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# *FOAM APPLICATIONS FOR WILDLAND & URBAN FIRE MANAGEMENT*

***Prepared by:*** **NWCG Fire Equipment Working Team's Task Group for International/Interagency Foams and Applications Systems**

## CHAIRPERSON'S CORNER

*by Doc Smith, USDA Forest Service*

### International Workshop on Foam Applications/ Foam Task Group

The June 1988 International Foam Applications Workshop was a large success. The Workshop—sponsored by the Petawawa National Forestry Institute, Canada, and the National Wildfire Coordinating Group, United States—had participants from Australia, West Germany, Canada, and the United States. The action items and recommendations that resulted from this effort will help to firmly establish foam as another tool in the firefighter's "bag of tricks." There is a brief overview of the Workshop in this document, as well as other articles generated by the conclave. A recent meeting in Canada of the Fire Equipment Working Team and the Canadian Forest Fire Equipment Subcommittee affirmed the Foam Task Group and this publication. There is still much to be learned about foam, and each of us still must contribute where we can.

The Foam Task Group has the following members:

- H. B. "Doc" Smith, Chairperson; USDA Forest Service, Kaibab National Forest, Williams, AZ
- Dave Day, California Department of Forestry and Fire Control, Sacramento, CA
- Pat Ebarb, Texas State Forest Service, Lufkin, TX
- Gordon Ramsey, Canadian Forestry Service, Petawawa National Forestry Institute, Chalk River, Ont.
- Bob Read, Ministry of Forests and Lands, Prince George, B.C.
- Ron Rochna, USDI Bureau of Land Management, Salem, OR
- Larry Segreto, USDI Bureau of Land Management, BIFC, Boise, ID
- Lee Young, USDI Bureau of Indian Affairs, BIFC, Boise, ID

The NWCG Fire Equipment Working Team Coordinator is Bob Webber, USDI Bureau Of Land Management BIFC, Boise, ID. Task Group advisors—from the USDA Forest Service—are Paul Hill, Technology & Development Center, San Dimas, CA; and Chuck George Intermountain Fire Sciences Laboratory, Missoula, MT

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## THE FOAM PROJECT—WERE ARE WE?

*by Jack Wilson, USDI Bureau of Land Management*

**Keynote Address at International Workshop on Foam Applications, Denver, CO, June 1988, by Director BLM, Boise Interagency Fire Center**

It is again an honor and special privilege to attend a meeting of this group which has been so interested and dedicated to forwarding the use of foams in wildland firefighting. Since the last major meeting of this kind in Texas, a lot has happened, yet I still have the uneasy feeling that we are only getting a small portion of the action that is going forward into a system to share among even ourselves—we who like to think that we are on the cutting edge. But I also believe we are making a lot of progress; some known examples are:

(1) The National Wildfire Coordinating Group (NWCG) assigned the whole area of foams and water expansion to their Fire Equipment Working Team (FEWT), which met and decided that a totally new effort would be necessary, and established a Task Group under the leadership of the USDA Forest Service's "Doc" Smith. The Foam Task Group includes many of you who are present today. Of importance is the fact that this the first such group convened by the NWCG that is international in scope with the inclusion of Gordon Ramsey from the Petawawa National Forestry Institute of the Canadian Forestry Service. You will be hearing much more about this Task Group for International/ Interagency Foams and Applications Systems, it's charter, and the progress and plans that it is making.

(2) Progress is being made toward the development of a foams standard through at least two major efforts. The Forest and Rural Fire Committee of the National Fire Protection Association (NFPA), Quincy, MA, had a draft to consider at their annual meeting recently held in Los Angeles, CA. A committee established at the initial Salem, OR, meeting and led by Randy Lafferty (Nanaimo, B.C., Canada) is working on a short-term fix, and is making good progress.

(3) There are four fully approved products now available for use by the fire community. These are Fire-Trol FireFoam 103, Chemonics Industries; Forexpan, Angus Fire Armour Corp.; Phos-Chex WD861, Monsanto Co.; and Silv-ex, Ansul/Wormald. At this point, approved means that the USDA Forest Service Intermountain Fire Sciences Laboratory, Missoula, MT, has cleared them under an interim standard for use in ground tankers and helicopter buckets. Use in air tankers is still only authorized in conjunction with the Operational Retardant Evaluation (ORE) Program, Redding CA.

