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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**

Canadian Committee on Forest Fire Management
Comité canadien de gestion des feux de fôret

USE OF FOAM IN HAWAII VOLCANOES NATIONAL PARK

by Jack Minassian, Pacific Area Fire Management Officer, Hawaii Volcanoes National Park

Since 1983, Hawaii Volcanoes National Park has had, just outside its eastern boundary, an active surface lava flow. This flow can ignite fuels at any time of the day during any time of the year. These fuels are grasses that behave similar to fuel model No. 3. To protect the National Park's resources from wildland fires, we have adopted a containment strategy with the help of Class A foam. It is important to note here that foam does not work on lava.

Figure 1. Hawaii National Park fire engine laying a foam wet line.

First we put in a wet line with foam (fig. 1), then we start a back fire (fig. 2) to the desired width along the 2-mile border from the Pacific Ocean to an inactive lava flow. For a portion of the black line we use Class A foam delivered by a foam proportioner system with a medium expansion nozzle on one of our engines. The remaining portion of the black line is a foam solution delivered by helicopter with a Bambi bucket. The foam allows us to construct the 2 miles of black line within 4 hours with a minimum of personnel.

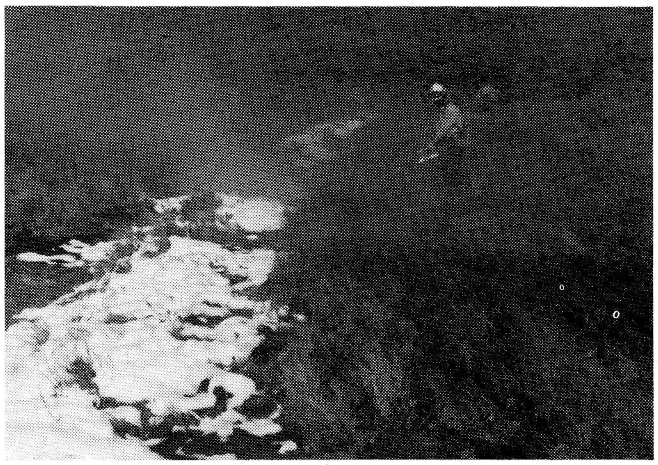

Figure 2. Park Service crew burning a black line into a foam control line.

This strategy has proved successful by stopping a wildland fire that was ignited by lava during the night but was extinguished when it reached the black line. Thus, we prevent fires ignited by lava from entering the National Park. In addition,

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the Hawaii Volcanoes National Park has successfully used foam on wildland and structural fires and is converting all its water operations to include foam.

If you have any questions about our use of foam, please contact Jack M. Minassian, Pacific Fire Management Officer, P.O. Box 52, Hawaii Volcanoes National Park, HI 96718; 808/967-7768.

SASKATCHEWAN SKIMMER FLEET FOAM CONVERSION

by Mark Campbell, Air Attack Officer, Saskatchewan Parks and Renewable Resources

Over the past 4 years, Saskatchewan has been faced with record fire seasons—both in numbers of starts and fire severity. In this type of fire environment, the need for quick, successful initial air attack is greatly magnified. Aerial application of foam from our skimmer aircraft is one way that Saskatchewan has moved to meet this demand for more effective initial attack. Saskatchewan's air attack fleet consists of six S2F Trackers for our land-based bombing operations. Four Canadair CL-215's and three PBY Cansos comprise the skimmer operations. It is this skimmer component of the Provincial fleet that has been converted to foam capabilities for aerial suppression.

The first use of foam in Saskatchewan occurred in June 1987, when CL-215 aircraft on loan from Yukon Territories utilized foam concentrate on a number of fires in the La Ronge region. Yukon machines were often working in tandem with Saskatchewan CL215's, which at the time had no foam capabilities.

Observations reported by Air Attack Officers on the increased effectiveness of foam seen during these side-by-side operations led to the installation of foam injection systems on all four provincial CL-215's for the 1988 season. Following two more seasons of observations involving our own CL-215 aircraft, the decision was made to also convert our Canso group to foam injection operation for the 1990 season. Bulk loading systems have been installed at La Ronge and Buffalo Narrows, the two highest use bases in the system. Drummed foam concentrate is also available at our peripheral bases, where demand does not require bulk systems.

In terms of effectiveness, foam affects all three parts of the fire triangle by:

1. Coating horizontal and vertical fuel types with a foam blanket that, on some drops, can exceed 8 inches in thickness
2. Removing oxygen from the fire through the same blanketing action
3. Removing heat from the fire as moisture drains from the foam.

Ongoing evaluation of foam effectiveness has resulted in its use in all initial attack situations, and it is often used during support actions as well. Increased load visibility has also enhanced the efficient use of the tankers, as identification of previous drops help the pilots and Air Attack Officers in determining subsequent load placements.

Ground forces have also grown very enthusiastic about aerial use of foam as a method to "buy time;" allowing them to reach the fire location prior to the reappearance of any open flame. In actual ground evaluation tests performed in 1989, a foam drop using 0.5 percent solution removed all open flame from a torching spruce and surrounding fuels, and subsequently held the fire for 45 minutes before a very low-intensity flame appeared at the bole of the tree in question. Penetration of the dense duff layer was 5 cm after 38 minutes, with a fair amount of foam still visible on the surface fuels. Product safety, environmental factors, and handling precautions have all been thoroughly discussed in previous issues of this publication.

In air attack, foam use actually serves to significantly reduce dangers to ground crews who may get caught in the drop zone. Compared to water drops, aerated foam substantially reduces load impact at crown level and below. Recommended drop height is 100 to 120 feet above canopy to fully aerate the drop and provide the thickest foam blanket possible. All foams used in Saskatchewan require U.S. Department of Agriculture approval for corrosion, toxicological, and environmental acceptability. Canadair corrosion standards must also be met for all foams used in the CL-215 aircraft.

To summarize, foam will continue to be a vital part of our aerial suppression operations, based on (1) increased efficiency when compared to straight water, (2) ability to hold a fire from flare-up for a significant time after the drop, and (3) favorable field reports from Air Attack Officers and ground crews alike. The decision to totally convert our skimmer operations to foam has proven very beneficial overall, and we fully expect to continue in this program well into the future.

For additional information contact Mark Campbell, Air Attack Officer, Forest Fire Management Branch, Provincial Fire Centre, P.O. Box 3003, Prince Albert, Saskatchewan S6V 6G1; 306/953-3473; FAX 306/953-2530.

ENGINE 11 FOAM REPORT

by Edward L. Littler, Engine Captain, USDA Forest Service, Angeles National Forest

I feel that, overall, foam saves time and will reduce reburn potential. This, in turn, should be a cost savings on most fires. It should be noted that foam should not be looked at as the only tool needed. When using water we have always been trained to use as little water as possible. With foam, however, we have found that if you use more volume on the first application you will not have to rework the areas as much. In the long run it has been our experience that less water and time is expended.

On initial attack, foam has the following ***advantages:***

1. Slower evaporation
2. Foam seems to absorb the heat better—better knockdown power
3. Less water used overall because of penetration power
4. Structure protection is better due to adhesive properties
5. Structure overhaul is more effective because of better penetration
6. Less reburn potential due to retention on ground fuels.

On initial attack, foam has the following ***disadvantages:***

1. Better developed nozzles are needed
2. Less fog pattern
3. Foam breaks down at extended straight streams.

On mop-up, foam has the following ***advantages***:

1. Due to penetration properties, less water application used
2. Less time consumed
3. Extremely effective on large, punky logs
4. Second application, if needed, is easily identified by foam residue
5. Foam identifies areas that have already been mopped-up.

On mop-up, foam has the following ***disadvantages:***

1. None noted at this time.

"Reading the foam" is a term we started using this last summer. We found that after we put down the first application of foam on mop-up, we can walk away from the area and come back 10 or 20 minutes later, depending on the fuel type. We *read the foam*: If there is foam residue, the area will be cold; if the foam has started breaking down the area will be warm; if the foam is completely gone, the area will be hot. Of course, the warm and hot areas need rework.

For additional information, please contact Edward L. Littler, Arroyo Seco Ranger District, Angeles National Forest, Oak Grove Park, Flintridge, CA 91011; 818/790-1151.

DETERMINATION OF THE CAUSE OF AIRTANKER CORROSION

by Charles W. George, USDA Forest Service

Background

Extensive corrosion occurred on airtankers based at Redding, Calif., during the 1988 fire season. The corrosion was in the form of severe pitting that occurred only on 6061 aluminum. Because the aircraft had been exposed to a number of long-term retardants and wildland fire foams, the corrosion damage could not be tracked to a specific chemical. Inspections of airtankers that had been exposed to similar retardants, but not foams, somewhat narrowed the number of possible causal agents. Nevertheless, an in-depth inspection of aircraft, analysis of exposure data for the tankers, and an analysis of alloys and corrosion products involved did not isolate the cause. Recommendations for minimizing the corrosion, altering operational procedures, and conducting specific studies to determine the cause were made.

Study Objective and Approach To Be Taken

The study objective is to identify the conditions (exposure or exposure sequence) that occurred during the 1988 fire season that initiated (and allowed to continue) the severe corrosion attack seen in northern California. Corrosion tests will be conducted on 6061-T6 aluminum (not currently included in the specifications), using the standard test procedures and methods for measuring the corrosivity of wildland fire chemicals as defined in Forest Service specifications.

