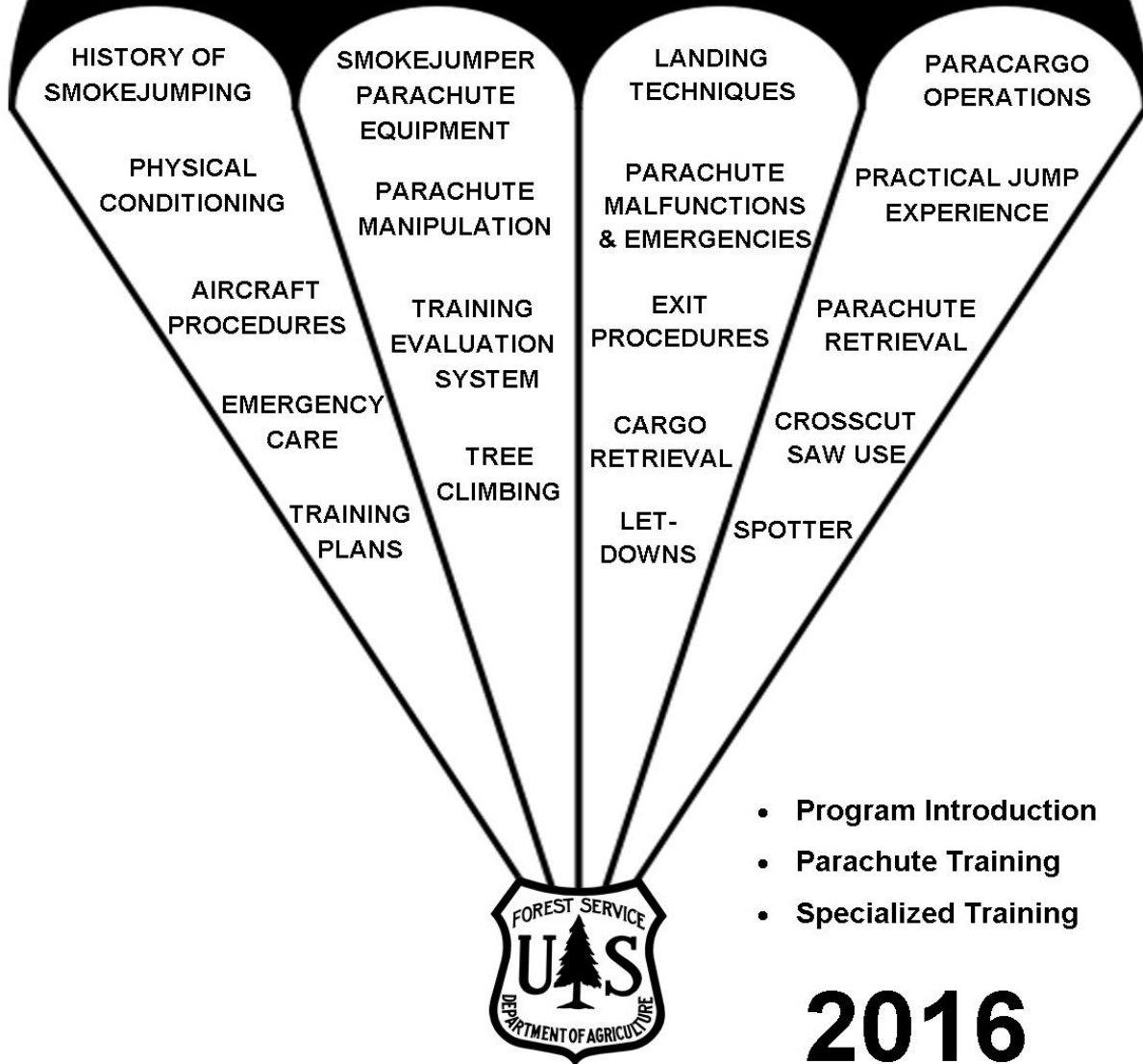


# U.S. FOREST SERVICE NATIONAL SMOKEJUMPER TRAINING GUIDE



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## Review

This 2016 update of the U.S. Forest Service National Smokejumper Training Guide was reviewed by the following:

<b>Reviewed By</b>	<b>Date</b>
<u>/s/ Mike Fritsen</u> Mike Fritsen Missoula Smokejumper Base Manager	<u>6/14/2016</u> Date
<u>/s/ Pete Lannan</u> Pete Lannan West Yellowstone Smokejumper Base Manager	<u>6/13/2016</u> Date
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<u>/s/ Joe Brinkley</u> Joe Brinkley McCall Smokejumper Base Manager	<u>6/06/2016</u> Date
<u>/s/ Bill Selby</u> Bill Selby Redmond Smokejumper Base Manager	<u>6/14/2016</u> Date
<u>/s/ Daren Belsby</u> Daren Belsby North Cascades Smokejumper Base Manager	<u>6/14/2016</u> Date
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# U.S. Forest Service National Smokejumper Training Guide

## U.S. Forest Service National Smokejumper Training Guide Units

<b>Unit/Chapter</b>	<b>Description</b>
<b>Unit 1</b>	<b>Program Introduction</b>
Chapter 1	History of Smokejumping
Chapter 2	Smokejumper Training Plans
Chapter 3	Training Evaluation System
Chapter 4	Physical Conditioning
<b>Unit 2</b>	<b>Parachute Training</b>
Chapter 1	Smokejumper Parachute Equipment
Chapter 2	Aircraft Procedures
Chapter 3	Exit Procedures
Chapter 4	Parachute Malfunctions and Other Emergency Procedures
Chapter 5	Parachute Manipulation
Chapter 6	Landing Techniques
Chapter 7	Letdowns
Chapter 8	Tree Climbing
Chapter 9	Parachute Retrieval
Chapter 10	Cargo Retrieval
Chapter 11	Practical Jump Experience
<b>Unit 3</b>	<b>Specialized Training</b>
Chapter 1	Spotter
Chapter 2	Paracargo Operations
Chapter 3	Crosscut Saw Use
Chapter 4	Emergency Care

## Introduction

The intent of the National Smokejumper Training Guide is to provide a broad, flexible, yet standardized, instructional package for the training of smokejumper personnel.

This guide has been developed to train both the inexperienced and experienced smokejumper. Where applicable, performance-based objectives, tasks, and skill levels are defined in the lesson plans. The primary criterion for qualification as a smokejumper is individual performance as observed by an evaluator using the standards set forth in this guide.

Each smokejumper base is responsible for adapting the lesson plans to fit their unique organizational, geographic, and training environment.

## Objectives

The overall objectives of the National Smokejumper Training Guide are to:

1. Train smokejumper personnel according to the principles and policies outlined in the U.S. Forest Service Section of the Interagency Smokejumper Operations Guide (ISMOG) as well as other Handbooks and Manuals which govern the smokejumper program.
2. Improve the quality of smokejumper training and instruction by providing the best training and reference information available.
3. Develop a minimal level of competence in smokejumping and firefighting skills.
4. Standardize smokejumper training so the smokejumper can operate effectively regardless of location.

Evidence of satisfactory performance will be demonstrated by the trainee's performance at the conclusion of each lesson as measured against the specific lesson objective(s), and by the trainee's performance on actual smokejumper missions.

## Use of This Guide

To facilitate its use, the Training Guide has been divided into three units: (1) Program Introduction, (2) Parachute Training, and (3) Specialized Training.

It can be easily updated by inserting a revised or new lesson and discarding the outdated one.

In order to help standardize and improve instruction, each lesson plan is presented in a standard approved format. Each plan is in an outlined format so that each base can further develop their own materials and maintain flexibility within their unit.

As you develop better techniques, equipment, and procedures, you are encouraged to share your ideas with other bases. Your input should be brought

to the attention of the appropriate officials through your smokejumper base, smokejumper workshops, and MTDC.

## **Instructor Qualifications**

Instructors are generally drawn from squad leaders and overhead personnel with expertise in certain areas. Occasionally, non-supervisory smokejumpers with special knowledge and skills may be used as instructors. For some topics, personnel from outside the smokejumper organization may serve as instructors.

# Unit 1 – Program Introduction

## Chapter 1 – History of Smokejumping



### Lesson Plan Outline

<b>Lesson(s):</b>	<b>History of Smokejumping</b>
<b>Objective(s):</b>	To provide a detailed history of smokejumping.
<b>Suggested Duration:</b>	To be determined by instructor.
<b>Training Aids Needed:</b>	To be determined by instructor.

### Introduction

This unit is intended to provide instructors and trainees a detailed outline of the history of smokejumping. The smokejumper project has been a success since its beginning in 1939 and has weathered many challenges in an effort to maintain the program's flexibility, efficiency, and effectiveness in support of the wildland fire program.

### Early Experiments

In 1917, the U.S. Forest Service started using aircraft in California for fire detection. This was the first use of aviation in Fire Management. The 1920's found attempts being made to drop water and foam on fires in 5-gallon tin cans, paper bags, and in 8-gallon oak beer kegs attached to a parachute. The results were disappointing, but the dreams continued to grow with the development of technology. Aerial photography was implemented in 1925, and free-falling supplies to firefighters was first employed on fires in 1929. During this same period, non-emergency parachute jumps were occasionally being made in the military and by thrill-seeking barnstormers.

In 1934, T.V. Pearson from the Intermountain Region (Region 4) of the Forest Service proposed the use of parachutes as transportation for firefighters. A professional parachutist, J.B. Bruce, made a few demonstration jumps, but the response from the Washington Office was unfavorable.

In 1935, the Washington Office founded the Aerial Fire Control Experimental Project. Located in California, the project conducted experiments in dropping water and chemicals on fires from aircraft. These fire retardants proved impractical, but improvements in cargo delivery by parachute helped set the stage for later experiments with parachute jumping.

David Godwin gained support for and led the inception of the smokejumper program after the Black Water Fire of 1937 killed 15 firefighters on the Shoshone National Forest. His idea was to catch fires early while small before they become a conflagration.

In the spring of 1939, the Aerial Fire Control Experimental Project directed all of its efforts into parachute jumping. Led by David Godwin, the Project was moved to Winthrop, Washington. Beach Gill and Frank Derry from the Eagle Parachute Company were hired as consultants. Seven experienced smokejumpers and two local men were added to the project crew. During the summer of 1939, approximately 60 live jumps were made successfully into rough terrain on the Forests near Winthrop.

## **Beginning of the Parachute Project**

1940 -- This was the first operational season for the Parachute Project. A crew of six smokejumpers was established in Region 6 at Winthrop, Washington, and a crew of seven was established in Region 1 at Moose Creek, Idaho. Frank Derry was hired as an instructor-rigger for both bases. In June 1940, Major William H. Lee, of the U.S. Army visited the Region 1 smokejumper training camp at Seeley Lake, Montana. He later incorporated Forest Service techniques in the establishment of the U.S. Army Airborne. Major Lee commanded the 101st Airborne during World War II and became known as "Father of the Airborne Troops."

On July 12, 1940, Rufus Robinson and Earl Cooley made the first fire jump in Region 1 over Martin Creek on the Nez Perce National Forest. On August 10, 1940, Francis Lufkin and Glen Smith bailed out over Bridge Creek on the Chelan National Forest in Region 6. Nine fires were jumped that year and their early suppression saved an estimated \$30,000, or three times more than the entire cost of the project.

On July 15, Chet Derry made the first rescue jump in history on a plane crash in the Bitterroot National Forest.

1941 -- In 1941, the entire Parachute Project was centralized at Missoula, Montana. It was less expensive to dispatch smokejumpers from Missoula to other Regions than to maintain permanent facilities in those Regions. Missoula was chosen because it was the home of Johnson's Flying Service, the private contractor supplying aircraft and pilots for the project.

A total of 16 smokejumpers trained at the Nine Mile training camp, 20 miles west of Missoula. After training, eight smokejumpers were sent on project work to Moose Creek on the Nez Perce National Forest. Eight more were sent to Big Prairie on the Flathead National Forest, and the rest remained at Nine Mile.



A serious outbreak of fires in Region 6 was the only real fire threat in 1941, and again only nine fires were jumped. Still, the program accounted for considerable savings in fire suppression costs and more than proved its worth.

## **World War II Years (1942-1945)**

1942 -- The Second World War depleted the supply of qualified personnel available for smokejumping. In 1942, only five smokejumpers returned to smokejumping from the previous year. Thirty-three smokejumpers trained at Nine Mile that year, but only a few of them had any previous fire experience. These smokejumpers were stationed at Nine Mile, Moose Creek, Big Prairie, and Seeley Lake. Francis Lufkin set up an air cargo program at the Twisp Ranger Station near Winthrop, Washington and continued this operation until 1945. During this time, he also helped with smokejumper training at the Nine Mile center.

1943 -- By spring of 1943, the personnel shortage had reached a critical stage. Only five smokejumpers were available, including the instructor. The most strenuous recruiting efforts yielded only four smokejumpers whose youth or minor physical defects had kept them out of the military. In the meantime, a number of inquiries had been received from individual 4-E (conscientious objector) draftees in public service camps. The end result was that 70 smokejumper candidates from the Civilian Public Service (CPS) trained at Nine Mile. The same year, the project trained 25 personnel from the U.S. Coast Guard, Canadian Air Observers School, and U.S. Air Force for para-rescue work.

In 1943, the Parachute Project expanded to other regions. New bases were established at McCall, Idaho (Region 4) on the Payette National Forest and at Cave Junction, Oregon (Region 6) on the Siskiyou National Forest. Each base received one squad of smokejumpers from Region 1.

1944 -- The CPS smokejumper program was expanded in the spring of 1944 to 110 men. The number of smokejumpers assigned to each of the three regions was proportionately increased. Training of the inexperienced and most of the experienced smokejumpers was conducted at the Nine Mile training facility in Region 1. The Smokejumper Project was officially adopted by the Forest Service in 1944 and was no longer considered to be in trial stages. Consequently, a number of National Forests reduced their ground forces and relied totally on smokejumpers.

1945 -- Continued expansion of the CPS program and returning war veterans increased the number of smokejumpers to 220. Training was conducted at Nine Mile, and the smokejumpers were stationed at Missoula, Montana and Cave Junction, Oregon. During the severe fire season of 1945, smokejumpers proved to be invaluable firefighters.

Members of the 555th Battalion of Black Paratroopers were trained in timber jumping and firefighting to combat Japanese balloon fires. This was done at Pendleton, Oregon by instructors from Missoula. The 555th was stationed at Pendleton, Oregon and Chico, California, and on occasion spiked out at other locations throughout the west. The expected Japanese incendiary balloon menace did not materialize, but the 300 paratroopers were used as suppression crews on large fires throughout the west. The 555th made a total of 1,200 jumps to 36 fires, 19 from Pendleton and 17 from Chico. These paratroopers were and are referred to as the "Triple Nickel."

On August 6, 1945, a member of the U.S. Army's 555th Parachute Infantry Battalion was killed during a letdown from a tree on the Umpqua National Forest in Oregon.

In addition to the 555th, 14 military para-rescue jumpers were trained in rough terrain jumping in 1945.

## Forest Service Region 1 Timeline

1946 -- With the end of the war, the CPS jumper program was discontinued. In 1946, there were 164 smokejumpers in Region 1. Eight-four percent were war veterans and 40 percent were college students.

1947 -- Regions 4 and 6 developed training centers of their own. A smokejumper base was established in Region 3 to serve the Gila National Forest. A crew of nine smokejumpers set up operations at the Demming Airport in Demming, New Mexico. The Canadian government conferred with personnel at Missoula and began development of a smokejumping project of their own. Region 1 trained 20 military jumpers that fall.

1949 -- Four smokejumpers from Missoula flew to Washington, D.C. in a Ford Tri-Motor and made a demonstration jump on the White House lawn. The fire season of 1949 was extreme. Twelve smokejumpers and a District guard (former smokejumper) were fatally burned on the Helena Forest's Mann Gulch Fire. Feasibility tests were conducted in the use of helicopters for smokejumper retrieval at Moose Creek Ranger Station.

1951 -- This year marked the beginning of the West Yellowstone Base with a crew of five smokejumpers and of the Grangeville base with a crew of eight smokejumpers. In late August, 61 Region 1 smokejumpers were sent to Cave Junction as a booster crew.

1952 -- The Region 3 crew (increased to 18) moved from Demming to Silver City, New Mexico.

1954 -- President Eisenhower dedicated the new Aerial Fire Depot facilities in Missoula, Montana. These facilities are still in use, although they have undergone several makeovers.

1955 -- The Region 3 crew was made up of 12 smokejumpers from Region 1, three from Region 4, and three from Region 6.

1958 -- The Region 3 crew was increased to 24 with eight smokejumpers coming from Region 4 and the rest from Region 1.

1959 -- 129 smokejumpers were stationed at Missoula, 16 at Grangeville, 24 at Silver City, and 5 at West Yellowstone. Missoula trained 17 experienced smokejumpers that were recruited by the Bureau of Land Management (BLM) in Fairbanks, Alaska. This marked the beginning of the BLM smokejumpers.

Two smokejumpers, a Forest Supervisor, and the pilot of a Ford Tri-motor died in an airplane crash at Moose Creek, Idaho.

1960 -- A career development plan was adopted for forestry students who desired field training. They were given refresher training, then assigned to a Forest, and were subject to recall for fire duty. This marked the first year that 20 smokejumpers were detailed to Alaska in June.

1961 -- The number of smokejumpers increased to 171.

1962 -- West Yellowstone increased in number from five to nine.

1963 -- On August 4, 105 jumps were made on 35 fires, a record for the Region for one day.

1964 -- Para-rescue personnel from the Air Force X-15 project were given rough terrain jump training in Missoula which continued through 1967.

1967 -- New facilities at West Yellowstone were built and the base was manned with 13 smokejumpers.

1970-1971 -- Numbers were reduced from 190 to 170 within Region and use of smokejumpers as organized ground crews increased due to budget cuts nationally and the need for ground crews.

1974 -- Region 3 and West Yellowstone had record fire seasons. Fireline explosives were used on a fire for the first time by smokejumpers.

1975-1985 -- Jumping activity varied depending on the season. Smokejumpers were used as boosters to Alaska and to support Silver City, New Mexico. Project crews were based at Plains, Lincoln, Condon, and Hamilton for a period of time and the first women were trained in Region 1 in 1982.

198?-1992 -- West Yellowstone smokejumpers trained and operated with Yellowstone National Park on repelling/insertion/short-haul.

1986-1995 -- 1988 was extremely busy with fire activity throughout the Region, especially around West Yellowstone. Booster crews were brought in from around the west. The rest of the years varied in activity. 113 fires were jumped out of Grangeville in 1994.

1996-2001 -- Silver City continues to be a spike base operation of Region 1. Movement of smokejumpers around the west is common, and the fire season of 2000 is extremely busy with several days of dry lightning igniting numerous fires.

2001 -- The Dornier 228 becomes West Yellowstone's smokejumper aircraft operated by Bighorn Airways.

2002-2003 -- Silver City had 30 smokejumpers assigned both seasons, with 2003 being one of the busiest since 1989. Albuquerque was an operational jump base in 2002 with 30 smokejumpers assigned. West Yellowstone had a busy season in 2002 to lead Region 1 bases in activity. Missoula's fire season started early in 2003 to lead Region 1 in activity.

2004-2011 -- Randy Nelson, Smokejumper Base Manager of Grangeville.

2006 -- West Yellowstone increases from 24 to 30 smokejumpers.

2008 -- Region 1 started training some of their previously round parachute smokejumpers on ram-air parachutes in cooperation with BLM smokejumpers (Alaska and Boise). As of 2014, there are nearly 60 Region 1 smokejumpers on the square parachutes (approximately 50 percent of the region's total smokejumper force).

2009 -- Region 1 ram-air smokejumpers start evaluation jumps on the CR-360, Eiff-Pro, and Eiff Classic Canopies.

2010 -- The last Department of the Interior, Parks Service position was eliminated from the West Yellowstone Program.

2012-Present -- Sarah Doehring, Smokejumper Base Manager at Grangeville, the first female smokejumper base manager.

2014 -- 20 of the 27 West Yellowstone smokejumpers are utilizing the BLM ram-air system.

## **Forest Service Region 4 Timeline**

1943 – Five smokejumpers were trained at Missoula, Montana and sent to the Intermountain Region at McCall, Idaho on the Payette National Forest. A Travelaire owned by Johnson's Flying Service and piloted by Pen Stohr was used for dropping smokejumpers.

The first fire jump out of McCall was made on August 14, 1943, by John Furguson and Lester Gohler at the head of Captain John Creek. The spotter, Stewart "Lloyd" Johnson, served as the McCall base foreman through the summer of 1953.

1947 – Civilian Conservation Corps (CCC) buildings were moved in for smokejumper operations, and training facilities were built. McCall trained 50 smokejumpers in 1947.

1948 -- Ten smokejumpers were positioned at Idaho City, Idaho with James "Smokey" Stover in charge. Stover remained in charge when the based was moved to Boise, Idaho, and retired in 1973.

1955 -- McCall contributed three smokejumpers to the 18-jumper Region 3 crew for the first time.

1957 -- Francis "Del" Catlin became the base manager and served until 1977.

1958-1964 -- A laundry building and three barrack buildings were constructed as well as a new loft building. A new kitchen was built in 1964.

1965 -- On July 9, a Johnson's Flying Service Twin Beech crashed while dropping cargo. McCall squad leader Ken Salyer and pilot "Skip" Knapp were killed.

1974 -- McCall assigned 15 smokejumpers to the Alaska detail crew for the first time.

1977 -- Harry Roberts became the McCall Smokejumper Base Manager and served until 1984.

1980 -- The Boise smokejumper base was closed, and McCall became the base for Region 4.

1981 -- Deanne Shulman completed rookie training to become the nation's first female smokejumper. Charlotte Larson was hired and became the first woman smokejumper pilot.

1984 -- Neal Davis became the McCall Smokejumper Base Manager and served until 2003.

1988 -- A new smokejumper facility located at the McCall airport opens.

1991 -- McCall gets first Turbine DC-3.

1994 -- The South Canyon Fire in Colorado claims the lives of 14 firefighters, including McCall smokejumpers Jim Thrash and Roger Roth.

1997 -- McCall sends Dan Felt and Hector Madrid to Russia for smokejumper exchange.

1998 -- McCall trains and uses two Russian smokejumpers for the season.

1999 -- Fred Pavlovic and Steve Daigh exchange for two Russian smokejumpers.

2001 -- Ogden, Utah becomes a permanent spike base for Region 4.

2003 -- Longtime smokejumper pilots Marc (Captain Andy) Anderson and Eldon Askelson both retire.

2004 -- Eric Brundige served as the Acting Smokejumper Base Manager

2005 -- Frankie Romero became the McCall Smokejumper Base Manager and served until 2012.

2006 -- McCall performs at the Hill Air Force Base Air Show in Ogden, Utah, jumping from the TDC-3 aircraft with the U.S. Air Force "Wings of Blue" Demo Team to open the show.

2010 -- McCall was invited to take part in a ceremony at the Washington Office honoring the last surviving members of the Triple Nickel Smokejumpers. Base Manager Frankie Romero participated by giving a speech at this special event.

2012 -- Joe Brinkley became the McCall Smokejumper Base Manager.

2012 -- The DC-3 turbine Doug J42 officially retired from McCall's Aircraft fleet and is currently flying missions for the Canadian Smokejumpers and Antarctica.

## **Forest Service Region 5 Timeline**

1944 -- Smokejumpers from Cave Junction, Oregon were dropped on fires on the Sequoia National Forest. This was the first use of smokejumpers in California.

1957 -- A permanent base was set up in Redding, California. The new base was administered by the Shasta-Trinity National Forest. A crew of 26 smokejumpers was trained at Cave Junction.

1959 -- A spike base at the Columbia, California Airport was used to cover the High Sierras. The first use of smokejumpers in Yosemite National Park occurred this year.

1960 -- "Fifty jump" pins were earned by Redding smokejumpers for the first time. Activity was very busy through November.

1962 -- This was the first year of the detail or "retread" program. New smokejumpers were selected from Region 5 forests and detailed to the smokejumper base. These individuals underwent an intensive training program that included smokejumper training, leadership and instructor training, hydraulics, and advanced fire behavior. At the end of the season, these retreads would return to their original units. They would be regular smokejumpers for only one season.

1963 -- The "retread" program was initiated this year. Smokejumpers that had previously trained via the detail program received a 5-day refresher, returned to their home unit, then were called in when activity increased and additional smokejumpers were needed.

1970 -- The first fatality associated with parachuting occurred on June 3, 1970. The accident was attributed to a poor exit and a misrouted static line. Redding smokejumpers were used as twenty-person crews when initial attack activity decreased.

1974 -- This was the last year of the "retread" program.

1976 -- The crew increased to 41 smokejumpers.

1979 -- Two groups of beginning smokejumpers were trained this year. The first session was in Redding and the second was a combined session in Missoula.

1981 -- Tragedy struck Redding when on May 11, a Forest Service aircraft crashed into the para-cargo building at the base killing the four people on board. The ensuing fire completely wiped out the Redding smokejumper's equipment, loft, and facilities. Temporary quarters were set up in the aircraft maintenance hangar and equipment was borrowed from other Regions. The smokejumpers were back in operation by June 10.

1983 -- This was the third and final year of operation in the hangar as new facilities were nearing completion. The move took place in the spring of 1984 when the new facility was completed.

1984-2001 -- The number of smokejumpers at Redding stayed around 45. Fresno was used as a spike base operation on several occasions. A diverse workforce with female smokejumpers was established. Smokejumpers were used not only in fire, but for a variety of forest projects, prescribed fire, and tree climbing. 1999 was an enormous year for Northern California, and Redding was boosted with a total of close to 200 smokejumpers. They were used as 20-person crews and on numerous initial attack fires.

2003 -- Don Sand becomes the Redding Smokejumper Base Manager.

2008 -- A record year for Redding. 616 smokejumpers were thrown on 101 fires, with boosters increasing the base number to 147. During the month-long period from June 20th to July 20th, 431 smokejumpers were delivered to 41 fires within the Region. This number means there were more smokejumpers put on fires in a month than Redding normally does during a regular season. At one point, during that 30-day period, there were three 30-person smokejumper fires deployed simultaneously.

2013 -- Josh Mathiesen becomes the Redding Smokejumper Base Manager.

## **Forest Service Region 6 Timeline**

1939 -- Smokejumper training was initiated at Winthrop, Washington.

1943 -- Region 6 established a base at Cave Junction, Oregon.

1944 -- Smokejumpers from Cave Junction made the first fire jumps in Region 5.

1945 -- Winthrop, Washington was the location for the North Cascades Smokejumper Base. It was reestablished as a permanent base.

Smokejumping's first fatality in the line of duty occurred on the Umpqua National Forest near Roseburg, Oregon on August 6, 1945. Private First Class Malvin L. Brown, a medic and member of Headquarters Company, 555th Infantry Battalion, fell from a tree while attempting a letdown near the Lemon Butte Fire.

1948 -- Training facilities were constructed at North Cascades Smokejumper Base (NCSB), but were destroyed by floods.

1949 -- Training facilities were reconstructed at NCSB. Eight smokejumpers were stationed at Cave Junction, Oregon.

1950 -- Spike bases were staffed in eastern Oregon.

1954 -- The NCSB crew expanded to 32 smokejumpers.

1956 -- Northeast Oregon jump crews were moved to La Grande, Oregon.

1957 -- Cave Junction trained the original Redding Crew.

1958 -- A tragic crash of a USFS Twin Beech claimed the lives of the pilot and three Winthrop smokejumpers. The crash was attributed to severe air turbulence while dropping cargo.

1964 -- A smokejumper base was established at Redmond, Oregon where the new Redmond Air Center (RAC) facility had just been completed. The original crews came from Cave Junction and Winthrop which now had 41 smokejumpers.

1970 -- A record-setting year for fire activity in Region 6. NCSB, Redmond, and booster crews made a record 1,066 jumps on 223 fires.

1971 -- Smokejumper operations were initiated in Region 8 by a crew from Cave Junction. From 1971 through 1976, a total of 705 fire jumps were made to 126 fires

in 11 states and one National Park. Spike bases in Region 8 were operated out of Wise, Virginia; Tri Cities, Tennessee; Andrews Murphy, North Carolina; and Fort Smith, Arkansas.

1974 -- An independent smokejumper base was established at the La Grande Fire Control Center where NCSB had been operating a spike base since 1956. During the year, all facilities needed to train smokejumpers, including a three cable jump tower, were built.

1975 -- La Grande trains their first "rookie" class.

1977 -- Redmond set a record for number of fires jumped with action taken on over 160 fires.

1981 -- NCSB was reduced to 11 smokejumpers and Redmond was increased to 60 in a "centralization effort". Redmond became a core base and NCSB was a satellite base.

After 38 continuous years of operation, the Cave Junction base was closed. From 1943 through 1981, smokejumpers out of Cave Junction made 5,390 fire jumps on 1,445 fires, as well as operating the Region 8 detail.

1982 -- After 9 years of operation, the La Grande base was closed. During that period, 1610 fire jumps were made on 449 fires.

1983-1990 -- The number of smokejumpers in Region 6 was established at 55, with 35 smokejumpers at Redmond and 20 at Winthrop. Those numbers varied depending on severity budgeting. The first female smokejumper was successful in 1983 within the Region, with several making it through training during the 90's. Gary Johnson was selected as Base Manager in 1988, replacing Tom Bowen.

1991-2000 -- Activity within the Region varied during this period, with peaks in 1990 and 1994. Booster activity increased with travel a norm. In 1994 Redmond received two C23-A Sherpa aircraft to be used as smokejumper platforms. In 1995 Dewey Warner replaced Gary Johnson as the Base Manager. The Rookie Class of 1997 was the first to be trained solely on the FS-14 parachute. The '97 class consisted of rookies from Redmond, North Cascades, Grangeville, Missoula, and Redding. In 1999, RAC underwent renovations adding an expanded men's locker room, women's locker room, and kitchen.

2001-2005 -- A Training Manager was added to the organization in 2000, with Michael Jackson becoming the first Redmond Training Manager. Bill Selby was selected in 2004 to replace Dewey Warner as Base Manager. The organization also underwent a change in 2004. Assistants were added to each of the three Manager positions (Loft, Operations and Training). The Spotter GS-8 was added and permanent positions at the 6 and 7 level were increased for a total of 28 permanents on the organization chart. This era held one of the leanest years in 2005 (28 fires), and one of the busiest in 2001 (120 fires).

2006 -- First all-female rookie class for the Redmond Smokejumpers (5 rookies).

2007-present -- The era began with the latest start ever for the Redmond Smokejumpers. The first fire was jumped August 2, 2011, eclipsing the old record of



July 24, 1976. In 2014, Redmond acquired C23-B Sherpa aircraft. They are targeted to replace the A model aircraft in 2017.

## **BLM Alaska Timeline**

1959 -- The Alaska Fire Control Service (AFCS) was implemented in 1939 and suppressed fires on a limited basis. During World War II, the AFCS and the military suppressed fires in Alaska. Smoke from these fires was a hindrance to flight and was considered a threat to national security. The AFCS was absorbed by the BLM in 1946. An extreme fire season in 1957 prompted the BLM to consider using smokejumpers in Alaska. The BLM activated a smokejumper unit with 17 smokejumpers. A Fish and Wildlife Service DC-3 was used and a loft facility was constructed.

1962 -- Along with other activity, four men were used during the summer to jump from helicopters and clear helispots at section corners so that engineers could survey at a faster rate. This program continued through 1966.

1963 -- Inexperienced smokejumpers were trained for the first time in Fairbanks.

1965 -- A separate base was established at Anchorage. Anchorage was a base until 1972. McGrath was also used as a spike base.

1966 -- A smokejumper was killed while making a letdown from a tree.

1970 -- New loft facilities were built at Fort Wainwright near Fairbanks.

1972 -- Alaska smokejumpers were given functional responsibility of air cargo operations.

1974 -- Smokejumper operations were moved to Fort Wainwright.

1976 -- Fireline explosives were first tested by BLM smokejumpers in 1976.

1978 -- The Alaska crew was expanded to 69 smokejumpers. A loft building was moved to the Fort Wainwright site.

1979 -- Ram-air parachutes were first tested in Alaska.

1980 -- Alaska smokejumpers were sent to Grand Junction, Colorado to support initial attack activity in the Great Basin.

1982 -- Fire suppression under BLM control was reorganized into a single statewide entity—the Alaska Fire Service. The ram-air parachute was first used on fires.

1983 -- Alaska smokejumpers were increased to 100. A total of 1,725 fire jumps were made in Alaska. Ram-air parachutes were first used in the Great Basin on fires.

1984-2001 -- The ram-air parachute evolved with a drogue system of deployment. Activity varied throughout this period; however, fire suppression policies within the state continued to decrease lands needing full suppression. Boise is established as a separate BLM base to cover the Great Basin. Mike Clarkson leaves Fairbanks to head up that operation.

## Smokejumper Equipment

1939 -- The main parachute canopy was a 30 ft. diameter backpack, manufactured by the Eagle Parachute Company. The reserve was a 27 ft. chest pack. Both parachutes were constructed so they would face into the wind automatically. They could be turned, but had negligible forward speed. Both parachutes were activated by ripcords. A one-piece heavy canvas suit was tried first. A lighter, two-piece, felt padded suit proved to be more practical. A wire mask was fitted on a leather football helmet to protect the head. A cotton webbing, quick attachable harness was used. The outfit also included a wide leather and elastic belt to guard against back and abdominal injuries during parachute opening. Leather ankle braces were used over the logger style boots. One trouser leg of the suit had a pocket to carry a rope for tree letdowns.

1941 -- The static line was adopted.

1942 -- Frank and Chet Derry invented the Derry slotted parachute. These slots increased stability, turning speed, and forward speed.

1945 -- The FS-1 parachute was first used. This parachute was a 28 ft. flat circular canopy with 7 ft. Derry slots, 7 gores apart. These parachutes were manufactured by the Irving Parachute Company.

1953 -- Drawings for crepe paper streamers were made. The Missoula Aerial Equipment Development Center was founded. It was later changed to Missoula Equipment Development Center and then to Missoula Technology and Development Center (MTDC) which was the focal center for development of smokejumper equipment.

1954 -- The FS-2 parachute was first used incorporating "slots and tails." This canopy was nearly identical to the FS-1 except it had material extensions on the back three gores.

1956 -- The FS-5, a 32 ft. flat canopy with 7 ft. slots and tails, was first used. The H-3 harness was also incorporated.

1960 -- The FS-5A was introduced. This canopy was identical to the FS-5 except that it had 10 ft. steering slots. A white nylon jump suit was adopted. Fire shelters were made available, but were not required until 1978.

1963 -- This was the first year that D-bags were used. This greatly reduced the opening shock experienced by smokejumpers.

1969 -- The FS-9 was an experimental canopy. The final version was designated the FS-10.

1970 -- The FS-10, a military style 35 ft. parabolic canopy, was adopted. It had a 7-TU modification in back that gave it more forward and turning speed than the FS-5A. The FS-10R reserve was adopted in conjunction with the FS-10.

1977 -- The FS-11 was an experimental parachute which went through testing, but never made the cut.

1978 -- Anti-inversion netting was first used on Forest Service personnel parachutes. This netting has greatly decreased partial malfunctions and the occurrence of partial inversions has been rare in Forest Service smokejumping operations.

1980 -- The FS-12, a 32-foot flat circular, multiple porosity parachute was adopted. It also had Russian-style turning slots with the addition of two large drive windows.

1983 -- The ram-air parachute system became operational for BLM smokejumpers.

1997 -- After several versions of the Concept 7, the FS-14 was adopted as the Forest Service parachute. It has three sizes, small, medium, and large, which are 28 ft., 30 ft., and 32 ft. in diameter, respectively. A size chart was developed for use depending on weight of the smokejumper. The new design allows for much quicker flat turns with a forward speed of 10 miles per hour.

2015 -- The Director, Fire and Aviation Management, decides to begin a measured transition to a ram-air parachute system.

## Smokejumper Aircraft

**Stinson** (1939) -- The first aircraft ever purchased by the Forest Service. It was a five-place, high-winged, single-engine airplane used at Winthrop, Washington during the experimental jumping of 1939.

**Curtis Travel air** (1940-1969) -- This airplane carried four smokejumpers. It had high wings and a single engine.

**Ford Tri-Motor** (1941-1969) -- This airplane carried eight smokejumpers and their cargo. It was large, slow-flying, high-winged, and had three engines—one on each wing and one on the nose.

**UC-64 Noor dyne-Norseman** (1945-early 50's) -- This was a high wing, single-engine aircraft that carried four smokejumpers and cargo.

**DC-3** (1944-1970's) -- A large, low-winged, two-engine aircraft that was capable of carrying up to 16 smokejumpers.

**DC-2** (50's and 60's) -- Similar to the DC-3, but slightly smaller, this aircraft carried 12 smokejumpers and cargo.

**Twin Beech** (early 50's-early 70's) -- The Twin Beech had low wings, twin engines, and carried four smokejumpers and cargo.

**Turbo Porter** (1966-1968) -- Used in McCall and Grangeville, the Turbo Porter carried four smokejumpers. This was a high-wing, single turbine engine airplane.

**Twin Otter** (1968-present) -- The twin otter has high wings, twin turbine engines, and can carry eight to ten smokejumpers. It is an excellent short takeoff and landing (STOL) aircraft for backcountry strips.

**Lockheed Lodestar** (1957-58) -- Used in Redding, California, this aircraft had high wings and twin engines. It carried four smokejumpers and cargo.

**C-46** (1960-1970) -- This airplane was similar to the DC-3. It had a much larger belly, carried 32 smokejumpers, and was primarily used in Regions 1 and 5.

**B-26** (1973) -- This was only used in Alaska.

**Fokker** (Late 50's) -- Use was limited to West Yellowstone.

**Beaver** (60's) -- This was a high-winged, single-engine aircraft. It was owned by the Forest Service and carried four smokejumpers. Only one fire jump in Region 1 was ever made out of the Beaver.

**Cessna 206** (Late 60's-80's) -- This was a high-winged single-engine aircraft that carried two smokejumpers and cargo.

**Caribou** (1972-early 80's) -- This was a high-winged, twin reciprocating engine airplane capable of carrying 20 smokejumpers. It had a large rear door exit and was used primarily in Region 1.

**Volpar** (1974-late 80's) -- The Volpar is an extended Twin Beech with turbine engines and carried eight smokejumpers and cargo. It lost its status when one went upside down while doing a practice jump in Alaska. Fortunately, it uprighted with enough elevation to return to base and land.

**Grumman Goose** (1960-early 70's) -- It had high wings, twin engines, and can land on ground or water. It was only used in Alaska and could hold four smokejumpers.

**Bell 212** (April 1976) -- This was a twin turbine engine helicopter that was only tested and never used for jumping.

**Aero Commander** (1959-1975) -- This was a high-winged, twin turbine engine aircraft capable of carrying only two smokejumpers.

**Beech 90** (1978-early 90's) -- This was also called the King Air 90, a small twin engine, low-winged airplane capable of carrying four smokejumpers. The Forest Service owned one and it was used at several bases.

**Beech 99** (1974-early 90's) -- This was a low-winged, twin turbine, fast airplane capable of carrying six to eight smokejumpers. The Forest Service owned one and it was used at several bases.

**Beech King Air 200** (1974-early 90's) -- This was a twin turbine, fast airplane similar to the Beech 99, but with a high "T" tail. It carried six to eight smokejumpers and cargo.

**Sky Van** (1976) -- This was a twin turbine, high-winged airplane with a large rear exit door. After a one-season trial, it was not used again.

**Banderanti** (1983-late 90's) -- This was a Brazilian-made aircraft similar to the Beech 200 with twin turbines capable of carrying eight smokejumpers and cargo.

**Casa 212** (1981 to present) -- The Casa is a Spanish-built aircraft, high winged, twin turbaned, with a large rear opening door. Exits are done from a side door. Capacity is eight smokejumpers and cargo.

**AT-11** (1966-1967) -- Use was limited to Redding, California.

**TDC-3** (mid 80's to present) -- Two Forest Service DC-3's were converted over to twin turbines. The airframe was taken totally apart and the fuselage was extended, with the turbines added. This airplane is capable of carrying 20 smokejumpers at over 200 knots. Contract TDC-3's were introduced in the 90's.

**Sherpa C-23A** (90's to present) -- Developed by the Shorts Brothers of Ireland, this short-winged, twin-tailed, twin turbine aircraft is capable of carrying 12 smokejumpers and cargo. It is boxy in design, with 30 percent of its lift capacity coming from the fuselage. Exit is side door.

**Dornier 228** (90's to present) -- This fast, twin turbine aircraft is capable of carrying 10 smokejumpers. It has an inflight door allowing the airplane to fly in excess of 200 knots until time to go into jump configuration.

**Grand Caravan** (90's to present) --This high-winged, single turbine aircraft was tested in the 70's, but didn't get totally evaluated until 1999 out of Grangeville. It proved capable of carrying six smokejumpers and cargo.