(4) We are beginning to learn about some of the limitations and requirements for foams. For example, we found that viscosity changes between 32 and 40° F were critical in stored product, and caused thickening and crystallization in most of the current products. This is important because future systems will require flow through small orifices at low temperatures. We also found that the insulation/reflection characteristics were a valid criteria for judging foam effectiveness. I would recommend that you read the report of Paul Schlobohm and Ron Rochna (see p. 6-7, Vol. 1, No. 2 of this publication for an abstract and ordering information), if you haven't already.

(5) There is a veritable explosion in the development of hardware to supplement the use of foam. Just in the area of aspirated nozzles there are literally a plethora to choose among. There are some promising developments in compressors, concentrate injector systems, rotary engines, and other equipment.

(6) The uses of foams is expanding into other facets of the fire world. I hear that one company has made substantial progress on a foam-based home protection system that can be triggered either manually or by a heat sensor that automatically causes the house to be covered by foam to protect it from fire. Purportedly, it does not rely on water pressure. Further, I saw a system in South Australia that simply charged the guard rail that is found on most fire engines and placed an in-line valve and some sprinkler heads along the rail. By this simple expedient, they were able to foam an engine should it be overrun by fire.

### Where Are We?

With all of these events moving out rapidly, where are we? Today I think we are finally getting a concept in focus. We went through a discovery phase where there were some pioneers—notably the Texas Forest Service—and some inventors who brought forth some great new ideas. Then we went through an expansion (or experimenting) phase where these ideas were adopted,

then improved and tried. Since there are never any sharp lines between phases, both of these phases are continuing.

We began the organization phase at Salem, OR. This meeting in Denver, CO, marks the ending of that phase. We began by searching out the best ideas and practices; establishing approval processes; involving management in the decisions regarding foam uses; providing for information exchanges, and looking to the future uses of foams. If this analogy is valid, then the future direction isn't so cloudy. Our next efforts must be in the implementation and evaluation phases. Remember that through all this time, all of the phases will continue. We will still get new ideas, experiment, and organize—as well as begin operational uses, testing, and evaluations.

### Where To Next?

There are still some key pieces in the implementation phase to address. In my view, the top priority should go to training. We need the manuals, handbooks, operational guides, and "how-to" things—but we more critically need just the basic and fundamental uses, methods, and safety precautions clearly and simply spelled out. We need some good video products NOW.

We still need to perfect our information-sharing processes. Remember that this effort is international, and there is worldwide interest. Being a leader also bears the burden of making your knowledge available to any who would have it. We need to begin expanding our horizons to other uses of foams and CAFS technology beyond fire suppression to the management of natural resources, and yes, even beyond into the urban/wildland, and the rural/wildland interfaces.

And last, but by no means least, be proud that each of you has had a rare opportunity to be a small part of history, for surely you are the leaders in a movement that will have a dramatic influence on how fires are fought in the next generation.

## TEXAS FOREST SERVICE FOAM REPORT

*by David Abernathy, Texas Forest Service*

**Presentation to International Workshop on Foam Applications, Denver, CO, June 1988, by Dstrct. Tech.-Camp County Office/Fire Instructor-Texas A&M Univer.**

### State-of-the-Art in Texas, California, and Mexico

I have been involved with Compressed Air Foam Systems (CAFS) since the start of my employment with the Texas Forest Service (TFS) in 1979. There are over 300 CAFS units in service throughout Texas. They are cost-shared through the Rural Community Fire Protection (RCFP) program, and are primarily 40-cfm slip-on modules having tank capacities that vary from 100 to 750 gal. Training in the use of CAFS is conducted throughout Texas after the delivery of the cost-shared units and, in addition, annually at the Texas A & M University's Firemen's Training School. The latter involves over 600 firefighters during the week-long school.

Within the TFS, we employ the CAFS with prescribed burns on slopes, near exposures, and in areas where dozers are unnecessary or impractical. The TFS uses direct and indirect attacks with the CAFS units on ground-cover fires. We have standardized our units, which range in tank capacity from 100 to 750 gal and have 20- to 100-cfm compressors. We also have fire extinguishers using compressed air cylinders for their propellent and agitation. A large number of our first-line supervisors have CAFS units in their pickups. We have some fluid injection pumps on CAFS units. These allow us to inject various foaming agents into the discharge line without having to pre-mix the solution. We have held a troubleshooting course for all TFS employees that work with CAFS. We developed and distributed a troubleshooting guide that lists problems and possible solutions.

