NAVAL AIR TRAINING COMMAND

NAS CORPUS CHRISTI, TEXAS **CNATRA P-868 PAT (07-17)**

FLIGHT TRAINING INSTRUCTION

PRIMARY SNFO CONTACT T-6A

2017

DEPARTMENT OF THE NAVY
CHIEF OF NAVAL AIR TRAINING
250 LEXINGTON BLVD SUITE 102
CORPUS CHRISTI TX 78419-5041

CNATRA P-868
N712
5 Jul 17

CNATRA P-868 (07-17)

Subj: FLIGHT TRAINING INSTRUCTION, PRIMARY SNFO CONTACT T-6A

1. CNATRA P-868 (07-17) PAT, "T-6 Flight Training Instruction, Primary SNFO Contact T-6A" is issued for information, standardization of instruction and guidance of all flight instructors and student aviators within the Naval Air Training Command.

2. This publication shall be used as an explanatory aid to the T-6A Primary SNFO Flight Curriculum. It will be the authority for the execution of all flight procedures and maneuvers therein contained.

3. Recommendations for changes shall be submitted via the electronic TCR form located on the CNATRA website.

4. CNATRA P-868 (02-11) PAT, is hereby cancelled and superseded.

T. H. SHEPPARD
By direction

Distribution:
CNATRA Website

FLIGHT TRAINING INSTRUCTION

FOR

PRIMARY SNFO CONTACT

T-6A

LIST OF EFFECTIVE PAGES

Dates of issue for original and changed pages are:
Original...0...24 Apr 03 (this will be the date issued)
Change Transmittal…1…21 Dec 07
Revision …1…14 May 11
Revision …2…05 Jul 17

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 156 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

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INTRODUCTION TO T-6A CONTACT

100. INTRODUCTION

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 applicable to all Instructors and Student Naval Flight Officers (SNFOs) operating T-6A aircraft in the Primary Phase of training in the Naval Air Training Command. It is very important that the factual material contained herein be thoroughly studied and retained. The use of "gouge" or unapproved products in training is prohibited unless expressly approved by the Squadron Training Department or an approved CNATRA authority.

The process by which a student is transformed into a skilled Naval Flight Officer is both complex and demanding. It can be accomplished only by intensive instruction in the air as well as in the classroom. 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, because of either their lack of motivation or ability, must and will be attrited.

The Contact FTI should in no way be your sole source for study and preparation. Instead, 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 concerning fleet operations. Every effort has been made to remain in accordance with current fleet procedures. It is important to note that the emergency procedures shown are to aid in the topic discussion. For all emergencies, the T-6A NATOPS Flight Manual is the final authority. Through this cross-referencing and organization of information, the student should be able to develop a thorough understanding of the manual and flight procedures that form the backbone of an aviation career.

During the contact stage of T-6 training, SNFOs receive "stick time" in a pilot-like syllabus in order to create and build the following skills:

1. **Situational Awareness (SA):** The perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future. In simpler terms, SA is the accurate perception of what's going on with you, the aircraft, and the environment around you; now and in the future. When perception matches reality, you are situationally aware. SA is essential in recognizing unsafe conditions and taking appropriate action to prevent mishaps. There are three types of SA: Zero, Good, and Bad. Zero SA is where all students start, unaware and not knowing which factors require attention. Good SA is developed with time and by asking instructors to help build awareness as frequently as possible. Bad SA is the result of assuming that one is aware of their environment, but in reality does not match. Bad SA is a dangerous state and can be highly contagious. It is the job of both aircrew members to check flight parameters, communications, and game-plans to maintain a heightened state of awareness.

2. **Visual scan:** Visual scan encompasses two components. The first is the ability to recognize deviations from the base airspeed, altitude and heading with reference to flight instruments and the horizon. The second component is the ability to recognize and avoid potential traffic conflicts.

3. **Procedural recall and execution:** The T-6A contact stage will provide your initial training in procedural recall and execution while operating in a dynamic environment. Throughout one's aviation career, understanding and application of flight procedures, both normal and emergency, is an essential component of flight safety.

You will accomplish a series of maneuvers from this manual including takeoffs, transitions, stalls, spins, landing pattern work, and finally, aerobatics. These maneuvers will be graded in accordance with the course training standards. Preparation is key to enjoying your initial military flight experience and getting the most out of it.

Congratulations on your commencement of primary SNFO flight 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 Flight Officer is a highly trained professional. 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 SNFO apply himself or herself completely. Anything less than your best effort is unacceptable. Best of luck in your endeavor to earn your "Wings of Gold."

101. HISTORY OF CONTACT TRAINING

Naval aviation training has come a long way since 1910 when Lieutenant T. G. Ellyson was ordered to undergo flight instruction to become the first Naval Aviator. Soon thereafter, the U.S. Navy purchased its first airplane, the Curtis Triad, at a cost of $5,500. Since that time, naval aviation technology has progressed at a rapid rate. The fleet aircraft of today's Navy are tremendously complex and demanding machines, capable of astonishing performance. Advancements in aviation technology are only part of a much bigger picture. Even the most modern aircraft will fail to accomplish its mission if employed by a poorly trained or incompetent aviator. Therefore, a thorough and comprehensive training program is essential for mission accomplishment. This training starts with basic maneuvers and exploring the aircraft's performance characteristics while in visual conditions with a visible ground reference, i.e., "contact" with the ground.

Early aviation pioneers suffered through many accidents, which were of course, unwanted yet commonplace occurrences. A "good" landing was any landing you could walk away from! Today, the safety record of naval aviation is the best it has ever been. Accidents or "mishaps" are rare, yet do occur. Anything greater than a zero mishap rate is undesirable. Mishap-free operation is the ultimate goal, and SAFETY is a primary concern during all aspects of training. There is NO acceptable loss and NO toleration for anything less than total professionalism. This is a goal we can achieve. Your instructors will set an example that you should strive to emulate.

102. SCOPE OF INSTRUCTION

So far as is practical, all information and instructions governing T-6A Contact procedures and the execution of curriculum maneuvers will be published for inclusion in this manual. Other T-6A procedures, operating limits, etc., are found in the T-6A NATOPS Manual. Procedures peculiar to NAS Pensacola can be found in the Training Wing SIX (TW-6) Standard Operating Procedures, Training Squadron TEN (VT-10) Standard Operating Procedures, Training Wing SIX (TW-6) In-Flight Guide, NAS Pensacola Course Rules, and the shared Training Wing FIVE (TW-5) Fixed-Wing Standard Operating Procedures (FWOP).

Each event in this stage is comprised of various tasks the student will have to perform. This could be performing a spin on a contact flight, or reciting an emergency procedure during a lecture, or answering a test question correctly in an end-of-course exam. The Naval Flight Officer Training System (NFOTS) Curriculum and Flight Training Instructions delineate each of these tasks in detail.

The maneuvers or other items that you will perform on the events may be graded or non-graded. This means that this 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 non-graded item meaning that the student is just as responsible for a demo (non-graded) item as for a graded item. If the instructor determines a blatant lack of preparation for either, an unsatisfactory grade is warranted.

103. CURRICULUM RESOURCES

PRIMARY NAVAL FLIGHT OFFICER TRAINING SYSTEM (NFOTS) MASTER CURRICULUM GUIDE (MCG) CNATRAINST 1542.162 Series. This pocket guide is the curriculum outline. It describes what each Student Naval Flight Officer (SNFO) will do in the Primary 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.

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 SNFO will be required to perform, and list any additional pubs or study material that the student may need to reference for an event. The SNFO is responsible for all material listed in these training instructions. Each stage of training has an associated Flight Training Instruction (FTI) containing the information necessary for a student to complete the curriculum satisfactorily. It is every SNFO’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 SNFOs operating the T-6A aircraft.

CNATRAINST 1500.4 series TRAINING ADMINISTRATION (TA) MANUAL AND THE AVIATION TRAINING JACKET (ATJ). The TA manual is Student Control's guide to handling its students. Normally, those areas of the TA manual for which the SNFO is responsible will be outlined to the student upon check in. Such student responsibilities always include obtaining weekly jacket reviews, ensuring Aviation Training Forms (ATFs or gradesheets) 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 is applying himself/herself to this aviation training program.

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 SNFO's jacket forever. They are never removed or altered by anyone except under very special circumstances listed in the TA manual.

NAVAL AIR TRAINING AND OPERATING PROCEDURES STANDARDIZATION (NATOPS) PROGRAM. Every Student Naval Flight Officer becomes familiar with the NATOPS early in his or her career. You will be issued a T-6A NATOPS Flight Manual before you start ground school, and a General NATOPS (CNAF M-3710.7 series) should be available to you. The NATOPS program is the responsibility of all who use it. NATOPS only works if everyone is involved. Even as a student, it is your responsibility to originate changes if you find errors or ambiguities in the T-6A NATOPS Flight Manual. See the squadron NATOPS officer regarding the correct procedure to submit a change recommendation to the NATOPS Flight Manual.

T-6A NATOPS FLIGHT MANUAL AND POCKET CHECKLIST. The T-6A NATOPS Flight Manual is the definitive instruction on the operation of the aircraft. The Pocket Checklist (PCL) is a convenient pocket sized listing of those items in the T-6A NATOPS Flight Manual that would be of particular concern while airborne or at a remote location. No student or flight instructor has the authority to deviate from the Flight Manual without specific written authority except in specific situations. The T-6A NATOPS Flight Manual also lists the crew requirements for flying the aircraft. There is a bank of questions in the back of the T-6A NATOPS Flight Manual that every student and instructor should be familiar with. Both the T-6A NATOPS Flight Manual and the PCL list emergency procedures. Some of these procedures are listed in ***Boldface*** or with ***Asterisks*** next to them. These items are memory items, and the SNFO shall be able to recall and apply any of these procedures correctly to the appropriate aircraft malfunction. Other than these, every checklist should be performed with the aid of the PCL or appropriate guide. Familiarity with the PCL should be acquired in an attempt to ensure efficient use under potentially arduous situations while airborne.

In Primary Training, there is no room for libraries of publications. T-6A aircrews must be thoroughly familiar with their aircraft. They must study the Flight manual in-depth and have a thorough knowledge of it because no opportunity exists to do so while airborne. The T-6A NATOPS Flight Manual requires the use of checklists. Although a student may become familiar with a checklist, pocket checklists are to be used to ensure no items are missed.

104. ACADEMIC/FLIGHT SUPPORT TRAINING

The objective of flight support training and academics is to provide the SNFO with the basic knowledge and skills directly applicable to satisfactory progression in the T-6A curriculum. Upon completion of the academic and flight support activities, the student will be capable of relating these acquired cognitive skills and applying them through simulation and actual flights, thus developing the motor skills and headwork necessary to meet CNATRA standards to complete primary flight training.

105. STANDARDS OF PERFORMANCE

STANDARDIZATION. Flight instruction must be highly standardized. The syllabi that are currently being used are the result of constant evaluation and revision and as a result the procedures taught are lessons learned over the course of many years. The FTI and T-6A NATOPS Flight Manual set forth the one standardized way of doing any specific maneuver. Adherence to these standards will be a part of any instructor's evaluation of a student's performance during an event. Occasionally, a student may question a particular instructor's technique, or he/she may 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, he/she must request clarification. If, however, the student feels that the instructor's methods contradict the T-6A NATOPS Flight Manual or the FTI, he/she should consult their class advisor on the appropriate way to address the issue. In any event, when the student feels that flight safety is in jeopardy, he/she is bound to request a ***Training Time Out*** to obtain clarification. Training Time Out is defined in Paragraph 108 of this section.

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 applied to review of previous difficulties, clarification of misunderstandings, and immediate flight planning. It is essential that the instructor and the 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.

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 compare performance to a set standard or criterion.

There is little to be gained by sweating over grades. There is much to learn by focusing on the learning objectives for a course. 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 simply concentrate on correctly performing the maneuvers of the next hop, and meeting the stage and phase objectives. Students who are able to do this are successful in training.

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 other instructors have given 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 him/her to continue ahead in 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, trained to provide the student with a sound foundation in the operation of the aircraft. He/She has undergone a training course similar to the student's, which familiarizes them with the curriculum maneuvers and teaches an effective means of presenting them. This training is designed to be highly standardized. 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 his/her abilities. No two instructors will be identical in their techniques and each may vary his/her presentation to fit the needs of the individual student.

In order to teach you to operate within the T-6A properly, the instructor must criticize! His/Her 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 Naval Flight Officer.

Your flight instructor is a vital part of your training. Nonetheless, you must do your part as well. The one word that you will hear most from your instructor is *"**PROCEDURES!**"* In order that your time in the aircraft can be devoted to the improvement of maneuver performance, it is imperative that you learn, memorize, and understand the procedural steps required in performing each of the various maneuvers. Then and only then can your instructor's time with you be profitably utilized. The instructor is well trained and qualified to teach his/her student, but his/her success requires the fullest cooperation of the student himself/herself. If you have questions about procedures or concepts, ask them. Again, 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.

CONTRACT INSTRUCTORS. Simulator instructors are generally civilians, contracted to the Navy to provide simulator flight instruction, and teach academics. These instructors are all experienced military aviators. They are bound by the same instruction as their military counterparts. The simulator event should be treated just as a flight event. Both events require the same dedicated preparation and forethought. The contract instructor (CI) is also responsible for standardization. If you notice a nonstandard maneuver or technique, bring it to the attention of the standardization officer at the squadron.

107. THE STUDENT NAVAL FLIGHT OFFICER

The qualifications to become an NFO are high. The SNFO has been selected for flight training by a screening process that determines his/her superiority over the average American youth with respect to physical condition, intelligence, ability to grasp and retain new ideas, and apparent emotional stability. Superior reasoning ability will enable him/her to combine these talents into experience that will produce a qualified NFO. 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. Along with a positive mental attitude, such elements as willingness to conform to military discipline, acceptance of curtailed personal freedom and leisure, and the ability to encounter occasional difficulties and still maintain enthusiasm and self-confidence are required.

Motivation and mental attitude are closely related. The student's motivation greatly affects his or her mental attitude and consequently his or her progress throughout training. The majority of students have had little or no previous aviation experience. Flight training is arduous and places great demands on the student's time and energy. Therefore, motivation plays an important part in difficult periods. The student who discovers that he or she does not enjoy flying but remains because of prestige or monetary compensation will find that his or her chances of successfully completing the program are poor. The desire to earn those coveted Wings of Gold**,** and the love of flying, provide the highest motivation and the greatest likelihood of success.

With these basic qualities as a foundation, the experience you gain as you progress through each stage of your training will develop the many facets of your skill and judgment. This will allow you to cope with the many and varied problems that may confront you in the handling of your aircraft under all conditions. Although your instructor and other personnel are at your disposal to help solve various problems, your own intelligent analysis, based on acquired knowledge, will generally permit you to arrive at correct and logical conclusions.

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. But, because 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 T-6A is one of the most enjoyable classrooms in the world. Every student should remember these guidelines when managing his/her training program.

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

2. Preparation is the key to professionalism. Do not be satisfied with only knowing enough to complete the hop. What is being taught in the primary phase 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. As an aviator beginning the flight training syllabus, you must demonstrate one of the most critical qualities a professional aviator has: self-discipline. This means that you 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 appraisal of your flight performance. You are expected to come well prepared, but you must expect to make mistakes. Most of these mistakes are forgiven as long as you deal with them professionally, on the spot and learn from them. That is why they call this flight ***training***.

108. TRAINING TIME OUT

CNATRAINST 1500.4 (series) defines the conditions under which a Training Time Out (TTO) may be requested. It states in part, "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. As defined in CNAF M-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.

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 CNAF 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.

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 SNFO being "along for the ride." It is important to remember that no crewmember 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 crewmember, your primary responsibility is to support and back up the pilot at the controls and ensure the success of the mission.

Stay alert and be assertive when necessary. The instructor/student relationship often fosters reluctance on the part of the SNFO to confront the Instructor Pilot (IP). But 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.

Concepts that aid aircrew coordination:

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

To help you understand some of the physical and psychological factors affecting your training, the remainder of this chapter will be devoted to paraphrasing our flight surgeon's thoughts on the matter.

"I'm Safe" Checklist. 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. 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 find you 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?

Mental attitude is a very essential element to your relaxation in an aircraft. It affects your nervous system and, if allowed to continue in an unhealthy trend, can result in actual physical incapacitation. Therefore, its significance should be fully appreciated. As with physical handicaps, any mental distraction will also detract from the full use of your required senses. A poor mental attitude will interfere with your ability to concentrate, learn, and apply your knowledge. In turn, a good or positive mental attitude will increase your learning capacity and will make your flight training a pleasure rather than an unpleasant job.

If for any reason you find yourself "flying more, and enjoying it less," whether from some known cause or not, discuss it with your flight instructor or class advisor. Another aid to acquiring a positive mental attitude, after you have satisfied yourself that it is not an outside problem affecting you mentally, is to find some healthy diversion that will get your mind away from the subject of flying for a time. The base as well as the local area offers much in the way of recreational opportunities and diversions.

Mental alertness on both aircrews' part has a direct bearing upon safety of flight as well as contributing significantly to the learning process. Remember that the training areas utilized are not very large and are used by many aircraft. Being constantly on the alert while flying may save your life and that of one of your squadron mates. Mental laziness is the constant enemy of every aviator. So, as you progress through flight training, plan ahead and try to anticipate all possible contingencies that could affect the operation of your aircraft. Proper planning not only refers to the environment around you but also the aircraft in which you are sitting. Check your engine instruments from time to time to ensure that all is well up front. In other words, train yourself to be alert to all facets of your flight rather than concentrating on the problem of the moment. You will find yourself surprised at the amount of information your eyes will transmit to your brain during a quick SCAN of your surroundings. Planning ahead will also equip you to take immediate and appropriate action should an emergency occur.

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 70% of all fatal accidents are due to 100% 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 aircrews begin to lose that feeling of respect due an aircraft, they have reached a stage when anything can happen and usually does. Good aircrews 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.

Occasionally physiological problems arise during the course of a flight. Airsickness, fatigue, hypoxia, food poisoning, or dehydration can overcome a crewmember and result in reduced situational awareness and even complete incapacitation. Students must not only recognize these symptoms in themselves but also in other crew members. At any time, the non-affected crew member should be ready to take the controls, and if necessary, fly to a safer environment (i.e., higher altitude, away from other aircraft and clouds) to include termination of the flight. Airsickness is common during early Contact flights and, even though it is not usually incapacitating, it affects judgment and reduces situational awareness. If this occurs, inform your instructor.

111. FLIGHT SIMULATORS

You won't always have a formal training device at your disposal to prepare for your simulators and flights. "Chair flying" is an excellent way to prepare at home, preferably with a classmate. Strap your checklist on your knee, put on your gloves, grab a simulated control stick, sit in front of your cockpit poster, 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.

Simulators have proven to be invaluable assets in helping students learn the physical attributes necessary to become good NFOs. Before you climb into the T-6A aircraft for the first time, you will have practiced the use of checklists, basic flight and emergency procedures several times. There are 3 types of simulators available for your use: a static trainer, Unit Training Device (UTD), and Operational Flight Trainer (OFT). In addition to the syllabus training that you receive in the UTD or OFT, you should utilize the static trainers at every opportunity. Practice will pay off with better grades, increased self-confidence, and more professional performance.

UTD/OFT FLIGHT SIMULATOR. The UTD is a training device with no visual system designed to support procedural and instrument flight requiring no outside visual references. The OFT is a training device with a wide field of view visual system to support instrument and visual flight training. These simulators do not have full motion. The instruments and flight controls behave exactly as those in the aircraft. If there is a discrepancy in the device, it is the responsibility of the aircrew (you) to provide maintenance data. Normally, this consists of telling the simulator instructor about the problem. Do not be complacent about discrepancies on a flight simulator, and ***never treat a simulator like a simulator***, treat it exactly like it was an aircraft.

112. THE AIRCRAFT

The aircraft you will fly in this program is the Hawker-Beechcraft T-6A "Texan II." It is a pressurized, tandem cockpit, low wing, high-performance, single engine monoplane equipped with dual controls. Power is provided by a turbo-prop engine manufactured by Pratt & Whitney Aircraft of Canada, Model PT6A-68, with inverted flight capabilities, providing a flight envelope with altitudes to ~31,000 feet. Reference your T-6A NATOPS Flight Manual for detailed aircraft information and operating procedures.

Figure 1-1 T-6A Texan II

CHAPTER TWO
T-6A AERODYNAMICS AND FLIGHT CONTROLS

200. INTRODUCTION

Prior to your first flight in the T-6A, there are several fundamental topics that you should review and understand if you are to obtain maximum benefit from your primary training. These topics include not only basic aerodynamics, but also certain principles pertaining to safety of flight. While more complex theories were covered in the classroom during Aviation Indoctrination, the basics are considered to be of sufficient importance to repeat in broad terms at this time. The discussions in this chapter provide SNFOs with the basic factors of flight before actually beginning to fly.

In addition, this chapter discusses the controls with which you will operate the aircraft about the three axes of motion, and how to use them effectively.

201. THEORIES OF FLIGHT

Lift and Thrust. Our discussion will include several basic laws of physics that help to explain how an airplane flies. Sir Isaac Newton is credited with having observed in 1687, "for every action, there is an equal and opposite reaction.” This principle applies whenever two objects act upon each other, such as the air and the propeller, or the air and the wing of the airplane. In short, the statement about "action and reaction" tells us how lift and propulsion of airplanes are produced.

The predominant method by which air exerts force on a solid body, such as an airplane’s wing, is through pressure. For our purposes, friction can be ignored. In the 1700’s, Daniel Bernoulli (a Swiss mathematician) discovered the Venturi Principle. He found that if the velocity of a fluid (air) is increased at a particular point, the static pressure of the fluid (air) at that point is decreased. The airplane’s wing is designed to increase the velocity of the air flowing over the top of the wing as it moves through the air. To do this, the top of the wing is curved, while the bottom is relatively flat. The air flowing over the top travels a little farther (since it is curving) than the air flowing along the flat bottom. This means the air on top must go faster. Hence, the static pressure decreases, resulting in a lower static pressure (as Bernoulli stated) on top of the wing and a relatively higher static pressure below. The pressure differential then pushes the wing up towards the lower pressure area, i.e., ***lift***. To increase the lift, the wing is tilted upward in relation to the oncoming air (relative wind) to increase the deflection of air. Relative wind during flight is the direction of the airflow in relation to the wing as it moves through the air. The angle at which the wing meets the relative wind is called the angle of attack. (Figure 2-1)

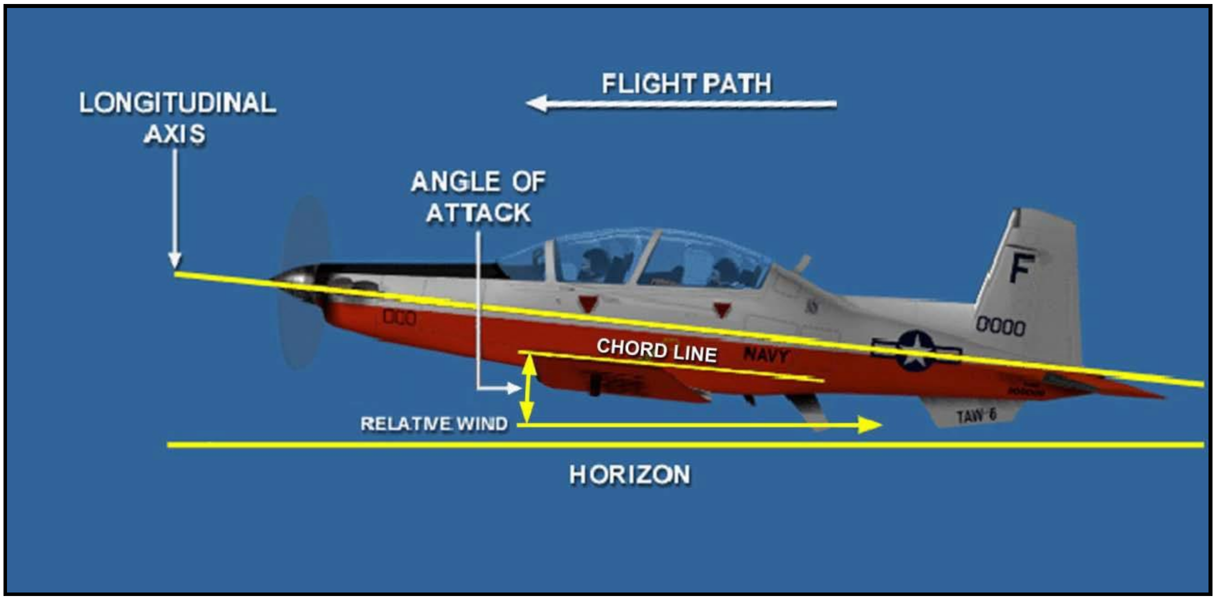

Figure 2-1 Angle of Attack

If the airplane's speed is too slow, the angle of attack required will be so large that the air can no longer follow the upper curvature of the wing. This results in a swirling, turbulent flow of air over the wing and "spoils" the lift. Consequently, the wing stalls. On most types of airplanes, this critical angle of attack is about 15-20°.

When the propeller rotates, it provides the force to pull the airplane forward. This forward motion causes the airplane to act on the air to produce lift. The propeller blades, just like a wing, are curved on one side and straight on the other side. Hence, as the engine rotates the propeller, forces similar to those of the wing create "lift" in a forward direction. This is called thrust.

Up to this point, the discussion has related only to the "lifting" force. Before an understanding of how an airplane flies is complete, other forces must be discussed.

Gravity. While the airplane is propelled through the air and sufficient lift is developed to sustain it in flight, there are certain other forces acting at the same time. Every particle of matter, including airplanes, is attracted downward towards the center of the earth by gravitational force. The amount of this force on the airplane is measured in terms of weight. If the airplane is to keep flying, lift must overcome its weight or gravitational force.

Drag. Another force that constantly acts on the airplane is drag. Drag is the resistance created by air particles striking and flowing around the airplane when it is moving through the air. Aircraft designers constantly try to streamline wings, fuselages and other components to reduce the rearward force of drag as much as possible. The portion of drag caused by resistance and skin friction is termed parasite drag, since it is not the result of the production of lift.

A second part of the total drag force is caused by the wing's lift. As the wing deflects air to produce lift, the total lift force is not exactly vertical, but is tilted slightly rearward. This means that it causes some rearward drag force. This drag is called induced drag, and is the price paid to produce lift. The larger the angle of attack, the more the lift force on the wing tilts towards the rear and the larger the induced drag becomes. To give the airplane forward motion, thrust must overcome drag.

In a steady flight condition (no change in speed or flight path), forces that oppose each other are also equal to each other and are always present. That is, lift equals weight, and thrust equals drag.

Centrifugal Force. Still yet another force that frequently acts on the airplane is centrifugal force; however, this force occurs only when the airplane is turning or changing the direction (horizontally or vertically) of the flight path. Another of Newton's laws of energy states that "a body at rest tends to remain at rest, and a body in motion tends to remain moving at the same speed and in the same direction . . ." Thus, to make an airplane turn from straight flight, a sideward inward force must act upon it. The tendency of the airplane to keep moving in a straight line and outward from a turn is the result of inertia and it produces centrifugal force. Therefore, some impeding force is needed to overcome centrifugal force so that the airplane moves in the desired direction. The lift of the wings provides this counteracting force when the airplane's wings are banked in the desired direction. Refer to the section on Turns in chapter three.

Since the airplane is in a banked attitude during a properly executed turn, the pilot will feel the centrifugal force by increased seat pressure, rather than the feeling of being forced to the side as is experienced in a rapidly turning automobile. The amount of force (G force) felt by seat pressure depends on the angle of bank. The pilot will, however, be forced to the side of the airplane (as in an automobile) if a turn is improperly made and the airplane is made to slip or skid.

Yaw Forces. One other force which affects the aircraft during certain conditions of flight and which will be frequently referred to in the discussions on various flight maneuvers is torque effect or "left turning tendency." It is probably one of the least understood forces that affect an aircraft in flight. Torque effect is the force which causes the airplane to have a tendency to swerve (yaw) to the left, and is created by the clockwise rotation of the engine and the propeller. There are four factors that contribute to this yawing tendency:

1. Torque reaction to the engine and propeller.

2. The propeller's gyroscopic effect.

3. The corkscrewing effect of the propeller slipstream.

4. The asymmetrical loading of the propeller (P-factor).

It is important that pilots understand why these factors contribute to torque effect.

1. **Torque Effect**. Torque Effect (Figure 2-2) in a propeller-driven aircraft acts opposite the direction of propeller rotation. In the case of the T-6A, the aircraft tends to yaw to the left as a result of torque when power is increased, and the aircraft tends to yaw right when power is reduced. Rudder and the TAD are the primary means for compensating for engine torque.

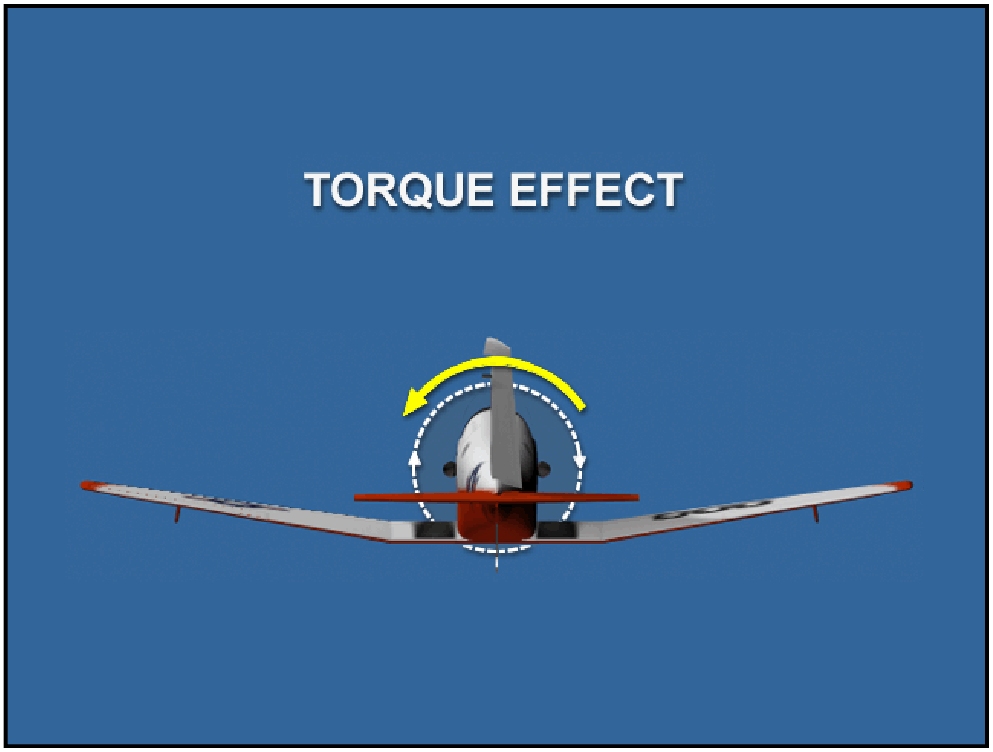

Figure 2-2 Torque Effect

2. **Gyroscopic Effects.** Gyroscopic effects (Figure 2-3) are called gyroscopic precession. This occurs when a force is applied to displace a spinning mass such as the propeller or, in the case of a spin, the aircraft as a whole. Gyroscopic precession causes an applied force to act in a plane 90° from that in which it was applied (it is applied in the same direction as the rotation). The effect of gyroscopic precession depends on the rate of movement about the pitch or yaw axis. Increased rotation rates tend to increase the effect. This explains why a pilot, who abruptly corrects aircraft deviations (pitch, bank, and yaw), ends up frustrated with the adverse effects of precession. The relatively large propeller on the T-6A and high revolutions per minute (rpm) result in more precession effect than an aircraft with a lighter, smaller propeller turning at slower rpm. Typical reactions from a clockwise-turning propeller (as viewed from the pilot's seat) include:

a. If the nose is yawed to the left, the nose tends to pitch up.

b. If the nose is yawed to the right, the nose tends to pitch down.

c. If the nose is pitched down, a left yaw tends to develop.

d. If the nose is pitched up, a right yaw tends to develop.

