94th AIRMANSHIP TRAINING SQUADRON

STUDENT HANDBOOK FOR AIRMANSHIP 490 BASIC FREE FALL PARACHUTING

MAY 1990

UNITED STATES AIR FORCE ACADEMY

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DEPARTMENT OF THE AIR FORCE
Airmanship Training Sq (USAFA)
Colorado Springs CO 80840-5576

94 ATS STUDENT HANDBOOK

January 1990

This handbook is designed to provide written background and guidance to students undergoing training in Airmanship 490, Basic Free Fall Parachuting Course.

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94th Airmanship Training Squadron

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FOREWORD

The mission of the United Stated Air Force Academy Parachute Program is to provide an inspiring and challenging environment for cadets to learn of themselves, acquire new skills, and to develop and perform personal qualities basic to effective leadership.

Airmanship 490, Basic Free Fall Parachuting, is designed to provide cadets with expert instruction in the techniques of Air Force parachuting and to familiarize them with its application to their career. Overall emphasis of the course is on free fall parachuting techniques. Participation in AM-490 will enhance cadet motivation toward rated careers as aircrew members and give them a thorough preview of an operational environment.

Personnel that complete this course will be awarded the Basic Parachutist rating. This rating can enhance your career in that you may be required to perform parachuting duties in future assignments. These duties can be both rewarding and self-fullfilling. However, if you are unwilling to perform in a parachuting environment in future assignments, you should reevaluate your reasons for enrolling in AM-490.

Parachuting activities throughout the world, both military and civilian, use countless variations of parachute equipment, aircraft, procedures, and methods of instruction. This handbook covers the general basis of parachuting and will only cover specific information when considering parachuting operations at the USAF Academy. It is designed to supplement and reinforce material that is covered throughout AM-490 training. In no way should it be used in place of the individual training you will receive from your instructors. Your undivided attention and strong motivation during all phases of instruction and training are the keys to successful completion of the course.

Any suggestions for improvement of the course, this handbook, or any area that you have trouble in understanding, should be brought to the attention of a staff or cadet instructor as soon as possible. The simplest and most basic misunderstandings can possibly lead to disaster while participating in parachuting operations.

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CHAPTER 1

INTRODUCTION

BACKGROUND

Parachutes are mechanical devices that have been used since the 1600's to assist man's safe descent through the atmosphere. They have since been recognized as a means of escape from disabled aircraft when in 1808, a Polish balloonist named Kuparento, jumped from a burning balloon using an emergency-type parachute.

As aircraft were developed that could fly higher and faster, it was obvious it would be safer for a person to jump from a disabled aircraft and manually deploy a self-contained, compact parachute. In this way, they would be clear of the aircraft and could free fall to a lower, more life-sustaining altitude. On 28 April 1919, tests were begun on a free fall parachute assembly at McCook Field, Ohio. Three and a half years later, on 22 October 1922, Lt Harold R. Harris saved his life by making the first actual, emergency-type, free fall parachute jump from a disabled aircraft. Parachutes then became accepted as safety equipment throughout aviation, including the military. It was also recognized that troops and equipment could be safely deployed to remote areas by parachute. The first demonstration of deployment by air was done in October 1930. It took less than three minutes for six "Paratroopers" to set up a machine gun nest at Kelly Field, Texas. This demonstration was arranged by none other than Gen "Billy" Mitchell. Unfortunately, it took the U.S. government almost ten years to fully accept the idea.

Airborne deployment has become a significant and integral part of the Armed Forces, world-wide. Today's U.S. Air Force includes many duties which involve parachuting techniques. The greatest single need for this knowledge and skill is required for emergency bail-outs from aircraft. Other duties within the Air Force include Forward Air Controllers, Para Rescue and Recovery, Combat Control, Combat Weather, Intelligence and Communications Teams, and Air Liaison officers that work with Army Combat units.

Military members that require training in static line parachuting attend the Army's 4th Airborne Training Battalion at Fort Benning, GA. This physically demanding course contains instruction and practical use of static-line deployed parachutes. A "static-line" acts as an automatic ripcord puller and thus, no free fall is involved. This method is widely used for mass deployment of troops and equipment from relatively low altitudes. Cadets are authorized to attend this training on a voluntary basis. It provides them with a working knowledge in the practical use of parachutes.

Certain situations, however, require the military member to exit an aircraft from much higher altitudes and faster speeds. For instance, if a pilot has to eject from an F-16 that is flying at mach speed and at an altitude of 40,000 feet, a static-line

deployed parachute is not feasible. The pilot must free fall for two obvious reasons; (1) Emergency parachutes are not designed to withstand the opening forces involved at speeds greater than 150 mph. (2) Oxygen and temperature is not life-sustaining at altitudes higher than 20,000 feet above sea level. For this type of situation and the need for strategic High Altitude, Low Opening (HALO) parachute operations, free fall training is required. This has been the responsibility of specialized organizations throughout the military that have these operational requirements. This kind of training was not available to Academy cadets who would later become future aircrew members.

USAF ACADEMY PARACHUTING

It was realized that the training and experience acquired by participating in free fall parachuting would be of great benefit to the individuals at the USAF Academy and for the rest of their career. In 1964, the Academy Parachute Club was formed and by 1966, the Parachute Branch was established under the Airmanshp Division of the Commandant of Cadets. Within a year, four military free fall courses evolved. The program developed and grew to be one of only two centers within the Department of Defense that could train military members and award the Parachutist rating. The parachuting program, conducted by the Parachute Flight, 94th Airmanship Training Squadron, is a highly organized, accredited military course of instruction. The "primary" mission of the Parachute Flight is to train safe, competent, military free fall parachutists. The "secondary" mission is to safely train as many as possible.

AIRMANSHIP-490, BASIC FREE FALL PARACHUTING

AM-490 was designed to provide cadets with expert and professional instruction in the basics of free fall parachuting techniques. Each participant will complete five jumps in which the individual will manually activate the parachute deployment within ten seconds after exiting the aircraft. Successful completion of the course will entitle the student to be awarded a "Basic Parachutist" rating and authorize them to wear the basic parachutist insignia.

AIRMANSHIP-491, ADVANCED PARACHUTE TRAINING

AM-491 provides additional ground and aerial training to 2 degree and 3 degree cadets that have completed AM-490. They will progress in the basics of delayed free falls, controlled body maneuvers, and precision landings. Students will also transition to high performance canopies that are used in sport and competition parachuting. They will also learn how to inspect, maintain, and pack these canopies.

AIRMANSHIP-492, CADET PARACHUTE INSTRUCTOR TRAINING

AM-492 trains selected 2 degree and 3 degree cadets that complete AM-491 to become instructors and jumpmasters for AM-490. Cadets will receive training in the methods, techniques, and procedures of instructors and jumpmasters. Additional aerial training provides parachuting proficiency while the students engage in individual free fall maneuvers and basic free fall relative work that prepares them for competitive parachuting.

AIRMANSHIP-496, CADET PARACHUTE INSTRUCTOR DUTY

AM-496 is comprised of selected 1 degree and 2 degree cadets that are highly motivated, knowledgeable, and professional individuals. They serve as the instructor/jumpmaster team that conducts the hands-on training of AM-490 students and are members of the USAF Academy Parachute Team, the "WINGS OF BLUE." They have the opportunity to actually perform duties and work with other cadets in a leadership, supervisory position within an operational Air Force unit. By participating in demonstrations and intercollegiate and inter-service competition throughout the United States, they develop a great sense of pride and loyalty toward the U.S. Air Force.

AM-490 PARACHUTE TRAINING

Selection for AM-490 is voluntary and requires specific procedures. The process is accomplished through normal channels within the Cadet Wing. Candidates are primarily selected by their Air Officer Commanding (AOC) with the assistance of Academic Advisors and the Cadet Curriculum Scheduling Department (DFSC). All cadets selected must be enrolled through DFSC prior to participation. AM-490 is primarily a cadet course, however, officers and enlisted may attend. This is normally done during the summer semester. They must have a specific reason to attend which will benefit the USAF Academy and the U.S. Air Force. Officers and enlisted are required to apply by letter stating their reasons and, following Parachute Flight approval, they are enrolled on a first-come, first-served basis. Prior to final enrollment, all candidates (cadets, officers, and enlisted) must be certified as medically

qualified for parachuting through the Flight Surgeon's office. In addition, all candidates must pass a Parachuting Physical Fitness Test (PPFT). The PPFT is comprised of physical exercises that ensure fitness, strength, and stamina. Daily Physical Training (PT) is also conducted prior to each full day of training. This is done to stretch out and limber up the muscles in order to prevent injury during training. It is also a way to detect previous injuries that may interfere with training performance.

Following the enrollment process, each participant will be required to complete three phases of training; Academic, Ground, and Aerial. During the spring and fall semesters, the duration of the course is approximately four to six weeks, depending on weather. Students train on weekends and on off-intramural days, 7th period, during the week. During the summer semester, students train every day and the course duration is about two weeks.

Academic Training is four and a half hours of classroom instruction comprised of administrative procedures and formal lectures supported by 35mm slides. Detailed lessons are presented that cover the How's and Why's of Parachuting, Equipment Operation, Aircraft Procedures, Free Fall Techniques, Canopy Control, Parachute Landings, and Emergency Procedures. The academic training phase is conducted by Parachute Flight staff instructors.

Ground Training is the next phase of instruction where students physically and mentally attain the skills and techniques necessary to properly perform and execute safe free fall parachute jumps. This training is both physically and mentally demanding, requiring the students to be highly motivated and attentive. Students are constantly graded on their performance while they demonstrate every aspect of the required skills and techniques. Ground training lasts approximately two weeks during the spring and fall, and about one week during the summer. The ground training facility uses sophistocated training devices that assist the student's physical performance by providing realism in respect to actual jumps.

- Parachute Landing Fall (PLF) training consists of five blocks of instruction used to train students to properly and consistently perform a PLF. After the basics are mastered, students are suspended to provide realism. The students are released while moving horizontally above the ground from four to six feet. This simulates the actual landing with the drift created by the forward speed of the canopy and the wind.

- Suspended Harness (SH) training consists of two blocks of instruction that teach the basic techniques of free fall and canopy control.

Students are suspended vertically in a harness and are familiarized with the arch-count-pull sequence, afteropening procedures, canopy control techniques, and slow malfunction procedures.

- Free Fall Body (FFB) training has four blocks of instruction used to train free fall techniques and free fall emergency procedures. The students are suspended horizontally in a harness to simulate body positions in free fall and are released to a vertical position which simulates opening shock. The students are then required to perform after opening procedures and/or emergency procedures.

- Mock Door (MD) training consists of three blocks of instruction that familiarizes the students with aircraft loading, in-flight procedures, exit techniques, parachute donning, and related emergency procedures. Training is done with a full-sized mock-up of the UV-18B aircraft fuselage.

Aerial Training is the phase in which AM-490 students will complete the actual parachute jumps. Each jump is observed, graded, and critiqued by a staff instructor. Observation of the students is done from the time they exit the aircraft to the time they recover from the parachute landing. High powered telemeters are used for this purpose. Performance is graded on a system in which a perfect score of 100% is equal to 100 points. In order to complete the course, a 70% average must be maintained throughout the aerial phase.

AM-490 is a pass/fail course. During any phase of training, students may be disenrolled or removed due to an inability to meet the stringent course standards. These standards encompass all areas of performance, attitude, and aptitude. When areas of unsatisfactory performance are identified, retraining is accomplished to afford extra instruction and assistance where needed. In cases where satisfactory performance cannot be achieved by retraining or repeat failures occur, a staff review will convene to determine if the student will remain in training. Consideration is given to the student's capability to safely continue in the course, his/her level of understanding, and the individual's attitude and cooperation. Students may be removed from training for the following reasons:

Absences/Excessive Tardiness	Illness/Injury
Attitude/Conduct	Safety Violations
Unsatisfactory Performance	Self-Initiated Elimination

Under certain circumstances, students who have been removed from training may be authorized to re-enroll in a later class. However, any removals that were due to intentional safety violations, severe conduct/attitude problems, or were self-initiated will not be authorized to re-enter the course.

At the completion of the course, final averages will be calculated and the grades awarded. Each graduate will receive a Certificate of Training and will be awarded the Basic Parachutist rating on Air Force Aeronautical Orders. The individual with the highest average will be designated as the honor graduate.

Since the establishment of the Parachute Branch in 1967, basic free fall parachuting has been conducted without any disabling injuries or any fatality. Each year, between 500 and 600 cadets complete AM-490. Many of these cadets have progressed and joined the USAF Academy Parachute Team, the 'WINGS OF BLUE, and have completed thousands of jumps in front of millions of spectators. They have been consistent in winning competitions, both inter-collegiate and inter-service. The Parachuting Program at the Academy has proven to be worthwhile to many and it has been instrumental in the education of leadership and professionalism of the graduates that later become valuable members of the U.S. Air Force. The knowledge and experience gained through participation of these courses has been the documented basis for lifesaving situations that involved actual ejections from disabled aircraft on numerous occasions.

The Parachute Flight will continually strive to offer the utmost in professional, military instruction for conduct of safe, competent free fall parachuting and provide courses that are very challenging and extremely rewarding to the cadets of the U.S. Air Force Academy.

WELCOME TO AM-490

BASIC FREE FALL PARACHUTING

CHAPTER 2

PARACHUTING TERMS AND DEFINITIONS

Throughout the realm of parachuting, common everyday words have taken on new meanings, phrasings, and twists. As a basic free fall student, you need to understand and speak the language. You will be required to use the proper terms for specific parts of parachuting equipment and the related phrases used to correctly explain procedures and operational functions of its use. Therefore, the following list of words and phrases has been provided to assist thorough understanding and standardization when used by students and instructors.

AAD, Automatic Activation Device - A self-contained mechanical device attached to the parachute, other than a static line, which automatically initiates parachute deployment at a preset altitude, time, percentage of terminal velocity, or in combination thereof.

ADAPTER, HARNESS - A rectangular metal fitting with a fixed crossbar. It is incorporated in a harness to permit proper adjustment of the webbing. Also called an adjuster.

ADAPTER, FRICTION - An adapter with a floating friction grip. This adapter is incorporated in a parachute web to permit quick adjustment.

AGL, Above Ground Level - Referring to altitude above the surrounding terrain.

APEX - The center and top-most point of a parachute canopy.

ATTITUDE - Orientation of an air drop system as determined by the inclination of its axis to a frame of reference, usually the earth or the aircraft upon exit.

AUXILIARY PARACHUTE - see "Reserve Parachute".

BACKSTRAP - A part of the harness which extends across the wearer's back. It may be diagonal or horizontal and may or may not be adjustable.

BACK TYPE PARACHUTE - A parachute which is worn on the back and shoulders.

BINDING - A piece of tape or fabric folded over and stitched to the raw edge of the fabric to prevent raveling or fraying.

BLOWN PANEL - A ripped or torn panel in a canopy caused by strain during opening.

BREAKAWAY - The jettisoning of a malfunctioned main canopy by activating riser release assemblies followed by deployment of the reserve parachute.

BREAKCORD - A thread or tape tied between parachute components that is intended to break under desired load conditions during deployment.

BREATHING - The pulsating or pumping action of an inflated parachute during descent.

BRIDLE - A line which attaches the pilot chute to the apex of the canopy or to a sleeve or deployment bag.

BURNS (FRICTION) - The result of two textile surfaces rubbing together rapidly and generating frictional heat which reduces the tensile strength of the textile and causes deterioration of individual threads; occurs primarily during canopy deployment and initial inflation.

BURBLE (HESITATION) - A condition whereby the pilot chute hesitates bounces, or flutters within the low pressure area immediately behind the jumper's back without catching air from the slipstream.

BUTTERFLY SNAP - A snap with a wide flange, found on chest mounted parachutes.

CANOPY - The umbrella-like surface of a parachute and its framework of cords, called suspension lines, from which the intended load is suspended.

CANOPY RELEASE ASSEMBLIES - Devices which allow immediate release of the parachute canopy. They disconnect the main harness lift webs from the risers.

CANOPY SPEED (FORWARD SPEED) - The inherent horizontal speed of a canopy generated by the control of cloth porosity and the deflection of escaping air through specifically designed control or escape vents (the modification).

CENTER OF GRAVITY - That point in a body at which the force of gravity may be considered to be concentrated.

CHUTE UP (SUIT UP) or CHUTING UP (SUITING UP) - Donning and adjusting parachute equipment prior to jumping.

CONE, PACK (LOCKING CONE) - A small cone-shaped metal post sewn to one of the side flaps of the container. A hole is drilled longitudinally through the cone a short distance from the top to admit the ripcord locking pin. Grommets of the opposing flap and

the end tabs are placed over the cones and are held tightly in place by inserting the ripcord pins in the holes provided.

CONTAINER - That portion of the parachute assembly which holds the canopy in place after being folded. Not to be confused with the term 'PACK'.

CRAB, CRABBING - Directing the canopy at various degrees sideways against the wind while moving across the line of wind direction.

DAISY CHAIN - A method of gathering the suspension lines when field packing a parachute to reduce the possibility of their becoming entangled.

DELAYED DROP - A live parachute descent where the activation of the parachute deployment is delayed longer than necessary to clear the aircraft.

DEPLOYMENT - That portion of the parachute's operation occurring from the moment of pack opening to the instant the suspension lines are fully stretched but prior to the inflation of the canopy. See 'Development'.

DEPLOYMENT DEVICE (SLEEVE, BAG, DIAPER) - A method of deployment using a container, usually of fabric, for retaining the cloth of the canopy until the suspension lines are fully deployed, thereby reducing 'snatch force' in small increments. The lines may or may not be stowed on the device, as dictated by its intended use.

DEVELOPMENT - That portion of the parachute's operation occurring from the period of initial inflation to full inflation of the canopy. Synonymous with 'Inflation'.

DIAMETER, NOMINAL - The diameter of any design of parachute canopy based upon a circle having an area equal to the cloth area. The diameter may be determined with the formula 1.128 times the square root of the total cloth area.

