Launch:

The launcher is a pneumatic catapult designed to provide a steady 12g acceleration upon launch. The catapult is mounted on a wheeled frame with a supply tank and air compressor. The 16-foot (~5 m) assembly requires only a small footprint, and deploys easily.

The kickstand (or forward support post) has two positions, which are used for varying wind and terrain conditions:

Launcher pressure calculator

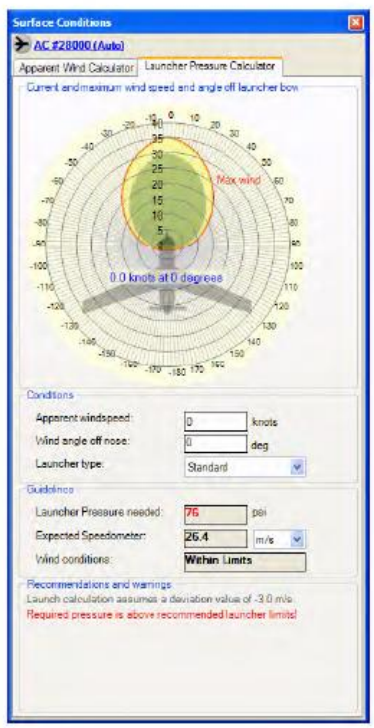
Note: **For operations with I-MUSE 5.1.X and earlier, the Launcher Pressure Calculator tool is not available. Use the *Launch & Retrieval Guidance Spreadsheet*, discussed later in this section.**

The **Surface Conditions** panel in I-MUSE has two tabs: **Apparent Wind Conditions** and **Launcher Pressure Calculator**. The **Apparent Wind Conditions** tab is used to compute correct winds for takeoff and retrieval from shipboard. The **Launcher Pressure Calculator** is used to calculate launcher pressure for the selected aircraft and for evaluating ground wind conditions.

To open the Launcher Pressure Calculator in I-MUSE:

- Select **Surface Conditions** from the **Panel** menu on the I-MUSE toolbar.
- Select the **Launcher Pressure Calculator** tab.

Note: **The panel will not display data unless an aircraft or simulator is connected to I-MUSE.**



- ❑ **Aircraft Selector Icon**

  This icon enables selection among all aircraft to which the I-MUSE client is connected.

- ❑ **Current and maximum wind speed and angle off launcher bow**

  This pane displays current surface conditions and a visual indication of operational limits.

Note: **A launcher type must be selected for the display to occur.**

- ❑ **Conditions**

  Enter readings from the weather station in the Conditions pane.

  Select the Launcher type from the drop-down menu.

- ❑ **Guidelines**

  The results of the calculations are displayed in the Guidelines pane. Red indicates the result is outside Launcher limits.

- ❑ **Recommendations and warnings**

  This pane displays information in black and warnings in red.

Basic Launch Procedure

Engine run-up

RPM comparison with baseline

Before flying a new aircraft, obtain a baseline wide open throttle (WOT) RPM by performing an engine run-up. Record the baseline WOT RPM. Prior to every flight, conduct an engine run-up and compare the results with the baseline. If the RPM at WOT is 10% less than the baseline, replace the engine module. For example, if the baseline RPM at WOT is 6,800 RPM when the aircraft is new, then 10% of the baseline is 680. Subtract this from the baseline to find that the engine module should be replaced when RPM at WOT is less than 6,120.

Note: **A propeller change may reduce the baseline RPM by 2%. For a valid engine health assessment, the outside air temperature (OAT) should be within 20°F (11°C) of the baseline OAT, and the pressure altitude (PA) should be within 500 feet (150 meters) of the baseline PA.**

CAUTION: Operating an aircraft with a WOT of 10% less than the baseline RPM may result in loss of the aircraft. Exercise caution when the baseline RPM loss is greater than 5%, especially with a heavy aircraft, high density altitude, and when there is little headwind component over the CAT. Engines with RPM loss greater than 5% have reduced climbing ability.

Charging the cylinder

1 Plug site power into pigtail located at air compressor.

Note: **If an extension cord is needed, a 12 AWG extension cord is recommended.**

2 With power connected, ensure that rail speedometer is powered on and armed.

WARNING!

Safety pin must be in place before pressurizing the cylinder.

3 Locate release ring at rear of launcher, then locate release/trigger rope and carefully attach it.

Basic Launch Procedure

Charging the cylinder (cont.)

4 Switch on the air compressor and close the remote valve to pressurize the cylinder.

5 Pressurize the cylinder per the chart posted on your launcher. Launchers vary, as do operating variables. In addition to using your launcher's specific Pressure Chart, use a test dummy to check for operating variables in question.

Note: **If cylinder is pressurized to exact pressure and there is a delay before launch, some pressure can bleed off. It may be necessary to depressurize and start over. To avoid this, some operators find it useful to pressurize up to 5 psi above the intended launch pressure. If taking this tactic, just before launch, open valve slightly using the yellow handle to bleed to desired pressure.**

Late model ship launchers are equipped with unloaders to allow compressor start-up at any pressure.

Note: **This chart is a *SAMPLE*. Be sure to use the current chart posted on the specific launcher model that you use.**

***SAMPLE* Launcher Pressure, PSI**

Launcher Speed, m/s	Aircraft Launch Weight					Aircraft Speed, m/s
	12kg	14kg	16kg	18kg	20kg	
20	35	37	40	42	45	18
21	38	40	43	46	49	19
22	41	44	47	50	53	20
23	44	47	50	54	58	21
24	48	51	54	58	62	22
25	52	55	59	63	67	23
26	56	60	64	68	72	24
27	60	65	69	73	77	25

Sample Launcher Pressure, PSI chart

CAUTION: Do not exceed a launcher speed of 28 m/s (54 knots) or 80 psi.

6 When pressure is reached, turn off compressor.

You are now ready to start the engine and launch the aircraft or dummy.

Launching the aircraft

1 Get go-ahead from ground station.

2 Check and call out "All clear?"

3 Pull safety pin.

4 Count down aloud, "3, 2, 1."

5 Pull trigger rope.

6 Check end speed.

Launcher limitations & tolerances

The maximum indicated speedometer reading on launch is 28 m/s. Failure to obey this limit can result in failure or massive deformation of the gripper system. In particular, note that this represents a relaxation of the previous maximum limit of 27 m/s (52 knots), so operators must be extremely careful to inspect the launcher after every launch that approaches the limit.