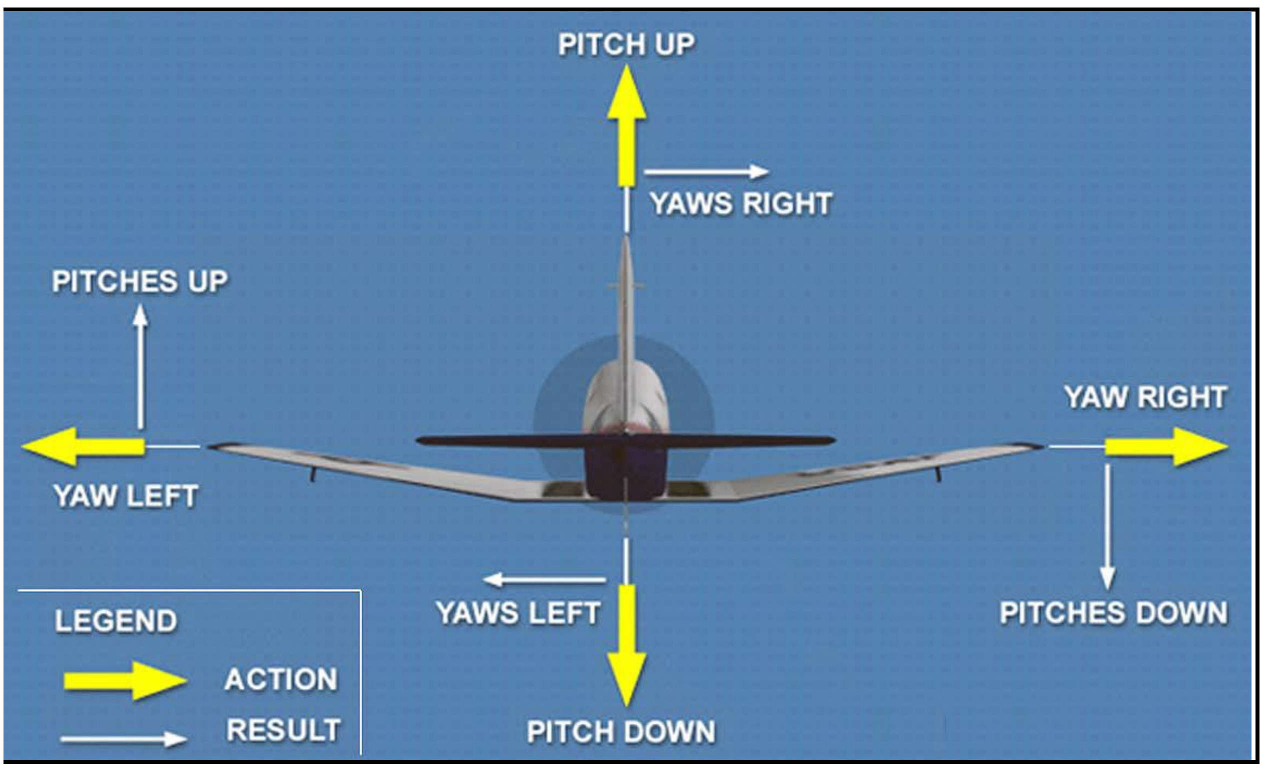

Figure 2-3 Gyroscopic Effects

3. **Slipstream Effect.** The thrust generated by the rotation of the propeller induces a phenomenon called corkscrew slipstream effect (Figure 2-4). Specifically, the rotating prop produces a helical (or corkscrew) shaped air stream about the longitudinal axis. This slipstream strikes the wing root, fuselage, and tail surfaces with a constant high- energy force proportional to power setting and airspeed. The addition of power increases airflow over the tail surfaces and makes them more effective at slow speeds. In the T-6A, the corkscrew slipstream induces a slightly higher angle of attack (AOA) on the left wing root and left tail surfaces, and slightly lowers AOA on the right wing root and right tail surfaces. This causes the aircraft to yaw to the left when power is increased, and requires right rudder input to counter the yaw and maintain coordinated flight. As the power is increased by moving the power control lever (PCL) forward with the left hand, the right foot must move forward to counter the yaw that is induced to the left. The amount of rudder movement is proportional to the amount and rate of PCL movement. The amount and rate of rudder movement can be determined by looking out the front of the aircraft and using the rudder to keep the nose from swinging either left (too little rudder application) or right (too much rudder application). A power reduction has the opposite effect, requiring left rudder to maintain coordinated flight.

Figure 2-4 Slipstream Effect

4. **P-Factor.** P-factor (Figure 2-5) is another effect of the propeller. It is caused by AOA being higher on the downward moving propeller blade than on the upward moving propeller blade. This occurs when the aircraft's thrust line is above the free air stream relative wind or at low speeds and high angles of attack with power-on. This moves the aerodynamic center of the propeller to the right of the shaft on a clockwise-rotating propeller, causing the aircraft to yaw left as AOA or power is increased. This is why increasing right rudder is required to maintain coordinated flight as angle of attack is increased on the aircraft, such as in a pull-up for an over- the-top aerobatic maneuver. As the airspeed decreases and the AOA increases, the aerodynamic center of the propeller shifts to the right and right rudder is required to keep the aircraft in coordinated flight. The opposite is true when the thrust line is below the free air stream relative wind. The upward-moving propeller blade then has a higher angle of attack than the downward-moving blade. This moves the aerodynamic center of the propeller to the left of the shaft on a clockwise-rotating propeller, causing the aircraft to yaw to the right and requires left rudder to maintain coordinated flight. A right yawing situation seldom occurs since pushing over to the point of shifting the thrust line below the free air stream relative wind is rarely warranted.

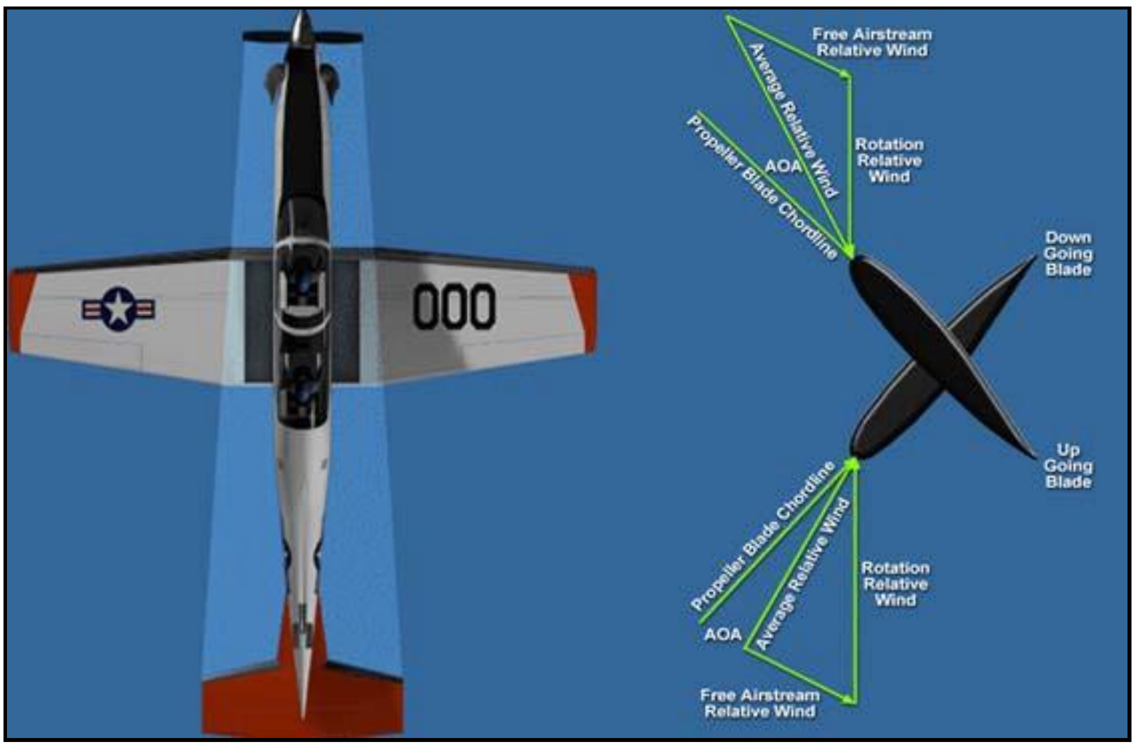

Figure 2-5 P-Factor

202. STABILITY AND CONTROL

Most naval aircraft have been designed with satisfactory handling qualities in addition to adequate performance. In particular, the T-6A is stable enough to maintain uniform flight conditions, recover from disturbances (such as turbulence), and minimize pilot workload. It has sufficient controllability to achieve the desired performance; however, there are certain conditions of flight which produce the most critical requirements of stability and control. These conditions must be understood and respected to accomplish safe and efficient operation of the aircraft.

Static Stability. Besides being supported in flight by lift and propelled through the air by thrust, an airplane is free to revolve or move around three axes. These axes may be thought of as axels around which the airplane revolves much like a wheel does. Each axis is perpendicular to the other two and all three intersect at the airplane's center of gravity (CG). The point around which the airplane's weight is evenly distributed or balanced is considered the CG of the airplane. Figure 2-6 depicts the axes about which the aircraft rotates.

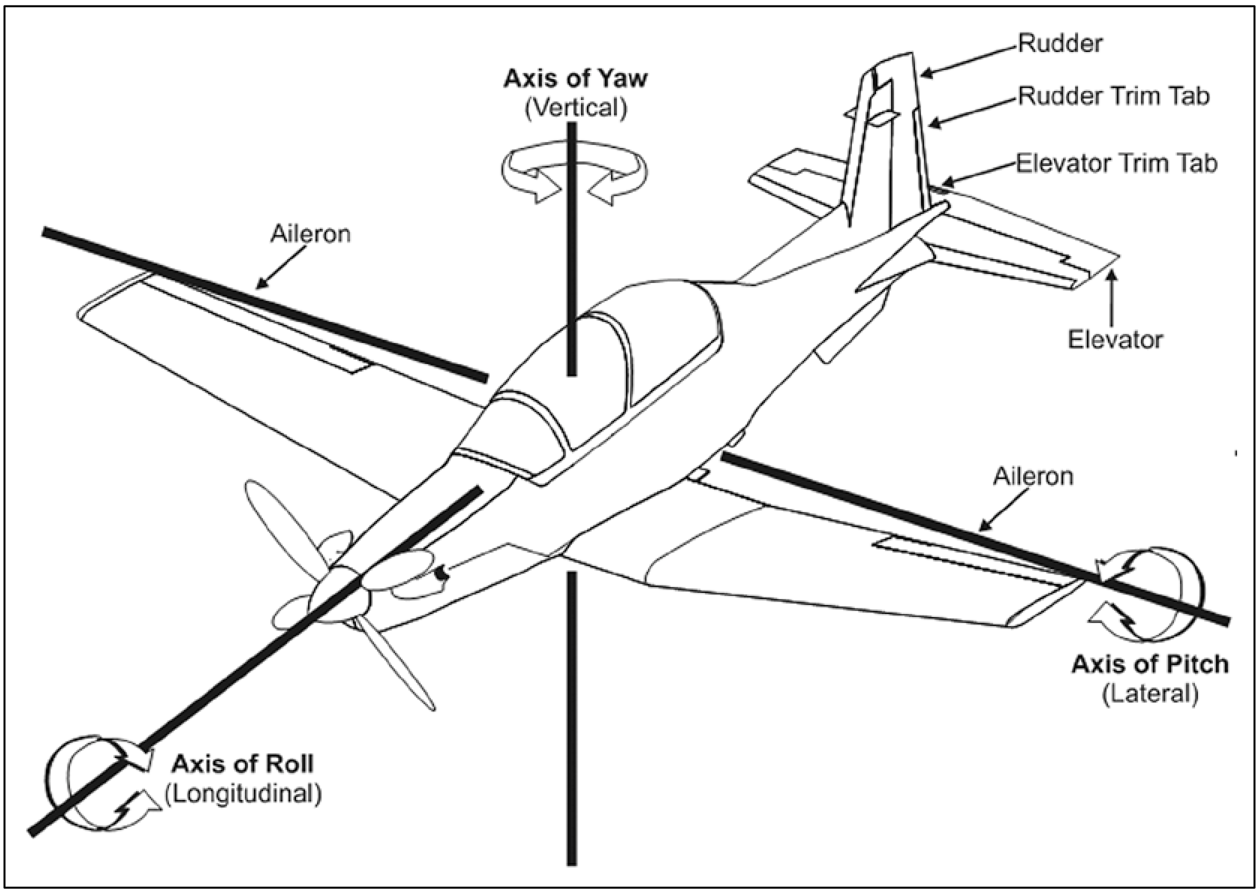

Figure 2-6 Aircraft Axes

An aircraft trimmed for steady flight is in a state of equilibrium. In other words, the sum of all the forces and moments is zero. Displacement from this position by some outside force, such as a gust of turbulence, creates an unbalance and causes the aircraft to demonstrate an initial tendency. This tendency will be to (a) return, (b) be displaced further, or (c) remain in the new attitude or position. This initial tendency is known as static stability. If the aircraft tends to move back in the direction of its trimmed attitude, it is said to be statically stable or to have positive static stability. If the aircraft continues to move away from trimmed equilibrium, it is statically unstable or it has negative stability. An aircraft that stays in its displaced attitude, neither moving positively nor negatively, is said to be neutrally stable or neutrally statically stable (Figure 2-7).

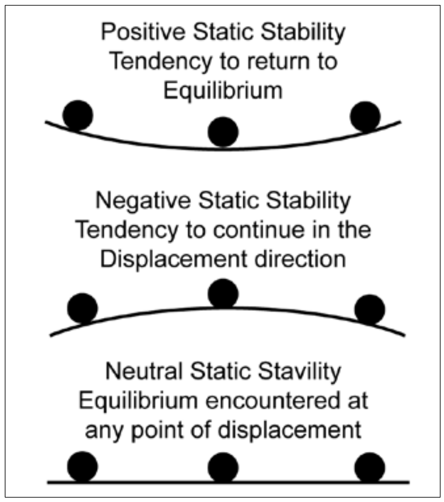

Figure 2-7 Static Stability

Dynamic Stability. Dynamic stability is the movement of an aircraft with respect to time. If an aircraft has been disturbed from its equilibrium position and the maximum displacement decreases with time, it is said to have positive dynamic stability. If the maximum displacement increases with time, it is said to have negative dynamic stability. If the displacement remains constant with time, it is said to have neutral dynamic stability. Both static and dynamic stability are usually desired in an airplane.

Static stability does not guarantee that an airplane will also be dynamically stable; however, the airplane must first be statically stable before it will oscillate at all and, thus, exhibit any kind of dynamic stability. Possible cases of stability can be summarized in Figure 2-8.

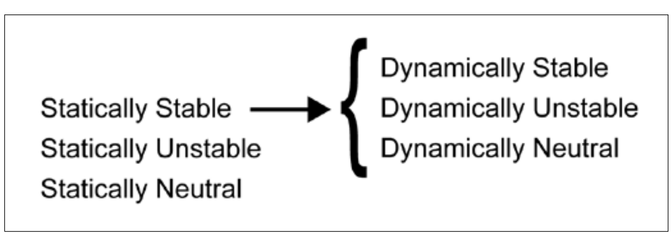

Figure 2-8 Cases of Stability

In addition to positive static stability, the T-6A has positive dynamic stability. Over a period of time, it will tend to return to most conditions for which it was trimmed.

Let us again consider the ball in the saucer shown in Figure 2-7. If you move the ball to the displaced position and then let go, it will not go directly to the equilibrium point and stop. Rather, its inertia will carry it well past the bottom and up the other side. As gravity overcomes its inertial acceleration, it rolls back the other way towards the original displacement point until it succumbs again to gravity. This motion could go on indefinitely if there were no friction present between the ball and the dish. Eventually, friction will reduce the momentum of the ball sufficiently so that it finally settles down once again to the bottom of the dish. A pendulum that is pushed to one side and released displays the same action. The resulting motion is an oscillation (movement from one side of the equilibrium point to the other) until friction damps out the motion.

Your instructor will demonstrate the stability characteristics of the T-6A aircraft by trimming for straight and level balanced flight. He/She will then place the aircraft in various attitudes and permit the aircraft to return to straight and level balanced flight, demonstrating the necessity and ease of proper use of trim. As discussed earlier in this chapter, the T-6A is capable of equilibrium flight in all airspeeds and configurations that you will encounter. That is, for all changes in power, airspeed, and configurations, the aircraft is able to maintain a "hands-off" straight and level balanced flight condition, but will require a ***change in trim setting*** for those changes. Further discussion on the use of trim will occur later in this chapter.

An aircraft is said to be trimmed if all moments in pitch, roll, and yaw are equal to zero. The establishment of equilibrium at various conditions of flight is the function of the controls and will be accomplished by pilot effort and trim tabs. Pilot effort is necessary to establish equilibrium conditions and trim tabs will be used to hold the desired conditions (i.e., reduce control pressure). During training, trim will be of extreme importance and trimming rapidly and properly will become a habit. The necessity to trim the T-6A cannot be overemphasized. When all of the pilot’s energy is consumed fighting the controls, little is left over for flying the aircraft and maintaining situational awareness.

Control. Control is concerned with the maneuverability of the aircraft. Although the T-6A aircraft is "inherently stable" due to its positive static and dynamic stability, it is not so stable as to inhibit aircraft maneuverability. Since the T-6A is a primary trainer, it was designed with flight controls capable of aerobatic flight, yet not so sensitive as to make the aircraft difficult to control or allow aircraft limits to be easily exceeded. Generally speaking, control forces are highest in the directional axis (ailerons). The magnitude of these forces varies depending on the airspeed, trim setting and the amount of deflection. At higher speeds, controls become difficult to deflect due to higher dynamic pressure impinging on the control surfaces. Although the higher dynamic pressure makes the controls more effective, resulting in a greater aircraft reaction for a given control deflection, the forces required to obtain that control deflection are higher. Trim setting affects control forces in that the further the aircraft is flown from its trimmed airspeed, the greater the forces required (in all axes) to maintain balanced flight conditions. These forces serve as physical cues to the pilot that the aircraft has deviated from its trimmed airspeed.

203. STALLS

In earlier discussions it was shown that an airplane would fly as long as the wing is creating sufficient lift to counteract the load imposed on it. When the lift is completely lost the airplane stalls. Remember that the direct cause of every stall is an excessive angle of attack. There are a number of flight maneuvers which may produce an increase in the angle of attack, but the stall does not occur until the angle of attack becomes excessive.

It must be emphasized that the stalling speed of a particular airplane is not a fixed value for all flight situations; however, a given airplane will always stall at the same angle of attack regardless of airspeed, weight, load factor, or density altitude. Each airplane has a particular angle of attack where the airflow separates from the upper surface of the wing and the stall occurs. Each airplane has only one specific angle of attack where the stall occurs. The airplane can be stalled in straight and level flight by flying too slowly. As the airspeed is being decreased, the angle of attack must be increased to continue creating the lift required for maintaining altitude. The slower the airspeed becomes, the more the angle of attack must be increased. Eventually an angle of attack is reached which will result in the wing not producing enough lift to support the airplane and it will start settling. If the airspeed is reduced further, the airplane will stall since the angle of attack has exceeded the critical angle and the airflow over the wing is disrupted.

In naval aviation, there is great importance assigned to precise control of an aircraft at high angle of attack conditions. Safe operation in carrier aviation demands the ultimate in precision flying at low airspeed. The aerodynamic lift characteristics of an airplane must be fully understood by the SNFO as well as the seasoned "fleet pilot" for obvious safety reasons. Additionally, mission requirements and their execution may depend on the pilot’s own capabilities and grasp of these basic concepts.

During flight maneuvers, landing, approach, takeoff, etc., the airplane will ***stall if the critical angle of attack (18 units for the T-6) is exceeded***. The airspeed at which stall occurs will be determined by weight, load factor, altitude, and configuration, but the stall angle of attack remains unaffected. At any particular altitude, the indicated stall speed is a function of weight and load factor. An increase in altitude will produce a decrease in density and an increase in true airspeed. Also, an increase in altitude will alter compressibility and airflow viscosity, which will cause the indicated stall speeds to increase.

Modern airplanes are characterized by having a large percentage of their maximum gross weight as fuel. Most Navy inventory aircraft carry 25-40% of their total gross weight in this manner. Hence, the gross weight and stall speed of the airplane can vary considerably throughout the flight. A general "rule of thumb" is that a 2% change in weight will cause a 1% change in stall speed (see Figure 6-3 in the T-6 NATOPS Manual for Indicated Stall Speeds).

Load factor/centrifugal force. Turning flight and maneuvers produce an effect on stall speed, which is similar to the effect of weight. The stalling speed of an airplane is higher in a level turn than in straight and level flight. This is because centrifugal force is added to the airplane’s weight, and the wing must produce sufficient additional lift to counterbalance the load imposed by the combination of centrifugal force and weight. In a turn, the necessary additional lift is acquired by applying back pressure to the elevator control. This increases the wing’s angle of attack, and results in increased lift. As stated earlier, the angle of attack must increase as the bank angle increases to counteract the increasing load caused by centrifugal force. If, during a turn, the angle of attack becomes excessive (i.e.: >18 units AOA for the T-6A), the airplane will stall. Thus, the aircraft in a steady turn still develops lift greater than weight, but experiences increased stall speeds due to load factor increases. This fact emphasizes the need to avoid steep turns at low airspeeds - a flight condition common to stall/spin accidents. (Refer to T-6 NATOPS Figure 5-4 V_n Diagram.)

It must be reemphasized here that low speed is not necessary to produce a stall. The wing can be brought into an excessive angle of attack at any speed. For example, take the case of an airplane which is in a dive at an airspeed of 200 KIAS, when suddenly the pilot pulls back sharply on the elevator control. Because of gravity and centrifugal force, the airplane would not immediately alter its flight path, but would merely change its angle of attack abruptly from quite low to very high. Since the flight path of the airplane, in relation to the oncoming air, determines the direction of the relative wind, the angle of attack is suddenly increased, and the airplane will quickly reach the stalling angle at a speed much greater than normal stall speed.

The primary purpose of high lift devices (i.e., flaps, slats, and slots) is to increase the coefficient of lift and reduce the stall speed for an airplane. Therefore, flap extension increases the total lift available and reduces the angle of attack for any given lift coefficient.

At this point we should examine the action of the airplane during a stall. In our earlier discussion of pitching (longitudinal) stability, we learned that to balance the airplane aerodynamically, the center of lift is normally located aft of the center of gravity. It should be noted that although this airplane is inherently "nose heavy," downwash on the horizontal stabilizer counteracts this condition. It can be seen then, that at the point of stall when the upward force of the wing’s lift and the downward tail force cease, an unbalanced condition exists. This allows the airplane to pitch down abruptly, rotating about its center of gravity. During this nose down attitude change, the angle of attack decreases and the airspeed again increases; hence, the smooth flow of air over the wing begins again, lift returns, and the airplane is again flying; however, considerable altitude may be lost before this cycle is complete.

The associated loss of altitude and control response in the stalled configuration has cost the lives of both students and seasoned Naval Aviators. Therefore, it is important to remember that the stall is not merely a precision maneuver, but an actual situation into which you may inadvertently fly while concentrating on some other aspect of your flying.

204. PRIMARY FLIGHT CONTROLS

To maneuver an aircraft, you will learn to control its movement about its lateral, longitudinal, and vertical axes (Figure 2-6). This is accomplished by the use of the flight controls (elevators, ailerons, and rudder), which can be deflected from their neutral position into the flow of air as the aircraft moves forward. In flight, the controls have a natural live “feel” due to the force of the airflow around them. With this in mind, the student should think of exerting force against this live pressure or resistance not of moving the flight controls.

Elevators

The elevators control the aircraft's movement about its lateral or pitch axis. They form the rear part of the horizontal stabilizer, are free to be moved up and down by the pilot, and are connected to a control stick in the cockpit by means of cables, push/pull rods and pulleys. Applying forward pressure on the stick causes the elevator surfaces to move downward. The flow of air striking the deflected elevator surfaces exerts an upward force, pushing the aircraft's tail upward and the nose downward. Conversely, exerting back pressure on the control causes the elevator surfaces to move up, exerting a downward force to push the tail downward and the nose upward. In effect, the elevators are the angle-of-attack (AOA) control. When back pressure is applied on the control, the tail lowers and the nose rises, thus increasing the wing's AOA and lift.

Ailerons

The ailerons control the aircraft's movement about its longitudinal or roll axis (Figure 2-9). There are two ailerons, one at the trailing edge of each wing, near the wingtips. They are movable surfaces hinged to the wing's rear spar and are linked together by cables so that when one aileron is deflected down, the opposite aileron moves up. The ailerons are statically mass balanced with weights installed on the leading edges of each aileron forward of the hinge line.

The two wings produce differences in the lift that actually turns the aircraft. To obtain the horizontal component of lift required to pull the aircraft in the desired direction of turn, apply lateral control stick force in that direction. When the pilot applies pressure to the left on the control stick, the right aileron surface deflects downward and the left aileron deflects upward. The force exerted by the airflow on the deflected surfaces raises the right wing and lowers the left wing. This happens because the downward deflection of the right aileron changes the wing camber and increases the AOA and lift on that wing. Simultaneously, the left aileron moves upward and changes the effective camber, resulting in a decreased AOA and less lift. Thus, decreased lift on the left wing and increased lift on the right causes the aircraft to bank to the left.

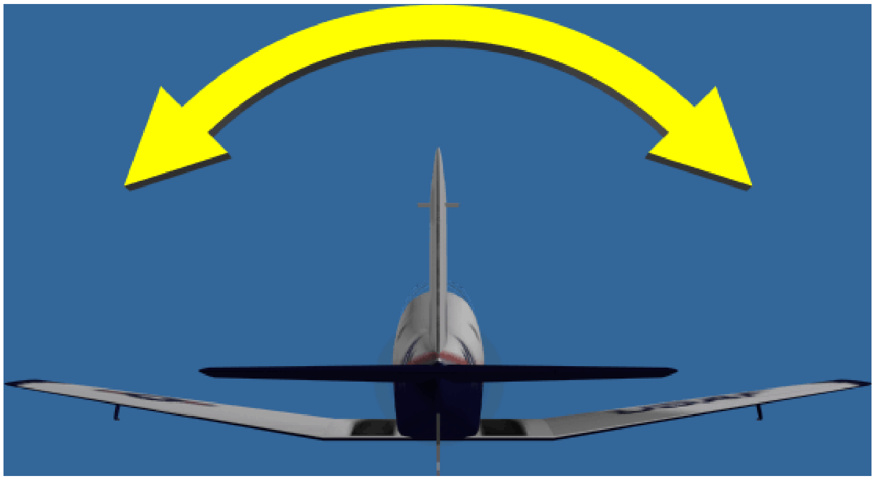

Figure 2-9 Aileron Control

Adverse Yaw. During a roll the downward deflected aileron produces more lift; it also produces more drag, while the opposite aileron has less lift and less drag. This added drag attempts to pull or veer the airplane's nose in the direction of the raised wing; that is, it tries to turn the airplane in the direction opposite to that desired. This undesirable veering is referred to as adverse yaw (Figure 2-10).

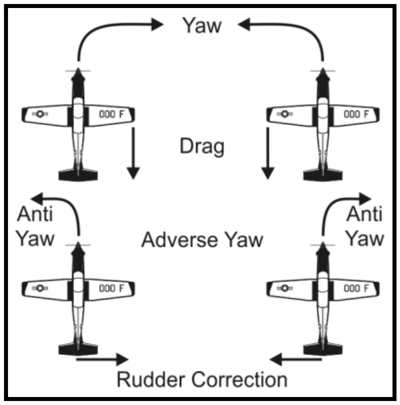

Figure 2-10 Adverse Yaw

To demonstrate this in flight, an attempt can be made to turn to the right without using the rudder pedals. As right aileron pressure is applied, the airplane rolls into a right bank and tries to turn to the right. But the adverse yaw, or the drag on the downward deflected left aileron, pulls the airplane's nose to the left. The airplane banks, but it turns hesitantly and sideslips. This is undesirable and corrective action should be taken by applying right rudder pressure.

When right rudder pressure is applied simultaneously with right aileron pressure, it keeps the airplane from yawing opposite to the desired direction of turn. In fact, the rudder must be used because the ailerons were used. Coordinated use of the rudder with the ailerons in a turn will counteract the effects of adverse yaw.

Adverse yaw is an undesirable effect, and is most apparent at low speeds and extreme control- surface deflections. At faster airspeeds, adverse yaw becomes less apparent and may be unnoticeable. When accomplishing slow flight, watch closely for the effects of adverse yaw in the turn. Your instructor can share methods on how to appropriately use the rudder while initiating a turn to counter adverse yaw effects.

Rudder. The rudder controls the aircraft's movement about its vertical or yaw axis. Like the other primary control surfaces, the rudder is a movable surface hinged to a fixed surface in this case to the vertical stabilizer. Left and right rudder pedals control rudder movement. Its action is much like that of the elevators, except the motion is side to side instead of up and down. When the rudder is deflected to one side, it protrudes into the airflow, causing a horizontal force to be exerted in the opposite direction. This pushes the tail of the aircraft in that direction and yaws the nose in the desired direction. For example: when the rudder is deflected to the left, it protrudes into the airflow on the left side of the tail, causing a horizontal force to be exerted on the tail to the right. This pushes the tail of the aircraft to the right and yaws the nose to the left. The primary purpose of the rudder in flight is to counteract the effect of adverse yaw and to help provide directional control of the airplane. In flight, the rudder does not turn the airplane; instead, the force of the horizontal component of wing lift turns the airplane when the wings are banked. As in the demonstration of turning by use of ailerons alone, this can be verified by flying straight and level and then, after taking the hands off the control stick, trying to turn to the right by applying right rudder pressure only. At first it may seem to work pretty well. The airplane will turn to the right, but it will also skid to the left (a skid in a turn is an unbalanced flight condition caused by insufficient angle of bank for a given radius of turn). Since the airplane possesses inherent stability, it will tend to stop the skid by banking itself to the right.

If the pilot were now to neutralize the rudder, only a shallow banking turn would result; however, inasmuch as the purpose of this demonstration is to make a turn using only the rudder, continue to hold right rudder pressure. Since the airplane is slightly banked to the right, the rudder will force the nose of the airplane downward to the right. The reason for this is that yawing is the only movement the rudder can produce. As a result, the nose yaws downward, the airspeed increases, and the airplane starts losing altitude. At the same time, the airplane, being stable, attempts to stop the increased skidding by banking more steeply. The more steeply it banks, the more the nose is yawed downward by the right rudder action. The net result, of holding rudder alone, is a descending spiral unless back elevator pressure is applied. Thus, it can be seen that rudder alone cannot produce a balanced turn. Coordinated application of aileron, rudder, and elevator pressure will produce a balanced flight condition.

On the ground, the T-6A rudder pedals manipulate the nose wheel steering (if engaged), which is used to directionally control the aircraft while taxiing. Taxiing will be discussed in greater detail in Chapter Four, Ground Procedures.

Primary Control Application. The following will always be true in controlled flight, regardless of the airplane’s attitude in relation to the earth:

1. When backpressure is applied to the elevator control, the airplane’s nose rises in relation to the pilot.

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

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

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

5. When pressure is applied to the right rudder pedal, the airplane’s nose moves to the right in relation to the pilot.

6. When pressure is applied to the left rudder pedal, the airplane’s nose moves to the left in relation to the pilot.

205. SECONDARY FLIGHT CONTROLS - TRIM DEVICES

The secondary flight controls include electrically actuated pitch/roll/yaw trim systems and a rudder Trim Aid Device (TAD). The secondary flight controls are used for trimming and balancing the aircraft in flight and to reduce the force required to actuate the primary flight control surfaces.

Trimming the aircraft is an essential skill for you to master and its importance is often overlooked by fledging aviators. When an aircraft's flight conditions (attitude, power, airspeed, loading and configuration) are changed, the control pressures required to maintain the desired conditions are affected by the resulting changes in aerodynamic forces. The T-6A is equipped with systems that allow you to trim the aircraft for balanced flight in all axes.

Trim System and Switches

The elevator and aileron trim system utilizes a thumb-actuated switch (Figure 2-11) at the top of the control stick (fore/aft for elevator trim and left/right for aileron trim). The rudder trim switch is located on the forward side of the Power Control Lever (PCL). To trim, deflect the trim switch in the same direction as the applied flight control force until that force is relieved. When perfectly "trimmed," you can release flight control pressures (momentarily) and the aircraft will remain in its current balanced state. The Trim Interrupt button on the control stick will remove electrical power from the trim devices and is used during certain trim malfunctions. The general sequence for trimming the aircraft is: Rudder, Elevator and then Aileron. The rudder trim is usually first because a correction for yaw precipitates a change in the trim setting for pitch and roll. Consequently, not trimming the rudder first will generally cause you to go back and re-trim the elevator and aileron after trimming the rudder.

Figure 2-11 Control Stick

Rudder trim. An electromechanical actuator located in the vertical stabilizer, which drives an anti-servo trim tab on the trailing edge of the rudder, provides rudder trim. Reference the balance ball of the turn and slip indicator to help determine the proper direction of rudder and rudder trim pressure. For example, if the ball is out to the right, the nose is actually out to the left and you are in unbalanced flight. Smoothly apply right rudder pressure ("Step On The Ball") to regain balanced flight. Then smoothly apply right rudder trim until you relieve the rudder pressure you are holding. If you have trimmed properly, the ball should stay in the center when you raise your toes off the rudder pedals and you should feel as if you are flying straight and level.

TAD. The rudder TAD of the T-6A assists in trimming about the yaw axis of the aircraft. The inputs to the TAD include engine torque, altitude, airspeed, and pitch rate. Based on these inputs, the TAD sends a signal to the rudder trim actuator physically moving the trim tab surface to a computed position. Although the TAD is effective at approximating a valid rudder trim position, it by no means replaces the need to appropriately apply the rudder, especially during rapid accelerations and large power changes.

Remember any pilot-actuated electric rudder trim inputs are additive to the trim input the TAD commands. Thus, a good method during minor trim changes is to allow the TAD to complete its trim cycle, then make fine adjustments as necessary. Loss of the TAD in flight does not affect the overall controllability of the aircraft and its loss would minimally impact most training missions.

Elevator trim. Elevator trim is provided by an electromechanical actuator which drives a tab surface on the right side of the elevator. To trim the aircraft nose attitude, first move the stick to position the nose for the attitude you desire in relation to the horizon. As the fore/aft stick force increases, maintain the desired nose attitude and apply elevator trim in the opposite direction as the control pressure (i.e., pull back against control pressure, pull back on the trim button) until it is relieved. Always use a light grip on the stick so as to "feel" the pressure. "Finger-tip control" is the key to smooth flying.

Aileron trim. The aileron trim is utilized much like the elevator trim but about the longitudinal or roll axis of the aircraft. Interestingly, unlike the other two trim systems that utilize movement of trim tab surfaces on their trailing edges (rudder and elevator); aileron trim in the T-6A is accomplished by physical movement of the ailerons (+/- 6°). Ground adjustable trim tabs are installed on the trailing edge of each aileron to allow maintenance personnel to adjust the "neutral" setting. Aileron trim is only necessary if, after the rudder is trimmed, the aircraft tends to roll to one side.

206. TRIM REQUIREMENTS - RUDDER/ELEVATOR

When airspeed is increased (with power unchanged), the nose will have a tendency to rise and the aircraft will yaw slightly to the right; consequently, we need to add left (rudder) and down (nose down) trim. If power is unchanged and airspeed is reduced, we see from the box above that right rudder trim and up elevator trim is needed. If airspeed is constant and power is increased, then right rudder trim and down elevator trim is needed. If power is reduced with airspeed constant, then left rudder trim and up elevator trim are necessary.

