OBJECTIVE
- Familiarize the student with hover auto procedure, use, and technique. Demonstrate maneuver and have student safely execute the maneuver at first with help from instructor. In the end, at least once with as little help as possible from instructor

CONTENT
- Introduction, performance factors, HV-diagram and purpose of maneuver
- Recognition of power failure
- Control functions and RPM control
- Preparation and wind
- Technique
- Common errors and hazards

SCHEDULE
- Pre-flight Discussion 10
- Instructor Demonstration 10
- Student Practice 20
- Post-flight Critique 15

EQUIPMENT
- Whiteboard + pens for pre- and post-flight discussions
- Helicopter model

INSTRUCTOR’S ACTIONS
- Pre-flight - Discuss lesson objective
- In-flight - Demonstrate maneuver in head wind conditions and coach student practice
- Post-flight - Critique and evaluate student performance

STUDENT’S ACTIONS
- Pre-flight - Discuss lesson objective and ask questions
- In-flight - Perform new maneuver as directed
- Post-flight - Ask pertinent questions

COMPLETION STANDARDS
- Student should demonstrate knowledge of elements related to maneuver
- Determine that the terrain below is suitable for safe touchdown
- Perform autorotation from stationary hover into wind at recommended altitude and RPM
- Maintain established heading ±10° (CPL ±5°)
- Touchdown with minimum sideward and no rearward movement
- Exhibits orientation, division of attention and proper planning
POWER FAILURE AT A HOVER

OBJECTIVE
- Safe forced landing in case of an engine failure at a hover
- You will experience a rapid yaw to the left

CONTROLS
- CYCLIC  Correct for drift
- COLLECTIVE  Cushion landing
- PEDALS  Heading
- THROTTLE  Closed

TECHNIQUE

1. Hover
   - Into wind
   - Steady 3 feet hover
   - RPM in the top green
   - Check landing zone
   - Eyes outside, reference point

2. Engine failure
   - Close throttle firm in detent
   - Right pedal to keep heading
   - A little right cyclic to stop drift
   - Let the aircraft settle
   - One foot above the ground
   - Sharply and progressively pull collective

3. Touchdown
   - No side- or backward movement
   - Make sure skids are level
   - Collective full down

PEDAL - SETTLE - PULL

FACTORS
- Hover height
- Wind
- Density altitude
- Main rotor RPM
- Gross weight

HAZARDS
- Dynamic rollover
- Ground resonance

ERRORS
- Delayed or inadequate pedal
- No or inadequate drift correction
- Early or late on collective
- Rolling on the throttle
- Landing on the back skids
- Collective not down
OBJECTIVE
- Familiarize the student with power failure at altitude procedure, use, and technique. Demonstrate maneuver and have student safely execute the maneuver at first with help from instructor. In the end, at least once with as little help as possible from instructor

CONTENT
- Introduction, performance factors, HV-diagram and purpose of maneuver
- Recognition of power failure
- Control functions and RPM control
- Preparation, landing areas and wind
- Different ranges of autorotations
- Technique
- Common errors and hazards

SCHEDULE
- Pre-flight Discussion 10
- Instructor Demonstration 10
- Student Practice 25
- Post-flight Critique 15

EQUIPMENT
- Whiteboard + pens for pre- and post-flight discussions
- Helicopter model

INSTRUCTOR’S ACTIONS
- Pre-flight - Discuss lesson objective
- In-flight - Demonstrate maneuver in head wind conditions and coach student practice
- Post-flight - Critique and evaluate student performance

STUDENT’S ACTIONS
- Pre-flight - Discuss lesson objective and ask questions
- In-flight - Review autorotation and perform new maneuver as directed
- Post-flight - Ask pertinent questions

COMPLETION STANDARDS
- Student should demonstrate knowledge of elements related to maneuver
- Establish an autorotation and select a suitable landing area
- Establish proper aircraft trim and autorotation airspeed ±5kts
- Maintain rotor RPM within limits
- Compensate for wind speed and direction to avoid over/undershooting the selected landing area
- Terminate approach with power recovery at safe altitude when told to do so
### POWER FAILURE AT ALTITUDE

