



pacific northwest chapter

## **THE TRAINMASTER**

OCTOBER 1982

NUMBER 246

Pacific Northwest Chapter  
National Railway Historical Society  
Room 1, Union Station  
Portland, Oregon 97209 (503) 227-6747

### CHAPTER TIMETABLE

Friday, October 15 7:30pm The regular monthly meeting of the Chapter will be held at the Union Pacific Clubhouse which is located just south of the intersection of North Interstate and Russell Streets.

The program will feature a slide spectacular entitled "A Decade of Northwest Railroading" by Randy Nelson. There will also be a newsreel consisting of slides of recent happenings supplied by members - limit 6 slides each.

Nov 6, 7, 13, 14, 20, 21 Annual model railroad show by the Columbia Gorge Model Railroad Club. This will be the last show before the club moves to new quarters. See elsewhere in this issue for more information.

Friday, November 19 7:30pm The regular monthly meeting of the Chapter will be held at the Union Pacific Clubhouse. The program will be "New York Central Steam". There will also be the election of officers for the upcoming year.

NOTE: THE CHAPTER DOES NOT MEET DURING THE MONTH OF DECEMBER

Friday, January 21 7:30pm The regular monthly meeting of the Chapter will be held at the Union Pacific Clubhouse.

THIS ISSUE OF THE TRAINMASTER HAS BEEN SHORTENED SINCE MANY OF THOSE WHO ARE INVOLVED IN THE PRODUCTION OF THE PUBLICATION ARE ALSO WORKING ON THE GREAT NORTHWEST RAIL EXCURSION THE WEEKEND OF OCTOBER 9 and 10.

SUMMARY OF MINUTES OF REGULAR CHAPTER MEETING - SEPTEMBER 17, 1982

The meeting was called to order by President Ben Fredericks at 7:40 PM in the Union Pacific Clubhouse.

Spokane-Seattle Circle Trip: Ben Fredericks reported that the trip was completely sold out as of 9/1/82. About 620 tickets have been sold with an additional 300 turned away due to lack of space. The trip had very good publicity. The train will stop at The Dalles to pick up 78 passengers. There will be two photo run-bys enroute to Spokane. Hotel room keys will be passed out on the train before arrival in Spokane. Sunday breakfast will be served buffet style at the Ridpath Hotel. On Sunday lunch will be at Leavenworth, WA where the train will stop from 11:45 to 1:15. The train is scheduled to arrive in Seattle at 4 PM and in Portland at 9:20 PM. The consist will be nine Superliner coaches and one Superliner lounge.

Swap Meet: Terry Parker reported that the 1983 Swap Meet location has been changed to the National Guard armory on N.E. 33rd near Marine Drive. The Red Lion Hotel will not be used due to an unacceptably high increase in price. There will be as many or more tables than at the last meet. Advance flyers for the 1983 meet will be out shortly.

Railfan's Guide to Oregon: Ben Fredericks reported that preparation of the Guide is well along and that it is scheduled to be available for the spring of 1983. Black and white photos of favorite photo locations are still needed by Oct. 15.

Museum update: Ben Fredericks reported that a presentation has been made to the BN on use of the Ninth St. roundhouse as a museum. BN officials responded that they plan to continue use of the roundhouse. Later in the summer the BN advised that the roundhouse building is to be demolished but that the facility will continue in use. Still later the BN stated that they are interested in helping to find a museum site and in moving the SP&S #700 out of The Oaks Park.

Insurance for Car Mount Hood: Ben Fredericks advised that insurance is available through the American Assn. of Private Car Owners. For a base price of \$1000 it will cover the car when in storage and when moving. The amount of the coverage is \$2 million bodily injury and \$2 million property damage. Additional premium is payable when the car is used on trips. Ben asked for a motion to purchase the \$1000 base policy. Gordon Zimmerman moved, Ray Myer seconded, that the policy be purchased. Motion passed.

Crown Zellerbach equipment: Ben Fredericks reported that the Chapter has acquired by donation 3 electric motors (locomotives), and 1 line car from the abandoned electric plant railroad at Crown Zellerbach's Camas, WA mill. Arrangements have been made with the Oregon Electric Railway Historical Society to store the equipment at Glendwood.

President Ben Fredericks made the following announcements:

- 1.) The committee to nominate Chapter officers for 1983 is Al Haij, Roger Phillips and Walt Grande.
- 2.) A change in expenditure limits in the Chapter by-laws will be presented at the October meeting and voted on at the November meeting.
- 3.) Chapter membership is now 244. A membership list will be published in time for distribution at the October meeting.

Respectfully submitted, Chuck Storz, Secretary

# New Steam Locomotives: A Solution to Imported Fuel?

There are alternatives to diesel fuel oil. This first in a series of articles examines the latest state-of-the-art responses by entrepreneurs in the form of highly efficient coal-fired locomotives.