Acceleration	LEFT/DOWN
Deceleration	RIGHT/UP
Power Addition	RIGHT/DOWN
Power Reduction	LEFT/UP

Figure 2-12 Trim Gouge

Aside from these four basic scenarios, many flight maneuvers combine two of the "rules" simultaneously. For example, when initiating a 180 knot climb from normal cruise (200 knots, level), you add power, raise the nose, and decelerate. In this case, right rudder trim is required for both the power addition and deceleration; however, the requirement conflicts on what to do with the elevator (power addition = nose down/deceleration = nose up). In this example, trim "nose up" because, generally speaking, in opposing situations such as this one, airspeed will have a greater and more lasting effect on the elevator and rudder trim. Therefore, as a common trim rule, *"Airspeed trumps Power."*

207. 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 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, the actual amount of deflection of the control surfaces is of little importance as long as you reach the desired result.

When using the rudder pedals, pressure should be applied smoothly and evenly by pressing with the ball of one foot just as when using the brakes of an automobile. The rudder pedals are interconnected and act in opposite directions; when pressure is applied to one pedal, pressure on the other must be relaxed proportionally. For positioning, comfortably rest the balls of your feet against the lower portion of the rudder pedals while supporting the weight of your feet on the cockpit floor. The pedals should be adjusted so that full throw is available with a slight flex in the knee.

208. POWER CONTROL LEVER

The PCL controls the power output of the engine (Figure 2-13). This power, transmitted through the propeller, produces thrust. As discussed in the previous chapter, this thrust will propel the aircraft through the air, developing lift. When sufficient power is combined with the appropriate AOA, the desired performance is obtained.

Moving the PCL forward increases power; moving it aft decreases power. If a constant airspeed is maintained with adjustments in the attitude relative to the horizon, a variation in power will control the gain or loss of altitude. This concept of control establishes a basic fundamental of the mechanics of any powered flight**.**

The PCL should be operated firmly but smoothly. You will learn to set the desired power with your peripheral vision and then go back and fine-tune the power as required for a particular maneuver. Occasionally check to see that the desired power setting is still in fact set.

Figure 2-13 T-6A PCL

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CHAPTER THREE
FUNDAMENTAL FLIGHT CONCEPTS

300. INTRODUCTION

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.

301. FUNDAMENTAL FLIGHT MANEUVERS

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

1. Straight and level flight

2. Turns

3. Climbs

4. 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 aircrew see this relationship exactly the same, especially between the front and rear cockpits. 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.

302. INTEGRATED FLIGHT INSTRUCTION

In introducing the basic flight maneuvers, the "integrated flight instruction" method will be used. This means that each flight maneuver will be performed by using both outside visual references and the flight instruments.

When aircrew use this method, they achieve a more precise and competent overall flying ability. This results in less difficulty holding desired altitudes and more control of airspeed during takeoffs, climbs, descents, and landing approaches; and maintaining headings in the traffic pattern.

A sharp lookout for other aircraft must be maintained at all times, particularly when using instrument references, to avoid the possibility of a collision. Frequently, other aircraft are unnoticed until they suddenly appear within the limited area of one or both aircrews' vision. Consequently, it is imperative to not only divide attention between controlling the airplane by outside visual references and flight instruments, but also be observant of other aircraft. For visual flight, scanning should be directed outside the cockpit at least 80 - 90% of the time!

303. ATTITUDE FLYING

Airplane control is composed of four components:

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

Bank control: Bank control is the control of the airplane's lateral axis about its longitudinal axis by use of the ailerons to attain the desired Angle of Bank (AOB) in relation to the horizon.

Yaw control: Yaw control is the control of the aircraft's longitudinal axis about its vertical axis by use of the rudder.

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

The Electronic Attitude Director Indicator (EADI) displays both the pitch and bank attitude of the aircraft and the Electronic Horizontal Situation Indicator (EHSI) shows the aircraft's direction of flight.

1. The attitude indicator (EADI) shows directly both the pitch and bank attitude of the airplane.

2. The heading indicator (EHSI) shows directly the airplane's direction of flight.

3. The altimeter indicates the airplane's altitude and, indirectly, the need for a pitch change.

4. The vertical speed indicator shows the rate of climb or descent.

5. The airspeed indicator shows the results of power and/or pitch changes in the airplane's speed.

The outside visual references used in controlling the airplane include the airplane's nose and wingtips to show both the airplane's pitch attitude and flight direction with the wings and frame of the windscreen showing the AOB.

304. "SEE AND AVOID" DOCTRINE

Simply stated, the "See and Avoid" Doctrine is the aircrew'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/she had been using their eyes properly. As an NFO, it is imperative that you back-up your pilot and use your extra set of eyes to clear the airspace around you.

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.

The eye is vulnerable to just about everything: dust, fatigue, emotion, germs, age, optical illusions, and effects from alcohol consumption. In flight, our vision is affected by atmospheric conditions, windscreen distortion, too much or too little oxygen, acceleration, glare, heat, lighting, and aircraft design. Most importantly, the eye is vulnerable to the vagaries of the mind. We "see" and identify only what the mind lets us see. For example, a daydreaming pilot staring into space sees no approaching traffic and is a number one candidate for a midair collision.

A constant problem source to the pilot (though he/she is probably never aware of it) is the time required for "accommodation." Our eyes automatically accommodate for (or focus on) near and far objects. But the change from something up close, like a dark panel two feet away, to a well- lighted landmark or an aircraft target a mile or so away, takes one to two seconds or longer for eye accommodation. That can be a long time when you consider that you need 10 seconds to avoid a midair collision.

Another focusing problem occurs on drab, colorless days above a haze or cloud layer when no distinct horizon is visible. If there is little or nothing to focus on, we do not focus at all. We experience something known as "empty-field myopia”; we stare but see nothing, not even opposing traffic.

The effects of "binocular vision" have been studied by the National Transportation Safety Board (NTSB) during investigations of midair collisions. The board concluded that this is also a causal factor. To actually accept what we see, we need to receive cues from both eyes. If an object is visible to one eye, but hidden from the other by a windscreen post or other obstruction, the total image is blurred and not always accepted by the mind.

Another inherent eye problem is that of narrow field of vision. Although our eyes accept light rays from an arc of nearly 200º, they are limited to a relatively narrow area (approximately 10-15º) in which they can actually focus on and classify an object. Though we can perceive movement in the periphery, we cannot identify what is there. We tend not to believe what we see out of the corner of our eyes. This often leads to "tunnel vision."

That limitation is compounded by the fact that at a distance, an aircraft on a collision course will appear to be motionless. It will remain in a seemingly stationary position, without appearing either to move or to grow in size for a relatively long time, and then suddenly bloom into a huge mass filling the canopy. This is known as "blossom effect." We need motion or contrast to attract our eyes’ attention. A large bug smear or dirty spot on the windscreen can hide a converging plane until it is too close to be avoided.

In addition to built-in problems, the eye is also severely limited by environment. Optical properties of the atmosphere alter the appearance of traffic, particularly on hazy days. "Limited visibility" actually means "limited vision." You may be legally Visual Flight Rules (VFR) when you have three miles visibility, but at that distance, on a hazy day, opposing traffic is not easy to detect. At ranges closer than three miles, even though detectable, opposing traffic may not be avoidable.

Lighting also affects our vision. Glare, usually worse on a sunny day over a cloud deck or during flight directly into the sun, makes objects hard to see and scanning uncomfortable. Also, a well-lighted object will have a high degree of contrast and be easy to detect, while one with low contrast at the same distance may be impossible to see. For instance, when the sun is behind you, an opposing aircraft will stand out clearly, but when you are looking into the sun, and your traffic is "back-lighted,” it is much more difficult to see.

A contrast problem exists when trying to see an airplane against a cluttered background. If an aircraft is between you and terrain that is varied in color or heavily dotted with buildings, it will blend into the background until it becomes quite close.

So what can be done to overcome the vulnerabilities of the eye? The most important thing is 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 as depicted in Figure 3-1. This does not, however, mean that the rest of the area should be ignored.

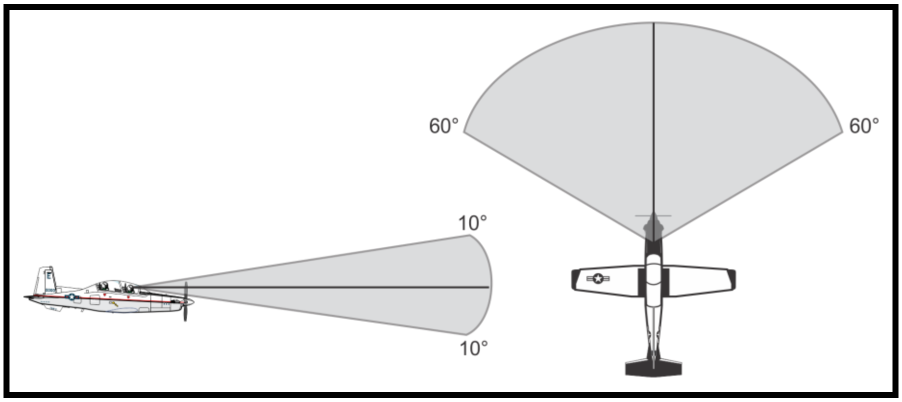

Figure 3-1 Outside Scan

The Traffic Advisory System (TAS) can enhance a pilot's visual scan by detecting several ***transponder equipped*** aircraft simultaneously. Depending upon the mode selected, a series of traffic advisory symbols (see T-6A NATOPS Flight Manual) may appear, enabling earlier visual detection of possible conflicting traffic. In this way, TAS effectively complements but does not replace the VFR scan for transponder equipped and non-transponder equipped aircraft, which remains the pilot's primary means to see and avoid conflicting traffic.

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. The other 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 you are expected to take the controls and/or initiate a deviation in bank, pitch or power (or combination of these) as required 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. If a TAS advisory is encountered outside the landing pattern, cease dynamic maneuvering and attempt to gain visual contact with traffic. ***Do not*** make a traffic avoidance maneuver, based on TAS, until you have acquired the traffic visually.

If you are not at the controls, you are expected to call out the traffic using the "clock code" and classify the traffic as a "factor" (collision or near mid-air possible) or "no factor" (no risk of collision or near mid-air). If you are not at the controls, it is imperative that any communications for an impending collision be ***directive before descriptive. Directive*** communications involve moving the aircraft with your words and particularly with your intonation. It is perfectly acceptable and expected of you to yell ***"Break right, traffic on the nose!!!"*** in order to avoid a collision. The "break right" is the ***Directive Comm*** as it commands the pilot at the controls to move the aircraft. The "traffic on the nose" is the ***Descriptive Comm*** and explains why the ***Directive Comm*** is necessary. Sometimes, there is neither time nor SA to provide ***Descriptive Comm*** and that is ok as long as the ***Directive Comm*** gets passed and collision is avoided.

305. FLIGHT INSTRUMENTS

Of the basic skills required for flight, instrument interpretation requires the most thorough study and analysis. It begins with your understanding of each instrument's construction and operating principles. Then you must apply this knowledge to the performance of the aircraft you are flying, the particular maneuvers to be executed, the scan and control methods, and the flight conditions in which you are operating. For each maneuver, you will learn what performance to expect and the combination of items that you must interpret in order to control aircraft attitude during the maneuver.

For flight that is not restricted to cockpit references for setting aircraft attitudes, the following flight instruments (located in the center of the instrument panel) will comprise the group to be used as "crosscheck" or performance instruments in succeeding chapters:

1. Attitude Indicator (EADI)

2. Altimeter

3. Vertical Speed Indicator (VSI)

4. Airspeed Indicator

5. Heading Indicator (EHSI)

6. Turn and Bank Indicator (Turn needle and ball)

NOTE

For a complete discussion of these instruments, refer to the T-6A NATOPS Flight Manual Chapter I.

306. 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:

1. Look outside the airplane to see where you are going.

2. Look at the aircraft with respect to the horizon to check and maintain a desired attitude.

3. 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.

It might seem that the task of having to be aware of so many events and circumstances at the same time is impossible; however, the ability to do so is an integral part of your flight training and can be developed naturally. Of course, as in any endeavor, its development is expedited by a conscientious effort to learn.

In order to divide your attention, your development of an efficient scan pattern will offer the most efficient means by which you can readily ascertain required information and not dwell on any one item with subsequent failure to notice other equally important details.

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, thoroughly and completing the pattern at the starting point. A scan pattern may be started anywhere, but it must be complete and continuous.

What we refer to as the integrated scan involves combining contact flying and flight instruments through a systematic pattern. The task of scanning in contact flying (VMC) 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 of an ***outside-inside-outside*** scan:

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 EADI and correct nose position with the altimeter and 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 of 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 with 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. 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.

There are other methods of scanning, some of which may be more effective for you than the preceding type. Figures 3-2 and 3-3 illustrate other frequently utilized outside scan patterns.

Figure 3-2 Side-to-Side Scanning Method

For Side-to-Side scans (Figure 3-2) start at the far left of your visual area and make a methodical sweep to the right, pausing in each block of viewing area to focus your eyes. At the end of the scan, return to the instrument panel, then start over.

Figure 3-3 Front-to-Side Scanning Method

An equally effective scan pattern is the Front-to-Side method illustrated in Figure 3-3. In this pattern, start in the center block of your visual field (center of front windscreen), move to left focusing in each block, then, after reaching the last block on the left, swing quickly back to the center block and repeat the performance to the right. At the end of the scan, return to the instrument panel and start over. There are no real advantages or disadvantages of one method over the other. Use the method that works best for you.

In order to establish an efficient and useful scan in flight, one also has to establish a good internal (instrument) scan and learn to give each instrument its proper share of time. The amount of time spent scanning outside the cockpit in relationship to inside depends on cockpit workload and traffic density.

Remember, while you are looking at the instruments, the nose attitude and wing position may become erratic, and while you look at the nose position and correct it, the instrument readings may vary. You cannot afford to gaze at any one item for any 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 your nose and wings are blind spots. Never assume that others see you!

307. BALANCED FLIGHT

Balanced flight exists when the aircraft is neither in a slip nor a skid as it progresses along a flight path. With respect to balanced flight, there are two principles of control application:

1. Any control deflection will result in an attitude change until the control is returned to neutral.

2. There is a definite aerodynamic interrelationship between the rudder and aileron to maintain balanced flight.

For an aircraft to be in a balanced flight condition, the controls must be applied so that the longitudinal axis lies in the plane of forward motion. The utilization of either the rudder or the ailerons, independent of one another, will result in a condition of unbalanced flight. The "turn and bank" indicator indicates an unbalanced condition by the ball moving away from the center position in the direction of the slip or skid. The pilot can also recognize this condition by an awareness of a sensation of sideways motion. The sideways motion causes a tendency to lean in the direction of the slip or skid. This unbalanced condition can be corrected by the proper application of the rudder, ailerons, or both.

308. TURNS

The turn is the most complex of all the basic flight maneuvers. During the turn, coordinated use of all three flight controls is required. Although there are other important considerations, the first requirement for the turn is that balanced flight be maintained.

You will recall that when an airplane is flying straight and level, the total lift is acting perpendicular to the wings and to the earth. As the airplane is banked into a turn, the lift then becomes divided into two components. One, the vertical component, continues to act perpendicular to the earth and opposes gravity. The other, the horizontal component, acts parallel to the earth's surface and opposes centrifugal force caused by the turn. These two lift components act at right angles to each other, causing the resultant lifting force to act perpendicular to the banked wings of the airplane. It is this lifting force that actually turns the airplane, not the rudder.

When applying aileron to bank the airplane, the depressed or lowered aileron (on the rising wing) produces more drag than the raised aileron (on the lowering wing). As previously discussed this increased aileron drag, which is called adverse yaw, tends to yaw the airplane towards the rising wing, or opposite to the desired direction of turn, while the banking action is taking effect. To counteract the yawing tendency, rudder pressure must be applied simultaneously in the desired direction of turn. This produces a coordinated turn.

After the bank has been established in a theoretically perfect turn, in smooth air, all pressure on the aileron control may be relaxed. The airplane will remain at the bank angle selected with no further tendency to yaw since there is no longer a deflection of the ailerons. As a result, pressure may also be relaxed on the rudder pedals, and the rudder allowed to streamline itself with the direction of the air passing it. If pressure is maintained on the rudder after the turn is established, the airplane will tend to skid to the outside of the turn. If a definite effort is made to center the rudder rather than let it streamline itself to the turn, it is probable that some opposite rudder pressure will be exerted inadvertently. This would tend to force the airplane to yaw opposite its original turning path. As a result, the airplane would tend to slip to the inside of the turn. The balance ball in the turn indicator will be displaced off-center whenever the airplane is skidding or slipping (Figure 3-4).

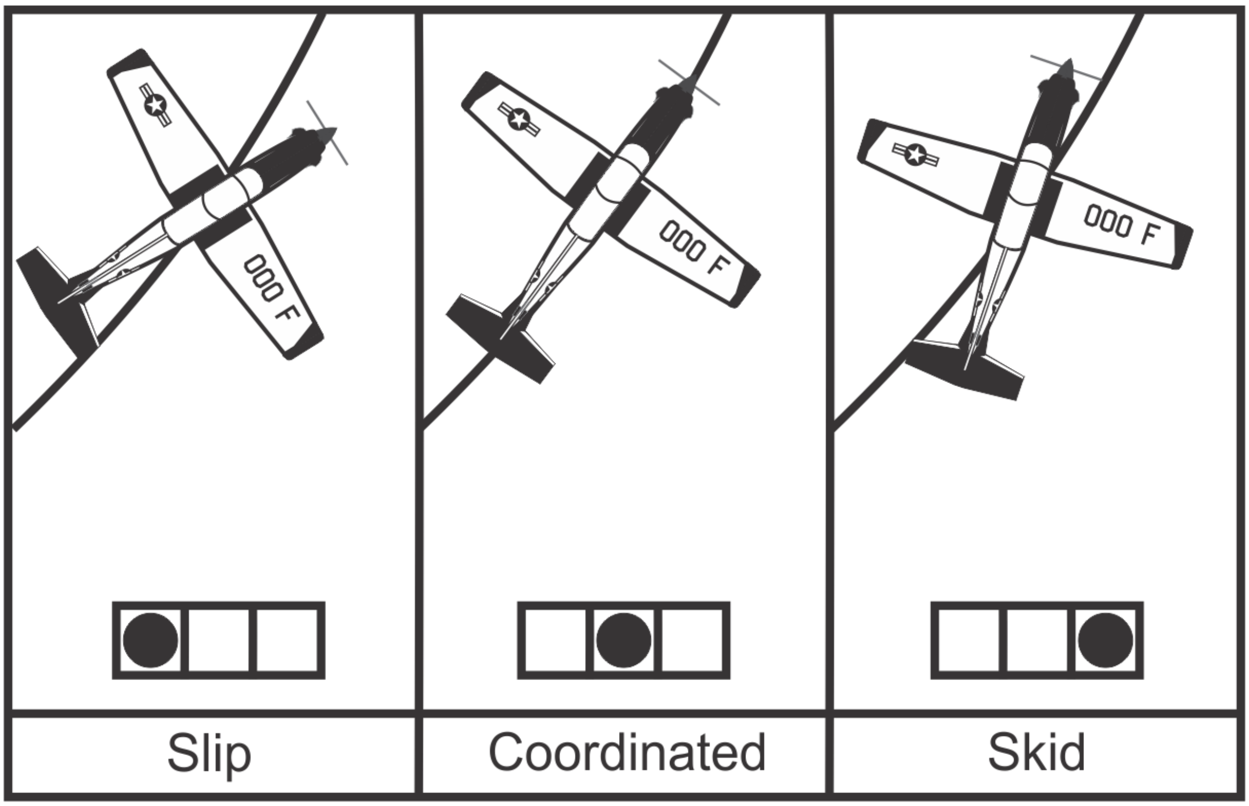

Figure 3-4 Coordinated vs. Uncoordinated Turns

In all turns in which a constant altitude is to be maintained, it is necessary to increase the AOA by applying back elevator pressure. This is required because the lift produced to equal the weight of the airplane and the centrifugal force caused by the turn must be obtained from the wing to maintain altitude. The force of lift must be further increased as the turn becomes steeper and the centrifugal force builds up, but must be slowly decreased as the airplane is being rolled back to level flight when completing the turn.

To stop the turn, the wings must be returned to laterally level flight by the use of the ailerons, and the resulting adverse yaw (now acting in the same direction as the turn), must be overcome by the coordinated application of rudder. The yaw effect will often be more apparent when rolling out of a turn than rolling into a turn, due to the higher angle of attack and wing loading which exists when the rollout is started.

To understand the relationship between airspeed, bank, and radius of turn, it must be recalled that the rate of turn at any given airspeed depends on the amount of sideward force causing the turn; that is, the horizontal component. The horizontal lift component varies in proportion to the amount of bank. Thus, the rate of turn at a given airspeed increases as the AOB is increased. On the other hand, when a turn is made at a higher airspeed for a given bank angle, the centrifugal force created by the turn becomes greater, causing the turning rate to become slower with an increase in radius of turn. It can be seen, then, that at a given angle of bank, a higher airspeed will make the radius of the turn larger because the airplane will be turning at a slower rate.

The inherent positive stability of the T-6A wing has an effect on the manner in which it turns. Turns in the T-6A may be divided into three types: shallow, moderate, and steep. Briefly, if a shallow angle of bank turn is established and the controls released, the aircraft tends to return to wings level flight. This may not always occur, because friction in the control surface rigging may cause a very slight control deflection. In a moderately banked turn, if the aileron and rudder pressures are released, the aircraft will tend to stay at the established angle of bank. In a steep AOB turn, the aircraft will tend to increase its bank. The actual amount of AOB for each type is undefined and varies with changes in airspeed and configuration.

As in all maneuvering, the aircrew should form the habit of ensuring that the area towards which a turn is to be made is clear of other aircraft. If nearby aircraft are not detected before lowering the wing, it may be too late to avoid a collision.

As soon as the airplane rolls from the wings-level attitude, the nose should also start to move along the horizon, increasing its rate of travel proportionately as the bank is increased. Any variation from this will be indicative of the particular control that is being misused. The following variations provide excellent guides:

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

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

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

During all turns, the ailerons and rudder are used to correct minor variations just as they are in straight-and-level flight; however, during very steep turns, considerably more back elevator pressure and trim is required to maintain altitude than in shallow and moderate turns, and additional power may be needed to maintain a safe airspeed. Frequently, there is a tendency for the airplane's nose to lower, resulting in a loss of altitude.

To recover from an unintentional nose-low attitude during a steep turn, the pilot should first reduce the AOB with coordinated aileron and rudder pressure. Then back elevator pressure should be used to raise the airplane's nose to the desired pitch attitude. After accomplishing this, the desired AOB can be reestablished. Attempting to raise the nose first by increasing back elevator pressure will usually cause a tight descending spiral, and could lead to overstressing the airplane or stall.

309. THE ONE-THIRD RULE

Since the airplane will continue turning as long as there is any bank, the rollout must be started before reaching the desired heading. The amount required to lead the heading will depend on the rate of turn and the rate at which the rollout will be made; however, a good rule of thumb is to start the rollout one-third the number of degrees of AOB in use. Example: If a 30º AOB turn was being used, the rollout would be started 10º prior to the desired heading. As the wings become level, the control pressures should be gradually and smoothly released so that the controls are neutralized as the airplane assumes straight-and-level flight. As the rollout is being completed, attention should be given to outside visual references as well as the EADI and EHSI to determine that the wings are being leveled precisely and the turn stopped on the proper heading.

310. SKID

A skid occurs when the aircraft slides sideways away from the center of a turn. It is caused by too much rudder pressure in relation to the AOB used. In other words, if you try to force the aircraft to turn faster without increasing its bank angle, 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. Figure 3-5 shows a coordinated turn and a skid.

A skid may also occur when you are flying in a level flight attitude if the nose of the aircraft is permitted to move sideways along the horizon when the wings are level. This condition would occur when excessive rudder pressures are applied or when the aircraft is improperly trimmed. A skidded turn can develop into a dangerous situation when in close proximity to the ground, such as trying to correct from overshooting the turn to final in the traffic pattern. 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 and a very rapid roll in the direction of the stalled wing. This will likely result in the aircraft becoming inverted or even entering into a spin.

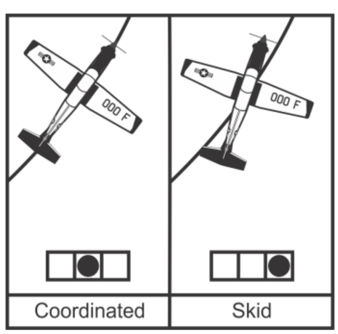

Figure 3-5 Skidded vs. Coordinated Turn

311. SLIP

A slip occurs when the aircraft slides sideways towards the center of the turn. It is caused by an insufficient amount of rudder in relation to the amount of aileron and the AOB 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 slide sideways towards its center of turn. 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. Although any unccordinated turn results in a further increase in stall speed, a stall encountered from a slip will result in a roll towards a wings-level attitude, as the outside wing will stall first. Any ***inadvertent tendency*** to fly in an out-of-balanced flight (either a slip or skid) is ***not*** an acceptable practice.

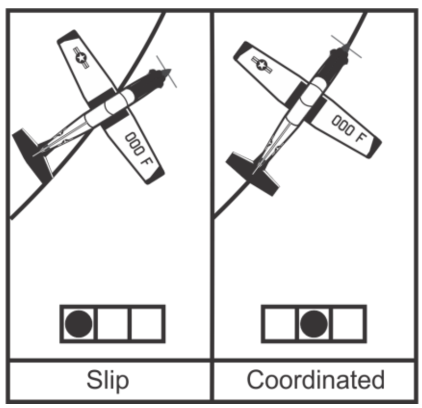

Figure 3-6 Coordinated vs. Slip Turn

The flight paths for a coordinated turn and a slipping turn are depicted in Figure 3-6. During a turn, balanced flight is maintained by causing the aircraft to move in a curve at a rate which is in direct proportion to its bank angle. The AOB is established by the coordinated application of ailerons and rudder. The amount of rudder required to establish a turn is dependent upon the rate at which the AOB is established. In other words, rolling into a turn rapidly requires more rudder than rolling into the same turn slowly. This interrelationship is absolute and should be thoroughly understood.

The overlapping function of the controls provides a safety factor in the control of the aircraft. It is quite possible to fly the plane without the use of one or more controls. For example, suppose that the elevators failed to operate properly. It is possible to control the position of the nose by the use of power. As the power is increased, the nose will rise; as the power is decreased, the nose will drop.

It is also possible to bank the airplane and to turn it without the use of the ailerons. Using only the rudder, the plane can be turned in any desired direction. This use of the rudder will cause the aircraft to yaw or skid in the direction in which the rudder is applied. During the yawing motion, the outside wing moves faster through the air than the inside wing. This increases the lift of the outside wing, causing it to rise, thus producing a bank in the direction in which the rudder is applied. A turn can also be accomplished by using only the ailerons. In this instance, the aircraft will have a tendency to slip before it begins to turn.

The foregoing discussion was given to show the advantage of the overlapping functions of the controls. It must be emphasized, however, that smooth and balanced flight can only be achieved through the proper coordinated use of all controls. You can also make it easy on yourself by trimming the aircraft.

312. WIND EFFECTS AND CRAB CORRECTIONS

All aircraft must operate in an air mass and any movement of this 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 heading in which it is pointed, but also by the direction and velocity of the air mass it is moving through. In perfectly still air, for example, the nose of the aircraft points in exactly the same direction as its path over the ground, or to put it another way, the path of the aircraft through the air and its path over the ground coincide; however, you will notice the aircraft does not always follow a course over the ground in the same direction the nose is pointed.

You have been or will be, at one time or another, flying parallel to a road or section line. The longitudinal axis of the aircraft is aligned perfectly with this road or section line and you are flying a straight and level course. Suddenly, you realize that the aircraft is getting closer to the road or has actually crossed it, without any turn having been made. This would indicate to you that the air in which you are flying is moving in a direction which has caused the aircraft to cross the road at some angle.

Suppose you were flying along straight and level and the wind was blowing 30 knots from a direction 90º to your left. At the end of one hour, the body of air in which you were flying would have moved 30 miles to your right. 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 groundtrack, 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 same 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 3-7).

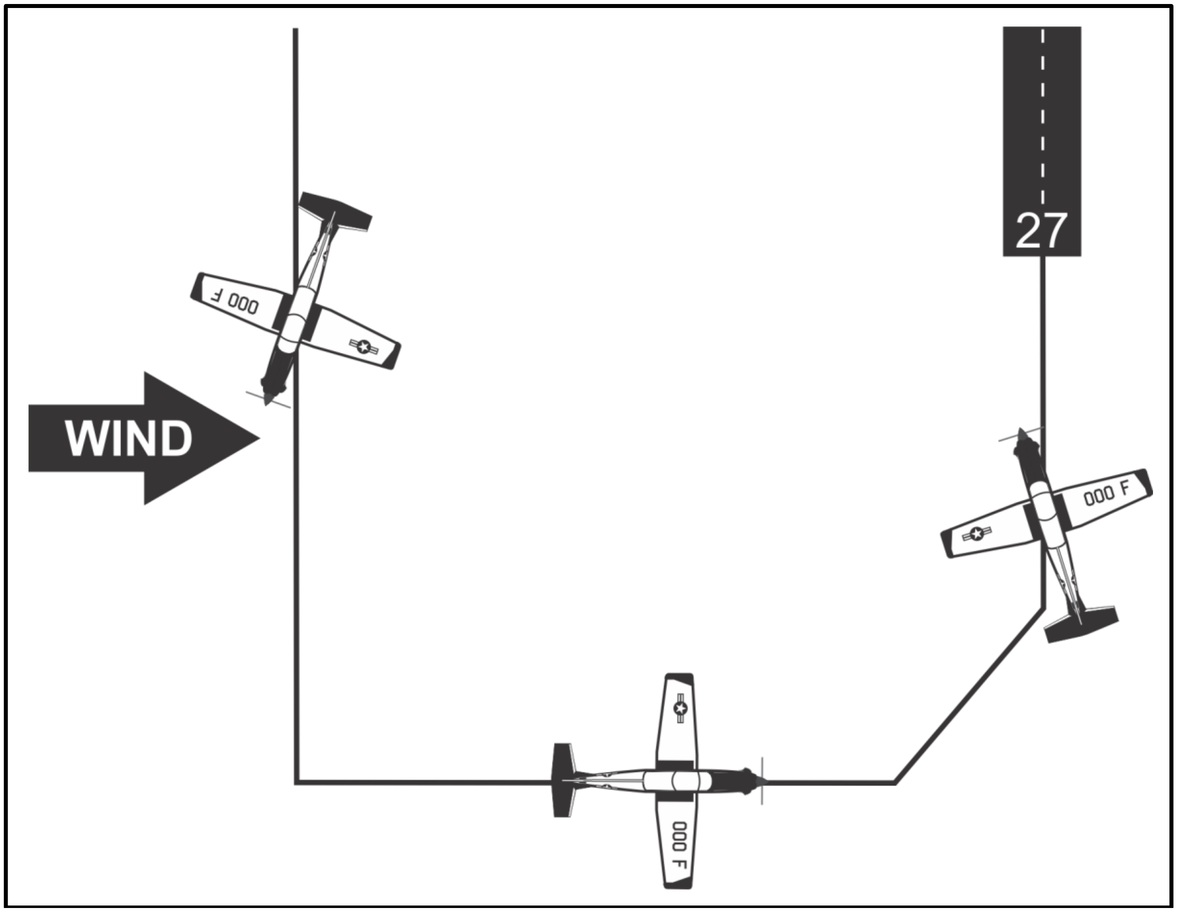

Figure 3-7 "Crabbing" Flight Path

313. CLIMBING FLIGHT

For an automobile to go uphill at the same speed as that being maintained on a level road, the driver must "step on the gas"; that is, power must be increased. This is because it takes more work to pull the car’s weight up the hill and to maintain the same speed at which the car was moving along the level road. If the driver did not increase the power, the automobile might still climb up the incline, but it would gradually slow down to a speed slower than that at which it was moving on the level road.

Similarly, an airplane can climb at the cruise power setting with a sacrifice of speed, or it can, within certain limits, climb with added power and no sacrifice in speed. Thus, there is a definite relationship between power, attitude, and airspeed.

When transitioning from level flight to a climb, the forces acting on the airplane go through definite changes. After the addition of power, an increase in lift occurs when back pressure is applied to the elevator control. This initial change is a result of the increase in the AOA, which occurs when the airplane’s pitch attitude is being raised. This results in a climbing attitude. When the inclined flight path and the climb speed are established, the AOA and the corresponding lift again stabilize.

As the airspeed decreases to the climb speed, the downward force of the air striking the horizontal stabilizer becomes less, creating a longitudinally unbalanced condition that produces a tendency for the airplane to nose down. To overcome this tendency and maintain a constant climb attitude, additional back pressure must be applied to the elevator control.

The primary factor which affects an airplane's ability to climb is the amount of excess power available; that is, the power available above that which is required for straight-and-level flight.

During the climb, lift will increase with the flight path, so that it is not directly opposing gravity to support the airplane's weight. With the flight path inclined, the lift is partially acting rearward. This adverse or retarding lift is termed induced drag. This adds to the total drag. Since weight is always acting perpendicular to the earth's surface and drag is acting in a direction opposite to the airplane's flight path during a climb, it is necessary for thrust to offset both drag and gravity.

As the aircraft continues to climb at a constant angle of attack, torque will drop off as air density decreases. The volume of air entering the induction system gradually decreases, resulting in a pressure reduction within the combustion chamber. Consequently, power decreases. The PCL must be continually advanced to maintain constant power.

314. CLIMBING TURNS

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

1. 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.

2. The bank angle should be neither too steep nor too shallow. Too steep a bank intensifies the effect mentioned above. If too shallow, the AOB may be difficult to maintain because of the inherent stability of the airplane.

3. A constant airspeed, a constant rate of turn, and a constant AOB must be stressed. The coordination of all controls is likewise a primary factor to be stressed and developed.

4. The airplane will have a greater tendency towards nose-heaviness than in a normal straight climb, due to the decrease in effective lift that is the case in all turns.

5. 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 AOB 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.

