San Dimas

Fire & Aviation

USDA Forest Service

• Technology & Development Program •

5100 Fire, 5700 Aviation



The Fire and Aviation Management Program San Dimas Technology and Development Center—

The Fire and Aviation Management (F&AM) Program of the San Dimas Technology and Development Center (SDTDC) provides a systematic application of scientific knowledge to create new or substantially improved equipment, systems, materials, processes, techniques, and procedures to meet the objectives and challenges presented to fire and aviation managers. To help solve current resource management problems that have national scope and significance the Technology and Development program has primary charge of the working partnerships with:

- Private Industry
- Consultants
- Academia
- Other international, Federal and State agencies.

This report summarizes current work projects and lists recent publications, drawings, and audiovisual productions. The F&AM team at SDTDC include Sig Palm and Carl Bambarger, Program Leaders; Roger Bergmann, LaMoure Besse, Joy Burton, Fred Cammack, Susan Clements, Sue Cox, Manuel Damole, Gabriel Duran, Dave Erlenbach, Joe Fleming, Skip Garrett, Ralph Gonzales, Dan McKenzie, Steve Raybould, Victor Rios, Eric Shilling, Lois Sicking, Ralph Taylor, and Janie Ybarra.



The SDTDC Fire and Aviation Management Team Members.



SDTDC Fire and Aviation Program Leaders



Sig Palm, Fire Program Leader

Sig Palm joined the San Dimas Center in July 1992 as the Fire Program Leader. Sig brings an extensive background in fire management to the Center having served as Prevention, Training and Emergency Services Group Leader for the Northeastern Area, as Incident Commander of the Eastern Region Interagency Incident Management Team, serves as an advisor to NWCG Fire Equipment Working Team and National Fire Equipment System and represents the W.O. Fire & Aviation Operations staff on several National Steering Groups and committees.

Sig also worked in the Southwestern Regional Office, served as District Ranger on the Tonto National Forest, District Ranger on the Gila National Forest and concurrently administered

the Gila Cliff Dwellings National Monument for the National Park Service, and Assistant District Ranger on the Prescott National Forest. He also served as District Resource Staff and District Fire Management Officer on the Bighorn National Forest, was the first Superintendent of the Wyoming Interagency Hot Shot Crew in Greybull, WY, and worked seasonally (fire, recreation, and forest management) on the Roosevelt National Forest. Sig has a B.S. degree in Forestry and Range Management from Utan State University.

> Carl is a graduate Aeronautical Engineer from California State Polytechnic University at Pomona, California. He joined the San Dimas Center in 1995 and his current projects are Technical Services-Aviation, Air Tanker Base Noise, Helicopter Operations Safety Training Materials, Helicopter Accessories, Wildland Fire Engine Design, Helicopter Dip Tanks, and Hi-Tech Fire Simulator.

> Carl's prior federal service was with the U.S. Air Force in development and procurement of missile systems, guidance



Carl Bambarger, Aviation Program Leader

and control computers, and aircraft avionics. His most recent experience with the Air Force was in the development, testing and production of the C-17 Airlift Cargo Aircraft.

Technical Services, Fire Management TE01P11 Sig Palm is the Project Leader

This project is one of the most frequently provided services of SDTDC. It provides the resources for the Center's Program Leader to manage the program through SDTDC Budget Planning and Project Development, support current operational requirements for National Fire and Aviation Operations, provide technology transfer, special assignments and administrative studies, and networking with the public, other fire service agencies, industry representatives, and Forest Service field personnel.

The SDTDC maintains active participation in National Fire Protection Association (NFPA) committees, Society of Automotive



Engineers (SAE), American National Standards Institute (ANSI) and serves as an advisor/member on a variety of task groups and committees, such as the National Wildfire Coordinating Group (NWCG) Fire Equipment Working Team (FEWT), Foam Task Group, The National Fire Equipment System (NFES) plus regional and geographic area fire equipment committees. SDTDC supports a variety of In-Service as well as interagency meetings, conferences, workshops, and special task forces. In addition, this project supplies current information, drawings, and new product information to the field user.

Airtanker Base Noise 7E71P12 Carl Bambarger is the Project Leader

Airtanker bases are inherently noisy on the ramp and, in many cases, in the office. As more turbine powered aircraft become airtankers, either through replacement or upgrade, the noise environment at the bases will increase. The effects of noise on people can include stress, impair decision capability, and result in permanent hearing loss. The goal of this project is to investigate the noise environment at airtanker bases, measure the exposure and compare it to established regulatory standards. Hearing protection technologies will be investigated if these technologies are exceeded.