## Notes

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# Unit 1—Program Introduction

## Chapter 2 – Smokejumper Training Plans



### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Smokejumper Training Plans</b>
<b>Objective(s):</b>	To provide a comprehensive overview of training and performance requirements for specific areas of smokejumper activity.
<b>Suggested Duration:</b>	To be determined by instructor.
<b>Training Aids Needed:</b>	To be determined by instructor.

### Introduction

This unit is intended to provide instructors, supervisors, and trainees with an insight into the elements required of smokejumper training in critical areas of operation.

It is the responsibility of each smokejumper base to follow the principles outlined in the Training Guide when developing agendas and lesson plans for the various phases of smokejumper training. Smokejumper training is performance-based and requires individuals to demonstrate identified skill levels.

For a detailed lesson plan outline for each topic, refer to the appropriate chapter of the Training Guide.

### Initial Smokejumper Training (4.5 to 5 weeks)

1. **Orientation.**
  - a. Forest Service Organization and Regulations.
  - b. General Unit Information.
  - c. Training Program.

- d. Safety.
  - e. Physical Fitness Test.
  - f. Work Capacity Test.
  - g. Pack-Out Test.
- 2. Parachute Jumping Techniques.**
- a. Pre-Jump Training.
  - b. Parachute Landing Simulator.
  - c. Exit Tower.
  - d. Letdown Simulator.
  - e. Aircraft Mock-up.
  - f. Aircraft Procedures.
  - g. In-Flight Emergencies.
  - h. FS-14 Parachute Maneuvering.
  - i. Parachute Malfunctions/Emergency Procedures.
  - j. Water Landings. (Note: Simulated water landing should be conducted in actual water; performing an actual water jump is optional.)
- 3. Physical Fitness.**
- 4. Annual Fire Safety Refresher Training.**
- 5. Emergency Medical / First Aid Training.**
- 6. Tree Climbing / Parachute and Cargo Retrieval.**
- 7. Practical Parachute Jumping Experience.**
- a. Parachuting skills evaluation system.
  - b. Minimum of 15 initial training jumps to qualify.
  - c. Refer to the ISMOG and Training Guide, Unit 2, Chapter 11, Practical Jump Experience.

## **Refresher Smokejumper Training (1 to 2 weeks)**

- 1. Mandatory Pre-Jump Training.**
- a. Physical Fitness Test.
  - b. Parachute Landing Simulator.

- c. Exit Tower.
- d. Letdown Simulator.
- e. In-Flight Emergencies.
- f. First Aid/CPR.
- g. Review video and classroom discussion of parachute handling characteristics of the FS-14 parachute.
- h. Parachute Malfunctions/Emergency Procedures.
- i. Water Landings (performing an actual water jump is optional).
- j. Practical Jump Experience.
  - i. Recurrence on parachute type (minimum of two and one jump simulating a broken steering line).
  - ii. Currency on unfamiliar parachute type.
  - iii. Standards to certify on type.

**2. Annual Fire Safety Refresher Training.**

**Smokejumper Spotter Training**

**1. Policies.**

- a. 5700 Manual Direction.
- b. Federal Aviation Regulations.
- c. Interagency Smokejumper Operations Guide (ISMOG).

**2. Safety.**

- a. Pre-Jump Safety Checks.
- b. Aircraft Procedures.
- c. Spotter's Role in Aircraft Emergencies.
- d. Administrative Responsibilities.
- e. Crew Resource Management (CRM) Training.

**3. Navigation.**

- a. Geography.
- b. Aeronautical Charts and Maps.
- c. Aircraft Instruments and Navigation Aids.



**4. Spotter and Paracargo Training.**

- a. Refer to the ISMOG and the Spotter and Paracargo Operations chapters of the Training Guide (Unit 3, Chapters 1 and 2).
- b. Classroom Training.
  - i. Review the Professional Smokejumper Spotter video.
  - ii. Lead spotter conduct refresher from Training Guide, Unit 3, Chapter 1, Spotter.
- c. Jump Spot Selection.
- d. Procedures for Dropping and Interpreting Streamers.
- e. Practical Training for New Spotters.
- f. Radio Operation and Communications.
- g. Fire Staffing / Incident Commander Selection.
- h. Paracargo Dropping (refer to ISMOG and Training Guide, Unit 3, Chapter 2).
- i. Spotter Performance Documentation (Task Book) and Certification.
- j. Mixed Load Spotting Procedures.
- k. Recurrent Spotter Training.

**Smokejumper ICS Qualifications Path**

The following are target ICS qualifications for smokejumper personnel:

**Target ICS Qualifications for Smokejumpers**

<b>Smokejumper Position</b>	<b>Target Qualifications</b>
GS-9 and above	ICT3, DIVS, ATGS, SOPL T2 Command, and General Staff
GS-8 Spotter	ICT3, DIVS, ATGS, RxB2, SOFR
GS-7	ICT4, STLD, TFLD, FOBS
GS-6	ICT4, CRWB, FIRB
GS-5	ICT5, FFT1, FEMO

Other target qualifications will be identified on Individual Development Plans.

# Unit 1 – Program Introduction

## Chapter 3 – Evaluation System



### Lesson Plan Outline

Lesson(s):	Evaluation System
<b>Objective(s):</b>	<ul style="list-style-type: none"> <li>• To aid instructors in determining the progress of an individual during training.</li> <li>• To give instructors a framework for developing a performance-based training and evaluation system.</li> <li>• Evaluation begins with clear, measurable objectives so that both the instructor(s) and student(s) know what the intended performance outcome will be.</li> </ul>
<b>Suggested Duration:</b>	To be determined by instructor.
<b>Training Aids Needed:</b>	To be determined by instructor.

### Overview

The overall objective of training is for trainees to meet the performance-based objectives for each individual unit at the end of the training period. It is essential that both the trainers and trainees know and understand what is expected of them throughout the training units so that maximum effort can be put forth to achieve success in smokejumper operations. It is also a basis for the performance of each individual throughout training.

### Performance-Based Objectives

The foundation of a training evaluation system is performance-based objectives. An objective is a description of a performance you want learners to be able to exhibit before you consider them competent. An objective describes an intended result of instruction, rather than the process of instruction itself. Throughout the Training Guide, individual lessons have these objectives that the trainees must achieve prior to becoming a smokejumper or prior to becoming re-qualified as a smokejumper.

## Evaluation Process

The evaluation process needs to be used daily to determine progress. It is critical to evaluate all individuals, debrief, and document performance. If any trainee does not meet the daily objectives for a unit, an unsatisfactory rating will be given and this sub-par performance will be discussed with the individual and the appropriate overhead for further observation. If a trainee earns three unsatisfactory ratings over the course of the training, the trainee will be recommended for dismissal from the program.

## Communicating with Objectives

So that it clearly communicates an intent, every objective must answer the following three questions:

1. What should the learner be able to do?
2. Under what conditions do you want the learner to be able to do it?
3. How well must it be done?

Answering these questions in clear text will communicate to the trainee what is expected--how many, how fast, in what sequence, to what level, how often, given what timeframe, given what margin of error, and what is the level necessary for success. By answering these questions in the objectives, the performance necessary is evident to both trainers and trainees.

If, within the Training Guide, objectives are not present or are not to individual base expectations, adapt your own so there is no doubt as to the perceived outcome of trainer and trainees. Communicate, document, and follow through with debriefings.

# Unit 1 – Program Introduction

## Chapter 4 – Physical Conditioning



### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Physical Conditioning</b>
<b>Objective(s):</b>	This lesson plan is designed to assist the smokejumper in maintaining the physical fitness level needed to meet or exceed the minimum smokejumper physical fitness standards.
<b>Suggested Duration:</b>	Ongoing.
<b>Training Aids Needed:</b>	To be determined by instructor.

### Overview

A continual physical training program is essential to perform smokejumping safely and efficiently. Trainees will accomplish this goal by participating daily in a physical conditioning program.

### Muscle Groups

All basic muscle groups are to be exercised when selecting a program. The body can be divided into four muscle groups for conditioning:

1. Arms and Shoulders.
2. Abdominal and Back.
3. Hips and Legs.
4. Cardiovascular System.

Stretching and strength exercises should be selected for each muscle group from suitable fitness reference source(s).

An excellent cardiovascular conditioning program can be built around the basic exercises required in the Smokejumper Minimum Physical Standards. Alternate

aerobic exercises can be used to balance out the conditioning program and reduce long-term wear and tear on the trainee.

Voluntary conditioning programs may be instituted and have proven to be successful. For maximum benefit, a conditioning program should be started well before entering into smokejumper training or firefighting duties.

## **Physical Training and Conditioning**

### **Smokejumper Minimum Physical Standards**

1. 7 pull-ups or chin-ups.
2. 25 push-ups.
3. 1.5 mile run in 11 minutes or less.
4. Pack out – 110 pound pack for 3 miles in 90 minutes or less.
5. Standard Firefighting Pack Test for U.S. Forest Service.

The test must be passed before making the first training or refresher jump. Except for the pack out and 1.5 mile run, the test shall be performed during one established time period with a break of not less than five minutes, nor more than seven minutes between events. Prior to the 1.5 mile run, employees shall be given a reasonable warm-up period. Experienced smokejumpers will be allowed up to three opportunities to pass the test during the time frame allotted for pre-jump training. A failure of any one exercise will require retaking the entire test. New trainees will have one opportunity to pass the test during the first day of training and the 110 pound pack test must be passed, in one attempt, no later than the first week of training.

A conditioning program based on the Smokejumper Minimum Physical Standards has several advantages:

1. The exercises can be done anywhere and no specialized equipment is necessary.
2. These standards are easily measured both by trainers and by smokejumpers measuring their own progress.
3. The muscle groups and endurance being tested are necessities in the smokejumping job and the test is an indication of how well a candidate will perform the job.

### **Fitness and Conditioning Programs**

1. **Stretching Exercises.**
  - a. Designed for stretching (lengthening) and warming muscles, cartilage, ligaments, and tendons before high intensity exercises.
  - b. Helps provide maximum flexibility.

- c. Aids in the prevention of injury due to improper warm-up before strenuous exercise or improper parachute landings.

**2. Strength Exercises.**

- a. Designed to build the strength of the upper and lower body.
- b. Benefits include increased strength, cardiovascular improvement, and significant gains in endurance.

**3. Cardiovascular Exercises.**

- a. Designed to develop the lower body, the respiratory system, and improve cardiovascular activity.
- b. Improvements can be gained in both coordination and agility.
- c. Help reduce stress and tension.

**4. Running Exercises.**

- a. Running promotes improvements in motor fitness.
- b. No extra equipment or facilities are needed for running exercises.
- c. Both interval and distance training can give maximal results in the improvement of physical condition if the degree of difficulty is adequate.
- d. Reliance on running as the sole cardiovascular exercise may create physical problems.

**5. Alternative Aerobic Exercises.**

- a. Exercise biking, road or mountain biking, swimming, and cross country skiing are some examples.
- b. Develops the cardiovascular system without contributing to the cumulative wear and tear that running has on some people's bodies.
- c. Cross training balances cardiovascular development.
- d. Alternative programs are recommended by sports medicine doctors who have examined the orthopedic problems of smokejumpers.

**Weight training**

1. Weight training is designed to increase endurance and muscle strength.
2. Endurance training using a high number of repetitions increases the availability of energy producing materials to the muscles.
3. Strength training, using heavy load and low repetitions, will increase the size of muscle fibers.

4. Indirect benefits include strengthening of the joint fibers, improvement of the cardiovascular system, and increased coordination.
5. Weight training has shown excellent results in strengthening muscles, ligaments, and tendons following injuries to the joints.
6. Progressive resistance exercises such as weight training do not decrease flexibility, especially if done in conjunction with a stretching program.

### **Job Performance Exercises**

These exercises are designed to directly benefit and improve on-the-job physical and technical performance:

1. All terrain pack outs.
2. Tree or pole climbing.
3. Obstacle course.
4. Fire line construction.

### **Injury Prevention Exercises**

Sports medicine specialists have studied the job of smokejumping and recommended specific exercises which may reduce the chance of injury. The additional strength and flexibility these exercises promote may prevent an injury from occurring or decrease the likelihood of another injury to a previously injured joint.

### **Physical Conditioning Evaluation Parameters**

1. All experienced smokejumpers must pass the Physical Fitness Test before making the first training or refresher jump.
2. All new recruit smokejumpers must pass the Physical Fitness Test during the first week before being allowed to participate in further recruit training.
3. Failure to maintain a high level of fitness will result in smokejumpers being removed from operation jump status and may result in removal from the program.
4. All experienced and new recruit smokejumpers must report each year in good physical condition prior to the report date for training.

### **Physical Conditioning Program Development**

It should be pointed out that physical conditioning programs outlined in the Training Guide are meant to be used merely as guidelines. Since requirements for each base, group, or individual PT program are different, the Training Guide cannot possibly be a final authority on physical conditioning. Unlike some of the other topics in the Training Guide, physical conditioning is not a field exclusive to smokejumpers and our organizations are not the final experts in this field.





## Unit 2 – Parachute Training

### Chapter 1 – Parachute Equipment



#### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Smokejumper Parachute Equipment</b>
<b>Objective(s):</b>	Upon completion of this unit, trainees will be able to: <ul style="list-style-type: none"><li>• Name the components of all smokejumper rough terrain parachuting equipment.</li><li>• Complete error-free suit-up drills within two minutes.</li><li>• Perform pre-jump equipment safety checks to the complete satisfaction of the Training Cadre.</li></ul>
<b>Suggested Duration:</b>	To be determined by instructor.
<b>Training Aids Needed:</b>	To be determined by instructor.

#### Overview

Smokejumping requires the development of specialized parachute jumping equipment to facilitate safe parachute landing falls in rough terrain. Individual smokejumpers are responsible for the proper use and care of all equipment assigned for their use. A smokejumper can depend upon the equipment for a high degree of protection if it is adjusted properly and kept in good repair.

#### Smokejumper Parachute Equipment

During a demonstration explain the use and care of each item.

Check all equipment for rips and tears, check zippers for proper function check stitching on material, looking for wear or breaks and make certain the pads are tacked securely. Adjust jump pants suspenders and crotch strap to the proper fit.

Standard smokejumper equipment is listed below. Small variances between bases are unavoidable and do occur. Additional protective equipment may be substituted and used in place of standard equipment with the approval of the home unit's loft or base manager.

## **Jump Suit and Accessories**

### **Jacket**

- Kevlar material.
- High, protective padded collar.
- Rib pads.
- Shoulder pads.
- Elbow pads.
- Static line tab or rubber bands on left shoulder.
- Spine protector.

### **Pants**

- Kevlar material.
- Adjustable suspenders.
- Adjustable crotch strap.
- Hip pads.
- Full length zippers.
- 2 Drop Forged 2500 lbs. rings.
- Leg pockets and closures.
- Knee pads.

### **Letdown System**

- Tubular nylon 3/4-inch in width, 150 feet in length in stuff bag or bird nest.
- Rings in jump pants provide friction point during let-down procedure.
- Single action auto-locking carabineer.

### **H-5 Harness Assembly**

- Three sizes (Small, Medium, Large).

- Check all harness hardware for smooth operation. Check stitching, webbing, and Velcro for wear.
- Capewell Release: Slider in place, lanyards unfrayed, unimpeded closure.
- FS-14R reserve parachute attachment D-rings (2,500 lbs.).
- Chest strap adjustment.
- Leg Straps. Snap and V-Ring attachment point (2,500 lbs.).
- Fastex:
  - FS-14R lower attachment is black 1-inch male.
  - PG bag attachment is black, heavy, 1-inch Type male Fastex.

### **Helmet (ISMOG Approved)**

- Wire face mask with retainer strap.
- Chin strap.
- Mouth guard (optional).

### **Nomex Flight Gloves**

- Fire resistant.

### **Ankle Braces**

- Check for cracks or breaks in the plastic.

### **Personal Gear Bag (PG Bag)**

- Attaches to the harness under reserve parachute using black heavy, 1-inch Type V Fastex, female.
- Contents depend on local base policy.

### **Pack-Out Bag**

- Bag is used for carrying entire jump suit, parachute/ and other firefighting equipment.

### **Signal Streamers**

- Ground to air communication.
- Drift streamer for wind indicator.

## **Parachutes**

### **FS 14 Main Canopy**

- Back, static line deployed, steerable, round canopy.
- Three sizes
  - Small 28 feet diameter.
  - Medium 30 feet diameter.
  - Large 32 feet diameter.
- Forward speed approximately 10 mph.
- Descent rate approximately 15 fps.

### **FS-14R Reserve Canopy**

- Chest, center pull handle deployed pilot chute.
- Steerable 26 feet conical design.

### **Demonstration**

- Demonstrate the deployment sequence for each parachute type.
- See rigging manuals for care and maintenance of each system.

## **Smokejumper Pre-Jump Equipment Checks**

1. See Pre-Jump Equipment Check in Training Guide, Unit 2, Chapter 2, Aircraft Procedures.
2. Suit up and pre-jump equipment safety check demonstration.
  - a. Fully suit and inspect one smokejumper, explaining pre-jump equipment check and sequence.
  - b. Questions and discussion.

## **Smokejumper Parachute Equipment Evaluation Parameters**

At the completion of this training unit, the trainee will be able to:

1. Correctly identify the components of the USFS parachute equipment system.
2. Perform a complete suit-up drill without error.

3. Perform progressive timed suit-ups without error within each unit's designated time frame (most bases will have trainee correctly suited within 2 minutes consistently). Suit-up will be done from "quick suit-up rack" or by putting individual components on in individual sequence.
4. Perform smokejumper pre-jump equipment checks without error.

## Unit 2 – Parachute Training

### Chapter 2 – Aircraft Procedures



#### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Aircraft Procedures</b>
<b>Objective(s):</b>	<p>Upon completion of this lesson, the trainee will be able to:</p> <ul style="list-style-type: none"> <li>• Describe the general sequence of events occurring aboard smokejumper aircraft during smokejumper missions.</li> <li>• Learn and apply prescribed procedures for responding to fire calls, loading aboard aircraft, takeoff, enroute flights, jumping and cargo operations over the fire, emergency procedures, and landing.</li> <li>• Learn and apply aircraft-specific procedures for each approved smokejumper aircraft utilized.</li> </ul>
<b>Suggested Duration:</b>	To be determined by instructor.
<b>Training Aids Needed:</b>	To be determined by instructor.

#### Overview

This unit is intended to stress the importance of utilizing correct aircraft procedures for personal safety and efficiency in accomplishing smokejumper mission. Minor differences may apply to various bases; however, correct aircraft procedures are essential to the safety of smokejumper operations.

#### General Sequence of Events for Smokejumper Fire Missions

1. Jump list and local base readiness procedure established.
2. Smokejumper fire call occurs.
3. Designated load of smokejumpers suit up.
4. Parachutes are put on.
5. Parachute numbers are recorded by spotter or assistant spotter.

6. **Pre-Jump Equipment Safety Check or “Buddy Check”** made by a qualified Forest Service round parachute smokejumper prior to boarding the aircraft.

**Qualified Smokejumper** = Active smokejumper recertified annually to do pre-jump equipment checks on a round parachute system.

- a. Must be performed on all smokejumpers prior to boarding the aircraft to ensure smokejumper gear is in safe condition and correctly worn.
- b. For the proper sequence and items to be inspected, see the Pre-Jump Equipment Safety Check or “Buddy Check” for the FS-14 parachute system at the end of this lesson.

**Instructor Note:** *This section is taught by the demonstration of a pre-jump equipment check by the instructor; then by having the trainee go through the routine. The instructor should ensure that several subtle problems exist in the equipment that the trainee will be required to identify and correct.*

7. Boarding designated aircraft.

Rear-Loading Aircraft	Front-Loading Aircraft
	Do not board the aircraft unless the propeller on the loading side is completely stopped.
Load by reverse order, i.e., last smokejumper first.	Load in actual jump order.
Each smokejumper boarding should sit as far forward as possible.	Move to the rear of the aircraft enough to provide sufficient room for all boarding smokejumpers to sit down. Adjust toward the front of the aircraft so that everyone is sitting as far forward as possible.

8. Take-off and landing.
- Seat belts will be worn by all smokejumpers and spotters.
  - Smokejumpers must wear their protective jump suit, gloves, and helmet with mask down on take-offs, landings, and during low-level cargo drops.
  - Do not move around inside the aircraft during take-offs, landings, and low-level patterns. Changes in center of gravity (CG) can adversely affect pilot’s control of the aircraft.
  - No smoking is allowed.

9. Flight to fire.

- Avoid unnecessary movement.
- Know the location of airsick bags and take them at the first indication of nausea.
- Know the location of emergency exits and fire extinguishers.
- Exercise caution near aircraft windows. Avoid putting pressure on them with boots, helmets, or other gear.
- Stay away from an open door unless the spotter has given approval and static line is hooked up.
- Protect your reserve. Be especially aware of your reserve handle and protect it from the possibility of getting snagged or caught and opening inadvertently.
- Do not remove parachute or un-suit unless specifically instructed to do so by the spotter.

10. Over the fire.

a. Dropping the smokejumpers:

- i. The spotter selects the jump spot (the smokejumper-in-charge should be involved in selection) and determines the wind drift.
- ii. During observation and streamer passes, pay particular attention to jump spot location and relationship to fire location, alternate spots, ground hazards, terrain features, water sources, and fire behavior.
- iii. If possible, watch the streamers (and other smokejumpers dropped before you) to get an indication of wind direction and amount of drift. Do not bunch up at the rear of the aircraft.

b. Forest Service Round Spotter Commands. See Forest Service Round Spotter Commands Checklist at the end of this lesson.

- i. The spotter (and assistant spotter if present) will make a final visual check of each smokejumper prior to the exit. All smokejumpers should also be making a visual check of each other.
- ii. Exit the aircraft only when signaled by the spotter.
- iii. If the spotter discovers a safety problem and the pass is aborted, a "NO EXIT" signal will be given by the spotter to the smokejumper in the door and reinforced by a verbal command not to jump. The "NO EXIT" signal is the spotter's arm blocking the door in front of the smokejumper's face or spotter placing his hand over the smokejumper's face mask.



c. Important Procedures to Remember

- Do not get in the door if the door strap is still in place. It should be removed during jumping and cargo dropping operations. It is the spotter's responsibility to remove the door strap at the appropriate time.
- On final, spotter directs smokejumpers to assume exit position. Exit positions vary according to the aircraft type and are covered later in the Specific Aircraft Procedures portion of this lesson as well as in Training Guide, Unit 2, Chapter 3, Exit Procedures.
- Procedures from hooking up to exit continue until the specific number of smokejumpers have been dropped.
- When the first stick lands, one of the smokejumpers will radio up to the aircraft prior to the second stick going out the door. This is done to verify that conditions are as the spotter indicated in the briefing. Also, one of the smokejumpers will hold up a streamer to help subsequent smokejumpers identify the wind direction close to the ground for final approach.

11. Cargo dropping (with smokejumpers on board).

- a. Remain as far forward as possible during cargo dropping operations and avoid unnecessary movement.
- b. Stay away from the open door. Do not try to help move cargo while fully suited to lessen the chance of an inadvertent opening of the reserve.
- c. All smokejumpers must wear helmets, gloves, protective suits, and seat belts during cargo drops.

12. Return flight to base.

- a. Do not un-chute/un-suit unless instructed to do so by the spotter. All appropriate equipment will be worn for landings as previously designated.

13. Unloading from aircraft.

- a. Do not leave the aircraft until the spotter or assistant spotter has given the approval to do so.

## Specific Aircraft Procedures

**Instructor Note:** After informal discussion with trainees covering general sequence of events and local SOPs, trainees should suit up and be talked through specific procedures for each aircraft utilized at the base.

- A mock-up of the aircraft should be utilized to practice correct procedures.



**Casa 212**

**Casa 212**

Aircraft and Characteristics	Procedures Specific to Aircraft
<p>100 Series payload 3,300 pounds (8 smokejumpers with 3 hours useable fuel).</p> <p>200 Series payload 5,000 pounds (8 smokejumpers with 4+ hours useable fuel).</p> <p>Pilot and co-pilot required.</p> <p>Spotter and assistant spotter utilized. Single spotter can be used if only using single stick exits.</p> <p>Cruise speed 190 knots.</p> <p>Excellent short takeoff and landing (STOL) characteristics.</p> <p>Spotter position forward of jump door.</p> <p>Assistant spotter position aft of jump door.</p> <p>In-flight door plug available.</p> <p>Rear ramp/door aft of main cabin utilized for dropping larger quantities of cargo (side door used for dropping standard amounts of cargo).</p> <p>Main cable mount is short vertical stand. Emergency cable is overhead.</p>	<p>Spotter will be positioned forward of the jump door. Two smokejumper sticks are standard, although three smokejumper sticks are used on occasion.</p> <p>Spotter will initiate standard commands. The assistant spotter will make sure that each static line routing is clean on each smokejumper and signal the spotter.</p> <p>Standard large door exits, although the slap from the spotter will be on the right calf.</p>

**Notes**

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**DeHavilland Twin Otter 300 Series**

**DeHavilland Twin Otter 300 Series**

Aircraft and Characteristics	Procedures Specific to Aircraft
<p>3,000 lb. payload (8-10 smokejumpers with 2.5 hours useable fuel).</p> <p>Single or Two Pilots.</p> <p>Cruise speed 150 knots.</p> <p>Excellent STOL characteristics.</p> <p>Spotter position aft of jump door.</p> <p>Assistant spotter used at most bases.</p> <p>Vertical main cable.</p> <p>Step mounted on fuselage.</p> <p>Most widely used smokejumper aircraft.</p> <p><i>Note: 200 Series Otter is slower (140 knots) and has reduced payload (2500 lb., 6-8 smokejumpers).</i></p>	<p>Spotter denotes size of stick to smokejumpers (two smokejumpers stick standard) and gives hook-up command.</p> <p>Jumpers in stick will then hook up their static line snaps to the jump cable (in succession) and attach safety pins. Some bases have second smokejumper go through a rubber band (if only one spotter).</p> <p>Spotter or assistant spotter, if used, will check hook-up; scan the smokejumpers to ensure proper routing of static line. The spotter will then instruct the first smokejumper to get in the door.</p> <p>Smokejumpers should assume first and second positions outlined in standard small door exit procedures.</p> <p>First smokejumper may have to shift forward in door to give spotter visibility. Make sure reserve handles are protected.</p> <p>Spotter will signal first smokejumper to exit with a sharp slap on the left shoulder. Second smokejumper should move into first smokejumper exit position as soon as the door is vacated. Second smokejumper will exit aircraft without a slap from the spotter after a slight hesitation.</p> <p>Care must be taken by second smokejumper to "find" the step with the left foot prior to applying weight to that foot to ensure a good exit.</p>

**Notes**

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**Dornier 228**

**Dornier 228**

Aircraft and Characteristics	Procedures Specific to Aircraft
<p>Twin turbine.</p> <p>3,500 pound payload (8 smokejumpers with 3 hours useable fuel).</p> <p>One pilot and one or two spotters (base preference).</p> <p>Two smokejumper stick is standard.</p> <p>Cruise speed is 200 knots.</p> <p>Spotter position is aft of jump door.</p> <p>Vertical main cable.</p> <p>Jump step with in-flight door.</p>	<p>Small door exit with step. Normally two smokejumpers per stick.</p> <p>Hand rail on right side of door sits back inside airplane and it is very important to use the rail and not put right hand on the inflight door to push-off from.</p> <p>Second smokejumper needs to make sure to see the step prior to putting weight on the left foot.</p> <p>Exit signal will be a slap on the left shoulder. Second smokejumper will swing into first smokejumper position and exit without receiving a slap from the spotter.</p>

**Notes**

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**Shorts SD3-30 (C-23A-Sherpa)**

**Shorts SD3-30 (C-23A Sherpa)**

Aircraft and Characteristics	Procedures Specific to Aircraft
<p>Twin turbine</p> <p>4,850 pound payload (12 smokejumpers with 2.5 hours useable fuel).</p> <p>Pilot and co-pilot and two spotters. Single spotter can be used if using single stick exits.</p> <p>Two smokejumper sticks are standard.</p> <p>Cruise speed 170 knots.</p> <p>Spotter position is aft of jump door.</p> <p>Assistant spotter position to the side of spotter.</p> <p>Vertical main cable on short stand.</p>	<p>Spotter will initiate standard commands. Assistant spotter will monitor static lines and check each smokejumper for proper routing/hook-up.</p> <p>Standard large door exit procedures are followed.</p> <p>Exit command will be a sharp slap on the left calf of the first smokejumper. Exit should be vigorous.</p> <p>This aircraft is roomy so movement around the interior should be limited and reserve handles need to be monitored.</p>

**Notes**

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**Shorts SD3-60 (C-23B+-Sherpa)**

Reserved.

**Turbine DC-3**

**Turbine DC-3**

Aircraft and Characteristics	Procedures Specific to Aircraft
<p>4,500 pound payload (12-16 smokejumpers with 3 hours useable fuel).</p> <p>Pilot and copilot required for all operations.</p> <p>Cruise speed 180 knots.</p> <p>Spotter and assistant spotter required.</p> <p>Assistant spotter position to the side of spotter.</p> <p>Overhead main cable.</p>	<p>Spotter denotes size of stick (two smokejumper sticks standard and three smokejumper sticks may be utilized). Spotter begins standard commands.</p> <p>Jumpers in stick will then hook up their static lines to the overhead cable (in succession) and attach safety wires.</p> <p>Spotter or assistant spotter will check hook-up and spotter will instruct first smokejumper to get in the door.</p> <p>Assistant spotter will scan each smokejumper to ensure proper routing of static line.</p> <p>Jumpers should assume first, second, and third positions according to large door exit procedures.</p> <p>As a safety precaution, survey the smokejumper in front of you to check correct static line routing.</p> <p>Spotter will signal first smokejumper to exit with a sharp slap on the left calf. Second smokejumper will move into the first smokejumper position after the door is clear and then exit without a slap, after a slight hesitation.</p> <p>If a third smokejumper is exiting, the procedure is to assume the second smokejumper position as the smokejumper exits, and then move into the first smokejumper position, exiting without a slap after a slight hesitation to allow some separation between smokejumpers.</p>

**Notes**



## General Aircraft Safety

### Propellers

1. Always avoid the aircraft propellers, even when they are motionless. Treat them as if they are always turning.
2. Maintain propeller awareness. Know where it is and keep a safe distance away from it.

### Approaching or Leaving Aircraft

**Note:** Refer to 5709.11, specifically 43.12, and the June 6, 1997, Washington Office letter "Smokejumper Operations, Jumpers Boarding with an Engine Running."

1. Always approach or leave aircraft on a path that takes you away from the propellers.
2. Do not take shortcuts close to the nose or under the wings of an aircraft.
3. Rear-loading aircraft: approach from the rear.
4. Forward-loading aircraft: approach from the front. Do not approach or attempt to leave if propeller on the loading door side is still running. Wait until it stops.

### Smoking

1. No smoking allowed on any Forest Service aircraft.
2. Do not smoke in close proximity to aircraft while parked. Spilled fuels could be ignited.

### Fueling Operations

1. No smoking allowed within 50 feet of the aircraft while it is being fueled or within 50 feet of fuel tanks at any time.
2. No one is allowed on board the aircraft during fueling operations.

### General Considerations

1. Stay clear of instrument sensors and antennae that may be attached to the fuselage or wings.
2. Avoid contact with control surfaces of the aircraft.
3. The pilot(s) and spotter(s) are a team. They are the final authority on matters pertaining to normal operating procedures aboard that aircraft. The spotter is responsible for making sure smokejumpers assigned to the load follow established procedures. It is the individual smokejumper's responsibility, however, to know and apply those procedures in accordance with the spotter's instructions.

4. It is advisable to wear ear protection, particularly in turbine aircraft.
5. Always follow procedures for use of simula seats utilizing proper equipment for specific configured aircraft.

## Regulations

1. Specific regulations pertaining to aircraft safety are found in FSH 5709.11 Fixed Wing Operations Handbook and BLM Manual 9430, as well as FAA and DOT publications and the manufacturer's flight handbooks.
2. Waivers have been granted for some DOT and FAA regulations pertaining to use of aircraft in emergency and other specified flight situations including smokejumper missions.

## Emergency Aircraft Procedures

Situations that require an emergency exit vary. The spotter shall be responsible for maintaining control during an emergency.

## Non-Critical Emergency

A non-critical emergency means that *the safe flight of the aircraft is not compromised*.

The pilot shall inform the spotter about the nature of the emergency and course of action. If an emergency exit is necessary, the spotter shall be responsible for maintaining control over the smokejumpers and for ensuring that the emergency exit is orderly and timely. Emergency exit procedures in a non-critical emergency usually are the same as those for an operational jump. In some cases, the spotter may even select a jump spot.

## Jumper-Related Non-Critical Emergencies

1. **Inadvertent opening of reserve inside aircraft.**
  - a. Try to contain, gather and cover canopy.
  - b. If part of the canopy catches air out the door, smokejumper will follow it out, exiting quickly.
2. **Jumper-in-tow.**
  - a. If OK and able to deploy reserve, smokejumper should place hands on top of helmet.
  - b. If this effort is unsuccessful and the smokejumper has given the OK signal, the spotter will cut the smokejumper away.
  - c. After being cut loose, the smokejumper should assume basic exit position, LOOK at the reserve handle, and deploy the reserve. DO NOT PULL RESERVE PREMATURELY.

## Critical In-Flight Emergency

A critical in-flight emergency means that the *safe flight of the aircraft is compromised*. Examples include bad fuel, landing gear stuck up, onboard fire, etc.

The spotter must assume control in a critical emergency to ensure that exits proceed as smoothly and quickly as possible. Considerations and procedures for an emergency exit in a critical emergency are as follows:

1. **Center of Gravity Limitations.** A pilot cannot maintain adequate control of an aircraft with an aft center of gravity; therefore, spotters must not allow smokejumpers to rush toward the aircraft door, if they anticipate an emergency exit.
2. **Decision to Initiate Emergency Exit.** The pilot shall be the primary authority in matters pertaining to the aircraft's condition and the necessity for an emergency exit. The pilot shall notify the spotter to initiate an emergency exit. Before initiating an emergency exit, the spotter must be certain that a crash is imminent and that the aircraft is high enough for a parachute to open. During a critical emergency exit from a smokejumper aircraft, gloves, helmets, and other protective equipment may be left behind.
3. **Critical Emergency Exit Procedures with Main Parachute.** If smokejumpers are wearing main parachutes when the pilot or spotter orders an exit, the smokejumpers shall use the designated emergency cable. They must not attempt to fasten the static line safety pin. Depending on the aircraft accessories, smokejumpers may need to keep one hand on the static line snap to guide it along the cable while moving toward the door. This prevents the main parachutes from opening accidentally in the aircraft.
4. **Exit Procedures with Reserve Parachute.** Smokejumpers shall jump with their emergency parachute when it is impractical to hook their static lines to the emergency cable or if they are not equipped with main parachutes.

## Emergency Bailout Command

1. Spotter or assistant spotter (whoever is closest to door) will open in-flight door and secure step (if applicable).
2. If in-flight door is not utilized, spotter/assistant will remove door-strap from the door.
3. A standard command of "**Bailout, Bailout, Bailout**" should be used, accompanied by a hand signal which will mean the same thing to smokejumpers and spotter, consisting of patting or pointing to the belly (reserve area) meaning bailout on your reserve, or grasping and shaking the overhead cable meaning bailout on your main canopy.
4. In orderly fashion, move to rear of aircraft one at a time, hook static line clip to static line cable (no time to use safety pin), assume exit position, and exit. No delays.

5. If it is necessary to use reserve, assume proper exit position, exit the aircraft, look at reserve handle, reach, and pull following procedures.

### **Aircraft Crash on Takeoff**

1. All personnel shall be prepared for an aircraft crash on takeoff.
2. Smokejumpers and spotters shall use proper seating arrangements for the model aircraft used in the operation and must know where all the emergency exits are located and how to use them.
3. If the aircraft crashes on takeoff, personnel shall evacuate the aircraft as soon as the aircraft stops moving.
4. Be alert to smokejumpers and crewmembers who may have been hurt or incapacitated in the crash, and get them out quickly.
5. Evacuate away from any fire that exists, depart the crash upwind, and account for all personnel.

### **Crash Landing Procedures**

Whenever possible, follow the procedures below when a crash landing is imminent:

1. Helmets and gloves on.
2. Fasten seatbelts.
3. Assume a fetal position, arms close to the body. Occupants of side-facing seating shall attempt to face 45 degrees to the front of the aircraft.
4. Restrict unnecessary movement within aircraft.
5. Locate emergency exits and emergency equipment.
6. After a crash, vacate the aircraft quickly and in an orderly manner.
7. Be alert to smokejumpers or crewmembers who may have been hurt or incapacitated in the crash, and get them out quickly.
8. Evacuate and depart the aircraft upwind, and account for all personnel.

### **Aircraft Fire in Flight**

The spotter and pilot shall make a coordinated decision concerning appropriate action if a fire occurs in flight. The spotter must maintain control of the situation and take aggressive action to control the fire. If the fire becomes uncontrollable, begin emergency evacuation procedures.

### **Practical Training**

1. Successful completion of this Aircraft Procedures Unit will be demonstrated by practical training.



## Pre-Jump Equipment Safety Check or “Buddy Check” for FS-14

### Pre-Jump Equipment Safety Check or “Buddy Check” for FS-14

	Equipment	What to Check and Ensure	What to Say
<b>1</b>	<b>Ankle Braces</b>	Ankle braces are on. Ankle braces are not broken. Stirrups are seated under the boot.	<b>“Ankle braces are on.”</b>
<b>2</b>	<b>Jump Pant Stirrup Straps</b>	Stirrup straps are seated under the boot.	<b>“Stirrups are seated.”</b>
<b>3</b>	<b>Leg Pockets</b>	Smokejumper has letdown rope, pack out bag, and signal streamer. Leg pockets are cinched. Strings are inside.	<b>“Pack out bag, letdown rope, signal streamer?”</b>
<b>4</b>	<b>Harness Leg Straps</b>	Leg straps are not twisted. Leg straps are underneath the crotch protector. Snaps are attached to the D-rings. Excess strap stowed in holders.	<b>“No twist in your leg straps and metal on metal.”</b>
<b>5</b>	<b>PG Bag Fastex</b>	Fastex are not broken. Fastex are not twisted around the harness. Fastex are appropriate length.	<b>“PG Fastex are good.”</b>
<b>6</b>	<b>Reserve Fastex</b>	Reserve male Fastex are attached to the reserve female Fastex.	<b>“Reserve Fastex are seated.”</b>
<b>7</b>	<b>Reserve Due Date</b>	Reserve has good due date. Reserve has rigger’s name or seal number.	<b>“Good due date.”</b>
<b>8</b>	<b>Reserve Pins</b>	Reserve opening pins are seated. Seal is not broken.	<b>“Pins are seated, seal is good.”</b>

	<b>Equipment</b>	<b>What to Check and Ensure</b>	<b>What to Say</b>
<b>9</b>	<b>Reserve Knife</b>	There is a knife. Knife is pointed in right direction. Blade is damage free.	<b>“Has your knife been checked?”</b> (If smokejumper confirms that knife has been checked, move to the next step, if not, check the knife.)
<b>10</b>	<b>Reserve Clips</b>	Clips on reserve are attached to D-rings on harness. Pins are firmly seated.	<b>“Clips are metal on metal and pins are seated.”</b>
<b>11</b>	<b>Pack Tray Bellyband</b>	Belt is attached around harness. No twists in belt.	<b>“Good bellyband.”</b>
<b>12</b>	<b>Chest Strap</b>	Chest strap is routed correctly. Velcro is seated securely.	<b>“Chest strap is routed correctly.”</b>
<b>13</b>	<b>Capewells</b>	Check each Capewell. Ears are seated. Slider is up.	<b>“Your ears are seated and your slider is up.”</b>
<b>14</b>	<b>Risers</b>	Risers are flat across shoulders. Parachute number is on smokejumper’s right or left shoulder (location of number may differ by base).	<b>“Your risers are flat, number is on the left/right, and you are jumping a small/medium/large.”</b>
<b>15</b>	<b>Harness</b>	Shoulder straps on properly (look for X on back).	<b>“You have a good X on your harness.”</b>
<b>16</b>	<b>Main Container</b>	Break tape is going through all four tie-off loops. Break tape is going through the static line. Tie-off loop on static line is pointing down at the seven o’clock position.	<b>“Static line is coming out the middle and tied off at the seven o’clock position.”</b>
<b>17</b>	<b>Due Date</b>	Due date is good. Rigger has signed the tape.	<b>“Main has a good due date.”</b>
<b>18</b>	<b>Harness</b>	Back strap of harness is not twisted.	<b>“You have no twist in your harness.”</b>

	Equipment	What to Check and Ensure	What to Say
<b>19</b>	<b>Static Line/Snap</b>	Free of knots. Excess stowed. Routed properly. Route static line over left shoulder of smokejumper and through the rubber band. Static line clip is functioning properly. Attach clip to reserve handle (attachment may vary according to base).	<b>“Your clip is good.”</b>
<b>20</b>	<b>Helmet, Gloves, PG Bag</b>	Ask smokejumper if they have helmet, gloves, and PG bag.	<b>“Helmet, gloves, PG bag?”</b>

**Important:**

1. If sequence is interrupted, begin again. If a problem is found, it should be corrected and the sequence can be restarted at the step immediately preceding the one uncovering the problem.
2. Actually check each step versus just vocalizing the step.
3. Always follow along with the person giving the Buddy Check to ensure steps are not being missed.
4. Do your own check on the aircraft prior to jumping.
5. The pre-jump safety checks of smokejumpers utilizing a ram-air system are to be performed only by qualified ram-air system spotters or smokejumpers.