TFS established a CAFS strike team. An internal committee developed equipment and established training needs and requirements. This team has been to California and Kentucky, as well as Texas. While on the California assignment, we pumped continually for 7

hours without shutting off the nozzle. This was with 1,500 ft of hose in rugged terrain during mop-up of a line that had been lost for 3 days consecutively prior to our arrival. Enough back-pressure developed in the hose that, when we shut down our engine three times to refuel, pressure was never lost at the nozzle during the downtime. During the mop-up, we were using nozzle tips that allowed us to operate in an "expanded wet water" mode and deliver only 4.5 gpm. As we would come along the line to a tree that was involved in fire and needed felling, we would remove the nozzle tip, go into a foam application, and coat the base of the tree up to a level of about 6 ft. This would allow the felling crew to cut the tree and be shielded from the heat and sparks.

My desire was to develop a low-cost, similar consistency, and readily available foaming agent. We started experimenting with dish soaps at Texas A & M University. Working with the Oil and Hazardous Materials Training Division, we made applications with various agents, timed product delivery, calculated percentages, made costs comparisons, etc. At my fire department in Pittsburg, TX, we made various application tests and documented actual experiences. These consisted of ground cover, structure, hydrocarbon, exposure protection, bulk storage facilities, transport trucks, "wet water," foam, and "expanded wet water." In addition, we also experimented with various foaming agents.

We developed an attic fire application. We also discovered that smoke was being trapped in the foam bubbles, thus dissipating the smoke over a period of several hours. This held down smoke volume and, likewise, damage. We have developed a "blitz attack" using water and foam on structures. We have made film documentaries of structure attack procedures. These include: "flash-over" and "back-draft;" one-room, two-room, one-room and attic, two-rooms and attic, and full attic; one-line and two-line. As a result of our testing, we can produce foam at less than 0.2 percent concentrate and charge a 250-gal tank at a cost of approximately $1.50.

We have just returned from Mexico where we provided training and demonstrated applications of a CAFS unit on loan from the TFS. We worked with fire crews unfamiliar with any firefighting methods other than with hand tools. The forest service of the Republic of Mexico has no fire trucks and only has a few sections of brand new hose—these were still banded with straps when we arrived. We observed the crews having their first experience holding, unrolling, and coupling hoses. We actually made a hose lay and pumped foam through "all of the hose in the Mexican forest service." I provided instruction in basic ground-cover fire tactics, as well as application of foam and wet water and how to troubleshoot the system.

**Needed Future Efforts**

In Texas, the State Insurance Board sets standards for fire apparatus. At present, no CAFS is recognized, regardless of volume delivery. In addition, neither the NWCG Fireline Handbook nor manuals for the Incident Command System (ICS), a subsystem of the National Interagency Incident Management System (NIMS), recognize CAFS or foam volume output. Everything is measured in gpm capacity. Most of the CAFS units in Texas don't even fall in the lowest category of water units and yet will out perform them. These ratings must change.

I worry about developing standards for equipment and training. For example, in this meeting you have seen many types of CAFS or foam systems and yet everyone stresses proper and adequate training. If we don't develop a standard type of unit, it will be impossible to establish training that is universal. We can't tell a department or agency that they can use their CAFS unit on certain fire applications if their unit doesn't have the same capability as the units tested. Troubleshooting will become a nightmare, with the various possibilities of configurations. At present, a great deal of our troubleshooting in Texas can be handled over the telephone because of the similarity of the units. Our training packages can be consistent throughout Texas.

Another goal is to continue to seek low-cost foaming agents that can be used on a variety of fire types. This is the only way that foam use will be accepted universally. High dollar agents are what has held the use of foam from displaying its potential as being superior over water.

