Basic Air Operations
S-270

NFES 002112

Student Workbook
MARCH 2011

CERTIFICATION STATEMENT

on behalf of the

NATIONAL WILDFIRE COORDINATING GROUP

The following training material attains the standards prescribed for courses developed under the interagency curriculum established and coordinated by the National Wildfire Coordinating Group. The instruction is certified for interagency use and is known as:

Basic Air Operations, S-270
Certified at Level I

This product is part of an established NWCG curriculum. It meets the requirements of the NWCG Curriculum Management Plan and has received a technical review and a professional edit.

Member NWCG and Operations and Workforce Development Committee Liaison

Date 3/2/11

Chairperson, Operations and Workforce Development Committee

Date 3/1/11

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PREFACE

Basic Air Operations, S-270 is training that supports development of knowledge and skills for positions identified in the National Wildfire Coordinating Group (NWCG), Wildland and Fire Qualification System Guide (PMS 310-1). It was developed by an interagency group of experts with guidance from NWCG Training under authority of the NWCG. The primary participants in this development effort were:

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NATIONAL INTERAGENCY FIRE CENTER
NWCG Training Development Unit, Evaluation Unit, and Instructional Media Unit

The NWCG appreciates the efforts of these personnel and all those who have contributed to the development of this training product.

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Basic Air Operations, S-270

Unit 0 – Introduction

OBJECTIVES:

Upon completion of this unit, students will be able to:

1. Introduce instructors and students.
2. Discuss course logistics.
3. Provide a course overview.
4. Explain student evaluation methods.
5. Discuss students' expectations for the course.
6. Review pre-course work.

I. WELCOME AND INTRODUCTIONS

- Name and job title
- Agency and home unit
- Brief background
  - Incident qualification
  - Aviation experience

II. COURSE LOGISTICS

- Lodging
- Transportation
- Ground rules
- Facilities – location of vending machines, drinking fountains, restrooms
- Cell phones should be turned off
- Message location and available telephones
- Meals
- Agenda
- Breaks – be prompt; return to class at scheduled times
- Restrooms
- Smoking policy
- Other local concerns

III. COURSE OVERVIEW

A. Course Objective

Upon completion of this course, the student will have obtained the basic understanding of the different functions of Air Operations.

B. Reference Materials

1. Basic Aviation Safety

   Basic Aviation Safety is a publication distributed by the Aviation Management Directorate (AMD) to serve as an aviation user reference.

2. Interagency Helicopter Operations Guide (IHOG)

   The IHOG is the primary job guide for interagency helicopter operations and the primary reference for this course.

3. Incident Response Pocket Guide (IRPG)

   The IRPG is a pocket guide designed to assist the user in managing daily functions and emergency incidents.

C. Unit and Course Evaluation Forms

- Students will complete a unit evaluation form at the end of each unit.
- Students are expected to complete a course evaluation form at the end of the course.

IV. STUDENT EVALUATION

Final Examination

Students must obtain a minimum of 70% on the final exam to receive a certificate of completion for the course.

V. EXPECTATIONS

What are your expectations for this course?

Some expectations may be difficult to achieve because this is an introduction to aviation operations class. The discussion of tactical use of aircraft will be minimal.

VI. REVIEW PRE-COURSE WORK

- Basic Aviation Safety

For those that may require additional career or agency-specific aviation training, the following Interagency Aviation Training (IAT) courses are available at www.iat.gov. Below are some selected examples; the IAT Web Site has the complete catalog.

- A-101: Aviation Safety
- A-105: Aviation Life Support Equipment (ALSE)
- A-106: Aviation Mishap Reporting
- A-110: Aviation Transport of Hazardous Materials
- A-112: Mission Planning & Flight Request Process

Basic Air Operations, S-270

Unit 1 – Aircraft Types and Capabilities

OBJECTIVES:

Upon completion of this unit, students will be able to:

1. Describe aircraft types and capabilities.

2. Describe the ICS criteria for typing aircraft used for fire suppression.

I. AIRCRAFT TYPES AND CAPABILITIES

A. Categories of Aircraft

There are two primary categories of aircraft used for fire suppression and project work. The airplane or "fixed wing" and the helicopter or "rotor wing."

B. Engine Types and Fuel

Another factor used in classifying aircraft is engine type and fuel required. There are two basic kinds of aircraft engines currently in use and they are described below:

1. Reciprocating engines

Reciprocating engines have back and forth motion of pistons and rods, which drives a shaft. The shaft turns the propeller of an airplane or rotor of a helicopter.

Reciprocating engines may have the pistons arranged horizontally opposed (flat) or radially arranged in a circle.

Some reciprocating engines are modified with a supercharger or turbocharger, which compresses the air used for combustion and increases engine performance at higher altitudes. These engines use aviation-grade fuel (100LL), also known as AVGAS, which is blue. Most light fixed-wing aircraft have reciprocating engines.

2. Turbine engines

Turbine engines use fans for compressing and producing a circular motion of air. The circular motion of air drives a shaft that turns the propeller of an airplane or rotor of a helicopter or produces thrust by a jet stream of air. In general, turbine engines have a greater power-to-weight ratio than piston engines. Most of the helicopters we see have turbine engines. Some of the larger fixed-wing aircraft that we see also have turbine engines.

When the turbine engine on an aircraft drives a shaft that turns a propeller, it is normally referred to as a turbo prop. When the turbine engine drives a stream of air to produce thrust, it is called a jet.

Turbine engines use jet fuel that contains additives for different engine performance and cold-weather starting.

Some reciprocating engine aircraft have been retrofitted with turbine engines, which increases engine power and aircraft performance.

C. Airplanes (Fixed Wing)

Airplanes are used regularly for daily project work, point-to-point personnel transportation, aerial reconnaissance, and aerial fire suppression.

Air tankers are airplanes that are used during aerial fire suppression to drop water, foam, gel, or fire retardant on wildland fires.

The Incident Command System (ICS) has classified air tankers into four different ICS “types” according to the gallon capacity of fire retardant they carry.

The Type 1 air tanker has the largest capacity, 3,000+ gallons, down to Type 4 which has the smallest capacity, 799 gallons.

All air tankers are “restricted” category aircraft that are not allowed to carry passengers.

D. Helicopters (Rotor Wing)

Helicopters are used regularly for daily project work, passenger and cargo transport, and for aerial fire suppression to drop water, foam, gel, or fire retardant.

Most helicopters used in fire suppression have turbine engines. Some agencies, such as the U.S. Forest Service, and BLM do not allow use of reciprocating engine helicopters for firefighting work. This is because turbine engine helicopters are capable of higher performance.

In the Incident Command System (ICS), helicopters have been classified as being a particular “type” according to passenger seats, minimum allowable payload, and minimum gallon capacity of fire retardant they carry.

One criterion must be met for each type. For example, most Type 1 helicopters are “restricted” category aircraft and are not allowed to carry passengers. Additionally, all Type 1, 2, and 3 helicopters are not allowed to carry passengers during retardant or water delivery and slingload operations.

“Restricted” is a term that signifies how the Federal Aviation Administration (FAA) has certified a particular aircraft for civilian use. Aircraft are certified by the FAA, for various reasons, to conduct special purpose missions defined by the FAA. Restricted category aircraft are restricted to flying cargo only, because they do not meet standard category airworthiness criteria.

These aircraft may have been manufactured for the restricted category, may have been type-certified in another category and altered for a special purpose operation, or may be surplus military aircraft altered for a special purpose mission.

II. ICS AIRCRAFT TYPING

For the purpose of managing aerial fire resources used during fire suppression, the Incident Command System developed a classification to distinguish the different types, sizes, and capabilities of aircraft.

Aircraft were classified by "type" and number to distinguish the category in which an aircraft belongs. Typically, a Type 1 is the largest category.

Typing of aircraft took the guesswork out of what kind of aircraft to order, or what type of aircraft you are expecting. This simplified the entire air operation management organization.

A. Air Tanker Types

Type	Gallons
1	3,000+
2	1,800-2,999 gallons
3	800-1,799 gallons
4	799 gallons or less

Type 1 and 2 Federally contracted air tankers can only be loaded (downloaded) to 15% capacity. This limit on downloading stems from accidents in 2002 when the wings of a C-130A and a PB4Y2 detached in flight, and to assure that the planes have not been overloaded. Some air tankers used by states and Canada have not been certified for U.S. Federal use due to the lack of manufacturer certification of operational service life.

Currently, the P3A, P2V, CL 215 and 415, and the single-engine air tankers are approved for Federal contracts.

1. Type 1 (3,000+ gallons)

- Very Large Air Tanker (VLAT)

  – DC-10

    It has a 12,000-gallon capacity with 3 constant flow tanks, 280 knot cruise. CalFire contracts for the DC-10 Air tanker. The DC-10 comes with its own Lead Plane.

  – The Martin Mars

    The largest scooping air tanker is from Coulson Group Inc., British Columbia, Canada.

    It has a 7,200-gallon capacity tank with foam and gel capabilities. It has a bottom drop door and a side door drop system. Has a 6-hour operational duration. Can scoop fresh or sea water. Has a 60-to 70-knot skim/loading speed, and can reload in 25 seconds. Can average 4 drops per hour (load, transit, set up, drop, transit to water source). The planes are based on Vancouver Island, British Columbia.

    The Martin Mars air tanker is used for initial attack in the State of Washington. In 2008 and 2009, it was used in California on a Forest Service contract.

  – Boeing 747

    Owned by Evergreen Aviation. Was developed and certified in 2006. It has a pressurized tank system of approximately 24,000 gallons. Evergreen Aviation was awarded a Federal contract in 2009.

- Lockheed P-3A Orion

- Lockheed C-130 (military, referred to as MAFFS, "Modular Airborne Firefighting System")

- Douglas DC-7 (not used by Federal agencies)

2. Type 2 (1,800 – 2,999 gallons)
   Examples include:

   - Douglas DC-4 (not used by Federal agencies)

   - Douglas DC-6 (used in Canada and some states)

   - Lockheed P2V

   - Convair 580

     Used in Canada. During the first decade of the 21st century several have been used in Alaska, California, and other parts of the 48 states under an international agreement.

3. Type 3 (800 – 1,799 gallons)
   Examples include:

   - Grumman S-2F "Tracker"

   - Grumman S-2T

   - Canadair CL-215T and CL-415

   - Consolidated PBY (no longer used by Federal agencies)

   - Air Tractor 802F (if equipped with Interagency Air Tanker Board approved gate system)

4. Type 4 (799 gallons or less)

Commonly referred to as Single Engine Air Tankers (SEATs)

Some of the SEATs (Air Tractor 802) can carry more than 800 gallons (see above).

Examples of SEATs include:

- Ayres Turbine Thrush (various models)
- Dromader M-18/M-18T
- Air Tractor (various models; AT-802 is most commonly seen today)

SEATs do not need as long a takeoff and landing distance as other air tankers, and they can use smaller airports.

They can take off and land on unpaved surfaces such as dirt and gravel roads.

All SEATs have support vehicles that come with fuel (8 hours worth), a water tank(s) that holds twice the aircraft's capacity, and a portable foam and retardant mixing system. They can and should be operated close to a fire with short turnaround times to make them efficient and effective.

B. Helicopter Types

Type	Passenger Seats	Minimum Allowable Payload	Minimum Gallons Retardant
1	15+	5,000 lb	700
2	9–14	2,500 lb	300
3	4–8	1,200 lb	100

It is important to recognize that not all makes of helicopters are equal. A helicopter may have 12 passenger seats, but that does not mean it can lift that much weight. Density altitude and other environmental factors can dramatically affect payload. Density altitude will be covered in another unit.

Different models within the same series of helicopter may look the same, but newer models generally have increased performance. An example is the Bell 206 "Long Ranger" Series (L-1, L-3, L-4). The L-1, L-3, and L-4 look the same, but the L-4 has a more powerful engine and better performance.

Even within the same make and model, some helicopters may have engine and/or rotor blade modifications that dramatically increase performance. If you don't know, whether modifications have been made to the helicopter in question, ask the pilot.

1. Type 1–Minimum of:

   - 15 passenger seats
   - 700 gallons retardant or water
   - 5,000 pounds allowable payload at 59 degrees Fahrenheit at sea level

   Examples include:

   - Kaman K1200 “K-MAX”
   - Bell 214 B-1
   - Sikorsky S-70
   - Sikorsky UH-60 “Blackhawk” (Military)
   - Boeing Vertol 107-II
   - Boeing Vertol 234/CH-47 (Military)
   - Sikorsky S-64 “Sky Crane”
   - Sikorsky S-61

2. Type 2–Minimum of:

- 9-14 passenger seats
- 300 gallons retardant or water
- 2,500 pounds allowable payload at 59 degrees Fahrenheit at sea level

Examples include:

- Bell 204B

  The 204B is a restricted-category civilian model. It is used primarily for cargo and water bucket operations. The military designation is a UH1-B. The Bell 204B is a rare helicopter. UH1-B military version is more common. Bucket size is 325 gallons. The B-204/UH1-B has one engine.

- Bell 205A-1

  The Bell 205A-1 looks similar to the B-204/UH1-B; it has a single engine, carries up to 9-passengers and has a 325-400 gallon bucket capacity.

- Bell Super 205

  The Bell Super 205 has an upgraded engine, transmission, rotor blade, and tail rotor from the standard model. All “Super 205s” have been upgraded to “Supers” by third party companies. The military version is a UH-1H.

- Bell 212

  The Bell 212 looks like a B-205 but has two engines. The upgraded performance model of B-212 is the B-212HP, which performs better at higher elevations and temperatures than the standard 212. The performance is similar to the B-205. The military version is a UH1-N.

- Bell 412

  The Bell 412 is a four main rotor blade version of the Bell 212. It typically is used for offshore oil operations. The Los Angeles County and City Fire Departments have 412s for fire operations. The 412s are faster than the 212/205s, but they do not have the same high temperature and elevation performance.

- Sikorsky S-58T

  These are not commonly seen.

- Eurocopter BK-117 A-4

  These are not commonly seen.

- Bell 209 Cobra

  The States of Florida and Washington both have ex-military Bell 209 Cobra helicopters for bucket operations. Bucket size is 320-gallons. The Florida helicopters can also have a 360-gallon fixed tank. The U.S. Forest Service also has two Cobras that are used for aerial supervision missions.

3. Type 3–Minimum of:

- 4-8 passenger seats
- 100 gallons retardant or water
- 1,200 pounds allowable payload at 59 degrees Fahrenheit at sea level

Examples include:

- McDonnell Douglas (MD) & Hughes 500D
- MD 500E
- MD 530F (not commonly seen)
- MD 600 (not commonly seen)
- MD 900 NOTAR (not commonly seen)
- Bell 206 B-3 “Jet Ranger”

  The “B-206 B-3 Jet Ranger” typically carries three passengers; bucket capacity is around 100 gallons depending on elevation, fuel load, and temperature.

- Bell 206 L-3/4 “Long Ranger”

  The B-206 L-3 and L-4 models are similar to the Jet Ranger but have better performance capabilities: six passengers, 120- to 144-gallon bucket, external cargo load of up to 1,300 pounds. The L-4 model is considered to be a high performance Type 3 helicopter.

- Bell 407

  The Bell 407 has four main rotor blades and a more powerful engine than the 206L series. Passenger seats are the same, external cargo loads are slightly increased, and the bucket capacity is 144 to 180 gallons. It is a faster cruising helicopter than the L series. The Bell 407 is considered to be a high performance type 3 helicopter.

- Aerospatiale AS-350 “Astar”

  Comes in several different versions. The AS-350 B2 and the AS-350 B3 are the newer, more powerful versions (B3 is the most powerful) and are most commonly seen in natural resource work.

- Aerospatiale AS-355 “Twin Star” (not commonly seen)

- Aerospatiale SA-315B “Lama” (not commonly seen)

- Aerospatiale SA-316B Alouette III (not commonly seen)

EXERCISE: Project Helicopter

C. Summary

ICS types of air tankers and helicopters are intended to provide a general classification of their capability.

Aircraft dispatched to incidents are generally those that are available based upon supply and demand. However, it is important for firefighters and other aviation users to know the general capabilities of the various types of air tankers and helicopters to safely, effectively, and efficiently use aircraft assigned to an incident.

