

A Publication of the
**National Wildfire
Coordinating Group**

Sponsored by
United States
Department of Agriculture

United States
Department of Interior

National Association of
State Foresters

In Cooperation with
Petawawa National
Forestry Institute
Forestry Canada/
Forêts Canada

Volume 4, No. 2 1992

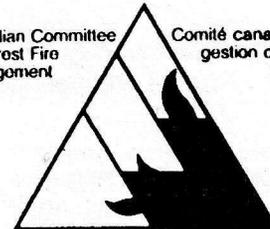
FOAM APPLICATIONS FOR WILDLAND & URBAN FIRE MANAGEMENT

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



Canadian Committee
on Forest Fire
Management

Comité canadien de
gestion des feux
de forêt



FOAM ENGINE GROUP "READY TO ROLL"

By Merrill Tester, BLM, Fire Management
Staff, Roseburg District Office, BLM Oregon
and Robert Cunningham, USFS, Fire
Management Officer, Diamond Lake Ranger
Station District, Umpqua National Forest

Reprinted from FIRE QUIP

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A new program in Oregon could become a model of interagency cooperation throughout the wildfire suppression community. With the goal of more efficient use of resources, two federal agencies have pooled Type-3 compressed air foam system (CAFS) engines into a group ready to roll within two hours of a fire order.

The recently-formed Western Oregon Interagency Foam Group (WOIFG) is comprised of engines from four BLM Districts and the Umpqua National Forest.

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Tactically, the WOIFG will provide a powerful resource for incidents involving wildland-urban interface and/or incidents that require a high level of CAFS engine fire power. The heavy engines are capable of delivering massive quantities of compressed air foam in a running attack or a static mode. These engines are especially effective in holding actions during critical burnout or backfiring operations.

As with any "new endeavor," the WOIFG is laying down the organizational foundation from which it will operate. A six-member management team is responsible for the group's guidance and direction. The members are totally committed to the concept of heavy CAFS in support of extended attack and other critical suppression operations.

This is to be carried out in the most cost-effective and professional manner possible. The group is building the program around the key elements of rapid response, strong leadership, and tactical proficiency.

In addition, an equipment support element will accompany the foam group. This comprises two Type-2 water tenders, and one mechanic support truck staffed by a qualified mechanic. These resources come from BLM and Forest Service units.

Both the tactical and support elements of the group will arrive at an incident staffed for round-the-clock operations and equipped for 48 hours of firefighting without any logistical support. Four engines and one water tender are the required minimum to form and dispatch the group.

The CAFS engines are equipped with high-volume foam compressors, and are capable of running attacks using water monitors. The group will always be dispatched with at least one qualified Water-handling Specialist to enhance flexibility and capability.

The group supervisor is a qualified Division/Group Supervisor. Two task force leaders are also dispatched, one with the tactical element and one with the support element.

The WOIFG is available for order through the Northwest Coordinating Center (NCC) in Portland. The NCC requests the group through the Roseburg BLM district dispatcher. The dispatcher maintains a "T-card" display which shows the readiness and availability of the group at all times. This will be determined by networking with the dispatchers of participating units.

During dispatch actions, one member of the group's management team will have oversight responsibility.

However, specific information will be provided to all of those being called. This includes:

Rally point — The meeting point for all group resources. This will be as close to the incident as possible.

Radio frequency — usually one of three BLM National Scene of Action frequencies, in a specified order.

Administrative information — fire number and location; resource order number; names of overhead; any pertinent facts about the fire.

The group has a strong commitment to rapid response. The target get-away for the group components is two hours, and every reasonable effort will be made to arrive at the rally point and the incident within the designated ETA. The group supervisor will proceed directly to the incident. The task force leaders will be responsible for getting the group to the incident from the rally point.

Please feel free to contact members of the Group Management team for further information or details.

Merrill Tester (co-leader), fire management staff, BLM Roseburg D.O.; FTS 390-8300, 503-672-4491.

Robert Cunningham (co-leader), district fire management officer, Diamond Lake Ranger District, Umpqua National Forest; 503-672-5469.

Larry Matthews, fire management staff, BLM Coos Bay D.O.; FTS 422-9214, 503-756-0100.

Wes Hunter, fire management staff, BLM Eugene D.O.; FTS 430-6408, 503-683-6200.

Gene Rogers (Park Service Liaison), fire management officer, Crater Lake National Park; FTS 421-2000, 503-594-2211.

Mike Dietrich, fire management staff, BLM Salem D.O.; FTS 392-5691, 503-375-5691.—FQ

Engine group pumps foam, lots of it ...

Each of the Type-3 CAFS engines in WIFG have water-flow capabilities of 200 gallons per minute (gpm) at 150 pounds per square inch (psi) of pressure. The jurisdictions involved and their engines are:

Coos Bay D.O. — 3,500 gal. tank; 125 cubic feet per minute (cfm) CAFS.

Eugene D.O. — 2,000 gal. tank; 125 cfm CAFS.

Roseburg D.O. — 1,600 gal. tank; 125 cfm CAFS.

Salem D.O. — 1,600 gal. tank; 50 cfm CAFS.

Umpqua N.F. — Model-80 standard engine with a 1,000 gallon tank; 225 gpm pump.

BLM Oregon has an extensive prescribed burn program, hence the number and size of engines.

BOHEMIA MILL FIRES, A REPORT

*by Dan Collins, Fire Captain,
California Dept. of Forestry*

Date: 5/27/91

Location: Bohemia Mill, 1445 Hwy 65

Type of fire: Hog Fuel

Time Out 1330

Weather: Wind W. 10 to 15 mph

Time 1315, First units on scene report ten acres of hog-fuel piles, with two acres fully involved.

1316 Received call: Wind direction NW. 10 to 15 mph.

1316 Received a call from Grass Valley ECC Capt. Reina to put the Washington Ridge foam cache on stand by for a possible dispatch.

1330 Capt. Reina dispatches E-2380 and Washington Ridge foam cache to Bohemia Mill in Lincoln, CA. Unit 2781 Capt. Collins and two wards responding, Capt. Brown also responding.

1435 Arrive at the scene, Capt. Collins with foam cache, check in with battalion 2312, Chief Clarebut, who had assumed Bohemia Opps., Chief Silva I.C. and Chief Clarebut had established a command post on the South end of the incident. Instructions for the Class A Cache were to go to the north end of the incident and set up proportioners to protect exposures on the east side. It should be noted that strong winds were causing piles next to the involved piles to ignite upon our arrival.

Foam was injected to the downstream side of the Lincoln City Engine by the use of a Flameco Model #500 at the rate of .4 tenths of one percent. This unit supplied two 1 1/2-inch attack lines with conventional Akron 95-gpm nozzles. The firefighters were unfamiliar with foam application, but were quick to pick up its tactical use. Also within little time they had picked up a 1/2-acre grass and brush fire.

Our North Eastern team of firefighters now put their efforts to good use by beginning extinguishment of their side of this incident. This writer found another engine and tied a Chemonics Educator to it and began pretreatment of the adjoining piles.

While all this was going on, Capt. Gary Sweet was sending his engine company up the north side of the incident using its natural air aspirated Akron tip to extinguish the existing fire to the south.

Shortly after 1448 hours Grass Valley ECC advised of a second incident. Incident Commander taking a look at what progress was being made immediately released the additional responding type-one strike team to the new wildland incident now threatening dwellings. At 1700 hours the incident was turned over to mill staff with all apparatus returning to their respective departments.

Conclusion: Through the use of Class A Foam on this incident dollar loss, total time out, and equipment needs were greatly reduced. The additional need for training in the area of foam and foam typing has been identified and will be addressed this fall.

All mill staff, firefighters, and the city fathers were extremely impressed with Class A Foam. Lincoln Chief Sam Silva will pursue purchase and use of Class A Foam for his department.

Date: 9/29/91

Location: Bohemia Mill, 1445 Hwy 65

Type of fire: Bark Pile

Incident # 6817 Fire # 10,107

Time Out 1222

Weather Wind W. 10 mph Hum 12% temp 94%

At 1212 hours Lincoln City Fire Department received a call of a chip fire at Bohemia Mill.

Upon arrival 1220 Chief 1701 requests foam unit from Washington Ridge and engine 2380 with its foam monitor. Two minutes later Chief 1701 requested water tenders from companies 34 and 35.

With the added wind and after sizing up the exposures (1 log deck and numerous saw dust piles) Lincoln City Chief 1701 requested one strike team of type-1 engines from local government.

Shortly after 1235 the IC requested a helicopter with a bucket to protect the adjoining log deck until the arrival of engine 2380 and the foam cache.

ECC Captain Rienna asked for a report on conditions and gave the IC a report on what was coming at 1252.

Chief 1701, Sam Silva's report was brief, "We have a large pile of chips endangering a large deck".