**Notes**

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## Forest Service Round Spotter Commands

- Note: When dropping smokejumpers, the spotter should request from pilot any noticeable wind variances at streamer/drop elevations. Streamers are dropped from 1500 feet. Spotter signals to the smokejumpers the number in the stick.

Spotter Command	Details
<b>1. “Are you ready?” &amp; “Leg straps tight?”</b>	These two questions are asked of the first smokejumper in each stick, who answers for the entire stick. Being “ready” means you have been checked, PG bag is hooked up, and helmet is on. The smokejumper should protect the reserve handle when moving around, especially back by the door.
<b>2. “Hook up.”</b>	This command is given to the entire stick. Each smokejumper hooks up to the appropriate cable (horizontal/vertical/floor) by attaching the parachute static line clip with button up or facing smokejumper and safety pin should be inserted downward and slightly bent.
<b>Pre-Jump Briefing</b>	Should include as a <b>minimum</b> : jump spot confirmation, jump spot hazard identification (if any), estimated streamer drift, type of drop pattern, jump spot elevation, and pertinent wind info at jump elevation. End the briefing by asking if the smokejumper has any questions.
<b>3. “Get in the Door.”</b>	This command is given after the pre-jump briefing for round smokejumpers, to the first smokejumper in the stick. Round exits will be using the step or standing, depending on the type of aircraft.
<b>4. “Turning final, 1,500 ft. Static line(s) clear.”</b>	Confirmation given so that each smokejumper in the stick can hear. The spotter may have previously notified the smokejumper that their static line is clear, but this is a final check. Pilot confirms “On final, 1,500 feet” with spotter. This is minimum jump altitude.
<b>6. “Get Ready.”</b>	Command given just prior to slapping first smokejumper out the door.  <b>Rounds:</b> Slap only the first smokejumper in the stick. The spotter (and assistant spotter if present) will make a final visual check of each smokejumper prior to the exit. All smokejumpers should also be making a visual check of each other. Exit the aircraft only when signaled by the spotter. If the spotter discovers a safety problem and the pass is aborted, a “NO EXIT” signal will be given by the spotter to the smokejumper in the door and reinforced by a verbal command not to jump. The “NO EXIT” signal is the spotter’s arm blocking the door in front of the smokejumper’s face or the spotter placing his/her hand over the smokejumper’s face mask.

### Notes

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## Unit 2 – Parachute Training

### Chapter 3 – Exit Procedures



### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Exit Procedures</b>
<b>Objective(s):</b>	<p>Upon completion of the lessons in this chapter:</p> <ul style="list-style-type: none"> <li>• New trainees will be able to perform large door and small door exits following all correct procedures, both as first and second smokejumper (also third for large door).</li> <li>• New trainees will be able to perform correctly all parachute malfunction procedures.</li> <li>• Returning smokejumpers will refresh on exit procedures and perform small door exits, both as first and second smokejumper, and large door exits, as a first, second, and third smokejumper, following all correct procedures.</li> <li>• Returning smokejumpers will be able to perform correctly all parachute malfunction procedures.</li> </ul>
<b>Suggested Duration:</b>	To be determined by instructor.
<b>Training Aids Needed:</b>	To be determined by instructor.
<b>Notes:</b>	This lesson includes four progressive lessons for first-year smokejumpers.

### Overview

Successful and safe smokejumper operations require the completion of consistent exits from aircraft. A vigorous and stable exit position is fundamental in providing a good beginning to manipulating the parachute to a designated jump spot. Poor exits can result in twists or malfunctions, which may require precious time to correct and could result in the smokejumper missing the jump spot. A good exit is essential to a fluid parachute jump.

## Pre-Jump Exit Procedures

### Static Line Hook-Up

1. Instructor demonstrates procedure for hooking up static line snap to the appropriate cable with button up or facing smokejumper and safety pin inserted.
2. Instructor demonstrates awareness of proper static line routing over shoulder to cable.
3. Instructor demonstrates appropriate position near the exit door while receiving the pre-jump briefing.
4. Instructor demonstrates proper position prior to exiting mock-up, tower, or aircraft on appropriate commands.
  - a. **Large Door Exit Command:** Spotter slaps door sill to indicate trainee/jumper to position left toe on door sill.
  - b. **Small Door Exit Command:** Spotter verbally commands the trainee/jumper to “Get in the Door” with the first person placing left foot on step.

### Exit Signals

1. Only first smokejumper receives the signal, a slap from the spotter; second and third smokejumpers exit with a 2 to 3 second hesitation.
2. Large door exit signal is a slap to the calf or upper part of the leg.
3. Small door exit signal is a slap to the scapula or shoulder of exiting smokejumper.
4. **NEVER** exit from the tower or aircraft on a voice command.
5. In a “No Jump” or “Go Around” situation, the spotter will place his/her arm across in front of the smokejumper or a hand across the face mask of the first smokejumper.

### Basic Exit

#### Initial Thrust

1. Hand and feet placement.
2. Special attention to reserve parachute protection.
3. Equal thrust of legs and arms.
4. Eyes on the horizon.
5. Exit up 6 inches and out 36 inches from the aircraft.

## **Body Position**

1. Head with chin firmly against the chest, eyes open looking at the reserve handle.
2. Hands grabbing onto each leg pocket.
3. Elbows held firmly against the side of the body.
4. Feet and legs together, feet tucked (try to touch heels to butt while bringing knees up). (Cannonball)

## **Exit Count**

1. Count begins when smokejumper clears the door on exit.
2. "Jump thousand, 2 thousand, 3 thousand, 4 thousand, Look thousand."

## **Standard Checks with a Normal Opening**

1. Check canopy.
2. Check jump partner and separation.
3. Communicate with jump partner.
4. Check jump spot location.
5. Wind check.
6. Set up and landing checks.

## **Standard Checks with a Malfunction**

1. Perform correct emergency procedure for the malfunction.
  - a. Total.
  - b. Partial.

## **Progressive Practical Training (First-Year Smokejumpers)**

### **Progressive Lesson 1**

1. Explain reason and function of exit.
2. Explain ground rules for tower operations.
3. Explain grading system.
4. Review exit signals (slap on shoulder or leg).
5. Static line hook-up procedures.
6. Demonstrate large door position.

- a. Explain count, toggles, canopy check, and twists.
7. Use “Hit It” exercises on ground.
  - a. Individual jumps up 6 inches and out 36 inches, snaps into a good body position, and holds tightly through jump count.
  - b. Trainees can count and on “look thousand” look at imaginary canopy and reach for toggles.
8. Demonstrate the correct door position, stressing static line hook- up and safety by protecting the reserve handle.

### **Progressive Lesson 2**

1. Suit up in less than three minutes.
2. Review basic instruction, “Hit It” exercise.
3. Mock-up, tower or ramp.
  - a. Large door for one smokejumper.
  - b. Second smokejumper position.
  - c. Stress body position and exit vigor, up and out.
4. Tower
  - a. Explain tower procedures and safety.
  - b. One exit per trainee.
    - i. Large door.
    - ii. Single stick, first smokejumper position.

### **Progressive Lesson 3**

1. Suit up in less than three minutes.
2. Demonstrate a small door exit.
3. One smokejumper stick, small door.
  - a. One exit each trainee.
  - b. Second smokejumper assumes door position.
4. Two smokejumper stick, small door.
  - a. Two exits each smokejumper.
5. One smokejumper stick.
  - a. Three exits each, minimum.

6. Review main points.
  - a. Hook up static line.
  - b. Check canopy.
  - c. Second smokejumper hesitation.
  - d. Second smokejumper assumes first smokejumper position.

#### **Progressive Lesson 4**

1. Suit up in less than 2 minutes.
2. Tower or ramp.
  - a. Large and small door exits.
  - b. One smokejumper sticks (large and small door exits).
  - c. Second smokejumper assumes first smokejumper's position.
  - d. Start red tag on crosstie for simulated malfunction and pulling of the reserve.
  - e. Two smokejumper stick.
    - i. Each smokejumper to be involved in at least one exit of each type.
  - f. Three smokejumper stick.
    - i. Demonstrate on ramp or mock-up.

#### **Exit Procedures (Experienced Smokejumpers)**

1. Review hook-up and exit procedures for large door and small door exits.
2. Perform single smokejumper stick, small door, and then two smokejumper stick.
3. Repeat until smokejumper performs small door exit (first and second position), following proper exit procedures.
4. Perform single smokejumper stick large door and then two smokejumper stick.
5. Repeat until smokejumper performs large door exit (first and second position), following proper exit procedures.
6. Discuss third smokejumper position, large door, and go through a mock-up on the ramp or in the training area. This can also be simulated on the tower for correct foot placement and procedures.



## Unit 2 – Parachute Training

### Chapter 4 – Parachute Malfunctions and Other Emergency Procedures



#### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Parachute Malfunctions and Other Emergency Procedures</b>
<b>Objective(s):</b>	<p>Upon completion of this lesson, the student will be able to</p> <ul style="list-style-type: none"> <li>• Recite correct procedures for identifying parachute malfunctions.</li> <li>• Identify and describe the two classes of parachute malfunctions.</li> <li>• Identify and describe proper procedures for given parachute malfunctions.</li> <li>• Demonstrate verbally and physically proper procedures for reserve parachute deployment.</li> <li>• Describe steps necessary to avoid Mid-Air Collisions</li> <li>• While viewing Malfunction Training Video, accurately and without hesitation, recognize and perform appropriate malfunction procedures.</li> </ul>
<b>Suggested Duration:</b>	To be determined by instructor
<b>Training Aids Needed:</b>	<p><b>Classroom:</b> FS-14 Malfunction Training DVD, DVD player and monitor</p> <p><b>Simulator:</b> FS-14 Malfunction Training DVD, DVD player and monitor, structure to suspend fully-equipped smokejumper</p>

#### Overview

While parachute malfunctions in Forest Service smokejumper operations are not common, **they can and do happen**. To successfully avoid disastrous consequences when a malfunction or emergency develops, every smokejumper must be trained to recognize **all** malfunctions and **to correctly apply** the appropriate emergency procedures.



## Procedures for Identifying Parachute Malfunctions

### Exit Procedures

The possibility of a malfunction should be anticipated each time a smokejumper exits the aircraft.

### Exit Counting Procedure

To correctly estimate the time of deployment, the correct procedure is:

1. Commencing immediately upon exiting the aircraft: Count “**Jump thousand...two thousand...three thousand...four thousand...look thousand.**”
2. Looking up on the count of “look thousand,” the smokejumper should perform the canopy check.
3. It is important that all smokejumpers perform the count at the correct tempo. Counting too fast, the canopy will still be deploying and the smokejumper will be performing canopy checks out of order. Counting too slow will use precious time that would be needed to correct a potential malfunction of the system.

## Types of Parachute Malfunctions

Parachute malfunctions are divided into two classes: (1) total malfunctions, and (2) partial malfunctions.

### Total Malfunctions

Total malfunctions occur when the parachute canopy does not deploy or inflate. The parachute canopy may remain with the parachute container or D-bag and the smokejumper essentially free falls.

Ways in which a total malfunction may occur with an FS-14 include:

1. A total malfunction will occur if a smokejumper exits without hooking up the static line.
2. If the static line snap comes off the static line cable on exit.
3. If the static line cable in the aircraft breaks.
4. The static line is cut on exit.

Correct procedures to reduce total malfunctions include:

1. Jumpers must hook up their own static line to the static line cable. The spotter will check to see that the static lines are properly hooked up as a safety check, but it is every smokejumper’s responsibility to ensure their static lines are correctly hooked up.

2. Each smokejumper must correctly insert the safety wire through the hole in the static line snap to prevent the snap from being pulled off the cable during the exit.
3. Each smokejumper unit must ensure that the components of each parachute system (D-bags, static lines, etc.) are in air worthy condition, the static line anchor cables in the aircraft are properly installed, and that there are no exposed sharp edges in the aircraft door area which could cut a static line.

**Table 1 -- Time Available for Reserve Deployment in a Total Malfunction**

<b>Time (in seconds)</b>	<b>Distance (in total feet)</b>
1	16
2	48
3	96
4	160
5	240

**Table 2 -- Earliest Chance to Pull Reserve Handle**

<b>Time (in seconds)</b>	<b>Distance (in total feet)</b>
6	336
7	448
8	576
9	720
10	880
11	1,056

**Table 3 -- Last Chance to Deploy Reserve Parachute and Have it Be Effective**

<b>Time (in seconds)</b>	<b>Distance (in total feet)</b>
12	1,232
13	1,408
Ground	Ground
14	1,584

**Partial Malfunctions**

A partial malfunction occurs when a parachute canopy has opened partially or is damaged during deployment.

1. The smokejumper may not have full control of canopy.
2. A partial malfunction slows the descent rate of the smokejumper.

3. There is more time to deal with a partial malfunction than a total malfunction.
4. The rate of descent may be great enough to cause serious injuries or death if emergency procedures are not initiated.

**Table 4 -- Partial Malfunctions**

<b>Type of Partial Malfunction</b>	<b>Cause/Description</b>	<b>Measures</b>
Partial Opening	<p>One or more gores of the canopy became entangled during opening.</p> <p>Similar in appearance to Line Over.</p>	<p>Probably not able to clear the malfunction.</p> <p>Check your rate of descent against your jump partner.</p> <p>Deploy your reserve if your rate of descent is judged to be too great.</p>
One Riser Release	<p>Riser becomes unattached from harness on one side, caused by improper Capewell connection.</p> <p>Canopy will have slow built-in turn.</p>	<p>Attempt to regain control of loose riser.</p> <p>Maintain situational awareness.</p> <p>Deploy reserve if descent rate is judged to be too great.</p>
Cross Tie or Suspension Line Entanglement	<p>Caused by poor body position during exit.</p> <p>Cross tie or suspension lines become entangled in smokejumper's lower body.</p> <p>Smokejumper's body position is altered with feet possibly raised.</p>	<p>Smokejumper should attempt to clear suspension lines from lower body.</p> <p>Suspension lines may need to be cut to remove entanglement.</p>
Blown Canopy	<p>A canopy with holes or tears.</p>	<p>Check your rate of descent against your jump partner.</p> <p>Deploy your reserve if your rate of descent is judged to be too great.</p>

Type of Partial Malfunction	Cause/Description	Measures
Broken Steering Line(s)	This could occur from a rigging error or opening shock.	<p>If only one line on one side breaks the smokejumper may have limited steering control on the affected side. The smokejumper can expect a slower turn rate to the affected side and hand placement might not be even to acquire a straight flight. The smokejumper will need to maneuver the parachute by using his good steering line and rear riser turns on the broken line side while minimizing toggle inputs.</p> <p>Should both lines break, the smokejumper will need to maneuver by using both rear risers being careful to face into the wind upon landing.</p> <p>In either case, the canopy will have diminished performance characteristics and the smokejumper should plan accordingly. Final approaches should be flown requiring minimum canopy manipulation.</p>
Steering Line Connector Link Entanglement	<p>Steering line entangled with connector link.</p> <p>Parachute can be maneuvered, but will have an increase in toggle pressure.</p>	<p>Attempt to clear steering line by pulling down appropriate riser and manually clearing steering line.</p> <p>Maintain awareness of jump partner.</p>

Type of Partial Malfunction	Cause/Description	Measures
Line Twist(s)	<p>Line twists are not normally considered to be a partial malfunction unless they are excessive.</p> <p>Caused by the movement of the D-bag outside of the airplane or poor body position of the smokejumper.</p> <p>Excessive line twists make the canopy not steerable, increasing the probability of missing the jump spot.</p>	<p>Procedure for clearing line twists are to reach up and put tension on the twisted lines by spreading the risers. Scissor kicking the legs will help unwinding.</p> <p>The best way to prevent line twists is to perform a vigorous, tight exit out the door.</p>
Line Over	<p>One or more suspension lines pass over the top of the canopy and remain there after inflation.</p>	<p>May be cleared by the smokejumper reaching up and pulling on the line(s) to cause it to slip off.</p> <p>After one attempt to clear the line(s), deploy the reserve if rate of descent is judged to be too great.</p>
Total Inversion	<p>The main canopy opens inside out due to a rigging error or material going through a canopy modification.</p> <p>Though this is considered a malfunction, it does not require deployment of the reserve because the canopy is complete and the rate of descent is not affected.</p> <p>Flight characteristics of the parachute will now be reversed. The canopy will drive backwards and steering will be reversed.</p> <p>Toggle pull may be more difficult due to twist in the riser groups.</p>	

Type of Partial Malfunction	Cause/Description	Measures
Full Streamer	Parachute canopy is deployed but fails to inflate, Also called a “full streamer.” A full streamer will look as if a pole-like tail of material is trailing above the smokejumper. The descent rate is essentially the same as free fall. Full Streamers are uncommon in Forest Service smokejumper operations.	

## Malfunction Reporting

All malfunctions shall be reported immediately to the loft manager or their assistant and the appropriate forms shall be completed.

## Reserve Deployment Procedures

### Deploying Your Reserve

1. **Descent Rate:** Checking the rate of descent against that of your jump partner is a good way to determine if the rate of descent is significantly increased. If jumping in single stick configuration, descent rate is determined by “ground rush” or air moving through the smokejumper’s helmet. If the integrity of the canopy is compromised or the rate of descent is excessive, the reserve should be deployed.
2. **Tight Body Position:** This will decrease the chance of the smokejumper’s legs becoming entangled in the reserve as it deploys. It is especially important if the smokejumper is tumbling during the malfunction.
3. **Look at the Handle:**
  - a. Note the color of the handle to identify.
  - b. Look at the handle to locate it, otherwise the smokejumper will be clutching and clawing the harness, reserve and suit, wasting valuable seconds trying to find it.
4. **Reach for the Handle:**
  - a. One hand should reach for the handle, with the other hand at the smokejumper’s side.
  - b. The center pull handle (red) can be pulled by either hand.

5. **Pull the Handle:** Pull the handle out and away to open the reserve; then move the hand to the side of the body, arm extended.
6. **Head to the Side:** Falling at a high rate of descent, the smokejumper can avoid the rush of canopy material by turning the head to the side.
7. **Check Canopy:** Check to verify fully inflated canopy.

### **Reserve Main Entanglements with a Full Streamer**

In a full streamer malfunction, there is a possibility that the reserve canopy will entangle in the main canopy. The clearing procedure is:

1. Watch the reserve deployment closely.
2. If the reserve is entangled, quickly pull the reserve down, hand over hand and re-deploy by throwing it back out.

### **Reserve Fails to Inflate**

1. If the reserve will not inflate after opening the chest pack, the descent rate is probably not great enough to need the reserve.
2. The reserve may not pull out all of the line stows and the skirt may remain causing canopy to remain uninflated. The smokejumper should grab the lines and shake to open the skirt and to facilitate inflation.
3. If after a couple of attempts the reserve still does not inflate, pull the canopy material back in, gather it up as best as possible and release from the harness or tuck it between the smokejumper's legs.

### **Both Parachutes Open**

1. This would occur if the smokejumper deployed the reserve parachute for a malfunction and the deployment cleared the malfunction, usually a partial malfunction.
2. Each parachute will be offset approximately 15 degrees as each parachute will spill some air that it would normally hold. The amount of air spilled is compensated by the additional canopy support.
3. Rate of descent is about normal.
4. There will be no canopy steering control.
5. If the main canopy clears the malfunction, it would be desirable to release the reserve. Once the reserve is released from the harness rings, the ability to steer the main parachute is restored.
6. Do not become so task-focused in releasing the reserve that you lose situational awareness. If you are unable to release reserve, it is vitally important that you do a good parachute landing fall (PLF) due to body position with the reserve out.

7. At 250 ft. altitude, abandon the attempt to release the reserve and prepare for a normal PLF. Releasing the reserve below 200 feet will cause oscillations due to the main straightening and vacating the space left by the reserve.

### **Static Line Entanglement**

1. This would occur if the smokejumper exited the aircraft with the static line misrouted and entangled in some way.
2. The smokejumper would be “in tow” and trailing along behind the aircraft.
3. Emergency procedure is to signal the aircraft that you are conscious and unhurt. The signal is to put your hands on the top of your helmet.
4. This is also the signal that you are prepared for the possibility that the spotter will cut the static line freeing you from the “in tow” situation. You must be prepared to deploy your reserve immediately after being cut away.
5. A reserve that is deployed with a smokejumper “in tow” could result in serious injury or death of the smokejumper and/or catastrophic damage to the aircraft.

### **Mid-Air Collision Avoidance and Mitigations**

Given the FS-14's inability to consistently achieve vertical separation, it is critical that smokejumpers focus on developing horizontal separation and maintain situational awareness throughout the entire jump sequence.

1. Prior to exiting aircraft, smokejumpers in a two person stick should develop a flight plan to achieve horizontal separation.
2. After opening and canopy checks, locate jump partner(s) and develop horizontal separation.
3. Communicate verbally with your jump partner(s).
4. Low smokejumper has the right of way.
5. Recognizing that below 250 feet AGL is a critical zone, smokejumpers should locate jump partner(s), and vocalize “turning final” prior to turning on final.
6. In the event of a potential head on collision, both smokejumpers involved should make right hand turns until they have mitigated the potential collision.
7. In the event of a convergence collision, smokejumpers should turn in the appropriate direction to avoid their jump partner(s)
8. In the event of a collision, spread arms and legs to avoid passing through lines.
9. Avoid passing over lower smokejumpers when close (less than 100 feet). The lower person will steal your air, causing a potential for you to drop onto their canopy.



10. If you land on another canopy, carefully walk off, avoiding slots of modifications.

## Malfunction Video Training

Malfunction video training is designed to reinforce and evaluate the learning of emergency procedures presented earlier in this lesson. The trainee must perform, without hesitation, the appropriate malfunction procedure for the given malfunction presented on the screen.

This training is most effectively accomplished in a classroom setting followed by a practical skills session.

### Classroom Session

#### Equipment Needed

- FS-14 Malfunction Training DVD
- DVD player and monitor

#### Malfunction Training Video Categories

In a classroom setting the instructor will show the FS-14 Malfunction Training DVD. This video shows FS-14 malfunctions in the following categories:

**Table 5 -- FS-14 Malfunction Training Video Categories**

Total Malfunctions	Partial Malfunctions
Normal opening.	Normal opening.
Static line not hooked up.	Partial opening.
Static line cut during exit.	One riser release.
	Steering line / connector link entanglement.
	Blown panels / multiple holes.
	Line twists.
	Total inversion.
	Full streamer.

**Instructor Note:** It is advised to stop the video after each section to discuss malfunction identification and the appropriate response.

### Malfunction Simulator Session

The malfunction simulator involves an interactive video, with the student responding to a variety of parachute deployment scenarios with instructor(s) evaluating the trainee's response.

Instructors are encouraged to create realistic scenarios by altering smokejumper's body position and equipment.

#### Equipment Needed

- FS-14 Malfunction Training DVD

- Structure to suspend fully equipped smokejumper
- DVD player and monitor

### **Sequence**

1. Jumper must be in complete jump gear, PG bag included and “dummy” reserve.
2. Leg straps tight?
3. Jumper is then suspended from risers via step ladder.
4. Normal spotter commands given, turning final at 1500 feet, you’re clear, etc.
5. Get ready.
6. SLAP (video should have been cued up to a given malfunction and play is pressed at the slap to ensure correct timing of video and trainee count).
7. Trainee assumes correct exit position and vocalizes exit counting procedure.
8. Trainee looks up at screen, verbally states what they are seeing and responds appropriately.

### **Evaluation Criteria**

Evaluation criteria include:

1. Correct body position.
2. Accurate jump count.
3. Verbalizing after exit procedures (check canopy, check JP, check spot).
4. Canopy malfunction identification.
5. Correct response to given malfunction.

## **Parachute Malfunctions and Other Emergency Procedures Evaluation Parameters**

Upon completion of this training unit, the student must:

1. Recite correct procedures for identifying parachute malfunctions.
2. Identify and describe the two classes of parachute malfunctions.
3. Identify and describe proper procedures for given parachute malfunctions.
4. Demonstrate verbally and physically proper procedures for reserve parachute deployment.
5. Describe steps necessary to avoid mid-air collisions
6. While viewing Malfunction Training Video, accurately and without hesitation, recognize and perform appropriate malfunction procedures.



## Unit 2 – Parachute Training

### Chapter 5 – Parachute Manipulation



#### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Parachute Manipulation</b>
<b>Objective(s):</b>	Upon completion of this unit, trainees will be able to: <ul style="list-style-type: none"><li>• Explain the performance of smokejumper parachutes.</li><li>• Be able to define and describe the terms and concepts of parachute maneuvering.</li><li>• Satisfactorily maneuver a parachute to the intended landing spot within performance parameters.</li><li>• Be able to identify the various ground hazards.</li><li>• Describe safety procedures relative to canopy collisions and hazardous landings.</li></ul>
<b>Suggested Duration:</b>	To be determined by instructor.
<b>Training Aids Needed:</b>	To be determined by instructor.
<b>Notes:</b>	This lesson occurs in three phases: (1) presentation in a classroom setting, (2) simulator training, and (3) actual parachute jumps.

#### Overview

The ability to steer and maneuver a parachute consistently to within approximately 50 feet of a pre-selected spot on the ground is one of the most important skills a smokejumper must possess. Snag patches, rocky areas, as well as streams or ponds, often lie in close proximity to landing areas on fire jumps. If you, as a smokejumper, are to be able to perform your job safely, you must be able to maneuver your parachute to avoid these obstacles and arrive at your intended landing zone.

#### Training Outline

The following outline includes topics that need to be presented in a classroom setting prior to the simulator and then performing actual parachute jumps.

## **Pre-jump Plan**

### **Size-Up Jump Spot and Area**

1. Size.
2. Shape (orientation to wind line).
3. Slope.
4. Alleyways.
5. Alternate jump spots.
6. Hazards – in and around.

### **Assess Wind Conditions**

1. Streamers.
2. Smoke.
3. Weather.
4. Terrain induced or modified.
5. Listen for spotter's briefing of previous jumpers.

### **Develop Basic, Initial Strategy for Jump**

1. Approach.
2. Flight.

### **Plan with Jump Partner**

1. Determine first smokejumper.
  - a. Heavier smokejumper first.
  - b. Heavier in weight range (three sizes of parachutes).
2. Plan for horizontal separation.
  - a. Split the wind line.
  - b. Approach.
  - c. Intended area within jump spot for landing.

### **Spotter Briefing**

1. Modify jump strategy.
2. Modify changes to plan with jump partner.

## **Exit**

Refer to Training Guide, Unit 2, Chapter 3, Exit Procedures.

## **Initial Procedures**

1. Count.
2. Check canopy.
3. Grab toggles.
4. Check JP (jump partner).
  - a. Fly parachute toward planned flight zone, check wind drift, check parachute performance.

## **Flight**

1. Parachute maneuvers and performance.
  - a. Observe FS-14 parachute manipulation video and written materials that go along with video about maneuvering and performance.
2. Maneuvering strategies.
  - a. S-turns.
  - b. Backing.
  - c. Remain upwind of the spot for a good portion of the jump.
  - d. Face the jump spot while using braking to control forward speed.
  - e. Deliberate and purposeful maneuvers.

## **Situational Awareness**

1. Jump Partner.
2. Position awareness in relation to jump spot.
  - a. Wind line.
  - b. Wind cone.
  - c. Angle to jump spot.
  - d. Mis-spotted/twisted.
3. Changing conditions.
  - a. Wind changes.
  - b. Changes in plan.

- c. Seeing unfamiliar terrain and obstacles as you get close to the ground.

## Approach

### Approach Summary

No to Low Wind	Low to Moderate Wind	Moderate to High Wind	High Wind	Other Less Desirable Approaches
With-the-wind/base/into-wind final  With-the-wind/crabbing base/into-wind final	With-the-wind/into-wind final	Quarter in	Back in	No wind approach from any direction  Running (with any wind).  Low hook turn  Straight down

### Set-Up to Land

1. For body position, refer to Training Guide, Unit 2, Chapter 6, Landing Techniques.
2. 100 feet AGL (approximately).
3. Into the wind.
4. Parachute controlled to appropriate ground speed.
5. Minor corrections (maintaining into wind, hazard avoidance).

### Power Line Landings

In the event of a power line landing, the smokejumper's main concern is to avoid touching two of the wires at the same time. Maintain good body position and try to avoid the wires.

### Timber Landings

1. If a tree landing is unavoidable, hands must be kept on toggles. Landing with brakes on should be accomplished by rotating hands and elbows into the body while still holding toggles. Keep hands and elbows in to prevent grabbing for limbs or injuring elbow.
2. Make sure you are going to hang securely by aiming at a point 15 feet from the top of the tree. This will allow the canopy to cover the tree and avoid a poor hang-up.

3. If a tree landing is imminent, don't try to avoid the tree by maneuvering around it. This has caused many injuries to smokejumpers as the canopy collapses as it snags on branches rather than capping the top of the tree.
4. Once secure, communicate to your jump partner and to the aircraft, if possible.

### **Mid-Air Collision Avoidance and Mitigation**

1. After opening and canopy checks, locate jump partner(s) and avoid them.
2. Develop a plan with your jump partner(s) in the aircraft and communicate verbally and audibly with your jump partner(s) during parachute flight.
3. Low jumper has the right of way.
4. In the event of a potential head on collision, both smokejumpers involved should make right-hand turns until they have mitigated the potential collision. The exception to this would be if the smokejumpers are flying offset to each other's right, in which case a left turn is the obvious maneuver to avoid a canopy collision.
5. In the event of a collision, spread arms and legs to avoid passing through lines.
6. Avoid passing over lower jumpers when close (less than 100 feet). Lower person will steal your air, causing a potential for you to drop onto their canopy.
7. If you land on another canopy, carefully walk off, avoiding slots of modifications.

### **Examples of Task Progression and Evaluation Methods**

1. Trainees view FS-14 manipulation video. Consider written test or have open discussion with class.
2. Classroom lecture to reinforce video and cover peripheral issues. Consider written test.
3. Begin practicing standard initial checks in the training units.
4. Simulator training.
  - a. Practice parachute maneuvers.
  - b. Practice parachute maneuvers in relation to wind.
  - c. Practice jump strategies.
5. Evaluation Criteria.
  - a. Evaluation parameters are included in the Training Guide, Unit 2, Chapter 11, Practical Jump Experience.





## Unit 2 – Parachute Training

### Chapter 6 – Landing Techniques

#### Lesson A -- Parachute Landing Falls



### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Parachute Landing Falls</b>
<b>Objective(s):</b>	Trainees shall perform correct parachute landing falls (PLF) according to approved techniques outlined in this training. Trainees will be able to perform parachute landing falls forward, quartering, and backwards facing both right and left, without error, to the satisfaction of the instructors.
<b>Suggested Duration:</b>	To be determined by instructor.
<b>Training Aids Needed:</b>	To be determined by instructor.
<b>Notes:</b>	This lesson has a seven-part progression. See Table 1, Parachute Landing Fall Training Progression.



### Overview




The parachute landing fall is a very important phase of parachute training. Most injuries to smokejumpers result from improper parachute landings. Smokejumpers must learn to land with the correct degree of relaxation, and perform a proper landing fall to ensure a maximum distribution of shock over their entire body upon contact with the ground. Distributing the shock is a critical element in the prevention of jump injuries.

### Parachute Landing Falls

Parachute landing falls (PLF) can be made either to the left or right, forward left or forward right, depending on the body position when the smokejumper makes contact with the ground.

**Parachute Landing Fall (PLF)**

PLF Stage	Photograph Example
<p><b>Preparing to Land</b></p> <p>Have an instructor demonstrate a roll utilizing the approved techniques of the parachute landing fall. A flight suit with a stripe sewn over the points of contact can aid in illustrating proper procedures. A roll matching the stripe to a straight line laid out on the ground would cover all the contact points in one smooth motion.</p> <p>Keep body erect, toes pointed in the opposite direction of the PLF, knees together and slightly bent, body relaxed, and hands on toggles. Keep eyes ahead and down 45 degrees and arch the hips in the direction of the roll. (See Figure 1.)</p>	<p><b>Figure 1</b></p> 
<p><b>Performing a Parachute Landing Fall</b></p> <p>The parachute landing fall is performed in one smooth, fluid motion. There should not be any excessive shock on any one part of the body.</p> <p>Initial contact with the ground will be made on the balls of the feet, knees slightly bent and thrown in the direction of travel. At the same time, tuck the elbows and chin into the chest and rotate the body to expose the back. (See Figure 2.)</p>	<p><b>Figure 2</b></p> 

PLF Stage	Photograph Example
<p><b>Initial contact</b></p> <p>The five contact points of the body should touch the ground in this order:</p> <ol style="list-style-type: none"> <li>1. Feet.</li> <li>2. Calf.</li> <li>3. Thigh.</li> <li>4. Buttocks. (See Figure 3.)</li> <li>5. Diagonally across the back.</li> </ol>	<p style="text-align: center;"><b>Figure 3</b></p> 
<p>At this point, the smokejumper is lying on one side, legs together, elbows pinned to the chest, and grasping the toggles. (See Figure 4.)</p>	<p style="text-align: center;"><b>Figure 4</b></p> 
<p>The smokejumper's feet are brought across the body in the direction of momentum. (See Figure 5.)</p>	<p style="text-align: center;"><b>Figure 5</b></p> 

## Key Points to Emphasize During Instruction

1. The parachute landing fall (PLF) must be performed in one smooth and continuous motion.
2. Smokejumpers should not look directly at the ground when preparing to land. They should look out in front at approximately a 45 degree angle, to determine forward speed, and should not anticipate contact.
3. The actual PLF should be done instinctively. A smokejumper should not have to think through each step of the PLF.
4. Hands must remain on the toggles during entire execution of the PLF. Dropping the arms for support or contacting the ground with the elbows or hands must not be allowed.
5. Hands, arms, elbows, and chin must be tucked into the chest from braking position as soon as smokejumper contacts the ground.
6. Landing on the sides of the feet must not be allowed.
7. Excessive shock on the feet and legs must not be allowed.
8. Feet and knees must be kept together.
9. Making ground contact directly on the knees must not be allowed.
10. Avoid a direct backward PLF; instead, twist the body in the direction of the PLF.
11. The chin/head must be tucked down for protection as initial contact is made.

## Parachute Landing Fall Practical Training Outline

Parachute landing falls are taught in seven lessons as follows:

**Table 1 – Parachute Landing Fall Training Progression**

Lesson	Training Topics
1	Instructor will explain and demonstrate the proper parachute landing fall. Practice forward PLF (left and right). Start from the standing position. Rolling down a slight incline will aid the smokejumper to complete the PLF. Practice backward PLFs. Start the smokejumpers from the standing position.
2	Practice forward and backward PLFs from a standing position with the gear on. Practice forward PLFs off of the low ramp.

Lesson	Training Topics
3	Practice forward and backward PLFs off a low ramp with gear on. Practice forward PLFs on a landing simulator and or low ramp.
4	Practice forward, left and right side PLFs on the landing simulator and/or low ramp.
5	Practice forward, left and right side, and backward PLFs on the landing simulator and/or low ramp.
6	Practice all variations of PLFs on the landing simulator and/or low ramp.
7	Practice all variations of the PLF on the landing simulator and or low ramp. Final evaluation period.  All trainees must consistently be able to perform a proper PLF, forward, quartering, and backwards to the right and left, before being permitted to make a parachute jump.  Extra training may be scheduled for those trainees who cannot perform all correct techniques of the six basic PLF positions.  Returning smokejumpers must also be able to perform a proper PLF, forward, quartering, and backwards to the right and left, before making a refresher/requalifying jump. Training sessions should be consistent to allow the trainee to perform the six basic PLF positions correctly.

## Parachute Landing Fall Final Evaluation Parameters

1. Trainees shall correctly apply the accepted techniques of the parachute landing fall consistently during training.
2. For final evaluation (Lesson 7), trainees shall demonstrate performance of the six basic PLF positions following all correct procedures.
3. During training, practice, and refresher jumps; smokejumpers will consistently demonstrate the ability to apply correct techniques of the parachute landing fall. Each landing will be evaluated.
4. All parachute jumps and landing falls should be critiqued to monitor performance and correct improper procedures. This is very important.

## Landing Techniques Review

The mechanics of the parachute landing fall are very simple; however, certain natural instincts or reflexes must be overcome to perform the PLF satisfactorily.

These are natural instincts or reflexes are:

- Taking the shock entirely on the feet and legs when landing.



## Unit 2 – Parachute Training

### Chapter 6 – Landing Techniques

#### Lesson B – Water Landings



#### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Water Landings</b>
<b>Objective(s):</b>	To provide each smokejumper with the knowledge and skills necessary to deal with unintentional water landings.
<b>Suggested Duration:</b>	To be determined by instructor.
<b>Training Aids Needed:</b>	To be determined by instructor.

#### Overview

While infrequent, water landings present a potential hazard in smokejumping. The dangers can be reduced by providing each smokejumper with the knowledge and skills necessary to deal with unintentional water landings.

#### Prior to Water Landing

1. Steer for the most accessible land.
  - a. Wind direction may make the far shore more accessible.
  - b. Don't discard any gear – keep steering.
  - c. Seek an alternative spot such as a sand bar, island, or shallow water.
2. Inform your jump partner that you are landing in water.

#### Water Landing

1. Turn into the wind.
2. Land in the water while performing a standard PLF.



- a. The water may be shallow.
- b. There may be hidden obstacles beneath the water surface.
3. In running water, attempt to make the parachute land downstream from you.
4. In high winds or in running water, release the Capewells immediately upon completing the PLF.

## Water Impact

### Equipment Response

1. A fully suited smokejumper will float indefinitely--do not jettison jump gear! Gloves may be discarded if they are slippery.
2. Estimated flotation times for components are displayed in Table 1.
3. Low porosity main canopy will retain trapped air once in the water. Maintain an air bubble around your helmet throughout the clearing procedure to reduce the chance of claustrophobic panic or asphyxiation.
4. Reserve Knife: The hook-type reserve knife is very difficult to use on canopy material and cannot be considered an alternative method of clearing the canopy itself. The knife is very effective with shroud line entanglement.

**Table 1 – Estimated Flotation Time for Components**

<b>Component</b>	<b>Estimated Float Time (in minutes)</b>
Main Canopy	3 to 6
Reserve	3+
Shroud Lines	0 to 1
Jump Suit	Indefinitely

### Jumper Response

1. Avoid panic.
2. Water will rush into helmet.
3. Canopy may settle over the smokejumper, causing claustrophobia.
4. Helmet and mask will provide an ample air supply under a wet canopy for the smokejumper to clear the parachute.
5. Beware of entanglement in the shroud lines or anti-inversion net.
6. Running water may cause buffeting.
7. The smokejumper may land face down in the water. If being towed face down by running water, roll over on your back as quickly as possible.

8. Remember: The best defense is always calm, deliberate action.
9. Float and swim on your back.
  - a. Arm and leg movement is restricted by jump gear.
  - b. Back paddling is best method of getting to shore.
  - c. Water in helmet may make breathing difficult.
10. Get clear of the canopy, shroud lines, and anti-inversion netting. If the canopy does settle over you:
  - a. Keep legs together, arms close to chest. Keep calm, think clearly, and act decisively.
  - b. Reach over your head and draw canopy or lines over your body to your stomach.
  - c. Look at canopy and determine the shortest direction to skirt. For FS-14, follow radial seam to skirt.
  - d. Gather the parachute until out from under canopy.
  - e. Swim clear from the parachute and lines.
5. Release the Capewells if still attached, but hold onto the risers.
6. High winds and/or running water increase the danger of being entangled or towed.
  - a. Release the Capewells immediately upon completion of PLF.
  - b. Be ready to use the reserve knife, if necessary.
7. In rapids, keep your helmet on and float feet first downstream to ward off obstacles.

### **Parachute Retrieval**

It should be emphasized to the smokejumper that their safety will supersede any attempt at parachute retrieval. If the smokejumper feels their life is in jeopardy due to cold water temperature, distance from shore, or they are just uncomfortable in the water, the parachute should be abandoned, allowing the smokejumper to focus on swimming quickly to shore.

Three methods of retrieving a parachute in the water are:

1. Throw risers onto the canopy, hook the apex of the parachute over the toe of the boot, and swim to shore with the parachute.
2. Grasp a portion of the parachute near the apex and swim to shore with parachute.

3. Attach the letdown rope to the parachute or riser and swim ashore paying out the rope as you go.

Snags on the bottom or water temperature may determine which method you choose.

## Ice Landings

1. Generally, ice is scarce and thin during jump season, so a smokejumper will go through it and into the water.
2. Perform a good PLF. Thick ice is a particularly hard surface.
3. If you break through the ice, crawl onto the ice surface as quickly as possible, yell for help, release the canopy, and crawl toward shore.