In investigating hearing protection devices, the airtanker base noise frequency spectra will be used with the manufacturer's published noise frequency attenuation ranges. Ear muffs and plugs provide different hearing protection at slightly different frequency ranges. In addition to the standard protection devices, the new Active Noise Reduction (ANR) through cancellation technology will be investigated. ANR senses the incoming sound sources and generates an inverse sound wave which effectively cancels the outside noise. These devices are also frequency range limited. The investigation may show that a combination of protection devices will be needed.



Model 47 Marmon-Harrington courtesy of Dan Gosnell, San Bernardino National Forest



Model 52 Engine.



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Wildland Fire Engine Design 4E41P20 Carl Bambarger is the Project Leader

For over fifty years, the Forest Service has been designing and building wildland fire engines. The Marmon Harrington Model 47 was built at the Arcadia Equipment Development Center, now known as the San **Dimas Technology and Development** Center. Since that time, the Center's involvement in designing wildland mobile fire equipment has varied. Regional fire equipment committees began designing and building their own equipment to meet their identified specific needs. One such example is the Model 62, designed by the Region 5 fire equipment committee. Other regions have not only designed, but have and continue to build under force account their fire engines. One of the more successful engines is the Model 52, designed and built in Region 1. The success of this engine is found in that other regions have and continue to purchase it. Regional fire equipment committees have shown their ability to design, develop and build excellent wildland fire engines. However, in recent years through down-sizing and retirement, a significant loss in fire engine design talent has occurred. This project is established to centralize wildland fire engine design expertise at the Center.

The project will examine the current fleet and available private contractor solutions, and extract from them the best of the best in design. In that, this is not a "wheels up" design project, but rather an integration of the experience found within the Forest Service. Engineering practices and evaluation will be applied to assure that the highest performance is achieved, safety is not compromised, and maintaining cost efficiency. The resulting designs will be made available to the all regions.

Helicopter Accessories 1E01P83 Carl Bambarger is the Project Leader

The goal of this sustained project is to develop new equipment and techniques to enhance the effectiveness of Forest Service Helicopter operations. Additionally, this project continually reviews field reports on existing helicopter equipment. Field reports are obtained directly from the field or through participation in national and regional helicopter committee meetings. The identified problems are examined for potential change to the equipment requirements in the accessories specification. This results in helicopter equipment which better meets the operational needs. In support of this, the Center has updated the specification for Type II and III helicopter equipment. Comments from the field and examination of equipment identified that procurement quality assurance required improvement.

As a result of discussions at the Interagency Helicopter Operations Workshop, the Center is examining equipment standards for Type I helicopters and reviewing dust abatement products for use at helibases. The identified need for Type I helicopter standards came as a result of recent a bucket failure. Dust abatement has always been a problem in helicopter operations, and products have been evaluated for effectiveness. Several products have been used over the years, however there is increased interest in environmental concerns and the effects on watershed and fish. Existing products will be evaluated for environmental impacts and effectiveness. A Tech Tip will be published providing the recommended products which best meet the need and provide the least impact on the environment.

Another project, which will be completed this year, is to develop a better Type I helicopter dip tank. Current dip tanks have some constraints or problems when used with Type I helicopters. A field survey was used to identify these problems, provide a forum for suggestions, and help define system requirements. Because many of the design needs are in conflict with one-another, a single solution is not seen as practical. Hence, the Center is working with several suppliers to potentially provide multiple new solutions for the field. Each new solution results in a larger tank than is currently available. Also, each potential design is balancing the needs of handling, set-up, tear-down, storage and bucket insertion.



Technical Services, Aviation TE01P12 Carl Bambarger is the Project Leader

The Aviation program at San Dimas provides technical support to both the Washington Office and the field in the area of aviation engineering for both fixed and rotor wing aircraft.

Recently the Center provided technical support and evaluation of future candidate airtanker platforms in the National Airtanker Study. The study was chartered to identify the airtanker fleet that the Forest Service should pursue for the next fifteen to twenty years. As such, twenty-one aircraft (both commercial and excess military) were analyzed. Their performance, tank capacity and compatibility with existing and potentially new airtanker bases was examined. The results of the study identified that cost efficiency and operational effectiveness is achieved through large airtankers. The study recommended that C-130 and P-3 aircraft be acquired with a 3000 gallon tank capacity. Also, that later models of the C-130, e.g. E and K models, be acquired to provide a 5,000 gallon retardant capacity to the fleet.

In a follow-up study, the Center is providing technical expertise and analysis in the selection of the next Forest Service Leadplane. The study, Tactical Aerial Resource Management Study, is examining new commercial and excess military aircraft for replacement of the current Beech 58P Baron leadplane. The process being used is to



P2V Air Tanker.



Air Tanker dropping retardant on fire.

establish the criteria for the platform evaluation in its roles, needs and mission as a leadplane and Air Tactical Group Supervisor aircraft. The study group also includes representatives of the Bureau of Land Management who are considering the replacement of the OV-10. The study in addition to recommending the selection of the next leadplane, is examining the entire aerial resource management system. In that regard, the study is challenging current methods, roles and responsibilities of aerial resource management. Alternative organizations are being analyzed against the current with objective criteria to determine the recommended alternative.