The maximum bunk pressure for aluminum grippers is 40 +/- 10 lbs. Bunk pressure in excess of this figure may place too much pressure upon the UAV fuselage during the over-center release, and the fuse may crack.

The following failure modes are known, when pressure exceeds 80 PSI or speed exceeds 28 m/s (54 knots):

- The crossbeam on the welded chassis may bend downward, resulting in reduced over-center squeeze force on subsequent launches.
- Grippers may over-rotate upon release and damage each other. Gripper brake performance needs to be monitored very carefully.

<table>
<tr><td rowspan="5">Launch system</td><td>Minimum ceiling</td><td>0 ft. AGL</td><td rowspan="2">The system's autonomous launch capability minimizes the impact of weather.</td></tr>
<tr><td>Minimum visibility</td><td>0 nm</td></tr>
<tr><td>Maximum gusting headwind component</td><td>35 knots (18 m/s)</td><td rowspan="3">The aircraft normally uses a catapult launcher for takeoff. The catapult can be easily aligned into the wind, so, space permitting, wind is not normally a limiting factor for launch operations.</td></tr>
<tr><td>Maximum gusting downwind component</td><td>2 knots (1 m/s)</td></tr>
<tr><td>Maximum crosswind component</td><td>10 knots (5 m/s)</td></tr>
</table>

Retrieval:

Approach Principles

Length and slope

Approach length and slope must be chosen to ensure good clearance between the aircraft and the ground obstacles. For approach over obstacles (such as power lines), approach slope may be increased to give extra height. The limits for approach slope are:

- Min 3.1%
- Max 7.0% or so — this varies with weight and wind. Simulations will show the point at which the aircraft has trouble descending to keep on the approach path, and simulations are the best tool to design the approach parameters.

For operation near tall structures, it is recommended to increase final length. This makes the FAF higher, so it is safer. This also allows margin for convergence on centerline, as the aircraft will often start to descend as it turns onto the approach path, even if it is on the outer edge of its holding orbit.

Hold position

Offsetting hold position from FAF may help reduce issues with ground structures. **Important!** Hold in an offset position and trigger the approach only when aircraft is heading roughly in the direction of final approach fix. In any other direction, aircraft may enter sequence of maneuvers to converge on centerline, potentially reducing the distance to obstacle to an unsafe level.

Misses – Parameters and types

The SkyHook approach allows the operator two types of miss behavior: a wave-off or a go-around. Normal procedure is to use the wave-off, but go-arounds are used in some situations.

During a wave-off, the aircraft performs an immediate turn out from final approach and climbs back to the FAF, in a specified direction.

During a go-around, aircraft climbs straight out, offsetting its track if desired, and turns only once before reaching the miss point past TD length or approaching FAF height. This allows a long climb out before the turn. Take care, as this means the aircraft will stay longer in the low pass state. Furthermore, if the go-around is not manually triggered, the aircraft will not climb, but will stay at retrieval height for this distance. In the event of a missed rope or a practice attempt, the go-around must be triggered when the aircraft is past the SkyHook. If the aircraft decides to go-around, no triggering is needed, and behavior will be safe.

For information about disabling Approach Miss Reasons, refer to the *Approach Monitor* heading in the *Approach Settings* table, later in this chapter. The primary purpose of switching to go-arounds is obstacle avoidance. Situations where the approach area is constrained may include:

- trees at the side of the runway
- towers close to the approach path
- power lines and buildings in the wave-off path

Remember that the aircraft could decide to go missed at any moment during the approach. This means that all areas of the wave-off side must be clear of structures above a certain height. If this could be an issue, then go-arounds should be used.

In both a wave-off and a go-around, the aircraft will go directly to the FAF if the observer state is left as **OK**. This may not be desirable for obstruction proximity, as the direction of the aircraft's sharp turn cannot be controlled. A safer method is to leave the observer state in **Reject!** until the aircraft is established in the procedure turn. Then, allow the aircraft to go to FAF once in a safe position.

Note: **In a go-around, there is little control over the direction the aircraft turns once reaching the upwind x length or approaching FAF height. The best means to guarantee a turn to the desired direction is to offset the hold orbit in the direction of the desired turn (i.e. left or right), and then ensure the observer state is left in Reject! as mentioned above.**

Retrieval system	Minimum ceiling	0 ft. AGL	The system's autonomous retrieval capability minimizes the impact of weather, however it is recommended that a safety observer be present as normal practice.
	Minimum visibility	0 nm	
	Maximum headwind component	40 knots (20 m/s)	The aircraft normally uses a SkyHook arrested recovery system. The SkyHook system can be easily oriented with the wind, so, space permitting, wind direction is not normally a limiting factor for recovery operations.
	Maximum downwind component	0 knots	
	Maximum crosswind component	20 knots (10 m/s)	

Approach Procedures

In this section:

- Angle – Crab angle
- Control wheel tracking (CWT)
- Engine – Idle setting
- Observers
- Speed of retrieval

Approach Procedures
Angle – Crab angle
When approaching into a strong crosswind, the aircraft will crab or yaw into the wind. Occasionally this leads to a large crab angle. The aircraft senses the crosswind and offsets its position autonomously, but care should be taken for the direction it is offsetting. This may be towards the SkyHook or away. During normal operations, the crab angle should be checked once converged onto centerline of the approach path. I-MUSE automatically calculates the crab angle. The aircraft wing sweep is about 23°, so any crab exceeding 20° is very dangerous, as this may lead to an unsuccessful capture. Normal procedure is to offset half a meter away from the rope, but if there is a crosswind that the nose of the aircraft to point towards the SkyHook, it is safer to offset towards the SkyHook to catch the wing that is most forward. This is an inside catch, but can be safe when done with an observer.
Control wheel tracking (CWT)
Control Wheel Tracking allows the operator a method for an accurate SkyHook retrieval despite trouble with DGPS. This procedure corrects small errors in track position through input on the pilot's console rudder stick. Select **Standard Tables** from the **Tables** menu on the I-MUSE toolbar and enter **CWT** in the track field of the **Autopilot** table. This method requires the observer to be in a bore-sight position with the pilot's console. If this is not possible, the alternative – to give direction over a radio – is extremely difficult and not recommended. For any CWT attempt, first make many practice attempts using HiL, followed by many practice runs over top of boom before final approach. If approaching without DGPS, altitude may be incorrect due to GPS inaccuracy. If possible, verify altitude by passing to the side in practice attempts. Adjust the touchdown point if necessary.
Engine – Idle setting
The faster the aircraft flies, the faster the propeller spins (like a windmill). Hence when flying fast but descending (perhaps in procedure turn), engine RPM will appear higher than at loiter speed or on the launcher. Do not reduce minimum throttle setting at this point, as this would lead to RPM roll-back when the aircraft slows to approach speed, and the propeller slows. Therefore, only adjust the idle setting when flying at slow speeds. Always match throttle settings to the published minimum limitations for that engine. Only adjust the setting in small increments, and monitor the electrical state of the aircraft. To manually enter RPM values, select **Standard Tables** from the **Tables** menu on the **I-MUSE** toolbar and enter the desired RPM in the **AP thr/rpm** field of the Autopilot table. With reduced generator output and a high power draw, some drop may be seen in bus voltages. If this occurs, the operator may opt to turn a video transmitter off, or maybe even disable the video system to reduce electrical load. To make changes, select **Open Plot** from the **Plots** menu on the I-MUSE toolbar. Select **Electrical Group** and click **Open**.