## Water Landing Simulation

Water landing simulation may be done during rookie training. Every smokejumper should go through a water landing simulation at least once. Subsequent refresher training should consist of a review of the lecture material in a classroom or at the training units.

1. Equipment and resources needed.
  - a. Deep pool with a high diving board or similar environment. (A large fold-a-tank may be substituted if a water source is not available).
  - b. EMT or CPR qualified personnel and first aid equipment.
  - c. Swim fins and masks for 3 to 4 assistants.
  - d. Full set of jump gear (including a PG bag), a packed reserve parachute and a dry main canopy for each smokejumper.
2. Review previous discussion for water landings.
3. Demonstrate.
  - a. Have one instructor jump into the water with full jump gear. This will show floatation qualities of the jump suit and proper floatation and swim attitude in the water.
  - b. Show proper movements of arms and legs in clearing canopy and lines over smokejumper.
4. Individual practice.
  - a. Position a smokejumper in jump gear at the end of the diving board.
  - b. Hook canopy to the Capewells.

- c. Use an assistant on the board behind the smokejumper to hold the shroud lines clear as the smokejumper jumps into the water, making sure that all lines are clear of the board.
- d. Use assistants to cover the smokejumper with the canopy so that there is moderate entanglement.
- e. Allow the smokejumper to free him/herself, following approved procedures and techniques. (See Figure 1.)
- f. Assistants in water should monitor progress and ensure for smokejumper trainee safety.
- g. Following each practice session, critique the performance of each trainee.
- h. Repeat the process for each trainee.

**Figure 1 – Water Landing Simulation**



## **Water Landing Practice Jump**

An optional water landing practice jump may be performed. While good experience, the knowledge gained from a live jump versus pool practice is negligible and requires a great amount of logistical support in equipment and personnel.

1. Equipment needed at the jump spot (lake).
  - a. A minimum of three instructors with masks and fins, and one or two rafts or boats with minimum one smokejumper each.
  - b. There should be at least one qualified EMT present with medical gear.
2. Procedures for instructors.
  - a. Stay near each smokejumper as they clear canopies and shroud lines. Do not offer assistance unless trouble develops.



## Unit 2 – Parachute Training

### Chapter 7 – Letdown Procedures



#### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Letdown Procedures</b>
<b>Objective(s):</b>	Upon completion of these lessons, the trainee will be able to safely and efficiently descend to the ground from the letdown simulator using approved procedures and techniques. These techniques will also be carried forth into the smokejumping environment.
<b>Suggested Duration:</b>	To be determined by instructor.
<b>Training Aids Needed:</b>	To be determined by instructor.

#### Overview

Often smokejumpers, either intentionally or unintentionally, make timber landings when parachuting to smokejumper missions. Executing a quick, safe letdown is essential if the smokejumper is to reach the ground safely. To avoid the rise of serious injury or a fatality, it is imperative that the trainee follow all of the correct procedures.

#### Letdown Procedures

1. Trainees should view the slide tape or a video illustrating proper letdown procedures.
2. Trainers will demonstrate the proper coiling of the letdown tape or rope<sup>1</sup>. It is necessary to have a rope that can be dropped from 150 feet or more and deploy without tangling. A bird's nest coil or rope bag is the approved method of stowing the rope.
3. Demonstrations and training should be conducted using the following tested and approved letdown procedures and standards. Two basic letdown

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<sup>1</sup> In this lesson it will be referred to as a letdown rope.

systems covered in this lesson are both Capewell release letdowns. Both systems employ the use of a carabiner, but one system uses the carabiner as an integral part in the event of a two-rope letdown or the need to tie off during descent.

4. Have an experienced smokejumper demonstrate a correct letdown as the instructor verbally explains each step. Demonstrate the letdown completely.

### **Capewell Release Letdown with a Tie-Off**

This letdown method employs the use of a locking gate carabiner which is attached to the standard smokejumper suit. The carabiner is attached by running it through the same loop that attaches the right friction ring (or 'D' ring) to the jump pants. The mechanics of making this letdown are as follows:

1. Check to see how well your parachute is hung in the tree. If at all possible, the smokejumper should attempt to pull themselves over to the tree trunk or a large live limb (+4") and tie off there. All movements should be careful, smooth, and fluid. Optional Safety Device: The K-palm letdown safety device may be used to secure a smokejumper to a limb or bole of the tree to free up both hands in order to perform the letdown procedure.
2. Starting at the top and working down, the smokejumper will check suspension lines around the helmet, under the chin, arms legs, and harness. Make sure all lines are clear of the body.
3. Do not remove helmet or gloves. They will be needed during the descent for protection against limbs and rope burns.
4. Release the following in order from top to bottom:
  - a. The FS-14 reserve parachute by releasing both safety pins and riser snaps. Release the bottom right fastex snap, but not the left one, which allows the reserve to hang by the left fastex. Let the reserve hang to the left.
  - b. Release the right fastex snap on the PG bag and allow it to hang by the left fastex. If a small carabiner is used as a safety device, release the carabiner from the handle of the PG bag now.
  - c. Release the back tray and drop it to the ground. This will avoid the possibility of the suspension lines hanging up on the container. (It may be desirable to throw the back tray to the ground with vigor to avoid having it hang up in the tree.)
5. Pull out the friction rings sewn into the jump pants and make sure they are not twisted. The carabiner should also be pulled out at this time. The carabiner should be to the outside of the right friction ring with the gate up and the opening away from the smokejumper (Figure 1).

**Figure 2**



6. Reach into the right leg pocket and pull out the running end of the letdown rope. Make sure to leave the rest of the rope in the leg pocket until the letdown rope is tied to the riser. This will ensure that the rope is not dropped and lost. Leaving this pocket tied will ensure against dropping the rope. Pull out about six to ten feet of rope.
7. Pass the letdown rope through the friction rings two or three times depending on body weight. (Two wraps are sufficient for most smokejumpers, however those over 190 lbs. may want to try three wraps.) **ALWAYS** insert the rope into the rings from right to left (Figure 2).

**Figure 3**





8. Starting from the inside, thread the rope between the 'V' formed on the tight riser, continuing around the back, with a complete circle around the riser. Finish off by tying a minimum of three half hitches and leaving at least a 12-inch tail (Figure 3).

**Figure 4**



9. Tuck the tail between the riser so it will not be in the way later.
10. Take up the slack in the rope between the tight riser and the friction rings by:
  - a. Grasp the tight riser with one hand and the rope below the friction ring with the other hand, and then
  - b. Simultaneously perform a one-arm pull-up on the tight riser, taking up the slack with the other hand.

**Remember to use smooth, fluid movements!**

11. While hanging onto the rope, with slack pulled up, untie the leg pocket. Make sure the rope makes it to the ground and is clear of obstacles. The descending rope should run between the smokejumper's legs.
12. Catch the running end of the rope with the heel of the right foot. Reaching behind, the smokejumper grabs the rope with the right hand and brings it up on the outside of the right thigh (Figure 4).

**Figure 5**



13. Take the running end of the rope and pass it through the gate of the carabiner while maintaining continuous tension on the rope with the right hand to keep the rope taut (Figure 5).

**Figure 5**



14. Pinch the rope off at the carabiner with the left hand. With the right hand, form a loop and push running end of that same loop **UNDER**, then **OVER** the rope that is running up from under the thigh. Continue by passing the same end through the original loop, thus forming a slipknot. Pull the slipknot snug to the carabiner and finish off by maintaining at least a 12-inch tail. Then form a new loop, pass it over the loop of the slipknot to form a safety hitch (Figures 6 through 10).

**Figure 6**



**Figure 7**



**Figure 8**



**Figure 9**



**Figure 10**



15. **Final Check.** The smokejumper should stop and do a deliberate, final four-point check. This check consists of:
  - a. Checking to make sure the correct tie is made at the risers.
  - b. The rope is routed properly through the friction rings in the proper manner and the proper number of wraps has been made.
  - c. Check to make sure that the rope runs under the leg, through the carabiner, and is properly tied off.
  - d. Do a final check for any suspension lines to make sure there is no possibility of becoming entangled once the Capewell release has been initiated.
16. Begin the Capewell release by reaching up to the loose riser with the hand on the loose riser and do a one-arm pull-up while simultaneously releasing the Capewell fitting with the other hand. Check for suspension lines.

**Figure 11**



17. Release the tight riser by reaching up to the tight riser with the “tight riser side hand,” place hand in ‘V’ of riser, do a one-arm pull-up while simultaneously releasing the Capewell fitting with the other hand. **SMOOTHLY** transfer the body weight from the riser to the letdown rope. Check for suspension lines (Figure 12).

**Figure 12**



18. The smokejumper is now hanging by the letdown rope, but is being held securely by the slipknot at the carabiner (Figure 13).

**Figure 13**



19. Release the safety hitch and then to release the slipknot, the smokejumper grasps the rope at the outside of the thigh firmly with the right hand and the running end below the slipknot with the left hand (Figure 14).

**Figure 14**



20. With a smooth strong outward thrust with the left hand, the slipknot will be released (Figure 15).

**Figure 15**



21. The right hand can now release the rope at the thigh and is moved up to where the left hand is holding the running end of the rope. Keep both hands on the rope for maximum control (Figure 16).

**Figure 16**



- Before descending, check for suspension lines.
- Control rate of descent by exerting pressure on the rope.
- **BE SMOOTH!** Remember to avoid sudden stops as this could dislodge the canopy from the tree.
- **KEEP** hands out away from the carabiner to prevent gloves from getting tangled.



- DO NOT descend too rapidly as this will have the potential to burn the rope.
- Remember to keep your helmet and gloves on during letdowns!

## Tie-Off Procedures

When using the carabiner letdown system, it is possible to tie-off during the descent thereby freeing both hands should the need arise. (The need for a tie-off may arise in the case of shroud line entanglement, injury, or need for a two-rope letdown). The procedure is as follows:

1. Stop descent by grasping the running end of the rope with your left hand 4 to 6 inches in front of the carabiner and hold firmly.
2. With the right hand, make the same slipknot used during the original procedure before the Capewell release step.
3. Keeping a hold of the slipknot tail, pull up on the loop and let the weight draw the knot smoothly up to the carabiner. Follow slipknot with a safety hitch.
4. To release the tie, first release safety hitch and then grasp the rope that goes around the thigh with the right hand below the carabiner and then release the slipknot with the left hand. (Note: The knot and knot release are the same as those used in the initial release.)

## Two-Rope Letdown

If the smokejumper's letdown rope is not of sufficient length to reach the ground, it will then be necessary to use a second rope. The procedure for a two-rope letdown system is detailed below:

1. Once a smokejumper has determined that their letdown rope is not of sufficient length to complete the letdown, they should tie-off as detailed above in Tie-Off procedures, leaving at least 10' of unused rope.
2. The smokejumper should then acquire an additional letdown rope from a smokejumper already on the ground.
3. The smokejumper should then attach the additional letdown rope to the running end of their letdown rope below the carabiner with an overhand follow-through knot (Figure 17).

**Figure 17**



4. Once the knot has been secured, the smokejumper should release the tie-off knot at the carabiner and continue the letdown. The RING BEND splicing of the two letdown ropes will clear both the carabiner and the friction rings and allow the smokejumper to continue the letdown.

### **Capewell Release Letdown Without a Tie-Off**

This letdown method is quite similar to the tie-off system; however the use of a carabiner as a tie off point is not employed. The mechanics of making this letdown are as follows:

1. Check to see how well your parachute is hung in the tree. If at all possible, the smokejumper should attempt to pull themselves over to the tree trunk or a large live limb (4+ inches) and tie off there. All movements should be careful, smooth, and fluid. Optional Safety Device: The K-Palm letdown safety device may be used to secure a smokejumper to a limb or bole of the tree to free up both hands in order to perform the letdown procedure.
2. Starting at the top and working down the smokejumper will check suspension lines around the helmet, under the chin, arms, legs, and harness. Make sure all lines are clear of the body.
3. Do not remove helmet or gloves. They will be needed during the descent for protection against limbs and rope burns.
4. Release the following items in order from top to bottom:
  - a. The FS-14 reserve parachute by releasing both safety pins and riser snaps. Release the bottom right Fastex snap but not the left and allow the reserve to hang by the left Fastex.

- b. Release the right Fastex snap on the PG bag and allow it to hang by the left Fastex. If a small carabiner is used as a safety device, release the carabiner from the handle of the PG bag now.
  - c. Release the back tray and drop it to the ground. This will avoid the possibility of the suspension lines hanging up on the container. (It may be desirable to throw the back tray to the ground with vigor to avoid having it hang up in the tree.)
5. Pull out the friction rings sewn into the jump pants and make sure they are not twisted. The carabiner should also be pulled out at this time. The carabiner should be to the outside of the right friction ring with the gate up and the opening away from the smokejumper (Figure 1).
6. Reach into the right leg pocket and pull out the running end of the letdown rope. Make sure to leave the rest of the rope in the leg pocket until the risers are tied off. This will ensure that the rope is not dropped and lost. Pull out about six to ten feet of rope.
7. Pass the letdown rope through the friction rings two or three times depending on body weight. (Two wraps are sufficient for most smokejumpers; however those over 190 lbs. may want to try three wraps.) **ALWAYS** insert the rope into the rings from right to left (Figure 2).
8. Starting from the inside, thread the rope between the 'V' formed on the tight riser, continuing around the back, continue with a complete circle around the riser. Finish off by tying a minimum of three half hitches and leaving a 12-inch tail (Figure 3). Tuck the tail between the risers so it will not be in the way later.
9. Take up the slack in the rope between the tight riser and the friction rings by:
  - a. Grasping the tight riser with one hand and the rope below the friction ring with the other hand, simultaneously perform a one-arm pull-up on the tight riser and take up the slack with the other hand. **REMEMBER – SMOOTH, FLUID MOVEMENTS!**
10. Untie the leg pocket. Pull out the coiled tape or rope bag and drop it to the ground. Optional bag placement is to keep in the leg pocket as smokejumper progresses down the tree. Make sure the rope makes it to the ground and it is clear of obstacles. The descending rope should run between the smokejumper's legs.
11. Catch the running end of the rope with the heel of the right foot. Reaching behind, the smokejumper grabs the rope with the right hand and brings it up on the outside of the right thigh (Figure 4).
12. Take the running end of the rope and pass it through the gate of the carabiner while maintaining continuous tension on the rope with the right hand to keep the rope taut (Figure 5).

13. Once the smokejumper has passed the rope through the carabiner, they should grasp the running end firmly with the right hand. The carabiner provides one additional point of friction for the descent.
14. The smokejumper should again take up as much slack as possible before doing a final four-point check.
15. **FINAL CHECK.** The smokejumper should stop and do a deliberate, final four-point check. This check consists of:
  - a. Check to make sure the correct tie is made at the risers.
  - b. The rope is routed properly through the friction rings in the proper manner and the proper numbers of wraps have been made.
  - c. Check to make sure that the rope runs under the leg, through the carabiner, and is held firmly in the right hand.
  - d. Do a final check for suspension lines to make sure there is no possibility of becoming entangled once the letdown has been initiated.
16. Begin the Capewell release by reaching up to the loose riser with the left hand. Lift the weight off the Capewell by doing a one-arm pull-up with the left arm and simultaneously release the Capewell fitting with the right hand. Keep the running end of the rope firmly in the right hand. Check for suspension lines.
17. Continue the letdown by reaching up to the tight riser with the left hand always keeping the running end of the rope in the right hand. Release the tight Capewell by doing a one-arm pull-up with the left arm and simultaneously release the Capewell fitting with the right hand. Once the tight Capewell has been released, **SMOOTHLY** transfer body weight from the riser to the letdown rope. Check for suspension lines.
18. It is important to have just enough slack in the rope when releasing the Capewell so that the line will not be pulled out of the hand. Another way to avoid losing the rope is to wrap it around the right hand once.
19. Keep the letdown rope in the right hand while reaching over with the left hand to grip the rope just beyond where it is gripped with the right hand. Once the rope is firmly in both hands, check for suspension lines, and then begin descent by releasing the grip slowly and allowing the rope to slip through the hands. Control the descent by tightening or loosening the grip on the rope.

- Avoid sudden stops as this could dislodge the canopy from the tree.
- If a tie-off is needed during descent, follow the procedures outlined in this lesson plan.
- Keep your helmet and gloves on during letdowns!

## K-Palm Letdown Safety Device

If in an insecure hanging position, a smokejumper has the option of using this safety device to secure themselves to a limb or bole of the tree to free up both hands in order to safely perform the letdown procedure.

1. Locate and firmly grab the carabiner with right hand
2. Extract the carabiner and attached line and place over a limb or around the bole of a tree.
3. Attach the carabiner on the left side of harness preferably to the reserve chute D-ring attachment point. Note: the carabiner may be attached to anywhere on the harness or on its own line.
4. At this point both hands are free to safely perform the letdown procedure.
5. Before releasing safety knot of the letdown procedure, remove the safety device by releasing the carabiner from the left harness attachment point. (May have to use your reserve knife to cut lanyard in order to release from attachment point.)

**Instructor Note:** See loft managers for construction of the K-Palm Safety Device.

## Evaluation Parameters for Letdowns

At the completion of this unit, the trainee will demonstrate the correct procedures for performing an approved smokejumper letdown, including:

- At the letdown simulator, perform a minimum of three approved letdowns within 2 1/2 minutes.
- Correctly describe all of the steps in performing an approved smokejumper letdown.
- These are minimum standards for both new smokejumpers and experienced smokejumpers who are performing letdowns during refresher training sessions.

## Notes

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## Unit 2 – Parachute Training

### Chapter 8 – Tree Climbing



#### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Tree Climbing</b>
<b>Objective(s):</b>	Upon completion of this lesson, trainees will demonstrate the ability to safely, efficiently, and expediently climb (including free climbing) according to proper procedures. They will demonstrate the ability to identify defective equipment and make minor repairs.
<b>Suggested Duration:</b>	To be determined by instructor.
<b>Training Aids Needed:</b>	Locate climbing trees 24 to 36 inches in diameter with nearly uniform trunk size and few limbs for 30 to 40 feet from ground level. Obtain the necessary number of smokejumper tree climbing sets.

#### Overview

The Forest Service Health and Safety Code Handbook (FSH 6701.11) authorizes the climbing procedures and equipment outlined in the Training Guide for climbing in support of the smokejumper mission. The National Climbing Guide should be referred to for project climbing missions.

Tree climbing is one of many skills that smokejumpers must master. Fire jumps often result in timber landings for smokejumpers and paracargo. Parachutes and cargo must be retrieved skillfully to minimize damage and repair cost. Safe and competent tree climbing is an important part of an effective smokejumper program. Each jumper must possess the ability to safely and expediently retrieve fire equipment from timber hang-ups to effectively perform initial attack on wildland fires. Tree climbing has also become an effective means for utilization of smokejumpers in resource management and requires highly skilled, trained individuals.

Tree climbing is an important smokejumping skill that must be mastered so that smokejumpers can be efficient and safe in performing their duties. All smokejumpers should take opportunities to practice tree climbing whenever possible to develop and master this skill. Confidence and muscular coordination are keys to safe climbing.

## Equipment

**Figure 6 – Tree Climbing Equipment**



1. Tree spurs (lightweight, adjustable, and equipped with shin guards).
2. Climbing harness meeting ANSI A10.14 Type 1 standards.
3. Steel core flip line with locking snap on one end and steel core prusik with locking snap or mechanical ascender meeting ANSI A10.14 Type 1 standards. Minimum length 16 feet.
4. Sharp, clean, folding pruning saw.
5. Safety lanyard with locking carabiners or snaps, meeting ANSI A10.14 Type 1 standards.

## Pre-Climbing and Safety Procedures

### Equipment Inspection

1. Climbing Harness.
  - a. Check for cuts in the webbing and for broken stitching.
  - b. Inspect hardware for cracks and for broken stitching at attachment points.
2. Flip Line and Safety Lanyard.
  - a. Check for any cuts or excessive wear and abrasion.
  - b. Check the loop splices.
  - c. Check the snaps and carabiners for proper operation and for any cracks in the metal.
  - d. Check that prusiks are tied properly.
3. Tree Spurs.

- a. Check for worn out or cracked stirrups.
  - b. Check the ankle and cuff straps for cuts, excessive wear, and any broken buckles.
  - c. Check the gaffs for proper length, tightness, sharpness, and cracks. (Do not field sharpen the gaffs with a file.)
  - d. Check for any missing or damaged pins and retainer rings.
4. Pruning Saw.
    - a. Make sure the screw between the blade and handle is secure.
    - b. Make sure the handle is in good shape.
    - c. The saw should have a lanyard of suspension line to facilitate attachment to harness for hands-free climbing.

### **Personal Protective Equipment**

Wear proper personal protective equipment as follows:

1. Gloves.
2. Long-sleeved shirt.
3. Leather boots with 8-inch uppers.
4. Hard hat with chinstrap down.

### **Tree Inspection**

Inspect trees before climbing. Determine whether the tree can safely be climbed.

1. **Adjacent Trees** -- Identify hazards from adjacent trees.
2. **Rot** – Do not climb.
3. **Lean** – Always climb on the high side of the lean. If lean is excessive, do not climb.
4. **Snags** – Do not climb except to retrieve an injured jumper. Consider establishing a belay point in a nearby tree if available.

### **Some Additional Safety Considerations**

1. Do not walk around unnecessarily while wearing climbing spurs. Put the guards on the gaffs when not climbing.
2. Do not climb without climbing harness, flip line, and lanyard.
3. Keep safety rope properly adjusted to the size of the tree being climbed. Do not wait and put this off, but keep adjusting as the tree bole narrows.



4. Always use a pruning saw for trimming limbs. Never use an ax, pulaski, or power saw.
5. Take care to avoid cutting any safety gear or yourself with the pruning saw or with the gaffs.
6. Do not climb unless there is another smokejumper to assist as a ground person.
7. Ground personnel should not stand directly under climber.
8. Climbing above the 4-inch bole diameter requires a safety tie-in at or below that point.

## **Equipment Adjustments and Fitting**

1. Spurs.
  - a. Adjust shank (shin guards and cuffs should fit in the hollow between the knee and the calf).
  - b. Fit the stirrup in the arch indentation of the boot.
  - c. Buckle the foot strap as securely as possible.
2. Climbing harness should fit just below the hip bones with the leg straps passing between the legs and secured at the buckle.
3. Attach the flip line and safety lanyard prusik snaps to the load rings on the harness. Which side they go on may depend on if the climber is right- or left-handed.
4. Tie the pruning saw to an attachment point on the back of the harness.

## **Climbing Procedures**

### **Load Ring Attachments**

Anytime a climber attaches a flip line or safety lanyard to a load ring, they will visually check to ensure the hardware is hooked to the proper attachment point and securely locked.

### **Secure the Flip Line**

1. Route the snap end of the flip line around the tree and attach it to the load ring opposite the prusik.
2. Take up all of the slack.
3. Adjust the length to allow the body to set an arm's length away from the trunk of the tree.

## Climbing

1. On trees less than 36 inches DBH, grip the rope with both hands and flip it up, approximately 18 inches above waist level. On larger trees, the “Western Roll” is sometimes necessary to advance the rope up the tree. This technique requires the climber to maintain approximately 15 to 20 inches of slack in the flip line between the right hand and the prusik. This slack allows the climber to vigorously snap the wrist while slipping the right arm up and out, while maintaining a positive grip with the flip line. The brisk nature of the throw will cause the flip line to travel in a wave around the tree until it reaches the left hand at which time the rope is then lifted. This technique also enables the climber to advance the flip line over rough bark and short “stabs” or limbs without the need to contour around the tree and manually free the flip line.
2. Place the right or left spur into the tree with the knees out and away from the tree.
3. Step up onto the spur embedded in the tree bark and sink the opposite spur into the bark about 8 to 12 inches above the first spur.
4. Keep the body straight and lock the knee of the lower or trailing knee.
5. Repeat the steps.
  - a. Pull the upper body next to the tree to release tension on the rope before moving it up.
  - b. Flip the rope up about 18”.
  - c. Step up two steps at a time before the next flip of the rope.
  - d. Avoid allowing the flip line to drop below waist level.
5. Establish a smooth rhythm.
6. Keep the body weight near the tree by keeping the back straight and thrusting the hips toward the tree with each step. If a spur sticks, rotate the heel away from the tree and pry it out.
7. The climber should stop periodically and relax by setting the spurs firmly in the bark, locking the knees and leaning back on the flip line.
8. To descend, step down, allowing the body weight to engage the spur. Throw the rope down to about waist level with every two steps.

## Properly Adjusting the Flip Line

1. Place the flip line about waist level.
2. Place feet at an even level. Keep at least one knee locked.

3. Taking up slack when ascending the tree: grasp the flip line behind the prusik, tension the rope, and use the other hand to slide the prusik to the desired length.
4. Letting out the slack while descending the tree: grasp the flip line in front of the prusik with one hand and use the other hand to slide the prusik to the desired length.
5. In the classroom or in the field before climbing, practice making adjustments.

### **Limbing**

1. It may be necessary to remove small limbs, which impede progress by snarling the flip line.
2. Use a pruning saw or for small dead limbs, cut a green limb to use as a beater stick.
3. Remove broken or small and dead limbs. This will keep the climber from inadvertently using them for climbing steps.
4. Prune far enough above the flip line to prevent damaging or cutting it.
5. Undercut larger limbs to prevent breakage or unnecessary damage to the tree.
6. Cut all limbs flush with the trunk and avoid cutting blind.

### **Burning Out of the Tree**

1. Occasionally, spurs will break loose from the tree, due to misplaced spur position. This is caused mainly by knees too close to the tree; spurs not securely embedded in the bark or cambium; rotten bark; spurs placed in a crack, crevice, thick bark, or a knot; or not locking the knees when stopping.
2. Corrective action is to:
  - a. Immediately pinch the flip line in by pulling the elbows down and into the torso.
  - b. Keep legs clear to prevent gaffing of lower legs.
  - c. Throw your head back or to the side to prevent contact with the tree trunk.
  - d. Replace spurs in sound bark and continue.

### **Limb-Over (With Safety Lanyard)**

This procedure is used to go over a limb too large to cut or to make the transition from spurs to free climb or vice versa. This procedure requires the use of a safety lanyard.

1. Climb as high as possible up to the limb.

2. Throw the safety lanyard around the tree, above the limb, and then snap it into the opposite load ring on the harness.
3. Unsnap your flip line.
4. Continue up the tree, utilizing the safety lanyard in lieu of the flip line to reduce the overall number of limb-over procedures.
5. Throw the snap end of the flip line around the tree above limbs and snap into the opposite load ring.
  - a. This procedure can take some skill and timing to perform. Try throwing the snap as far out, slightly above your head and with as much force as possible, then catch the snap as it comes around the tree trunk. Often, multiple tries are required.
6. When the flip line snap is secured to the load ring, unsnap the safety lanyard and continue.
7. If the tree is too large to get the safety lanyard around:
  - a. Climb as high as possible.
  - b. Place a double wrap around the limb with the safety lanyard, as close to the tree as possible and snap it into the load ring.
  - c. Limb should be a minimum of four inches in diameter and not downward sloping.
  - d. Take up all the slack and test the load on the safety lanyard.
  - e. Unsnap the flip line and then reattach before continuing on.
  - f. Release the safety lanyard and continue.
8. Reverse these procedures when descending.

### Three-Point Climbing

Three point climbing presents additional hazards as the flip line or safety lanyard is not used as a safety line while ascending. All necessary safety tree climbing equipment, minimum of harness and safety lanyard, shall be required.

1. Maintain three points of contact at all times.
  - a. The climber shall have two feet and one hand or two hands and one foot at **ALL** times.
2. Do not climb on **ANY** dead limbs.
3. Do not climb if the limbs are spaced too far apart to maintain good hand and feet positions.

4. Always take species and condition of the tree into consideration before climbing.
  - a. Cedar and Western Larch (Tamarack) trees are brittle and limbs break easily.
5. When three-point climbing, keep feet and hands close to the bole of the tree.
6. If spurs are removed during three point climb, be certain that they are secured in the tree before continuing on.
  - a. Lash with parachute cord or binding straps.
  - b. Take care in leaving spurs behind; some areas above may require the use of spurs to ascend safely.
  - c. When three-point climbing with spurs on, be extra cautious with spur placement and stepping on limbs.

## **Tree Climbing Letdown and Rappel Systems**

At this time none of the smokejumper bases are teaching this. Ongoing research and development may make it necessary to add these back in at a later date.

## **Evaluation Parameters for Tree Climbing**

At the completion of this unit, the trainee will demonstrate the following smokejumper tree climbing skills:

1. Ascend a tree or pole (preferably 30+ DBH) to a height of 45 feet and perform a limb-over. Safely descend back down the tree in a time not to exceed 5 minutes. This is a minimum. Most bases will exceed this parameter by having the trainee climb to the top of a 100- to 150-foot tall tree, using limb over techniques and free climbing techniques, following all correct procedures.
2. Describe the components of smokejumper tree climbing equipment and the care and maintenance of each part, including:
  - a. Flip line.
  - b. Safety Lanyard.
  - c. Spurs.
  - d. Pruning Saw.
  - e. Climbing Harness.
3. Demonstrate the correct attachment of the prusik to flip line or safety lanyard.

## Unit 2 – Parachute Training

### Chapter 9 – Parachute Retrieval



#### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Parachute Retrieval</b>
<b>Objective(s):</b>	Upon completion of this lesson, trainees will be able to safely retrieve cargo and personnel parachutes in the field while minimizing parachute damage.
<b>Suggested Duration:</b>	To be determined by instructor.
<b>Training Aids Needed:</b>	To be determined by instructor.

#### Overview

Care must be taken when retrieving parachutes from jump spots and trees. The cost of parachutes and parachute repair is far greater than the labor required to retrieve parachutes properly. Extra time and care during retrieval saves money. Each step in parachute retrieval must be thought out before proceeding. Classroom and field demonstrations are very important for this lesson plan.

The techniques of parachute retrieval are important because of the potential that exists for injury to the jumper, damage to the parachute system, and additional costs for repair. An important part of smokejumping is the retrieval of gear and the ability to safely and efficiently return the components to the smokejumper base to be quickly repaired, repacked, and reissued; keeping valuable firefighters out of the loft and back on the fireline.

#### Open Field Retrieval

1. Grasp the apex of the canopy. Use a partner to grab the risers and pull taut.
2. Shake out all foreign material from the canopy and lines. Foreign matter may puncture the nylon canopy when placed in a seamless bag or a pack-out bag.
3. Chain the parachute lines.
4. Place the parachute (apex first) into the seamless sack or pack-out bag.

5. For ram-air canopies, gather canopy by the packing tabs located on the upper surface. Put this end into the bag first.

## Standard Timber Retrieval

1. Ensure appropriate gear is on site, including climbing harness, spurs, two lanyards (one wire core), and pruning saw.
2. One jumper will climb the tree and the other will stay on the ground to assist and help pull the parachute out of the tree. Determine from which side of the tree the parachute will be removed.
3. While ascending the tree, attempt to move as much parachute material as possible to the removal side. Remove any limbs that may interfere with parachute removal.
4. When topping of the tree is necessary, climb the tree until the tree bole is 4 inches in diameter. The steel core lanyards will be secured around tree. Using a pruning saw, face-cut the trunk on the side the canopy is to fall. Take into account wind direction and velocity, and any natural lean. Be sure to leave at least one appropriately sized green limb above your lanyard to prevent it from flipping over the top, as canopy and cut tree top fall.
5. The assistant should hold slight tension on the letdown tape toward the undercut side of the tree. Good communication between the climber and assistant is essential. Do not pull on tape unless climber gives the OK.
6. Climber will check to ensure that no part of the parachute is located behind them where it can entangle them when top and canopy are released from the tree. Inform ground personnel that back-cut is beginning. The climber will make a back-cut of appropriate size.
7. Stress the importance of suspension line and canopy management to prevent entanglements with the climber.
8. When told to do so, the assistant will pull the top of the tree over and to the ground. Stress safety and the importance of **NEVER** pulling on the rope until instructed to do so by the climber.
9. When the canopy is on the ground, remove as much of the tree material as possible. If sawing is necessary, use care to avoid cutting suspension lines or canopy materials.

## Tree Felling Retrieval

1. Fell all trees that are unsafe to climb (snags, rotten green trees, etc.).
2. Clear small trees, brush, stumps (if possible), logs, and other debris which could damage the canopy.
3. Attempt to fell the tree so the canopy will land on the top side of the tree.

4. Clear the letdown rope to avoid fouling under the felled tree by pulling the rope to one side.
5. Fell the tree.
6. Use care in extricating the tree out from the canopy and suspension lines. Do not cut the lines or canopy material.
7. Remove foreign material from the canopy and lines. Chain the lines and stow in a seamless bag or a pack-out bag.

## **Parachute Retrieval Evaluation Parameters**

To successfully complete this unit, the student must:

1. Show correct procedures in simple jump spot retrieval.
  - a. Layout of parachute and clear debris.
  - b. Clear and chain lines.
  - c. Stow parachute in bag.
2. Demonstrate correct procedures in timber retrieval of cargo or personnel parachutes.
  - a. Safely climb the tree using accepted tree climbing practices.
  - b. Remove the parachute and/or cargo using the techniques in this lesson plan.
  - c. Minimize damage to canopy and lines.
  - d. Layout of parachute and clear debris.
  - e. Clear and chain lines.
  - f. Stow parachute in bag.

## **Notes**

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## Unit 2 – Parachute Training

### Chapter 10 – Cargo Retrieval



### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Cargo Retrieval</b>
<b>Objective(s):</b>	Upon completion of this unit, the trainee will be able to retrieve cargo safely and expediently from parachutes that hang up in trees, lowering all gear to the ground in an operable condition.
<b>Suggested Duration:</b>	To be determined by instructor.
<b>Training Aids Needed:</b>	To be determined by instructor.

### Overview

Efficient initial attack of fires requires that tools and other equipment be delivered to firefighters in usable condition. This unit deals with the retrieval of paracargo that hangs up in trees.

### Drop Zone Safety

1. Clear the drop zone of all persons, animals, and vehicles before dropping cargo. The drop zone is 200 feet wide on each side of the flight path, 300 feet in the direction of the approach and 1,300 feet in the direction of departure.
2. Keep the drop zone clear until dropping is completed.
3. Keep personnel in the vicinity of the drop zone from bunching up. Have them in an open area, away from weak trees and snags.
4. Provide lookouts to observe and log where cargo is landing and to keep the drop zone clear.
5. If helicopter operations are present or expected, gather and secure all parachutes to prevent fouling a rotor system.

## Retrieving Cargo

Use these steps as guidelines. Slight amendments and changes to these procedures may be implemented as the jump spot environment is dynamic and procedures cannot be written to cover all situations.

1. All personnel will wear personal protective equipment (PPE).
  - a. Long-sleeved shirts, leather gloves, and hard hats at a minimum.
2. Cargo retrieval requires two people. One person will climb the tree and one will stay on the ground to assist the climber.
3. All tree climbing will follow the guidelines and procedures of the “Tree Climbing” lesson in this Training Guide and the Health and Safety Code, Tree Climbing.
4. Climbing above the 4-inch tree bole diameter requires a safety tie-in at or below that point.
5. If the cargo is above the one-half length of your letdown tape, retrieval will require two tapes.
6. The climber should take the loose end of one tape up the tree, paying the tape out of the bird nest coil or rope bag on the ground. The climber may choose to take the tape up in the tree to the retrieval area and throw from there to the ground.
7. The smokejumper on the ground will monitor the letdown tape for knots and help feed the tape up to the climber.
8. The climber should ascend to the attachment point of the parachute riser and the cargo bundle.
9. The climber will thread the end of the letdown tape through a friction device. Route the tape through a carabineer attached to the parachute riser or lashed to a large limb with parachute cord. Another option is to route the tape over a strong limb; however, this system causes undue wear on the tubular tape. Be certain to complete a thorough inspection of the tape before using again.
10. The letdown tape will continue on and tie to the cargo loop, or the cargo bundle strapping with three half hitches. This strapping will be made of nylon webbing, Kevlar strapping, or Avis strapping.
11. The slack in the tape should be taken up by the smokejumper on the ground at this time.
  - a. If there is any doubt as the amount of tape needed, a second tape should be added at this time.
  - b. The smokejumper on the ground should grasp the tape in one hand and pass the tape behind the back. As the tape is passed behind the back, the smokejumper on the ground will grasp the tape by the other hand. Friction will be increased by sliding along the lower back or

buttocks. The smokejumper on the ground should grip the tape firmly and back away from the tree slightly. The slack in the tape will be taken up at this time.

12. The smokejumper on the ground will tell the climber that the slack has been taken up and the actual letdown of cargo may begin. The smokejumper on the ground must make a concerted effort to move away from the base of the tree. If the bundle should freefall, no one on the ground would be injured. *It is important to stress this safety step!*
13. Unhook the tied riser from the bundle. This can be done if enough slack can be put in the riser to disconnect. However, if this cannot be done, then the climber will use a knife to cut the cargo loop or parachute riser if no loop is present. The climber will first notify the smokejumper on the ground that the nylon loop or riser is going to be cut. No cutting should be done unless the smokejumper on the ground first responds positively to this warning. *Emphasize this procedure!*
14. The smokejumper on the ground will let the bundle down from the tree by letting the tape pass through one hand and across the back. The rate of descent can be controlled by the amount of friction on the tape.
15. The climber should stay in place to assist the descent of the cargo bundle. However, the climber may have to move down the tree to assist the cargo descent by sawing tree limbs. Note: If two tapes have been used, the knot that tied the two together may have to be pushed through the friction loop.
16. The climber will stay in the tree until the smokejumper on the ground releases the cargo bundle all of the way to the ground.

## **Problem Cargo Letdowns**

Situations may arise that call for some “on the spot” decisions. One of the problems is when the cargo is suspended away from the trunk and out of reach of the climber. The steps to retrieve this type are:

1. Follow all of the steps of a normal retrieval up to the climber reaching the attachment point of the parachute riser and cargo bundle.
2. Use two smokejumpers, one to climb the tree and one on the ground.
3. Follow accepted tree climbing practices.
4. If the cargo is above one-half the length of your tubular tape, it will take two letdown ropes to complete the procedure.
5. Take the running end of the tape up the tree with the climber.
6. When the climber has reached the cargo attachment point, the smokejumper on the ground should tie a stick to the letdown rope. The climber will pull the tied stick up to them. The stick with the tape attached should be thrown through the lines of the parachute. The tape and stick provide a means to pull the cargo bundle to the climber’s arm’s reach.

7. The climber will thread the end of the letdown tape through a friction device. Route the tape through a carabineer attached to the parachute riser or lashed to a large limb with parachute cord. Another option is to route the tape over a strong limb; however this system causes undue wear on the tubular tape. Be certain to complete a thorough inspection of the tape before using again.
8. The slack in the tape should be taken up by the smokejumper on the ground at this time.
  - a. If there is any doubt as to the amount of tape needed, then a second tape should be added at this time.
  - b. The smokejumper on the ground should grasp the tape in one hand and pass the tape behind the back. As the tape is passed behind the back, the smokejumper on the ground will grasp the tape by the other hand. Friction will be increased by sliding along the lower back or buttocks. The smokejumper on the ground should grip the tape firmly and back away from the tree slightly. The slack in the tape will be taken up at this time.
9. The letdown tape will continue on and tie to the cargo loop, or the cargo bundle strapping with three half hitches.
10. The smokejumper on the ground will tell the climber that the slack has been taken up and the actual letdown of cargo may begin.
11. The remaining procedures are the same as in the previously outlined standard cargo retrieving procedures.
12. The climber will stay in the tree until the smokejumper on the ground lowers the cargo bundle all of the way to the ground.

## High Impact Cargo

If high impact cargo is hanging in a tree with no limbs and not higher than 35 to 40 feet above the ground, the bundle may be cut at the cargo strapping.

1. Remember, if this is a high impact delivery system, the cushioning material has not been damaged.
2. The reason for no limbs is that the bottom of the cargo box may hit a limb and tip. The box could then land on its top and damage the tool handles and other equipment necessary for fire suppression.
3. Do not use this technique with water cubitainers as they would more than likely break on impact.

## Progressive Training

1. Stress working as a team. Good teamwork is necessary to safely and expediently lower cargo to the ground.
2. Utilize classroom work with an emphasis on interaction.



## Unit 2 – Parachute Training

### Chapter 11 – Practical Jump Training



#### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Practical Jump Training</b>
<b>Objective(s):</b>	To provide interactive, performance-based training during parachute jumps for experienced and beginning smokejumpers.
<b>Suggested Duration:</b>	To be determined by instructor.
<b>Training Aids Needed:</b>	To be determined by instructor.

#### Overview

Based on known performance expectations, the smokejumper will demonstrate satisfactory parachuting skill levels in progressively more challenging jump spots and wind scenarios. The individual must demonstrate these acceptable skill levels prior to conducting operational smokejumper missions.