In addition, a series of sequential exposure tests will be conducted to determine the conditions that may have caused the pitting to 6061-T6 aluminum to initiate and propagate, especially during continual exposure to water. Coupons of 6061-T6 aluminum will be exposed alternately to long-term retardants and foam solutions for prescribed time periods and then exposed to water in an attempt to duplicate the pitting that occurred during operational use.

Test Matrix
All tests described will use approved long-term retardants and fire foams; specific products are as follows:

Long-Term (LT) Retardants	**Wildland Fire Foams**
Fire-Trol PS-F	*Fire-Trol Fire Foam 103B*
Fire-Trol LC-A	*Phos-Chek WD861*
Fire-Trol GTS-R	*Ansul Silv-Ex*
Phos-Chek D75-Ra	

NOTE: Fire-Trol is a registered trademark of Chemonics Industries, Phoenix, AZ; Phos-Chek is a registered trademark of Monsanto Co., St. Louis, MO; and Silv-Ex is a product from Ansul Fire Protection, Marinette, WI.

Item A. The uniform corrosion test methods described in Forest Service specifications for wildland fire chemicals will be used to determine the corrosivity of four long-term retardants and three wildland fire foams (concentrate and 0.6 percent solution) to 6061-T6 aluminum:

4 LT's + 6 foams (3 conc + 3 dilute) =
10 samples x 2 temperatures x 2 dilutions
x 3 replicates = *120 coupons.*

Item B. Coupons will be totally immersed in room temperature (75 to 80 °F) retardant for 2 weeks. After air drying, the coupons will be totally immersed in room temperature water for 24 hours. The coupons will again be allowed to air dry, and then totally immersed in either foam concentrate or foam solution at room temperature for 24 hours. After drying, the coupons will be totally immersed in room temperature water for an extended period of time. After 90 days, one of the coupons from each exposure series will be removed, cleaned, and weighed; and the uniform corrosion rate determined. A second coupon will be inspected visually after 90, 120, and 150 days immersion in water and then put back into the water. After 180 days, the coupon will be inspected visually, cleaned and weighed:

4 LT's x 6 foams (3 conc + 3 dilute)=
24 samples x 2 coupons (1 uniform +
1 visual inspection) = *48 coupons.*

Item C. Coupons will be alternately immersed, in retardant for 23 hours and foam (0.6 percent solution) for 1 hour, for 3 days and then totally immersed in room temperature water as described in item B.

4 LT's x 3 foams (dilute only) =
12 samples x 2 coupons (1 uniform +
1 visual inspection) = 24 coupons x
2 alloys (2024-T3 + 6061-T6) =
48 coupons.

Study Results
Data on the uniform corrosion to 6062-T6 aluminum will be compared to that already available for 2024-T3 aluminum for all products being tested. The tests described in items B and C will provide information on conditions that may allow pit initiation to occur and propagate when the alloy is exposed to water. The matrix may be altered during the test if pitting attack is discovered and identified during the continuing exposure to water. Depending on results, corrosion products will be isolated and further exposures/test matrices will be developed and initiated.

If you have any questions on this study, contact Charles W. George, Intermountain Fire Sciences Laboratory, P.O. Box 8089, Missoula, MT 59807; 406/329-4814.

COMPANY USES CLASS A FIRE FOAM

by Jim Doull, Fire Equipment Coordinator, J.D. Irving, Limited

Forestry foam units are being installed in nine 1,200-gallon forestry fire tankers. A unit is also being installed in the company's tracked fire tanker. This will give our districts access to fire foam in Maine, New Brunswick, and Nova Scotia.

A steel drum with a bottom drain will be welded into the fire tanker water tank. This will allow a barrel of foam to be hooked up to a foam unit in the rear compartment of the tanker.

The company is also using forestry fire foam in the airtanker fleet in cooperation with the Provincial Forestry Service in New Brunswick.

For additional information contact Jim Doull, Fire Equipment Coordinator, J.D. Irving Woodlands Division, P.O.Box 3281, Stn. B, Fredericton, New Brunswick E3A 5H1.

NOTES FROM FEWT FOAM TASK GROUP MEETING, JANUARY 1991

by Bill Weaver, California Department of Forestry and Fire Protection

A meeting of the Foam Task Group, made up of men and women from the United States and Canada who are involved with foam and its applications, was held January 29-31, 1991, at Milpitas, Galif. The attendees were:

- H.B. "Doc" Smith, Chairperson, USDA Forest Service (FS), Williams, AZ
- Bill Weaver, Sacramento Hq., California Department of Forestry and Fire Protection (CDF)
- Paul Hill, San Dimas Technology and Development Center (SDTDC), FS
- Gordon Ramsey, Petawawa National Forestry Institute, Forestry Canada
- Bob Webber, USDI Bureau of Land Management (BLM), Boise Interagency Fire Center (BIFC)
- Steve Raybould, SDTDC, FS
- Ron Rochna, BLM, BIFC
- Bob Joens, Washington Office, FS, and Chairperson, Fire Equipment Working Team (FEWT)
- Lee Young, USDI Bureau of Indian Affairs (BIA), Boise, ID
- Del Starner, BLM, BIFC
- Mark Stanford, Texas Forest Service
- Ed Stechisen, Forestry Canada
- Paul Schlobohm, BLM, BIFC
- Steve Perez (Guest), San Jose City Fire Department.

Notes I took during the 3-day meeting follow.

Tuesday, January 29

0900, Technical Reports. Paul Schlobohm presented the final draft of "A Performance Test of Low-Expansion, Nozzle-Aspirated Systems and Class A Foam." Attendees then discussed the role of the Foam Task Group in the review process for this and future publications. It was agreed that Group members should review technical reports for accuracy and completeness prior to publication. After review, the publications would be presented to FEWT and NWCG for official approval. The "Proportioner" technical report was also reviewed by the Group, and a determination made that this report should remain a BLM publication and not sponsored by the Foam Task Group.

0950, Canadian Foam Update. Gordon Ramsey gave an update report on foam use in Canada. This use has increased dramatically with ground attack forces. Much of this is attributed to increased knowledge and exposure. This situation lead to a discussion of the relationship of all fire fighting chemicals to the Foam Task Group charter. It was suggested that FEWT discuss the need to incorporate the subject of all fire chemicals within the Foam Task Group.

The Group discussed the need to develop foam performance and equipment standards. This will help assure continuity of products between the U.S. and Canada. The National Fire Protection Association (NFPA) is very active in setting performance criteria; therefore, it is important that the Foam Task Group become proactive with this work to assure that standards are appropriate.

Finally, Gordon presented a slide show reviewing the extensive foam workshops presented throughout Canada in 1990. Long-term exposure to the foam solution and concentrate revealed the importance of addressing safety during training. It was also suggested that people be made aware that leather boots can be treated to resist the adverse affects of long-term exposure to foam.

1110, Foam Caches. Ron Rochna discussed the need to have foam caches available for delivery to major fires. Also discussed was that there exists a lack of knowledge by many fire managers of the role that foam can have in their fire planning and operations. The Foam Task Group discussed the need to integrate the use and application of foam in all key fire management training and workshops.

ACTION: Doc will send a letter to Class 1 fire teams expressing the need for their consideration and understanding of this issue.

1150, Proposed Foam Specifications. Paul Hill updated the Group on the proposed foam specification standards. SDTDC is continuing to develop the standards and should have information for review in the near future. He discussed the importance of avoiding the development of design standards that would limit the improvement of the product. The Group discussed impact of multiple vendor awards for future competition and lower cost.

1345, "American Heat" Videos. Ron Rochna presented the 1990 "American Heat" video about Class A foam. The attendees discussed the importance of including metropolitan/rural fire agency foam use as a key element of the Group's work. Also, the Group needs to interface with the NFPA 298 Standards Committee.

ACTION: Bill Joens, Doc Smith, and Mark Stanford will call Bill Baden to discuss the possibility of filling one of the vacant NFPA positions with a Foam Task Group member.

1455, Foam Task Group Publication. Steve Raybould discussed funding alternatives for the "Foam Applications for Wildland & Urban Fire Management" publication, since the demand for the publication has exceeded all expectations. The Group felt that NWCG and FEWT resources should be exhausted before the membership is tapped for funding assistance. Forestry Canada and CDF have both offered to assist in the funding of future editions of the publication. It is planned that three issues will be produced this year.

ACTION: Doc Smith will write a letter to SDTDC expressing appreciation for their efforts in producing the Foam publication.

1540, Video Magazine. Bob Webber presented a short informational video on single-engine airtankers. This generated a discussion by the Group on the feasibility of producing a periodic video magazine incorporating short announcements on the latest fire suppressant foam technology.

ACTION: Bob will work on this project as time allows, and report to the Group at the next meeting.

1605, Foam Training Cadre. Paul Schlobohm updated the Group on the foam training cadre development. He recently had a meeting with approximately ten of the cadre instructors in Boise. This led to a lengthy discussion regarding support of the cadre. It was agreed that the concept of using this Group to train-the-trainers would be most successful. Each cadre member would be the key trainer in their general area of operation, thus reducing the demand for training on the BLM. It was agreed that the Foam Task Group would continue to support the growth and development of this cadre.

1655, Meeting adjourned for the day.

