

	<b>NEW MEXICO STEAM LOCOMOTIVE &amp; RAILROAD HISTORICAL SOCIETY</b> MAILING ADDRESS P.O. Box 27270 Albuquerque, NM 87125-7270 Restoration Site: 1833 8th St. NW, Albuquerque Web Site: <a href="http://www.nmslrhs.org">www.nmslrhs.org</a> Email: <a href="mailto:nmslrhs@nmslrhs.org">nmslrhs@nmslrhs.org</a>	
	Vol. VIII, No. 3      Tel: 505 246-2926      Jul—Aug—Sep 2014	

# IMPROV\* AT THE 2926 RESTORATION SITE

Improvising With Available Resources To Solve Problems And Reduce Cost

*\*NOTE: Improv; Diminutive form of improvise or improvisation, meaning to make do by using available resources. Today 'improv' is commonly used to describe ad lib comedy. There is nothing funny about the improv work of the volunteer 2926 crew. To them, improvising—making do with available resources—is a very serious business, and they are good at it.*

Restoration of antique and classic machines to original operating condition can be very challenging—especially in the case of items the size and complexity of AT&SF 2926. The lack of resources, i.e. equipment, tools, knowledge, parts, and readily available skills necessary to build and maintain such machines disappeared decades ago. Those resources can be found, but they are costly.

With enough cash, almost anything can be replicated, but sometimes just answering the “How did they do it?” or “Where can we find that?” questions can be time consuming and expensive. It all adds up as a barrier to operational restoration. That is probably the main reason that many surviving steam locomotives are resting in parks and museums. Faced with high cost of operational restoration, they defaulted to a ‘cosmetic restoration’, and were simply put on display. In the case of a steam locomotive, cosmetic restoration requires no more than a bit of rail, a few ties, a coat of paint and regular polishing to preserve an icon of the steam rail era.

Cosmetic restoration does preserve images of an earlier time. But operational restoration brings back all the sights, sounds, and related activity of our rich rail heritage. Thus, when a group of rail heritage fans managed to acquire one of the largest high speed steam locomotives ever built, their vision was more than just a static display. They planned operational restoration to bring back all of the big steam passenger rail experiences of the last century. **And they planned to do it with a bunch of volunteers?**

At first, the vision of those ambitious volunteers was not widely recognized by the public. Quite probably, many people considered the group naïve if not a bit delusional. That view has changed. During the past dozen years, the vision of an operating 2900 Series locomotive has come into focus. Help arrived from organizations, businesses, and individuals throughout the U.S. and abroad. Previous newsletters have described the heavy lifting, equipment donations, cash contributions, professional services, and public support that have helped transform the vision to reality. But one major factor that has only been mentioned occasionally is the on-site improvisation by the 2926 volunteers themselves. Even with all the outside help, on-site problem solving has often been necessary to avoid both time consuming research and high cost. The following cases are typical of the 2926 volunteer improvisation.