At 1318 CDF Battalion Chief Tony Clarebut arrived at the scene and assumed command of Bohemia operations. Chief Clarebut's familiarity with Class A foam sized up the incident with Lincoln City Chief Sam Silva. Copter 203, a UH-1 equipped with a 300-gallon "Bambi" bucket but no foam, was used to protect exposures until the arrival of engine 2380 and the foam cache.

At 1304 engine 2380 arrived. Capt. Bernie Paul sized up the incident and spotted his apparatus. Roseville City engine 81, a 1,500 gallon-per-minute Pierce, laid a 5-inch supply line 750 feet from the Mill proper to a 3-inch supply line which was laid from 2380.

At this time, Roseville City engine 81 began supply operation, while engine 2380 began a monitor treatment of the burning chip pile.

To expedite operation, a 1 1/2-inch attack line, and two 1-inch booster lines were pressed into service to assist the monitor.

At 1434 the strike team from local government and all equipment except Roseville engine 81, CDF engine 2380, and the Washington Ridge Foam Cache were released.

Two hours later, the remaining three units were released and the Mill was turned back to the foreman, Greg Cantrell.

Chip pile: \$160,000
Adjoining log deck: \$150,000
Total log deck: \$6 million
Cost of foam used: 40 gallons of concentrate \$329.20
Percent of foam on engine 0.4%

Conclusion: Again Class A foam and monitor application has paid for itself with increased safety and decreased engine commitment time. In the past we have witnessed fire apparatus tied up on this type of incident for days as compared to hours as in this case. Note: foam penetrations 4 to 5 feet were observed.

For additional information, please contact Captain Dan Collins, CDF, Washington Ridge Conservation Camp, 11425 Conservation Camp Rd., Nevada City, CA 95959, 916-265-7855.

WHAT IS THE COMPRESSED AIR FOAM SYSTEM?

*By: Ron Rochna and Paul Schlobohm,
USDI, Bureau of Land Management, BIFC*

Have you been wondering what is meant by the phrase, "Compressed Air Foam System or CAFS?" Does it generate some sort of magical fire extinguishing foam? Is there truth to the claims that it's 10 times more effective than plain water? We will try to answer these and other questions in order to provide an understanding of compressed air foam mechanics and to separate some truth from fallacy about performance.

1. What Is A Compressed Air Foam System?

In the simplest terms, it is a standard water pumping system that has an entry point where compressed air can be added to a foam solution to generate a foam.

A brief history is necessary to crack the mystique the compressed air foam system, or CAFS, has acquired. CAFS is old technology. The Royal Engineering Handbook (Provisional) on the Use of Foam Fire-Fighting Equipment of 1941 describes in detail a compressed air foam system used to combat fires on floating bridges.

The U.S. Navy explored the concept in 1947. By using an air compressor that produced the same pressure (static) as that of the water pump, the Navy found that two agents, foam solution and air, would readily merge at the mix point. An infinitely variable foam generating system was created that could make a small bubbled foam with a full range of consistencies, from shaving cream to melted ice cream. The consistency was easily changed by adjusting the air to solution ratio.

It is critical that pressures at static be equal or slightly higher on the foam solution side. If there is a difference in static pressure when the discharge valves or nozzles are shut off, the agent with the higher pressure will dominate. If the air is at a higher pressure it will override the water.

The greater the difference in pressure the greater the volume of air stored for release through the discharge valve when it is opened. The last thing a firefighter wants to do is discharge a large volume of air while fighting a compartment fire! This concept was dropped as too complex in the forties. Today, equal static pressure combinations should be a basic function of any CAFS unit.

During the 1960's, the car wash industry adopted a method for maximizing the effectiveness of detergent-laden water for cleaning autos and trucks. You've seen them: "The Jiffy Do-it-Yourself Car Wash." You put several quarters in the slot, select "Wash, Rinse, Wax, or Foam Brush." Yes, this is a compressed air foam system running at low pressure through a small diameter line where the foam oozes through the brush fibers. The same principle applies to the truck washers with the hand held straight tipped wand which projects a stream of foam 40 feet using 4 gallons per minute (gpm) of solution and 4 cubic feet per minute (cfm) of air.

The Texas Forest Service reintroduced the concept of compressed air foam to the fire service in 1972 as the "Texas Snow Job," the "Water Expansion System" (WES), and the "Water Expansion Pump System" (WEPS). The concept was promoted as a water saving or water expansion device. You could convert 250 gallons of foam solution into 2500 gallons of a water-based product for extinguishing fire. These systems were simple and inexpensive with water flows of 20 to 30 gpm. Many of these systems are still in use in Texas today.

In the mid-1980's, the Bureau of Land Management and the USDA Forest Service increased the pumping scale on the Texas system by adding a reciprocating air compressor to a standard heavy fire engine, with a centrifugal water pump. This enabled the engine to maintain its water pumping capabilities and the air compressor to augment the fire stream reach. A larger variety of applications became available to meet objectives of any given incident.

Current technology advances reflect a competitive industry that believes compressed air foam systems are part of future standards. Engineering is replacing marketing. CAFS is no longer being validated with equipment designed for other uses. Components such as rotary screw air compressors, auxiliary and hydraulic power plants, water pumps, and motionless mixers are matched to the task.

2. Is CAFS More Effective Than Other Foam Generating Systems?

Yes. With CAFS you can control and vary the volume of foam solution and compressed air at will. This flexibility permits structuring foams of varying densities and drain rates for various incidents (hazardous materials, structure, wildland, etc.). The air compressor also provides energy which, gallon for gallon, propels compressed air foam farther than aspirated or standard water nozzles.

3. Why Is There Such An Interest In CAFS?

The interest is high for several reasons. First, the system's versatility and success as a fire suppression tool are dramatic. In an age of shrinking budgets and increasing fire hazards, efficiency is vital.

Second, the system is not well understood. The fire equipment industry is promoting the concept to cash in on a naive market. CAFS is a technology learned at the nozzle, not at the video tape player. An investment in CAFS education will prevent a bad investment in equipment.

4. What Should Be The Criteria In Selecting a CAFS?

What is the minimum water flow you are willing to accept? Select your equipment based on your water flow requirements. Personal safety and success on the incident are dependent on water flow. CAFS requires a foaming agent to permit the entrapment of air in the foam solution. Without a foaming agent the air and water will separate causing slug flow and eliminating foam discharge. If the air compressor should go down, you will need to increase water flow to maintain discharge. The fire stream should be enhanced by the air compressor, not be dependent upon it.

Are the components (air compressor, water pump, and drive scheme) of the system endorsed and warranted by their manufacturer for application on a compressed air foam system? It is recommended that the CAFS be equipped with a centrifugal rather than a positive displacement water pump. The air compressor should be an industrial rated, modulating, continuous duty type rotary screw (or equivalent).

Make sure that the drive system can provide the needed hp to run both the water pump and the air compressor at the desired flows and pressure. A 25-hp system at sea level will not have the same hp at 7000 feet. A gas engine loses 1% to 3% of its power for each 1000 feet of elevation increase. If you operate a CAFS that requires 40 horsepower at sea level with just enough horsepower, at 5000 feet there will not be sufficient power to run the system.

Compressing air requires a tremendous amount of energy. It takes one brake hp to compress four cubic feet of air to 100 psi. To find required size of a small gas engine multiply the required hp by 1.7. A 10 brake hp air compressor (40 cfm) requires a 17 hp engine.

The air compressor system should have a pressure balancing valve. This valve, located on the control panel, permits the automatic balancing of air to water pressure, or, if the operator wishes, the valve will establish the air pressure manually. CAFS that are equipped with this valve allows the operation of the fire system without first manually matching air and water pressures. It does it automatically. Just turn on the system and open the discharge.

5. Does CAFS Increase The Volume of Water In My Tank?

NO! The foaming agent does make the water more effective and the structure of the foam generated appears to be superior for some applications, but compressed air foam does not miraculously create more water. If you have a 200-gallon water supply and a CAFS producing a 10 to 1 expansion ratio, you will generate 2000 gallons of foam. The volume of water is still only 200 gallons.

6. What Are The Advantages Of A CAFS?

The system produces an infinitely variable array of foam types. This is accomplished by changing the volume of air to water. Instant flexibility enables you to tailor the foam to suit the mission such as a dry foam (shaving cream) for vapor suppression, a wet foam (froth) for optimum heat absorption and extinguishment, or anything in between.

The energy provided by the air compressor gives compressed air foam systems greater discharge distance per gallon of water flowed than other foam generating devices.

Hose lines will float.

The air compressor can be used separately to run any type of pneumatic tool. The air can be delivered many thousands of feet through any type of fire hose at pressures less than 150 psi.

The system cannot water-hammer. CAFS foam is compressible. Energy can be stored in stand pipes and hoses, to be used like a fire extinguisher when needed.

CAFS foam can be pumped about twice as high as plain water at the same pressure. The compressed air foam system pumps foam through the hose to the nozzle. Foam-filled hose is significantly lighter than hose filled with water. For example, a 1 1/2-inch cotton jacket, rubber-lined hose filled with 10 to 1 expansion foam weighs less than half the weight of a 1-inch hose filled with water.