Another fear of mine is the notion that CAFS units MUST be used to deliver just foam. In my part of Texas the foam, even a wet foam, will not penetrate some of our vegetation. I have pioneered the use of a nozzle tip

to cause restriction on the line and make a wet-water instead of foam in certain instances. I believe that we should get the maximum out of the CAFS unit and the "expanded wet water" is just one of its many talents. Pumping time can be tripled over a wet foam and have a far superior penetration, and to go into a foam delivery is as simple as removing the nozzle tip. We have extinguished fires in round bales of hay with this method. Foam alone would not have; at least not without delivering three times the amount of water. All the components of CAFS are necessary to make "expanded wet water" and so it is not taking away from the unit. It is difficult to encourage the use of it in this manner to some of the "die-hard true-foam applicators;" however, this further restricts its potential.

For further information, contact the author at Texas Forest Service, P.O. Box 1000, Pittsburg, TX 75686; 214/856-7181.

## WATERBOMBERS USE FOAM IN BRITISH COLUMBIA

*by Tom Irving, Forest Industries Flying Tankers Ltd., Port Alberni, B.C. Canada*

Forest Industries Flying Tankers (FIFT) is a very small company operating very big airtankers. Since 1960, FIFT has been flying two Martin Mars tankers in a waterbombing role on the coastal mainland of British Columbia and Vancouver Island. Each of the Mars, which were built for the U.S. Navy between 1946 and 1949, have a payload of 60,000 lb or 7,200 U.S. gal and, because they are scooper aircraft and water sources are plentiful, they routinely deliver their 7,200 gal payloads every 10 to 20 min, depending on the distance of the fire from the water source. The aircraft are owned by a consortium of large, integrated forest products companies—MacMillan Bloedel Ltd., British Columbia Forest Products Ltd., and CIP Forest Products Inc. The primary role of FIFT is to provide forest fire detection and suppression services to the owning corporations. FIFT has successfully fulfilled its role for almost 30 years using the two Mars tankers supplemented with helicopters strategically located throughout the area of responsibility.

Prior to 1985, the Mars dropped only fresh water, sea water, or fresh water treated with a gelling agent to give the load a slurry effect. The company helicopters were dropping foam from their buckets in 1985 and it was decided to carry out fixed-wing trials dropping foam from the Mars aircraft. In July 1986, the first test drop from a Mars using a foam additive was made with spectacular results. A quantity of 72 gal of foam concentrate was added to the 7,200 gal water load to produce a 1-percent solution, which was then dropped from 150 ft above ground level in calm winds. The drop pattern covered 4.5 acres, with depths ranging from 1 inch at the outer extremities to 8 inches over most of the pattern. Several other tests were carried out in 1986, using varying solution strengths with inconclusive results, before it was determined that the manufacturer's recommended 0.7-percent solution strength should be observed.

During the early stages of the 1987 fire season, several operational foam drops were made with outstanding results, and it was decided to install permanent injection systems on both Mars. Attempts to evaluate and quantify the foam drops throughout the fire season were less than successful because of the many variables that affect the quality and characteristics of the foam. For example, it was found that very slight variations in airspeed, altitude, and wind could have a dramatic effect on the end project. Difficulty was experienced in even establishing the correct solution strength to produce best results; 0.7 percent seemed to produce a foam that was too "dry." It was not until the last firefighting effort of the season that the opportunity presented itself for productive evaluations.

One Mars bomber made 27 consecutive foam drops of 7,200 gal each with all variables remaining constant except for the amount of concentrate that was being injected after each water pickup. Throughout the 27 drops, the amount of concentrate was progressively changed; it was finally determined that a 0.4-percent solution produced a foam that gave the most favorable results with respect to wetting characteristics and insulation. Based on these findings, FIFT has entered into the 1988 fire season using a 0.4-percent solution for the first drop as a matter of routine, with any changes to the strength for subsequent drops being dictated by the fire boss.

FIFT plans to carry out additional tests in 1988 to attempt to establish the effects of dropping large quantities of foam on or near people and structures in life-threatening situations. These tests will be somewhat rudimentary and will be conducted only if circumstances allow.

During the 1987 season, the Mars operated on one particularly dangerous "urban/rural interface" wildfire using foam. The results proved without any doubt that the Martin Mars—with their ability to each deliver 7,200 gal of foam every 15 min, is a most valuable and unique tool in forest fire suppression, and it is anticipated that they will continue to operate in the service of their owners for many years to come. For further information, contact Tom Irving, General Manager, Forest Industries Flying Tankers Ltd., R.R. No.3, Port Alberni, B.C., Canada V9Y 7L7; 604/723-6225.