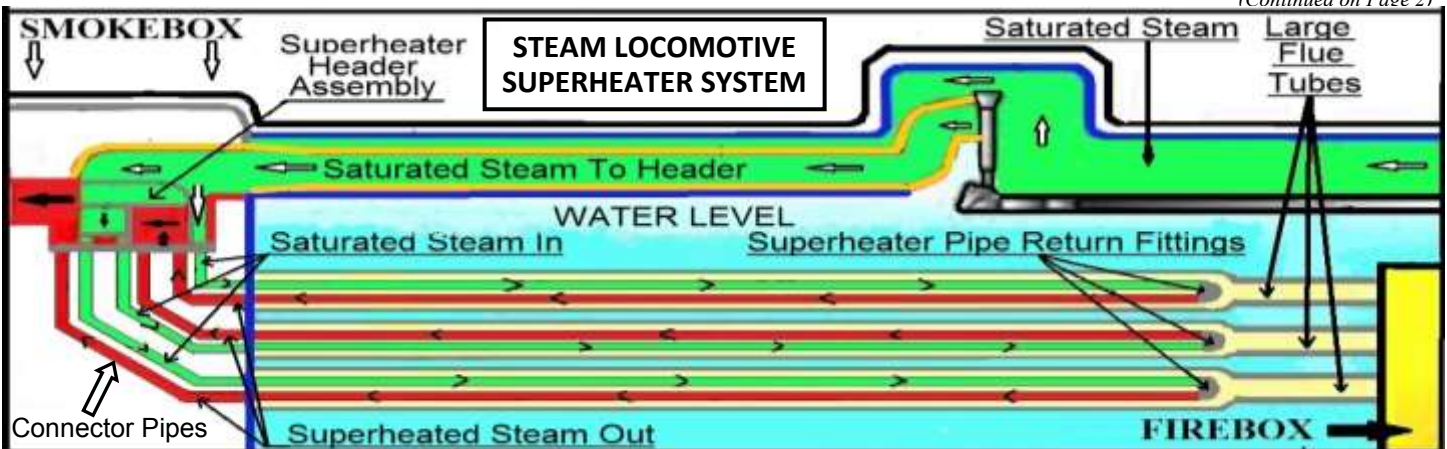
## Superheater Tubes

Like most high performance steam locomotives, the AT&SF 2926 boiler is equipped with a superheater system. The system converts saturated (‘wet’) steam produced at the firebox to much higher temperature unsaturated (‘dry’) steam used to power the locomotive. The effect on locomotive performance is a significant increase in power and fuel efficiency.

The impact on a restoration is greatly increased demand on resources—both on-site labor and direct cost. In the case of 2926, volunteer labor is readily available and its cost is minimal. With a limited budget, direct cost, i.e. purchase of parts, tools, and equipment, or hiring work done off site is always a concern. Dollars for direct cost items are not so easy to find. Therefore, any direct cost that can be avoided by doing the work on site is critical to the restoration effort. That is where ‘improv’ enters the picture.

The sketch in Figure 1 depicts the basics of superheater design. It shows three flue tubes and three pairs of superheater pipes with one loop each. It is just a ‘wet steam in’ and ‘dry steam out’ example. The 2926 superheater is more complex. In the 2926 boiler, there are 220 large flue tubes and 50 smaller ones to carry hot exhaust about 20 feet from the firebox to the smokebox.

*(Continued on Page 2)*



**Figure 1:** This drawing shows the basic layout and functions of a locomotive superheater system. The 2926 system described in the following paragraphs is far more complex. Replacement includes a number of work elements.

(Swaging: Continued from Page 1)

To produce higher temperature, dryer steam, and thus more power and fuel efficiency, the superheater pipes in the 2926 system make two complete loops in the flue tubes before exiting to the header.

Installing new flue tubes involves a lot of work that can be handled by the volunteers. The superheater pipe assemblies that rest inside those flue tubes are another story, and much more work. Just their preparation prior to installation is a challenge. It should be labeled *“some assembly required”*.

Preparation of pipe assemblies is as follows:

Using connectors like those in Figure 4, two pipes are connected at one end to create a superheater pair that can fit inside a large flue tube. The connected end will face the firebox to resist the high heat and abrasiveness of sand used to clear the flue tubes. At the smokebox end, two pipes, (one each from two pairs) are connected with a fitting similar to the one at the firebox to create a four pipe assembly. The remaining two pipes are connected to the header, one on the inlet side (wet steam), and one to the outlet side (dry superheated steam).

Tasks required before installation of the superheater pipes are: 1) Measuring, cutting, cleaning; 2) Swaging (expanding) one end of each pipe for fitting to connections on the smokebox end; 3) Welding the return fittings to create pairs of superheater pipes; and, 4) Welding the swaged ends to the header pipes. Only then were the superheater assemblies ready to install in the flue tubes.

Tasks 1, 3, and 4 were well within the capability of the 2926 volunteers. Task 2 was a different story. Some commercial metal shops could do the swaging, and their price was reasonable, but transportation and handling would have made the cost too steep for existing budget. Purchasing commercially built equipment to do the work on-site was also too expensive. Yet, the lack of swaging was about to hold up the preparation of the superheater pipe assemblies. It was time to review available resources and improvise.