<table>
<thead>
<tr>
<th>OBJECTIVE</th>
<th>- Safe forced landing in case of an engine failure at altitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONTROLS</td>
<td>- CYCLIC       Attitude, Airspeed   - PEDALS       Trim, Heading</td>
</tr>
<tr>
<td></td>
<td>- COLLECTIVE  Rotor RPM, Cushion landing - THROTTLE Closed</td>
</tr>
<tr>
<td>TECHNIQUE</td>
<td><strong>Enter Autorotation</strong></td>
</tr>
<tr>
<td></td>
<td>- Lower collective immidiately</td>
</tr>
<tr>
<td></td>
<td>- Aft cyclic to a 60 knots attitude</td>
</tr>
<tr>
<td></td>
<td>- Right pedel to keep heading</td>
</tr>
<tr>
<td></td>
<td>- Identify a suitable landing area</td>
</tr>
<tr>
<td></td>
<td>- Maneuver to the landing area a neasesary</td>
</tr>
<tr>
<td></td>
<td>- Mayday - Mixture - Magnetoes - Masters</td>
</tr>
<tr>
<td></td>
<td><strong>Landing</strong></td>
</tr>
<tr>
<td></td>
<td>- Into wind, as much as possible</td>
</tr>
<tr>
<td></td>
<td>- 50 feet flare the helicopter</td>
</tr>
<tr>
<td></td>
<td>- 10 feet level the helicopter</td>
</tr>
<tr>
<td></td>
<td>- Cushion touchdown with collective</td>
</tr>
<tr>
<td></td>
<td>- Keep helicopter straight during ground slide</td>
</tr>
<tr>
<td></td>
<td>- When practiced terminate in power recovery or go around</td>
</tr>
<tr>
<td></td>
<td><strong>Ditching in water or trees</strong></td>
</tr>
<tr>
<td></td>
<td>- Make touchdown with no or little forward movement</td>
</tr>
<tr>
<td></td>
<td>- Lower collective after contact</td>
</tr>
<tr>
<td></td>
<td>- Release seatbelt and harness</td>
</tr>
<tr>
<td></td>
<td>- Open doors and exit helicopter</td>
</tr>
<tr>
<td></td>
<td><strong>Choosing a landing area</strong></td>
</tr>
<tr>
<td></td>
<td>- Height above the ground</td>
</tr>
<tr>
<td></td>
<td>- Wind direction and speed</td>
</tr>
<tr>
<td></td>
<td>- Distance to field</td>
</tr>
<tr>
<td></td>
<td>- Obstacles</td>
</tr>
<tr>
<td></td>
<td>- Surface</td>
</tr>
<tr>
<td></td>
<td>- Size</td>
</tr>
<tr>
<td></td>
<td><strong>Performance considerations</strong></td>
</tr>
<tr>
<td></td>
<td>- Density Altitude</td>
</tr>
<tr>
<td></td>
<td>- Gross weight</td>
</tr>
<tr>
<td></td>
<td>- Wind speed</td>
</tr>
<tr>
<td></td>
<td><strong>Maneuvering to make the landing area</strong></td>
</tr>
<tr>
<td></td>
<td>- Overshoot; Correct with s-turns</td>
</tr>
<tr>
<td></td>
<td>- Undershoot; Correct with heigher airspeed and lower RPM</td>
</tr>
<tr>
<td></td>
<td><strong>HAZARDS</strong></td>
</tr>
<tr>
<td></td>
<td>- Dynamic rollover</td>
</tr>
<tr>
<td></td>
<td>- Ground resonance</td>
</tr>
<tr>
<td></td>
<td>- Low rotor RPM</td>
</tr>
<tr>
<td></td>
<td><strong>ERRORS</strong></td>
</tr>
<tr>
<td></td>
<td>- Same as for straight in and 180° autorotations</td>
</tr>
<tr>
<td></td>
<td>- Failing to maneuver to the choosen landing area</td>
</tr>
<tr>
<td></td>
<td>- Forgetting mayday call and forced landing drills</td>
</tr>
</tbody>
</table>

- **THE TOP PRIORITY ABOVE EVERYTHING ELSE, IS TO REACH YOUR CHOOSEN LANDING SITE**
SETTLING-WITH-POWER

OBJECTIVE - Familiarize the student with settling with power procedure, feeling and technique. Demonstrate maneuver and have student safely execute the maneuver at first with help from instructor. In the end, at least once with as little help as possible from instructor.