By Bill Paul

With the recent flare up of armed hostilities in the Middle East the railroad industry was reminded of its precarious dependence on imported, petroleum-based fuel. It was a disquieting jolt, though in a way the reminder wasn't really necessary.

The past few years have witnessed an explosion of activity by researchers, railroads, and entrepreneurs, as they have accelerated their search for alternate fuels and alternate motive power suited to railroad applications. The level of activity is so great and some of the claims so alluring that even knowledgeable experts are hard pressed to keep up.

It's not only a matter of quantity either, but quality as well. R&D has taken on a degree of sophistication that simply was not present when diesel motive power displaced the steam era.

One of the most important aspects of the renewed interest in both fuels and motive power is an awareness of life cycle costs. Potential savings from a new form of motive power may lead to discommodities elsewhere in the rail transportation system.

To date nothing definitive has emerged from all the fragmented research into either alternate fuels or alternate motive power. The best that can be

said is that several avenues look promising: coal for new motive power and residuals and blends in the area of fuels.

A survey by *Modern Railroads* magazine found more than a score of industry energy related projects. In this first of a series of articles we'll examine proposals for alternate motive power. Subsequent articles will report on: fuel extenders, improvements to existing diesel electric engines, and life cycle costs analysis.

As careful analysis of electrification keeps turning up capital investments that are nothing short of monumental, the greatest interest in alternative motive power has come to focus on the coal fired locomotive. In large part the interest can be traced to economies that appear compelling. Diesel fuel mounted 10-fold in price over the last decade and the *raison d'être* of coal has come to be its significantly reduced cost per BTU. The price differential ranges upwards to six-to-one, that is \$6 per million BTU's from diesel fuel compared to \$1 per million BTU from coal. What's lost in this simple equation is the fact that it's more difficult—and costly—in the railroad environment to extract BTU values from coal, than it is from diesel oil.

## Three proposals

Currently three companies in the U.S. are known to have developed conceptual designs for coal fired steam locomotives.

A common thread that runs through these coal fired concepts is simplicity. As William L. Withuhn of American Coal Enterprises noted in a speech to the Coordinated Mechanical Associations, "In the severe and unforgiving railroad operating environment, complexity in design is the sure route to failure."

The most publicized of the three proposals is the American Coal Enterprise ACE 3000. It represents a textbook marriage of the new and old—gains made in numerous fields over the past four decades married to proven technologies. "There will be innovations," says one of its chief designers, Dr. David Berkowitz, a physicist and noted expert in power plant engineering, coal combustion and fluidized bed combustion, "but mainly in assemblage and not in technology. The innovations are with respect to materials, control concepts, the condensing steam cycle, and so on."

The most proven of the three alternatives appears to be a design put forth by North American Locomotive Company. The NACL team is one of the school of thought that steam locomotives were always superior to diesel electrics—if only some of the bugs could have been worked out. Their proposal culminates an unbroken march of refinement and innovation to the basic steam locomotive since steam was eclipsed in this country 40 years ago. Most of their work has been carried on overseas.

NACL's design is based on the Roosen Henschel locomotive: presently more than 5,000 of these units are in service in Russia, South Africa and elsewhere throughout the world. NACL, with the assistance of German railway interests, has made some modifications to this locomotive to adapt it to North American use.

## The ACE 3000

The ACE 3000 will be a four cylinder, direct drive, reciprocating locomotive sized to match the starting tractive effort characteristics of a 3,000 hp diesel electric, claim its designers. It can be operated by a one man crew—with the aid of a microprocessor—and work in multiple unit service as well; it can even MU with diesels. No fireman will be needed as the stoking will be automatic.

Power will be generated in a two stage, gas producing combustion system.

In contrast to diesel oil, a big lump of coal simply burns too slowly. In the old-era steam engines it burned incompletely too, leading to cinders, black smoke and other factors that would be unacceptable today.

To circumvent this inherent disadvantage of coal the ACE team turned to gas producing combustion in which the coal burns completely and efficiently. "In the first stage combustion is incomplete because not enough air is used," says Berkowitz. "We burn off the volatile portion and we're left with the char which is then gasified and that completes the combustion." A steam turbine driven fan drafts the firebox and supplies the added air to complete the combustion process.

Since more of the coal is burned to completion, and the ash is collected, less smoke, cinders and particulates remain to go up to the stack.

Low temperatures in the firebox also help to reduce emissions of nitrogen oxide below existing EPA standards, through as Berkowitz observes, environmental standards for coal fired locomotives presently don't exist. "The standards that we anticipate will come along we deduced from standards that apply to large stationary coal fired plants. If our system is viewed as a vehicle then one set of standards apply; if we're viewed as a stationary plant then another set may apply." No word from the EPA yet.

