# MTDC Helitorch Evaluation


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**Introduction:**

The US Forest Service Missoula Technology and Development Center (MTDC) has developed a helitorch designed for reliable operation that could be built by a designated manufacturer. The helitorch has been flight tested on several occasions and modified to enhance performance. The ignition module is the only working component that has been changed since testing in 2010, and the module was installed during the most recent two days of flight tests.

**History:**

The MTDC helitorch has been in development for several years. The torch evolved through two designs with the second design being chosen to complete testing. The first prototype was designed to function as either a barrel helitorch or a fixed-drum helitorch. This design used a 'backbone' with a bulkhead as the primary frame which was adapted with either a clamp system (figure 1) to hold the barrel in a manner similar to a barrel helitorch, or with a lower frame (figure 2) to hold the barrel in place similar to a standard helitorch. The design was flight tested during three burns for a total of 25 drums of fuel:

March 17, 2007 – 16 drums (Radersburg, MT)

August 17, 2007 – 3 drums (Glendive, MT, BLM)

September 9, 2008 – 6 drums (Glendive, MT, BLM)


**Figure 1. Backbone concept configured as a barrel helitorch with a clamp system on the backbone. A Northern Helitorch frame is sitting in front of the barrel.**


**Figure 2. Backbone concept configured as a standard helitorch.**
**The lower frame holding the barrel is connected to the backbone and bulkhead.**

The backbone concept did not perform well so a new frame was designed. The frame was changed to the current configuration (figure 3) which holds the drum similar to a standard helitorch. The design has been flight tested during five burns for a total of 39 drums of fuel:

April 16, 2010 – 13 drums (Superior, MT, USFS)

April 19, 2010 – 4 drums (Riggins, ID, BLM)

April 20, 2010 – 5 drums (Riggins, ID, BLM)

April 23, 2012 – 10 drums (Missoula, MT, USFS)

May 15, 2012 – 7 drums (Missoula, MT, BLM)

Figure 3. MTDC helitorch in the current configuration.

**MTDC Helitorch Description:**

The MTDC Helitorch uses a UN specification 55-gallon removable head drum to hold gelled fuel. The drum has four sight glasses plus a Clay & Bailey two-way vapor valve mounted on a cam-lock fitting. The cam-lock fitting is removable so a vapor hose can be attached while filling the drum with fuel. A dry-break fitting is positioned low on the drum for connection to a batchmixer or mix transfer system. See figures 4 and 5.

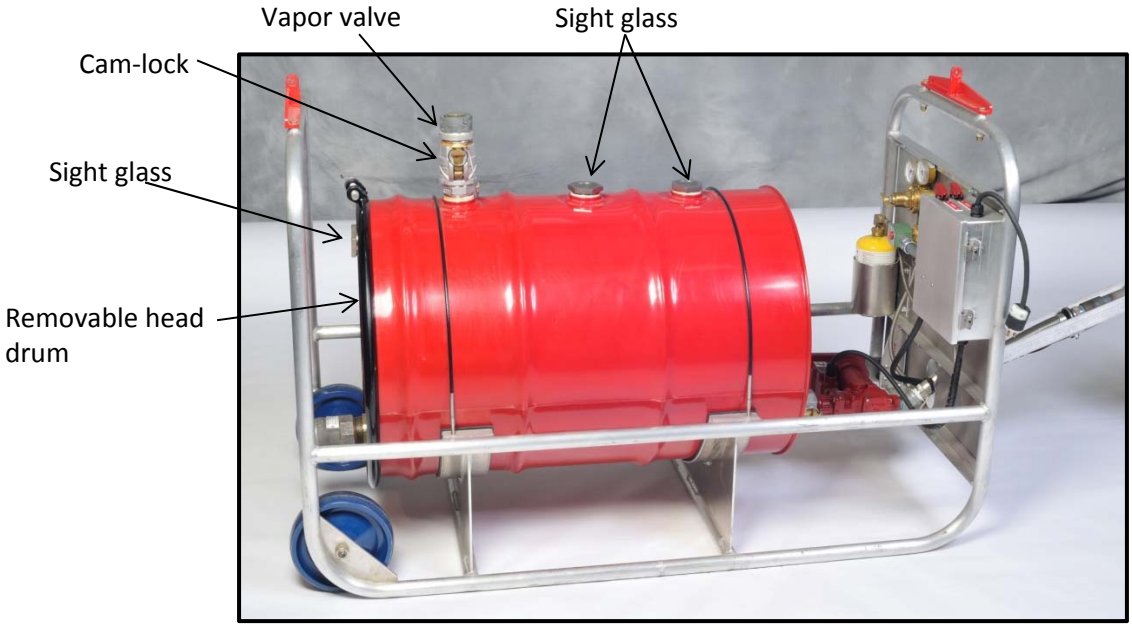


Figure 4. Tank components on the MTDC helitorch.