7. What Are The Disadvantages Of A CAFS?

The large amount of energy stored in the hose by the air compressor is "hidden" by the light weight of the hose. The initial discharge of compressed air foam can be difficult to control if the nozzle person is unprepared. This is caused by operating pressures being too high. Pressures in excess of 100 psi are needed only for extended hose lays or to impress you at a vendor demonstration.

CAFS is more complex than pumping water alone. Obtaining the appropriate discharge of three inputs (water, air, concentrate) rather than one (for water) or two (for aspirated foam) requires education and training. Maintaining a system with more components requires more expertise and time.

8. What Are The Major Differences Of The CAFS Presently On The Market?

The different systems vary by the type, model, and capability of the components used such as: water pumps, air compressors, relief valves, check valves, drive engine or system, flow gauges, and concentrate injection systems. Remember: the water flow is the most critical requirement.

Questions to ask include: Are the components endorsed by their manufacturer in writing? What type of warranty is included? What is the rating of the water pump? What is the duty life of the system? Some CAFS manufacturers use the least expensive components which may not be suited for your specific application.

Many CAFS lack the proper engineering essential for system reliability, total system performance, ease of operation and maintenance.

Has a problem tree been developed? This is an analysis that identifies a system/component probability of failure. The more complex the system, the greater the chance of a component failure. Component failure is reduced by using high-performance items, which results in lower overall system operating and maintenance costs.

9. What Foaming Agents Will Work With A CAFS?

The compressed air foam system is compatible with all Class A and Class B foaming agents at each product's recommended mix ratio.

10. Are Special Mixers Or Blenders Required To Make CAFS Produce Foam?

No. Compressed air foam can be produced in the hose. Like any foam, compressed air foam needs agitation to combine foam solution with air. Friction from the hose lining and back pressure provide this agitation over several feet of hose. For example, 1 1/2-inch hose should be 100 feet in length to adequately create compressed air foam.

If foam discharge must occur closer to the pump, for example from a monitor, then special mixers can be employed successfully.

11. Is It Possible To Shape Compressed Air Foam Into A Protective Fog Pattern?

Yes. The idea that compressed air foam must flow through an unrestricted valve is false. Compressed air foam is compatible with standard variable pattern nozzles with flow settings above 200 gpm.

12. Is My Proportioner Just As Good As A Compressor Unit?

No. Proportioners are frequently confused with CAFS. Proportioners are devices, like eductors, that add foam concentrate to water creating foam solution. By themselves these devices cannot make compressed air foam or any other foam.

Foam generating devices, such as aspirating nozzles and compressed air foam systems, combine foam solution and air to make bubbles and foam. You will need a proportioner to go with your CAFS.

13. Is There A Simple Way To Demonstrate And Experiment With A CAFS Without Purchasing One?

Yes. Obtain a rotary screw air compressor from your maintenance shop or an equipment rental business. The trailer-mounted ones are most convenient. If you do not have a proportioner, batch mix your water supply. With your own water pump, plumb a CAFS manifold.

Start the air compressor to see at what pressure it is set. Be sure that the outlet valve is closed. Now match water pressure to air pressure. This static setting is the only time you will need to check pressures. Open valves to provide air and water to your manifold or inverted gated wye.

With the nozzle open, allow 40 to 50 gallons per minute of water to pass, then open the air valve.

Be sure that the nozzleman is prepared for the increase in energy due to the air compressor.

The proper air to foam solution mix ratio for most Class A fire situations is one cfm of air to one gpm of foam solution.

14. Does CAFS Require Special Training?

Yes. There are several reasons this technology requires special training.

The complexity of compressed air foam generation, with inputs of water, air, and foam concentrate; the difference in pumping properties between the hydraulics of water and aspirated foam and the combination of hydraulics and pneumatics of CAFS; the variable output capability providing new strategies for fire suppression; and the improved efficiency of water as foam are some of the variables that must be understood.

15. Where Is This Training Offered?

The Bureau of Land Management offers a course on compressed air foam systems and Class A foam use at the Boise Interagency Fire Center in Boise, Idaho. "Class A Foams, Equipment, and Tactics" details the properties of water and foam for fire suppression, examines proportioning and foam generating devices including CAFS, and describes applications and tactics of Class A foam. Applications in natural and structural fuels include direct attack, indirect attack, mop-up/overhaul, and exposure protection. Also the tactical use of foam in the urban interface is included.

Instruction for the two-day course is a combination of lecture and hands-on exercises. The course is scheduled for April 22-23, 1992; and July 14-15, 1992. Tuition is \$125.

Nominations can be sent to Ron Rochna, course coordinator, Bureau of Land Management, Boise Interagency Fire Center, 3905 Vista Avenue, Boise, ID 82795 or 208-389-2432.

Biography: Ron Rochna is the Foam Project Leader at the Boise Interagency Fire Center. He has been studying the use of Class A foams in natural fuel and structure fires since 1983. His specialty is in the areas of foam chemical evaluation, foam equipment development and evaluation with verification through use, and foam education and training. He has been in the fire service for 22 years with 10 years of municipal experience.

Paul Schlobohm works for Ron and has been studying the use of Class A foams since 1985. Paul has a Bachelor of Science degree in Forestry from the University of California, Berkeley. His experience is in quantitative modeling and analysis of foam chemicals and generating systems effectiveness in fire suppression.

FOAM TRAINING IN NEW HAMPSHIRE

*by E. Sven Carlson, Regional Ranger,
New Hampshire Department of Resources
and Economic Development*

With the advent and use of Class A foam becoming a very hot topic throughout the Northeast, the New Hampshire, Division of Forests and Lands, Forest Protection Staff felt it was a timely subject for training for our Forest Fire Wardens, Deputy Wardens and fire departments. See article by E. Sven Carlson, "So You Want To Teach A Foam Class."

A 2-hour lesson plan was developed with assistance from Ron Rochna, Paul Schlobolm and Al Olson of the Boise Interagency Fire Center and Mark Stanford of Texas Forest Service. We scheduled 10 training sessions throughout the state.

Our training program included a lecture on what Class A foam is, NFPA Standard 298, surface tension, a surfactant, drain time, and table top demonstrations. We discussed the different types of foams and their pro's and con's; how to make foam, expansion ratios, safety and delivery systems. We also covered delivery systems and nozzles and included an outdoor demonstration.

After conducting a dry run for our Forest Protection Section staff, we then scheduled our 10 sessions to run from 6:30 p.m. to 8:30 p.m. allowing us to take advantage of daylight for the outdoor demonstrations.

The training sessions were a huge success with a total attendance for the 10 sessions of over 1,200 fire fighters.

We developed a handout book for each fire department in the state. We contacted most of the companies that had something to do with Class A foam concentrate to delivery systems and nozzles for copies of their products and included them in the handbook. We put together 300 handbooks which proved to be very successful.

In July 1991 the New Hampshire Forest Protection Section hosted a 3-day workshop sponsored by the Forest Service, Northeast Area State and Private Section out of Radnor, Pennsylvania.

The instructors for the session were Ron Rochna and Paul Schlobolm from the Boise Interagency Fire Center in Boise, Idaho and Dan McKenzie from the San Dimas Technology and Development Center in San Dimas, California. These instructors were highly knowledgeable with experience in all aspects of Class A foam technology.

The workshop was designed to give fire managers a comprehensive understanding of Class A foam technology with both classroom and practical hands on-use of the equipment. We finished up with a live fire burn in pine slash.

This session was attended by 25 people from the Northeast. Everyone came away with a full understanding of Class A technology.

For additional information, please contact E. Sven Carlson, Regional Ranger, Division of Forests and Lands, P.O. Box 856, Concord, NH 03302-0856.

MINUTES FROM FEWT, FOAM TASK FORCE GROUP MEETING

GRAND RAPIDS MN, OCTOBER 29, 30, 31, 1991.

TUESDAY, 29TH OF OCTOBER 1991

Because of travel delays caused by weather the meeting was called to order by Doc Smith at 1300 hrs.

Welcome by Dennis Gardner of the Minnesota DNR. Around the table introductions:

Doc Smith, Chairman, Forest Service Kiabab, N. F.
Bob Joens, Washington Office, Forest Service
Roger Spaulding, Fish & Wildlife, Boise
Chuck George, IFSL-FS
Gordon Ramsey, Petawawa-Canada
E. Sven Carlson, N.H. Forest Protection
Bob Ross, Minn. DNR
Bill Weaver, CDF
Ron Rochna, BLM, Boise
Paul Schlobohm, BLM, Boise
Del Starner, BLM, Boise
Mark Stanford, Texas Forest Service
Paul Hill, SDTDC, Forest Service
Dennis Gardner, Minn. DNR
Carson Berglund, Minn. DNR

Bob Joens - FEWT Update on projects presently working on.

Budget:

Base Level\$86,000

Everything budgeted except 1 project.