EXERCISE
PROJECT HELICOPTER

Read the following scenario. Upon completion choose one of the three suggestions you are likely to make?

At a project planning meeting at your home unit the project leader announces the project requires a helicopter to transport 1,875 pounds of materials plus personnel to the worksite. He knows some helicopters are restricted; he is not sure what that means or what type of helicopter is needed in order to complete the aviation project plan. He asks for your input on the matter. Which one of the following suggestions are you likely to make?

1. Inform him that most helicopters are restricted, and the type doesn't matter for the project based on the mission. A helicopter like a Blackhawk would work.

2. Inform him that the term "restricted" applies to helicopters used in wildland fire suppression. Based on the mission, a helicopter like a Bell Long Ranger would be sufficient.

3. Inform him that the term "restricted" means the helicopter is only used for wildland fire suppression. Any one of the fire-restricted helicopters would do the job, especially one like the Lama.

Name ____________________________ Score ______________

Unit 1 - Aircraft Types and Capabilities
(20 pts possible)

1. List the two major categories of aircraft used in fire suppression. (2 pts)

2. Correctly fill in the ICS Type air tanker for the following criteria. (4 pts)

_____ 799 or less gallons of retardant
_____ 3,000 or more gallons of retardant
_____ 800–1,799 gallons of retardant
_____ 1,800–2,999 gallons of retardant

3. Correctly match the ICS Type helicopter for the following criteria. (5 pts)

Type 1
Type 2
Type 3

___ 15 or more passenger seats
___ 100–299 gallons of retardant or water
___ 4–8 passenger seats
___ 700 or more gallons of retardant or water
___ 9–14 passenger seats

4. It is okay to transport passengers aboard restricted-category aircraft. (1 pt)

True
False

5. Why did the Incident Command System develop a classification scheme to distinguish the different types, sizes, and capabilities of aircraft? (5 pts)

6. If an air tanker has a 3,000-gallon tank capacity, will it always be able to carry 3,000 gallons? (1 pt)

   True
   False

7. The Bell L4 "Long Ranger" and the Bell 407 are both examples of high performance Type 3 helicopters. (1 pt)

   True
   False

8. Most helicopters used in fire suppression have __________ type engine(s). (1 pt)

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Unit 2 – Aviation Management and Safety

OBJECTIVES:

Upon completion of this unit, students will be able to:

1. Describe the importance of flight planning and flight following for aircraft missions.

2. Specify the safety procedures to follow while loading and unloading passengers and cargo from an aircraft.

3. Describe Federal agency pilot and aircraft certification procedures.

4. Identify what hazardous materials cannot be transported on any aircraft and the exemptions.

5. Describe your responsibility for accident prevention.

6. Describe the procedure for reporting an incident or mishap.

I. SAFETY RESPONSIBILITY

The Entire Organization Must Be Committed To Safety!

What is a Safety Management System (SMS)?

- Uses techniques to identify system weaknesses from initial planning stage to mission completion through four components of policy, quality assurance, risk management, and safety promotion.
- Risk management identifies conditions that, if left unchanged, could lead to unwanted events.
- Safety promotion communicates concerns to users.
- SAFECOMS are an important part of Safety Management Systems and quality assurance.
- An SMS is a proactive program that focuses resources towards mitigation or elimination of risk.

A. Four Pillars of Aviation Safety

1. Policy

   - Agency handbooks, manuals, and guides
   - Organization and position requirements
   - NWCG position standards and task books
   - Contract requirements and national, regional, and zone aviation plans

   The policies and rules are guidelines to help us conduct our operations safely (example: we only use approved aircraft and pilots).

Where can you find policy?

In your pocket: Federal agencies provide a variety of tools to enable you to comply with policy and procedures.

The “orange card” is one such tool. The five steps were developed to enable you, the user, to implement agency aviation policies.

2. Risk Management

- Risk Management Worksheet (RMW)
- Job Hazard Analysis (JHA)
- Go-No Go checklists
- SMS risk assessments
- Crew resource management “team decision-making”
- Assignment “turn-down” policy

If flying under certain conditions seems too risky, there may be other ways to do it (or not do it). Example: Too foggy, smoky, or windy – don’t fly, or fly when these conditions have subsided.

3. Quality Assurance

- Briefings
- Training
- FAST teams
- Duty limitations
- Check rides and carding requirements
- Accident investigations
- Program reviews

There is often room for improvement. Example: we often conduct After Action Reviews to see how we can conduct our operations better and safer.

4. Promotion

We want to promote safe practices and a well-informed reporting and safety culture.

- Lessons Learned bulletins
- Safety alerts
- Training
- Briefings

- SAFECOM reporting system
- Airward
- Effective leadership
- Safety communication

We want to recognize people who have taken the initiative to make significant contributions to safety. Example: the Airward was established to recognize individuals who have demonstrated positive behavior or taken action(s) to correct a hazard, submit a good idea, or make a positive difference.

B. Five Steps To a Safe Flight

1. Pilot Qualification Card and Aircraft Data Card approved and current.
2. Flight plan and flight following initiated.
3. PPE in use when required.
4. Pilot briefed on mission and flight hazards.
5. Crew and passengers briefed.

II. MISSION PLANNING

Federal agencies classify flights into three categories or missions:

- Point to point or administrative (airport to airport)
- High reconnaissance (flights more than 500-feet above ground level [AGL])
- Special use activities (flights lower than 500 feet AGL, e.g., firefighting, wildlife surveys, other types of natural resource missions, etc.)

Most aircraft used by federal agencies come from the following sources:

- Agency-owned (fleet) aircraft
- Agency-contracted aircraft
- Aircraft Rental Agreement (ARA)
- Military and cooperator aircraft
- Call When Needed (CWN) aircraft
- On call aircraft
- Exclusive use

A. Flight Plans

All aviation missions for U.S. Forest Service and Department of the Interior agencies, regardless of how simple or complex, are required to have an approved flight plan filed.

This is a detailed outline of where, when, and how the mission will be flown. Good, thorough flight planning leads to a safe mission; poor planning only increases the chances for problems or accidents.

Either of the following is an acceptable flight plan:

- Federal Aviation Administration Flight Plan (for point-to-point flights) with agency flight following.
- FAA Flight Plans shall be filed by the pilot before take-off whenever possible.

B. Flight Manager

Federal agencies use the term flight manager to denote the agency person in charge.

A flight manager should be assigned for each aircraft flight. This person, who may be the only passenger, is the agency's representative to ensure that the contractor meets their obligations. The flight manager will ensure that the aircraft and pilot are "approved" for the mission.

Helitack personnel will perform this function when transporting personnel by helicopter during fire suppression operations.

Dispatch or aviation managers will generally arrange and approve cross-country or extended flights and should provide the flight manager with the following information:

- Aircraft type and identification ("N" number)
- Aircraft color

- Pilot name(s)
- Passenger name(s)
- Passenger and cargo weights
- Nature of mission
- Flight hazards
- Flight routes and points of departure and destination
- Planned fuel stops
- Estimated duration of mission
- Check-in procedures
- Estimated time of departure
- Estimated time of arrival

It is the flight manager's responsibility to confirm this information and notify dispatch of any changes concerning the flight.

C. Pre-Flight Preparations

After you are assured that the aircraft and pilot are approved for the mission, and planning and coordination for the mission is completed, you are ready for the flight.

The pilot is in command of the aircraft.

The flight manager or passengers can terminate the flight if they have a safety concern.

1. Aircraft Fueling

   You will not be involved in refueling; this is the responsibility of the pilot.

   Here are some safety practices:

   - No passengers on board

   - No smoking within 50 feet

2. Pre-flight Inspection

   The first flight of any operational period must start with the pilot doing a preflight inspection. This inspection is to check the aircraft for oil or fuel leaks, drain water and sediment from fuel sump, proper tire inflation, control surfaces, any exterior damage, etc. A visual once-over of the aircraft's condition.

3. Pre-flight Briefing

   A preflight briefing is required before each mission. The flight manager is responsible for providing the pilot with a briefing specific to the mission.

   Before the flight, the pilot should be provided or notified of:

   - Specifics of the mission

   - Manifest with accurate weights of passengers

   - Accurate weight of cargo

   - All hazardous material to be transported

   - Radio frequencies

   - Flight following procedures

- Other aircraft that may be in the area

- Current and forecasted weather conditions

- Fire traffic areas (FTA), airspace issues, etc.

- Aerial and ground hazards in the flight area (review hazard map)

  All Federal agency field offices must have an aviation hazard map. The map displays hazards such as:

  - Power lines

  - Military aircraft training routes

  - Towers

  - Special use airspace

  - Any other potential aviation hazards

  Hazard maps must be updated annually or as hazards change. This map and the hazards must be discussed with the pilot before agency flights in these areas.

  If hazard maps are not available, call the unit dispatch office for information on hazards in the flight area.

D. Passenger Safety Briefing

Before any flight, all passengers must receive a safety briefing from the pilot or helitack personnel. The briefing should include:

- Approaching, entering, and exiting the departure aircraft
- Loading and storage of gear or cargo
- Smoking rules
- In-flight rules
- Seat belt use and seat back in upright position
- Location and operation of emergency exits and passenger doors
- Use of oxygen, if appropriate
- Location and operation of fire extinguisher
- Location of first aid kit and survival equipment
- Location and operation of Emergency Locator Transmitter (ELT)
- Crash positions

  Passengers should be briefed on the correct crash positions by the pilot or helitack personnel during the passenger safety briefing.

E. Personal Protective Equipment (PPE)

Personal protective equipment is required for all special use flights. Collars should be turned up and sleeves rolled down on fire resistant clothing.

For helicopter missions, the following items will be worn:

- Flight helmet
- Hardhat with chin strap (fire crew transport only when overseen by helitack)
- Fire resistant clothing
- Leather or Nomex flight gloves
- Leather boots
- Nonsynthetic undergarments
- Eye and ear protection

F. Manifesting

All passengers, on both airplanes and helicopters, will be manifested before the flight.

This list contains among other information:

- Passenger names
- Flight weight of each passenger
- Pilot's name
- Destination

Airplane manifests are completed by the agency dispatcher or flight manager.

Helicopter manifests are completed by helitack personnel before the flight.

G. In-Flight Emergency

During flight, it is important to always be prepared for an emergency. PPE should be correctly worn at all times, in preparation for any potential emergency. If the pilot declares an emergency:

- Collars should be turned up and sleeves rolled down on fire resistant clothing
- Gloves on
- Hardhat on with chinstrap in place (from staffed or managed helispot to staffed or managed helispot)
- Visor down on flight helmet with visor adjustment knob in tightened position
- Seat restraints snug

- Keep away from controls
- Secure loose gear
- Locate emergency exit(s)
- Assume the crash position

Wait for all motion to stop before exiting unless there is a postcrash fire. The safest environment during a crash is in the aircraft.

If there is a fire, it is important to get away as soon as safely practical. Time may be required to help those in need. The fire extinguisher may buy added time to help others.

H. Flight Following

1. Flight following will be accomplished under the user agency's written flight following policy.

2. Radio contact will be made at predetermined intervals not to exceed 1 hour. (Most agencies use predetermined intervals of less than 1 hour, e.g., 15 to 30 minutes).

3. Position reports or updates are communicated and recorded.

4. Personnel tasked with flight following responsibility must monitor the communications radio at all times during the flight.

5. Flight following must minimally include:

    - Aircraft type and identification ("N" number)
    - Aircraft color
    - Pilot name(s)
    - Fuel on board (e.g., 2 hours of fuel)

- Passenger name(s)
- Passenger and cargo weights
- Nature of mission
- Flight routes and points of departure and destination
- Estimated duration of mission
- Estimated time of departure
- Estimated time of arrival
- Check-in procedures

6. Automated Flight Following (AFF):

   AFF is a satellite/web-based system, which allows the dispatcher to monitor aircraft location on a computer screen.

   - Reduces the requirement to "check in" via radio every 15 minutes; and provides the dispatcher near real time information regarding the aircraft latitude and longitude, heading, airspeed, altitude, and flight history.
   - Reduces pilot workload, clears congested radio frequencies, and provides the dispatcher with much greater detail and accuracy on aircraft location.
   - An approved method of agency flight following. Most agency aircraft have AFF capability.

I. Overdue and Missing Aircraft

Report overdue and missing aircraft immediately to your supervisor, dispatcher, or aviation manager.

1. Overdue aircraft

   An aircraft normally will be initially considered “overdue” when the pilot fails to check in (radio, telephone, or AFF) within the timeframe specified in the agency’s flight following request.

   When operating on an FAA (VFR) flight plan and the aircraft fails to arrive within 30 minutes past ETA, and its location cannot be established, it is considered overdue.

2. Missing aircraft

   An aircraft is officially missing when its known fuel duration, as reported on its request for flight following or as reported on its FAA flight plan, has been exceeded and the aircraft’s location is not known.

J. Emergency Response

Filing a written flight plan and flight following dramatically decreases the response time for Search and Rescue (SAR) efforts. It may still require more than 5 hours for individuals to check and confirm there is a missing aircraft.

1. The average time for SAR initial notification is about 30 minutes after an aircraft is determined to be overdue or missing.

2. Average time for SAR units to arrive on scene is about 4 hours.

The search area may be massive because only written information from a flight plan is available to determine the flight route and destination. Deviation from a flight plan only complicates the potential of locating a downed aircraft. By the time SAR efforts locate the aircraft and arrive on scene, an average time of 38 hours has passed. What is the potential of surviving a trauma if it takes more than a day to get to you?

Without a flight plan, if you are in a downed aircraft and if you have even minor injuries, the chances of your survival are slim. It may take more than a day for someone to acknowledge that you are missing (FAA average of 35.5 hours).

More than 3 days (FAA average of 82 hours) may pass before someone arrives at the scene of the accident. What are your chances for survival?

Postcrash Survival Time – After an accident in a remote area, an injured person may survive for 1 day. An uninjured person may survive for 3 days.

Always consider the environment in which you will be flying. Even on routine flights, remember to bring clothing and/or supplies commensurate with the conditions in the event you have a mishap. Know what your agency's policy is regarding supplemental survival equipment.

	SAR Alert	**Arrival**
Flight following	0.5 hours	4.0 hours
Flight plan	5.5 hours	38.0 hours
No flight plan	35.5 hours	82.0 hours

III. AIRCRAFT AND PILOT REQUIREMENTS

Each year aircraft are used to support numerous natural resource projects and fire suppression missions. For the past 20 years, the general trend has been for flight hours to increase annually to support the aforementioned missions.

As an incidental aircraft user, safety and management of these resources should be a major concern. Accident prevention is of the greatest importance, and this can be accomplished by THINKING and USING COMMON SENSE when around aircraft.

A. Federal Aviation Administration (FAA)

The FAA has established rules and regulations that all pilots are required to follow. Known as the Federal Aviation Regulations (FARs) 14 CFR:

- Part 91 – General Operating and Flight Rules
- Part 133 – External Load Operations
- Part 135 – Aircraft for Hire
- Part 137 – Agricultural Aircraft Operations

Common acronyms used:

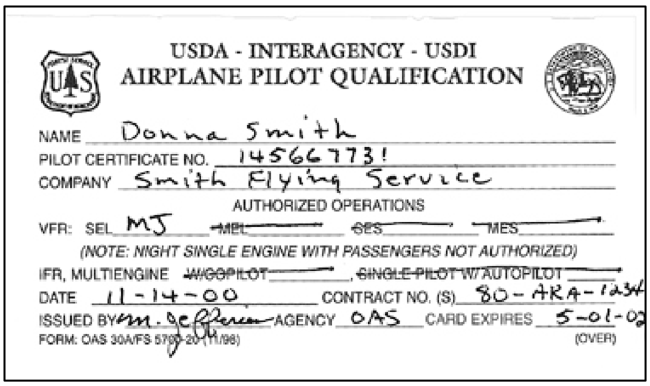
- Notice to Airmen (NOTAM)
- Advisory Circulars (AC)
- Temporary Flight Restrictions (TFR)
- Instrument Flight Rules (IFR)
- Visual Flight Rules (VFR)

Aircraft and pilots used by Federal agencies must:

- Meet Federal Aviation Administration (FAA) aircraft safety and pilot qualification requirements

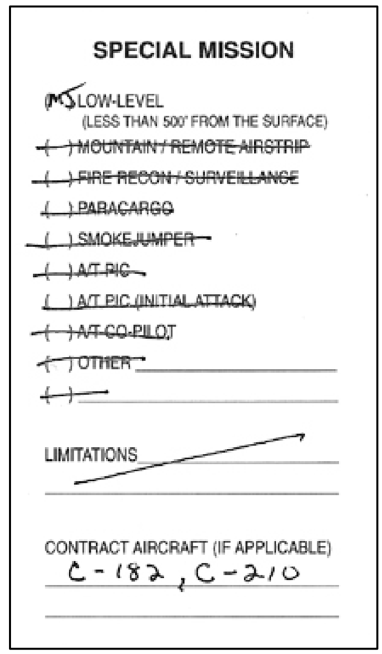
- Meet specific federal agency requirements (aircraft inspection and pilot proficiency training, flight hours, medical and physical requirements, etc.)