DOOR EXIT - Leaving an aircraft without touching any part of the aircraft outside of the door; made without bracing to achieve a stable fall position.

DRIFT - The horizontal movement of the canopy through the air caused by external wind force against the canopy.

DRIFT INDICATOR - see 'Wind Drift Indicator'.

D-RING - A metal fitting shaped like a 'D' into which snap connectors are hooked.

DROP ALTITUDE - The actual altitude that an aircraft is at above the ground at the time equipment or personnel are released.

DROP ZONE - The open area or field surrounding the intended target area used for the landing of parachutes.

EQUIPMENT CHECK (PIN CHECK, JUMPMASTER CHECK) - The final and visual check of the equipment made by the jumpmaster on all parachutists prior to boarding the aircraft.

EMERGENCY AIRCRAFT PROCEDURES - Pre-planned actions, established by the pilot, to be followed by the parachutists in the event of any aircraft emergencies or failures.

EMERGENCY BODY POSITION - A physical body position in which the extremities are drawn close to the body while maintaining the arched back. It is used when deploying the reserve parachute to prevent entanglements. This position can also be 'modified' to assist in the extraction of the main parachute ripcord.

EMERGENCY PARACHUTE - A certificated parachute intended for emergency use only.

EXIT POINT - A computed air position at which personnel leave an aircraft in order to arrive at a designated area.

FIELD PACKING - The temporary stowing of a canopy in the container or a separate holding bag, after a jump so that it may be more easily transported back to the packing area.

FORWARD THROW - The horizontal movement of a parachutist immediately after exit, caused by inertia created from the aircraft's horizontal speed.

FLAP, PIN PROTECTOR - A flap that covers the locking pins and cones (or loops) to prevent the pack from being opened by any means other than the ripcord.

FLAP, PACK (CONTAINER) - A fabric extension on the side or end of a container designed to enclose and protect the canopy and/or its parts.

FORWARD SPEED - see "Canopy Speed".

FREE FALL - A parachute jump in which the parachute is activated manually at the discretion of the parachutist. Also see "Delayed Drop".

GORE - The portion of the canopy contained between two adjacent suspension lines and the area between them extending from the apex of the canopy to the skirt.

GROAT - A metal eyelet, used as a reinforcement around a hole in fabric. Grommets are used on pack and container flaps to fit over locking cones or loops.

HALO - High Altitude Low Opening.

HARNESS - An arrangement of cotton, linen, or nylon webbing designed to conform to the shape of the load being carried. It also secures the load properly so that the opening shock and the weight are evenly distributed during descent.

HOLDING - Countering the exterior wind speed with the inherent canopy speed by facing the canopy directly into the wind. Opposite of 'Running'.

HOUSING, RIPCORD - A flexible tubing in which the ripcord is installed for protection and to provide a free path for the extraction of the ripcord.

JUMP GEAR - All of the parachute equipment and personal gear that a parachutist wears during a jump.

JUMPMASTER - A designated person in command of other parachutists from the time they are ready to enter the aircraft until the time they exit.

JUMP AND PULL (HOP AND POP) - Jumping and clearing the aircraft and immediately activating the parachute deployment (normally within three seconds).

JUMPRUN - The final leg of flight just prior to exiting the aircraft. This varies in length due to the number exiting, type and style of aircraft, altitude, etc.

LATERAL BAND (LOWER AND UPPER) - A reinforcement tape or web which runs completely around the skirt of the canopy or around the apex, used to provide flexibility and extra strength in these two critical areas.

LEG STRAP - The part of the harness webbing that encircles the wearer's legs and can be adjusted for proper fit.

LINE OVER (MAE WEST) - A type of deployment malfunction in which one or more suspension lines pass over the top of the canopy and restrict complete or normal inflation. Not to be confused with a 'partial inversion'.

LINE STOW (STOWING) - see Stow

LINE STRETCH - Occurs during deployment, after the lines are fully extended, and almost simultaneously with 'snatch force'.

LOCKING LOOP - A loop sewn directly to a canopy, container, or deployment device used to delay its opening. Usually made of suspension line, elastic cord, or a rubber band.

LOFT, PARACHUTE - An establishment or place designated for the repair and maintenance of parachutes and parachute equipment.

LIFT WEB, MAIN - The main load-carrying member of the harness formed by two lengths of webbing, beginning at the shoulder adapter (release assembly) or at the D-ring, continuing down across the seat and up the other side, ending at the opposite adapter or D-ring.

MAE WEST - see 'Line Over'.

MALFUNCTION - The complete or partial failure of the parachute canopy that affects proper opening and descent. Some malfunctions are physical canopy damage, twisted suspension lines, inversions of the canopy, a line over, streamer, etc.

MODIFICATION - Refers to a change or the removing of canopy material to achieve steerability and forward glide.

MODIFIED EMERGENCY BODY POSITION - see 'Emergency Body Position.'

MSL - Mean Sea Level, referring to the altitude above sea level.

OPENING POINT - A physical ground reference point, established prior to exit, over which the jumper opens the parachute with the most favorable chance of maneuvering to land on the intended target.

OPENING SHOCK - The tug or jerk felt by the jumper as the canopy opens and fully inflates.

OPENING TIME - The interval between the beginning of the deployment and the first full inflation of the canopy.

OPERATIONS AREA - The designated area of the Airmanship building complex used for parachute donning, equipment checks, manifesting, and pre-jump coordination.

OSCILLATION - Pendulum-like tilting or swinging of the suspended load beneath an inflated canopy, caused by air escaping randomly under the lower lateral band.

PACK, PARACHUTE - The parachute assembly without the harness; the container, canopy, suspension lines, pilot chute, risers, and connector links. The terms 'pack' and 'container' are not synonymous.

PACK OPENING BAND - A cloth covered steel spring with hooks at each end, used to expedite the opening of the pack by rapidly pulling the flaps away from the canopy.

PARABOLIC - Simply stated, the canopy has an extended skirt which increases the curvature of the sides of the canopy to assist in reducing canopy oscillation.

PARACHUTE - An umbrella-like device designed to trap a large volume of air in order to slow the speed of a falling load that is attached.

PARACHUTE STATIC LINE - see 'Static Line'.

PARACHUTE LANDING FALL (PLF) - A method of falling down on landing whereby the shock is spread over a large portion of the body.

PARTIAL INVERSION - A type of parachute malfunction that occurs when one or more gores near the skirt become inverted during deployment and forms a small pocket which inflates on the inside of the canopy. This condition may or may not work out, or may become a complete inversion where the entire canopy becomes inverted or inside-out. Not to be confused with a 'line over'.

PERSONAL GEAR - Not part of the actual parachute assembly, i.e. helmet, boots, jumpsuit, goggles, etc.

PINS, LOCKING - Short metal prongs attached to a ripcord cable. They are inserted into locking cones or loops to secure the pack flaps as a function of closing a parachute pack or container.

PILOT CHUTE - A small, spring-loaded parachute used to accelerate deployment; constructed similar to a main canopy and from similar materials. It serves as a dragging anchor to lift and deploy the parachute assembly until the main canopy inflates.

POCKET, RIPCORD HANDLE - An elastic or spring edged pocket that holds the ripcord handle in an accessible position, either sewn to the harness or the reserve parachute pack.

RATE OF DESCENT - The vertical velocity, in feet per second, of a fully opened parachute. The rate of descent of a parachute depends on the design and the area of the canopy, the permeability of the canopy fabric, the weight of the load, and the density of the air in which it is descending.

RELATIVE WIND - The speed and direction of the airstream with reference to the movement of an aircraft and air drop system.

RELATIVE WORK - The cooperative aerial maneuvers by two or more free falling parachutists in order to pass a baton, create or 'hook up' various formations, or for air-to-air photography.

RESERVE PARACHUTE - The second parachute worn by a person making an intentional jump, used when the main parachute malfunctions and as a safety backup.

RETAINER BAND - A rubber band or elastic used to hold folded suspension lines to the parachute pack or container.

RIGGER - A person trained in the techniques of parachute packing, maintenance, repair, and construction. Properly authorized riggers are only those who have been tested and licensed by the Federal Aviation Administration (FAA).

RIPCORD - A locking device that secures the pack in a closed condition and releases the pack when extracted.

RIPSTOP NYLON - Nylon fabric woven in intermittent box form with additional closely picked yarns.

RISER - The portion of the suspension system between the lower end of a group of suspension lines and the point of attachment to the harness.

RUNNING - Allowing the canopy to move horizontally at its full inherent speed, or moving forward and downwind on a direct line with the wind. Opposite of 'Holding'.

SIDE FLAP - A fabric extension on each of the long sides of the pack or container which fold over to enclose the canopy.

SKIRT - The reinforced hem forming the lowest portion of the canopy, encompassing the lower lateral band.

SLIPSTREAM - The mass of air forced rearward by the propeller.

SNATCH FORCE - The shock produced on the load when the parachute assembly fully strings out and becomes suddenly accelerated to the same speed as the load just prior to opening shock.

SPOTTING - Selecting the course to fly, directing the pilot, and selecting the correct ground reference point over which to exit the aircraft.

STABLE FALL POSITION - A face-to-earth, spread-eagled body position where the back is arched and arms and feet are spread in a manner in which to stabilize the body. This position prevents spinning, turning, or tumbling while in free fall.

STATIC LINE - A line that is attach to the aircraft and the parachute which initiates the parachute deployment as the load falls away approximately 8 feet.

STEERING LINE (LOOPS) - The lines and their handles which are attached to key control panels and vents that change the shape of the canopy in such a way that the canopy will rotate or change its inherent direction.

STOW - Any one loop or fold of suspension lines that are compactly 'stowed' to the pack.

STOW LOOP - A loop used for the stowing of suspension lines in a pack, can be made from a piece of suspension line, a rubber band, or elastic cord.

STREAMER - A malfunction in which a parachute stretches out during deployment but does not inflate.

STRENGTH, TENSILE - The maximum tension measured in pounds required to break a material.

STUDENT LANDING AREA - The area of the drop zone designated for students use as a landing site. At USAFA, the drop zone has been plowed for easy identification from the air and for softer landings.

SUSPENSION LINE - The small individual lines of the parachute between the canopy and the risers.

TERMINAL VELOCITY - The greatest speed at which a body falls through the atmosphere. Resistance of the air overcoming the pull of gravity establishes the approximate figure of 120 mph which is reached around the 12th second of free fall.

WEBBING - A stout, closely-woven cloth tape used for straps, belts, harnesses, risers, etc.

WIND DRIFT INDICATOR (WDI) - A device used to predict wind drift, constructed to descend at the same rate as an average weight parachutist under a fully deployed parachute. This is usually a weighted strip of crepe paper 10" x 14' long.

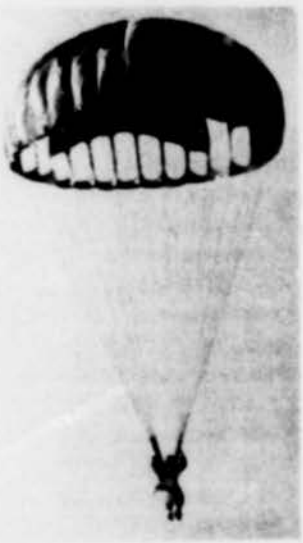
WIND LINE - An imaginary wind direction line extending downwind from the true opening point to the target center. Such lines may vary in direction and velocity at different altitudes.

WIND SOCK - A cloth tube of varying diameter and length which shifts with wind changes and indicates the ground wind velocity and direction.

CHAPTER 3

PARACHUTES - HOW THEY WORK

GENERAL



Contrary to what many people believe, the parachute comes quite close to being a perfect mechanical device. In almost all cases of reported parachute failures, the cause is found to be human error. This covers a wide spectrum of reasons that begins with inspecting, packing, and using parachutes with insufficient care, knowledge, or training. Continuous and successful usage can be consistently accomplished by eliminating the 'human factor'. Therefore, a thorough and complete understanding of the equipment, its limitations, and how it works is mandatory.

Parachutes are designed for a great variety of uses where horizontal and vertical deceleration is needed. Descent of equipment and personnel is accomplished by numerous types of parachutes that may vary to a great deal in their appearance, in their function, and/or in the components used to assist their operation. Personnel parachutes are available in many configurations, designs, and arrangements that can be worn in seat packs, back packs, chest mounted, or in combinations thereof. Overall, they can be separated into two basic categories to distinguish their intended use; emergency or intentional.

Any individual that performs an intentional parachute jump is required to wear two parachutes; a 'main' and a 'reserve'. If a malfunction of the main occurs, the reserve will be used immediately. The main parachute is generally worn in a back pack, while the reserve is usually worn chest-mounted or above the main in a tandem arrangement. Every parachute assembly consists of six major parts; pilot chute, deployment device, canopy, suspension lines, container, and a harness.

"WARNING"

ALL USAF ACADEMY PARACHUTES ARE OF THE INTENTIONAL TYPE AND HAVE BEEN SPECIFICALLY DESIGNED AND BUILT FOR USE IN AM-490. THEREFORE, THEY WILL BE THE ONLY SYSTEMS DISCUSSED IN DETAIL IN THIS HANDBOOK. ALTHOUGH OTHER SYSTEMS MAY APPEAR TO BE SIMILAR, IT IS IMPERATIVE FOR STUDENTS WHO ATTEMPT PARACHUTE JUMPS OUTSIDE OF THE USAF ACADEMY TO RECEIVE PROPER INSTRUCTION TO ATTAIN THOROUGH UNDERSTANDING AND KNOWLEDGE OF THE EQUIPMENT AND PROCEDURES USED PRIOR TO ANY PARACHUTE JUMP.

THE P-78 PARACHUTE ASSEMBLY

The P-78 parachute assembly is an intentional jump, free fall, combination style system. It is certified by the FAA and is used exclusively by the USAF Academy. It consists of a main parachute (back pack), a reserve parachute (chest mounted), and a fully adjustable harness.

The main parachute (Fig 1) is a derivative of the Army MC-1-1 troop parachute. It is deployed by a manually activated ripcord, but uses an FXC model 12,000 Automatic Activation Device (AAD) as a back-up. This system uses a coiled-spring pilot chute as a primary means of deployment. To assist and improve opening characteristics, a small deployment bag and pocket opening bands are permanently sewn to the canopy. The canopy diameter is 35 feet (nominal) and is parabolic in shape to minimize oscillation during descent. An 'anti-inversion' net has been attached to the lower lateral band, and 70 square feet of material has been removed from the rear surface of the canopy. This 'modification' provides an orifice where air can escape to create a forward speed of about 8 knots. Steering lines are attached to the outer-most portion of the modification. When either one is pulled downward, it distorts the canopy and creates an uneven airflow which will then cause the canopy to rotate.

The reserve parachute is very similar to the main in appearance and has the same general parts with the following major differences; the canopy is 26 feet in diameter, it has three small mesh covered modifications, it uses a deployment diaper instead of a bag, and it does not have an anti-inversion net or pocket opening bands. The forward speed remains at 8 knots and it is also steerable. The reserve parachute is a complete, self-contained assembly. It is merely attached to the P-78 harness by means of snap connectors on its risers and by alligator snaps on its hold-down straps.

The P-78 harness is a system of nylon webbing and metal fasteners that is designed to encase the parachutist without discomfort or danger of unintentional separation from a deployed parachute, main or reserve. The major part of the harness is the 'main lift web'. It forms a strong sling, or saddle, in which to sit. Prevention from falling out of the main lift web is done by the attachment of the chest strap, the leg straps, and the diagonal back straps. Also included are two metal 'D'-shaped rings for attachment of the reserve, two metal fittings for attachment of the main (part of the canopy release assemblies), an elastic pocket and a flexible housing for the main parachute ripcord handle and cable, and the main parachute pack.

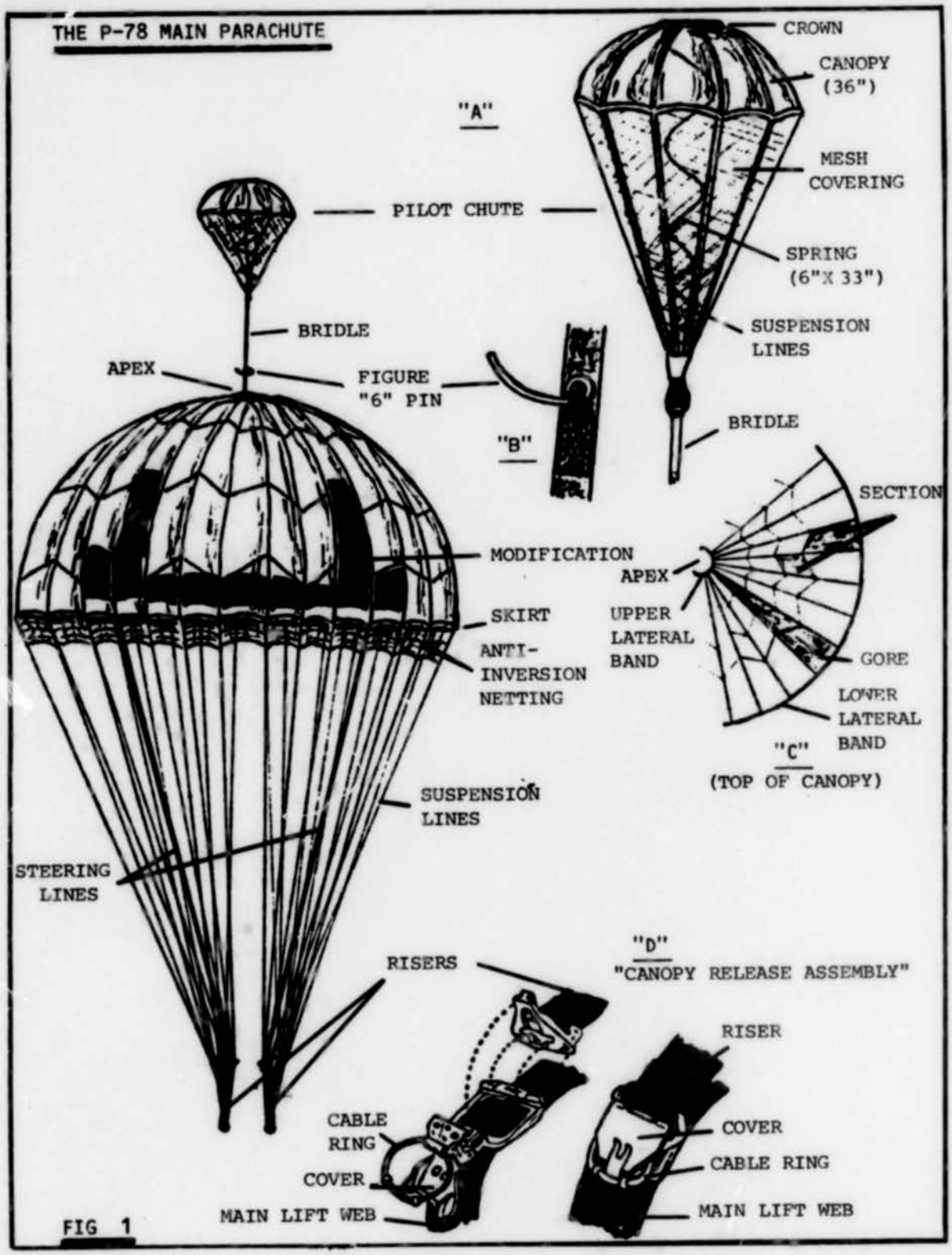

THE P-78 MAIN PARACHUTE
"A"
CROWN
CANOPY (36")
MESH COVERING
PILOT CHUTE
SPRING (6"X 33")
SUSPENSION LINES
BRIDLE
APEX
FIGURE "6" PIN
"B"
BRIDLE
SECTION
MODIFICATION
APEX
SKIRT
UPPER LATERAL BAND
ANTI-INVERSION NETTING
GORE
LOWER LATERAL BAND
"C"
(TOP OF CANOPY)
SUSPENSION LINES
STEERING LINES
"D"
"CANOPY RELEASE ASSEMBLY"
RISERS
RISER
CABLE RING
COVER
COVER
CABLE RING
MAIN LIFT WEB
MAIN LIFT WEB

FIG 1

To fully understand how the P-78 parachute works, a more detailed description of the components is necessary. Each major component is outlined in approximately the same order as it would occur during the opening sequence. The main and the reserve parachutes function in practically the same way and use the same basic parts. Therefore, a separate detailed description is not necessary. Except where noted, the following information will apply to both the main and the reserve parachutes.