Foam Newsletter
1 NWCG
1 CDF
1 Canada

Foam training video's\$20,000
Computer foam data base.....\$ 2,000
Foam Primer and Foam vs. Fire Publications

Membership:

Discussion reference to Pat Ebarb's position from when he was a state representative from Texas. Mark Stanford, from Texas, will replace Pat Ebarb as a state representative to the committee. Pat Ebarb will still be welcome to attend the meetings or send a representative.

Committee:

Doc Smith, Chairman, USDA Forest Service
Gordon Ramsey, Canada, Forestry Canada
Steve Grimaldie, Canada, British Columbia
Mark Stanford, Texas Forest Service
Bill Weaver, State, CDF
Lee Young, BIA
Ron Rochna, BLM
Paul Schlobohm, BLM

FEWT Advisors:

Bob Joens, Washington DC, U.S. Forest Service
Chuck George, IFSL, FS
Paul Hill, SDTDC, Forest Service
Steve Raybould, SDTDC, USDA Forest Service
Roger Spaulding, F&WS
Del Starner, Cache Committee

Newsletter:

CDF, Bill Weaver will get with Steve Raybould about the next newsletter. Concerns on content, lengthy discussion:

Company or vendors writing articles.

Talked about the disclaimer.

Distribution:

46,500 copies before the last issue.
7,500 copies last issue
54,000 total copies.
Approximate cost per copy \$.62

Discussed distribution in Texas, California and New Hampshire. Success in distribution to fire departments.

Foam Training Videos:

Foam Properties complete. Storyboard done on two more. Paul Schlobohm previewed the new video # 2 "Foam Properties".

Discussion from the FEWT meeting on the # 2 video:

Product endorsement, i.e., Silvex bucket - try to edit out if possible. Add credit for FEWT. Hard copy of the glossary, discussion on instructor guide.

Storyboard done on the following, production ready to start:

- #3 Proportioners.
- #4 Aspirating Nozzles.
- Last 2 videos in the next two years:
- #5 Compressed Air Foam Systems
- #6 Tactics, may be two units

Discussion on listing in NEFS catalog, will talk with Cindy when she arrives. Discussion on the review process of the storyboards and videos, the process is working.

Paul Schlobohm explained the video process:

Paul, Ron and Al Olson meet with Bob Canbridge, production manager and BRAINSTORM. Develop outline. Develop storyboard and review. Edit footage to make the video and review.

Foam Courses:

Rochna talked about the 4-hour class Al Olson has been working on; just about finished and student workbooks are in draft form.

Discussion about the course being an S course:

Procedure to get an S course approved or put out under FEWT. Will check with Cindy about S course approval tomorrow.

Discussion on foam training:

Train the trainer, the trainer should then be able to go back and work with his organization on their equipment, but not be expected to be able to teach a complete course as presented.

Need for qualified and knowledgeable instructor. Complete lesson plans and distribute under NFES # and be put into the catalog by 1992.

Break for supper 1730 hrs. - reconvened the meeting 2000 hrs.

Foam Data Base: Chuck George

Discussion on \$2,000 budget.

CRS - Citation Retrieval System.
DG and/or floppy disk, PC compatible

Will have a person doing abstracts and bibliographies this summer.

Distribution was discussed.

Process is dynamic and needs updating.

Discussion about additional funding.

Update this summer on a disk copy, get it into the PMS system (will talk to Cindy about process) with regular update every 2 to 3 years. Same as the Water Handling Guide. Updates will be handled by the IFSL. Additional Funding as follows:

\$2,000	FEWT
\$2,000	Fish & Wildlife (Roger Spaulding)
\$2,000	SDTDC (Paul Hill)

Chuck George to determine best way of getting project completed.

General Discussion:

Cindy Wolf arrived and will discuss information on the PMS - Publication Management System later.

Discussion on NFPA 298 "Chemicals for Wildland Control." There will be an updating meeting in Montreal, Canada on November 14 & 15, 1991. This committee would work with the NFPA sub-committee on "298" and offer technical assistance to bring everyone together. Where the committee is just starting the review process, Gordon Ramsey will attend to offer our assistance.

Meeting adjourned at 2130 hrs.

WEDNESDAY, 30TH OF OCTOBER 1991 0800 HRS.

Chuck George mentioned the passing away of Lee Northcutt, who was an active member of the original chemicals committee.

Carson Burgland of Minnesota DNR went over today's workshop agenda. See the attached agenda for the day's activities.

THURSDAY, 31ST OF OCTOBER 1991 0800 HRS.

Cindy Wolf talked on the NWCG Publications Management System PMS.

Passed out the NWCG PMS Guide 6/91

Has been working on setting up the archives for past NWCG training materials. There is a gap of some of the material a few years back.

Where do outdated publications go? Recycled. If you have a need for them write Cindy a letter with what you are looking for.

When the committee is putting a document into PMS, they may want to buy some as seed documents. Distributions to cooperators, anyone else there is a surcharge, private individuals cannot purchase items.

Sponsoring a document.

Has FEWT ever asked the working team to develop lesson plans? NO.

Ron Rochna stated he has been working with Cindy for the correct format and layout on the four-hour course lesson plan that Al Olson has been developing.

Chart at the end of the Guide shows the flow process for approval of publication, lesson plans, videos etc.

Bob Joens - the videos developed by Ron and Paul are for managers to determine product use as a technical document not a training video.

How does the approval process determine whether it is a technical document or a training production?

Is the product being presented as a technical product or as a training product?

We are in a state of technical transfer not training. Does the training working team have a guideline as to what is a training product? YES.

Doc Smith recommends that Bob Joens, as chairman of FEWT, contact the training working team chairman and explain where we are with training lesson plans and want them to be approved. Bob Joens will contact the FEWT committee to get the blessings for the lesson plans.

Ron Rochna will send a copy of the lesson plan to Doc Smith, who will forward it to Bob Joens for the training working team formal approval, and keep on going the way we have been.

When the committee is looking at revising a document, please let PMS know so they do not go back to print if stocking levels are low. Pricing on a revised document is determined by the total price of the inventory added onto the price of the new revised document.

Number of copies needed for a new document is helpful to PMS. Once PMS receives a photo-ready document, it usually takes 4 to 5 weeks to be ready. There is no way to get a preassigned NFES number. For an assigned NFES number the new material needs to be in by January 1 of each year, as the catalogs are done in February. Real deadline is January 30 at 1630 hrs MST on Cindy's desk.

Cindy's closing comments:

FOAM TASK GROUP video's are excellent quality. Primer is good for the end user. Foam vs. Fire is good for the managers. Suggestion, a pamphlet accompany the videos with a separate NFES # to make them user friendly.

What you want to end up with is a composite program that is developed for the end user.

Publications and Information Packages:

Foam vs. Fire - Chuck George

As it now stands, after many reviews it should go to San Dimas, with license to make necessary changes. Stay with the fire triangle for now.

Publications and Information Packages, Con'td

San Dimas (Paul Hill) met with the Publication staff person and they are working on 8 publications that will come out this year. Work needs to be interface with present work already going on. Get it in as soon as possible.

Discussion on metric measurements in the publication. Add a metric conversion table at the end. The conceptual drawing on the front of the Foam vs. Fire will be the symbol for all future Class A foam publications. Also the disclaimer needs to appear.

CiCi, Ron and Paul to forward to San Dimas all the needed illustrations. Steve Raybould is the project leader and will work with Ron, Paul and CiCi.

Target date to Cindy at PMS is February, 1992.

Status Report on Foam Chemicals - Chuck George

Passed out draft copies of Wildfire Chemical Qualification and Testing Fire Suppressant Foam and a list, Qualified or Approved Fire Chemicals.

Pyrocap B-136 is finally approved but does not foam well at normal use rates (.1-1.0%). Angus and Ansul are not the same foams as used in the United States.

Discussed qualifications of the product's ability to foam. Table of characteristics of foams to be available next spring.

Discussion on GSA pricing on foams.

Discussion on the breaking of some of the square containers, also some of the round ones.

Technical Committee to make available to the Foam Committee, for comment, the information on the foam characteristics before going public.

Foam Primer - Mark Stanford

It is a great starting point for the publication and needs to be reviewed and comments back to Mark Stanford by 12/1/91 with Mark getting it to San Dimas by 1/1/92.

General Discussions:

Video Time Schedule - Paul Schlobolm

1. Introduction to Class A Foam - Done
2. Properties of Class A Foam - 3 weeks
3. Proportioners - January 1992
4. Aspirating Nozzles - January 1992
5. Compressed Air Foam Systems - 1993
6. Foam Applications (see following discussions) - 1993

CRS - Citation Retrieval System Time Schedule - Chuck George, Fall 1992

A discussion on the following areas - Ron Rochna
Mark Stanford:

Common Situations: (we are all seeing)

Chemicals

1. Approved rates - being exceeded
2. Environmental concerns
3. Approved agents - not being used

Equipment

1. Class B devices
2. Approved rates - being exceeded
3. Manual vs automatic
4. Foam generating equipment

Tactics

1. Critical application rates

Reasons For This Misinformation:

1. Lack of trained and qualified instructors
2. Need for guidelines
3. Lack of technical knowledge and information

Solutions:

1. Technical information - working on videos, publications, etc.
2. Training materials - working on lesson plans and student work books,
3. Qualified instructors
4. Develop guidelines

Lengthy discussion reference to foams Class A & B and the fluorine, flouropoteins, also MIL and performance specifications.