B. Pilot Qualification Card



USDA - INTERAGENCY - USDI
AIRPLANE PILOT QUALIFICATION

NAME Donna Smith
PILOT CERTIFICATE NO. 145667731
COMPANY Smith Flying Service
AUTHORIZED OPERATIONS
VFR: SEL MJ ~~MEL~~ ~~SES~~ ~~MES~~
(NOTE: NIGHT SINGLE ENGINE WITH PASSENGERS NOT AUTHORIZED)
IFR, MULTIENGINE ~~W/COPILOT~~, ~~SINGLE PILOT W/ AUTOPILOT~~
DATE 11-14-00 CONTRACT NO. (S) 80-AKA-1234
ISSUED BY M. Jefferson AGENCY OAS CARD EXPIRES 5-01-02
FORM: OAS 30A/FS 5700-20 (11/98) (OVER)



SPECIAL MISSION

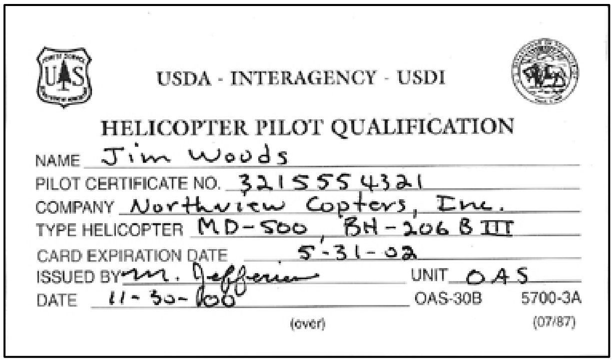
(MJ) LOW-LEVEL
(LESS THAN 500' FROM THE SURFACE)
~~( ) MOUNTAIN / REMOTE AIRSTRIP~~
~~( ) FIRE RECON / SURVEILLANCE~~
~~( ) PARACARGO~~
~~( ) SMOKEJUMPER~~
~~( ) A/T PIC~~
~~( ) A/T PIC (INITIAL ATTACK)~~
~~( ) A/T CO-PILOT~~
~~( ) OTHER~~
~~( )~~

LIMITATIONS

CONTRACT AIRCRAFT (IF APPLICABLE)
C-182, C-210

The Pilot Qualification Card provides information regarding what types of aircraft and types of missions the pilot is approved to fly.

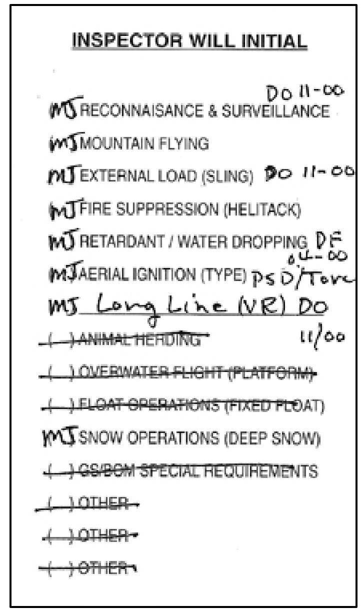
Special use missions require pilots to demonstrate their ability to perform to the satisfaction of an Aviation Management Directorate (AMD) or U.S. Forest Service (USFS) pilot inspector. Both the AMD and USFS use the same Pilot Qualification Card and inspection criteria, and each recognizes cards issued by the other.



USDA - INTERAGENCY - USDI

HELICOPTER PILOT QUALIFICATION

NAME Jim Woods
PILOT CERTIFICATE NO. 3215554321
COMPANY Northview Copters, Inc.
TYPE HELICOPTER MD-500, BH-206 B III
CARD EXPIRATION DATE 5-31-02
ISSUED BY M. Jefferson UNIT OAS
DATE 11-30-2000 OAS-30B 5700-3A
(over) (07/87)



INSPECTOR WILL INITIAL

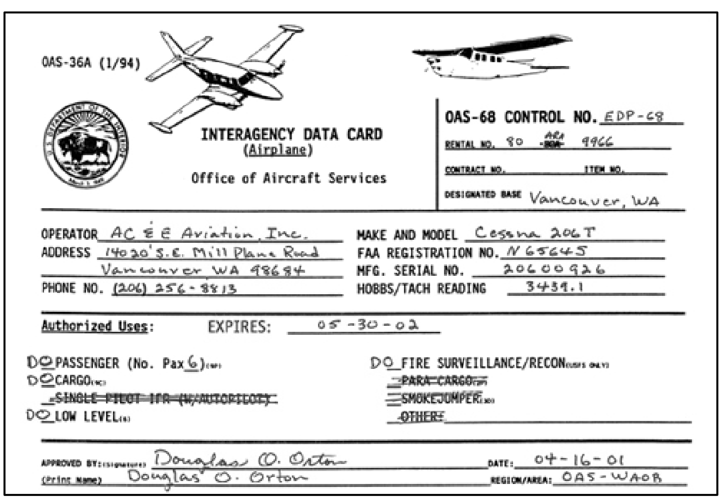
MJ RECONNAISANCE & SURVEILLANCE DO 11-00
MJ MOUNTAIN FLYING
MJ EXTERNAL LOAD (SLING) DO 11-00
MJ FIRE SUPPRESSION (HELITACK)
MJ RETARDANT / WATER DROPPING DF
MJ AERIAL IGNITION (TYPE) PSD/Torch 6-4-00
MJ Long Line (VR) DO 11/00
~~( ) ANIMAL HERDING~~
~~( ) OVERWATER FLIGHT (PLATFORM)~~
~~( ) FLOAT OPERATIONS (FIXED FLOAT)~~
MJ SNOW OPERATIONS (DEEP SNOW)
~~( ) GS/BOM SPECIAL REQUIREMENTS~~
~~( ) OTHER~~
~~( ) OTHER~~
~~( ) OTHER~~

The back of the card will display a list of special use missions. The pilot inspector will initial the card, identifying the missions the pilot is approved to perform.

Pilots must keep the card in their possession at all times. Check the expiration date on the card to be sure it is current. **If a type of mission has a slash through it and is not initialed, DO NOT FLY THAT MISSION!**

C. Aircraft Data Card

The Aircraft Data Card contains information about the aircraft and its authorized uses. An AMD or USFS aircraft inspector will inspect aircraft used for special use activities. The aircraft will be checked for "special use" mission needs and equipment.



OAS-36A (1/94)

INTERAGENCY DATA CARD
(Airplane)
Office of Aircraft Services

OAS-68 CONTROL NO. EDP-68
RENTAL NO. 80 - ARA - 9966
CONTRACT NO. ITEM NO.
DESIGNATED BASE Vancouver, WA

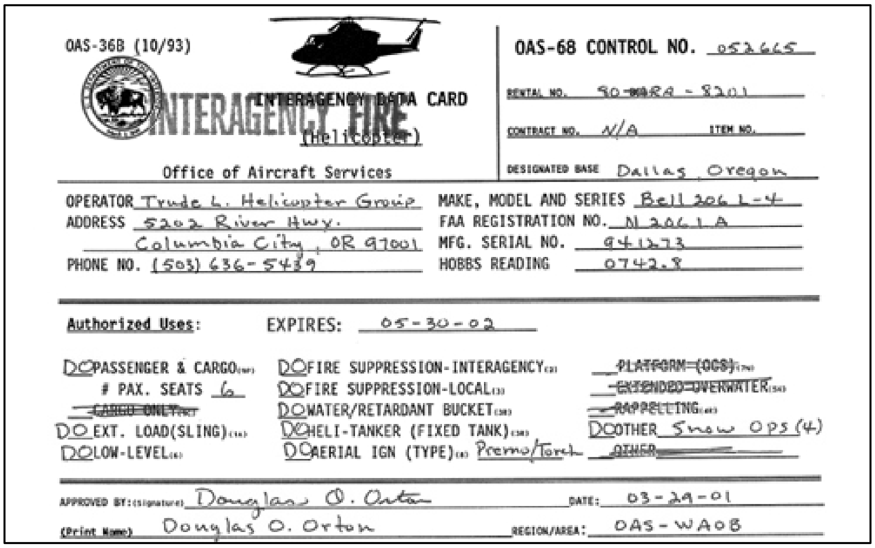
OPERATOR AC & E Aviation, Inc.
ADDRESS 14020' S.E. Mill Plain Road, Vancouver WA 98684
PHONE NO. (206) 256-8813
MAKE AND MODEL Cessna 206T
FAA REGISTRATION NO. N65645
MFG. SERIAL NO. 20600926
HOBBS/TACH READING 3431.1

Authorized Uses: EXPIRES: 05-30-02

DO PASSENGER (No. Pax 6)
DO CARGO
~~SINGLE PILOT IFR (W/AUTOPILOT)~~
DO LOW LEVEL
DO FIRE SURVEILLANCE/RECON (USFS ONLY)
~~PARA-CARGO~~
~~SMOKEJUMPER~~
~~OTHER~~

APPROVED BY: (signature) Douglas O. Orton DATE: 04-16-01
(Print Name) Douglas O. Orton REGION/AREA: OAS-WAOB

A helicopter data card with a red “Interagency Fire” stamp on it indicates that it has the necessary equipment required for interagency fire use.


OAS-36B (10/93)

INTERAGENCY FIRE

INTERAGENCY DATA CARD (Helicopter)

Office of Aircraft Services

OAS-68 CONTROL NO. 052665

RENTAL NO. 50-WARA-8201

CONTRACT NO. N/A ITEM NO.

DESIGNATED BASE Dallas, Oregon

OPERATOR Trude L. Helicopter Group

ADDRESS 5202 River Hwy.

Columbia City, OR 97001

PHONE NO. (503) 636-5439

MAKE, MODEL AND SERIES Bell 206 L-4

FAA REGISTRATION NO. N 2061 A

MFG. SERIAL NO. 941273

HOBBS READING 0742.8

Authorized Uses: EXPIRES: 05-30-02

DO PASSENGER & CARGO

PAX. SEATS 6

~~CARGO ONLY~~

DO EXT. LOAD(SLING)

DO LOW-LEVEL

DO FIRE SUPPRESSION-INTERAGENCY

DO FIRE SUPPRESSION-LOCAL

DO WATER/RETARDANT BUCKET

DO HELI-TANKER (FIXED TANK)

DO AERIAL IGN (TYPE) Premo/Torch

~~PLATFORM (OGS)~~

~~EXTENDED OVERWATER~~

~~RAPPELLING~~

DO OTHER Snow Ops (4)

~~OTHER~~

APPROVED BY: (signature) Douglas O. Orton DATE: 03-29-01

(Print Name) Douglas O. Orton REGION/AREA: OAS-WAOB

The card must be kept in the aircraft. Check the expiration date for currency. AMD and USFS both issue Aircraft Data Cards, and each recognizes cards issued by the other.

If the mission on the card has a slash through it and is not initialed, DO NOT FLY THAT MISSION!

Forest Service fleet aircraft are not carded. All U.S. Department of the Interior fleet aircraft are carded and must have an Aircraft Data Card in the aircraft.

Airplanes not approved for special use missions are issued a separate card or letter.

The card or letter will state “Rental Only – Not for Special Use” or “Point-to-Point” use. These aircraft can be used only for point-to-point or administrative flights (airport to airport).

If the Pilot Qualification Card or Aircraft Data Card has expired or is missing before the flight, do not go.

Report the situation to your dispatcher, immediate supervisor, or unit aviation manager or specialist.

As a passenger, you should ensure the pilot and aircraft are qualified for the mission by asking to see the pilot/aircraft cards.

D. Cooperator Aircraft (State, Private, Military)

Generally, a Memorandum of Understanding (MOU) is necessary for Federal agencies to use cooperator aircraft and pilots.

The AMD or USFS must approve all use of cooperator aircraft and pilots. The AMD or USFS will issue a letter stating which aircraft and pilots may be used.

E. Single Pilot Flight and Duty Limitations

1. A pilot cannot fly more than 8 hours and cannot be on duty more than 14 hours during one 24-hour period.

2. A pilot is required to have 10 hours of uninterrupted rest between flight days.

3. When a pilot acquires 36 or more flight hours (not to exceed 42 hours) in a consecutive 6-day period, the pilot shall be given the following 24-hour period of rest (off duty) and a new 6-day cycle shall begin.

4. A pilot is required to have 2 days off in any 14-day period.

   NOTE: Cooperator aircraft pilots may have different rules than Federal agencies. For example, CAL FIRE only flies 7 hours regardless of jurisdiction, and Federal agencies follow these rules when working under CAL FIRE jurisdiction.

IV. ACCIDENT PREVENTION

As an agency employee, your responsibility as a passenger is more than sitting in the seat and taking up space. Employees are responsible for their own safety as well as the safety of others.

Recognizing and reporting unsafe situations is a dual responsibility of both pilots and passengers.

A. Proactive Passenger Responsibilities

- Question things you encounter that you consider unusual. Don't be afraid to speak up.
- Decline flights you feel are unsafe, and report these to an aviation manager.
- Ensure the pilot is aware of any discrepancies you observe.
- Trust your senses, and don't be intimidated by peers or superiors. If it doesn't feel right, it probably isn't.
- Be professional, continue to learn, maintain situational awareness, and respond to challenging situations appropriately.
- Adhere to standard operating procedures.
- Never assume the pilot sees everything. As a passenger, you are another set of eyes for the pilot. Look for and notify the pilot of other aircraft flying or taxiing in the area, power lines, environmental hazards, and other potentially hazardous situations. "If you see something, say something."
- The Incident Response Pocket Guide gives us guidelines on "How to Properly Refuse Risk."

B. Maintenance Deficiency

A maintenance deficiency report is any serious defect or failure causing mechanical difficulties to be encountered in aircraft operations and not specifically identified as an aircraft incident or aviation hazard.

Example: Aircraft engine will not start.

C. Transportation of Hazardous Material

Hazardous material is a substance or material that has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce.

1. Department of Transportation (DOT) and Transportation Security Administration (TSA) regulations do not allow the following hazardous materials on commercial airlines:

   - Fuel and oil containers
   - Gasoline
   - Strike-anywhere matches
   - Fusees and other firing devices
   - Fireline explosives
   - Compressed gas
   - Chainsaws
   - Guns and ammunition

2. Federal agencies have applied for and received a limited Grant of Exemption, which allows carrying hazardous materials, e.g., fuel, fusees, fireline explosives, etc., on agency aircraft (including contract aircraft).

   Hazardous materials must be in approved, properly labeled and secured containers.

   The pilot can refuse to carry any hazardous material that is determined to be potentially unsafe for the flight.

EXERCISE: Hazardous Material Transport

D. Reporting Aviation Mishaps

Mishap reporting is used to indicate trends in problems and causes, make changes in training and policy, and ensure safer aircraft.

Mishaps are classified as follows:

1. Aircraft accident

   An aircraft accident is an occurrence associated with the operation of an aircraft, which takes place between the time any person boards the aircraft with the intention of flight and the time all such persons have disembarked, and in which any person suffers death or serious injury, or in which the aircraft receives substantial damage.

   Example: Airplane crash with serious injuries or fatalities.

2. Incident with potential

An incident with potential is an incident that narrowly misses being an accident and in which the circumstances indicate serious potential for substantial damage or injury.

Classification of incidents with potential is determined by the AMD Aviation Safety Manager or the USDA Forest Service Branch Chief, Aviation Safety Management.

3. Aircraft incident

An occurrence, other than an accident, associated with the operation of an aircraft that affects, or could affect, the safety of operations or the mission.

