waveoff is recognized, the safer the waveoff will be. The waveoff maneuver is not inherently dangerous in and of itself. It becomes dangerous only when delayed unduly or executed improperly. Delay in initiating the waveoff normally stems from two sources: (1) landing expectancy, or set—the anticipatory belief that conditions are not as threatening as they are and that the approach will surely be terminated with a safe landing, and (2) pride—the mistaken belief that the act of going around is an admission of failure—failure to execute the approach properly. The improper execution of the waveoff maneuver stems from a lack of familiarity with the three cardinal principles of the procedure: power, attitude, and configuration.

- **Power**. Power is the pilot's first concern. The instant the pilot decides to waveoff, full or maximum allowable takeoff power must be applied **smoothly and without hesitation** and held until flying speed and controllability are restored. Applying only partial power in a waveoff is never appropriate. In the Carrier Qualification Stage of Advanced flight training, failure to apply maximum power on a waveoff will result in an UNSAT (and possibly a "Disqual"). Abrupt movements of the throttle in some airplanes will cause the engine to falter. Carburetor heat in NIFE aircraft should be "OFF" for maximum power.

- **Attitude**. Attitude is always critical when close to the ground, and when power is added, a deliberate effort on the part of the pilot will be required to keep the nose from pitching up prematurely. The airplane executing a waveoff must be maintained in an attitude that permits a buildup of airspeed well beyond the stall point before any effort is made to gain altitude or to execute a turn. Raising the nose too early may produce a stall from which the airplane could not be recovered if the waveoff is performed at a low altitude.

A concern for quickly regaining altitude during a go-around produces a natural tendency to pull the nose up. The pilot executing a waveoff must accept the fact that an airplane will not climb until it can fly, and it will not fly below stall speed. In some circumstances, it may be desirable to lower the nose briefly to gain airspeed. As soon as the appropriate climb airspeed and pitch attitude are attained, the pilot should "rough trim" the airplane to relieve any adverse control pressures. Later, more precise trim adjustments can be made when flight conditions have stabilized.

- **Configuration**. In cleaning up the airplane during the waveoff, the pilot should be concerned first with flaps and secondly with the landing gear (if retractable). When the decision is made to perform a waveoff, maximum power should be applied immediately and the pitch attitude changed so as to slow or stop the descent. After the descent has been stopped, the landing flaps may be partially retracted or placed in the takeoff position as recommended by the manufacturer. **Caution must be used, however, in retracting the flaps**. **Depending on the airplane's altitude**

and airspeed, it may be wise to retract the flaps intermittently in small increments to allow time for the airplane to accelerate progressively as they are being raised. A sudden and complete retraction of the flaps could cause a loss of lift resulting in the airplane settling to the ground.

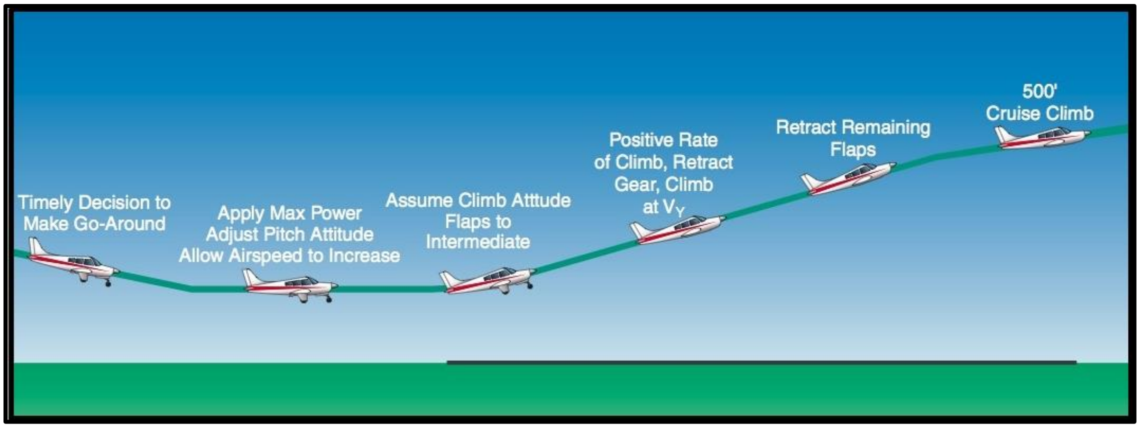

Figure 6-8 Waveoff

When maximum power is applied, it will usually be necessary to hold considerable pressure on the controls to maintain straight flight and a safe climb attitude. Since the airplane has been trimmed for the approach (a low power and low airspeed condition), application of maximum allowable power will require considerable control pressure to maintain a climb pitch attitude. **The addition of power will tend to raise the airplane's nose suddenly and veer to the left. Forward elevator pressure must be anticipated and applied to hold the nose in a safe climb attitude. Right rudder pressure must be increased to counteract torque and P-factor, and to keep the nose straight**. The airplane must be held in the proper flight attitude regardless of the amount of control pressure that is required. Trim should be used to relieve adverse control pressures and assist the pilot in maintaining a proper pitch attitude. On airplanes that produce high control pressures when using maximum power on waveoffs, aviators should use caution when reaching for the flap handle. Airplane control may become critical during this high workload phase.

If the pitch attitude is increased excessively in an effort to keep the airplane from contacting the runway, it may cause the airplane to stall. This would be especially likely if no trim correction is made and the flaps remain fully extended. The pilot should not attempt to retract the landing gear until after a rough trim is accomplished and a positive rate of climb is verified both visually and on the Vertical Speed Indicator (VSI). In Primary, you will verbalize, "Two positive rates, Gear" as you perform this function.

Ground effect is a factor in every landing and every takeoff in fixed-wing airplanes. Ground effect can also be an important factor in waveoffs. If the waveoff is made close to the ground, the airplane may be in the ground effect area. Pilots are often lulled into a sense of false security by the apparent "cushion of air" under the wings that initially assists in the transition from an approach descent to a climb. The apparent increase in airplane performance is, in fact, due to a reduction in induced drag in the ground effect area. It is "borrowed" performance that must be repaid when the airplane climbs out of the ground effect area. The pilot must factor in ground effect when initiating a waveoff close to the ground. An attempt to climb prematurely may result in the airplane not being able to climb, or even maintain altitude at full power.

621. PROCEDURES FOR WAVEOFF

Execute waveoffs according to procedures no matter where in the pattern the decision is made.

1. POWER – Smoothly apply max power.

2. CARB HEAT – Off.

3. ATTITUDE – Increase pitch to nose slightly above the horizon.

4. FLAPS – While ensuring a positive rate of climb, retract flaps incrementally.

5. ATTITUDE – Pitch for Vy.

622. COMMON ERRORS DURING WAVEOFF

- Failure to recognize a condition that warrants a waveoff.
- Indecision.
- Delay in initiating a waveoff.
- Failure to apply maximum power in a timely manner.
- Abrupt power application.
- Improper pitch attitude.
- Failure to configure the airplane appropriately.
- Failure to adequately compensate for torque/P-factor.

623. CROSSWIND APPROACH AND LANDING

Many runways or landing areas are such that landings must be made while the wind is blowing across, rather than parallel to, the landing direction. All pilots should be prepared to cope with these situations when they arise. The same basic principles and factors involved in a normal approach and landing apply to a crosswind approach and landing; therefore, only the additional procedures required for correcting for wind drift are discussed here.

The ”wing-down, top rudder” (sideslip) method will compensate for a crosswind from any angle, but more importantly, it enables the pilot to simultaneously keep the airplane’s ground track and longitudinal axis aligned with the runway centerline throughout the final approach, roundout, touchdown, and after-landing roll. This prevents the airplane from touching down in a sideward motion and imposing damaging side loads on the landing gear.

Figure 6-9 Sideslip technique for crosswind landing

To use the wing-down, top rudder method, the pilot aligns the airplane’s heading with the centerline of the runway, notes the rate and direction of drift, and then promptly applies drift correction by lowering the upwind wing. The amount the wing must be lowered depends on the rate of drift. When the wing is lowered, the airplane will tend to turn in that direction. It is then necessary to simultaneously apply sufficient opposite rudder pressure to prevent the turn and keep the airplane’s longitudinal axis aligned with the runway. In other words, the drift is controlled with aileron and the heading with rudder. The airplane will now be side slipping into the wind just enough that both the resultant flightpath and the ground track are aligned with the runway. If the crosswind diminishes, this crosswind correction is reduced accordingly, or the airplane will begin slipping away from the desired approach path.

Flaps can and should be used during most approaches since they tend to have a stabilizing effect on the airplane. The degree to which flaps should be extended will vary with the airplane’s handling characteristics, as well as the wind velocity.

It should be noted that the “wing-down, top rudder” method of crosswind correction is an intentional slipping of the aircraft. Like all slips, there is an increase in drag. The increased drag will steepen the angle of descent and the pilot may need to compensate by adjusting the position of the base leg or increasing and carrying additional power on final approach.

624. PROCEDURE FOR CROSSWIND LANDING

1. WING DOWN – Use aileron / angle of bank into the wind to counter drift.

2. TOP RUDDER – Use rudder to maintain nose pointed straight down runway.

625. CROSSWIND FLARE

Generally, the transition to landing, or "roundout," can be made like a normal landing approach, but the application of a crosswind correction is continued as necessary to prevent drifting.

Since the airspeed decreases as the roundout progresses, the flight controls gradually become less effective. As a result, the crosswind correction being held will become inadequate. When using the wing-low method, it is necessary to gradually increase the deflection of the rudder and ailerons to maintain the proper amount of drift correction.

Do not level the wings. Keep the upwind wing down throughout the roundout. If the wings are leveled, the airplane will begin drifting and the touchdown will occur while drifting. Remember, the primary objective is to land the airplane without subjecting it to any side loads that result from touching down while drifting.

626. CROSSWIND TOUCHDOWN

If a crab method of drift correction has been used throughout the final approach and roundout, the crab must be removed the instant before touchdown by applying rudder to align the airplane's longitudinal axis with its direction of movement. This requires timely and accurate action. Failure to accomplish this will result in severe side loads being imposed on the landing gear.

If the sideslip or wing-low method is used, the crosswind correction (aileron into the wind and opposite rudder) should be maintained throughout the roundout, and the touchdown made on the upwind main landing gear.

During gusty or high wind conditions, prompt adjustments must be made in the crosswind correction to assure that the airplane does not drift as the airplane touches down.

As forward momentum decreases after initial contact, the weight of the airplane will cause the downwind main landing gear to gradually settle onto the runway.

627. CROSSWIND AFTER-LANDING ROLL

Particularly during the after-landing roll, special attention must be given to maintaining directional control by the use of rudder or nosewheel steering, while keeping the upwind wing from rising by the use of aileron. Airplanes have greater profile, or side area, behind the main landing gear than forward of the main landing gear. With the main landing gear acting as a pivot point and the greater surface area exposed to the crosswind behind that pivot point, the airplane will tend to turn, or weathervane, into the wind.

Retaining control on the ground is a critical part of the after-landing roll because of the weather vaning effect of the wind on the airplane. Additionally, tire side load from runway contact while drifting frequently generates roll-overs in tricycle geared airplanes. The basic factors involved are cornering angle and side load.

While the airplane is decelerating during the after-landing roll, more and more aileron is applied to keep the upwind wing from rising. Since the airplane is slowing down, there is less airflow around the ailerons and they become less effective. At the same time, the relative wind is becoming more of a crosswind and exerting a greater lifting force on the upwind wing. When the airplane is coming to a stop, the aileron control must be held fully toward the wind.

628. MAXIMUM SAFE CROSSWIND VELOCITIES

Before an airplane is type certificated by the Federal Aviation Administration (FAA), it must be flight tested to meet certain requirements. Among these is the demonstration of being satisfactorily controllable with no exceptional degree of skill or alertness on the part of the pilot in 90° crosswinds up to a velocity equal to 0.2 Vso. This means a wind speed of two-tenths of the airplane's stalling speed with power off and landing gear/flaps down.

The headwind component and the crosswind component for a given situation can be determined by reference to a crosswind component chart. It is imperative that pilots determine the maximum crosswind component of each airplane they fly and avoid operations in wind conditions that exceed the capability of the airplane.

629. COMMON ERRORS DURING CROSSWIND APPROACHES AND LANDINGS

- Attempting to land in crosswinds that exceed the airplane's maximum demonstrated cross- wind component on the turn from Base leg to final approach, resulting in undershooting or overshooting.

- Inadequate compensation for wind drift on the turn from Base leg to final approach, resulting in undershooting or overshooting.

- Inadequate compensation for wind drift on final approach.

- Unstabilized approach.

- Failure to compensate for increased drag during sideslip resulting in excessive sink rate and/or too low an airspeed.

- Touchdown while in a crab.

- Excessive airspeed on touchdown.

- Failure to apply appropriate flight control inputs during rollout.

- Failure to maintain direction control on rollout.

- Excessive braking.

630. TURBULENT AIR APPROACH AND LANDING

Power-on approaches at an airspeed slightly above the normal approach speed should be used for landing in turbulent air. This provides for more positive control of the airplane when strong horizontal wind gusts, or up and down drafts, are experienced.

To maintain good control, the approach in turbulent air with gusty crosswind may require the use of partial or no-wing flaps. With less than full flaps, the airplane will be in a higher pitch attitude. Thus, it will require less of a pitch change to establish the landing attitude, and the touchdown will be at a higher airspeed to ensure more positive control. The speed should not be so excessive that the airplane will float past the desired Touchdown Zone.

A common procedure is to use the normal approach speed plus one-half of the wind gust factors. If the normal speed is 65 KIAS, and the wind gusts factor is 14 knots, 72 KIAS is appropriate.

Landings from power approaches in turbulence should be such that the touchdown is made with the airplane in approximately level flight attitude. The pitch attitude at touchdown should be only enough to prevent the nosewheel from contacting the surface before the main landing gear have touched the surface. After touchdown, the pilot should avoid the tendency to apply forward pressure on the yoke as this may result in wheelbarrowing and possible loss of control. The airplane should be allowed to decelerate normally, assisted by careful use of main landing gear brakes. Heavy braking should be avoided until the wings are devoid of lift and the airplane's full weight is on the landing gear.

631. COMMON ERRORS DURING APPROACHES AND LANDINGS

1. **Low Final Approach**

When the Base leg is too low, power is insufficient, landing flaps are extended prematurely, or the wind is misjudged, sufficient altitude may be lost which will cause the airplane to be well below the proper final approach path. In such a situation, the pilot would have to apply considerable power to fly the airplane (at an excessively low altitude) up to the runway threshold. When it is realized the runway will not be reached unless appropriate action is taken, power must be applied immediately to maintain the airspeed while the pitch attitude is raised to increase lift and stop the descent. When the proper approach path has been intercepted, the correct approach attitude should be reestablished and the power reset and a stabilized approach maintained. DO NOT increase the pitch attitude without increasing the power, since the airplane will decelerate rapidly and may approach the critical angle of attack (stall). DO NOT retract the flaps; this will suddenly decrease lift and cause the airplane to sink more rapidly. If there is any doubt about the approach being safely completed, it is advisable to EXECUTE AN IMMEDIATE WAVEOFF.

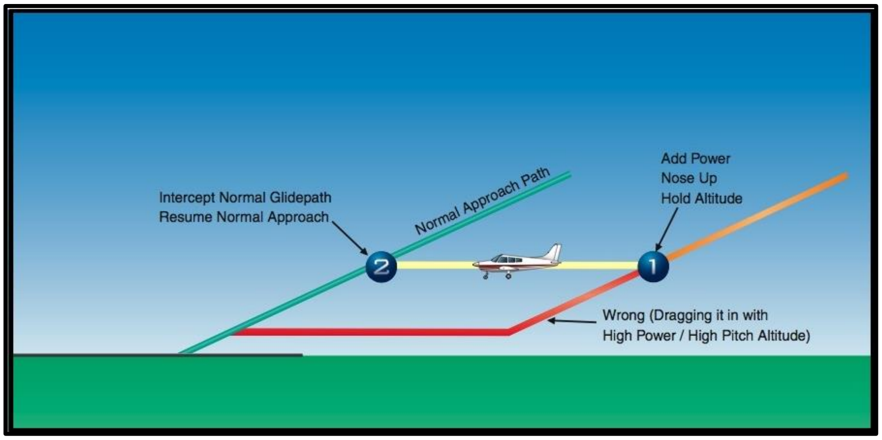

Figure 6-10 Low final approach

2. **High Final Approach**

When the final approach is too high, lower the flaps as required. Further reduction in power may be necessary, while lowering the nose simultaneously to maintain approach airspeed and steepen the approach path. When the proper approach path has been intercepted, reset the power and attitude to maintain a stabilized approach. When steepening the approach path, however, care must be taken that the descent does not result in an excessively high sink rate. If a high sink rate is continued close to the surface, it may be difficult to slow to a proper rate prior to ground contact. For NIFE aircraft, any sink rate in excess of 800 - 1,000 feet per minute is considered excessive. A waveoff should be initiated if the sink rate becomes excessive.