The Center also is providing support of the MAFFS program by evaluating the structural integrity of the system after twenty years of use. In the last few years, maintenance servicing of the MAFFS retardant systems has discovered corrosion in the tanks and distribution system. The Center has performed non-destructive testing on the two units located at Channel Islands. The data gathered is being analyzed to determine the residual material and remaining structural integrity of the tanks and tubes in the areas were corrosion was detected. A report will present the results of the analysis and provide recommendations for continued testing/study as necessary.

Technical Services, Fire Chemicals TE01P22 Ralph Taylor is the Project Leader

Some of the more effective tools available to fire management today are fire retardants and foams. The Center assists fire management in providing cost-effective, efficient, and safe fire chemicals for fire protection agencies. By providing prompt technical assistance to the field user in problem solving, technical transfer, and technical services, we help achieve overall Forest Service objectives and goals in the fire chemical program.

The Center continually updates the National Wildfire Coordinating Group's "Lot Acceptance, Quality Assurance, and Field Quality Control for Fire Retardant Chemicals" publication. Plans are underway to update and streamline current submission procedures. This is another cooperative effort with the National Wildlife Suppression Technology (NWST) program in Missoula, Montana and will include



Fugitive color fade tests.

a number of items to be addressed such as the assessment procedure, cut off dates for inclusion of new products on the qualified products list and on the national contract, and fees for conducting the operational field trials.

SDTDC provides technical assistance to Washington Office NIFC contract administration on fire chemicals and base contracts (Regional and National) and serves as Contracting Officer's Representative for the National Bulk Retardant contract. We assist the Washington Office Fire and Aviation



Retardant pumpability test stand



Ralph Taylor

Ralph joined the San Dimas Technology and Development Center in October 1996 as the Fire Program Assistant. He is project leader for Fire Chemical Technical Services, Hi-Tech Fire Simulator, and National Wildfire Coordination Group (NWCG) Working Team publications. He has worked 27 years on three National Forests (Plumas, Stanislaus and Sierra), the last 10 years as a Division Chief (Fire Management Officer) on the Minarets District, Sierra National Forest. Ralph brings to the Center a strong background in fire and fuels management, ecosystem management, forest management, and recreation.

Ralph is a qualified Type I Safety Officer and Type II Operations Section Chief and is currently assigned to a National Type I Incident Management Team.

He is a graduate from Lassen Community College with a degree in Forest Management. Management with the Value Analysis policy, providing technical assistance to field units conducting Value Analysis in accordance with Forest Service guidelines.

SDTDC maintains and revises, as needed, Fire Chemical Specifications for Long Term Retardants (5100-304), Wetting Agents (5100-305), and Short Term and Liquid Concentrate Retardants (5100-306). National procurement for retardant is 14 to 15 million gallons annually which provides fire services to the federal and state's firefighting agencies nation wide.

For the last several years the Center has been working with NWST and Forestry Canada to develop an international specification for Long Term Fire Retardant (5100-304) and an interim specification has been adopted that ensures quality fire retardant for both countries. The Center participates in the international effort to develop a specification for wildfire foam (5100-307); advises the National and Regional Fire Equipment Working Teams (FEWT) on fire chemicals and the FEWT International/Interagency Foam Task Group.

NWCG Guides 3E31P66 Ralph Taylor is the Project Leader

The National Wildfire Coordinating Group (NWCG), through its Fire Equipment Working Team (FEWT), issues various Fire Management Guides. These guides are provided to the field in support of fire prevention and suppression efforts that are interagency in scope.

The Center's personnel serve as both members and technical advisors to these groups and prepare the camera ready copy for printing and distribution by the Publications Management System.

Some of the NWCG publications prepared by SDTDC are:

- Lot Acceptance, Quality Assurance, and Field Quality Control for Fire Retardant Chemicals.
- Spark Arrester Guides—General Purpose and Locomotive (Volume 1) and Multi-Position Small Engine (Volume 2).
- Water Handling Equipment Guide.
- Foam Applications for Wildland and Urban Fire Management.
- Wildland Fire Engine Component Guide.
- Foam verses Fire-Class A Foam for Wildland Fires, 2nd addition.
- Foam verses Fire-Primer.
- Foam verses Fire Aerial Application.
- Wildland Fire Hose Guide.
- Fire Equipment Storage and Refurbishing Standards.
- Interagency Retardant Base Planning Guide-Fixed and Rotor Wing.



NWCG Publications.







Carl Bambarger operating Hi-Tech Fire Simulator.