Some examples are:

- Failure to file a flight plan or flight following.
- Precautionary landing. A landing necessitated by apparent impending failure of engines, systems, or components, which makes continued flight inadvisable.
- Aircraft ground mishap. An aircraft mishap in which there is no intent to fly; however, the power plants and/or rotors are in operation and damage incurred required replacement or repair of rotors, propellers, wheels, tires, wing tips, flaps, etc., or an injury occurred requiring first aid or other medical attention.
- Near midair collision. When an airborne aircraft encroaches within 500 feet of another aircraft.

4. Aviation Hazard

An aviation hazard is any condition, act, or set of circumstances that compromises the safety of personnel engaged in aviation activities. These hazards may address, but are not limited to, such areas as:

- Deviation from policies, procedures, regulations and instructions as contained in manual and handbook releases, interim directives, standard operating guides, etc.
- Hazardous materials handling and/or transport
- Flight following
- Deviation from planned operations, flight plan, or type of use (for example, general to special-use)
- Failure to use personal protective equipment (PPE) or Aviation Life Support Equipment (ALSE)
- Inadequate training or failure to meet training requirements
- Failure to use load calculations and/or manifests correctly
- Weather conditions
- Ground operations and pilot procedures
- Fuel contamination
- Unsafe actions by pilot, air crew, passengers, or support personnel

E. SAFECOM

The Department of the Interior (DOI) and the U.S. Forest Service (USFS) has an incident/hazard reporting form called the Aviation Safety Communiqué (SAFECOM).

- The SAFECOM is used to report any condition, observance, act, maintenance problem, or circumstance that has the potential to cause an aviation-related mishap.
- A SAFECOM's sole purpose is for mishap prevention.
- A SAFECOM is not intended to point fingers or place blame, and should not be used in disciplinary action against any employee or used against contractors in any manner including contract evaluations.
- Use of a SAFECOM for any other purpose is prohibited.

The SAFECOM database, available at www.safecom.gov, fulfills the Aviation Mishap Information System (AMIS) requirements for aviation mishap reporting for the DOI agencies and the USFS.

The SAFECOM system is **not** intended for initiating punitive actions. Submitting a SAFECOM is **not** a substitute for "on-the-spot" correction(s) to address a safety concern.

It is a tool used to identify, document, track and correct safety related issues. A SAFECOM **does not** replace the requirement for initiating an accident or incident report when an incident involving aircraft under the operational control of the DOI or USFS results in an accident, an incident involves damage or injury, or an overdue aircraft is suspected of having had an accident.

Any individual (including cooperators) with knowledge of an incident or hazard should complete a SAFECOM. The SAFECOM form should be entered directly on the internet at www.safecom.gov.

Or it can be faxed to the Department of the Interior, Aviation Management Directorate, Aviation Safety (208) 433-5007 or to the Forest Service at (208) 387-5735 ATTN: SAFETY.

SAFECOMs should be filed within two (2) days after the incident. Aviation managers should provide their comments and/or corrective actions within five (5) working days after the SAFECOM is filed.

There have been instances where persons were unaware of a problem and received the notification as a result of information sharing through a SAFECOM. It has been demonstrated that as the instances of reporting hazards increase, the number of accidents decreases.

If you observe or experience an unusual aviation event or occurrence that has the potential to be unsafe and place people at risk:

- Report it orally to your supervisor, dispatcher, or aviation manager as soon as possible or practical.

- Make factual notes leading up to the mishap, and protect the site for investigators.

- Responsible aviation manager, user, pilot or dispatcher shall document facts and file SAFECOM per agency policy.

- State agencies will use the appropriate agency form and reporting procedures.

You have probably heard the buzz phrase "Safety Culture." Culture is a set of beliefs, norms, attitudes, roles, social practices, and technical practices. Safety Culture is actually a bit more than this. The hallmarks of a Safety Culture include:

- INFORMED CULTURE—employees understand "hazards" and associated "risks."
- LEARNING CULTURE—people are encouraged to develop and apply their own skills and knowledge to enhance organizational safety.
- PROACTIVE CULTURE—employees and management work continuously to identify and overcome hazards.
- And there is the JUST CULTURE—employees are encouraged to voice safety concerns without fear of reprimand or reprisal. The SAFECOM system was intended to provide this to the Safety Culture.

EXERCISE: Hazardous Situations

V. SUMMARY

Safety is Everyone's Responsibility

Remember – To report any aircraft mishap call: 1-888-464-7427 (1-888-4MISHAP)

- Anyone can refuse or curtail a flight when an unsafe condition may exist.
- Never let undue pressure (expressed or implied) influence your judgment.
- Avoid mistakes and don't hurry.
- Never pressure the pilot to accomplish the mission.

SAFETY – Accident prevention is of the greatest importance, and this can be accomplished by THINKING and USING COMMON SENSE when around aircraft.

Name ______________________________ Score ______________

Unit 2 - Aviation Management and Safety
(20 points possible)

1. Why must a pilot posses a valid Pilot Qualification Card in order to fly an aircraft to transport Federal agency personnel? (1 pt)

2. Why are Aircraft Data Cards issued by the USFS and AMD? (1 pt)

3. List two reasons flight following is required by Federal agencies. (2 pts)

4. As a passenger, identify the proper procedure for approaching an airplane. (1 pt)

   a. Approach from the front in full view of the pilot and with the pilot's approval after the propellers have stopped.

   b. Approach from the side in full view of the pilot and with the pilot's approval after the propellers have stopped.

5. As a passenger, identify the proper procedure for approaching a helicopter. (1 pt)

   a. Approach in a slight crouch from the front or side in full view of the pilot and with the pilot's approval.

   b. Approach from the side or rear with the pilot's approval.

6. List five procedures to safely approach, ride in, and depart from a helicopter. (5 pts)

7. An aircraft and pilot that have been carded by the USFS may be used by Department of the Interior personnel if the cards are current and the aircraft and pilot are approved for the type of mission to be flown. (1 pt)

   a. True
   b. False

8. Cooperator (state, private, military) aircraft and pilots must be approved by the USFS or AMD before use by Federal agency personnel. (1 pt)

   a. True
   b. False

9. Why must hazardous materials **not** be carried by passengers or checked as personnel baggage on commercial aircraft flights? (1 pt)

10. List one responsibility of the flight manager. (1 pt)

11. Match the terms to the following situations that best describe the definition of the terms. (4 pts)

    a. Aircraft accident
    b. Aircraft incident
    c. Aviation hazard
    d. Maintenance deficiency

    ___ Aircraft engine will not start.
    ___ Near midair collision.
    ___ Passengers are not wearing required PPE.
    ___ Airplane crash with fatalities.

12. What is your responsibility if you observe an aircraft mishap? (1 pt)

Basic Air Operations, S-270

Unit 3 – Aircraft Missions

OBJECTIVES:

Upon completion of this unit, students will be able to:

1. Define tactical and logistical use of aircraft.
2. Identify the advantages and disadvantages of the various tactical aircraft missions.
3. Identify the different logistical aircraft missions and their purpose.
4. Describe the proper air-to-ground communication procedures.
5. Describe safety procedures to follow during aerial fire suppression operations.
6. Describe Special Operations.

I. TACTICAL AIRCRAFT MISSIONS

Tactical aircraft missions can be defined as any mission that uses an aircraft to accomplish a specific tactical task during the fire suppression efforts, e.g., deliver aerial fire suppressant, smokejumpers, and transport firefighters and equipment, rappellers, and aerial ignition.

A. Aerial Fire Suppressants Delivery

Both airplanes and helicopters are used to drop aerial fire suppressants (retardant, water, gel and foam) onto a wildland fire in an effort to help slow its advancement and to contain the wildland fire. This is very effective during initial attack.

1. Advantages of Air Tankers/Single Engine Air Tanker (SEAT)

   - Large volumes
   - Multiple drop capability
   - Fast travel times
   - Good for initial attack

2. Disadvantages of Air Tankers/SEAT

   - Nonaccessible terrain
   - Long turnaround times
   - Less accurate than helicopters
   - Single purpose use

- May interrupt other aircraft missions until retardant is dropped.

- Currently there are only about 20 to 24 Federal large air tankers available in any given year. A few states operate large air tankers, but not all of them are approved for used on Federal fires.

3. Advantages of helicopters

   - They can drop more gallons per hour of water, foam, or retardant if a close source is available.

   - They can be used for other types of missions besides delivering water, foam, or retardant.

   - Helicopters can work (fill in the gaps) in steep terrain where air tankers can't drop.

   - Helicopters can make accurate drops near homes when fires occur in the wildland/urban interface.

4. Disadvantages of helicopters

   - Helicopters have wind limitations affecting their use in high winds.

   - Limited by aircraft size, payload, airspeed, and range.

   - Weather and daylight dependent.

B. Smokejumpers

1. Smokejumpers are firefighters delivered to a fire by parachuting from airplanes. Very effective for initial attack in remote areas.

2. Advantages of smokejumpers

   - Rapid delivery of firefighters to remote areas.
   - No aircraft landing area is required.
   - Self-supporting for two shifts.
   - Smokejumper aircraft can deliver firefighting supplies and equipment by paracargo.

3. Disadvantages of smokejumpers

   - High training and equipment cost.
   - Can't jump in high winds.
   - Logistics of retrieval (pack out).
   - Weather and daylight dependent.

C. Fire Crews and Equipment Delivery

Aircraft have the ability to rapidly deliver the following for tactical assignment:

1. Firefighters, crews, and their equipment.

2. Helitack

   a. Aerially delivered firefighters specially trained in helicopter operations are called helitack crews. Effective for initial attack.

   b. Advantages of helitack

      - Rapid aerial delivery of firefighters to remote areas.

      - Self-supporting for two shifts.

   c. Disadvantages of helitack

      - Dependent on natural or preestablished landing areas (unless rappelling).

      - Limited by aircraft size, airspeed, and range.

      - Weather and daylight dependent.

D. Rappelling

1. Rappelling is a method of delivering firefighters when the vegetation cover or terrain makes it impossible or unsafe to land a helicopter. The firefighters descend down ropes from a hovering helicopter. Can be effective for initial attack in remote areas.

2. Advantages of rappelling

   - Rapid delivery of firefighters to remote areas.

   - No landing area is required.

   - Self-supporting for two shifts.

   - Rappel helicopter can be used to deliver firefighting supplies and equipment and for water bucket work.

3. Disadvantages of rappelling

- Higher training and equipment cost.
- Limited by aircraft size, airspeed, and range.
- Limited to rappel rope length.
- Helicopter may not be able to hover in high winds to let down rappellers.
- Weather and daylight dependent.

E. Aerial Ignition

Aerial ignition systems are used to apply fire on the ground from the air to assist in the containment and control during fire suppression efforts.

- Ignition is done quicker than ground igniting methods.
- Ignition can cover a large area.
- Area to be burned is inaccessible or unsafe for people on the ground to accomplish.

II. LOGISTICAL MISSIONS

Logistical aircraft missions can be defined as any aviation activities that support the suppression effort of a fire or to assist in the completion of a project but are not in themselves tactical in nature. These include the transport of people and supplies to the area of the fire or project, fire perimeter mapping, detection and reconnaissance, infrared mapping, aerial photography, medical aid, and rescue missions.

A. Transportation of People and Supplies

1. Airplanes are used when:

   - Many people or lots of equipment must be moved long distances.
   - When ground transport methods are not feasible due to the location of the incident.
   - Short timeframe exists to meet the needs of the fire suppression efforts.
   - Depending on the number of people and amount of supplies to transport, the aircraft may range from a light single-engine airplane to a large Boeing 737.

2. Paracargo

   Supplies are often dropped by parachute (paracargo) to support fire operations in remote areas of Alaska and the Western United States.

   Smokejumpers and their aircraft are most commonly used to do paracargo operations.

   Firefighters must stay out of the flight path of the airplane and the drop zone.

   The symbol “T” signifies the target in the drop zone. Do not enter the area until the all-clear signal is given.

3. Helicopters transport equipment and supplies internally and externally.

   The pilot has the ultimate responsibility for the operation of the helicopter including loading of equipment and supplies.

   Internal cargo is carried inside the helicopter in cargo compartments or within the cabin.

   External cargo is carried in cargo racks or in slings suspended beneath the helicopter.

B. Fire Perimeter Mapping

Aircraft are used to map the perimeter of large fires, prescribed burns, etc., with the helicopter being the preferred aircraft.

Usually a Field Observer (FOBS) from the Planning Section will be onboard the aircraft with a global positioning system (GPS).

As the aircraft flies the perimeter, the FOBS will enter waypoints of the perimeter into the GPS unit. Upon return to the planning section, the FOBS will download the waypoints into a computer to generate a map of the current fire perimeter.

This map is used to plan suppression tactics, determine fire resource needs, and to assist with other aspects of short- and long-term decision-making to support the fire.

C. Detection and Reconnaissance

1. Aircraft are often used for detection and reconnaissance of fires because of their:

   - Ability to cover vast areas in a short time to detect or find fires.

   - Better visual vantage point for reconnaissance.

- Sometimes the only safe or possible way to monitor the fire's behavior is by aircraft.

NOTE: Aircraft are not a substitute for a ground-based lookout on a fire.

2. Single or small twin-engine airplanes are used for detection and high reconnaissance missions (flights above 500 feet above ground level [AGL]) when long distances must be covered or the fire needs to be monitored for long durations.

3. Helicopters are generally used when:

   - Special use missions are required (flights lower than 500 feet AGL).

   - For close scouting and mapping of the fire perimeter.

D. Infrared Mapping System

1. Heat detecting devices, which can be mounted on or operated from an aircraft to allow firefighters to:

   - Determine where the fire is burning during poor visibility conditions.

   - Locate hot spots not easily detected outside the fire perimeter.

   - Assist in mop up by pinpointing heat sources.

2. Twin-engine airplanes or small jets are generally used and are equipped for flying at night or during poor visibility conditions due to smoke.

   Airplanes are used for large fires or when large areas need to be covered.

   Unmanned aerial vehicles (UAV) are currently being evaluated for use in large-scale infrared mapping.

3. Helicopters are most commonly used for the detection of spot fires outside the fire perimeter or for locating small hot spots within or adjacent to the fire perimeter.

   Helicopters are limited to daylight flying when infrared systems are the least effective.

E. Aerial Photography and Video Recording

Aerial photography and video recording are often done for fire behavior documentation, training purposes, and public relations (news media). Helicopters are generally used when the mission requires detailed pictures over a small area. Airplanes are generally used for flights of long duration.

F. Medical Aid

Aircraft are used to deliver medically trained personnel to the scene of an accident on an incident and to transport injured personnel to medical facilities.

Helicopters are often the only means of rapidly evacuating injured personnel from the incident to medical facilities at the incident base or nearby towns. It is common to use military and privately owned contract Life Flight aircraft because of their expertise in dealing with all types of medical emergencies.

G. Search and Rescue (SAR)

Because of their capabilities, aircraft are often used for search and rescue mission. Airplanes and helicopters are both used for SAR.

Airplanes can cover a larger area in a more efficient timeframe. Helicopters can concentrate on a general area for more precise coverage.

III. SELECTION OF AIRCRAFT FOR THE MISSION

First and foremost before placing an order for an aircraft, you must determine if an aircraft is absolutely necessary to accomplish the mission, or can the mission be accomplished by other ground resources. Agency aviation operations employ a variety of aircraft to accomplish different missions.

Although some missions can be accomplished by both helicopters and airplanes, one type of aircraft can usually accomplish the job best in terms of cost, efficiency, speed or time, and quantity of payload. Specific aircraft for specific missions are selected and assigned by dispatchers, aviation managers, or incident air operations personnel based on the following criteria:

A. Aircraft Operational Requirements

A mission may require a specific make or model of aircraft based on performance criteria (i.e., smokejumper aircraft or air tanker).

B. Payload

Which aircraft has the capability to haul the number of passengers or pounds of cargo, etc.?

Fixed-wing aircraft are generally cheaper than helicopters considering cost of passengers delivered over longer distance.

C. Special Considerations

When planning to use an aircraft for a mission, there are some special considerations to factor into your decision:

- Aircraft Speed

  What timeframes are needed to accomplish the mission? Airplanes are generally faster than helicopters.