Figure 5. Tank and frame components on the MTDC helitorch.

A frame with wheels holds the drum and protects it from damage from contact with the ground or objects during transportation. The wheels allow the torch to be moved fairly easily on level ground with minimal personnel. The drum is secured to the frame with cables. The suspension system attaches to the frame through two brackets. The frame's rounded corners are the first points to touch the ground when lowering the helitorch onto a level surface.

A 24-volt gasoline transfer pump (figure 6) draws fuel from the drum and supplies pressure to the fuel discharge tip. The pump has an on/off switch that is locked in the 'on' position. Flow at the fuel discharge tip is regulated by a plunger that allows flow when pressurized by the pump and shuts off flow by spring pressure when the pump is secured. The plunger and fuel discharge tip (figure 7) are removable for cleaning and inspection.

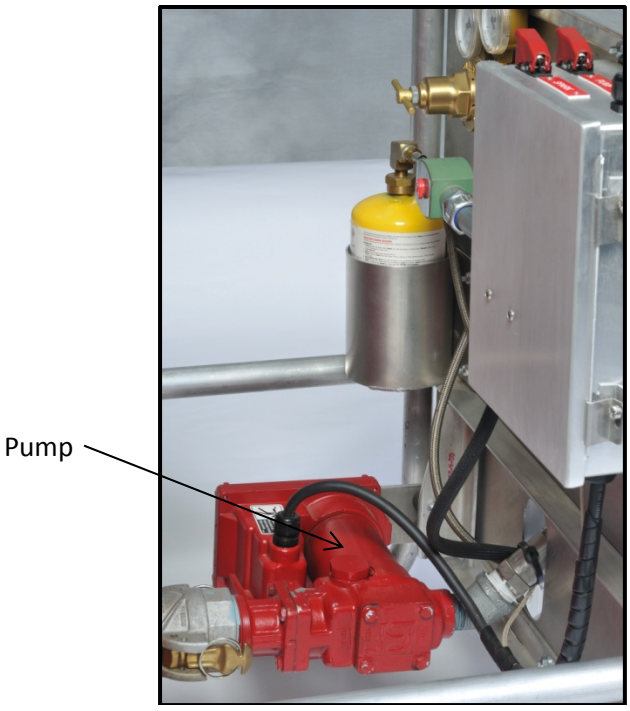


Figure 6. Fuel transfer pump.

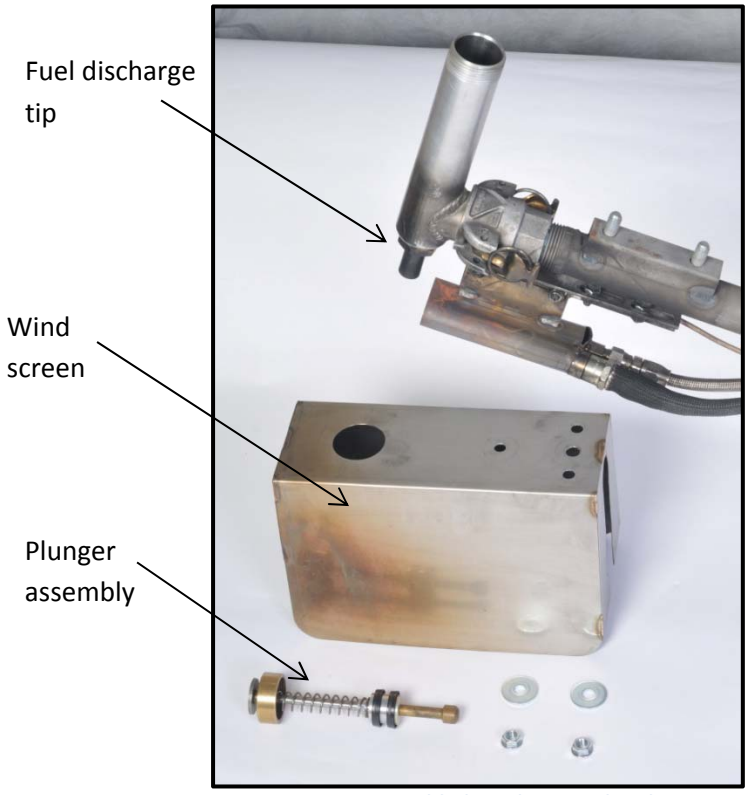


Figure 7. Disassembled tip showing the plunger.