CONTENT - Introduction, performance factors and purpose of maneuver
- The three elements you need do to get into it and aerodynamics
- Preparation, landing areas and wind
- Technique
- Recognition of settling with power
- Common errors and hazards

SCHEDULE - Pre-flight Discussion 15
- Instructor Demonstration 10
- Student Practice 25
- Post-flight Critique 15

EQUIPMENT - Whiteboard + pens for pre- and post-flight discussions
- Helicopter model

INSTRUCTOR’S ACTIONS - Pre-flight - Discuss lesson objective
- In-flight - Demonstrate maneuver in down wind conditions and coach student practice
- Post-flight - Critique and evaluate student performance

STUDENT’S ACTIONS - Pre-flight - Discuss lesson objective and ask questions
- In-flight - Perform new maneuver as directed
- Post-flight - Ask pertinent questions

COMPLETION STANDARDS - Student should demonstrate knowledge of elements related to maneuver
- Select an altitude that will allow recovery to be completed no less than 1000 feet AGL or at manufacturers recommended alt
- Promptly recognize and announce onset of settling with power
- Utilize the appropriate recovery procedure
DEFINITION
- The helicopter settles into its own main rotor downwash, even with full power applied

OBJECTIVE
- To determine when the helicopter is settling into its own downwash, recognize the symptoms and recover from it

CONDITIONS
- Rate of descent > 300 ft/min
- Power applied, 20-100%
- Airspeed below ETL

FACTORS
- Gross weight
- Density altitude
- Low RPM

AERODYNAMICS

Induced Flow Velocity During Hovering flight

Induced Flow Velocity During Vortex Ring State

Vortex Ring State

TECHNIQUE

1 Setup
- 2000 feet
- 360° clearing turn
- Landing checks
- Downwind
- Eyes outside, reference instruments
- Lower collective to 18”
- Aft cyclic to slow down, holding altitude

2 Recognition
- Vibrations of ETL
- Feel the sink
- Controls become unresponsive
- Random pitch, roll and yaw
- Increased rate of descent
- Eyes outside
- Keep heading with pedals

3 Recovery
- Ease cyclic forward, tip-path plane to horizon
- Lower collective 1”
- Accelerate through ETL to 35 knots
- Raise collective to climb power
- Keep RPM with throttle
- Keep heading with left pedal
- Stabilize helicopter in a positive climb

SITUATIONS
- OGE hover
- Quickstop

HAZARDS
- Raising collective
- Recover to late
- Normal recover not helping

ERRORS
- Getting behind the aircraft
- Over controlling
- Radio work
OBJECTIVE - Familiarize the student with low rotor RPM recovery procedure and technique. Demonstrate recovery and have student safely execute the recovery at first with help from instructor. In the end, at least once with as little help as possible from instructor

CONTENT - Introduction and purpose of maneuver
- Low RPM factors
- Consequence
- Technique
- Recognition low RPM
- Common errors and hazards

SCHEDULE - Pre-flight Discussion 15
- Instructor Demonstration 10
- Student Practice 25
- Post-flight Critique 15

EQUIPMENT - Whiteboard + pens for pre- and post-flight discussions
- Helicopter model

INSTRUCTOR’S ACTIONS - Pre-flight - Discuss lesson objective
- In-flight - Demonstrate recovery and coach student practice
- Post-flight - Critique and evaluate student performance

STUDENT’S ACTIONS - Pre-flight - Discuss lesson objective and ask questions
- In-flight - Perform recovery as directed
- Post-flight - Ask pertinent questions

COMPLETION STANDARDS - Student should exhibit knowledge of elements related to low rotor RPM recovery including combination of conditions that are likely to lead to this situation
- Detect the development of low rotor RPM and initiate prompt corrective action
- Utilize the appropriate recovery procedure
LOW ROTOR RPM RECOVERY

OBJECTIVE
- Situations that can lead to it, how to recognize the symptoms and how to recover

AERODYNAMICS

The airflow around an aerofoil
The more pitch, the more drag, the more engine power required
When the critical angle is reached the blade will stall

CAUSES
- Rolling the throttle the wrong way
- Pulling too much collective without adding throttle
- Over pitching
- Heigh gross weight
- Heigh density altitude

RECOGNITION
- The RPM needle outside the bottom of the green
- Change in the sound of the helicopter
- Increase in vibrations
- In the new CBi’s the low RPM warning horn will come on

RECOVERY
- Lower the collective - which reduces the angle of attack
- Roll on the throttle - which increases the rotor RPM - $L = C_L \cdot \frac{1}{2} \rho \cdot S \cdot V^2$
- Apply aft cyclic if in forward flight to create a flare effect

HAZARDS
- Complete blade stall, where the helicopter will fall out of the sky!
- Sinking into obstacles during maximum performance takeoff

ERRORS
- Not detecting low RPM
- Improper control inputs
OBJECTIVE - Familiarize the student with anti torque system failure procedure and techniques. Demonstrate recovery and have student safely execute the recovery at first with help from instructor. In the end, at least once with as little help as possible from instructor