315. DESCENDING FLIGHT

When the power is reduced during straight and level flight, the thrust needed to balance the airplane’s drag is no longer adequate. Due to the unbalanced condition, the drag causes a momentary reduction in airspeed. This decrease in speed, in turn, results in a corresponding decrease in the wing’s lift. The weight of the airplane now exceeds the force of lift so the resulting flight path is downward, with the force of gravity providing a portion of the forward thrust. In effect, the airplane is actually going "downhill."

As in entering a climb, the forces acting on an airplane again go through definite changes when transitioning from level cruising flight to a descent. When forward pressure is applied to the elevator control or the airplane’s pitch attitude is allowed to lower, the wing’s AOA is decreased, the lift is reduced, and the flight path starts downward. The initial reduction of lift, which starts the airplane downward, is momentary. When the flight path stabilizes, the AOA and lift stabilize.

316. THE P.A.T. PRINCIPLE

For corrections and to execute many maneuvers you must:

1. Set/reset power

2. Adjust the nose attitude

3. Trim for the new power and attitude

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

1. **P**ower

2. **A**ttitude

3. **T**rim

Although power and attitude changes are almost simultaneous, lead with PCL movement. For example, consider the transition to an enroute 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.

NOTE

The power may not be exactly the 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.

CHAPTER FOUR
GROUND PROCEDURES

400. INTRODUCTION

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

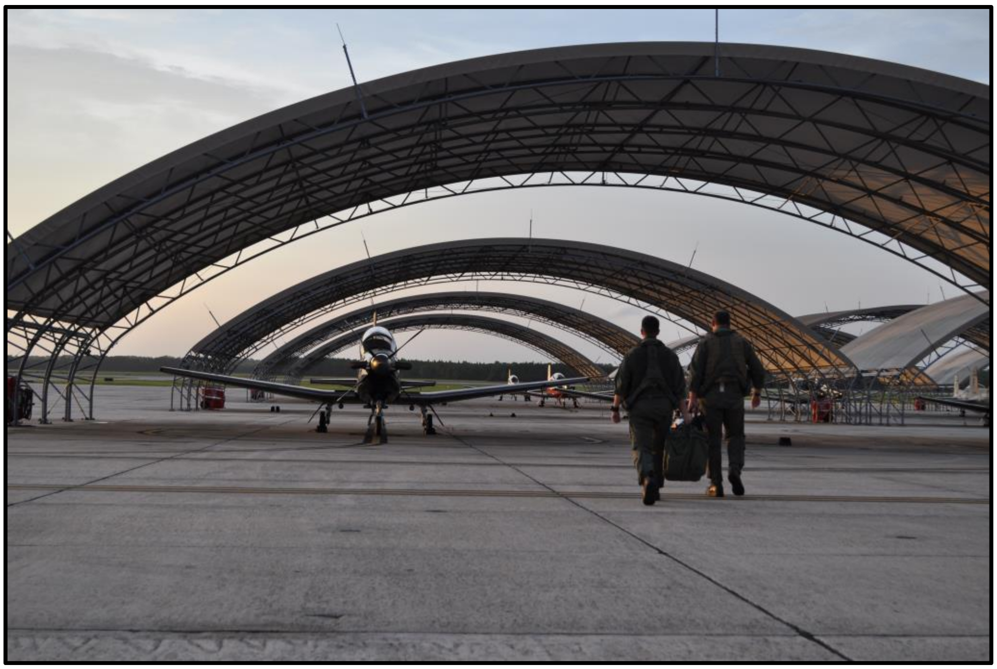

Figure 4-1 T-6A Preflight

In the line area, ***safety is paramount***. Aircraft are constantly taxiing in and out, and fuel trucks and maintenance personnel are often moving about. Constant vigilance must be exercised at all times while performing ground operations. The propeller is the most dangerous part of the aircraft for pedestrians, and under certain light conditions, it is difficult to see a revolving propeller. As a result, the files of aviation safety offices contain many cases reading: "Victim walked into a rotating propeller."

401. NAVAL AVIATION LOGISTICS COMMAND MAINTENANCE INFORMATION SYSTEM

The Naval Aviation Logistics Command Maintenance Information System (NALCOMIS) is the standard Navy-wide aviation maintenance system. It is a fully integrated, computerized system that allows input, tracking, and monitoring of discrepancy repair in real time. Aircrews use a Maintenance Action Form (MAF) to document aircraft discrepancies in NALCOMIS. Aircraft data is then integrated from NALCOMIS into the Aircraft Discrepancy Book (ADB). The ADB is primarily used for pre-flight operations by aircrew to check the aircraft's maintenance status.

All discrepancies are assigned either an UP or DOWN status. A discrepancy assigned an UP status does not impair the safety-of-flight or mission capability of the aircraft. An airplane may be flown with outstanding (not yet corrected) UP write-ups or gripes, with no danger to the crew. An example of an UP gripe would be "paint peeling off leading edge of starboard wing just forward of primary pitot tube." Notice the specific details used in this example. Detailed discrepancy reports foster a closer working relationship between aircrew and maintenance and save both time and money.

A discrepancy assigned a DOWN status immediately "downs" the aircraft until it is fixed. You must be able to interpret an outstanding MAF and determine whether the aircraft is safe for flight. Besides any uncorrected write-ups, discrepancies recorded over the past ten flights should be reviewed as a minimum.

402. CHECKLISTS

It is mandatory to use checklists to inspect, start, and ensure aircraft systems are operating properly. There are no excuses for lack of checklist discipline. Checklists ensure the standardization of all operating procedures pertaining to the aircraft and provide a logical, safe, and precise sequence to follow. Positively confirm completion of all checklists regardless of how they are accomplished (for example, memory aid, mnemonic, approved unit-developed checklist or flight crew checklist). The checklists will be conducted in the challenge-action-response format. This means you report the challenge, accomplish the required action, and state the appropriate response.

403. CONTACT C1201

Contact C1201 (FAM-0) is ground training you receive from a flight instructor to help prepare you for your first flight in the T-6A. This is your first opportunity to present yourself well-prepared, motivated, and ready for training.

You are required to wear/bring to the brief all of your flight gear. This includes the following items:

- Flight gloves
- Helmet/O_2 mask
- Harness
- G-Suit
- Dog tags
- Ejection-seat compatible kneeboard

- NATOPS pocket checklist (PCL)

- In-flight Guide

You may not have all of these items and some may be planned issues. Come to the brief with as many of the items as you have been previously issued. Your instructor will show you where the additional items can be obtained prior to your flights. If by the end of the FAM-0, you still have questions about flight gear, ask your instructor. Do not show up to your first flight unequipped!

You should be ready to discuss all the items listed under C1201 in the curriculum guide with the instructor. A major objective of the event is the preflight inspection. Study the T-6A NATOPS, Preflight Checklists, and all applicable discuss items for the C1201 found in the NFOTS master curriculum guide (CNATRAINST 1542.162 series).

404. FLIGHT BRIEFING

Prior to each flight you will be scheduled for a brief with your instructor, which usually lasts from 60 to 90 minutes, depending on the requirements. SNFOs are expected to arrive at a flight brief early enough to prepare the briefing space and board. An instructor's first impression of a student occurs in the brief and professionalism is critical. Students' appearance must reflect that of a Naval Officer and Naval Flight Officer. Additionally, students will prepare a briefing board by erasing any previous markings and using a black marker and straight-edge to neatly write all applicable briefing info on the board according to squadron standardization. Students will also pull up the appropriate event's e-brief and all applicable weather, NOTAMS, TFRs, BASH, etc. During the brief, the instructor will explain the conduct of the flight. The instructor will expect you to know the procedures for all the maneuvers to be flown per the syllabus. You must also be prepared with a thorough knowledge of all the discussion items. Additionally, the instructor may ask general questions from any subject area pertaining to T-6A systems, operating limitations, etc.

With respect to contact flight maneuvers, to "know" is to "memorize" each action of the procedure. Nothing less is acceptable. For emergency procedures, only boldfaced or asterisked items are required to be committed to memory, although you must have a thorough understanding of the remaining non-memory items and the systems involved. ***You cannot prepare for your contact flights solely with this manual.*** You must reference the NATOPS Flight Manual, Wing SOP, TW-5 Fixed Wing Operating Procedures, Squadron SOP, Course Rules, and applicable lectures and courseware. You are highly encouraged to ask questions during the brief. Do not fly with unanswered questions.

1. Emergency Procedures/Discussed Items

The Master Curriculum Guide (MCG) lists all maneuvers and items to be discussed for each flight. You should be prepared to answer in depth questions about any item listed under discussion. Ensure that you refer to any and all available resources when you are studying a particular item. For example, the FTI, T-6A NATOPS Flight Manual, Aeronautical Information Manual (AIM) and many ground school texts all contain information germane to your studies. Your instructor may quiz you on each discussion/demonstration and introduction item for that flight. Additionally, he/she may ask you about any maneuver previously introduced or any subject general in nature to the T-6A (systems, limitations, etc.). The T-6A MCG also has a listing of all emergency procedures to be discussed for each flight. The T-6A NATOPS Flight Manual lists these procedures and you are not only responsible for knowing the boldface in the Pocket Checklist (PCL) but also for reading the applicable chapters in NATOPS Section 3. For example, for the ***engine failure inflight*** briefing item, it is insufficient to know only the boldface. You should read the applicable section in NATOPS Section 3 and be familiar with the “Zoom” procedure as well as all other items associated with an ***engine failure***.

2. **Headwork, Procedures, and Basic Airwork**

a. Headwork - The ability to understand and grasp the meaning of instructions, demonstrations, and explanations; the facility of remembering instructions from day to day, the ability to plan a series or sequence of maneuvers or actions, the ability to foresee and avoid possible difficulties and the ability to remain alert and spatially oriented.

– Headwork is the instructor’s evaluation of the student’s situational awareness (SA), and his or her ability to effectively manage the aircrew responsibilities. An example of a measure of headwork is whether the student remembers to "aviate, navigate, and communicate" in the correct order. Another measure of headwork is whether the student is able to effectively communicate his or her SA. Headwork is purely a subjective item, and the student should never question the instructor’s assessment of his or her headwork.

b. Procedures - The demonstrated knowledge of the sequential steps required to perform the curriculum maneuvers and actions. Procedures are simply an instructor’s evaluation of the SNFO’s ability to recall and/or apply the correct procedures to any situation. This may include emergency procedures, or such things as in-flight checks. It may also include compliance to course rules or squadron SOP. Procedures are a fairly straightforward item.

c. Basic Airwork Recognition- Recognized/Demonstrated mastery of the PCL and flight controls to obtain the desired attitude, heading, airspeed and altitude consistently through a range of maneuvers.

3. **Fuel Considerations**

Awareness of fuel quantity and the aircraft’s range and endurance is essential and must be constantly monitored throughout the flight. Regular fuel checks are required and are an important part of each mission. Bingo fuel and at least one Joker fuel are briefed on every mission.

a. Joker fuel is set at pre-planned transition points in the sortie. For example, a Joker fuel of 750 lbs. might be used to depart the working area to ensure enough fuel to accomplish pattern operations. A mission may require several joker fuels.

b. Bingo fuel is the fuel at which recovery should be initiated to arrive at the intended destination with the required fuel. On most T-6 syllabus training sorties, recovery is often initiated prior to reaching bingo fuel due to sortie duration limitations. Mission priorities and flight conditions may change while airborne (area assignment, weather conditions, alternate airfield requirements, etc.) The aircraft commander may adjust joker and bingo fuels during flight to accommodate mission conditions.

405. PREFLIGHT INSPECTION

The pilot who accepts an airplane for flight is in effect the commanding officer of that plane and is responsible for the efficient operation and safety of the aircraft, its equipment and its crew. Prior to every flight, a thorough preflight inspection must be performed by all aircrew.

A poor preflight may easily result in an embarrassing, if not dangerous, situation. Any pilot who thinks that there is a possibility that a discrepancy exists which would make the aircraft unsafe for flight should "down" the plane, inform maintenance of the trouble, and write a thorough and comprehensive description of the trouble on the Maintenance Action Form (MAF). Each pilot, in signing the aircraft acceptance form ("A-Sheet") prior to the flight, acknowledges acceptance of the aircraft in a satisfactory, safe-for-flight condition. He/She should always keep in mind that mistakes are sometimes made even by the most competent mechanics. All aircrew must, therefore, make their inspections accordingly.

Regardless of the number of items you check on a preflight, you will forget something unless you follow a systematic pattern each time. For this reason, the Preflight procedure published in the T-6A NATOPS Flight Manual shall be used by all aircrew.

As you approach your aircraft, notice its position and the position of adjacent aircraft in relation to the yellow parking spots. An aircraft parked too far off the spots may have insufficient taxi clearance. Also note the position of fire bottles and other obstructions in relation to the path of your aircraft as you leave the chocks. Although a signalman will direct you out, you have the final responsibility to see that the aircraft clears all obstructions.

406. EJECTION SEAT SAFETY

“Respect the Seat.” Think of this motto every time you get in and out of a T-6A or any other ejection seat airplane. Ejection seat and Canopy Fracturing System (CFS) safety is absolutely critical during ground operations. If unintentionally or improperly fired, results could easily be fatal. Take extra care to ensure you and those around you never compromise ejection seat safety.

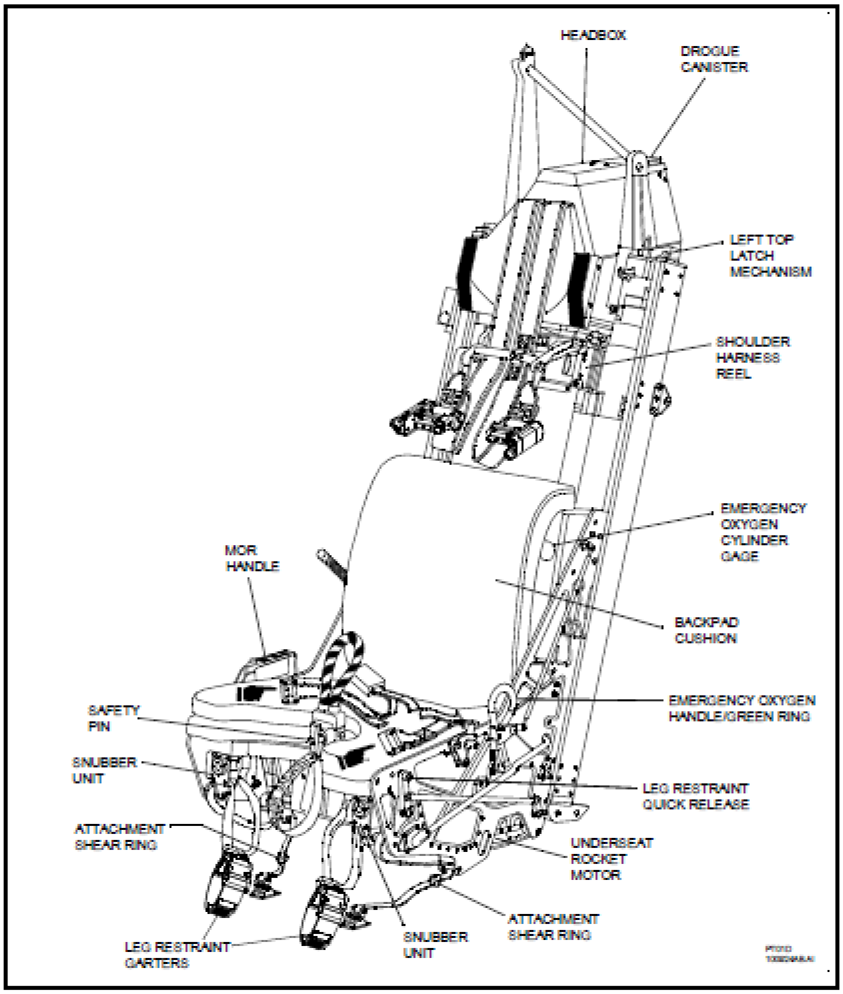

Figure 4-2 The Martin-Baker Ejection Seat

Upon initially opening the canopy, ensure all safety pins (ejection seat and CFS) are installed per the NATOPS checklist, and verbally confirm with your instructor. ***Never enter or exit the airplane without the ejection seat safety pins installed.*** With the pin(s) removed, always be conscious of the ejection handle. Do not rest your hands on the ejection handle and never allow any equipment, such as kneeboards, checklists, and approach plates to interfere with it. Remember, “Respect the Seat.”

407. STRAPPING IN TO THE SEAT

Upon completion of the preflight inspection, your instructor will show you how to enter the cockpit. The T-6A is not a particularly simple aircraft to strap into and it is easy to forget one or more buckles or straps (Figure 4-3). Be patient, but precise; there is no fast way to do it. Ensure all of the ***harness buckles*** are fastened and ***G-suit zippers*** are secure before entering the cockpit. A good strap-in method is to start at your feet and work up. Fasten your leg garters, then Lower Koch fittings, followed by the G-suit. Attach the ***main oxygen hose*** and ***emergency*** O_2 ***hose*** to your CRU-60/P (before putting on the helmet) and then reach back, grab, and fasten the ***parachute risers*** to the ***harness Upper Koch fittings***. You should now be ready to don the ***helmet***, ***connect the chin strap*** and lower the ***visor***. Attach the ***oxygen mask hose*** to the CRU-60 and plug into one of the two available ***ICS plugs***. Consult the T-6A NATOPS Flight Manual for Notes, Cautions, and Warnings during pilot hookup.

Each time you fly, your seat position should be the same. The electronic seat adjustment switch is located on the left console aft of the PCL. When sitting straight in the seat, line up the bottom edge of the Master Warning/Caution-Fire Warning panel with the top of the Airspeed and Altimeter EIDs, so the top of the EADI AOB indexer is just visible. Adjust rudder pedals so you can get full forward throw of either pedal with the corresponding brake fully depressed without locking your knee.

NOTE

Take extra care to ensure no straps or buckles are entangled with any of the side panel switches or components before actuating the electronic seat adjustment to prevent inadvertent (and potentially very costly) damage to the ejection seat and/or cockpit side consoles.

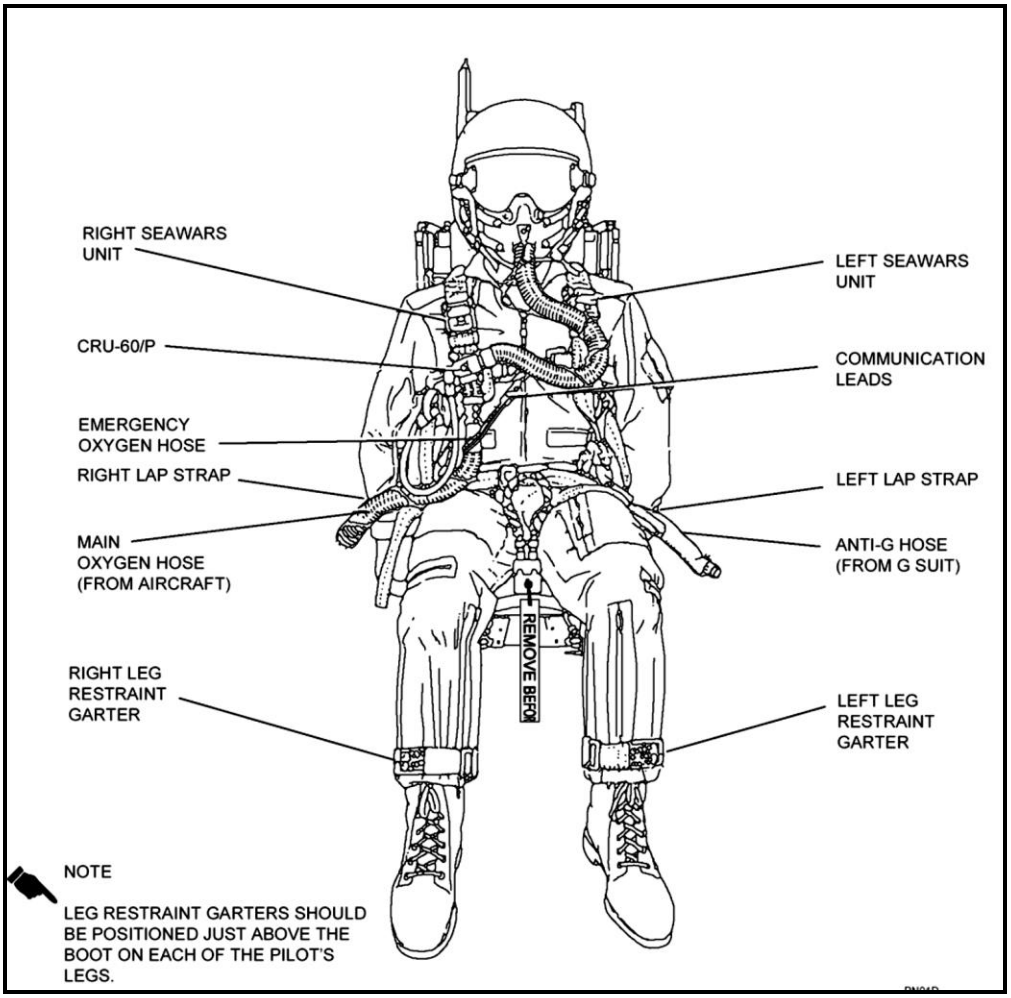

Figure 4-3 Strapping into the Seat

Common Errors.

- Forgetting to zip up G-suit.
- Forgetting to connect the chin strap.
- Forgetting to lower the visor.

408. STARTING ENGINE

After completion of the COCKPIT (ALL FLIGHTS) Checklist, ensure the prop area is clear, a fire extinguisher is available, and the plane captain is ready for start. Initiate the ENGINE START (AUTO) Checklist, while being conscious of any hazard indications from the plane captain. With the canopy closed and latched, check the green mechanical canopy lock indicator is visible (Figure 4-4), the red CANOPY annunciator is extinguished and at least one fist between your helmet and the canopy.

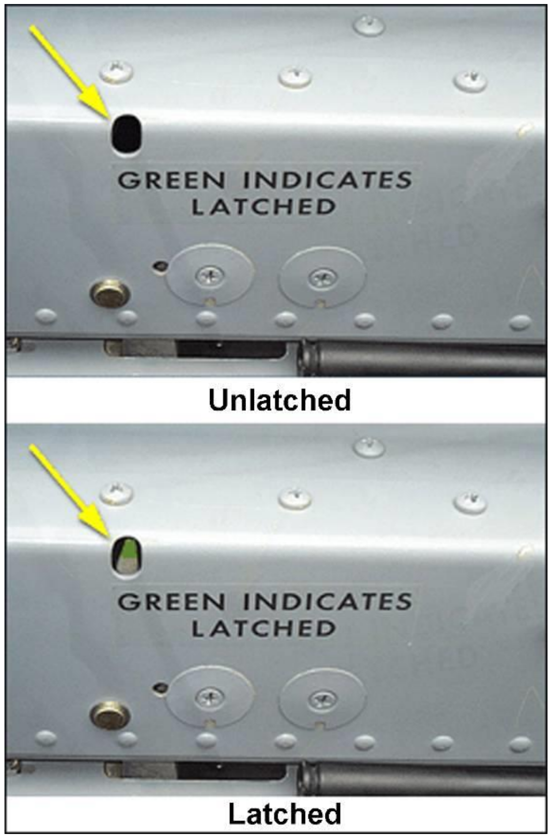

Figure 4-4 Canopy Lock Indicator

Monitor the engine start sequence. If the power management unit (PMU) detects a malfunction, such as a hot or hung start, it will automatically terminate the start sequence. You should always be prepared to manually abort a start if the PMU fails to do its job and an abort is warranted.

Common Errors.

- Advancing the PCL past Start Ready.
- Failure to give thumbs-up to plane captain after good start.
- Fixating on one instrument (i.e., oil pressure) thereby failing to monitor all aspects of the start sequence.

At the completion of the BEFORE TAXI CHECKLIST, you will perform a brake check prior to releasing the lineman. The SNFO in the front cockpit (for Contacts) will conduct the first brake check by releasing the parking brake, with permission from the IP. To properly release the parking brake, press and hold firmly the toe brakes at the top of the rudder pedals while also rotating and releasing the parking brake. ***Be sure to only touch the parking brake handle as the shaft is sharp.*** Once the parking brake is released, signal the lineman that you are ready for brake checks with a “thumbs-up.” He/She will pass the “Come Ahead” ground hand signal (see NATOPS 8-4-1 for Visual Communications) while you clear the area ahead of your aircraft for safety. Then, you will very slightly advance the PCL while releasing the brakes. As a result, you will taxi straight forward a few feet then smoothly apply the brakes to ensure the aircraft stops. Next, you will conduct a three-way positive exchange of controls to the IP and he/she will conduct a brake check then pass you back the controls. Set the parking brake. Failure to properly set the aircraft parking brake may result in inadvertent aircraft movement.

NOTE

Watch the lineman while the chocks are being removed or any time someone approaches your aircraft. Keep both of your hands above the rails if ground crews are under the aircraft or near the flight controls.

Common Errors.

- Failure to ensure positive change of controls during brake checks.
- Failure to adhere to lineman's signals.
- Adding excess power for the brake check.

409. TAXIING

Once the engine is running and all applicable checks are complete, it is time to taxi the aircraft from its starting point on the airfield to an active runway for takeoff. You should develop the habit of always taxiing with the airfield diagram at your disposal (on your kneeboard, etc.). Have a taxi plan and know exactly where you are going before leaving the chocks. This becomes even more important later in the program as you begin to conduct training off-station. Build good habits now. Your Instructor Pilot will always taxi the aircraft out of the line area. Once on a dedicated taxiway, he/she may pass the controls to the SNFO for taxi familiarization in the Contact phase of training. Once clear of the ramp area, complete the TAXI checklist.

Taxiways have a yellow line painted down the middle. Always taxi with the nose wheel on the yellow line. This should ensure a safe taxi clearance from fixed objects, such as parked airplanes and buildings; however, the aircrew is solely responsible for obstruction clearance. At any time, if there is doubt about obstruction clearance, ***stop***! Most taxi accidents are easily prevented if someone makes the right decision to stop and re-evaluate the situation.

Taxiing in the T-6A uses power generated by the propeller. Once the aircraft is rolling, idle PCL setting provides sufficient thrust for taxi. Control speed with periodic brake applications. Refer to the applicable SOP for proper taxi speeds. Directional control during taxi is accomplished by using the aircraft Nose Wheel Steering (NWS) system, or by use of the rudder and/or differential braking. Keep your left hand on the PCL; keep your right hand on the control stick, facilitating ready access to the NWS button (Fig 4-5). Attempt to keep the ailerons deflected into the wind during taxi. The NATOPS Flight Manual has warnings and cautions on the NWS and brake system that you must understand and be familiar with:

CAUTION

Minimum radius turns are possible through use of power, full rudder and differential braking. To preclude damage or unnecessary wear to NWS and tire, disengage NWS prior to executing sharp turns with differential braking. To re-engage NWS, actuate the NWS switch prior to applying opposite rudder. Failure to do so may result in NWS not engaging.

CAUTION

If brake pressure appears to fade during application, or brakes are not responding as expected, fully release brakes then re-apply. Both crew members must fully release brakes for this to be effective.

WARNING

NWS is to be used at ramp speeds only. Engaging NWS at high taxi speeds can result in directional control problems due to increased sensitivity.

Figure 4-5 Nose Wheel Steering Button

410. PRIOR TO TAKEOFF

Before contacting tower for takeoff, ensure the following checklists are accomplished:

OVERSPEED GOVERNOR CHECK: The overspeed governor check will be conducted at designated run-up areas in compliance with local procedures. In the absence of a designated area, find a non-congested area and attempt to position the aircraft into the wind. Ensure the nose wheel is straight before adding power. Remember to check the engine is operating within prescribed limits at each point in the checklist: First, at idle with the PMU off initially, then when the PCL is advanced to ensure prop RPM is properly governed, then finally once the PMU is returned to the NORM position and the PCL is at idle.

Common Errors.

- Omitting items from the checklist.

- "Looking but not seeing" - calling an item checked/set when in fact it is not.

BEFORE TAKEOFF CHECKLIST: Initiate this checklist after the OVERSPEED GOVERNOR CHECKLIST while in the run-up area. Before you contact the tower, conduct a departure briefing for the appropriate takeoff runway.

Common Errors.

- Omitting items from checklist.

LINEUP CHECKLIST: Initiate this checklist when cleared onto an active runway to ***takeoff*** or ***lineup and wait***. Use NWS to position the aircraft on the runway and center the nosewheel. Ensure NWS is turned off IAW the checklist.

Common Errors.

- Omitting items from checklist.

411. TAXIING BACK TO THE RAMP

Begin the AFTER LANDING CHECKLIST when clear of all active runways and after contacting Ground for taxi. Taxi inbound to the ramp with the same vigilance you used in taxiing outbound. Many runways you operate on will have barriers or arresting cables installed at the approach and/or departure end. The T-6A has limited capability for taxiing over certain raised cables. A listing of the cables is found in Section V of the NATOPS Manual. If taxiing over cables is unavoidable, keep your speed as slow as possible and steer to avoid nose and main landing gear contact with the cable support donuts. You must plan to take off and land beyond any arresting cables.

Common Errors.

- Switching to Ground Control or Starting Checklist prior to clearing all active runways.

- Omitting items on checklist.

- Forgetting to note the land time.

ENGINE SHUTDOWN CHECKLIST: When the aircraft has reached the parking spot, complete the engine shutdown checklist. When shutting down the engine, verify the PCL is fully in the OFF position to preclude engine damage. Remember, after the battery switch is placed off, you will lose the ICS. A good technique is to open the canopy after the PCL is brought to OFF. Always challenge your instructor by saying "rail clear" over the ICS prior to opening the canopy.

NOTE

Always be cognizant of ground crew approaching the aircraft. Ensure PCL, speed brake, and flight controls are not moved until ground crew is clear of aircraft.

Common Errors.

- Starting checklist prior to acknowledging plane captain.
- Securing strobe lights/battery prior to prop stopping.

BEFORE LEAVING AIRCRAFT CHECKLIST: As with all checklists, reference the checklist to ensure completion. Check the exterior for signs of damage, such as from a bird strike, tail strike, etc. Confirm you have all of your flight items and ensure no potential Foreign Object Damage (FOD) is left in the airplane. Be safety conscious leaving the flight line.

Common Errors.

- Failing to perform walk-around inspection.
- Omitting items from the checklist.
- Leaving personal items (FOD), in the aircraft.

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CHAPTER FIVE
FLIGHT PROCEDURES

500. INTRODUCTION

This chapter discusses the basic procedures that you will practice at the beginning of your contact 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 and spin 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 strapping into the aircraft. If you do not know the procedures on the ground, you will not be able to perform them in the air. Some procedures, such as the spin, require extra care and preparation due to the dynamic and possibly disorienting nature of the maneuver.

The Master Curriculum Guide requires the SNFO to "perform or direct" each maneuver. The purpose of the Contact stage of flight training is to allow each SNFO to experience the competing requirements inherent in controlling the aircraft, recalling then performing procedures airborne, remaining aware of the aircraft's location in the MOA or working area, and communicating with the IP and controllers concurrently. Flying the aircraft through each maneuver is strongly encouraged to the max extent practical.

501. CONTACT FLIGHT TERMINOLOGY

FAST CRUISE	240 KIAS / Clean Power as required (~80%) / 1° Nose Down
NORMAL CRUISE	200 KIAS / Clean Power as required (~54%) / 0° Nose Up
SLOW CRUISE	150 KIAS / Clean Power as required (~33%) / 3.5° Nose Up
NORMAL CLIMB	180 KIAS / Clean MAX Power, 100% / 8° Nose Up
ENROUTE DESCENT	200 KIAS / Clean Power 20% / 5° Nose Down
NO FLAP APPROACH, or DOWNWIND CONFIGURATION	120 KIAS / Gear Down, Flaps Up Power as required (~31%) / 4° Nose Up
TAKEOFF FLAP APPROACH CONFIGURATION	115 KIAS / Gear Down, Flaps TO Power as required (~42%) / 3° Nose Up
LANDING FLAP APPROACH CONFIGURATION	110 KIAS / Gear Down, Flaps LDG Power as required (~50%) / 1° Nose Up

Figure 5-1 Contact Flight Terminology

NOTE

Power settings are approximate and will vary with aircraft weight, altitude, etc. Make corrections as needed. Throughout this instruction, when mandated by procedure to establish a specific power setting, a power setting within ±3% is acceptable. The only exception is for procedures that mandate a 4-6 % power setting to simulate the feathered propeller condition.

502. OPERATIONS CHECKS

Accomplish the operations check, including the nearest divert field, to ensure various aircraft systems are operating properly and, if not, where to land the aircraft safely. For safety considerations, complete an operations check at least once every 20 minutes in flight, with the first check being accomplished during the initial departure climb.

503. ASSUMING CONTROL OF THE AIRCRAFT

It is critical to flight safety that a pilot be at the controls of the aircraft at all times. A misunderstanding between two aircrew as to who is actively controlling the aircraft could become a causal factor in a mishap. Therefore, you must be knowledgeable of the procedures involved in transferring controls. Throughout your flying career, you will fly with many pilots of various experience levels and backgrounds. To avoid miscommunication, all pilots transfer the controls the same way, regardless of platform.

Either aircrew may initiate a change in control of the aircraft. It shall be accomplished by means of a positive three-way exchange using the word ***"controls."***

NOTE

Do not use the words "it," "aircraft," or "command" to refer to the controls.

For example, the instructor may initiate a change by telling you over the ICS, "I have the controls." You will then acknowledge by saying over the ICS, "You have the controls." You will then take your hands and feet off the controls and your instructor will confirm he/she has control by saying, "I have the controls."

If your instructor wants you to take control, he/she will say, "You have the controls," whereupon you will take control and acknowledge by saying over the ICS, "I have the controls." Your instructor will complete the three-way exchange with, "You have the controls."

Stay on the controls and keep flying the aircraft until you are told to do otherwise. Never be in doubt as to who is doing the flying. Always fly as if you are flying solo unless you know that the instructor has control. The important thing is that a "demand and reply" series of responses is used so that there is no question as to who is flying.

NOTE

> In the event of ICS failure, the pilot requesting control will shake the control stick laterally, and the pilot relinquishing control will pump the stick gently fore and aft then raise both hands. Pilot at controls will shake the control stick again to confirm he/she has controls. This is referred to as "push to pass, shake to take."