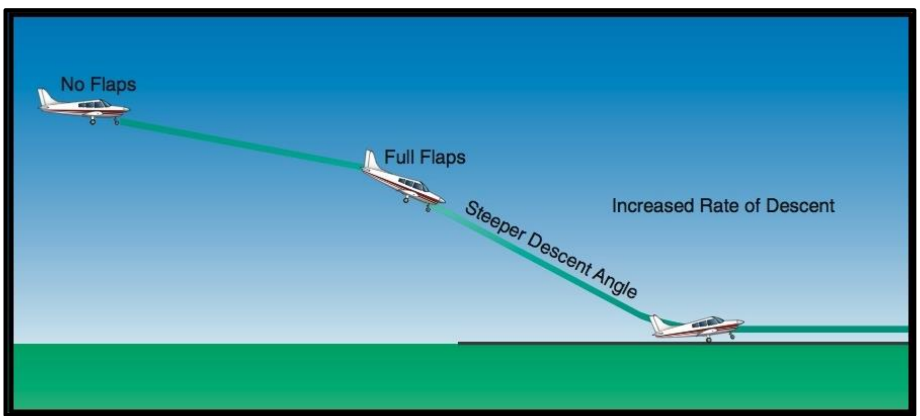

Figure 6-11 High final approach

3. **Slow Final Approach**

When the airplane is flown at a slower-than-normal airspeed on the final approach, the pilot's judgment of the rate of sink (descent) and the height of roundout will be difficult. During an excessively slow approach, the wing is operating near the critical angle of attack and, depending on the pitch attitude changes and control usage, the airplane may stall or sink rapidly, contacting the ground with a hard impact.

Whenever a slow-speed approach is noted, the pilot should apply power to accelerate the airplane and increase the lift to reduce the sink rate and to prevent a stall. This should be done while still at a high enough altitude to reestablish the correct approach airspeed and attitude. If too slow and too low, it is best to EXECUTE A WAVEOFF.

Power can be used effectively during the approach and roundout to compensate for errors in judgment. Power can be added to accelerate the airplane to increase lift without increasing the angle of attack; thus, the descent can be slowed to an acceptable rate. If the proper landing attitude has been attained and the airplane is only slightly high, the landing attitude should be held constant and sufficient power applied to help ease the airplane onto the ground. After the airplane has touched down, it will be necessary to close the throttle so the additional thrust and lift will be removed and the airplane will stay on the ground.

4. **High Flare**

Sometimes, when the airplane appears to temporarily stop moving downward, the flare has been made too rapidly and the airplane is flying level, too high above the runway. Continuing the flare would further reduce the airspeed, resulting in an increase in angle of attack to the critical angle. This would result in the airplane stalling and dropping hard onto the runway. To prevent this, the pitch attitude should be held constant until the airplane decelerates enough to again start descending. Then the flare can be continued to establish the proper landing attitude. This procedure should only be used when there is adequate airspeed. It may be necessary to add a slight amount of power to keep the airspeed from decreasing excessively and to avoid losing lift too rapidly.

Although back-elevator pressure may be relaxed slightly, the nose should not be lowered any perceptible amount to make the airplane descend when fairly close to the runway unless some power is added momentarily. The momentary decrease in lift that would result from lowering the nose and decreasing the angle of attack may be so great that the airplane might contact the ground with the nosewheel first, which could collapse.

When the proper landing attitude is attained, the airplane is approaching a stall because the airspeed is decreasing and the critical angle of attack is being approached, even though the pitch attitude is no longer being increased.

Execute a WAVEOFF any time it appears the nose must be lowered significantly or that the landing is in any other way uncertain.

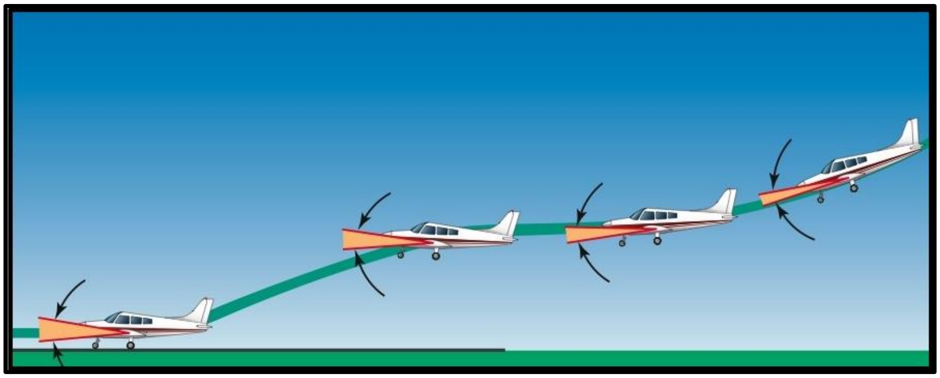

Figure 6-12 High flare

5. **Late or Rapid Flare**

Starting the roundout too late or pulling the elevator control back too rapidly to prevent the airplane from touching down prematurely can impose a heavy load factor on the wing and cause an accelerated stall.

Suddenly increasing the angle of attack and stalling the airplane during a roundout is a dangerous situation since it may cause the airplane to land extremely hard on the main landing gear and then bounce back into the air. As the airplane contacts the ground, the tail will be forced down very rapidly by the back-elevator pressure and by inertia acting downward on the tail.

Recovery from this situation requires prompt and positive application of power prior to occurrence of the stall. ***This may be followed by a normal landing if sufficient runway is available—otherwise the pilot should EXECUTE A WAVEOFF***.

If the roundout is late, the nosewheel may strike the runway first, causing the nose to bounce upward. No attempt should be made to force the airplane back onto the ground; EXECUTE A WAVEOFF.

6. **Floating During Flare**

If the airspeed on final approach is excessive, it will usually result in the airplane floating. Before touchdown can be made, the airplane may be well past the desired landing point and the available runway may be insufficient. When diving an airplane on final approach to land at the proper point, there will be an appreciable increase in airspeed. The proper touchdown attitude cannot be established without producing an excessive angle of attack and lift. This will cause the airplane to gain altitude or balloon.

Any time the airplane floats, judgment of speed, height, and sink rate must be especially acute. The pilot must smoothly and gradually adjust the pitch attitude as the airplane decelerates to touchdown speed and starts to settle, so the proper landing attitude is attained at the moment of touchdown. The slightest error in judgment and timing will result in either ballooning or bouncing.

The recovery from floating will depend on the amount of floating and the effect of any crosswind, as well as the amount of runway remaining. Since prolonged floating utilizes considerable runway length, it should be avoided, especially on short runways or in strong crosswinds**. *If a landing cannot be made on the first third of the runway, or the airplane drifts sideways, EXECUTE A WAVEOFF*.**

7. **Ballooning During Flare**

If the pilot misjudges the sink rate during a landing and thinks the airplane is descending faster than it should, there is a tendency to increase the pitch attitude and angle of attack too rapidly. This not only stops the descent, but actually starts the airplane climbing. This climbing during the flare is known as ballooning. Ballooning can be dangerous because the height above the ground is increasing and the airplane may be rapidly approaching a stalled condition. The altitude gained in each instance will depend on the airspeed or the speed with which the pitch attitude is increased.

When ballooning is slight, a constant landing attitude should be held and the airplane allowed to gradually decelerate and settle onto the runway. Depending on the severity of ballooning, the use of throttle may be helpful in cushioning the landing. By adding power, thrust can be increased to keep the airspeed from decelerating too rapidly and the wings from suddenly losing lift, but throttle must be closed immediately after touchdown. Remember that torque will be created as power is applied; therefore, it will be necessary to use rudder pressure to keep the airplane straight as it settles onto the runway. ***When ballooning is excessive, EXECUTE A WAVEOFF; DO NOT ATTEMPT TO SALVAGE THE LANDING***. Power must be applied before the airplane enters a stalled condition.

The pilot must be extremely cautious of ballooning when there is a crosswind present because the crosswind correction may be inadvertently released or it may become inadequate. Because of the lower airspeed after ballooning, the crosswind affects the airplane more. Consequently, the wing will have to be lowered even further to compensate for the increased drift. It is imperative that the pilot makes certain that the appropriate wing is down and that directional control is maintained with opposite rudder. ***If there is any doubt, or the airplane starts to drift, EXECUTE A WAVEOFF***.

8. **Bouncing During Touchdown**

When the airplane contacts the ground with a sharp impact as the result of an improper attitude or an excessive rate of sink, it tends to bounce back into the air. Though the airplane's tires and shock struts provide some springing action, the airplane does not bounce like a rubber ball. Instead, it rebounds into the air because the wing's angle of attack was abruptly increased, producing a sudden addition of lift.

The abrupt change in angle of attack is the result of inertia instantly forcing the airplane's tail downward when the main landing gear contact the ground sharply. The severity of the bounce depends on the airspeed at the moment of contact and the degree to which the angle of attack or pitch attitude was increased.

Since a bounce occurs when the airplane makes contact with the ground before the proper touchdown attitude is attained, it is almost invariably accompanied by the application of excessive back-elevator pressure. This is usually the result of the pilot realizing too late that the airplane is not in the proper attitude and attempting to establish it just as the second touchdown occurs.

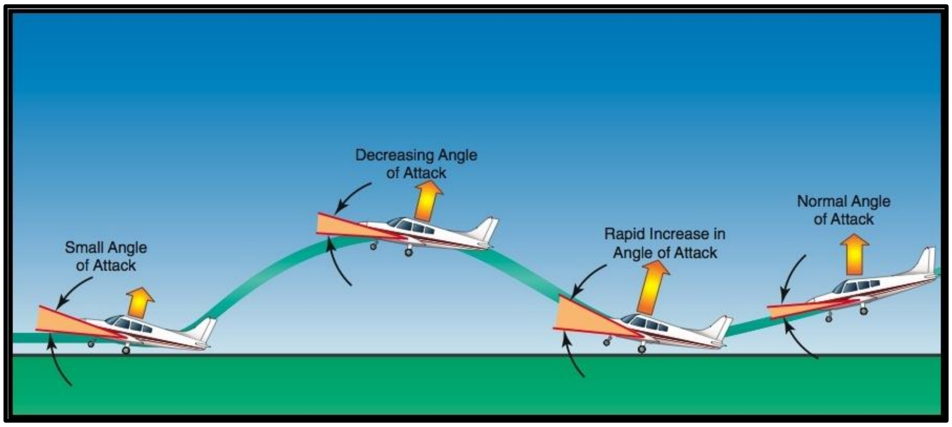

Figure 6-13 Bouncing during touchdown

The corrective action for a bounce is the same as for ballooning and similarly depends on its severity. When it is very slight and there is no extreme change in the airplane's pitch attitude, a follow-up landing may be executed by applying sufficient power to cushion the subsequent touchdown, and smoothly adjusting the pitch to the proper touchdown attitude.

In the event a very slight bounce is encountered while landing with a crosswind, crosswind correction must be maintained while the next touchdown is made. Remember that since the subsequent touchdown will be made at a slower airspeed, the upwind wing will have to be lowered even further to compensate for drift.

Extreme caution and alertness must be exercised any time a bounce occurs, but particularly when there is a crosswind. Inexperienced pilots will almost invariably release the crosswind correction. When one main landing gear of the airplane strikes the runway, the other wheel will touch down immediately afterwards, and the wings will become level. Then, with no crosswind correction as the airplane bounces, the wind will cause the airplane to roll with the wind, thus exposing even more surface to the crosswind and drifting the airplane more rapidly.

When a bounce is severe, the safest procedure is to EXECUTE A WAVEOFF. No attempt to salvage the landing should be made. Max power should be applied while simultaneously maintaining directional control, and lowering the nose to a safe climb attitude. The waveoff procedure should be continued even though the airplane may descend and another bounce may be encountered. It would be extremely foolish to attempt a landing from a bad bounce since airspeed diminishes very rapidly in the nose-high attitude, and a stall may occur before a subsequent touchdown could be made.

9. **Porpoising**

In a bounced landing that is improperly recovered, the airplane comes in nose first setting off a series of motions that imitate the jumps and dives of a porpoise—hence the name. Porpoising is the result of improper airplane attitude at touchdown due to inattention, poor judgement of height above ground, improper trimming or forcing the airplane onto the runway.

Ground effect decreases elevator control effectiveness and increases the effort required to raise the nose. Not enough elevator or stabilator trim can result in a nose low contact with the runway and a porpoise develops.

Porpoising can also be caused by improper airspeed control. Usually, if an approach is too fast, the airplane floats and the pilot tries to force it on the runway when the airplane still wants to fly. A gust of wind, a bump in the runway, or even a slight tug on the control wheel will send the airplane aloft again.

The corrective action for a porpoise is the same as for a bounce and similarly depends on its severity. When it is very slight and there is no extreme change in the airplane's pitch attitude, a follow-up landing may be executed by applying sufficient power to cushion the subsequent touchdown, and smoothly adjusting the pitch to the proper touchdown attitude.

When a porpoise is severe, EXECUTE A WAVEOFF. In a severe porpoise, the airplane's pitch oscillations can become progressively worse, until the airplane strikes the runway nose first with sufficient force to collapse the nose gear. Pilot attempts to correct a severe porpoise with flight control and power inputs will most likely be untimely and out of sequence with the oscillations, and only make the situation worse. ***No attempt to salvage the landing should be made. Max power should be applied while simultaneously maintaining directional control, and lowering the nose to a safe climb attitude.***

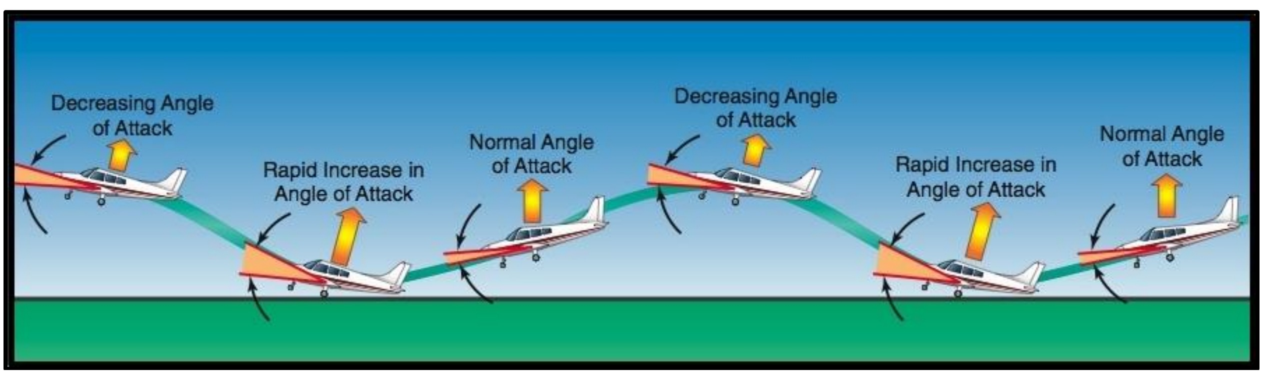

Figure 6-14 Porpoising

10. **Wheelbarrowing**

When a pilot permits the airplane weight to become concentrated about the nosewheel during the takeoff or landing roll, a condition known as wheelbarrowing will occur. Wheelbarrowing may cause loss of directional control during the landing roll because braking action is ineffective, and the airplane tends to swerve or pivot on the nosewheel, particularly in crosswind conditions. One of the most common causes of wheelbarrowing during the landing roll is a simultaneous touchdown of the main and nosewheel, with excessive speed, followed by application of forward pressure on the elevator control. Usually, the situation can be corrected by smoothly applying back-elevator pressure. **However, if wheelbarrowing is encountered and runway and other conditions permit, it may be advisable to promptly EXECUTE A WAVEOFF**. Wheelbarrowing will not occur if the pilot achieves and maintains the correct landing attitude, touches down at the proper speed, and gently lowers the nosewheel while losing speed on rollout. If the pilot decides to stay on the ground rather than attempt a waveoff or if directional control is lost, the throttle should be closed and the pitch attitude smoothly but firmly rotated to the proper landing attitude. Raise the flaps to reduce lift and to increase the load on the main landing gear for better braking action.

11. **Hard Landing**

When the airplane contacts the ground during landings, its vertical speed is instantly reduced to zero. Unless provisions are made to slow this vertical speed and cushion the impact of touchdown, the force of contact with the ground may be so great it could cause structural damage to the airplane.

The purpose of pneumatic tires, shock absorbing landing gears, and other devices is to cushion the impact and to increase the time in which the airplane's vertical descent is stopped. The importance of this cushion may be understood from the computation that a 6-inch free fall on landing is roughly equal, to a 340-foot-per-minute descent. Within a fraction of a second, the airplane must be slowed from this rate of vertical descent to zero, without damage.
During this time, the landing gear together with some aid from the lift of the wings must supply whatever force is needed to counteract the force of the airplane's inertia and weight. The lift decreases rapidly as the airplane's forward speed is decreased, and the force on the landing gear increases by the impact of touchdown. When the descent stops, the lift will be practically zero, leaving the landing gear alone to carry both the airplane's weight and inertia force. The load imposed at the instant of touchdown may easily be three or four times the actual weight of the airplane depending on the severity of contact.

12. **Touchdown in a Drift or Crab**

If the roundout and touchdown are made while the airplane is drifting or in a crab, it will contact the ground while moving sideways. This will impose extreme side loads on the landing gear, and if severe enough, may cause structural failure.

There are three factors that will cause the longitudinal axis and the direction of motion to be misaligned during touchdown: drifting, crabbing, or a combination of both.