The coiled-spring pilot chute (Fig 1, "A") is a miniature parachute with a canopy of 36 inches in diameter. It is self-contained. All of its components are encased within its canopy or mesh covering. This makes it almost impossible to snag or tangle. Connected to the pilot chute is the bridle cord which is attached to the apex of the main canopy. The bridle is 6 feet long and has an attached figure "6" pin. This pin (Fig 1, "B") is used only on the main parachute and is used to hold the main pack closed until the pilot chute and bridle are at full extension above the jumper.

The deployment device used is a small nylon bag which promotes controlled, systematic and staged deployment of the parachute. It discourages canopy inflation by holding the skirt closed until the suspension lines are completely deployed. This prevents the jumper from becoming entangled in either the suspension lines and/or the canopy during the opening sequence and will also slow the deployment and opening time by a slight margin. Approximately half of the canopy is neatly folded into the deployment bag and it is then closed by bringing one flap over the other, running locking loops through the grommets, and then inserting a stow of suspension line through the locking loop (Fig 2). The remaining suspension line is then neatly "S"-folded and stowed on top of the deployment bag (Fig 3). The protector flaps on the deployment bag are then folded over to cover and protect the suspension line stows.

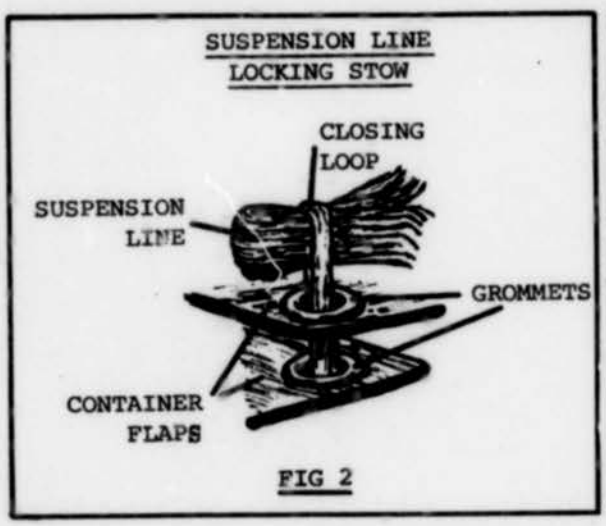


FIG 2

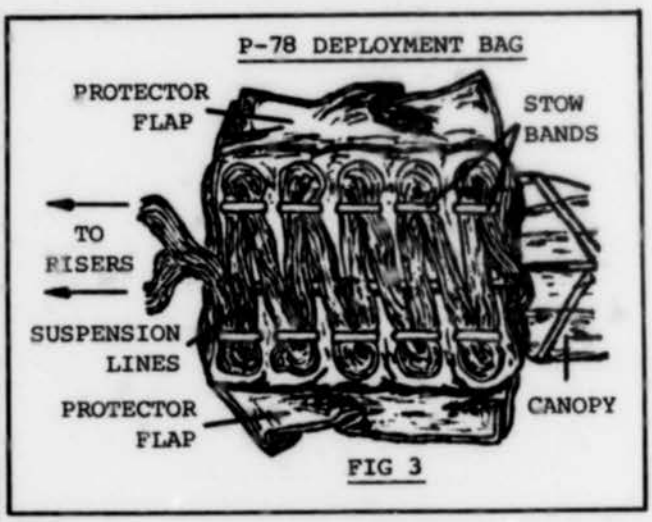


FIG 3

The 'risers' are the four 30" nylon straps that connect the harness to the suspension lines. On the canopy end of each riser is a metal connector link for the attachment of the suspension lines, and two of the risers include a metal guide ring that retains the steering line and loop. The opposite end of each pair of risers contains the male fittings of the canopy release assemblies (Fig 1, "D"). The two female fittings are permanently sewn into the main lift web of the harness assembly. The canopy release assembly is designed to quickly 'release' the main canopy from the harness when necessary (see Chap 6 and 8).

The parachute pack is the only (non-load-bearing) part of the parachute assembly. Its purpose is to contain or hold the deployment bag, canopy, suspension lines, and pilot chute until the deployment is activated. After the suspension lines have been stowed, the deployment bag is physically tied into the pack by using light weight breakcord. The remaining half of the canopy is then folded into the pack and closed with two internal flaps, a locking loop, and the figure "6" pin. The pilot chute is then compressed on top of these internal flaps and the pack is closed by two more locking loops and the locking pins on the main ripcord cable.

NOTE: The reserve parachute uses a diaper in place of the deployment bag. This is a rectangular piece of nylon cloth that is only wrapped once around the skirt of the canopy. Two locking stows of the left group, or half, of the suspension lines are used to secure the diaper closed. The remaining line is stowed in the bottom of the reserve pack. The canopy is then folded on top of the line stows and the pilot chute is compressed on top of the canopy. The reserve pack is closed by using two locking cones, instead of locking loops, and the pins on the reserve ripcord cable (Fig 4). In addition, six pack opening bands are placed on the outside of the pack to assist in opening the flaps during deployment.

FIG 4

OPERATION OF THE P-78 PARACHUTE

Once activated, the parachute assembly quickly deploys in the reverse order in which it was packed. This is accomplished by the downward velocity and thrust of the jumper against the opposing drag of the pilot chute. The opening sequence is best described as a set series of forced actions rather than just one. Technically, the typical parachute opening progresses in the following order and terms:

Step 1 - Release or activation.

Step 2 - Deployment

- a - Line and canopy 'stretch' or elongation, terminated by 'snatch force'.
- b - Inflation to 'opening shock', terminated by over inflation.
- c - Rebound and recovery to a steady-state condition.

Step 3 - Completion of deceleration to near-equilibrium velocity.

Step 4 - Steady and/or controlled descent.

Less technically stated (using Fig 5); (1) The locking pins on the ripcord cable are slipped out of the locking loops of the pack when the ripcord handle is pulled. The pack is allowed to open and the compressed, spring-loaded pilot chute leaps out into the airstream, grabs air, and acts as a dragging anchor. The pilot chute will generate almost 200 pounds of force as it is towed through the air. (2) The action of falling away from the pilot chute causes the figure '6' pin to be extracted and the upper half of the canopy is drawn out of the pack. (3) At this point, the breakcord that is tied around the deployment bag breaks and allows it to be drawn from the pack tray. As this occurs, the suspension lines are pulled from their stowed position on the deployment bag. (4) As soon as all of the suspension lines are released, the bag opens and air is allowed to enter the folds of the canopy skirt. This is where full canopy/line 'stretch' is achieved and 'snatch force' occurs. The jumper will be pulled upright at this time in the opening sequence. (5) Free of the deployment bag, air rushes into the skirt of the canopy, becomes trapped within the apex area, builds up in pressure, and forces the canopy to fill from top to bottom, until completely inflated or open. (6) Due to the extra air pressure caused by the downward velocity, the canopy is stretched to its maximum diameter and 'opening shock' occurs. As the downward velocity rapidly decreases, the pressure tries to equalize and the canopy will flex inward and outward to a steady state, called breathing. The pilot chute will simply fall on top of the canopy in its wake. With the deployed canopy, the jumper's rate of descent is approximately 15-17 feet per second (17.5 fps under a reserve).

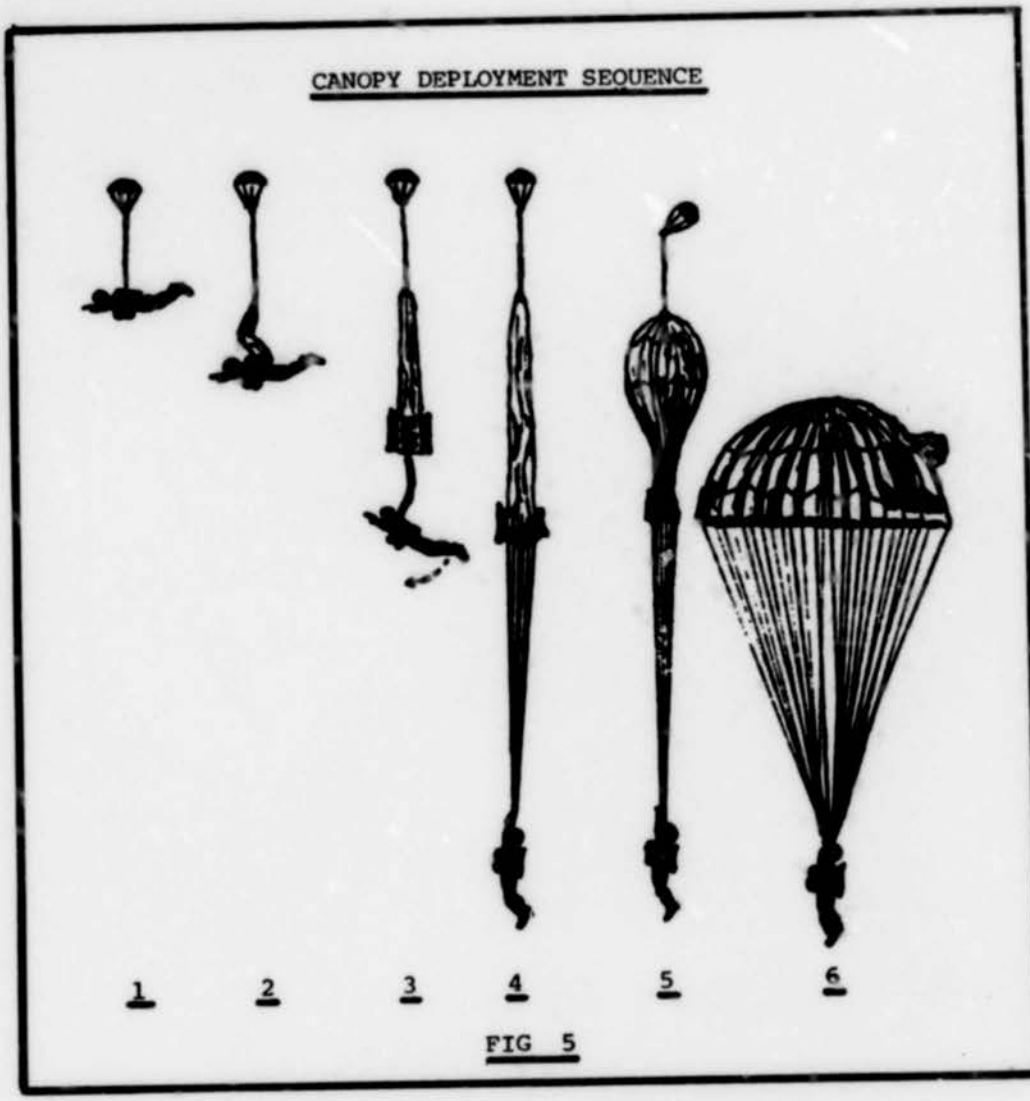


FIG 5

This entire opening sequence takes approximately 3.2 seconds from the time that the ripcord is pulled until full canopy inflation. As you can see, all of the related components cause a sequenced and staged deployment that actually increases the relative opening time. The opening shock that the jumper receives is diminished by the elasticity of the components and the deployment devices to a heavy but smooth tug that is not particularly uncomfortable. On the other hand, the reserve parachute will deploy in about 1.5 seconds. Fewer components are used on the reserve to intentionally allow it to open rapidly. Steps 2 and 3 of figure 5 do not exist. In an emergency situation, time is a very precious commodity.

Intensity of the opening shock depends on many variables. Generally, the greater the difference between the jumper's rate of descent in free fall and his/her rate of descent under canopy, the greater the opening shock. The difference between the two also increases with altitude. All parachutes are designed and constructed with the old idea that "a chain is only as strong as its weakest link". Each component and each connection, from the top of the pilot chute to the lowest leg strap fastener, must be capable of carrying its share of the peak stress or load which occurs during the opening sequence. Stringent strength and stress specifications (Fig 6) must be maintained during the construction of a parachute so that it will absorb much greater loads than are placed on it during normal use. Therefore, it is essential that a parachute is properly used for its intended purpose only. If it is not, the capabilities and limitations could easily be exceeded and its use would be unsuccessful (resulting in injury or death). You cannot make it do something that it is not designed to do!

TENSILE STRENGTH

Component	Qty	Lbs (ea)
Suspension Lines	30	350
Risers	4	3600
Harness Webbing	A/R	6500
Leg Strap Fasteners	2	2500
Chest Strap Fastener	1	2500
Canopy Release Assemblies	2	5000
Bridle Cord	1	1000
Reserve Parachute Attachments	2	5000

Fig 6

PARACHUTE CARE AND PACKING

Proper care and handling of parachute equipment is mandatory at all times. If done improperly and without concern, damage can easily be done that can result in a malfunction and/or shorten or discontinue the serviceability of the equipment.

To prevent unnecessary damage and to facilitate repacking, all students are required to field pack their main parachute as soon as they land. Upon return from the drop zone, they will also suspend the parachute in a tower at the loft to remove any and all debris (see Chapter 8). Prior to packing, each parachute is laid out on long packing tables and is inspected for proper alignment, any damage, and complete serviceability. It is then meticulously folded and packed by the riggers that are assigned to the Parachute Loft. They are all highly trained, competent, and conscientious individuals.

Federal Aviation Regulation 105.43 states that the main parachute will be packed by a certified rigger, or the person making the jump, within 120 days before its use. The same holds true for the reserve parachute, except it can be packed by a certified rigger. All of the riggers at the loft have been certified by the FAA to perform parachute inspections, maintenance, construction, and packing.

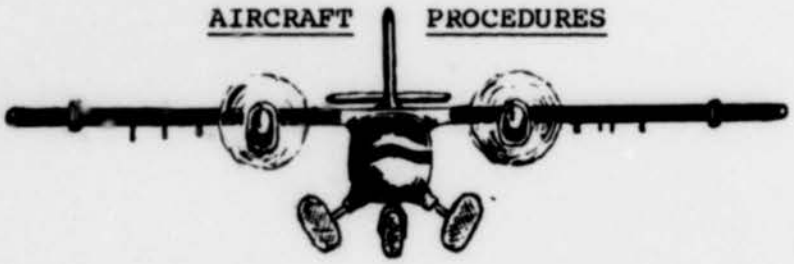
HOW TO HANDLE PARACHUTE EQUIPMENT

DO NOT
- Pick up your parachute by the risers or ripcord handles.
- Place parachutes near heat sources or leave it in the sun. This will cause the nylon to become brittle and lose its strength.
- Drop or throw your parachute; metal parts can bend or break.
- Place heavy objects on top of the parachute.
- Eat or drink near any parachute equipment.

DO
- Handle your parachute carefully and gently.
- Keep your parachute away from any dirt sources, particularly grease and oil.
- Keep the parachute dry.
- Carry your parachute by its handles, wear it without the straps fastened, or carry it the laundry bag issued to you prior to jumping.
- Take care of your parachute, and it will take care of you!

CHAPTER 4

AIRCRAFT PROCEDURES



Once the student is properly trained, equipped, and ready to take that next "big step," the next consideration is getting into the air - safely. The first requirement is 'safety while in the aircraft' and the second is 'safety during the exit.' There are, of course, specific procedures related to jump aircraft that have unusual entrances, seating, and ways to exit. The following information is general and applies to most jump aircraft.

The pilot is always the highest authority in the aircraft. His complex job entails his flying skills, compliance with flight regulations, requirements for air traffic communications and coordination, etc. Above all, the pilot is responsible for your safety. To assist the pilot in the control of the parachutists and to ensure their safety, a jumpmaster is assigned to each jump sortie. The jumpmaster is a highly trained individual that is thoroughly familiar with the jump aircraft and the parachuting operations. This person directly controls and supervises jumper preparation, loading, in-flight conduct, and exiting procedures. At many drop zones, specifically at the USAF Academy, the jumpmaster is also responsible to inspect and ensure the aircraft is set up and ready for jump operations, conduct parachute equipment inspections, and coordinate information with the pilot to assure a safe and efficient jump sortie.