Approach Procedures
Observers
Normal procedure is to have an observer watching approach. The operator has full readout of position through telemetry, but there may be a situation where the observer thinks that the situation is unsafe. Note the aircraft has no information on ground obstacles; it monitors its approach position and aircraft state, and will wave-off autonomously if needed. Ideally, an observer bore-sights the approach, standing a safe distance back from the SkyHook (100 m (328 feet)). Recording the approach is a good idea – in the event anything goes wrong, the video data can be analyzed for causal factors.
Speed of retrieval
When aircraft turns onto final approach path, check ground speed in Approach Monitor located under **Panel** in I-MUSE toolbar. Aircraft accelerates if above desired glide slope, or in presence of tailwind. When groundspeed reaches approx. 27 m/s (52 knots), airframe damage begins to occur. Always do approach into the wind, and monitor crab angle. Call a miss if the ground speed is too high, and check wind direction and engine idle setting (the aircraft will speed up to descend if the RPM is too fast).

Approach Settings

In this section:

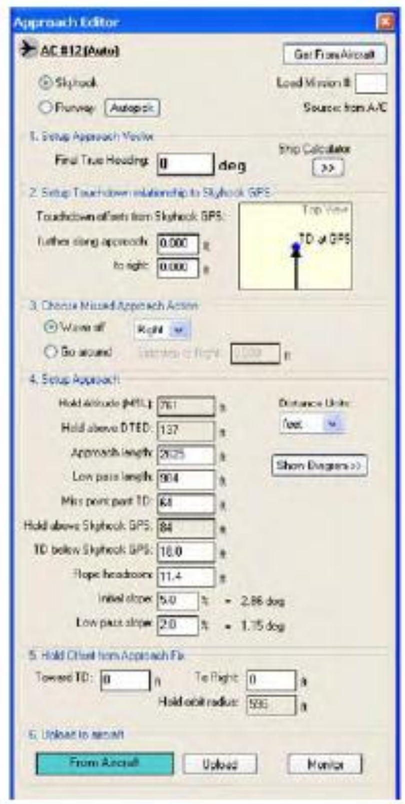
- Approach plan – Specifying
- Approach plan – SkyHook
- Approach plan – Runway
- Approach Monitor
- Miss reasons – Effect of disabling
- Data values
- Wind & pressure
- Auto retrieval

Note: All approach information is contained in the Approach Editor and Approach Monitor located in the Panel menu on the I-MUSE toolbar. Most GCS location information is located under Location in the Panel menu.

Approach Settings

Approach plan – Specifying

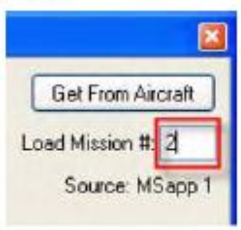
Using I-MUSE software Approach Editor, you're able to select an approach plan based on whether a SkyHook retrieval or runway landing is desired. The Approach Editor is located under **Panel** in the I-MUSE toolbar.



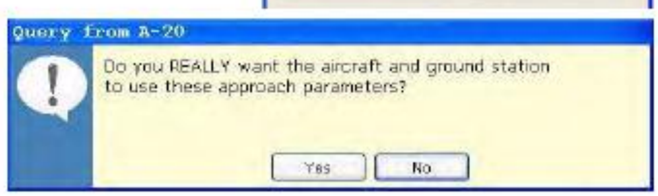
Predefined approaches are stored in the mission parameter file that is loaded on the aircraft. Approaches can be loaded from this file into the **Approach Editor** panel.

To load an approach from the Mission Parameter File:

1. Enter the number of the approach to load in the **Load Mission #: field**.



2. Press **Enter** key.
3. Click the **Upload** button to load the approach into the aircraft.
4. Click **Yes** to confirm the dialog:



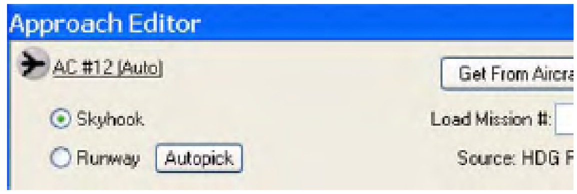
5. To get the approach currently uploaded into the aircraft, click the **Get From Aircraft** button on the **Approach Editor** panel.

Approach Settings

Approach plan – SkyHook

To create a new SkyHook approach, select the radio button indicating **SkyHook**. For a Standard SkyHook approach which will require only specification of Final True Heading, type **std** into the **Load Mission # field**.

Source: HDG RQD indicates that a heading must be provided for the SkyHook approach to be valid.

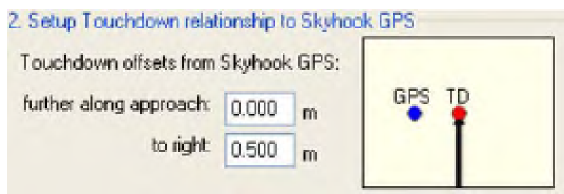


Specify the **Final True Heading** for the approach. This angle is measured relative to true north and should typically put the aircraft on a heading that will be into the wind for final approach. The field accepts positive numbers from 0 to 360 as valid input.

When the GCS is moving and AHRS data is available, the **Ship Calculator** can be used to specify **Final True Heading** for a SkyHook approach.

The **Relative Heading** field is specified with respect to the **Ship Heading** and Calculated FTH will display the actual **Final True Heading** with respect to true north.

