AIR OPERATIONS II

FOR FIELD TEAM LEADERS

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"If you are looking for perfect safety, you will do well to sit on the fence and watch the birds." -Wilbur Wright

I. Review of Level I Material
- A. Safety.
  - 1. High risk involved in air operations.
  - 2. Personal equipment.
    - a. In any LZ or tactical use of aircraft.
    - b. Three stages of air crash survival: impact, fire, wilderness.
      - i. Impact--structural and restraint protection; positions.
      - ii. Fire--JP4 burns at 1150° C, personal protection is vital.
        - (a.) A brief intense flash follows a crash.
        - (b.) Best protection: Nomex, leather, wool, cotton.
        - (c.) Synthetics are the worst thing you can wear.
        - (d.) Helmet, goggles.
        - (e.) Leather or Nomex gloves, heavy leather boots.
        - (f.) Ear protection.
      - iii. Wilderness survival.
        - (a.) Ten essentials.
        - (b.) Identify safety and survival gear on the aircraft.
  - 3. Safety around the helicopter.
    - a. Dangers of rotors.
      - i. Main--dips low.
      - ii. Tail--can't see.
    - b. Intakes, exhaust, antennae.
- B. LZ Operations.
  - 1. Site selection.
    - a. Large site, 360° approach or ridge ideal.
    - b. 300' approach/departure corridors.
    - c. Free of hazards and debris.
  - 2. LZ design.
    - a. Military--30x33 steps.
    - b. ICS--three classes. See level I handouts.
  - 3. LZ markings.
  - 4. Marshalling--review signals in detail. See handout.

II. Principles of helicopter flight.
- A. Rotors.
  - 1. Main rotor=a lifting body. Altering lift in one part of the disk by altering pitch of the blades in a part of their rotating cycle produces translation. This is done with the cyclic pitch stick.
  - 2. Increased or decreased lift throughout the disk causes the helicopter to ascend or descend. These changes are produced by altering the pitch of the blades throughout their cycle with the

collective pitch stick.

3. The tail rotor counters engine torque. Altering pitch in the tail rotor blades moves the tail boom one direction or the other (yaw). Pedals alter this pitch. This control becomes less important at speed > 50 kts.

B. Throttle controls power output of the engine(s). The throttle may be adjusted manually or automatically.

C. The interactions between cyclic, collective, pedal, and throttle are complex and critical. Altering one control necessitates adjustment of all the others.

D. Ground effect.

1. When altitude < rotor radius and airspeed is low, a cushion of dense air builds up beneath the helicopter and buoys it up. In these circumstances, the helicopter is said to be In Ground Effect (IGE).

2. If airspeed is increased (by movement or wind), the cushion is dispersed and the helicopter is left Out of Ground Effect (OGE). Tall thick grass and other surface textures can also disperse the cushion.

3. Much less power is necessary to maintain a hover IGE than OGE.

4. At V_{trans}, airflow over the disk due to forward translation begins to provide significant lift. Because there is usually a gap between the speed at which the ground effect is dispersed and V_{trans}, takeoffs and landings (when this velocity gap is traversed) require a lot of power.

5. Safety note: There is a circular pattern of airflow IGE which may result in loose objects being picked up and forced into the top of the disk.

E. Autorotations.

1. Loss of power results in downward movement of a helicopter (like a rock). Air flowing up through the rotors moves them (windmilling); increasing the pitch of the rotors disperses the energy of descent through the transmission.

2. Thus, increasing collective pitch and positioning the aircraft appropriately (flaring), allows a soft landing....

3. ...unless the transmission locks up.

4. This process is called **autorotation.**

5. A helicopter cannot autorotate in certain parts of the flight envelope, namely at altitudes less than 50' (unless airspeed is very low) or at speeds less than 50 kts if at altitude. For this reason, high performance take-offs (straight up) are unsafe.

F. Density altitude.

1. Relative altitude is dependent on temperature, humidity, and atmospheric pressure (elevation). Therefore these values at the LZ should be reported to the pilot.

2. High temperature and high humidity result in a higher density altitude (less dense air).

3. Payload and stay time (fuel capacity) decrease at higher altitude because more power is required to operate in thin air.

4. When weight of fuel and equipment necessary for flight is considered, usable payload capacity goes fast.

III. Tactical principles of helicopter operations

A. Approaching and loading a helicopter

1. Never approach a helicopter until the pilot or crew chief/medic gives a signal to do so. Stay clear while the aircraft is in flight or hovering.
2. Always approach in view of the pilot, from the front quadrants of the ship (see diagram), and never from the uphill side.
3. Keep your head down.
4. Secure ropes, webbing, shirt tails, loose clothing.
5. Carry long objects parallel to the ground.
6. Never stand underneath a hovering helicopter.
7. Load any cargo and patients at the direction of the crew chief/medic. Secure any such loads well. Any shift in the center of gravity could be disastrous.