It is the responsibility of the pilot and jumpmaster to work together as a team to ensure that conditions are safe for parachutists to exit the aircraft. This includes the aircraft's configuration, speed, altitude, ground conditions, and aerial hazards (such as other aircraft or parachutists). In emergency situations and any non-standard conditions, action is taken by the pilot and jumpmaster using specific, preplanned procedures. If the pilot should become incapacitated, the jumpmaster will assume sole responsibility for your safety. Always listen to and obey the jumpmaster's commands, he may be the person that saves your life.

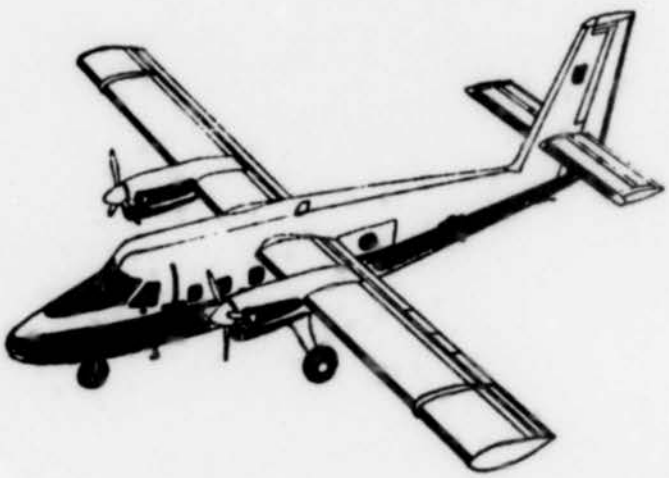
Jump aircraft are usually quite crowded. This can make movement difficult when encumbered with 50 pounds of equipment. A jumper must move slowly, surely, and deliberately amongst others and their equipment to prevent damage and accidental bending or dislodging of locking pins. The most dangerous situation is to have a parachute deploy inside of the aircraft, especially if the door is open. If the canopy is drawn out of the cabin, the jumper

must immediately try to beat the canopy by diving out of the door, no matter what the altitude. If the canopy does get out of the door before the jumper, it will inflate and undoubtedly, the jumper will follow; either out of the door or through the side of the aircraft! If the canopy is caught and contained before it can reach the door, it is still a very awkward and disappointing adventure to ride the aircraft down.

Parachute equipment must be handled and treated carefully. It is an important and mandatory procedure to protect the ripcord handle of a chest mounted reserve parachute at all times. Due to its location, it is the easiest to accidentally deploy. From the time that the aircraft is boarded, everyone should find a secure and comfortable position to minimize movement. If movement is necessary, the key to doing it safely is to look before you move, and then move. It is also common practice to watch out for and assist others with their equipment during their movements.

The last consideration for aircraft safety is the exit. When it's your turn to jump, you must preplan your every move. At the jumpmaster's command, move carefully to the door and be keenly aware of what is happening around you. If something unexpected should occur, you will be able to react quickly and prevent any accidents.

THE UV-18B AIRCRAFT



The two primary aircraft used for parachuting operations at the USAF Academy are UV-18Bs; DeHavilland Twin Otters (DHC-6). These are highwinged aircraft that have a 65' wing span, a 51' 9" fuselage, and non-retractable landing gear. They are powered by twin turboprop engines which yield an exceptional rate of climb. Each aircraft can carry 14 student parachutists on center-facing, troop-type, canvas seats and one jumpmaster. The in-flight jump door is 56" long and 50" high and is located on the left, rear side of the fuselage. Present cost is around $1.7 million each, so take real good care of them!

The following procedures apply for normal operations of AM-490. They have been outlined here in the order in which they will occur to provide an understanding of the specific requirements of the UV-18B. They include many of the jumpmaster's actions and responsibilities, however, it does not include all of them. The ones listed are the ones that every AM-490 student should be familiar with.

1. Student parachutists will comply with all commands of the jumpmaster at all times and do so expeditiously. Your own safety may be involved and you may not realize it.

2. Parachutists will not approach the aircraft until directed to do so by the jumpmaster.

3. AM-490 students will move into the aircraft and to the position that was designated by the jumpmaster. The last person in will be the first person to exit.

4. Helmets and seat belts will be secured prior to taxi. Prior to takeoff, the jumpmaster will request a 'THUMBS UP FOR SEAT BELTS.' Respond using the signal only if your seat belt and helmet are in fact secured.

5. Seat belts will be removed at the direction of the jumpmaster when the aircraft reaches an altitude of 1,500' AGL.

6. Before the first jump of the day and whenever deemed necessary, the jumpmaster will drop a Wind Drift Indicator (WDI) over the intended Landing site and from the planned opening altitude of 3,000' AGL. The WDI will show the environmental wind conditions and velocity so that the jumpmaster can determine the proper exit and opening points.

7. At the jumpmaster's command, 'STAND BY,' two students will move to the end of the canvas seats, facing to the rear.

8. At the jumpmaster's command, 'KNEEL', the student will turn to the <u>right</u> and kneel on the floor. The jumpmaster will perform a final check of the student's equipment prior to exit. NOTE: <u>Always</u> turn to the right to prevent the reserve ripcord from being extracted accidentally.

9. At the command, 'STAND IN THE DOOR,' the student will move carefully into the door position and prepare to edit.

10. At the command, 'GO,' the student will exit the aircraft and turn directly into the wind in an immediate arched free fall body position and at 45 degrees to vertical. The arch must be attained to establish and maintain stability. The arch will be reinforced by looking back up at the jumpmaster and aircraft after exit.

11. If the student gets into the door prior to exit and the pilot's clearance to drop is cancelled or an unsafe condition develops, the pilot will bank the aircraft sharply to the right, away from the open door. The student will quickly follow the jumpmaster's instructions and get back to his/her seat as requested.

12. Student parachutists will exit the aircraft at a location upwind of the landing site and on the wind line. When the main parachute is deployed (at least 2,500' AGL), the jumper should be upwind a sufficient distance to practice running, holding, and crabbing during the descent and still be able to land on the drop zone. The student will have approximately two and a half minutes from parachute opening until landing.

13. All students must realize that there can be changes in the wind speed and direction after leaving the aircraft. The jumper must compensate for these changing conditions and may have to face the same direction for almost the entire descent.

We've never had any problems with the UV-18B aircraft, but as with any mechanical device, it can fail. You must be prepared for any and all emergencies, whether in-flight or on-ground. There are specific procedures to follow that will enable you to survive, should an emergency situation occur.

If an ON-GROUND emergency occurs, your major concern is to evacuate the aircraft as quickly and safely as possible. Care must be taken to avoid getting hung up on the aircraft with any part of your equipment. Prior to evacuating the aircraft when it is taxiing or on takeoff roll, you will have to remain in your seat and assume a 'crash position. This is done by keeping your feet flat on the floor, clasping your hands behind your neck, and pulling your head down between your knees as far as possible. Remain in this position until the aircraft comes to a complete stop.

At the jumpmaster's command, as quickly and safely as possible, evacuate the aircraft and run a minimum of 300 feet and at a 45 degree angle to the aircraft (Fig 7). Rally in groups so that everyone can be readily accounted for. No one will re-enter or get closer than 300 feet to the aircraft, FOR ANY REASON! During an emergency evacuation certain exits will be used in a certain order. This will, of course, depend on their accessibility. The 'primary' exit is the door that you boarded the aircraft. This door is on the right rear of the fuselage. As a 'secondary; exit, use the large jump door on the left rear. 'Alternate exits are the pilots' doors and the two under-wing emergency exits. Use them as a last resort due to their size and location. You will have to remove your gear to fit through the under-wing exits and will have to climb over the seats and around the flight controls to use the pilots' doors. Also, these exits are quite close to the propellers and you may have to wait for them to stop turning.

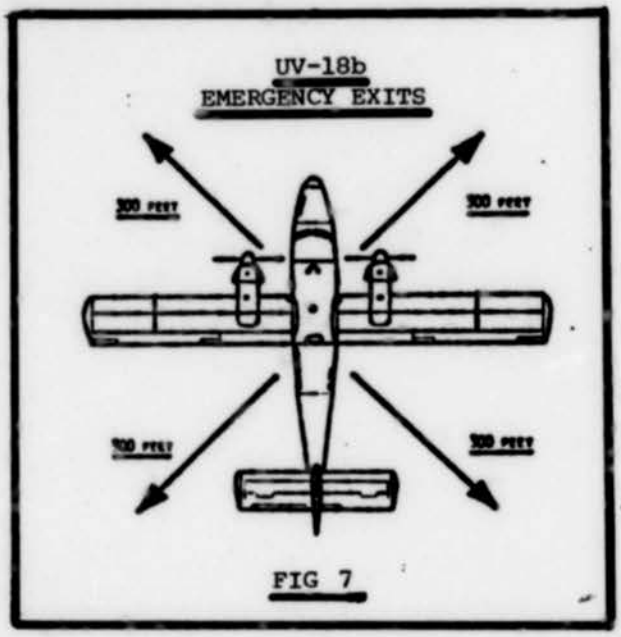


FIG 7

If an IN-FLIGHT emergency occurs prior to reaching an altitude of 1,500' AGL, everyone will remain with the aircraft and land. Assume the 'crash position' and maintain it until the aircraft comes to a complete stop. At the jumpmaster's command, get out! If the aircraft attains an altitude of 1,500' AGL or above, everyone will evacuate the aircraft through the jump door and at the jumpmaster's command. You must assume a 'modified emergency body position' (see Chapter 6), and pull your main parachute ripcord as soon as possible after exit.

If a parachute deploys inside of the aircraft with the door open, it could cause catastrophic results. If your main parachute inadvertently deploys, contain it by leaning back against it and don't let it go anywhere. If your reserve deploys, contain the pilot chute and canopy as quickly as possible. In either case, get the jumpmaster's attention immediately! The signal used in any situation when a parachutist requires assistance is to raise the right arm at a 45° angle toward the ceiling. If either pilot chute or canopy should get out of the door, you must get out of the aircraft as fast as possible! The canopy will inflate and immediately pull you out of the aircraft, no matter what you do. The best way to prevent this from happening is to always cover your reserve and minimize your movements.

In the event that the aircraft has to land with jumpers aboard, or if the jumpmaster accidentally falls out, the Automatic Activation Devices (AADs) will have to be turned off. To prevent leaving the reserve parachutes unprotected, one row of students will bend over while the other row turns the main AADs off, and then vise versa. After all main AADs are in the off position, each individual will be responsible to turn off his/her reserve AAD. In a situation where the jumpmaster accidentally falls out of the aircraft for any reason, all students will land. Notify the pilot, remain seated, fasten your seat belt, and turn all AAD's off.

AM-490 parachute jumps are conducted from an altitude of 4,000' AGL. This is actually 10,500' MSL. Normally, the lowered oxygen levels at this altitude cause no significant problems. However, everyone's physiological needs vary. Some of the symptoms of hypoxia or hyperventilation may occur. If you feel any of the related symptoms listed, notify the jumpmaster <u>immediately</u>. There is oxygen available and the jumpmaster will get a mask for you. When you use the oxygen system, breathe slowly and relax. If you experience hyperventilation, you must slow your breathing rate and hold each breath for about 10-15 seconds.

Blurred or spotted vision.
Dizziness or light-headedness.
Sleepiness or tingling sensation of the extremities.
Euphoria or slow thinking.

If there is no improvement after using oxygen for these symptoms or if you haven't been feeling good throughout the day, DON'T JUMP! If you become nauseous in the aircraft, get the jumpmaster's attention and request a sick bag. If there isn't enough time, use your glove. If you mess up the aircraft, guess who is going to clean it up?

The UV-18B aircraft is quite windy, noisy, and sometimes rough-riding during the flight patterns used for parachuting operations. It will benefit every student to keep track of what is going on and react quickly, carefully, and positively to the jumpmaster 's directions. Once again, remember to <u>always</u> protect your reserve ripcord handle!

CHAPTER 5

BASIC FREE FALL PROCEDURES

"Free Fall"

It wasn't long ago that people believed a person falling for any length of time would dangerously twist, spin, and tumble out of control and would quickly black out. This theory has been unquestionably disproved. In 1948, Leo (Birdman) Valentine experimented with the idea and developed a technique which succeeded in consistent, stabilized, free fall. This arched, spread-eagled body position is the foundation of today's free fall parachuting. Anyone can fling themselves out of an airplane, however, the idea is to do it easily, safely, and consistently. The key element is 'stability.'

Not only can parachutists stabilize and control their descent, but they can also maneuver themselves in the air, or actually 'fly.' An experienced free fall parachutist can change his/her rate of descent, execute intentional turns, loops and rolls, and can even travel horizontally in any direction at a ratio of about 1 foot for every 1.5 feet of vertical descent. All of this is done by changing arm, leg, and/or body position. The body is maneuvered from the stable position by the amount of surface area presented to the airflow by shifting the center of gravity and by deflection of the air. The arms, legs, and body are then used in the same way as the control surfaces of an aircraft.

Once students master these 'flying' skills they can progress to the 'art' of free fall Relative Work (RW). By definition, this is when two or more free fall parachutists maneuver in close proximity of each other to pass a baton, or create or 'hook up' various formations. These various formations are given names that represent their physical appearance; star, round, donut, diamond, wedge, "T", line, etc. Each parachutist flies to a preplanned, relative position amongst the others and grasps a hand, arm, leg, etc, called a 'grip.' During one descent, grips can be changed to create new formations and can be accomplished several times. Sequencial RW, as it is called, can be done well enough that 8-10 completed formations, or points, can be made during one 35 second delay by four persons. This type of RW is used in both sport and competitive parachuting. Another part of RW is to attempt to make one formation with as many people as possible. There have been completed formations in excess of 70 people!

Individual parachutists can also use their skill in sport or competition to perform set series of specific aerial maneuvers within the least amount of time, called "style." A style series, or set, may include (in order); 360^{o} right turn, 360^{o} left

turn, back loop, 360° right turn, 360° left turn, back loop. Competitive stylists can complete this set in 7-8 seconds.

As with all physical and mental skills, everyone must start with the basics. The first task of the student is to learn how to fall in a stable, face-to-earth manner, without twisting, turning, tumbling, or spinning. This is done by the adoption of the aerodynamically balanced, basic free fall body position (Fig 8). This position must be assumed as soon as possible upon leaving the aircraft in order to permit orderly deployment of the back pack main parachute. To consistently fall face-to-earth, it is necessary to lower the center of gravity by arching the back and maintaining balance by the spread-eagled position. The key part of the body is the head since the rest of the body will always tend to follow the actions of the head.

In the basic free fall body position, the head is thrown back with the eyes up. This assists in arching the back while the pelvis is pushed forward. The arms are spread wide so the hands are even with the head and at an equal distance on each side. The upper arms are 90° to the body, the elbows are bent at approximately 20°, and the hands are relaxed with the fingers spread. The legs are comfortably spread, with the feet about 24" apart and the toes pointed. The knees are also slightly bent to 20°. The arms and legs are pushed behind the body, exaggerating the arch, and they must remain symmetrical to each other and to the rest of the body.

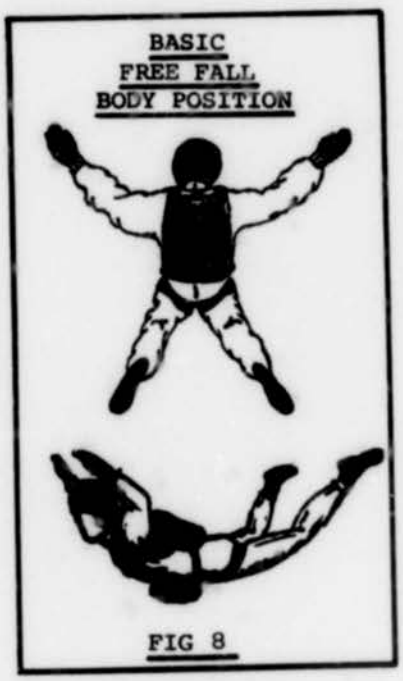


FIG 8

This position must be attained and maintained to assure stability in free fall. As long as the body remains arched and the extremities balanced and symmetrical, the body will fall like a badminton birdie. One arm lower than the other can cause turns, too far forward can cause a head-high attitude, and too far back can cause a head-low attitude. One leg lower or bent more than the other can also cause turns, while losing the arch can result in rolls to the front, back, or side, usually ending up on the back. The degree to which the parachutist loses the body position is equal to the degree or speed at which instability occurs.

EXITS

The most important part of your free fall is the exit. If you leave the aircraft in a good position, it will automatically set you up for a good free fall. If you exit poorly or improperly, you may have a difficult time getting stable. Experienced free fall parachutists can exit in any body position. Their stability is not critical because they can regain it within two to three seconds at will. What is important to all parachutists is to be falling flat, stable, and face-to-earth for the duration of the parachute deployment. Therefore, students must exit stable and remain stable for their entire free fall. The challenge of controlling their stability will require them to concentrate on their attention and efforts. This is due to their lack of sensitivity to the air pressure and the use of their extremities for balance in this foreign environment.

Whether the type of exit is sitting, standing, or kneeling depends on the type of aircraft, size of the jump door, and the equipment worn. For proper control during and after exit, all parachutists must understand the direction and flow of the air to use the proper body position to establish stability within it. A falling object will accelerate through the air until its drag is balanced with gravity. This 'terminal velocity' is achieved by a parachutist after about 12 seconds of free fall and at a speed of around 120 mph. As the jumper falls straight down, face-to-earth, the wind created is straight up, or 'relative wind.' When a parachutist leaves the aircraft that is traveling horizontally between 70-130 knots, he/she is also going to travel in the same path as the aircraft for about 3-4 seconds, called 'forward throw. In this situation, the relative wind that the parachutist experiences is horizontal for a very brief time and he/she will have to exit almost standing up. The forward throw and the horizontal relative wind diminishes rapidly as the vertical velocity and relative wind increases. As the relative wind changes, the parachutist must also change his/her body position. A good, arched configuration will automatically maintain stability by blending into the relative wind, causing a smooth transition to a more face-to-earth attitude (Fig 9).