- Aircraft Range

  Airplanes generally can fly a longer distance without a fuel stop than helicopters.

- Aircraft Cost

  What does it cost to accomplish the mission considering flight time and fixed cost? Other factors being equal, helicopter operating costs are generally higher than airplanes.

- Mission Accomplishment

  Which aircraft type best accomplishes the task under the existing conditions? Conditions may change for a number of reasons – wind, clouds, visibility, terrain, etc.

  Helicopters are generally more versatile. They can be used for personnel transport, cargo (internal and external), helitorch, reconnaissance, and air attack.

- Logistics

  Aircraft availability, sources, flight distance, and time involved for aircraft use.

- Landing Site

  Airplanes generally require longer and improved landing areas (airports). Helicopters are more versatile in where they land (helibase, helispot).

IV. AIR-TO-GROUND COMMUNICATIONS

There may be occasions when you will act as the ground contact in directing the tactical and logistical use of aircraft. This is generally achieved by radio contact with the pilot; however, signal mirrors or other communication devices may be used.

A. Use of Radios

Normally, an air-to-ground frequency will be predesignated and known by both ground personnel and pilots. This might be a discrete air-to-ground frequency, or it might be an assigned tactical frequency for your division or fire. During initial attack, this frequency may be the daily forest net.

You should be sure that the assigned frequencies are programmed in your radio:

1. Preassigned initial attack frequencies (local frequencies)

2. Incident assigned air-to-ground frequency (may be discrete frequency or assigned tactical frequency for your division or fire)

3. All aerial resources must monitor the air guard frequency (168.6250). If unable to establish communications with aerial resources on the preassigned frequencies, air guard can be used to establish initial contact. (Air guard is to be used only for emergencies and to establish initial contact.)

B. Target Description (TD)

TD is a systematic technique meant to enable the pilot to locate, identify, and take the appropriate action on the target. TD is accomplished by radio communication between the ground contact and the pilot. It is meant to communicate the target description and the target location.

The purpose of TD is to have the aircraft in the "low and slow" zone the shortest amount of time possible to reduce risk exposure to air and ground personnel.

1. The ground contact may need to communicate with:

    - Air Tactical Group Supervisor (ATGS)
    - Aerial Supervision Module (ASM1) (ATGS and ATCO are in same aircraft)
    - Air tanker/Fixed-Wing Coordinator (ATCO)
    - Helicopter Coordinator (HLCO)
    - Air Tanker Pilot
    - Helicopter Pilot

2. Before talking to aircraft, it is important for the ground contact to know:

    - Hazards to aircraft
    - Your location
    - Your call sign
    - Your tactical objectives (plan)
    - Aircraft call sign

- Aircraft frequencies
- Primary and secondary targets
- Wind speed and direction

3. Where do you get this information?

- Helibase
- Incident Action Plan (IAP), ICS 204 and 220
- Appropriate incident supervisor (IC, Division/Group Supervisor, etc.)
- Personal observations
- Radio traffic
- Briefings

4. Operating procedures

a. Use the ICS aerial supervision resources (ATGS, HLCO, ATCO) to request and coordinate drops.

b. Have and know the tactical plan:

   - Anchor and flank
   - Hot spot
   - Buy time
   - Secure the edge

c. Use standard fire terminology.

Parts of the fire:

- Head
- Heel
- Right flank
- Left flank
- Spot fire
- Hot spot

d. Use standard target orientation techniques:

- Parts of the fire
- Clock orientation (from the aircraft's position)
- Right, left, nose, tail
- High, even, low
- Cardinal points (north, south, east, west). Only use compass directions if you and the pilot both agree on which way is north. This is the least desirable method.

EXERCISE: Clock Orientation

e. Use easily identifiable target references, such as:

- Extend previous drop
- From your position
- To topographic or terrain features (e.g., rock slides, streams, outcroppings, etc.)
- To human-made features (cut areas, trails, roads, dozer line, vehicles, structures)
- Part of fire (heel, head, flanks) or fire activity, e.g., spot fire on right flank
- To cardinal points (agree with pilot which way is north)

f. Describe target when pilot is in position to see target.

- Use clear text.
- Be brief, clear, and to the point (short, concise communication).
- Plan your transmission before you key the radio.
- Don’t “think out loud” on the radio.

5. Stages of pilot orientation

   a. Long distance (radio contact but no visual contact with aircraft)

      - Geographical and topographical reference points must be large and obvious.

      - GPS coordinates are useful if the air crew has time to enter the information.

      - Relay latitude and longitudes to helibase or ATGS when making initial order for aircraft, allowing pilots to enter coordinates into the aircraft GPS unit.

Refer to the Latitude and Longitude Procedures on page 3.39.

      - Keep positive communication with aircraft until visual contact is established (both the ground contact and pilot).

   b. Medium distance (may or may not have visual contact with aircraft, about 3 to 5 miles)

      - Reference points must be obvious.

      - If aircraft is in sight, use the clock orientation technique.

      - Signaling devices are effective (mirrors, strobes, flares).

      - Keep positive radio communication with aircraft until visual contact is established (both the ground contact and pilot).

- Relay aerial hazards to pilot including other aircraft expected or already on the incident.

- If appropriate, relay overall tactical plan to pilot.

c. Short distance (visual contact with aircraft)

- Reference points must be unique to your target area and easily understood by the pilot.

- Clock orientation technique is effective.

- Signaling devices are effective (mirrors, strobes, flares, space blankets, flagging).

- Describe target(s) and give tactical plan to pilot (including location of ground forces).

- Reemphasize aerial hazards including other aircraft expected or already on the incident.

- If the aircraft is getting close and the pilot doesn't have the target location, repeat target instructions and verify that pilot understands them. Communicate any known aerial hazards!

- If pilot is still experiencing trouble locating target, consider having them do a go-around.

- If the pilot is unable to safely make the drop, consider reevaluating tactics or aborting mission.

6. Feedback

Give an honest, constructive, and timely evaluation of the drop.

- Early, late, uphill, downhill, on target, etc.
- If conditions allow, pilot will adjust drop(s) based on your feedback.

C. Sterile Cockpit Procedures

Sterile cockpit procedures mean that we must maintain radio silence except in emergencies.

As a passenger or ground contact, you must always adhere to safe practices. Regardless of the type of airspace you are in, you must maintain sterile cockpit procedures during approach and departure phases of all flights.

This is not only true for airports but for all takeoffs and landings as well as aerial fire suppressant delivery – especially where there is other air traffic.

Sterile cockpit procedures are used:

- Upon pilot request, within a 5-mile radius of an airport or target-area, there should be no communications within the aircraft. It is important for the pilot to listen for other air traffic in the landing or target area and/or other instructions from airport or air traffic controllers.
- Unless you need to inform the pilot of other aircraft or hazards, do not distract them from their takeoff or approach within the 5-mile radius.

V. AERIAL FIRE SUPPRESSION OPERATIONS

A. Air Tactical Group Supervisor (ATGS)

On incidents where there are numerous aircraft assigned, an ATGS will also be assigned to coordinate the aircraft flights over the incident (tactical and logistical) for safety and efficiency.

The ATGS reports to the Air Operations Branch Director and is responsible for the coordination of fixed-wing and/or rotary-wing aircraft operations.

Critical Safety Responsibilities of the ATGS:

- Determines what aircraft are operating within the area of assignment.
- Determines and recommends aircraft needs for the incident.
- Ensures that a good flight following plan is in place for all aircraft.
- Determines that adequate and appropriate FM and VHF radio frequencies are used.
- Identifies aviation safety issues and mitigates any hazards.
- Is responsible for airspace and air traffic management for the incident.
- Establishes and maintains communications with Air Operations Branch Director, Air tanker and Helicopter Coordinators, incident helibase, fixed-wing bases, and ground resources.
- Receives and acts on reports of non-incident aircraft violating Temporary Flight Restriction (TFR).

- Makes tactical recommendations to appropriate Operations Section personnel.

- Informs Air Operations Branch Director of tactical recommendations affecting the air operations portion of the Incident Action Plan (IAP).

B. Air Tanker/Fixed-Wing Coordinator (ATCO)

- Establishes communication with the ATGS and obtains operational briefing on overall strategy and tactics.

- Establishes communication with the air tanker pilot(s) and ensures compliance with the communication plan.

- Surveys incident for hazards to ensure the safe operation of **all** aircraft.

- Assigns air tanker(s) to specific tasks based on the action plan and the limitations of the air tanker(s).

- Ensures that the air tanker pilot understands the overall strategy and tactics.

- Coordinates with the ATGS for safe separation of rotor and fixed-wing aircraft.

- Gives direct supervision to air tankers. Will lead air tankers on specific runs to ensure safe drops and exit route.

- Can fulfill some responsibilities of the ATGS if requested.

C. Air Tanker Pilot

- Delivers retardant at the direction of the ATCO.

- Confirms with the ATCO that the tactics and strategy are appropriate.

- Communicates with the ATCO on air tanker capabilities and limitations.

- Air Tanker Captain, in conference with the co-pilot, has the final authority on the mission.

- Air tanker pilots carded for initial attack can assume some of the responsibilities of the ATCO and the ATGS in their absence.

D. Helicopter Coordinator

- Establishes communication with the ATGS and obtains operational briefing on overall strategy and tactics.

- Establishes communication with the incident helibase to determine logistical needs of incident to be supported by helicopter.

- Surveys incident for hazards to ensure the safe operation of **all** aircraft.

- Assigns helicopters to specific tasks based on incident action plan and the capabilities and limitations of the assigned helicopter(s).

E. Temporary Flight Restriction (TFR)

In an effort to keep nonincident aircraft out of the incident airspace for safety purposes, a TFR may be requested by incident aviation management if they deem it necessary.

The request will be passed on to incident dispatch, who will make a formal TFR request to the Federal Aviation Administration (FAA).

1. TFR area includes:

   - Center point – Identified by latitude and longitude.
   - Radius – Distance in miles around the center point.
   - Vertical height – usually about 2,000 feet or more above the highest point on the fire.

   Think of a standard TFR as having the attributes of a cylinder placed over a piece of land (fire area).

2. TFR shape can be:

   - Circular – Generally for a single incident.
   - Noncircular – Generally to accommodate multi-incidents or unusually shaped incidents.

   If the FAA approves the TFR request, they will issue a notification that all nonincident aircraft must avoid entering the TFR area.

   When the TFR is no longer needed, the incident dispatch will make a request to the FAA to cancel the TFR.

F. Aerial Fire Suppressant Delivery

Both airplanes and helicopters are used to deliver and drop aerial fire suppressants onto a wildland fire in an effort to help slow its advancement and to contain the wildland fire.

1. Air tankers

Airplanes that drop water, foam, gel, or retardant on wildland fires are called “Air tankers”.

- Air tankers usually require an air tanker base at an airport for mixing and loading the retardant in the aircraft.
- Some air tankers can reload water from large lakes or rivers.
- Smaller single-engine air tankers (SEATs) have the capability and should be operated from remote or unimproved airstrips that are closer to the fire.
- Air tankers carry retardant or other approved wildland fire chemicals in various tank configurations inside the aircraft.

The pilot controls the sequential opening of tank doors to release the desired coverage level of retardant.

This allows the air tankers to disperse their load in different volume increments to produce the desired coverage.

Coverage level is the number of gallons of retardant that is needed to cover 100 square feet (10 feet x 10 feet) of fuel on the ground.

The air tactical group supervisor, air tanker coordinator, or retardant aircraft pilot will determine the coverage level based on drop capabilities of specific air tankers and recommendation from ground forces regarding the fuel model(s) and fire behavior.

- A lower coverage level will produce a long line of retardant (trail drop).

- A salvo drop is when the whole load is dropped at once.

- Or the load can be divided into two or multiple “split load” drops to produce the desired coverage.

Regardless of the kind of drop, retardant should fall to the ground as a light rain or mist.

The minimum safe drop height for large air tankers is 200 feet above the fuel canopy, where as the minimum for SEATs is 60 feet above the fuel canopy. A safe and effective drop height could very well be above the minimum.

Pilots of air tankers, SEATs and helicopters want to do a good job. Their livelihoods depend on doing a job that accomplishes the mission safely and efficiently. Therefore, constructive criticism can be the finite adjustment to making a better pilot. Accuracy in dropping fire suppressants is a function of a number of factors.

The aimpoint is not the only uncertainty in placement of fire suppressants. Other considerations include:

- Density altitude

- Ground speed

- Drop height

- Aiming error (i.e., pilot reaction time)

- Line of flight

- Wind and mountain currents

- Equipment (release) response time
- Variability in drop trajectory

2. Helicopters

Helicopters use either a suspended bucket system or fixed tank system to drop water, foam, gel, or retardant on fires. They may be used for initial attack or operate from helibases on larger fires.

a. Bucket systems

There are different bucket systems, ranging in size from 72 to 3,000 gallons, which are all suspended by cables from the helicopter cargo hook. Buckets reduce helicopter flying speed. Types of bucket systems include:

- Collapsible

  Example: Bambi Bucket

- Rigid hard-sided

  Example: Simms

- Semirigid

  Example: Griffith

b. Fixed tank systems

Fixed tanks can be inside the helicopter or attached directly underneath.

The tank can be filled by a hose and pumping system on the ground, or an internal pump can draw water through an extended hose (snorkel) while the helicopter hovers over a water source.

c. Internal mixing systems allow the addition of foam or gel to the water in buckets and fixed tanks, eliminating the need for an external mixing system on the ground.

d. A portable retardant base can be set up close to a fire, which makes short turnaround times for helicopters with buckets or tanks.

e. Working with helicopter drops:

Consider the following questions when you have a helicopter with a bucket or fixed tank working in your area:

- Do you have good communications?
- Does the pilot have a clear understanding of the target?
- Are trees and snags in the drop zone?
- Are ground crews clear of the area?
- What are the winds doing?
- Are other aircraft in the area?
- Are people on the ground aware of the effects of the helicopter's rotorwash?
- Will terrain and obstructions allow the helicopter to attain the proper drop height?
- Be aware that helicopter performance capabilities may be significantly reduced at high altitudes and/or high temperatures.

EXERCISE: Retardants and Suppressants
Refer to the Basic Guide for Use of Aerial Retardant on page 3.43.

G. Safety Procedures During Aerial Operations

Ground personnel MUST move a safe distance away from water, foam, and retardant drops.

1. Air tankers are capable of dropping several tons of retardant, which is most effective if it falls to the ground as a mist or light rain.

   However, if an air tanker drops too fast or too low, the retardant may not disperse and a large volume may reach the ground, which can result in critical injury to anyone caught within the drop area.

   ATGS if assigned will assure the drop zone is clear for air tankers to drop. If no ATGS is assigned, either the air tanker coordinator (lead plane pilot) or the air tanker will make a low-level pass or dry run over the target area before the actual drop to ensure the area is clear of personnel.

   Even without ground-to-air radio communications, the aircraft passover is a warning for ground personnel to move out of the drop area. Do not hang around to watch the air show.

2. Type 1 helicopters can drop as large a volume as some air tankers, and buckets have been accidentally dropped.

   Down-wash from the rotor blades may blow over standing snags and suddenly spread the fire if the pilot gets the helicopter too low.

3. Firefighters must clear out of the drop area before drops are made by air tankers or helicopters.

   Clear the area by moving up or down the fireline or away at a right angle to the flight path:

   - At least 200 feet away from the drop area.

   - Clear of snags. Move away 1½ times the height of the tallest snag.

   - Watch for dislodged material if drop is made upslope from you.

   - Foam, gel, and retardant are slippery when wet. Watch your footing when working in areas where drops have been made.

4. Safety procedures if caught by surprise in a retardant drop area.

   - Lie on the ground face down with your head towards the approaching aircraft.

   - Fasten the chin strap on your hardhat or hold onto it with one hand.

   - Any tools should be held with the hand extending away from your body and on the downhill side.

H. Air Tanker and Helicopter Tactics

On large fires, air operations personnel with recommendations from ground forces will determine tactics for air tanker and helicopter use.

On initial attack or small fires, you may be the Initial Attack Incident Commander (IAIC) making the decisions. Take into consideration the following:

- The resource value
- Homes and structures in the vicinity of the fire
- Accessibility to the fire
- Restrictions of the use of aerial suppressants, i.e., wilderness, rivers, etc.
- It is best to order an aerial resource early rather than later.