B. Hoist Operations

1. Avoid if at all possible.
2. Never touch a hoist cable until it has touched the ground first. Static electrical charges build up from rotors moving through the air and can discharge through the steel cable, giving a fatal shock.
3. Never secure the cable to any fixed object.
   a. A small gust of wind can lead to major structural damage.
   b. The crew will want to retract the cable and orbit when not hoisting to save fuel and prevent engine heat buildup.
4. Be ready. Minimize waiting (i.e. minimize wasting flight time).
5. Types of hoists.
   a. Horse collar--worn under the armpits. If the patient has a decreased level of consciousness or weak arms, he can fall out. These collars can also injure blood vessels and nerves (brachial plexus).
   b. Jungle penetrator--fold down the seat, straddle it, secure the strap around your chest, bear hug it for dear life.
   c. Billy Q. net.
   d. US CG cage.
   e. Stokes litter.
      i. The only acceptable way to hoist any injured person.
      ii. Should be rigged with a four point bridle such that the height of the system from the bottom of the litter to the top of the bridle ring is less than three feet.
      iii. Balance the litter carefully.
      iv. Tag lines may be rigged from the litter to the ground; if they are used they should be attached to the litter by some quick-release mechanism, they should **not** be secured to the ground, and they should be of nylon rope (static or dynamic).
6. As any other time the helicopter is hovering, be acutely aware of any loss of power (a change in engine noise).

C. Passenger briefing outline--for briefing field team members being transported by helicopter, for example.

1. Aircraft features.
   a. Location and operation of doors and emergency exits.

b. Operation of seatbelt mechanisms.
c. Location and operation of fire extinguishers, ELT, first aid kits, and survival gear.

2. Landing Zone
a. Keep area free of litter, sleeping bags, clothing, other light items.
b. Keep unauthorized persons out of safety circle.
c. Emergency procedures.

3. Approach/departure procedures.
a. Unbuckle seatbelt and disembark only when directed.
b. Always approach/depart within view of the pilot/crew chief.
c. Carry long items parallel to the ground.

4. In-flight discipline.
a. No moving about.
b. No smoking.
c. Keep arms and legs free of controls and inside aircraft.
d. Flight hazards.
e. Emergency procedures.

IV. Special tactical concerns related to patient care.

A. Precautions related to pressure changes--atmospheric pressure decreases as altitude increases, causing the expansion of any contained compartment of air.

1. Airsplints.
2. Endotracheal/EOA tube cuffs.
3. MAST garments.
4. IV pressure bags (will affect flow rate).
5. O_2 flow rates.
6. Gas in various body compartments can cause pain when it expands--gut, sinuses, ears.
7. Gas in other body compartments can cause more serious problems when it expands.
a. Stomach--vomiting possible. NG tube may be indicated.
b. Thoracic wounds--exacerbation of pneumothoraces.

B. Other patient concerns.

1. Vomiting/aspiration due to motion sickness.
2. Ear protection from noise and provision of communication.

C. Restrain patient movement, but be aware that this causes anxiety and discomfort.

D. Have complete and thorough documentation secured to patient.

E. Arrange to pick up your gear.

V. Strategic principles of air operations.

A. Navigation.

1. Review the LORAN-C format for latitude and longitude.
a. Degrees, minutes in decimal form instead of degrees, minutes, seconds.
b. Most of the helicopters used in SAR have LORAN-C equipment and can use it to navigate within 50 feet of any point.

2. Using the aeronautical chart.
a. Identify VOR stations, name, frequency, radial.

b. Very briefly review resection (as used with VOR's).
c. Identify latitude/longitude and distance scales.
d. Other as time allows.

B. Communications.
1. Most EMS and police aircraft have radios that can dial up any selected frequency. They need to know the frequency and any CTCSS tone to be used.
2. Military aircraft are generally limited to communications on the aircraft band (118-135 MHz A.M.), but can often dial up frequencies on the VHF low band (30-50 MHz F.M.).
3. Prearrange all communications when requesting the helicopter.

C. Deployment of aircraft in SAR--choice of resources, fixed vs. rotary wing.
1. Transport to the site of a distant search.
a. Fixed wing twin ideal for a small team.
b. CAP, military, state dept. of aviation, local volunteers.
c. DES SARDU can arrange.
d. Large, fast helicopter another alternative.
2. Tactical search.
a. Class I helicopter ideal.
b. VSP, military, Park Police, EMS aircraft.
c. DES SARDU can arrange; VSP divisions, local law enforcers, rangers, EMS agencies may also be able to request.
d. Limitations of helicopters to remember.
i. Altitude and OGE hover ceiling (limit payload and fuel, stay time).
ii. Brush and darkness limit visibility dramatically.
iii. Best uses of helicopters: cover large areas with a low POD, patrol roads, scout areas of planned expansion, give staff members an overview of the area, locate and transport field teams rapidly.
e. Limitations of fixed wing aircraft to remember.
i. For most aircraft available, stall speed is too high to permit observation of any but the most open areas.
ii. They are very useful in electronic search, especially of large areas, in communications relays, and in transportation.

V. A practical problem.
A. Appoint an IC, plans chief, ops chief, LZ coordinator, and medic from members of the class.
B. The Scenario: You are on the summit of Second Peak (near Mt. Rogers) in SW Virginia with a critically injured hiker who needs aeromedical evacuation (he has an air splint on his right femur, two broken left ribs with subcutaneous air, and two large bore iv's running) to Bowman-Gray Medical Center in Winston-Salem.
C. Questions:
1. What type of aircraft do you want and where will you get it?
2. Who will request the aircraft? How?
3. What special equipment will be needed by the field team? ...by

the LZ team?....by the flight crew of the aircraft you have chosen?
4. Find an acceptable LZ on the map. What are its LORAN-C coordinates? What is its position relative to two VOR's?
5. What information will the pilot need?

D. Role play radio traffic between the aircraft and ground teams as the aircraft approaches. Work the incident over the radio in real time.