In AM-490, the student's body position starts prior to the exit and at the jumpmaster's command, 'STAND IN THE DOOR,' In this position, the right knee is placed on the floor about two inches from the edge of the door and with the lower part of the leg at 45 degrees to the edge. The left knee is bent, with the foot placed close to and aft of the right knee. The back is arched, with the pelvis pushed forward as far as possible, while the head is held up and back. The right arm is straight down and placed on the floor slightly to the right of the right knee. The left arm is parallel to the left side of the body, the elbow bent at 20 degrees, and with the palm facing out. As much as 75% of the body weight should be placed on the right hand and the student should be looking at the left engine to assist in keeping the head back.

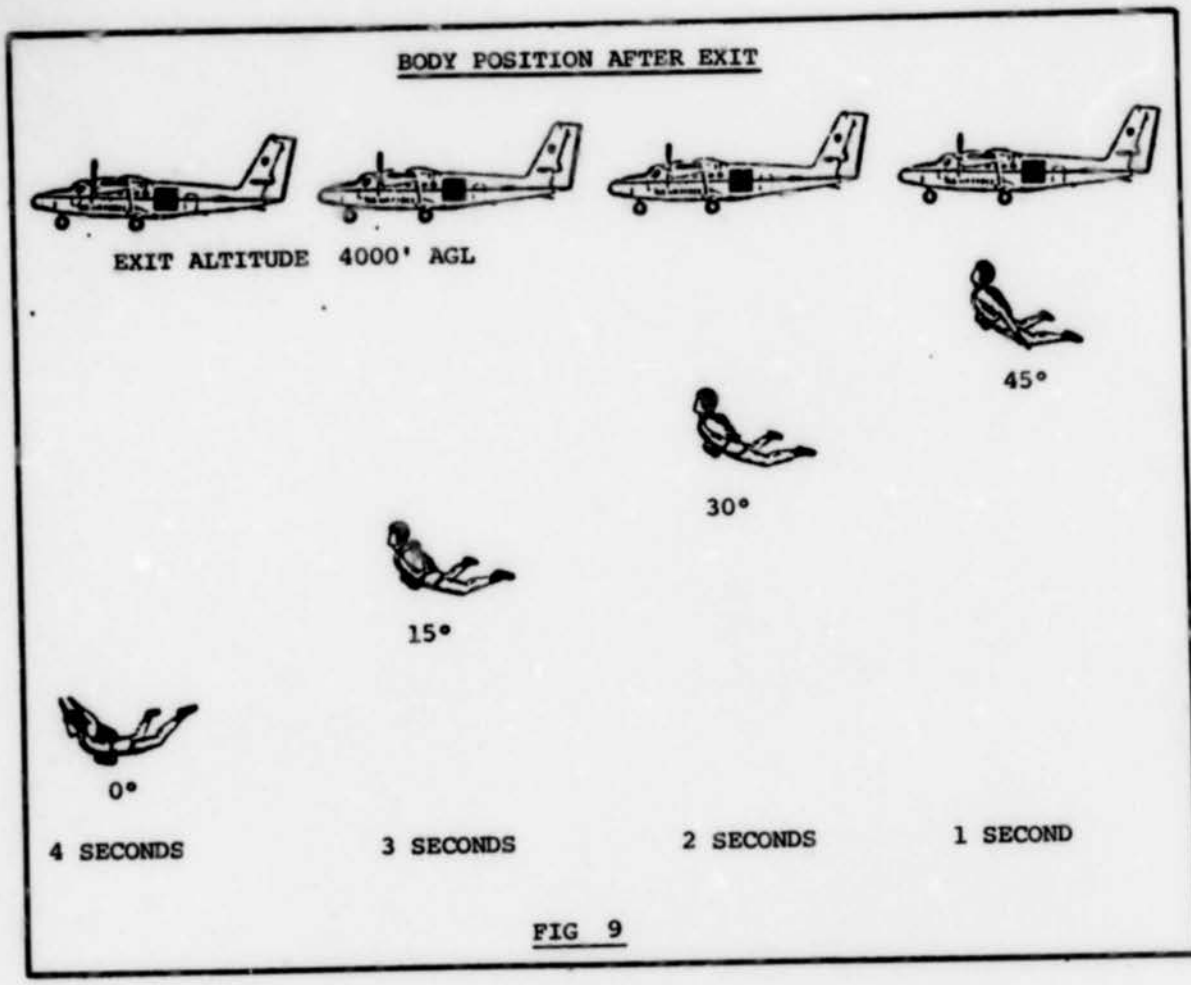


FIG 9

At the jumpmaster's command,"GO", you must pivot on your right hand and rotate out and into the line of flight. Immediately assume a symmetrical and arched body position at 45° from vertical, and keep your head up. Physically slap your thighs to start a slow arm transition. As this slap occurs, the upper arms will be at the sides, the elbows bent at 20°, and the palms forward. As the forward throw decreases, the arms must transition, or pivot slowly at the shoulders, to the basic free fall position within 3-4 seconds.

ARCH-COUNT-PULL

After knowing how to exit and knowing how to remain stable in free fall, the question of when to pull the ripcord and how to know it's time to pull the ripcord arises. Generally, four ways can be used to know when it's time; a verbal count, visual sight of the ground, a stopwatch, or an altimeter. After proper training and practice, the count is the most reliable and accurate for students, while visual methods take a lot of experience. Stopwatches and altimeters are valuable 'aids' for longer delays when counting is not practical. The verbal count is done aloud during training and during the actual jumps. The verbal count of "ONE-THOUSAND" is equal to one second if done at a normal speaking rate. This is where the "ARCH-COUNT-PULL" technique originates.

AM-490 students are required to pull their ripcords within ten seconds from the time they leave the aircraft. During each second of free fall, certain physical actions and performance are accomplished. On the jumpmaster's command, "GO", the student will exit, pivot into the relative wind, assume the arched body position with the head held back, and slap the thighs. As this is done, the student must <u>immediately</u> start the count sequence;

"SLAP-THOUSAND, TWO-THOUSAND, THREE-THOUSAND, FOUR-THOUSAND" - During the first four seconds, the arch must be maintained, the head held back, and the arms must be transitioned into the stable free fall position as the vertical speed increases. The legs and arms must remain symmetrical. By the fourth second, the student will be falling straight down.

"FIVE-THOUSAND, SIX-THOUSAND, SEVEN-THOUSAND" - During these three seconds, the student must maintain attitude and heading while accelerating toward terminal velocity and nearing the ripcord pull time.

"ARCH-THOUSAND" - This count is done as a performance reminder for the student to vigorously arch in anticipation of the ripcord pull. The best possible face-to-earth position must be attained to assure that the parachute can deploy cleanly, without having to go around arms, legs, the side of the body, etc.

"LOOK-THOUSAND" - In order to readily find the ripcord handle, <u>all</u> parachutists must first <u>LOOK.</u> While maintaining the basic free fall body position, the head is tilted to one side, the chin drawn in, and the eyes are lowered to the ripcord handle instead of the head. In this way, body symmetry and arch are not lost because the head remains in the same relative position.

"PULL-THOUSAND" - This is actually done in two parts which should easily flow together as one; 'reach' and 'pull.' While still looking at the ripcord handle, bend both of your arms only at the elbows. 'Reach' with the right hand to firmly grip the ripcord handle while the left hand is placed in front of and near the top of the helmet. Both arms must move simultaneously and

symmetrically to maintain stability. As soon as a good grip is achieved, the wrist is rotated behind the handle and the right elbow is pulled into the side. The ripcord is then 'punched' out to full arm extension without letting go of the handle. At the same time, the left arm must be returned to its original position. The eyes must remain on the handle to insure its extraction.

'CHECK-THOUSAND' - Watch the ripcord until the cable is completely extracted. Then shift your head and eyes to the left and over the shoulder. Ensure that the pilot chute has cleared and is properly anchored in the airstream. Once verified, quickly return your head to the front. This will prevent the risers from slapping you on the side of the face and it will also be a lot easier for your neck to absorb the opening shock. Remember, it only takes about three seconds for opening shock to occur once the ripcord is pulled.

One point must be emphasized; ALWAYS LOOK BEFORE YOU MOVE! In other words, your eyes should always lead your movements so that you can surely and positively accomplish whatever it is you're about to do. This is especially true with ripcord pulls. People have had severe collisions with the ground after spending their entire free fall fumbling around for the ripcord or were tugging on the harness. These accidents could have been very easily avoided if they only looked first!

For this reason, as well as other situations when the ripcord is not manually pulled, an Automatic Activation Device (AAD) is installed on all P-78 parachutes, mains, and reserves. The main parachute AAD is set to 'fire' at 2,500' AGL, and the reserve is set at 1,000' AGL. These devices are mechanical sensing units that react to altitude/velocity and they can fail! Therefore, it is imperative for you to pull your ripcord; NEVER rely on the AAD to save your life!

AFTER OPENING PROCEDURES

Once you have pulled the ripcord, the parachute will deploy above your head and reduce your rate of descent from about 176 fps to 15-17 fps in a very short time. Prior to looking around at the scenery and enjoying your ride down, there are a few mandatory procedures that you need to accomplish.

1. 'CHECK AND INSPECT MAIN CANOPY' - The most logical thing to do once the parachute opens is to look at it. Look up at it to ensure that it is in fact fully deployed, the modifications are in the rear surface of the canopy, there are no holes or tears, the lines are not twisted, and in general, it looks like a parachute should.

2. 'LOOK AROUND FOR OTHER JUMPERS' - It is possible that you may find yourself on a collision course with another jumper (or even a glider). This can occur since two AM-490 students exit

the aircraft on each pattern, or 'pass', that is flown over the drop zone. There may be adequate differences in free fall times or rates of descent under canopy for two students to be at relatively close distances. If any parachutists are on a collision course, each individual <u>will</u> veer to the right. Furthermore, in any situation where parachutists are close to each other but not necessarily at the same altitude, the lower canopy will always have the right-of-way.

3. 'ORIENT MYSELF TO THE DROP ZONE' - After assuring you are in clear airspace, physically look around at the ground to find out where you are in reference to the drop zone. This is an important step that tells you which way you will have to steer your canopy and be able to land in the student landing area (see Chapter 8).

4. 'TURN OFF RESERVE AAD' - Now that you have a good operational canopy above your head, you no longer need the assistance of the AAD. Look down at the reserve parachute pack, find the AAD arming switch with your eyes, and then manually turn the AAD off. This is a necessary step because there is a slight possibility that your rate of descent during hard canopy maneuvers may be enough to trigger the AAD and deploy your reserve parachute.

5. 'POP DOWN STEERING TOGGLES' - Next you will have to concentrate on steering your canopy back to the student landing area. As mentioned in Chapter 3, two risers have guide rings that retain the steering lines and loops. During packing, the steering loops are also tacked to the riser with light-weight breakcord. You will have to reach up, firmly grasp a loop in each hand, and vigorously pull down on both of them to 'pop' the steering loops free.

During training and the actual jump phase, all of your actions will be verbalized while you accomplish them. This is done to engrave all of the procedures in your mind, and is also a way to demonstrate to your instructors that you know exactly what to do in each situation. You should become thoroughly familiar with all of the actions and/or procedures and know exactly what to do for each of them. A list appears in Chapter 9 for easy reference.

CHAPTER 6

PARACHUTING EMERGENCIES

FREE FALL EMERGENCIES

It is not uncommon for student parachutists to lose concentration and relax their efforts to maintain proper body position. This is a result of many distracting factors which, in actuality, may be quite minor. However, the determining difference is the environment of free fall, especially to a first jump student.

In a high altitude, long free fall delay, instability can result in unconsciousness, preventing manual activation of the parachute deployment. It can also result in considerable disorientation with associated symptoms. An unstable position throughout the parachute deployment may cause the jumper's limbs to interfere with the deploying canopy and/or suspension lines. It will also increase the possibility of severe opening shock which can cause various injuries. Action must be taken immediately upon the slightest turn or the slightest loss of the arch to maintain a face-to-earth attitude. When control of attitude or heading is lost, <u>always</u> regain attitude <u>first</u> and then heading. When control cannot be achieved or regained, the parachutist must make a positive decision according to the situation and environment. In AM-490, when action has been taken to correct a problem and there is no evidence of improvement, deployment of the main parachute is mandatory. NEVER go beyond the allotted free fall time to achieve stability, regardless of the body position. When it's time to pull, definitely <u>PULL</u>!!!

Most attitude and control problems can be solved within two or three seconds by exaggerating the basic free fall body position. The student must hold the corrective body position long enough to allow it to take effect. As a general rule, it will take about the same amount of time to regain the proper free fall position as it took to lose it.

INSUFFICIENT ARCHING of the body, arms, legs, and neck will cause you to lose the face-to-earth attitude. It is common for beginners to think they are arching more than they really are. You must exaggerate the arch to recover. It will seem to require greater effort than when practiced on the ground. Recovery time will take two to three seconds for a good, hard, vigorous arch. Do not give up, give the arch time to react.

A SPIN is nothing more than a turn caused by an asymmetrical body position. Turns can be caused by either an arm or leg, or both, being out of position. Exaggerate the arch and look in the opposite direction of the turn. You can also move your arms to

force your body to turn by tilting the shoulders, dropping the inside arm, raising the outside arm, and looking in the direction that you want to turn. The amount of response obtained will depend on the degree to which the body position is changed. A slow turn may be nothing more than a hand being slightly lower than the other. Moving the hand to the proper position should be sufficient. For a significant turn rate, the effort to turn in the opposite direction must be held only until the turn stops or the proper heading is attained. Should it be held longer, a turn in the opposite direction will begin.

In a HEAD DOWN ATTITUDE, the hand position is too far back toward the feet, looking at the ripcord during free fall, or the legs are not bent. Move the hand position further forward and push the head back. For a significant head down problem, move the hands about one foot forward and ensure that the knees are bent 20 degrees. HEAD HIGH ATTITUDES are caused by the hand position too far forward or the legs bent too much. To correct this problem, do just the opposite of head down corrections.

ROLLS can occur when the arm and leg on one side of the body are not extended far enough to the side. Rolls are not a common problem, however, if it does occur, it's usually during the ripcord pull. The right hand will move inward for the ripcord handle and the left hand remains where it's at. In this situation, remember to move both hands simultaneously.

If INSUFFICIENT OR IMPROPER CORRECTIVE MEASURES are used and control cannot be regained within the time allotted or the situation is getting worse, pull the main ripcord to deploy the parachute. It is not reasonable to extend the free fall time to try and regain control when efforts up to this point have been unsuccessful. Nine times out of ten, the problem lies with an improper free fall body position. The cure for this is to learn it correctly and thoroughly on the ground BEFORE you jump.

INABILITY TO DETERMINE YOUR ALTITUDE may be caused by several factors. In AM-490 you will be jumping in daylight and under controlled conditions. The primary reasons will be losing count or forgetting to count! If you cannot positively determine your elapsed time in free fall, immediately initiate main parachute deployment. NEVER re-start or continue your count!

DIFFICULTY IN FINDING THE RIPCORD HANDLE may come from neglecting to look for it in the first place. In parachuting, always guide your hands with your eyes and things will become vastly easier. Also, take the time to find out what your ripcord looks like from a perspective while wearing it, prior to jumping. As mentioned earlier, people have looked in the wrong place or they have not looked at all. It is possible in some cases that when do you look for it, you may experience a 'floating ripcord.' The ripcord may be out of its elastic pocket and near the right arm-pit due to the wind. It is also possible that the force needed to extract the ripcord cable is greater than expected. This may be due to

increased friction somewhere in the system, called a 'hard pull. The solution is to bring both hands back in and try once and only once again to pull. If you are still unable to extract the ripcord, use both hands to apply as much force as possible. In this situation, it is very important to concentrate on proper body position. In either case, if the ripcord cannot be found after a reasonable amount of time (about 2 seconds) or after using both hands, the ripcord cannot be extracted; deploy the reserve parachute.

PARACHUTE MALFUNCTIONS

On very rare occasions, some part of the parachute system may 'malfunction.' A malfunction is any failure or improper functioning/operation of the parachute or equipment and sometimes the jumper himself. Malfunctions can range from premature opening of either parachute inside of the aircraft (Chapter 4) to torn canopy fabric on opening. It is because of the possibility of a malfunction that a spare parachute is carried, emergency procedures are well practiced, and the opening altitude is a minimum of 2,500' AGL. If a total malfunction occurs at 3,000', studies have shown that it will take almost 1,000', or six seconds, to recognize it, react to it, and to deploy the reserve parachute.

Parachute malfunctions (Fig 10), are divided into two major categories; FAST or SLOW. With a fast malfunction, none or very little of the parachute assembly is deployed. Your rate of descent may only be slightly diminished or not at all. If you have a fast malfunction, deploy the reserve immediately. With a slow malfunction a small or major portion of the parachute is deployed, but it is not fully developed or functional. Your rate of descent will usually be diminished considerably. When you determine that your rate of descent is unsafe or you are uncertain whether you can land safely, you will use the reserve parachute.

FAST MALFUNCTIONS

TOTAL - Due to problems with the parachute assembly, the pack may not open to allow the pilot chute to be released and create subsequent deployment of the canopy. During your 'check-thousand' there will be no sign of the pack opening or evidence that the pilot chute and/or the parachute is deploying.

PILOT CHUTE HESITATION - Due to the airflow around the body in free fall, a person in a flat, stable body position creates an area of turbulence behind the body called the 'burble.' This 'burble' may prevent the pilot chute from moving away from the jumper's back or it may delay its action. Normally, the slight dropping of one shoulder, as when performing the 'check thousand', will be sufficient to change the airflow over the back and release the pilot chute.