504. 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 the Voice Communications FTI as well as the Checklist Study Guide (also known as the "Hollywood script"). Realize that these communications are a "place from which to deviate" and while specific voice calls will vary, these concepts will be used throughout your aviation career. Be able to use the Voice Communications FTI and Checklist Study Guide as a resource on how communications should be formatted, but don't use the script as a crutch. The flight environment is constantly changing, and never follows the script exactly. Instead, strive to understand WHY each communication is being made, and what response is expected to be returned.

505. TAKEOFF

Description. Takeoff is the movement of the aircraft from its starting point on the runway until it leaves the ground in controlled flight.

General. The takeoff requires a smooth transition from ground roll to controlled flight. Although a relatively simple maneuver, the takeoff presents numerous potential hazards. The dynamics of high engine thrust, possible directional control problems, the potential for runway incursions, high-speed aborts, and low-altitude engine failures, to name a few, make the takeoff regime of flight unique in its safety challenges. Thorough and disciplined ground operations help lead to a safe, uneventful takeoff.

Takeoffs should always be made as nearly into the wind as practical. The aircraft's ground speed in a headwind is slower at liftoff than in a tailwind or crosswind, thus reducing wear and stress on the landing gear. Secondly, a shorter distance is required to develop the minimum lift necessary for takeoff and climb. Aircraft depend on airspeed to fly. A headwind provides some airspeed before the aircraft even begins its takeoff ground roll as the wind flows over the wings.

Although the takeoff and climb process is one continuous maneuver, it is divided into three separate steps for purposes of explanation: takeoff roll, rotation, and initial climb (Figure 5-2).

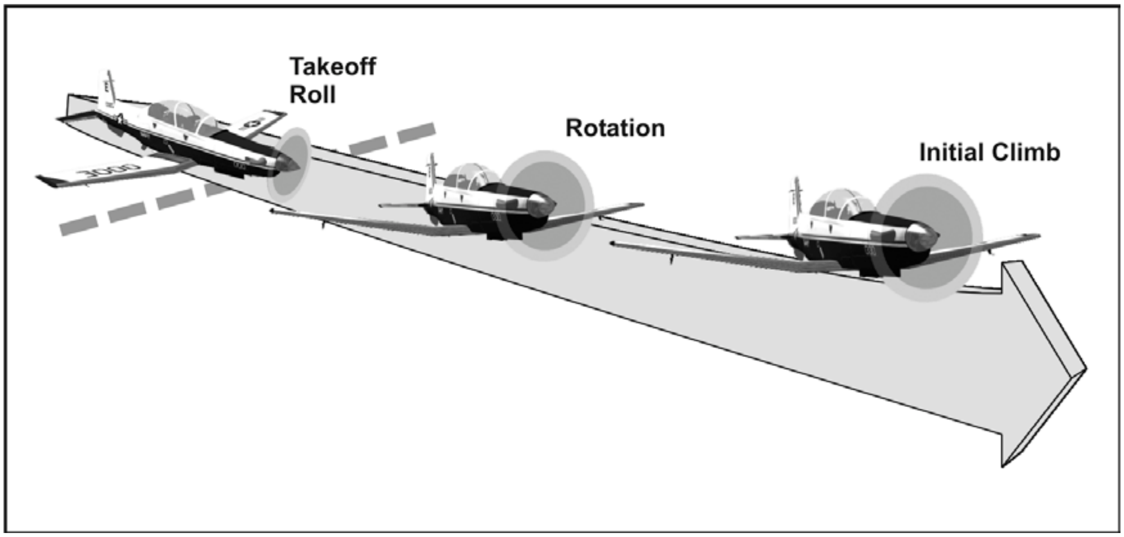

Figure 5-2 The Takeoff Roll, Rotation, and Initial Climb

The takeoff roll is the portion of the takeoff procedure during which the aircraft is accelerated from a standstill to an airspeed providing sufficient lift for it to become airborne.

The rotation is the act of raising the nose of the aircraft to a set pitch attitude, increasing AOA and allowing the aircraft to become airborne in controlled flight.

The initial climb is the period just after the aircraft has left the runway and is normally considered complete when the aircraft has reached a safe maneuvering altitude.

During the takeoff an abrupt application of power will cause the aircraft to yaw sharply left because of the torque effects of the propeller. Steady the yawing tendency with right rudder as the engine spools up and the aircraft begins rolling down the runway. Remember, the Trim Aid Device (TAD) will not begin making rudder trim adjustments until 80 KIAS and weight off wheels. As speed increases, more and more pressure will be felt on the flight controls, particularly the elevator and rudder. Since the tail surfaces receive the full effect of the propeller slipstream, they become effective first.

To rotate, apply back stick pressure at 85 KIAS, or gust factor adjusted rotation speed, to gradually raise the nose wheel off the runway and establish the takeoff attitude (8º nose high, spinner on or slightly below the horizon). This is referred to as “rotating.” Allow the aircraft to fly itself off the ground. Do not force the aircraft into the air with excessive back- stick pressure as this will only result in an excessively high pitch attitude, possible stall or tail strike. Compensate for the left yaw tendency as the aircraft leaves the runway with rudder, not aileron.

As you move to the initial climb phase of the takeoff, check pitch attitude at approximately 8° nose high and begin accelerating. The aircraft will pick up speed rapidly after becoming airborne. Once a positive climb is verified and a safe landing cannot be made on the remaining runway in front of you, raise the gear and flaps (as per After Takeoff Checklist and the procedures below). Accelerate to 140-180 KIAS and climb.

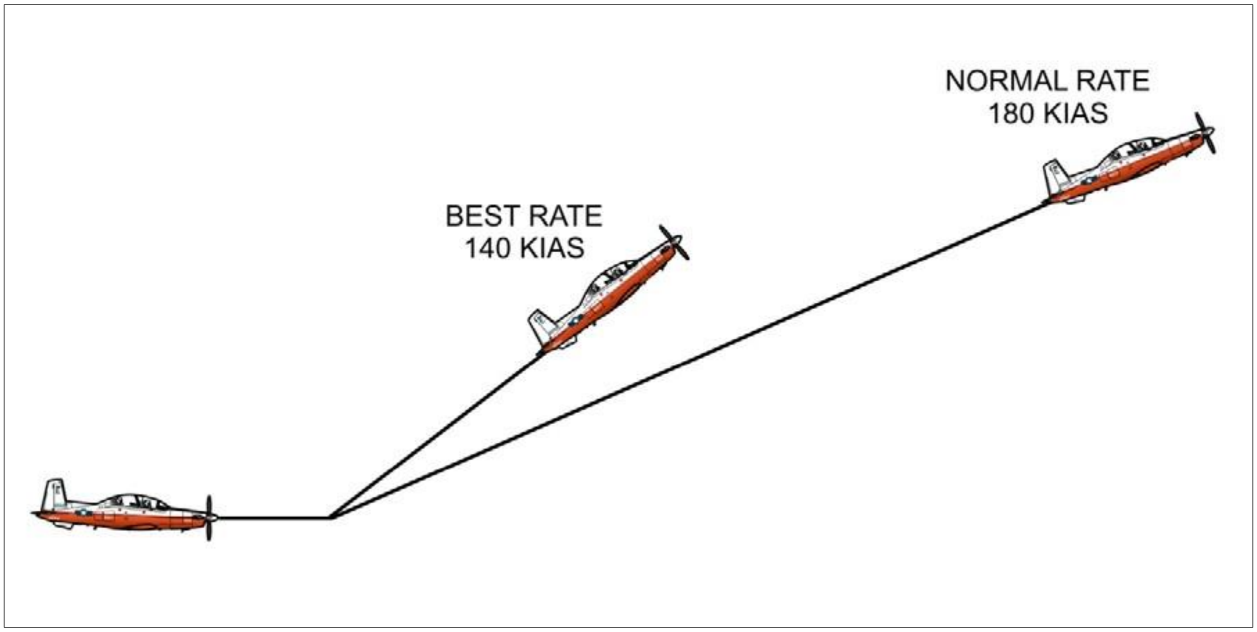

Figure 5-3 Climb Rate

NOTE

More efficient climbs may be required for obstacle clearance or other requirements such as noise abatement or cloud avoidance. The T-6A best rate of climb speed is 140 KIAS and 15º nose high (Figure 5-3).

Since power during the initial climb is fixed at maximum, airspeed must be controlled with slight pitch adjustments; however, do not stare at the airspeed indicator when making these slight pitch changes; crosscheck airspeed to confirm the correct pitch picture in relation to the horizon is set.

For takeoffs in crosswind conditions, the aircraft will tend to weather-vane into the wind and the upwind wing will begin to rise even in light-to-moderate crosswinds. This tendency can be controlled with rudder and aileron. Maintain positive aileron deflection into the wind once in position for takeoff, and maintain this crosswind control throughout the maneuver. Use up to full aileron deflection into the wind at the beginning of the takeoff roll, and relax aileron input as speed increases to the amount required to keep wings level at liftoff. Use rudder as necessary to maintain centerline. Realize that a left crosswind will add to the aircraft's natural left yawing tendency due to engine torque effect, requiring even more right rudder to maintain directional control. Once the aircraft has safely left the runway in controlled flight, level the wings, allow the aircraft to crab into the wind, and check balanced ball centered.

Procedures.

1. Approaching the hold short line (approximately 200 feet prior) switch to Tower frequency.

2. When appropriate, and in accordance with the SOP, call the tower for takeoff clearance. Prior to making this call, listen carefully to avoid cutting out other transmissions. Instructions to "Lineup and wait" or "Hold short" must be read back. Clearance for takeoff will be acknowledged with, "Call sign, cleared for takeoff (runway number)." Upon receiving takeoff clearance, taxi into the takeoff position in accordance with local course rules.

3. After acknowledging tower's "Cleared for takeoff" or "Lineup and wait" call, visually clear final, then begin taxi to the takeoff position and initiate the Lineup Checklist. Verbally note right to left or left to right crosswinds as called out by tower. Verify with windsock, if available. Align the aircraft on the runway. After turning NWS off, pull forward slightly to ensure nose wheel is properly aligned with the runway and rudder pedals are centered.

4. When cleared for takeoff and properly aligned on the runway (nose wheel centered, NWS disengaged, and brakes held). Increase torque to ~30% and check engine instruments. Confirm instruments checked in both cockpits.

5. Select a reference point. Position the elevator neutral to slightly aft of neutral. For crosswinds, position aileron as required into the prevailing winds. To compensate for torque effect in zero crosswind conditions, add slight right aileron at MAX power. Release brakes, dropping your heels to the deck (toes off the brakes but still on the rudder pedals).

NOTE

Select a reference point on centerline and towards the end of the runway or beyond. Keep the nose pointed toward this reference throughout ground roll and rotation to aid directional control.

6. Smoothly advance the PCL to MAX in 2 to 3 seconds. Anticipate the need for right rudder as the engine spools up. Maintain directional control. Verbalize "Off the peg" when airspeed indicates greater than 40 knots.

7. At 60 KIAS, check torque is at or above minimum power calculated on the TOLD card. If not abort the takeoff. Verbalize over the ICS "60 knots, XXX%."

8. At 85 KIAS or gust factor adjusted rotation speed, smoothly apply back-stick pressure and position the nose to takeoff attitude (spinner on or slightly below the horizon). Verbalize, "85 knots, rotate" and allow the aircraft to fly itself off the deck.

NOTE

If gusty winds are present, increase rotation speed by 1/2 the gust factor (up to 10 KIAS). For example, if winds are reported at 10 gust 22 (i.e., 12-knot gust factor), rotate at 91 KIAS (85 + 1/2 (12) = 91). This is independent of wind direction.

9. When a safe landing can no longer be made, check for two positive rates of climb (ALT and VSI) and airspeed below 150 KIAS. Report over ICS, "Two positive rates, Gear" then raise the gear. Verbalize "Gear UP" when the gear is up and locked. When airspeed is above 110 KIAS, Report over ICS, "Above 110, Flaps UP" then raise the flaps (as per the After Takeoff Checklist). Report over the ICS, "Gear up flaps up XXX KIAS. After Takeoff Checklist complete."

NOTE

Retraction of flaps from the TO to the UP position is not recommended below 110 KIAS to preclude the aircraft from settling back to the runway; however, there is no minimum to raise the flaps from the LDG to TO position once safely airborne.

10. Check nose attitude at 8º nose high and continue acceleration, trimming as necessary. Approaching 180 KIAS, set the 180 knot climbing attitude and climb out in accordance with local course rules or departure procedures.

Common Errors.

- Failure to maintain directional control on takeoff roll through improper use of rudder.
- Not assuming the takeoff attitude at rotation speed.
- Not relaxing back-stick pressure as necessary to maintain takeoff attitude, hence over- rotating.
- Pulling aircraft off the deck prematurely or over-controlling.
- Swerving or skipping on takeoff roll due to improper use of crosswind correction.
- Applying insufficient right rudder on liftoff and attempting to correct with right aileron.
- Failure to trim left rudder, nose down after gear are retracted and airspeed increases.
- Failure to report "Gear up, flaps up XXX knots."

506. CROSSWIND TAKEOFF

General. The procedures for a takeoff with a crosswind are the same as for a no wind takeoff except aileron is held into the wind to keep the wings level. Aileron deflection is necessary because the upwind wing develops more lift, causing it to fly (begin rising) before the downwind wing. If the upwind wing rises, skipping may result (Figure 5-4). Skipping is a series of very small bounces caused when the aircraft attempts to fly on one wing and settles back onto the runway. During these bounces, the aircraft moves sideways and stress on the landing gear is increased. Anticipate aileron requirements due to the crosswind and either pre-position aileron into the wind or apply aileron into wind as required during takeoff roll. Use rudder to keep the aircraft from weathervaning (i.e., crabbing or turning into the wind). The flight controls become more effective as airspeed increases, so progressively smaller control inputs are required to maintain aircraft control.

As the airplane is taxied into takeoff position, mentally note the winds as called by tower (also check the windsock and other indicators) so that the presence of a crosswind may be recognized and anticipated. Aileron should be held into the wind as the takeoff roll is started. As the airspeed increases and the ailerons become more effective, adjust the aileron inputs to maintain the wings level.

Firmly rotate the aircraft off the runway when flying speed is reached to avoid side-slipping and damage to the tires. Once the aircraft has become airborne, initial drift correction is made by turning into the wind with a shallow bank, then rolling wings level to maintain runway centerline (crabbing).

Figure 5-4 Skipping on Takeoff

507. DEPARTURE

General. See local Course Rules.

Procedures. See local Course Rules.

508. STRAIGHT AND LEVEL FLIGHT

Description. Maintain a constant altitude, airspeed and heading using the horizon as the primary reference.

General. Straight-and-level flight requires familiarity with flight instruments and visual cues. To fly in level flight, consciously fix reference points on the aircraft in relation to the horizon, and compare or crosscheck this relationship with the flight instruments. In addition to outside references, refer to the EADI, EHSI and crosscheck the altimeter and vertical speed indicator.

In straight-and-level unaccelerated flight at 200 KIAS, the level flight visual pitch picture is approximately half-ground/half-sky referencing the top of the glare shield with the wings equidistant from the horizon, (Figure 5-5). At higher airspeeds, hold the nose at a lower attitude to maintain level flight; at lower airspeeds, hold the nose at a higher attitude. Straight and level flight is a balanced flight condition while maintaining a constant heading and altitude.

Figure 5-5 Straight and Level Flight

Familiarity with the design, location and purpose of flight instrumentation speeds up the composite (outside/inside) cross check and aids in detecting small deviations (while they are still small). Good aircraft control is a continuous succession of minor, almost imperceptible corrections to keep the aircraft on the desired flight path.

When straight and level, trim the aircraft in all three axes. A trim change is necessary when continuous control stick or rudder pressure is required to maintain the desired attitude. Straight-and-level flight requires almost no pressure on the controls if the aircraft is properly trimmed and the air is smooth; however, when flying through turbulence, the flight attitude may change abruptly.

A properly trimmed aircraft is trimmed for a specific airspeed. It flies at the trimmed airspeed hands-off; that is, with little or no force applied to the control stick or rudders. Changes to airspeed require additional trim input potentially in all three axes, but predominantly in elevator and rudder (pitch and yaw) trim. For example, if the PCL is retarded to slow from 200 to 120 KIAS in level flight, the nose of the aircraft drops to seek 200 KIAS. Back-stick pressure is required to maintain level flight until nose up trim relieves the back-stick pressure. A trimmed aircraft reduces pilot fatigue and allows the pilot to devote more attention to task management and development of situational awareness on events occurring outside the cockpit. Large changes in airspeed in a short amount of time will require large changes in elevator trim and will require running the trim or holding the trim button forward or aft. After heavy forces are trimmed off, a method to fine tune the trim is to loosen the grip on the control stick and note the direction that the nose or wings travel. Apply very small trim adjustments in the opposite direction to nose or wing movement, for example; if the nose drops, reset it and apply (click) aft elevator trim, if the aircraft rolls left, reset wings level and apply (click) right aileron trim.

A common error in straight-and-level flight is to apply force to the control stick inadvertently due to the weight of the pilot's arm. Minimize this by resting the forearm on the thigh.

1. **To achieve straight flight (constant heading)**

a. **VISUAL**: The aircrew at the controls selects two or more outside visual reference points directly ahead of the airplane (such as fields, towns, lakes, or distant clouds, to form points along an imaginary line) and keeps the airplane's nose headed along that line. Roads and section lines on the ground also offer excellent references. Straight flight can be maintained by flying parallel or perpendicular to them.

Straight flight (constant wings level attitude) may also be accomplished by visually checking the relationship of the airplane's wingtips with the horizon. Both wingtips should be equidistant below the horizon, and any necessary adjustments should be made with the ailerons, noting the relationship of control pressure and the airplane's attitude.

b. **INSTRUMENT**: An occasional check of the heading indicator should be made to determine that the airplane is actually maintaining flight in a constant direction.

c. **CORRECTIONS**: Whenever an error in heading is noted, first stop the error and stabilize, then correct back to proper heading. As a rule of thumb, the AOB used for heading corrections should not exceed the number of degrees you want to turn. Lead the rollout on heading by the "one-third rule" (by the number of degrees equal to one-third the AOB). This lead in rollout will preclude turning beyond the desired heading.

Continually observing the wingtips has advantages other than being a positive check for leveling the wings. It also helps divert the pilot's attention from the airplane's nose, prevents a fixed stare, and automatically expands the radius of visual scanning. In straight-and-level flight, the wingtips can be used for both estimating the airplane's AOB, and to a lesser degree, its pitch attitude.

In balanced flight, any time the wings are banked, the airplane will turn. Thus, close attention should be given to the wing position and attitude indicator to detect small indications of bank, and to the heading indicator to note any change of direction.

Straight-and-level flight requires almost no application of control pressure if the airplane is properly trimmed and the air is smooth. For that reason, the student must not form the habit of moving the controls unnecessarily.

When practicing this fundamental flight maneuver, the aircrew at the controls should trim the airplane so it will fly straight and level without assistance. By using the trim tabs to relieve all control pressures, the student will find that it is much easier to hold a given altitude and heading. The airplane should be trimmed by first applying control pressure to establish the desired attitude, and then adjusting the trim so that the airplane will maintain that attitude without control pressure.

2. Corrections In Straight-And-Level Flight

There are several methods for correcting a deviation from desired altitude/airspeed when maintaining level flight. These consist of a power correction, or a power and attitude correction with a continual need for re-trimming.

a. **Off airspeed/on altitude**. If you note that the altitude is being maintained, but the airspeed is slow or fast, a power adjustment is necessary, since power controls airspeed in level flight. Remember each torque setting given in this manual is a suggested starting point. Once the appropriate power setting has been changed, a change in the pitch may be required to maintain the attitude for level flight and, as always, re-trim.

b. **Off airspeed/off altitude**. If you have a high airspeed and a loss of altitude or a low airspeed and a gain in altitude, it is the result of not maintaining the proper nose attitude. Stop the loss or gain by resetting the level flight attitude, then correct by trading the excess altitude or airspeed to return to the desired airspeed and altitude. Re-trim.

c. **On airspeed/off altitude**. If you note that you are 100 feet high, yet the airspeed is correct, correct to altitude by reducing the power slightly and allow the nose attitude to lower just slightly so the aircraft will descend back to the desired altitude. Once returned to altitude, reset normal cruise power setting and re-trim.

Procedures.

1. Maintain balanced flight. Trim.

2. Set the nose position for straight and level by visually bisecting the windscreen with the horizon. Crosscheck the altimeter and VSI. Trim.

3. Set the wing position for straight and level flight by setting the wingtips equidistant below the horizon. Crosscheck the heading. Trim.

4. Continue a working scan and if an error is recognized, make proper corrections.

5. If an error in altitude is noted on the altimeter, stop the error by adjusting the nose attitude. Then, using coordinated power and stick pressure, adjust back to desired altitude. Re-trim.

6. If an error is noted in heading, stop the drift by leveling the wings. Turn back towards the desired heading, never using a greater AOB than the number of degrees off heading. Re-trim.

Common Errors.

- Over-controlling: Making control movements too great for the amount of correction necessary.

- Not recognizing a wing low or nose attitude too high or too low.

- Fixating. Not maintaining a good scan.

- Not re-trimming.

509. BASIC TRANSITIONS

Description. Basic transitions are used to initiate and/or level off from a climb or descent. The following are the four basic transitions: climb-to-cruise, cruise-to-climb, cruise-to-descent, and descent-to-cruise.

General. Use the P.A.T. (Power, Attitude, Trim) principle to make all transitions. Trim is vital to this section; now would be a good time to review the Trim Requirements discussion in Chapter Two.

During climbs and descents greater than 1000 feet, a constant integrated scan outside and reference to the Traffic Advisory System (TAS) shall be used to clear traffic around you. S-turns may be used during descent to clear airspace below the flight path if required.

Your cockpit references will vary by the type of transition. During climbs and descents, the airspeed indicator becomes the nose attitude crosscheck instrument. The heading indicator remains the crosscheck for wings level (constant heading). When leveling off from a climb or descent, the altimeter and vertical speed indicator become the nose attitude crosscheck instruments.

Procedures.

Cruise-To-Climb Transition:

1. ***P***ower - smoothly advance power to MAX.

2. ***A***ttitude – simultaneously raise the nose to 12-15º nose high (nose attitude slightly above the 180-knot climbing attitude shown in Figure 5-6).

3. ***T***rim - as required and commence clearing turns as appropriate.

4. As airspeed decreases to 180 KIAS, lower nose slightly to the normal climbing attitude, 8º nose high (Figure 5-6).

5. Re-trim as necessary to remove all pressures from the flight controls and check balance ball centered.

Figure 5-6 Normal Climb Attitude ~8º Nose High

Climb-to-Cruise Transition:

1. 200 feet prior to level-off altitude, begin lowering nose toward the level flight attitude.

2. Trim for acceleration.

Five knots prior to desired cruise airspeed:

3. ***P***ower – smoothly reduce to normal cruise, ~54% (fast cruise, ~80%).

4. ***A***ttitude – simultaneously set level flight picture.

5. ***T***rim - as necessary to remove all pressures from the flight controls and check the balance ball centered (coordinated flight).

Cruise-to-Descent Transition:

1. ***P***ower – smoothly reduce to 20%.

2. ***A***ttitude – simultaneously lower nose to the enroute descent nose attitude (~5º nose low).

3. ***T***rim - for power reduction and commence clearing turns as appropriate.

4. Re-trim as necessary to remove all pressures from the flight controls and check the balance ball centered.

Descent-to-Cruise Transition:

Passing 100 feet prior to level-off altitude,

1. ***P***ower – advance to normal cruise ~54% (fast cruise, ~80%).

2. ***A***ttitude – simultaneously raise the nose to level flight picture.

3. ***T***rim - for power addition.

4. Re-trim as necessary to remove all pressures from the flight controls and check the balance ball centered.

Common Errors.

Cruise-to-Climb Transition:

1. Not concentrating on horizon and remaining scan. Use your peripheral vision.

2. Not trimming as airspeed slows.

3. Overcorrecting nose attitude for airspeed error. If the aircraft is off airspeed, check torque at MAX allowable, readjust the nose and re-trim.

Cruise-to-Cruise Transition:

1. Lowering the nose to the level flight altitude immediately instead of TOWARDS the level flight attitude. Remember, the airspeed is still slow.

2. Not trimming during the transition.

Cruise-to-Descent Transition:

1. Rushing the maneuver.

2. Not trimming properly.

3. Not performing clearing turns (when required).

4. Not setting/holding sufficient nose down, thereby getting slow.

Descent-to-Cruise Transition:

1. Moving nose first. Remember P.A.T.

2. Under-trimming the nose and continuing in a descent.

510. TURN PATTERN

Description. The Turn Pattern (TP) is a series of constant AOB turns while maintaining altitude and airspeed.

General. The TP is started in normal or slow cruise 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 (Figure 5-7). 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 EADI 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.

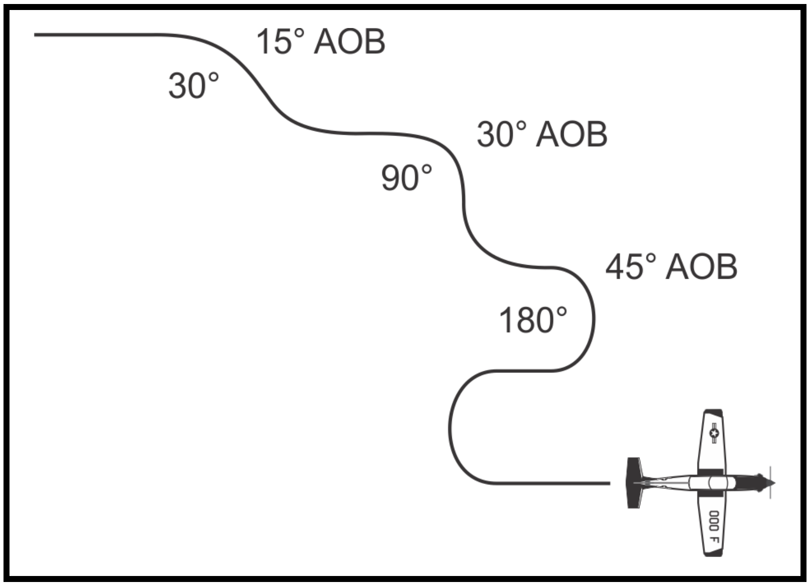

Figure 5-7 Turn Pattern

Procedures.

1. Establish the aircraft straight and level on any cardinal heading, base altitude and normal or slow cruise.

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.

Common Errors.

- 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.

- 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 EADI instead of scanning the horizon.

- Not clearing the area before and during all turns.

- Not flying in balanced flight.

511. LEVEL SPEED CHANGE

Description. The Level Speed Change (LSC) is taught to familiarize you with the various trim adjustments required with changes in airspeed, power setting, and aircraft configuration.

General. The LSC maneuver will be commenced on any assigned numbered heading. The sequence is flown from normal cruise (200 KIAS) to the downwind configuration (120 KIAS), to the landing flap approach configuration (110 KIAS), and then to normal cruise (200 KIAS).

Because of the numerous tasks associated with these transitions, a good outside visual scan pattern cannot be overemphasized. You will experience changes in aircraft attitudes and control pressures during each transition. Your instructor will require you to fly the aircraft at various angles of bank in the downwind and landing approach configurations 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.

Procedures.

1. Establish the aircraft in the normal cruise configuration (200 KIAS) on any numbered heading.

2. Reduce power to idle. Trim for deceleration. When airspeed is below 150 KIAS, call “below 150, gear” and wait for dual concurrence from IP before any configuration changes.

Once cleared by IP, lower the landing gear and as the airspeed approaches 120 KIAS, adjust power to ~31% to maintain 120 KIAS.

3. Perform the Before Landing Checklist down to ‘flaps’ over the ICS and state “holding checklist at flaps”

4. Stabilize aircraft in the downwind configuration. Trim off control pressures.

NOTE

> Your instructor may want you to practice a few shallow turns in this configuration and the Landing flaps configuration prior to continuing. Remember, you will see these nose attitudes on the downwind leg and turning final respectively when you begin practicing the landing pattern.

5. Lower Landing flaps. As airspeed approaches 110 KIAS, advance power to ~ 50% and stabilize in the landing flap approach configuration. Trim.

6. Complete the Before Landing Checklist over the ICS, “Gear down, flaps landing, speedbrake retracted, and checklist complete.”

8. Advance power to maximum, check airspeed below 150 KIAS, and raise the gear and flaps. When gear up, door lights extinguished, and flaps indicate up report over the ICS, “Gear up, flaps up at XXX knots.” Trim for acceleration.

9. Accelerate to normal cruise. As airspeed approaches 200 KIAS, reduce power to ~54%.

10. Re-trim as necessary to remove all pressures from the flight controls and check the balance ball centered.

Common Errors.

- Failure to properly trim rudder pressures, resulting in poor heading control.
- Commencing the Landing Checklist in the middle of a transition, resulting in poor basic airwork.
- Failure to maintain proper nose attitudes associated with configuration.
- Failure to properly trim elevator pressure, resulting in poor altitude control.

512. STALLS

Description. Stalls are taught to develop your ability to recognize a complete stall or an approaching stall and to recover correctly with a minimum loss of altitude.

General. You will learn to recognize the approaching stall or complete stall through a combination of the senses of sight, sound and feel.

1. Vision is useful in detecting a stall condition by noting the attitude of the airplane. This sense can be fully relied on only when the stall is the result of an unusual attitude of the airplane; however, 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.

2. Hearing is also helpful in sensing a stall condition, since the tone level and intensity of sounds incident to flight decrease as the airspeed decreases. The reduction of the noise made by the air flowing along the canopy as airspeed decreases is also quite noticeable, and when the stall is almost complete, vibration and its incident noises often increase greatly.

3. Kinesthesia, or the sensing of change in direction or speed of motion, is probably the most important and the best indicator to the trained and experienced pilot. 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.

4. The feeling of control pressures is also very important. As speed is reduced, the "live" resistance to pressures on the controls becomes progressively less. Aircraft response to control movements also decreases until a complete stall when all controls can be moved with almost no resistance, and with little immediate effect on the airplane. The Stick shaker will normally occur 5-10 knots prior to the stall, with airframe buffet occurring almost immediately thereafter. The stick shaker may sometimes mask airframe buffet making it difficult to feel. In some circumstances, aircraft buffet may occur before the stick shaker activates.

513. THE 3C CONCEPT

During all contact maneuvers, a helpful memory aid for setting up and executing procedures is known as “the 3Cs.” Perform or direct these steps as appropriate. Accomplish and/or review the THREE Cs before performing stall maneuvers:

C- Configuration - normal cruise, downwind, etc.

C- Checklist - Pre-stalling, spinning, and aerobatic checklist and the Before Landing Checklist (if applicable)

C- Clearing Turn- 45° AOB if clean, or 30° AOB if configured

A clearing turn (approximately a 180° of turn – two 90° turns in opposite directions or one 180° turn) utilizing 30-60° AOB, 45° AOB maximum in the landing configuration. Normally, turning stalls should be performed in the same direction of the last 90° of clearing turn but can be adjusted as needed to remain within the working area boundaries. Recovery from all stall maneuvers must be accomplished above 6000 feet AGL.

Stalls will be preceded by the stick shaker or airframe buffet (whichever occurs first), at which point, recovery will be initiated; however, during some training maneuvers you will practice full stalls (nose pitches down) before initiating recovery. This is done, not to foster a complacent attitude towards stalls, but to build skill and confidence in the recovery procedures. Obviously, if a stall warning (i.e., stick shaker) is encountered at any time other than during stall practice, you will initiate recovery immediately.

Common Errors.

Not recovering at the first indication of stall.

514. POWER-OFF STALL

Description. Stall the aircraft in a power-off condition to demonstrate the proper recovery when power is not available.

General. POWER-OFF stalls are flown to practice recovery from potentially dangerous low airspeed conditions when power is not available. Power-off stalls could occur, for example, during a dead-engine glide to high key when the pilot gets distracted and fails to maintain proper flying speed. Recovery can only be accomplished with nose pitch, since power is unavailable. Speed may decrease for various reasons including inattention, task saturation, and attempts to stretch the glide to regain profile.

Before starting this maneuver, ensure you have plenty of airspace below you, as you will lose at least 1500 feet during the recovery, and will probably lose another 1000- 2000 while setting up your dead engine glide. Best dead engine glide speed in the clean configuration is approximately 125 KIAS with a sink rate of 1350 to 1500 feet per minute (FPM). Pay close attention to the nose attitude and flight characteristics of the airplane when flying at the best glide speed of 125 knots in the clean configuration. After the recovery, you will return to this attitude and airspeed to complete the maneuver.

Procedures.

- **CONFIGURATION**: Establish the aircraft in the normal cruise configuration (200 KIAS).

- **CHECKLIST**: Perform the Pre-Stalling, Spinning, and Aerobatic Checks.

- **CLEARING TURN**: Clear working area with visual scan and TAS. The maneuver includes a 45 degree clearing turn included in the procedures.

1. Begin the maneuver on a numbered heading. Smoothly reduce power to 4-6% torque and roll the aircraft into a 45 degree AOB turn for 180 degrees, roll out on desired heading. Assertively trim nose up for deceleration.

2. As airspeed approaches 125 KIAS, lower the nose to the 125 KIAS glide attitude (horizon bisecting windscreen) and stabilize the glide. Crosscheck VSI for a 1350-1500 foot per minute descent on the VSI. Trim the aircraft.

3. Smoothly raise nose 8 to 10 degrees nose high while keeping the wings level. Smoothly increase back stick pressure to maintain this nose attitude until the first indication of stall, i.e., stick shaker or airframe buffet.

NOTE

Do not initiate recovery at the landing gear position warning horn which, if not manually silenced, will sound with airspeed below 120 KIAS and N_1 less than 87%.

4. Recover by relaxing back stick pressure, lowering the nose to "slightly below" the 125 KIAS glide attitude. Check wings level and hold this nose attitude, allowing airspeed to increase towards 125 KIAS.

5. Re-establish 125 KIAS glide. Re-trim as necessary to remove all pressures from the flight controls and check the balance ball is centered.