These offsets define the location of touchdown relative to the GPS unit located at the top of the SkyHook boom. Both fields accept either positive or negative numbers.

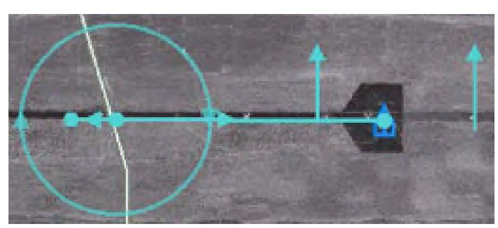


WARNING!

For ship-based operations, if the SkyHook is unable to be assembled and raised until just before recovery, a second GPS sensor is mounted to the ship. During recovery, make sure that the SkyHook GPS antenna is selected.

Selecting **Wave off** allows specification of the direction in which the aircraft will turn when a miss is called.

The turn will be executed anywhere along the approach path depending on when the miss is called. Arrows on the I-MUSE map indicate the direction of the wave off but provide no information about where the turn will occur.

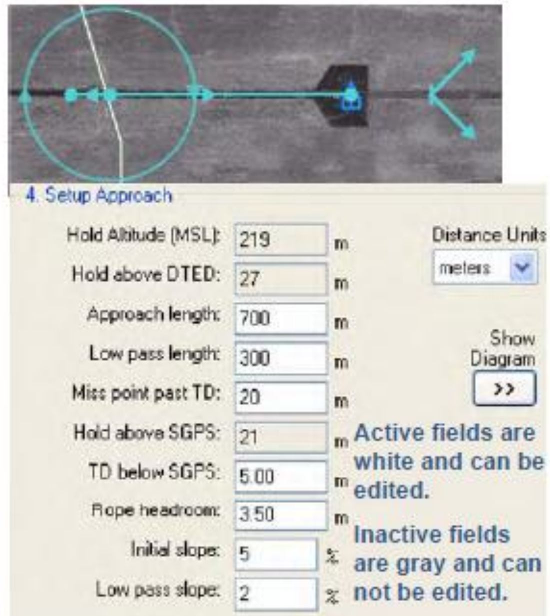


Approach plan – SkyHook (cont.)

Selecting **Go around** allows specification of a sidestep to be executed when a miss is called. A go around does not allow specification of the direction in which the aircraft will turn back to the FAF or hold when it reaches **miss point past TD** or FAF altitude after the miss is called. The aircraft will make the decision about what direction to turn based on conditions at the time the miss is called. Arrows on the I-MUSE map indicate the **miss point past TD** location where the aircraft will have to turn regardless of altitude or whether a miss was already called.

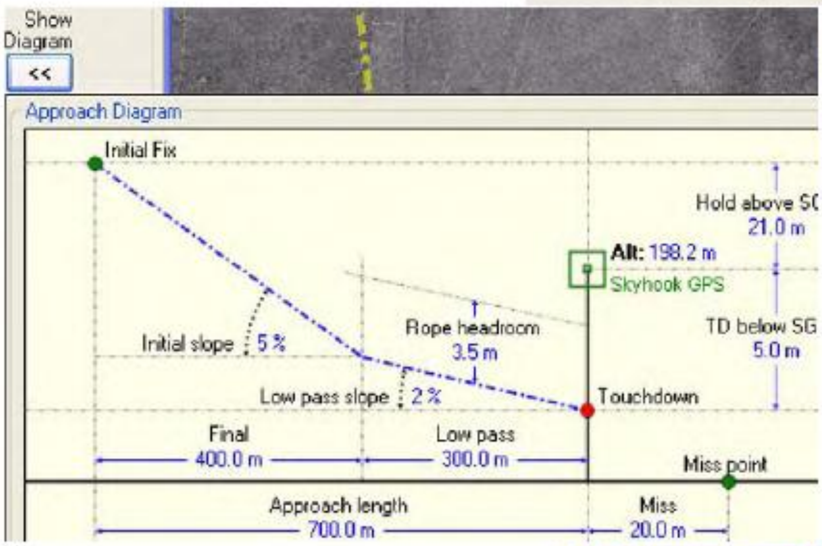
Numerical values are accepted if they constitute a valid approach. If the values don't meet minimum requirements for approach, a variety of prompts may be displayed.

Left-click on **Show Diagram** button for a display:



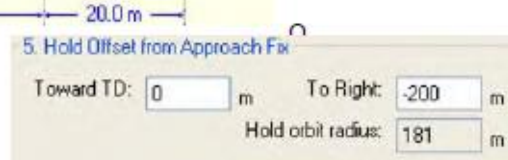
Active fields are white and can be edited.

Inactive fields are gray and can not be edited.



Note: The diagram is not to scale and is intended only as a quick reference to help visualize the approach.

Offsets define location of hold orbit relative to final approach fix. Both positive and negative numbers are valid. Hold orbit radius is calculated by the aircraft and its field cannot be edited directly.

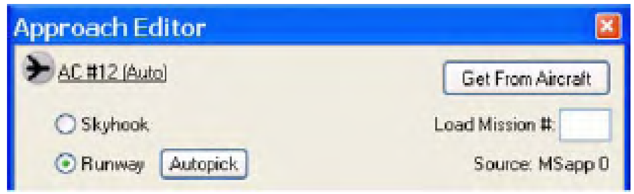


Note: **The radius of the Final Hold Orbit cannot be calculated until the approach is commanded. Before the approach is commanded, the orbit is drawn as a band representing all possible radii. The final orbit will fall within the band drawn on the I-MUSE map.**

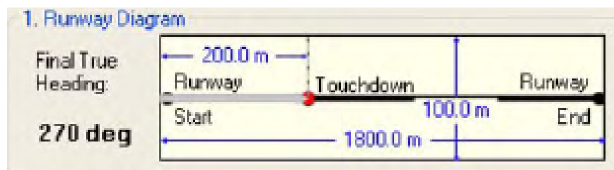
Approach Settings

Approach plan – Runway

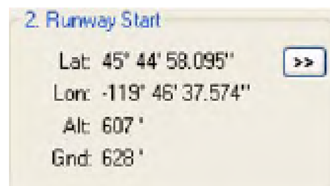
In the **Approach Editor,** click **Autopick** to instruct the aircraft to select and load the best runway approach in the Mission Parameter File based on the current conditions. Or, to create a new runway approach, select the **Runway** radio button.