If you are not sure how to accomplish your tactical objectives when using retardant, describe to the lead plane pilot, air tanker pilot, helicopter pilot, or air attack pilot what you want to accomplish. They will be able to advise you on kinds of drops and retardant coverage levels.

The use of retardant is basically another tool available to slow down the spread rate or suppress fires. The three methods of attack are:

1. Indirect attack

   Usually a large fire tactic where fireline is constructed a considerable distance away from the fire edge.

   Air tankers can be used to pretreat ridgelines or firelines. Indirect attack generally requires the use of foam or retardant because they coat the fuel and/or their chemical content inhibits burning for a longer period of time than water.

2. Direct attack

Fireline is constructed or work is done directly on the fire edge.

Both air tankers and helicopters can drop water, foam, gel, or retardant on the fire edge to cool it down for ground forces to follow up.

Helicopters can make pinpoint drops in areas that air tankers can't get to or tie-in lines between air tanker drops.

3. Parallel attack

Fireline is constructed a short distance away from the fire edge to take advantage of light fuels or barriers, and to straighten ragged fire edges.

Both air tankers and helicopters can pretreat or strengthen the fireline being built, help tie-in firelines, or drop on the fire edge or hot spots to cool them down to allow time for the parallel fireline to be built.

The aircraft effectiveness depends on the fuels being treated. Example: for fuels with a canopy, SEATs may not be able to penetrate the canopy; a helicopter with a bucket would be more effective.

I. Aerial Ignition Systems

Aerial ignition systems are generally used when ignition must be done quicker than ground-igniting methods or when the location to be burned is inaccessible or unsafe for people on the ground to accomplish.

1. Helitorch

- A helitorch is an aerial ignition device, suspended by cables below a helicopter, which ignites and dispenses a gelled gas mixture.
- Never get under the flight path of a helicopter carrying a torch. The torch may accidentally be dropped or the pilot may drop burning gel on you.
- No passengers are allowed in the helicopter. Only trained and qualified personnel shall assist with supporting helitorch operations.

2. Plastic sphere dispenser (PSD)

- The plastic sphere dispenser is a machine that injects ethylene glycol (antifreeze) into a plastic sphere containing potassium permanganate, thus causing an exothermic reaction. The injected plastic sphere is expelled from the helicopter and later ignites on the ground.
- Only operator and Ignition Specialist shall assist the pilot in plastic sphere dispenser operations.
- Stay out from underneath the aircraft. The spheres are unlikely to be ignited before hitting the ground, but they could hit you or become lodged in your clothing.

- If you find any unburned spheres, don’t pick them up; they should be buried or burned.

- Spheres typically produce a circular burn pattern.

VI. SPECIAL OPERATIONS

“Special operations” are nonfire projects. “Special use” is the utilization of airplanes and helicopters in support of Federal agency programs that are not point-to-point flight activities and that require special control measures (e.g., training) due to their inherently higher risk. Special pilot qualification and techniques, special aircraft equipment, and personal protective equipment are required to ensure the safe transportation of personnel and property.

A. Different Nonfire Missions

Aircraft are used every day for various missions other than fire suppression. Within the Federal government, agencies depend on aircraft to do their daily operations. All aviation regulations apply for each Federal agency regardless of the type of mission(s) conducted.

Each natural resource project requiring the use of an aircraft may require a Project Aviation Safety Plan (PASP).

If the mission requires a PASP, be sure you have a copy, and brief all personnel associated with the mission.

B. Animal Capture and Eradication (ACETA)

Federal land managers and wildlife biologists use aircraft regularly to accomplish specific resource management goals for their programs.

Some projects that utilize aircraft are:

- Wild-horse roundups
- Animal capture and tagging
- Animal relocation
- Animal tracking

C. Aerial Seeding

After a large fire, when all of the vegetation has been burned away, a Burned Area Emergency Rehabilitation (BAER) plan is developed to restore the vegetation.

If the BAER plan requires reseeding the burned area by aircraft application, the plan will have an Air Operations section. A PASP will be required for this type of project.

Aerial seeding on a large scale may require the use of an aircraft to dispense the seeds over a large area.

D. Law Enforcement

Aircraft are used by Federal law enforcement to accomplish their daily mission(s). Law enforcement missions can include:

- Patrol
- Surveillance
- Access to remote areas
- Drug interdiction

E. Other Missions

Some of the other missions that may use aircraft may include:

- Aerial forest health surveys
- Military operations
- Short haul
- Hydro mulch
- Cone collection
- Habitat improvement or restoration

There is a reference list of Aerial Firefighting Terms on page 3.51.

LATITUDE AND LONGITUDE PROCEDURES

LATITUDE: The imaginary survey lines running east to west. From the equator, there are 90º North latitude and 90º South latitude, each degree being 60 minutes, each minute being one nautical mile (approximately 1.15 statute miles) for a constant distance apart of about 69 miles.

LONGITUDE: The imaginary survey lines running south to north. There are 360º of longitude, each degree varying in width from about 69 miles wide at the equator to convergence at the North and South Poles.

Latitude and longitude may be shown in three formats:

A.	Degrees Decimal Degrees (seldom used)	48.6033ºN 114.1367ºW
B.	Degrees Decimal Minutes (Degrees Minutes Decimal Minutes or Degrees Minutes Tenths)	48º 36.20'N 114º 08.20'W
C.	Degrees Minutes Seconds (many maps)	48º 36' 12"N 114º 08' 12"W

Table 1

There is also a new format specific to the National Mobilization Guide, for requesting TFRs, which is an exception to the above formats. An example would be 483612N/1140812W (uses no punctuation at all).

<u>**It is CRITICAL that you use correct punctuation!**</u>

<u>Degrees</u>: º (MS Word, use Insert Symbol)
<u>Minutes</u>: '
<u>Seconds</u>: "

<u>Note in "**A**" above, only the º is used.</u>
(said "forty-eight point six zero three three degrees.")

<u>Note in "**B**" above, both º and ' are used.</u>
(said "forty-eight degrees, thirty six point two zero minutes.")

<u>Note in "**C**" above, the º and ' and " are used.</u>
(said "forty-eight degrees, thirty six minutes, and twelve seconds.")

<u>Note in requesting a TFR no punctuation is used.</u>
(said "forty-eight thirty six twelve North/one hundred and fourteen zero eight twelve west")

Plotting the three formats will place the location in three different places. Thus, it is critical you use your agency or geographic area format. However, the National standard is format **"C."**

The common general aviation format used is degrees and decimal minutes. Most aircraft-mounted GPS units are not easily changed from degrees decimal minutes format. Some aircraft GPS units (KLN 90 B) cannot be changed from the degrees and decimal minutes format.

Most handheld GPS units and mapping software can be easily set up to do any of the formats. Conversion charts, software programs, and formulas are available.

To convert **degrees minutes seconds** to **degrees decimal minutes**, divide seconds by 60.

Example: 48º 20' 30" → 30" ÷ 60 = .5' → 48º 20.5'

To convert **degrees decimal minutes** to **degrees minutes seconds**, multiply the decimal (e.g., .5) by 60.

Example: 48º 20.5' → .5' x 60 = 30" → 48º 20' 30"

Important "Etiquette"

- Use ONLY ONE period/decimal point when writing a latitude or longitude.
- Do NOT use ANY periods/decimal points when writing a latitude or longitude in Degrees Minutes Seconds format (C).
- When requesting a TFR, use the new format of ddmmssN/ddmmssW (no periods, commas or spaces)
- Remember there can never be more than 60 seconds in degrees minutes seconds format (C).
- For clarity, insert a zero ("0") in front of single-digit minutes, as many GPS units and map programs require two digits.
- Do NOT mix formats.

Degrees and **<u>whole</u> minutes** don't change with either "**B**" or "**C**" formats. Only **seconds** and **decimal minutes** change. A minute is broken into either 60 or 100 parts, depending on which format you want to use. For our purposes, we want to divide a minute into 100 parts: **decimal minutes**.

So, how much error is there if you confuse latitude/longitude format? Here is a table of ground distance for latitude and longitude in the Sacramento, California, area.

Approximate Distance in Feet

	Latitude	Longitude
Degree	363,600	282,600
Minute	6,060	4,710
Second	101	78.5

Table 2

Let's look at 48 degrees 50.58 minutes, more specifically the .58 minutes. Using the distance for a minute of latitude from the table, this location is 3,515 feet (.58 minutes x 6,060 feet/minute) north of the 48 degree 50 minute latitude line. If this latitude was meant to be 48 degrees, 50 minutes, 58 seconds, then this location is 5,858 feet (58 seconds x 101 feet/second) north of the 48 degree 50 minute latitude line. The distance error between these two locations is 2,343 feet (5,858 feet – 3,515 feet), which is almost one-half mile.

If you have any doubt which latitude and longitude format ('?"?) you have been given, ASK!! You need to be sure.

BASIC GUIDE FOR USE OF AERIAL RETARDANT

This guide is intended to provide you with some basic and fundamental information about aerial retardants in order to facilitate your decision to use retardant and determine when it is being used effectively. This guide is not intended to be comprehensive, nor does it contain technical specifications or aircraft capabilities and limitations, but it does ask some common sense questions and provide answers. You should always consult and obtain your agency's policy on the ordering, use, and evaluation of retardant. In order to talk the same language, we need to understand some basic terminology of the various chemicals used in fire suppression:

1. Suppressant – A fire suppression chemical mixture or formulation, including water, when applied directly to a fire, usually at the base of the flames, is called a suppressant because the attempt is made to suppress the flames, not just to prevent their spread.

2. Retardant – A fire suppression chemical mixture or formulation, when applied ahead of a fire front to reduce rate of fire spread or intensity, is called a retardant.

3. Wetting Agent or Surfactant – A formulation that, when added to plain water in proper amounts, will materially reduce the surface tension of the water and increase penetration and spreading capabilities.

4. Foam – Liquid concentrate forming tiny gas-filled bubbles which provides for adhesion and penetration of fuels. Its intended action is to blanket the entire area, cutting off oxygen, preventing formation of combustible gases, and cooling the flammable surface.

Retardants and suppressants assist in the fire suppression effort by doing all or some of the following:

1. Fuel coating – The fuel is coated by the liquid and breaks the fire triangle by removing fuel and oxygen.

2. Fuel cooling – The ambient air temperature is reduced by the evaporation of the water, as well as reducing the temperature of the fuel, making the fuel harder to ignite.

3. Fuel modification – The fuel is modified by the salts or other chemicals in the retardant. This modification inhibits combustion or causes a decrease in burning intensity.

Factors to Consider Before Using Retardant

1. Values at risk – The decision to use, not use, or discontinue use of retardant should be based upon the protection of, by priority ranking in this order, LIFE, PROPERTY, and RESOURCES.

2. Availability of other suppression resources – normally the use of retardant is in conjunction with other tactical assets on the fire. Retardant is used to buy time for ground forces, providing them the opportunity to complete sections of line, tie-in sections of line where line construction is difficult and slow, to cool off a section of line to allow ground forces to direct attack, or to strengthen and widen control lines that may be too narrow to contain the fire.

    a. Crews – Handline is the most time-consuming method of line construction. The retardant can be used for cooling to allow access to the area by line crews, or to allow them the opportunity to complete a threatened section.

    b. Engines – Access to an area by mobile suppression equipment may necessitate the use of retardant to prevent escape of the fire and to buy time for the engines to tie into the retardant line or to reinforce engine line.

    c. Other – Dozer line, such as sharp corners caused by topography or heavy fuel loading directly adjacent to the line, may need to be reinforced.

3. Fire behavior – Can the retardant be effective with the fire acting the way it is?

    a. Crowning – Difficult to get enough retardant to be effective.

    b. Spotting – If spotting is widespread, then the intensity is too severe for effective use of retardant. Retardant is very effective when used on isolated spots or slopovers.

    c. Creeping – retardant can be very effective, but other tactical assets may be more cost effective to use if there is no threat of escape or if sufficient ground forces are available.

d. Torching – Retardant can be effective if the torching is not widespread. Retardant can prevent torching from becoming a crown fire.

e. Flame lengths – Retardant is inappropriate for direct attack when flame lengths exceed 8 to 12 feet.

4. Purpose of retardant use – what will be the tactical use of retardant?

a. Holding – To allow time for crews to arrive.

b. Delay – To slow the advance so that the fire will hit barriers outside burning period, in front of highways, ridges, and control lines.

c. Control – Can the fire be controlled with retardant?

d. Herding – Direct the fire head.

e. Cooling – Reduce intensity of the fire so crews or equipment can work.

f. Spot control – Keep the fire within the lines.

g. Socio/Political – Make a show of force.

5. Availability of retardant and air tankers.

a. Can an adequate volume or amount be delivered to the fire to be effective?

(1) Are flight times too long to get enough retardant to do the job?

(2) Are enough aircraft available to have a continuous volume delivered?

b. If flight times and number of aircraft are not sufficient to be effective, then ground attack may be the only alternative unless a single load will provide protection for crews, threatened structures, or improvements.

c. When is retardant needed? Sporadic use–continuous use. Many people delay requests for retardant until the fire is going over the hill and ground suppression efforts are futile.

d. Are you competing with other fires for aircraft?

6. Flight conditions.

   a. What are the winds? Retardant may be ineffective when wind speed exceeds 20 to 25 mph.

   b. Can the pilot see the fire? Smoke conditions may prevent the pilot from seeing the target.

   c. Can the air tanker make the drop and hit the target considering topography?

   d. Proper drop height is a function of retardant type, coverage level desired, tank flow rates, aircraft door combination, and type of drop desired (salvo or trail). Height may vary from 200 to 400 feet for Type 1-3 air tankers and 60 to 80 feet for SEATs.

      To assure aircraft safety in clearance of terrain features and protect ground personnel, most agencies adhere to a 200-feet minimum above canopy drop height for large air tankers (Type 1-3) and 40 feet minimum above canopy drop height for (SEATs).

7. Retardant application tactics.

   a. Retardant is most effective when planned for and used early in the morning before the burning period.

   b. If you are not sure how to accomplish your tactical objectives by using retardant, describe to the air tanker pilot or air tactical group supervisor basically what you want to accomplish. The pilot or air tactical group supervisor will be able to advise you on aircraft needs, kinds of drops, and retardant coverage levels.

Ten Principles of Retardant Application

1. Determine tactics (direct or indirect), based on fire sizeup and resources available.

2. Establish an anchor point and work from it.

3. Use the proper drop height, which is approximately 150 to 200 feet. However, many factors such as topography, type of air tanker, and gating system, wind direction and speed, type and height of fuel, etc., affect drop height.

4. Apply proper coverage levels.

5. Drop downhill and down-sun when feasible.

6. Drop into the wind for best accuracy.

7. Maintain honest evaluation and effective communication between you and the aircraft.

8. Use direct attack only when ground support is available or extinguishment is feasible.

9. Plan drops so that they can be extended or intersected effectively.

10. Monitor retardant effectiveness and adjust its use accordingly.

Safety

Make sure that you adhere to the principles of safety whenever you are involved with ground forces and retardant or suppressant dropping operations.

1. Clear the area of the drop—move back in as soon as the aircraft has left the area—take advantage of the retardant or suppressant.

2. Caution your ground forces to watch their footing when working in the area of retardant drops, as wet retardant is very slick. Wet tool handles are dangerous too; clean them off before using.

3. If the retardant has been dropped across a highway, wash it off or slow down the traffic; it makes cars slip and slide, too.

4. If working in timbered areas, be alert for snags, tree tops, or the possibility of other falling debris knocked loose by retardant or suppressants.

5. Be cautious of low drop heights by aircraft. The resulting retardant drop will pick up and move rocks, dirt, brush, logs, fire tools, engines, etc. The smaller airborne materials will travel at the drop speed of the retardant.

6. Don't try to "cut line" with retardant drops. It's hazardous to the aircraft and its crew and to personnel on the ground.

Effective Retardant Use Evaluation Criteria

Evaluation of retardant effectiveness can be very complicated and subjective; however, there are some very simple and visible indicators to look for.