Common Errors.

- Failure to recognize an approach to stall indication.

- Lowering the nose too far, resulting in excessive loss of altitude.

515. APPROACH TURN STALL

Description. Proper recognition of and recovery from approach to stall conditions in the landing pattern. Training emphasis is on recognition of approach-to-stall indications and appropriate recovery procedures in the traffic pattern at low altitude, when timely recovery is of utmost importance.

General. In the landing pattern, unrecoverable stall or sink rate situations can occur before indications become obvious. If a stall indication occurs in the landing pattern, disregard ground track, and recover as described below. If in the pattern, do not hesitate to eject if recovery appears unlikely. Approach Turn Stalls may be practiced in either direction and in any flap configuration. Pay close attention to rudder control during the recovery. When maximum power is applied at low airspeed, the torque produced by the engine necessitates significant right rudder regardless of the turn direction. Misapplication of flight controls, particularly the rudder, during recovery can cause a rapid departure from controlled flight.

Procedures.

- **CONFIGURATION**: Establish the aircraft in the downwind configuration (gear down, flaps up, 120 KIAS).

- **CHECKLIST**: Perform the Pre-Stalling, Spinning, and Aerobatic Checklist and the Before Landing Checklist through the "Brakes- checked" portion. The checklist will be completed during the rest of the maneuver.

- **CLEARING TURN**. Clear working area with visual scan, TAS, and 30 degree AOB clearing turns for a minimum of 180 degrees heading change. Two 90 degree turns can be substituted for area management.

1. Start the "4 T's" as per the landing pattern procedures in chapter 6 at a simulated abeam position:

Transition: Reduce power to 15% and lower the flaps to the TO position.

Trim: Trim the aircraft for 115 KIAS

Turn: Start a descending, 30 degree AOB approach turn in the direction of the clearing turn.

Talk: Report over the ICS "Gear Down, flaps takeoff, speed brake retracted, Before Landing Checklist complete."

2. Once stabilized on airspeed 115 KIAS in the simulated approach turn, raise the nose to 5-10 degrees nose high, and then reduce power to idle. Adjust ailerons to maintain AOB between 30-45 degrees, and increase back stick pressure to hold the pitch attitude.

3. At first indication of stall, whether stick shaker or airframe buffet, recover with minimal altitude loss utilizing the "RELAX MAX LEVEL BALL" method.

RELAX: Relax back-stick pressure slightly to decrease AOA and break the stall. Do not dump the nose.

MAX: Power to MAX (PCL full forward, a.k.a. firewalled).

LEVEL: Level the wings to the horizon, and then establish a positive climbing attitude. Target 14-15 units AOA for maximum performance and to avoid a secondary stall. (Up to 17.9 units may be used)

BALL: Apply right rudder as necessary to center the balance ball.

4. Confirm a positive rate of climb, as verified by both the altimeter and VSI, and report over the ICS "aircraft climbing."

5. After a safe climb is established, accelerate to and establish a 115 knot climb. Level off at the next 500 feet MSL interval. Reduce power to ~34%, maintain level flight at 115 KIAS and re-trim as necessary to remove all pressures from the flight controls and check the balance ball is centered.

NOTE

While "relax max level ball" is an excellent technique for remembering stall recovery procedures, it is important to understand the stall recoveries are not step-by-step procedures. Rather, the recovery inputs are nearly simultaneous.

Common Errors.

- Failure to maintain AOB during the entry. The aircraft will have a tendency to continue rolling past 30º to 45°. In addition, with increasing bank angles, the nose will have a tendency to drop.
- Releasing instead of relaxing back-stick pressure, or applying forward stick pressure on recovery, thus resulting in a nose low attitude and excessive altitude loss.
- Not relaxing back-stick pressure enough, causing the aircraft to remain stalled.
- Cycling rudders in an attempt to keep the ball centered before reaching flying speed.
- Delay in raising the nose to the recovery attitude to stop the altitude loss.
- Failure to add sufficient power on recovery.

516. SPIN

Description. A ***spin*** is a category of stall resulting in an auto-rotation about the vertical axis. Spins can be entered intentionally or unintentionally, from any flight attitude if the aircraft has sufficient yaw while at the stall point. Normally, both wings are stalled but the angle of attack of each wing, and consequently its lift and drag, are different. This causes the aircraft to yaw toward the more stalled wing due to its higher drag and loss of lift. Spins and Out of Control Flight are covered in depth throughout Chapter 6 in your NATOPS Flight Manual; this instruction is not a substitute for a thorough understanding from gained through the NATOPS manual.

General. Spins are taught to increase your situational awareness and confidence in extreme unusual attitudes and Out-of-Control Flight (OCF) conditions. Practice spins may be performed to the left or right. The spin entry is straight forward and procedural; the spin entry is not a finesse maneuver. It requires full back stick (ailerons neutral), fully deflected rudder, and idle power.

A spin progresses through three phases: post-stall gyrations, incipient spin, and steady state spin. The aircraft progresses from one phase to the next as long as pro-spin controls are applied. Failure to promptly apply proper recovery procedures during the first stages eventually results in a steady state spin. It is important to understand the recovery method required in each phase.

NOTE

Spins ***shall*** be practiced in the clean configuration. In the event of an unintentional spin with gear and flaps down, they shall be retracted immediately to prevent possible damage by exceeding their speed limitations.

Post-stall Gyrations: A post-stall gyration can usually be identified by uncommanded (and often rapid) aircraft motions about any axis, a feeling that the controls are no longer effective nor acting in the normal sense, stalled or near-stalled AOA, transient or erratic airspeed indications, and random turn needle deflection. In order to recover from post-stall gyrations execute the INADVERTANT DEPARTURE FROM CONTROLLED FLIGHT Procedure.

Incipient Spin: Incipient spins are the spin-like motion that occurs between a post-stall gyration and a fully developed spin. An incipient spin can be identified by an oscillatory spin-like motion, a fully deflected turn needle, a stalled AOA, and airspeed that is accelerating or decelerating toward the steady-state value. The incipient spin phase lasts approximately 2 turns. After completing the initial turn, the nose will pitch to approximately 60° below the horizon, with pitch attitude becoming oscillatory. In order to recover from the incipient spin execute the INADVERTENT DEPARTURE FROM CONTROLLED FLIGHT Procedure.

Steady State Spin: After completing approximately 3 turns, the spin will have entered a near steady-state condition. Spin rotation rates will stabilize to approximately 2 to 3 seconds per turn with altitude loss of 400 to 500 feet per turn. The AOA will be 18+ and airspeed will stabilize at 120 to 135 KIAS. The turn needle will be fully deflected in the direction of the spin; the balance ball may be either inside or outside the turn. When performing spins to the left, some differences in pitch attitude and magnitude of pitch, roll, and yaw oscillations may be noted. Spins in either direction may exhibit roll and yaw oscillations after 3 turns with neutral ailerons. Recover from a steady state spin by using NATOPS erect spin recovery procedures.

NOTE

All spin maneuvers shall be done with a clearly defined horizon, clear of clouds.

NOTE

Ailerons have pronounced effect on spin characteristics. With ailerons held in the direction of spin rotation, roll and yaw become noticeably oscillatory. With ailerons held full opposite to direction of spin rotation, roll and yaw oscillations are damped out and the spin appears to reach steady-state in all axes. Keep ailerons neutral for all spin training in the T-6A.

Intentional Spin Entry Procedures

- **CONFIGURATION**: slow cruise configuration (150 KIAS). Start the maneuver at an altitude so that the spin itself is entered below 22,000 feet MSL and will be fully recovered prior to the bottom of the MOA.

- **CHECKLIST**: Perform the Pre-Stalling, Spinning, and Aerobatic Checklist.

- **CLEARING TURN**: Sufficiently clear the working area. Since considerable altitude will be lost in the spin, be sure that the area below is clear of other aircraft or clouds. TAS "Below" mode may be used to aid clearing area below.

1. Pull the PCL to Idle, check the wings level and smoothly raise the nose (referencing the EADI) to 20-30° above the horizon. When the gear warning tone activates, SNFO shall acknowledge the warning horn, however the IP shall silence the tone prior to spin entry.

2. At the stick shaker, lead the stall with a slight amount of rudder in the desired direction of spin. Spins will be conducted in same direction as the last half of the clearing turn.

3. When the aircraft stalls, smoothly apply full rudder in the direction of spin and full back-stick. Hold both elevator and rudder at their fully deflected position until the recovery is initiated. Do not use aileron in the entry or during the spin. Call out altitude, AOA, airspeed, turn needle deflection/direction.

Steady State Spin Recovery

Upon reaching steady state spin indications, initiate the recovery by first applying FULL rudder in the direction opposite the turn needle. Then, position the control stick forward of neutral with ailerons neutral. Once this is accomplished, the aircraft will continue for approximately 1.5 additional turns before abruptly ceasing rotation. At this point, you will neutralize the controls and recover from the unusual attitude. Lastly, check and report the oil pressure and verify it is within proper NATOPS limits prior to advancing the PCL. ***Reference applicable NATOPS procedures for recovery.***

Common Errors.

- Not reducing power to idle after rolling wings level from the clearing turn.

- Becoming disoriented by looking outside and delaying initiation of recovery.

- Not neutralizing the controls as the rotation stops.

- Commencing the pullout too rapidly and/or too early, resulting in a secondary stall.

- Insufficient G pull on recovery, resulting in inadvertently exiting lower working area boundaries.

- Not checking the oil pressure, late in adding power when level, and not reporting oil pressure to the instructor.

- Inadvertently placing the stick aft of neutral, delaying, or preventing recovery.

517. HOW TO DIRECT A MANEUVER

All of the maneuvers may be flown or directed and it is highly encouraged that you attempt to fly the maneuvers. When you direct them, you need to be descriptive and directive to your IP. When being directive, utilize the commands LEFT, RIGHT, CLIMB, DESCEND, and SET. The first four are self-explanatory; "Set" may be used for things like airspeeds, power settings, fuel flow, or an attitude. Speak headings and frequencies as individual digits, and airspeeds, altitudes, and quantities as whole numbers.

- "LEFT two four zero."

- "SET two-forty."

- "SET thirty-three percent."

- "DESCEND four thousand five hundred."

When studying and practicing your procedures, practicing the directive comm, scan, and control inputs required together will ensure success whether you are at the controls or not. The following example of a Power Off Stall is one way to be both descriptive and directive in your comms.

- **CONFIGURATION**: Establish the aircraft in the normal cruise configuration (200 KIAS). "Set 54% torque, maintain two hundred, clean configuration"

- **CHECKLIST**: Perform the Pre-Stalling, Spinning, and Aerobatic Checks. "Loose Items-Stowed, Engine Instruments-Check, Fuel Balance-Within 50 pounds"

- **CLEARING TURN**: Clear working area with visual scan and TAS. The maneuver includes a 45 degree clearing turn included in the procedures.

1. Begin the maneuver on a numbered heading. Smoothly reduce power to 4-6% torque and roll the aircraft into a 45 degree AOB turn for 180 degrees. Assertively trim nose up for deceleration. Starting on a heading of 090. "Clear Left, Turn Left, set 4 to 6% torque and forty-five degrees Angle Of Bank, roll out heading two seven zero."

2. As airspeed approaches 125 KIAS, lower the nose to the 125 KIAS glide attitude (horizon bisecting windscreen) and stabilize the glide. Crosscheck VSI for a 1350-1500 foot per minute descent on the VSI. Trim the aircraft. “Airspeed approaching one-twenty-five, intercept one-twenty-five knot glide attitude. VSI is fourteen hundred feet per minute”

3. Smoothly raise nose 8 to 10 degrees nose high while keeping the wings level. Smoothly increase back stick pressure to maintain this nose attitude until the first indication of stall, i.e., stick shaker or airframe buffet. “Set 8 to 10 degrees nose up” “Stick Shaker, recover”

4. Recover by relaxing back stick pressure, lowering the nose to “slightly below” the 125 KIAS glide attitude. Check wings level and hold this nose attitude, allowing airspeed to increase towards 125 KIAS. “Set 5 degrees nose low and intercept one-twenty-five knot glide attitude”

5. Re-establish 125 KIAS glide. Re-trim as necessary to remove all pressures from the flight controls and check the balance ball is centered. “one-twenty-five knot glide established, maneuver complete”

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CHAPTER SIX
LANDING PROCEDURES

Figure 6-1 T-6 On Approach

600. INTRODUCTION

This chapter discusses the procedures and operations required for the T-6A to enter, land, and depart the landing pattern.

601. LANDING PATTERN

The Navy landing pattern is a geometric racetrack-shaped course flown so that an approach and landing may be executed in a systematic sequence. For purposes of clarity in this instruction, the landing pattern will be subdivided into three parts: field entry; landing pattern; departure.

602. LANDING PATTERN TERMINOLOGY

Visual Wing References

3/4 WTD	Where blue/orange meets white on the wing leading edge
2/3 WTD	Fuel cap
1/4 WTD	Where the canopy rail visually bisects the wing

Figure 6-2 T-6A Defined Wingtip Distances

Initial Point. A point over the ground at the appropriate distance from the runway as specified by the local SOP. At this point the aircraft shall be at the altitude and airspeed specified by the local SOP.

Break. A decelerating 180º overhead transition from cruise to the downwind configuration.

Break Altitude. Consult local SOP or Course Rules.

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:

- The aircraft ahead of you is abeam or behind your wingtip ***and*** has completed at least 90º of turn.
- The aircraft ahead has departed in accordance with local SOP or course rules.
- At a tower-controlled field, the above conditions are met, ***and*** you are cleared by the controller.
- If the preceding aircraft is a full stop or you are a break aircraft, the proper interval for breaking behind another T-6 is 45º behind your wingtip. Other break intervals are specified by local SOP.

NOTE

If following an aircraft conducting AOA approaches, your instructor will judge the proper interval for the crosswind turn.

Upwind. The extended runway centerline past the departure end.

Downwind. That portion of the racetrack pattern offset from the runway in the opposite direction of landing.

Crosswind Turn. The turn between upwind and downwind.

Abeam. The position in the racetrack pattern opposite the intended point of landing, at pattern altitude.

180º Position. The position in the racetrack pattern opposite the intended rollout point on final.

135° Position. Point in approach turn halfway between 180 and 90.

90º Position. The bisector between the 180 and intended rollout point. The aircraft should be approximately450 feet AGL (or ½ the pattern altitude in feet AGL) and perpendicular to the runway. Airspeed is dependent on the type of approach. (Civilian equivalent: Base Leg)

45° Position. Point in approach turn halfway between 90 and final.

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. Airspeed is dependent on the type (Flaps UP/TO/LDG) of approach.

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 arresting gear or a displaced threshold.

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. Safe landings may be made outside the touchdown zone, either prior to the Intended Point of Landing or past 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***.

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. It is the point on 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, when the aircraft is on speed and altitude. Stable airspeed, proper glide path, and a fixed aimpoint provide the consistency required for successful landing.

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

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 raised the landing gear to depart.

Course Rules. Predetermined route of flight from an entry point into a field as determined by local area procedures

NOTE

In order to depart, you do not have to be number one with interval, but you must be number one upwind. There is a difference!

603. NORMAL FIELD ENTRY

Description. Field entry is a series of uniform procedures by which aircraft enter the landing pattern. To enter a field it is important to first look at the airspace requirements of that field along with pertinent info pertaining to weather, runways, if it is towered, etc.

General. Since numerous aircraft may be using the same field simultaneously, it is absolutely necessary that each aircraft conform to the same systematic pattern and standard operating procedures for safety and efficiency.

Procedures.

1. Obtain field weather, if available. This may be in the form of ATIS, ASOS, or simply requesting advisories. This should be done before checking in with approach, tower, or proceeding to uncontrolled airfields and is generally done at 10 NM by "requesting airport advisories."

2. Contact controlling agency, if airspace requires. For the purposes of Contact training, most flights will be conducted in Class C, D, E, or G airspace. Prior to entry of controlled airspace, certain criteria must be met per the AIM:

CLASS C – 1. Two-way radio communications

2. An operable radar beacon transponder with automatic altitude reporting equipment

CLASS D – 1. An operable two-way radio

CLASS E, G – 1. No specific requirements.

CLASS C Example (NPA):

KATT: *"Pensacola Approach, KATT 6XX, three thousand five hundred, Information (ATIS INFO), request course rules."*

APPROACH: *"KATT 6XX, squawk XXXX."*

KATT: *"KATT 6XX, squawk XXXX."*

APPROACH: "*KATT 6XX, radar contact two miles west of Jack Edwards at three thousand five hundred. Descend and maintain 2000, report point Golf in sight."*

KATT: *"KATT 6XX, leaving three thousand five hundred for two thousand, WILCO."*
As you approach Point G:

KATT: *"Approach, KATT 6XX, Point Golf in sight."*

APPROACH: *"KATT 6XX, contact tower."*

Because approach used your specific KATT callsign and number, you have sufficiently established two-way radio comms. Had Approach said "KATT Callsign, standby" or if they had not even responded then you are required to remain clear of Class C.

CLASS D Example (BFM):

KATT: *"Downtown Tower, KATT 6XX is 10 miles to the east at four thousand five hundred for the overhead."*

TOWER: *"KATT 6XX, report a 3 mile initial Runway three two, there is a T-6 on instrument final and another T-6 on downwind."*

The T-6 is always equipped for Class D operations, but it is important to both provide good Situational Awareness for the benefit of the tower and other aircraft in the pattern as well as receive good awareness through good listening and an active visual scan.

CLASS E Example (1R8):

At 10 NM on CTAF:

KATT: *"Bay Minette traffic, KATT 6XX is 10 miles to the south at seven thousand five hundred, request advisories."*

CTAF: *"Bay Minette winds are two seven zero at ten kts, altimeter two niner niner two."*

CTAF: *"KATT 6XX is on 3 mile RNAV Final runway two six, Bay Minette."*

By requesting advisories, you are asking anyone with Situational Awareness at Bay Minette airfield to share over CTAF (Common Traffic Advisory Frequency). There will not always be a manned FBO (Fixed Base Operator) with a radio and weather information. Also, there will not always be traffic in the pattern to provide a runway in use. As a result, use the data available (prevailing winds, windsock, runway length, etc.) to determine the best runway available.

When cleared, proceed to entry point. In contacts, there are 5 primary entries to a field:

- Straight in – field entry obtained on final for a straight in approach of usually less than 5 NM (traffic dependent)

- Break entry – field entry by a 3 NM initial at break altitude (reference In-Flight Guide), then direct to field for break maneuver to intercept downwind leg.

- High Key entry – field entry at High Key position (reference T-6A NATOPS).

- Downwind entry – field entry by a 45 degree cut into the downwind leg of the pattern, this is the preferred entry for non-towered civilian fields. A variation of this is the Low Key entry.

- Base leg entry – field entry by the base leg of the landing pattern.

Common Errors.

- Not selecting the appropriate frequency.
- Not positioning the aircraft for the correct runway.
- Incorrect voice report.
- Not properly established at initial point.
- Not establishing the proper interval.
- Not keeping visual scan for traffic and communicating traffic once in sight.

604. STRAIGHT IN

Description. The straight-in is a generally benign maneuver to put an aircraft directly on final for the purpose of landing.

General. The following procedures will prepare the aircraft for landing via straight in.

Procedures.

1. Establish the proper interval in accordance with local course rules.

2. Confirm airspeed below 150 KIAS and state over the ICS “Below 150, gear." Lower the landing gear and flaps to the desired setting after the IP has acknowledged the airspeed call.

3. Slow to 120 KIAS, maintain altitude, trim right rudder and up elevator for deceleration.

4. Approaching glideslope, begin descent for landing. As a reference, use the following numbers for the T-6 Straight In as checkpoints on final (assumes a 120 kts groundspeed and 3° glideslope):

5NM – 1,600 ft AGL
4NM – 1,280 ft AGL
3NM – 960 ft AGL
2NM – 640 ft AGL
1NM – 320 ft AGL

605. THE BREAK

Description. The break is a procedure to transition the aircraft from normal cruise configuration to the landing configuration and position the aircraft on the downwind leg (Figure 6-5).

General. The following procedures will prepare the aircraft for landing at a field.

Procedures.

1. Establish the proper interval in accordance with local course rules.

2. With interval, execute the break in accordance with local SOP or NOLF procedures.

3. Clear in the direction of turn, then roll into a 45º- 90° AOB turn, reduce power to idle, extend speed brake as required and maintain altitude. AOB and back-stick pressure will vary with wind conditions. Trim for deceleration.

4. Halfway through the break turn, adjust the AOB to establish a ¾ wingtip distance on downwind.

5. Once rolled out and established on downwind, Confirm airspeed below 150 KIAS on the ICS, “Below 150, Gear.” , then lower the landing gear and flaps to the desired setting after the IP has acknowledged the airspeed call.

6. Slow to 120 KIAS, maintaining break altitude, trimming right rudder and up elevator for deceleration.

7. Approaching 120 KIAS, lower the nose and descend at 120 KIAS to pattern altitude (as directed by local SOP).

8. Add power and raise the nose to level off at pattern altitude and trim as necessary.

606. HIGH KEY

Description. High Key entry is used for training purposes to simulate the ELP and various emergency procedures in Contacts. Reference the T-6A NATOPS for the Emergency Landing Pattern and Chapter 7 in this FTI for additional ELP info.

607. DOWNWIND AND BASE LEG ENTRY

Description. There are various methods available for intercepting downwind and base legs. The simplest methods in the scope of Contact flights are the 45 degree downwind entry (Figure 6-3) and the direct base leg entry (Figure 6-4).

General. The following procedures will prepare the aircraft intercepting the appropriate landing pattern leg.

Procedures.

1. Scan for other traffic in the pattern and establish the proper interval while joining the pattern in accordance with local course rules.

2. Clear in the direction of turn, if applicable, and slow to below 150 KIAS.

3. Confirm airspeed below 150 KIAS on the ICS, then lower the landing gear and flaps to the desired setting after the IP has acknowledged the airspeed call. Perform Before Landing Checklist.

4. Slow to 120 KIAS, maintaining altitude, trimming right rudder and up elevator for deceleration.

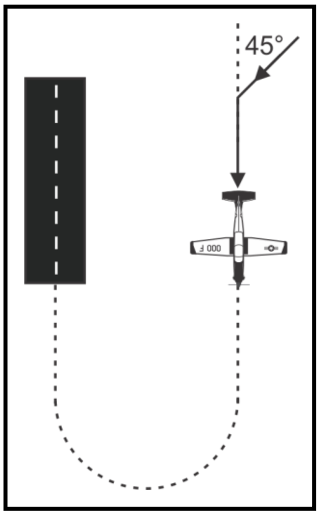

Figure 6-3 Downwind Entry

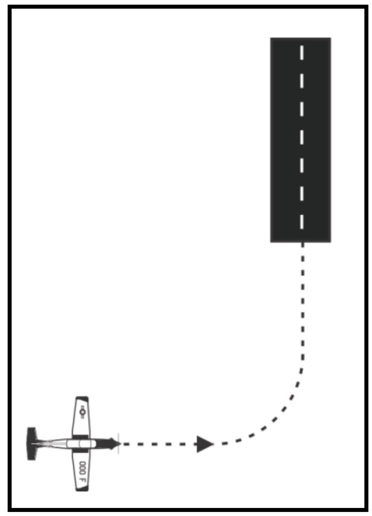

Figure 6-4 Base Leg Entry

608. T-6A LANDING PATTERN

Description. Once established in the landing pattern using one of the entry methods, it is important to maintain Situational Awareness as to other traffic in the pattern. Additionally, completion of the Before Landing Checklist is required for every lap in the pattern. The T-6 Navy Landing Pattern is depicted in Figure 6-5.

General. The following procedures will prepare the aircraft for executing a touch and go. These procedures will assume you have just entered the pattern via a break or downwind entry and will be executing a Touch and Go.

Procedures.

1. Once established on downwind, confirm airspeed is below 150 KIAS and state over the ICS “Below 150, gear.” Lower the landing gear after the IP has acknowledged the airspeed call.

2. Increase power to ~31% to maintain 120 KIAS and level flight.

3. Begin the Before Landing Checklist and pause the checklist at Flaps.

4. Abeam the intended point of landing (ABEAM position), begin the 4Ts:

TRANSITION: Reduce power to 15% and lower flaps to desired position*. Use TO flaps unless directed otherwise by the IP*.

TRIM: Trim for deceleration and flap deployment.

TURN: On airspeed, initiate descending turn, utilizing ~25-30° AOB to fly to the 90° position. Pitch attitude should be approximately 3-5° nose low.

TALK: At Navy airfields: "KATT 6XX, Abeam, gear, [Touch and go, Full stop, option, or low approach]."

At civilian airfields: "KATT 6XX, right/left base, [Touch and go, Full stop, option, or low approach]."

NOTE

Airspeeds in the approach turn for no-flap, takeoff, and landing flaps are 120/115/110 KIAS, respectively. Speeds on final will be 110/105/100 KIAS. Power settings in the approach turn will be approximately 14/15/18 % respectively. Never fly slower than the AOA on-speed indication (amber donut) in the pattern. While operating at or near maximum allowable gross weight, the AOA on-speed indication may in rare instances be faster than the defined pattern speeds.

5. After receiving and reading back the appropriate landing clearance from Tower, report over the ICS, "Gear down, flaps **(*UP/TO/LDG*),** Speedbrake retracted, Before Landing Checklist complete."

Planned bank angle for the final turn is approximately 30°. This allows a "cushion" for increasing or decreasing bank angle so you can roll out on final without angling or overshooting. You may increase bank angle up to a maximum of 45° in the final turn. If you will still overshoot at 45° of bank, execute a go-around. You should then adjust downwind displacement slightly wider on subsequent patterns so that you can fly the final turn at 30° bank.

6. Fly to the 90° position, perpendicular to the runway and on airspeed. The altitude at the 90° is 450 feet AGL (or 1/2 the pattern altitude in feet AGL).

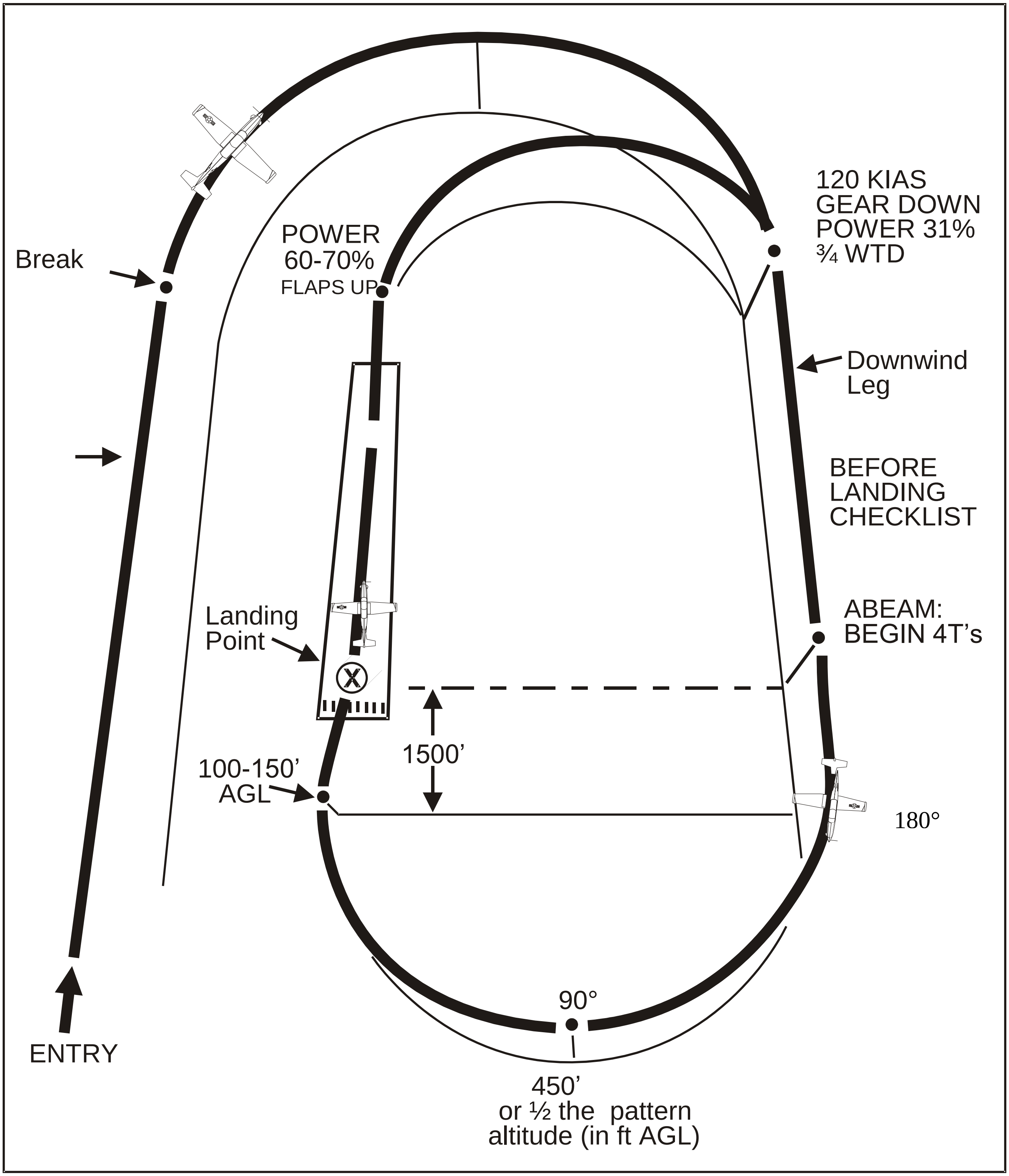

Figure 6-5 T-6 Landing Pattern

609. FINAL APPROACH

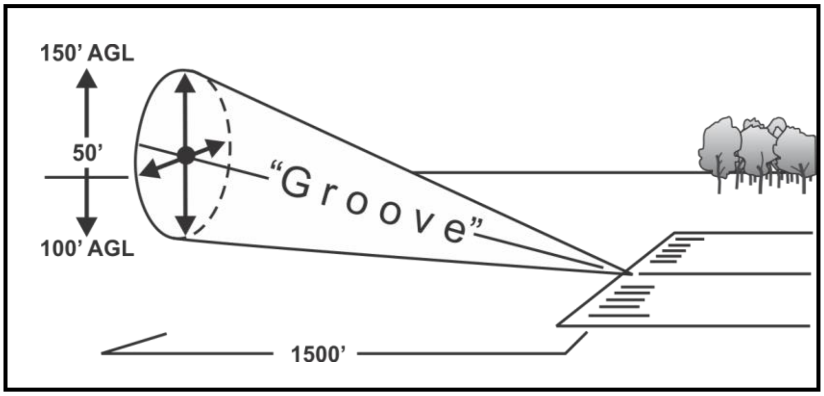

Figure 6-6 The Groove

The goal leaving the 90° position is to position the aircraft on final approach on airspeed and in the "Groove." The groove is defined as 100 to 150 feet AGL with approximately 1500 feet of straightaway (Figure 6-6). The roll out on final will normally necessitate a power reduction to decrease airspeed to final approach speed (110/105/100 KIAS) and to counter the increase in lift, resulting from leveling the wings.

When established on final approach in a VFR pattern, attempt to position the correct aimpoint at the right level in the windscreen. Correct airspeed with coordinated nose attitude and power changes. Figure 6-7 illustrates an aimpoint. Flying the proper glide path down final will hold the aimpoint steady in the correct windscreen position all the way down to the flare. Make pitch corrections and power adjustments for airspeed as necessary. In the absence of a landing flare, the aimpoint would equal the intended point of landing.

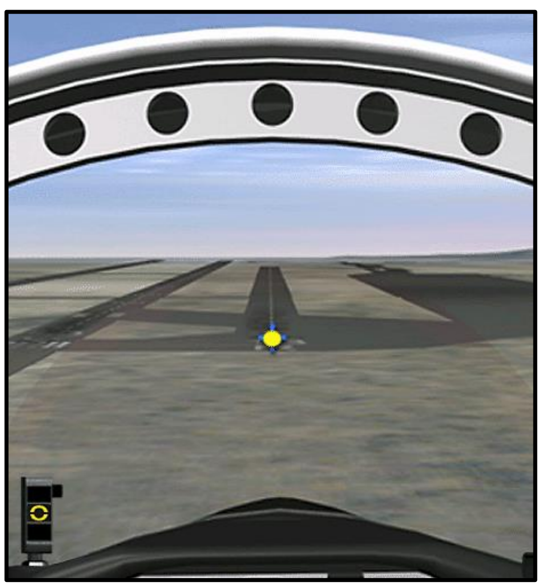

Figure 6-7 Aimpoint On Final

610. LANDINGS

Crossing the runway threshold, further power reduction may be required to stay on speed. When five to ten feet above the runway surface, transition your eyes down the runway and begin a smooth power reduction to idle. In ground effect, set the landing attitude, steadily increasing back stick pressure to flare the airplane and touchdown at the intended point of landing. The landing attitude in the T-6A is slightly higher than the takeoff nose attitude. Use the rudders as necessary to keep the fuselage aligned with the runway.

If the landing is to a full stop, use rudder and ailerons to maintain runway centerline. Do not apply brakes prior to nose wheel on the deck and never above 80 KIAS on landing roll-out, unless stopping distance on the runway is questionable. Be very smooth and coordinated with brake applications to bring the aircraft to a safe taxi speed. As a reminder, the N_1 will automatically reduce from flight idle (67%) to ground idle (60%) approximately four seconds after touchdown. After the aircraft is at a safe taxi speed and the rudder pedals are verified neutral, engage nose wheel steering to taxi off the runway.

611. CROSSWIND LANDINGS

In crosswind conditions, fly the same ground track around the pattern, crabbing into the wind as required. Once established on final, use the rudders as necessary to keep the fuselage aligned with the landing runway. Use the ailerons as necessary to maintain centerline. This will necessitate lowering the wing into the wind to offset the crosswind-induced drift (Figure 6-8). Maintain this "wing-low" attitude all the way down to the flare and landing. Touchdown on the upwind main gear tire first, as required. Maintain ailerons deflected into the wind during ground roll and takeoff, if touch & go. After liftoff and positive climb verified, allow the aircraft to crab into the wind. Discontinue the wing low method and check balance ball centered.