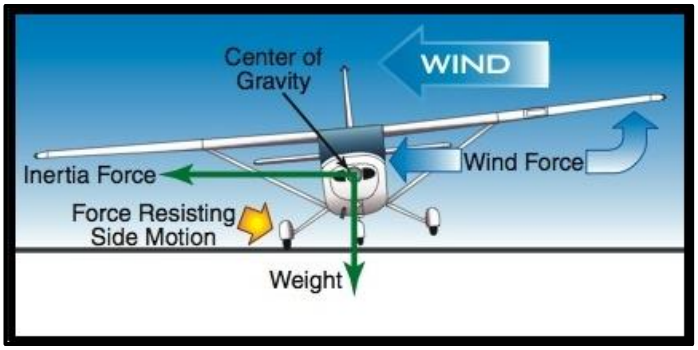

Figure 6-15 Forces during touchdown in a drift or crab

If the pilot has not taken adequate corrective action to avoid drift during a crosswind landing, the main landing gear's tire tread offers resistance to the airplane's sideward movement in respect to the ground. Consequently, any sidewise velocity of the airplane is abruptly decelerated. This creates a moment around the main wheel when it contacts the ground, tending to overturn or tip the airplane. If the windward wingtip is raised by the action of this moment, all the weight and shock of landing will be borne by one main landing gear. This could cause structural damage. Not only are the same factors present that are attempting to raise a wing, but the crosswind is also acting on the fuselage surface behind the main landing gear, tending to yaw (weathervane) the airplane into the wind. This often results in a ground loop.

13. **Ground Loop**

A ground loop is an uncontrolled turn during ground operation that may occur while taxiing or taking off, but especially during the after-landing roll. Drift or weathervaning does not always cause a ground loop, although these things may cause the initial swerve. Careless use of the rudder, an uneven ground surface, or a soft spot that retards one main landing gear of the airplane may also cause a swerve. In any case, the initial swerve tends to make the airplane ground loop.

If the airplane touches down while drifting or in a crab, the pilot should apply aileron toward the high wing and stop the swerve with the rudder. Brakes should be used to correct for turns or swerves only when the rudder is inadequate. The pilot must exercise caution when applying corrective brake action because it is very easy to over control and aggravate the situation.

If brakes are used, sufficient brake should be applied on the low-wing wheel (outside of the turn) to stop the swerve. When the wings are approximately level, the new direction must be maintained until the airplane has slowed to taxi speed or has stopped.

In nosewheel airplanes, a ground loop is almost always a result of wheelbarrowing. The pilot must be aware that even though the nosewheel-type airplane is less prone than the tailwheel-type airplane, virtually every type of airplane, including large multiengine airplanes, can be made to ground loop when sufficiently mishandled.

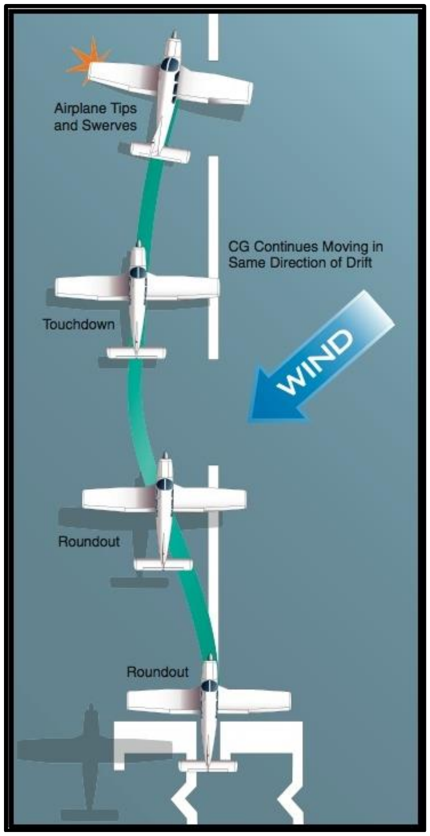

Figure 6-16 Ground Loop

14. **Hydroplaning**

Hydroplaning is a condition that can exist when an airplane is landed on a runway surface contaminated with standing water, slush, and/or wet snow. Hydroplaning can have serious adverse effects on ground controllability and braking efficiency. The three basic types of hydroplaning are dynamic hydroplaning, reverted rubber hydroplaning, and viscous hydroplaning. Any one of the three can render an airplane partially or totally uncontrollable anytime during the landing roll.

When confronted with the possibility of hydroplaning, it is best to land on a grooved runway (if available). Touchdown speed should be as slow as possible consistent with safety. After the nosewheel is lowered to the runway, moderate braking should be applied. If deceleration is not detected and hydroplaning is suspected, the nose should be raised and aerodynamic drag utilized to decelerate to a point where the brakes do become effective.

Proper braking technique is essential. The brakes should be applied firmly until reaching a point just short of a skid. At the first sign of a skid, the pilot should release brake pressure and allow the wheels to spin up. Directional control should be maintained as far as possible with the rudder. Remember that in a crosswind, if hydroplaning should occur, the crosswind will cause the airplane to simultaneously weathervane into the wind as well as slide downwind.

CHAPTER SEVEN
EMERGENCY PROCEDURES

700. INTRODUCTION

This chapter contains information on dealing with non-normal and emergency situations that may occur in flight. Throughout your aviation career, you will be required to be extremely familiar with your aircraft, systems, performance, and Emergency Procedures (or "EPs"). The key to successful management of an emergency situation, and/or preventing a non-normal situation from progressing into a true emergency, is maintain good headwork/situational awareness and possessing a thorough familiarity with, and adherence to, the procedures developed by the airplane manufacturer and contained in the FAA-approved Airplane Flight Manual and/or Pilot's Operating Handbook (AFM/POH). The following guidelines are generic and are not meant to replace the airplane manufacturer's recommended procedures. Rather, they are meant to enhance the pilot's general knowledge in the area of non-normal and emergency operations. If any of the guidance in this chapter conflicts in any way with the manufacturer's recommended procedures for a particular make and model airplane, the manufacturer's recommended procedures take precedence.

– **General**. During any flight evolution, an engine or system malfunction may occur either while on the ground or in flight. These malfunctions can range from system failures to complete power losses. All emergencies or malfunctions will be handled in accordance AFM/POH utilizing with good headwork. When an airborne emergency occurs, three basic rules apply. These rules should be thoroughly understood by all aircrew:

a. **Maintain aircraft control:** Establishing the aircraft in safe controlled flight should always be your first priority in any emergency, even if it means consciously continuing in straight and level flight. Conversely, if performing high work such as stalls or Slow Flight, recover from the maneuver to straight and level flight first, if possible, and maintain control of the aircraft.

b. **Analyze the situation and take proper action:** Analyze the indications you have to determine the nature of the emergency. You should verify what you see in your cockpit with the other crewmember. Once the problem is diagnosed, execute the appropriate memory items and use the appropriate checklists.

c. **Land as soon as conditions permit:** The severity of the problem will dictate the course of action to safely recover the aircraft. Power losses fall into two main categories: those that occur without warning and those that present ample warning.

Impending engine problems may be prefaced by loss of oil pressure, excessive exhaust gas temperature (EGT)/cylinder head temperature (CHT), fluctuating RPM, vibrations, etc. These may be classified as deferred emergencies requiring action to prevent catastrophic failure. The Power-off Approach pattern (Emergency Landing Pattern) can be used for both the impending engine failure and the immediate power loss. This way, in the event of actual engine failure, the aircraft may already be established at the appropriate point on the Power-off Approach profile, ensuring sufficient energy remains to make a safe landing.

701. PSYCHOLOGICAL HAZARDS

There are several factors that may interfere with a pilot's ability to act promptly and properly when faced with an emergency.

1. **Reluctance to accept the emergency situation**. A pilot who allows the mind to become paralyzed at the thought that the airplane will be on the ground, in a very short time, regardless of the pilot's actions or hopes, is severely handicapped in the handling of the emergency. An unconscious desire to delay the dreaded moment may lead to such errors as:

   a. Failure to lower the nose to maintain flying speed,

   b. Delay in the selection of the most suitable landing area within reach, and

   c. Indecision.

Desperate attempts to correct whatever went wrong, at the expense of airplane control, fall into the same category.

2. **Desire to save the airplane**. The pilot who has been conditioned during training to expect to find a relatively safe landing area, whenever the flight instructor closed the throttle for a simulated forced landing, may ignore all basic rules of airmanship to avoid a touchdown in terrain where airplane damage is unavoidable. Typical consequences are:

   a. Making a 180° turn back to the runway when available altitude is insufficient

   b. Stretching the glide without regard for minimum control speed in order to reach a more appealing field

   c. Accepting an approach and touchdown situation that leaves no margin for error.

The desire to save the airplane, regardless of the risks involved, may be influenced by two other factors: the pilot's financial stake in the airplane and the certainty that an undamaged airplane implies no bodily harm. There are times, however, when a pilot should be more interested in sacrificing the airplane so that the occupants can safely walk away from it.

3. **Undue concern about getting hurt.** Fear is a vital part of the self-preservation mechanism. However, when fear leads to panic, we invite that which we want most to avoid. The survival records favor pilots who maintain their composure and know how to apply the general concepts and procedures that have been developed through the years. The success of an emergency landing is as much a matter of the mind as of skills.

702. EMERGENCY LANDINGS

The first time a pilot should be thinking of what to do and where he would land if the engine stops is not after the engine has actually stopped. If the pilot's SA to an emergency landing site begins after the engine has failed, then poor headwork is bound to follow. A successful emergency landing begins prior to flight.

Instead, the pilot should ALWAYS be thinking about where to go and what areas are available in the event of an emergency. This process begins during preflight planning; Where are the available runways and landing areas? Where are the working areas in relation to the landing areas? What is the glide distance to shore? Where can the aircraft be safely put down if the engine fails prior to /after takeoff? In the climb out? In the pattern? The best time to ask and answer these questions is before the pilot ever preflights the aircraft. The information in this section is to help the student answer these questions.

There are three basic types of emergency landings:

1. **Forced landing**. An immediate landing, on or off an airport, necessitated by the inability to continue further flight. A typical example of which is an airplane forced down by engine failure.

2. **Precautionary landing**. A premeditated landing, on or off an airport, when further flight is possible but inadvisable. Examples of conditions that may call for a precautionary landing include fuel shortage and gradually developing engine trouble.

3. **Ditching.** A forced or precautionary landing on water.

A precautionary landing, generally, is less hazardous than a forced landing because the pilot has more time for terrain selection and the planning of the approach. In addition, the pilot can use power to compensate for errors in judgment or technique. The pilot should be aware that too many situations calling for a precautionary landing are allowed to develop into immediate forced landings, when the pilot uses wishful thinking instead of reason, especially when dealing with a self-inflicted predicament. The non-instrument rated pilot trapped by weather, or the pilot facing imminent fuel exhaustion who does not give any thought to the feasibility of a precautionary landing accepts an extremely hazardous alternative.

Attitude and Sink Rate Control. The most critical and often the most inexcusable error that can be made in the planning and execution of an emergency landing, even in ideal terrain, is the loss of initiative over the airplane's attitude and sink rate at touchdown. When the touchdown is made on flat, open terrain, an excessive nose-low pitch attitude brings the risk of "sticking" the nose in the ground. Steep bank angles just before touchdown should also be avoided, as they increase the stalling speed and the likelihood of a wingtip strike.

Since the airplane's vertical component of velocity will be immediately reduced to zero upon ground contact, it must be kept well under control. A flat touchdown at a high sink rate (well in excess of 500 feet per minute (fpm)) on a hard surface can be injurious without destroying the cockpit/cabin structure, especially during gear up landings in low-wing airplanes. A rigid bottom construction of these airplanes may preclude adequate cushioning by structural deformation. Similar impact conditions may cause structural collapse of the overhead structure in high-wing airplanes. On soft terrain, an excessive sink rate may cause digging in of the lower nose structure and severe forward deceleration.

Terrain Selection. A pilot's choice of emergency landing sites is governed by:

- The route selected during preflight planning.
- The height above the ground when the emergency occurs.
- Excess airspeed (excess airspeed can be converted into distance and/or altitude).

The only time the pilot has a very limited choice is during the low and slow portion of the takeoff. However, even under these conditions, the ability to change the impact heading only a few degrees may ensure a survivable crash.

If beyond gliding distance of a suitable open area, the pilot should judge the available terrain for its energy absorbing capability. If the emergency starts at a considerable height above the ground, the pilot should be more concerned about first selecting the desired general area than a specific spot. Terrain appearances from altitude can be very misleading and considerable altitude may be lost before the best spot can be pinpointed. For this reason, the pilot should not hesitate to discard the original plan for one that is obviously better. However, as a general rule, the pilot should not change his or her mind more than once; a well-executed crash landing in poor terrain can be less hazardous than an uncontrolled touchdown on an established field.

Airplane Configuration. Since flaps improve maneuverability at slow speed, and lower the stalling speed, their use during final approach is recommended when time and circumstances permit. However, the associated increase in drag and decrease in gliding distance call for caution in the timing and the extent of their application; premature use of flap, and dissipation of altitude, may jeopardize an otherwise sound plan.

Deactivation of the airplane's electrical system before touchdown reduces the likelihood of a post-crash fire. However, the battery master switch should not be turned off until the pilot no longer has any need for electrical power to operate vital airplane systems. Positive airplane control during the final part of the approach has priority over all other considerations, including airplane configuration and cockpit checks. The pilot should attempt to exploit the power available from an irregularly running engine; however, it is generally better to switch the engine and fuel off just before touchdown. This not only ensures the pilot's initiative over the situation, but a cooled down engine reduces the fire hazard considerably.

Approach. When there is time to maneuver, approach planning should be governed by three factors.

- Wind direction and velocity.
- Dimensions and slope of the chosen field.
- Obstacles in the final approach path.

These three factors are seldom compatible. When compromises have to be made, the pilot should aim for a wind/obstacle/terrain combination that permits a final approach with some margin for error in judgment or technique. A pilot who overestimates the gliding range may be tempted to stretch the glide across obstacles in the approach path. For this reason, it is sometimes better to plan the approach over an unobstructed area, regardless of wind direction. Experience shows that a collision with obstacles at the end of a ground roll, or slide, is much less hazardous than striking an obstacle at flying speed before the touchdown point is reached.

Landing in Trees. Although a tree landing is not an attractive prospect, the following general guidelines will help to make the experience survivable.

- Use the normal landing configuration (full flaps, gear down).
- Keep the groundspeed low by heading into the wind.
- Make contact at minimum indicated airspeed, but not below stall speed, and “hang” the airplane in the tree branches in a nose-high landing attitude. Involving the underside of the fuselage and both wings in the initial tree contact provides a more even and positive cushioning effect, while pre- venting penetration of the windshield.
- Avoid direct contact of the fuselage with heavy tree trunks.
- Low, closely spaced trees with wide, dense crowns (branches) close to the ground are much better than tall trees with thin tops; the latter allow too much free fall height. (A free fall from 75 feet results in an impact speed of about 40 knots, or about 4,000 fpm.)
- Ideally, initial tree contact should be symmetrical; that is, both wings should meet equal resistance in the tree branches. This distribution of the load helps to maintain proper airplane attitude. It may also preclude the loss of one wing, which invariably leads to a more rapid and less predictable descent to the ground.
- If heavy tree trunk contact is unavoidable once the airplane is on the ground, it is best to involve both wings simultaneously by directing the air- plane between two properly spaced trees. Do not attempt this maneuver, however, while still airborne.

Water (Ditching). A well-executed water landing normally involves less deceleration violence than a poor tree landing or a touchdown on extremely rough terrain. Also an airplane that is ditched at minimum speed and in a normal landing attitude will not immediately sink upon touchdown. Intact wings and fuel tanks (especially when empty) provide floatation for several minutes even if the cockpit may be just below the water line in a high-wing airplane.

Loss of depth perception may occur when landing on a wide expanse of smooth water, with the risk of flying into the water or stalling in from excessive altitude. To avoid this hazard, the airplane should be "dragged in" when possible. Use no more than intermediate flaps on low-wing airplanes. The water resistance of fully extended flaps may result in asymmetrical flap failure and slowing of the airplane.

703. SIMULATED EMERGENCY APPROACHES AND LANDINGS

The instructor will give simulated emergency landings by retarding the throttle and calling "simulated engine out." The objective of these simulated emergency landings is to develop the pilot's accuracy, judgment, planning, procedures, and confidence when little or no power is available.

A simulated emergency landing may be given with the airplane in any configuration. When the instructor calls "simulated engine out," the student should immediately establish a glide attitude and ensure that the flaps are in the proper configuration for the existing situation. When the proper glide speed is attained, the nose should then be lowered and the airplane trimmed to maintain that speed.

A constant gliding speed should be maintained because variations of gliding speed nullify all attempts at accuracy in judgment of gliding distance and the landing spot. The many variables, such as altitude, obstructions, wind direction, landing direction, landing surface and gradient, and landing distance requirements of the airplane will determine the pattern and approach procedures to use.

There are a combination of normal gliding maneuvers: 360° turns, bow ties, S-turns, slips, or configuring early. The pilot should eventually arrive at one of the normal key High-key positions for the selected landing area if able.

With the greater choice of fields afforded by higher altitudes, the inexperienced pilot may be inclined to delay making a decision, and with considerable altitude in which to maneuver, errors in maneuvering and estimation of glide distance may develop.

The ELP is a **360° pattern** designed to position the aircraft for landing at a prepared surface during a complete power loss or when an impending engine failure exists in which sufficient power for continued flight is available. The ELP is used for both actual/simulated emergency approaches and landings.