Fuel for the ACE 3000 is stored in three, eleven ton containerized "coal packs" in the second trailing unit. Rubber tired trucks load mine mouth coal aboard the tender—rechristened the "support unit." Thirty-three tons of coal—the equivalent of 800 million BTU's—will take the locomotive over 500 miles; that means it can run at 55 mph in notch 8 for 15 hours or more. Once onboard the support unit the coal is delivered to the firebox via a remote stoking unit; the microprocessor will monitor this task.

In addition to tracking the stoking rate, the microprocessor keeps watch over other locomotive functions such as firebox temperature, steam flow, high amperage auxiliary power needs and more; even adhesion and tractive effort can be controlled through direct action on the piston thrust. The microprocessor will respond to the eight-notch throttle or the dynamic brake handle to keep the

various functions operating in sync with the power needs.

Ten thousand gallons of water circulate through a closed cycle condensing system. Pressure in the boilers will be 300 psi and produce 850 degree fahrenheit superheated steam. Spent steam is condensed in an eductor in the power unit; the device converts the steam to water and reduces it to about 190 degrees. Regular water cooling radiators in the support unit drop the temperature further. ACE officials say the locomotive can run 1,000 miles without having to add water.

Eight 54" drivers, in what appears to be a 4-4-4-2 configuration, supply traction; actually the locomotive is set up in a 4-8-2 arrangement. The drivers are mounted in a fixed frame interconnected by side rods and connecting rods. All eight drivers work as a single unit.

Two high pressure cylinders power the front axes with two low pressure cylinders for the back axes; all four cylinders are sized for equal and opposite thrust.

ACE claims the drive wheels will be free of dynamic augment. Says Berkowitz, "Balanced design cylinders are locked in phased opposition eliminating any unbalanced reciprocating mass in the the drivers."

The net of these various innovations is to boost the thermal efficiency of the ACE 3000 more than double—and perhaps triple that of the last generation steamers of 40 years ago. At their best those old behemoths delivered no more than 10 percent thermal efficiency to the rear coupler; they averaged less than half that. The ACE 3000 promises 15 percent to 18 percent. The company further claims it will deliver 65,000 lbs. of starting tractive effort; at 30 mph, tractive effort drops to 50,000 lbs., and at 60 mph it drops further—due to boiler limitations—to 25,000 lbs.

For Rily Deem the renewed interest in coal-fired steam locomotives represents a sweet victory of sorts. Deem is a mechanical engineer. He's been in railroading since steam was in its heyday though his roots in the industry go deeper; his forebearers built one of the first railroads across Hungary and Austria nearly 150 years ago.

In his view the 40 year hiatus of steam is over. The renewed product incorporates all the important advances made to steam technology in the interim; and Deem and his associates hold many of the worldwide patents. More importantly, in his opinion, his group's knowledge about steam locomotives was accumulated incrementally through first hand experience, rather than from a text book.

Deem and his German associates have a coal-fired, full condensing (read closed cycle), constant torque, reciprocating steam locomotive. They claim it can deliver up to 14,000 indicated horsepower at the drawbar at sustained speeds of 70 mph. One of the three units the group has designed, the Class 190, will supply 190,000 lbs. of starting tractive effort. That's better than three times the tractive effort of a conventional diesel electric, and of one of the principal competitive designs.

The Class 190—that's the version modified for North American usage—will be a five cylinder, compound, direct drive locomotive. Its basic wheel configuration will be a monstrous 2-8-8-4, with 16 64" drivers. Cross balancing and adding weights to counter balance the drivers eliminates most all dynamic augment.

Dual cab controls, with the second set in a cab at the rear of the tender, will permit this unit to travel in either direction.

To give 40,000 lbs. of extra tractive effort at speeds below 25 mph, a steam turbine in the tender will drive electric traction motors mounted beneath the tender. One will be attached to each of three single axle trucks. Traction motors are electrically interlocked to stay in sync with one another, but not mechanically joined.

## The Class 190

NACL will use high sulphur Illinois #6 coal. To reduce the sulphur content to acceptable levels Deem plans to employ the Lurgie process. The first step of this cleansing technique involves the mine

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mouth removal of any visible sulphur; up to 90 percent reductions are possible through grinding and crushing. The remaining pellets—about the size of a large pill or the last digit of a child's little finger—are blended with limestone. The pellets are fed into the firebox by an automatic stoker and burned at about 2,500 degrees.

Exhaust steam from a turbine-driven induced draft fan in the smokebox sup-

plies steam to air preheaters on each side of the firebox—even when the locomotive is at a standstill. The fan pulls the preheated air over and through the grate, ensuring complete combustion and eliminating smoke and cinders. The system almost completely eliminates scaling inside the boiler and cuts boiler repair by up to 80 percent.