## CANADIAN FORESTRY SERVICE CURRENT RESEARCH WORK

*by Ed Stechishen, Canadian Forestry Service*

The emphasis at present at CFS's Petawawa National Forestry Institute is on conducting a series of laboratory test fires using white spruce and balsom fir slash to determine the superiority of foam relative to water when used to control low-intensity fires. The series of test fires are being conducted in parallel, using slow- and rapid-draining foams in the two fuel complex types to identify the impact of fuel penetration deficiencies and lag time (time between application and fire arrival) on foam effectiveness. Another laboratory activity is determination of the amount of foam that will adhere to a spruce branch—based on the fluidity of the foam and the rate of its breakdown when subjected to a controlled environment.

The need for an evaluation of foam in wildfire situations is recognized by all parties, but commitments to fund and provide the necessary resources are lacking. Token efforts are being made. A pumping unit (Mark III or Briggs-ECO) will be used to suppress fires (controlled burns) of different intensities, with the hope of developing a foam effectiveness scale which will relate to fire intensity and the fire weather indices. Tentative plans call for field evaluations of the CL-215 as a foam delivery system. This includes on-the-ground assessment of the foam's ability to control the spread of fire.

The Canadair injection system has been evaluated and recommendations concerning the "Picolo tube" injector have been made. The recommended changes attempt to maximize the concentrate's dispersion during its entry into the water reservoir. Other injection systems will be calibrated, their efficiency to disperse the concentrate will be assessed, and the prescription for injection settings for given fire situations will be developed. The latter is essential when dealing with canopy interception and a need to get adequate material through the crowns to ground level.

For further information, contact Ed Stechishen, CFS Research Forester, Petawawa National Forestry Institute, Chalk River, Ontario, Canada K0J 1J0; 613/589-2880, ext. 209.

## BRITISH COLUMBIA FOREST SERVICE FOAM USE

*by Bob Read, British Columbia Forest Service*

The British Columbia (B.C.) Forest Service is responsible for forest and range fires; not for structural fires. As interface areas grow around us, we are slowly getting drawn into some structural firefighting, but we are neither trained nor funded to do this. We rely mainly on volunteer and municipal fire departments for structural fires. Thus, our immediate interest in foam is primarily for the forest environment.

Most years there is considerable fire throughout B.C., be it wildfire or prescribed fire. In 1987, wildfire consumed 35,000 hectares (ha), while our prescribed fires were carried out on 155,000 ha. That's 190,000 ha or, in the U.S., 475,000 acres (English units). This is a lot of area on which to increase our efficiency, and foam is certainly one more tool to use towards this end.

In the early 1980's, foam was experimented with on a very small basis. During the severe 1985 fire season, the B.C. Forest Service started to use firefighting foam on a much larger scale, but without fully understanding its use, or having the capability to cost effectively apply

it. We continued to use the product in 1986 and, although we had a better appreciation of the product, problems— particularly with safety and lack of "any" foam equipment—arose.

To rectify the problem, we obtained information from other provinces and the U.S. on the use and handling of the product. In addition, we have developed, in conjunction with the private sector, some rather inexpensive methods of application. The products in concentrated form are expensive, but, if properly applied, can be cost effective.

During the 1987 season, we carried out our first formal training sessions in foam use. This was done throughout the Province. The first use operationally in B.C., with scooper aircraft, was also seen in 1986. Foam regulators and foam nozzles were used operationally and considerable use was seen with helicopter buckets and belly tanks. On-board injector systems for buckets were developed by the private sector, and these have greatly increased the efficiency of helicopter operations.

In 1988 we have all our contracted, belly tanked, medium helicopters with on-board injector systems. We are testing one Conair Firecat with on-board injectors for straight foam and a foam/retardant mix.

As with any new product or piece of equipment, concrete field data are always hard to get from field users. We have developed a questionnaire which is to be submitted by the field user to better help us evaluate foam and foam equipment. For further information, contact B.A. Read, Fire Management Coordinator, 1011 Fourth Avenue, Prince George Forest Region, British Columbia Forest Service, B.C., Canada V2L 3H9.