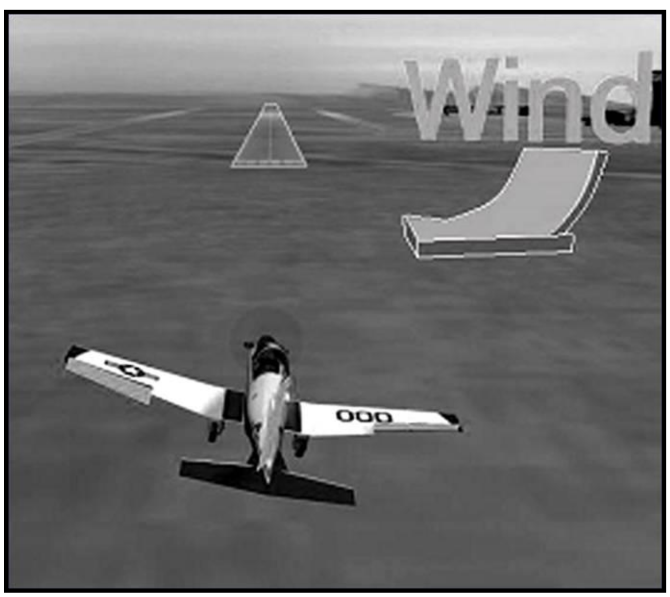

Figure 6-8 Crosswind Approach

612. WAVEOFF (GO-AROUND)

The waveoff or go-around is an intentional discontinuation of an approach. Generally speaking, a waveoff should be initiated for three reasons: runway not in sight (this typically happens during instrument approaches in IMC conditions), directed by an external source (i.e., the tower or RDO), or unable to make a safe landing. The first two reasons are clear-cut. As you gain experience, you will better recognize unsafe approaches that should lead to waveoffs. Examples of unsafe approaches are unsafe altitude, unsafe airspeed, overshooting approach, insufficient traffic separation, and drifting or crabbing prior to touchdoown.

The waveoff can be initiated anywhere inside the 180° position all the way to the landing flare. Waveoffs are an invaluable tool to safe pattern operations and should not be viewed as an abnormal procedure unless executed too late. Once you've initiated a waveoff, do not change your mind and attempt to land.

613. WAVEOFF PROCEDURES

Use good judgment when executing the waveoff procedure. Depending on where the waveoff is initiated, procedures may be modified to fit existing conditions.

1. Advance PCL to maximum power (firewall).

2. Level the wings and set pitch as required to begin climb.

3. When a positive rate of climb and airspeed 110 KIAS or more is confirmed, select flaps up and transmit radio call, "***(Call Sign),*** waveoff." Trim.

4. Reduce power, as appropriate. Accelerate to and climb at 120 KIAS. Adjust your flight path, moving to the side of the runway, as necessary, to avoid conflicting traffic and to keep an aircraft on the runway in sight.

5. With interval, call crosswind to re-enter downwind or depart the pattern.

NOTE

The preceding waveoff procedure is specific to VFR pattern operations. If in IMC Conditions, a waveoff is normally followed by a return to IFR procedures, in which case the gear will be raised prior to raising the flaps. Refer to the "Missed Approach" and "Go Around/Waveoff" sections in Chapter 2 of the NATOPS.

NOTE

A common and potentially lethal waveoff situation you should be aware of and understand occurs in any landing pattern where practice Emergency Landing Patterns (ELP) are flown on the opposite side of touch & go traffic (such as at some OLFs). The potential conflict exists when one aircraft is inside the 180° position on one side of the pattern and another aircraft (normally executing a practice PEL is inside the low key position on the other side of the pattern (Figure 6-9). Both aircraft are converging to the same runway. PEL traffic always has priority over traffic established in the normal landing pattern. Therefore, be vigilant to clear visually and over the radios during your touch & go practice. If there is any question as to a possible conflict, with PEL traffic inside low key (on the opposite side), waveoff your approach. If you have any questions about this potential conflict situation, ask your IP.

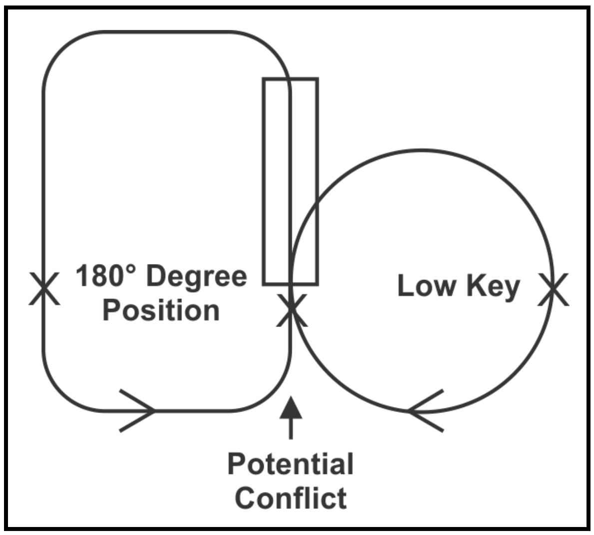

Figure 6-9 Potential Conflict with ELP Traffic

614. TOUCH AND GO PROCEDURES

A Touch and Go landing, as opposed to a Full Stop, will normally be flown on training sorties to maximize training repetition. Ensure the airfield's runway is of sufficient length IAW Wing and Squadron standard operating procedures.

1. When the main tires touch down, smoothly lower the nose gear to the runway and increase power to maximum (firewall). Commensurate with PCL movement, apply right rudder to counteract the engine/propeller induced left yaw.

2. After the engine spools up and 85 KIAS (or gust adjusted rotation speed), raise the nose to the takeoff attitude. Allow the aircraft to fly itself off the runway. When a positive rate of climb is confirmed and airspeed 110 KIAS or more, fully retract the flaps and leave the gear down. Trim.

NOTE

Retraction of flaps from the TO to the UP position is not recommended below 110 KIAS to preclude the aircraft settling back to the runway; however, there is no settling when raising the flaps from the LDG to the TO position.

3. Reduce power to 60 to 70 percent torque. Accelerate to and climb straight ahead at 120 KIAS. Begin visually acquiring interval traffic.

4. When above 400 feet AGL and "#1 with interval," make the crosswind radio call and begin the crosswind turn. For tower controlled airfields, you must request and receive clearance to turn crosswind. Maintain 120 KIAS in the climb.

NOTE

You are “#1 upwind, with interval” for the crosswind turn when: 1) the aircraft ahead of you is abeam or behind your wingtip and has completed at least 90º of turn, or 2) the aircraft ahead of you on the upwind leg has departed the pattern (thus doing away with any “abeam” requirement to turn).

5. Initiate level off 50 feet prior to pattern altitude by lowering the nose and reducing power to ~31%. Level off, maintain 120 KIAS, and establish 3/4 WTD spacing from the duty runway. In perfectly calm wind conditions, the downwind heading (reciprocal of runway heading) will maintain the proper spacing. This is not true when crosswind conditions exist. If there is a crosswind, angle or crab the aircraft sufficiently into the wind to prevent drifting into or away from the runway. It is not uncommon to alter the downwind heading as much as 10º to maintain the proper 3/4 WTD spacing parallel the runway.

6. Initiate BEFORE LANDING checklist. From this point, procedures are identical to those outlined in sections 608 and 609 above.

615. OLF ENTRY PROCEDURES

The following procedures guide you from Outlying Field (OLF) entry to OLF departure. Although they are uncontrolled, many OLFs have a Runway Duty Officer (RDO) and a crash crew positioned at the approach end of the runway. They observe and monitor pattern operations and provide traffic de-confliction/general information for aircrews. A few of the radio calls are provided, however, you should review the Voice Communications FTI for expanded radio procedures in the pattern.

1. Determine the duty runway. Select the appropriate OLF frequency and transmit, “***(Field name)***, landing” over the radio. The RDO/crash crew will reply with the duty runway.

2. As you diligently clear the area for traffic, proceed inbound to intercept the traffic pattern from an initial or high key position.

3. Approaching the airfield, offset the runway, 1/4 WTD on the opposite side of the break direction (i.e., offset to the left for a right break). As you offset, attempt to determine wind direction (windsock, etc.). Begin intently clearing for pattern traffic on the downwind and/or crosswind legs. Locate your “interval” traffic (the aircraft you will be following).

4. When at the upwind numbers and “#1 upwind, with interval,” transmit the break radio call.

5. Perform the break as described in paragraph 605.

616. DEPARTING THE OLF PATTERN

To depart an OLF, you must be #1 upwind. You are “#1 upwind” when: 1) the aircraft ahead of you has begun the crosswind turn (no abeam requirement), or 2) the aircraft ahead of you on the upwind leg has departed the pattern. Note the differences from “#1 upwind, with interval,” which is required to turn crosswind.

NOTE

> Reducing power to 60-70 percent torque is only required to maintain spacing on the aircraft in front of you until you are #1 upwind. In the absence of traffic conflicts, accelerate with max power, taking care to not overspeed the gear.

1 After liftoff on the last touch and go, raise flaps and accelerate IAW normal Touch and Go Procedures.

2. When above 400 feet AGL and “#1 upwind,” transmit departing radio call, “(*NOLF name*) RDO, (*call sign*), departing.”

3. Advance PCL to max power.

4. Raise the landing gear handle, and complete the AFTER TAKEOFF Checklist.

5. When clear of the pattern, switch to area common frequency and comply with course rules for departure.

CHAPTER SEVEN
EMERGENCY PROCEDURES

700. INTRODUCTION

Arguably the most significant training you will receive during the contact stage will be in Emergency Procedures (EPs). You will learn how to appropriately interpret and apply NATOPS Emergency Procedures, establish strong crew coordination during an emergency, and manage the external radio communications required. Moreover, beyond merely developing these skills for the future, realize now that should an emergency occur during your T-6A training, you will be expected to be a proactive, contributing crewmember from day one on the flight line.

Figure 7-1 Aircraft Emergency

The T-6A NATOPS Flight Manual, Section III, will be your governing publication for all T-6A EPs and the primary focus of your study and preparation. This chapter of the FTI merely expands and amplifies certain procedures from the NATOPS. If discrepancies exist between the FTI and the NATOPS Manual, the NATOPS takes precedence.

You are required to memorize all of the NATOPS boldfaced emergency procedures. During your preflight briefings and in the aircraft, you will be expected to verbalize boldfaced items. Although not required to commit non-boldfaced items to memory, you should have an in-depth understanding of each step of the emergency procedure. Apply your knowledge of T-6 systems to understand the "how" and "why" of EP composition.

When an emergency occurs, three basic rules apply. These rules should be thoroughly understood by all aircrew:

Maintain aircraft control: Establishing the aircraft in safe controlled condition should always be your first priority in any emergency. On the ground this may be stopping the aircraft and setting the parking brake, in the air this often requires nothing more than continuing in straight and level flight at a safe altitude; however, if performing aerobatic maneuvers, stalls, or spins, maintaining aircraft control will require an OCF, or unusual attitude recovery in order to establish aircraft control.

Analyze the situation and take proper action: Next, 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, apply any applicable boldfaced items, then open your Pocket Checklist and with good aircrew coordination, continue with the emergency procedure. Part of taking the proper action will involve coordinating your intentions with controlling agencies. Do this only after the aircraft in under control, appropriate checklists have been run, and a recovery plan has been developed.

Land as soon as conditions permit: The severity of the problem will dictate the course of action required to safely recover the aircraft. As the SNFO, you should always identify the nearest suitable landing field. Review the definitions for "Land as soon as possible" and "Land as soon as practical" in the T-6A NATOPS, Section III Introduction.

701. EMERGENCY LANDING PATTERN

The Emergency Landing Pattern (ELP) is a 360º overhead pattern (Figure 7-3) designed to position the aircraft for landing when the possibility of a power loss exists (Precautionary Emergency Landing [PEL]) or no power is available (Forced Landing). In the case of a Forced Landing, ELPs should be flown to prepared fields, as ejection is strongly preferred over forced landings into unprepared terrain, but if a prepared field is not reachable and ejection is not possible the ELP will be flown to the unprepared touchdown point.

The underlying function of the PEL is to establish the aircraft in a position such that, if the engine quits, you will have sufficient energy (altitude and airspeed) to perform a propeller-feathered glide to a suitable runway. PEL procedures are found in NATOPS and will fall under Aviate, Navigate, Communicate priorities. For example:

1. Turn toward the nearest suitable landing area.

2. Climb or accelerate to intercept the ELP

    a. PWR (Max allowable)

    b. Climb IAS (140 KIAS as a consideration for best rate of climb)

    c. Altitude (Calculate what altitude is required to intercept ELP and reach desired field)

        – Distance from landing area divided by 2 X 1000 + 3000 (hi key) or 1500 (low key) + Field Elevation

3. Gear, Flaps and Speed brake UP (aircraft climbs and glides better clean)

4. PCL - Read

Unlike the total power loss scenarios, power is available in a PEL and should be used, if necessary, to an intercept point on the ELP. If weather precludes a climb to dead engine glide altitude, accelerate to intercept the ELP at some point at or below high key. Power can also be used while on the ELP anytime the aircraft is off profile. Once established on the ELP profile (i.e.: at or above dead engine glide altitude), set power to 4 to 6 percent torque to simulate a feathered propeller and 125KIAS, crosschecking the VSI for 1350 to 1500 ft/min rate of descent.

702. MANAGING PROFILE ENERGY

NOTES

SNFOs will not be at the controls once the aircraft reaches high key in the ELP. The student will inform the IP of the ELP check points and ensure the aircraft is on profile.

At 125 KIAS the aircraft should glide 2 miles per 1000 feet AGL. 125 KIAS is the maximum glide distance airspeed for clean configuration with the propeller feathered. Realize the 2 NM/1000 feet glide ratio is based on no wind conditions. A strong headwind can degrade glide performance considerably.

There are several methods of correcting for low energy, one is to delay gear/flap extension until established in the ELP. If you find yourself low on energy and unable to make high key, aim for another checkpoint on the ELP, whether it be crosswind, low key, or base key. If you find yourself low on energy once established in the ELP, as stated before, add power if it is available, or increase your AOB to tighten your turns which will shorten your ground track as needed.

If excess altitude exists during the glide to high key, the most common methods to lose altitude are Bow Ties, S-Turns, Slips, and 360° turns. Any one or all of these methods may be used while gliding to high key. Lowering the gear to increase your descent rate to high key should be a last resort option since the emergency hydraulic system, if used, does not allow for raising the gear once lowered. If power is available, PCL idle or speedbrake may also be used.

Bow Ties are essentially a continuous set of mild turns in the shape of a bow tie flown approximately ½ WTD away from the approach end of the runway. During each bow tie turn, you should attempt to keep the landing runway in sight. Bow ties are not precise maneuvers and different techniques exist on how to fly them. Your instructor will provide guidance; however, a good technique is to depart the bow ties for high key at least 1000 feet above high key altitude.

S-Turns are used to effect milder/smaller altitude losses and may be used to make controlled corrections while proceeding direct to high key. Designed to increase the actual track over the ground, S-Turns are simply lazy turns back and forth deviating from a straight-line ground track in order to provide more time to descend.

The Slip is a faster method than the others to affect a controlled altitude loss. As explained in Chapter Three, the slip is uncoordinated flight during which the airplane slides sideways toward the center of the turn. This is intentionally accomplished by lowering one wing and applying opposite rudder (remember "wing down, top rudder").

A 360° turn is generally accomplished very near or directly over the intended landing destination (Figure 7-2). Be certain you have enough altitude to “play” with. A 360° turn, flown at 125 KIAS can lose approximately:

2000 feet at 30° bank
1500 feet at 45° bank
1000 feet at 60° bank

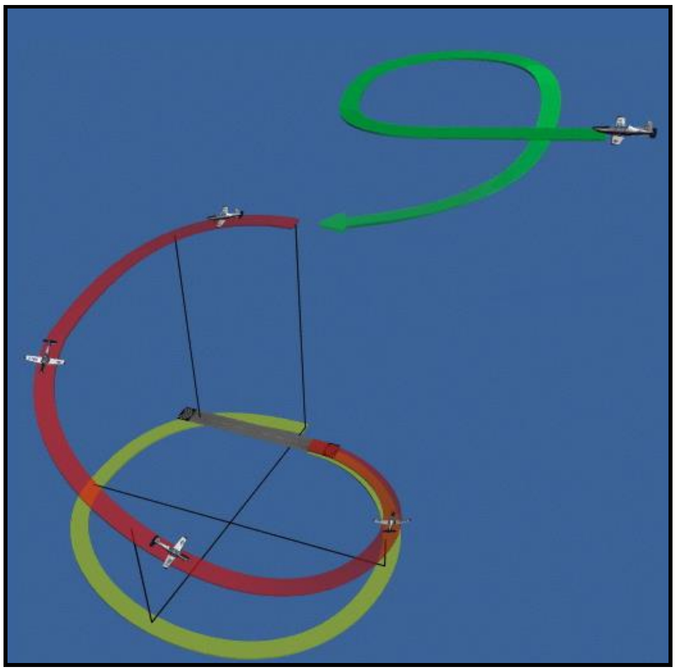

Figure 7-2 ELP 360° Turn

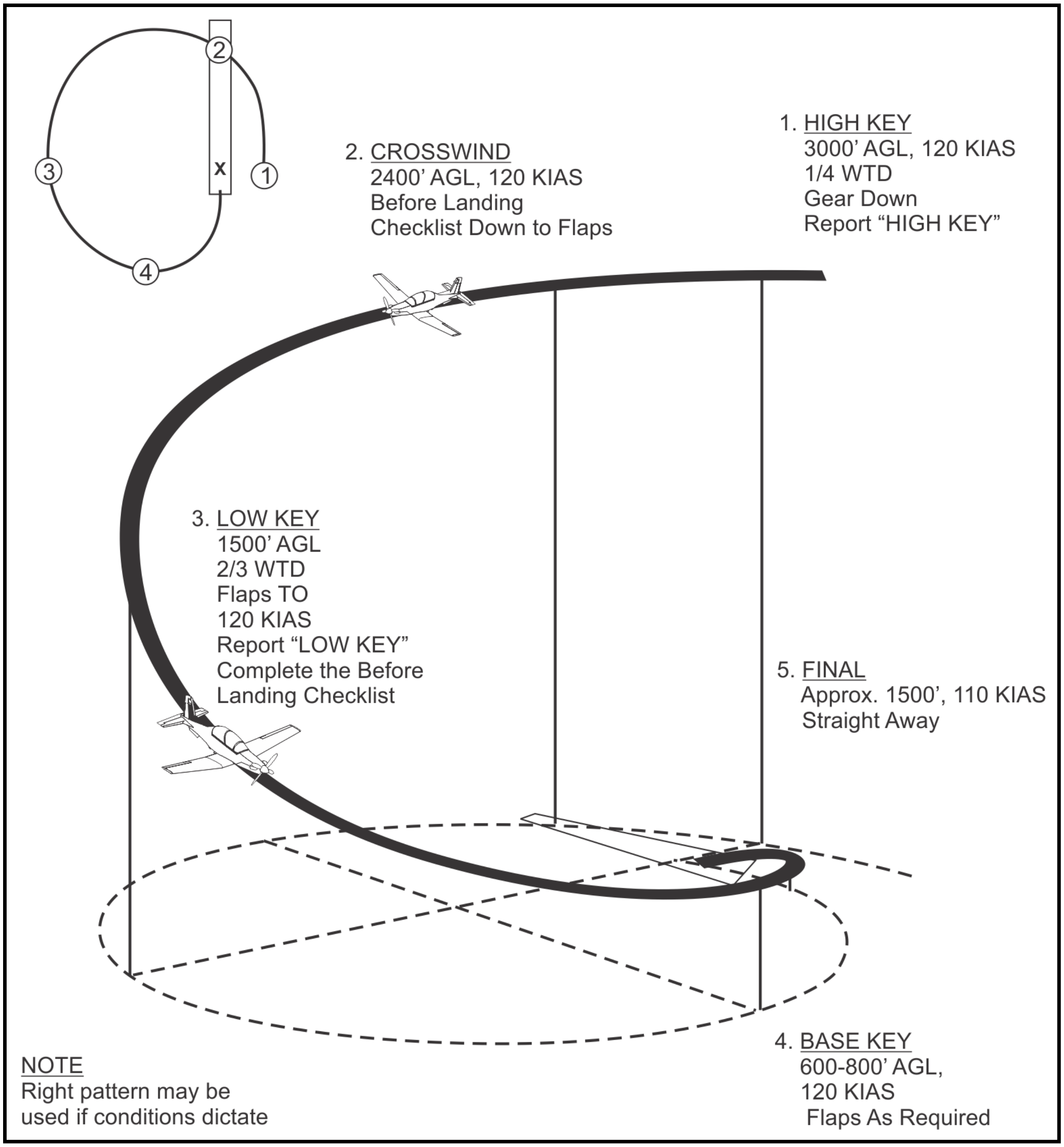

Figure 7-3 Emergency Landing Pattern

703. PRACTICE EP IN FLIGHT

The instructor will initiate the simulated EP above 3000 feet AGL. This may occur at any airspeed and/or configuration. Fly to intercept the ELP profile, if necessary, while simultaneously executing the appropriate procedures. At the instructor's discretion, simulated EPs may ultimately be resolved by a Forced Landing, PEL, successful airstart, or ejection. Stay focused, during the emergency, follow the appropriate procedures, and carry the simulated emergency to a logical conclusion.

NOTE

When conducting simulated emergencies in the aircraft, verbalize emergency procedures that actually move switches or the PCL with "simulated." For example, use "PMU Switch – "Simulated Off." During your aircraft simulated EP training, ***do not*** actually manipulate switches or position the PCL to OFF in flight. In response to "PCL" – "Simulated Off" the instructor will set the power to 4 to 6 percent to simulate the feathered propeller condition, when appropriate.

An alert crewmember is constantly on the lookout for suitable landing fields in the event of an actual emergency. If available, a 4000 foot or longer, hard-surfaced runway with no obstructions (trees, power lines, etc.) on the approach end is ideal. The absolute minimum recommended field length for *emergency* operations is 3000 feet. Always be aware of wind direction and velocity. A strong headwind is helpful in many respects, but it can make an ELP a challenge, ***especially*** for forced landings. Visually, the best wind indicator is blowing smoke. If unable to determine the winds, use your last known wind. SNFOs will not be at the controls once the aircraft reaches high key in the ELP. The student will inform the IP of the ELP check points and ensure the aircraft is on profile.

704. PRACTICE ELP PROCEDURES

1. Receive the appropriate clearance for high key entry from the tower, RDO, or approach control (as applicable).

2. Manage energy so as to arrive at High Key on altitude with proper runway displacement.

3. Report "High Key" to the controlling agency (as required).

4. Maintain airspeed on ELP IAW Forced Landing Procedures, if simulating as in a Practice Precautionary Emergency Landing (PPEL) or an actual PEL.

5. Initiate the Before Landing Checklist stopping at FLAPS.

6. Arrive at Low Key on altitude with proper runway displacement. Report "Low Key, Gear Down" to the controlling agency.

7. Lower Flaps as required and complete the Before Landing Checklist.

NOTES

1. Do not lower flaps to LDG until landing is assured. Drag will increase dramatically once landing flaps have been lowered; attempt to utilize LDG flaps more as means to shorten landing roll and less as a means to manage energy in the ELP.

2. At low key, do not lower the flaps if below profile. If engine power is available (PEL), add power to maximum allowable per emergency procedure, regain profile, and select flaps to TO. If without power, continue on the ELP, modify ground track if required, regain profile, and select flaps as required.

705. EMERGENCY VOICE REPORTS

The FIH, Section A, delineates all communications (verbal and nonverbal) for aircraft in distress. Ensure you bring the FIH on all flights for reference.

Emergency voice reports are transmitted in the **I**dentification, **S**ituation, **P**osition, and **I**ntention (ISPI) format. Emergency voice reports regarding situations of an immediate or serious nature which require immediate assistance are prefaced with "MAYDAY, MAYDAY, MAYDAY." Emergency reports of a delayed or less serious nature are preceded with "PAN-PAN, PAN-PAN, PAN-PAN." An example of an emergency voice report of an engine failure is as follows:

"MAYDAY, MAYDAY, MAYDAY, (*Call Sign*), engine failure, five miles northeast of Barin OLF at 6000 feet, executing forced landing at Barin, Runway 09."

In a radar environment (Radar Contact), or positive radio contact with a tower/RDO, standard procedure for a distressed or urgent situation is to declare an emergency. An example of an emergency voice report in a radar environment or positive radio contact with a tower/RDO is as follows:

"*(Call sign)* emergency. Chip light, proceeding to high key for runway 19 NPA."

Time permitting, expect to inform ATC/Tower/RDO of fuel remaining in hours and minutes (i.e., 1+00) and the number of people on board after delivery of ISPI information.

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CHAPTER EIGHT
AEROBATICS

800. INTRODUCTION

The FAR AIM defines aerobatics as an intentional maneuver involving an abrupt change in an aircraft's attitude, an abnormal attitude, or abnormal acceleration, not necessary for normal flight. The instructor will fly aerobatics as demonstration items on your contact checkride, but also may fly them on other contact flights, depending on your tolerance to airsickness. SNFOs are responsible to know the geometric shapes of the maneuvers, as well as their defining parameters (Figure 8-1).

Aerobatic Maneuver	Entry Airspeed	Gs Required	Altitude Change	Exit Airspeed	Energy Classification
Loop	230 – 250	High	NC	230 - 250	Neutral
Wingover	200 – 220	Low	NC	200 - 220	Neutral
Barrel Roll	200 – 220	Moderate	NC	200 - 220	Neutral
Aileron Roll	180 – 220	Low	NC	200 - 220	Loser
Split S	120 – 140	High	- 2500 feet	220	Neutral
1/2 Cuban Eight	230 – 250	High	NC	230 - 250	Neutral
Chandelle	200 – 250	Moderate	+ 3000 feet	Flying A/S	Gainer
Cloverleaf	200 – 220	Moderate/High	NC	200 - 220	Slight Loser
Immelmann	230 – 250	High	+ 2500 feet	Flying A/S	Gainer

Figure 8-1 Aerobatic Maneuver Parameters

Prior to performing aerobatic maneuvers, perform a G warm maneuver, complete the Pre-Stalling, Spinning, and Aerobatic Checks, and accomplish a clearing turn. Start your aerobatic maneuvers from an altitude which will permit a complete maneuver and a return to straight and level flight at or above 6000 feet. You must not exceed the maximum altitude permitted for your operating area. Many aerobatic maneuvers performed require approximately 2500 feet vertically.

801. G-INDUCED LOSS OF CONSCIOUSNESS

G-induced loss of consciousness (G-LOC) is a fainting episode caused by gravity-induced physiological changes on the human body. G forces are common when pulling out of a high speed dive, or during a high AOB turn. The G force is felt from head to foot and gives the feeling of being squashed down in the seat. Positive Gs cause blood to pool in the lower body extremities. This pooling dramatically reduces the available blood to the brain and eyes, thereby reducing the oxygen required to maintain consciousness and vision.

An impending sign of G-LOC is “grayout” in which there is a loss of peripheral vision. In a “blackout,” vision is lost completely. G-LOC usually coincides with blackout and lasts from 15-30 seconds. When the aviator awakens, it is to a disoriented or “dream-like” level of consciousness, which can last from only a few seconds to several minutes. Amnesia, uncontrollable muscle spasms, and a feeling of weakness are common occurrences. This impaired ability to fly may last as long as 30 minutes.

The Navy has reported numerous Class A mishaps identifying G-LOC as a possible causal factor. The Air Force estimates at least 12% of all fighter/trainer pilots have experienced G-LOC at least once. The G loading capability of the T-6A is comparable to most fighter/trainer jets and is therefore notorious for causing G-LOC among new pilots. Most G-LOC incidents in similar aircraft occur during G loading of 3 to 5 Gs during rapid G loading intervals of two to five seconds.

802. THE ANTI-G STRAINING MANEUVER

There are two components to the recommended Anti-G Straining Maneuver (AGSM):

1. A continuous and maximum contraction (if necessary) of all skeletal muscles including the arms, legs, chest, and abdominal muscles (and any other muscles if possible). Tensing of the skeletal muscles restricts blood flow in the G dependent areas of the body and thereby assists in the retention of blood in the thoracic (chest) area, the heart and brain.

2. The second component of the AGSM involves repeated closing of the respiratory tract at 2.5 to 3.0 second intervals. Its purpose is to counter the downward G force by expanding the lungs and increasing chest pressure, thereby forcing blood to flow from the heart to the brain.

The respiratory tract is an open breathing system which starts at the nose and mouth and ends deep in the lungs. It can be completely closed off at several different points, the most effective of which is the glottis. Closing the glottis (which is located behind the “Adam’s Apple”) yields the highest increase of chest pressure. The glottis can be closed off by saying the word “HICK” and “catching” it about ¾ of the way through the word (“Hiii-“). This should be said following a deep inspiration, followed by forcefully closing the glottis as you say “HICK.” Bear down for 2.5 to 3.0 seconds, and then rapidly exhale by finishing the word HICK (“ka). This is immediately followed by the next deep inhalation repeating the cycle until the G loading is discontinued. The exhalation and inhalation phase should last no more than 0.5 to 1.0 second.

NOTES

1. Do not hold your respiratory straining too long (more than five seconds) since this will prevent the proper returning of blood to the heart and may result in loss of consciousness.

2. Anticipate a rapid-onset, high G exposure whenever possible. The skeletal muscles should be tensed prior to the onset of Gs and coupled with the "Hick" cycle as the increasing of G's begins. Initiating the AGSM too early can inhibit the body's natural cardiovascular reflex responses. Starting the AGSM too late is a difficult situation to make up without reducing the G- stress.

3. If you have trouble or are in doubt about using the AGSM correctly, see your Wing Aeronautical Medical Safety Officer (AMSO) or squadron flight surgeon.

803. G-WARM

The G-Warm is a maneuver designed to accustom your body to high G loadings prior to attempting any dynamic maneuvering such as aerobatics and is required prior to attempting any maneuvers expected to be completed at 3 G's or greater. It consists of a 90 degree turn at 3 G's, followed closely by a second 90 degree turn at 4 G's.

804. LOOP

The Loop (Figure 8-2) is a 360º turn in the vertical plane. Since it is executed in a single plane, the primary control surface used is the elevator. Ailerons and rudder are used for coordination and directional control. The objective of this maneuver is to maintain a constant nose track.

The loop begins from straight and level flight and passes successively through a climb, inverted flight, a dive, and a return to level flight. The loop teaches understanding of the elevator in aerobatics, and situational awareness throughout the entire range of pitch angles. The loop is probably the oldest and one of the simplest aerobatic maneuvers, yet one which requires finesse to do well.

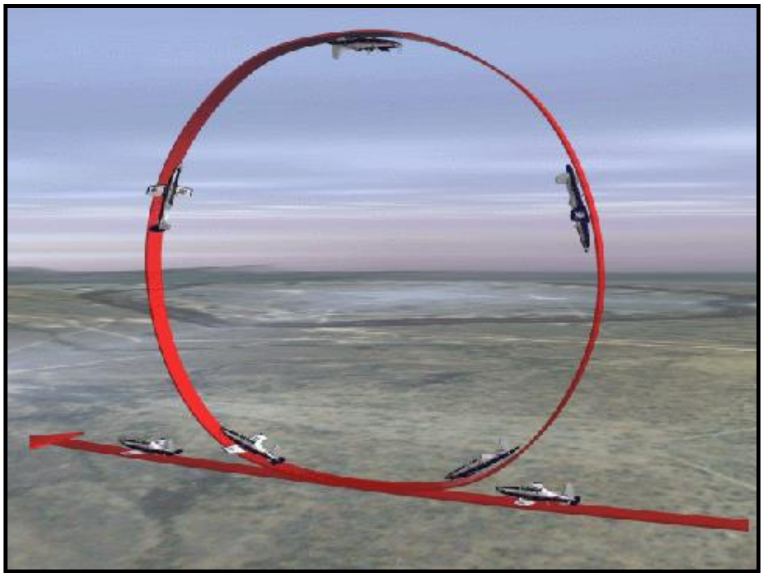

Figure 8-2 The Loop

The loop has six parts:

- Entry
- Initial pull-up
- Vertical
- Inverted climbing
- Inverted descending
- Maneuver completion

Entry: The loop begins with airspeed at 230 to 250 KIAS and MAX power. Complete the pre-aerobatic check, as necessary, then clear the area and align the aircraft with a section line or straight road that extends ahead and behind the aircraft. Check that you have enough altitude above you to complete the maneuver. You will need approximately 2500-3000 feet, depending upon the amount of "g" force you apply in the pull-up.

Initial Pull-Up: Commence your anti-G straining maneuver and increase the back pressure to 3-4 Gs to pull the nose up at a constant rate. If you pull too fast, you may stall by exceeding the critical AOA. If you pull too slowly, your airspeed will be slow over the top and you may stall. When you can't see the horizon in front of you anymore, crosscheck the wing tips to assure they remain parallel to the horizon. Make sure you don't inadvertently bank the aircraft toward the direction you are looking while checking the wing tips.

Vertical: As the airspeed decreases in the climb, more back stick pressure is required to keep the nose tracking at a constant rate. Use right rudder pressure to keep the nose tracking in a straight line, and aileron to keep the wings level. Relax your anti-G straining maneuver as aircraft G-loading decreases.

Inverted Climbing: Shortly after passing the vertical, tilt your head back and pick up the horizon and your reference line. Once you pick up the horizon, use it as the reference to maintain wings-level. Keep the nose track constant by adjusting back stick pressure until you pass through the horizon inverted. Airspeed should be approximately 100 to 120 KIAS wings level inverted.

Inverted Descending: The last half of the loop is the opposite of the first. As airspeed increases, resume your anti-G straining maneuver and increase back stick pressure to maintain the rate of nose track. The G's will increase to 3-4 Gs. Right rudder pressure is now reduced to maintain coordinated flight. Continue cross-checking the wingtips and the ball in the turn and bank indicator to maintain wings level and to keep the nose tracking along the reference line.