PARACHUTE MALFUNCTIONS

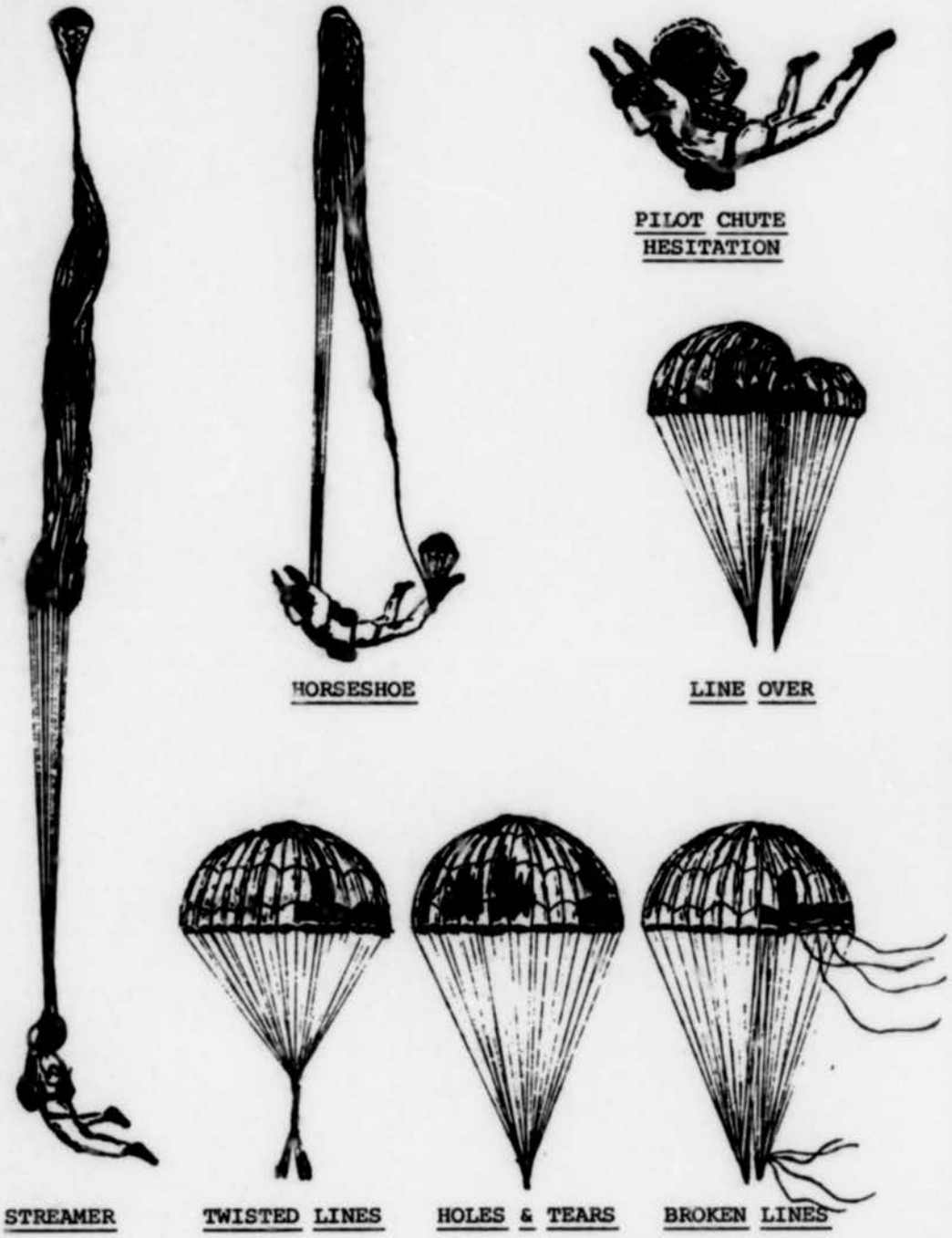


FIG 10

STREAMER - If the canopy and/or the suspension lines are drawn from the pack but the canopy does not inflate, it will appear as a streaming mass of material above your head. The various malfunctions that result in a streamer may be caused by broken connector links on the risers, a premature activation of the canopy release assemblies, the figure '6' pin not releasing the deployment bag, the locking loops on the deployment bag not releasing the canopy, air cannot enter the canopy skirt, etc. A streamer may create enough drag to pull you upright, but your rate of descent will definitely be insufficient to land safely.

HORSESHOE - This malfunction occurs when the pilot chute or any part of the canopy snags or hangs up on the parachutist's leg, foot, arm, or equipment. The suspension lines partially or fully deploy and the canopy and lines form a horseshoe-shaped extension. This will extend above the jumper from the pack or shoulders to the point at which it is caught. As a result, the parachutist will be suspended at any angle during descent. Horseshoe malfunctions are primarily caused by improper body position during the parachute deployment.

SLOW MALFUNCTIONS

LINE OVER (MAE WEST) - This is a result of one or more lines lying across the top of the canopy after inflation. This results in the canopy being pinched closed at that point and thus, it forms two canopy lobes, however not necessarily of the same size. This configuration may induce slow or fast rotation of the canopy and the jumper. Its appearance is how it got its nickname, "Mae West."

PARTIAL INVERSION - A partial inversion occurs when one or more gores near the skirt of the canopy become inverted during deployment and form a small pocket which inflates on the inside of the canopy. This condition may or may not work itself out or may become a complete inversion where the entire canopy becomes inverted or inside-out. To prevent this type of malfunction, all P-78 main canopies have a netting sewn to the skirt of the canopy called the "anti-inversion net."

BROKEN LINES - Suspension lines can break during the opening shock if it is severe or if there are weak lines on the canopy that are undetected during packing. Your rate of descent will obviously increase according to the number of lines that are broken. You can usually land with five of them broken. However, consider the effect it will have on the maneuvering capability and how many other lines are weakened and may break during your descent. If the parachute has six or more broken lines, or you have any doubt whether your rate of descent is within safe limits, by all means deploy your reserve.

HOLES AND TEARS - Any of these in the canopy will be obvious during your after-opening check. In comparison to the neatly edged modification in the rear surface of the canopy, holes and tears will be rough edged and ragged. As with broken lines, your rate of descent will be increased, so the deciding factor will be if you have obvious holes and/or tears that exceed the size of two sections, deploy the reserve (see Fig 1, "C", page 18). In addition, if either the upper or lower lateral band is torn, do not hesitate to deploy the reserve.

TWISTED LINES - This type of malfunction results from the canopy and/or deployment bag or the jumper rotating or spinning during the deployment sequence. Twisted lines can restrict the parachutist from lifting his/her head to check the canopy and it can cause restricted maneuverability of the canopy. Normally this situation is not considered an emergency that requires immediate activation of the reserve parachute. The solution is to spread the twisted lines and risers apart and look up. To assist the untwisting action, perform a vigorous bicycling action with your legs and force your body to rotate in the opposite direction of the twists. After a genuine attempt to untwist the lines you cannot raise your head or you cannot see any apparent sign that the lines are clearing, the situation then becomes an emergency.

The best way to reduce the possibility of a malfunction is to maintain the proper free fall body position throughout the deployment sequence. The best way to cope with a malfunction, should it happen, is to know the appropriate corrective procedure and use it.

EMERGENCY PROCEDURES

The reserve parachute must be used when the parachutist is unable to deploy the main or determines that the main will not provide a safe rate of descent for landing. The major concern is to deploy it within sufficient time. Immediately upon determining that the safety of your descent is uncertain or that it is definitely unsafe, you must make the decision to deploy the reserve parachute. Once made, the decision is firm. You will then proceed to activate the deployment as required for each type of malfunction. Both types, fast and slow, require you to act quickly and not delay.

The MODIFIED EMERGENCY BODY POSITION (MEBP) will be used when confronted with a free fall type emergency situation. In this body position, the arch is exaggerated and the feet and knees are pulled together. The legs are bent sharply at the knees and are forced back over the buttocks as far as possible in an attempt to touch the back of the helmet with the toes. The eyes and hands are on the main ripcord or at its pocket while bending the arms at only the elbows. Student parachutists will 'SNAP' into the Modified Emergency Body Position under the following conditions:

UNCONTROLLED FREE FALL - If after leaving the aircraft you become unstable and cannot regain it within a few seconds, 'snap' into the MEBP and pull. In an unstable condition, the MEBP will prevent any entanglements with tne canopy and/or lines.

FLOATING RIPCORD - As you 'look-thousand' during your free fall and you can see that the ripcord handle is not physically in it's pocket, 'snap' into the MEBP and actively seek the handle for a maximum of two seconds. Start at the ripcord housing and follow the cable to the handle, grasp it firmly with both hands, and vigorously punch it out past the face and in front of the helmet. If the handle cannot be found, the situation now becomes a fast malfunction and you must take the appropriate actions to deploy the reserve.

HARD PULL - When you experience a hard pull and you have attempted to pull the second time unsuccessfully, 'snap' into the MEBP and pull the ripcord with both hands in the same manner as a floating ripcord. If it cannot be pulled, the situation also becomes a fast malfunction.

In the above situations when the Modified Emergency Body Position was assumed and the corrective action was insufficient to correct the problem, the deployment of the reserve parachute is mandatory. In any and all circumstances when activation of the reserve is evident, the EMERGENCY BODY POSITION (EBP) will be used. This position is identical to the 'modified' version except; the eyes are focused on the reserve ripcord handle, the elbows are brought inward to the sides, and the hands are clenched in fists on the ends of the reserve parachute pack.

SEVERE PILOT CHUTE HESITATION - When you pull the ripcord, check over your shoulder. If the pilot chute has not cleared your back, 'snap' into the EBP and do another 'check-thousand.' This will definitely have a positive effect on the burble and normally it will allow the pilot chute to do its job. If it still has not cleared, treat it as a 'fast malfunction' and deploy the reserve.

Since the 'FAST MALFUNCTION' do not change the parachutist's rapid rate of descent, the corrective actions will be taken by the following verbal and physical procedures:

1. 'THROW AWAY MAIN RIPCORD' - In cases other than a floating ripcord or hard pull, immediately and vigorously discard the main ripcord throwing it down and away from your body.

2. 'SNAP INTO THE EMERGENCY BODY POSITION'

3. 'LEVER OUT RESERVE RIPCORD' - Grasp the reserve ripcord handle with only the fingers and place the thumb firmly on the side of the reserve pack. Use the thumb as a pivot point to lever the handle out.

4. 'THROW AWAY RESERVE RIPCORD' - Immediately and vigorously discard the reserve ripcord handle.

5. 'CHECK-THOUSAND' - Check the reserve parachute as it deploys using the same method as a main parachute (page 36). With your fast rate of descent, the reserve pilot chute will anchor itself in the airstream and follow it around your side and deploy the canopy above your head.

Since a SLOW MALFUNCTION' will change the rate of descent to a certain degree, there may be insufficient airflow to induce canopy inflation. Therefore, you may have to manually assist its deployment. ALL slow malfunctions will be handled by the following procedures:

1. 'THROW AWAY MAIN RIPCORD'

2. 'SNAP INTO THE EMERGENCY BODY POSITION'

3. 'LEVER OUT RESERVE RIPCORD'

4. 'THROW AWAY RESERVE RIPCORD'

5. 'TUCK TOP FLAP UNDER CHIN' - Physically pull the top flap of the reserve pack up and tuck it under your chin to keep it out of the way.

6. 'RAKE OUT LINE GROUPS' - Holding your fingers tightly together and extended away from your chest, point the thumbs downward at 90 degrees to physically 'rake' the suspension line stows out of the bottom of the reserve pack.

7. 'SEPARATE LINE GROUPS' - Grasp the two line groups starting at the two short risers which are about 6-8" long. Wrap your fingers around each group so that your palms are facing downward and your elbows are out to the sides. Then, extend your arms to full length away from your chest.

8. 'PUMP BOTH GROUPS TWICE' - Simultaneously and vigorously pull the line groups apart and around toward your back. This will separate the two line groups and open the skirt so that air can flow into the canopy.

9. 'PUMP LEFT GROUP TWICE' - Use the same method as above except pump only the left group. The right hand and line group remains in front of your chest. This is done to assist the extraction of the two locking stows on the deployment diaper (Chapter 3, page 20).

NOTE: Repeat steps 8 and 9 until the canopy opens.

10. 'CHECK AND INSPECT RESERVE CANOPY' - Once the canopy opens, perform the same after-opening procedures as a main. The only only difference is that there are no 'steering loops on the reserve canopy. The suspension lines that are used for steering are marked or 'flagged' with a red piece of material that is sewn directly to the line. In addition, with an opened reserve canopy you will be leaning back due to its attachment location on the harness. This will not create any problems during your descent, however, you must pull yourself upright to land. Use the suspension lines or line groups to accomplish this.

RESERVE PARACHUTE MALFUNCTIONS

As with a main parachute, the reserve is also subject to malfunctions. You will have to do everything you possibly can, for as long as you can, to assist its deployment and inflation. In the extremely rare case of a double malfunction where neither canopy will inflate, you will have to land with what you have and do an outstanding parachute landing fall. Use the following procedures if you should experience difficulties in the reserve deployment:

RIPCORD HANDLE WITHDRAWAL RESTRICTED - Open the ripcord protector flap and withdraw the pins from the cones manually.

STREAMER - Separate and vigorously pump the lines widely apart to assist inflation.

HORSESHOE - Direct all efforts toward detaching the snagged portion of the canopy to allow full extension and inflation.

LINE OVERS AND OTHER PARTIAL MALFUNCTIONS - Pull down on the suspension lines of the smallest lobe to deflate it and allow the lines across the top to slide off. If the lobes are divided equally, pull the lines on either lobe. If tears, holes, and burns occur, slowly ease the line back up. If it clears, check the canopy after full inflation. If holes, tears, and burns are noticed after it inflates, there is no corrective action with the exception of doing an outstanding parachute landing fall.

TWISTED LINES - Same as for the main parachute.

FOULING IN AN UNINFLATED MAIN CANOPY - If the reserve hangs up or fouls in the malfunctioned main, immediately grasp the left and right reserve suspension line groups as high as possible. Spread them as far apart as possible and pull downward vigorously to separate the entangled canopies to assist inflation.

PARTIALLY INFLATED RESERVE WITH AN INFLATED MAIN - Pull the reserve parachute down by the suspension lines into clear airspace, release and assist inflation as required by spreading the suspension lines apart.

RESERVE SLOW TO INFLATE OR FALLS BELOW JUMPER - The cause is probably due to the parachutist not descending at a fast enough rate. Assist inflation by separating the lines and shaking them to open the diapered canopy. If necessary, gather the material and throw it out again. Continue attempts to deploy the reserve until such time as it is necessary to prepare for landing.

ACCIDENTAL DEPLOYMENT OF THE RESERVE - Should the reserve parachute accidentally deploy at any time after the main parachute, try to contain it. Bundle it up and hold it between the legs during descent unless you determine that you need to deploy it. If the reserve is not needed and it does deploy, you will lose maneuverability that the main parachute provides. Students beneath a well inflated main and a reserve canopy will descend under both.

CHAPTER 7

CANOPY CONTROL

GENERAL

One of the most important tasks for a student parachutist is to learn how to maneuver the canopy and make safe landings on the intended site; the drop zone. Proper techniques must be used to land in the preferred area, avoid ground hazards, and to reduce landing forces. The key elements to successful canopy control are for the student to use a good sense of judgment for speed, distance, and direction. In addition, it is up to the individual to control and maneuver the canopy, instead of the canopy controlling and maneuvering the individual.

In order to effectively understand how to maneuver, you must understand the environment through which you are descending and the effects that it will have. This can be a very complex subject and would require a separate, in-depth study of the various local conditions and weather phenomenon. Therefore, only basic ideas will be considered. Once opened, the canopy is influenced by four major factors: gravity, atmospheric pressure, the variable wind speed and direction pushing on the canopy, and the inherent forward speed of the canopy.

- Gravity and atmospheric conditions will affect your rate of descent. Gravity is the force that pulls the parachutist back to earth at a rate based on the canopy's weight-to-drag ratio. Different weight individuals will descend at different rates and each individual's rate will vary with the atmospheric conditions, or air pressure. The air pressure is constantly changing due to the warming effects of the sun on different types of terrain and due to the constant movements of air masses within the area. Under a P-78 main parachute, the average rate of descent is approximately 15-17 fps. The main point to remember is that your rate of descent <u>is</u> a very important factor to consider during your entire descent.

- Variable wind speed and direction will play the major part in your canopy control. The air masses may well be composed of several layers of air flow which may be moving at different directions and different speeds. Vertical as well as horizontal air currents exit which may cause turbulence. This can be experienced when descending into a layer of air that is moving in a different direction and/or velocity, causing the canopy to shift or bounce. The closer to the ground, the more effect turbulence will have on the safety of your landing. It is next to impossible to predict exactly what wind conditions you will experience during your parachute jumps. However, you will be able to gauge

your drift across the ground by looking down between your feet and will be able to estimate the surface winds by observing its effects on various objects on the ground. Constant evaluation of wind velocities, movement across the ground, and your rate of descent are required to properly maneuver your canopy and land at a particular point. In AM-490, the most valuable indicators of wind conditions are: actual parachute jumps in progress, the Wind Drift Indicator (WDI), the wind sock, movement of cloud shadows over the ground, and blowing dust or smoke. These indicators also show where to exit the aircraft and which direction to face when landing.

- The inherent forward speed of the P-78 canopy is about 8 knots. This is created by the modification in the rear surface of the canopy. The air pressure within the canopy vents to the rear and thus causes the forward speed or drive. By steering the canopy in different directions you can use the forward speed within a moving mass of air to effectively increase, decrease, or maintain your drift over the ground. In a situation where the wind speed is 8 knots and the canopy is facing the same direction as the wind, or downwind, your ground speed will be 16 knots, called ''running.'' If you turn around 180 degrees and face directly into the wind, or upwind, you will be in a position called 'holding.' You 'hold' the forward speed of the canopy against the wind speed, and in this example you would come straight down. You can also turn and face a direction which would be at any angle to the wind, called 'crabbing.' This would be very similar to swimming in a river. As you try to reach the other side, the current will carry you downstream. You can counter this by swimming at various angles upstream to reach a desired point on the other side.