Wednesday, January 30

0800, "Foam vs Fire" Training Manual. Speaking for Chuck George (Intermountain Fire Sciences Laboratory, FS), who was absent, Paul Hill distributed the draft handbook "Foam vs Fire" that was compiled by the handbook subgroup of the Foam Task Group. After some discussion by the Group, it was decided that the subgroup would meet in the evening to work on the details of the draft revisions. (See last entry in these Notes for an outline of the subgroup's meeting).

Foam Computer Database. Paul updated the Group on Chuck George's efforts on the foam computer database, which uses a citation retrieval system to access data. The database is not completed and is currently unavailable for field use. Paul did not know at this time what Chuck needs to complete the project.

ACTION: Doc Smith will contact Chuck for an update on this project.

Airtanker Corrosion Problem. Paul gave a report on the efforts to identify the corrosion problems with airtankers from the use of foam. The Foam Task Group expressed interest in resolving this problem at the San Antonio meeting last year. Chuck George is attempting to replicate the corrosion conditions found in the field. If successful, he hopes to have some answers and solutions by May or June of this year.

Helicopter Fixed Tank Corrosion Problem. Helicopter fixed tank corrosion has been occurring in some helicopters in southern California. Field evaluation of the problem is occurring at this time with corrosion coupons. Lee Young recommended contacting the French and Canadians on the problems they have experienced with tank corrosion. The results of the study will be provided to the Foam Task Group.

1000, Air Program and Foam. Lee Young discussed U.S. aviation's slow progress in foam applications as compared to the French and Canadians. Many systems available internationally are not being pursued. He felt that large helicopters are being underutilized.

Lee presented an industry video of helicopter drops utilizing fixed tanks with attached pump and foam injection systems. To deal with the question of underutilization of foam resources, in general, the Group recommended that some information on the use and application of foam be included into the incident command system (ICS) management position courses.

ACTION: Doc Smith will send a letter to Ken Otten and Fred Fuchs requesting the inclusion of foam courses to the FS aviation staff.

Chuck George, Paul Hill, and Bob Joens will be involved in followup and support of this request. The Group also discussed the need to develop a "foam checklist" for IC's and other fire personnel for use by field units.

1110, Typing of Equipment for the Incident Command System. Paul Schlobohm discussed the efforts made to provide ICS typing for fire equipment with foam capabilities. He presented some slides suggesting the several types of capability alternatives. The Group agreed that the system should continue with current engine typing with additional letter(s) added to designate compressed air foam system as (C) or foam proportioner as (F).

ACTION: These changes will be presented by Rochna and Scholbohm by the end of February for presentation to the ICS committee.

1330, Field Trip. The Group took part in a field trip conducted by the California Department of Forestry and Fire Protection (CDF). CDF displayed its current foam capabilities with its engines and helicopters. The Group reviewed some of the automatic proportioners that CDF has retrofitted on its existing fire engines. A CDF helicopter demonstrated its foam proportioning system and made foam drops from various elevations to illustrate effectiveness under certain conditions. The Bureau of Land Management and the San Dimas Technology and Development Center displayed various field foam kit configurations currently available through the BIFC fire cache.

Thursday, January 31

0800, Foam Applications Catalog. Paul provided an update on the catalog of foam applications. He has been getting many requests for it, including from many municipal fire departments. Cost of the publication will be in the range of $5,000 to $10,000. It is ready to submit to the NWCG publication management system (PMS).

ACTION: Paul Schlobohm will submit the necessary paperwork for printing to Doc Smith for review. The package will then be submitted to Bob Joens for final approval before going to PMS.

0830, Foam Kit Configuration for Fire Caches. Del Starner presented his report on recommendations for fire cache foam kit inventory. Several foam kit configurations were sent to the field for evaluation; however, only two formal evaluations were received. After lengthy discussion by the Group as to kit component criteria, the following decision was made:

ACTION: Doc Smith assigned a subgroup to develop one or more foam kits for the cache. The subgroup will be composed of Paul Schlobohm, Ron Rochna, Del Starner, Steve Raybould, and Gordon Ramsey. The subgroup will also recommend appropriate aspirating nozzles for the inventory.

0950, Foam Training Videos. Paul Schlobohm updated the Group on the development of the training videos for the properties of foam, proportioners, and aspirating nozzles. These training videos are in the final stages of completion. Other videos being developed at BIFC are: Compressed air foam (CAF) application and use, foam tactics, and foam safety/environmental concerns. Paul recommended that production be kept at one site, if possible, and should not be contracted out. This would ensure continuity of subject matter and keep costs to a minimum.

1015, Class A Foam Lesson Plans. Ron Rochna presented the detailed lesson outline on Class A Foams to the Group. The Group gave input and ideas on the lesson plan. Bob Webber suggested adding a few slides on both aircraft foam application and structure firefighting techniques.

Mark Stanford discussed the need to have an instructor's kit with all of the materials required to give a class. BIFC will have a few kits made up and available at some future date for loan to cadre instructors. Completion of the short-version course should be available for NWCG approval in September of this year.

1140, Foam Research in Canada. Ed Stechisen presented an update on Canada's foam research. They are working with Canadair to modify airtanker doors so as to reduce their size. Tests were conducted on (1) foaming vertical fuels to create a fire barrier and (2) burning blocks of vegetation to quantify extinguishment of fire with water only, as compared to the use of foam. Unfortunately, poor burning conditions caused the results of the test to be inconclusive. Finally, Ed informed the Group that his department will possibly be cut from the budget.

1335, Foam Corrosiveness Report. Paul Hill presented a paper on the "Relative Corrosiveness of Currently Approved Wildland Fire Chemicals" and the current list of qualified or approved and commercially available fire chemicals. The Group discussed the need to change the term "wildland fire foam" to "Class A foam". The Group recommended no change at this time.

The Foam Task Group Publication. The Group discussed the format of its publication "Foam Applications for Wildland & Urban Fire Management." There is a need to reflect more on the latest developments in the subject of Class A foam.

ACTION: Doc Smith requested the following articles for future publications:

Aerating nozzles	*Paul Schlobohm*
Proportioners	*Paul Schlobohm*
Foam availability on major fires	*Paul Schlobohm*
Update on the foam training cadre	*Paul Schlobohm*
Airtanker corrosion study	*Chuck George*
Corrosiveness of wildland fire chemicals	*Chuck George*
Foam kits	*Del Starner.*

1420, Review of the Foam Task Group. Doc Smith briefly reviewed the past 4 years of Foam Task Group accomplishments. The Group discussed its future direction and emphasis. The original charter was reviewed and a recommendation was made to emphasize (1) structural fire suppression and (2) the aviation aspects of foam development and application. It was also recommended that the Group consider including representation by vendors and municipal fire departments in some of the subgroup activities.

ACTION: Doc Smith asked guest Steve Perez and the general membership to speak to appropriate officials in their respective areas to size-up the metropolitan fire department needs for the Foam Task Group's work and recommendations. Mark Stanford will head this subgroup to collect and evaluate the information obtained. He will report at the next Foam Task Group meeting.

Foam Task Group Budget. Doc Smith discussed the 1992 Foam Task Group budget. The categories were:

- Travel
- "Foam vs Fire" publication
- "Foam Applications for Wildland & Urban Fire Management" publication (three issues)
- Video productions (three).

ACTION: The amount of funding available was not clear at this time. Doc Smith will talk with Harry Croft about the 1991 budget and current balance.

Next Foam Task Group Meeting. The next meeting will be scheduled for the week of October 28th in the Northeastern States area. Doc will ask Pat Ebarb to host the meeting.

"Foam vs Fire" Training Handbook Subgroup Meeting. The Group reviewed the draft training handbook and realized that the information it contained was far more comprehensive than what should exist in a "primer." It was agreed by the subgroup that work should continue to complete the comprehensive manual and name it "Foam vs Fire, a Comprehensive Guide to Ground Application." Upon completion of the comprehensive handbook, the subgroup will develop a condensed version called "Foam vs Fire, a Primer." It was also agreed that a follow-up publication be compiled at some time in the future covering air application of foam. This training publication would be called "Foam vs. Fire, a Comprehensive Guide to Aerial Application."

ACTION: The subgroup members will send their individual edits and comments to Chuck George by 2/28/91. Chuck will make a determination if another meeting is necessary, or if consultation with members can occur over the telephone.

(*Note*: The subgroup decided to add the "Critical Application Rate" principle to the handbook. This subject had not been placed into the original draft.)

If you have any questions on either these Notes or the Foam Task Group, contact Doc Smith, USDA Forest Service, Kaibab National Forest, 800 South 6th Street, Williams, AZ 86046; 602/635-2681.

CANADIAN FOAM EFFECTIVENESS STUDY

by C.J. Ogilvie, Forestry Canada

Over the last few years, firefighting foam has become an important component in the Canadian aerial forest fire suppression arsenal. The basic question of whether or not foam is effective seems to have been largely confirmed by the users. The field use of foam has, however, raised a number of other questions that should be answered. These questions include: What consistency of foam is desirable for different fuel parameters and weather conditions? How do factors such as mixing rations, water conditions, tank and gating systems, drop heights, and drop speeds affect foam consistency? What strategy and tactics should be employed?