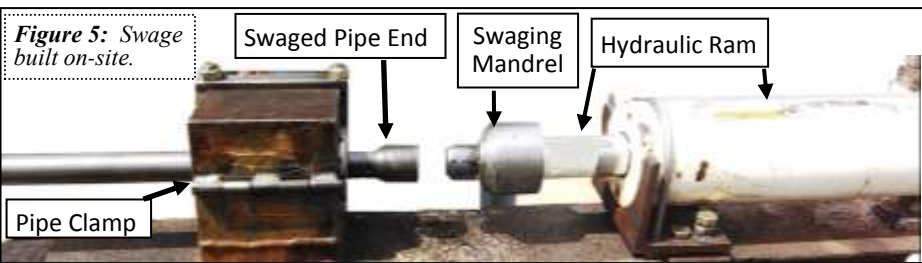
That is when Dave V. decided to design and build a swaging device. With some high pressure hydraulic equipment, and the talents of the 2926 machinists and welders, the device soon began to take shape. It was mounted on a steel shop wagon that once hauled parts at the AT&SF backshops. With several volunteers pulling pipes out of storage, carrying them to the wagon for swaging, and placing them back in storage for easy access to welders building the assemblies, the entire stock of pipes was quickly swaged.

Figure 5, right shows the improvised swaging device up close. The clamp, mandrel and other parts were assembled on site. The setup may not look like a slick commercial model, but it did the job at a large cost saving.

Figures 6 & 7, The swaging setup mounted on the wagon and operating. A brief video clip of the swage at work can be seen at the NMSLRHS web site ([nmslrhs.org](http://nmslrhs.org)) or on YouTube in a video titled “The 2926 Story”.



Figure 4: Fittings used to pair superheater pipes at the firebox end of the flue tubes are pictured above. Except for purchase of the fittings, this portion of the superheater tube task was on-site labor—a lot of labor, as in highly skilled welding by Carlos O. and a handful of pipe handlers.



### Tramming and Cylinder Honing

This on-site improv case involved two separate tasks. The first task was tramming—aligning the crosshead slides with the cylinder bore. This was probably a routine operation in the AT&SF backshops, but both the equipment and knowledge of just how to do it were long gone. There was advice from several sources—each different from the others. The 2926 team decided it was better to do it themselves, so it was back to improv.

Fortunately, they were also looking ahead to the second task—honing the huge cylinders. The two tasks were combined by building a custom honing tool, and using the center of that tool as a front anchor point for the tramming line. Available material, ingenuity, and volunteer machining work were combined to make the center plate of the hone at minimal cost.

Continued on page 3

(Tramming and honing cont.)

the hone was mounted and centered in the cylinder. A bolt in the center of the plate then served as the front anchor point for the tramming line. Figure 8 at right shows the plate mounted in the front of the cylinder on the engineer's side of the locomotive.

The tramming line is then extended through the back of the cylinder directly beneath the crosshead guide and shoe to the rear anchor point on a bracket near the drive rod as shown in Figure 9.

Once the tramming line was installed and drawn tight, a number of measurements were made to check alignment of the drive rod, crosshead, crosshead shoe, and the center of the cylinder. Final adjustments were then made at the crosshead guide and crosshead shoe.

With tramming complete on both sides of the locomotive, the volunteer locomotive mechanics turned their attention to completing work on the hone. Building the hone on-site with available resources would avoid the \$7500 cost of a commercially built one.

Prior to the tramming, the 2926 crew had designed and built internal parts of the hone. Those parts, center plate and related hardware, were used in the tramming process. Now it was time to finish building the device and get on with the honing task.



Figure 8, Above: Engineer side cylinder, front view., with center plate of hone in place.



Figure 9, Right: The gauge (left center) is a key feature of the tramming setup. The bracket on which it and the rear terminus of the tramming line are mounted was fabricated in the 2926 machine shop.

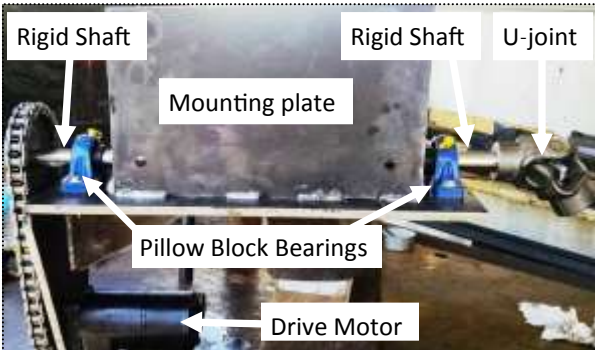


Figure 11: Cylinder hone drive under construction.