In consideration of the four factors that influence the canopy during descent, you will have to exit the aircraft at a certain point or location over the ground to allow you to land on the drop zone. This location is called the 'exit point.' While participating in AM-490, determination of the exit point is a responsibility of the jumpmaster. Furthermore, it is also his/her responsibility to assist the pilot in flying over the exit point and to give you the command to 'go' over the exit point.

The procedure for determining the exit point is called 'spotting.' Consideration and allowances are given for all four of the above mentioned factors in an honest effort to select the most desirable exit point. The methods used include: Observation of any and all meteorological data, visual measurement of the wind speed and direction, and making an educated decision based on the observed evidence and a knowledge of the canopy's 5 capabilities. These methods are, at best, an estimate and the student parachutist must always be prepared for incorrect exit points or environmental changes which can occur after leaving the aircraft.

There are two parts to determining the exit point or 'spot'; the first being the determination of the 'opening point.' This location is 3,000' above a ground reference point where an AM-490 student should be when the canopy opens. To determine the opening point, the jumpmaster will throw a Wind Drift Indicator (WDI) directly over the student landing area at the altitude of 3,000' AGL (Fig 11). As the WDI descends, the aircraft will orbit while the jumpmaster watches and times it to ensure its proper rate of descent. The WDI will drift and land at a point directly downwind of the landing area. The jumpmaster can then mentally draw an imaginary line from the WDI to the student landing area and beyond called the "wind line." He/she will estimate the distance from the WDI to the student landing area and then find a reference point or 'spot' upwind an equal distance and on the wind line. This will be the opening point.

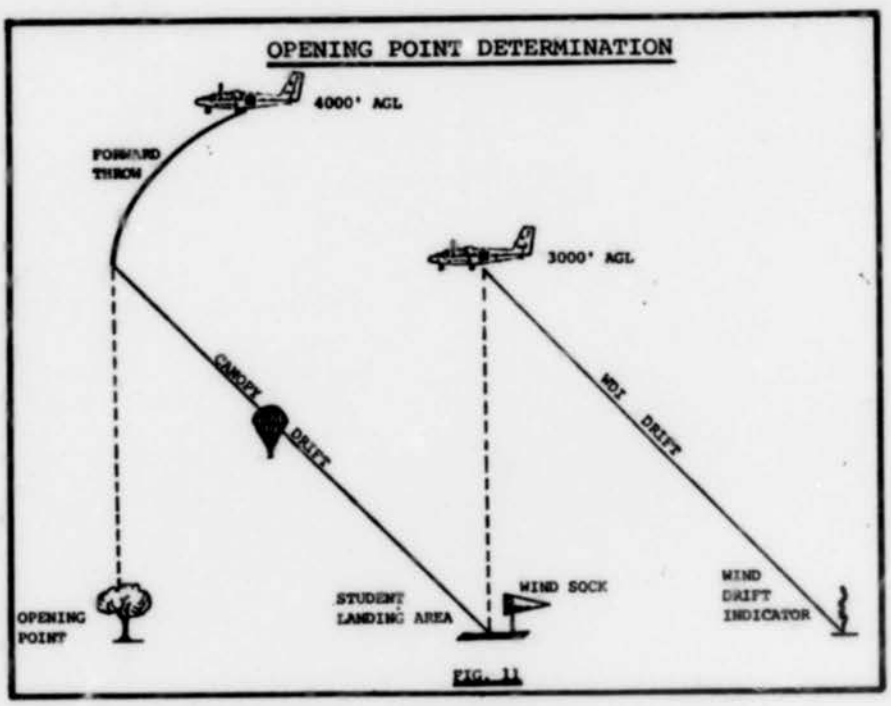


FIG. 11

The second consideration is to determine the proper 'exit point' so that the student can leave the aircraft and deploy the main parachute at the opening point. To do this, three additional factors are involved; forward throw, wind conditions above 3,000' AGL, and a margin of error for student drift in free fall. Improper student body positions can cause this horizontal movement. Figure 12 shows the relationship between the exit point, the opening point, the area that a student has to maneuver the canopy, and the student landing area.

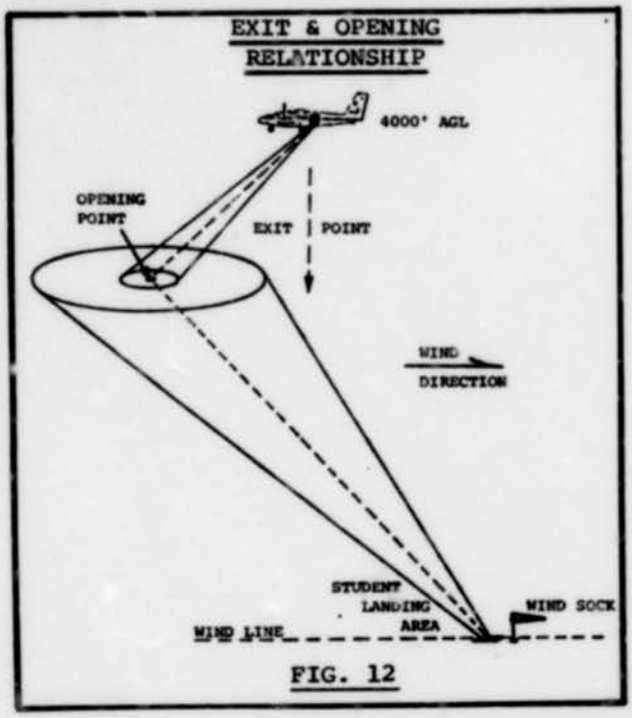


FIG. 12

MANEUVERING THE CANOPY

Maneuvering to land at a particular point requires constant evaluation of wind velocities, wind directions, drift over the ground, and the descent rates of the parachute. The parachutist must use combinations of running, holding, and crabbing in relationship to the wind line, and continually make corrections of the canopy's heading. By continuous evaluation of movement and timing, the student parachutist will be able to safely land within the boundaries of the student landing area. In AM-490, wind limits have been established at 13 knots to prevent landings in hazardous areas due to improper canopy control. In addition, this limit also prevents severe landing force due to excessive ground speed (covered in Chapter 8).

The canopy's heading is changed in either direction by pulling down on the steering lines on the side to which the turn is desired - pull the right steering line to turn right, pull the left steering line to turn left. The further the line is pulled down, the faster the rate of turn. Pull the steering line down smoothly to establish a comfortable turn rate, and when the desired degree of turn has been reached, ease the line back up to its guide ring or 'keeper.' With a P-78 parachute, a 360^{o} turn can be accomplished in about 5-6 seconds with the steering line fully depressed. The maximum forward speed of 8 knots can only be obtained when both steering lines are in their keepers. Pulling both lines down at the same time should be avoided as the canopy will lose its forward speed and it may begin to oscillate. Also, avoid jerking the steering lines down rapidly as this will also cause oscillation. Allowing or causing this to happen near the ground can cause severe landing forces.

The theory of canopy control is quite simple, it is more difficult to accomplish and will always be affected by the individual's judgment and subsequent actions. To learn the ability of the canopy under various, always changing conditions takes many jumps. The best advice is learn the basic ideas and then simply get up there and learn how to control the canopy by applying the ideas. It is very similar to riding a bicycle for the first time.

Ideally, the parachutist should receive opening shock directly on the wind line and upwind of the landing area. Then it would be possible to control the downward glide by holding and/or running as necessary to land in the desired area. However, spotting and wind variables prevent this from happening very often. With this in mind, the heading of the canopy should be constantly changed or corrected to allow or cause movement closer to the wind line. Once there, or as you approach the wind line, you will have to time your rate of descent so that you will reach the student landing area at an altitude of about 200' AGL. This location will be considered as the 'target', not a location on the ground.

The first objective is to get on, or ensure that you are on the wind line. If you can face directly toward the target or directly away from the target without detecting any ground drift to the left or right, chances are that you have attained a good position over the wind line. If you encounter any drift to the side, you will have to correct by 'crabbing' at angles to the wind that will cause you to drift to the wind line. However, you must always attempt to stay upwind of the target. As an example, you check your drift and can see that you're going sideways to the left. You turn right about 45 degrees to get back to the wind line. At the same time, you check and estimate your drift toward the landing area and realize that you are drifting downwind too fast. This will put you on the downwind side of the landing area prior to reaching the wind line or after you land. In this situation, you will have to turn back to the left about 20 degrees to slow your downwind drift and your drift toward the wind line.

The wind line can be considered as a 'wind cone', sometimes called the 'cone of possibility' (Fig 13). The wind cone is based on the fact that a parachutist will have more time and space to maneuver at the beginning of his/her descent to get on the wind line than he/she does near the landing area, both vertically and horizontally. As long as the student parachutist stays within the wind cone, it is 'possible' to reach the landing area. The further traveled away from the wind line and anywhere outside of the wind cone, the longer it will take to return to the wind line and/or reach the landing area. In other words, if the student drifts outside of the wind cone, he/she will enter the 'cone of embarrassment!'

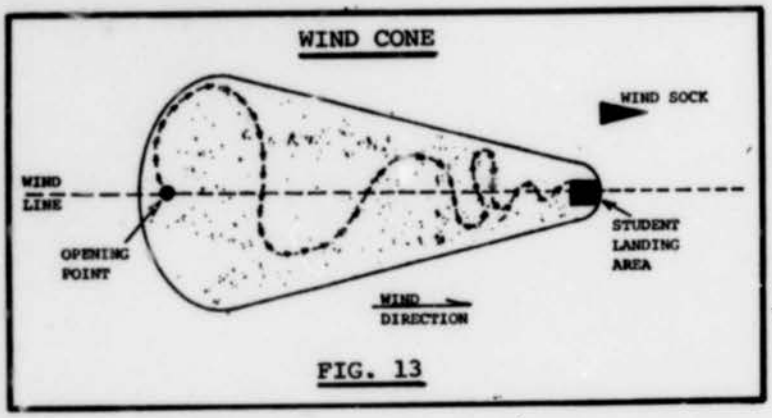


FIG. 13

Once a parachutist is on the wind line and upwind of the landing area, he/she may only have to consider running and holding. You will find that by running toward the target for an excessive time will cause you to overshoot it. You can either maneuver back and forth within the wind cone to use up time and altitude, or if you are still moving downwind, you can turn and hold directly into the wind. Holding for an extended time may cause you to be too far upwind and undershoot the landing area. In this instance, you will have to turn around again to run back toward the landing area.

As you can see, canopy control takes some skill and a lot of judgment. As you descend under canopy, remember that there is less room to maneuver both horizontally and vertically as you near the landing area. Always pre-plan where you want to be before you get there, and change what you are doing if you are going where you don't want to be.....PLAN HIGH.

CHAPTER 8

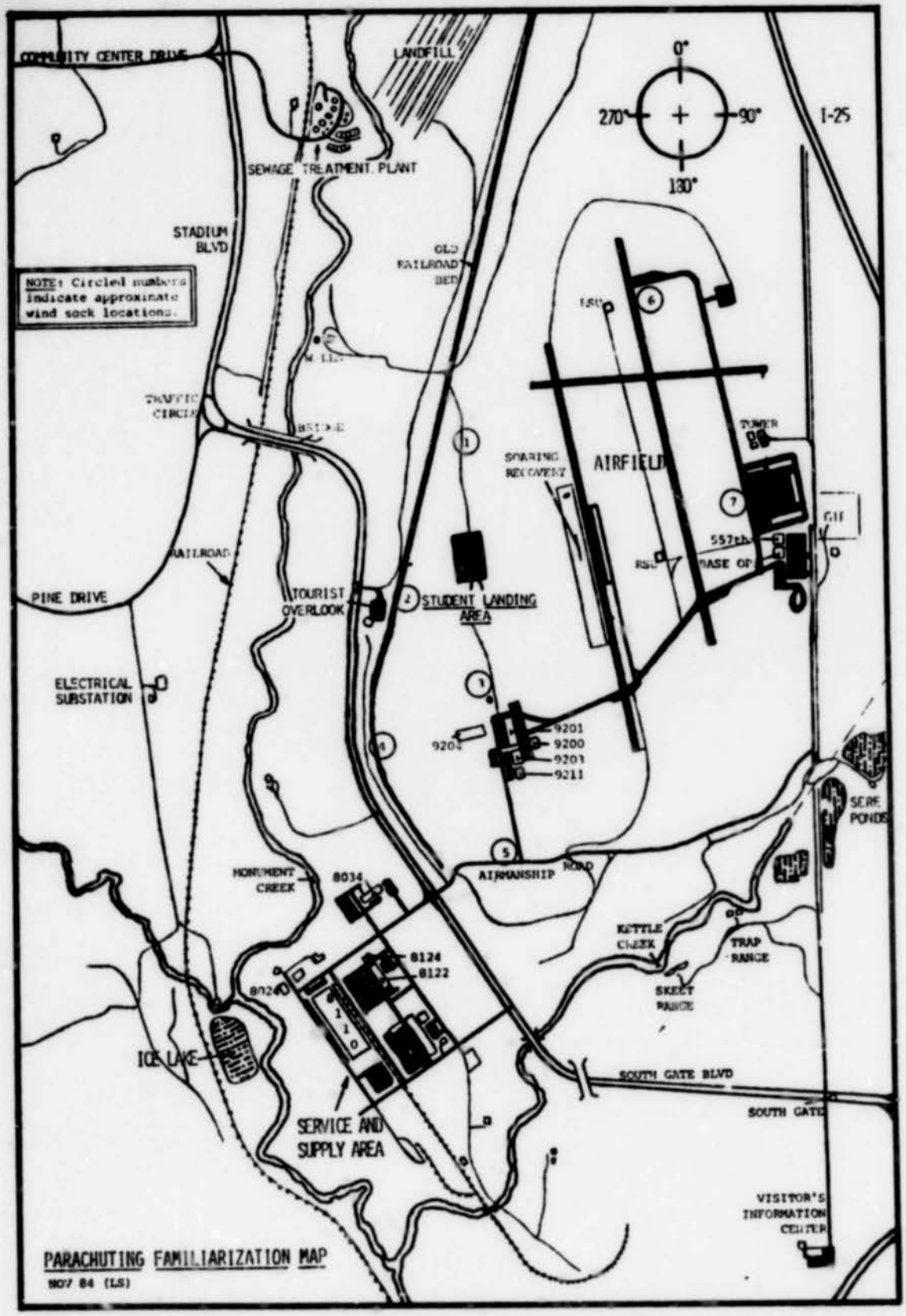
PARACHUTE LANDINGS

Parachute landings can be separated into three distinct phases; preparation, landing, and recovery. The whole purpose of each phase is to place the parachutist in the best possible situation to enter the next phase. To learn how to land safely and effectively, the student must thoroughly learn the basic techniques and then modify those techniques according to the environmental conditions of terrain and weather. In training situations, students are provided ideal conditions. However, these can seldom be chosen when a parachute is used for survival. For this reason, landing techniques and precautions for landing under adverse conditions will also be covered in this chapter.

PREPARATION

In spite of whatever maneuvers are desirable during descent, when the parachutist is 200' above the ground, regardless of the location, concentration must be on preparation to land. At the USAF Academy, the student landing area is a plowed, rectangular section of the drop zone which measures 100 X 200 yards (see familiarization map on page 55). This is only an aiming point or reference; the primary task is to land SAFELY - NOT to land on a target! During descent, the actual 'target' is a location parallel to the wind line and 200' above the ground, on the edge of the student landing area.

Assuming that a student is passing over the edge of the student landing area at 200' and is heading downwind, he must gently depress a steering loop and make a 180° turn. This will cause the canopy to face directly into the wind in a 'holding' position. It is mandatory for <u>all</u> students in AM-490 to attain a holding position for landing to provide them with the least amount of ground speed upon landing. Once holding into the wind, you must maintain directional control by gentle movements of the steering lines. To maintain your heading, first ensure that you are on the windline and in a holding position. Look straight out toward the horizon and find a reference point. This reference should always be directly in front of you throughout the PLA and landing. While on your final descent approach, assume a PREPARE TO LAND ATTITUDE (PLA) no lower than 50' AGL. In the PLA (Fig 14), the head is held up and the eyes are no more than 45° below the horizon. This is to prevent watching the ground coming up and anticipating contact. 'Ground rush' can cause a tendency for a student to either lift the feet up or stiffen the legs against the impact. Your hands remain high on the steering loops in


COMMUNITY CENTER DRIVE
LANDFILL
SEWAGE TREATMENT PLANT
STADIUM BLVD
OLD RAILROAD BED
NOTE: Circled numbers indicate approximate wind sock locations.
TRAFFIC CIRCLE
BRIDGE
SOARING RECOVERY
AIRFIELD
TOWER
RAILROAD
PINE DRIVE
TOURIST OVERLOOK
STUDENT LANDING AREA
ELECTRICAL SUBSTATION
9201
9200
9203
9211
9204
SEWAGE PONDS
MONUMENT CREEK
8034
AIRMANSHIP ROAD
KETTLE CREEK
TRAP RANGE
SKEET RANGE
8124
8122
8024
ICE LAKE
SERVICE AND SUPPLY AREA
SOUTH GATE BLVD
SOUTH GATE
VISITOR'S INFORMATION CENTER
0°
270°
90°
180°
I-25
PARACHUTING FAMILIARIZATION MAP
NOV 84 (LS)

readiness to correct canopy heading. The feet and knees are held tightly together, legs bent slightly at the knees, and the toes are pointed downward to ensure that the balls of the feet are exposed to strike the ground.

FIG 14

The essence of the PLA is to relax the body as much as possible while maintaining sufficient muscular tension to ensure that the feet and knees remain together. Both legs should act as one to share an equal amount of the landing force. Once gained, you must hold the PLA until positive contact is made with the ground.

PARACHUTE LANDING FALLS

The Parachute Landing Fall (PLF) is an exact method of landing which permits the parachutist to distribute the shock of landing through his entire body and thus, reduce the possibility of injury. When the body is moderately tensed, the muscular system is more capable of absorbing the landing forces than is the bone structure. Bone joints must be unlocked by slightly bending the knees to prevent sharp jolts which can migrate through the skeletal system.