In an attempt to answer these questions, a study has been initiated by the Northern Forestry Centre of Forestry Canada, and the Alberta Forest Service with cooperation from the Government of the Northwest Territories Department of Natural Resources (DNR), the Saskatchewan Department of Parks and Renewable Resources, and Chemonics Industries (Canada), Ltd. The study is closely patterned after the USDA Forest Service, Operational Retardant Effectiveness (ORE) study conducted by Chuck George and colleagues at the Intermountain Fire Sciences Laboratory Missoula, Mont., in cooperation with the USDI Bureau of Land Management, and the California Department of Forestry and Fire Protection. The purpose of the ORE study is to provide detailed information on optimum tank and gating systems; the most effective chemical and physical retardant properties; and the selection, allocation, and deployment of airtankers.

The Canadian study is primarily concerned with foam applied with the Canadair CL 215 airtanker (fig. 3). Field data are collected by a four-man team transported by an infrared (FLIR)-equipped helicopter (Bell 206L). The team consists of an aerial attack person and a foam evaluation person who are put down near the fire to conduct ground evaluations, while an infrared scanner operator and the pilot conduct aerial observations.

Figure 3. CL 215 dropping foam.

The ground evaluations include collecting fuel type and fuel moisture information, weather observations, topographic information, fire behavior characteristics, and foam performance data. Collecting the foam performance data includes sampling the foam to determine expansion ratios, measuring foam depth and penetration over time, and estimating foam coverage over the area covered by the drop.

The aerial observations are made with a FLIR scanner and a 35-mm still camera with data back. The infrared capability enables through-the-smoke evaluation of a foam drop with regard to its placement and effectiveness, over time, in stopping or slowing the fire. The results of the study will be summarized in the form of a guideline for aerial application of foam from a CL-215, and a case study report containing a pictorial and written record of each fire documented.

For additional information contact C.L. Ogilvie, Fire Management, Northern Forestry Centre, Forestry Canada, 5320-122 Street, Edmonton, Elberta T6H 3S5; 403/435-7210; FAX 403/435-7359.

ASPIRATED NOZZLE PERFORMANCE

by Paul Schlobohm, Ron Rochna, and Al Olson, USDI Bureau of Land Management

In 1988 Rochna, Grady, and Schlobohm measured the performance of low-expansion aspirated nozzles and Class A foam. Water flow, discharge distance, expansion ratio, and drain rate were examined according to the Standard for Evaluating Foam Fire Fighting Equipment on Aircraft Rescue and Fire Fighting Vehicles (NFPA 412). A report on this appeared in Volume 2, Number 2, of this "Foam Applications..." publication.

At least ten new nozzles have been developed and marketed since 1988. During the summer of 1990, we repeated our 1988 test for the new devices. We also considered the discharge efficiency of each nozzle tested on either date. Discharge efficiency is defined as the total foam discharge distance relative to the water flow required for this output. An efficiency of 2.0 means the nozzle projects foam 2 feet for every gallon per minute of water it flows.

Original 1988 data are reprinted in figures 4 and 8. Discharge efficiencies for nozzles tested in 1988 are shown in figure 5. Corresponding data for nozzles tested in 1990 appear in figures 6, 7, and 9. Differences in results for the same nozzles between the 1988 and 1990 tests demonstrate the influence of local factors like air temperature, water temperature, and water pH, which were not identical.

The low-expansion aspirated nozzle is a simple method of foam production, having low initial cost and improved water efficiency. We recommend nozzles with (1) discharge efficiencies that indicate adequate discharge patterns for your water flow requirements and fire behavior conditions, and (2) expansion and drain rate production appropriate for your applications.

For additional information, please contact Ron Rochna or Paul Schlobohm, Bureau of Land Management, Boise Interagency Fire Center, 3905 Vista Avenue, Boise, ID 83705; 208/389-2432.

GROUND APPLIED FOAM EVALUATION

by Paul McBay, Aviation and Fire Management Centre, Ministry of Natural Resources, Ontario

The use of firefighting foams is not a new concept. One of the earliest foam patents in North America was recorded in 1877. Through most of this century its use has been limited on forest fires for a variety of economic and logistics reasons. Over the last 5 to 10 years improvements have been made to foam concentrates and to the technology of foam delivery systems. These improvements, as well as the effectiveness of foam dropped by Canadair CL-215 airtankers led to an evaluation of ground foam systems in Ontario in the 1990 fire season. This operational evaluation project has been established to:

Discharge patterns and water flow rates of low expansion nozzle aspirated systems tested in 1988. Foam was produced at 100 psi and projected 30 degrees from horizontal.

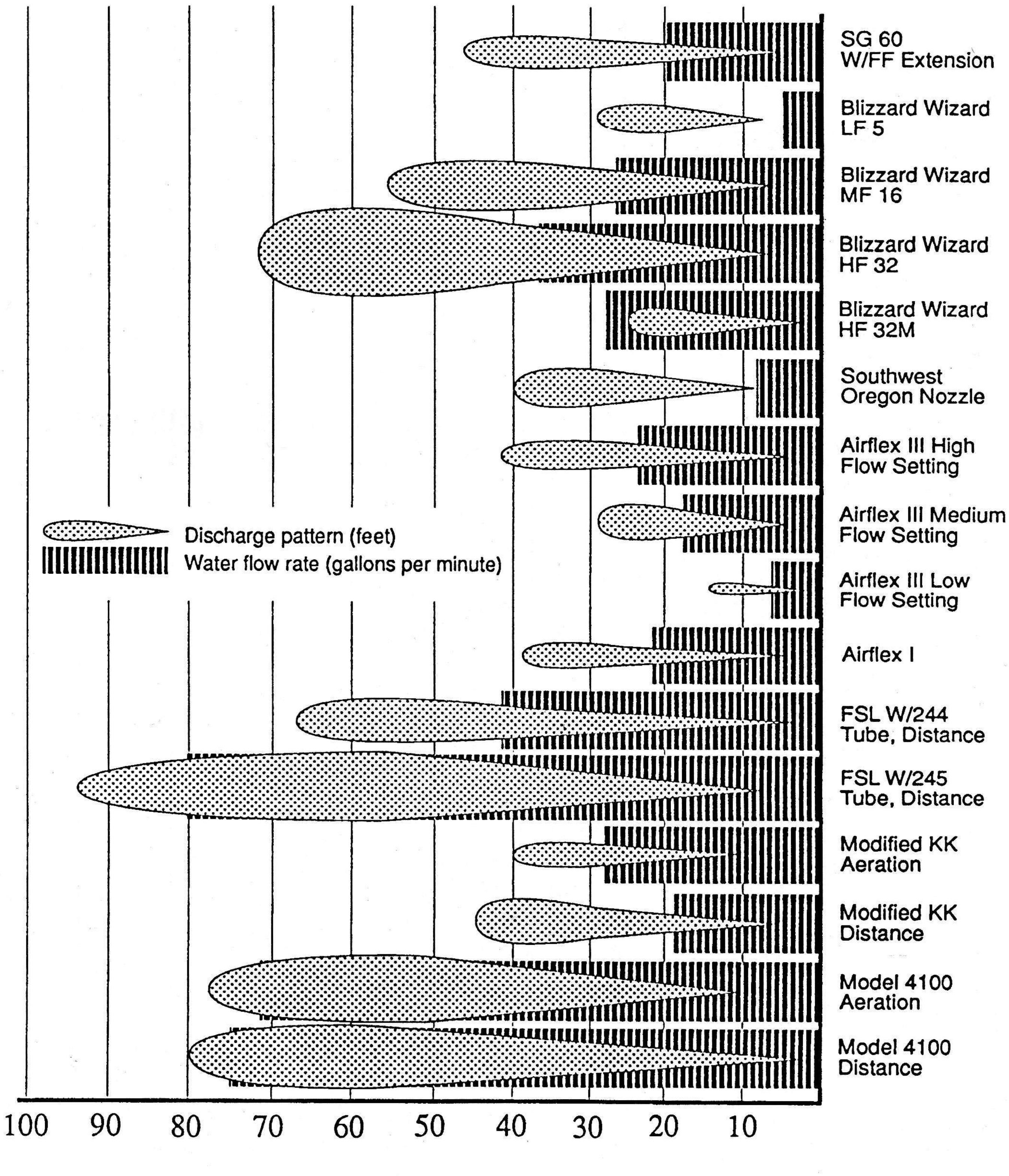


Figure 4. Discharge patterns and water flow rates.