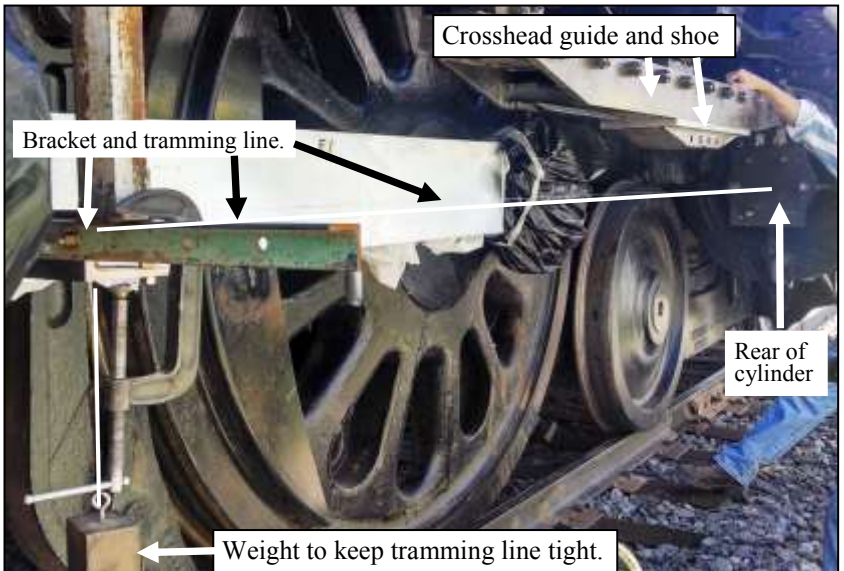


Figure 10: Oblique rear view of tramming line looking toward cylinder.

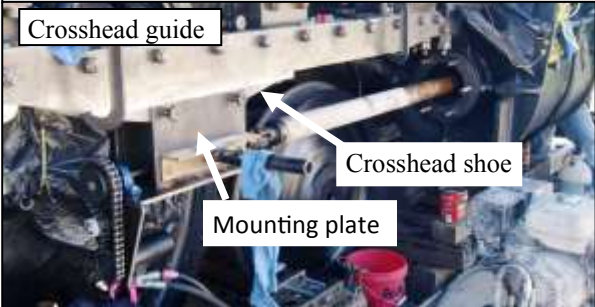


Figure 12: Cylinder hone drive assembly mounted to the crosshead shoe and connected to cylinder hone.

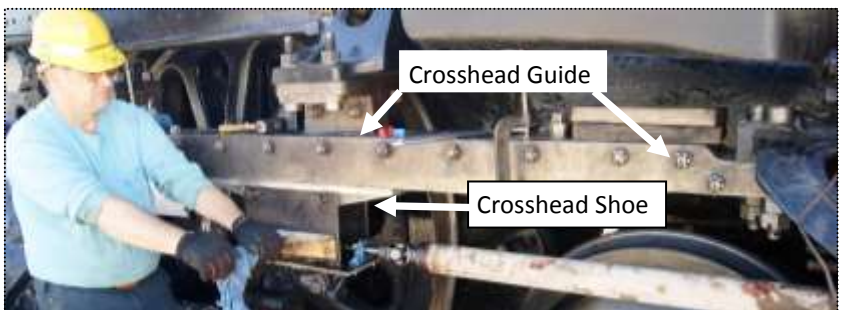


Figure 13: Using a handle attached to the drive assembly mounting bracket, Don MacCornack moves the crosshead shoe and attached hone assembly back and forth.

Material needed for the drive assembly of the hone was either available on-site, could be picked up at local parts and hardware stores, or across the tracks at Reliance Steel. In Figure 11, the drive assembly under construction on a work bench., and in Figure 12, it is mounted on the crosshead shoe.

Heavy steel plate was used to build a frame for the drive assembly. A portion of that frame was used as a mounting plate to be attached to the crosshead shoe. That allowed the assembly to be moved back and forth manually as the drive rotated. A handle was attached to facilitate the movement.

The 'homebuilt' honing system worked fine. There was plenty of volunteer labor available at the 2926 site, and the parts cost was minimal. The before and after pictures in Figure 14 reveal once again that ingenuity, determination, a few bolts and nuts, and assorted scrap items can meet challenging tasks and significantly reduce cost. Next, a less complex, but important improv case.