Video on Tactics - Ron Rochna

Video on tactics should be renamed to "Foam Applications". Ron showed some video footage on foam application with the medium expansion nozzle on making a fire break down a hillside in southern California.

Equipment Caches - Del Starner, Cache Manager, Boise

A special thank-you to Bob Joens for the Robwin Flow-Mix 500 unit in the caches. Nozzles, Co-Son LF8, LF16 and LF 32, about 400 of each out so far this year.

No one but cooperators can purchase from the caches. If others are interested, they should contact their cooperators.

Doc Smith presented tokens of appreciations from the FOAM TASK GROUP to Minnesota DNR.

As travelling is getting bad and predicted to get worse, George, Hill, Spaulding and Weaver left for the airport at 1530 hrs. Because of limited seats Chuck George and Paul Hill returned.

STATE TRAVEL - BOB JOENS

Budget

NWCG Foam Committee - FEWT - NWCG
(Then it approves state travel)

AD 202

1. Request by committee chairman (DG is ok) Name, state from, position, address, fax #, meeting location, dates and the estimated cost.
2. Send it to FEWT
3. Forest Service clerk develops the AD 202.
4. Send fax copy to individual, state, NASF and budget coordinator.

Voucher

1. Travel submitted
2. Go to NASF
3. Approved with Budget Coordinator.

NEXT MEETING:

Doc Smith talked with Steve Grimaldi and has tentative schedule for May 11 through 15, 1992 in Victoria, BC. Doc to get with Bob Joens reference to travel approval.

Meeting Note:

On Thursday, October 31, 1991 at approximately 1530 hours it started to snow in Minnesota and it kept snowing until Saturday, November 2, 1991. This made for some interesting travel plans and long delays of people and aircraft, but everyone got home safely between Friday and Sunday. On behalf of the committee, we are all indebted to Carson Berglund and his staff at the Minnesota DNR for going out of their way in assisting everyone to get home safely.

Minutes of the meeting written and typed by E. Sven Carlson, N. H. Dept. of Resources. For additional information, please contact H.B. "Doc" Smith, USDA Forest Service, Kaibab National Forest, 800 South 6th Street, Williams, AZ 86046.

A LIGHTWEIGHT, INEXPENSIVE PORTABLE PUMP FOAM INDUCTION SYSTEM

by Tom French, Warehouse Foreman
USDA Forest Service

Portable pump foam systems are here to stay! During the 1988 fire season, personnel on the Payette National Forest developed, tested, and used a portable pump foam Induction system. The system weighs 2 pounds and costs approximately \$29.17. The Payette National Forest used this foam system to protect 38 structures at 6 private locations within the Frank Church RONR wilderness in Idaho. On September 6, 1988 the 69,400-acre Silver Creek fire burned over the Root Ranch, a private recreation ranch in the middle of the Idaho wilderness. The portable pump foam system was used and successfully protected all structures at the ranch.

After our success with this foam system during our worst fire season on record, we have decided to include it in our portable fire pump kits.

The system consists of the following items:

Item – Induction System (Fig. 1)	Cost
A. Tee 1-1/2 inches NH-F x 1/2 inch NH-M x 1 inch NPSH	13.63
B. Valve 1/2-inch gate	2.99
C. Nipple 1/2 inch close x close29
D. Reducer 1/2 inch x 1/4 inch	1.20
E. Nipple hose 1/4 inch for tubing75
F. Tubing clear 5/16 inch ID x 60 inches long	1.35
Induction total	\$20.21

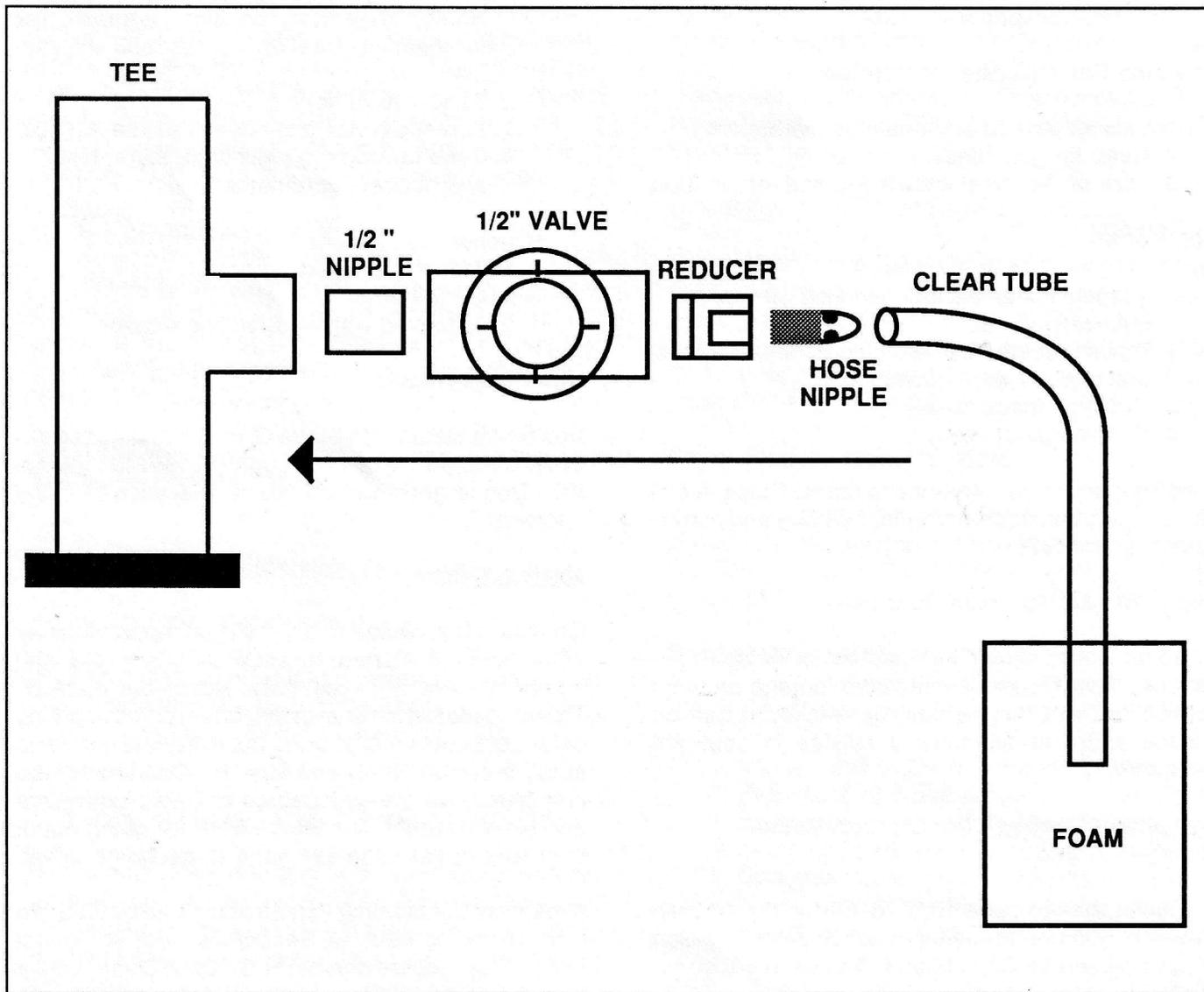


Figure 1. Induction System

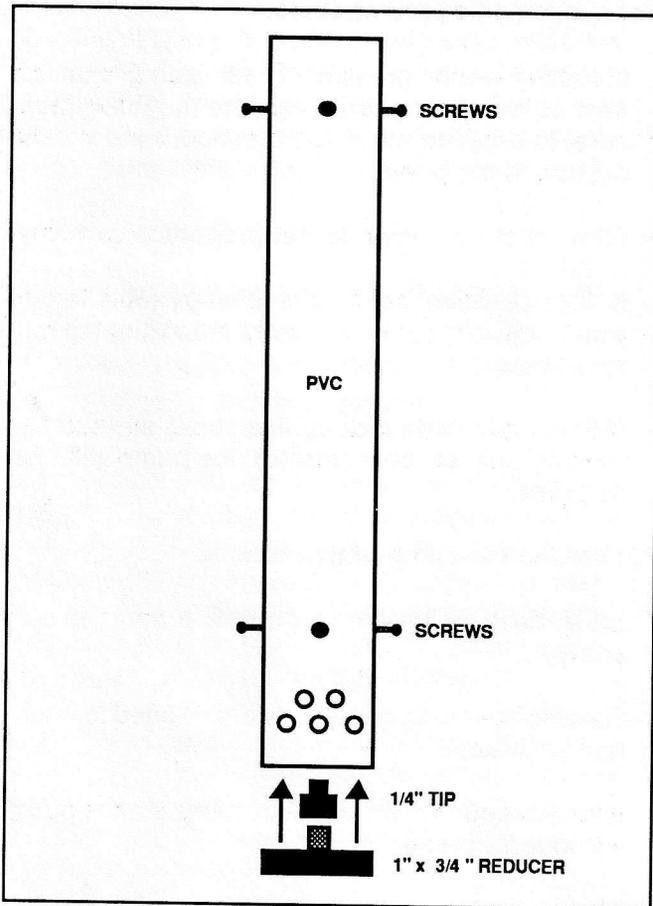


Figure 2. Aspirating Nozzle

Item – Aspirating Nozzle (Fig. 2)	Cost
A. 1-1/2-inch SCH 40 PVC pipe x 18 inches long	95
B. 1 inch NPSH x 3/4 inch GHT reducer	3.75
C. Tip straight stream 1/4 inch	3.86
D. Eight 1/8 inch machine screws (optional)	40
Nozzle total	8.96
Foam system total	29.17