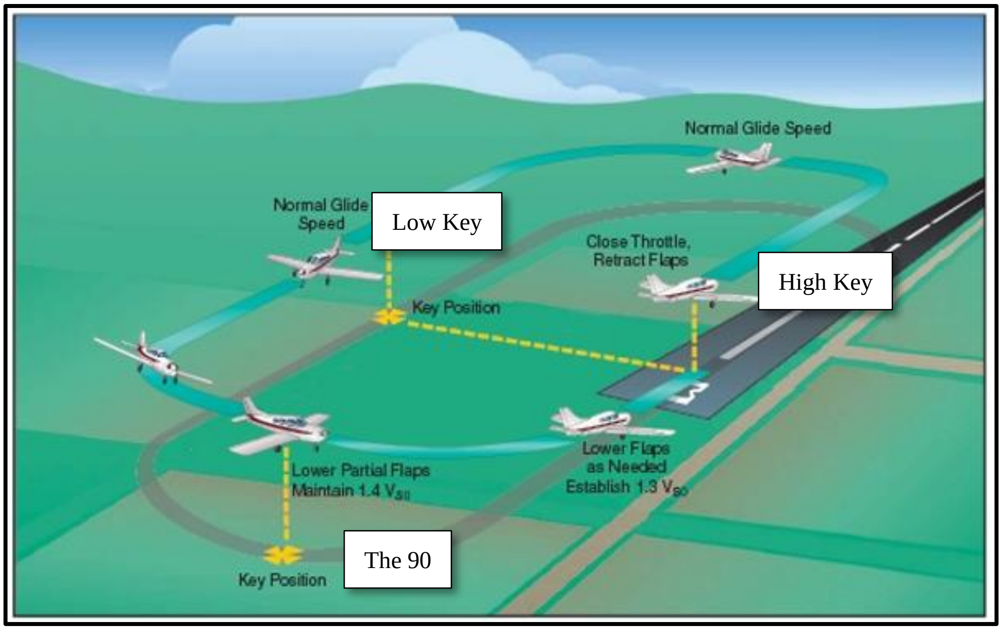

Figure 7-1 Emergency Landing Pattern

The entire pattern is designed to be **circular**, but the turn may be shallowed, steepened, or discontinued at any point to adjust the accuracy of the flightpath.

The 360° approach is started from a position over the approach end of the landing runway or slightly to the opposite side of it from the downwind side, with the airplane headed in the proposed landing direction and the landing gear and flaps retracted.

It is usually initiated from High Key, approximately 1,500 feet or more above the ground, on the opposite side of the runway from the pattern side. Spacing requirement is runway numbers above the main wheel.

After the throttle is closed at High Key, the proper glide speed should immediately be established, and a small-medium banked turn made in the desired direction so as to arrive at the Low Key position opposite the intended landing spot. The altitude at the Low-key position should be approximately 700-800 feet above the ground, runway intersecting with ½ of the wing strut.

After reaching that point, select first notch of flaps and the turn should be continued to arrive at a Base Key position at an altitude of about 400 feet above the terrain. The angle of bank can be varied as needed throughout the pattern to correct for wind conditions and to align the airplane with the final approach. Once a safe landing is assured, select full flaps.

All pilots should learn to determine the wind direction and estimate its speed from the windsock at the airport, smoke from factories or houses, dust, brush fires, and windmills.

Once a landing runway or cleared area has been selected, the student shall indicate it to the instructor. Normally, the student will be required to plan and fly a pattern for landing at the area first elected until the instructor terminates the simulated emergency landing. This will give the instructor an opportunity to explain and correct any errors; it will also give the student an opportunity to see the results of the errors. However, if the student realizes during the approach that a poor area has been selected—one that would obviously result in disaster if a landing were to be made—and there is a more advantageous field or area within gliding distance, a change to the better field should be permitted. The hazards involved in these last-minute decisions, such as excessive maneuvering at very low altitudes, should be thoroughly explained by the instructor. Slipping the airplane, using flaps, varying the position of the base leg, and varying the turn onto final approach should be stressed as ways of correcting for misjudgment of altitude and glide angle.

Eagerness to get down is one of the most common faults of inexperienced pilots during simulated emergency landings. In giving way to this, they forget about speed and arrive at the edge of the field with too much speed to permit a safe landing. Too much speed may be just as dangerous as too little; it results in excessive floating and overshooting the desired landing spot. It should be impressed on students that they cannot dive at a field and expect to land on it.

During all simulated emergency landings, the engine should be kept warm and cleared. During a simulated emergency landing, either the instructor or the student should have complete control of the throttle. There should be no doubt as to who has control since many near accidents have occurred from such misunderstandings.

Every simulated emergency landing approach to an area other than a runway should be terminated as soon as it can be determined whether a safe landing could have been made. In no case should it be continued to a point where it creates an undue hazard or an annoyance to persons or property on the ground.

In addition to flying the airplane from the point of simulated engine failure to where a reasonable safe landing could be made, the student should also be taught certain emergency cockpit procedures. The habit of performing these cockpit procedures should be developed to such an extent that, when an engine failure actually occurs, the student will check the critical items that would be necessary to get the engine operating again while selecting a field and planning an approach. Combining the two operations, accomplishing emergency procedures and planning and flying the approach, will be difficult for the student during the early training in emergency landings.

There are definite steps and procedures to be followed in a simulated emergency landing. They should be learned thoroughly by the student, and each step called out to the instructor.

Critical items to be checked should include the position of the fuel tank selector, the quantity of fuel in the tank selected, the fuel pressure gauge to see if the electric fuel pump is needed, the position of the mixture control, the position of the magneto switch, and the use of carburetor heat. Many actual emergency landings have been made and later found to be the result of the fuel selector valve being positioned to an empty tank while the other tank had plenty of fuel. It may be wise to change the position of the fuel selector valve even though the fuel gauge indicates fuel in all tanks because fuel gauges can be inaccurate. Many actual emergency landings could have been prevented if the pilots had developed the habit of checking these critical items during flight training to the extent that it carried over into later flying. Instruction in emergency procedures will not be limited to simulated emergency landings caused by power failures. Other emergencies associated with the operation of the airplane will be explained, demonstrated, and practiced. Among these emergencies are such occurrences as fire in flight, electrical or hydraulic system malfunctions, unexpected severe weather conditions, engine overheating, loss of engine oil pressure, imminent fuel exhaustion, and the emergency operation of airplane systems and equipment. As always, the priority is **Aviate-Navigate-Communicate.**

Below is a general emergency landing procedure/checklist. Like all EPs, the bold items in the emergency landing procedure specific to your aircraft are memorized verbatim.

Engine Failure During Flight Procedure

1. **AIRSPEED**

    a. Maintain altitude as airspeed decreases to best glide, then…

    b. Set pitch and trim to best glide airspeed.

2. **BEST PLACE** – Select suitable emergency landing field.

If above 1000' feet attempt restart:

3. **CHECK ENGINE**

    a. Fuel Selector – Both.

    b. Mixture – Full rich.

    c. Throttle – Full.

    d. Carb Heat – On.

    e. Magnetos – Check by cycling Left/Right/Both/Start.

    f. Master – Verify on.

If below 1000' feet:

4. **EMERGENCY SHUTDOWN**

    a. Fuel Selector – Off.

    b. Mixture – Idle cutoff.

c. Throttle – Idle.

d. Magnetos – Off.

e. Declare Emergency – Squawk 7700 and radio call.

f. Flaps – As required.

e. Master – Off.

5. **FLY** – Fly emergency approach profile.

a. Intercept appropriate power-off approach position.

b. Control airspeed and glidepath with pitch and flaps.

6. **GET READY TO EGRESS** – Doors unlatched

7. Touch down nose high.

8. Braking as required.

704. COMMON ERRORS DURING EMERGENCY LANDING PATTERNS

- Downwind leg too far from the runway/landing area.
- Overextension of downwind leg resulting from tailwind.
- Inadequate compensation for wind drift on base leg.
- Skidding turns in an effort to increase gliding distance.
- Attempting to “stretch” the glide during undershoot.
- Premature flap extension.
- Forcing the airplane onto the runway in order to avoid overshooting the designated landing spot.

705. ENGINE FAILURE AFTER TAKEOFF

What characterizes all power loss or engine failure occurrences after takeoff is urgency. In most instances, the pilot has only a few seconds after an engine failure to decide what course of action to take and to execute it. Unless prepared in advance to make the proper decision, there is an excellent chance the pilot will make a poor decision, or make no decision at all and allow events to rule.

In the event of an engine failure on initial climb-out, the pilot's first responsibility is to maintain aircraft control. At a climb pitch attitude without power, the airplane will be at or near a stalling angle of attack. At the same time, the pilot may still be holding right rudder. It is essential the pilot immediately lower the pitch attitude to prevent a stall and possible spin. The pilot should establish a controlled glide toward a plausible landing area (preferably straight ahead on the remaining runway).

The altitude available is, in many ways, the controlling factor in the successful accomplishment of an emergency landing. In order for the pilot to exercise good headwork in this situation, his SA must be excellent. This involves becoming intimately familiar with the aircraft performance, airfield and surrounding areas PRIOR to takeoff. The pilot should know prior to takeoff what the plan will be in the event of an engine loss at various key altitudes during initial climb out. These decision points should be briefed prior to takeoff so the CFI and the SMA are on the same page in case of engine failure.

If an actual engine failure should occur immediately after takeoff and before a safe maneuvering altitude is attained, it is NOT usually advisable to attempt to turn back to the field from where the takeoff was made. Instead, it is safer to immediately establish the proper glide attitude and select a field directly ahead of or with 45 degrees of either side of the takeoff path.

With regard to deciding to turn back to the field - consider the following example of an airplane which has taken off and climbed to an altitude of 300 feet AGL when the engine fails. After a typical 4 second reaction time, the pilot elects to turn back to the runway. Using a standard rate (3° change in direction per second) turn, it will take 1 minute to turn 180°. At a glide speed of 65 knots, the radius of the turn is 2,100 feet. At the completion of the turn, the airplane will be 4,200 feet to one side of the runway. Therefore, the pilot must turn another 45° to head the airplane toward the runway. By this time the total change in direction is 225° equating to 75 seconds plus the 4 second reaction time. If the airplane in a power-off glide descends at approximately 1,000 fpm, it will have descended 1,316 feet, placing it 1,016 feet below the runway. The key is to know your aircraft performance, and have a plan prior to takeoff on when and how to execute a turn back to the field.

Note that descent rates during and actual engine failure are poorly represented during simulated engine failures. Even at idle setting, the engine is producing some thrust. When the engine fails and is "wind-milling" some of the aircraft's energy is being used to turn the propeller resulting in increased drag. A ceased engine (not "wind-willing") will increase drag even further.

706. FIRES

A fire in flight demands immediate and decisive action. The pilot therefore must be familiar with the procedures outlined to meet this emergency contained in the AFM/POH for the particular airplane. For the purposes of this handbook, in-flight fires are classified as: inflight engine fires, electrical fires, and cabin fires.

1. **Engine Fire.** An in-flight engine compartment fire is usually caused by a failure that

allows a flammable substance such as fuel, oil or hydraulic fluid to come in contact with a hot surface. This may be caused by a mechanical failure of the engine itself, an engine-driven accessory, a defective induction or exhaust system, or a broken fuel line. Engine compartment fires may also result from maintenance errors, such as improperly installed/fastened lines and/or fittings resulting in leaks.
Engine compartment fires can be indicated by smoke and/or flames coming from the engine cowling area. They can also be indicated by discoloration, bubbling, and/or melting of the engine cowling skin in cases where flames and/or smoke is not visible to the pilot. By the time a pilot becomes aware of an in-flight engine compartment fire, it usually is well developed. Unless the airplane manufacturer directs otherwise in the AFM/POH, the first step on discovering a fire should be to shut off the fuel supply to the engine by placing the mixture control in the idle cut off position and the fuel selector shutoff valve to the OFF position. The ignition switch should be left ON in order to use up the fuel that remains in the fuel lines and components between the fuel selector/shutoff valve and the engine. This procedure may starve the engine compartment of fuel and cause the fire to die naturally. If the flames are snuffed out, no attempt should be made to restart the engine.

If the engine compartment fire is oil-fed, as evidenced by thick black smoke, as opposed to a fuel-fed fire which produces bright orange flames, the pilot should consider stopping the propeller rotation by feathering or other means, such as (with constant-speed propellers) placing the pitch control lever to the minimum RPM position and raising the nose to reduce airspeed until the propeller stops rotating. This procedure will stop an engine driven oil (or hydraulic) pump from continuing to pump the flammable fluid which is feeding the fire.

Prior to securing the electrical master switch, the pilot should consider that unless the fire is electrical in nature, or a crash landing is imminent, deactivating the electrical system prevents the use of panel radios for transmitting distress messages and will also cause air traffic control (ATC) to lose transponder returns. Make radio calls and configure the aircraft (if applicable) prior to securing the electrical master switch unless the fire is definitely electrical in nature.

Pilots of powerless single-engine airplanes are left with no choice but to make a forced landing. Pilots of twin-engine airplanes may elect to continue the flight to the nearest airport. However, consideration must be given to the possibility that a wing could be seriously impaired and lead to structural failure. Even a brief but intense fire could cause dangerous structural damage. In some cases, the fire could continue to burn under the wing (or engine cowling in the case of a single- engine airplane) out of view of the pilot. Engine compartment fires which appear to have been extinguished have been known to rekindle with changes in airflow pattern and airspeed.

The pilot must be familiar with the airplane’s emergency descent procedures. The pilot must bear in mind that:

- The airplane may be severely structurally damaged to the point that its ability to remain under control could be lost at any moment.

- The airplane may still be on fire and susceptible to explosion.

- The airplane is expendable and the only thing that matters is the safety of those on board.

2. **Electrical Fire.** The initial indication of an electrical fire is usually the distinct odor of burning insulation. Once an electrical fire is detected, the pilot should attempt to identify the faulty circuit by checking circuit breakers, instruments, avionics, and lights. If the faulty circuit cannot be readily detected and isolated, and flight conditions permit, the battery master switch and alternator/generator switches should be turned off to remove the possible source of the fire. However, any materials which have been ignited may continue to burn.

If electrical power is absolutely essential for the flight, an attempt may be made to identify and isolate the faulty circuit by:

- Turning the electrical master switch OFF.

- Turning all individual electrical switches OFF.

- Turning the master switch back ON.

- Selecting electrical switches that were ON before the fire indication one at a time, permitting a short time lapse after each switch is turned on to check for signs of odor, smoke, or sparks.

This procedure, however, has the effect of recreating the original problem. The most prudent course of action is to land as soon as possible.

3. **Cabin Fire.** Cabin fires generally result from one of three sources: (1) careless smoking on the part of the pilot and/or passengers; (2) electrical system malfunctions; (3) heating system malfunctions. A fire in the cabin presents the pilot with two immediate demands: attacking the fire, and getting the airplane safely on the ground as quickly as possible. A fire or smoke in the cabin should be controlled by identifying and shutting down the faulty system. In many cases, smoke may be removed from the cabin by opening the cabin air vents. This should be done only after the fire extinguisher (if available) is used. Then the cabin air control can be opened to purge the cabin of both smoke and fumes. If smoke increases in intensity when the cabin air vents are opened, they should be immediately closed. This indicates a possible fire in the heating system, nose compartment baggage area (if so equipped), or that the increase in airflow is feeding the fire.

The pilot can attempt to expel the smoke from the cabin by opening the foul weather windows. These windows should be closed immediately if the fire becomes more intense. If the smoke is severe, the passengers and crew should use oxygen masks if available, and the pilot should initiate an immediate descent.

707. FLIGHT CONTROL MALFUNCTIONS

1. **Total Flap Failure.** The inability to extend the wing flaps will necessitate a no-flap approach and landing. In light airplanes a no-flap approach and landing is not particularly difficult or dangerous. However, there are certain factors which must be considered in the execution of this maneuver. A no-flap landing requires substantially more runway than normal. The increase in required landing distance could be as much as 50 percent.

When flying in the traffic pattern with the wing flaps retracted, the airplane must be flown in a relatively nose-high attitude to maintain altitude compared to flight with flaps extended. Losing altitude can be more of a problem without the benefit of the drag normally provided by flaps. A wider, longer traffic pattern may be required in order to avoid the necessity of diving to lose altitude and consequently building up excessive airspeed.

On final approach, a nose-high attitude can make it difficult to see the runway. This situation, if not anticipated, can result in serious errors in judgment of height and distance. Approaching the runway in a relatively nose-high attitude can also cause the perception that the airplane is close to a stall. This may cause the pilot to lower the nose abruptly and risk touching down on the nosewheel.

With the flaps retracted and the power reduced for landing, the airplane is slightly less stable in the pitch and roll axes. Without flaps, the airplane will tend to float considerably during roundout. The pilot should avoid the temptation to force the airplane onto the run- way at an excessively high speed. Neither should the pilot flare excessively, because without flaps this might cause the tail to strike the runway.

2. **Asymmetric (Split) Flap.** An asymmetric “split” flap situation is one in which one flap deploys or retracts while the other remains in position. The problem is indicated by a pronounced roll toward the wing with the least flap deflection when wing flaps are extended/retracted.

