

Helitorch Redesign

Dave Finn, Mark Ackerman, Roy Campbell

Background

Alberta Agriculture and Forestry's Wildfire Management Branch and the Ignition Working Group have endorsed the development of a replacement helitorch. Existing helitorch inventory has been in service for over 20 years, and based on helitorch life expectancy and the advancements in technology, wildfire management staff decided to explore design improvements and construction of a replacement helitorch prototype. Based on this need, and with the backing of management, the Ignition Working Group channeled a project proposal through Alberta's Wildfire Management Science and Technology program, and FPIinnovations was ultimately assigned to manage the project delivery.



Approach

Alberta's Ignition Working Group played a key role in prototype design, construction, and testing. FPIinnovations provided administrative support and oversaw the project requirements. Design engineering was completed through the University of Alberta's Mechanical Engineering MEC E 460 design project. Prototype construction was completed by independent contractor MYAC Consulting Inc. using the university student design work. The Ignition Working Group and MYAC continue to be involved in prototype construction and field testing.

Methods

Wildfire management staff developed the initial design concepts and incorporated them into the project planning criteria. The new design does not alter the fundamental concept of mixing a carbon-based fuel with a gelling agent, as is used in the current Alberta helitorch model, but rather aims to streamline the mixing process and downsize or remove obsolete components.

University of Alberta mechanical engineering students took on the challenge of completing two separate designs, including the gel mixing system and the leg-stabilizing system. Wildfire management staff provided design input through this process, and students were provided access to the current helitorch model for reference.

MYAC completed the helitorch prototype build using the design concepts provided by the university student design teams. Wildfire management staff also worked closely with MYAC during the construction and testing phases.

Prototype construction and testing

The most significant changes from the existing helitorch design included overall reconfiguration, which focused on helitorch mounting and stabilization; the use of a standard fuel drum as its gel mixing/storage reservoir; and incorporation of an internal circulation concept, which provides for pump-driven fuel and gel mixing in the fuel reservoir.

The prototype was bench-tested throughout the construction stage, and field testing began on June 14, 2017, at the Loon River Forestry Base. An experienced ignition specialist participated in the field testing and provided critical feedback to the project.

Observations and findings

Given that the prototype has been focused mainly on proof of concept, challenges and a need for improvements were anticipated. Basic mixing design has proven satisfactory, and initial testing yielded successful gel mixing and production via the pump and fuel reservoir design.

Field testing at Loon River began with a basic flight test to establish helitorch flight characteristics. The key issue encountered during the flight test was a tendency for the prototype to yaw during flight. A possible cause for this may be prototype alignment or balance (e.g., the discharge boom may be acting as a tail fin). Actual ignition testing was postponed due to the flight issues encountered, and further flight and ignition testing will resume at a later date.

Future work

The prototype improvements identified during the Loon River test are not anticipated to be critical to its overall design. Plans to stabilize the helitorch while in flight are underway and include:

- Replacement of the three-cable suspension system with a two-cable system.
- The addition of spreader bars in the cable system.
- The addition of a wind brake to the discharge boom to counteract the yaw tendency.

The discharge head valve is also being redesigned to simplify ignition and facilitate the use of an electronic ignition system.

Blueprints and/or CAD drawings will be completed once the prototype has proven acceptable.

Future work will include additional field trials, and continued improvements and alterations are anticipated.

All changes to the helitorch, particularly in size and the manner in which it is deployed, may in turn foster change in how it is used. The final product is anticipated to be much smaller and more portable than the current model, lending itself to quicker deployment.