"From there the steam exhausts into another turbine in the tender where the condensing system is located," explains Deem. "It's geared to drive fans to pull the air around the tubes to cool the steam. The exhaust steam from the turbine goes into the headers on both sides of the tender where it is converted back into water."

Coal is carried in the tender in a closed bin. The Class 140 can carry up to 45 tons of pellet-sized coal, says Deem. "With an auxiliary tender we can go from Chicago to the West Coast and never stop."

One way to sum up the net gain of 40 years of non-stop improvements to the old era steam locomotives—at least as represented by NAACL's adaptation of the Roosen Henschel system—may be this: "We use 15 lbs. of coal and 9.5 lbs. of water to develop one horsepower per hour," says Deem. "The old compound engines used up to 3.5 lbs of coal and 22 lbs. of water to develop one horsepower per hour."

Deem adds that tests of the engine in Europe show a net thermal efficiency at the drawbar of 38 percent. By contrast some of the latest generation diesels claim to deliver 42 percent, a claim

Deem says is "pure fiction."

Deem now finds himself in the same predicament as promoters of the ACE 3000—he needs a prototype to prove that it all works.

His task may be considerably easier and cheaper than for American Coal Enterprises. Since his is a design based on the traditional steam locomotive he plans to retrofit a 1942 S. Union 2-8-0 that is presently in service on a short line railroad. He estimates cost for the retrofit will be about one million dollars and take six months to complete.

### Some questions

Are the new coal fired steam locomotive an alternative the industry should pursue? Of course. Still, questions remain whether coal's six-to-one cost advantage can withstand a host of related expenses, infrastructure costs such as coaling facilities, manpower training, dual inventories and many more.

What about those environmental standards? Will coal fired locomotives be considered stationary or vehicular? Will these standards be uniform nationally, or fragmented, as states, in a burst of enthusiasm for New Federalism, devise multiple—and perhaps conflicting—standards?

And what about the matter of track train dynamics? Given the enormous weights of the coal fired alternative is the industry facing another 100-ton coal car fiasco?

Do the principles coal advocates advance to eliminate dynamic augment really work? The jointed rail common four decades ago at least had some give

every 39 feet, and look at the beating it took as those heavy side rods and unsprung drivers delivered their enormous hammer-like thumps with each turn of the drive wheel. What happens on the continuous welded rail in common use today? Thump, thump, thump! Against softer track than of yesteryear, on the concrete ties of coming years?

None of this is to assert the reincarnation of the old fashioned steam locomotive is a bad idea, or won't work. After all 5,000 locomotives of the Roosen-Henschel design are in service overseas. Coal fired locomotives may meet all the tests and free the railroad industry from dependence on imported, petroleum based fuel. Rather, it is to suggest that the technology confronts a vastly different environment than it left 40 years ago.

In these days of high interest rates quantum leaps in efficiencies carry with them quantum leaps in costs.

### LAST SHOW FOR COLUMBIA GORGE MODEL RAILROAD CLUB

The Columbia Gorge Model Railroad Club will present its last public shows in their present quarters before beginning the move to a new building. Due to the move there will not be a model railroad show presented by the club for three or four years. Their present building has been purchased to make way for the expansion of a medical clinic.

The club is located at 3405 North Montana Avenue. The show begins at 12 noon on Saturday (1pm Sundays) and lasts both days until 8:00pm. Admission price is \$1.25 for adults and 75¢ for children under 12.

The weekend of November 6 and 7th will be the all steam weekend with nothing but steam locomotives pulling the many freight and passenger trains. Both steam and diesel locomotives will share the workload the other two weekends. All the trains operate over 25 scale miles of track on the 20x55 foot railroad empire. The model includes some 80 thousand feet of electrical wiring along with model cities, industrial complexes, a hydroelectric dam, rivers and mountains. There is also theatrical lighting and sound effects to help dramatize railroading.

**PACIFIC NORTHWEST CHAPTER**

**NATIONAL RAILWAY HISTORICAL SOCIETY**

(An Oregon Non-Profit Corporation)

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**PACIFIC NORTHWEST CHAPTER MEMBERSHIP**

Membership in the National Railway Historical Society and the Pacific Northwest Chapter is open to all persons 16 years of age and over who are interested in railroads and railroad history. Dues for the Pacific Northwest Chapter are \$16.50 a year. Membership includes six issues of the NRHS Bulletin (national publication) and nine issues of the Pacific Northwest Chapter's publication The Trainmaster. The Pacific Northwest Chapter meets on the third Friday of the month except during July, August and December. Meeting location and time are given in the monthly issues of The Trainmaster. Write to the Pacific Northwest Chapter at the address given at the top of this page for an application or for more detailed information.

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