CONTENT - Introduction, aerodynamics, causes and indications of failure
- Selecting safe landing area
- Technique if complete failure in a hover and in fwd flight
- Technique if fixed pitch right/left in a hover and in fwd flight
- How to avoid
- Common errors and hazards

SCHEDULE - Pre-flight Discussion 15
- Instructor Demonstration 15
- Student Practice 30
- Post-flight Critique 15

EQUIPMENT - Whiteboard + pens for pre- and post-flight discussions
- Helicopter model

INSTRUCTOR'S ACTIONS - Pre-flight - Discuss lesson objective
- In-flight - Demonstrate recoveries and coach student practice
- Post-flight - Critique and evaluate student performance

STUDENT'S ACTIONS - Pre-flight - Discuss lesson objective and ask questions
- In-flight - Review hover auto and perform new recovery maneuvers as directed
- Post-flight - Ask pertinent questions

COMPLETION STANDARDS - No set standards
ANTITORQUE SYSTEM FAILURE

OBJECTIVE
- To understand the aerodynamics related to the failure, indications, pilot techniques to maintain controlled flight, how to select a landing area and how to land safely

INTRODUCTION
- There are three different categories that we need to look into with regards to loss of antitorque
  1. Complete loss of tail rotor thrust
  2. Stuck pedel
     - Neutral
     - Left
     - Right
  3. Loss of Tail Totor Effectiveness (LTE)

COMPLETE LOSS OF TAIL ROTOR THRUST

THEORY
- Caused by power drive failure, loss of the tail rotor, transmission failure
- Results in a total loss of tail rotor thrust
- Causes an immediate yaw to the right
  - Severity of the yaw depends on the
    1. Power used: The more power the more yaw
    2. Airspeed: The higher the airspeed the less the yaw (Streamlining effect)

RECOVERY
GENERAL
- Need to reduce the torque from the main rotor = Autorotation

RECOVERY
HOVER
- Enter a hover auto by rolling off the throttle

RECOVERY
CRUISE FLIGHT
- Maintain cruise speed to maintain effect of the vertical stabilizer
- Use of slight left cyclic will compensate for some of the yaw
- But don’t allow your airspeed to drop with the increase in drag
- Select area for a save autorotation - need space for run-on
- Reduce collective and roll off throttle for a full down autorotation
ANTITORQUE SYSTEM FAILURE

STUCK PEDAL

THEORY - Caused by a mechanical control failure that limits or prevents control of tail rotor thrust
- Broken control rod
- Object interference with pedals - Remove object if possible
- Techniques differ on how much thrust is being produced
- Figure out where it is stuck relative to normal cruise - Neutral on 300CB

RECOVERY - If you are going right - Roll off throttle = Decrease torque
GENERAL - If you are going left - Raise collective = Increase torque

RECOVERY
HOVER - Anti-torque = Torque
NO WIND - So there is no yaw

- Roll off the throttle
  - Descent because of decrease in RPM
  - Left yaw because of reduced torque
- Raise collective
  - Increase in torque brings nose back to center
- When you stop descending due to the increase in ground effect
  - Roll off more
- Remember, small inputs - there is no rush!

Stuck Right
- Anti-torque < Torque
- Yaw to the right

- Roll off the throttle = Decrease in torque
- Raise collective to cushion landing and continue to roll off
- Basically a slow hover auto

STUCK NEUTRAL

No immediate yaw

STUCK RIGHT

Right yaw
STUCK PEDAL CONTINUED...

**Stuck Left**
- Anti-torque > Torque
- Yaw to the left
- Roll off throttle
  - Increases yaw initially
  - Reduces the yaw because of the decrease in tail rotor RPM
- RPM ratio: MR RPM = 400 and TR RPM = 3000
- 10% reduction is MR 40 less and TR 300 less
- More decrease in tail rotor thrust than torque
- Raise collective to maintain height
- When the yaw stops you have stuck neutral

**RECOVERY**
**HOVER**
**WITH WIND**

**Stuck Neutral**
- No effect on the technique

**Stuck Right**
- Use timing with same technique as for no wind conditions
- The effect of recovery is immediate
- Start recovery when aligned with the wind line

**Stuck Left**
- Use timing with same technique as for no wind conditions
- There is a lag in the recovery
- Start recovery when the nose is 90° prior to the wind line
STUCK PEDAL CONTINUED...