The **Runway Diagram** provides a top view of the runway. The diagram is not to scale and is only a quick reference to help visualize the approach. The final heading required to complete the approach also is provided. All fields are read-only.



The **Runway Start** provides the precise location of the beginning of the runway.



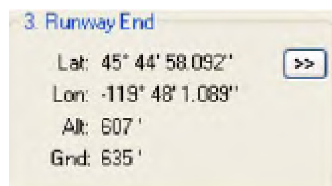
To edit this location:

1 Click the arrow button to open a **Coordinate Control**.

2 Use the **Coordinate Control** to enter specific location information to define the beginning of the runway.

Input will vary depending on the configuration of the **Coordinate Control**.

Runway End provides the precise location of the end of the runway.



To edit this location:

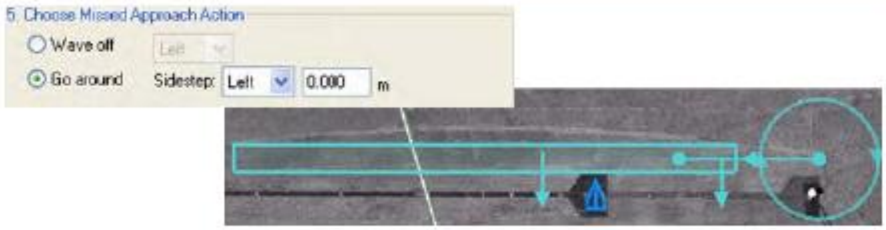
1 Click the **arrow** button to open a **Coordinate Control**.

2 Use the **Coordinate Control** to enter specific location information to define the end of the runway. Input will vary depending on the configuration of the Coordinate Control.

Touchdown provides the location of the touchdown point relative to the beginning of the runway. The touchdown point is the location at which the aircraft will attempt to make initial contact with the ground. Fields accept both positive and negative numbers as input. Negative numbers cause the aircraft to attempt touchdown before it reaches the specified runway. Positive numbers greater than the length of the runway cause the aircraft to attempt to touchdown beyond the end of the specified runway.

Selecting a **Wave off** allows specification of the direction in which the aircraft will turn when a miss is called. The turn will be executed at different points in the approach depending on when in the approach the miss is called. Arrows on the I-MUSE map indicate the direction of the **Wave off** but provide no information about where the turn will occur.

Approach plan – Runway (cont.)



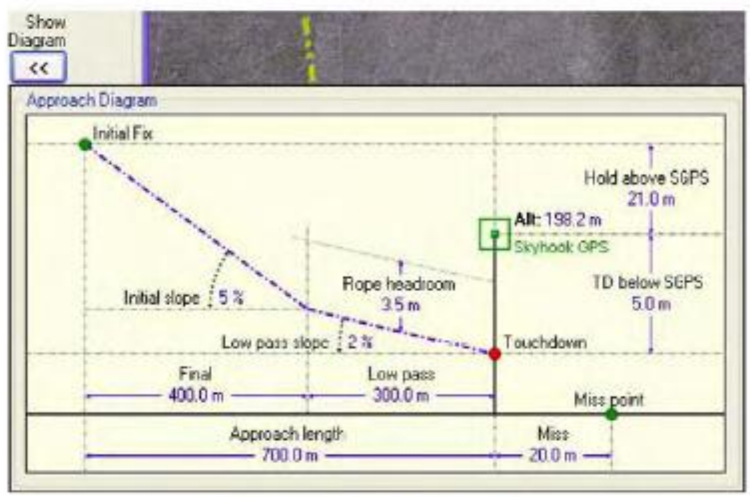
Selecting a **Go around** allows specification of a sidestep to be executed when a miss is called. A **Go around** does not allow specification of the direction in which the aircraft will turn when a miss is called. The aircraft will make the decision about what direction to turn based on conditions at the time the miss is called. Arrows on the I-MUSE map indicate where the turn will begin but provide no information about the direction in which the turn will be.

Either right or left may be selected from the Sidestep drop-down menu. The Sidestep field accepts both positive and negative numbers. A negative entry will automatically toggle the drop-down menu selection and display the numerical entry as positive.

Numerical values are accepted if they constitute a valid approach. If the values don't meet minimum requirements for approach, a variety of prompts may be displayed.

Clicking **Show Diagram** opens a side view of the approach.

Note: The diagram is not to scale and is intended only as a quick reference to help visualize the approach.



Offsets define the location of the hold orbit relative to the final approach fix. Both fields accept positive and negative numbers as valid. Hold orbit radius is calculated by the aircraft and cannot be edited directly.

After an approach has been edited, its status is displayed in the Upload to aircraft control as **Not Uploaded**. This means that the approach exists only on the local I-MUSE client.

Approach Settings

Approach plan – Runway (cont.)

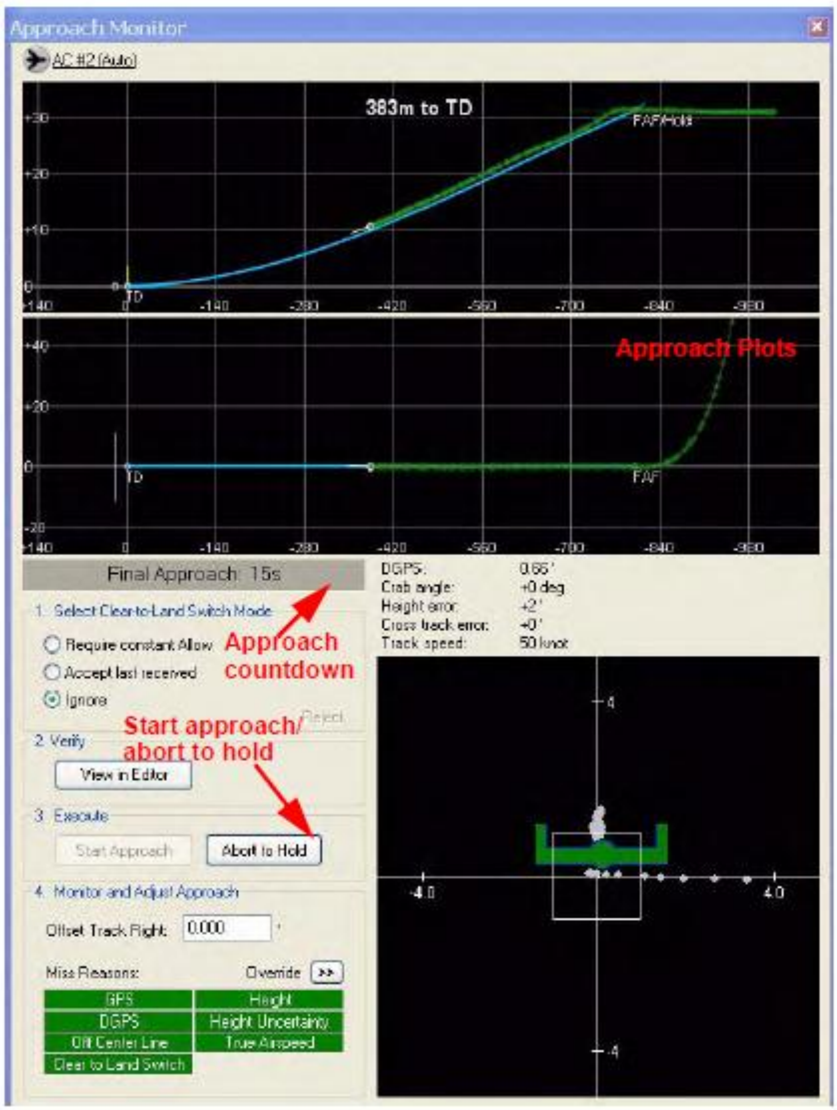
To load an approach in the aircraft, left-click **Upload** and select **Yes** to confirm the dialog.