Hi-Tech Fire Simulator 6E61P01 Ralph Taylor and Carl Bambarger are the Project Leaders

SDTDC is developing a Hi-Technology Fire Simulator for training of firefighters with an objective to become qualified initial and extended attack Incident Commanders (IC). The simulator is a group or individual training tool and uses computer controlled high resolution visual presentations with stereo sound. The computer controls access to a library of video clips and still pictures which are stored in a digital format. A training simulation is developed by the instructors and the student watches the fire unfold in an "as it happens" scenario with an objective to control the fire. The scenario begins with early fire detection and dispatch of local initial attack forces including the IC. From this point on the simulation will respond to the IC's request for information, such as weather predictions; and additional resources, such as helicopters, air tankers, engines, ground forces, etc. The instructors control the fires progress by acting as role players in response to the IC's request. The library of images contain various fuel models, fire intensities, and firefighting resources that will allow the instructor to develop simple to difficult scenarios. Emphasis is placed on the IC's ability to identify and recognize fire behavior, order the necessary resources and deploy those resources, such as helicopters, air tankers, engines, ground forces, etc. The instructors control the fires progress by acting as role players in response to the IC's request. The library of images contain various fuel models, fire intensities, and firefighting resources that will allow the instructor to develop simple to difficult scenarios. Emphasis is placed on the IC's ability to identify and recognize fire behavior, order the necessary resources and deploy those resources in a safe and effective manner to control the fire. The use of high resolution imaging and stereo sound create a realistic firefighting experience for the students.

A prototype system has been purchased which contains the computer and software to control access to the library of images and sound clips. The capability of the system allows for the audio visual information to be stored on multiple media formats, e.g. laser disc, audio and video tape, etc. The Center is also looking at CD ROM technology as a way to reduce the cost of the simulation unit to the field. This next year will concentrate on increasing the video, still pictures and sound library for the system, and begin integration of the system with a fire behavior model. Integration with the fire behavior model is expected to provide a projected image of the fire predicted growth. Another point of interest (which may not be capable to achieve at the first release of the simulator) is the possible capability of the fire model to react to the tactics and strategy used by the IC. For example, if retardant drops are successful the model would make changes in the fires growth due to decreased fire behavior (flame lengths and rates of spread). Completion of the simulator project is expected by the end of 1998.



Fred Cammack

Fred received a Bachelor of Science degree in Engineering from California State University, Los Angeles and a Master of Science degree in Organizational Management from University of La Verne. Fred is a Licensed Mechanical Engineer in the State of California. Prior to coming to the Center Fred gained experience in manufacturing, design engineering and project management.

In 1990, Fred redesigned and managed the construction of an improved Spark Arrester Test Laboratory at SDTDC. Currently, Fred provides technical support to the Center's Fire Chemicals Qualification and Test Program. He is a participating team member in the qualification and operational field testing of new products. Fred has project leadership responsibility for airtanker base operations support and technical services projects. Since 1992 he has worked with Regional and Forest personnel to define acceptable methods for the proper handling and disposal of wastes produced as a result of airtanker base operations. He has participated directly in the planning of base facilities in Regions 3, 4, 5 and 6. Fred recently conducted extensive field testing of fire retardant chemical base storage tank recirculation systems which resulted in improved system designs, and training and guidance literature for base use. Currently Fred is leading a project to define and improve fire retardant batch mixing systems.

Airtanker Base Technical Support 3E21P28 3E21P29 Fred Cammack is the Project Leader

This group of projects addresses airtanker base environmental issues and the mixing and handling of fire chemicals stored at the bases.

Recent environmental concerns have brought out the need to address airtanker ramp and helicopter pad washdown residues. In FY-93 SDTDC was directed to conduct a review of technology and to look into the problem of how to economically separate washdown residues in a manner that would allow their environmentally proper disposal or use. SDTDC surveyed a number of bases and determined many of the problems encountered were site specific. Meetings were initiated with manufacturers and consultants to determine if a universal solution could be identified. As a result of this work, effective waste management and treatment methods that will assist engineers in the planning and/or modification of future or existing base facilities were identified. Waste management guidelines were published in the "Interagency Retardant Base Planning Guide." Technical support was given to Forest Service and BLM engineers planning new bases or modifying existing bases. SDTDC continues to provide technical support by answering field requests for information and encourages the implementation of base waste management planning. The information gathered to date from this project was published in a project report in FY-96.



SDTDC personnel inspecting retardant storage tanks.

Currently, SDTDC is conducting a survey to assess commercially available batch mixing systems and components used in the fertilizer industry and fire retardant business for mixing dry powders in water. Total costs of providing bases with a standardized retardant mixing system are being determined. SDTDC plans to coordinate with retardant manufacturers and NWST to determine special mixing issues for each approved



Retardant tank sampling system.

product. Mixer system design goals and requirements are being identified along with potential mixer system suppliers. The plan is to furnish selected mixer manufacturers with samples and data for mixing hardware sizing and costing at the end of the fiscal year to support hardware procurement in early FY-98. Field testing is planned for the 1998 fire season. SDTDC plans to publish a final project report in FY-99. Completion of this project is expected at the end of FY-99 or early in FY-2000.