## BRITISH COLUMBIA FOAM HEALTH, SAFETY, ENVIRONMENT— WHERE IT'S AT!

*by Bob Read, British Columbia Forest Service*

### Health

All foams used in B.C. must be registered with the B.C. Drug and Poison Information Center. All hospitals are linked to this and, if any immediate concerns arise, a doctor simply calls the Center for an ingredients list. Ministry of Forests and Lands, B.C. Forest Service, has issued a contract for a toxicological review of firefighting foams used in fire suppression as a result of our use in some domestic watersheds. The review will cover:

1. Composition by chemical and component levels for currently approved foams.
2. Review of the fate of foam products and their components in air, water, soil, and biota; the hazards of their degradation and metabolic by-products; and an evaluation of exposure potentials for these media.
3. Conduct a toxicological evaluation of the products and chemical constituents. The evaluation will include a review and discussion of animal studies and species and human data for:

   a. Tera togenicity (i.e., birth defects in the unborn).

   b. Mutagenicity (inducing genetic change to organisms through reproduction).

   c. Carcinogenicity (cancer causing); discuss the carcinogenic risk from human exposure.

4. Draft a media summary for the foam product that will provide pertinent information to a nonexpert when fielding questions about the use of the product from the public.

### Safety

Since our Province-wide training, this has become more manageable. We had pressure from the Workers Compensation Board to address this, and basically it is following the manufacturers' instructions for safety. We also supply all our users with a medicated skin cream, which has helped skin problems tremendously.

As an example of safety problems, we had people drinking the foam mixture from hand tank pumps, which we now mark as having foam in them. We also had cases of people using a hand tank pump with foam in it to wash out foreign objects caught in their eye. Crazy, yes—but that's what you get with the human element.

### Environment

To date, these are the guidelines we follow:

1. Mixing sites are safeguarded to facilitate containment and rapid cleanup of concentrate spills.

2. We ensure pumps and ground tanker loading units are equipped with back check valves to avoid siphoning of mixing materials back into the water source. An additional caution needed (as we have recently discovered) is to ensure that regulators are turned off when pump is not running.

3. Avoid the use of foam near domestic water sources. Use dip tanks wherever possible.

4. Ensure a foam-free buffer along water courses. Avoid application on rock surfaces near streams.

5. Use dip tanks for all helicopter applications, particularly near populated areas and domestic watersheds.

## CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION HELICOPTER FOAM SYSTEM

*by Art Trask, California Department of Forestry & Fire Protection*

To evaluate the effectiveness of helicopter-dropped foam/water, as compared to plain water, the California Department of Forestry and Fire Protection (CDF) equipped two UH-1F helicopters with foam injection systems. The systems are used in conjunction with the 324-gal "Bambi" water bucket (S.E.I. model No. 2732).

### Results

During the 1987 fire season, the two helicopters (Vina and Bieber) dropped approximately 600,000 gal of foam. In addition, several commercial "call when needed" helicopters dropped similar amounts of foam. While the effectiveness of foam has been reasonably well documented in other publications and articles, the following summarizes CDF experience:

1. Foam can be up to three times more effective than water, particularly during mop-up operations.

2. Except for unusual situations (such as protecting the roof of a structure where "actual foam" may be desired), the ratio of foam concentrate to water was gradually reduced—with no apparent loss in effectiveness.

3. Corrosion (particularly in the helicopters' tailboom area, which contains magnesium) is a concern. CDF protocols covering the use of foam require a thorough water rinse at the conclusion of each day's flight activity. In some cases, the crew reported spillage/leakage of foam concentrate solution from the externally mounted tank and pump area. Rotorwash then spread the solution along the tailboom. An extensive postseason inspection of both helicopters, including removal of the tailboom, revealed no evidence of corrosion. The department will, however, closely monitor for any sign of corrosion side effects.

### System Design

The foam system is of simple design and consists of:

- Externally mounted, 15-gal storage tank attached to the left side hard points. Some operators have elected to mount the tank internally; however, we did not want to compromise crew/cabin space and, therefore, mounted the tank externally.
- 28-volt pump (Shurflo model 2173, or equivalent).
- Anti-siphon, 28-volt shut-off solenoid (may not be required, depending on type of pump used).
- 28-volt relay.
- Control panel/timer unit mounted on instrument pedestal.
- Sufficient 5/8-in garden hose to run down shroud lines and into "Bambi" bucket, approximately 1 ft below water level.
- Slip joint hose fitting for emergency breakaway.