To assemble the induction system follow the diagram in Figure 1. Assembly instructions for the aspirating nozzle, Figure 2 are:

Drill eight 5/16-inch holes in PVC pipe 2 inches from base; drill six 7/16-inch holes, 3-3/16 inches from PVC base; cut off the ears of the 1-inch x 3/4-inch reducer; attach the 1/4-inch nozzle tip to the reducer and press it into the PVC pipe base.

Drill four 1/16-inch holes 7 inches from base; drill four 1/16-inch holes 17 inches from base and insert the eight 1-inch machine screws (optional).

This sounds difficult but it only takes about 15 minutes for assembly.

To set up and use the foam system, attach the 1-1/2-inch tee to the suction side of the pump. Place the suction hose in any water source. Then attach the aspirating nozzle to the end of the hose. Place the clear tube in a bucket of any wildland fire foam.

Start the pump and adjust it to the desired pressure of operation. We found that 100 psi and above worked best for us. Open the gate valve until the foam concentrate moves slowly up the clear tube. With good communication between the pump operator and the nozzle person, you can adjust the foam by closing or opening the valve to produce a thinner or thicker foam. You now have foam capability with any portable fire pump.

After field testing, the following are possible uses for this foam system:

1. Can be used at back country or wilderness fire locations where protecting structures and property is a priority.
2. Can be used on any wildland fire where there is a water source, either natural or provided, and it is not accessible by fire engine.
3. Can be used at subdivisions or urban interface areas using swimming pools, irrigation ditches, creeks, fold-a-tanks, or any water source and portable fire pumps. This would free the fire engines to be more mobile.
4. Use on prescribed burns to control perimeter and suppress spots.
5. Can be used to construct a control line from which to backfire.
6. The induction tee can be used to introduce disinfectant, detergent or most liquid solutions into the water stream of fixed or portable pumps.
7. The aspirating nozzle can be used on any engine with foam capability.

This system could be enhanced and modified by using different size nozzle tips or PVC pipe to produce different foam patterns and by placing a check valve on the induction tee.

We believe that many wildland and structural fire agencies or departments will find that a lightweight (2 pounds), inexpensive (\$29.17) portable pump foam system would be applicable to their fire protection needs.

For additional information, please contact Tom French, USDA Forest Service, Warehouse Foreman—Payette National Forest, McCall, ID83638.

PROPORTIONERS

*by Ronald Rochna, Paul M. Schlobohm,
and Alan K. Olson, USDI Bureau of Land
Management, BIFC*

BACKGROUND

Over the past five years, the superior fire-extinguishing properties of foam have become increasingly well known. Using foam to protect improvements and natural resources is becoming the norm for many firefighters.

Class A foam has the potential to reduce firefighter injuries and the cost of fire suppression. To capitalize on the benefits, management will have to be willing to invest in training and adopt the appropriate equipment for the mission.

INTRODUCTION

When using foam from a fire engine, it is desirable to inject the foam concentrate, at a set proportion, directly into the discharge side of the water pump regardless of water flow and pressure. The only way this can be done is with a direct automatic regulating injection-type proportioning system. This type of a system will eliminate the following problems associated with batch mixing, eductors, suction-side and around-the-pump proportioners:

For batch mixing:

- Foam proportion cannot be conveniently changed while operating—it can be increased by adding more foam concentrate to the water tank.
- When refilling a partially used pre-mixed tank of water, dip sticking, or gauging is required.
- The fire engine cannot draw water directly from a nurse tanker or hydrant and make foam solution.
- Over time, foam solution degrades, tends to lose potency, and does not foam as well.
- Agitation of the foam solution, such as driving over rough terrain, water recirculation, or tank refill produces a head of foam that can overflow the tank.

For suction-side proportioners:

- Incoming water pressure to the pump must be kept below atmospheric pressure (negative pressure) in order to move foam concentrate into the suction of the pump.
- Flow must be known to set proportion correctly.
- If the operating conditions change (flow rate of water or water level in the tank) proportioning rate may change.
- If the concentrate pick up line sucks air (such as running out of concentrate) the pump will lose its prime.

For around-the-pump-proportioners:

- Flow must be known to set the proportion correctly.
- Specific operating conditions are needed to maintain accuracy.
- If the concentrate pick-up line sucks air, the pump will lose its prime.

For batch mixing, suction-side regulator, and around-the-pump proportioners:

- Corrosion (results from the foam concentrate cleaning the tank, pump, and plumbing).
- Can cause pump-priming difficulties.
- Foaming in the tank can cause water-level gauge troubles.
- Foaming in the tank will overflow when refilling.
- Use of more foam concentrate than required.
- Problems with pump and valves caused by the foam concentrate washing out lubricants.
- Contamination of the water tank makes water from the tank unusable for other purposes (such as transporting fish or potable water use).

For pump discharge-side (Inline) eductor proportioners:

- Require specific operating conditions to operate. Any change in operating conditions may result in large changes in foam concentrate ratio or may not work at all.

- Can expect high pressure loss in flow line, 35% or more.
- They are sensitive to increased hose lengths and changes in nozzle sizes. Water flow at nozzle must match what is stamped on the eductor (cannot flow less).

IT SHOULD BE NOTED THAT THE LISTED EDUCATORS WERE ORIGINALLY DESIGNED FOR OTHER PURPOSES BESIDES CLASS "A" FIRE FIGHTING. BECAUSE THESE DEVICES ARE EXTREMELY SITUATION SENSITIVE, IT IS THE OPINION OF THE AUTHORS THAT THEY NOT BE USED ON ENGINES WORKING CLASS "A" FIRES.

These problems can be eliminated by a pump discharge-side automatic regulating proportioner. Ideally, a pump discharge side injection proportioner should:

- Be proportional over the entire range of the water pump's flow capacity and pressure. Once concentrate percent is set it should:
 1. Not change over the range of the water pump.
 2. Be proportional down to almost zero flow.
 3. Stop flowing when the water is completely shut off.
- Prevent any chemicals from returning to the water tank or passing through the water pump. This is important because most centrifugal fire pump installations have (or should have) a continual small bleed back to the tank for pump cooling when water is shut off in the hose line.
- Inject foam concentrate into the water stream on the discharge side of the water pump in the correct proportion to make foam solution in the desired ratio of concentrate to water.
- * Foam solution should flow directly from the piping system into the hose line with no possibility of the foam solution recirculating and contaminating the water tank, plumbing, and pump.
- Be low in cost and simple in design, highly reliable (infrequent breakdown), and highly maintainable (minimal repair time if it does break down).
- Be able to use different types of Class A&B foam concentrates at up to 1 per cent concentration and be able to change percentage while operating.

- Be able to provide (at a minimum) enough concentrate to treat a load of water on the engine it is installed.
- Provide insignificant or no water pressure loss.
- Maintain accurate foam proportioning ($\pm 10\%$ of the set concentration down to 10% of rated flow and $\pm 25\%$ down to near zero flow) across the range of operating flows and pressures of the proportioner. It should perform up to its rated capacity regardless of the type and amount of hose and appliances being used.

The following foam proportioners address, or attempt to address, most of the criteria listed above. They are currently under evaluation by BIFC, Branch of Technical Support, Foam Section.

- I Balanced Pressure Pump Foam Proportioner by KK Products
- II Electronically Controlled Direct Injection Proportioner by Hypro Corp.
- III Balanced Pressure Bladder Tank Proportioner by Robwen

MODEL I - The Pro/Proportioner
 MANUFACTURER - KK Products
 TYPE - Balance Pressure Pump Foam Proportioner

The main components of the system are a mechanically-run positive displacement pump, a venturi, a pilot-operated relief valve, a check valve, and a needle valve.

Using a proportioning block, it meters Class A or 1% AFFF foam concentrate from 0.1% up to 1.0% into the discharge side of the water pump. With the low flow venturi, flow ranges from near zero gpm to 80 gpm at 1.0%. With the high flow venturi, flow ranges from near zero gpm to 250 gpm at 0.5% and from near zero gpm to 125 gpm at 1.0%. Pressure ranges up to 450 psi.