Ralph Gonzales

Ralph has a Bachelor of Science degree in Mechanical Engineering from the University of California, Santa Barbara and a Master of Science degree in Systems Management from the University of Southern California.

He brings 10 years of Navy experience in design and testing to his project at the Center. Ralph is a project leader in Fire and Aviation responsible for Spark Arrester qualification and testing. He also has other responsibilities in other program areas such as forest management, recreation, and engineering roads technology.

Fire & Aviation Management Qualification Program The Project Leaders are: Ralph Gonzales—Spark Arresters - SE01P42 Lois Sicking—Fire Equipment, Water Handling - SE01P13 Ralph Taylor—Fire Chemicals - TE01P22

The F&AM Qualification Program provides for the qualification testing of water handling fire equipment, fire chemicals, and spark arresters submitted by a manufacturer. Testing is funded under Collection Agreements with test fees collected from the manufacturer. These test items include water handling accessories, fire chemicals, general purpose and locomotive spark arresters and multiposition small engine exhaust systems.

The Water Handling Program is comprised of the Qualification and First Article Test Programs. The USDA Forest Service has identified 13 water handling items as critical to firefighter safety, such as fire hose, pumps, wye valves and couplings. Manufacturers must prequalify these items and be placed on a Qualified Products List, before they are eligible to bid on GSA contracts in an effort to supply the FS with their product. Other water handling items, such as fire hose connections and fittings, nozzles, valves and strainers, are evaluated under the First Article Test Program. Rather than prequalify, a first article off the production line is submitted to SDTDC for testing, after the manufacturer has been awarded the GSA contract, and before product is allowed to be shipped to the national fire equipment caches.



Line drawing of qualified multi-position small engine exhaust system and chain saw combinations (like the above illustrations) are placed in the Spark Arrester Guide for field use in spark arrester inspections. As part of the SDTDC mission, in alliance with The National Wildfire Suppression Technology group in Missoula, Montana, we are responsible for the preparation and updating fire chemical specifications, conducting the qualification and testing of fire chemicals, test procedure development, and procurement for equipment for qualification testing, tracking developments in fire chemicals and associated equipment technology, and contract administration of the National Retardant Contract.

SDTDC is the only spark arrester qualification evaluation facility in the world. General Purpose arresters are used on a fixed position internal combustion engines such as motorcycles and agricultural machinery. MSE arresters are used on an internal combustion engine with several positions of application such as chainsaw, brush cutters and trimmers. All internal combustion machinery is required to have a qualified spark arrester when operated on public lands administered by the USDA Forest Service and US Department of Interior. Other states, counties and municipalities have similar regulations. Nationally, fire ignitions as a result of internal combustion engine use has been significantly lower in recent years due to strict administration of spark arrester programs.

In addition, SDTDC has completed a search for independent outside laboratories that would be suitable for conducting MSE testing. Underwriters Laboratories and Canadian Standards Association have been accepted as qualified independent laboratories. Data packages from these laboratories are sent to SDTDC for qualification evaluation.

All qualification testing is conducted according to minimum performance requirements defined in associated specifications and standards established by the USDA Forest Service. The overall goal of these projects is to establish Qualified Products Lists for critical fire items in order to ensure competition, product availability, and the quality assurance that minimum performance requirements have been met and are being maintained.





Lois Sicking

Lois has a Bachelor of Science degree in Mechanical Engineering from Texas A&M University and Associate of Science in Nursing. She came to the Center with a background in engine laboratory studies, biomedical research and agricultural equipment. She has managed several test laboratories, including the Fluid Mechanics, Fire Pump, Bio-Mechanics and Spark Arrester Laboratories. She has worked on a number of fire equipment development projects, including Fire Tool Ergonomics and the Spark Arrester Test Replacement Study. She authored the Wildland Fire Hose Guide. Lois is a Project Leader in the fire management, recreation and forest management programs.

Fire Tool Ergonomics 4E41P15 Project Leader Lois Sicking

Many of the tools used in fireline construction remain unchanged despite dramatic change in the population dynamics of the work force. Questions arise about standard hand tools meeting the needs of contemporary firefighters. Professionals at the local level are making changes for improved efficiency and effectiveness. There is interest at the National level to apply robust scientific technology to assist in the evaluation of tool modifications and the tool selection process.

SDTDC is evaluating the more popular hand tools used by firefighters, the pulaski, shovel, combi-tool, McLeod and others to determine if they can be refined for greater efficiency, while minimizing the risks of ergonomically induced injuries such as repetitive motion injury and carpel tunnel syndrome.