Once the upload is complete, the Upload to aircraft control window should look like this:

It should now be possible to execute the approach as programmed.

Approach Monitor

The approach can then be observed using the **Approach Monitor** located under **Panel** in the I-MUSE toolbar. The Approach Monitor provides the interface to command an approach and to call a missed approach. It provides additional functions to monitor, modify, and execute an approach. It is used in conjunction with the Approach Editor to specify and execute both SkyHook and Runway approaches. The Approach Monitor Plots provide the ability to monitor the aircraft before and during an approach.



The upper plot provides a side view of the aircraft in relation to the approach while the lower plot provides a top view. The white data values at the top indicate:

- Aircraft altitude MSL according to available DTED data.
- Aircraft altitude above final approach fix.

Approach Monitor (cont.)

The bread crumbs behind the aircraft are an indication of the general health of the aircraft and its subsystems. The color corresponds to that of the aircraft on the I-MUSE map. The aircraft is indicated by a white vector that provides a reference of speed and direction. The plots can be rescaled by double left-clicking on each plot window. They will auto-scale during an actual approach.

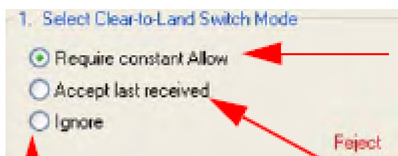
The **Approach Monitor** will plot the current approach phase.

The possible phases of approach are:

- Off
- To Hold
- Procedure Turn
- Slow to Final Approach
- Final Approach
- Lowpass (SkyHook only)
- Go Around
- Wave off

Note: During the final approach and low pass phases, the estimated time to touchdown is also displayed.

The Clear-to-land switch is a safety precaution that allows an observer on the ground to call a miss during approach. There are three options for configuration in this control. If the Clear-to-land status is reject, the word will appear in red at the lower right.

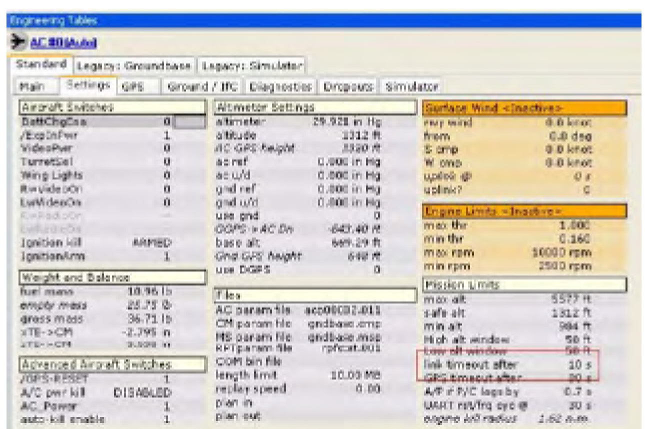


Signal from CTL switch must indicate proceed at all times. Loss of comm with CTL switch will cause a miss to be executed.

Ignore signal from CTL switch and proceed with approach.

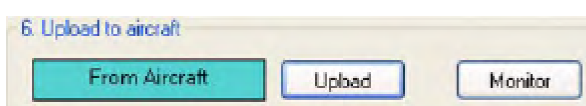
Last signal from CTL switch must indicate proceed. Loss of communication with CTL switch will not cause a miss; only a reject signal will cause a miss to be executed.

CAUTION: If Accept last received or Ignore is used and uplink (comm) is lost, aircraft won't execute a miss due to reason "Clear-to-land switch." To avoid this situation when using either of these two modes, it is recommended that link timeout after be set to a short value for approach, e.g. 5 seconds or shorter. This will limit the length of time that the aircraft will continue an approach without uplink.



To verify the correct approach is loaded on the aircraft:

1. Click the **View in Editor** button in **Approach Monitor** to open **Approach Editor**.
2. Click the **Get From Aircraft** button in **Approach Editor.**



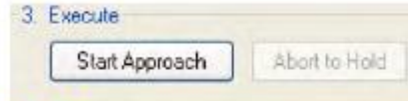
Approach Settings

Approach Monitor (cont.)

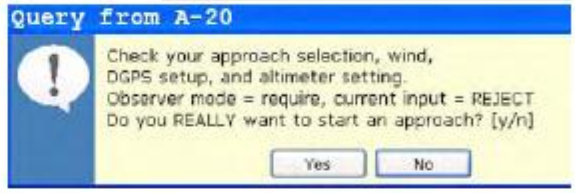
3 Verify that **Upload to Aircraft** indicates that the approach is **From Aircraft.**

4 Verify that the approach in the editor is the correct approach to command.

The Execute control provides the interface to command an approach or to command a miss. Only one of the two options will be available at any given time.



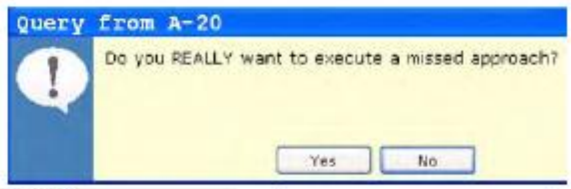
When an approach is commanded, confirm the dialog to continue:



The aircraft then executes an approach, begins a procedure turn and descend to its final approach fix.