RECOVERY

Stuck Neutral
- Same as stuck right

IN FLIGHT

Stuck Right
- Low power approach with a running landing
- Steep approach profile
- Left yaw during descend
- Helicopter turns right when power is applied
- When aligned with the landing area
- Start a flare to slow the helicopter down
- If no left yaw at the conclusion of the flare
- Roll of the throttle
- Cushion touchdown with collective
- Maintain groundtrack with

Stuck Left
- Auto rotation will only make it worse
- Normal approach
- Momentary 3 feet hover
- What way is the helicopter turning?
- Follow hover procedures
ANTITORQUE SYSTEM FAILURE

- The unanticipated yaw to the right due to inadequate thrust of the tail rotor
  - Weathercock
  - Tail rotor vortex ring state
  - Main rotor disc interference
  - LTE at altitude

WEATHERCOCK
- 120° to 240°
  - Helicopter attempt to weathercock its nose into the wind

TAIL ROTOR VORTEX RING STATE
- 210° to 330°
  - The wind causes a tail rotor vortex ring state

MAIN ROTOR DISC INTERFERENCE
- 285° to 315°
  - Wind causes the main rotor vortex to be blown into the tail rotor

LTE AT ALTITUDE
- At higher altitudes, where the air is thinner, tail rotor thrust and efficiency is reduced
- High altitudes and high gross weights, especially while hovering
- Tail rotor thrust may not be sufficient to maintain directional control
- In this case, the hovering ceiling is limited by tail rotor thrust and not necessarily power available
- Gross weights need to be reduced and/or operations need to be limited to lower density altitudes
ATTENTION - One of the most common helicopter accidents. Seen film with medic helicopter?

MOTIVATION - Dynamic rollover can happen anywhere even here in parking.

OBJECTIVE - Familiarize the student with dynamic rollover, dangerous situations, aerodynamics and recovery.

CONTENT - Introduction and aerodynamics, causes and indications
- Static and dynamic rollover
- Contributing factors
- Recovery technique
- How to avoid
- Common errors and hazards

SCHEDULE - Ground Discussion 30

EQUIPMENT - Whiteboard + pens for pre- and post-flight discussions
- Helicopter model
- Chair to sit in for demo

INSTRUCTOR’S ACTIONS - Discuss lesson objective
- Give homework
- Ask the student questions

STUDENT’S ACTIONS - Discuss lesson objective and ask questions
- Ask pertinent questions

SUMMARY - Review lesson emphasis on weak areas and recovery
DYNAMIC ROLLOVER

DEFINITION
- A lateral rolling tendency causing the helicopter to roll around its skid

OBJECTIVE
- Be aware of dynamic rollover, the factors and the corrective action
- The only real reason for dynamic rollover is pilot error!

STATIC ROLLOVER
- Pivot point
- Centre of Gravity beyond the pivot point
- Demonstrate it with a chair

CONDITIONS
- Pivot point
- Lifting action
- Rolling tendency

REASONS
- Failure to remove a tiedown or skid securing device
- If the skid or wheel contacts a fixed object while hovering sideward
- If the gear is stuck in ice, soft asphalt, or mud
- If you do not use the proper landing or takeoff technique
- While performing slope operations

THEORY

Takeoff to a hover
- Collective is raised and lift generated
- The right skid is stuck and becomes the pivot point
- Left cyclic keep the disc level with the horizon
- A small roll rate develops

Dynamic Rollover
- Collective is raised further and more lift generated
- No more left cyclic is left to level the disc
- Now a horizontal component will add to the rate of roll
- The rate of roll gets bigger

Corrective action
- Lower collective to get rid of horizontal component
- The helicopter has inertia and will continue to roll
- Hope that the roll will stop before the CG is beyond the pivot point
ATTENTION - Ground resonance on first solo and once during shutdown

MOTIVATION - Must always be prepared, cannot tell when it is going to occur

OBJECTIVE - Familiarize the student with ground resonance, dangerous situations, aerodynamics and recovery.

CONTENT - Introduction  
- Different kind of rotor systems and landing gear  
- Aerodynamics and factors that causes it  
- Indications  
- Recovery technique  
- How to avoid  
- Common errors and hazards

SCHEDULE - Ground Discussion 30

EQUIPMENT - Whiteboard + pens for pre- and post-flight discussions  
- Helicopter model  
- Relate to washer

INSTRUCTOR'S ACTIONS - Discuss lesson objective  
- Give homework  
- Ask the student questions

STUDENT'S ACTIONS - Discuss lesson objective  
- Ask pertinent questions

SUMMARY - Review lesson emphasis on weak areas and recovery
DEFINITION
- Where rotor blades become out of phase, causing severe vibrations that if not corrected may destroy the helicopter