#### Skill Performance

Performance will be measured by evaluating the jumper's demonstrated skill level on each jump in the following elements (optional elements may be added):

1. Pre-Boarding Procedures (suit-up, readiness, etc.).
2. Aircraft Procedures.
3. Aircraft Exits.
4. Airspace and Situational Awareness.
5. Parachute Maneuvering.
6. Landings.
7. Post Landing Procedures.

## Practical Jump Training

The purpose of conducting proficiency and training jumps is to build excellence in the performance, confidence, and competence of the smokejumper.

The trainer has the responsibility to plan, conduct, evaluate, and document live jump training. As with every activity, risks must be evaluated and every reasonable effort made to anticipate and eliminate unsafe procedures, situations, and locations.

Each jump should have specific objectives, performance expectations and evaluation criteria. The trainee must demonstrate their ability to meet established performance standards before proceeding to more difficult jump scenarios.

The trainer has the responsibility to initiate corrective actions based on individual performance in meeting evaluation standards. If an individual shows incompetency in mastering a basic skill necessary for safe parachute jumping, they should be counseled and given further instruction. The following are some examples of corrective actions.

1. Additional unit training to improve specific skill deficiencies.
2. Continue or return to using ground to air communications for “under canopy” instruction.
3. Provide additional parachute simulator training.
4. Have the trainee observe other jumpers while being coached by the instructor.
5. Have the trainee observe proper parachuting techniques on video.
6. Provide a training jump of low complexity to hone basic parachute handling skills.
7. Have the trainee jump a single person stick so they can concentrate solely on parachute maneuvering and proper landing techniques.

If an individual, after a reasonable amount of remedial training, still does not demonstrate basic competency in all phases of parachute jumping, consideration should be given to terminating them from the smokejumping program.

## Jump Exercises

The following jump exercises outline possible jump training sequence for both experienced and first-year smokejumpers.

All jumps must have a pre-jump briefing which, at a minimum, should include:

1. Jump Objectives.
2. Performance Skills Expectations.

3. Evaluation Criteria.
4. Jump Spot Environment and Hazards.
5. Spotter/Pilot Briefing.

### **Experienced Smokejumpers**

1. Minimum of two jumps, four recommended.
2. It is desirable to expose smokejumpers to a variety of wind (3 to 15 mph), terrain, and jump spot conditions during jump exercises.
3. Deviations from the accuracy standards may be acceptable if certain consequences preclude the smokejumper from landing within the set target limits. Failure to meet the accuracy standards must be based on sound rationale and acceptable maneuvering techniques by the smokejumper.
4. NOTE: All experienced smokejumpers shall annually perform a simulated broken steering line.



**Table 1 -- Recommended Jump Exercises for Experienced Smokejumpers**

Jump No.	Jump Spot	Altitude (feet AGL)	Stick Size (number)	Slope (degrees)	Accuracy (within X yards)	Miscellaneous
1	3+ Acres	1500 Minimum	2		50	Manipulate to the spot, set-up and land facing into the prevailing wind, accuracy within 50 yards of designated target within jump spot.
2	100 Yards		2		40	Recommend a 100 yard diameter spot surrounded by broken forest canopy. Manipulate to spot, set-up and land facing into the prevailing wind, accuracy within 40 yards of designated target within jump spot.
3	50 x 100 Yards		2	15-30	30	Recommend 50 x 100 yard spot surrounded by scattered timber, 15-30 degree slope desirable. Manipulate to spot, set-up and land facing into the prevailing wind. If on a slope, demonstrate correct side hill approach and landing, accuracy within 30 yards of designated target within the jump spot.

**First-Year Smokejumpers**

1. First year smokejumpers need (mandatory) a minimum of 15 training jumps before they qualify for operational parachute jumps.
2. The jump exercises will increase in difficulty and complexity, allowing the trainee to develop and demonstrate necessary skill levels.
3. Environmental conditions such as wind, slope, and jump spot size are important variables. Jump training should provide a controlled mix of each variable and trainees should be evaluated on their ability to successfully meet the challenges of each jump separately and in combination.
4. The trainee must perform at least one simulated broken steering line jump.

## Suggested Progression of Practical Jump Experience

Table 2 – Suggested Progression of Practical Jump Experience

Jump No.	Jump Spot	Altitude (feet AGL)	Stick Size (number)	Wind Speed (mph)	Slope (degrees)	Accuracy (within X yards)	Miscellaneous
1	Large Meadow	2000	1	0-5	0	100	Radio communications between new trainee and trainer.
2	5-10 Acres	2000	1	0-5	0	100	Windline orientation, running, quartering, radio communications.
3	5-10 Acres	1500	2	3-10	0	100	Airspace awareness, windline, jump partner communications.
4	3-5 Acres	1500	2	3-10	0	75	Airspace awareness, brakes, ground track, approach.
5	3-5 Acres	1500	2	3-10	10-30	75	Side hill approach and landing.
6	2-4 Acres	2000	1	0-7	0-30	50	Broken Steering Line Simulation (see below), reverse flight, transition zone, side hill landing.
7	Large Meadow	1500	2	10-15	0	75	Higher wind jump, maneuvering techniques.
8	2-3 Acres Timber	1500	2	7-15	10-30	50	Approach in moderate winds, flight planning.
9	1-3 Acres Timber	1500	1 or 2	3-10	0-10	50	Steep approach into timbered spot.
10	1-2 Acres Timber	1500	1 or 2	7-15	0-20	50	Good approach, leeward avoidance, turbulence, side hill.
11	3-5 Acres Timber	1500	2	10-15	0-20	100	High wind jump, maneuvering techniques, land upwind of jump spot.
12	1 Acre Timber	1500	1	7-15	0-30	40	Use of alternate spots, continue more challenging conditions.

Jump No.	Jump Spot	Altitude (feet AGL)	Stick Size (number)	Wind Speed (mph)	Slope (degrees)	Accuracy (within X yards)	Miscellaneous
13	1-2 Acres Timber	1500	2	7-15	30-50	30	Nonstandard aircraft pattern, flight planning, proper approach.
14	5-10 Acres	1500	3	3-10	0-30	30	Three person stick in large door aircraft, flight planning.
15	0.5 Acre Timber	1500	2	3-10	0-30	25	Final test, proper use of all techniques and procedures.

### Broken Steering Line Simulation

With the current FS-14 configuration and rigging procedures in place, there is an occurrence of 1:1000 of having a steering line break upon a successful main parachute opening. In the event of this happening, the smokejumper is trained how to manipulate their parachute using risers and/or good steering toggle. Much of this technique is arm fatigue management, for which the jumper plans ahead, making only necessary steering inputs. Jumper will often plan final turns favoring their good toggle side.

### Notes

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## Unit 3 – Specialized Training

### Chapter 1 – Spotter Training

#### Overview



#### Preface

The Smokejumper program, in order to be viable and productive, must be a safe program. From upper management to the first year smokejumper, every effort should be made to ensure safety is the number one priority in carrying out the smokejumper mission.

The safe delivery of smokejumper personnel and paracargo is the spotter's ultimate responsibility. With that responsibility, comes the burden of making correct decisions under stressful conditions. The pressure a spotter feels in staffing a fire cannot outweigh proper risk management assessment and decision making.

All aspects of spotter training must be approached with safety as the primary concern. Instructors are responsible for infusing this "safety first" attitude into the training plan so that it becomes ingrained in the duties of the position.

#### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Spotter Training (10 sections with 29 separate lessons)</b>
<b>Objective(s):</b>	This chapter consists of all the facets of fulfilling the duties of a smokejumper spotter. It involves classroom and practical application of navigation, aircraft procedures, jump spot selection, cargo dropping, aircraft emergency procedures, communication, and crew resource management. Becoming a fully qualified spotter takes smokejumping experience, time, and fulfilling the position as a trainee in practice and fire missions.
<b>Suggested Duration:</b>	This chapter includes 10 sections with 29 separate lessons. See each lesson for suggested duration.

<b>Lesson(s):</b>	<b>Spotter Training (10 sections with 29 separate lessons)</b>
<b>Training Aids Needed:</b>	This chapter includes 10 sections with 29 separate lessons. See each lesson for training aids needed.

## Introduction

The spotter's responsibility in the safe and efficient deployment of smokejumpers is critical. No two missions are the same, and the decisions made by a spotter are essential to the success of the program. Spotters must possess the necessary knowledge, skills, and abilities to access each situation, evaluate the risks, and make sound decisions under stressful conditions.

## Contents

### Sections and Lessons in Unit 3, Chapter 1, Spotter Training

<b>Section/Lesson</b>	<b>Description</b>
<b>Section I</b>	<b>Management Policies</b>
Lesson A	Manuals, Handbooks, and Guides
Lesson B	Fire Staffing and Other Policies
<b>Section II</b>	<b>Safety</b>
Lesson A	Pre-Jump Equipment Check
Lesson B	Interagency Spotter Commands
Lesson C	General Aircraft Procedures: Hookup to Exit
Lesson D	Aircraft Emergency Procedures
<b>Section III</b>	<b>Navigation</b>
Lesson A	Geography
Lesson B	Aeronautical Charts and Maps
Lesson C	Aircraft Instruments and Navigation Aids
<b>Section IV</b>	<b>Radio Communications</b>
Lesson A	Spotter/Dispatch Communications
Lesson B	Flight Traffic Area
Lesson C	Spotter/Incident Commander Communications
Lesson D	Aircraft Radio Operations

**Sections and Lessons in Unit 3, Chapter 1, Spotter Training, continued**

<b>Section/Lesson</b>	<b>Description</b>
<b>Section V</b>	<b>Information Gathering and Reporting</b>
Lesson A	Fire Size Estimation from Aircraft
Lesson B	Analyzing and Reporting Fire Weather
<b>Section VI</b>	<b>Spotting and Streamer Dropping</b>
Lesson A	Reading Assignment and Pretest
Lesson B	Classroom Lecture and Discussion
Lesson C	Flight 1
Lesson D	Flight 2
<b>Section VII</b>	<b>Records and Forms</b>
Lesson A	Spotter Mission Recordkeeping
Lesson B	Aircraft Contract Familiarization / Flight Invoices
<b>Section VIII</b>	<b>Operational Procedures and Responsibilities</b>
Lesson A	Spotter Daily Routine Responsibilities
Lesson B	Additional Responsibilities
Lesson C	Fire Mission Procedures (Take-Off to Landing)
<b>Section IX</b>	<b>Integrated Spotter Skills</b>
Lesson A	Problem Situation Exercises
Lesson B	Simulated Fire Mission, Flight 3
Lesson C	Supervised Practice Jump Spotting
Lesson D	Supervised Fire Mission Spotting
<b>Section X</b>	<b>Spotter Refresher Session</b>

## Unit 3 – Specialized Training

### Chapter 1 – Spotter Training

#### I -- Management Policies

#### Lesson A -- Manuals, Handbooks, Guides



#### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Manuals, Handbooks, and Guides</b>
<b>Objective(s):</b>	Upon completion of this lesson, the trainee will be able to: (1) identify manuals, handbooks, and guides that control smokejumper policies and procedures, and (2) locate management policy and direction within the appropriate manual, handbook, or guide.
<b>Suggested Duration:</b>	1 hour classroom plus study time
<b>Training Aids Needed:</b>	FSM 5700 Aviation Management FSH 5709.16 Flight Operations Interagency Smokejumper Operations Guide (ISMOG) National Interagency Mobilization Guide

#### Overview

Each base shall provide the trainee with current manuals, handbooks, and guides that apply to the spotter mission. The instructor shall describe the manual system and give specific sections to study, i.e., Paracargo Operations in the ISMOG.

Trainees shall demonstrate to the instructor a working knowledge of policies and guidelines specific to the spotter mission. This may be done orally or by a written test developed by the instructor.

## Unit 3 – Specialized Training

### Chapter 1 – Spotter Training

#### I -- Management Policies

#### Lesson B -- Fire Staffing & Other Policies



#### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Fire Staffing and Other Policies</b>
<b>Objective(s):</b>	Trainee shall demonstrate a working knowledge of incident complexity, staffing requirements, and other policies specific to the spotter mission.
<b>Suggested Duration:</b>	1 hour classroom plus study time
<b>Training Aids Needed:</b>	Interagency Standards for Fire and Fire Aviation Operations (Red Book) Regional and/or Local Policy Guidelines

#### Overview

Each base shall provide the trainee with current references related to fire staffing and other policies. Trainees shall demonstrate to the instructor a working knowledge of incident complexity, staffing requirements, and other policies specific to the spotter mission. This may be done orally or by a written test developed by the instructor.

#### Notes

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## Unit 3 – Specialized Training

### Chapter 1 – Spotter Training

#### II -- Safety

#### Lesson A -- Pre-Jump Equipment Check / Buddy Check



#### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Pre-Jump Equipment Check / Buddy Check</b>
<b>Objective(s):</b>	Upon completion of this section, the trainee will be able to ensure that each smokejumper has had a complete pre-jump equipment check before boarding the aircraft and be able to recognize and correct any problems that may be found while boarding.
<b>Suggested Duration:</b>	30 minutes
<b>Training Aids Needed:</b>	Fully suited smokejumpers
<b>Notes:</b>	All lessons in the Safety section of Spotter Training may be taught on the ramp, exit jump tower, or smokejumper aircraft.

#### Overview

- The pre-jump equipment check is the responsibility of each smokejumper.
- The spotter is responsible for confirming that each smokejumper has received a pre-jump equipment check prior to boarding the aircraft.
- Pre-jump equipment checks will be completed by a qualified Forest Service round smokejumper.
- Pre-jump equipment checks on smokejumpers utilizing a ram-air system will be completed by a qualified ram-air system smokejumper.

#### **Pre-Jump Equipment Safety Check or “Buddy Check” for FS-14**

	<b>Equipment</b>	<b>What to Check and Ensure</b>	<b>What to Say</b>
<b>1</b>	<b>Ankle Braces</b>	Ankle braces are on Ankle braces are not broken Stirrups are seated under the boot	<b>“Ankle braces are on.”</b>
<b>2</b>	<b>Jump Pant Stirrup Straps</b>	Stirrup straps are seated under the boot	<b>“Stirrups are seated.”</b>
<b>3</b>	<b>Leg Pockets</b>	Smokejumper has letdown rope, pack out bag, and signal streamer Leg pockets are cinched Strings are inside	<b>“Pack out bag, letdown rope, signal streamer?”</b>
<b>4</b>	<b>Harness Leg Straps</b>	Leg straps are not twisted Leg straps are underneath the crotch protector Snaps are attached to the D-rings Excess strap stowed in holders	<b>“No twist in your leg straps and metal on metal.”</b>
<b>5</b>	<b>PG Bag Fastex</b>	Fastex are not broken Fastex are not twisted around the harness Fastex are appropriate length	<b>“PG Fastex are good.”</b>
<b>6</b>	<b>Reserve Fastex</b>	Reserve male Fastex are attached to the reserve female Fastex	<b>“Reserve Fastex are seated.”</b>
<b>7</b>	<b>Reserve Due Date</b>	Reserve has good due date Reserve has rigger's name or seal number	<b>“Good due date.”</b>
<b>8</b>	<b>Reserve Pins</b>	Reserve opening pins are seated Seal is not broken	<b>“Pins are seated, seal is good.”</b>

	<b>Equipment</b>	<b>What to Check and Ensure</b>	<b>What to Say</b>
<b>9</b>	<b>Reserve Knife</b>	<p>There is a knife</p> <p>Knife is pointed in right direction</p> <p>Blade is damage free</p>	<p><b>“Has your knife been checked?”</b></p> <p>(If smokejumper confirms that knife has been checked, move to the next step, if not check the knife.)</p>
<b>10</b>	<b>Reserve Clips</b>	<p>Clips on reserve are attached to D-rings on harness</p> <p>Pins are firmly seated</p>	<b>“Clips are metal on metal and pins are seated.”</b>
<b>11</b>	<b>Pack Tray Bellyband</b>	<p>Belt is attached around harness</p> <p>No twists in belt</p>	<b>“Good bellyband.”</b>
<b>12</b>	<b>Chest Strap</b>	<p>Chest strap is routed correctly</p> <p>Velcro is seated securely</p>	<b>“Chest strap is routed correctly.”</b>
<b>13</b>	<b>Capewells</b>	<p>Check each Capewell</p> <p>Ears are seated</p> <p>Slider is up</p>	<b>“Your ears are seated and your slider is up.”</b>
<b>14</b>	<b>Risers</b>	<p>Risers are flat across shoulders</p> <p>Parachute number is on smokejumper’s right or left shoulder (location of number may differ by base)</p>	<b>“Your risers are flat, number is on the left/right, and you are jumping a small/medium/large.”</b>
<b>15</b>	<b>Harness</b>	<p>Shoulder straps on properly (look for X on back)</p>	<b>“You have a good X on your harness.”</b>
<b>16</b>	<b>Main Container</b>	<p>Break tape is going through all four tie-off loops</p> <p>Break tape is going through the static line</p> <p>Tie-off loop on static line is pointing down at the seven o’clock position</p>	<b>“Static line is coming out the middle and tied off at the seven o’clock position.”</b>

	<b>Equipment</b>	<b>What to Check and Ensure</b>	<b>What to Say</b>
<b>17</b>	<b>Due Date</b>	Due date is good Rigger has signed the tape	<b>“Main has a good due date.”</b>
<b>18</b>	<b>Harness</b>	Backstrap of harness is not twisted	<b>“You have no twist in your harness.”</b>
<b>19</b>	<b>Static Line/Snap</b>	Free of knots Excess stowed Routed properly Route static line over left shoulder of smokejumper and through the rubber band Static line clip is functioning properly Attach clip to reserve handle (attachment may vary according to base)	<b>“Your clip is good.”</b>
<b>20</b>	<b>Helmet, Gloves, PG Bag</b>	Ask smokejumper if they have helmet, gloves, and PG bag	<b>“Helmet, gloves, PG bag?”</b>

## Unit 3 – Specialized Training

### Chapter 1 – Spotter Training

#### II -- Safety

#### Lesson B – Interagency Spotter Commands



#### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Interagency Spotter Commands</b>
<b>Objective(s):</b>	Upon completion of this lesson, the trainee will be able to consistently perform the Interagency Spotter Commands for each stick of smokejumpers.
<b>Suggested Duration:</b>	45 minutes per trainee
<b>Training Aids Needed:</b>	Interagency Jump Door Checklist (see attached), smokejumper aircraft, training units (exit tower), minimum of two smokejumpers.
<b>Notes:</b>	All lessons in the Safety section of Spotter Training may be taught on the ramp, exit jump tower, or smokejumper aircraft.

#### Overview

It is important for the trainee to train to the standard as outlined in the Interagency Spotter Commands Jump Door Checklist in order to maintain consistency when giving briefings to all smokejumpers.

## Interagency Spotter Commands and Jump Door Checklist

- The spotter in charge of each mission should be clearly identified.
- Note: Prior to dropping ram-air smokejumpers, spotter should request from pilot any noticeable wind changes at 3,000 feet AGL. Adjust exit point accordingly. Although rarely necessary, streamers thrown from 3,000 feet AGL are always an option.
- Spotter signals to the smokejumpers the number in the stick.

Spotter Command	Details
<b>1. “Are you ready?” and “Leg straps tight?”</b>	These two questions are asked of the first smokejumper in each stick, who then answers for the entire stick. Being ready means you have been checked, PG bag is hooked up, and helmet is on.
<b>2. “Hook up.”</b>	This command is given to the entire stick. Round smokejumpers hook up to the appropriate cable (vertical/horizontal/floor). Ram-air smokejumpers hook to appropriate extender handed them by the spotter.
<b>Pre-Jump Briefing</b> End briefing by asking, “Any questions?”	Should include as a <b>minimum</b> : jump spot confirmation, jump spot hazard identification (if any), estimated streamer drift, type of drop pattern, jump spot elevation, and pertinent wind info at jump altitude for both rounds and ram-air.
<b>3. “We are at 3,000 feet. Activate your AAD.”</b>	This command is for ram-air smokejumpers only and will always be given prior to the smokejumper getting in the door. This command prompts ram-air smokejumpers to activate their CYPRES AADs.  (The spotter, before giving this command, will confirm with the pilot that the aircraft has leveled off at 3,000 feet AGL.)
<b>4. “Get in the door.”</b>	This command is given before or after the pre-jump briefing for round smokejumpers, and after the briefing for ram-air smokejumpers, to the first smokejumper in the stick. This command also prompts the ram-air smokejumper’s 4-point check. All ram-air exits will be sitting. Round exits will be using the step or standing, depending on the type of aircraft.
<b>5. “Turning final 1,500/3,000 ft. Static lines clear.”</b>	Confirmation given so that each smokejumper in the stick can hear. The spotter may have previously notified the smokejumper that their static line is clear and confirmed the jump altitude, but this is a final check.  Pilot confirms “On final, 1,500/3,000 feet” with spotter. Minimum round altitude is 1,500 feet AGL. Ram-air drop altitude is 3,000 feet AGL.
<b>6. “Get ready.”</b>	Command given just prior to slapping first smokejumper out the door.  <b>ROUNDS:</b> Slap only the first smokejumper in the stick. <b>RAM-AIR:</b> Slap each smokejumper, spacing smokejumpers a minimum of three seconds apart.  Drogue static lines can be cleared for the next smokejumper in the stick by sliding it toward the upper left corner of the door, after the drogue has deployed from the D-bag.

## Unit 3 – Specialized Training

### Chapter 1 – Spotter Training

#### II -- Safety

### Lesson C – General Aircraft Procedures



#### Lesson Plan Outline

<b>Lesson(s):</b>	<b>General Aircraft Procedures: Hook-up to Exit</b>
<b>Objective(s):</b>	Upon completion of this lesson, the trainee will be able to recognize and correct equipment problems and static line misroutes that occur in the jump door prior to exit.
<b>Suggested Duration:</b>	30 minutes per trainee
<b>Training Aids Needed:</b>	Smokeyumper aircraft parked on the ramp, four fully suited smokejumpers to assist in the training, and Training Guide Unit 2, Chapter 2, Aircraft Procedures Lesson Plan.
<b>Notes:</b>	All lessons in the Safety section of Spotter Training may be taught on the ramp, exit jump tower, or smokejumper aircraft.

#### Overview

One of the most critical safety-related responsibilities of a spotter is proper handling of smokejumpers from static line hook-up to exit. General safety-related procedures applicable to all aircraft are covered in this lesson. Specific procedures for the various approved smokejumper aircraft are covered in the Training Guide, Unit 2 (Parachute Training), Chapter 2, Aircraft Procedures Lesson Plan. This lesson plan should be referred to for information concerning variations in procedures in different aircraft.

## Training Outline

To begin this section, the instructor should demonstrate and explain the following:

1. The signal from the spotter for the smokejumpers to hook-up
2. First and second person hook-up
3. Safety check of static line routing and smokejumper equipment
4. Positioning the first person in the door
5. Slap out signal to exit

The trainee should then be given a chance to practice the routine. The first time through, no attempt should be made by the instructor or smokejumpers to introduce special problems.

The second or third time through the routine, subtle problems may be introduced by the smokejumpers. Examples might be a static line under the arm, a safety pin not properly inserted in the static line snap, or a helmet chin strap unfastened. The smokejumpers need to be carefully briefed by the instructor on specific problems they should present to the trainees (see below). Smokejumpers should be cautioned not to overplay their part and introduce too many problems at once.

As the exercise proceeds, trainees should identify and correct each problem. If they fail to notice a problem, the instructor should, at the last moment (or perhaps after exit), point it out. This exercise dramatically illustrates to trainees how easy it is to miss seeing a critical safety problem when handling smokejumpers in the door prior to exit.

Specific problems that may be used in this exercise corresponding to the outline above are as follows:

1. **Signal to Smokejumpers from Spotter:** After a repetition or two of the exercise, the first smokejumper should hook up and get in the door without being signaled by the trainee spotter. If the trainee tolerates this, the instructor should point out that a spotter needs to be in control of all moment and action near the jump door.
2. **First and Second Person Hookup:** Hook-up presents many opportunities to introduce problems. A safety pin left out of the static line snap is one; too much slack static line is another; not utilizing static line monitoring rubber band clusters (if present) is a third.
3. **Safety Check of Static Line Routing and Equipment:** The smokejumpers can subtly arrange an under-the-arm misroute, an open leg pocket, a loose harness, etc.
4. **Positioning First Person in the Door:** Problems initiated in #2 or #3 above may be unnoticed by the trainee. If so, the instructor should let the trainee





## Unit 3 – Specialized Training

### Chapter 1 – Spotter Training

#### II -- Safety

#### Lesson D – Aircraft Emergency Procedures



#### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Aircraft Emergency Procedures</b>
<b>Objective(s):</b>	Upon completion of this section, the trainee will be able to describe appropriate procedures and spotter responsibilities in emergency bail-out and crash situations.
<b>Suggested Duration:</b>	30 minutes (lecture)
<b>Training Aids Needed:</b>	Smokejumper aircraft on the ramp.
<b>Notes:</b>	All lessons in the Safety section of Spotter Training may be taught on the ramp, exit jump tower, or smokejumper aircraft.

#### Overview

In an aircraft emergency situation requiring bail-out, or in the event of an aircraft crash, established emergency procedures can save lives. It is the spotter's responsibility to maintain positive control during an emergency bail-out and to do everything to ensure that all the smokejumpers get out of the aircraft safely. A spotter must be thoroughly familiar with the established emergency procedures.

This lesson includes the following topics:

- Bail-Out Procedures in a Non-Critical Emergency
- Bail-Out Procedures in a Critical Emergency
- Emergency Crash Procedures

## Bail-Out Procedures in a Non-Critical Emergency

A non-critical emergency would be a situation such as the pilot being unable to get his landing gear down. There is no immediate danger, but it might be advisable for the smokejumpers to evacuate the aircraft.

In a non-critical emergency, the pilot will always confer with the spotter concerning the nature of the difficulties and the course of action. If emergency bail-out is necessary, the spotter is responsible for seeing that the emergency bail-out is accomplished in an orderly manner. Emergency bail-out in a noncritical emergency will usually be accomplished in much the same manner as a normal jump. A jump spot may even be selected.

## Bail-Out Procedures in a Critical Emergency

Considerations and procedures for an emergency bail-out in a critical emergency are as follows:

1. **Aft Center of Gravity:** Even under the best of circumstances, a pilot cannot maintain adequate control of his aircraft with an aft center of gravity. A spotter must never allow smokejumpers to rush aft toward the door of the aircraft in anticipation of an emergency bail-out. Excess weight in the door of the aircraft will compound whatever problem exists.
2. **Positive Control:** The instinct for self-preservation runs high in human beings in an emergency situation, sometimes at the expense of clear thinking action that could improve the chances of survival. Positive control by the spotter is the only way to bail-out in a critical emergency and should be carried out as quickly and as smoothly as possible.
3. **The Decision to Bail-Out:** The pilot is the first authority in matters pertaining to the conditions of the aircraft and the necessity for an emergency bail-out. In situations where time permits, it will be the pilot who initiates an emergency bail-out through the spotter. In other situations, however, the spotter may have only a few moments or an instant to recognize that a bail-out is required and must give the order himself/herself without hesitation or word from the pilot. The spotter must be certain that the plane is high enough for a parachute to open before initiating bail-out. The minimum altitude for reliable main or reserve parachute deployment is 500 feet AGL.
4. **Verbal and Visual Commands:** A standard command of "Bail-out, Bail-out, Bail-out" should be used, accompanied by a hand signal which will mean the same thing to smokejumpers and spotter: patting or pointing to the belly (reserve area) meaning "bail-out on your reserve," or grasping and shaking the overhead cable meaning "bail-out on your main canopy."
5. **Speed:** Along with the need for order in a critical bail-out situation, the need for speed is the foremost concern. Protective clothing worn in smokejumping work is designed to give maximum protection, but it is not a necessity in an emergency. In the event of a critical emergency exit from a smokejumper aircraft, gloves, helmets, and other protective gear are usually best left behind in favor of a prompt exit.

6. **Bail-Out Procedures with the Main Parachute:** If smokejumpers are wearing a main parachute when the order comes to bail-out, the smokejumpers should hook to the overhead cable. They should not attempt to fasten the safety pin. One hand should be kept on the static line snap while stowing the excess static line in a military bite. Glide the snap along the cable while moving toward the door. This procedure is necessary to prevent an accidental opening of the main parachute in the aircraft. Only smokejumpers who are in or near the door should attempt to hook to the standard anchor cable. This will help prevent congestion around the door.
7. **Bail-Out Procedures with the Reserve Parachute:** In a situation where it is impractical for smokejumpers to hook their static lines to the overhead cable, or if they are not equipped with main parachutes, on a ferry flight for example, smokejumpers should jump with their reserve parachute.
8. The best exit procedure with the reserve parachute is to leave the door in the standard manner, with one exception: the smokejumper will be looking at the reserve handle. It is very easy to miss the handle when not looking at it. The instant the smokejumper leaves the door; he/she should pull the reserve handle.
9. **Aircraft Fire in Flight:** The spotter and pilot shall make a coordinated decision concerning appropriate action if a fire occurs in flight. The spotter must maintain control of the situation and take aggressive action to control the fire. If the fire becomes uncontrollable, begin emergency evacuation procedures.
10. **The Spotter's Responsibility:** The spotter is responsible for maintaining positive control during an emergency bail-out and for doing everything he/she can to ensure that all smokejumpers get out of the aircraft safely.

## Emergency Crash Procedures

1. **Spotter Restraint:** At a minimum, secondary restraint (harness/tether) training shall include the following actions/considerations on an annual basis:
  - a. Aircraft connection point and secondary restraint configuration (Interagency Safety Alert IASA 17-02).
  - b. Proper donning and adjustment of the spotter secondary restraint system (harness and tether).
  - c. Understanding of the secondary restraint interaction with FAA approved seatbelt. Spotters should be tethered with a quick release mechanism within reach or untethered while seat belted.
  - d. Location and use-of the secondary restraint quick-release mechanism(s)
  - e. Understanding the buddy-check process to confirm proper configuration and connection (double-check/re-inspection).
  - f. Egress training (secondary restraint quick-release mechanism,

removal of seatbelt, existing aircraft).

- g. Location and use of rescue knife (seatbelt/webbing cutter).
2. **Aircraft Crash on Takeoff:** All personnel shall be prepared for an aircraft crash on takeoff. Smokejumpers and spotters shall use proper seating arrangements for the model aircraft used in the operation and must know where all the emergency exits are located and how to use them. If the aircraft crashes on takeoff, personnel shall evacuate the aircraft as soon as the aircraft stops moving. Be alert to smokejumpers and crewmembers who may have been hurt or incapacitated in the crash, and get them out quickly. Evacuate away from any fire that exists, depart the crash upwind, and account for all personnel.
3. **Crash Landing Procedures:** Whenever possible, the following procedures should be followed when a crash landing is imminent:
- h. Helmets and gloves on.
  - i. Fasten seatbelts.
  - j. Assume fetal position, arms close to the body. Occupants of side-facing seating shall attempt to face 45 degrees to the front of the aircraft.
  - k. Restrict unnecessary movement within aircraft.
  - l. Locate emergency exits and emergency equipment.
  - m. After a crash, vacate the aircraft quickly and in an orderly manner. Be alert to smokejumpers or crewmembers who may have been hurt or incapacitated in the crash, and get them out quickly. Evacuate and depart the aircraft upwind and account for all personnel.

**Notes**

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## Unit 3 – Specialized Training

### Chapter 1 – Spotter Training

#### III -- Navigation

#### Lesson A – Geography



#### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Geography</b>
<b>Objective(s):</b>	Upon completion of this section, the trainee will be able to identify on a map or aeronautical chart each of the geographic features listed on the prepared handout.
<b>Suggested Duration:</b>	2-3 hours study time
<b>Training Aids Needed:</b>	Maps and aeronautical charts of the base's primary coverage area; a prepared list of key geographic features, rivers, peaks, forests, districts, etc.
<b>Notes:</b>	Practical application of navigation skills is beyond the scope of this lesson. The information presented in this section should form a basis for the trainee to learn practical navigation skills on supervised spotting missions.

#### Overview

To supplement aircraft navigation skills that will be covered in subsequent lessons, instructor should ensure that the trainee has memorized key features and important landmarks. A list of features and landmarks should be prepared by the instructor at each smokejumper base. Forests, districts, major drainages, peaks, and other features that are commonly referenced in locating or reporting fires should be included on this list. The trainee should be provided maps, charts, and study time. A verbal test should be used to complete this section in which the trainee is required to quickly point out features on a map or chart as they are named by the instructor.

## Unit 3 – Specialized Training

### Chapter 1 – Spotter Training

#### III -- Navigation

### Lesson B – Aeronautical Charts and Maps



#### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Aeronautical Charts and Maps</b>
<b>Objective(s):</b>	Upon completion of this section the trainee will be able to read important information from aeronautical charts and Forest Service maps that will be needed to carry out navigation and fire-locating responsibilities on spotting missions.
<b>Suggested Duration:</b>	1 hour classroom
<b>Training Aids Needed:</b>	Aeronautical charts and maps
<b>Notes:</b>	Practical application of navigation skills is beyond the scope of this lesson. The information presented in this section should form a basis for the trainee to learn practical navigation skills on supervised spotting missions.

#### Overview

This section should be conducted in the classroom for the purpose of discussing and familiarizing the trainee with how charts and maps are used on spotting missions. The flight exercise in Training Guide, Unit 3, Section IX will provide some opportunity for practical instruction.

Various private pilot manuals or textbooks may provide instructors with good reference material regarding aeronautical charts.





## Unit 3 – Specialized Training

### Chapter 1 – Spotter Training

#### III -- Navigation

#### Lesson C – Aircraft Instruments & Navigation Aids



#### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Aircraft Instruments and Navigation Aids</b>
<b>Objective(s):</b>	Upon completion of this exercise the trainee will be able to demonstrate basic familiarity with aircraft instruments by describing the function of instruments and navigation aids found in smokejumper aircraft.
<b>Suggested Duration:</b>	1 hour
<b>Training Aids Needed:</b>	Smokejumper aircraft parked on the ramp. The instructor may wish to enlist the help of a smokejumper pilot in teaching this lesson. The lesson should be conducted in the cockpit of the smokejumper aircraft.
<b>Notes:</b>	Practical application of navigation skills is beyond the scope of this lesson. The information presented in this section should form a basis for the trainee to learn practical navigation skills on supervised spotting missions.

#### Overview

While it is not necessary for a smokejumper spotter to have a pilot's knowledge of aircraft instruments and navigation, it is helpful if the spotter has a general knowledge of aircraft radio navigation aids, particularly the VOR.

A spotter spends a lot of time sitting up front with the pilot. By being able to interpret the basic aircraft instruments, a spotter can stay oriented as to direction of flight, altitude, and location of the aircraft.

## Magnetic Compass

The magnetic compass is a magnet that aligns itself with the magnetic North Pole while the airplane turns around it.

Smokejumpers are familiar enough with the compass so an involved description isn't necessary, but some hints on using the compass in an aircraft might be helpful.

The magnets in the compass tend to align themselves parallel to the earth's lines of magnetic force. This tendency is more noticeable as the Magnetic North Pole is approached. The compass would, theoretically, dip or point straight down when directly over the pole. The compass card is mounted so that a low center of gravity location fights this dipping tendency. Dip causes certain errors to be introduced into the compass readings and should be noted as follows:

### 1. Northerly Turning Error

In a shallow turn, the compass leads by about 30 degrees when passing through south, and lags about 30 degrees when passing through north. On passing east and west headings in the turn, the compass is approximately correct (30 degrees is the rule of thumb for the U.S.).

For instance, the plane is heading south and makes a left turn to fly due north. As soon as the left bank is entered the compass will indicate about 30 degrees of left turn, when actually the nose has hardly started to move. So, when a turn is started from a heading of south, the compass will indicate an extra fast turn in the direction of the bank. It will then hesitate and move slowly again when approximately the correct reading as the heading of the east is passed. The compass will lag as north as approached so when the plane rolls out the magnetic compass indicates 30 degrees.

If the plane had made a right turn from a south heading, the same effects would have been noticed: an immediate indication of turn in the direction of bank, a correct reading at a heading of west, and a compass lag of 30 degrees when heading north.

If the plane starts a turn from a heading of north, the compass will initially register a turn in the opposite direction, but will soon race back and be approximately correct as an east or west heading is passed. It will then lead by about 30 degrees as the airplane's nose points to magnetic south.

### 2. Acceleration Errors

Because of its correction for dip, the compass will react to acceleration and deceleration of the airplane. This is most apparent on east or west headings, where acceleration results in a more northerly indication.

Deceleration gives a more southerly indication.

### 3. Conclusions about the Magnetic Compass

The magnetic compass reads correctly only when the airplane is in straight and level flight (and sometimes not even then). In bumpy air, the compass oscillates so that readings are difficult to take.

The fluid in the case (acid free white kerosene) is designed to keep the oscillations at a minimum, but the problem is still there. A spotter observing an aircraft compass behaving strangely during turns or while climbing or descending may be assured that this is not out of the ordinary. Also, a spotter should realize that the compass is not necessarily the best place to look for an indication of aircraft heading. The best reference is a properly set directional gyro.

## **Directional Gyro**

The directional gyro depends on one of the main properties of gyroscopes: "rigidity in space." Once spinning, the gyroscope resists any effort to tilt its axis (or plane of rotation.) In the case of directional gyro, the plane of rotation is vertical. The directional gyro has a compass card or azimuth scale which is attached to the gyro gimbal and wheel. The wheel and card are fixed, and, as in the case of the magnetic compass, the plane turns around them.

The directional gyro has no magnet that causes it to point to the magnetic North Pole, and must be set to the heading indicated by the magnet compass to a moment when the plane is flying straight and level and the magnetic compass is reading correctly. (Many gyros are self-correcting.)

The advantage of the directional gyro is that it does not oscillate in rough weather and gives a true reading during turns when the magnetic compass is erratic.

Spotters will find the directional gyro the best aircraft instrument to refer to for information concerning heading. However, the spotter must be sure that the directional gyro has been set recently with the magnetic compass as reference. Frequently, pilots do not set the DG in the right seat instrument display. Particularly, after a series of turns and banks, a directional gyro may have to be reset by reference to the magnetic compass. In any case, it should be checked and reset, if necessary, every 20 or 30 minutes as directional gyros have some tendency to drift.

## **Airspeed Indicator**

The airspeed indicator is nothing more than a specialized air pressure gauge. The airspeed system is comprised of the pitot and static tubes and the airspeed indicator instrument.

An airplane moving through the air creates its own relative wind. This relative wind exerts a ram pressure in the Pitot tube where its effects are passed on into a diaphragm which is linked to an indicating hand. This relative wind force is calibrated in miles per hour, or knots, rather than pounds per square foot of pressure. The static tube acts as a neutralizer of the static pressure around the airplane and within the instrument, so that only the dynamic pressure is measured.

For accuracy, static tube openings are placed at some point on the airplane where the most accurate measurement of the actual outside air static pressure is found. A usual spot is on the side of the fuselage somewhere between the wing and stabilizer. These points are selected as being places where the static pressure is least affected by the airflow about the airplane. The Pitot tube is placed at a point on the aircraft where the actual relative wind is measured, free from any interfering aerodynamics effects. A particularly bad place, for example, would be just above the wing where the air velocity is greater than the free stream velocity.

Light plane airspeed indicators are calibrated for standard sea level conditions with a temperature of 59 degrees F and a pressure of 29.92 inches of mercury. Spotters should realize that as aircraft altitude increases, the air density decreased so that, for example, an airplane indicating 180 knots at 10,000 feet actually has a higher “true airspeed” than an airplane at sea level indicating the same dynamic pressure.

The FAA requires that the airspeed indicator be marked for various important speeds. These speeds are as follows:

**Airspeed Indicator Markings**

Airspeed Indicator Marking	Meaning
Red Line	Never exceed speed
Yellow Arc	Caution range. Strong vertical gusts could damage the airplane in this speed range; therefore, it is best to refrain from flying in this speed range when encountering turbulence of any intensity.
Green Arc	Normal operating range. The airspeed at the lower end of this arc is the flaps-up, gear-up, power-off stall speed at gross weight. The upper end of the green arc is the maximum structural cruising speed.
White Arc	The flap operating range. The lower limit is the stall speed at gross weight with the flaps in the landing positioning, and the upper limit is the maximum flap operating speed.

**Altimeter**

The altimeter is an aneroid barometer calibrated in feet instead of inches of mercury. Its job is to measure the static pressure and register this fact in terms of feet or thousands of feet.

The altimeter has an opening that allows static (outside) pressure to enter the otherwise sealed case. A series of sealed diaphragms or “aneroid wafers” within the case are mechanically linked to the three indicating hands. Since the wafers are sealed, they retain a constant internal “pressure” and expand or contract in response to the changing atmospheric pressure surrounding them in the case. As the aircraft climbs, the atmospheric pressure decreases and the sealed

wafers expand; this is duly noted by the indicating hands and increase in altitude (or vice versa).

Standard sea level pressure is 29.92 inches of mercury and the operations of the altimeter are based on this fact. Any change in local pressure must be corrected by the pilot. This is done by using the setting knob to set the proper barometric pressure (corrected to sea level) in the setting window.