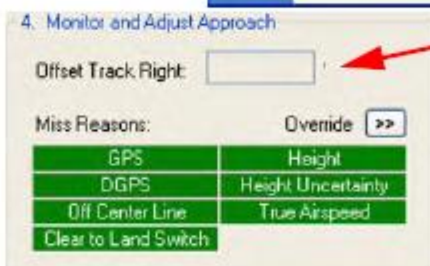
When a miss is called, confirm the dialog to continue with the miss and abort to hold.

The aircraft then executes a missed approach, climbs to a safe altitude, and proceeds to its hold orbit.



Monitor and Adjust Approach enables:

- Offsetting the aircraft to the left or right during specific phases of approach.
- Disabling/Enabling Miss Reasons.
- Reporting of Miss Reasons.



The track of the aircraft can be offset at different points during the approach. Positive values offset to the right while negative values offset to the left.

WARNING!

Although I-MUSE allows disabling the approach miss reasons, doing so can result in injury/damage to personnel or aircraft and equipment. Before disabling an approach miss reason, read *Miss reasons – effect of disabling*, later in this table. Removing a miss reason reduces safety margin, and missing a few approaches for the same reason is not always grounds for disabling a miss reason. It is often better to fix the cause of the miss. An observer should be used when disabling an approach miss reason.

To disable/enable **Miss Reasons** in I-MUSE:

1 Click the arrow button under **Monitor and Adjust Approach** in **Approach Monitor**.

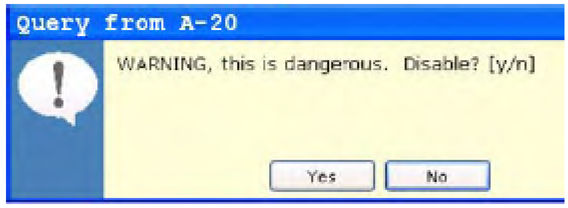
2 Click **Enable** or **Disable** as appropriate for corresponding fields.

Approach Settings

Approach Monitor (cont.)

3 When disabling **Miss Reasons** the aircraft will query:

4 Confirm the dialog to disable the **Miss Reason**.



Note: Approach miss reasons can't be disabled when the approach is off. Any approach miss reasons that were disabled will be enabled again if the approach is turned off.

Disabled Miss Reasons display red with a line through text.

Enabled Miss Reasons display green.

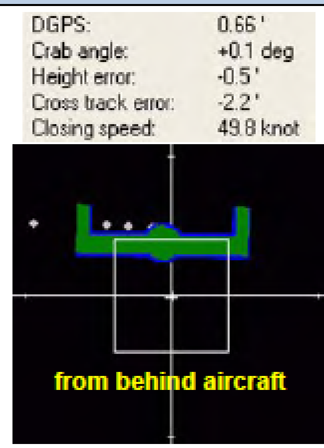
Reasons for a miss display in yellow in the **Monitor and Adjust Approach**.

Miss reasons – Effect of disabling

DGPS	▪ For SkyHook approach, there will not be a miss because of no DGPS. ▪ For SkyHook approach, there will not be a miss for DGPS uncertainty greater than half a wingspan. **CAUTION: One of the many possible dangers of disabling this would be that the aircraft would continue down final without good DGPS and crash into the SkyHook, ground, or personnel because it was too low/ high or wide, even if the aircraft thought it was tracking the approach path perfectly.**
GPS	▪ There will not be a miss because of no GPS ▪ For Runway approach, there will not be a miss at the decision point because GPS uncertainty is greater than 6 m (19.6 feet). **CAUTION: One of the many possible dangers of disabling this would be that the aircraft would continue down final after completely losing GPS, possibly crashing into property or personnel even if the aircraft thought it was tracking the approach path perfectly. Another of the many possible dangers is that after losing GPS, the aircraft would circle at low altitude, drifting with the wind, after turning after nav by DR only for time.**
Height	▪ During LOW_PASS, there will not be a miss if the aircraft is more than rope headroom above the glide-slope. ▪ For Runway approach, there will not be a miss at the decision point because the projected touchdown position is beyond the touchdown limit. **CAUTION: One of the many possible dangers of disabling this would be that the aircraft would crash into the SkyHook boom, or overshoot the runway entirely, crashing into personnel and property.**
Height Uncertainty	▪ There will not be a miss because of a height discrepancy, e.g. a discrepancy between DGPS and barometric pressure altitude because of an error in one or both sensors or because of vertical ground-station (SkyHook) motion. **CAUTION: One of the many possible dangers of disabling this would be that the aircraft would be too high or low, or suddenly climb or descend, even if it thought it was tracking the approach path perfectly.**

Approach Settings	
Miss reasons – Effect of disabling	**(cont.)**
Off Center Line	▪ During LOW_PASS (SkyHook approach only), there will not be a miss if the aircraft is more than a wingspan towards the SkyHook. ▪ For Runway approach, there will not be a miss at the decision point because the aircraft is outside the runway width. **<u>CAUTION</u>: One of the many possible dangers of disabling this would be that the aircraft would crash into the SkyHook mast or personnel/ property along the side of the runway.**
True Air Speed (TAS)	▪ For Runway approach, there will not be a miss at the decision point because TAS differs from commanded TAS by more than 10%. **<u>CAUTION</u>: One of the many possible dangers of disabling this would be that the aircraft would suffer considerable damage from impact at high speed or under- or over-shoot the runway because of unexpectedly high or low speed.**

Data values



The five data values considered to be most important during an approach are displayed on the **Approach Monitor** panel.

Specific values are available during various approach phases.

When key values get out of range they are highlighted. Caution values are highlighted in yellow. Warning values are highlighted in red.

The ranges are based on alarm definitions and can be viewed and edited in the **Alarm Editor**.

The Wingman display on the **Approach Monitor** panel provides a glide-slope centric view of aircraft location. The glide-slope point for the approach is located at the center of the cross-hairs. An ideal approach will show the aircraft centered on the plot during final approach.