The maximum volume of concentrate is always being pumped in a closed looped system. The needle valve determines the amount of concentrate to inject based upon a water flow through the venturi.

PRO/PORTIONERS are available with a choice of power options. Twelve-volt DC electric motor units are available for truck-mounted applications. These can be used for a fixed or running attack.

Two-and four-cycle engine models can either be mounted on engines or used with portable pumps or when water relays require remote injection of foam concentrate. Also the proportioner pump can be mechanically driven.

The unit that is being evaluated is a model E.J.L.T. E stands for electric motor, 12 volt DC/ 30 Amp Max. 1/3 hp., truck mount; J stands for NPSH Threads Mounted on Remotely Mounted Water Inlet & Outlet; L stands for Low Flow Ranges 5 gpm to 80 + gpm @ .5%, or 1.0%, and pressure range 0 to 300 psi; I stands for Eight Gallon Poly Tank.

The limitations that have been identified to date are:

- The pump can be damaged by running dry for a few minutes. This can occur during priming, flushing (if water pump is not on or is out of water), or running out of foam concentrate.
- The system requires some sort of auxiliary power supply (unit being evaluated is electric).
- The electric system, when turned on, continuously draws approximately 15 to 30 amps of power regardless if water is being pumped or not.
- The recommended method of installation will result in the concentrate injection line to the venturi rupturing or the concentrate pump blowing head seals. This will occur when all discharge lines are closed and a check valve was installed between the water pump and the venturi.
- * In a static flow, the pilot-operated relief valve sets the concentrate return pressure slightly higher than the water pressure. So, if the water pressure is 100 psi the concentrate pressure is at 101 psi.

Because of the check valve and the discharge being closed, the system steps the pressure in the venturi and closed plumbing higher. This increase will continue until the maximum concentrate pump pressure is reached (1000 psi) or something ruptures. THIS IS A CRITICAL ISSUE WITH A HIGH POTENTIAL FOR PERSONAL INJURY.

- The system can be corrected by disconnecting the water sensing line from the venturi and relocating it on the other side of the check valve (towards the water pump). On later models this problem has been corrected by using a check valve between the pressure sensing line and foam injection line and reducing over pressure to minus 1 psi.

- Because of the closed loop system there is always a small amount of concentrate being injected into the water line. This prevents the concentrate pump from heating up when no water is being discharged.
- The system can malfunction or component failure can occur without proper instruction and training.

For additional information on the PRO/PROPORTIONER call, KK Products, 1004 Silhavy Road, Valparaiso, IN 46383, 800-537-7553.

MODEL II - FOAMPRO 2000
MANUFACTURER - Hypro Corporation
TYPE - Direct Injection Proportioner

The FoamPro is a complex electronically controlled proportioning system. It uses a positive displacement Hypro metering pump to directly inject foam concentrate into the discharge side of the water pump. To control the concentrate pump, the system uses an electronic water flow sensor, a pump speed sensor, and the operator control unit (totalizer).

These sensors send and receive signals from the microprocessor to obtain desired concentrate ratios. FoamPro monitors water flow, not pressure. By directly measuring the engine's water, this system is able to maintain the proportion of foam concentrate to water based on volume.

The positive displacement metering pump directly injects a known quantity of concentrate into the water stream with each revolution of the pump shaft. None of the foam is bypassed or recirculated back to the foam tank. This makes for an efficient system by saving power, for only the foam concentrate required is pumped.

The system uses a "closed-loop" operation. The system constantly monitors output of the foam concentrate pump and compares this actual value with the desired output to maintain the specified percentage of foam concentration in the flowing water. Because of this feedback, the system can automatically adjust to variable operating conditions such as changing discharge pressures and foam concentrate viscosity.

In normal operations in automatic mode, water flow is directly measured by the flowmeter, with the foam proportioning corresponding to this flow measurement. The system also has a manual mode which allows the operator to override the flow sensor signal and tell the system how much foam concentrate to inject. The operator can switch between

automatic and manual mode by using the control switches on the totalizer display. The simulated (override) flow rate can also be varied with the switches.

The totalizer readout displays can show current water flow in gpm and cumulative water flow in gallons. It can also display and/or change the foam concentrate injection rate in increments of 0.1% while the system is operating.

The BLM has been field testing two FoamPro units mounted on heavy CAFS engines. The limitations that have been identified with two years of field testing are:

- The microprocessor was temperature sensitive (manufacture limits effective use to 150 degrees F). We experienced system failure at 120 degrees. Once it was allowed to cool down, it resumed working. The manufacturer has corrected the problem as of 1/91.
- It was not proportional at water flows less than 25 gpm. Concentrate continues to be injected as if it is flowing 25 gpm even if actual flow is only 10 gpm. The manufacturer has corrected the problem with a three-piston pump.
- The flow sensor often sticks in the off position. This causes the flow meter to read 0 gpm and the concentrate pump to remain off. The microprocessor must receive a signal from the flow meter before it can send a command to the concentrate pump to run. The manufacturer has corrected this problem with a newly-designed paddle wheel.
- The many wires and connections tying the components together increase the possibility of an electrical failure. This has occurred on several occasions.

All exposed wiring should be shielded (in addition to what the manufacturer has provided) in places where it could be walked on or pinched in cabinet doors.

- The system is not "field repairable" if the microprocessor fails. Field operation is straight-forward (user friendly) for the average engineer after reading the operations manual and receiving the appropriate training.

For additional information on the FoamPro proportioner, call Hypro Corporation, FoamPro Department, 375 Fifth Ave. NW. New Brighton, MN 55112, 800-533-9511.

MODEL III - FLOW-MIX

MANUFACTURER - Robwen Incorporated

TYPE - Balanced Pressure Bladder Tank Proportioner

The FLO-MIX proportioner is designed to be used on the discharge side of the pump or at any point in a pressure hose line. The standard model is available either as a portable or a built-in. The unit is self-powered, so no external power source is required.

The system can be set for proportioning from 0.1% to 1.0% ratios calibrated in settings of 0.2%. The unit operates by exerting line pressure on a bladder, filled with foam concentrate, within a pressure tank. The pressure in the tank is created by the flow of incoming water from the discharge side of the water pump.

The concentrate is forced through a variable metering orifice down a feed line to the discharge side of a differential valve or venturi. The valve or venturi creates a lower pressure than incoming line pressure when water is flowing. This lower pressure is a function of water flow rate.

When water flow through the differential valve stops, pressure within the differential valve becomes equal and the flow of foam concentrate stops. A modified hand pump or electric pump with built-in check valves refills a five gallon system within two minutes. The proportioner can be refilled at any time without shutting down the hose line flow. However, during refill no foam concentrate is injected into the hose line.

The FLOW-MIX proportioner is available in 5, 10, and 20-gallon sizes. Other sizes can be specially ordered. It can be mounted almost anywhere on the engine. If servicing of the unit is required, it can be accomplished in the field in approximately forty-five minutes. The unit is self powered. Auxiliary power is not needed.

The BLM has been evaluating three models of this unit: (1) Model 500 portable Foam Proportioner (2) Model 500 built-in Foam Proportioner and (3) Model 1000 built-in Foam Proportioner. All of the units performed as claimed by the manufacturer as long as operating and maintenance requirements were met. With two years of evaluation we have identified several deficiencies:

- On a model 500 portable unit the bladder developed a leak where it attaches to the container on the outlet port on a model 500 portable unit. This occurred when the bladder was allowed to run dry and the pressurized water outside of the bladder

tried to push the bladder through the outlet tube. The bladder developed a small hole where it rubbed against the outlet tube. The manufacturer was notified of the problem and solved it by attaching a perforated tube to the outlet. This allows the bladder to collapse around the tube.

Units produced prior to 1989 could develop this problem if the selector valve is left in the foam setting, rather than off, when the bladder is empty of concentrate.

Operators should make sure that the bladder is refilled after each use. Units produced after '89 have been modified to eliminate this problem.

A check valve failed due to corrosion. The manufacturer recommends that the unit be flushed with clean water after each use. This pertains to not only the regulator valve assembly, but also to the refill pump. Without flushing, concentrate residue builds up in small orifices and eventually closes them off. Many of the units installed on BLM engines do not have a flushing system plumbed in.

A spring check valve is required between the refill pump and the three-way selector valve. This will prevent back pressure, from a leaking three-way selector valve, from damaging the diaphragm in the refill pump.

If an inline strainer is not used, the differential pressure valve should be inspected yearly for foreign matter blocking the waterway.

Air can be trapped in the bladder on built-in units mounted in other than an upright position. It is possible to pump air into the bladder if the electric refill pump is not primed. Each time the bladder is refilled, a pocket of air is pushed into it. Over time this will accumulate, reducing its capacity. To eliminate the air pocket, set the selector valve in the "foam" position with the mixture valve set at 1.0% and empty the proportioner tank of foam concentrate. (The manufacturer is correcting this problem.)