Pressure changes can give false indications when using an altimeter if corrected local pressures are not set into the altimeter. For example, when a plane flies from a high pressure area into a low pressure area, the altimeter “thinks” you have climbed and will register accordingly -- even if you haven’t changed altitude. If a pilot sees this, he may fly the plane down to the “correct altitude” and this will actually be low. Flying from a low to a high pressure area makes the altimeter think you have let down to a lower altitude and it registers too low. Temperature variations affect pressure and here too there is a chance for altimeter error.

With respect to reading altimeters in smokejumper aircraft, a spotter should be certain the altimeter has been set to local barometric pressure. Frequently, aircraft have dual altimeters and the pilot sets one altimeter but does not bother to set the altimeter in the right seat instrument display. If the altimeter has not been set and the spotter uses it to give altitude information, say to an air attack supervisor, a serious error in aircraft spacing may result.

## **VOR Radio Navigation**

Smokejumper aircraft pilots frequently use VOR navigation in flying point to point. Also, fire locations are often identified by reference to a particular VOR radial and a number of miles. It is desirable that a smokejumper spotter has at least a basic understanding of VOR navigation.

VOR stands for VHF Omni range. The omni receiver in the airplane is able to measure the aircraft’s position relative to a particular VOR station by electronic timing.

The omni station puts out two signals. One is omni-directional; this signal is transmitted in all directions simultaneously at the rate of 30 times per second. The other is a rotating signal which is turning at the rate of 30 revolutions per second (clockwise). The rotating signal has a positive and a negative side. The all directional or reference signal is timed to transmit at the instant the positive side of the rotating signal passes magnetic north. So, let us suppose that instead of 30 times per second, the rotating signal turned one time a minute (and the reference signal also flashed once a minute as the positive side of the rotating signal passed north). Suppose that at your geographic position, the omni set in the aircraft receives the reference signal and 45 seconds later receives the rotating signal. Your position is 45/60 or 3/4 of the way around (clockwise); you are somewhere on the 270 degree radial.

The airplane’s VOR is composed of four main parts:

1. Frequency selector.

2. Azimuth or bearing selector, calibrated from 0-360 degrees (called OBS or omni bearing selector).
3. Deviation indicator or left-right needle.
4. TO-FROM indicator.

Suppose you are in a vicinity of a VOR and want to fly directly to it. The pilot would: 1) tune in the correct frequency and identify the station; 2) turn the omni bearing selector until the TO-FROM indicator says "TO" the station, center the needles, and then fly the needle; 3) if after a period of time, the needle drifts, for example, to the left, the pilot would turn left and fly until the needle is centered again. The aircraft would then be back on the preselected course. The left - right needle is set up so that a full deflection to either side means that you are off 10 degrees or more. A half deflection to either side means that you are about 5 degrees from your selected bearing.

The VOR has the great advantage of being useable from all directions and is not affected by thunderstorms as are low frequency radios. One disadvantage of the VOR is that being VHF it is line of sight so you may not be able to pick up a station at any great distance.

One misunderstanding common with VOR navigation is that the airplane's heading has an effect on the OBS and TO-FROM indicator. The receiver merely tells your position relative to the VOR. If you made a tight 360 turn, the indicators would remain the same because you would still be at essentially the same position with respect to the VOR station.

## **Distance Measuring Equipment (DME)**

The DME (distance measuring equipment) in an aircraft sends out interrogating pulses at specific spacing which are received by the ground station. The ground station then transmits a paired pulse back to the aircraft at a different pulse spacing and on a different frequency. The time required for the round trip of this signal exchange is measured by the DME unit in the aircraft and is indicated on a counter or dial as nautical miles from the aircraft to the station. An aircraft one mile high directly over a DME station would receive a reading of being one mile from the station; an aircraft some distance from the station will receive a read-out closer to ground distance, depending on the angle. Like the VOR, DME depends on line-of-sight reception.

## **Global Positioning System (GPS)**

It is important that all Smokejumper spotters understand, and can operate, the Global Positioning System (GPS) navigation equipment found in Smokejumper aircraft. Since different models are in use, spotters will need to familiarize themselves with the models in use at their particular base.

### **What is GPS?**

The Global Positioning System (GPS) is a worldwide radio-navigation system formed from a series of 24 satellites and their ground stations. The satellites

orbit above the earth at about 12,000 miles and at a speed of roughly 7,000 mph. This allows the satellites to make two complete orbits in less than 24 hours. The GPS satellites transmit two low power radio signals, designated L1 and L2. Civilian GPS uses the L1 frequency of 1575.42 MHz in the UHF band. The signals travel by line of sight, meaning they will pass through clouds, glass and plastic but will not go through most solid objects such as buildings and mountains.

### **How does it work?**

GPS uses “triangulation” from satellites by measuring distance using the travel time of radio signals. The GPS receiver compares the time a signal was transmitted by a satellite with the time it was received. The time difference tells the GPS receiver how far away the satellite is, and with this measurement from at least two more satellites, the receiver can determine the user’s position and display it on the unit’s screen. A GPS receiver must be locked on to the signal of at least three satellites to calculate a 2D position (latitude and longitude) and track movement. Once the user’s position has been determined, the GPS unit can calculate other information, such as speed, bearing, track, trip distance, distance to destination, sunrise and sunset time, and more.

*Much more detailed and up-to-date information on GPS systems can be found at the Garmin and Trimble websites.*

Latitude is the angular distance north or south of the equator, measured in degrees, minutes and seconds or one hundredths of a minute. (Example: 45 30’ 30” or 45 30.50’) Each minute of latitude is equal to one nautical mile or 6,067 feet from the Equator to the North Pole.

Longitude is the angular distance east or west of the prime meridian at Greenwich, England, measured in degrees, minutes, and seconds or one hundredths of a minute. (Example: 121 35’ 05” or 121 35.08’) Each minute of longitude at the equator is equal to one nautical mile or 6,076 feet, but reduces in length moving north to south due to the convergences at the poles.

The Western United States lies between 102 degrees and 124 degrees longitude measured from east to west and 32 degrees and 49 degrees latitude measured from south to north.

Properly programmed and operated, GPS is capable of producing an exact and precise latitude and longitude constantly with position accuracy to within 50 feet.

The use of GPS navigation can be invaluable to the smokejumper spotter. Once the latitude and the longitude of the fire, or multiple fires, are received from dispatch, the spotter can enter them into one or more of the waypoints (locations stored in memory) of the GPS unit. The waypoint can then be noted and called up at any time.

Once the waypoint has been called up, the spotter will be able to read the heading and distance to the fire from the present location. The GPS will also give the spotter is the ETA from present location, the ground speed, ground track, and the latitude and longitude at present location. If the smokejumper





**Unit 3 – Specialized Training**  
**Chapter 1 – Spotter Training**  
**IV – Radio Communications**  
**A – Spotter/Dispatch Communications**



**Lesson Plan Outline**

<b>Lesson(s):</b>	<b>Spotter/Dispatch Communications</b>
<b>Objective(s):</b>	Upon completion of this section, the trainee will be able to correctly accomplish the required radio communications with dispatch while on spotting missions.
<b>Suggested Duration:</b>	30 minutes classroom lecture, discussion, and practice
<b>Training Aids Needed:</b>	Lesson plan covering specific procedures and requirements
<b>Notes:</b>	Due to the differences in radio communication policies and procedures, each smokejumper base should develop their lessons for this section

**Notes**

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## Unit 3 – Specialized Training

### Chapter 1 – Spotter Training

#### IV – Radio Communications

##### B – Fire Traffic Area



### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Fire Traffic Area</b>
<b>Objective(s):</b>	Upon completion of this section, the trainee will be able to correctly carry out spotter's radio communication responsibilities with regard to air traffic control when approaching and over fires.
<b>Suggested Duration:</b>	1 hour lecture, 30 minutes practical exercise
<b>Training Aids Needed:</b>	Classroom, two hand-held talk radios
<b>Notes:</b>	Due to the differences in radio communication policies and procedures, each smokejumper base should develop their lessons for this section

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## Unit 3 – Specialized Training

### Chapter 1 – Spotter Training

#### IV – Radio Communications

#### C – Spotter/Incident Commander Communications



#### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Spotter/Incident Commander Communications</b>
<b>Objective(s):</b>	Upon completion of this section, the trainee will be able to correctly accomplish radio communication with smokejumper incident commanders.
<b>Suggested Duration:</b>	To be determined by instructor.
<b>Training Aids Needed:</b>	Classroom, two hand-held talk radios
<b>Notes:</b>	Due to the differences in radio communication policies and procedures, each smokejumper base should develop their lessons for this section

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**Unit 3 – Specialized Training**  
**Chapter 1 – Spotter Training**  
**IV – Radio Communications**  
**D – Aircraft Radio Communications**



**Lesson Plan Outline**

<b>Lesson(s):</b>	<b>Aircraft Radio Communications</b>
<b>Objective(s):</b>	Upon completion of this section, the trainee will be able to effectively operate the FM and VHF radios in the cockpit of the smokejumper aircraft, and the spotter's communication panel near the jump door.
<b>Suggested Duration:</b>	To be determined by instructor.
<b>Training Aids Needed:</b>	Smokejumper aircraft on the ramp
<b>Notes:</b>	Due to the differences in radio communication policies and procedures, each smokejumper base should develop their lessons for this section.

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# Unit 3 – Specialized Training

## Chapter 1 – Spotter Training

### V – Information Gathering and Reporting

#### A – Fire Size Estimation from Aircraft



### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Fire Size Estimation from Aircraft</b>
<b>Objective(s):</b>	Upon completion of this section, the trainee will be able to explain techniques that can be used to estimate small and large fire size from an aircraft.
<b>Suggested Duration:</b>	20 minutes in classroom. (If desired, 10 minutes on a training flight may be added as a practical exercise.)
<b>Training Aids Needed:</b>	Blackboard

### Overview

The smokejumper spotter is often the first person in a position to provide accurate information concerning five characteristics for fires to which initial attack forces are being dispatched. Early reports of new fires are often incomplete and estimated fire size inaccurate. It is part of the responsibility of the spotter to size up the fire and provide information back to the dispatch so decisions can be made to allocate resources and set priorities. An important part of sizing up a fire is estimation of acreage. It is important the spotter be able to accurately estimate the size of small initial attack fires and large project fires.

### Fire Size Estimation

Fire size estimation can be divided into estimates of small fires, which for the purpose of acreage determination are less than 50 acres, and estimates of large fires which are 50 acres or more.

There is a tendency to overestimate the acreage of a fire from the air due to smoke drift. An inexperienced observer will sometimes include the area

obscured by drifting smoke with the actual fire area. This is especially easy to do if a temperature inversion holds the smoke on the ground. Poor visibility due to smoke can make it very difficult to see the actual burned area and fire perimeter.

## Small Fire Size Estimation

Estimation of the size of a small fire from the air is for determining the potential of the fire to become a problem and for record of the fire size at initial attack. It is not practical for the spotter to fly the perimeter of a small fire. Small fire size estimation becomes an educated guess on the part of the spotter. However, it does help to have a standard by which to estimate the acreage of a small fire. The close similarity of an acre to a football field makes it a practical reference to use. This area should not be confused with the entire part inside the track, which totals 2.28 acres. Fires rarely burn in the shape of a football field, but an awareness of the similarity in size will allow spotters to use it as a standard.

*The instructor may want to mark an acre on the ground for the trainee to look at from the air.*

## Large Fire Size Estimation

There are times when it will be necessary to estimate the acreage of a large fire. A spotter may be asked by the Incident Commander or Dispatcher to estimate the acreage and this estimate should be accurate.

The aircraft flight method of determining fire size is likely to be more accurate than an eyeball guess on a large fire. The smokejumper aircraft is flown at a convenient airspeed, such as 120 mph, which equals 2 miles per minute.

The spotter then times how long it takes to fly the length and width of the fire. Length and width flight times can easily be translated into miles. The spotter then selects an appropriate geometric shape to use in his size calculations which most closely matches the shape of the fire. The size of the fire is then calculated in square miles. Since we know that one square mile equals 640 acres, area of the fire in square mile x 640 = fire size in acres.

For example, we have just flown an approximately rectangular shaped fire for size. It took 15 seconds to fly the width, 30 seconds to fly the length. The formula for the area of a rectangle is  $A = \text{length} \times \text{width}$ ; in this case, 0.5 square miles.  $0.5 \text{ square miles} \times 640 = 320 \text{ acres}$ . The fire wasn't really quite a rectangle; there were rounded corners, etc., so eyeballing it now, we adjust our calculations and say that 250 acres looks like a good figure on size.



## Unit 3 – Specialized Training

### Chapter 1 – Spotter Training

#### V – Information Gathering and Reporting

#### B – Analyzing and Reporting Fire Weather



#### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Analyzing and Reporting Fire Weather</b>
<b>Objective(s):</b>	Upon completion of this section, the trainee will be able to discuss and explain the various stages of thunderstorm development and observations that should be included when communicating weather information to a dispatch office.
<b>Suggested Duration:</b>	30 minutes in classroom
<b>Training Aids Needed:</b>	To be determined by instructor.

#### Role of the Spotter in Weather Observation

Fire weather information is sometimes requested from smokejumper aircraft on patrol or enroute to a fire. Spotters should be familiar with cloud types, thunderstorm development, weather indicators of thunderstorms, and fire potential so that they can provide useful information back to dispatch.

#### Conditions Necessary for Thunderstorm Development

For thunderstorms to occur, warm air must be able to move upward through the atmosphere. Stable air will prevent this up-warm movement; neutral air will hinder it; and unstable air will encourage it. For thunderstorms to actually occur, the air must be unstable through a deep layer of the upper atmosphere so that lower air is lifted to the level of free convection where it is warmer than the surrounding air and will continue to rise freely until it is cooled by the upper air.

The rate of cooling is called the adiabatic lapse rate and is 5.5 degrees per 1,000 feet.



As the warm air cools, it condenses into water droplets at the dew point, and if convection continues, ice crystals begin to form at the freezing level. Convection must continue beyond the freezing level for sufficient electrical charge separation to occur to result in lightning discharge.

Weather indicators of unstable air are good visibility, gusty winds, clouds developing vertically (cumulus development) and smoke rising straight up to great heights. On the other hand, steady wind, stratiform clouds, poor visibility (fog layers), and inversion layers where smoke drifts apart and forms layers after rising, indicate stable atmospheric conditions and little likelihood of thunderstorm development.

Some form of lifting, called a triggering mechanism, must begin the upward movement of air. This can be orographic (physical features), thermal (usually requiring temperatures of 70 degrees or more), frontal (a cold air mass lifts warm air in front of it), or convergent (where two air masses meet in a low pressure area and force the air upward). All lifting mechanisms act to bring warm air up from below near the surface to the level of free convection where it attains its own buoyancy and no longer needs an external lifting force.

The third condition necessary is sufficient moisture for the condensation of water vapor into droplets and ice crystals. Heat is released in the condensation process, resulting in even greater air instability and making it easier for the lower air to reach the level of free convection. If little or no moisture is available, it is likely that no clouds will form at all, even though other factors may be favorable for thunderstorm development. The higher the moisture content, the easier the level of free convection is reached.

## **Factors That Can Stop Thunderstorm Development**

Even when air instability, a triggering mechanism, and sufficient moisture at lower altitudes are all present, the building upward of cumulus clouds into thunderstorms may not occur. Very stable air at intermediate altitudes (6,000 to 15,000 feet) may suppress the upward movement of the air. Very dry air at intermediate altitudes may also cause the building convection columns before they build high enough (25,000 feet) to become thunderstorms. Thunderstorms require that air be lifted to the condensation level, lifting continue beyond the freezing point, a continuous supply of water vapor be available for condensation, and upper atmosphere winds are not too strong to interfere with the cloud development.

## **Thunderstorm Development**

Each thunderstorm cell has its own identity and goes through a definite life cycle which may last from 20 minutes to 1.5 hours. A storm may last 6 hours or more with some cells growing while others dissipate. A single cell may range from a few miles in diameter up to 10 miles in diameter with clusters of cells ranging up to 50 miles in diameter.

There are three stages in the development of a single cell:

1. **Cumulus Stage:** Cumulus clouds form when moist air is lifted and the water vapor condenses as it cools. Water droplets are carried upward and held in suspension. This stage is characterized by strong updrafts which can reach as much as 50 mph. Cloud types associated with this stage are fair weather cumulus and alto cumulus.
2. **Mature Stage:** The start of rain from the base of the cumulus cloud marks the beginning of the mature stage. The droplets of water have grown to a size where they can no longer be held in suspension by the updraft. This usually occurs 15-20 minutes after the cell has built upward beyond the freezing level. The top of the convection cell reaches its maximum height during this stage rising to as much as 30,000 – 40,000 feet. The visible cloud top flattens and spreads laterally into the anvil top, often characteristic of this stage of development. The cloud profile is distinct with sharp edges. A change in air circulation within the cloud occurs with a progressive switch from updrafts to downdrafts as the falling rain drags air down with it by friction and by cooling. As rain increases, downdrafts increase, sometimes reaching 30 mph.

The horizontal outflow of air movement below the base of the cloud produces strong gusty surface winds which are strongest in the direction in which the cloud is moving. Updrafts also continue to increase in speed and the most intense air turbulence associated with the cell occurs at this stage. The start of rain during the mature stage also marks the start of the greatest lightning danger.

3. **Dissipating Stage:** As the downdrafts continue to develop, the updrafts weaken and the source of energy and moisture for continued cell growth and activity is cut off. Finally, the falling water particles available are exhausted and the downdrafts weaken and dissipation follows shortly. During this stage, the top of the cell glaciates or ices causing the appearance of the top to become wispy and the edges to lose their sharp outlines. Lightning will still occur at this stage. If lightning has not occurred during the mature stage, it will not occur during the dissipating stage.

## Lightning

The energy release from a single well-developed thunderstorm may exceed by 10 times the energy release from a WWII atomic bomb. This energy results from the latent heat released by the condensation of water vapor. For every pound of water that condenses, 1,000 BTUs of energy are released. Part of this energy is converted to the kinetic energy of motion which is released through violent winds, and the rest is released through lightning activity. Lightning occurs when the electrical potential exceeds the resistance of the atmosphere to a flow of electrons between the centers of opposite charge. Charge separation in a developing cell causes positive charges to accumulate in the upper portion of the cell while negative charges accumulate in the lower portion. The negative base induces a critical point, electrical current jumps the gap. Most lightning however, is within a single cell or between cells with only about 30 percent of the lightning

associated with a storm system occurring between the clouds and the ground. A lightning discharge actually consists of two stages. A leader strike works its way downward in a series of probing steps and once ground contact is made, an average of four return strikes flash back upward.

## Thunderstorm Ignition Potential

Fire occurrence from lightning depends on a number of factors such as temperature, fuel moisture content of ground fuels, amount of precipitation, base of the clouds, and the rate of development of the cells.

Recent research on thunderstorms indicates that approximately 1 percent of lightning strikes are of longer duration than a normal strike and it is thought that these strikes, called hybrid strikes, are the ones that start fires.

Rapidly building cells seem to create greater charge separation and produce lightning in greater quantities than convection columns that have developed slowly.

Fire starts increase significantly when surface temperatures climb above 70 degrees and relative humidity drops lower than 30 percent.

The amount of precipitation produced by a thunderstorm that actually reaches the ground is perhaps the single most important factor in the potential of the thunderstorm to start fires.

The altitude of the base of the cells above the ground level is extremely important in determining the ignition potential of the thunderstorm. The higher the base of the cells, the more rain will evaporate before reaching the ground, and the greater probability of fire starts.

Thunderstorms are classified by the altitude of their bases above ground level as follows:

### Thunderstorm Classification

Classification	Altitude of Base AGL
DRY	8,500 feet and above
MOSTLY DRY	6,500 feet to 8,500 feet
AVERAGE WET	4,500 feet to 6,500 feet
WET	4,500 feet and below

Fire starting potential is low when thunderstorms are wet because of weaker lightning strikes, higher fuel moisture, and colder surface temperatures. Fire potential is highest when bases are above 8,500 feet since most, if not all, of the precipitation evaporates before reaching the ground and the humidity and fuel moisture remain low.

## Checklist for Aircraft Weather Reporting

The following information should be included when reporting weather observations:

- Visibility in miles.
- Cloud types.
- Base of clouds.
- Estimated top of clouds.
- Thunderstorm development is observed and stage of growth of the cells.
- Amount of precipitation with storm system.
- Whether or not lightning has been observed.
- If cloud-to-ground lightning was observed.

# Unit 3 – Specialized Training

## Chapter 1 – Spotter Training

### VI – Spotting and Streamer Dropping

#### Overview



#### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Spotting and Streamer Dropping</b>
<b>Objective(s):</b>	See each individual lesson.
<b>Suggested Duration:</b>	See each individual lesson.
<b>Training Aids Needed:</b>	See each individual lesson.

#### Overview

This section on spotting and streamer dropping consists of four parts:

- Reading Assignment and Pretest
- Classroom Lecture and Discussion
- Flight 1 – Practical Training
- Flight 2 – Practical Training

#### Notes

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**Unit 3 – Specialized Training**  
**Chapter 1 – Spotter Training**  
**VI – Spotting and Streamer Dropping**  
**A – Reading Assignment and Pretest**



**Lesson Plan Outline**

<b>Lesson(s):</b>	<b>Reading Assignment and Pretest (20 Questions)</b>
<b>Objective(s):</b>	Upon completion of the pretest, the instructor will be able to identify the knowledge level of the trainee(s). The reading assignment and pretest is intended to enhance the effectiveness and quality of the classroom lecture and discussion lesson on spotting and streamer dropping.
<b>Suggested Duration:</b>	2 hours for reading assignment, 30 minutes for pretest, 30 minutes for instructor grading of pretest
<b>Training Aids Needed:</b>	Handouts of narrative written material for classroom lecture on spotting and streamer dropping. Have student's complete written test.

**Notes**

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## Spotting and Streamer Dropping Pretest

1. Minimum jump altitude is \_\_\_\_\_ feet.
2. Minimum jump altitude is specifically related to the above ground level (AGL) altitude above the jump spot.

True \_\_\_\_\_ False \_\_\_\_\_

3. List two methods of determining drop altitude.

A.

B.

4. List two reasons why “timing the streamers” may not give an accurate indication of AGL altitude.

A.

B.

5. To provide the best determination of wind drift, the first set of streamers dropped should be released:

A. Directly over the selected jump spot.

B. An estimated distance upwind.

C. Over high terrain upwind of the jump spot.

6. Check streamers are normally dropped directly over the jump spot.

True \_\_\_\_\_ False \_\_\_\_\_

7. Describe the most likely error to be encountered using the “timing method” of determining the exit point rather than visually selecting an exit point. (Short answer)

8. List three types of special wind air conditions that may make selection of a correct exit point impossible.

A.

B.

C.

9. By watching the streamers a spotter can gain very accurate information regarding wind velocity and direction at different altitudes during their descent.

True \_\_\_\_\_ False \_\_\_\_\_

10. What effect does variation in terrain elevation between the jump spot and where the streamers land have on selection of an exit point and estimating wind velocity?  
(Short answer)

11. Maximum wind for smokejumping with FS-14 canopies is considered to be how many \_\_\_\_\_ mph?

12. List three factors a spotter needs to consider beyond the distance streamers drift when estimating ground wind velocity.

A.

B.

C.



13. List five possible hazards a spotter should look for when selecting a jump spot.

A.

B.

C.

D.

E.

14. List the four standard smokejumper aircraft patterns used over a fire in the process of spotting.

A.

B.

C.

D.

15. Describe two methods a spotter may use to describe the desired jump run to the pilot after dropping streamers.

A.

B.

16. On "final" during a jump run, a 5 degree correction on long final will have less effect than a 5 degree correction on short final.

True \_\_\_\_\_ False \_\_\_\_\_

17. Describe a situation where a cross wind pattern may be desirable when dropping smokejumpers. (Short answer)

18. List three important pieces of information that can be obtained when making a low pass.

A.

B.

C.

19. Why should jump spots on the lee side of ridges be avoided? (Short answer)

20. It is more desirable to use a marginal jump spot close to the fire rather than a large open jump spot which may be a twenty minute walk to the fire.

True \_\_\_\_\_ False \_\_\_\_\_

**Unit 3 – Specialized Training**  
**Chapter 1 – Spotter Training**  
**VI – Spotting and Streamer Dropping**  
**B – Classroom Lecture and Discussion**



**Lesson Plan Outline**

<b>Lesson(s):</b>	<b>Classroom Lecture and Discussion</b>
<b>Objective(s):</b>	Upon completion of this section, the trainee will be able to demonstrate the principles of spotting and streamer dropping by (1) satisfactorily answering verbal questions on the material after classroom lecture and discussion; and (2) correctly applying the material during subsequent training flights.
<b>Suggested Duration:</b>	4 hours
<b>Training Aids Needed:</b>	Classroom, blackboard

**Notes**

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## **Spotting and Streamer Dropping**

### **Jump Altitude**

#### **Minimum Altitude**

Jump altitude should be a minimum of 1,500 feet above the ground. A jump altitude lower than 1,500 feet does not allow a smokejumper enough time to recognize a malfunction and achieve full deployment of a reserve parachute at a safe altitude above ground level.

#### **Jump Altitude = Altitude above Exit Point**

It should be emphasized that “jump altitude” is altitude above the exit point, not altitude above the jump spot. In many cases, the exit point upwind of the jump spot will be higher or lower terrain than the jump spot. This difference in terrain elevation must be taken into account when establishing drop pattern altitude. Smokejumper pilots should look ahead and anticipate this factor when selecting an altitude prior to streamer dropping. Spotters should point out high terrain upwind of the jump spot to the pilot and remind him to add extra altitude.

#### **Methods of Determining Drop Altitude**

There are a number of methods which may be used to determine and check drop altitude. No one method should be relied upon; rather, one method should be checked against another. As a final test of altitude, a spotter should “look” to see if the altitude seems reasonable.

##### **1. The Low Pass**

A low pass in the smokejumper aircraft (500 feet or so) on approaching the fire is one good method of determining ground elevation. 1,000 feet or so added to ground elevation gives the pilot his altimeter reading at jump altitude. The low pass also affords a good look at the fire, hazards in the drop zone, etc.

##### **2. The Radar Altimeter**

Some smokejumper aircraft are equipped with radar altimeters. These altimeters give an accurate AGL read-out. In flat and rolling terrain, if the pilot is careful in taking a reading over the probable exit point, radar altimeters are extremely useful in determining drop pattern altitude. However, in steep terrain the cone-shaped “foot print” of the radar altimeter is too large to provide accurate AGL altitude information.

##### **3. Timing the Streamers**

A rough check on altitude is made by the spotter timing the descent of the streamers. For 20-foot streamers, 75 seconds of streamer descent indicates an altitude of approximately 1,500 feet. These streamers descend 20 feet per second. If the streamers descend and land in 60 seconds, the spotter would have the pilot increase altitude by 300 feet.

In rugged, hilly terrain, the spotter must be aware that if the streamers land down slope at a lower elevation than the exit point, the altitude will need to be increased even though there was 75 seconds of descent time. If the streamers landed in high terrain but the exit point is out over a valley, 45 seconds of descent may be sufficient.

Updrafts and downdrafts affect streamer descent time and if a spotter feels that the altitude indicated by a streamer descent time looks or seems unreasonable, this method of determining altitude should not be used.

Timing the streamers is only one of a number of tools a spotter uses to determine and check drop altitude and a spotter should not be under the impression that timing the streamers is a precise or universally reliable method.

### **High Terrain Upwind**

Any time the jump run is being made toward high terrain, a spotter must take into account the possibility of a smokejumper hanging up in the door or exiting the aircraft late, well beyond the exit point. If significantly higher terrain lies upwind of the exit point, additional altitude or a crosswind pattern may be needed.

### **Determining Wind Drift**

The basic procedure used to determine wind drift is to drop a set of drift streamers (weighted to descend and drift as a smokejumper under the canopy) over the selected jump spot at jump altitude and then note the distance downwind from the “release point” where the streamers land. A point upwind of the jump spot equal to the distance the streamers landed downwind is then selected as the “exit point.” A second set of “check streamers” may be dropped over this point and, in theory, should land in the jump spot.

### **Importance of Accurately Releasing Streamers over the Jump Spot**

In the process of spotting smokejumpers, there is nothing that leads to more confusion than dropping the initial set of drift streamers incorrectly, 100 yards or so from the jump spot, with the idea that the initial error in release point will be compensated for when the exit point is selected. This situation occurs frequently when the spotter has difficulty guiding the smokejumper aircraft over the spot on the initial streamer run, but decides to drop streamers. From the pilot’s point of view, confusion can easily begin here – the pilot assumes that the streamers have been let out over the jump spot and that the wind line is the line from where the streamers landed to the jump spot. While the spotter may tell the pilot that the streamers were let out 100 yards to the left, the pilot is left to guess just where the streamers were released. The pilot then must compensate for the error in release point and imagine where the streamers would have landed had they been let out over the jump spot. The spotter can also become easily confused making adjustments for the error in the release point.

Finally, the spotter must look upwind of the jump spot and pick an exit point based on the total result of his memory and compensations. Determining wind direction and release point is a very simple procedure if the streamers are

released over the jump spot accurately. However, a combination of errors can add up in a hurry if the spotter does not direct the smokejumper aircraft accurately over the jump spot before dropping the initial set of streamers.

### **Importance of Selecting Specific Exit Point**

Once the streamers have landed, the spotter must immediately select an exit point upwind of the jump spot. It is important that the spotter select a specific object like a tree, rock, etc., and informs the pilot of the exit point. From this time on, the spotter will be directing the aircraft toward this exit point, and need not be overly concerned if the smokejumper aircraft does not pass directly over the jump spot. If the spotter fails to select a specific exit point, the spotter may have a tendency to concentrate on lining the smokejumper aircraft up on the jump spot and then flying an appropriate distance past for the release point. With this approach, the smokejumper aircraft too often winds up flying over the jump spot and on out the correct distance past the spot but in somewhat the wrong direction. The result is that smokejumpers end up exiting the aircraft to one side of the correct exit point. Or, if a set of check streamers are dropped, the spotter can easily assume that the wind has changed between the first and second set of streamers. A good percentage of the spotting errors that occur are caused by not selecting an exit point.

### **Check Streamers**

The second set of streamers is normally dropped over the selected exit point. This set of “check streamers” gives a spotter confidence that the correct exit point was selected. Any time rugged terrain, a tight jump spot, high winds, etc., are a factor, a spotter should not hesitate to spend the time to drop two or more sets of check streamers. The majority of smokejumper fires present a straight forward wind drift situation. A spotter who accurately drops the initial set of streamers over the jump spot, carefully selects the exit point, and drops one set of check streamers can usually feel confident about dropping smokejumpers.

### **The Timing Method of Determining the Exit Point**

An alternative method to visually selecting an exit point upwind is the “timing method.” This method is easily abused and can lead to inaccurate spotting if care is not used.

Specifically, the timing method of determining the exit point is accomplished by flying the smokejumper aircraft over the streamers and timing or counting off the seconds it takes to cover the distance from the streamers to the jump spot. Over the jump spot, the count is reversed. Upon arriving at “O”, the smokejumper aircraft should be over the correct exit point exactly as far upwind as the streamers landed downwind. The problem of this method is that the spotter has no reference once he has passed the jump spot to direct the plane toward. It is easy for the plane to be flying at enough of an angle across the wind line by the time it has flown out 10 seconds to be considerably off to the side of the correct exit point. Counting can be most useful when combined with a selected ground reference exit point.

## **Significant Altitude Changes**

Any time the drop altitude is changed significantly based on streamer descent time the spotter must be aware that the amount of drift indicated by the streamers will also be affected. A good rule of thumb is that any time a spotter makes an altitude change of 300 feet or more after dropping an initial set of streamers; another set of streamers should be dropped to check both drift and the new altitude. Generally, a spotter is better off to simply start over and drop the second set of streamers directly over the spot as if no streamers have been dropped.

## **Unusual Winds**

There are a number of wind drift conditions which make selection of a correct exit point impossible.

### **1. Thunderstorm Winds**

Winds coming out of thunderstorm cells change direction as the cells move and as the cells develop or dissipate. When the winds in the area of a drop are erratic because of thunderstorm winds there is simply no way in which a spotter can select a good exit point. In this situation, the spotter has the choice of abandoning the drop or perhaps orbiting the area for 15 to 20 minutes before trying again. If wind velocity is not a problem, and the terrain for a wide area surrounding the drop zone is not hazardous, the spotter may go ahead and drop after briefing the smokejumpers of the conditions.

### **2. Local Winds**

There are situations where local wind caused by terrain can cause some unusual wind problems. One example would be converging drainages. It sometimes happens that drift from the exit point downwind indicates an area which will be affected by local winds from other drainages which are blowing in an entirely different direction.

Experience and an eye for the terrain are a help to the spotter here. Sometimes a different jump spot can be selected which will locate the exit point out of the influence of the erratic winds.

### **3. Updrafts and Downdrafts**

Updrafts and downdrafts may extend or decrease drift. As long as the updrafts prevail, streamer indication of drift is valid (though altitude indication is not). However, updrafts and downdrafts seem to be erratic or so localized that in the course of dropping a load, some smokejumpers may be affected by them, others not. In this situation, accuracy in spotting can be a problem.

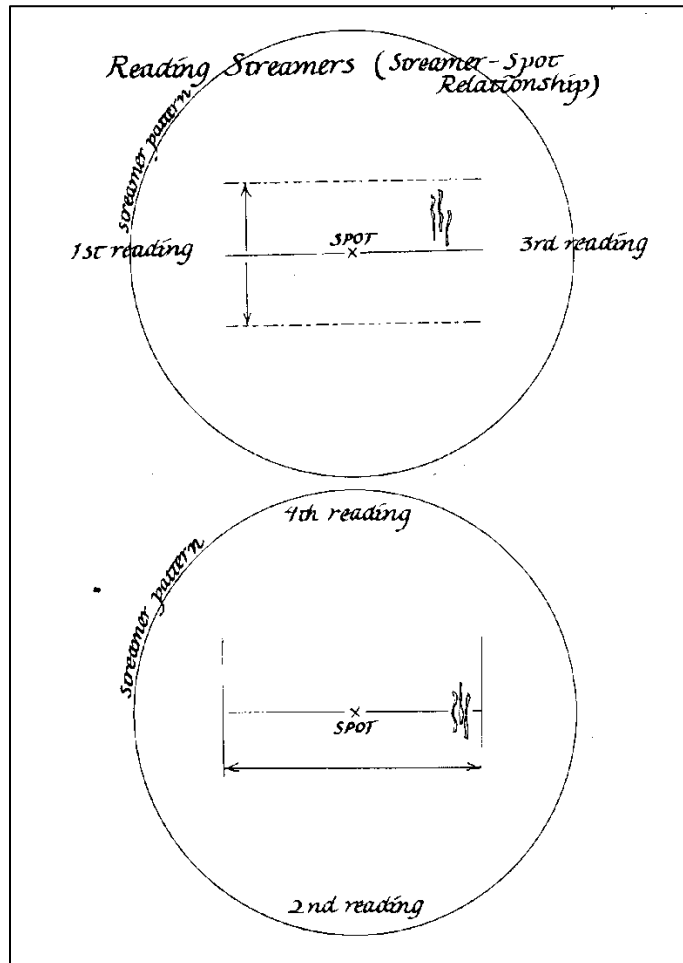
## **Reading the Streamers**

Wind is a mass of air moving across the ground. A set of streamers descending on a windy day behaves just as if it were a calm day. They descend through a still body of air which happens to be moving across the ground. The point is that the tail of the streamers do not lean any particular direction that gives the spotter

any useful information about wind direction. It is true that the tail of the streamers may flutter when descending through turbulence, gusts, or shear layers of wind. However, there are limits to the useful information about wind direction that can be drawn from this.

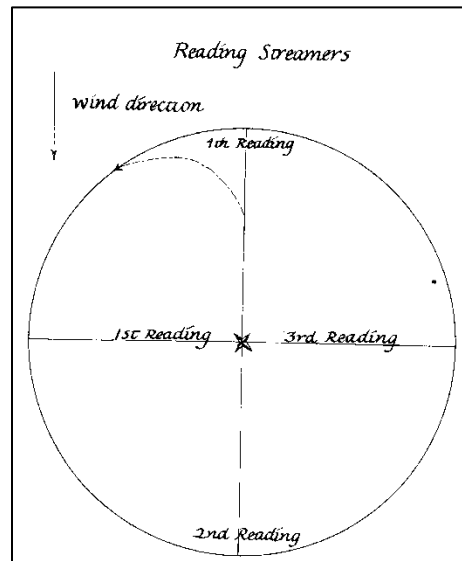
A spotter can develop the ability to tell generally where the streamers are over the ground while looking at them from various angles. However, a spotter can't glance at the streamers at any point as the plane circles around the streamers and know "exactly" where the streamers are over the ground. A systematic approach to watching streamer descent can give a spotter a good idea of streamer drift throughout their descent. Specifically, if a spotter takes note of the streamers when the airplane is directly in line with the streamers and the jump spot, and 90 degrees on each side of the wind line, the spotter can quite accurately observe wind drift. (See Figures 1 and 2.)

Figure 7





**Figure 8**



## Where the Streamers Land

### 1. Flat Terrain

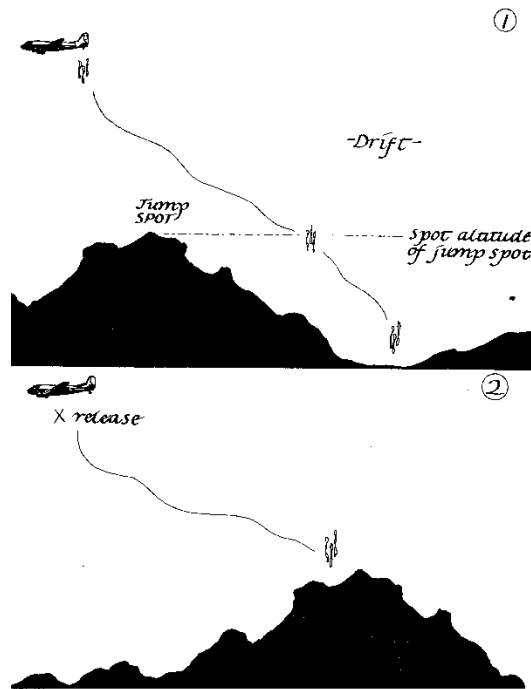
With respect to selecting an exit point in flat terrain, the most critical time for a spotter to be watching the streamers is when they land, particularly when the streamers are descending into timber or non-distinct terrain. Unless the spotter has all of his attention focused on the streamers, it is easy to forget or become confused within a few minutes as to just where the streamers land.

For this reason, it is a good idea for the spotter to use a stop watch for timing the streamers rather than the sweep hand of a wrist watch which requires the spotter to look away to check streamer descent time. Another solution is for the spotter to delegate the timing of the streamers to the assistant spotter.

### 2. Steep Terrain

In steep terrain where the streamers are descending into a valley, the landing point of the streamers is not the critical factor. The critical factor is how far the streamers have drifted when they have descended into the altitude of the jump spot. Conversely, if the streamers are landing in higher terrain than the jump spot, the spotter must estimate what additional drift there would have been if the streamers had not landed up slope on the hill. (See Figure 3.)

Figure 9

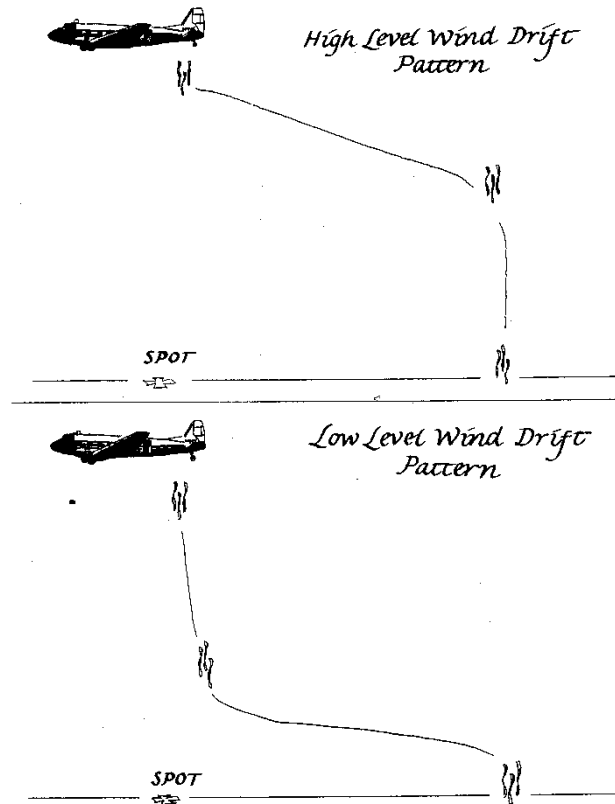


## Determining Wind Velocity

### Ground Wind

A spotter's primary concern with respect to wind velocity is the velocity of the wind on the ground that the smokejumpers will be landing in. In many cases the winds aloft are quite strong while ground winds are negligible. Occasionally, winds aloft are calm while ground winds are non-jumpable. The distance the streamers drift is an indication of overall wind conditions from drop altitude to the ground, but a spotter must keep a close watch on the streamers the moment they land to get an idea of ground wind conditions. Also, the spotter must keep a close eye on other clues as to ground wind conditions such as the behavior of smoke drifting from the fire, waves on bodies of water, the swaying of trees, etc. (See Figure 4.)