The goal of this project is to determine, based on physics and human engineering principles, the tool configurations and user techniques that best balance physiological characteristics with optimum fireline production.

National interest propelled an initial study entitled, "Fire Tool Ergonomics, Interim Report", 9551 1208-SDTDC, December 1995. This combined qualitative and quantitative study compared the hoe blade of three Pulaski tool heads and two handles. With a larger heavier hoe, production increased by as much as 20%. When the blade width is increased, the center of gravity and center of percussion move, changing the angular acceleration - often to the detriment of the user, i.e. stinging hands, fatigue, impact rotation. In addition, firefighters have to work harder and use more calories with a larger blade.



Fire tool ergonomics test, firefighter using Pulaski.

The benefit derived from this initial study was that applied scientific methodology provided a positive contribution to the tool selection process. Among several recommendations for further study, kinematic testing was proposed to evaluate in greater detail, the potential for tool design.

Investigations have revealed that new technology in measuring human-tool kinematics has been recently developed, with practical applications in fire tool studies. Use of this magnetic high speed sensor system to measure and collect high speed dynamic data will enable the analysis of user technique, tool balance, shock, bending, center of gravity, grasp and contour.

Field testing with this magnetic sensor system has been completed. Preliminary indications from data analysis are promising. SDTDC is developing a bio-mechanics laboratory to evaluate hand tool technique and to screen ideas for improving hand tools before costly field testing.

Technical Services, Fire Prevention and Investigation TEO1P27 Project Leader Lois Sicking

This project involves providing technical support in activities related to Fire Prevention and Fire Investigations on a national basis. SDTDC has the lead role in maintaining four Society of Automotive Engineer (SAE) documents supporting fire prevention legislation, policy and direction. These documents define spark arrester testing of general purpose and locomotive spark arresters, multiposition small engine exhaust systems and spark arrester test carbon. Due to initial developmental work and ongoing spark arrester testing, SDTDC has been requested to provide technical support in the area of carbon particle emissions, and the use and application of spark arrester exhaust systems.

SDTDC provides technical support to the field in the development of fire prevention training programs, demonstrations and presentations on a regional and national basis.

This project also includes providing technical support to state representatives regarding the development and revision of state laws relating to the operation of fire equipment. SDTDC provides technical support to state and federal field inspectors required to enforce agency fire prevention regulations. SDTDC also provides technical support to other federal agencies regarding carbon particle emissions, spark arrester testing, fire equipment safety, and the administration of a federal qualification test program.

SDTDC has developed a video on the identification, operation and inspection of spark arresters for use by state and federal field inspectors required to enforce agency fire prevention regulations. This video also illustrates the use of the Spark Arrester Guides and describes the field inspection of General Purpose and Locomotive spark arresters and Multiposition Small Engine exhaust systems. Intended as a supplemental training tool, this video contains five separate modules titled "Introduction, Multiposition Small Engine, General Purpose, Off Highway and Railroad" running 68 minutes in a VHS format and available through the National Interagency Fire Center publications management system.



Providing technical support in a fire investigation includes handling confiscated hardware (top photograph), examining and testing of modified equipment (middle), and evaluating general maintenance (bottom)

F&AM Specifications and Standards Program SEO1P13 Project Leader Lois Sicking

The development and maintenance of specifications and standards for procurement of wildland firefighting equipment is a long-standing project at SDTDC. The continuous updating of these documents ensures the acquisition of the most suitable and economical equipment needed by the field. As technology advances and suitable newer products are introduced into the commercial market, SDTDC specifications and standards are revised to include these changes.

The development of new specifications, revisions and/or amendments to the current specifications and standards, is an ongoing process to incorporate new technology, design changes, requirements and test procedures. Specifications and standards developed and maintained under this project annually procure an estimated 25 million dollars in fire equipment and chemicals. SDTDC manages approximately 47 specifications and standards that encompass water handling equipment and helicopter accessories to fire chemicals in support federal and state wildland firefighters. These specifications describe, in detail, production and quality requirements for items such as fire hose, fire hose connections and fittings, valves, fire retardant, fire pumps, helicopter leadlines, cargo net, swivel hooks and accessories. Manufacturers submit first articles off the production line to SDTDC for testing to assure that the item meets Forest Service specifications.



All water handling items procured under the Specification and Standards Program are first tested at the SDTDC. Such items include twin-tip nozzles, (top illustration) wye valves (center) and shutoff valves (left).

The Specification and Standard Program is coordinated with other user agencies such as the Forest Service and General Services Administration (GSA). This project involves working with field users, manufacturers and GSA contract administration and quality assurance.