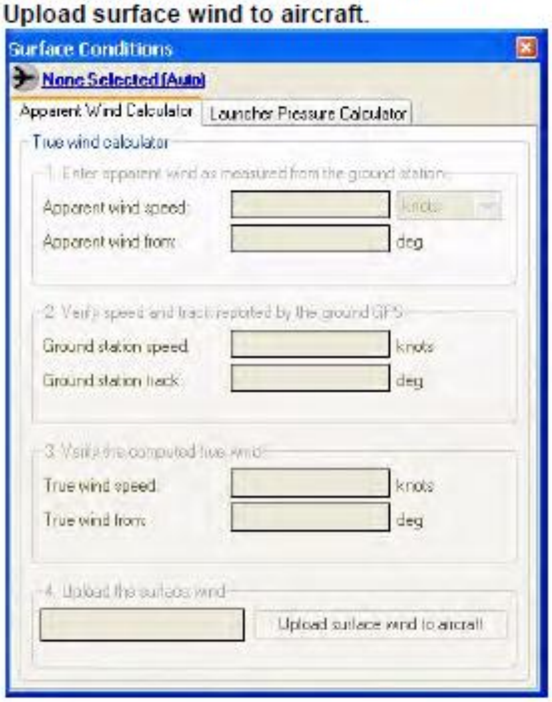
The coloration of the aircraft in the Wingman display is an indication of its general health and the health of its subsystems. The coloration is the same as it is for the aircraft icon on the I-MUSE map.

Approach Settings

Wind & pressure – Surface wind and base pressure

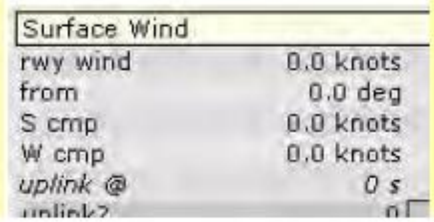
Note: There is a 15-minute time limit from the time surface wind is uploaded to the time that an approach is executed. (In I-MUSE 5.0.X and earlier, the time limit is 5 minutes.) If this time limit is exceeded, you must recheck and reenter surface wind before you can proceed with the approach.

To enter surface wind values, enter the **Panel** menu on the I-MUSE toolbar, and select **Surface Conditions**. In the **Apparent Wind Calculator**, enter and verify the data in all fields, then click **Upload surface wind to aircraft**.

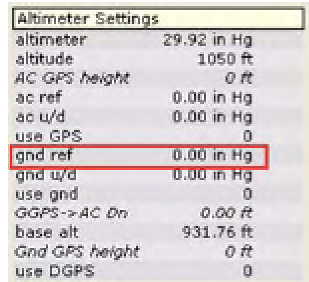


In I-MUSE 5.1.X and earlier:

In the **Surface Wind** table, select **Standard Tables** from the **Tables** menu on the I-MUSE toolbar. Go to **Standard** then **Settings**. After values are correct, enter **1** in the **uplink?** field and press the **Enter** key on the keyboard. After the information is entered and successfully uploaded to the aircraft, the entire table appears gray.



Approach Settings	
Wind & pressure – Surface wind and base pressure	**(cont.)**



Altimeter Settings	
altimeter	29.92 in Hg
altitude	1050 ft
AC GPS height	*0 ft*
ac ref	0.00 in Hg
ac u/d	0.00 in Hg
use GPS	0
gnd ref	0.00 in Hg
gnd u/d	0.00 in Hg
use gnd	0
GGPS->AC Dn	*0.00 ft*
base alt	931.76 ft
Gnd GPS height	*0 ft*
use DGPS	0

During the Pre-Takeoff tasks of the System Check, the ground reference pressure was measured using the optional weather station (handheld GPS if weather station is not available) or obtained from an onsite authority, and then recorded in the **gnd ref** field in the **Altimeter Settings** table located under **Settings** in the **Tables** menu on the I-MUSE toolbar.

You may need to update barometric altitude before starting an approach. The ambient barometric pressure may have changed over the course of the flight and updating the aircraft's reference for the ground will correct any errors in its barometric altitude from GPS height. Generally, if GPS height and aircraft barometric altitude are within 5 m (16 feet) of each other (with low GPS uncertainty) it is unnecessary to update the aircraft's barometric altitude. This is done generally at lower altitudes before proceeding with the approach.

Use one of the following methods to update the altitude in the **Altimeter Settings** table:

- Using the same handheld GPS or other device, read the pressure on the ground, and record the ground update pressure in the **gnd u/d** field. Then type **1** in the **use gnd** field. The base pressure on the aircraft is updated by comparing the original pressure at the beginning of the flight to the updated pressure prior to the approach. This corrects for any changes in weather since takeoff, while not requiring the exact altitude of the aircraft.
- If the reference pressure update does not correct the split between barometric and GPS altitude, or if there was a reset on the aircraft, you can type **1** in the **use DGPS** field. The base altitude (which should be set to the ground station altitude), plus the differential down measurement, is used to update the aircraft altitude. This will be more accurate than using the GPS reported height because you can survey the ground station over a longer period of time to average out the GPS noise.

Note: **During lost comm, with I-MUSE 5.2 and later, if GPS uncertainty is sufficiently small, the altimeter automatically resets on procedure turn and FAF. This is the equivalent of typing 1 in the use GPS field.**

Approach Settings
Auto retrieval

Auto retrieval information can be found in the I-MUSE software.

1. Select **Checklists and Procedures** from the **Panel** menu on the I-MUSE toolbar.
2. Select **Start New**.
3. Select **Auto-Retrieval** and click **Start.**

Retrieval Operations

Land-based retrieval

WARNING!

In strong winds, use caution when retrieving the aircraft because it can swing wildly and cause injury; hard-hats must be worn!

Retrieval with land-based SkyHook requires at least **two operators**.

Note: **In high wind, SkyHook retrievals require a third operator to pull on the capture rope as soon as possible and continue holding the rope while the aircraft is lowered.**

1 Operator #1 lowers the telescoping boom carefully.

Land-based retrieval (cont.)

2 Operator #2 holds the lower rope to stabilize the aircraft.

3 Operator unhooks the aircraft.

Maritime retrieval

WARNING!

In strong winds, use caution when retrieving the aircraft because it can swing wildly and cause injury; hard-hats must be worn!

A **minimum of 3 operators** are required to retrieve an aircraft from a maritime SkyHook.

1 Operator #1, retract the telescoping boom until Operator #2 has a good hold on the aircraft.

Note: **Maritime SkyHook retrievals require a third operator to pull on the capture rope, raising the aircraft to the anti-spin device (red tube) as soon as possible. The third operator continues holding the rope while the aircraft is lowered.**

2 Continue lowering the boom down, or telescoping in, until the full weight of the aircraft is supported by operators.