THEORY
- Ground resonance is an aerodynamic phenomenon associated with fully-articulated rotor systems
- Rotor blades move out of phase with each other and cause the rotor disc to become unbalanced
- This condition can cause a helicopter to self-destruct in a matter of seconds
- However, for this condition to occur, the helicopter must be in contact with the ground
- If you allow your helicopter to touch down firmly on one corner the shock is transmitted to the main rotor system
- This may cause the blades to move out of their normal relationship with each other
- This movement occurs along the drag hinge

INDICATIONS
- Rapidly increasing vibrations
  - Following a hard or uneven landing
  - During startup or shutdown

RECOVERY
- If the RPM is low
  - Close the throttle immediately
  - Fully lower the collective
- If the RPM is in the normal operating range
  - Fly the helicopter off the ground
  - Allow the blades to automatically realign themselves
  - You can then make a normal touchdown
- If you lift off and then allow the helicopter to firmly re-contact the surface before the blades are realigned, a second shock could move the blades again and aggravate the already unbalanced condition
- This could lead to a violent, uncontrollable oscillation

CAUSES
- Fully-articulated rotor system with ground contact
  - Bad oleo dampers or flat tire
  - Out of balance blades
  - Bad drag dampers
  - Unbalanced blades

NOTES
- This situation does not occur in rigid or semi-rigid rotor systems, because there is no drag hinge
- In addition, skid type landing gear are not as prone to ground resonance as wheel type gear
ATTENTION - R22 accident in New York due to low G condition when avoiding a kite

MOTIVATION - If going to fly the R22 this is very, very important

OBJECTIVE - To familiarize the student with conditions where low G can occur, dangerous situations, aerodynamics and recovery.

CONTENT - Introduction and background
- Indications
- Aerodynamics and factors that causes it
- Effect and recovery technique
- Different kind of rotor systems
- How to avoid
- Common errors and hazards

SCHEDULE - Ground Discussion 30

EQUIPMENT - Whiteboard + pens for pre- and post-flight discussions
- Helicopter model

INSTRUCTOR’S ACTIONS - Discuss lesson objective
- Give homework
- Ask the student questions

STUDENT’S ACTIONS - Discuss lesson objective
- Ask pertinent questions

SUMMARY - Review lesson emphasis on weak areas and recovery
DEFINITION - Pushing the cyclic control forward abruptly from either straight-and-level flight or after a climb can put the helicopter into a low G (weightless) flight condition.

AERODYNAMICS

RECOGNITION - A feeling of weightlessness - An uncontrolled roll to the right.

RECOVERY - Immediately and smoothly apply aft cyclic - Do not attempt to correct the rolling action with lateral cyclic - By applying aft cyclic, you will load the rotor system, which in turn produces thrust - Once thrust is restored, left cyclic control becomes effective, and you can roll the helicopter to a level attitude

HAZARDS - Droop stop pounding - Mast bumping

ERRORS - Improper control inputs leads to this - Improper corrective actions kills you
ATTENTION - According to the National Transportation Safety Board (NTSB) carboneror ice was involved in over 360 accidents in the past five years. These figures do not include the unreported off-airport landings and incidents caused by icing. The results were 40 deaths, 160 injuries, 47 aircraft destroyed and 313 aircraft severely damaged.

MOTIVATION - We can get induction icing also in CBI. Here it is very high humidity that makes it easy for carboneror icing to develop.

OBJECTIVE - To familiarize the student with different system and equipment malfunctions, dangerous situations and precautionary measures.

CONTENT - Electrical system malfunction
- Smoke/fire types, actions and considerations
- Engine and components malfunction
- Oil and fuel systems failure
- Anti-torque failure in the hover and flight
- Power train failure
- The 2 different kinds of carboneror/induction icing
- Abnormal vibrations
- Warning lights
- Flight controls malfunction
- Tachometer failure
- Rotor/drive system malfunction
- Pitot/Static system malfunction

SCHEDULE - Ground Discussion 30

EQUIPMENT - Whiteboard + pens for pre- and post-flight discussions
- Helicopter model

INSTRUCTOR’S ACTIONS - Discuss lesson objective
- Give homework
- Ask the student questions

STUDENT’S ACTIONS - Discuss lesson objective
- Ask pertinent questions

SUMMARY - Review lesson emphasis on weak areas and recovery
OBJECTIVE

- To recognize systems and equipment malfunctions and know recommended pilot action
- Refer to the Pilot Operating Handbook, Emergency and Malfunction procedures

SMOKE OR FIRE DURING GROUND OR FLIGHT OPERATIONS

- There is no smoke/fire detection systems installed on the Schweizer 300CB/CDi
- We smell it, see it, feel it or somebody notifies us about it
- Leave the radio on, for others to inform us of a fire during shutdown

Engine/Fuselage/Electrical Fire On Ground

- Mixture ......................... IDLE CUTOFF
- Fuel valve....................... CLOSE
- Battery............................ OFF
- Alternator ....................... OFF

Engine/Fuselage Fire, Or Fire Of Undetermined Origin, In Flight

If a fire is observed during flight, prevailing conditions such as day/night, altitude, and available landing area must be considered in order to determine whether to execute a power-on or a power-off landing.