1. Did it stop, reduce, or change the rate of spread or intensity of the fire?

2. Did it hit the target? Are you providing adequate and descriptive target identification to the pilot?

3. Did it allow you the opportunity to catch up; in other words, did it buy you the time you needed?

4. Did it penetrate the forest of fuel canopy? Dense brush or tree canopies restrict the penetration of retardant to the ground fuel. High canopies restrict penetration of retardant.

5. Did the retardant fall as a light rain or mist? If retardant is dropped too high, it dissipates before reaching the ground. If it is dropped too low, it doesn't adequately disperse and provide proper coverage.

6. Are ground forces available and able to take advantage of the cooling effect of retardant?

7. What is the turnaround time for air tankers? Can continuous dropping be made without long delays causing loss of line or are enough air tankers available to compensate for long turnaround time?

8. Remember that the overuse of retardant is also inappropriate; if one load will do, don't order two or three. If you do have a continuing need to use retardant, consider an air tanker coordinator (most of us call them lead planes), or an air attack group supervisor, but remember they work for you. Don't be timid when you feel that the retardant isn't helping you do your job; just bid them a fond farewell and a thank you.

AERIAL FIREFIGHTING TERMS

Anchor Point A strategic and safe point, usually a barrier to fire spread, from which to start constructing fire line (or retardant line).

Base (heel of a fire) The part of the fire perimeter opposite the head.

Break Left/Right Means “turn” left or right. Applies to aircraft in flight, usually on the drop run, and when given as a command to the pilot. Implies a prompt compliance.

Canopy The uppermost spreading, branchy layer of vegetation. Usually above 20 feet.

Cardinal Directions The four chief points of the compass: north, south, east, and west.

Clock Method A means of establishing a target or point by reference to clock directions where the nose of the aircraft is 12 o’clock, moving clockwise to the tail at 6 o’clock. “The target is now at your 9 o’clock position.”

Configuration How a helicopter is equipped.

Control Line An inclusive term for all constructed or natural fire barriers and treated fire edge used to control a fire’s spread.

Coverage Level Density of retardant in drop. Normally ranges from 1 to 7 and represents the number of gallons in a 100-square-foot area.

Crown Fire A fire that advances from top to top of trees or shrubs.

Divert Change in aircraft assignment from one target to another or to a new fire.

Dozerline Fire line constructed by a dozer. Same as cat line.

Drainage Area drained by a river or stream. Usually includes at least one main canyon and several side canyons.

Drift Smoke Smoke that has drifted from its point of origin and has lost any original billow form.

Drop That which is dropped in a cargo dropping or retardant dropping operation.

Drop Zone The area around and immediately above the target to be dropped on. Target area for air tankers, helitankers, and cargo dropping.

Early Indicating drop was early or short of the target.

Exit A Command used to indicate the direction air attack wants the tanker pilot to fly after a given maneuver, i.e., “Exit southbound over the lake.”

Extend To drop retardant in such a way that the load slightly overlaps and lengthens a previous drop. “Extend your last drop.”

Fingers The long, narrow tongues of a fire projecting from the main body.

Fire Break A strip of land on which the vegetation is removed to mineral soil for fire control purposes.

Fire Perimeter The active burning edge of a fire or its exterior burned limits.

Flanks of a fire The parts of a fire’s perimeter that are roughly parallel to the main direction of spread. The left flank is the left side as viewed from the origin or base of the fire, looking toward the head.

Flareup A sudden acceleration of fire spread or intensity.

Fuel Break A wide strip or block of land on which the vegetation has been permanently modified to a low volume fuel type so that fires burning into it can be more readily controlled.

Head (of fire) The most rapidly spreading portion of a fire’s perimeter, usually to the leeward or upslope.

Hook Term used to describe making a turn from the flank and across the head.

Hotspot A particularly active part of a fire.

Hotspotting Checking the spread of a fire at crucial points.

Island An unburned area within a fire perimeter.

Knock Down To reduce flame or head in a specified target. Indicates the retardant load should fall directly on the burning perimeter or object.

Late Indicating drop was late or overshot the target.

Low Pass Low altitude run over the targeted area. May be used by air attack or lead plane to get a close look at the target or to show a tanker pilot a target that is difficult to describe. May be used by tanker pilot to get a better look at the target or to warn ground personnel of an impending drop.

Main Ridge Prominent ridgeline separating river or creek drainages. Usually has numerous smaller ridges (spur ridges) extending outward from both sides.

On Target Acknowledgement to tanker pilot that his drop was well placed.

Origin (of a fire) Point on the ground where the fire first started.

Parts of a Fire On typical free-burning fires the spread is uneven, with the main spread moving with the wind or upslope. The most rapidly moving portion is designated the head of the fire, the adjoining portions of the perimeter at right angles to the head are known as the flanks, and the slowest moving portions are known as the base.

Pretreat Laying a retardant line in advance of the fire where ground cover or terrain is best for fire control action, or to reinforce a control line.

Retardant Coverage Area of fuel covered by a retardant. Also degree of coverage of fuel.

Routes The paths aircraft take from departure pattern to arrival pattern at destination.

Running Fire Behavior of a fire or portion of a fire spreading rapidly with a well-defined head.

Saddle Low gap or pass in a ridgeline.

Salvo Dropping the entire load of retardant at one time, or dropping a combination of tanks simultaneously.

Safety Island An area used for escape in the event the line is outflanked or in case a spot fire causes fuels outside the control line to render the line unsafe. During an emergency, tankers may be asked to construct a safety island using retardant drops.

Scratch Line A preliminary control line hastily built with hand tools as an emergency measure to check the spread of a fire.

Secondary Line A fire line built some distance away from the primary control line, used as a backup against slop overs and spot fires.

Shoulder Where the flank and the head meet.

Slop Over The extension of a fire across a control line.

Smoldering Behavior of a fire burning without flame and with a slow spread.

Snag A standing dead tree or part of a dead tree from which at least the leaves and smaller branches have fallen.

Split Drop The dropping of a partial load.

Spot Fire A fire caused by the transfer of burning material through the air into flammable material beyond the perimeter of the main fire.

Spotting Behavior of a fire producing sparks or embers that are carried by the wind and start new fires outside the perimeter of the main fire.

Spur Ridge A small ridge that extends finger-like, from a main ridge.

Surface Fire Fire that burns surface litter, other loose debris of the forest floor, and small vegetation.

Target The area or object you want a retardant drop to cover. "Your target is the right flank."

Tie-in To connect a retardant drop with a specified point (road, stream, previous drop, etc.).

Traffic Pattern The path aircraft traffic takes when landing or taking off.

Trail Drop To drop tanks in sequence causing a long unbroken line.

VHF Very high frequency radio. The standard aircraft radio that all civil and most military aircraft have to communicate with Federal Aviation Administration facilities. Some frequencies are designated for tactical use also.

Vee Pattern To make two separate drops in an overlapping configuration, usually to stop the head.

Wingspan Term of measurement used to adjust the flight path of a tanker (for example; “move two wingspans to the right on the next run.”

Basic Air Operations, S-270

Unit 4 – Helicopter Operations

OBJECTIVES:

Upon completion of this unit, students will be able to:

1. Describe helicopter takeoff and landing areas.

2. Describe air density altitude and its effect on helicopter performance.

I. HELICOPTER TAKEOFF AND LANDING AREAS

Possibly the most important consideration in helicopter operations is the selection of takeoff and landing areas. Individuals may have at their disposal the finest helicopter on the market, a good support crew, and the best helicopter accessories available, but they will still need a network of suitable takeoff and landing areas to fully utilize the aircraft. The types of activity and the volume of traffic will affect selection and development of these areas.

Personnel on the fireline and other field operations need to be aware of considerations in selecting takeoff and landing areas so they can provide for an efficient and safe operation. You may be the only individual on the ground and may be directed to construct a helispot in your area as part of the fire suppression plan, or you may have to construct or modify an area for an emergency evacuation of one or more of your personnel.

A. Takeoff and Landing Area Definitions

1. Permanent helibase

A permanent facility for helicopter operations.

It is usually the home base of permanently based helicopter(s) and personnel. It should be large enough to accommodate at least two Type 2 helicopters, have adequate fueling facilities, a reliable wind indicator, signs, fire extinguisher, paved pad, vehicle parking areas, and reliable telephone and/or radio.

2. Temporary helibase

A helibase to be activated intermittently as the need arises. The helibase should contain most of the facilities required for a permanent helibase. A helibase can be established for incidents or special projects. It should be located in the vicinity of the incident or project operations area.

In a large operation such as a large incident, there may be two or more helibases. Facilities should include parking areas for refueling and maintenance trucks, rest areas for pilots and crews, reliable telephone and/or radio communications, and an operations coordination site.

3. Helispot

A natural or improved takeoff and landing area intended for temporary or occasional helicopter use. It may or may not have road access, but should have a wind indicator, if possible.

4. Unimproved landing area

An unimproved landing spot is used only at the discretion of the pilot, and is typically intended for one-time use only. If it is to be used again, improvements will be made.

B. Takeoff and Landing Area Components

1. Safety Circle

This is a safety zone that surrounds the landing area and provides an obstruction-free area on all sides of the takeoff and landing area.

2. Touchdown Pad

The part of the takeoff and landing area where it is preferred that a helicopter land (where the skids or wheels will come to rest).

3. Approach and Departure Path

A clear flight path selected for flight extending upward and outward from the touchdown pad and safety circle and into the prevailing wind.

C. Takeoff and Landing Area Requirements

1. Helibase requirements

The helibase needs to be large enough to accommodate, and have a surface that will support, the type and amount of helicopters anticipated to be used on the incident.

It is desirable to select a site that can be expanded if additional helicopters are needed.

The helibase should be located so that takeoffs and landings are not over the incident base or camps and far enough from the incident base and camps so that sleeping areas for crews are not disturbed by the noise of the helibase operation.

The helibase should also be located where helicopters do not have to fly over busy roads and populated areas. Helibases are normally selected by qualified helitack or air operations personnel.

2. Helispot requirements

The following minimum guidelines should be used in the construction of helispots:

- ICS Type 1 helicopters

  Safety circle at least 110 feet in diameter (1½ times the rotor diameter) and touchdown pad 30 feet by 30 feet and capable of supporting more than 12,500 pounds.

- ICS Type 2 helicopters

  Safety circle at least 90 feet in diameter (1½ times the rotor diameter) and touchdown pad 20 feet by 20 feet and capable of supporting up to 12,500 pounds.

- ICS Type 3 helicopters

  Safety circle at least 75 feet in diameter (1½ times the rotor diameter and touchdown pad 15 feet by 15 feet and capable of supporting up to 6,000 pounds.

D. Critical Elements of Helispot Locations and Construction

Once a helispot has been constructed, the area should be approved by someone experienced in helicopter operations such as an air support group supervisor, helibase manager, or helicopter manager. The pilot makes the final decision to land on any helispot.

The helispot must then be staffed and operated by qualified helitack personnel.

Approach and Departure Path

1. An approach and departure path of 360 degrees for a helispot is an ideal situation. Helispots should have at least separate approach and departure paths (two-way helispot) into the wind.

2. The minimum width of the approach and departure paths should be the same as the diameter of the corresponding safety circle. Safety may be improved if the approach and departure paths are widened 20 degrees from the safety circle and extending for a distance of 300 feet.

3. The approach and departure paths should be cleared of all obstacles higher than the touchdown pad and for a distance of 300 feet along the approach and departure paths.

4. The approach and departure paths should not overfly structures, inhabited areas, personnel, and vehicle parking areas. Routes for sling operations should never fly over these areas.

E. Touchdown Pad and Safety Circle

1. The touchdown pad should be as level as possible and not exceed 10% slope. It should be large and firm enough to support the weight of the helicopter.

    a. Toe-in landings are not approved.

    b. One-skid landings are not approved.

2. Clear the safety circle for the touchdown pad. The rule of thumb is 1½ times the rotor diameter of the helicopter to be used.

3. Within the safety circle, clear brush, trees, downed logs, and rocks to the ground surface level with as little as possible disturbance to the surface vegetation and soil. This will help to control dust.

4. Clear anything that might interfere with the helicopter landing gear or tail rotor.

5. Remove all cleared material from the helispot that could be blown into the main or tail rotors.

6. Mark any hazards that can't be removed, and inform air operations personnel and pilots.

7. Make a final inspection of the area.

F. To Make Helispot Suitable For Use

1. If a lot of work is required, consider another location. The time spent may not be worth it.

2. Areas that require less work will have less environmental damage.

3. Environmental constraints should be considered before construction begins. If possible, consult local resource advisor before construction.

G. Wind Influence

1. Locate helispots so takeoffs and landings can be made into the wind.

2. Changes in wind direction should be considered.

3. Wind socks or flagging should be put up to indicate wind direction.

4. Dirt can be thrown into the air to indicate wind direction, but not if the helicopter is close enough to get dirt into the engine.

5. Hand signals can be used to indicate wind direction for the pilot.

H. Dust Abatement and Debris on Helispots

1. Visibility problems as well as aircraft engine and component damage can occur if helispots are poorly constructed or maintained.

2. If dust becomes a problem, consider using commercially available dust abatement liquid.

3. Another option is to keep the landing area moist with water applied by a portable pump and hose, water tender, engine, or aerial application from a helicopter with a tank or bucket.

4. Avoid areas with dust and ash such as dozer-constructed helispots and helispots located within the burned area.

I. Fire Behavior

Consider fuels, fire behavior, LCES, and other hazards when locating helispots. An area may be an ideal helispot, but unsuitable considering fire behavior and the possibility of being overrun by the fire. Make sure LCES is in place.

1. Consider escape route to safety zone. Many people have mistakenly assumed a helispot was a safety zone.

2. Consider the size of the safety zone in relationship to the potential number of people at the helispot.

3. Locate helispot where people can see the fire or are in contact with someone who can see the fire.

4. Don’t rely on the helicopter as a means of evacuating people if fire activity increases.

Exercise: Helispot Locations.

II. FACTORS AFFECTING AIRCRAFT PERFORMANCE

A. Density Altitude

Density altitude refers to a theoretical air density that exists at a given altitude as compared to standard conditions. Density altitude conditions with regard to aircraft performance on a standard day are considered to be:

- Sea-level elevation
- Atmospheric pressure equals 29.92 Hg (inches of mercury)
- Temperature equals 59 degrees Fahrenheit (15 degrees Celsius)

By definition, density altitude is pressure altitude corrected for temperature and humidity. It can have a profound negative effect on aircraft performance.

Density altitude is the altitude at which your helicopter thinks it is.

Air, like other gases and liquids, is fluid. It flows and changes shape under pressure. Air is said to be "thin" at higher elevations. There are fewer air molecules per cubic foot at 10,000 feet elevation than at sea level.

At lower elevations, the rotor blade or propeller is cutting through more dense air, which increases aircraft performance.

There are three factors that affect air density in varying degrees; – atmospheric pressure, temperature, and, to some degree, humidity.

The lower the atmospheric pressure at a given elevation, the less dense the air. Aircraft performance is decreased. The effect would be similar to your car traveling up a high mountain pass.

The most dramatic influence on density altitude is temperature. The same volume of air contained in one cubic foot, at a low temperature, will expand two or three times as the temperature rises. There are fewer air molecules, because of expansion, in a given space so the air has become less dense. The rotor blade or propeller has less air to grab, and performance is decreased. To compensate for loss of lift, engine power must be increased, thus reducing or possibly even eliminating any reserve power that might have been available.

High density altitude reduces aircraft performance. Conditions associated with high density altitude (thin air) are high elevations, low atmospheric pressure, high temperatures, high humidity, or some combination thereof. When you're hot and high, you're in a watch-out situation.

It is the pilot's responsibility to determine the effect of density altitude on aircraft performance before and during every flight. However, aviation users need to be aware of the process.

One of the ways to determine density altitude is through the use of charts designed for that purpose.

To determine density altitude from this chart, you will need to know the outside air temperature and pressure altitude.

To determine the pressure altitude at a given location, use the altimeter in the aircraft. The pilot will adjust the altimeter to 29.92 Hg, the standard sea-level atmospheric pressure.

The altimeter converts barometric pressure to pressure altitude.

An example of using the density altitude chart:

1. Locate the outside air temperature on the bottom of the chart. For an example, select 90 degrees Fahrenheit.

2. Move vertically up the chart to intercept pressure altitude. For an example, select 4,000 feet pressure altitude.

3. Then move straight left and read density altitude from the left side of the chart, which would be 7,000 feet.

Refer to the Density Altitude Chart on page 4.21. Use this chart to determine the density altitude when given the temperature and pressure altitude for the following two examples.