Special Projects & Development TE21P30 Dan McKenzie is the Project Leader

These projects provide technical assistance and services to field units through Regional Fire operations and Fleet Management staffs and committees as requested. Representative activities include but are not limited to engineering assistance in the development or modification of technical data packages, assistance in problem solving and making recommendations for design changes is an ongoing need. End results often incorporate new or emerging technology, correcting for obsolescence, and accommodate mechanical as well as individual component changes, while addressing performance needs and safety requirements. This support work is accomplished primarily through advisory and technical support roles with the various regional equipment committees that oversee fire fleet development standards and development. This project activity provides the regional equipment groups with validated engineered design criteria that is appropriate as well as affordable in meeting mission requirements. Some examples are:

- Engine Noise Study
- Mobile Fire Equipment Operator Guides
- CAFS & Aspirated Foam Systems
- Advisor to Regional Fire Equipment Committees
- Technical Services Support
- Special Studies—Roadability Evaluation
- Troubleshooting
- Special Design Support



Engine noise study and equipment to monitor and reduce downhill hose pressures are special products completed by SDTDC



Dan W. McKenzie

Dan holds a Bachelor of Science degree in Mechanical Engineering from the University of Arizona at Tucson. Dan has been with the Center thirty-five years and has been involved in the development of the Forestland Tree Planter, the Rangeland Drill, range vegetative equipment, range water pumping equipment, firefighting equipment, slash treatment equipment, and reforestation equipment.

In 1994 Dan was awarded the Forest Service Chief's award for "Excellence in Technology Transfer" for his work in transferring firefighting foam technology. He was also selected to receive the Federal Laboratory Consortium award for "Excellence in Technology Transfer" in 1994 for this same work.

Dan is a graduate of the U.S. Army Command and General Staff School, Fort Leavenworth, Kansas. He holds a Certificate of Proficiency as a research and development manager from the U.S. Department of the Army which was earned through the Army Reserve.



Skip Garrett

Skip received his Bachelor of Science degree in Mechanical Engineering from the University of Virginia and also completed the two-year advanced logging program at Oregon State University. He came to the Center with nine years of experience in design and testing for the US Navy and after working as a logging engineer on the Six Rivers NF. Skip is a Professional Engineer registered in California and currently supports projects in the Aviation, Forest Management, and Engineering programs.

Helicopter Operation Safety Training Materials 1E01P48 Skip Garrett is the Project Leader

The objective of this project is to develop training videos and supplemental information. The videos are intended to provide training in a "self help" method to helicopter operation specialists, helitack crew members, helicopter pilots, and firefighters who use helicopters. The videos the developed in partnership with other leading land management and wildfire suppression agencies.

Under this program four videos and one publication are currently available. They are:

"The Helicopter Performance and Limitations." This video provides information on the helicopter's flying performance and limitations, as well as some design features of helicopters. The target audience is helicopter passengers (firefighters, novice helitack personnel, and others).

"The Professional Helicopter Pilot Supporting Wildland Fire Suppression", Part I and II. This video is targeted toward the experienced helicopter pilot who may have little or no experience in land management flying. The video presents the fire organization structure, radio frequencies, and a general overview of flying in support of wildland fire suppression.

"Helicopter Bucket Operations." This video provides training to the helicopter pilot who has little or no experience in performing water handling with a bucket. The video describes the available buckets, how and where to dip, flying with the bucket, and dropping over the fire.

"The Professional Helicopter Pilot Guide." This publication is a companion text to the Professional Helicopter Pilot Supporting Wildland Fire Suppression.

Currently in work is a video similar to the "Helicopter Bucket Operations," except that this video covers the aspects of operating a helicopter with a fixed tank. This video covers the same topics as the bucket operations, except with the unique capabilities that the fixed helicopter tank provides.

Fire and Aviation Management Technical Support is provided by the following teams.

The Shop and Maintenance Team includes Roger Bergmann, Gabriel Duran, Victor Rios, Gene Golden, Jaime Ocampo, and Camillo Temores. They provide solid support for the F&AM program throughout the year. Services include fabrication of special or unique items, machining prototype tools, welding, technical operator support, office and equipment maintenance and repair, providing safe and clean work areas, vehicle maintenance, and many other services as the need arises.

Our Business Management Team partners are Connie Relph, Jane Manchip, Marty Willbee, Jackie Meeker, Alix Greene, Dottie Britt, and Charlotte Carter. Their technical service support includes fiscal and accounting, property, partnerships, agreements, unique one-of-a-kind procurements, travel, mail, as well as other administrative services essential to program administration.

Kathleen Kreyns is the SDTDC Operations Program Leader and provides supervision support for all project personnel and is the key link in coordinating the best talents for assignment to the respective project workload at SDTDC.

The Visual Information and Editorial Team includes Janie Ybarra, Sue Cox, Joy Burton, and Susan Clements. The team provides direct support to Fire and Aviation Management by preparing project reports, technical documents, brochures, displays, visual aids for formal program presentations, documents and outlines for special meeting support, as well as other publications to assure positive and professional media is transferred to the field.