The roll encountered in a split flap situation is countered with opposite aileron. The yaw caused by the additional drag created by the extended flap will require substantial opposite rudder, resulting in a cross-control condition. Almost full aileron may be required to maintain a wings-level attitude, especially at the reduced airspeed necessary for approach and landing. The pilot therefore should not attempt to land with a cross-wind from the side of the deployed flap, because the additional roll control required to counteract the cross-wind may not be available.

The pilot must be aware of the difference in stall speeds between one wing and the other in a split flap situation. The wing with the retracted flap will stall considerably earlier than the wing with the deployed flap. This type of asymmetrical stall will result in an uncontrollable roll in the direction of the stalled (clean) wing. If altitude permits, a spin will result.

The approach to landing with a split flap condition should be flown at a higher than normal airspeed. The pilot should not risk an asymmetric stall and subsequent loss of control by flaring excessively. Rather, the airplane should be flown onto the runway so that the touchdown occurs at airspeed consistent with a safe margin above flaps-up stall speed.

3. **Loss of Elevator Control.** In many airplanes, the elevator is controlled by two cables: a “down” cable and an “up” cable. Normally, a break or disconnect in only one of these cables will not result in a total loss of elevator control. In most airplanes, a failed cable results in a partial loss of pitch control. In the failure of the “up” elevator cable (the “down” elevator being intact and functional) the control yoke will move aft easily but produce no response. Forward yoke movement, however, beyond the neutral position produces a nose down attitude. Conversely, a failure of the “down” elevator cable, forward movement of the control yoke produces no effect. The pilot will, however, have partial control of pitch attitude with aft movement.

When experiencing a loss of up-elevator control, the pilot can retain pitch control by:

a. Applying considerable nose-up trim.

b. Pushing the control yoke forward to attain and maintain desired attitude.

c. Increasing forward pressure to lower the nose and relaxing forward pressure to raise the nose.

d. Releasing forward pressure to flare for landing.

When experiencing a loss of down-elevator control, the pilot can retain pitch control by:

e. Applying considerable nose down trim.

f. Pulling the control yoke aft to attain and maintain attitude.

g. Releasing back pressure to lower the nose and increasing back pressure to raise the nose.

h. Increasing back pressure to flare for landing.

Trim mechanisms can be useful in the event of an in-flight primary control failure. For example, if the linkage between the cockpit and the elevator fails in flight, leaving the elevator free to weathervane in the wind, the trim tab can be used to raise or lower the elevator, within limits. The trim tabs are not as effective as normal linkage control in conditions such as low airspeed, but they do have some positive effect — usually enough to bring about a safe landing.

If an elevator becomes jammed, resulting in a total loss of elevator control movement, various combinations of power and flap extension offer a limited amount of pitch control. A successful landing under these conditions, however, is problematical.

708. SYSTEM MALFUNCTIONS

1. **Electrical System.** The loss of electrical power can deprive the pilot of numerous critical systems, and therefore should not be taken lightly even in day/VFR conditions. Most in-flight failures of the electrical system are located in the generator or alternator. Once the generator or alternator system goes off line, the electrical source in a typical light airplane is a battery. If a warning light or ammeter indicates the probability of an alternator or generator failure in an airplane with only one generating system, however, the pilot may have very little time available from the battery.

What constitutes an "emergency" load following a generating system failure cannot be predetermined, because the actual circumstances will always be somewhat different—for example, whether the flight is VFR or IFR, conducted in day or at night, in clouds or in the clear. Distance to nearest suitable airport can also be a factor.

The pilot should remember that the electrically powered (or electrically selected) flaps will not function properly on the power left in a partially depleted battery. Flap motors use up power at rates much greater than most other types of electrical equipment. The result of selecting these motors on a partially depleted battery may well result in an immediate total loss of electrical power.

If the pilot should experience a complete in-flight loss of electrical power, the following steps should be taken:

a. Shed all but the most necessary electrically-driven equipment.

b. Understand that any loss of electrical power is critical in a small airplane—notify ATC of the situation immediately. Request radar vectors for a landing at the nearest suitable airport.

c. If landing gear or flaps are electrically controlled or operated, plan the arrival well ahead of time. Expect to make a no-flap landing, and anticipate a manual landing gear extension.

2. **Pitot-Static System.** The source of the pressure for operating the airspeed indicator, the vertical speed indicator, and the altimeter is the pitot-static system. The major components of the pitot-static system are the impact pressure chamber and lines, and the static pressure chamber and lines, each of which are subject to total or partial blockage by ice, dirt, and/or other foreign matter. Blockage of the pitot-static system will adversely affect instrument operation.

Partial static system blockage is insidious in that it may go unrecognized until a critical phase of flight. During takeoff, climb, and level-off at cruise altitude the altimeter, airspeed indicator, and vertical speed indicator may operate normally. No indication of malfunction may be present until the airplane begins a descent.

If the static reference system is severely restricted, but not entirely blocked, as the airplane descends, the static reference pressure at the instruments begins to lag behind the actual outside air pressure. While descending, the altimeter may indicate that the airplane is higher than actual because the obstruction slows the airflow from the static port to the altimeter. The vertical speed indicator confirms the altimeter's information regarding rate of change, because the reference pressure is not changing at the same rate as the outside air pressure. The airspeed indicator, unable to tell whether it is experiencing more airspeed pitot pressure or less static reference pressure, indicates a higher airspeed than actual. To the pilot, the instruments indicate that the airplane is too high, too fast, and descending at a rate much less than desired.

If the pilot levels off and then begins a climb, the altitude indication may still lag. The vertical speed indicator will indicate that the airplane is not climbing as fast as actual. The indicated airspeed, however, may begin to decrease at an alarming rate. The least amount of pitch-up attitude may cause the airspeed needle to indicate dangerously near stall speed.

Managing a static system malfunction requires that the pilot know and understand the airplane's pitot-static system. If a system malfunction is suspected, the pilot should confirm it by opening the alternate static source. This should be done while the airplane is climbing or descending. If the instrument needles move significantly when this is done, a static pressure problem exists and the alternate source should be used during the remainder of the flight.

709. ABNORMAL ENGINE INSTRUMENT INDICATIONS

The AFM/POH for the specific airplane contains information that should be followed in the event of any abnormal engine instrument indications.

710. DOOR OPENING IN FLIGHT

In most instances, the occurrence of an inadvertent door opening is not of great concern to the safety of a flight, but rather, the pilot's reaction at the moment the incident happens. A door opening in flight may be accompanied by a sudden loud noise, sustained noise level and possible vibration or buffeting. If a pilot allows himself or herself to become distracted to the point where attention is focused on the open door rather than maintaining control of the airplane, loss of control may result, even though disruption of airflow by the door is minimal.

In the event of an inadvertent door opening in flight or on takeoff, the pilot should adhere to the following:

- Concentrate on flying the airplane. Particularly in light single- and twin-engine airplanes; a cabin door that opens in flight seldom if ever compromises the airplane's ability to fly. There may be some handling effects such as roll and/or yaw, but in most instances these can be easily overcome.

- If the door opens after lift-off, do not rush to land.

- Climb to normal traffic pattern altitude, fly a normal traffic pattern, and make a normal landing.

- Do not release the seat belt and shoulder harness in an attempt to reach the door. Leave the door alone. Land as soon as practicable, and close the door once safely on the ground.

- Remember that most doors will not stay wide open. They will usually bang open, then settle partly closed. A slip towards the door may cause it to open wider; a slip away from the door may push it closed.

- Do not panic. Try to ignore the unfamiliar noise and vibration. Also, do not rush. Attempting to get the airplane on the ground as quickly as possible may result in steep turns at low altitude.

- Complete all items on the landing checklist.

Remember that accidents are almost never caused by an open door. Rather, an open door accident is caused by the pilot's distraction or failure to maintain control of the airplane.

711. INADVERTENT FLIGHT INTO INSTRUMENT METEOROLOGICAL CONDITIONS (IMC)

It is beyond the scope of this FTI to incorporate a course of training in basic attitude instrument flying. That information is contained in FAA-H-8083-15, Instrument Flying Handbook. Due to the short syllabus of NIFE, the chances of the student entering inadvertent IMC are extremely low. In general, if the student enters inadvertent IMC, immediately perform a level standard rate turn for 180° and return to VMC conditions.

APPENDIX A
AIRPORT OPERATIONS AND SAFETY

A100. INTRODUCTION

Airports vary in complexity from small grass strips to major terminals having many paved runways and taxiways. Regardless of the type of airport, the pilot must know and abide by the rules and general operating procedures applicable to the airport being used. These rules and procedures are based not only on logic or common sense, but also on courtesy, and their objective is to keep air traffic moving with maximum safety and efficiency. The use of any traffic pattern, service, or procedure does not alter the responsibility of pilots to see and avoid other aircraft.

A101. STANDARD AIRPORT TRAFFIC PATTERNS

To assure that air traffic flows into and out of an airport in an orderly manner, an airport traffic pattern is established appropriate to the local conditions, including the direction and placement of the pattern, the altitude to be flown, and the procedures for entering and leaving the pattern. **Unless the airport displays approved visual markings indicating that turns should be made to the right, the pilot should make all turns in the pattern to the left.**

When operating at an airport with an operating control tower, the pilot receives, by radio, a clearance to approach or depart, when to turn crosswind, or when to turn base. If there is not a control tower, it is the pilot’s responsibility to determine the direction of the traffic pattern, to comply with the appropriate traffic rules, and to display common courtesy toward other pilots operating in the area.

The pilot is not expected to have extensive knowledge of all traffic patterns at all airports. As a military pilot, we are expected to continue flying the standard military racetrack pattern unless tower says otherwise or during so involves a possible safety hazard with other aircraft. If other aircraft utilizing the airfield (usually non towered airports) are flying the rectangular pattern with extended crosswind or downwind turns, military pilots are expected to manage spacing between aircraft in order to still fly a racetrack pattern if the situation allows it.

The standard traffic pattern altitude is usually 1,000 feet above the elevation of the airport surface. The use of a common altitude at a given airport is the key factor in minimizing the risk of collisions at airports without operating control towers.

When entering the traffic pattern at an airport without an operating control tower, manage entry into the pattern based on safest course of action regarding your current location and other aircraft positions or intentions.

As stipulated in 14 CFR part 91, aircraft while on final approach to land or while landing, have the right-of-way over other aircraft in flight or operating on the surface. When two or more aircraft are approaching an airport for the purpose of landing, the aircraft at the lower altitude has the right-of-way. Pilots should not take advantage of this rule to cut in front of another aircraft that is on final approach to land, or to overtake that aircraft.

Additional information on airport operations can be found in the Aeronautical Information Manual (AIM).

A102. COLLISION AVOIDANCE

All pilots must be alert to the potential for midair collision and near midair collisions. The general operating and flight rules in 14 CFR part 91 set forth the concept of "See and Avoid." This concept requires that vigilance shall be maintained at all times, by each person operating an aircraft regardless of whether the operation is conducted under instrument or visual meteorological conditions.

Simply stated, the "See and Avoid" Doctrine is a pilot's best defense against a midair collision. The "Big Sky, Little Airplane" theory is the key ingredient in the recipe for a midair collision. The causal factor most often noted in aircraft accident reports involving midair collisions is, "failure of the pilot to see and avoid the other aircraft." In most cases, at least one of the pilots involved could have seen the other in time to avoid contact if he had been using his eyes properly.

Studies show that nearly all midair collisions occur during daylight hours, in VMC weather. Most midair collisions occur within five miles of an airport, in the areas of greatest traffic concentration, and usually on warm, weekend days. Most midair collisions also involve maneuvers that are classified as crossing or overtaking. Very rarely are head-on collisions reported.

It is also noteworthy to find that the closing speed (rate at which two aircraft approach each other) in a crossing or overtaking maneuver is often relatively slow, usually much slower than the airspeed of either aircraft involved. Again, that is because the majority of midair collisions are the result of a faster aircraft overtaking and striking a slower one.

Studies also reveal some interesting information regarding the vulnerabilities of the human eye and how its limitations contribute to midair collisions. Details of these human factors can be found in the P-764 and other details of "See and Avoid" can be found in AIM Section 5.

A103. WAKE TURBULENCE

Every aircraft generate a wake while in-flight, caused by a pair of counter-rotating vortices trailing from the wing tips. The vortices from larger aircraft pose problems to encountering aircraft such as severe rolling moments while near the ground. Section 3. Wake Turbulence in the Aeronautical Information Manual (AIM) outlines details of how wakes behave, and methods for avoiding them.

In general, AVOID THE AREA BELOW AND BEHIND THE GENERATING AIRCRAFT, ESPECIALLY AT LOW ALTITUDE WHERE EVEN A MOMENTARY WAKE ENCOUNTER COULD BE HAZARDOUS. This is not easy to do. Some accidents have occurred even though the pilot of the trailing aircraft had carefully noted that the aircraft in front was at a considerably lower altitude. Unfortunately, this does not ensure that the flight path of

the lead aircraft will be below that of the trailing aircraft.
Pilots should be particularly alert in calm wind conditions and situations where the vortices could:

- Remain in the touchdown area.
- Drift from aircraft operating on a nearby runway.
- Sink into the takeoff or landing path from a crossing runway.
- Sink into the traffic pattern from other airport operations.
- Sink into the flight path of VFR aircraft operating on the hemispheric altitude 500 feet below.

Pilots of all aircraft should visualize the location of the vortex trail behind larger aircraft and use proper vortex avoidance procedures to achieve safe operation. It is equally important that pilots of larger aircraft plan or adjust their flight paths to minimize vortex exposure to other aircraft.

The following vortex avoidance procedures are recommended for the various situations:

- Landing behind a larger aircraft- same runway. Stay at or above the larger aircraft's final approach flight path-note its touchdown point-land beyond it.
- Landing behind a larger aircraft- when parallel runway is closer than 2,500 feet. Consider possible drift to your runway. Stay at or above the larger aircraft's final approach flight path- note its touchdown point.
- Landing behind a larger aircraft- crossing runway. Cross above the larger aircraft's flight path.
- Landing behind a departing larger aircraft- same runway. Note the larger aircraft's rotation point- land well prior to rotation point.
- Landing behind a departing larger aircraft- crossing runway. Note the larger aircraft's rotation point- if past the intersection- continue the approach- land prior to the intersection. If larger aircraft rotates prior to the intersection, avoid flight below the larger aircraft's flight path. Abandon the approach unless a landing is ensured well before reaching the intersection.
- Departing behind a larger aircraft. Note the larger aircraft's rotation point and rotate prior to the larger aircraft's rotation point. Continue climbing above the larger aircraft's climb path until turning clear of the larger aircraft's wake. Avoid subsequent headings which will cross below and behind a larger aircraft. Be alert for any critical takeoff situation which could lead to a vortex encounter.

- Intersection takeoffs- same runway. Be alert to adjacent larger aircraft operations, particularly upwind of your runway. If intersection takeoff clearance is received, avoid subsequent heading which will cross below a larger aircraft's path.

- Departing or landing after a larger aircraft executing a low approach, missed approach, or touch-and-go landing. Because vortices settle and move laterally near the ground, the vortex hazard may exist along the runway and in your flight path after a larger aircraft has executed a low approach, missed approach, or a touch-and-go landing, particular in light quartering wind conditions. You should ensure that an interval of at least 2 minutes has elapsed before your takeoff or landing.

- Enroute VFR (thousand-foot altitude plus 500 feet). Avoid flight below and behind a large aircraft's path. If a larger aircraft is observed above on the same track (meeting or overtaking) adjust your position laterally, preferably upwind

A104. RUNWAY INCURSION AVOIDANCE

A runway incursion is any occurrence at an airport involving an aircraft, vehicle, person, or object on the ground that creates a collision hazard or results in a loss of separation with an aircraft taking off, landing, or intending to land. A runway incursion is formally defined by the FAA as “any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle, or person on the protected area of a surface designated for the landing and takeoff of aircraft” (PHAK App 1). Detailed investigations of runway incursions over the past 10 years have identified three major areas contributing to these events:

- Failure to comply with ATC instructions

- Lack of airport familiarity

- Nonconformance with standard operating procedures

Clear, concise, and effective pilot/controller communication is paramount to safe airport surface operations. You must fully understand and comply with all ATC instructions. It is mandatory to read back all runway “hold short” instructions verbatim.

Taxi operations require constant vigilance by the entire flight crew, not just the pilot taxiing the airplane. This is especially true during flight training operations. Both the student and the flight instructor need to be continually aware other aircraft and ground vehicles on the airport movement area. Many flight training activities are conducted at non-tower controlled airports. The absence of an operating airport control tower creates a need for increased vigilance on the part of pilots operating at those airports. “Taxiing on an unfamiliar airport can be very challenging, especially during hours of darkness or low visibility. Ensure you have a current airport diagram, remain “heads-up” with eyes outside, and devote your entire attention to surface navigation per ATC clearance. All checklists should be completed while the aircraft is stopped. There is no place for non-essential chatter or other activities while maintaining” (PHAK App 1).

Planning, clear communications, and enhanced situational awareness during airport surface operations will reduce the potential for surface incidents. Safe aircraft operations can be accomplished and incidents eliminated if the pilot is properly trained early on and, throughout his/her flying career, accomplishes standard taxi operating procedures and practices. This requires the development of the formalized teaching of safe operating practices during taxi operations. The flight instructor is the key to this teaching. The flight instructor should instill in the student an awareness of the potential for runway incursion, and should emphasize the runway incursion avoidance procedures contained in Advisory Circular (AC) 91-73, Part 91 Pilot and Flightcrew Procedures During Taxi Operations and Part 135 Single-Pilot Operations, and Pilot Handbook of Aeronautical Knowledge, Appendix 1.