Gelled fuel is ignited by a propane flame which in turn is ignited by a spark plug. The propane orifice and spark plug are contained within an igniter tip shroud (figures 8 and 9) which directs

the flame below the fuel discharge tip. The igniter tip shroud and fuel discharge are enclosed by a larger wind screen that shields the flame from air flow and protects the components if the arm strikes an object while setting down.

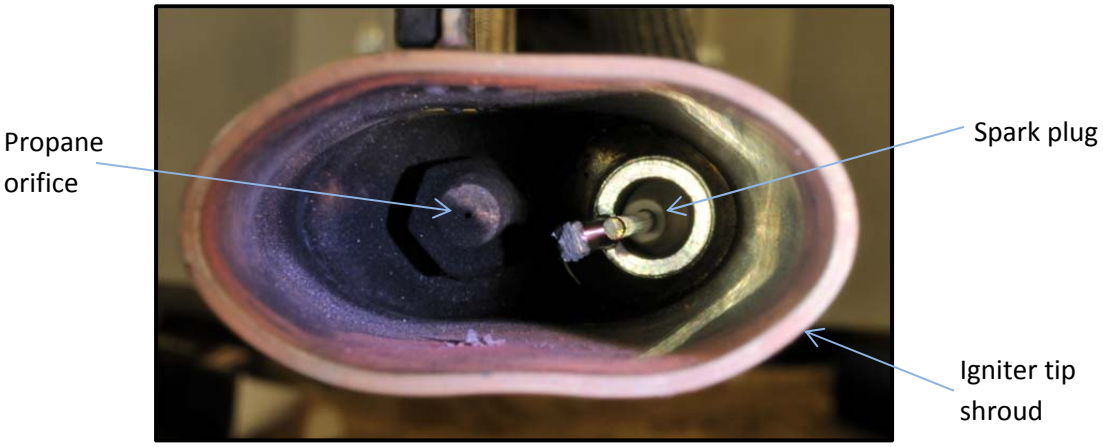


Figure 8. The propane orifice and spark plug are visible from the end of the igniter tip shroud.


Figure 9. The fuel discharge tip and igniter shroud with the larger protective wind screen removed.

The igniter arm is hinged so the tip can be raised for transport and storage (figure 10). This also prevents damage to the igniter arm components by allowing the arm to pivot if the helitorch is set down on uneven ground.

**Figure 10. The igniter arm is shown in the raised position. Removal of one push-lock pin releases the arm for use.**

Control settings of the helitorch are located on a panel which houses the propane bottle, propane regulator, propane solenoid valve, and the electronic control box (figure 11). The propane regulator has two pressure gauges. One gauge shows the pressure remaining in the bottle and the other gauge shows the pressure flowing to the propane orifice. The regulator adjustment screw for the orifice pressure can be secured in place with a nut when the desired propane flow is achieved. The electronic control box houses the 24-volt ignition coil and ignition module (figure 12) which supply electrical energy to the spark plug. One switch on the control box provides power to the pump and another switch provides power to the propane solenoid valve and the ignition system. The propane solenoid valve prevents propane from flowing from the bottle while ignition is stopped.

