Burned from Above

The development of aerial ignition devices was a major step in the use of controlled burns throughout the Canadian logging industry.

By Leigh Barratt

Above: National Interagency Prescribed Fire Training Center photo of Pyroshot HS handheld launcher being tested. The Pyroshot launches Dragon Eggs over water bodies and into fuels that are inaccessible by foot. Photo taken Feb. 28, 2008, Tate's Hell State Forest, Florida.

Right: Dragon Egg testing on asphalt. Ignition occurs 30–40 seconds after ethylene glycol is injected into the sphere. Three injection devices exist for these spheres – the helicopter-mounted Red Dragon, the vehicle-mounted Green Dragon launcher, and the hand-held Pyroshot launcher. The spheres are also known as Delayed Chemical Ignition Devices (DCIDs).

In the early 1960s in British Columbia, following an increase in logging and cutblock, or clearcut, areas, it became apparent that a more efficient, cost-effective and safer method of controlling fire on the land was needed. Using fire to reduce hazard, remove fuel ahead of fire, prepare sites for reforestation and modify vegetation for wildlife enhancement was recognized as a valuable tool. However, to achieve these goals, the tools and techniques to pursue them needed to be safe, efficient and effective.

The challenges were many because Canada had limited staff with burn experience. Wildlife enhancement areas were large, and logging cutblocks were getting larger. The Interior of British Columbia was rapidly expanding logging operations, but

USFWS prescribed burn on the Texas Midcoast National Wildlife Reserve. Red Dragon aerial ignition device and helicopter used to drop spheres and burn indigenous grasses. Note the circular burn pattern from the ignition of each sphere. Photo taken Oct. 17, 2009.

the terrain and fuels were much different from the coasts where most logging had traditionally taken place. New techniques and equipment were needed for burning operations.

In 1966, three Australians who worked for the government's research group — Baxter, Pacham, and Peet — developed and used the first ever aerial ignition device, or AID. The process consisted of using a pharmaceutical vial that contained potassium permanganate powder, manually injecting glycol into that vial and tossing it out the window of a fixed-wing aircraft into the designated burn area. The two chemicals mixed, and a delayed exothermic reaction occurred, usually within 15 to 45 seconds, depending on climatic conditions.

FURTHER DEVELOPMENTS

Into the 1970s, Australia continued to pioneer airborne incendiary devices and techniques for fire suppression burning. Between the 1960s and early 1970s, the Canadian Forestry Service collected data and observed burning techniques used across Canada and around the world. The Federal Research Institute approached the Australians to learn more about their methods to see what could be used in Canada.

In 1972, the hand-release method was used to operationally test AID in the Yukon. The method used was the same as the Australians, except that a helicopter was employed as the aerial delivery platform. This was mostly successful, but the procedure was limited in that only 12 to 20 vials could be dropped per minute. Because this method of priming and dropping incendiary devices was slow, a mechanical device was needed. Recognizing the requirement to use aerial techniques to burn as well as the need for improved delivery methods, the Yukon Forest Service requested the Canadian Forestry Service, with which the Pacific and Northern Research Institutes were involved, to develop an efficient, effective and safe AID for burning out and back-firing large areas. The CFS immediately began to develop a mechanical device.

The need for safer, more efficient methods and mechanisms seemed to have been generally satisfied in Canada with the development of two types of fire ignition systems: the AID, developed in 1972 by the CFS, and the aerial drip torch developed in concert between the CFS and Northwood Pulp and Paper in 1973. Further testing and improvements of these devices continued over the years, but the operational need for automated aerial burning had been fully embraced.

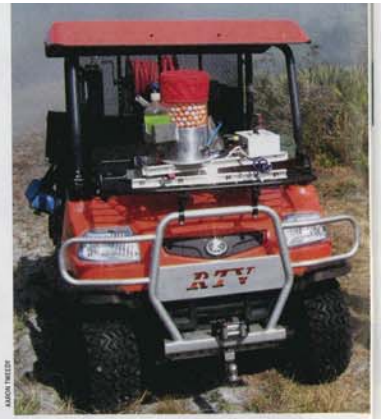
John Muraro, a researcher who worked for the CFS, and his colleagues conducted a 1972 study that consisted of two phases: The first phase was the testing of incendiaries, and the second phase was the design and construction of a priming and release mechanism. Under Muraro's guidance, the first truly operational AID was built.