A105. AIRPORT SIGNS, MARKINGS, AND LIGHTING

It is important to know the meanings of the signs, markings, and lights that are used on airports as surface navigational aids. All airport markings are painted on the surface, whereas some signs are vertical and some are painted on the surface. An overview of the most common signs and markings are described on the following pages. For more detailed information on runway signs and markings, refer to the AIM.

1. **Runway Holding Position Sign.** Noncompliance with a runway holding position sign may result in the FAA filing a Pilot Deviation against you. A runway holding position sign is an airport version of a stop sign. It may be seen as a sign and/or its characters painted on the airport pavement. The sign has white characters outlined in black on a red background. It is always collocated with the surface painted holding position markings and is located where taxiways intersect runways. On taxiways that intersect the threshold of the takeoff runway, only the designation of the runway may appear on the sign.

Figure A-1 Runway holding position signs

If a taxiway intersects a runway somewhere other than at the threshold, the sign has the designation of the intersecting runway. The runway numbers on the sign are arranged to correspond to the relative location of the respective runway thresholds. Figure xx shows “18-36” to indicate the threshold for Runway 18 is to the left and the threshold for Runway 36 is to the right. The sign also indicates that you are located on Taxiway Alpha. If the runway holding position sign is located on a taxiway at the intersection of two runways, the designations for both runways are shown on the sign along with arrows showing the approximate alignment of each runway. In addition to showing the approximate runway alignment, the arrows indicate the direction(s) to the threshold of the runway whose designation is immediately next to each corresponding arrow.

2. **Runway Holding Position Marking.** Noncompliance with a runway holding position marking may result in the FAA filing a Pilot Deviation against you. Runway holding position markings consist of four yellow lines, two solid and two dashed, that are painted on the surface and extend across the width of the taxiway to indicate where the aircraft should stop when approaching a runway. These markings are painted across the entire taxiway pavement, are in alignment, and are collocated with the holding position sign as described above. As you approach the runway, two solid yellow lines and two dashed lines will be visible. Prior to reaching the solid lines, it is imperative to stop and ensure that no portion of the aircraft intersects the first solid yellow line. Do not cross the double solid lines until a clearance from ATC has been received. When the tower is closed or when operating at a non-towered airport, you may taxi onto or across the runway only when the runway is clear and there are no aircraft on final approach. You should use extreme caution when crossing or taxiing onto the runway and always look both ways. When exiting the runway, the same markings will be seen except the aircraft will be approaching the double dashed lines. In order to be clear of the runway, the entire aircraft must cross both the dashed and solid lines. An ATC clearance is not needed to cross this marking when exiting the runway.

Figure A-2 Runway holding position marking

3. **Runway Safety Area Boundary Sign.** In addition to the runway hold marking, some taxiway stubs also have a runway safety area boundary sign that faces the runway and is visible to you only when exiting the runway. This sign has a yellow background with black markings and is typically used at towered airports where a controller commonly requests you to report clear of a runway. This sign is intended to provide you with another visual cue that is used as a guide to determine when you are clear of the runway safety boundary area. The sign shown is what you would see when exiting the runway at Taxiway Kilo, and is out of the runway safety area boundary when the entire aircraft passes the sign and the accompanying surface painted marking.

Figure A-3 Runway safety area boundary sign

4. **Location Signs and Markings.** Taxiway location signs and markings and runway location signs aid you in identifying the taxiway or runway on which you are currently located. They have a black background with yellow characters. These signs may stand alone or be collocated with direction or runway holding position signs.

Figure A-4 Taxiway location sign

Runway location signs are intended to complement the information available to you through your aircraft magnetic compass. They are installed in areas where the proximity of two or more runways could cause you to be confused. Complex airport geometry, a single taxiway leading to multiple runway thresholds, and/or the close proximity of multiple runway thresholds can lead to confusion and a higher risk of you departing on the wrong runway. At airports where these risk factors are present and the proximity of two runway thresholds could cause confusion, runway location signs may be present. Cross-check your aircraft compass heading with the assigned takeoff runway heading prior to brake release.

NOTE

Runway designation surface painted markings are large white block numbers and are located at the threshold of the runway.

Figure A-5 Runway location sign

Surface painted taxiway location markings are normally located on airports where there has been a history of navigation confusion. These signs and markings are designed to help you navigate difficult or potentially confusing intersections. If ever in doubt about your taxi clearance, ask ATC for help.

5. **Taxiway Direction Signs and Markings.** Taxiway direction signs have a yellow background and black characters, which identifies the designation or intersecting taxiways. Arrows indicate the direction of turn that would place the aircraft on the designated taxiway.

Direction signs are normally located on the left side of the taxiway and prior to the intersection. These signs and markings (with a yellow background and black characters) indicate the direction toward a different taxiway, leading off a runway, or out of an intersection. The figure below shows Taxiway Delta and how Taxiway Bravo intersects ahead at 90° both left and right.

Figure A-6 Taxiway direction sign

Taxiway direction signs can also be displayed as surface painted markings. Figure A-9 shows Taxiway Bravo as proceeding straight ahead while Taxiway Alpha turns to the right at approximately 45°.

Figure A-7 Painted taxiway direction markings

Figure A-10 below shows an example of a direction sign at a complex taxiway intersection. Taxiway Bravo intersects with Taxiway Sierra at 90°, but at 45° with Taxiway Foxtrot. This type of array can be displayed with or without the taxiway location sign, which in this case would be Taxiway Bravo.

Figure A-8 Complex intersection direction sign

6. **Holding Position Signs and Markings for Instrument Landing System (ILS).** The instrument landing system (ILS) broadcasts signals to arriving instrument aircraft to guide them to the runway. Each of these ILSs has a critical area that must be kept clear of all obstacles in order to ensure quality of the broadcast signal.

At many airports, taxiways extend into the ILS critical area. Most of the time, this is of no concern; however, during times of poor weather, an aircraft on approach may depend on a good signal quality. When necessary, ATC will protect the ILS critical area for arrival instrument traffic by instructing taxiing aircraft to “hold short” of this critical area.

The ILS critical area boundary sign has white characters, outlined in black, on a red background and is installed adjacent to the ILS holding position markings. The holding position markings for the ILS critical area appear on the pavement as a horizontal ladder and consist of two solid yellow lines spaced two feet apart connected by pairs of solid lines spaced ten feet apart extending across the width of the taxiway.

Figure A-9 ILS critical area boundary sign

When instructed to "hold short of the ILS critical area," you must ensure no portion of the aircraft extends beyond these markings. If ATC does not instruct you to hold at this point, then you may bypass the ILS critical area hold position markings and continue with your taxi. This figure shows that the ILS hold sign is located on Taxiway Golf and the ILS ladder hold position marking is adjacent to the hold sign.

7. **Runway Approach Area Holding Position Signs and Markings.** At some airports, it is necessary to hold an aircraft on a taxiway located in the approach or departure area for a runway so the aircraft does not interfere with operations on that runway. In these situations, a sign with a designation of the approach end of the runway followed by a "dash" (–) and letters "APCH" will be located at the holding position on the taxiway. Holding position markings will be located on the taxiway pavement. In the example in Figure A-12, the sign may protect the approach to Runway 32 and/or the departure for Runway 14. If you are expected to "hold short" of a runway approach ("APCH") area, ATC will issue instructions.

Figure A-10 Runway approach area holding sign

8. **Runway Permanent Closures.** For runways and taxiways that are permanently closed, the lighting circuits are disconnected. The runway threshold, runway designation, and touchdown markings are obliterated and yellow "X's" are placed at each end of the runway and at 1,000-foot intervals.

9. **Runway Temporary Closures.** For temporarily closed runways and taxiways, a visual indication is often provided with yellow "X's" or raised lighted yellow "X's" placed at each end of the runway. Depending on the reason for the closure, duration of closure, airfield configuration, and the existence and the hours of operation of an ATC tower, a visual indication may not be present. As discussed previously in the chapter, you must always check NOTAMs and ATIS for runway and taxiway closure information.

Figure A-11 Lighted runway closure "X"

Figure A-14 below shows a yellow "X" laid flat with an adequate number of heavy rubber weights to keep the wind from getting under and displacing the vinyl material. The black rubber weights are positioned along the edge giving the appearance of a black outline. A very effective and preferable visual aid to depict temporary closure is the lighted "X" placed on or near the runway designation numbers. This device is much more discernible to approaching aircraft than the other materials described above.

Figure A-12 Runway closure "X"

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APPENDIX B
COMMUNICATIONS

B100. INTRODUCTION

NOTE

> Information in this document was adapted from FAA pamphlet P-8740-47 and the Aeronautical Information Manual.

Radio communications are a critical link in the air traffic control system. The link can be a strong bond between aircrew and controller, but it can be broken with surprising speed and disastrous results. The most important aspect of aircrew-controller communications is understanding. The controller must understand what you want to do before he can properly carry out his control duties. Similarly, you must know exactly what he wants you to do. ***It is essential that pilots acknowledge each radio communication with ATC by using the appropriate aircraft call sign.*** Although brevity is important, concise phraseology may not always be adequate. Use whatever words are necessary to state your message. It cannot be stressed enough that communication plays a vital role in the flight evolution. With experience, it will become second nature.

Pilots will find the Aeronautical Information Manual's Pilot/Controller Glossary very helpful in learning the meaning of certain words or phrases. ***A list of common phrases that students should know is included at the end of this appendix.*** Good phraseology enhances safety, and is the mark of a professional pilot. Jargon, chatter, and "CB" slang have no place in ATC communications. Understand that calls to ATC facilities may be monitored and recorded for operational uses such accident investigations, accident prevention, search and rescue purposes, specialist training and evaluation, and technical evaluation and repair of control and communications systems.

B101. RADIO TECHNIQUE

There are several things to consider when using aircraft radios:

- **First, pause and listen before you transmit**. If you hear others talking, the keying of your transmitter will be futile. You will probably jam the frequency, causing them to repeat their call. If you have changed frequencies, allow your receiver time to tune, then listen and make sure the frequency is clear before you begin your transmission. Also, do not transmit during an exchange between the controller and another aircraft. For example, if the controller asks another aircraft a question, you should wait until the other aircraft has answered before transmitting.

- **Think before keying your transmitter**. Know what you want to say. If it is a lengthy transmission such as a flight plan, write it down. Avoid saying "and" prior to each transmission.

- **Position the microphone very close to your lips**. After pressing the microphone button, a slight pause may be necessary to be sure that the first word is transmitted. Speak in a normal conversational tone.

- **Be patient**. After your call, release the button and wait a few seconds before calling again. The controller may be jotting down your call sign, looking for your flight plan, transmitting on a different frequency, or switching his transmitter to your frequency.

- **Be alert to the sounds, or lack of sounds, in your receiver**. Check your volume and frequency setting. Check your equipment to ensure that your microphone is not stuck in the transmit position. Frequency blockage can, and has, occurred for extended periods of time because of unintentional transmitter operation. This situation is referred to as a "stuck mike", and controllers may refer it in this manner when attempting to assign an alternate frequency. Avoid revealing your innermost thoughts during this time.

- **Be sure that you are within the performance range of station equipment**. Radios are limited to "line-of-sight" communications. Remote radio sites do not always transmit and receive on all of a facility's available frequencies, particularly with regard to VOR sites where you may hear but not reach a ground station's receiver. Remember that as altitude increases, radio range increases.

- **Know what to expect**. As you progress through each flight you should know what is expected to happen. In order to do this, you and controllers will make certain transmissions. If you know what is to be said ahead of time, responding correctly will be much easier. Use the proper formats and terminology to assist you in making brief and concise transmissions. Good phraseology enhances safety and is the mark of a true professional.

B102. CALL SIGNS

1. **ATC Station Call signs.** Aviation operations follow a logical order commonly referred to as “phases of flight.” These phases are: Preflight/Taxi (Ground Operations), Takeoff/Initial Climb, Climb, Cruise/Maneuvering, Descent, Approach, Landing, Postflight/Taxi (Ground Operations). Aviation communications follow a logical order that mirrors the normal sequential flow of the phases of flight. In order to ensure the safe and expeditious flow of aircraft, an air traffic controlling agency (ground station) is assigned responsibilities or control and oversight of aircraft in each of these phases of flight. These ATC agencies are listed in Table 1: ATC Call Signs.

ATC Call Signs							
Airport CTAF	FSS	Clearance Delivery	Ground Control	Control Tower	Departure Control	Approach Control	ARTCC (Center)
Jack Edwards Traffic	Gainesville Radio	Sherman Clearance	Pensacola Ground	Pensacola Tower	Pensacola Departure	Pensacola Approach	Houston Center

Table B-1: ATC Call Signs

2. **Aircraft Call Signs**. In order to converse with ATC, pilots need a consistent manner in which to reference themselves in the ATC environment. This is referred to as the aircraft call sign. <u>The aircraft's call sign is the aircraft type, model or manufacturer's name followed by the digits/letters of the registration number,</u> which is common for general aviation. Military call signs usually consists of one word followed by two numbers; e.g. KABAR 31, SHOOTER 22, or KATT 14.

It is very important to use the correct call sign. Aircraft with similar call signs may be on the same frequency, and improper use of call signs can result in one pilot executing a clearance intended for another aircraft. To avoid this problem, <u>never abbreviate your call sign on an initial contact</u>, or at any time when other aircraft call signs you hear on the frequency have similar numbers/sounds or identical letters/numbers to those of your own aircraft. Pilots must be certain that aircraft identification is complete and correct before taking action on an ATC clearance.

B103. INITIAL CONTACT WITH ATC

The term "initial contact" means the first radio call you make to a given facility, or the first call to a different controller or FSS specialist within a facility. Use the following format:

Hey You - *State the name of facility you are calling (e.g., "Pensacola Approach")*

This is me - *<u>State your full call sign</u> (as filed in the flight plan) (e.g., "KABAR 22")*

Where Are You - *State your position (e.g., "20mi to the east, 3500ft, information Mike")*

What You Want - *State your request (e.g., "Request inbound to Pensacola airport for full stop")*

As demonstrated above, adding your position, your altitude, or brief reports such as the phrase "with Information Mike" (for ATIS) in the initial contact can help decrease radio frequency congestion as the controller is required to pass ATIS information. Use discretion, though, and do not overload the controller with information he does not need. If you do not get a response, recheck your radios or use another transmitter, but keep the next contact short.

Courtesy Call. During busy times, if the controller is dealing with a high flow of traffic, a courtesy call can be used. Courtesy call is just using their and your call sign (*e.g. "Pensacola Approach, KABAR 22"*) and then pause. This allows ATC to continue talking to other aircraft with more pressing matters and get back to you when time allows them. Once they return your call, continue with a full initial contact report.

B104. RESPONSES FROM ATC INSTRUCTIONS/DIRECTIONS

After making your requests, ATC may give you following instructions or directions. **All instructions that include a clearance, shall be read back verbatim.** If no clearance is given, repeat back all numbers and you can acknowledge with one of the followings words to keep radio calls short. As a *technique only*, when reading back clearances or acknowledging instructions, relay pertinent info followed by your call sign rather than call sign first then relaying info. The radio calls will be smoother and the more important part of the call (read backs or acknowledgments) is taken care of first. The following examples will be using this technique. Acknowledge with one of the following words then followed by your call sign: *e.g. "Roger KABAR 22"*

- *Wilco,* which means "I will comply."
- *Roger,* which means "I have received and understood your last transmission."
- *Affirmative,* which means "Yes"
- *Negative,* which means "No" or
- *Other appropriate remark*

B105. COMMUNICATIONS AT TOWER-CONTROLLED AIRPORTS

1. **Preflight.** Prior to the taxi phase, the pilot should tune ATIS, listen to, and write down the information transmitted.

2. **Taxi clearance.** Surface operations at a towered airport are controlled by a member of the local ATC service team referred to as the ground controller. As shown in Table 1, this controlling agency is referred to by the airport name followed by the word ground, i.e. "Pensacola Ground." At towered airports, the ground controller has a discrete radio frequency on which to they coordinate the movement of all aircraft and vehicles on the airport surface. After engine start and before any movement on the airport surface, tune the appropriate frequency and contact the ground controller.

a. Pilot initial call up to Ground. *Pensacola Ground, KABAR 22, Pensacola Aviation Center ramp, taxi runway 17, information Alpha.*

b. Example Ground Controller response. *Ground Controller: KABAR 22, Pensacola Ground, taxi to runway 17 via Charlie, Delta, Alpha, hold short runway 17 on Delta altimeter 29.95.*

c. Pilot read-back. *Taxi to runway 26 via Charlie, Delta, Alpha, hold short runway 17 on Delta 29.95, KABAR 22.*

If you are unsure of any portion of the taxi clearance, request clarification and/or progressive taxi instructions (turn by turn instructions from the ground controller). It is important for you to know that you can request assistance.

NOTE

> When instructed to "*monitor*" a particular frequency, listen on the frequency and stand by for instructions. Under normal circumstances, do not initiate communications.