Figure 14: Left, before honing. Right, after honing.

(Improv continued on Page 7)

# OPEN HOUSE 2014: BETTER THAN EVER

Thanks to all those friends of 2926 who attended the Open House. Your continued support is helping bring New Mexico's flagship steam locomotive back to action.

The AT&SF 2926 Open House for 2014 was a roaring success. Channel 4 ace forecaster, Steve Stucker, on camera in full 2926 dress uniform, promised good weather for the 2014 Open House, and he was spot-on. The day dawned cool and clear. The 2926 crew, on site early and fortified with Golden Pride breakfast burritos set everything in place and began welcoming visitors at 9:00AM. The steady stream of visitors continued all day, almost doubling the previous record attendance. The photos below depict just a small sample of the day's activity. Many more photos, videos and related information are available at the 2926 web site, [www.nmslrhs.org](http://www.nmslrhs.org).

**Below:** In the first photo, Steve Stucker models the AT&SF 2926 dress uniform as he forecasts good weather for the 2014 Open House. Steve, that's a good looking canine you have, but maybe you shouldn't bring him to the 2926 site. Most of our feline 2926 guards are bigger than he is, and they can get a bit cranky and territorial regarding their locomotive.

In the second photo, visitors entering the site from the 8th Street gate stream past a BNSF diesel locomotive still carrying Santa Fe markings, (also see BNSF Diesel Page 7). In (3) they surround its rail heritage predecessor, and star of the show, AT&SF 2926. In (4), they line up to view the new woodwork in the 2926 cab, and to peek into the huge firebox. Then it is time for good music (5), good food and snacks (6 and 7), and a close up view of a model train layout (8).



Photographers, both professional and amateur, had a great day. Cameras everywhere, and plenty of opportunities for great pictures and videos. Cliff Dwellers Video Productions was also on site. Their work will be seen in the New Mexico True TV series.

**Below:** Photo (9) below depicts an always popular setting. . . a picture of the kids in front of 2926. But that's not kids in the cab of 2926 (10), those are Amtrak crew members, showing support the 2926 project. The Cliff Dwellers team, (11), Melinda and Michael, were all smiles enjoying the 'cushy' 2926 assignment. In this photo (12), Melinda is not sitting down on the job. She is just getting a head-on shot of 2926. Here, (13) they take a break inside the 2926 firebox with NMSLRHS Pres. Dr. Mike Hartshorne.



Finally, there was a lot of attractive railroad memorabilia. In (14), the lantern collection donated by former member Bob Scott is on display. All lanterns are available for purchase. The new store (15) wasn't quite finished, but was put to use at the Open House. The last four photos (16) show just a few of the stylish rail heritage items in the store. In addition to hats and cups, they include: T-shirts in a variety of colors, designs, and sizes; A variety of railroad art from recognized artists; Books about trains and railroads—and much more. Last, but not least, the 2015 AT&SF 2926 calendar. They are only \$12 while they last.



# WORTHINGTON FEEDWATER HEATER GAUGE

## First Instrument Ready To Install In The 2926 Cab Is The Gift Of A Beautifully Restored Gauge

As member Albert Leffler infers in the following article, the feedwater heater on 2926 is a sophisticated system with components located at different points on the locomotive. Except for the low pressure pump that moves water from the tender to the front of the locomotive, most of the components are shown in the picture (below) of the fireman's side of the smokebox and piston area.

The gauge described below is one of many critical instruments that went missing during the locomotive's decades on Coronado Park. Replacements must be located, acquired, and restored to operating condition for installation into the 2926 cab. Both Leffler and David Thorpe have donated their expenses and time in providing this essential gauge. Our thanks to both gentlemen for providing the very first gauge ready to go back into the cab of 2926! . . . Editor.

The specifications for the 2900 class of locomotives were created by the ATSF Office of Mechanical Engineering in Topeka. Listed in the hundreds of pages was the requirement that all locomotives be equipped with a **Worthington 6-SA feedwater heater**. The 6-SA Model Heater, built by the Worthington Pump & Machinery Corp., is an open type feedwater heater. The principle of operation of this feedwater heater can be compared to any simple water pumping system.

The feedwater system consists of a steam turbine and a centrifugal pump combined in one assembly. The usual speed of this pump when running at full capacity is about 3600 R.P.M. Water is brought from the tender to the feedwater heater by low pressure, low speed centrifugal pump.