Mounted on a Bell 47 helicopter, this device had a rotary turntable that could prime and release vials as fast as they could be placed in it. Neither the hand-powered nor hand-loaded prototypes constructed at the CFS Northern Forest Research Centre, nor the Australian hand-loaded, motorized dispensers, satisfied the need for a device that could dispense a large number of incendiary devices safely and efficiently over a wide area.

The first mechanical model used a pressurized glycol reservoir that shot a measured amount of fluid into a styrene vial containing the potassium permanganate through a hollow needle. The vials were contained in a 100-capacity magazine, gravity-fed into the dispenser, charged and then allowed to drop through a tube and fall to the forest for ignition.

The second model incorporated a centrifugal pump to force glycol through the needle. This provided a slightly faster (1.5 times) rate of dispensing vials. Roy Kruiger of the Alberta Forest Service became interested, and in consultation with CFS staff they focused their attention on an automatic feed gate system. They also developed a spherical container to hold the potassium permanganate, which improved efficiency in a hopper feed system. A machine was built to incorporate these features and was operationally tested in Alberta.

These trials were so successful that the CFS contracted a local machinist in Fulford Harbour, British Columbia, to immediately build five production models — two for the Yukon Forest Service, one for the Ontario Government and two for Alberta. These production models would later develop into the Mark III AID and become the only plastic sphere dispenser in the aerial fire ignition industry for the next 30 years.



The Green Dragon is mounted on a UTV, but can be mounted on almost any vehicle, from pick-up truck to airboat.

In 1973, the United States became interested in aerial incendiary devices for suppression reasons, and the U.S. Forest Service purchased incendiary equipment from CFS.

A NEW AGE OF FIRE IGNITION?

The fire management industry saw very little advancement in aerial ignition technology until 2006. After four years of research, development and comprehensive field testing, SEI Industries introduced a new generation of aerial ignition systems: the Red Dragon Plastic Sphere Dispenser. This modernized version is compatible with 1-inch polystyrene spheres known as "Dragon Eggs."

In December 2007, the Red Dragon dispenser and Dragon Eggs received approval from the Department of Interior for use by the U.S. Forest Service, U.S. Fish and Wildlife Service, Bureau of Indian Affairs, National Park Service and Bureau of Land Management. As an aerial ignition system, the Red Dragon incorporated feedback from end users and designed features, functionality and safety that were not available in the 30-year-old Mark III technology — namely seven-speed, variable dispensing with an adjustable range between 25 and 175 spheres per minute; a microprocessor controlled motor and feed-gates that virtually eliminated the potential for jams; fixed-displacement glycol pumps; and a remote power supply to ensure that safety systems remained operational independent of aircraft power.

Additional features in this new plastic sphere dispenser technology included a resettable sphere counter, a larger capacity hopper, water/glycol tank drain valves, tethered remote control and a removable base to provide easy installation and better ergonomics in various helicopter configurations. The spheres themselves were redesigned to work more efficiently — with a delayed chemical ignition device offering improved ignition reliability, multicolored spheres to increase visibility and a smaller sphere size to maximize each flight hour of expensive aircraft.

More recent innovations consist of taking this technology that was traditionally airborne and designing terrestrial-based equipment. These automated dispensers for ground ignition are known as Green Dragons and can be mounted easily on trucks, ATVs and airboats (as in Florida), using compressed gas to propel the spheres. Following the terrestrial application model, handheld plastic sphere launchers (known as Pyroshots) are now available that use both spring- and compressed-gas propelling mechanisms to launch spheres into areas that are not suitable to enter with a drip torch or have dangerous fuel accumulations that warrant launching from the comfort of a safety zone.

Fire ignition technology has come a long way since Australia was mandated to burn 200,000 hectares each year in 1939. North America's complex fire regime has definitely highlighted the need for an integrated approach to incorporate more fire into the landscape in order to minimize unwanted disasters. One thing is for sure: fire will continue to be part of our culture. How we decide to manage it is part of another story — one that will likely play out well beyond my years. W

Leigh Barratt is a contractor with West Coast Helicopters and the British Columbia Government Wildfire Management Branch. A veteran of the Canadian Army Reserve and regular forces, Barratt worked in cruising and surveying before becoming an assistant ranger in Mackenzie, B.C., where he learned the grassroots of forest and land use management and firefighting, serving on a number of incident command teams. He has held certifications as a Fixed Wing Air Attack Officer, Type 1 Air Branch Director, Rotary Wing Birddog Officer and Aerial Ignition Device Trainer. He has a forestry degree from the British Columbia Institute of Technology.