Discharge efficiency is the total foam discharge distance relative to the water flow this projection requires:

$$\frac{\text{total projected distance (ft.)}}{\text{water flow (gpm)}}$$

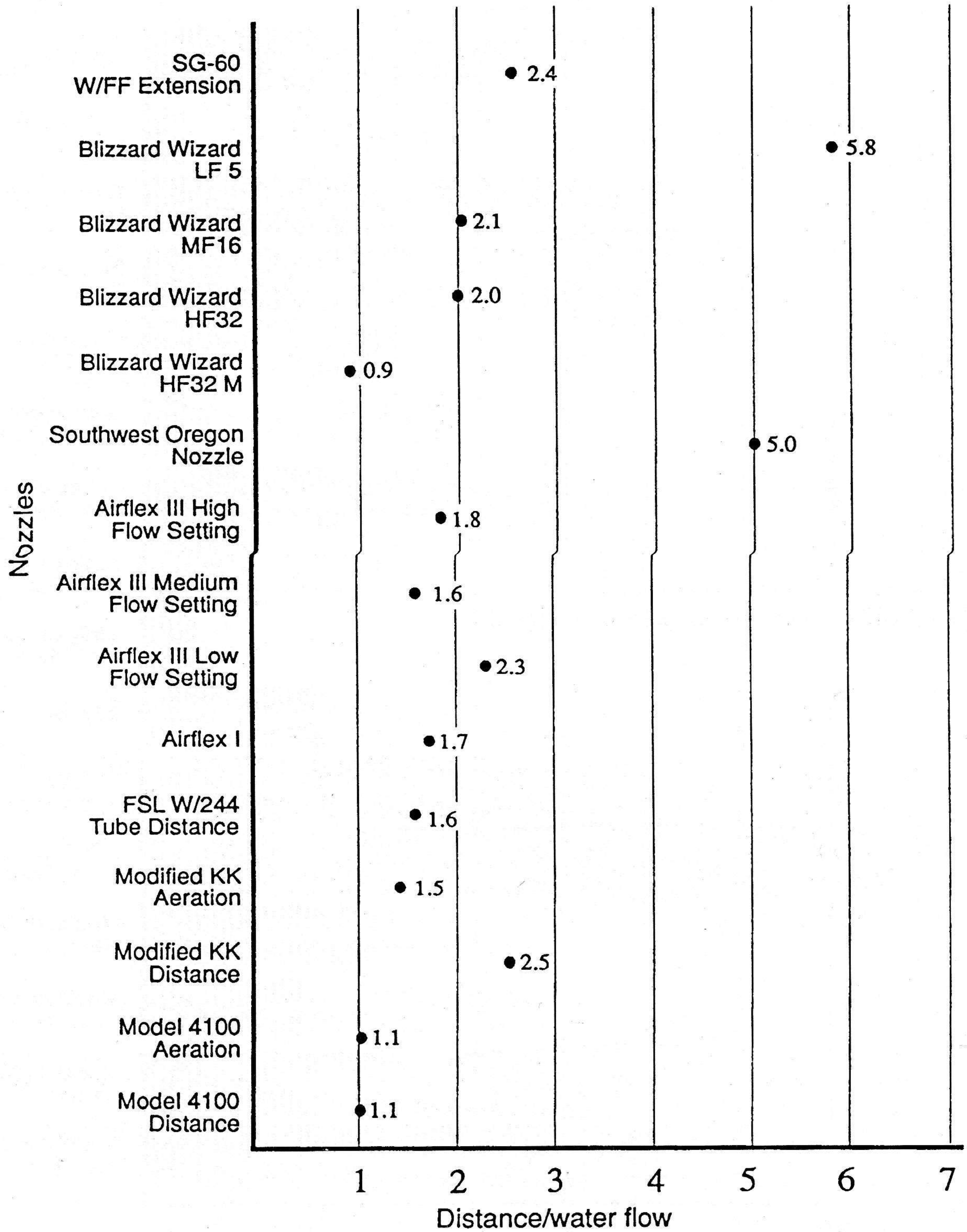


Figure 5. Discharge efficiency, 1988.

Discharge patterns and water flow rates of low expansion nozzle aspirated systems tested in 1990. Foam was produced at 100 psi and projected 30 degrees from horizontal.

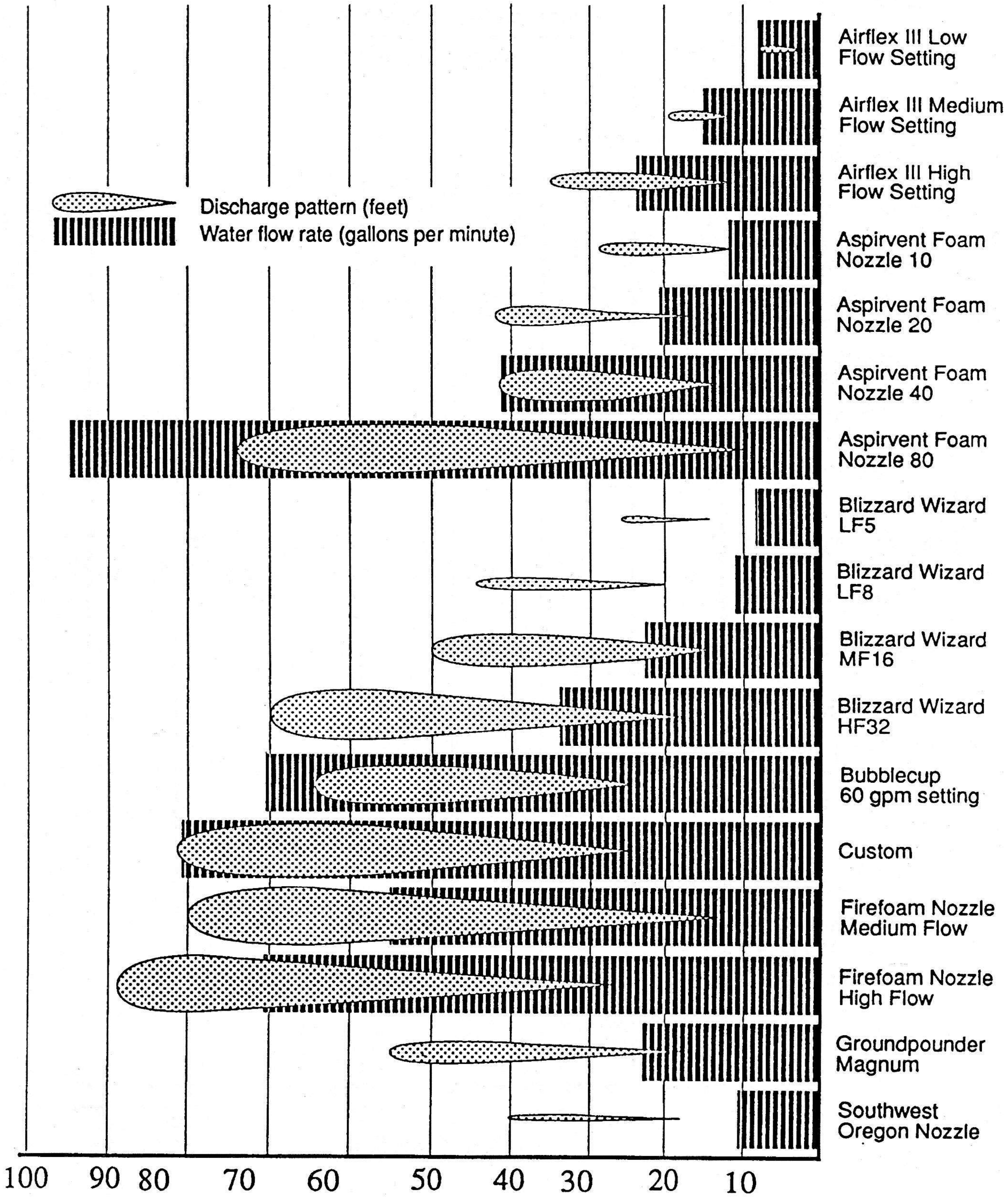


Figure 6. Discharge patterns and water flow rates, 1990.

Discharge efficiency is the total foam discharge distance relative to the water flow this projection requires:

$$\frac{\text{total projected distance (ft.)}}{\text{water flow (gpm)}}$$

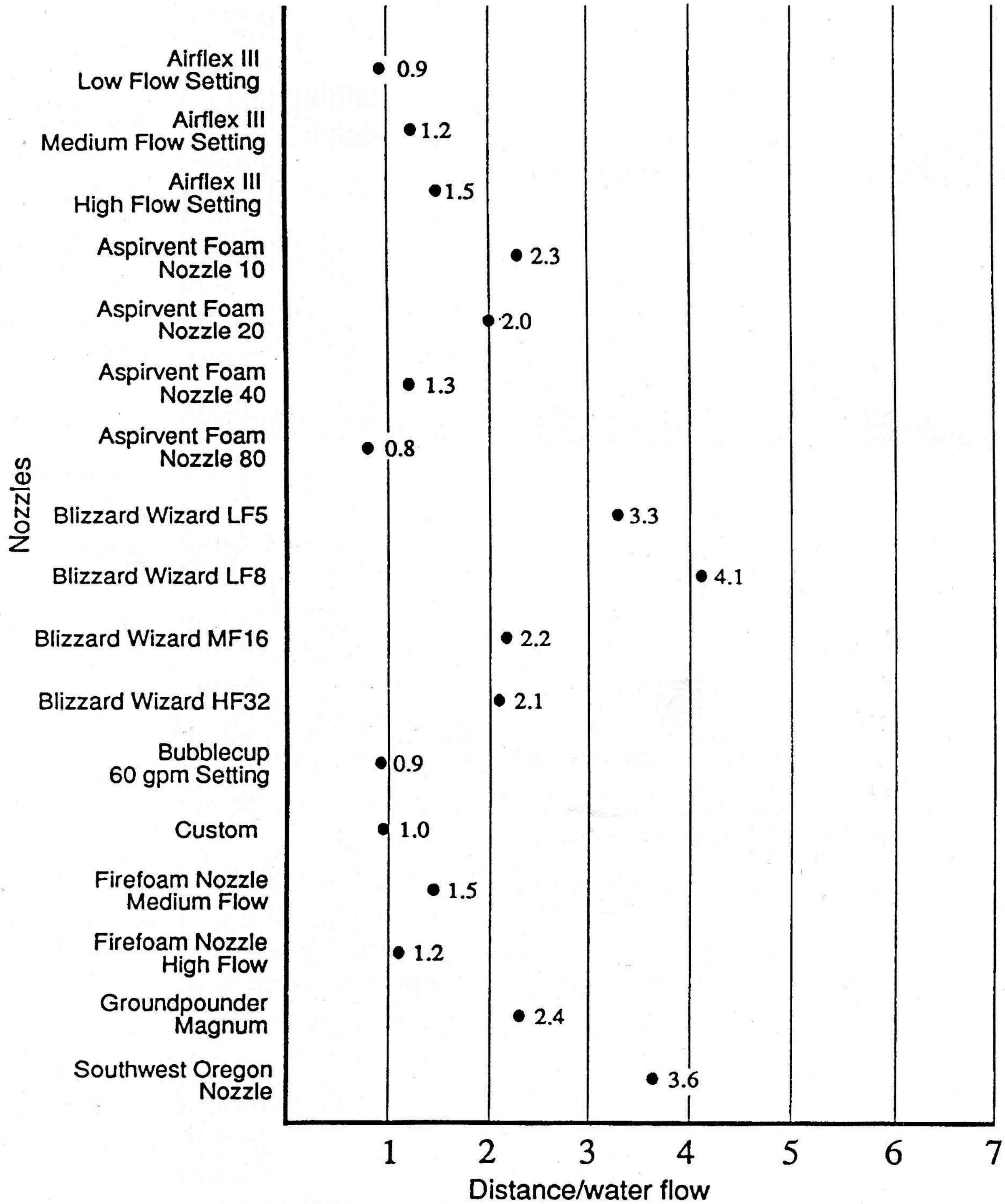


Figure 7. Discharge efficiency, 1990.

Expansion and 25 percent drain rates of low expansion nozzle aspirated systems tested in 1988. Foam was produced at 100 psi with 0.5 percent solution.

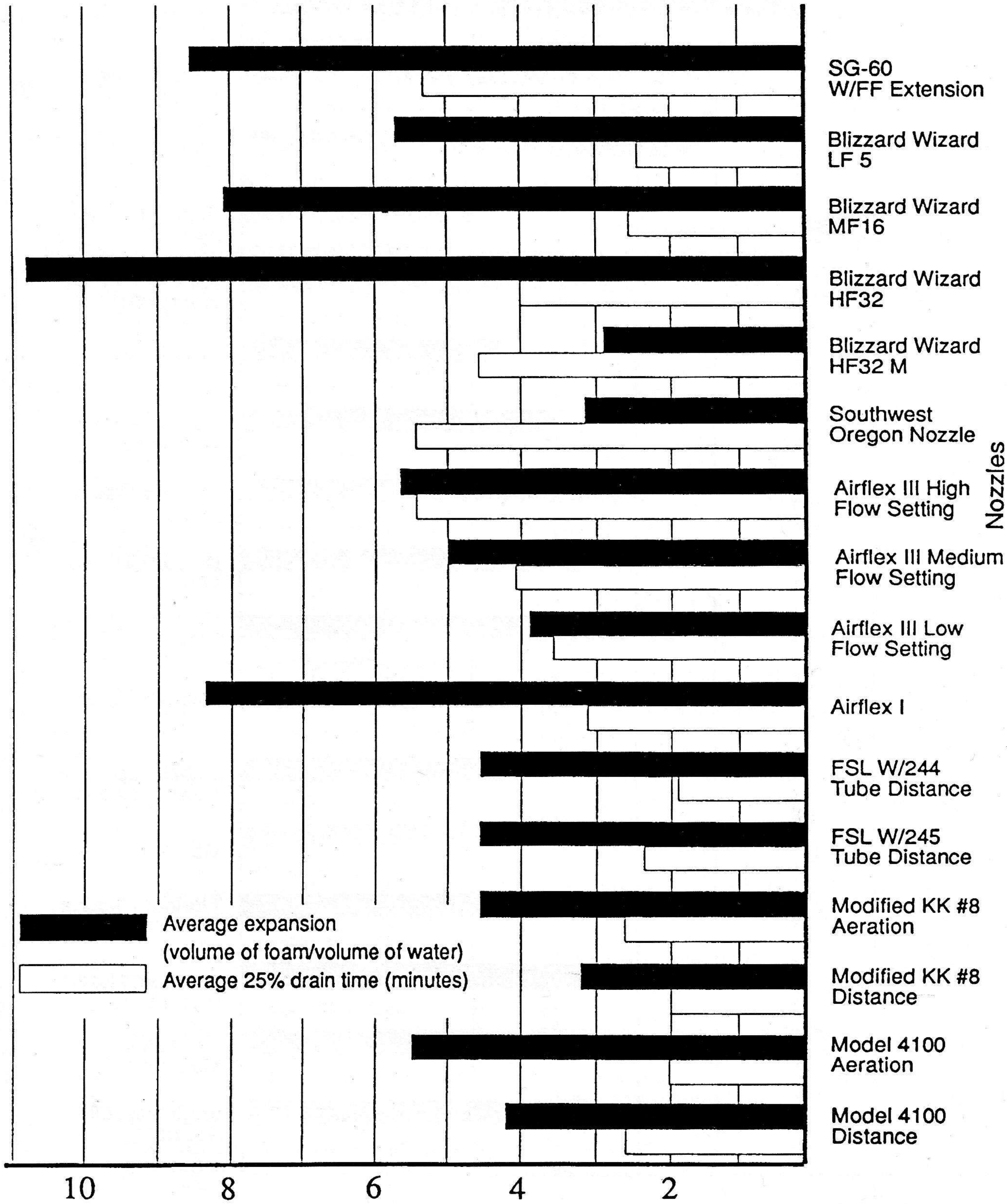


Figure 8. Expansion and 25 percent drain rates, 1988.

Expansion and 25 percent drain rates of low expansion nozzle aspirated systems tested in 1990. Foam was produced at 100 psi with 0.5 percent solution.

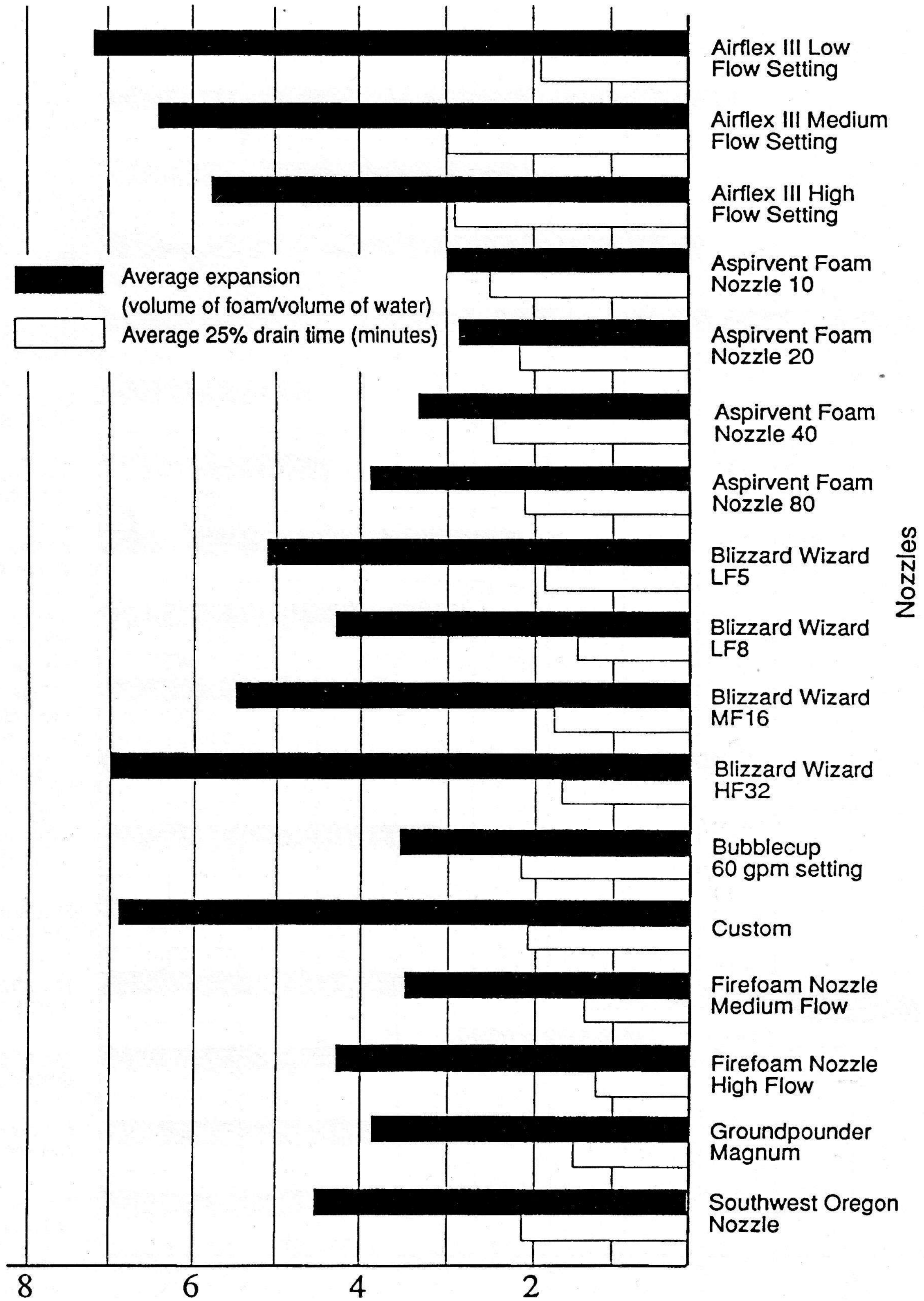


Figure 9. Expansion and 25 percent drain rates, 1990.