In the feedwater heater, the cold water from the tender is mixed with steam by spraying it into a body of exhaust steam. It then flows with gravity to the hot water reciprocating pump that pumps it into the locomotive boiler. Pump speed, cold water volume, and the steam that runs this pump are controlled by a float in the feedwater heater. See Figure 17 at right.

There is an essential gauge in the cab Figure 18, that is connected to the cold water pump discharge pipe, and registers the pressure developed by the cold pump, in delivering water to the heater. The pressure is a combination of three resistances: 1) the resistance of raising water from tender level to feedwater heater; 2) Resistance created by the friction in discharge pipe, line check valve, and spray valve; and 3) Resistance of locomotive exhaust steam pressure in feedwater heater against which the water is delivered.

A change in pressure indication on the cab gauge does not indicate a change in the capacity at which the pumps are delivering water, but may only indicate a change in the locomotive exhaust steam pressure in the heater. Regardless of a change in gauge pressure, unless the pump throttle position is changed, or unless the drifting control valve opens or closes, there will be no change in the water pumping rate.

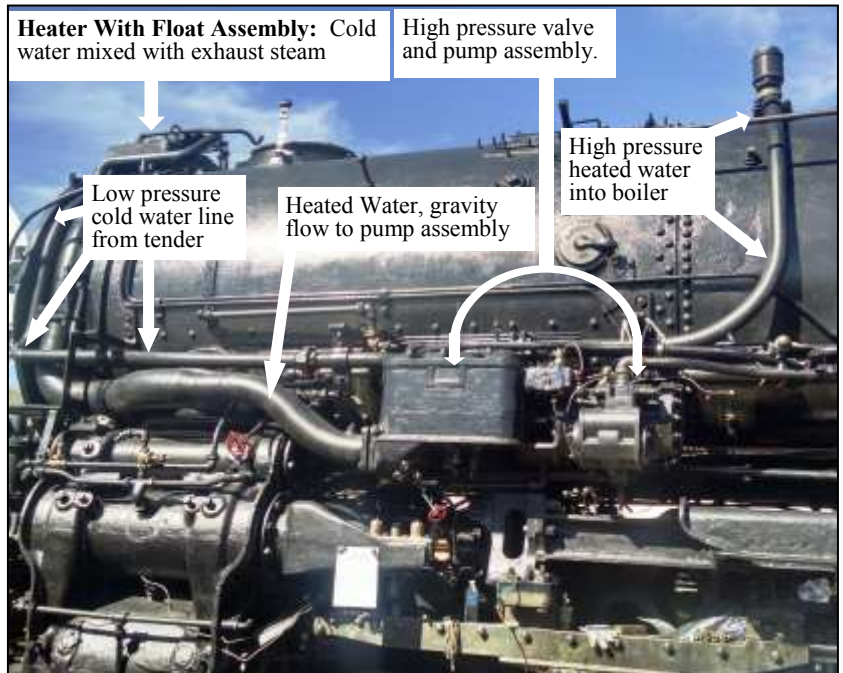


Figure 17: Fireman's side front of 2926 shows feedwater components.



Figure 18: A functional gauge for 2926, courtesy Albert Leffler's eBay shopping, and David Thorpe's restoration skill.

Since the gauge indicates the cold pump discharge pressure, gradual movements of the gauge hand indicate changes in cold water pump pressure caused by a change in cold water pump speed. Since the cold pump pressure increases when the back pressure of the locomotive increases, the gauge will register roughly some 4 to 12 pounds above the back pressure in the heater, depending on the amount of water being pumped.

For ATSF 2926, both the cold water pump and the hot water pump were intact after years in the park, but the cab gauge was missing. A search began, and soon an authentic Ashcroft Worthington Feedwater Heater Gauge Type 1160 was offered on eBay, and we purchased it. The gauge was then restored and calibrated by antique gauge expert David Thorpe in far-away New Hampshire. . . Albert Leffler

### TREASURE HUNT

To the hard working 2926 crew, locating missing parts is a treasure hunt. We are always seeking items such as the gauge. They can be found in the hands of collectors, at estate sales, flea markets, and yes, on the internet.