While communicating with ATC, focus on what the controller is instructing and do not perform any non-essential tasks. Refer to the AIM, Chapter 5, Section 5, Pilot/Controller Roles and Responsibilities. **Read back of any "hold short" of runway instructions is required. This read back should include the specific runway designator and taxiway intersection when appropriate, so if there are any misunderstandings or errors, they are obvious to ATC.**

A read back presents the first and most efficient opportunity to catch any miscommunications. It provides a "reality check" in two ways: it tells the controller, "This is what the pilot heard;" and it provides the controller the opportunity to reaffirm that is what he/she meant to say. For detailed information about radio communication phraseology and techniques, refer to Chapter 4, Section 2 of the AIM.

3. **Takeoff clearance.** Following completion of the aircraft run-up checks, the pilot can proceed from the run-up area to either the runway hold short line or line up behind preceding aircraft in preparation for takeoff. If there are still substantial tasks to be completed do not taxi to the hold short and block access to the runway for other aircraft that are ready to depart. Be prepared for precise directions after takeoff for altitude restriction or heading changes. The term "departure" is used prior to receiving a clearance. The term "takeoff" is used within a clearance or repeating the clearance

a. Pilot request to take the runway for takeoff. *Pensacola Tower, KABAR 22, holding short runway 17, ready for departure to the east.*

b. Tower Controller response. *KABAR 22, Pensacola Tower, runway 17 cleared for takeoff, after departure maintain runway heading until 1700' then cleared to the east.*

c. Pilot read-back. *Runway 17 cleared for takeoff, runway heading, 1700 then cleared east, KABAR 22.*

d. Tower Controller direction to "Line up and wait". *KABAR 22, runway 17, line up and wait, landing traffic runway 26.*

e. Pilot read-back. *Line up and wait" runway 17, KABAR 22.*

If a tower is within a Class B or C airspace, expect a squawk, departure frequency, and a switch to that controlled airspace during your climb out. Departure and Approach controllers are going to be the same person and same frequency in smaller airspaces/airport areas, so can be used interchangeably, e.g. It's ok to say "Approach" during your departure climb out. At large airports, usually Class Bravo airspaces, Departure and Approach controllers will be different people and have different frequencies and proper call signs should be used appropriately. Below is an example of a comm flow departure in Pensacola Class Charlie airspace.

a. Tower call. *KABAR 22, switch to Approach 119.0.*

b. Pilot response. *119.0 wilco, KABAR 22.*

c. Pilot call. *Pensacola Approach, KABAR 22, off of Pensacola Airport.*

d. Controller response. *KABAR 22, Pensacola Approach, radar contact, report clear of Class Charlie.*

e. Pilot response. *Roger, KABAR 22.*

f. Once clear of Class Charlie. Pilot call. *Pensacola Approach, KABAR 22 clear of Class Charlie.*

g. Controller response. *KABAR 22 roger, frequency change approved.*

h. Pilot response. *Roger, KABAR 22.*

4. **Returning to controlled airspace from a working area.** There are specific actions that a pilot must complete prior to entering controlled airspace. ATC expects that the pilot has listened to and assessed the ATIS information prior to contacting tower or approach. Additionally, the pilot cannot enter controlled airspace without first establishing radio contact. A full ATIS recording can last upwards of a minute. Additionally, if the airport or approach airspace is busy, it may take time for a break in communications with other aircraft to happen to afford a pilot to make an initial call. The pilot must plan his flight path and time his actions accordingly to ensure he does not enter controlled airspace prior to establishing communications.

Pilot initial call up. *Pensacola Approach, KABAR 22, 30mi to the east, 3500, information Papa, inbound full stop at Pensacola airport.*

a. Controller response. *KABAR 22, Pensacola Approach, squawk 1325.*

b. Pilot response. *1325, KABAR 22.*

c. Controller response. *KABAR 22, radar contact 30mi to the east, continue inbound.*

d. Pilot response. *Wilco KABAR 22.*

e. Controller call. *KABAR 22 switch tower 119.9.*

f. Pilot response. *119.9 wilco, KABAR 22.*

g. Pilot initial call. *Pensacola Tower, KABAR 22, 10mi east, information Papa, full stop.*

h. Tower Controller response. *KABAR 22 enter left downwind runway 35, report midfield.*

i. Pilot response. *Left downwind runway 35, wilco, KABAR 22.*

j. Pilot call. *Tower, KABAR 22 midfield.*

Clearance to land:

k. Tower Controller. *KABAR 22, cleared to land runway 35.*

l. Pilot response. *Cleared to land runway 35, KABAR 22.*

B106. COMMUNICATION AT NON-TOWERED AIRPORTS

Communications at non-towered field airports play a major role in the safe execution of operations in an uncontrolled environment. Pilot communications are an important component of executing standard procedures non-towered fields and are, therefore, contained in Appendix C - Operations at Non-towered Airports.

B107. RADIO MALFUNCTION PROCEDURES

Inoperative transmitter and receiver or one of the other. After extensive troubleshooting, squawk 7600 and proceed inbound to your destination while continuing to make all calls in the blind (making calls as if it still worked). Try to view traffic as soon as possible to provide separation and verify runway landing. If inbound to a controlled tower, be as predictable as possible and look at tower for light gun signals. If inbound to an uncontrolled field, continue to be predictable and vigilant for other aircraft nearby. Land when safe and clear of aircraft.

If radio malfunction occurs after departing the aircraft parking area (i.e., on the taxiway), squawk 7600, watch the tower for light signals, continue monitoring tower frequency. **After coming to a stop, consider using your cell phone to communicate with the SDO or tower.**

B108. LIGHT GUN SIGNALS

An airport control tower uses a directive traffic control signal which emits an intense narrow light beam of a selected color (either red, white, or green) to issue control instructions to aircraft with inoperative radios.

Although the traffic signal light offers the advantage that some control may be exercised over nonradio ("NORDO") aircraft, pilots should be aware of the following disadvantages.

- The pilot may not be looking at the control tower at the time a signal is directed toward him.

- The directions transmitted by a light signal are very limited, since only approval or disapproval of a pilot's anticipated actions may be transmitted. No supplement or explanatory information may be transmitted except by the use of the "General Warning Signal," which advises the pilot to be on the alert.

During daylight hours, acknowledge tower transmissions or light signals by moving the ailerons or rudder. At night, acknowledge by blinking the landing or navigation lights.

The following table summarizes light gun signals.

ATC Light Gun Signals	🟢 ⚪ 🔴 = Flashing Green / White / Red	
COLOR	ON THE GROUND	IN THE AIR
Steady Green	Cleared For Takeoff	Cleared to Land
🟢🟢🟢🟢🟢🟢	Cleared For Taxi	Return for Landing (to be followed by steady green)
Steady Red	Stop	Give way to other aircraft and Continue Circling
🔴🔴🔴🔴🔴🔴	Taxi Clear of the Runway	Airport Unsafe, Do Not Land
⚪⚪⚪⚪⚪⚪	Return To Starting Point	Not Applicable
🔴🟢🔴🟢🔴🟢	Exercise Extreme Caution	Exercise Extreme Caution

Table B-2: Light gun signals.

B109. VERBALIZATION

1. Time

The 24-hour clock system is used in radio-telephone transmissions. The hour is indicated by the first two figures and the minutes by the last two figures. FAA uses Greenwich Mean Time (GMT), Coordinated Universal Time (UTC) or Zulu ("Z") for all operations.

Example: 0000 ZERO ZERO ZERO ZERO

Example: 0920 ZERO NINER TWO ZERO

Time may be stated in minutes only (two figures) in radio-telephone communications when no misunderstanding is likely to occur. When two figures are used, the current hour (within 60 minutes) is understood to be the time being referenced.

Example: "Mobile Radio, [Call sign], low-level, entering Victor Romeo One Zero Two Zero at Point Alpha at Four Three, exit Point Foxtrot."

"Four Three" is understood to mean 43 minutes past the current hour. If the call was made at 0935 local time, the aircraft will enter the low-level route at 0943 local.

2. **Figures**

Digits indicating hundreds and thousands in round numbers, such as ceiling heights and upper wind levels up to 9999, shall be spoken as follows:

Example: 500 FIVE HUNDRED
4500 FOUR THOUSAND FIVE HUNDRED

Numbers above 9999 shall be spoken by separating the digits preceding the word "thousand."

Example: 10,000 ONE ZERO THOUSAND
13,400 ONE THREE THOUSAND FOUR HUNDRED

All other numbers shall be transmitted by pronouncing each digit.

Example: 10 ONE ZERO

When a radio frequency contains a decimal point, the decimal point is spoken as "point" or "decimal."

Example: 322.1 THREE TWO TWO POINT ONE
322.1 THREE TWO TWO DECIMAL ONE

3. **Altitudes and Flight Levels**

Up to but not including 18,000 feet MSL (FL180), state the separate digits of the thousands, plus the hundreds, if appropriate.

Example: 12,000 ONE TWO THOUSAND
12,500 ONE TWO THOUSAND FIVE HUNDRED

At and above 18,000 feet MSL (FL180), state the words "flight level" followed by the separate digits of the flight level.

Example: 19,000 FLIGHT LEVEL ONE NINER ZERO

Feet in MSL (Mean Sea Level) is understood in altitudes; therefore it is not necessary to say "feet."

4. Directions

State the three digits of all magnetic courses, bearings, headings, or wind directions. All are assumed to be magnetic. The word "true" must be added when it applies.

Example: (magnetic course) 005 ZERO ZERO FIVE
(true course) 050 ZERO FIVE ZERO TRUE
(magnetic bearing) 360 THREE SIX ZERO
(magnetic heading) 100 ONE ZERO ZERO
(wind direction) 220 TWO TWO ZERO

5. Speeds

Speeds are stated in single digits followed by the word knots ATC: “KABAR 22 increase speed to 110 knots if able” “KABAR 22 decrease speed to 75 knots”

Example: 110 ONE ONE ZERO KNOTS
75 SEVEN FIVE KNOTS

6. Phonetic Alphabet

The International Civil Aviation Organization (ICAO) phonetic alphabet (Figure B-1) is used by FAA personnel when communications conditions are such that the information cannot be readily received without their use. Air traffic control facilities may also request pilots to use phonetic letter equivalents when aircraft with similar sounding identifications are receiving communications on the same frequency.

Pilots should use the phonetic alphabet when identifying their aircraft during initial contact with air traffic control facilities. Additionally, use the phonetic equivalents for single letters and to spell out groups of letters or difficult words during adverse communications conditions.

CHARACTER	TELEPHONY	PHONIC (PRONUNCIATION)
A	Alfa	(AL–FAH)
B	Bravo	BRAH(–VOH)
C	Charlie	(CHAR–LEE) or (SHAR–LEE)
D	Delta	(DELL–TAH)
E	Echo	(ECK–OH)
F	Foxtrot	(FOKS–TROT)
G	Golf	(GOLF)
H	Hotel	(HOH–TEL)
I	India	(IN–DEE–AH)
J	Juliette	(JEW–LEE–ETT)
K	Kilo	(KEY–LOH)
L	Lima	(LEE–MAH)
M	Mike	(MIKE)
N	November	(NO–VEM–BER)
O	Oscar	(OSS–CAH)
P	Papa	(PAH–PAH)

Q	**Quebec**	**(KEH–BECK)**
R	**Romeo**	**(ROW–ME–OH)**
S	**Sierra**	**(SEE–AIR–RAH)**
T	**Tango**	**(TANG–GO)**
U	**Uniform**	**(YOU–NEE–FORM) or (OO–NEE–FORM)**
V	**Victor**	**(VIK–TAH)**
W	**Whiskey**	**(WISS–KEY)**
X	**Xray**	**(ECKS–RAY)**
Y	**Yankee**	**(YANG–KEY)**
Z	**Zulu**	**(ZOO–LOO)**
1	**One**	**(WUN)**
2	**Two**	**(TOO)**
3	**Three**	**(TREE)**
4	**Four**	**(FOW–ER)**
5	**Five**	**(FIFE)**
6	**Six**	**(SIX)**
7	**Seven**	**(SEV–EN)**
8	**Eight**	**(AIT)**
9	**Nine**	**(NIN–ER)**
0	**Zero**	**(ZEE–RO)**

Figure B-1 Phonetic Alphabet

7. Common Terms

English is the international aviation language. Through the years, aviators and controllers have developed what is, at times, their own language. Several terms have been modified to fit the aviation environment. Here is a list of common aviation terms you will use throughout your career.

ABEAM — An aircraft is "abeam" a fix, point, or object when that fix, point, or object is approximately 90 degrees to the right or left of the aircraft track. Abeam indicates a general position rather than a precise point.

ACKNOWLEDGE — Let me know that you have received and under stood my message

EXAMPLE: "[Call sign], _____ APPROACH, execute an immediate right turn heading 180, vector for traffic, acknowledge."

ADVISE INTENTIONS — Tell me what you plan to do.

EXAMPLE: "[Call sign], _____ TOWER, advise intentions after touch-and-go."

AFFIRMATIVE — Yes.

BLOCKED	Phraseology used to indicate that a radio transmission has been distorted or interrupted due to multiple simultaneous radio transmissions.
CLEARANCE ON REQUEST	Used by Clearance Delivery to inform the pilot that his clearance is being processed by ATC. **EXAMPLE:** "[Call sign], _____ CLEARANCE, your clearance is on request."
CLEARED	ATC authorization for an aircraft to perform a specific procedure (Approach, Land, Takeoff, etc.). **EXAMPLE:** "[Call sign], _____ TOWER, cleared to land RWY 14."
CLEARED FOR THE OPTION	ATC authorization for an aircraft to make a touch and go, low approach, missed approach, stop and go, or full-stop landing at the discretion of the pilot. It is normally used in training so that an instructor can evaluate a student's performance under changing situations. **EXAMPLE:** "[Call sign], _____ TOWER, cleared for the option RWY 14."
CLOSED TRAFFIC	Successive operations involving takeoffs and landings [touch-and-goes] or low approaches where the aircraft does not exit the traffic pattern. **EXAMPLE:** "[Call sign], _____ TOWER, cleared right closed traffic for RWY 14."
CONCUR	I agree with you.
CONTACT	Establish communications with (followed by the name of the facility, and, if appropriate, the frequency to be used). **EXAMPLE:** "[Call sign], _____ Mobile Approach, contact Pensacola Approach now on 120.65."
CONTINUE	When used as a control instruction should be followed by another word or words clarifying what is expected of the pilot. Example: “continue taxi,” “continue descent,” “continue inbound,” etc. If the runway is obstructed when the aircraft reports

	‘final’, but it is expected to be available in good time for the aircraft to make a safe landing, the controller will delay landing clearance by issuing an instruction to ‘continue approach’. The controller may explain why the landing clearance has been delayed. An instruction to ‘continue’ is NOT a clearance to land.
CORRECTION	An error has been made in the transmission and the correct version follows. **EXAMPLE:** "_____ CENTER, [Call sign], leaving niner thousand, correction eight thousand, for three thousand."
DISREGARD	Cancel my last message.
EXPEDITE	To execute promptly. **EXAMPLE:** "[Call sign], _____ TOWER, expedite clearing runway."
FLY HEADING (DEGREES)	Informs pilot of heading he should fly. **EXAMPLE:** "[Call sign], _____ APPROACH, fly heading 290."
GO AHEAD	Proceed with your message. **EXAMPLE:** "[Call sign], _____ CLEARANCE DELIVERY, I have your clearance. Advise ready to copy?" "[Call sign], go ahead."
GO AROUND	Instructions for a pilot to discontinue his approach to landing. Additional instructions may follow. Unless otherwise advised by ATC, a VFR aircraft or an aircraft conducting visual approach should overfly the runway while climbing to traffic pattern altitude and enter the traffic pattern via the crosswind leg. A pilot on an IFR flight plan making an instrument approach should execute the published missed approach procedure or proceed as instructed by ATC; e.g., "Go around" (additional instructions if required). **EXAMPLE:** "[Call sign], _____ TOWER, obstruction on runway, go around."

GUARD	Guard frequency (243.0 MHz) is the universal emergency UHF frequency.
HAVE NUMBERS	Used by pilots to inform ATC that they have received runway, wind, and altimeter information only.
HOW DO YOU HEAR/READ	A question relating to the quality of the transmission or to determine how well the transmission is being received. **EXAMPLE:** "[Call sign], _____ DEPARTURE, how do you hear (read)?"
IDENT	Request for a pilot to activate the aircraft transponder identification feature. This will help the controller to confirm an aircraft identity. (No verbal response necessary. **EXAMPLE:** "[Call sign], _____ CENTER, ident."
IMMEDIATE	Used by ATC when such action is required to avoid a hazardous situation. **EXAMPLE:** "[Call sign], _____ DEPARTURE, immediate right turn heading 180."
INOPERATIVE	Used to describe a piece of equipment which has ceased to function properly; e.g., an inoperative TACAN.
LINE UP AND WAIT	Informs a pilot to taxi onto the departure runway to line up and wait. It is not authorization for takeoff Used when takeoff clearance cannot immediately be issued because of traffic or other reasons.
MAINTAIN	Concerning altitude/flight level, the term means to remain at the altitude/flight level specified. The phrase "climb and" or "descend and" normally precedes "maintain" and the altitude assignment. **EXAMPLE:** "[Call sign], _____ APPROACH, descend and maintain two thousand two hundred." **EXAMPLE:** "Maintain VFR."
MAKE SHORT APPROACH	Used by ATC to inform a pilot to alter his traffic pattern so as to make a short final approach.