1. Provide an opportunity for fire staff to become familiar with foam
2. Enable staff to operationally evaluate foam delivery systems
3. Identify appropriate applications for ground foam.

The majority of development work and implementation of ground foam systems has taken place in the western United States and has concentrated on the use of foam equipment on truck tankers. Here weight and volume are less important than they are for helitack operations common in Ontario. The development work has also concentrated in areas where water shortages require firefighters to apply what little water they have as effectively as possible. In these conditions, foam has proven to be a very effective ground tool.

In many parts of Ontario helicopter access to remote fires restricts the weight of equipment that can be used on initial attack and a shortage of water sources is not normally a problem. The challenge for using foam economically and efficiently on the ground in Ontario will be to find the best mix of equipment and technique to use on those fire applications that respond best to the enhanced cycle of water effectiveness that foam provides.

The development and use of more portable ground foam systems for Canadian conditions has been taking place only over the last 3 to 4 years. The changes to equipment have been rapid and it may take several more years before the technology stabilizes. British Columbia and Alberta have led the Canadian implementation of ground foam systems appropriate to their conditions. The knowledge they have gained has been used as a starting point for the introduction of ground foam systems in Ontario.

During the 1990 season each of the five northern regions in Ontario had an opportunity to operationally assess ground foam equipment for a variety of applications and develop techniques appropriate for conditions in Ontario. In June 1990, a ground foam evaluation workshop was held at the Rinker Lake forward attack base near Thunder Bay. Representatives from participating regions attended 2 days of "train-the-trainer" classroom instruction and field demonstrations that included both aerial and ground foam systems. The objectives of the course were to explain foam concepts, demonstrate foam equipment, discuss application techniques and strategies used by other agencies, environmental impacts, health and safety requirements, and to present the instructor lesson plans and reference material and, on return to their bases, presented the information to other personnel who would be involved in the evaluation.

Each region received at least one air-aspirating foam kit consisting of the Robwen Model 500 Flow-mix Proportioner, two models of air-aspirating nozzles for 1.5-inch hose (CO-SON MF-32 and KK Bubblecup), aspirating nozzles for backpack pumps, personal safety equipment and Silv-Ex foam concentrate. The Northeastern region has been provided with a Mallory compressed air foam system (CAFS) mounted on their newest tanker truck. The Mallory slip-on CAFS unit, based at the Petawawa National Forestry Institute (PNFI), is available for use by the Pembroke fire operations headquarters staff. The North Central region also evaluated CO-SON LF8 Econoflo hose nozzles, in addition to a Blizzard Wizard round the pump system, and a GF-100 suction-side eductor—both of which the region had purchased several years ago.

The Flow-mix unit was chosen for this evaluation because (1) it provides accurate foam metering that produces a consistent, good quality foam, and (2) the unit and concentrate could be placed up the line from water sources to reduce the potential for spills. The intention was to allow fire staff evaluate the use of foam on fires without having to spend a lot of time adjusting the foam metering equipment. The Flow-mix unit is bulky and heavy to use for helitack operations that use light helicopters. After the crews are familiar with what they can do with a good foam, they will evaluate how to make good foam with less capable but lighter and lower cost equipment.

Evaluation forms were distributed to record data and comments about each dispatch of the equipment. These data will be analyzed at the AFMC at the end of the evaluation and will be used to formulate recommendations for ground foam implementation. In addition to the evaluation forms, crew leaders participating in the evaluation prepared a report at the end of August describing their experience with foam. This included initial recommendations about appropriate applications, techniques, preferred equipment configurations and modifications, additional training requirements, and concerns about the use of foam.

The 1990 season did not provide the number of opportunities hoped for the foam evaluation, but the equipment was used on 12 wildfires, 7 dump fires, 6 prescribed burns, 5 training and demonstration sessions, and 2 brush/slash pile burnings. The evaluation is being extended for an additional year before implementation recommendations are made. A number of areas still need to be investigated—including lighter weight, lower cost foam metering devices, hose retrieval techniques for removing foam from percolating hose without generating large amounts of foam in hose plant effluent, and backpack pump 90-ml foam pack replacement.

Direct comments or questions concerning this project to Paul McBay, Aviation and Fire Management Centre, Ministry of Natural Resources, 747 Queen St. East, P.O.Box 310, Sault Ste. Marie, Ontario P6A 5L8; 705/942-1800.

BIGGER ISN'T ALWAYS BETTER

by Gary F. Wallace,
Equipment Development Manager,
The Mallory Company

With the evolution of compressed air foam systems (CAFS), there has developed a belief in some circles that "bigger is the only way to go." Water flows have gone from the 30- and 50-gpm range to 300+ gpm, and air flows exceed 250 cfm. I believe we have lost sight of some of the benefits of Class A foam systems. The original CAFS (or "WEPS," as it was called then) was used by the State of Texas Forest Service to work with minimal water for fire extinguishment. Water conservation was a prime concern because of its limited availability.

Class A fire engines fed from hydrants with 5-inch hoses, in a metropolitan area, have little concern for water consumption. Although the small WEPS units served a purpose for their intended use, they were slow to gain acceptance in other areas. Larger timber and heavy fuel loading in the west required larger flows. With only 25 to 30 gpm water flow, they were not acceptable for direct attack on structure fires.

With the advent of the Class A foam chemicals of the 1980's, and waterflows in the 50- to 100-gpm range, firefighters are able to achieve rapid knockdown on medium structure fires. A fire in a typical three-bedroom home of about 1,500 square foot size can be attacked with a 50-gpm/40-cfm CAFS engine, and experience fire extinguishment similar to a conventional water attack at 100 gpm.

Information distributed by the Boise Interagency Fire Center (BIFC) over the last couple of years claims that Class A foam is three times better than plain water for fire suppression. Foam holds water in place and insulates the fuel twice as long. It also enhances the penetration, and wets fuel 20 times faster than plain water. Although water still puts the fire out, the use of foam makes water more efficient.

Small rural and volunteer fire departments can enhance their fire suppression ability by the addition of a light attack CAFS engine (fig. 10). To contend with the lack of adequate water, narrow driveways, overhanging trees, soft ground conditions, and restricted access, the light attack unit or CAFS minipumper (figure 11) is a very effective tool. Fifty-gpm waterflows converted to 500-gpm foam flows become a viable alternative. One-hundred-gpm water flow creating a 1,000-gpm foam flow is dynamic.

Figure 10. Mallory Company's light attack compressed air foam engine.

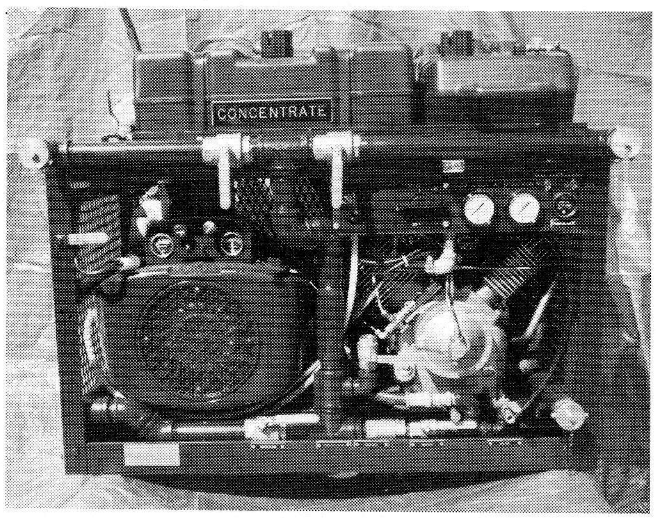


Figure 11. Compressed air foam system slip-on unit.

These engines are excellent first-response vehicles for fire/rescue because of their agility and maneuverability. They can get to places a large engine cannot. There is, of course, a place for a large engine, but the CAFS minipumper has definite benefits. Not every department can afford engines at $150,000+, and used apparatus are not always available or desirable. Brand new minipumpers with Class A foam and/or CAFS can be purchased for approximately $40,000 to $60,000. With limited budgets, this relatively inexpensive alternative to the big fire engine can maximize fire extinguishment in the wildland/urban interface.

In a four-wheel (4WD) drive configuration, chassis run in the 11,000 GVW range, which dictates tanks in 200 to 250 gallon range—when accompanied with the usual tool requirements. In 2WD, the 14,500 GVW chassis will easily handle a 300-gallon water tank with plenty of room left for optional equipment. By using fiberglass bodies and aluminum construction, a good weight savings is accomplished. With a conservative 10:1 foam expansion ratio, a 200-gallon engine will deliver 2,000 gallons of Class A foam, and 300 gallons of water expands to 3,000 gallons of fire suppressant foam. When a water tender is available as a backup to the initial attack, the advantage is obvious.

While the big engines are limited to good roads during a wildland fire, the light attack engine can get to a lot of places that are inaccessible to the "biggies." Because of maneuverability, time-consuming long hose lays from the road might not be necessary. The new 1-1/2-inch monitor or "Deck Gun" allows quick application from close range. Discharge distances of 80 to 90 feet from a single 1-1/2-inch line on a 50- to 60-gpm CAFS are the norm. The 120-gpm/70-cfm CAFS will deliver a 100- to 120-foot discharge, or handle two 1-1/2-inch lines at a sustained 70-foot discharge.