#### To 2926 members, supporters, and friends.

Help us with the Treasure Hunt. Let us know if you discover parts we might use. Even if we already have a particular item, we can always use backup parts and accessories.

(Improv, Continued from Page 3)

## Flushing Oil Lines

This improv case is not real high tech, but is typical of the way the 2926 crew members approach almost any problem. It beats buying new parts or paying for budget busting out-sourcing.

AT&SF 2926 has a self lubrication system, with three separate units, Figure 19. To reach all points that need a steady flow lubricating oil, there are hundreds of feet of small lines on the locomotive.

After a half century of inaction, those lines are clogged with gelled oil, rust, and in the lines that have been disconnected over the years, dirt, spiders, etc. Obviously, they need flushing. In discussing ways to clear the lines, machinist Dick Downing said, "Just get a power steering unit from an automobile, and drive it with an electric motor. Use it to pump solvent through the lines until they are clear."

Following Dick's advice, there was a quick trip to Independent Vehicle Service on 3rd St. to find a power steering pump. One was rescued from a wrecked Volvo wagon and donated to the cause.

At the site, the improv team went to work with the pump, an electric motor, hoses, fittings, and a plastic tank fluid reservoir. It was assembled and mounted on two pieces old garden train trestle and wood scraps—and **Presto!**—a custom built Swedish-American oil line flushing system shown in Figure 20 was ready to go. A combination of the jury-rigged flushing system and compressed air was immediately put to work clearing the many feet of clogged lines.

There have been many other cases of improvisation during the the 2926 crew's effort to bring the big locomotive back to operation. Without such efforts to make do with available resources, the locomotive would not be nearing completion.

Of course, 2926 could have been in operation years ago if a couple of million dollars had been available at the start. But the 2926 crew has proved that improvisation can often be a good substitute for cash. And just look at the fun they had!

That bottom line is a tribute to the eclectic volunteer group working outside in fair and foul weather, and improvising to bring an important piece of New Mexico's rich rail heritage back to life.

Thanks to their efforts, the sounds of big steam from the last century will echo across the landscape as AT&SF 2926 comes back to life. With classic rail coaches behind it, passengers can experience travel as it once was in New Mexico and the American Southwest.

\* \* \*

## CLASSIC DIESEL AT OPEN HOUSE

### BNSF Brings Diesel With Santa Fe Lettering

The first thing Open House visitors entering the site from 8th St. saw was BNSF diesel unit 2844. It was built in 1975 by GM's Electro-Motive Div. A Model GP-39-2 with 2300 horsepower, 2844 was originally numbered AT&SF 3654, and later renumbered to AT&SF 3440. After the corporate merger that created BNSF, it was renumbered BNSF 2844 on 10/2/1998, retaining the Santa Fe paint scheme and lettering.

One feature of #2844 startled visitors. It is equipped with "Smart Start". With that feature, when the air tank pressure falls, the locomotive starts automatically to recharge the air tank. Once the tank is recharged, it automatically shuts down.

Most folks never get so close to big diesel locomotives. Thus, if it starts when someone is posing next to it for a photo opportunity, it causes an often interesting reaction.

*The 2844 info is courtesy of NMSLRHS member Dave Wiegand, a retired BNSF engineer.*



Figure 19: Two of the 2926 self lubrication units on workbench awaiting cleanup before reinstallation.



Figure 20: Bob DeGroft activates the flushing system, appropriately named the Taylor-DeGroft Transmogripher. With the solvent flush and compressed air, the lines are once again ready to carry lubricating oil to critical points throughout the locomotive.



## BRAKING NEWS

TRAINS MAGAZINE AWARD TO SPEED SANTA FE 4-8-4 RESTORATION

*"Trains Magazine, the world's largest railway publication and website, has presented its annual \$10,000 preservation award to the restoration of a famous Santa Fe 4-8-4 steam locomotive built in 1944."*

*"As important as it is to see the locomotive move under its own power, it is equally important for it to be able to stop."  
Jim Wrinn, Editor Trains Magazine*

This newsletter was finished and ready for distribution when the breaking news arrived. Our next quarterly newsletter will provide technical details on the 26L brake stand that will be installed using the Trains grant. . . . Editor

This newsletter is published quarterly by the New Mexico Steam Locomotive & Railroad Historical Society, a New Mexico Non-Profit Corp.