The electric diaphragm concentrate refill pump (FLOJET Model 4300 - 143), provided by the manufacturer prior to October 1990, had a poor record of performance.

Some units were installed without a spring check valve on the supply line from the pump to the three-way valve. This caused the diaphragm in the pump to rupture because of the line being pressurized by a leaking three-way valve.

If the check valve does not solve the problem, we recommend the FLOJET pump be replaced by a heavy-duty type, such as that used on portable fuel transfer pumps. Or you can use a high-volume low-pressure hand pump. (The manufacturer has replaced this pump with a centrifugal bilge pump.)

When shutting down the water pump after generating foam, be sure to move the concentrate adjustment valve to the off position. Or, you can turn the selector valve to refill, which will relieve the water pressure in the bladder unit. This will prevent an unnecessary flow of concentrate through the differential valve due to higher pressure left in the bladder tank after the water pump is shut off.

The differential valve is not proportional (leans out) when water flows exceed 100 gpm. The concentrate flow can be reduced by as much as 40%. This can be solved by using a check valve and a venturi instead of the differential valve.

A significant amount of pressure is lost when flowing water above 100 gpm. We have had two diaphragms rupture on the manual refill pump on the portable units. (The manufacturer is working on this problem.)

For added information on the FLOW-MIX balanced pressure bladder tank proportioner, call Robwen, Inc., 1945 Blake Ave., Los Angeles, CA 90039, 213-665-5633.

It should be noted that all of the proportioners discussed above do work. What we have identified are some factors that can result in system malfunction due to operator error or mechanical failure. The frequency and severity of malfunction can be minimized through proper training of operating engineers and proper maintenance of the equipment.

All of the manufacturers are dedicated to providing a useful product and have spent a great deal of time in research and development. Only through actual field tests, comparing one system against another on the same vehicle, can you readily measure the pros and cons between them. The problems and idiosyncrasies, as identified in this paper, are being rectified by the appropriate manufacturer.

References: Dan McKenzie and Steve Raybould, 1990. "Foam Proportioning Systems", USDA Forest Service, San Dimas Technology and Development Center, San Dimas, CA 91773

Hypro Corporation, FoamPro Department, 375 Fifth Ave. NW. New Brighton, MN 55112

KK Products, 1004 Silhavy Road, Valparaiso, IN 46383

Robwen INC., 1945 Blake Ave., Los Angeles, CA 90039

For additional information, please contact USDI Bureau of Land Management, BIFC, 3905 Vista Ave., Boise, ID 83705, 208-389-2431

A POWER BACKPACK PUMP WITH FOAM CAPABILITIES

by Tom French, USDA Forest Service

During the 1990 fire season, personnel on the Payette National Forest converted, tested, and used a power backpack pump using Class A wildland fire foam and an aspirating nozzle for fire suppression.

We successfully used this backpack pump for both hot-line and mop-up operations. It was especially useful for mop up because of the efficient foam quality it produced.

THE BACKPACK SPRAYER

We used a Mauryama Power Backpack Sprayer, Model MS-045 with these specifications:

Dimensions:

(length by width by height) ...	365 x 410 x 590 mm
Weight (empty)	7.5 kg
Chemical tank capacity	23 liters
Fuel tank capacity	1.5 liters
Maximum pressure	14 kg f/cm ²
Normal output flow	1.5 - 7 ¹ /min
RPM	6,500
Fuel	Gas : Oil Mixture (25:1)
Cost	\$350

THE ASPIRATING NOZZLE

The nozzle is made from a brass tube which is 102mm long and 12mm inside diameter. This tube has six 4mm holes drilled 7mm from the end. The tube is attached to the spray side of a standard FSS FEDCO Backpack Twin-Tip Nozzle.

The small bell on the end of the spray side of the twin-tip nozzle must be filed off to allow proper air-to-water/foam aspiration. The attachment is made

using silver solder or by brazing it. When finished, the holes should be aligned just below the nozzle tip.

HOW TO USE

Fill the backpack pump with 6 gallons of water and 4oz wildland fire foam. We use Monsanto WD-881, which is packaged in 4oz bottles. Screw the aspirating nozzle either on the spray handle or to the end of the wand attachment. Start the engine and you are ready to apply foam. To use a straight stream simply unscrew the foam nozzle and screw on the straight tip, which is the other side of the FEDCO Twin-Tip Nozzle.

The quality of foam can be adjusted by adding more foam to the water and by increasing or decreasing the engine speed. Slow engine speed creates a wet foam and higher engine speed creates a drier foam.

We were able to produce a foam line 700 feet long and 1 foot wide in 5 minutes and 12 seconds using this power backpack pump.

OTHER APPLICATIONS

- Power sprayer for use in weed control and pest management.
- Disinfect the inside of campground out houses.
- Mark trees with paint for timber sales.
- Paint/stain fences, logs, houses, etc.
- Water seal driveways, bricks, cement, etc.
- Wash outside house windows.
- Fire extinguisher with AFFF 3% foam and the aspirated nozzle tip for shops, warehouses, lumber yards, boats, etc.
- Clean radiators of heavy equipment in the field.
- Wash cars, boats, airplanes, and equipment.
- Spray non-flammable degreaser on engines, lawn mowers, chain saws, aircraft engines, tools, and equipment.
- Apply fire retardant chemical to shake house roofs in the wildland urban interface.
- The nozzle tip can be used on a FEDCO trombone backpack pumps to produce foam using 4oz of wildland fire foam in the water.

With these additional applications, this sprayer can be utilized year 'round and not just during fire season. Yellowpine is a small, back-country town that is only accessible by snowmobile in the winter months. The town has a fire engine, but it is snowed in during the winter. This town uses the power backpack pump, with foam, for fire protection using snow machines because it is the only way they can reach the house fires.

After our use and testing this year, we have recommended these modifications of the sprayer to the company: Replace the plastic tank with a flex tank, reposition the throttle linkage, and improve the backpack and strap design. These modifications should be completed by the field season of 1991.

For the agencies, rural fire districts, farmers, or any persons that have a power weed sprayer, it can easily be converted to a fire fighting tool by just adding 4oz of wildland fire foam to 5 gallons of water and attaching an aspirating nozzle.

For additional information, please contact Tom French, USDA Forest Service, Warehouse Foreman, Payette National Forest, McCall, ID83638.

SO YOU WANT TO TEACH A FOAM CLASS

*By E. Sven Carlson, New Hampshire
Department of Resources and Economic
Development*

The State of New Hampshire, Division of Forests and Lands, Forest Protection decided to conduct Class A foam training for our Forest Fire Wardens, Deputy Wardens, and fire departments in 1991. We felt it would be a "piece of cake" to develop the lesson plan.

In 1990, I had the opportunity to attend a three-day foam workshop sponsored by the New Brunswick, Canada Forestry Department with instructors from Petawawa National Forestry Institute, Canadian Forestry. This gave me an introduction and a base knowledge of Class A foam technology. After the workshop I felt ready for the task of developing a lesson plan on Class A foam.

Our training committee decided that we should look into developing a lesson plan that incorporated lecture, table top demonstration, and outdoor demonstration.

First, we determined the amount of time available for the course. As most of our wardens, deputy war-

dens, and firefighters are volunteers (only paid when fighting forest fires), we have to train in the evenings, usually for 2 hours - 7:00 p.m. to 9:00 p.m.

Everything I learned in a three-day course had to be taught in 2 hours. What should we cover? We wanted them to have an understanding of the concepts of Class A foam for fire suppression, learn about creating a foam solution and foam generation, tactics and much, much more. All the objectives of the class were important. What do we cut out? Was I trying to invent the foam blanket or had it already been laid, tried and it worked?

We decided we needed to talk to people with a lot more knowledge than we had so we started to meet with people who were very knowledgeable in Class A foam.

At Boise Interagency Fire Center, Boise, Idaho we discovered a world of knowledge and experience in Ron Rochna, Paul Schlobohm and Al Olson. They had spent years on Class A foam. They had the experience, knowledge and had already done most of the work on lesson plans. They had published information packages and most of all, they were willing to talk with us and share their knowledge.

They also directed us to Mark Stanford of the Texas Forest Service and Pat Ebarb, retired from the Texas Forest Service but now in Radnor, Pennsylvania, with the USDA Forest Service, State and Private Forestry Division.

They were all very instrumental in assisting us in developing a very comprehensive and informative class that would meet all of our needs in the two hours.

After receiving direction needed to develop this training package, we determined that we needed more experience in Class A foam. Simply taking a course and talking to knowledgeable people does not prepare you for developing a top-notch training program. In addition, you need substantial "hands-on experience" and need to read as many technical articles as possible so you are knowledgeable in all aspects of Class A foam.

For additional information, please contact E. Sven Carlson, Regional Ranger, Division of Forests and Lands, P.O. Box 856, Concord, NH 03302-0856.

FOAM APPLICATIONS FOR WILDLAND AND URBAN FIRE MANAGEMENT

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