Power-On Landing

1. Maintain airspeed and rotor RPM
   - Be prepared to perform an autorotation

2. Immediately perform power on landing to suitable landing area

3. If time permits
   - Battery ......................... OFF
   - Alternator ....................... OFF

4. Upon landing
   - Throttle ......................... CLOSE
   - Mixture ......................... IDLE CUTOFF
   - Fuel Valve ....................... CLOSED
   - Exit aircraft with fire extinguisher
   - Extinguish fire
Power-Off Landing

1. Immediately enter autorotation

2. If time permits
   - Mixture ....................... IDLE CUTOFF
   - Fuel valve ................. CLOSE
   - Battery ...................... OFF
   - Alternator ................. OFF

3. Upon landing
   - Exit aircraft with fire extinguisher
   - Extinguish fire

Electrical Fire In Flight

1. Battery............................ OFF

2. Alternator ......................... OFF

3. Immediately perform power-on landing to suitable area

4. Upon landing
   - Throttle ......................... CLOSE
   - Mixture ......................... IDLE CUTOFF
   - Fuel valve ..................... CLOSE
   - Exit aircraft with fire extinguisher
   - Extinguish fire

Smoke And Fume Elimination In Flight

Smoke and/or toxic fumes entering the cockpit can be exhausted as follows

1. Open vents

2. Adjust cabin heat and defog handle, as required

3. Land as soon as possible
ENGINE/OIL AND FUEL SYSTEM

Fuel Low, Caution Indicator - AMBER

1. An amber fuel low caution light on the instrument panel comes on in flight when approximately one gallon of usable fuel remains in the tank
2. Land immediately

Fuel Tank Vent, Blocked

- If the fuel tank vent gets blocked a vacuum will be created
- This leads to fuel starvation of the engine
- The engine will quit

Air Restart

1. Establish 52 knots autorotation
2. Pick out landing spot - If less than 2000 feet above terrain, proceed with autorotation
3. If altitude permits - 300CB
   - Mixture ...................... FULL RICH
   - Throttle ..................... CRACK ½ INCH
   - Starter ....................... ENGAGE
4. If altitude permits - 300CBi
   - Mixture ...................... IDLE CUTOFF
   - Throttle ..................... CRACK ½ INCH
   - Starter ....................... Engage
   - Mixture ...................... FULL RICH when engine fires
Systems and Equipment Malfunctions

**Engine Oil Pressure**

**Engine Oil Temperature**

**Cylinder Head Temperature**
CARBURETOR OR INDUCTION ICING

1. When conditions conductive to carburetor ice are known or suspected
   - Fog
   - Rain
   - High humidity
2. When operation near water

Descends And Autorotation  

- During autorotation or reduced power below 18” MAP
- Apply full Carb Heat regardless of CAT gage temperature
- When power is reapplied, return Carb Heat control to off or partial heat position

Carburetor Temperature Indicator  

- During hover or cruise flight above 18” MAP
- Apply Carb Heat as required to keep CAT gage out of the yellow arc
- If an unexplainable drop in MAP or RPM occurs
- Apply full Carb Heat for about a minute
- Check for an increase in MAP or RPM
**ELECTRICAL SYSTEM**

**Low Voltage Caution Indicator - AMBER**

1. **Reason**
   - Alternator is not working and the battery is now the only source of electrical power

2. **Actions**
   - Recycle alternator
   - If this does not work, turn off all unnecessary electrical equipment
   - Fly to nearest airport
   - Advice ATC of your problem and inform that you might lose radio communications

**Runaway alternator**

1. **Reason**
   - The alternator produces too much voltage
   - The voltage regulator cannot stem the flow of electricity
   - The danger here is that the extra current will fry all the components currently in use
   - Could progress into a full-blown electrical fire

2. **Actions**
   - Recycle the alternator and hope that voltages returns to normal
   - If not, turn off the alternator switch, and leave it off
   - Turn off all unnecessary electrical equipment
   - Fly to nearest airport
   - Advice ATC of your problem and inform that you might lose radio communications