With critical application rate considered for fire extinguishment and the proper use of the light attack engine, "bigger is not always better." For additional information, contact Gary Wallace, The Mallory Company, 1814 Baker Way, Kelso, WA 98626; 206/636-5750.

TRAINING AND SAFETY NOTES

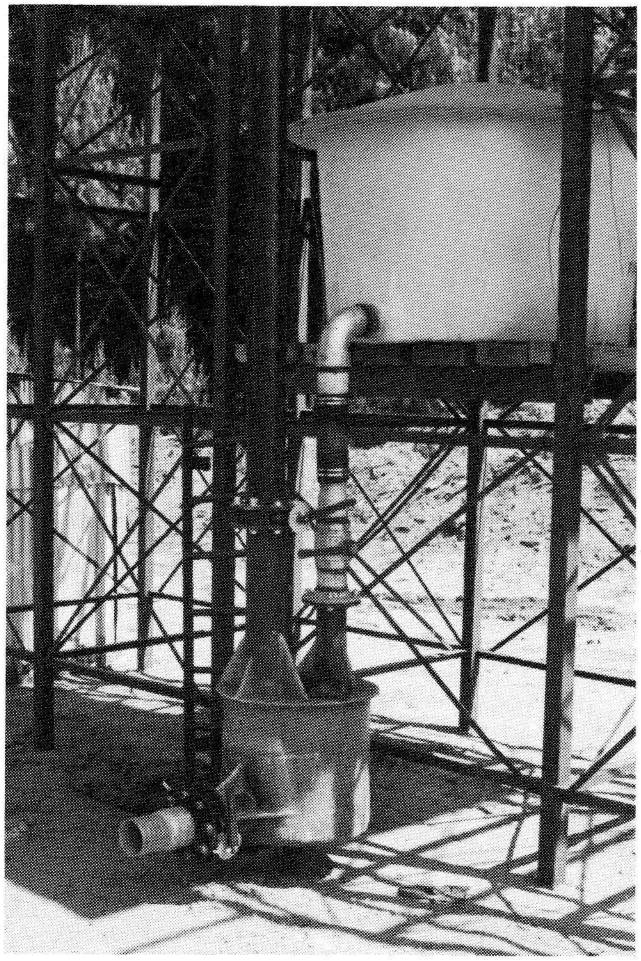
Class A Foam Education

by Paul Schlobohm, Forester, USDI Bureau of Land Management

The Bureau of Land Management has scheduled a course on Class A foams and their use entitled "Class A Foams, Equipment, and Tactics." The course details the properties of water and foam for fire suppression, examines proportioning and foam generating devices, and describes applications and tactics of Class A foam. Applications include direct and indirect attack, mop-up/overhaul, and exposure protection. Instruction for the 2-day session is a combination of lecture and hands-on exercises.

The course is scheduled for four occasions: October 24-25, 1991; November 19-20, 1991; April 22-23, 1992; and July 14-15, 1992. All sessions will be held at the Boise Interagency Fire Center (BIFC), 3905 Vista Avenue, Boise, ID 83705.

The Foam Task Group of NWCG's Fire Equipment Working Team has initiated a Class A foam instructor cadre to continue the presentation of this course in a uniform manner throughout the country. A cadre list will be forthcoming as the group becomes prepared and equipped. Cadre nominations can be sent to Paul Schlobohm at BIFC, or call 208/389-2432.



Foam batch mixing tank for aircraft.
(See "Letter to the Editor", pg. 20)

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Nelspruit Airport

8 January 1991

Mr Al Seltzer
Technical Editor/Writer
Foam Applications for Wildland and Urban Fire Management
C/o U S DAA Forest Service
444 East Bonita Avenue
SAN DIMAS CA 91773
UNITED STATES OF AMERICA

Dear mr Seltzer

I am very grateful for the information and back copies forwarded to me by Dan McKenzie.

We have been experimenting with a large variety of chemicals in aerial and ground applications since 1986.

It would be very useful for us to keep in touch with the Working Team Task Group, as our expertise is minimal in this field.

We were only introduced to Phoschek WD - 881 at the end of the 1990 fire season and only had the opportunity to use it on one fire, where we found it to be very effective. I enclose a copy of a report received from the Forester concerned.

We have become used to very low drops using fixed wing agricultural aircraft of 1400 litre capacity - it would appear that the load is more compact with Phoschek than with water, so that we could afford to increase the drop height and should do so for improved safety of ground crews.

6 year - old pine trees would be approximately 4 metres tall, on an average to poor site, as in this instance.

We are anticipating using Phoschek or similar foams in both the aerial and ground roles - in 1990 in our area alone we dropped 1,2 million litres of water and chemicals in 844 loads and 290 hours flying in 7 bombers, ground operations were also extensive and we are hoping to test our first C.A.F. system before the end of January.

You may wish to use some or all of this - although we are so far behind that I wonder whether anyone will be interested!

We use gravity loading and have developed a batching system as very often loading is done at remote sites with relatively unskilled workers. I enclose a photograph of the batching tank. Chemicals in the white tank are batched into the mixing tank - which is marked in 10 litre steps. Once the desired amount is received in the batching tank, the red-handled valve is closed, and the mixture is flushed into the aircraft by water via the black vertical pipe and the 100 mm. diameter ARCAL pipe (not shown.) As for times, we look for 2 minutes touch-down to take-off and unlike this type, normally have two loading points to enable simultaneous loading.

We look forward to keeping in touch with you - we are hoping to send a tour group overseas in May 1991 - I don't know whether time and finances will allow a visit to San Dimas.

Yours sincerely

S J MEIKLE
CHAIRMAN : LOWVELD FIRE PROTECTION ASSOCIATION

SJM/mam

LETTER RECEIVED FROM D BALLANTYNE (Forest Manager, Sudwala)
SAPPI, MOOIFONTEIN (14-11-90)

PERFORMANCE OF PHOSCHECK AT MOOIFONTEIN B34 FIRE, 13/11/90

A total of six drops using Phoscheck were inspected on the ground during the fire, with the observer being directly beneath two of the drops.

Before discussing the effects of the Phoscheck some characteristics of the drops must be mentioned. I feel that the drops were put-in too low because the leading edge trees (6 year old, unpruned Pinus patula) were completely knocked-over and uprooted with an average of about four trees per drop being taken out of the ground. Drops of this nature would be lethal to people working on the fire line at the beginning of the drop zone. The accuracy of the drops was excellent with minimal over- and undershooting.

The foam produced by the Phoscheck completely covers all the needles and branches of the trees and remains there for at least 30 minutes. (I was not able to stay longer than this but I am sure that is stayed for much longer.) The needle mat on the floor was approximately 70% covered with foam in most of the drop zone. At the end of the drop zone the Phoscheck forms clouds of foam which float down and have little effect.

I was directly under one drop and the approximately fifteen people on the fire line gave a huge cheer as they got drenched. My clipboard and map got instantly soaked through (much quicker than with water) so there must be an effective wetting agent in the Phoscheck. On one of the drops there was a definite explosion as the drop tore out trees and extinguished a very hot spot. After the drops the drop zones cooled down considerably.

The Phoscheck gives off a fairly strong, but not unpleasant, smell which permeates the whole area. I have suffered a peculiar headache the whole of today and feel that it is caused by the chemicals. I noticed that the containers recommend that Phoscheck must not be inhaled, so it must be poisonous.

I am not experienced with fire retardant chemicals but the Phoscheck certainly proved its worth on this fire and appeared to be very effective when applied correctly.

Ed is taking note Duncan.

Ed.

NELSPRUIT OPS KAMER

Hallo daar!

Einde ten laaste het 31 Oktober ook gekom en gegaan. My kantoor-almanak het gelyk soos dié van 'n dienspligtige ná "forty days", soos wat elke dag afgemerk was na die einde vaan die vuurseisoen toe!

Diegene ook op vuurdiens ken ook sekerlik almal die gevoel. Amptelik, volgens die gepubliseerde staatskoerant, eindig die vuurseisoen einde Oktober. Die ops-kamer was egter beman en twee spotter- en een bommer-vliegtuie op nood-bystand

SUGGESTED READING & VIEWING

The following papers on foam technology are for your suggested reading:

1. Johnson, Cecilia W.; George, Charles W. Relative corrosivity of currently approved wildland fire chemicals. Res. Paper INT-437. Missoula, MT: Intermountain Research Station, USDA Forest Service; December 1990.

2. Liebson, John. Introduction to Class A foams and compressed air foam systems for the structural fire service. Intrnatl. Soc. of Fire Service Instructors (ISFSI), 30 Main Street, Ashland, MA 01721.

The following videos on foam technology are for your suggested viewing:

1. Class A foams for structural firefighting. American Heat, Vol. 4, Program 11, May 1990.

2. Class A foam test at Sikeston. American Heat, Vol. 5, Program 4, October 1990.

[For complete information on these two videos, contact American Heat, 240 Sovereign Court, Suite C, St. Louis, MO 63011.]

3. Class A foam: Making water work better. Monsanto Chemical Co.

[For complete information, contact Monsanto Chemical Company, 800 N. Lindbergh Boulevard, St. Louis, MO 63167.]

FOAM APPLICATIONS FOR WILDLAND & URBAN FIRE MANAGEMENT

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