**Figure 10**



### **Thunderstorm Winds**

High winds are frequently associated with thunderstorms. When a spotter is prevented from dropping smokejumpers due to thunderstorm activity in the area, the plane may be able to orbit the area for 15 or 20 minutes or land at a nearby airport until the winds subside.

Terrain features are sometimes responsible for funneling or channeling wind through the area of a selected jump spot. A spotter confronted with this situation may be able to pull back and locate a sheltered area some distance from the fire where the smokejumpers can be dropped.

### **Maximum Wind**

Higher wind conditions should tell the spotter to pay close attention to the various indicators of ground wind velocity. A 15 mph ground wind is about maximum for safe round jumping, 30 mph ground wind is about maximum for safe ram-air jumping.

(Note: The instructor may desire to mark off 600 yards in 100 yard increments and have the spotter trainee observe it from 1500 feet.)

## The “Timing Method” of Determining Wind Velocity

As an alternative to judging the distance streamers drift downwind, the “fly over” method may be used. The aircraft is flown over the point where the streamers landed and the spotter counts off the seconds of flight from the streamers to the jump spot. Using 20-foot streamers, 12 seconds of fly over at 90 knots indicates an average wind of approximately 15 mph. This should alert the spotter to pay close attention to other clues of ground wind velocity.

## The Decision Not to Drop

The decision not to drop because of wind is one of the toughest a spotter must make. When smokejumpers are unable to jump a fire because of wind an FMO must make alternative initial attack arrangements. Dry runs contradict the concept of smokejumpers being the fastest most economical tool to use for initial attack on fires. However, no fire is worth hurting a person and no FMO wants to be confronted with the complication of a medical evacuation. Due to differences in judgment, there are situations where one spotter will say “no” and dry run a fire because of wind where another spotter would not hesitate to drop on the same fire. Spotters must be extremely careful in determining that wind conditions actually do preclude jumping or that alternatives such as a sheltered jump are not available. While the spotter may want to ask the opinion of the assistant spotter or an experienced smokejumper to help with this decision, the spotter should guard against being unduly influenced by opinions voiced by the crew either for or against the prospect of dropping in high wind conditions.

Note: If not able to jump, the smokejumpers could be trucked or helicoptered from the closest airport, and the cargo dropped on the fire.

## Jump Spot Selection

Selection of the jump spot is one of the most important responsibilities of a spotter on a fire mission. An error in analyzing the hazards of the terrain or the potential behavior of the fire can result in injured smokejumpers, or parachutes and equipment being burned over and destroyed.

### Hazards

#### 1. Terrain Hazards

A spotter should avoid dropping smokejumpers in snag patches, broken steep hillsides and bluffs, boulder strewn areas (especially if partially hidden by brush), excessively tall timber, areas where wind and air turbulence make jumping hazardous, areas with excessive windfalls, and any of the other varied hazards that may be present in rough mountainous terrain.

#### 2. Water

Jump spots near large streams or rivers should be avoided. A spotter should never select a spot in such close proximity to a large body of running water where there is a possibility of a smokejumper landing in the river. Ponds and small streams, on the other hand, are part of the normal range of obstacles

that are found in the vicinity of jump spots. It is not necessary from the standpoint of safety for a spotter to be overly concerned about the proximity of ponds or small streams to a jump spot. However, if there is a satisfactory jump spot located a reasonable distance from the pond or stream, a spotter may want to give extra consideration to it.

**3. Power Lines**

Power lines are sometimes difficult to see from jump altitude. Anytime a spotter is dropping in the vicinity of a road system, the spotter should look for power lines. A spotter should never select a drop zone so close to power lines that there is a possibility of smokejumpers landing in them.

**4. Clear Cut Blocks**

Cut blocks should be carefully evaluated as jump spots since they contain many hazards such as stumps, downed logs, etc. A low pass can determine if the jump spot is suitable for use.

**5. Old Helispots**

Old helispots should be carefully evaluated as jump spots since they contain many hazards such as stumps, downed logs, etc. A low pass can determine if the jump spot is suitable for use.

**6. The Lee Side of Ridges**

Jump spots on the leeward side of ridges frequently present the hazard of severe downdrafts. Jump spots on the leeward side of ridges should be avoided.

**7. The Fire**

The spotter must take a good look at the fire and use care to select a jump spot far enough from the fire that given a wind switch, etc., the fire is not likely to threaten the smokejumpers or their jump gear.

**8. Small Jump Spots**

Many times small (or tight) jump spots may be a safe option. The hazard may exist when smokejumpers in the same stick compete for a small spot. In cases like this the spotter should consider dropping smokejumpers one at a time.

**Positive Considerations in Jump Spot Selection**

Positive considerations a spotter may weigh in selecting a jump spot are: A location that is advantageous to begin initial attack on the fire; a location that has close proximity to water that may be used for pumps or fedcos; a location that will be least likely to damage parachutes on landing; a location that may be advantageous as a helispot later; a good camping area; a location sheltered from the wind; a location that facilitates a flight pattern in which visibility will not be obscured by smoke or terrain during drop operations; multiple jump spots if initial attack on the fire or helispot construction would appear to make it advantageous

to split the jump crew. A spotter should discuss jump spot location with the smokejumper-in-charge.

## **The Mechanics of Spotting**

With regard to the pattern the smokejumper aircraft flies, or the accuracy of the jump runs with regard to the wind line, etc., a spotter is never justified in coming home with the complaint that the “pilot wasn’t flying right.” It is the spotter’s responsibility to take the initiative to correct whatever might be wrong with a streamer pattern or a jump run pattern. Too often a spotter feels the only job is to select an exit point and give minor corrections to the pilot on final. In reality, the spotter may need to step in at any time and change a flight pattern a pilot has initiated. Efficient transitions from pattern to pattern should also be checked by the spotter. For example, a lot of time can be lost if a pilot drifts several miles away after a streamer run.

Following a normal routine the spotter should be able to drop streamers and two smokejumpers in about 6 to 8 minutes from the time the smokejumper aircraft arrives over the fire.

## **Smokejumper Aircraft Patterns**

### **1. The Observation Pass**

A low pass should be considered. A low pass (500 feet) over the jump spot gives the spotter a chance for hazards, check for any lower elevation turbulence and can also help determine drop elevation. The extra time spent making a low pass is time well spent. The spotter should inform smokejumpers of a low pass so everyone can be made aware of hazards.

### **2. The Streamer Run**

After the low pass, the spotter points out the selected jump spot to the pilot and describes which flight direction is desired for the streamer run. Generally, the drift of the smoke provides a good indication of wind. The spotter moves back to the rear of the plane and informs the pilot when ready. With the smokejumper aircraft up at jump altitude, the spotter guides the plane over the jump spot, releases the streamers, and informs the pilot of “streamers away.”

### **3. The Streamer Observation Pattern**

Upon receiving the signal “streamers away,” the pilot banks the plane to the left (to maintain visibility for the spotter out the jump door on the left side of the plane) and orbits the streamers as they drift and descend. If the pilot can see the streamers when orbiting them, they are generally visible to the spotter as well.

There are, however, some common errors made by smokejumper aircraft pilots when orbiting streamers. Getting too far away is probably the most common error and it is up to the spotter to tell the pilot to stay in closer if the plane seems to be circling too wide. Another common error is for the pilot to have the wing down obscuring visibility of the streamers. This seems to have a way of happening just at the critical moment when the streamers are landing. The solution here is simply for the spotter to tell the pilot to level the wings. Finally, an error which

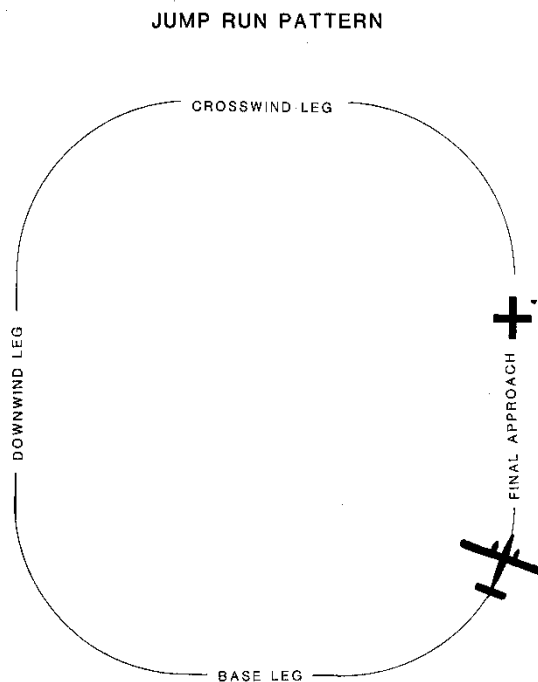
makes it difficult for the spotter to select an exit point happens when the smokejumper aircraft is between the jump spot and the streamers as they are landing. In this situation, a spotter cannot see just how far downwind the streamers landed from the jump spot, nor can the spotter look upwind and select an exit point. Confusion and disorientation of the spotter can result when there is no readily identifiable terrain reference mark where the streamers landed.

#### 4. The Jump Run Pattern

The jump run pattern resembles a small airport traffic pattern complete with a crosswind leg, a downwind leg, a base leg, and a final. Total time around the pattern should be about 90 seconds.

Ninety seconds allows a large enough pattern that is not difficult for the pilot to fly and it also allows plenty of time for the spotter to get the smokejumpers hooked up and briefed. Ninety seconds still provides a small enough pattern that excessive time is not wasted. (See Figure 5.)

**Figure 11**



Once the exit point has been selected, the spotter describes to the pilot what flight direction is desired on final. The spotter watches as the smokejumpers hook up, briefs them on jump spot location, wind conditions, and the fire. The plane turns on final into the wind. The spotter guides the pilot toward the exit point, gives the smokejumpers a final safety check, and slaps the smokejumpers out over the exit point. As the smokejumpers exit, the spotter looks out the jump door, checks to see that their parachutes deployed clear of the aircraft, and gives the pilot the signal, "jumpers away." The pilot then banks around for another pattern.

## **Methods of Describing the Desired Jump Run to the Pilot**

### **1. Streamers to the Spot**

Probably the easiest method for a spotter to describe to the pilot which direction is desired for the jump run after the streamers have indicated the wind line is to have the pilot fly over the streamers, over the jump spot, and on out to the exit point.

### **2. Ground Reference**

It sometimes happens that the pilot loses sight of the streamers and does not see where they land. In this case, the spotter must come up with some method of describing the jump run desired. Use of ground references is probably the easiest way. Examples would be: "fly parallel to the creek, down the drainage, and over the jump spot" or "fly from the small pond downwind of the spot toward the jump spot."

### **3. The Clock Method**

The nose of the aircraft is 12:00. A spotter can describe a new pattern to the pilot by saying, "Fly from 8:00 to 2:00 in relation to our last pattern."

### **4. Corrections off Base Leg**

One of the easiest places in a jump run pattern for a spotter to correct a slightly off-line final is on base leg. The spotter can simply tell the pilot to turn in early if the pilot has been turning in too late, or the spotter can tell the pilot to extend the base leg if the pilot has been turning in too soon.

### **5. Flying the Smokejumper Aircraft around the Pattern**

Sometimes, due to a lack of ground references and a communication breakdown in trying to describe a jump run, the spotter can simply take over and direct the aircraft around the entire pattern. The spotter would say something to the effect, "OK, start a left turn; OK, straighten it out. Now we are crosswind. Start a left turn; straighten it out. Now we are downwind..." and so on until the spotter has the pilot flying upwind on the correct final. Spotters should practice this technique to become familiar with the turning radius of the smokejumper aircraft.

## **Corrections on Final**

Minor corrections to head the smokejumper aircraft precisely over the exit point are made by the spotter on final approach. These corrections are normally made in 5 degree increments and accomplished by the pilot using flat rudder turns. A spotter must learn to time the corrections properly. If a correction is given too soon on a long final, the spotter may find that a correction back in the opposite direction is necessary before the exit point is reached. If a spotter waits too long to give a correction, it has little effect.



Corrections of greater magnitude than 5 degrees on final can be made. The spotter should call the corrections he wants. For example, '15 left' is sometimes useful for salvaging the jump run.

### **Determining Where the Smokejumper Aircraft is Over the Ground**

Determining where the smokejumper aircraft is over the ground is not a particularly difficult problem. Still, a spotter who is not careful can make considerable errors. One good technique for determining what is straight down in timber country is to look at the top of the trees. Trees which present only their crowns are straight down. If the spotter can see something of a side view of the tree, it is not straight down even though the altitude of the smokejumper aircraft makes it appear so.

### **Lead time**

The exit point is the point a spotter would like the smokejumper to be after exiting the aircraft and is hanging under an open canopy. To accomplish this, the spotter must lead the exit point. The spotter must allow for the time it takes to pull in and slap the smokejumper out, for reaction time, and for trajectory. A 2-person stick requires the spotter to head the first smokejumper so the first smokejumper exits short and the second smokejumper exits long. It may be helpful for the spotter to think of spotting for an imaginary smokejumper between the two smokejumpers on a 2-person stick.

### **Crosswind/Downwind Pattern Variations**

While on upwind pattern is standard, there are times when a crosswind or a downwind pattern may be desirable. Some examples of these situations are as follows:

1. The jump spot is on top of a steep ridge and the wind is blowing 90 degrees across the ridge. By making the jump run into the wind and across the ridge you increase the chance that long or short exits will miss the ridge top jump spot. In this situation it may be desirable to fly a crosswind pattern parallel to the ridge. With this pattern, smokejumpers getting out either short or long will still be in position to land along the top of the ridge.
2. In the case of a jump spot which results in an upwind pattern flying out towards a lake or a river, a crosswind pattern may protect smokejumpers from a wet landing if they were to hang up in the door or be carried long.
3. Sometimes an upwind pattern results in the plane flying toward excessively high terrain and a crosswind pattern is desirable.
4. In difficult terrain, a spotter may attempt to fly an upwind pattern for a jump spot on the left side of the fire.

Because the fire is underneath the aircraft and out of sight, the spotter may become disoriented. This is a situation where a downwind pattern may be used. The fire becomes visible from the left side of the airplane and may be used as a reference.

A spotter should not hesitate to use a nonstandard pattern when one is desirable. However, the spotter should brief the smokejumpers to avoid confusion on their part. Also, on the crosswind patterns, it is helpful to fly in a direction which puts the spotter looking out the jump door toward the jump spot. On downwind patterns, the spotter must guard against spotting long and letting the smokejumpers out short. This is easy to do because of the increased ground speed of the aircraft.

## Common Errors in Spotting and Streamer Dropping

A group of experienced spotters representing all the smokejumper bases agreed that the following list includes some of the most common errors in spotting and streamer dropping.

### Common Errors in Spotting and Streamer Dropping

No.	Error Description
1	Not getting the aircraft directly over the spot when dropping the initial set of streamers. This leads to confusion of both the spotter and the pilot.
2	Dropping too many sets of streamers and thereby causing smokejumpers to lose confidence in the spotter's ability.
3	Altering the exit point every time a smokejumper misses the jump spot. Canopy handling errors, not errors in spotting are many times the problem here.
4	Reluctance to drop more streamers after several smokejumpers have missed the spot by a wide margin and the spotter does not know the correct exit point.
5	Not picking a specific terrain reference (object, tree, rock) for the exit point.
6	Failure to take into account the reaction time of a smokejumper (lead time).
7	Spotting for the first smokejumper and carrying the second smokejumper long.
8	Failure to recognize variable winds caused by thunderstorms in the area and halting streamer dropping until conditions stabilize.
9	Losing the reference point or failing to identify the exit point in solid timber or tundra.
10	Failure to take into account cues such as smoke from the fire which may signal a wind shift.
11	Not recognizing high and low winds when reading streamers.
12	Not watching closely the last 100 feet of streamer descent and streamers show high ground wind velocity.
13	Not carrying smokejumpers far enough. Smokejumpers seem more often to drift back past the jump spot rather than land short as a result of miss-spotting.



# Unit 3 – Specialized Training

## Chapter 1 – Spotter Training

### VI – Spotting and Streamer Dropping

#### C – Flight 1 – Practical Training



### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Flight 1 – Practical Training</b>
<b>Objective(s):</b>	At the completion of this exercise, the trainee will be able to <ul style="list-style-type: none"> <li>• Select and verify correct drop altitude</li> <li>• Determine wind drift</li> <li>• Select an exit point</li> <li>• Accurately drop check streamers</li> <li>• Initiate and control flight patterns in no-problem flat terrain</li> </ul>
<b>Suggested Duration:</b>	0.75 to 1.5 hour flight, depending on number of trainees. (Three trainees is a suggested maximum per flight.)
<b>Training Aids Needed:</b>	Smokejumper aircraft and appropriate smokejumper/spotting equipment. Drift streamers and stopwatch. Pre-selected streamer drop spots appropriate to lesson objectives.

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## **Flight 1 – Practical Training Structure**

The effectiveness of training flights for instructing new spotters depends on careful preplanning. Specifically, appropriate drop spots need to be selected in advance of take-off; pilots need to be briefed on the objective of the training flight and their role; an ordered and logical sequence of applying classroom information to real streamer dropping and spotting needs to be preplanned prior to take-off; and trainees should be briefed in detail on the flight and informed of exactly what they will be expected to do.

Flight 1 should be conducted in low to moderate wind conditions. Calm conditions and high wind conditions should be avoided. Elements of Flight 1 are as follows:

### **Determining Where the Aircraft is Over the Ground**

The instructor will work with the trainee in the jump door to check and develop the trainee's ability to perceive exactly where the aircraft is over the ground. Buildings, ponds, crossroads, etc. can be used. Suggested techniques such as sighting over a rivet in the door sill, or sighting on a thumb positioned in the door sill will be explained. The effect of the aircraft banking will be demonstrated. The straight down appearance of trees will be pointed out.

### **Dropping Streamers over the Jump Spot**

1. The instructor will point out a pre-selected jump spot to the trainee. This spot should be small, well defined, and in flat terrain.
2. The instructor will tell the trainee to point out the drop spot to the pilot.
3. The instructor will ask which direction the trainee wants to make the streamer pass. The instructor will point out indicators of wind direction such as smoke, trees and brush swaying, dust on a road, etc. The trainee will instruct the pilot to fly an into-the-wind final for streamer drop.
4. On final, the instructor will work with the trainee to develop perception of correct line-up, possible aircraft crabbing, timing and magnitude of corrections, and perception of when the aircraft is over the jump spot.
5. After releasing the streamers, the trainee will inform the pilot "streamers away," and the instructor will work with the trainee as they watch the streamers descend. The instructor will point out the correct observation pattern, problems and solutions when visibility of streamers is blocked by a wing, and optimum points in the pattern to perceive direction and amount of drift.
6. Just prior to the streamers landing, the instructor will remind the trainee to concentrate and note exactly where the streamers land and simultaneously stop the stop watch. The instructor should caution the trainee not to look at the watch or break concentration before the streamer landing point is memorized and an appropriate exit point selected.

### **Selecting an Exit Point**

The instructor will have the trainee identify an appropriate exit point based on streamer drift. The advantage of selecting a well-defined exit point will be pointed out. Also, the advantage of selecting an exit point when adjacent to the jump spot, rather than up or down wind of the streamer landing point will be pointed out.

### **Altitude Determination**

After the exit point has been selected, the instructor will ask the trainee if altitude is all right. The trainee will check stop watch time. (By prearrangement, the pilot should know and select a correct altitude to avoid dealing with altitude problems on Flight 1).

### **Check Streamers**

The instructor should work with the trainee to initiate and drop a set of check streamers using an into-the-wind final pattern.

### **Simulated Smokejumper Drops**

Several sets of check streamers should be dropped by the trainee to develop familiarity with correct aircraft drop pattern size, line up and correction on final, communications with the pilot, and correct perception of when the aircraft is over the exit point.

### **Debriefing**

Immediately after landing, the instructor shall conduct a debriefing and critique of the training flight. If a trainee has particular difficulty understanding or performing any of the tasks required during the flight, the instructor is best advised to avoid lengthy discussions and explanations in the aircraft and wait for the debriefing. The noise and wind blast in the jump door precludes effective discussions to solve real problems of understanding.

### **Notes**

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## Unit 3 – Specialized Training

### Chapter 1 – Spotter Training

#### VI – Spotting and Streamer Dropping

#### D – Flight 2 – Practical Training



### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Flight 2 – Practical Training</b>
<b>Objective(s):</b>	At the completion of this flight the trainee will be able to recognize and appropriately take into account the many variables that affect spotting in difficult terrain and wind conditions. See a detailed outline of the many objectives of this flight below.
<b>Suggested Duration:</b>	1 to 2 hour flight, depending on number of trainees. (Two trainees is a suggested maximum per flight).
<b>Training Aids Needed:</b>	Smokejumper aircraft and appropriate smokejumper/spotting equipment. Drift streamers and stop watch. Pre-selected streamer drop spots appropriate to lesson objectives.

### Overview

Specifically, the trainee will be able to:

#### Objectives for Flight 2 – Practical Training

Objective	Description
A	Recognize when there is a need for significant altitude adjustments prior to dropping.
B	Recognize the significance of high terrain up-wind in selecting a drop altitude.
C	Use the “timing method” of determining the exit point to check visual selection.
D	Recognize the effects and options available when confronted with thunderstorm winds, local winds, updrafts, and downdrafts.

Objective	Description
E	Explain the effects of streamers landing in terrain significantly higher or lower than the jump spot.
F	Identify maximum wind for jumping.
G	Explain factors involved in selecting a good jump spot in rough terrain.
H	Recognize the jump hazard on lee side of the ridges.
I	Recognize and correct flight pattern mistakes made by the pilot.
J	Recognize situations that call for crosswind or downwind pattern variations.

## Flight 2 – Practical Training Structure

Even more than Flight 1, Flight 2 requires very detailed preplanning:

1. This flight requires moderate to hind-wind conditions.
2. Briefing of the pilot must be accomplished since the pilot will be required to intentionally commit certain errors in altitude and flight patterns for the trainees to identify and correct.
3. Carefully pre-selected jump spots must be identified in advance, which present specific terrain problems to the trainees.
4. Finally, the instructor must carefully organize the information and problems to present at each pre-selected jump spot in order to completely cover the objectives for this flight.

The structure and organization of this flight may vary in detail depending on the specific terrain and wind conditions. However, the objectives of this flight can usually be met if each trainee works three drop spots--one on a ridge top, one mid slope, and one valley bottom. If wind conditions are such that a specific problem cannot be demonstrated at the selected spots, alternates may need to be selected.

For example, Objectives A, B, C, and D can be incorporated in the valley bottom jump spot as follows:

1. Objective A: The pilot can be briefed to make the initial streamer run at 1,000 feet while the instructor watches for the trainee to catch and correct the altitude problem.
2. Objective B: The valley bottom spot may offer a good chance to illustrate a situation where high terrain upwind must be identified and drop altitude adjusted.
3. Objective C: If the wind is not appropriate to result in high terrain upwind, the instructor can identify a hypothetical wind direction that would create a problem for the trainee to perceive the situation. The instructor can have the trainee use the “timing method” of determining the exit point to check a visually selected spot.





## Unit 3 – Specialized Training

### Chapter 1 – Spotter Training

#### VII – Records and Forms

#### Lesson A – Spotter Mission Recordkeeping



#### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Spotter Mission Recordkeeping</b>
<b>Objective(s):</b>	Upon completion of this lesson, the trainee will be aware of information recording the spotter must do on a spotting mission such as: take off time, arrival over fire, parachute numbers, fire size-up, departure time from fire, etc. The trainee will be able to correctly fill out required forms.
<b>Suggested Duration:</b>	1 hour classroom
<b>Training Aids Needed:</b>	Smokejumper mission forms, jump requests, etc.
<b>Notes:</b>	Sections for this chapter will need to be developed by each smokejumper base for the appropriate recordkeeping and forms required.

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## Unit 3 – Specialized Training

### Chapter 1 – Spotter Training

#### VII – Records and Forms

### Lesson B -- Aircraft Contract Familiarization/Flight Invoices



#### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Aircraft Contract Familiarization/Flight Invoices</b>
<b>Objective(s):</b>	Upon completion of this section, the trainee will be able to explain the basic provisions of smokejumper aircraft contracts, daily availability, flight hour rate, pilot duty day limitations, etc., and will understand the process of signing and verifying flight invoice entries made by the pilot.
<b>Suggested Duration:</b>	1 hour
<b>Training Aids Needed:</b>	Aircraft contract and flight invoice forms.
<b>Notes:</b>	Sections for this chapter will need to be developed by each smokejumper base for the appropriate recordkeeping and forms required.

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## Unit 3 – Specialized Training

### Chapter 1 – Spotter Training

#### VIII – Operational Procedures and Responsibilities

#### Lesson A – Spotter Daily Routine Responsibilities



#### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Spotter Daily Routine Responsibilities</b>
<b>Objective(s):</b>	Spotter daily responsibilities vary depending upon the organization and practices of each smokejumper base. Upon completion of this lesson, the trainee will be able to explain the responsibilities in the local smokejumper organization. Checking aircraft load, pilot availability, briefing an assistant spotter, etc., are examples of responsibilities that may or may not be appropriate at the local base.
<b>Suggested Duration:</b>	30 minutes
<b>Training Aids Needed:</b>	All facilities of the smokejumper base, including a smokejumper aircraft on the ramp. Lesson plan prepared corresponding to local procedures.

#### Overview

The daily routine responsibilities assigned to spotters vary in each smokejumper organization. This is because facilities and organizational structures vary. For example, a large smokejumper organization may assign aircraft loading to a loadmaster. A smaller organization may assign aircraft loading responsibilities to the spotter. Each base needs to develop a lesson plan that outlines specific spotter daily responsibilities for their organization.

Examples of responsibilities that may or may not be assigned to spotters include:

1. Aircraft loading.



## Unit 3 – Specialized Training

### Chapter 1 – Spotter Training

#### VIII – Operational Procedures and Responsibilities

#### Lesson B – Additional Responsibilities



#### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Additional Responsibilities</b>
<b>Objective(s):</b>	Upon completion of this lesson the trainee will be able to apply the special spotter responsibilities discussed in this lesson on subsequent training and actual fire mission flights.
<b>Suggested Duration:</b>	45 minutes, lecture and discussion
<b>Training Aids Needed:</b>	Classroom

#### Spotter's Self-Control

Inexperienced smokejumpers on a load are likely to look to a spotter as an ultimately wise, experienced, and infallible individual. They trust the spotter with their lives as they take their positions in the door. There is no reason for a spotter to do anything to disturb their trust. For example, if it is windy and the spotter feels a little uncertain about the exit point, the spotter is best advised not to show this uncertainty, but to drop another set of streamers before making a decision.

A spotter who visibly becomes flustered, excited, has a fit of temper, or seems in any way out of control will immediately affect the confidence of the smokejumpers, especially the less experienced smokejumpers. A lot of minor mistakes can and will be made by a spotter without affecting the safety or success of a mission. If these mistakes ruffle and disrupt the spotter's composure, a smokejumper's confidence can be lost.

A new spotter on their first spotting run may have as many butterflies as a new person making their first fire jump. However, the spotter must not let the smokejumper know it. More than appearances are involved here. It is expected

that a spotter do the job without letting emotions override or distract from paying attention to the numerous critical details which can affect the safety or effectiveness of a mission.

## **Responsibility of Spotter vs. the Smokejumpers' Point of View**

When a smokejumper assumes the responsibility of spotter, suddenly there is a different relationship to other smokejumpers than in the past. A smokejumper's viewpoint is apt to be quite different from a spotter's in a number of situations.

Consider the following scenario as an example. A smokejumper aircraft is orbiting a 2-person fire. The scenery is beautiful and there is a camp spot by a lake. The only problem is that it is extremely windy. The first two smokejumpers on the load want to jump and are willing to take their chances on the wind. The spotter, on the other hand, is concerned about the wind, and is responsible for deciding if it is too windy. In this case, the smokejumpers' emotional desire to jump the fire may well have overwhelmed their better judgment.

The spotter is in a better position to evaluate the situation objectively and the smokejumpers expect it. The only factor in the situation that is working against the spotter's objectivity is the desire to please the two eager smokejumpers. In many situations, a spotter must forget the feelings of the crew to make a responsible decision.

A new spotter needs to realize two important points:

- Responsibility will change the view of many situations.
- The spotter cannot be influenced by the emotionalism or self-interest of the crew when safety or efficiency may be compromised.

## **Selecting an Incident Commander/Smokejumper-in-Charge**

Most smokejumper organizations have established local operational procedures that routinely place foreman or squad leader smokejumpers on each load dispatched to a fire. However, during "fire bust" level of activity it is not always possible to maintain these procedures. During fire busts, a spotter may well find that there are no supervisory smokejumpers on the load and may need to select a smokejumper incident commander or crew boss from the smokejumpers on the load. The experienced firefighter should routinely be assigned to be an incident commander.

Reasonable as this approach seems in principle, a number of factors work against a spotter applying it.

A spotter is responsible for selecting the smokejumper-in-charge or incident commander; it will not necessarily be the first smokejumper in the door.

## **Proper Staffing of Fires**

In most locations, requests for smokejumpers are received specifying a specific number of smokejumpers to be dropped on a specific fire. In some locations,

local fire personnel familiar with smokejumper personnel leave the determination of correct staffing to the smokejumper spotter. In any case, it is frequently appropriate for the spotter to contact local dispatch if the specified number of smokejumpers seems inappropriate when the smokejumper aircraft arrives over the fire.

Dispatch may be able to inform the spotter that ground crews or helitack are enroute to support the smokejumpers, or may accept a spotter's suggestion for adjustments in the number of smokejumpers that should be dropped on the fire.

Dropping the correct number of smokejumpers on a fire demands the best judgment of a spotter. There is no point in not dropping enough smokejumpers on a fire and having it get away. On the other hand, dropping too many smokejumpers on a fire may result in unnecessarily exhausting the smokejumper initial attack force.

Typically a fire bust begins suddenly after a period of inactivity. Particularly in the early stages of a bust, spotters have a tendency to drop too many smokejumpers on fires. A spotter may be sympathetic to a crew of smokejumpers who are ready for action and feel "now's their chance"--the spotter drops eight smokejumpers on a fire that could have been handled by four or six. A spotter may not think of the possibility of multiple fires and take the viewpoint that it is better to drop too many smokejumpers and be sure, than not enough and be sorry. A spotter may be influenced to drop more smokejumpers than are needed by the smokejumper incident commander whose only concern is this particular fire and who may be looking at people needed to mop-up as well as to catch the fire. A spotter dropping too many smokejumpers on an isolated person-caused fire early in the morning may not be thinking about the forecast that called for widespread dry lightning in the afternoon.

In situations where it is appropriate for a spotter to suggest or determine the proper number of people needed, it is a spotter's responsibility to carefully assess the situation and avoid either dropping too many or not enough smokejumpers on the fire.

A spotter should put the number of smokejumpers on the fire needed to catch it, and should resist whatever temptation may exist to drop more.

## **Spotter vs. Pilot Responsibilities**

The operational smokejumping mission experience of smokejumper pilots varies greatly. Some locations are fortunate to have contract or Forest Service pilots assigned to their smokejumper aircraft who have years of operational (smokejumper mission) experience. In other cases, a spotter may be working with a pilot who possesses only minimum smokejumper pilot qualifications and has little operational experience. Particularly, when working with inexperienced smokejumper pilots, a spotter has a responsibility to provide instruction and correction in smokejumper flight patterns and mission procedures necessary to maintain established standards of efficiency. These responsibilities are not always easy for a spotter.



Most spotters are not pilots. For some reason, this situation may inhibit some spotters. There is a mystique that endows the pilot with special superhuman knowledge and capabilities when flying the airplane. There may be reluctance on the part of the spotter to question anything the pilot does while flying. However, the pilot, as well as the spotter, is an ordinary human being. The pilot is not a firefighter and is likely to have considerably less fire knowledge than the spotter. New smokejumper pilots are likely to have little practical understanding of the need for operational efficiency in contrast to the spotter. A spotter is not adequately performing the job if the spotter does not take charge and see that the pilot, for example, flies at max cruise enroute to a fire, flies at an appropriate altitude on patrols, and does not spend excessive time flying in circles when arriving over a fire. If standards of smokejumper mission efficiency are left to inexperienced smokejumper pilots, smokejumper program standards are not likely to be met. This is not because the pilot lacks a desire to do a good job, but because the pilot lacks experience and knowledge of operationally efficient smokejumper procedures.

There is one area where a spotter should not direct a pilot. When a question of flight safety is involved, the pilot is the final authority. As a firefighter, it is not hard for a spotter to get carried away with the desire to get the job done. For example, a spotter on patrol receives coordinates of a new fire from dispatch and is asked to respond. The spotter checks with the pilot on the fuel situation and the pilot says, "Well, by the time we get down to the fire, we wouldn't be able to spend any more than 10 minutes dropping or we'll be short getting back, it's cutting it a little close." A spotter who responds, "Sure would like to give it a try," is putting pressure on a pilot to override his better judgment. Whether it is a question of runway condition or length, flying in bad weather or smoke, etc., the time to resolve any judgment questions of safety vs. operational efficiency is afterward on the ground. Let the pilot decide flight safety questions and avoid inadvertently pressuring the pilot beyond what he feels comfortable doing.

There have been occasions when pilots seemed to ignore reasonable concerns for flight safety. In this situation, it is the spotter who needs to step in and take charge.

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## Unit 3 – Specialized Training

### Chapter 1 – Spotter Training

#### VIII – Operational Procedures and Responsibilities

#### Lesson C – Fire Mission Procedures



#### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Fire Mission Procedures (Take-Off to Landing)</b>
<b>Objective(s):</b>	Upon completion of this lesson, the trainee will be able to explain the elements, tasks, and responsibilities of a spotter throughout a smokejumper mission.
<b>Suggested Duration:</b>	Two or three separate sessions. A total of three hours combined lecture, practical exercises, and drill in aircraft on ramp.
<b>Training Aids Needed:</b>	Smokejumper aircraft on ramp. Checklist of mission tasks corresponding to local procedures.

#### Overview

While each spotting mission has variations, the basic tasks of a smokejumper spotter on a fire mission follow a repetitive routine. Experienced spotters who are able to accomplish all the accumulated tasks of a spotting mission have memorized the routine. For an experienced spotter, the chronological order of tasks are carried out without great thought or difficulty—manifest and fire location are obtained; smokejumpers are checked; parachute numbers are recorded; a glance over the shoulder ensures the door strap is fastened and the crew has helmets and gloves on for take-off; take-off time is recorded; the fire is located on the map; navigation is accomplished; required routine communications with dispatch are made; the pilot is reminded to begin a descent to an appropriate altitude when approaching the fire; dispatch is contacted with a fire size-up; time over the fire is recorded; the spotter briefs the pilot on jump spot and pattern direction; the spotter puts on emergency parachute; moves from the cockpit to jump door; checks spotter panel pilot/spotter intercom; initiates streamer drop;

briefs smokejumpers; removes door strap; drops smokejumpers; kicks cargo; checks smokejumpers' safety, radios situation report to dispatch; etc.

In contrast, spotter trainees have no detailed knowledge of the specific accumulation and order of tasks that combine to make up a spotter's job on a fire mission. Despite years of smokejumping experience, the trainee is likely to be unaware of many routine spotter mission tasks that experienced spotters take for granted.

Unless the trainee is provided experience in the routine spotter tasks performed on a mission in the form of simulated exercises, the performance of the trainee on subsequent simulated fire mission flights, and on actual spotting missions, is likely to be punctuated by errors. These errors have a way of snowballing, requiring the new spotter to try to catch up a missed step. Confusion is created which often results in a chaotic, less-than-professional mission.

Simulated exercises that provide a spotter trainee with a routine to use on spotting missions can be conducted in the smokejumper aircraft parked on the ramp. The natural order of a fire mission--fire call, taxi, take-off, enroute, approaching the fire, over the fire, dropping smokejumpers, dropping cargo, and return to base--should be used to structure this exercise.

**Table 3 – Natural Order of a Fire Mission**

Stage	Description
1	Fire Call
2	Taxi
3	Take-Off
4	Enroute
5	Approaching the Fire
6	Over the Fire
7	Dropping Smokejumpers
8	Dropping Cargo
9	Departure / Return to Base

The instructor should first describe and demonstrate the routine spotter tasks from fire call to return to base. Then the trainee should be asked to go through the routine. The first time or two through the exercise the trainee is likely to omit numerous tasks--didn't check door strap, didn't record time off, forgot to get location of fire, didn't check spotter/pilot intercom, didn't time streamers, didn't check smokejumpers after drop, didn't tell pilot to drop down for cargo dropping, didn't tell pilot where cargo was to be dropped, etc. This exercise should be repeated until the trainee has memorized the entire routine and can easily complete it without missing a step.

The instructor should prepare a checklist that contains all the tasks for each phase of a spotting mission. Local variations such as communication requirements, radio frequencies, assistant spotter vs. spotter responsibilities, and variations in procedures in various types of aircraft require that this checklist be prepared by each smokejumper organization.

A general example of this checklist that would require adjustment for local variations is as follows:

## **Fire Call**

1. Obtain load manifest and fire location.
2. Check all smokejumpers present, pilot present.
3. Smokejumper equipment safety check, record parachute numbers.
4. Load smokejumpers, fasten door strap.
5. Sit right front seat, seat belt on.
6. Set appropriate FM frequency, headset on.
7. Record time fire call and time taxi.

## **Taxi**

1. Locate appropriate map/chart for fire location, fold open.
2. Contact dispatch for additional fire information (local procedures vary).
3. Inform pilot of general fire location.

## **Take-Off**

1. Prior to take-off roll, check door strap closed.
2. Prior to take-off roll, check smokejumpers' helmets and gloves on.
3. After take-off, inform dispatch you are off (local procedures vary).

## **Enroute / Approaching the Fire**

1. Use public address (PA) system, inform smokejumpers of fire information, size, etc.
2. Locate fire on map/chart.
3. Follow ground reference navigation procedures.
4. When level cruise, check that max cruise power is used.
5. Accomplish required position reports.
6. Check landing lights on 5 minutes out from fire.
7. Check descent initiated 5 minutes out from fire.
8. Contact other aircraft over fire 5 minutes out, if appropriate.

## **Over Fire / Dropping Smokejumpers and Cargo**

1. Record time over fire and check correct fire location -- inform smokejumper-in-charge and dispatch if reported location is in error.
2. Contact dispatch with size-up, planned action (local procedures may vary).
3. Prior to moving aft, select jump spot, inform pilot of spot and of desired streamer pass direction.
4. Prior to moving aft to jump door, ensure tether is clipped into appropriate attachment point.
5. Check pilot/spotter intercom.
6. Set FM and VHF frequencies on spotter panel as appropriate.
7. Locate streamers and stopwatch.
8. Issue map case to smokejumper-in-charge (local procedures may vary).
9. Make a low pass to check for hazards in jump spot or ground level turbulence. Discuss jump spot with smokejumper-in-charge.
10. Inform pilot when ready for streamer run.
11. Drop and time streamers.
12. Drop and time check streamers, if necessary.
13. Determine altitude, wind, exit point, ready to drop.
14. Inform pilot ready for live drop.
15. Inform smokejumpers of stick size.
16. Monitor and check hook-up.
17. Signal first smokejumper to position in door.
18. Brief smokejumpers on jump spot location, drift, and hazards.
19. Discuss cargo drop spot with smokejumper-in-charge.
20. Remove door strap.
21. Spot smokejumpers, retrieve and stow D-bags.
22. Make contact with smokejumpers on the ground as soon as possible.
23. All smokejumpers on ground, inform pilot ready for cargo.
24. Inform pilot of cargo drop location.
25. During cargo dry run, prepare cargo, check static lines clear.



## Unit 3 – Specialized Training

### Chapter 1 – Spotter Training

#### IX – Integrated Spotter Skills

#### Lesson A – Problem Situation Exercises



#### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Problem Situation Exercises</b>
<b>Objective(s):</b>	Upon completion of this section, the trainee will be able to find solutions to “real-life” problem situations that routinely confront a smokejumper spotter.
<b>Suggested Duration:</b>	2 hours
<b>Training Aids Needed:</b>	Handout of problem situations listed in this lesson.

#### Overview

Good spotting is primarily a matter of good judgment. The following points for discussion are intended to improve a spotter’s judgment in dealing with problem situations.

This lesson should be conducted as follows: the instructor should read one of the problem situations listed below and ask a trainee for the solution. After the trainee has responded, the instructor should open the situation problem for discussion among other trainees in the class, and perhaps offer a solution. Instructors should be able to provide additional problem situations from their own experiences.