Maneuver Completion: As you pass vertical and near the bottom of the loop, your airspeed rapidly increases. Continue to increase back stick pressure to keep the nose tracking at a constant rate. Use the rudder to maintain coordinated flight. Keep the nose tracking down the reference line and your wings parallel to the horizon. As the nose of the aircraft approaches the horizon, adjust the back pressure to return to the level flight attitude.

805. WINGOVER

The Wingover (Figure 8-3) is a 180º reversal in the direction of flight accomplished by combining a smooth climbing turn to 90º AOB and 90° of heading change with a smooth diving turn of 90º heading change to wings level flight, recovering at the same airspeed and altitude at which the maneuver has started, but on the opposite heading (Figure 8-3). It is a slow, smooth maneuver when properly executed. No abrupt control movements are necessary.

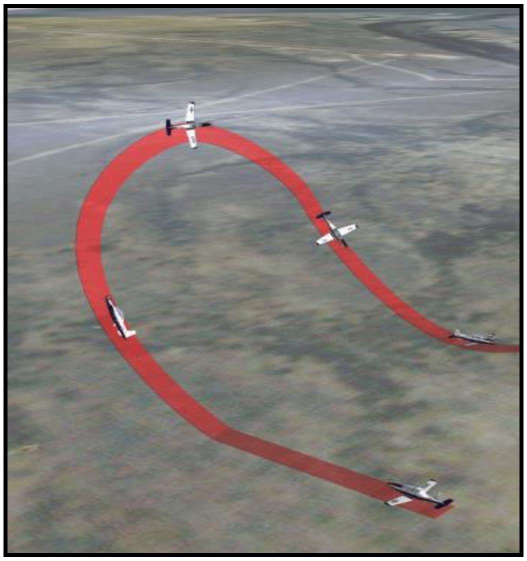

Figure 8-3 Wingover

The wingover is started from wings-level flight with airspeed at 200 to 220 KIAS and power set at 50% to 70%. Perform your pre-aerobatic check, if necessary, then clear the area and ensure that you have enough airspace above and in the direction of turn to complete the maneuver. Place a reference point off the wingtip in the direction of the desired turn. A straight road, cloud, or other prominent landmark makes good references for the wingover.

Once you are set up for the maneuver, blend aileron, rudder and elevator pressures simultaneously to start a gradual climbing turn in the direction of the reference point. Time the turn and pull-up so the nose reaches the highest pitch point (approximately 45°) when the aircraft has turned approximately 45° or halfway to the reference point. Use outside references and the attitude indicator to crosscheck the pitch and bank attitudes. Avoid rolling and turning too fast, think one degree of bank for each degree of pitch. Add lateral stick, aft stick, and rudder pressure as airspeed decreases to maintain coordinated flight, a constant roll rate, and a constant pitch rate.

As the nose of the aircraft passes the 45° reference, look ahead in the turn and find your original 90° reference. Continue the coordinated roll at a constant rate by increasing lateral stick pressure; however, relax back stick pressure so that the aircraft reaches 80 to 90° of bank as the nose reaches the horizon. The rate at which pitch decreases should be the same as it increased during the first 45° of turn. As the nose passes through the horizon, the 90° reference point should move through the center of the windscreen and the airspeed should be approximately 100 KIAS below the entry airspeed.

As the nose passes through the horizon, begin to decrease the bank gradually. When the aircraft has turned 135°, the nose should have reached its lowest attitude. The bank should diminish during the descending turn at about the same rate that it increased during the climbing turn. As airspeed increases, decrease lateral stick and rudder pressure but increase back stick pressure to maintain the pitch and roll rate in coordinated flight. Plan to arrive at the 180° point in level flight with entry airspeed. The original 90° reference point will now be off the opposite wingtip.

806. BARREL ROLL

The Barrel Roll (Figure 8-4) is a maneuver in which the aircraft is rolled 360º about an imaginary point 45º off the nose of the aircraft. The maneuver's beginning is similar to the Wingover except that after 90° of heading change, the aircraft will have rolled 180° (upside down). The roll is continued to complete another 90° of heading change and 180° of roll back to wings level and on the original heading, altitude and airspeed.

The barrel roll will help develop your confidence, coordination and situational awareness while flying the aircraft through rapidly changing attitudes and airspeeds. Since attitude, heading, bank and altitude change rapidly, this is an excellent maneuver for developing your ability to maintain orientation.

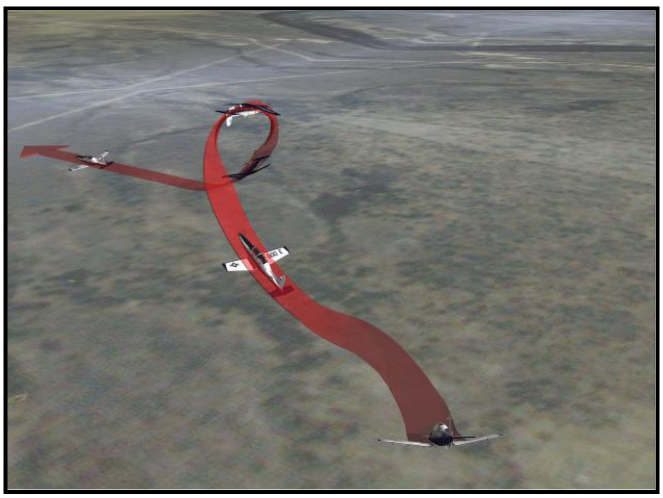

Figure 8-4 Barrel Roll

Commence your clearing turn at 200-220 KIAS. Roll out of the turn on/parallel to a good section line. Establish a reference point on the horizon 90º from your heading in the direction you intend to roll.

Raise the nose to commence the maneuver and start a roll so that the nose of the aircraft travels in an arcing path in the direction of your selected checkpoint. After 45º of turn, the AOB will be 90º and the nose will be at its highest point (55° to 60° above the horizon).

Continue rolling the aircraft at a constant rate until in a wings level, inverted attitude, heading directly at the 90º reference point on the horizon. Your nose should be slightly above the horizon and the airspeed ~120 KIAS. Fly the aircraft through the inverted position and continue rolling at a constant rate, completing the maneuver on your original heading and altitude at aerobatic cruise speed. Maintain a positive G load throughout the maneuver.

The nose should appear to make an arcing path about the imaginary point on the horizon 45º from your original heading. The last half of the arc will, therefore, be the same distance below the horizon as the first half is above the horizon. Remember, as the airspeed decreases toward the top of the maneuver, it is necessary to increase the deflection of the ailerons, rudder, and elevator to maintain a constant rate of roll and nose movement. Additionally, as the airspeed increases toward the bottom of the maneuver, it is necessary to decrease the deflection of the ailerons, rudder, and elevator to maintain a constant rate of pitch and roll. Notice this roll is started as a climbing turn, and then becomes a continuous roll at a constant rate.

807. AILERON ROLL

The Aileron Roll (Figure 8-5) is a 360º roll about the longitudinal axis of the aircraft. Roll at a rate to return the nose to the horizon as the wings return to level and reestablish straight and level flight.

Figure 8-5 Aileron Roll

The aileron roll begins from straight and level flight with airspeed at 180 to 220 KIAS and torque set ~80%. To set up for the aileron roll, complete the pre-aerobatic checklist, as necessary, and check your altitude and position before you begin the maneuver. Clear the area, with particular attention in front and above your position. Once you're aligned with a reference point, perform a wings-level pull-up to a pitch angle ~10° above the horizon. Relax back stick pressure prior to initiating the roll.

After relaxing backpressure, begin a brisk coordinated roll in either direction with lateral stick and rudder. The amount of stick deflection determines your roll rate. Hold constant lateral stick and rudder pressure and allow the nose to fall. A roll to the left requires less rudder and aileron deflection than a roll to the right due to engine torque. Do not apply additional back stick pressure to hold the nose on a point or above the horizon. Your roll rate should be fast enough to keep the nose above the horizon as you pass inverted flight.

As you approach the wings level attitude, gradually release aileron and rudder pressure to ensure a coordinated return to wings level.

808. SPLIT-S

The Split-S (Figure 8-6) maneuver combines the first half of an aileron roll with the last half of a loop. By seeing this maneuver demonstrated you will develop an appreciation of how rapidly airspeed increases and altitude decreases in such a situation.

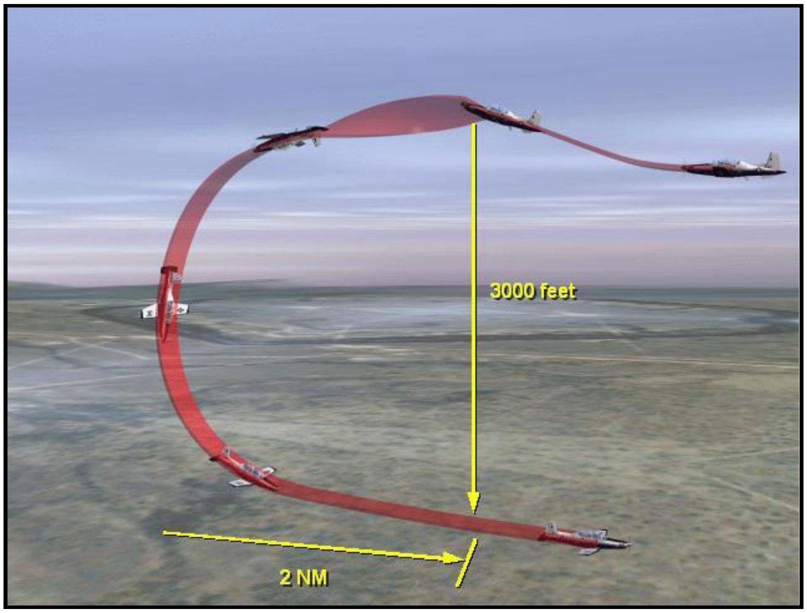

Figure 8-6 Split S

At an entry airspeed of 140 KIAS, with power at idle, raise the nose to approximately ~10° pitch attitude. Relax back stick pressure and momentarily pause in this nose high attitude. The pause is so you don't pull off your reference line when you roll. Roll the aircraft to the wings level inverted attitude.

Once wings level inverted, apply back stick pressure to bring the nose through the horizon. Attempt to achieve maximum nose track, without stalling the aircraft, by applying back pressure between the stick shaker and approximately 17 units AOA. Increase back stick pressure as the airspeed increases to continue maximum performance flight during the pull-through. Apply rudder as necessary to maintain coordinated flight throughout the pull-through. As the nose of the aircraft approaches the horizon, relax back stick pressure at the appropriate lead point and return to level flight. A good lead point for relaxing back pressure is when the horizon crosses the canopy bow.

809. ONE-HALF CUBAN EIGHT

The One-Half Cuban Eight (Figure 8-7) starts with the first half of a loop and continues to a point where you are inverted, nose 45º below the opposite horizon. At this point a half roll is performed to a wings level attitude in a 45º dive. Commence a recovery to level flight. The maneuver accomplishes a 180° change in direction and a return to the original altitude and airspeed.

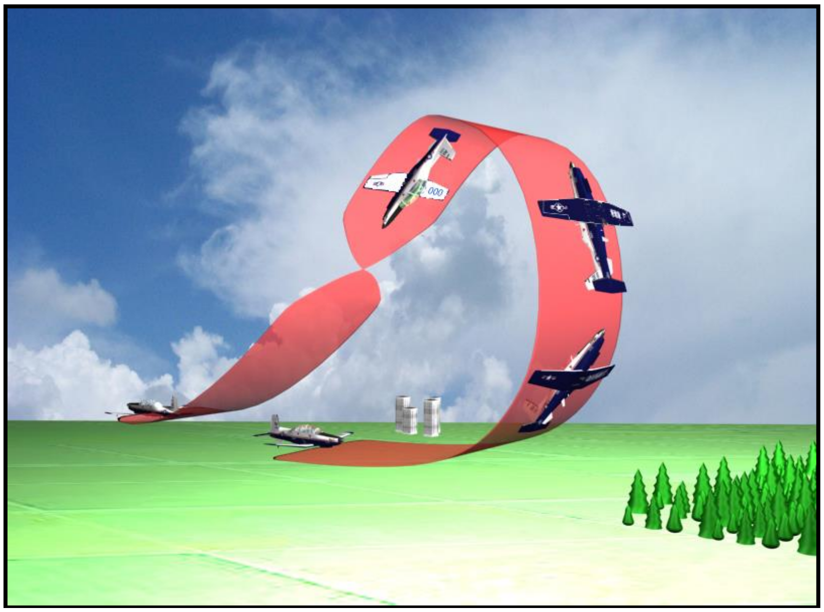

Figure 8-7 One-Half Cuban Eight

Do your pre-aerobatic check, if required, then clear the area and align the aircraft either over or parallel to a straight road, section line, or beach line. Check your position and altitude to ensure that you have sufficient altitude above and airspace ahead and behind to do the maneuver.

Begin the One-Half Cuban Eight or the Cuban Eight just like the Loop and Immelmann with a 3-4 G, wings-level pull. Keep the nose moving upward at a constant rate. Maintain wings level flight after the horizon goes below the nose of the aircraft by cross-checking the wingtips as in a Loop. Remember to increase right rudder as airspeed decreases to maintain coordinated flight. After you pass through the vertical, tilt your head up and find the opposite horizon. Use aileron as necessary to keep the wings-level as you pass through the horizon wings-level inverted. As the nose approaches approximately 45° nose low, relax back stick pressure and perform a half-roll in either direction with lateral stick and rudder. Remember to use opposite rudder during the first 90° of roll and coordinated rudder the last 90° of roll. The nose of the aircraft should roll around a point on the ground directly in front of you. After the roll, the aircraft should be wings-level, 45° nose low, and aligned or parallel to your reference line.

The ground point that the aircraft rolled around during the half-roll is now the aimpoint for the wings-level dive. Maintain the ground reference in the same point of the windscreen and perform a wings-level dive until reaching your recovery pull-up lead point to arrive on the original altitude and airspeed, heading 180° from original. A good lead point for the pull-up is approximately 205 to 210 KIAS. Begin a wings-level pull at 3-4 Gs so that the nose of the aircraft passes through the horizon at briefed entry airspeed. You will also be near your entry altitude at the end of the dive. If desired, the second leaf of the Cuban Eight is performed exactly like the first and the maneuver is complete at the original altitude, airspeed and heading.

810. IMMELMANN

The Immelmann is the combination of the first half of a loop followed by a half-roll to the wings level attitude (Figure 8-8). It achieves a 180º change of direction and a gain in altitude (approximately 2500 feet).

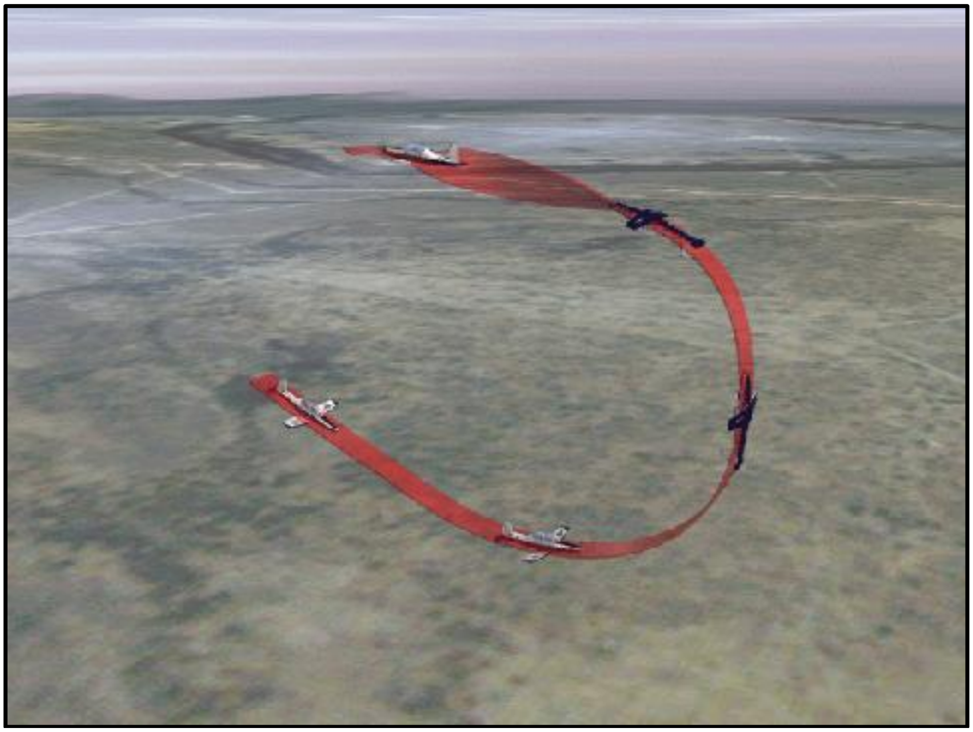

Figure 8-8 Immelmann

Begin the Immelmann just like the loop with a 3-4 G, wings level pull. Keep the nose moving upward at a constant rate. Maintain wings-level flight after the horizon goes below the nose of the aircraft by cross-checking both wingtips equal distance from the horizon. Moderate right rudder pressure is required to keep the aircraft coordinated as airspeed decreases. After you pass through the vertical, tilt your head up and find the opposite horizon. Use aileron and rudder as necessary to keep the wings-level as you approach the horizon wings-level inverted.

As the aircraft reaches a point approximately 10° above the horizon inverted, check your airspeed and freeze back stick pressure to stop the nose track. Do not begin the half-roll unless you can remain safely above level flight stall speed during the roll-out. Apply aileron in either direction to initiate a roll to level flight. During the first 90° of roll, rudder should be opposite to the applied aileron pressure. Rudder will be reversed and coordinated in the same direction as applied aileron in last 90° of roll. During the half-roll, the nose remains above the horizon and does not move either left or right. Maintain positive seat pressures throughout the roll.

The nose of the aircraft should not move either left or right during the half-roll. This is accomplished by using rudder to counteract the turning effect of lift. For a half-roll to the right you would use right stick and left rudder the first 90°, and right stick and right rudder the last 90°.

811. CHANDELLE

The Chandelle (Figure 8-9) is a180° steep climbing turn with a maximum gain of altitude. During the maneuver, the nose of the aircraft tracks along a line at a constant angle to the horizon. In a properly executed chandelle you should keep the nose of the aircraft rising at a constant rate during the climb to achieve the maximum altitude gain possible and still have enough airspeed to return to level flight without stalling the aircraft.

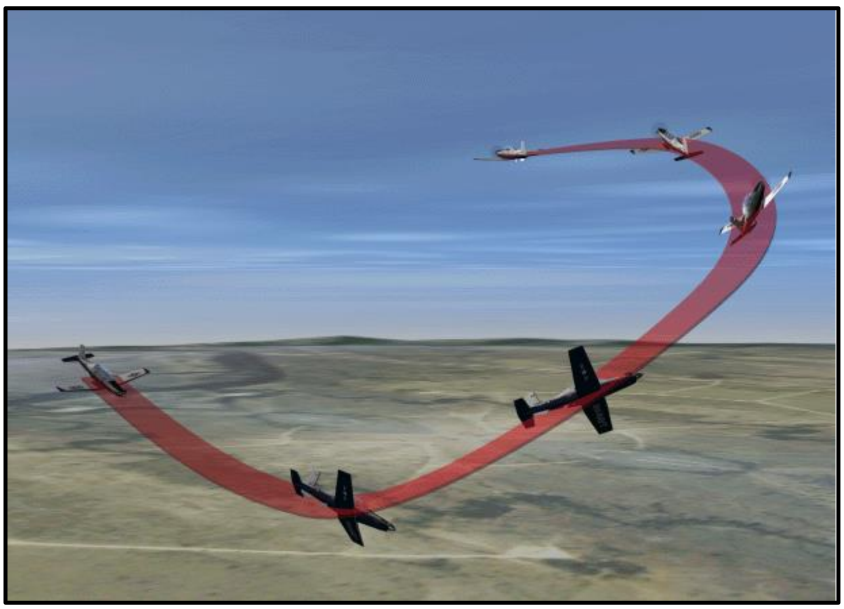

Figure 8-9 Chandelle

812. CLOVERLEAF

The Cloverleaf (Figure 8-10) is composed of four identical leaves, each of which changes heading by 90°. The pull up is similar to the loop, although with less G-load. The top part is a rolling pull to the horizon 90° displaced from the original heading. The diving portion of the cloverleaf is flown like a split S. The maneuver is complete in level flight after four leaves in the same direction. Fewer than four leaves may be performed when practicing the maneuver.

Begin in straight-and-level flight, with briefed entry airspeed and power setting. Pick a reference point 90° off the nose in the desired direction. The initial part of the maneuver is a straight pullup similar to a loop except for a slightly lower G-loading (2-3 Gs). As the aircraft reaches

45° nose-high (feet on the horizon), begin a coordinated roll toward the 90° reference point. Allow the nose to continue climbing during the roll so the maneuver is fairly slow and lazy.

Coordinate the pull and roll so the nose passes through the reference point with the aircraft wings level, inverted, and at a relatively low airspeed (100-120 KIAS). Do not stare at the airspeed indicator, but note the airspeed at the inverted point. Keep the wings level and pull through the bottom of the maneuver as in the split-S. To avoid excessive G and airspeed at the bottom, attempt to MAX perform (as in the split-S) once the nose passes the horizon.

Approaching the horizon in the pull through, reduce back pressure to allow acceleration to entry airspeed at the horizon and to intercept starting altitude. Complete three additional leaves in the same direction.

Figure 8-10 Cloverleaf

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CHAPTER NINE
NIGHT CONTACT

900. INTRODUCTION

Your night contact flight is designed to expose you to the night flying environment and familiarize you with the fundamentals of night flying. Many military operations are launched at night to negate the enemy threat. Consequently, basic night operating skills have increased in their importance to mission accomplishment.

901. NIGHT FLYING PHYSIOLOGY

You will remember from previous lectures on flight physiology that the eye uses rods for night vision and cones for day vision. Because these components function differently, there are a few considerations to prepare your eyes for night vision.

First, allow adequate time for your vision to adapt to the darkness. Secondly, minimize the use of white light, immediately before, and during flight. Bright light degrades your night vision. Just as you don't stare directly into oncoming headlights when driving at night, the same thing applies in the aircraft. Avoid staring at lights or objects. Instead, maintain a visual scan around them.

The lack of visual cues and a well-defined horizon at night can have several physiological effects on a pilot. Listed below are some of the common ones.

Spatial Disorientation

Spatial disorientation, often called vertigo, is a feeling of dizziness or disorientation and the inability to determine one's position and motion relative to their environment. Most often caused by the lack of a well-defined horizon, it can also be brought on by taking off from a well-lit runway environment into darkness, or from flashing strobe lights while flying through clouds. If you recognize you have spatial disorientation, verbalize it to your IP, and trust and use your instruments.

Visual Illusions

Night also makes you more susceptible to visual illusions. Lack of visual cues and human physiology can team up to cause visual auto-kinesis, or the apparent motion of stationary objects. This can create difficulty distinguishing between moving and stationary objects. Maintain a good cross-check and do not stare directly at objects since the center of the Retina, the focal point of the eye, has no rods with which to see at night and is, in a since, a blind spot.

Perception

Earth and sky blend together and can be perceived as reversed, especially over water, or sparsely populated areas.

Estimating Distance

At night, the lack of visual clues degrades perception of distance. Bright aircraft, obstacles, or city lights appear closer than they really are.

902. PERSONAL PREPARATION

In addition to the normal flight equipment required for day flight operations, all aircrew on night flights require an operational flashlight and clear visor. Review the operation of aircraft interior and exterior lighting in the T-6A NATOPS.

Come to the preflight briefing prepared to discuss two types of electrical failures per the T-6 NATOPS Flight Manual: generator failure and complete electrical failure. Electrical power is of great importance at night because of the need for interior and exterior lighting, two-way communications, and navigational equipment. An aircraft with no electrical power is virtually invisible at night, and difficult to navigate.

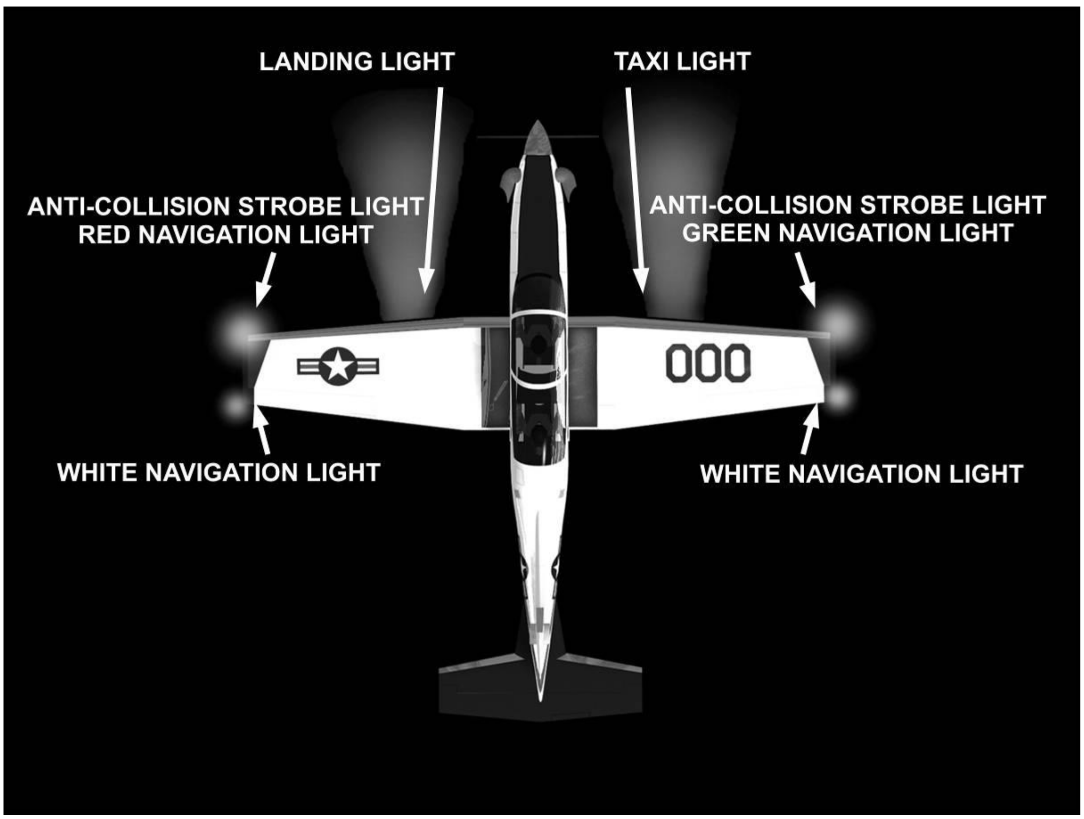

Figure 9-1 T-6A Exterior Lighting

903. PREFLIGHT PROCEDURES

The night pre-flight will include all items checked on day pre-flights with the following additions:

1. Check the operation of all interior lights in both cockpits during the cockpit check

2. With the battery on, complete a check of all exterior lights. Conduct a walk-around of the aircraft to ensure operation of all exterior lights. Ensure any discrepancies are corrected prior to flight.

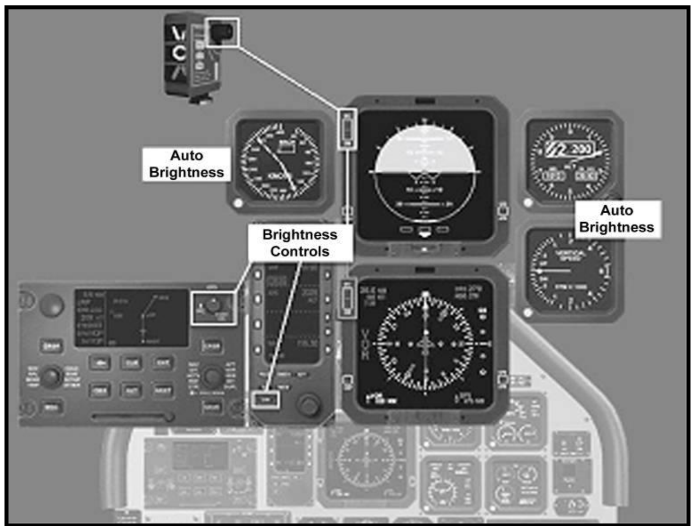

Figure 9-2 T-6A Instrument Panel Lighting

904. START

The start will be accomplished in the same manner as daylight operations except the NAV lights switch will be in the ON position and the ANTI-COLL (strobe) lights will be OFF. Cockpit lights will dim during start, so it is recommended you turn the FLOOD lights FULL BRIGHT before starting. After start, continue to dim the FLOOD lights and instruments as your eyes become adjusted to the darkness.

When the pilot is ready for the start, he/she will signal the lineman (if available) by rotating the flashlight at the lineman or if ambient light permits use appropriate hand signals for clearance to start. The lineman will repeat the signal with the wand or appropriate hand signal.

905. TAXI

Lack of outside references and depth perception makes taxiing at night a challenge. Use the GPS to monitor taxi speed. Consideration will be given to courteous use of lights to avoid the disorientation of other aircraft, ground support, and tower personnel. If there is any doubt as to your position on the field or any confusion caused by light signals, STOP!

906. NIGHT FIELD LIGHTING

BLUE LIGHTS: Blue lights mark all taxiways. Blue lights will be on both sides of the taxiway.

WHITE LIGHTS: White lights mark the boundaries of the duty runway.

GREEN LIGHTS: Green lights mark the threshold of the duty runway.

RED LIGHTS: Red lights mark all obstructions on the airfield.

ROTATING BEACON: There is a rotating white and green beacon located at fields that are open for night operations. A military airfield's white light will be split by a three degree void. This will give the impression there are two separate, closely timed flashes of white light in addition to the one green flash. A civilian beacon only has one flash of white light and one green to make it easily distinguished from a military field.

907. ALDIS LAMP SIGNALS

Aircraft with radio failure should observe the tower for light signals to obtain clearance to taxi, takeoff, land, etc. Acknowledge signals in the daytime by movement of ailerons or rudder on the ground and by rocking wings in the air. Acknowledge signals at night by flashing aircraft lights. Aldis lamp signals (Figure 4-5) (NATOPS Section 8) (FIH Section A) from an airport traffic control light gun have meanings as indicated.

COLOR AND TYPE OF SIGNAL	ON THE GROUND	IN FLIGHT
STEADY GREEN	CLEARED TO TAKEOFF	CLEARED TO LAND
FLASHING GREEN	CLEARED TO TAXI	RETURN FOR LANDING (followed by steady green at the proper time)
STEADY RED	STOP	GIVE WAY TO OTHER AIRCRAFT AND CONTINUE CIRCLING
FLASHING RED	TAXI CLEAR OF RUNWAY	DO NOT LAND
FLASHING WHITE	RETURN TO STARTING POINT ON AIRPORT	NOT USED INFLIGHT
ALTERNATING RED AND GREEN	GENERAL WARNING SIGNAL. EXERCISE EXTREME CAUTION	GENERAL WARNING SIGNAL. EXERCISE EXTREME CAUTION
RED PYROTECHNIC	NOT USED ON THE GROUND	NOTWITHSTANDING ANY PREVIOUS INSTRUCTIONS, DO NOT LAND. WAVE OFF IMMEDIATELY!

Figure 9-3 ALDIS Lamp Signals

APPENDIX A
GLOSSARY OF TERMS

A100. INTRODUCTION - N/A

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APPENDIX B
LIST OF ACRONYMS

ADB - Aircraft Discrepancy Book

AGL - Above Ground Level

AGSM - Anti-G Straining Maneuver

AIM - Airman's Information Manual

a.k.a. - also known as

AMSO - Aeromedical Safety Officer

AOA - Angle of Attack

AOB - Angle of Bank

AOPA - Aircraft Owners and Pilot Association

ASOS - Automated Surface Observing System

ATC - Air Traffic Control

ATIS - Automatic Terminal Information Service

ATS - Approach Turn Stall

CFS - Canopy Fracturing System

CNATRA - Chief of Naval Air Training

CNETINST - Chief of Naval Education and Training Instruction

CRM - Crew Resource Management

EADI - Electronic Attitude Direction Indicator

EHSI - Electronic Horizontal Situation Indicator

ELP - Emergency Landing Pattern

EP - Emergency Procedure

FAR - Federal Aviation Regulation

FIH - Flight Information Handbook

FLIP - Flight Information Publication

FOD - Foreign Object Damage

FTI - Flight Training Instruction

GLOC - Gravity-induced Loss of Consciousness

GPS - Global Positioning System

IAW - In Accordance With

ICS - Integrated Communications System

IFR - Instrument Flight Rules

IMC - Instrument Meteorological Condition(s)

IP - Instructor Pilot

ISPI - Identification, Situation, Position, Intention

IUT - Instructor Under Training

JPATS - Joint Pilot Aircraft Training System

KIAS - Knots Indicated Airspeed

LDG - Landing

MAF - Maintenance Action Form

MOA - Military Operating Area

MSL - Mean Sea Level

NACWS - Naval Aircraft Collision Warning System

NALCOMIS - Naval Aviation Logistics Command Information System

NATOPS - Naval Air Training and Operating Procedures Standardization

NFO - Naval Flight Officer

NFOTS - Naval Flight Officer Training System

NWS - Nose Wheel Steering

OCF - Out-of-Control Flight

OLF - Outlying Field

PAT - Power Attitude Trim

PCL - Power Control Lever

PEDD - Primary Engine Data Display

PEL - Precautionary Emergency Landing

PEL(P) - Precautionary Emergency Landing in the Pattern

PMU - Power Management Unit

RDO - Runway Duty Officer

SA - Situational Awareness

SNFO - Student Naval Flight Officers

SLOJ - Sudden Loss of Judgment

SSK - Seat Survival Kit

TAD - Trim Aid Device

TAS - Traffic Advisory System

TO - Takeoff

TTO - Training Time Out

UDC - Unit Developed Checklist

UTD - Universal Training Devices

VFR - Visual Flight Rules

VSI - Vertical Speed Indicator

WTD - Wingtip Distance