Example 1: 80 degrees Fahrenheit
5,000 feet pressure altitude

Example 2: 30 degrees Fahrenheit
6,000 feet pressure altitude

Effects of high density altitude:

- Can reduce margins of safety
- Reduces fuel load (less flight time and aircraft range)
- Reduces payload (cargo, passengers, retardant)
- Increases takeoff and landing distances
- Decreases climbing rate
- Decreases maneuvering performance
- Reduces mission efficiency

One way to remember the effects of density altitude is, “When you are high and hot, you’re not going to carry a heck of a lot.”

B. Ground Effect

A condition of improved rotor system performance encountered when a helicopter is hovering near the ground. The apparent result is increased lift or decreased engine power requirements. This provides for a greater allowable payload.

1. Be aware of meadows with high grass. High grass dissipates ground cushion effect and can hide logs, rocks, and other debris. Any ground cover reduces HIGE, e.g., soft snow, grass (especially tall grass), and slash.

2. Avoid tundra, boggy, and swampy areas, if possible. If these locations can't be avoided, a log pad may be necessary to support the helicopter.

   The pad should be placed so that the logs will be perpendicular to the helicopter's skids (to prevent the skids from becoming caught between the logs), and the logs should be firmly secured by pegs.

   All limbs should be completely removed, but don't remove the bark from the logs (fresh-peeled logs are slick).

   The landing surface should be close to level.

3. Helispots in valley bottoms may be shut down due to inversions, smoke, or fog.

4. When constructing a helispot in a canyon bottom, be aware of "dead air holes." Be sure the canyon does not have a downdraft from a neighboring ridge. Deep canyons need a long run to climb out of, or enough width to allow a helicopter to circle safely while climbing out.

C. Hover-In-Ground-Effect (HIGE)

HIGE is achieved when a helicopter is hovering approximately less than one-half the rotor diameter distance from the ground. In a hover, the rotor blades move large volumes of air from above the rotors down through the system. The ground in conjunction with the downward airflow produces a cushion of air under the helicopter and more lift due to the proximity to the ground.

Hovering over tall grass, rough terrain, or water dissipates this cushion and may reduce or eliminate ground effect. Helicopters typically use less engine power to maintain a hover under HIGE conditions. HIGE only occurs under the most ideal conditions.

D. Hover-Out-of-Ground-Effect (HOGE)

HOGE occurs when a helicopter exceeds approximately one-half the rotor diameter distance from the ground and the cushion of air disintegrates. To maintain a hover, the helicopter is now more power dependent. This situation will occur when the terrain does not provide sufficient ground base to reflect rotor thrust, or when performing external load work. Maximum performance is required and payload is usually reduced. Most helispots that we use are HOGE.

Maximum performance takeoffs and landings increase risk because a helicopter has little or no power reserve, thus reducing safety margins.

Note: Most helispots that we use are hover-out-of-ground-effect (HOGE). They will require the helicopter to use more power to take off or land there.

E. HIGE vs. HOGE

Need adequate unobstructed approach and departure to maintain HIGE until transitional lift is achieved.

Extending upward and outward from safety circle:

- How do you look at it?
- Obstruction-free (150 ft approach by 300 ft departure).
- Into prevailing wind. A headwind can reduce distance to achieve transitional lift.

F. Transitional Lift

Transitional (additional) lift is gained as a helicopter moves from the turbulent air created from hovering, to undisturbed “clean” air, which moves through the rotor system as the helicopter increases airspeed.

Transitional lift occurs when a helicopter approaches 15 to 18 miles per hour (mph) indicated airspeed. The rotor system produces more lift at this airspeed, much as the wing of an airplane would at a higher airspeed. Transitional lift will also be produced when a helicopter is hovering in a 15 mph steady headwind.

Keep in mind how ground effect and transitional lift affect helicopter performance during takeoffs and landings. A clear approach and departure path for helicopter takeoffs and landings provides a greater margin of safety.

1. Avoid helispots that require vertical takeoffs and landings (maximum power).

   Most small helicopters must be at approximately 400 feet above ground level (AGL) at zero airspeed to execute a safe autorotation in the event of engine failure.

2. Avoid one-way helispots if possible because they reduce the margin of safety due to the fact that takeoff or landing would have to be downwind.

3. Exposed knobs and ridge backs that provide a dropoff in mountainous terrain make good helispots. The higher the elevation the more important the dropoff.

4. Turnouts in roads can make good helispots. Traffic controls must be provided on roads.

5. Large, flat areas without vertical obstructions are the best helispots.

G. Manifest and Load Calculations

The manifest and the load calculation process are critical to the safe operation and performance of an aircraft.

1. Passenger Manifest

All passengers, on both airplanes and helicopters, will be manifested before the flight. This is a listing of name and flight weight of each passenger (personal weight, personal gear bag, PPE, etc.) plus pilot’s name, destination, etc. Airplane manifests are completed by the agency dispatcher or flight manager. Qualified helitack personnel will oversee passenger manifesting and helicopter loading.

2. Helicopter Load Calculation Form

A helicopter load calculation form must be completed by the pilot and checked by the helicopter manager before each helicopter flight.

The load calculation is a means of computing helicopter performance for a given set of temperatures and altitude conditions. Load calculation takes into consideration factors such as the weight of the aircraft and the amount of fuel onboard.

Density altitude for the elevation(s) the flight will incur is factored in to help ensure the aircraft is not overloaded. The helicopter load calculation form is another step to provide a safe flight.

INTERAGENCY HELICOPTER LOAD CALCULATION OAS-67/FS 5700-17 (11/03)		**MODEL** AS350B2
		N# 3598D
PILOT(S)	MACKENZIE	**DATE** 9-28-09
MISSION	PSD	**TIME** 0830

1 **DEPARTURE**	583	**PA** 2500	**OAT** 28°C
2 **DESTINATION**	L-CARIBOU	**PA** 4000	**OAT** 21°C

3 **HELICOPTER EQUIPPED WEIGHT**	2870
4 **FLIGHT CREW WEIGHT**	165
5 **FUEL WT** (_____ gallons X _____lbs per gal)	750
6 **OPERATING WEIGHT** (3 + 4 + 5)	3785

	Non-Jettisonable		Jettisonable
	HIGE	**HOGE**	**HOGE- J**
7a **PERFORMANCE REF** (List page/chart from FM)	SUPS-1 P96	SUPS-1 P96	SUPS-1 P96
7b **COMP GROSS WT** (FM **Performance** Section)	5300	5300	5300
8 **WT REDUCTION** (Req for all Non-Jettisonable)	160	160	—
9 **ADJUSTED WEIGHT** (7b minus 8)	5140	5140	5300
10 **GROSS WT LIMIT** (FM **Limitations** Section)	4960	4960	5512
11 **SELECTED WEIGHT** (**Lowest** of 9 or 10)	4960	4960	5300
12 **OPERATING WEIGHT** (From Line 6)	3785	3785	3785
13 **ALLOWABLE PAYLOAD** (11 minus 12)	1175	1175	1515

14 **PASSENGERS/CARGO MANIFEST**	
15 **ACTUAL PAYLOAD** (Total of all weights listed in Item 14) **Line 15 must not exceed Line 13 for the intended mission.**	
PILOT SIGNATURE [signature]	**HazMat**
MGR SIGNATURE Bob Wing	Yes X No ___

H. Additional Definitions

- Allowable Payload – Payload limit determined to be what the helicopter can safely carry for a given set of conditions. Found on the load calculation.

- Pressure Altitude (PA) – Altitude adjusted for variations in atmospheric pressure. Read altimeter when set to 29.92.

- Outside Air Temperature (OAT) – True ambient air temperature at any given altitude. Usually measured in Celsius (C).

- Density Altitude (DA) – Pressure altitude adjusted for variations in outside air temperature and/or humidity.

- Empty Weight – The weight of the helicopter including fixed equipment, unusable fuel, undrained oil, and hydraulic fluid.

- Equipped Weight – Empty weight plus weight of lubricants and any equipment required by the mission or contract.

- Operating Weight – Equipped weight plus weight of flight crew and fuel.

- Ground Effect – Beneficial gain in lifting power when operating near the surface, caused by the rotor downwash acting in conjunction with ground proximity to create a cushion of air.

- Hover-In-Ground-Effect (HIGE) – Operating at such an altitude that the influence of ground effect is realized. Usually one-half rotor diameter distance or less.

- Hover-Out-of-Ground-Effect (HOGE) – Hovering without the benefit of the ground effect cushion. Usually requires additional engine power.

- Maximum Certificated Gross Weight – Absolute maximum gross weight as established by the manufacturer and approved by FAA.

- Computed Gross Weight – The allowable gross weight, obtained from appropriate flight manual performance chart, based on applicable circumstances and environmental conditions.

- Gross Weight Limitation – From the limitations section of the flight manual. This may be a takeoff and landing limitation or a performance limitation.

III. HELICOPTER PERFORMANCE AND EFFECTIVENESS

Certain helicopter missions push the limits of the aircraft's performance capabilities. Items that reduce the effectiveness and increase the risk of the mission include weight, temperature, altitude, and marginal visibility.

- Helicopter missions that transport external loads increase risk.

- Helicopter performance capabilities are reduced as temperature and/or altitude increase.

- All helicopters have different maximum performance capabilities, so be aware of the capabilities of the specific helicopter that you are assigned to.

- Low-level helicopter operations often occur in heavy smoke where hazards (e.g., trees, snags, antennas, visibility, turbulence, and other aircraft) increase the risk level significantly.

- Determine the risk level for every mission. Is the risk level acceptable? Can the risk be mitigated? If the risk is not acceptable or it cannot be mitigated, then the mission should not be flown. The risk level can change rapidly as dynamic conditions such as weather change.

- A large part of the success of a helicopter mission is the result of good communications between the pilot and the user(s) on the ground.

- Accurate target and hazard descriptions are essential to a safe mission. Locate this information and relay it to the pilot. Things to consider in the target description include:

  - Have you considered what the target would look like from the air?

  - Are you located where the pilot can see you?

  - Do you have a signal mirror?

  - Are you using cardinal directions or clock directions in relation to the track of the aircraft?

  - What is the wind direction? Provide this information to the pilot.

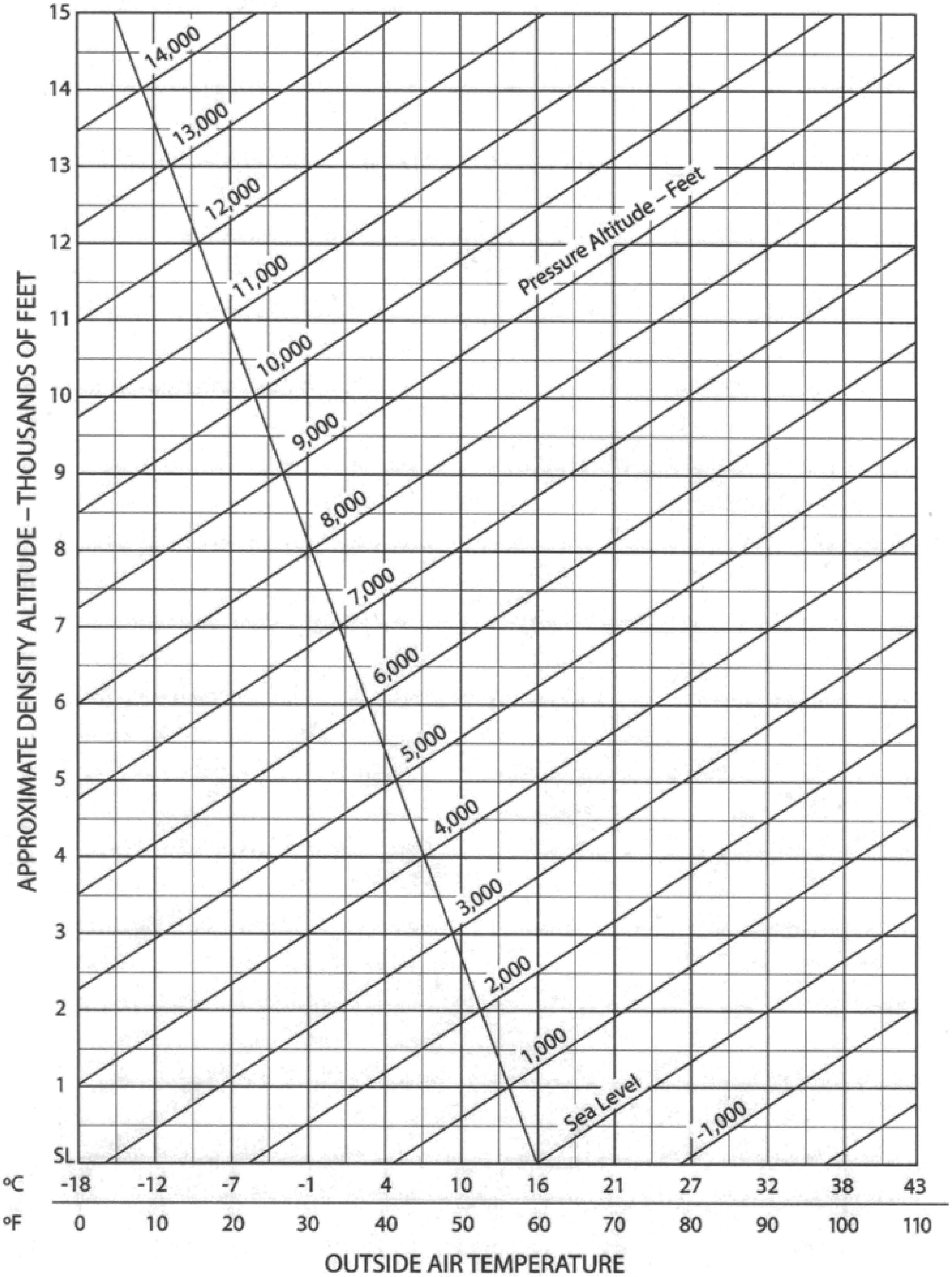
  - Are all firefighters clear of the drop area?

  - Is there a safer way to carry out an effective suppression action?

EXERCISE: IHOG Overview

EXERCISE: Operational Procedures

Density Altitude Chart



Name ______________________________ Score _______________

Unit 4 - Helicopter Operations
(14 pts possible)

1. Maximum-performance helicopter takeoffs and landings increase risk because the helicopter has little or no power reserve, thus reducing safety margins. (1 pt)

   a. True
   b. False

2. Correctly match the terms to the following descriptions. (3 pts)

   a. Hover-in-ground-effect
   b. Hover-out-of-ground-effect
   c. Transitional lift

   ___ Occurs when a helicopter moves from hovering and gains 15 – 18 mph indicated airspeed.
   ___ Occurs when a hovering helicopter exceeds approximately one-half the rotor diameter distance from the ground.
   ___ Occurs when a helicopter is hovering approximately less than one-half the rotor diameter distance from the ground.

3. Hover-out-of-ground-effect (HOGE) helispots require the helicopter to use more power to take off or land there. (1 pt)

   a. True
   b. False

4. List one effect of high density altitude on an aircraft? (1 pt)

   Any one of the following:

5. Using the density altitude chart on page 4.21 of the student workbook, calculate the density altitude for the following: (3 pts)

   a. 32 degrees Celsius and 3,000 feet pressure altitude

   b. 75 degrees Fahrenheit and 7,000 feet pressure altitude

   c. 100 degrees Fahrenheit and sea level

6. Match the correct ICS Type helicopter to the correct size safety circle. (3 pts)

   a. ICS Type 1 helicopters
   b. ICS Type 2 helicopters
   c. ICS Type 3 helicopters

   ___ Safety circle at least 90 feet in diameter (1½ times the rotor diameter).
   ___ Safety circle at least 110 feet in diameter (1½ times the rotor diameter).
   ___ Safety circle at least 75 feet in diameter (1½ times the rotor diameter).

7. One-way helispots should be avoided. (1 pt)

   a. True
   b. False

8. Helispots should be located so takeoffs and landings can be: (1 pt)

   a. Into the wind
   b. With the wind
   c. Straight up and down