## Problem Situations in Smokejumper Spotting

1. The winds are marginal, but the spotter decides to drop. One smokejumper refuses to jump. What should the spotter do?

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2. There has been an early morning fire call. Eight smokejumpers for a load have been notified. The spotter and pilot are ready for take-off, but only five smokejumpers have arrived; the other three are nowhere in sight but rumored to be coming. Should the spotter take-off with just five smokejumpers?

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3. The smokejumper aircraft is taxiing from the ramp with eight smokejumpers toward the runway for take-off and the spotter realizes that they are short two fire packs. Should the spotter turn around and get two more fire packs?

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4. The spotter has dropped six smokejumpers on a fire. After the cargo is out, the smokejumper incident commander on the ground calls and asks the spotter to drop an extra cube container of water because one of the cubitainers streamered in. The spotter realizes that if another cubitainers is dropped, there will not be any extra water left for the two remaining smokejumpers on board who may be dropped on another fire. Should the spotter drop the extra cube container?

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5. On a patrol, the spotter is called by an observer in a detection aircraft flying the area. The spotter is requested to drop smokejumpers on a fire to replace helitack that wants to get back to base for initial attack. Should the spotter drop smokejumpers as requested?

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6. It is a “fire bust” situation and the spotter takes off with the last four smokejumpers of the base. Upon arriving over the fire, the spotter finds that the fire is 0.25 acre; there are 15 people on it already, it seems to be controlled, and the critical burning period of the day is over. From listening to the radio, the spotter learns that pumps and reinforcements are on the way by road. The FMO is over the fire in a light twin and the spotter establishes radio contact with the FMO. The spotter suggests that considering the shortage of smokejumpers it might be best if the smokejumpers don’t drop. Did the spotter do the right thing?

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7. The spotter has dropped four smokejumpers on a fire. It looks marginal, but the spotter thinks four smokejumpers can handle it. There are several other fires in the area that need smokejumpers. The smokejumper incident commander on the ground calls the spotter and requests the remaining smokejumpers on board. Down on the ground, the smokejumper incident commander isn’t sure that four smokejumpers will be able to catch the fire. What does the spotter do?

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8. The smokejumpers have been dispatched to reinforce helitack on a fire in “fire bust” conditions. Upon arriving over the fire and looking at the natural barriers around the fire, the spotter doesn’t feel there is any need to drop smokejumpers. The helitack incident commander still wants the smokejumpers. Should the spotter suggest to the helitack incident commander that smokejumpers are not needed or should the spotter go ahead and drop?

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9. The smokejumper aircraft, helitack, and a retardant plane are all approaching a fire at the same time. There is no air attack supervisor in the area. What does the spotter do?

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10. The smokejumpers are dispatched to a fire. Upon arriving over the area, the spotter observes that the fire is located in a maze of lakes. It would be tight getting the smokejumpers on dry land, particularly considering one new person on board. There is a good chance someone will get wet. What does the spotter do?

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11. The smokejumpers receive a fire call for a fire 1-hour flight time away. As the pilot is cranking up the engine of the airplane, the pilot tells the spotter, "I have only 1.5 hours of flight time left." What should the spotter do?

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12. The spotter has dropped eight smokejumpers on a fire. It is obvious to the spotter that if the smokejumpers are going to have a chance to catch the fire, they will need a pump right away. The spotter would like to go back to base, pick up a pump, come back, and air drop it. How does the spotter proceed?

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13. After dropping two smokejumpers on a fire, the spotter is instructed to load and standby with the remaining six smokejumpers at an outlying station. Upon landing, the spotter encounters a situation where the six smokejumpers receive very poor treatment by the station manager. While there is a lodge and cafe available, the station manager wants the smokejumpers to spend the night in their airplane and eat MREs. What does the spotter do?

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14. It is the most miserable, roughest, most horrible fire the spotter has ever seen. It looks to the spotter like it is just too rough to jump. It looks that way to the smokejumpers on board, too. What does the spotter do?

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15. Two smokejumpers have been put on an eight-person fire. As the plane comes around for the second stick jump run, the spotter receives a call from one of the smokejumpers on the ground saying that the other smokejumper is broken up and hurt really bad. The fire is starting to take off. What does the spotter do?

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16. The smokejumpers have been dispatched to a fire. Enroute, the spotter finds a new fire that eight smokejumpers could handle. Should the spotter call dispatch and suggest the smokejumpers be dropped on this fire?

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17. The smokejumper aircraft is flying in the area of a large fire on patrol. The smokejumper aircraft receives a request from an assistant FMO asking if the smokejumper aircraft can work as lead plane for retardant on the large fire. The spotter has a load of smokejumpers on board. What does the spotter tell the assistant FMO? What would the spotter do if confronted with this situation after dropping all of the smokejumpers?

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18. On patrol, a spotter finds a new fire. The fire is located very close to Forest boundaries. In fact, the spotter is not sure which Forest the fire is on. The smokejumpers can catch the fire if they get on it quick enough, and the spotter doesn't want to spend any time figuring location and checking boundaries. The spotter drops the smokejumpers, then checks location and notifies the appropriate dispatch. Did the spotter do the right thing here?

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19. The smokejumper aircraft is orbiting a 50-acre fire along with the District FMO who is in a light twin. It is obvious that the smokejumpers will have a rough time with this fire. It is burning hot around the entire perimeter. The FMO tells the spotter to go ahead and drop the smokejumpers, and that retardant and helitack are on the way. The FMO then flies off as the spotter starts dropping streamers. As the spotter is about to drop the smokejumpers, the wind shifts and the fire spots into heavy timber and makes a run. It is obvious that the fire situation has changed drastically and there is little that can be done to contain the fire under the present weather conditions. Should the spotter go ahead and drop the smokejumpers anyway? Should the spotter hold off until communications can be reestablished with the FMO?

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20. On patrol, the smokejumper aircraft finds a two-person fire and is instructed to drop on it. The second smokejumper on the jump list wants to switch with the number six smokejumper because a friend is arriving in two days. Should the spotter allow the switch?

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21. On checking the smokejumpers prior to dropping an eight-person fire, the spotter discovers that one smokejumper has an out-of-date reserve. Does the spotter let that smokejumper jump with an out-of-date reserve?

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22. The spotter is dropping a re-burn. One of the smokejumpers on board, who was on the fire originally, points out the old camping area and helispot and suggests that it would be a good place for a jump spot. What problem is the smokejumper overlooking that the spotter should be aware of?

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23. Over a fire in a canyon bottom, the spotter finds it impossible to drop streamers and be able to watch their descent. What does the spotter do?

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24. On patrol, you stop at an airport for lunch. The pilot drinks a beer and says, "I am ready to fly." What should the spotter do?

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25. The smokejumper aircraft has been flying for 3 hours on patrol and is 20 minutes from an airport. The aircraft needs fuel, and the jump crew is hungry. What does the spotter do? The FMO has arranged hot meals at a restaurant in town and will haul the crew to the restaurant. It is 1400, hot, dry, and there are large cumulous build-ups all around. What does the spotter do?

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26. Upon approaching home base, the smokejumper aircraft develops landing gear problems and a gear up landing is necessary. What does the spotter do?

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27. On a cargo drop with four smokejumpers still on board, both engines suddenly feather. What does the spotter do?

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28. During a cargo drop, a static line misroutes and a fire pack goes into tow. What does the spotter do?

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## Unit 3 – Specialized Training

### Chapter 1 – Spotter Training

#### IX – Integrated Spotter Skills

#### Lesson B – Simulated Fire Mission, Flight 3



#### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Simulated Fire Mission, Flight 3</b>
<b>Objective(s):</b>	Upon completion of this lesson, the trainee will be able to perform a wide range of skills covered in the spotter training program as they occur on a fire mission. (See specifics below.)
<b>Suggested Duration:</b>	2 hours
<b>Training Aids Needed:</b>	Smokejumper aircraft, role players for radio communications, smokejumper aircraft to dispatch, other aircraft, and smokejumpers on the ground. Two suited smokejumpers, streamers, stopwatches, appropriate charts or maps, evaluation checklist.

#### Specific Objectives

Upon completion of this lesson, the trainee will specifically be able to:

1. Follow correct operational procedures in response to fire call.
2. Conduct a complete pre-jump safety check of smokejumper equipment.
3. Enforce correct take-off procedures (i.e., helmet and gloves on).
4. Navigate to a preselected simulated fire.
5. Correctly establish streamer drop patterns, drop streamers, and select an exit point.

6. Conduct appropriate radio communications with dispatch, other aircraft, and smokejumpers on the ground.
7. Respond appropriately to any unusual problem situation presented in the exercise.
8. Correctly complete required fire mission records and forms.
9. Correctly follow established aircraft procedures to hook-up and position smokejumpers in the door.
10. Accomplish tasks required of a spotter upon return to base.

## Overview

This flight should be structured as closely as possible to simulate an actual fire mission. In fact, this simulated fire mission can be far more effective training than an actual fire mission. This is because the simulated mission can be structured to include the full range of spotting skills, difficult jump spot problems, and special problem situations. In contrast, real fire missions may vary from a simple no-problem fire to a complex and difficult fire. The simulated fire mission allows the instructor to control the scenario so that a wide range of spotting skills is required and special problems are presented to the trainee.

The specific structure of the simulated fire mission must be supervised by each smokejumper base administering the training. This is because the structure of the training is dependent upon the specific spotter assigned responsibilities, facilities, aircraft, terrain, communication requirements, and procedures of the local area.

A smokejumper base that uses contract pilots with minimum experience in smokejumping procedures may want to focus the exercise more strongly on the spotter's role in maintaining correct mission procedures than does a base that uses very experienced contract or agency pilots. However, since all spotters may be called upon to work with a pilot who has minimum operational experience, all exercises should include at least some problems that reinforce the spotter's responsibility to maintain control of the operational aspects of the mission.

## Suggested Guidelines and Common Elements

The flight needs to be structured to a reasonable degree of complexity. The demands of the trainee should exceed dropping a two-person fire on a calm day in flat terrain. However, the instructor should not introduce so much complexity, and so many problems, that the trainee is overwhelmed. This exercise needs to be realistic, demanding, and fair; not demoralizing.

The effectiveness of this flight depends on the instructor accomplishing very careful preplanning. Selection of the simulated fire location and terrain is important. Planning the specific problems to include in the exercise--such as radio communications with dispatch, air attack, helicopter, and smokejumpers on the ground--needs to be carefully planned.



The exercise may be preplanned to include a simulated smokejumper injury, or request for additional people from the smokejumpers on the ground that requires the trainee spotter to respond appropriately.

The specific simulated problems included need to be selected and the scenario written down by the instructor. Each phase of the exercise--the fire call, takeoff, enroute, over-the-fire, simulated dropping, and return to base phase of the exercise--needs to be carefully planned.

Role players need to be selected and briefed. Provisions for radio communications with the smokejumper aircraft by role players during the flight need to be arranged. If possible, a dispatch office should be used. Both FM and VHF radio communications should be required so trainee spotters are confronted with the need to operate the aircraft audio panel as they would in a real fire mission.

Two suited smokejumpers should be included in the exercise. The trainee spotter should be required to accomplish equipment checks and hook-up procedures and pre-jump briefings for these smokejumpers just as if the flight were a real fire mission. The instructor should brief the two smokejumpers to arrange several subtle equipment problems that the trainee will be expected to identify. These smokejumpers could be briefed to delay putting on their helmets prior to takeoff to give the spotter trainee an opportunity to take control and correct the problem.

The pilot should be briefed on his role. In general, the pilot should be instructed to be cooperative with the trainee, but not to correct mistakes made by the trainee unless absolutely necessary. The instructor may want the pilot to introduce a problem, such as setting up for streamer dropping several hundred feet high or low. These arrangements will need to be covered in a pilot/instructor briefing.

Finally the instructor should brief the trainee on the simulated fire mission. This briefing should fall short of revealing the specific problems planned during the flight, but should include a general description of the pre-jump check, take-off, time recording, communications, streamer dropping, hook-up procedures, etc. that will be part of the exercise. The fact that problem situations will be included in the exercise should be explained to the trainee.

In general, "make believe" should not be a part of the exercise. Specifically, fire behavior that cannot be seen should not be made important to the exercise. The trainee should be clearly briefed to work through the exercise as if it were an actual fire, and should be told that no help will be provided by the instructor.

The instructor must prepare an evaluation check sheet for the flight to note trainee performance, omissions in procedures, and comments on trainee performance during various stages of the simulated fire mission. Unless absolutely necessary, the instructor should not correct mistakes as they occur, but rather note them on the evaluation check sheet. These notes can be used by the instructor during the debriefing after the flight.

Trying to correct mistakes as they occur breaks the continuity of the exercise and is difficult amid the noise and wind blast of an open-door smokejumper aircraft. Unless it is absolutely necessary for the instructor to intervene, the instructor should sit back during the course of the flight, take notes, and let the trainee succeed or fail in handling the situations of the exercise as they occur.

The debriefing from this flight is where the important instruction occurs. The pilot and role players should be included with the instructor and trainee. The debriefing should chronologically cover the flight from equipment check, take-off, enroute, streamer dropping, and return to base.

Mistakes such as problems missed in an equipment check, navigation, communications, jump spot selection, streamer dropping, or special problems should be pointed out. The accuracy and completeness of the trainee completed jump request should be reviewed. Correct performance should be identified as well as mistakes.

Perfect performance on an exercise such as this would be difficult for the most experienced spotter to achieve and the instructor needs to be careful to inform the trainee that mistakes are expected.

Properly conducted, the debriefing is excellent training. Carelessly conducted, the debriefing could unnecessarily demoralize the trainee. If the problems and structure of the exercise have been realistic and fair, as opposed to a series of tricks on the trainee, the trainee will have learned a great deal.

Suggestions for structure and problems to include in a simulated fire mission flight are listed below. Actual exercises should probably not include as many problems as are suggested. However, realistic problems should be included in each phase of the flight.

## **Prior to Fire Call**

If inspection and check of the smokejumper aircraft load is a spotter responsibility at the local base, this inspection should be part of the exercise. The instructor may arrange for several items of standard equipment to be missing, such as spotter kit gear, spotter helmet, or cargo parachutes.

## **Fire Call**

The trainee should accomplish all normal spotter tasks that are part of local base operating procedures. Obtaining fire location, maps, and load manifest are examples. Two smokejumpers should suit up and the trainee spotter should perform an equipment safety check. The instructor may have arranged with the role player smokejumpers to include several subtle equipment problems in the arrangement of their gear. An out-of-date reserve may be used, a letdown rope may be left behind, or a static line snap safety pin may be missing. The instructor may have arranged for the pilot to be late in responding to the fire call so that the trainee is required to take some quick action, such as using the public address (PA) system, to locate the pilot.

## Take-Off

Role player smokejumpers may have been briefed not to put on their helmets until requested by the trainee spotter.

NOTE: If the trainee spotter misses this point, role players should put their helmets on as the aircraft starts to role on take-off.

## Enroute

The enroute portion of the exercise provides navigation and radio communications experience for the trainee. The preselected simulated fire should be far enough out (20-25 miles) to allow time for navigation and communication exercises. The pilot may have been briefed to head 45 degrees off the correct course so the trainee will need to provide a correction. (NOTE: In this case, if the trainee misses the heading error, the instructor will need to correct it.) Prior arrangements could be made to have dispatch call and divert the smokejumper aircraft to a different fire, requiring the trainee spotter to locate the new fire on the map enroute. Some communications between dispatch and the spotter trainee in the smokejumper aircraft should be arranged that requires the trainee to contact another aircraft, station, or person on the ground when over the fire. The combined tasks of navigation and communication should be arranged to keep the trainee fairly busy, but not overloaded, enroute to the simulated fire.

## Approaching the Fire

The pilot may have been briefed to be inappropriately high near the fire so it is necessary to lose time spiraling down to drop altitude. The spotter trainee may catch the problem and suggest to the pilot to stay at an appropriate altitude, or start a descent about five miles out. Any radio communication required approaching the fire should be attended to by the trainee spotter.

## Over the Fire

The instructor should point out the simulated fire to the trainee. An old burn, a pond, or a clearing with defined boundaries is ideal. The simulated fire should be in rather difficult jump terrain. Selection of the jump spot, efficient initiation of the streamer drop pattern, direction of flight on final, the decision when stop dropping streamers and start simulated smokejumper drops should be left to the trainee spotter. Hookup procedures and positioning smokejumpers in the door should be accomplished but smokejumpers should not be dropped. The trainee should have been briefed by the instructor to drop streamers to simulate smokejumper drops. The trainee should accomplish routine communications with smokejumpers on the ground after completing the drop. On-the-ground smokejumper role players are to call the smokejumper aircraft while dropping is in progress. Simultaneously, the scenario may call for a helicopter or other aircraft to arrive and call the smokejumper aircraft on a VHF frequency rather than a FM frequency. In this situation the trainee spotter will have to set priorities and take appropriate action to sort out several things happening at once. Prior to departing the fire, the trainee should check and correct the reported location



## Unit 3 – Specialized Training

### Chapter 1 – Spotter Training

#### IX – Integrated Spotter Skills

#### Lesson C – Supervised Practice Jump Spotting



#### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Supervised Practice Jump Spotting</b>
<b>Objective(s):</b>	At the completion of these exercises, the trainee will be able to effectively serve as a spotter on a fire mission under the supervision of a check spotter.
<b>Suggested Duration:</b>	0.5 to 1.0 hour flights
<b>Training Aids Needed:</b>	Smokejumper aircraft, appropriate smokejumper/spotting equipment, and smokejumpers.
<b>Notes:</b>	Required number of supervised practice jump spotting missions will be determined by the instructor.

#### Overview

The number of practice jump spotting missions a trainee will need to meet the objective will be determined by the instructor. During this phase of spotter training, all of the spotter training knowledge and skills taught should be practiced by the trainee. The instructor may desire to develop a checklist or some other tool to assist in critiquing the trainee after each mission.

## Unit 3 – Specialized Training

### Chapter 1 – Spotter Training

#### IX – Integrated Spotter Skills

#### Lesson D – Supervised Fire Mission Spotting



#### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Supervised Fire Mission Spotting</b>
<b>Objective(s):</b>	Upon completion of spotting successfully four supervised fire missions, the trainee will become a qualified spotter.
<b>Suggested Duration:</b>	Depends on location of fires.
<b>Training Aids Needed:</b>	Smokejumper aircraft, appropriate smokejumping/spotting equipment, smokejumper request, map case, and smokejumpers.
<b>Notes:</b>	This lesson consists of a minimum of four actual spotter missions under the supervision of a check spotter.

#### Overview

A minimum of four actual spotter missions under the supervision of a check spotter must be performed before a trainee may become a qualified spotter. More than four missions may be necessary depending on the performance of the trainee. The instructor may desire to develop a checklist or some other tool to assist in critiquing the trainee after each mission.

## Unit 3 – Specialized Training

### Chapter 1 – Spotter Training

#### X – Spotter Refresher



#### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Spotter Refresher</b>
<b>Objective(s):</b>	It is of paramount importance that experienced spotters maintain their skills at the optimum level. One way to accomplish this is to conduct and require a comprehensive spotter refresher training session. This should be a yearly session and should be held just before, or in conjunction with, spring smokejumper refresher training. The following outlines a suggested agenda for a spotter refresher session.
<b>Suggested Duration:</b>	8 to 16 hours
<b>Training Aids Needed:</b>	See corresponding preceding chapters.

#### Spotting and Streamer Dropping

Refreshers should begin by completing the pretest found in Training Guide Unit 3, Section II, Lesson A. Upon completion of the test, the instructor should review the answers and promote discussion.

A review of spotting and streamer dropping procedures as outlined in Training Guide, Unit 3, Section VI, Lesson B should be conducted. The instructor should encourage open discussion.

#### Fire Staffing, Fire Mission, and Other Policies

This session should be conducted by the Smokejumper Base Manager or other upper level management personnel. At this time, any policy changes can be discussed and continuing policies can be reaffirmed.

A session of familiarization with the current aircraft contract and the spotter's responsibility under the contract can be conducted at this time.

## **Safety**

A review and update of safety procedures should be conducted as outlined in Training Guide, Unit 3, Section II. The review should include the pre-jump safety check, general aircraft procedures, and aircraft emergency procedures.

## **Spotter Duties and Responsibilities**

A review of spotter's daily responsibilities along with operational procedures and fire mission procedures should be conducted.

## **Navigation Review**

Session to include the following:

- Maps, aeronautical charts and plotters.
- Aircraft instruments and navigational aids.
- GPS.

## **Radio Use**

A review of radio use and procedures should be conducted. This session should include the use of aircraft radios as well as all other radios used in smokejumper operations.

## **Proficiency Jump Spotting**

Refresher spotters are required to display proficiency by spotting one proficiency jump before being placed in operational status (see Interagency Smokejumper Operations Guide). This also means that one cargo drop will be done, dropping at least one 5-gallon cubitainer, prior to dropping smokejumpers and cargo on operational missions.

Every effort should be made to train beyond the minimum requirement. The instructor may want to consider using the proficiency jump to set up some hypothetical training situations. Some examples are: use of nonstandard jump run patterns, use of jump-run corrections, communication with the pilot, navigation training, etc.



## Unit 3 – Specialized Training

### Chapter 2 – Paracargo Operations



#### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Paracargo Operations</b>
<b>Objective(s):</b>	Given the components and procedures of a smokejumper paracargo operation, the trainee will be able to successfully identify these and be able to assist in packaging equipment and supplies for smokejumper operations.
<b>Suggested Duration:</b>	To be determined by instructor.
<b>Training Aids Needed:</b>	To be determined by instructor.

#### Overview

Paracargo is an integral part of smokejumping operations. A safe and efficient paracargo operation depends on utilizing qualified personnel and maintaining equipment to very high standards. Paracargo operations consist of three main components: (1) packaging of cargo, (2) cargo parachutes, and (3) delivery of paracargo. Each smokejumper base maintains, as a core component of its operations, a paracargo operation capable of supporting normal smokejumping operations and larger, heavy paracargo operations.

#### Packaging

All paracargo will be packaged within a container with a harness constructed to withstand the forces of aerial delivery from a low flying aircraft.

#### Types of Paracargo

<b>Paracargo Type</b>	<b>Description</b>
Fire Packs	Cardboard boxes containing firefighting equipment such as fire hand tools, food, sleeping bags, water, and miscellaneous equipment.

<b>Paracargo Type</b>	<b>Description</b>
Chainsaw	Usually cardboard boxes containing a power saw, chainsaw chaps, fuel and oil. Some bases maintain their own chainsaws and others order this equipment from the cache system.
Cubitainer (“Cubie”)	5 and 2.5 gallon water containers inside a cardboard box which may be strapped with a harness and individual cargo parachute.
Pumps	Mark III and smaller pumps which are pre-packaged in cardboard boxes with accessory gear and mix-oil. 1 ½ and 1 inch hose is usually packaged separately in boxes or hose packs with parachute attached.
Climber Box	One of the few items delivered via free fall. Climbers are usually packaged in cardboard boxes and configured to withstand ground impact.
Rescue Equipment	All smokejumper bases have rescue/first aid trauma kits and other equipment essential for first responder emergencies. Some of this equipment is in boxes and others are packaged within specifically designed containers however all are delivered by air via parachute.

Other cargo is utilized at each base depending on specific needs. Some examples are:

- Heavy paracargo – Usually used in Alaska to support inaccessible incidents. All smokejumper bases support large fires to some extent and utilize heavy paracargo.
- Some bases use a high impact system to minimize risk of hanging cargo in trees.

## Preparation

1. All paracargo will be securely packaged and contained within either a pre-fabricated harness or a harness constructed from a “no-cut” webbing strap.
2. All paracargo containers will meet the minimum density requirements to minimize “floating” of cargo after kicking. A weight to volume ratio must be maintained at a “safe minimum density” when throwing cargo. An in depth discussion is included at the end of this lesson plan.

## Cargo Parachutes

All cargo parachutes shall incorporate the following features:

1. They shall be constructed and rigged for a line first deployment.

2. They will utilize a standard personnel static line snap (MS 70120).
3. The static line shall be 15 feet in length with an MTDC weak link incorporated and the words "Weak Link" stenciled on the static line.
4. The riser color will be red.
5. The container will have a protective flap over the static line stows.
6. Cargo loops should be used on all bundles to help identify misrouted static lines.
7. The cargo chute will be secured to the bundle, usually with Velcro tabs or break tape.
8. The canopy size, type, and weight use range will be stenciled on the container and the riser.

## **Delivery**

1. On most smokejumper missions, the drop zone will be selected by the spotter and the smokejumper incident commander, in conjunction with the mission pilot.
2. The drop zone should have a safety area and be clear of all personnel during the drop.
3. If necessary, insert qualified smokejumpers at the drop zone to provide control and safety measures during paracargo operations. At a minimum, communications shall be established with a pre-identified contact before dropping cargo.
4. During heavy paracargo operations, the drop zone should be established prior to aircraft arrival and should meet the following criteria:
  - a. At least one acre in size if there are no jumpers on site to climb for cargo that could potentially hang in trees. Preferably in a site free from trees that could prevent cargo from making it to the ground.
  - b. The drop zone will be an appropriate distance from all populated areas.
  - c. Drop zone will have a ground contact to oversee the paracargo operations who is in communication with the smokejumper aircraft in order to provide wind information and feedback to pilot.
  - d. Drop zone will be free of all personnel.
5. After selecting the drop zone, the spotter shall choose the cargo to be dropped.
  - a. Inform the pilot of the cargo type.

- b. Hook up the static line snap to the same static line cable used in personnel deployment.
  - c. Check that the static line is cleared to parachute D bag.
  - d. Check that the red parachute risers are attached to the white cargo loops.
  - e. Avoid stacking bundles. If necessary, use the roller track, if available.
  - f. Inform the pilot that you are hooked up and ready in the back.
6. Command from the pilot to kick bundles will be:
  - a. "On final"
  - b. "Short Final"
  - c. "Standby"
  - d. "Kick"
7. Upon the "kick" command, the spotter should vigorously push the cargo out the door, using arms to guide and the legs to supply the force.
8. The spotter should watch the cargo to the ground to give the pilot feedback on accuracy.
9. All smokejumpers will be in seats with restraint, helmet, and gloves on during cargo runs.

## Minimum Density

The problem of light, bulky cargo bundles striking the tail of an aircraft during aerial cargo delivery is a very real concern. Tail strike problems are not new, nor are they confined to rear exit aircraft. The possibility of lightweight cargo contacting the tail control surfaces has long been recognized, although actual occurrences have been fairly uncommon.

In an effort to prevent tail strike incidents, smokejumper paracargo programs will adhere to packaging standards of safe minimum density for aerial delivery. Bundles of sleeping bags, characterized by low weight and high volume, exhibit a tendency to veer upward toward the tail of the aircraft on ejection into the slipstream. Other cargo similar in volume to sleeping bag bundles, but heavier, drop cleanly away from the ship on ejection. The difference in behavior between sleeping bags and other cargo is attributed to the relationship of cargo weight to volume, or technically speaking, cargo density.

1. Density is the ratio of weight to volume.

$$\text{DENSITY} = \frac{\text{WEIGHT}}{\text{VOLUME}}$$

2. For an object of fixed weight, density decreases as volume increases; conversely, density increases as volume decreases.
3. A sphere contains the most volume for the least surface area. For flat sided objects, a cube contains the most volume for the least surface area. As surface area increases, the likelihood of floating increases for a bundle of fixed weight.
4. For instance, a cube measuring 1' x 1' x 1' has a volume of 1 cubic foot and a surface area of 6 square feet. A rectangular box measuring 1/2' x 1' x 2' also has a volume of 1 cubic foot, but its surface area is 7 square feet. If each box weighs 10 pounds and this weight is evenly distributed, the density of both the cube and the rectangle would be 10 pounds per cubic foot. However, the cube would be less likely to "float" since the surface area it presents on the slipstream is less than that of the rectangular box. Consequently, the cube would be the preferred container shape.
5. In bundles characterized by "heavy" weight or "high" density, the weight is the overriding force at the moment of ejection, and the box proceeds earthward without floating with the slipstream into the tail of the aircraft. A "lightweight" or "low" density bundle, however, presents enough surface area to the slipstream that the weight is not the predominate force, and the box is held aloft in the slipstream from the point of ejection to the tail of the aircraft. Ideally, there exists a safe minimum density that cargo can be packaged so that it will drop cleanly away from the ship upon ejection under normal cargo dropping conditions. Conversely, bundles below the safe minimum density will show a tendency to "float" in the slipstream toward the tail of the ship.

**Critical density** = the density at which a cargo bundle is first observed to float in the slipstream of the smokejumper aircraft.

**Safe minimum density** = the lowest cargo density safe for aerial cargo delivery in a specified aircraft.

6. Safe minimum density is invariably greater than critical density, providing a margin of safety sufficient to ensure positive cargo separation from the jump lane under normal conditions.

## Paracargo Evaluation Parameters

At the completion of this training unit, the trainee will be able to:

1. Recite the proper techniques and methods for packaging paracargo.
2. Recite the proper components and features of the cargo parachute.

3. Identify the features of a paracargo drop zone and recite drop zone safety measures.

## Review

Safety is of foremost consideration in any paracargo operation. All personnel and aircraft must have the necessary equipment and training to safely accomplish the mission. Cargo dropping personnel and pilots must meet the minimum requirements for training and experience, and show competence in and knowledge of standard paracargo operating procedures. Total mobility and interchange between smokejumper bases in a paracargo operation dictates that delivery methods and operating procedures be as standard as possible to ensure safety and efficiency in delivery.

## Smokejumper Base Inserts

### Standard Cargo Bundles and Packaging Instructions

Each base will insert photos of their standard cargo bundles and packaging instructions, specifically for:

1. Fire packs.
2. Chain saw packs.
3. Cubitainers.
4. Rescue equipment to include trauma kit with ked/sked.
5. Tree climbing equipment.
6. Fedcos.
7. Cross-cut saws.
8. Any other equipment that might be tied on to boxes.

### Rigging Instructions for Cargo Parachutes

Each base will insert rigging instructions for their cargo parachutes, including photos.

## Notes

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## Unit 3 – Specialized Training

### Chapter 3 – Crosscut Saw Use



#### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Crosscut Saw Use</b>
<b>Objective(s):</b>	Upon completion of this lesson, the trainee will be able to safely and effectively use a crosscut saw using accepted procedures in falling and bucking techniques.
<b>Suggested Duration:</b>	To be determined by instructor.
<b>Training Aids Needed:</b>	To be determined by instructor.

#### Overview

Many trainees undoubtedly have used crosscut saws in the past. There are many techniques that will enable the user to expend less energy and perform a safer job. Those techniques will be discussed in this lesson plan.

This lesson plan is a basic outline for training necessary to be proficient in the use of the crosscut saw. Crosscuts are using sparingly at some bases and at other bases are dropped to several fires during a season. That being the case, it is hard to stay proficient in the use of the crosscut with actual experience in the field. Make sure that each smokejumper has the basic annual refresher training in the use, care and maintenance, and safety procedures related to the use of the crosscut saw.

#### Saw Types

1. Falling.
2. Bucking.
3. Tapers.
  - a. Crescent taper ground saw.
  - b. Straight taper ground saw.

4. Tooth patterns.
  - a. Champion tooth.
  - b. Lance tooth.

## **Crosscut Saw Parts**

### **Handles**

1. Function.
2. Types.
3. Parts.
4. Assembly.

### **Blade**

1. Cutting teeth.
2. Raker teeth.
3. Sawdust gullet.

### **Oil use**

### **Wedges**

1. Types.
2. Uses.

### **Guard**

1. Function.
2. Types.
3. Use.

## **Use of the Crosscut Saw**

### **Safety Equipment**

1. Gloves.
2. Long-sleeved shirt.
3. Hardhat.
4. Safety glasses.



### **Advantages over Power Saws**

1. More dependable and less temperamental.
2. Less susceptible to damage when dropped by parachute.
3. Safer when used by inexperienced fallers.
4. Lighter and easier to pack out from a fire.
5. Quieter.
6. Slower action.

### **Procedure with a Crosscut**

1. Requires two operators.
2. All cuts start straight and must remain straight.
3. The undercut can be sawed or chopped out. Remove all wood.
4. Platforms can be built up or dug out to provide good footing.
5. Always put the guard on the crosscut when not in use for the protection of both the saw and sawyers.
6. The proper way to carry a crosscut is to place it on the shoulder with the teeth outward (guard on), hand grasping the front handle from underneath the saw blade, with the rear handle off.
7. All safety equipment and personal protective equipment (PPE) must be worn.

### **Crosscut Techniques**

Techniques for the use of the crosscut saw are unique.

1. The length of the saw is pulled through the cut, not pushed. Pushing will bend the saw, pinching it in the cut.
2. The saw must remain level at all times. Lifting or dropping the ends of the saw will arc or bow the cut. An arched or bowed cut will not meet to form a proper undercut or back cut.
3. Use the entire saw to cut. Short strokes waste energy.
4. Coordination is important. The two sawyers should talk and establish a rhythm of strokes.
5. The body position of the two sawyers is important to get maximum efficiency of energy expended.
6. A rocking motion works best if there is room.
7. Using just the arm to pull will tire a sawyer quickly.

Crosscut techniques will be demonstrated and practiced in the field.

## Felling

1. Size up the tree.
  - a. Species.
  - b. Size.
  - c. Soundness.
  - d. Dead limbs.
  - e. Burning top and/or bark.
  - f. Top heavy.
  - g. Direction of lean.
  - h. Nearby hazards, trees, and people.
  - i. Slope of ground.
  - j. Wind direction and velocity.
  - k. Position of standing or down timber that might deflect tree.
2. Determine direction of fall.
3. Clear brush and debris from working area; establish escape routes to a safe area.
4. Putting in the undercut:
  - a. The first cut is the bottom of the undercut. This cut must be
    - Level.
    - A minimum of one quarter of the tree's diameter.
    - On the same side of the tree as the direction of fall.
  - b. The second cut is the top cut of the undercut. This cut is angled to intersect the bottom cut to form a wedge. As a minimum, the opening of the undercut should be 1/3 of the undercut's depth or 1 inch vertical for every 3 inches horizontal.
    - Must intersect the bottom cut cleanly and have all chips removed.
    - Can be chopped out with an axe or Pulaski.
5. The "Humboldt" undercut is not recommended using a crosscut due to difficulty of holding the saw into the cut.

6. Cutting the back cut:
  - a. The back cut must be parallel to the bottom of the undercut.
  - b. Two inches above the bottom of the undercut to form an anti-kick-back step.
  - c. Sufficient holding wood must always remain to maintain control of the tree so that it does not break, skip, or twist off the stump, and fall in any direction other than that intended—no matter how heavy the lean.
  - d. Do not cut off the corners of the holding wood if side notching is used.
  - e. Always use wedges as soon as possible to prevent the tree from setting back and pinching the saw.

## **Bucking**

1. Plan each cut before starting.
2. Proper work areas must be chosen to insure safety.
3. Clear working area.
4. Avoid pinching the saw. Watch for compression and tension points of the log to be bucked.

## **Practical Training**

### **Demonstration**

1. Safety.
2. Felling.
3. Bucking.

### **Practice**

1. Safety.
2. Felling.
3. Bucking.

## **Notes**

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## Unit 3 – Specialized Training

### Chapter 4 – Emergency Care



#### Lesson Plan Outline

<b>Lesson(s):</b>	<b>Emergency Care</b>
<b>Objective(s):</b>	<p>Upon completion of this lesson, trainees will be able to:</p> <ul style="list-style-type: none"> <li>• Conduct a patient assessment and determine the patient's status.</li> <li>• Take measures to correct life threatening injuries.</li> <li>• Give proper emergency care for common injuries related to smokejumping and firefighting.</li> <li>• Effectively conduct a medevac operation utilizing resources normally available.</li> <li>• Effectively use the smokejumper base's trauma and rescue equipment.</li> </ul>
<b>Suggested Duration:</b>	To be determined by instructor.
<b>Training Aids Needed:</b>	To be determined by instructor.

#### Overview

While serious injuries in smokejumping are not common (1 in 525 for the period of 1992-1998), they do occur and each smokejumper must have the training and skills to administer emergency care when necessary. The Forest Service Section of the Interagency Smokejumper Operations Guide (ISMOG), Section 4.2, requires that each jumper have between 8 and 24 hours of classroom and practical instruction of basic first aid. This training must include emergency care for common firefighter or smokejumper injuries outlined in this lesson plan.

Each smokejumper base has established emergency care procedures that operate at different levels of expertise. The basic level requirements are from 8 to 24 hours of Emergency Care Training. The advanced Emergency Care Training involves many more hours of training with recommended completion of an Emergency Medical Technician course or equivalent. With many recognized courses available, instructors should design instructional materials to ensure that all smokejumpers possess the basic skills in order to care for common firefighting and smokejumping injuries and accidents.

## **Basic Emergency Care**

### **Introduction**

1. Course requirements.
2. General course objectives.
3. Course outline.
4. BLM/USFS/Agency accident prevention program.
5. BLM/USFS/Agency accident reporting system(s).
6. BLM/USFS/Agency roles in search and rescue.
7. Medical – legal problems.

### **Determining the Extent of Injury and Illness**

1. Vital signs and their significance.
2. Evaluating the patient.
3. Primary – Secondary patient assessment.
4. Triage.

### **Rescue Planning**

1. Accident scene management.
2. Back country planning considerations.
3. Aircraft accident management.

### **Patient Assessment**

1. Scene size up.
2. Primary assessment.
3. Vital signs and monitoring devices.
4. Assessment of the trauma patient.
5. Assessment of the medical patient.
6. Reassessment
7. Communication and documentation.

### **Traumatic Injuries**

1. Bleeding and shock.

2. Chest injuries.
3. Brain and spinal cord injuries.
4. Fractures and dislocations.
5. Soft tissue injuries.
6. Burns.

### **Medical Emergencies**

1. General pharmacology.
2. Respiratory and cardiac emergencies.
3. Abdominal emergencies.
4. Diabetes, seizures, and altered mental status.
5. Allergies and anaphylaxis.
6. Poisoning emergencies.
7. Mental health concerns.

### **Environmental Injuries**

1. Cold injuries.
2. Heat illness.
3. Poisons, stings, and bites.
4. Lightning injuries.
5. Altitude illness.
6. Drowning and cold water immersion.

### **Transportation Techniques**

1. Evacuation protocols.
2. Selection of technique.
3. Lifts and carries.
4. Spinal injury care.
5. Improvised litters.

### **Base Rescue Equipment and Procedures**

1. Familiarization with base rescue equipment.

2. Review unit rescue plan.
  - a. Unit accidents.
  - b. Smokejumper jumping accidents.
  - c. Rescue of non-Agency personnel.
3. Coordination with other resources and mission sequences.
  - a. Air ambulance.
  - b. National Guard: Hoist capabilities.
  - c. Agency Aircraft: Short haul capabilities.

### **Practical Field Exercise(s)**

1. Depending upon time, financing, etc., plan at least one half day field exercise. Simulate common jumper and fire line injuries, using role players.
2. Allow trainees to use only resources normally available to them on a fire jump (fire pack, cargo chute, etc.). Use these resources plus any "improvised" materials to care for victim, plus transport victim to medevac point. Fully critique each rescue exercise.
3. If possible, it is valuable to combine the field exercises for emergency care into a training jump. Try to arrange the use of a helicopter from a local helitack crew for medevacs and transportation training.

### **Annual Review**

All experienced smokejumper personnel shall receive a minimum of at least 8 hours of refresher emergency care training each year.

Refresher training should include the following topics:

1. Determining the extent of the injuries.
2. Shock.
3. Cardiopulmonary resuscitation; AED.
4. Bleeding and wounds.
5. Pain management; pain medication per medical direction.
6. Bone-related injuries.
7. Heat injuries.
8. Transportation techniques.
9. IV Therapy per medical direction.

10. Use of specialized equipment such as intravenous therapy, intraosseous therapy, advanced airway.
11. Set up and use of all base emergency care and rescue equipment.

## **Advanced Emergency Care**

Each base should encourage advanced training for their personnel to ensure that there are specially qualified emergency medical technicians who can instruct in basic emergency care skills, supervise para-rescue operations, and be available for situations requiring advanced and specialized emergency care skills.

Most of the skills listed below are taught in basic EMT courses, however in case the skill is not required in a particular course, it is recommended that advanced emergency care personnel obtain the training and become competent in the skill. Some state laws require first aid to be provided by EMS personnel certified in that state.

1. Skills and training.
  - a. Successful completion of a certified paramedic or emergency medical technician core course or the equivalent.
2. Specific skills.
  - a. Administration of pain medication per medical direction.
  - b. Administration of intravenous fluids per medical direction.
  - c. Administration of oxygen.
  - d. Administration of cardiopulmonary resuscitation techniques.
  - e. Use of stethoscope and sphygmomanometer for taking blood pressures.
  - f. Use of an oral airway.
  - g. Use of a bag valve-mask for resuscitation.
3. Additional training.
  - a. Set up and use of all unit emergency care and rescue equipment.
  - b. Helicopter medevac operations and techniques.
  - c. Winter survival.
  - d. Winter parachuting.
  - e. Agency search and rescue organizations and procedures.
  - f. Participate on a rescue or ambulance crew.