### Operation

Just as in the design, operation of the system is equally simple. Once the bucket is full and clear of the water source, the pilot activates the foam unit by pushing a button on the control panel which starts the pump sequence. Since the operating duration of the pump determines the mixture ratio, a timer unit that can be adjusted by the pilot has been built into the control head. Mixture adjustments are made in "seconds" of pump operation.

To ensure thorough mixing, some commercial operators are using a circulation pump mounted in the Bambi bucket (similar to an electric trolling motor used for fishing). CDF experience, however, has shown the water/foam mixes very well, even without a circulation pump. A factor which helps in mixing is the flexing action and drop mechanism of the Bambi bucket.

### Problems

Overall, the systems worked very well. One relay failed and required replacement. The anti-siphon solenoids were added to prevent static "run through" of the pump. Until these solenoids were added, excessive foam was consumed, and there was increased foam residue left on the surface of the pond when the bucket was filled.

### Foam Component Sources

1. Crew Concept, Boise, ID, 208/344-4691.
2. Egor Fire Systems, Redding, CA, 916/223-3598.
3. Most recreational vehicle parts stores.

### Current Activity

Due to the program's success, the department is in the process of equipping the remaining UH-1F fleet. For further information, contact Art Trask, CDF Aviation Management, Helicopter Program, P.O. Box 944246, Sacramento, CA 94244-2460; 916/323-0245.

## OVERVIEW—JUNE 1988 INTERNATIONAL WORKSHOP ON FOAM APPLICATIONS

*by Doc Smith, USDA Forest Service*

The NWCG Foam Task Group and the Petawawa National Forestry Institute of Canada held an International Workshop on Foam Applications in Denver, CO, June 6-10, 1988. This Workshop was designed to bring together some of the people most knowledgeable about foam, its action, and its chemistry and applications. The Workshop was intentionally limited and, in some cases (through ignorance or oversight), failed to include some who should have attended. The Workshop was a resounding success in developing the concerns of many individuals, agencies, and nations. The Workshop assembled into six groups to develop issues and recommendations—many of which had some overlap. The following is a brief glance at the results of the International Workshop taken from its "Proceedings of the Foam Applications for Wildland and Urban Fire Management:"

I. Policy and Organization Group: **Issue 1.**—There is a need for each of the cooperating agencies to develop a policy statement on foams as technology advances. **Issue 2.**—The USDA Forest Service can benefit by making its position clear on the use of foam. (This has been accomplished through a letter to the field.) **Issue 3.**—There is a need for central management/coordination in foam programs. (The FEWT and the CCFFM have asked the Foam Task Group to continue in this effort.)

II. Chemical Performance Characteristics Group: **Task 1.**—Develop fire performance tests to quantify foam performance for direct attack, indirect attack, mop-up, and vertical fuels. **Task 2.**—Provide guidance to manufacturers and users on the properties of foam that are important in fire control. **Task 3.**— Incorporate corrosion, mammalian toxicity, biodegradability, density, and flash point/flammability—as applicable—into standards and requirements. **Task 4.**— Provide information users need to use foam correctly. **Task 5.**— Generate environmental test data as appropriate.

III. Equipment Development Group: **Task 1.**—Develop an effective foam proportional injector system suitable for both CAFS units and portable pumps. **Task 2.**—Evaluate currently available nozzles. **Task 3.**—Develop a type 4 (ICS, Incident Command System), 200-gal capacity, 40-cfm CAFS lightweight engine. **Task 4.**—Provide a resource center and foster networking. **Task 5.**—Encourage equipment development conferences.

IV. Air Application Group: **Issue 1.**—Determine application rates and techniques for pilots. **Issue 2.**—Promote information and personnel exchanges. **Issue 3.**— Conduct cost effectiveness studies for foam options.

V. Ground Application Group: This group made a number of comments and suggestions on training needs, operational guides, operations, techniques, vehicles, and use with hazardous materials.

VI. Training, Information, Education Group: **Issue 1.**—Identify training needs, gather current curricula, provide interim guides. **Issue 2.**—Develop formal training packages. **Issue 3.**—Each wildland fire agency develop policy on structural protection and guides for firefighters, both inside and outside of structures. **Issue 4.**—Coordinate workshops and seminars; share information. **Issue 5.**—Use a variety of techniques to advance public education. **Issue 6.**— Increase the Foam Task Group to include structural, fire training, and hazardous materials representation.