MAYDAY	The international radio telephony distress signal. When repeated three times, it indicates imminent and grave danger and that immediate assistance is requested.
MINIMUM FUEL	Indicates aircraft's fuel supply has reached a state where, upon reaching the destination, it can accept little or no delay. This is not an emergency situation but merely indicates an emergency situation is possible should any undue delay occur.
NEGATIVE	"No" or "Permission not granted" or "That is not correct." Previous issued traffic is not in sight.
NEGATIVE CONTACT	Previous issued traffic is not in sight. **EXAMPLE:** "[Call sign], _____ APPROACH, you have T-6 traffic at your 12 o'clock at one mile, one six thousand." "[Call sign], negative contact."
NEGATIVE INFORMATION	Used by pilots to inform ATC that they have not received runway and wind information from ATIS. **EXAMPLE:** "_____ GROUND, [Call sign], taxi, negative information.
NO JOY	You were unable to contact ATC on a particular frequency.
NORDO	A contraction meaning "no radio." It is used to describe aircraft that have lost radio communication capability.
OUT	When said at the end of a transmission means: My transmission is ended; I expect no response. Should be used when it may not be apparent that no response is expected.
OVER	When said at the end of a transmission means: My transmission is ended, I expect a response. Should be used when it may not be apparent that a response is expected.

PASSING	Climbing or descending through an altitude/flight level. **EXAMPLE:** "_____ CENTER, [Call sign], passing eight thousand."
RADAR CONTACT	Used by ATC to inform an aircraft that it is identified on the radar display and radar flight following will be provided until radar identification is terminated.
RADAR SERVICE TERMINATED	Pilot is no longer be provided any of the services that could be received while in radar contact. Radar service is automatically terminated, and the pilot is not advised in the following cases: 1. An aircraft cancels its IFR flight plan, except within Class B airspace, Class C airspace, a TRSA, or where Basic Radar service is provided. 2. An aircraft conducting an instrument, visual, or contact approach has landed or has been instructed to change to advisory frequency. 3. An arriving VFR aircraft, receiving radar service to a tower controlled airport within Class B airspace, Class C airspace, a TRSA, or where sequencing service is provided, has landed; or to all other airports, is instructed to change to tower or advisory frequency. 4. An aircraft completes a radar approach.
READ BACK	Repeat the message back to me. **EXAMPLE:** "[Call sign] is cleared . . . Departure 314.0, read back."
RECYCLE	Reset your transponder. Indicates that ATC is not properly receiving your IFF. **EXAMPLE:** "[Call sign], _____ CENTER, recycle transponder, Code 2321."
REPORT	Used to instruct pilots to advise ATC of specified information. **EXAMPLE:** "[Call sign], _____ APPROACH, report PENSI."

REQUEST	To ask for. **EXAMPLE:** "_____ APPROACH, [Call sign], request TACAN 13R approach to a full stop."
ROGER	I understand (not yes); acknowledges information. **EXAMPLE:** "[Call sign], _____ CENTER, surveillance radar is down at Navy Pensacola." "[Call sign], roger."
SAY AGAIN	Used to request a repeat of the last transmission.
SAY ALTITUDE	Used by ATC to ascertain an aircraft's specific altitude/flight level. When the aircraft is climbing or descending, the pilot should state the indicated altitude rounded to the nearest 100 feet. **EXAMPLE:** "[Call sign], _____ DEPARTURE, say altitude." "[Call sign], passing eight thousand two hundred."
SAY HEADING	Used by ATC to request an aircraft heading. The pilot should state the actual heading of the aircraft. **EXAMPLE:** "[Call sign], _____ APPROACH, say heading."
SEARCH AND RESCUE/SAR	Service which seeks missing aircraft.
SQUAWK	Activate specific modes/codes functions on the aircraft transponder. (No verbal response necessary unless you did not hear all four digits that were specified and want to confirm them.) **EXAMPLE:** "[Call sign], _____ CENTER, squawk code two-one-zero-zero." Example Codes: Emergency squawk 7700. Lost Comm 7600. VFR squawk 1200.
STAND BY	The controller or aircrew must pause for a few seconds, usually to attend to other duties of higher priority. "Stand by" is not an approval or denial. Also means to "wait."

SWITCHING

A response to an ATC request to contact a new agency on a discrete frequency followed by reading back the frequency.

EXAMPLE: "[Call sign], _____ CENTER, contact JAX Center now on 351.9." "[Call sign], switching 351.9."

TRAFFIC IN SIGHT

I have visual contact with other air traffic.
EXAMPLE: "[Call sign], _____ DEPARTURE, traffic at your 12 o'clock and two miles, three thousand, type unknown." "[Call sign], traffic in sight."

UNABLE

Indicates inability to comply with a specific instruction, request, or clearance.

EXAMPLE: "_____ APPROACH, [Call sign], unable to execute the ILS approach."

VECTOR

Heading issued to an aircraft to provide navigational guidance by radar.

EXAMPLE: "[Call sign], _____ CENTER, turn left 090, vector for traffic."

VERIFY

Request confirmation of information.

EXAMPLE: "Verify assigned altitude."

WILCO

I have received your message, understand it and will comply."

EXAMPLE: "[Call sign], _____ GROUND, taxi runway 13L." "[Call sign], wilco."

8. Basic Formats

Adherence to the following guidelines will assist you in proper radio communication:

a. The format for contacting an agency is always, "Agency called, aircraft identification, message."

   If at a loss for the "right" words, remember: WHO you are, WHERE you are, and WHAT you want.

b. When instructed to squawk or ident on your IFF, no verbal response is necessary unless confusion exists.

Example: "[Call sign], _____ DEPARTURE, squawk 0622." (Dial Code 0622 in aircraft's IFF transponder.)

Example: "[Call sign], _____ DEPARTURE, IDENT." (Momentarily select the ident position on the transponder.)

c. When advised to "contact" a new controlling agency, acknowledge with "switching" and repeat the specific frequency.

Example: "[Call sign], _____ DEPARTURE, contact Houston Center on 322.4."
"[Call sign], switching 322.4."

If unable to contact the new agency on the frequency given, return to the transferring agency and state, "No joy." The transferring agency will give you an alternate frequency to reattempt contact.

d. Always report leaving an altitude. Unless requested, it is not necessary to report reaching an altitude.

Example: "[Call sign], _____ CENTER, climb and maintain FL210."
"[Call sign], leaving FL180 for FL210."

e. When in a climb and instructed to climb to a new altitude (i.e., other than that issued in your clearance), you should acknowledge the new altitude.

Example: (you are passing 6000 for 9000 and Departure says):
"[Call sign], _____ DEPARTURE, climb and maintain 13,000."
"[Call sign], climbing to 13,000."

f. When instructed to "report" a specific point or time of information, report only the item requested.

Example: "[Call sign], _____ APPROACH, report ROMEK."
"[Call sign], WILCO." (Upon reaching ROMEK): "_____ APPROACH, "[Call sign], ROMEK."

Example: "[Call sign], _____ CENTER, say altitude passing."
"[Call sign], passing 5500."

g. "Roger" nice-to-know information.

Example: "[Call sign], your clearance is on request."
"[Call sign], roger."

Example: "[Call sign], _____ DEPARTURE, radar contact."
"[Call sign], roger."

h. "Wilco" instructions or commands which do not require a readback. You may wilco several commands with a single wilco.

Example: "[Call sign], proceed direct to MARYS, report reaching."
"[Call sign], wilco." (Covers two commands: 1) proceed MARYS, report MARYS.)

Or

"[Call sign], proceeding direct to MARYS, wilco" (Wilco covers the command not repeated; i.e., report IAF.)

i. Mandatory readbacks include: headings, altimeter settings, leaving an altitude, and frequency assignments.

Example: "[Call sign], PENSACOLA DEPARTURE, turn left heading 180, descend and maintain one six thousand, altimeter 30.02."

"[Call sign], left 180, leaving FL210 for one six thousand, altimeter 30.02."

j. Always acknowledge call-ups to your aircraft call sign. If you do not respond, the controller has no way of knowing whether you received the information or have experienced radio failure.

9. Summary

We have covered some of the procedures and terminology used during communications with controlling agencies. Proper utilization of this basic knowledge will enhance your abilities to successfully operate in the aviation environment in a professional manner.

APPENDIX C
OPERATIONS AT NON-TOWERED AIRPORTS

C100. INTRODUCTION

Non-towered airports refer to airports not served by operating air traffic control towers, and that includes most of the airports in the United States. At present, some 20,000 airports are non-towered, compared to approximately 400 that have FAA towers. Right-of-way rules, and non-towered airport traffic patterns and procedures, exist for only one purpose—to prevent collisions in the air and on the ground. There are other benefits to adhering to the rules, such as an orderly traffic flow, noise abatement, and defusing potential right-of-way conflicts, but traffic separation is the prime concern.

C101. COMMUNICATIONS

The flow of communications at a non-towered field mirrors that of a towered field. There are two things to keep in mind: all communications happen on the same Common Traffic Advisory Frequency (CTAF) and all communications are in the form a self-announcement (broadcast) of the pilot's intentions.

Due to the limited number of CTAF's, these common frequencies are shared amongst the thousands of non-towered airports. It is not uncommon to be operating at one airport and hear communications from another airport. As a result, **announcements on CTAF always begin and end with the airport name.** The redundancy increases safety and allows aircraft switching on to the CTAF mid-announcement to discern to which airport the announcement is related.

At non-towered fields, you will most likely be talking to other civilian aircraft nearby who may be unfamiliar with military call signs. A good *technique* would be to include type aircraft in initial calls.

Preflight communications. Preflight communications at a non-towered field are essentially the same as at a towered field. Here, rather than monitor the ATIS**, the pilot will tune and monitor the Automated Weather Observation System (AWOS).** As the name implies, AWOS consists of a suite of weather sensors to collect and disseminate important aviation weather data to include, barometric pressure, ceilings, visibilities, winds and density altitude. The number of sensors, and therefore the amount of useable data, depends on the AWOS system in use at the airport. Refer to the Airport Facility Directory to determine the AWOS type at an airport. Note that the simplest AWOS system will not report ceiling and visibility.

Taxi communications. Active communications begin with the aircraft's initial movement from its parking place to the runway in use. The self-announcement (broadcast) of pilot intentions gives other pilots situational awareness regarding the movement of all aircraft on the airport taxiways and ideally will prevent two aircraft from attempting to use the same taxiway, but in opposite directions, or even worse, colliding.

Example ground communications at non-towered airports.

Jack Edwards traffic, KABAR 22 at the ramp, taxiing to approach end of runway 9, Jack Edwards traffic.

Jack Edwards traffic, KABAR 22 clear of runway 9 at alpha 2 ("active runway" if only one runway located at the airport), taxiing to the ramp, Jack Edwards traffic.

Takeoff communications. Takeoff communications take place at the same time and place as those at a towered airport. The main difference is that pilots are responsible for ensuring that their takeoff will not interfere with landing traffic. When arriving at the hold short line, the pilot should ensure that the aircraft is positioned in a manner that gives good visibility of the base and final legs of the traffic pattern. Only after scanning for traffic and before pulling out on the runway, the pilot announces their intentions to takeoff. Making the announcement before taking the runway allows aircraft in the pattern to respond, particularly aircraft on the final approach that might have been missed when visually scanning for traffic.

Example takeoff communications.

Jack Edwards traffic, KABAR 22, Cessna 172, taking runway 9 for a departure to the north, Jack Edwards traffic.

Inflight communications. There are three separate areas of concerning when addressing inflight communications at non-towered airfields: approaching the airspace surrounding the airfield, departing the airspace surrounding the airfield, and communications in the airport traffic pattern. Communications in the traffic pattern are covered as part of the section on non-towered airport procedures.

Approaching and departing the airport. Pilots of inbound traffic should tune and monitor the airport AWOS (if applicable) starting at approximately 15 miles. Beginning at 10 miles, pilots should monitor and communicate as appropriate on the designated CTAF through to landing and finishing their taxi to parking. Continue making updated position and intention calls to local traffic as necessary.

Pilots of departing aircraft should monitor/communicate on the appropriate frequency from start-up, during taxi, and until 5 - 10 miles from the airport or clear the area with no other traffic nearby.

Pilots of aircraft conducting other than arriving or departing operations at altitudes normally used by arriving and departing aircraft should monitor/communicate on the appropriate frequency while within 10 miles of the airport unless required to do otherwise by the CFRs or local procedures. Such operations include parachute jumping/dropping, enroute, practicing maneuvers, etc.

Example arrival communication.

Jack Edwards traffic, KABAR 22, Cessna 172, 10mi to the east, two thousand five hundred feet, for an extended final runway 09, Request traffic advisories, Jack Edwards traffic.

Jack Edwards traffic, KABAR 22, 5mi to the north, two thousand feet, inbound over the field for a left downwind entry runway 27, Jack Edwards traffic.

Jack Edwards traffic, KABAR 22, Cessna 172, 10mi to the northeast, three thousand five hundred feet, inbound for two thousand feet over runway 09 for a practice engine out landing, expect a short left downwind, Jack Edwards traffic.

Example departure communication.

Jack Edwards traffic, KABAR 22, 5mi (clear) to the north, climbing through 1500', last call, Jack Edwards traffic.

Example traffic pattern communication. Because communication in the traffic pattern is an integral part of safe operations at non-towered airports, the essential elements of those communications are integrated into the procedures and covered in the following section.

C102. PROCEDURES AT NON-TOWERED AIRPORTS

Adhering to standard procedures alleviates surprises and increases situational awareness and safety at non-towered fields. It is important to remember that the FAA has passed no direct regulatory requirements for traffic patterns at non-towered airports. The FAA has provided guidance, but it is important to stay alert. Just like on the highway where there are drivers who follow their own rules, there are pilots who view standard procedures at non-towered fields as an obstacle to doing what they want. Precise pattern procedures are discussed in the FTI.

Landing pattern at non-towered airports. Announcements (broadcasts) are made just before turning in order to give other pilots in the pattern a definite place to look for traffic. Banking airplanes are easier for other aircraft at the same altitude to spot. High-wing aircraft should always pick up a wing and look before turning.

Upwind Leg. *Atmore traffic, KABAR 22 turning left crosswind Runway 18, Atmore traffic.*

Crosswind Turn. *Atmore traffic, KABAR 22 turning left downwind runway 18, Atmore traffic.*

Downwind Leg. Establish the downwind track and execute your procedures for the downwind leg. All pilots should be especially vigilant, scanning and listening for traffic entering the pattern on the downwind leg. This could occur anywhere on downwind. At the 180, execute your procedures IAW the FTI.

Approaching the turn point to the base leg, scan for conflicting traffic and announce:
Atmore traffic, KABAR 22, turning left base runway 18 touch and go, Atmore traffic.

Base Turn. Continuously scan altitude, airspeed and position over the ground for runway orientation in order to adjust AOB as needed to accomplish a nice extended final for the "groove".

Approaching final, scan for traffic on the runway and then announce:
Atmore traffic, KABAR 22, short final runway 18 touch and go, Atmore traffic.

Arriving at the airport. Non-towered airport traffic patterns are entered at pattern altitude.

There are many ways to enter the pattern, depending on direction of arrival and runway orientation. There is no right or wrong way, just safe or not safe. Usually just go with an entry that involves less turning and make sure to clearly report any and all intentions to other traffic nearby. An extended downwind, 45° downwind entry, extended base, flying over the runway for an extended crosswind, and even using an opposite pattern entry (right base even though traffic flow is usually left pattern) are and can be acceptable. If using opposite traffic flow (right pattern vs left pattern) all intentions must be communicated as well as not to violate protected pattern sides in case of noise abatement procedures or possible protected wildlife areas.

Straight-in Approach at non-towered airports. Occasionally you might be inbound to a non-towered airport on a heading that will allow a straight-in approach. Though permissible, a straight-in approach requires extra situation awareness for other traffic and airplane energy state in order to provide proper spacing for an aircraft already established on a downwind or base leg. Announce your position on a 5, 3, and on a 1-mile final. Be flexible and prepared if needing to execute a waveoff in order to give any other aircraft priority.

APPENDIX D
LIST OF ACRONYMS

ADB - Aircraft Discrepancy Book

AGL - Above Ground Level

AIM - Airman's Information Manual

AOA - Angle of Attack

AOB - Angle of Bank

AOPA - Aircraft Owners and Pilot Association

ASOS - Automated Surface Observing Sys

ASOS – Automated Surface Observing System

ATC - Air Traffic Control

ATIS - Automatic Terminal Information Service

CRM - Crew Resource Management

EP - Emergency Procedure

FAR - Federal Aviation Regulation

FIH - Flight Information Handbook

FLIP - Flight Information Publication

FOD - Foreign Object Damage

FTI - Flight Training Instruction

IAW - In Accordance With

IMC - Instrument Meteorological Condition(s)

IP - Instructor Pilot

ISPI - Identification, Situation, Position, Intention

KIAS - Knots Indicated Airspeed

LDG - Landing

MAF - Maintenance Action Form

MSL - Mean Sea Level

OLF - Outlying Field

PAT - Power Attitude Trim

SA - Situational Awareness

SLOJ - Sudden Loss of Judgment

TO - Takeoff

TTO - Training Time Out

VFR - Visual Flight Rules

VSI - Vertical Speed Indicator