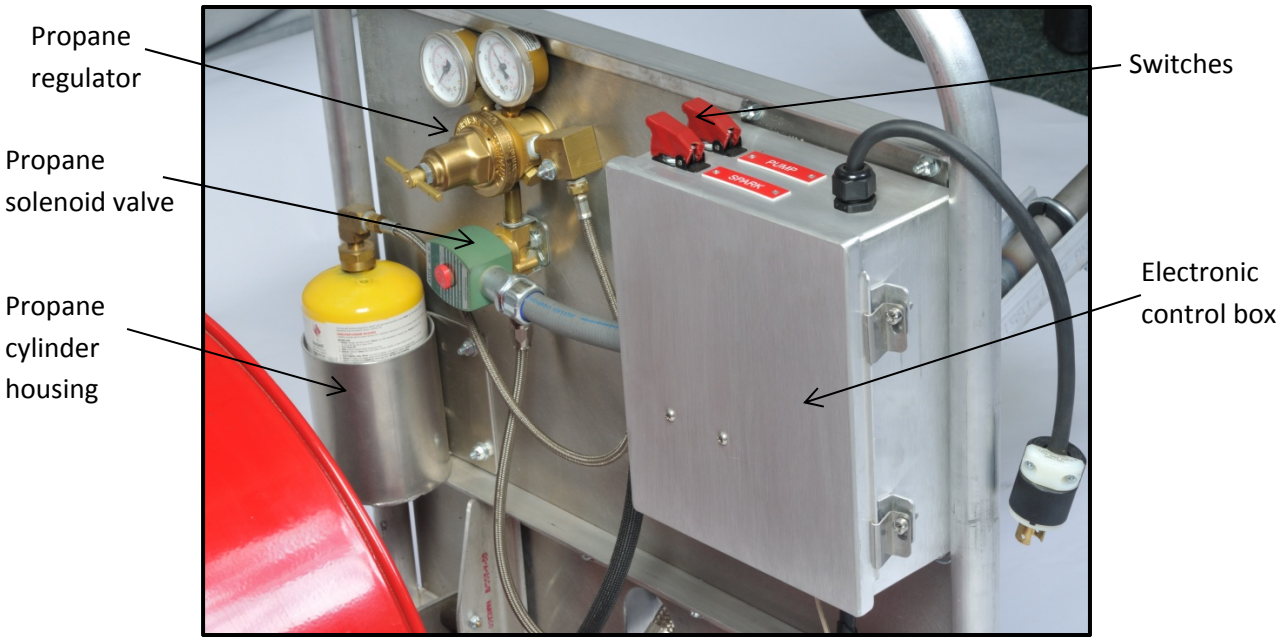


Figure 11. The helitorch control panel.

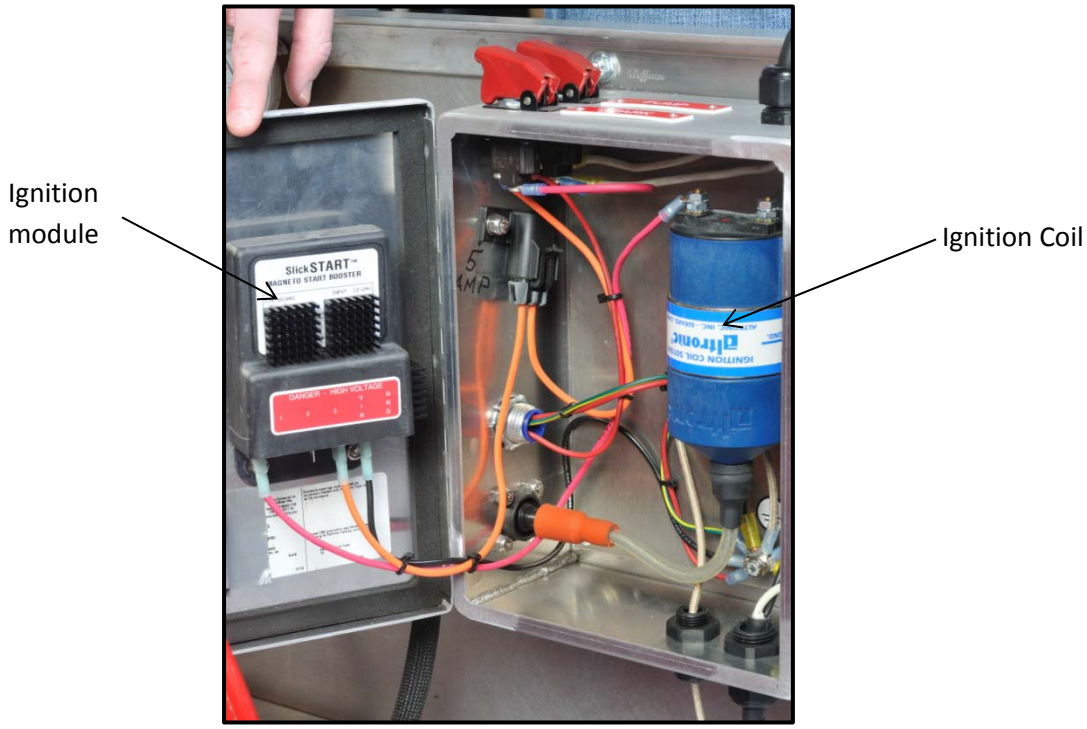


Figure 12. The control box houses the ignition module and coil.