President	Michael F. Hartshorne
Vice President	Bob DeGroft
Secretary	Gail Kirby
Chief Mech. Officer	Rick Kirby
Chief Safety Officer	Jon Spargo
Newsletter Editor	Doyle Caton
Web Master	Rich Bugge
Community Liaison	Steve Bradford
Fundraising	Ed Kibel

#### MAILING ADDRESS

NMSLRHS  
P. O. BOX 27270  
Albuquerque, NM 87125-7270  
**Restoration Site:** 1833 8th St. NW  
**Tel:** (505) 246-2926 **Web:** www.nmslrhs.org

### LOOKING DOWN THE TRACK

In the last issue of this newsletter, we opened discussion of the major change the NMSLRHS faces with operational status of the locomotive about a year away. For many of the volunteers, operation will still mean handling tools and doing mechanical work—just maintenance rather than restoration. The labor intensive nature of steam operation will assure continued grease and grunt work.

Beyond the fences of the restoration site, we will face a different environment. In addition to much more public involvement, there are many more tasks that do not involve handling power equipment and wrenches.

Operation means a working relationship with: 1) Railroad regulatory officials in Federal and State government; 2) Rail industry representatives; 3) Local governments at destinations or stops; 4) Hospitality and tourism representatives. And also the general public.

The NMSLRHS Advisory Council is stepping in to help with long range planning activity. Having been relatively dormant during the restoration the Council will become more active in dealing with the issues outlined above.

Most of the volunteers are forging ahead to complete the restoration. When complete, they will shift to several months of adjustments, testing, and other shakedown activities.

To make sure there is a place to begin the testing, several volunteers are laying aside their tools and spending time planning for the shakedown, and ultimate excursion operations.

Some are meeting with industry and government rail officials to learn about operating rules and regulations and what we must do to be allowed to operate on the railroad lines.

Still other volunteers are working with the tourism industry and other public entities. That activity includes presentations to civic clubs, schools, and other groups interested in rail heritage and the coming operations of New Mexico's flagship steam locomotive.

A few volunteers are addressing the logistics of rail excursions. A key logistics task is calculation of fuel and water needs. There are no fuel and water stops as once existed in virtually all towns along rail lines. Once they have calculated fuel and water needs, they must arrange to have those resources available at points along the excursion routes.

LOOKING DOWN THE TRACK will become very interesting in coming months. Look for updates in this column.

## VISIT BY AN OLD FRIEND OF 2926

### Retired Santa Fe Engineer Visits The Locomotive He Once Operated

There are only a few of them still around—those guys who once climbed into the right hand seat in the cab of 2926 or another of AT&SF's large fleet of strong, high speed 4-8-4's. Their job was to deliver passengers or fast freight to destinations between Chicago and Los Angeles. Recently, one of those guys showed up at the 2926 site.

Eighty-eight year old Bob Foster spent several decades working for AT&SF in Kansas where he still lives. Recently, Bob, his daughter B.J., and son-in-law Kurt, came by to see an old friend, AT&SF 2926. The 2926 crew all had questions for someone who knew and operated their locomotive in its prime. Bob spent a couple of hours answering them.

Bob was especially partial to the 2900 and 3776 class locomotives. He said that adding the lightweight Timken roller bearing rods and the extendable stack after WWII set the 2900s apart from all others. He remembered pulling 110 oil tank cars between El Dorado and Wellington Kansas with a 2900 class unit—yeah, flat country, but still quite a feat.

An avid collector of AT&SF memorabilia, Bob also provided us with 2926 historical info, such as the dates of retrofitting the extendable stack and other modifications. He also addressed a detail we had not previously been able to verify. The 2900s did operate between Chicago and Los Angeles. Some records indicated that they operated no further east than Kansas City. Bob said a shortage of locomotives between Kansas City and Chicago caused AT&SF to use 2900s there on occasion.

Having someone like Bob drop by to conduct a continuing education course for the 2926 crew was a real treat. Come back soon Bob.



*Bob Foster, former AT&SF engineer, an avid collector of AT&SF rail memorabilia stands next to an old friend, AT&SF 2926.*

*Bob has a large collection of builders plates from locomotives that were scrapped at the end of the steam era, all mounted on walnut plaques. Here he holds the plate from an early AT&SF 2-10-4.*