As the balls of the feet strike the ground, the PLF is initiated by shifting the knees in either direction (depending on direction of drift). As this is being done, five separate points of contact are laid smoothly onto the ground. In sequence; the balls of the feet, calf, thigh, buttocks, and the muscles on the sides of the back (Fig 15). The fall should be made in one rapid, continuous, fluid motion with each point of contact following the other. It is important for any landing that the individual does not reach for or retreat from the ground with the legs. You should assume the proper position in the PLA and let the ground come up to you.

FIG 15

The PLF is the safest and most effective way to land. It is essential to learn how to do them well and how to do them properly. On the same thought, stand-up landings should never be attempted by students. There is a high risk of leg and back injury if done wrong in any way. Even though they require a keen sense of landing technique, perception, and balance acquired only from experience, the P-78's rate of descent is too great to even attempt a stand-up landing. Anyone that tries to do so is only asking to get injured.

HAZARDOUS LANDINGS

Hazardous landing conditions may be present during an emergency parachute jump. They will require an extra effort to land safely. High winds, trees, water, obstructions, weather, etc, are all factors that influence how you will have to land. Many of these conditions can be avoided by proper canopy control techniques, but you must plan high and pre-select the best possible landing site; one that is readily attainable - within the capabilities of the canopy. Unfortunately, this will not always be the case. AM-490 students jump under very strict conditions and within an area that is 'relatively' free of obstructions. However, by studying the map on page 55, you can see that there are plenty of possible hazards which can be encountered. Landing in these areas will be due to poor or improper canopy control.

HIGH WIND LANDINGS are not an easy task. The initial ground contact may seriously injure the parachutist or could render him/her unconscious. The greatest danger lies in the fact that a high wind will blow the parachute across the ground with the jumper in tow. With this in mind, wind limits at the Academy have been established at 13 knots. Even at this rate you can be dragged and injured. As soon as you land, you must immediately get to your feet and run around the canopy. This will release the tension on the suspension lines and the canopy will deflate. If you are not able to get up and run, your main concern will still be to collapse the canopy. This can be done by activation of a canopy release assembly (Fig 16). Pull the cover down, insert your thumb through the cable loop, and vigorously pull out and down. In cases where there are no canopy release assemblies, such as on the P-78 reserve or many emergency type parachute systems, you will have to pull the bottom suspension lines, or groups, toward you in a hand-over-hand method. Continue to do this until the air spills out and the canopy collapses.

ACTIVATION OF CANOPY RELEASE ASSEMBLY

FIG 16

TREE LANDINGS are not necessarily hazardous if the proper precautions are taken. Obviously, the first thing to do, as with any hazard, is to avoid them. Pine trees normally provide a softer landing than hardwood trees. The main problem is that there are usually additional hazards hidden under the trees; rocks, logs, etc. When a tree landing cannot be avoided, a tree landing position must be assumed. As with any landing, turn and hold into the wind and assume a PLA. Modify it just prior to entry by letting go of the steering loops and bringing the hands to the face. Extend your fingers upward to cover your eyes, palms in. Place the thumbs under the jaws pointing to your ears. This will protect the jugular veins and carotid arteries in your neck. Your elbows are pulled tightly into your sides to protect the axillary arteries in your arm pits. It is very important to hold the legs tightly together with the elbows on top of the reserve pack so that you can slip through the branches of the trees, without getting hung up.

POWER LINE LANDINGS are very similar to tree landings; avoid them! When you are forced to land amongst power lines, the main precaution is to avoid touching two lines at the same time or making contact with the ground and any part of your body while hung up. Again, just prior to contact, modify the PLA by placing your hands flat against the inside of the front risers, as high as you can. Push out slightly to cause a rocking motion and bend your knees slightly more than in a normal PLA. This will make your body as stream-lined as possible so that you can slip through the lines and not get caught by a line under the reserve pack. With your knees bent, any power lines that hit them will bounce off and go over the reserve.

WATER LANDINGS require no special preparation. The lakes are so small at the Academy that with a minimum amount planning during descent, they can be avoided. If a landing in water is unavoidable, there are a few precautions to be aware of. You will have to assume a good PLA and be prepared to do a good PLF for the following reasons; it is extremely hard to gauge your distance above the surface due to the lack of familiar land marks, you cannot tell how deep the water is - it may appear to be quite deep when its only a few inches, and there may be hidden hazards under the surface. Once you have made positive contact with the water, disconnect the risers by activating the canopy release assemblies and swim to shore. Should the canopy fall on top of you, don't panic. The canopy material is porous enough for you to breathe through it. Simply find a seam between the gores and follow it to the edge of the canopy. If you become entangled with the suspension lines, make slow, deliberate movements. You may make matters worse if you hurry or kick and squirm amongst the lines.

OBSTRUCTIONS AND WEATHER create many problems to the parachutist. In situations where these are involved, you can only do your best to land and execute a good PLF. As soon as you are on a firm, fairly secure surface, collapse and release the canopy to prevent

dragging amongst or into other obstructions. Weather has been listed in reference to snow and night jumps. Snow is like water in that your altitude is very difficult to determine, the depth cannot be estimated, and you have no way of knowing what is under its surface. The main hazard that exists during night jumps is that your depth perception is severely diminished. Be ready to land well in advance, before you think you have to.

PARACHUTE RECOVERY

Once you have landed, the next problem is to gather up all of your equipment and return to the operations area. To make this easier and to facilitate repacking of the parachute, you will be required to field pack your main as soon as you land. However, if you land in a hazardous area or under a reserve parachute, your safety comes first, before trying to recover the equipment. A staff instructor will be dispatched immediately to assist you, so stay where your are. This is especially true if you are hung up in a tree, power lines, or you are injured in any way. If you are on firm ground, but the parachute is hung up, activate the canopy release assemblies and leave the equipment alone. Let the instructors take the responsibility of getting it untangled. Under normal conditions, field pack the main parachute in the following way:

1. Ensure that the reserve AAD is in the 'off' position.

2. Re-route the main ripcord cable through its housing and secure the handle in its pocket.

3. Disconnect the reserve parachute assembly and carefully lay it on the ground.

4. Walk backwards to carefully stretch out the canopy material and suspension lines.

   - If something snags on the canopy, STOP! and clear whatever it is.
   - If the pilot chute is tangled in the canopy, take your harness off at this point and lay it on the ground. Walk to the apex and clear the pilot chute by finding the apex first and then follow the bridle to the pilot chute.

5. Once the canopy is stretched out with the pilot chute, canopy, and lines cleared and laying in a straight line, 'daisy chain' the lines from the harness to the skirt of the canopy.

6. Take the laundry bag out of your flight suit and place the lines into the bag and then the canopy. Ensure that the main AAD is turned off and then place the harness on top of the canopy. Place the pilot chute into the bag by stuffing it down along or on top of the canopy, but do not compress it. The laundry bag is provided at the operations area prior to your jump.

7. Recover the reserve parachute assembly, helmet, and gloves (if you took them off) and quickly walk back to the operations area, no loitering.

8. After receiving your jump critique from a staff instructor, you will either retrain for problems that you had during your jump, suit up to jump again, or be instructed to shake out your parachute.

In order to shake out the parachute at the loft tower, connect the apex to the snap connectors on the ropes and hoist it up as far as possible. Straighten out the lines and physically shake the parachute so that all of the debris falls out. Then place the parachute back into the bag in the same manner as field packing and place it in the bins that are located in the parachute packing area. Make sure that you did in fact turn your AAD off. Also, if you detect any damage to the parachute, bring it to the attention of a staff instructor immediately.

CHAPTER 9

SAFETY REQUIREMENTS AND PROCEDURES

PURPOSE

The 'primary' mission of the Parachute Flight is to train safe, competent, military free fall parachutists. The 'secondary' mission is to safely train as many as possible. "Safety" is a state of mind and it is the most important factor in any parachuting activity. Every part of the equipment is designed with safety in mind and every phase of your training, your performance, and your actions are all safety oriented; every procedure from suiting up to the basic free fall body position to the PLA and the PLF.

THINK SAFETY

Every move made and each item of equipment used has a safety factor built in. 'Luck" can never be an adequate substitute for a valid awareness of safety on the part of the parachutist. When safety rules are respected and followed, parachuting is one of the safest activities in the nation. Whether or not rules and regulations are written or implicated, every individual must always use a good sense of judgment to protect himself, as well as others, against incident or injury. THINK SAFETY!!

SAFETY RULES AND REQUIREMENTS

Every student must be familiar with and adhere to established rules and requirements to ensure personal safety and the safety of others while engaging in AM-490. Violators will be dealt with immediately and severely.

GENERAL

1. DO NOT jump if you are sick, injured, or taking any medication.

2. Under NO circumstances will you engage in any parachuting activity while grounded for any reason, on 'academics only', need retraining, or have not received a critique for your last jump.

3. Any student that does not pull the ripcord and the AAD fires, will be removed from training. Never rely on the AADs!

4. DO NOT make any more than three jumps in one day.

5. Obey the jumpmaster at all times; when he/she tells you to do something, DO IT!

6. Get to your feet immediately upon landing so the observer can see that you are OK.

7. After field packing your main parachute, return to the operation area as soon as possible.

8. NO person may make a parachute jump within twelve hours after consuming alcoholic beverages, while under the influence of alcohol, while sick or injured, or while using any medication or drug without Flight Surgeon's written approval.

9. All personnel engaging in parachute jumps will obtain a minimum of eight hours of uninterrupted 'crew rest' prior to participating in these operations. The parachutist's duty day begins at the first required military formation. Crew duty day may be up to twelve hours.

10. Be where you're supposed to be - when you're supposed to be!

REMOVAL FROM TRAINING:

1. Committing an unsafe act in any phase of training.

2. Failure to execute proper emergency procedures when they are necessary.

3. Exceeding 13.0 seconds in free fall is grounds for removal. Fifteen seconds or more in free fall is a removal regardless of the circumstances.

4. Not executing obstacle avoidance under canopy, when it is required.

ENVIRONMENTAL REQUIREMENTS:

1. Surface winds cannot exceed 13 knots north-south, south-north and they cannot exceed 9 knots east-west, west-east.

2. No parachute jump may be done when the temperature is lower than 10 degrees on the ground, -10 degrees at jump altitude, or when the surface wind chill factor is lower than -20 degrees.

AIRCRAFT REQUIREMENTS:

1. NO person will approach the UV-18B aircraft, FOR ANY REASON, until both engines have completely stopped.

2. NO AM-490 student will approach the UV-18B aircraft until told to do so by the jumpmaster.

3. Approaches to the aircraft will be made from the side or rear only. DO NOT walk beneath the wings or through the propeller area.

EQUIPMENT REQUIREMENTS:

1. The main parachute used for intentional jumps will be repacked by a certified rigger, or the person making the jump, within 120 days of its use.

2. The reserve parachute used for intentional jumps will be repacked by a certified rigger only, within 120 days of its intended use.

3. AM-490 student gear will be inspected by the jumpmaster prior to manifesting, prior to boarding the aircraft, and prior to the actual jump.

PROCEDURES

The following procedures have been provided for quick reference and familiarization. If you have any questions or you do not understand any of the procedures, review the previous chapters or contact a cadet or staff instructor as soon as possible.

PRIOR TO EXIT

"THUMBS UP FOR SEAT BELTS"
"SEAT BELTS OFF"
"STAND BY"
"KNEEL"
"STAND IN THE DOOR"
"GO"

EXIT

"SLAP-THOUSAND"
"TWO-THOUSAND"
"THREE-THOUSAND"
"FOUR-THOUSAND"
"FIVE-THOUSAND"
"SIX-THOUSAND"
"SEVEN-THOUSAND"
"ARCH-THOUSAND"
"LOOK-THOUSAND"
"PULL-THOUSAND"
"CHECK-THOUSAND"

AFTER OPENING PROCEDURES

"CHECK AND INSPECT MAIN CANOPY"
"LOOK AROUND FOR OTHER JUMPERS"
"ORIENT MYSELF TO THE DROP ZONE"
"TURN OFF RESERVE AAD"
"POP DOWN STEERING LINES"

- - - - - AIRCRAFT EMERGENCY PROCEDURES - - - - -

ON-GROUND - ASSUME CRASH POSITION

AFTER COMPLETE STOP - EXIT RIGHT REAR DOOR

If blocked -
EXIT LEFT REAR DOOR

If blocked -
USE ALTERNATE EXITS
UNDER WINGS or PILOT'S
DOORS

AFTER EXIT, ASSEMBLE 300 FT at 45° TO AIRCRAFT

IN-FLIGHT - UNDER 1,500 FT AGL - ASSUME CRASH POSITION

USE ON-GROUND PROCEDURES
AFTER LANDING

ABOVE 1,500 FT AGL - EXIT THROUGH JUMP DOOR AND
IMMEDIATELY DEPLOY MAIN

- - - - - PARACHUTING EMERGENCY PROCEDURES - - - - -

UNCONTROLLED FREE FALL - "SNAP INTO THE MODIFIED EMERGENCY
BODY POSITION"

"PULL-THOUSAND"

FLOATING RIPCORD - "SNAP INTO THE MODIFIED EMERGENCY BODY
POSITION" Actively seek ripcord handle.

If found -
"PULL-THOUSAND"
"CHECK-THOUSAND"

If not found -
PROCEED TO FAST MALFUNCTION
PROCEDURES.

HARD PULL - - - - - "PULL- THOUSAND" AGAIN

If you cannot pull -
"SNAP INTO THE MODIFIED EMERGENCY BODY
POSITION"
"PULL-THOUSAND" with both hands ONCE!

If you cannot pull with both hands -
PROCEED TO FAST MALFUNCTION PROCEDURES

PILOT CHUTE - - - - "SNAP INTO THE EMERGENCY BODY POSITION"
HESITATION "CHECK-THOUSAND"

If doesn't clear -
PROCEED TO FAST MALFUNCTION PROCEDURES

FAST MALFUNCTIONS - "THROW AWAY MAIN RIPCORD"
"SNAP INTO THE EMERGENCY BODY POSITION"
"LEVER OUT RESERVE RIPCORD"
"THROW AWAY RESERVE RIPCORD"
"CHECK-THOUSAND"

SLOW MALFUNCTIONS - "THROW AWAY MAIN RIPCORD"
"SNAP INTO THE EMERGENCY BODY POSITION"
"LEVER OUT RESERVE RIPCORD"
"THROW AWAY RESERVE RIPCORD"
"TUCK TOP FLAP UNDER CHIN"
"RAKE OUT LINE GROUPS"
"SEPARATE LINE GROUPS"
"PUMP BOTH GROUPS TWICE"
"PUMP LEFT GROUP TWICE"
-- REPEAT UNTIL OPEN --
"CHECK THOUSAND"

CHAPTER 10

PREPARATION FOR PARACHUTING

MENTAL ASPECTS

Reasons for enrolling in AM-490 include as many and various motives as there are individuals. Many enter training with some 'natural' apprehensiveness regarding height and flying; fear of falling from high places, fear of a parachute malfunction, fear of a landing injury, etc. However, man naturally fears the unknown and all such factors are simply 'unknowns.' Knowledge and experience can overcome and dissipate many of these. The motivation behind enrollment plays a key role in whether or not an individual can or will make the necessary mental adjustment in coping with his/her own fears. Those who lack the motivation necessary or who cannot or who do not desire to overcome their fears are a hazard to themselves, as well as others, when participating in parachute training. Trying to pinpoint motivational factors in parachuting has proven to be somewhat complex. However, part of AM-490 is for cadets to learn of themselves and in doing so, they can eliminate their fears through knowledge and training.

Parachuting presents a motivational challenge to many. Some may even consider it somewhat daring. Individuals do have various degrees of anxiety and apprehension, but such fears are normal and they need to be overcome or displaced. The training received in AM-490 can do just that by developing a knowledge and understanding of the operation, function, and use of parachute equipment. As the fears are gradually reduced, confidence builds, within the equipment used and within one's self. Fortunately, there will always be an element of something going wrong. This is very healthy as a good warning; recklessness leads to disaster. Again, think safety! The person who can demonstrate an ability to overcome his/her fears and copes with the intricacies of parachuting will gain a great deal of satisfaction and a sense of accomplishment for having participated in such a challenging and rewarding activity. Such motivation is hard to beat....

PHYSICAL ASPECTS

Parachuting requires a sensible physical condition if an individual wishes to jump safely and avoid injuries. The physical requirements are definitely different from other sports and muscles are used much differently than they are in daily routines. For normal jumping, a fair physical condition is usually sufficient, however, it's the abnormal jumps that will require better conditioning. Therefore, the Parachuting Physical Fitness Test (PPFT) is used to assure your condition prior to the start of training. It will be up to you to maintain the same standards, or better, throughout training.

Generally, take care of yourself, especially during AM-490 training. You'll feel better, perform better, and learn quicker If you follow these very simple guidelines;

- Eat lightly before and during training.
- Get a good night's rest prior to training. An alert body and mind is needed when free falling at 120 mph.
- Alcohol and parachuting don't mix! To paraphrase, "If you jump, don't drink - if you drink, don't jump.
- If you're sick or injured, don't jump. Notify an instructor of any injuries during training.

TRAINING

Having decided to undertake parachute training, the student's main concern should be to learn as much as possible about the equipment and procedures. In parachuting, ignorance is not bliss - it's a disaster! The purpose of training is safety. Parachute training, admittedly, is not necessarily a fun experience, but then again, why should it be? Jumping without proper training is foolhardy and extremely hazardous.

Once training has started, it is very wise to stay motivated to move quickly through each phase. Lackadaisical or poor attitudes can be detrimental to training continuity, mental conditioning, and will definitely affect your performance. As long as you want to learn, the instructors are more than willing to teach. If you have trouble in understanding any part of training, do not hesitate to seek assistance. It is the misunderstandings or the unacquired skill and knowledge that becomes a threatening problem later on. On each training day, be there when you're suppose to be, stay motivated, and be ready to TRAIN!!!

ACKNOWLEDGEMENTS

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