The MTDC helitorch weighs 190 pounds including the suspension when dry and 575 pounds wet. The helitorch uses the standard suspension detailed in drawing MEDC-768.

**MTDC Helitorch Flight Test Evaluation:**

The helitorch in the current configuration has been flight tested twice without problems. On April 23, 2012, ten drums of fuel were flown to ignite a prescribed burn on the Missoula Ranger District of the Lolo National Forest. No torch problems were encountered. The helitorch crew remarked that the torch was lightweight and easy to maneuver along with being simple to operate. The pilot had no direct comment during the burn but later stated that he prefers flying the MTDC helitorch more than other helitorch models.

On May 15, 2012, seven drums of fuel were flown to ignite a prescribed burn on BLM land near Missoula, MT. The tip leaked a small amount of gelled fuel after shutting down the pump during the pre-burn pump test, but did not leak again. No other problems with the helitorch were encountered.

Prior to these flights, the helitorch was flown three times in the same configuration except that a mechanical starting vibrator was used in place of the Slick Start ignition module. The starting vibrator failed, so a reliable replacement was investigated. The Slick Start is a solid state electronic module which has no moving parts to fail and aids in providing a strong electrical energy to the spark plug. The module was tested in the shop to help determine reliability. Five cycles of thirty minutes continuous operation with a five minute break between cycles was performed. Another cycle of ninety minutes of continuous operation was also performed. The module worked with no noticed change in operation and is still installed in the helitorch.

The MTDC helitorch has been operated with fuel that was gelled with liquid and powdered gelling agents. Results have been similar with no noted differences in operation or performance.

**Conclusions:**

The MTDC helitorch has worked well for the last two flight tests and had only one component fail during the three flight tests prior to that. That component has been replaced and seems to be reliable. The prototype will continue to be used when possible for long-term reliability testing.

MTDC has developed a draft Operations Manual for this helitorch. A set of drawings will also be developed and provided to a designated manufacturer or sent to interested agency representatives for them to provide to a local fabrication shop for construction of the helitorch.

The draft Helitorch Technical Requirements checklist has been filled out and is attached as Appendix A.

Appendix A

Helitorch Technical Requirements

Design

| | |
|---|---|
| Sized for a Type III Helicopter | X |
| Components compatible with gasoline | X |
| Operates adequately with gelled fuel | X |
| Dry-break installed low on tank | X |
| Fuel hose is electrically conductive | X |
| 2” male camlock for vapor removal | X |
| Aviation grade hardware used | X |
| Site glass or equivalent installed | X |
| Pressure and vacuum relief valve installed | X |
| Locking camlocks installed | X |
| Loads applied to the shoulder of bolts, not threads | X |
| Switch guards installed | X |
| Igniter tip does not contact ground | X |
| Components are secure | X |
| Hardware meets MTDC specifications (MEDC-768) | X |
| Propane hose is compatible with propane | X |
| Propane hose has braided metal cover | X |
| No sharp bends in hoses | X |
| Weight (wet) | 575 lb |
| Weight (dry) | 190 lb |

Appendix A

Suspension System

| | |
|---|---|
| 9-pin connector (MS 3107B-24-11P) to helicopter | X |
| Hardware and components meet MTDC specifications (MEDC-768) | X |
| Attachment point working load limit at least 5,000 pounds | X |
| Adaptable to different cargo hook configurations | X |
| Will not bind easily | X |
| Loads applied to the shoulder of bolts, not threads | X |

Operation

| | |
|---|---|
| Controls clearly marked | X |
| Switches labeled for their function | X |
| Switches identifiable as on or off | X |
| Fuel flow and ignition switches are independent | X |
| Propane flow is adjustable | X |

Emergency Operation

| | |
|---|---|
| Helitorch is jettisonable | X |

Parts and Maintenance

| | |
|---|---|
| Tool kit provided or noted | X (noted in manual) |

Appendix A

Safety

| | |
|---|---|
| Components securely fastened | X |
| Hazardous materials labels are attached | X |

Support

| | |
|---|---|
| Operator's manual adequate | X (needs review by AIU) |
| Warranty | no |

Additional Observations