## U.S. DEPARTMENT OF COMMERCE NATIONAL BUREAU OF STANDARDS FOAM RESEARCH

*by Dan Madrzykowski, U.S. Dept. of Commerce National Bureau of Standards*


### Abstract

A report, "Study of the Ignition Inhibiting Properties of Compressed Air Foam," describes an initial step to quantify the effectiveness of water-based compressed air foam (CAF) generated using a synthetic hydrocarbon-based surfactant. Two series of tests were conducted with the synthetic hydrocarbon- based surfactant CAF—ignition retardation and wetting tests. The ignition-inhibiting capability of the foam was twice that of water when protecting a T1-11 plywood surface irradiated at 1.5 W/cm$^2$ from an external source. The wetting test, conducted on T1-11 plywood siding, exhibited an initial application efficiency for the foam of approximately 20 times the efficiency of water. Further study is recommended to generalize the results of these tests and to quantify the extinguishing capabilities of the CAF relative to water.


For further information, contact the author at the U.S. Department of Commerce National Bureau of Standards, Center for Fire Research, Gaithersburg, MD 20899.

## USDA FOREST SERVICE ENCOURAGES FOAM USE

*by L. A. Amicarella and Bill Shenk, USDA Forest Service*

At the International Foam Workshop held in Denver, CO, June 1988, it became apparent that many field units are still uncertain whether or not foams are approved for use on fire activity this year. Please refer to USDA Forest Service 5160 letters of February 10 and 23, 1988, which discuss foams and approved retardants.

Four foams are approved for use in all equipment except fixed-wing air tankers and helicopters with fixed tanks. Fire-Trol FireFoam 103 by Chemonics Industries; Forexpan by Angus Fire Armour Corp.; Phos-Chex WD861 by Monsanto Co.; and Silv-ex by Ansul/ Wormald are the foams that have been tested, approved, and are receiving field evaluation. [Editor's note: These tradenames, in some cases, were presented in a slightly different manner in previous editions of this publication; they are believed to be correctly spelled out here.]

If your units have the opportunity to use these products, we would appreciate receiving the field evaluation forms as outlined in our February 10, 1988, letter. The use of these products has been sanctioned for a considerable time. Please notify all field units and cooperators of this condition.

Further information may be obtained from the authors, USDA Forest Service, Director, Fire and Aviation Management, P.O. Box 96090, Washington, DC 20090-6090; 703/235-8039; DG, FIRE:W01B.

### SUGGESTED READING

The Foam Task Group compiled a list of over 30 references that contain valuable information on the world of fire foams. So far in Volume 1 of this publication 21 such documents have been listed (10 in No. 1 and 11 in No. 2). The following is the remainder of the articles, papers, and reports on foam technology for your suggested reading:

1. Anonymous. New liquid foam to fight forest fires in France. Fire Intl.p. 81; 1972.

2. Aubert, J. H., Kraynik, A. M., and Rand, P. B. Aqueous foams. Scientifi Amer. (5):74; 1986.

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4. Insurance Services Office. Fire suppression rating schedule. New York: Insur. Serv. Off.; 1980.

5. Lorberbaum, V. G., and Smirnova, K. V. The application of high intensity foam in fighting forest fires. In: Bull. 19, Forest fires and the technical means of combatting them. Lenin grad, USSR: Leningrad Sci. Res. Inst. of For.; 1974.

6. Lorberbaum, V. G., and Smirnova, K. V. Foam for forest fire control. Lesnoe Khozyaistvo (6): 74-75; 1972. [Edited Engl. transl. avail. from Library Environment, Canada.]

7. McKinnon, G., ed. Foam extinguishing agents and systems. 15th ed. Sect. 18, chptr. 4. Quincy, MA: Natl. Fire Protect. Assoc.; 1981.

8. Metzner, A. B., and Brown, L. F. Mass transfer in foams. Indstrl. & Engrg. Chem. 48(11): 2040-2045; 1956.

9. National Fire Protection Association. Mobile foam apparatus. Quincy, MA: NFPA; 1986.

10. Rivkind, L. E., and Myerson, I. Foams for industrial fire protection. Indstrl. & Engrg. Chem. 48(11): 2017-2020; 1956.



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