**Popped circuit breakers**

1. **Reasons**
   - When a circuit breaker pops, is another warning of electrical trouble
   - Component is either receiving too much current
   - Component is overheating
   - Component maybe just received an inconsequential, transient, random shot of voltage

2. **Actions**
   - Try pushing the circuit breaker back in to see if things return to normal
   - If the breaker pops again, leave it popped
   - Something bad is at work, and you don’t want to keep aggravating the fault
FLIGHT CONTROLS

Always make sure that the cockpit environment is clean, especially areas near the flight control. Loose articles can get stuck in control systems and prevent proper movement of the controls. If you have problems moving a flight control, check that for objects obstructing the control run and remove these if found.

ROTOR/DRIVE SYSTEM

Main Rotor - Transmission Oil Temperature And Pressure - RED

1. Reasons
   - A red warning light comes on
   - When the transmission oil pressure drops below 2.5 PSI
   - When the transmission oil temperature exceeds 235° F

2. Actions
   - Land as soon as possible

Clutch Warning Light - RED

1. Reason
   - A red clutch warning light (RELEASE) is illuminated
   - If the clutch is not fully engaged

2. Actions
   - Be prepared to enter autorotation
   - Land as soon as possible

Low Main Rotor RPM Horn

1. Reasons
   - A horn will warn the pilot of RPM below 442 RPM

2. Actions
   - Lower collective
   - Roll on throttle
**Tail Rotor - Chip Detector Caution Indicator** - AMBER  

1. **Reason**  
   - An amber warning light will illuminated  
   - To indicate possible deterioration of component within the tail rotor transmission  

2. **Actions**  
   - Land as soon as possible  

---

**Tail Rotor Failure**  

1. Different types of failure may require different techniques for optimum success in recovery  

2. **Complete loss of tail rotor thrust - Forward flight**  
   - Indicated by an uncontrrollable yaw to the right  
   - Reduce power by lowering collective  
   - Adjust airspeed to 50 to 60 knots  
   - Use left lateral cyclic in combination with collective pitch to limit sideslip to a reasonable angle  
   - If conditions permit, place the twistgrip in the IDLE position once a suitable landing area is selected, and perform a normal autorotation  
   - Plan to touch down with little or no forward speed  

3. **Complete loss of tail rotor thrust - Hover**  
   - Indicated by an uncontrrollable yaw to the right  
   - Place the twistgrip in the IDLE position  
   - Perform a hovering autorotation  

4. **Tail Rotor Control Failure - Fixed Pitch Setting**  
   - Adjust power to maintain 50 to 60 knots airspeed  
   - Perform a shallow approach and running landing to a suitable area  
   - Touch down onto wind at a speed between translational lift and 30 knots  
   - Directional control may be accomplished by small adjustments in throttle and/or collective
PITOT/STATIC SYSTEM

Blocked Pitot or Static System

<table>
<thead>
<tr>
<th>SITUATION</th>
<th>ASI</th>
<th>ALT</th>
<th>VSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blocked Pitot Tube</td>
<td>Zero</td>
<td>Works</td>
<td>Works</td>
</tr>
<tr>
<td>Blocked Pitot Tube and Drain Hole</td>
<td>Underread in descent</td>
<td>Works</td>
<td>Works</td>
</tr>
<tr>
<td></td>
<td>Overread in climb</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blocked Static</td>
<td>Overread in descent</td>
<td>Frozen</td>
<td>Returns to zero</td>
</tr>
<tr>
<td></td>
<td>Underread in climb</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using alternate cockpit static source</td>
<td>Overread</td>
<td>Overread</td>
<td>Show a momentarily climb</td>
</tr>
<tr>
<td>Broken VSI Glass</td>
<td>Overread</td>
<td>Overread</td>
<td>Reverse</td>
</tr>
</tbody>
</table>
ANY OTHER SYSTEM OR EQUIPMENT

Dual Tachometer Failure

If one of the cables driving the two needles fails the instrument will show zero RPM on the needle connected to the failed cable even though RPM is good. If one needle suddenly indicate zero while the other remains in the green and there are no other indications of failures, you can assume that the Main Rotor and Engine RPM are still superimposed.

Land as soon as possible.
OBJECTIVE

- Familiarize the student with emergency equipment and survival gear

FIRE EXTINGUISHER

- Location and operation

KNIFE

- A pocketknife can come in handy in case of an emergency

CLOTHES AND FOOTWEAR

- Consider materials and protection in case of a fire or landing in hostile environments