Shop and Maintenance Team



Operations and Business Management Team



Visual Information and Editorial Team

PROJECTNUMBER

CURRENTSDTDCPROJECTS

PROJECTLEADERS

SE01P13 F&AM Specifications & Standards Lois Sicking
SE01P42, SE01P13 Qualification & Test Program Ralph Gonzales, TE01P22 Ralph Taylor, & Lois Sicking
TE01P11 SigPalm
TE01P12 Tech Services—Aviation Carl Bambarger
TE01P22 Tech Services—Fire Chemicals Ralph Taylor
TE01P27 Tech Services—Fire Prevention and Investigation Lois Sicking
1E01P48 Helicopter Operations Safety Training MaterialsSkip Garrett
1E11P83 Carl Bambarger
TE21P30 Dan McKenzie
3E31P66 Ralph Taylor
7E71P11 Standard Retardant Mixing Systems Fred Cammack
4E41P15 Lois Sicking
6E61P01 Ralph Taylor & Carl Bambarger
4E41P20 Wildland Fire Engine Design Carl Bambarger
6E61P02 Carl Bambarger
7E71P12 Airtanker Base Noise Carl Bambarger

ΤΟ

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FIRE AND AVIATION PUBLICATIONS SAN DIMAS TECHNOLOGY AND DEVELOPMENT CENTER

	Publication	
 Qty	Number	Title
	00574004	Field Company of Holicopter Foor Inication Contemp
	9257 1201	Field Survey of Helicopter Foam injection Systems
	9257 1202	vertent External Load Releases
	9251 1203	Compressed Air Foam Systems for Use In Wildland Fire Apps.
	9251 1204	Proportioners for Use In Wildland Fire Applications
	9257 1307	Emergency Egress Air-Breathing Bottles
	9357 1302	Airtanker Cockpit Laser Visibility Evaluation Device
	9357 1304	Helicopter Operations and External Accessories: An Update
	9451 1206	Steep Slope Slash Treatment
	9451 1309	Slash Pile Covers
	9457 1307	Dip Tanks for Type 1 Helicopter Operations
	9551 1204	Care, Use and Maintenance of Hose for Wildland Fire Apps.
	9551 1208	Fire Tool Ergonomics—Interim Report
	9551 1304	CTI Fire Engine Safety
	9557 1305	Portable Retardant Bases
	9557 1307	Fixed Tank Systems for Type II and III Helicopters
	9651 1208	Airtanker Washdown Facilities
	9651 1209	Fire Retardant Recirculation Systems
	9651 1304	Wye Valves Left Mounted During Transport
	9651 1305	Hose Clamp Inserts for Use On Lightweight Synthetic Fire Hose
	9651 1307	Hose Adapters For Backpack Pumps
	9651 1803	Manufacturers Submission Procedures for Multipurpose Small Engine Spark Arrester Exhaust Systems
	9651 1804	Compressed Air Foam Systems
	9657 1301	Halon and It's Replacements for Fire Suppression Systems In Aircraft
	9657 1308	Personal Protection & Handling of Portable Toilets
	9751 1206	User Procurement Manual for Retardant Measurement Massflow Meter—3rd Edition
	9751 1304	Containment Systems for Small Volume Retardant Spills
	9751 1810	Fire & Aviation Management—Level 1 (available Jan 98)

Single copies or small quantities for group presentations of these SDTDC publications can be obtained by writing, phoning, or DG. There is no charge for the publication. If you need a large numbers of a publication, contact Sig Palm (S.PALM:W07A or 909-599-1267 x266). Send normal order requests as follows: Send To: USDA Forest Service Phone: 909-599-1267

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PROJECT PROPOSAL USDA Forest Service Technology and Development Program

SDTDC solicits input from the field for suggestions for future projects. Your suggestions are important to us, so please take a few moments to complete this form and return to the address provided.

Project Originat	r:		Name	Date
	Title			
	Unit			
	Mailing address			
	DG address	Telephone _		
Project Title:				

Current Problem/Need

Describe how work is currently being done; current problem/need, location; why improvement is needed.

Proposed Solution

Describe your concept of the end product, i.e., new equipment design, video production, handbook, etc.

Potential Benefits

Describe how this product will improve safety, resource management; increase efficiency, customer satisfaction, productivity; reduce cost, time.

	- affix	here -							
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	User Feedback Survey								
User Name (optional) Title Unit									
Fire & Aviation Level One/Nov	vember 1997	#9751 ⁻	1810						
Benefits Improves safety Saves money Saves time	YES	NO	Amount						
Increases efficiency Other									
How effective or relevant is this i	ntormation?								

What would you change?

General comments: