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T. W. BLASINGAME COMPANY, INC.

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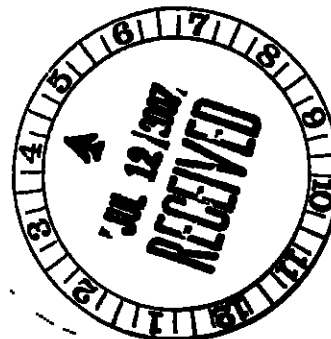
July 10, 2007

STB-070710-1

SURFACE TRANSPORTATION BOARD
395 E Street S. W.
Washington, DC. 20423-0001

Reference: Your Notice of Meeting on July 18, 2007
to discuss issues related to rail transportation
of resources critical to nation's energy supply

Subject: "Strategic Vulnerability of Coal Transportation"
and means to mitigate this serious problem



Ladies and Gentlemen:

We are an independent custom design and product development company located in Boise, Idaho. For the past 17 years we have been engaged in a project to design and develop locomotives and heavy duty trucks capable of operating cleanly, coolly and quietly on fuels other than oil.

We respectfully submit the attached booklet in support of our contention of the "Strategic Vulnerability of Coal Transportation." This booklet contains information on alternate fueled motive power which could provide a means to mitigate this serious problem.

Sincerely,

T. W. BLASINGAME COMPANY, INC.

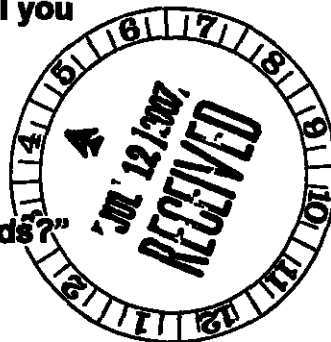
Thomas W. Blasingame
Thomas W. Blasingame
President

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The T. W. BLASINGAME COMPANY, INC. is an independent custom design and product development company. For the past 17 years, we have been engaged in an in-house project to design and develop locomotives capable of operating cleanly, coolly and efficiently on fuels other than oil. Presently we have locomotive designs that can utilize gaseous, liquid or solid fuels. Of these, the solid fuels are the most cost-effective and the least damaging to the environment.

The United States is totally dependent on petroleum-based fuels to power all forms of transportation and industry. The loss of our crude oil supply due to international politics or the destruction of this country's petroleum refineries would have the same result ... a total shutdown of all agriculture, mining and transportation services.

It is unfortunate that the only viable alternate fuel – coal – is totally dependent on the strategically vulnerable primary fuel – oil – for its production, transportation and distribution.

Our program is to provide state-of-the-art steam-electric locomotives to the world's railways on a full service lease, in which we provide all maintenance. Equipping the nation's coal hauling fleet with coal fueled motive power would be the first step in eliminating this country's strategic vulnerability to the loss of our crude oil supply.

What the National Coal Council Report doesn't tell you:

The National Coal Council Report "Coal: America's Energy Future" was a year long effort by the National Coal Council at the request of U. S. Department of Energy Secretary Samuel W. Bodman. The purpose of the report was to "Identify the challenges and opportunities of more fully exploring our domestic coal resources to meet the Nation's future energy needs." The report was released on March 22, 2006.

The nation's energy demand will increase significantly over the next twenty-five years. The Energy Information Administration (EIA) has projected that (energy) consumption will grow from 100 quadrillion BTUs in 2004 to 127 quadrillion BTUs in 2030, an increase of 27 percent. This increase of 27 quadrillion BTUs is the equivalent of the nation's total energy consumption increase from 1972 to 2004. Previously, oil imports were available to meet two-thirds of new demand; today such an international supply cushion no longer exists. Consequently, the greater portion of the new energy supply must come from coal or coal derivatives.

Before 1973, oil was cheap and generated almost 20% of the electric power in the United States. Today, oil produces only about 3% of the electric power in this country.

Coal is the main fuel for U. S power generation today, fueling over 55% of the nation's power plants, while meeting ever increasing environmental regulations. Nuclear power plants provide an additional 20% of generating capacity. Due to rising oil and natural gas prices, the coal and nuclear power plants are presently running at nearly full capacity. To meet the expected future demand, approximately 90 GW of new generating plants are under current design.

Today the U. S. Imports over 58% of the oil needed, and much of this oil is from countries that are not stable or which are not our friends. This is creating serious problems that can only be solved by breaking our addiction to foreign sources of oil.

Increasing petroleum demand from emerging nations is compounding the problem of petroleum sources that are or have peaked. China is expected to increase its consumption substantially, as will India.

Key points in the National Coal Council report were:

- 1. Coal-To-Liquids to Produce 2.6MMbd, use 475 M TPY**
- 2. Coal-To-Natural Gas to produce 4.0 Tcf / year, use 340 M TPY**
- 3. Coal-To-Clean-Electricity: add 100 GW, use 375 M TPY**
- 4. Coal-To-Produce Ethanol: use 40 M TPY (Tons Per Year)**

5. Coal-To-Hydrogen: 10% of transportation, use 70 M TPY
6. Enhanced Oil & Gas (Coalbed Methane) Recovery as Carbon Management Strategies to increase oil production
7. Delineate U.S. Coal Reserves & Transportation Restraints as part of effort to maximize U. S. Coal Production
8. Penn State Study, Economic Benefits of Coal Conversion Investments: "Using 1,300 million tons of additional coal for BTU conversion technologies would result in more than \$600 billion in increased annual economic growth and 1.4 million new jobs by 2025. To achieve this, a capital investment in BTU conversion technologies of some \$500 billion will be required, or \$350 billion on a present value discounted basis. In return, a present value discounted benefit of cumulative GDP gains of some \$3 trillion is expected."

In summary, the National Coal Council finds that the United States could increase coal production by 1,300 million tons per year by 2025 for BTU conversion technologies and still have a supply that would last for 100 years. Maximizing coal production would reduce dependence on imported energy and the economic benefit for the United States would be enormous.

Here is what is not in the National Coal Council's report:

The National Coal Council's report presumes that the transportation of coal from source to point of use would continue to be performed by existing types of rail or barge transportation systems, both which are totally dependent on petroleum based fuels. No mention is made in the report of the strategic vulnerability of U. S. petroleum refining or conversion facilities to destruction by enemy forces or natural disasters. The loss of less than 20 of these facilities would mean that no matter how much crude oil was on the world market, the United States would be unable to process it. All mining, agriculture and transportation services would immediately come to a halt, including the over 900 coal trains that leave coal producing areas each week, each with over 115 cars, and each car with 100 tons of coal. These unit coal trains feed over 55% of the electric generating plants in the U.S., and none of these trains would turn a wheel without Diesel fuel.

There may be compelling reasons why cars, trucks and airplanes need to have expensive liquid fuels, but there is no reason that the railroads in this country cannot use run of mine coal for fuel. For over one hundred and fifty years, coal fired steam locomotives hauled over 85% of the nation's rail freight. Today the development of modern coal fueled steam-electric

locomotives means the same transportation service is available without requiring expensive and polluting liquid fuels, and at much less cost.

These alternate fueled locomotives can be fueled at the mine mouth with the same equipment presently used to load the coal cars, or with front end loaders, conveyors or overhead structures. No processing of the coal is required. The largest bulk materials handling company in the United States has said that they will build, own and operate the fuel dispensing facilities at no capital cost to the railroads if suitable long term fuel supply contracts can be arranged. The locomotives and other equipment can be obtained on a full service lease, which provides all maintenance services.

It is stupid that this country's primary energy source is completely vulnerable to destruction by enemy or natural forces, and the only viable alternate fuel, coal, is totally dependent on that strategically vulnerable primary fuel for its production, transportation and distribution. To become truly independent of foreign oil, the coal production, transportation and distribution systems must also utilize coal as the fuel of choice.

We can't say we haven't been warned. For several years now, we have seen reports of crude oil production peaking. We have also seen reports of mushrooming demand for crude oil by China and India. More recently, we have seen other countries making sweetheart deals for crude oil directly with the oil producing countries, deals that will lock us out of the supply of crude oil in many cases. We have been fortunate that the oil shortages have not yet hit us. We can continue to ignore the black clouds on the horizon, or we can begin to replace the Diesel-electric locomotives now assigned to coal trains with modern coal fired steam-electric motive power. The displaced Diesel-electrics can easily be reassigned to other hauls as motive power demand grows, while the steam-electric locomotives on the coal hauls protect the fuel supply for the 55% of power plants that use coal for fuel. This country's motive power fleet is large, and an orderly rather than chaotic shift to using coal for a railroad fuel is to our long range advantage. Doing nothing now will insure a complete shut-down later. The choice is obvious.

**Thomas W. Blasingame III
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504. The US Department of Energy addresses Peak Oil

The US Department of Energy has submitted the following article for inclusion in this newsletter:

**The Mitigation of the Peaking of World Oil Production
Summary of an Analysis, February 8, 2005**

A recently completed study for the U. S. Department of Energy analyzed viable technologies to mitigate oil shortages associated with the peaking of world oil production.¹ Commercial or near commercial options include improved vehicle fuel efficiency, enhanced conventional oil recovery, and the production of substitute fuels. While research and development on other options could be important, their commercial success is by no means assured, and none offer near-term solutions.

Improved fuel efficiency in the world's transportation sector will be a critical element in the long term reduction of liquid fuel consumption, however, the scale of effort required will inherently take time and be very expensive. For example, the U. S. has a fleet of over 200 million automobiles, vans, pick-ups and SUVs. Replacement of just half with higher efficiency models will require at least 15 years at a cost of over two trillion dollars for the U. S. alone. Similar conclusions generally apply worldwide.

Commercial and near-commercial options for mitigating the decline of conventional oil production include: 1) Enhanced Oil Recovery (EOR), which can help moderate oil production declines from older conventional oil fields; 2) Heavy oil/oil sands, a large resource of lower grade oils, now produced primarily in Canada and Venezuela; 3) Coal liquefaction, an established technique for producing clean substitute fuels from the world's abundant coal reserves; and 4) Clean substitute fuels produced from remote natural gas.

For the foreseeable future, electricity-producing technologies, i.e., nuclear and solar energy, cannot substitute for liquid fuels in most transportation applications. Someday, electric cars may be practical, but decades will be required before they achieve significant market penetration and impact world oil consumption. And no one has yet defined viable options for powering heavy trucks or airplanes with electricity.

To explore how these technologies might contribute, three alternative mitigation scenarios were analyzed: One where action is initiated when peaking occurs, a second where action is assumed to start 10 years before peaking, and a third where action is assumed to start 20 years before peaking.

Estimates of the possible contributions of each mitigation option were developed, based on crash program implementation. Crash programs represent the fastest possible implementation – the best case. In practical terms, real-world action is certain to be slower.

Analysis of the simultaneous implementation of all of the options showed that an impact of roughly 25 million barrels per day might be possible 15 years after initiation. Because conventional oil production decline will start at the time of peaking, crash program mitigation inherently cannot avert massive shortages unless it is initiated well in advance of peaking. Specifically,

¹ Hirsch, R. L., Bezdek, R. H., Wendling, R. M. *Peaking of World Oil Production: Impacts, Mitigation and Risk Management*. DOE NETL. February 2005.

- **Waiting until world conventional oil production peaks before initiating crash program mitigation leaves the world with a significant liquid fuel deficit for two decades or longer.**
- **Initiating a crash program 10 years before world oil peaking would help considerably but would still result in a worldwide liquid fuels shortfall, starting roughly a decade after the time that oil would have otherwise peaked.**
- **Initiating crash program mitigation 20 years before peaking offers the possibility of avoiding a world liquid fuels shortfall for the forecast period.**

Without timely mitigation, world supply/demand balance will be achieved through massive demand destruction (shortages), accompanied by huge oil price increases, both of which would create a long period of significant economic hardship worldwide.

Other important observations revealed by the analysis included the following:

- 1. The date of world oil peaking is not known with certainty, complicating the decision-making process. A fundamental problem in predicting oil peaking is uncertain and politically biased oil reserves claims from many oil producing countries.**
- 2. As recently as 2001, authoritative forecasts of abundant future oil supplies of North American natural gas proved to be excessively optimistic as evidenced by the recent tripling of natural gas prices. Oil and natural gas geology is similar in many ways, suggesting that optimistic oil production forecasts need to be viewed with considerable skepticism.**
- 3. In the developed nations, the economic problems associated with world oil peaking and the resultant oil shortages will be extremely serious. In the developing nations, economic problems will be much worse.**
- 4. While greater end-use efficiency is essential in the long term, increased efficiency alone will be neither sufficient nor timely enough to solve the oil shortage problem in the short term. To preserve reasonable levels of economic prosperity and growth, production of large amounts of substitute liquid fuels will be required. While a number of substitute fuel production technologies are currently available for deployment, the massive construction effort required will be extremely expensive and very time consuming, even on a crash program basis.**
- 5. Government intervention will be essential, because the economic and social impacts of oil peaking will otherwise be chaotic, and crash program mitigation will need to be properly supported. How and when governments begin to seriously address these challenges is yet to be determined.**

Oil peaking discussions should focus primarily on prudent risk management, and secondarily on forecasting the timing of oil peaking, which will always be inexact. Mitigation initiated earlier than required might turn out to be premature, if peaking is slow in coming. If peaking is imminent, failure to act will be extremely damaging worldwide.

World oil peaking represents a problem like none other. The political, economic, and social stakes are enormous. Prudent risk management demands urgent attention and early action.

Review and comment:

The above report has serious implications for the United States. In this country, every lawn mower, every farm tractor, every car, bus and truck, every motor boat, every airplane and every locomotive is totally dependent on petroleum based fuel. Any loss of refining capability, or any disruption in the supply of crude oil, would create shortages that would bring all agriculture, mining and transportation to a complete halt. In effect, we would be back in an Amish society.

Each week, the major railroads originate over 750 coal unit trains from the Powder River Basin in Montana and Wyoming. These coal trains supply over 55% of the electric generating plants in the United States. Even though the coal costs only 25% the cost of Diesel fuel, these trains are pulled by Diesel-electric locomotives that require expensive Diesel fuel. Without Diesel fuel, these trains would not turn a wheel. It is ironic that the only viable alternate fuel, coal, is totally dependent on the strategically vulnerable primary fuel for its production, transportation and distribution.

The above analysis addresses the problems of converting the automobile fleet to alternate liquid fuels, and states that no one has defined viable options for powering heavy trucks or airplanes with electricity. The railroad industry, which currently consumes about one-third of the nation's petroleum-based transportation fuels, has a track record of over one hundred and fifty years in which the coal-fired steam locomotive hauled over 85% of this nation's freight. With the technologies that exist today, solid fueled steam-electric locomotives could replace Diesel-electrics and substantially reduce the impact of the liquid fuel shortages that appear certain. The solid fuel option is totally ignored in this report.

For the past fifteen years, our company has been engaged in a project to design and develop locomotives that can operate cleanly, coolly and efficiently on fuels other than oil. Our locomotive designs range from 1500 to 9000 horsepower, and we can provide this alternate fueled motive power on a full service lease in which we provide all maintenance services. The largest bulk materials handling company in the U. S. has stated that they will build, own and operate the solid fuel dispensing stations at no capital cost to the railroads if suitable long term fuel supply contracts can be arranged. When the funding to build and test the prototypes is available, we are ready to put this equipment into production. Cost increases can be addressed by fuel surcharges, but fuel shortages cannot. We can wait until Diesel fuel is not available at any price, or we can start now to make an orderly transition to solid fueled motive power. The alternative is chaos.

Thomas W. Blasingame

President

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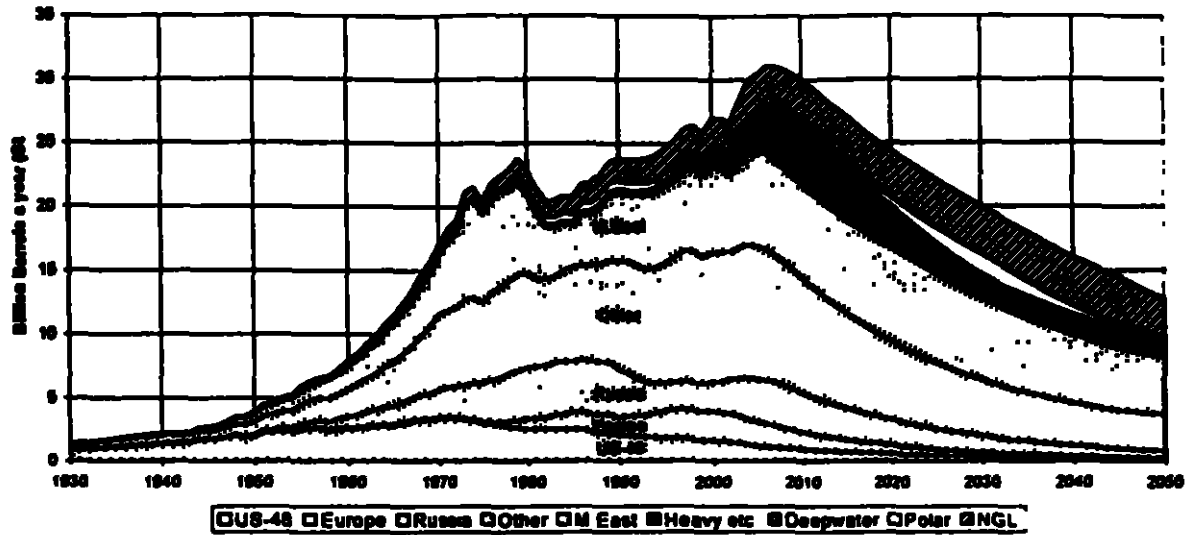
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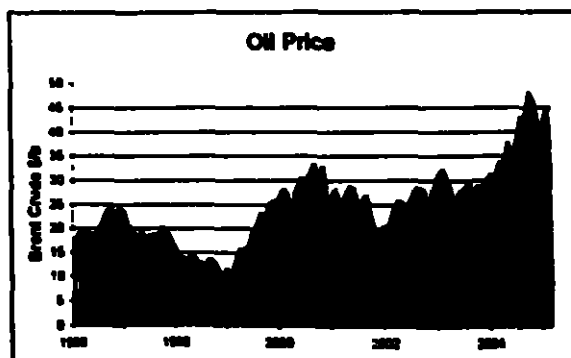
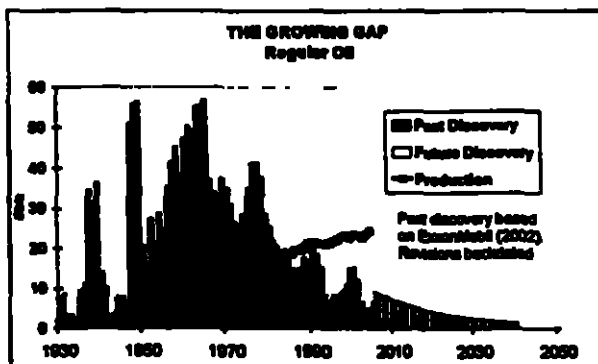
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The General Depletion Picture

OIL AND GAS LIQUIDS 2004 Scenario



ESTIMATED PRODUCTION TO 2100								End 2004		
Amount		Gb	Annual Rate - Regular Oil				Gb	Peak		
Regular Oil			Mb/d	2005	2010	2020	2030	Total	Date	
Past	Future	Total	US-48	3.4	2.7	1.7	0.4	200	1972	
Known Fields	New		Europe	5.2	3.6	1.8	0.3	75	2000	
945	760	145	1850	Russia	9.1	8	5.4	1.5	220	1987
	905		ME Gulf	20	20	20	12	680	1974	
All Liquids			Other	28	25	17	8	675	2004	
1040	1360	2400	World	66	59	46	22	1850	2006	
2004 Base Scenario			Annual Rate - Other							
M.East producing at capacity (anomalous reporting corrected) Regular Oil excludes oil from coal, shale, bitumen, heavy, deepwater, polar & gasfield NGL			Heavy etc	2.4	4	5	4	160	2021	
			Deepwater	4.8	7	6	0	70	2014	
			Polar	0.9	1	2	0	52	2030	
			Gas Liquid	8.0	9	10	8	275	2027	
			Rounding		0	2	-7			
Revised	26/01/2005		ALL	82	80	70	35	2400	2007	



ALTERNATE FUELS

Informal study for Telephone Conference of International Association for the Advancement of Steam Power members
August 5, 2006

1. **Crude Oil @ \$75.00/Bbl – No Processing - $\$75/42 = \$1.786/\text{Gallon}$
8 Lbs./Gal. (approx); $17410 \text{ BTU/Lb} \times 8 = 139,280 \text{ BTU/Gal.}$
 $\$12.816/\text{MBTU}$**
2. **Bunker C Oil (No. 5) – No Information Available**
3. **Diesel Fuel: 19170 – 19750 BTU/Lb.; 8 Lbs./Gal. (approx); $8 \times 19170 = 153,360 \text{ BTU/Gal.}$ Price varies with location and availability.**
4. **Synthetic Diesel – Coal to Liquid (CTL) – Bituminous Coal
Cost \$36/Ton from SSEB Appendix C, Pg. 48
 $11800 \text{ BTU/Lb.} \times 2000 \text{ Lb.} = 23,600,000 \text{ BTU/Ton}$
Coal Feed 5400 TPD divided into 11,000 BPD = 1:2.037 Production ratio
Per Report, Diesel req'd Selling Price is estimated to be \$67.23/Bbl
 $\$67.23/42 = \$1.363/\text{Gallon}$
 $\$57.23/1.3 = \text{Crude Oil Equivalent Basis} = \$44.023/\text{Bbl.}$
 $\$44.023/42 = \$1.0482/\text{Gallon}$
 $\$36 + \$1.48 = \$112.48 \text{ Processed Fuel Cost/Ton}$
 $\$4.978/\text{MBTU}$**
5. **Synthetic Diesel – Coal to Liquid(CTL) – Subbituminous Coal
Cost \$11/Ton from SSEB Appendix C, Page 48
 $10913 \text{ BTU/Lb.} \times 2000 \text{ Lb.} = 12,826,000 \text{ BTU/Ton}$
As received, the subbituminous coal had 30% moisture
As-Fed , the subbituminous coal was dried to 10% moisture
Per Report (Table 15), Diesel Required Selling Price is estimated to be
 $\$60.18/\text{Bbl.}; \$60.18/42 = \$1.433/\text{Gallon}$
 $\$60.18/1.3 = \$46.29/\text{Bbl.}; \text{divided by } 42 = \$1.102/\text{Gal. Crude Oil Equivalent basis}$
Coal Feed (as fed) 5348 TPD divided into Naptha + Diesel of 10,000 BPD =
1:1.87 Production Ratio
 $\$11 + \$93.50 = \$104.50 \text{ Processed Fuel Cost/Ton}$
 $\$4.788/\text{MBTU}$**
6. **Coal-Water Fuel(LRCWF) – Mississippi Lignite Coal
Coal Cost \$16/Ton
Cost of Processing \$24.05/Ton
Cost of Processed Fuel: \$40.05/Ton
Production Ratio for 6500 BTU/Lb. C-W Fuel : 1:1.85
 $\$2.665/\text{MBTU}; \$21.65/\text{Bbl.}; \$0.515/\text{Gallon}$**
7. **Coal-Water Fuel(LRCWF) – Alaska Subbituminous Coal
Coal Cost \$24/Ton
Cost of Processing: \$13.252/Ton
Cost of Processed Fuel: \$37.25/Ton
Production Ratio for 7000 BTU/Lb. C-W Fuel: 1:2.62
 $\$2.23/\text{MBTU}; \$14.782/\text{Bbl.}; \$0.352/\text{Gallon}$**

ALTERNATE FUELS, continued

8. **Coal-Water Fuel(LRCWF) – Powder River Basin Subbituminous Coal**
Coal Cost: \$13.50/Ton
Cost of Processing: \$16.40/Ton
Cost of Processed Fuel: \$29.90/Ton
Production Ratio for 7200 BTU/Lb. C-W Fuel: 1.252
\$1.69/MBTU; \$11.865/Bbl.; \$0.2626/Gallon

Note: The Mississippi Lignite and Alaskan Subbituminous fuels are tide water while the PRB subbituminous requires overland shipment. Supplier recommends that processing be performed near the fuel source.

9. **Coal Water Fuel(HRCWF) – West Virginia Pocahontas Coal – 14900 BTU/Lb.**
Coal Cost: \$90.00/Ton
Cost of Processing: \$26.40/Ton
Cost of Processed Fuel: \$116.40/Ton
Estimated Production Ratio for High Rank C-W Fuel: 1:3.3
\$3.906/MBTU; \$35.27/Bbl.; \$0.840/Gallon

Note: High Rank Coal-Water Fuel will probably require an oxygen-enhanced combustion system.

10. **Powder River Basin Subbituminous Coal – for Direct Combustion- 8300 BTU/Lb**
Coal Cost: \$9/Ton 8-4-2006
Cost of Processing: \$0.00
Total Cost of Fuel: \$9.00/Ton
 $8300 \times 2000 = 16,600,000$ BTU/Ton, 27% moisture
\$0.542/MBTU
11. **Powder River Basin Subbituminous Coal: for Direct Combustion: 8800BTU/Lb**
Coal Cost: \$13.50/Ton 8-4-2006
Cost of Processing: \$0.00
Total Cost of Fuel: \$13.50/Ton
 $8800 \times 2000 = 17,600,000$ BTU/Ton, 27% Moisture
\$0.767/MBTU
12. **Utah Bituminous Coal – for Direct Combustion – 11,700 BTU/Lb.**
Coal Cost: \$40/Ton 8-2-2006
Cost of processing: \$0.00
Total Cost of Fuel: \$40.00/Ton
 $11,700 \times 2000 = 23,400,000$ BTU/Ton, 9.3% Moisture
\$1.709/MBTU
13. **Tennessee/Kentucky Bituminous Coal – for Direct Combustion – 12,500 BTU/Lb. figure used as average (11,900 – 13,500 BTU/lb.)**
Coal Cost: \$40.00/Ton
Cost of Processing: \$0.00
Total Cost of Fuel: \$40.00/Ton
 $11,900 \times 2000 = 23,800,000$ BTU/Ton, \$1.681 BTU/Lb.
 $13,500 \times 2000 = 27,000,000$ BTU/Ton, \$1.481 BTU/Lb.

ALTERNATE FUELS, continued

14. **West Virginia Pocahontas Bituminous Coal – for Direct Combustion – 14,900 BTU/Lb.**
Fuel Cost: \$90.00/Ton 8-2-2006
Processing Cost: \$0.00
Total Cost of Fuel: \$90.00
14,900 x 2000 = 29,800,000 BTU/Ton, 6.5% Moisture
\$3.020/MBTU

Note: Coal for Direct Combustion can be loaded into locomotives at the mine mouth in applications where solid fueled motive power is used to pull unit coal trains, using the same equipment as is used to load the coal cars. At other locations, fueling may be accomplished using rubber tired or tracked front end loaders. Locomotives and fueling equipment are available on a full service lease. Overhead fueling and servicing structures are available also on a lease or contract basis.

15. **RDF Fuel Cubes – for Direct Combustion - 7500 to 10,000 BTU/Lb.**
per information on 8-4-2006
Fuel Cost: (\$50.00/Ton Tipping Fee, Average) - (-)\$50.00/Ton
Processing Cost: \$30.00/Ton (Sorting & Cubing)
Total Cost of Fuel: (-) \$20.00/Ton
7500 X 2000 = 15,000,000 BTU/Ton (-)\$1.333/MBTU
10,000 x 2000 = 20,000,000 BTU/Ton (-) \$1.000/MBTU

Note: In all cases, costs of transportation and taxes are not included. In the case of the RDF Fuel Cubes, this fuel can be manufactured by local subcontractors and the fuel will therefore not be subject to the same freight costs as the other fuels.

The above information has been provided to us from sources in the industry deemed reliable, but we have no way of verifying them or checking them. This information should be used with caution and verified with the supplier to insure accuracy. T. W. Blasingame Company, Inc. assumes no liability for errors, errata or omissions in the above data.

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NOT FOR PUBLICATION

From **Railway Age Late Breaking Rail Industry News (May 29, 2007):**

Liquefied coal: A boon for railroads?

The railroads are part of a broad-based group seeking the investment of billions of dollars in federally guaranteed loans to promote liquefied coal as an alternative fuel to diesel and jet fuel. Industry sources say that any such development on the industry front could substantially increase the movement of coal by railroads, which already derive 40% of their traffic, measured in ton miles, from coal.

As reported in the lead story in today's New York Times, legislators from coal producing states – pushed by a strong coal industry lobby led by such companies as Peabody Energy – are proposing taxpayer guarantees of billions of dollars in construction loans for six to 10 liquefied coal production plants, each of which could cost about \$3 billion; minimum price guarantees for the new fuel, tax credits of 51 cents for every gallon sold through 2020; and guarantees of major government purchases over the next 25 years, such as the U S. Air Force purchase of about a billion dollars a year for jet fuel. The proposed subsidies, which would be automatic if oil prices drop below \$40 per barrel, could exceed those for other alternative fuels, including corn-based ethanol. Peabody's lead lobbyist is former Democratic House Majority Leader Richard Gebhardt.

The coal-to-liquid conversion process, known as the Fischer-Tropsch Process, goes back to the 1920s. Opponents of liquefied coal say that it produces twice the amount of greenhouse gases as conventional diesel fuel when burned, and its production process produces about a ton of carbon dioxide per barrel. Coal industry executives counter that any gases produced during manufacture can be captured, stored underground, and used for other purposes as oil-field injection to force oil to the surface.

* * * * *

Comment

Making diesel fuel from coal is simple. Take \$14/ton coal, add \$80/ton processing, and Presto – you have diesel fuel. There may be a crying reason to make liquid fuel from coal for trucks, busses, airplanes and boats – but there is a very valid reason for not having the taxpayers pay for coal based synthetic diesel fuel for the railroads. For over 150 years, over 85% of the rail freight in this country was hauled by coal-fired locomotives using 2" minus run-of-mine coal, and they could do it again tomorrow if the taxpayers, shippers and railroads wanted them to.

Just as many people are not aware that the nuclear navy runs on steam, it is not common knowledge that the development of the steam-electric locomotive predates the development of the Diesel-electric locomotive.

Comments on Liquefied coal: A boon for railroads?, continued

In 1897, the Hellmann locomotives, with conventional boilers and a 1360 horsepower compound vertical engine driving eight traction motors in two four-axle trucks, gave good service with rapid acceleration in suburban passenger service

In 1938, General Electric built a 6000 horsepower, 2-unit steam-turbine-electric locomotive for the Union Pacific Railroad Co. The locomotive was oil-fired and fully condensing. The availability of new Diesel-electrics and teething troubles stopped this locomotive development effort.

In 1947, the Chesapeake & Ohio obtained from Baldwin three 6000 horsepower steam-turbine-electric locomotives with conventional fire-tube boilers. Problems with the draughting system design were corrected, but the modifications were not applied to the locomotives. New Diesels again stopped this development project.

In 1964, the Norfolk & Western obtained from Baldwin-Lima-Hamilton a 4500 horsepower steam-turbine-electric non-condensing coal-fired locomotive with water-tube boiler. After exhaustive tests, the N&W concluded that the prototype locomotive, although slower due to its lower horsepower, could save 20% on coal compared to N&W's famous modern reciprocating steam locomotives. N&W wanted to purchase 20 more similar locomotives of 5400 HP, and felt that in the future, full-condensing 7000 HP steam-turbine-electrics would be used. Unfortunately, no other railroads were interested. Baldwin-Lima-Hamilton went out of business, and the later coal-fired locomotives were never built.

In the 1980s, Shoemaker & Associates of Tampa, Florida designed a 9000 horsepower 2-unit fully condensing steam-turbine-electric locomotive, but could not obtain the funding to build and test the prototype.

In 1985, American Coal Enterprises, Inc., owned by Ross E. Rowland, Jr., designed and patented the ACE-3000 and larger reciprocating steam and steam-turbine-electric locomotives. Their group almost convinced Burlington Northern to use coal-fired motive power for Powder River basin coal trains, but they were unsuccessful in obtaining the necessary funding.

Since 1990, the T. W. Blasingame Company, Inc. of Boise, Idaho has been engaged in an effort to design and develop alternate fueled locomotives. Their design portfolio includes both Diesel-electric and steam-electric locomotives ranging from 1500 to 9000 horsepower. Since the company has developed both types of motive power, they have no preference for the type of fuel that is used. The Blasingame Company is looking for joint venture partners to participate in building its locomotives and in marketing them world-wide under a full service lease program in which all maintenance services are provided.

There are significant design differences between Diesel and steam engines. In a steam engine, there is no need to cool the engine and every effort is made to retain engine heat. In addition, electric energy created in dynamic braking operations is used to generate additional steam for propulsion at a later time rather than wasted.

Comments on Liquefied coal: A boon for railroads?, continued

Using modern combustion technologies, complete fuel combustion is achieved and operation is cleaner, cooler and quieter than with Diesel power

In a Diesel engine, cooling of the engine is the prime objective. Heat rejected is released to the atmosphere, and additional heat generated during dynamic braking is often also released into the atmosphere. The new technologies for making Diesel fuel from coal will also require the release of substantial heat into the atmosphere, over and above the large amounts of heat lost in normal operations.

When comparing steam-electric and Diesel-electric motive power, it is important to remember that these are not grandfather's old steamers. These are modern, state-of-the-art mobile electric power plants with equal or superior power density, tractive effort and modern environmental technology to be able to operate seamlessly in multiple with the best in Diesel-electric motive power.

Side-by-side fuel cost comparisons based on computer operating scenarios have shown that it is not uncommon for the coal-fired steam-electric locomotives to be projected to operate at about 25% of the cost of conventional Diesel fuel. When comparing the cost of synthetic Diesel fuel to the fuel costs for coal-fired steam-electric locomotives, a cost eight times the cost of the 2" minus Run-of-Mine unprocessed coal or other solid fuels can be expected. The taxpayers, shippers and railroads should be aware of this fuel cost advantage when planning future expenditures for fuel and motive power, because it is sure to end up on someone's bottom line.

Yes, liquefied coal can be a boon to the railroads, for the additional transportation services required, but even more so if they remember that coal in its natural state is going to be much more profitable to them as fuel in the coming oil-less age. The railroads have a 150 year old track record to prove it.

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A Shotgun Estimate looking at the cost of \$14.00/ton 2" minus Run of Mine Coal versus the cost of the same amount of the same coal processed into synthetic diesel fuel shows some surprising factors.

Data on the production costs of petroleum products and synthetic diesel fuel made from coal are hard to find. Therefore, we have just resorted to a few simple premises to let us explore the economics of this proposed synthetic diesel fuel. In our calculations, we have not included the costs for the coal processing facility, energy costs for processing, profit, transportation of the fuels, or taxes.

Taking \$14.00/ton coal and adding \$80.00 per ton for processing gives us a raw cost of \$94.00 per ton total fuel cost for one ton (2000 Lbs.) of 8500 BTU/Lb. coal. A gallon of petroleum based diesel fuel weighs about 7.39 Lbs., and usually has about 19750 BTUs/Lb. of heat value. In a scenario completely neglecting heat and fuel losses during processing, if we divide 2000 Lbs. of coal by 7.39 Lbs. per gallon, we will see that in this best case scenario we have a yield of approximately 270.64 gallons of synthetic diesel fuel. Actually, when all production losses are considered, the net yield would be much less, but this figure is good enough for our shotgun estimate.

Dividing our total fuel cost of \$94.00 per ton by our guesstimated 270.64 gallons of synthetic diesel fuel gives us a bare bones cost of \$0.3473 per gallon. In comparison, the ton of Run of Mine coal at \$14.00 per ton, divided by an imaginary 270.64 gallons, would give us a theoretical comparative cost of \$0.0517 per gallon. In this comparison, the synthetic diesel fuel is 6.7176 times more costly than the 2" minus Run of Mine coal.

When we look at the heat value of this synthetic diesel fuel, we see a problem:

$8500 \text{ BTU/Lb.} \times 2000 \text{ Lbs./Ton} = 17,000,000 \text{ BTU/Ton}$. This divided by 270.64 gallons/ton = 62,814.07 BTU/gallon in an ideal world where there are no production losses. This compares to $7.39 \text{ Lbs.} \times 19,750 \text{ BTU/Lb.} = 145,952.5 \text{ BTU/Gal.}$ for petroleum-based diesel. $62,814.07 \text{ BTU/Gal.} \div 145,952.5 \text{ BTU/Gal.} = 43\%$ of the heat value of the petroleum-based diesel fuel. Twice the quantity (2 gallons instead of one) would only provide 86% of the heat value of petroleum-based diesel fuel.

So in addition to more than doubling the price of diesel fuel, more than twice the quantity must be carried aboard the locomotive. If a locomotive using petroleum-based diesel fuel has an operating range between refuelings of 3000 miles, using this higher priced synthetic diesel fuel will yield a locomotive range of 1290 miles.

In comparison, not only is the 2" minus Run-of-Mine coal a cheaper fuel, it allows operating at the full operating range.

If we decide to tailor the synthetic diesel fuel to match the heat value of the petroleum-based diesel fuel to make the operating ranges the same, this is what we get:

$17,000,000 \text{ BTU/Ton} \div 145,952.5 \text{ BTU/Gal.} = 116.4762 \text{ Gallons}$, in an ideal world with no production losses; $\$94.00/\text{Ton} \div 116.4763 \text{ Gals.} = \$0.8070/\text{Gallon}$. Then we go back and divide $\$14.00/\text{Ton}$ coal cost by the imaginary 116.4763 Gals. = $\$0.1202/\text{Gal.}$ $\$0.8070 \div \$0.1202 = 6.7138$, so the synthetic diesel fuel is 6.7138 times as costly as the 2" minus Run of Mine coal. Again, these are just bare bones costs and do not include the items noted above as not included.

The question is, is it feasible to operate on diesel fuel made from coal when it is possible to operate cleaner, cooler and quieter with 2" minus Run-of-Mine coal at much less cost?

Railview

"Discussion of electrification with its tremendous capital costs is probably academic"

Coal vs electrification

By PERRY M SHOEMAKER

It was in 1929 that Kent Healy of Yale published his authoritative book, "Electrification of Steam Railroads," which included an analysis of electrification of portions of the Long Island Rail Road, the New Haven, the Pennsylvania, the New York Central, the Virginian, the Milwaukee, the Reading, and the Lackawanna. The Great Depression of the '30s, followed by World War II, left the capital costs of further electrification largely in the archives.

The diesel revolution in railroad motive power, culminating after the War, with cheap diesel fuel and unexcelled promotion by diesel electric locomotive builders, left little opportunity for the proponents of electrification, let alone the dwindling number of "doubters" of diesel vs steam economics. David Kerr of Westinghouse was an exception. So was Paul Kieffer of the New York Central. But it was not until 1970 that the three volume study by the Edison Electric Institute re-established some further somewhat desultory consideration of electrification.

And it was in the 1970s that America became aware of its precarious petroleum energy situation. As the cost of diesel fuel (\$0.04/gallon at the end of World War II) increased from \$0.0884/gallon in 1964 to \$0.2659 in 1974 to \$0.8160/gallon in 1980 (estimated by AAR), economic realities forced some of our largest railroads to consider alternative motive power. The emphasis has been on consideration of electrification.

Railway Age in August 1979 published an informative article, "Electrification: New interest in a old idea." An update published in November 1980, "Electrification talk is getting more serious," emphasized the interest of the FRA in electrification studies and a possible 26,000 mile electrification network. And in its June 8, 1981 issue, *Railway Age* titled its further story, "Mainline electrification: Who will be first?"

All three articles were consistent with the high standards of reporting which have long characterized *Railway Age*, but all three articles left an unfortunate implication that the only viable alternative to steadily rising diesel operating costs is electrification. This is not true. Modern coal burning steam locomotives are indeed an alternative. Their use is in the national interest of both defense and energy conservation. Their use is in the economic interest of the railroad industry.

COAL VS. ELECTRIFICATION, CONTINUED

Discussion of electrification with its tremendous capital costs is probably academic. Vital to the Department of Defense is the dependability and the availability of railroad transportation. As further confirmed by the recent study of the General Accounting Office, power plants are prime targets. Without electricity an electrified railroad is helpless. But a railroad powered by coal burning mobile power plants - which steam locomotives are - will continue to operate. The possibility of government funding for an extensive expansion of electrification of our railroads is a remote and unrealistic dream.

This nation makes the best diesel electric locomotives in the world. In an era of cheap diesel oil from a dependable and unthreatened source of supply, the diesel locomotive served our nation and its railroads well. That era has passed. The shipping public will not forever accept higher freight rates and a long succession of fuel surcharges when cheaper to operate motive power is available.

There are many ways to illustrate the effect of high diesel fuel costs. A BTU comparison is enlightening

Diesel fuel oil weighs approximately 6.87 pounds per gallon. Each gallon represents approximately 18,000 BTU per pound times 6.87, or 123,600 BTU per gallon.

At \$1.25 per gallon, \$0.01 buys 989 BTU

Using coal of 12,000 BTU per pound at \$36.00 per ton (eastern seaboard cost), \$1.00 provides 666,667 BTU and \$0.01 provides 6,667 BTU.

Using coal of 13,500 BTU [per pound] (such as Pocahontas coal on NW), \$0.01 provides 7,500 BTU

Thus the approximate 5-to-1 favorable cost ratios for \$1.00/gallon diesel and 12,000 BTU coal become 8.5-to-1 for \$1.25/gallon diesel fuel and 13,500 BTU coal

A few weeks ago the Union Pacific is reported to have stated in its employees magazine that its 1980 fuel cost of \$370 million (at \$1.04/gallon) took 14% of its gross revenue as compared with 3% in 1970.

In early 1980 Conrail made a study of comparative energy costs for 5,000-hp locomotives on a full throttle hour basis. Using electricity purchased at

COAL VS. ELECTRIFICATION, CONTINUED

\$0.0346/KW hour, the result for electric freight operations was \$273 per hour. Using diesel oil at \$1.00/gallon, the diesel electric cost was \$339/hour. Using coal at \$40.00/net ton, and assuming a condensing steam turbine electric achieving 21.3% net thermal efficiency at the rail, the Conrail computation was \$136.00/hour for steam.

We feel that Conrail's steam calculations include too many assumptions, particularly the effect of having a condensing system. Actual results in France, Germany, Russia and South Africa indicate only about 85% condensing efficiency with very substantial increased in original cost (for the Roosen-Henschel system - the only one of proven success in locomotive usage), and in continuing maintenance. The 6,000-hp coal burning steam turbine electric which we have designed is not condensing and we will be very satisfied to obtain 12% thermal efficiency at the rail - about half that of a modern diesel electric.

The Jan /Feb. 1981 issue of South Africa Rail printed the monumental paper presented in November 1979 by A. E. Durrant to the Rhodesian Institution of Mechanical Engineers entitled, "Steam Locomotion - a Reappraisal for an Oil-Starved World." The Institution of Mechanical Engineers, Railway Division, in London presented a special award to Durrant for the excellence of his paper.

On relative locomotive efficiencies, Durrant had this to say: "In condemning the steam locomotive, many, probably most of the diesel authorities have been guilty of overstating their case by simply not comparing like with like

"Diesel efficiencies of the order of 35% have been compared with steam efficiencies of 10% maximum, to give the impression that the diesel is at least 3.5 times as efficient as the steam locomotive. When we look carefully into this comparison, we find that the diesel figure is a test bed optimum measured at the engine output shaft, while the steam figure is measured at the drawbar. As the drawbar is the point at which haulage of the train takes place, it is the logical and commercial point at which to compare alternative means of locomotion, and if we assume that in the hurly-burly of every day operation the diesel engine can achieve 30% efficiency (a fairly optimistic figure), that 5% is taken off for auxiliaries, that traction motors and generators are each 90% efficient, and that about 15% of the residual power is required to propel the locomotive itself, then the drawbar thermal efficiency of a diesel-electric locomotive is $30 \times 0.95 \times 0.9 \times 0.9 \times 0.85$ equals 19.6, or about 20%. The true margin between diesel and steam is thus considerably reduced. Similar calculations for electric traction result in a slightly higher drawbar thermal efficiency of about 22% or 23%.

COAL VS. ELECTRIFICATION, CONTINUED

"However, accustomed as they are to thinking in terms of thermal efficiency expressed in ratios of heat units, today's engineers must think increasingly in terms of what might be called financial efficiency, or the cost of fuel per work done. It is very well to have a diesel locomotive of twice, or even thrice the efficiency of the competing steamer, but if the diesel oil is twenty or thirty times the cost per heat unit, then clearly steam wins by a ten to one ratio. For comparison with electric traction, where the unit is not truly a locomotive, being powered by an external prime mover, the cost of overhead wires, sub stations, and even additional power station and grid capacity, must be built in to the calculations in order to obtain a true comparison. Finally, the amortization of additional capital expenditure must be included, and very often, where electric traction shows superficial costs, the true cost, including amortization, turns out to be higher than either steam or diesel.

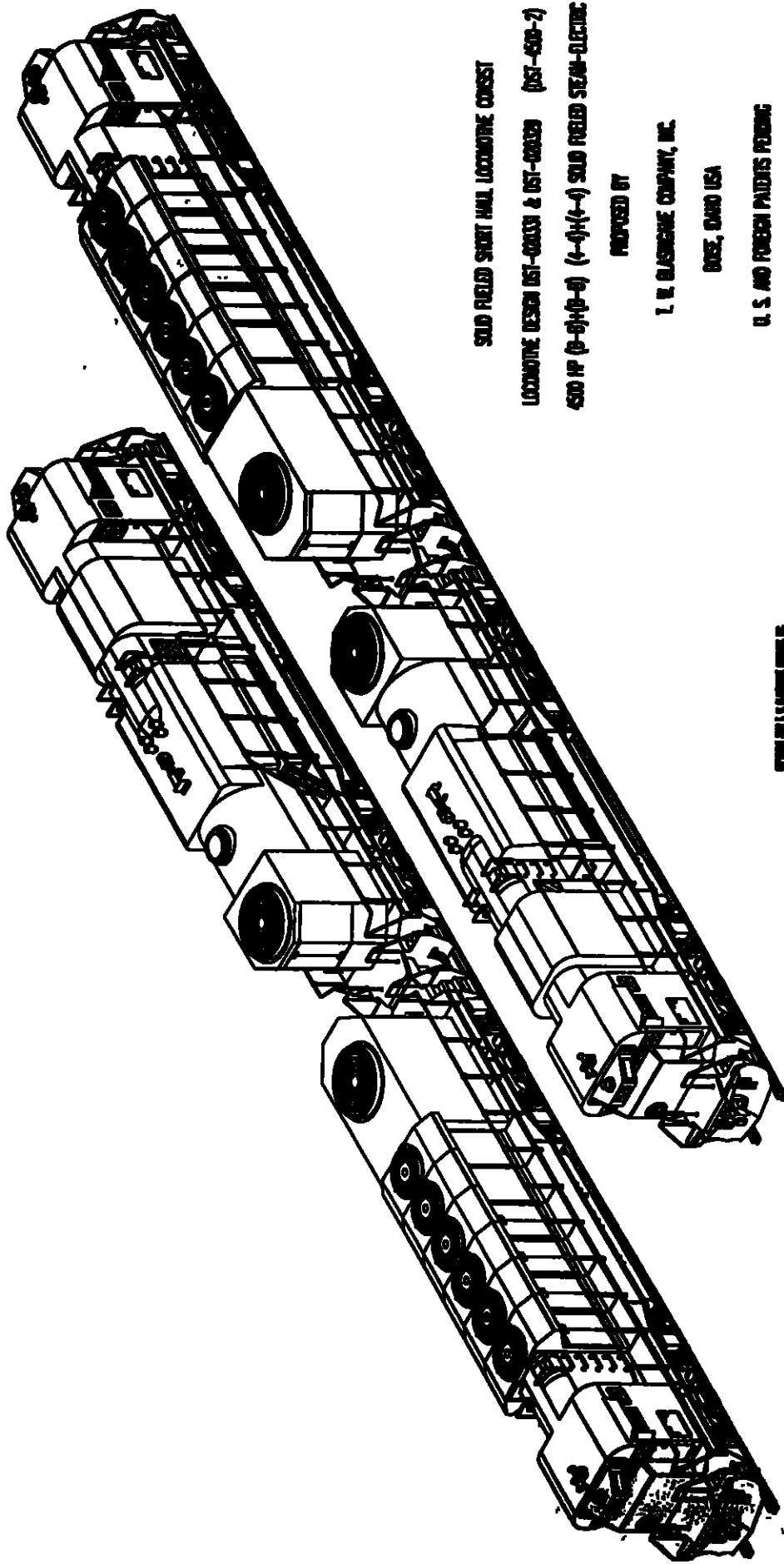
In commenting on the economic studies made on SAR for electrification between Salisbury and Gwelo, Durrant stated that an electrification cost of \$70 million compared with \$15 million for new sophisticated steam power and that actual operating costs for electric operation, including interest, were calculated to be three times the cost of steam on an annual basis.

Durrant anticipates new steam locomotive attaining 15% efficiency with such betterments as a gas producer firebox with water-tube construction, a complete installation of roller bearings, a Brotan boiler and greatly improved superheater. To these can be added the Giesl Ejector, air preheating and fluid bed combustion

What a tragedy it has been that we in the United States suspended steam locomotive R&D some 30 years ago and missed the opportunity to encompass the tremendous technology development of the period and apply them. This has been the penalty for the railroad industry largely depending on the diesel manufacturers for such R&D as has taken place in the motive power field. An industry controlled motive power R&D program could have done much to justify the AAR.

It is time for an objective analysis of the economic opportunities for American railroads by their progressively returning to the use of coal. The extensive substitution of coal burning steam locomotives for diesel electrics may indeed be the salvation of Conrail - and perhaps several others. A better than 50% reduction in fuel costs is in itself a powerful incentive

Note: The late Perry M. Shoemaker was the president of the Central Railroad of New Jersey, the Erie-Lackawanna Railroad, and Shoemaker & Associates, Inc., a locomotive design group which designed and promoted a fully condensing 9,000-hp steam-turbine-electric locomotive for use on American railroads in the 1980s. The above article originally appeared in Railway Age Magazine on July 27, 1981.



SOLID FUELED SHORT HAUL LOCOMOTIVE CONSIST

LOCOMOTIVE DESIGN DST-00000 & DST-00000 (DST-400-2)

4500 HP (P-0)(P-0) (4-0)(4-0) SOLID FUELED STEAM-ELECTRIC

PRODUCED BY

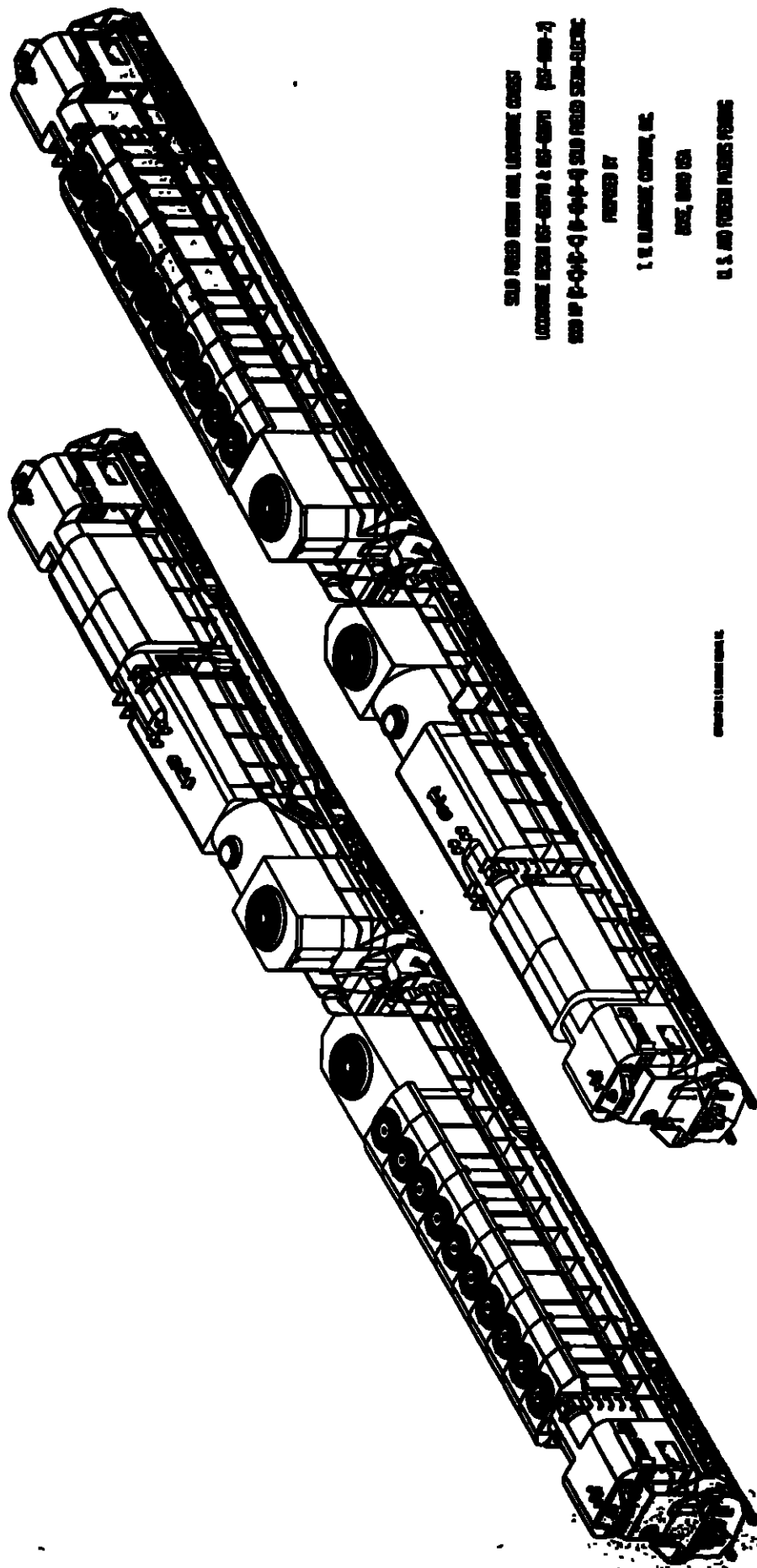
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SOLID FUELLED STEAM AND LIQUID FUELLED
LOCOMOTIVE GROUP (SFG-4000) & (SFG-4000A) (SFG-4000B)
SFG 40 (SFG-40) (SFG-40A) (SFG-40B) SOLID FUELLED STEAM-ELECTRIC

POWERED BY

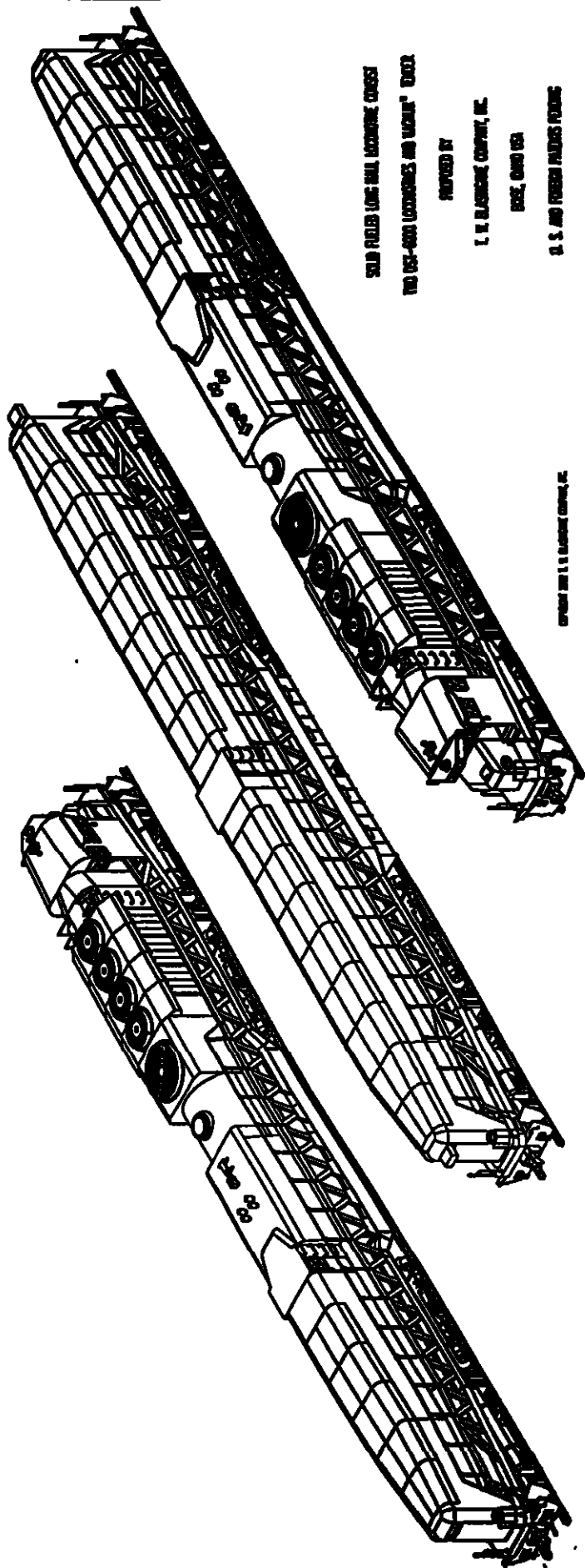
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SOLID RIBBED LONG HULL LOCOMOTIVE COUPLER
TWO 1051-4000 LOCOMOTIVES AND WORKING "ELECTRA"

PROVIDED BY

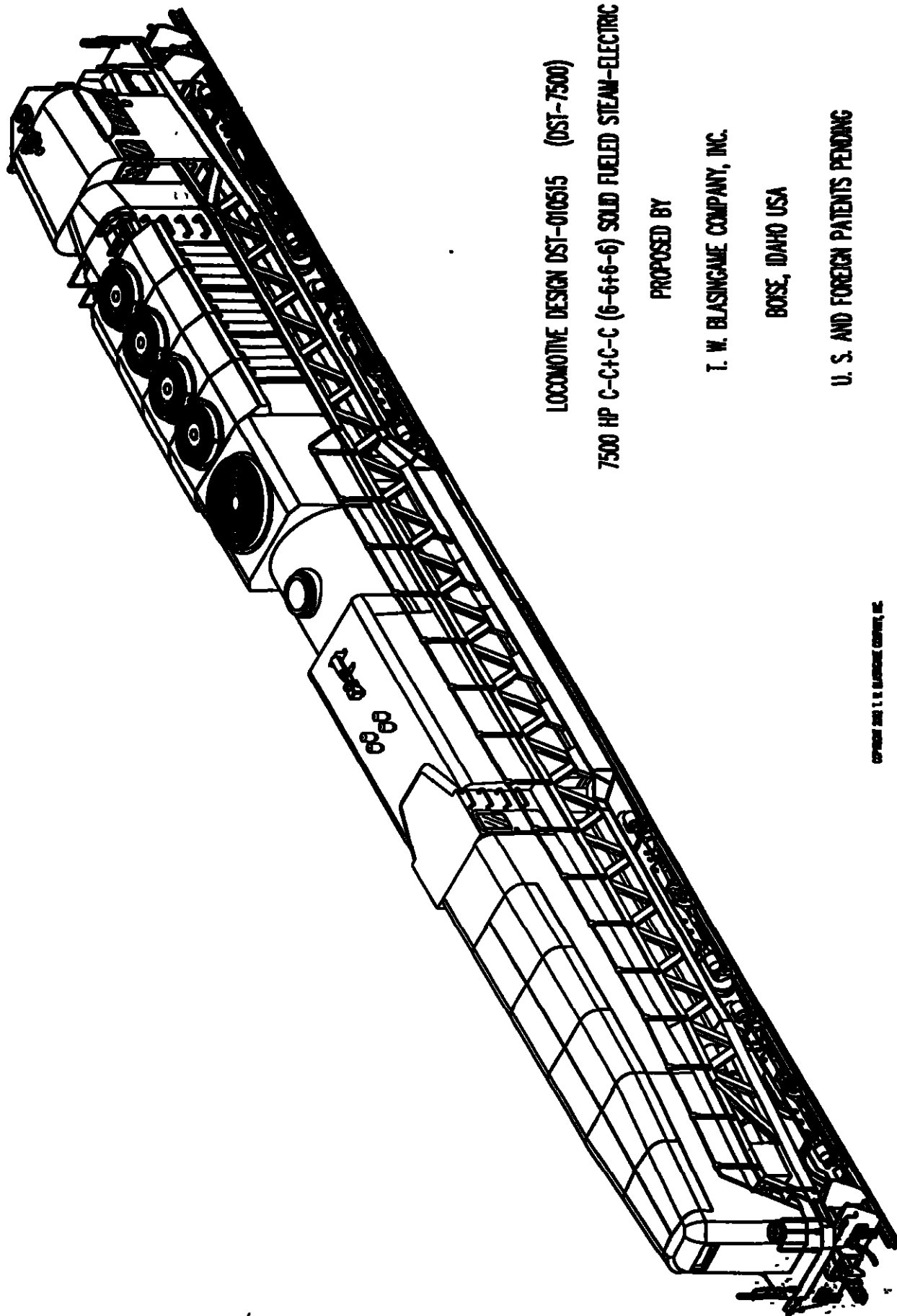
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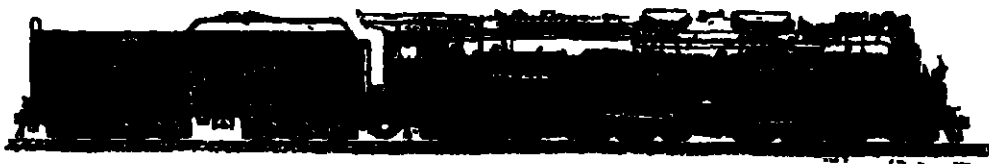


LOCOMOTIVE DESIGN DST-010515 (DST-7500)
7500 HP C-C+C-C (6-6+6-6) SOLID FUELED STEAM-ELECTRIC

PROPOSED BY
T. W. BLASINGAME COMPANY, INC.

BOISE, IDAHO USA

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HEAVY HAUL LOCOMOTIVES

Between 1941 and 1948, the Chesapeake & Ohio Railroad (now part of CSX Corporation) took delivery of 68 of the heaviest and most powerful reciprocating steam locomotives ever built in the United States. These locomotives, built by Lima Locomotive Works of Lima, Ohio, were of the 2-6-6-6 wheel arrangement, and were named "Allegheny" for the region in which they were to operate. "Triple-Service" machines, these 125'-7 7/8" long locomotives were utilized for drag freight, fast freight and passenger service. With an overall wheelbase of 112'-11", they could be turned on a 115' turntable. The 260 PSI boiler was rated at 4530 boiler horsepower, the 22 1/2" x 33" cylinder horsepower was 4734, and in actual tests one of these locomotives developed 7498 horsepower at 46 miles per hour. The front engine drive axle weights were 86,000 pounds, the rear engine drive axle weights were 83,000 pounds, total weight on the 67" drivers was 507,000 pounds, and the total locomotive and tender weight was 778,000 pounds. The ratio of adhesion was 4.49, and the maximum tractive effort was 110,200 pounds. Maximum curvature was 19 degrees, and Uniform Loading was 6195 pounds per lineal foot. Fuel capacity was 25 tons of coal, and water capacity of the 7-axle tender was 25,000 gallons. Reportedly, these giant articulated locomotives were easier on the track than their smaller 2-10-4 Lima-built sisters.¹

Recently, according to an article in the November 2006 issue of TRAINS Magazine, CSX Corporation has modified its 6-axle EMD SD70MAC and GE AC4400CW Diesel-electric locomotives to enhance performance in heavy haul service. The up-graded specifications for a GE AC4400CW locomotive include increasing the axle loading from 70,000 to 72,000 pounds, for a total locomotive weight of 432,000 pounds. The tractive effort of each electric traction motor was raised from 30,000 to 36,000 pounds. This raises the total tractive effort of this 4400 HP locomotive from 200,000 to 216,000 pounds, at an adhesion factor of 50% (starting tractive effort). Software refinements are included in this modification. Similar upgrades were made to the EMC SD70MAC 6-axle locomotives. Most of the upgraded locomotives have Alternating Current drives and steerable trucks. The horsepower per axle for these heavy haul locomotives is 627. This compares to the power per axle of a 6000 HP 6-axle Diesel-electric locomotive of slightly less than 660. In most of the above heavy haul locomotives, the total locomotive weight is 432,000 pounds. Uniform Loading is 6111 pounds per lineal foot. Two of these 73'-2" long locomotives would have a combined length of 146'-4" and a combined starting tractive effort of 432,000 pounds. Continuous tractive effort for two of these locomotives is 290,000 pounds. These modified heavy haul locomotives are reportedly performing well under adverse weather conditions.

The T. W. BLASINGAME COMPANY, INC. of Boise, Idaho has for the past 15 years been designing a family of alternate fueled locomotives capable of operating on fuels other than oil. Other design objectives are to reduce environmental damage, and reduce plastic deformation of the rail. All of these locomotives are capable of operation through 20 degree curves, and have a design axle loading of 70,000 pounds. All of these rotary steam-electric locomotives are fully condensing. DST Zero-Weight-Transfer trucks and DST modified switched reluctance DC traction motors with no brushes and no windings on the rotors are included in these locomotive designs. These traction motors provide non-generating dynamic braking throughout the entire operating range, and also permit reverse torque braking.

¹ Eugene L. Huddleston & Thomas W. Dixon, Jr. "The Allegheny - Lima's Finest"

HEAVY HAUL LOCOMOTIVES, continued

The smallest single unit locomotive is a 4500 horsepower double articulated rotary steam-electric on 8 axes (four four-wheel trucks), and with an overall length of 107'-6". The wheelbase of this locomotive is 89'-6". Horsepower at the rail is 3,672, and per axle is 459. Total locomotive weight is 560,000 pounds. Uniform Loading is 5,209 pounds per lineal foot. At 50% adhesion, the starting tractive effort is 280,000 pounds, up to 4.9 MPH. Continuous tractive effort at 35% adhesion is 196,000 pounds at 7.02 MPH. Two of these locomotives operated back-to-back will have a combined length of 216'-0", a combined weight of 1,120,000 pounds and a combined starting tractive effort of 560,000 pounds. Combined continuous tractive effort is 248,400 pounds. Fuel capacity is approximately 28 tons per locomotive. These locomotives can operate with auxiliary water or water and fuel tenders for long haul service. With these fuel and water tenders, operating range is approximately 600 miles.

The next size single unit locomotive is a 6000 horsepower double articulated rotary steam-electric on 10 axes (two four-wheel and two six-wheel trucks), and with an overall length of 116'-0". The wheelbase of this locomotive is 98'-0". Horsepower at the rail is 4896, and per axle is 490. Total locomotive weight is 700,000 pounds. Uniform Loading is 6,034 pounds per lineal foot. At 50% adhesion, the starting tractive effort is 350,000 pounds, up to 5.24 MPH. Continuous tractive effort at 35% adhesion is 245,000 pounds at 7.49 MPH. Two of these locomotives operated back-to-back will have a combined length of 232'-0", a combined weight of 1,400,000 pounds, and a combined starting tractive effort of 700,000 pounds. Combined continuous tractive effort is 490,000 pounds. Fuel capacity is approximately 45 tons per locomotive. These locomotives can operate with auxiliary water or water and fuel tenders for long haul general freight or passenger service. With these Magnum tenders, operating range is approximately 1000 miles.

The largest single unit locomotive is a 7500 horsepower double-articulated rotary steam-electric on 12 axes (four six-wheel trucks) and with a total length of 116'-0". The overall wheelbase is 99'-0". Horsepower at the rail is 6120, and per axle is 510. The total locomotive weight is 840,000 pounds. Uniform Loading is 7241 pounds per lineal foot. At 50% adhesion, the starting tractive effort is 420,000 pounds, up to 5.46 mph. Continuous tractive effort at 35% adhesion is 294,000 pounds at 7.81 MPH. Two of these locomotives operated back-to-back would have an overall length of 232'-0", a combined weight of 1,680,000 pounds, and combined starting tractive effort of 840,000 pounds. Combined continuous tractive effort is 588,000 pounds. Power limiting devices prevent excessive drawbar pull. Fuel capacity is approximately 45 tons per locomotive. These locomotives are intended for use with auxiliary water and water and fuel tenders for long haul heavy freight service. With Magnum tenders, the operating range is approximately 1000 miles.

These alternate fueled locomotives represent a significant departure from conventional steam locomotive design. Based on the "Garratt" configuration, but with electric drive to all axes, the double articulation permits operation over all types of trackwork with less rail stress damage. The fuel transfer system operates under computer control automatically depending on the steam requirements of the locomotive. An optional BTU Recovery System permits retention of energy generated during dynamic braking. The steam generators have no staybolts – a major maintenance item in the past – and include oxygen enhancement and electronic scrubbers to provide complete combustion and elimination of particulates. Advanced water treatment eliminates all scaling and corrosion. The rotary engines have no valves, valve train, cylinders, cylinder liners, pistons, piston rings, and only two bearings. Many systems have been completely eliminated, and those that have been retained have been simplified to reduce maintenance.

HEAVY HAUL LOCOMOTIVES, continued

The above rotary steam-electric locomotives are designed to operate with extended range solid fuel and water tenders of the same overall length and wheelbase. These tenders are equipped with a fuel transfer system to permit continuous refueling at track speed. These tenders traverse horizontal and vertical curves in the same manner as the locomotives since they are of the same size and wheel arrangement. Use of these tenders permits the operating range to be increased from 500 miles to 1000 miles between refuelings.

In addition to the above long range heavy haul locomotives, medium range two-unit locomotives in the 4500 and 9000 horsepower ranges are also available. These locomotives are designed for a 70,000 pound axle load and 20 degree curvature.

The two-unit 4500 horsepower locomotive has an overall length of 128'-0". Horsepower at the rail is 3672, and per axle is 367. The total weight of this 2-unit locomotive is 700,000 pounds, and the Uniform Loading is 5469 pounds per lineal foot. Starting tractive effort without wheelslip at 50% adhesion is 350,000 pounds at 3.39 MPH. Continuous tractive effort at 35% adhesion is 248,000 pounds at 5.62 MPH. Fuel capacity is approximately 28 tons. This locomotive is intended for use in heavy hump yard or branch line freight or passenger service. It can also be operated as a mobile electric generating plant to produce 3.2 MW of standby, emergency or industrial electric power while utilizing coal or fuel cubes manufactured from combustible materials normally consigned to landfills. When specified as a mobile electric generating plant, certain locomotive components are deleted.

The two-unit 9000 horsepower locomotive has an overall length of 160'-0". Horsepower at the rail is 7344, or 612 per axle. The total weight of this 2-unit locomotive is 840,000 pounds, and the Uniform Loading is 5250 pounds per lineal foot. Starting tractive effort without wheelslip at 50% adhesion is 420,000 pounds at 6.56 MPH. Continuous tractive effort at 35% adhesion is 294,000 pounds at 9.37 MPH. Fuel capacity is approximately 28 tons. This locomotive is intended for medium range heavy freight service. It can also be operated as a mobile electric generating plant to produce 6.4 MW of standby, emergency or industrial electric power while utilizing coal or fuel cubes manufactured from combustible materials normally consigned to landfills. When specified as a mobile electric generating plant, certain locomotive components are deleted.

Auxiliary fuel and water tenders, equipped with DST fuel transfer systems, can be used with modified versions of the above two-unit locomotives to increase the operating range for long haul service. These auxiliary tenders may be equipped as tractive effort booster units if desired for the particular application.

All of the above locomotives are available on a full service lease, in which all maintenance services are provided by the manufacturer. Fueling may be accomplished by front end loaders, conveyors or overhead structures as appropriate for the application. This fueling equipment can be provided under the same full service lease. When desired, on/off highway fuel transports can deliver solid fuel to the locomotives in remote locations under a separate services contract.

The advantages of these alternate fueled locomotives are:

1. Ability to operate cleanly, coolly and efficiently on domestic solid fuels which are available at a fraction of the cost of refined liquid fuels;

HEAVY HAUL LOCOMOTIVES, continued

- 2. Ability to operate cleanly, coolly and efficiently on domestic solid fuels which are available when Diesel fuel is not available at any price;**
- 3. Ability to provide comparable horsepower to current Diesel-electric locomotives;**
- 4. Ability to provide comparable tractive effort while operating at a reduced horsepower level per traction motor, for reduced rail stress damage.**
- 5. Ability to operate in multiple with other types of locomotives;**
- 6. Available on a full service lease in which the manufacturer provides all maintenance services, and without a capital investment;**

The ability of these alternate fueled locomotives to provide comparable tractive effort while operating at a reduced horsepower level per axle addresses a major maintenance cost for infrastructure on all railroads. Plastic deformation of the rail under high wheel and axle horsepower requires costly grinding of the rails by specialized equipment. The rail grinding operation also disrupts normal rail traffic, which adds additional cost. Even with the rail grinding operation, the repeated rail grinding reduces the metal at the top of the rail and requires more frequent replacement. These infrastructure maintenance costs are substantial and are not always considered when comparing locomotive specifications and performance.

The above alternate fueled locomotives are designed to operate on domestic solid fuels instead of expensive or imported liquid fuels. Fueling can be accomplished using the same equipment used to load unit coal train cars. The solid fuel can also be handled with tracked or rubber-tired front end loaders or conveyors or overhead structures, and these can be provided on a full service lease. For railroads that are interested only in the use of liquid fuels, T. W. BLASINGAME COMPANY, INC. has designs for 4-axle 3000, and 6-axle 4500 and 6000 horsepower locomotives that can operate on gaseous or liquid fuels. These locomotives are intended to operate with tractive effort booster unit liquid fuel tenders for reduced axle horsepower and maximum tractive effort capabilities.

The performance projections in this paper were calculated based on the locomotive horsepower, the design axle loading, and the number of wheels driving. These factors are as incorporated in the design of each locomotive. Any change in these factors will make a corresponding change in the locomotive performance.

The performance claimed for the Diesel-electric locomotives was based on a stated 50% adhesion. Since the Steam-electric locomotives also employ high adhesion (zero-weight-transfer) truck designs, the performance projections in this paper for the Steam-electric locomotives are also based on 50% adhesion, to provide an apples-to-apples comparison. In the specification sheets for the Steam-electric locomotives, 35% adhesion has been presumed.

This information is provided by Western Locomotive Group, Inc. and T. W. Blasingame Company, Inc., Post Office Box 1532, Boise, Idaho 83701-1532, 208-345-5467 (Phone) and 208-342-6879 (Fax). E-mail address is twblasco@peoplepc.com.

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ENVIRONMENTAL IMPACT STATEMENT

DST SOLID FUELED STEAM-ELECTRIC LOCOMOTIVES

COMPARISON WITH DIESEL-ELECTRIC LOCOMOTIVES

Basic Fuel Processing:

The Diesel-electric locomotive utilizes Diesel fuel refined from crude oil or from synthetic feedstocks. The refining of this fuel gives off substantial quantities of heat and gaseous emissions.

The Steam-electric locomotive utilizes coal or other solid fuel. For coal, no processing is necessary, except to transport it to rail cars or the fueling station. The transportation of the coal (or other solid fuel) requires Diesel fuel, but in a very small amount, so the heat and emissions from the use of a minor amount of this fuel to transport the coal (or other solid fuel) is miniscule compared to the amount of heat and gaseous emissions generated in refining the total amount of fuel used in a Diesel-electric locomotive.

In the case of Refuse Derived Fuels manufactured from 80% of the materials commonly consigned to landfills, the amount of Diesel fuel required to transport the feedstock to the sorting area is also very small. The amount of Diesel fuel or gasoline used to generate electric power to operate the hydraulic system of the cubing and densifying equipment is also very small when compared to the heat and emissions generated in refining petroleum-based fuels.

Combustion of Fuel:

The combustion of Diesel fuel in the Diesel engine is accomplished very rapidly, so that in many cases combustion is incomplete and unburned fuel is discharged into the atmosphere through the exhaust system. Some of the unburned fuel exits as particulates, and these have been proven to be carcinogenic (causing cancer).

The combustion of solid fuel in the Steam-Electric locomotive is accomplished in the firebox. The fuel stays in the firebox long enough that complete combustion can take place. In reciprocating steam locomotives of earlier times, the air in the firebox was composed of about 20 percent oxygen and about 79% nitrogen, which will not burn and was a prime source of NOx. In our proposed steam-electric locomotives, we are enhancing the amount of oxygen in the primary air (under the grates) and in the secondary air (over the grates) with a combustible gas stream of oxygen and hydrogen. By reducing the amount of nitrogen in the firebox we are automatically reducing NOx. The increase in the percentage of oxygen will insure that everything in the firebox that will burn will

ENVIRONMENTAL IMPACT STATEMENT, CONTINUED

be completely combusted in the firebox. Anything that will not burn will pass through the tube section of the boiler and pass through an electronic scrubber, which will cause these particulates to remain within the smokebox and/or collection tanks so they can be collected and disposed of in a controlled manner. With these advanced systems, our proposed Steam-electric locomotives will operate much cleaner than Diesel-electric locomotives.

Engine Heat Dissipation:

Diesel engines (and other internal combustion engines) generate heat in the combustion process and this heat must be dissipated through either a liquid or air cooling system into the atmosphere. The manufacturer's data sheets for each engine show how much heat is dissipated per horsepower/hour.

The steam expander engine, however, does not need to be cooled at all. In fact, the entire engine is jacketed and insulated in order to retain as much heat as possible inside the engine, and to minimize any steam condensation in the engine. There is substantially no heat loss into the atmosphere from our steam expander engines.

Dynamic Braking Heat Dissipation:

The conventional Diesel-electric locomotive equipped with dynamic braking equipment generates power at the traction motors during downgrade operations or in train control operations. This electric power is sent to heat grids at roof level, where electric fans blow off the heat into the atmosphere.

The traction motors we have designed for use in our Steam-electric locomotives have no brushes and no rotor windings; therefore, they do not generate electricity during dynamic braking operations. The elimination of this electric power generation during dynamic braking eliminates heat dissipation into the atmosphere.

Boiler Heat Dissipation:

The Diesel engine does not have a separate power source so this category does not apply to Diesel-electric locomotives.

The Steam-electric locomotive has a steam generator (boiler) to provide steam to the steam expander engine(s). The firebox, tube section and smokebox of this steam generator are insulated with woven silica fabric insulation and/or ceramic sprayed-on insulation. Both of these modern insulations are not hazardous to personnel, and both types can almost completely eliminate heat loss from the steam generator. It is obviously to our advantage to retain as much heat as possible within the steam generator to maximize efficiency and reduce the fuel requirements. The heat loss from conventional reciprocating steam locomotives was quantified many years ago by the Pennsylvania Railroad in its Altoona shops. The heat loss from combustion gases can be reduced by passing the hot combustion gases through feedwater heaters or other appliances. The resulting

ENVIRONMENTAL IMPACT STATEMENT, CONTINUED

heat dissipation from the steam generator of a Steam-electric locomotive will therefore be at substantially lower temperatures than from the exhaust of a Diesel-electric locomotive of comparable horsepower.

Heat Loss from Exhaust Steam:

Steam is not generated in Diesel engines, therefore this category does not apply to Diesel-electric locomotives.

Steam exhausted from the steam expander engines in our proposed Steam-electric locomotives will pass through roof mounted condensers which will convert the exhausted steam back into reusable water. With this system, about 85% of the steam will be retained for use as boiler water. The remaining 15% of the steam will be utilized to provide the oxygen/hydrogen combustible gas mixture to aid combustion. Heat generated in the condensers will be utilized in other appliances rather than dissipated into the atmosphere. There will be no heat loss from exhaust steam on our Steam-electric locomotives.

Ash and Clinker Disposal:

Diesel engines produce no ashes or other solid wastes and therefore this category does not apply to Diesel-electric locomotives.

In the Steam-electric locomotives, our system for augmenting the primary air (under the grates) will cool the fire sufficiently that no clinkers are formed. Coal suppliers tell us that ashes are not considered hazardous wastes and in fact have a use as road base materials in construction. They advise us that ashes can be reclaimed and buried in landfills with no environmental problems.

Summary:

The Diesel-electric locomotive is a machine which requires a high priced refined fuel, which is combusted in a manner causing excessive pollution which has been proven to cause cancer and other health problems. The oil when spilled is extremely toxic and kills everything it touches. The internal combustion engines require substantial amounts of heat to be dissipated into the atmosphere.

The Steam-electric locomotive utilizes solid fuels which require little or no use of petroleum-based fuels in their production, and only minimal amounts of petroleum-based fuels for handling and transportation. The steam expander engines do not emit heat to the atmosphere because they are completely insulated. The Steam-electric locomotive steam-generating system is insulated to prevent heat loss and to minimize fuel consumption. These steam generating systems are equipped with oxygen-enhanced combustion systems and electronic scrubbers to insure complete fuel combustion and the capture and control of unburned particulates. Ashes remaining after fuel consumption are not hazardous wastes and can be safely recycled or disposed of in landfills without environmental problems.

ENVIRONMENTAL IMPACT STATEMENT, CONTINUED

There is a effort being made to process coal to make Diesel fuel. We do not feel that it is economically feasible or environmentally acceptable to convert \$14/ton coal to Diesel fuel at a cost of \$40/ton, when raw run-of-mine coal was used in coal-fired steam locomotives in this country for over 150 years to haul 85% of this nation's rail freight.

Currently, the Diesel-electric locomotive business is being attacked by a "disruptive technology" in which two or more small Diesel engine/generator sets provide the electric power to operate relatively small locomotives. This concept is attractive because it reduces the amount of Diesel fuel used in operations where the locomotive must be at idle for substantial periods of time. This concept clings to the precept that liquid fuel is the only means of generating power. Without Diesel fuel, these multi-engine locomotives will be just as useless as those with the larger single Diesel engines.

We have developed locomotive designs which will allow the use of Diesel fuel, unrefined crude oil, or low or high rank coal-water fuels. However, none of the liquid fuels are as cost effective as the solid fuels such as coal or the fuel cubes manufactured from municipal solid wastes. This is why we are working hard to develop solid fueled locomotives that can be fueled with the same equipment used to load unit train coal cars or by front end loaders.

The bottom line is that a duck can stand on a pile of solid fuel for months with no adverse effects, but if he comes in contact with oil for 15 seconds, he's a goner. That is as simple and as meaningful an Environmental Impact Statement as you can get. Oil kills everything it touches.

Thomas W. Blasingame
President
T. W. BLASINGAME COMPANY, INC.
Post Office Box 1532
Boise, Idaho 83701-1532
208-345-5457
208-342-6879 Fax
twblasco@peoplepc.com

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The DST-8000 (8000 BHP) locomotive can also be used as a mobile electric generating plant to generate 6.4 MW of standby, emergency or industrial power. The solid fuel can be coal or fuel cubes manufactured locally from municipal solid wastes normally consigned to landfills. This reduces the volume of the buried municipal wastes by 88%. Many environmentalists are convinced this is a better disposal method than burying wastes.

NS
Norfolk Southern Corporation
Three Commercial Place
Norfolk, Virginia 23510-9225
757 629-2390
757 629-2805 FAX

S. C. Tobias
Vice Chairman and
Chief Operating Officer

May 3, 2004

Mr. Thomas W. Blasingame
Vice President - Operations
T. W. Blasingame Company, Inc.
Post Office Box 1532
Boise, Idaho 83701

Dear Mr. Blasingame:

Your proposal to develop a coal-fired steam-electric engine as described in your letter of April 12, 2004 is well beyond the scope of the day-to-day running of our railroad as well as our internal research initiatives. I suggest that you apply to the U. S. Department of Energy for a grant that would allow you to develop and test your proposal. I also suggest that as you progress with testing, it may be wise to involve the Transportation Technology Center, Inc. (TTCI) in Pueblo, Colorado in order to validate your concept and its value to the railroad industry. Roy Allen, President of TTCI, can be contacted at 719-584-0520.

Detailed comments are attached to assist you in your project.

Sincerely,



APPENDIX

Specific comments:

- A number of innovative features are contemplated. An industrial-type steam generator is specified that incorporates an independent fan exhaust system for optimal combustion, and the system is fully condensing (thus reducing the need for make-up water).
- The DST Modified Rand Cam™ Rotary Steam Expander has far fewer moving parts as compared with other expansion devices, so the potential for robustness and high reliability in a compact package exists.
- The DST Modified Switched Reluctance traction motors likewise are simple (no windings or brushes) and offer advantages such as dynamic braking down to zero miles per hour with no heat dissipation grids required.
- The proposed locomotives appear to be tailored to railroads that serve the Powder River Basin. Longer hauls and the ability to refuel at mine load-out sites are described, and the relatively high horsepower could most likely be used to greater advantage by western railroads. The comparatively longer length of the locomotives (and tender) and the running gear also seem more appropriate to operations where curves are fewer and less severe. You note, however, that eastern coal (higher BTU and less moisture content) could make the economics of the proposed locomotives even more favorable, and that overall length of the locomotives and tender (if required) could be somewhat shorter, depending on length of hauls.
- Refueling—Many coal mines with their associated track layouts may not be able to accommodate these locomotives, and the economics/logistics associated with the proposed solid fuel dispensing stations must be evaluated
- Train lengths—Particularly for the case where a separate tender is required, the associated length of the locomotive/tender combination may compromise the number of cars that can be handled with respect to siding lengths, yards, etc.
- Bridge loading/clearances/track center spacing—These must be evaluated to ensure that operations of the proposed equipment can be accommodated safely
- Emissions—Federal and state regulations must be satisfied. New diesel locomotives will be required to comply with Tier 1 requirements. With respect to the proposed locomotives, specific emissions data presumably must be acquired and evaluated by regulatory agencies. Operations in tunnels must also be evaluated to ensure that exhaust fumes do not pose crew health concerns and that combustion efficiency is not compromised
- Track worthiness—The ability of the locomotives to negotiate marginal track conditions at mines and in yards must be evaluated. Adequate wheel load equalization must be provided to accommodate cross-level variations and twist/short spiral situations.
- Duty cycles/flexibility of use/availability—For the targeted services, duty cycles must be evaluated to determine whether the economics are favorable. Also, the ability to use the locomotives in various services between unit train runs so as to

maximize utilization is a strong consideration. Downtime associated with maintenance/servicing activities must also be considered.

- **Lease rate**—The lease rate (estimate not provided) must be weighed against the overall operational costs, including those associated with fuel and fuel consumption rates, refueling facilities, maintenance/servicing, ash disposal, expected utilization/availability, modifications to infrastructure, and required labor for maintenance, servicing, and operation.
- **FRA safety requirements**—The FRA can be expected to evaluate the proposed locomotives and impose requirements in addition to those that presently exist for steam locomotives. Any such requirements could affect overall economics.
- The proposed locomotives should be sufficiently automated such that only an engineer and no fireman is required for over-the-road operation.
- The performance and reliability of the Rand Cam™ rotary steam expander and modified switched reluctance motors could be proven by first using them in other applications.
- Maximizing availability with respect to freezing temperatures, ice, and snow, with a minimum of additional precautions, if any, should be considered.
- Inasmuch as the designs incorporate a coal bunker over the trailing trucks of the locomotives, the wheel slip system must be sufficiently sophisticated to accommodate changing wheel loads (as coal is consumed). All-weather tractive-effort curves should be developed with respect to the consumable load ranging from full to near empty.
- Dynamic modeling should be performed with respect to identifying dynamic responses (pitch, bounce, yaw, and roll) for various speed and track geometry conditions. If prototypes are constructed, we advocate testing at TTCI to help identify and remediate operational problems, and further validate economic models

March 15, 1993

Mr. Thomas W. Blasingame
Vice President - Operations
T. W. Blasingame Company, Inc.
P.O. Box 1532
Boise, ID 83701

Dear Mr. Blasingame:

Thank you for your letter of February 8, 1993, concerning steam locomotives and the enclosed drawings.

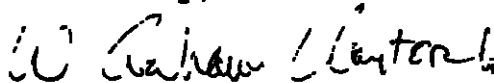
The subject of "steam locomotives" does occur periodically, but we have been unable to justify any development in this area. Amtrak operates approximately 26,000 miles of track, and our long-distance routes primarily support one (1) train per day. Thus, it would not be prudent to diverge from the established practice of the freight railroads, over which we operate, to initiate a completely separate infrastructure for fueling and watering. Research and development of new technology is often handled by the Association of American Railroads' Research & Test Department or the Federal Railroad Administration. You may wish to contact these organizations for guidance on your proposal.

I like the paint-scheme on your color rendition; it resembles our Dash 8's paint-scheme, which received a commendation from the International Brunel Award's competition in Madrid this past summer.

Your comments and suggestions for reducing our fuel costs are appreciated; however, I do not believe that the capital costs required for development of the infrastructure could be justified. Your drawings are being returned with this letter to guarantee the security of their proprietary information.

Thank you again for your interest.

Sincerely,



W. Graham Claytor, Jr.
President

Enclosures



May 3, 1993

Mr. Thomas W. Blasingame
T. W. Blasingame Company, Inc.
P. O. Box 1532
Boise, ID 83701

Dear Mr. Blasingame:

Thank you for your letter of March 22, 1993, and the additional information that you are working on with material handling companies to simplify the refueling of your locomotive.

Rather than trying to exchange information through the mail, I have requested Mr. K. M. Watkins, Director of Equipment Design in Philadelphia, telephone (215) 349-1327 to establish direct contact with you to provide any further technical information that you may require.

Thank you again for your interest.

Sincerely,

W. Graham Claytor, Jr.
President

cc: K. M. Watkins

T. W. BLASINGAME COMPANY, INC.

208-345-5457 • POST OFFICE BOX 1532 • BOISE, IDAHO 83701

May 4, 2001

NRPA-010504-1

Mr. George Warrington
President
NATIONAL RAILROAD
PASSENGER CORPORATION
60 Massachusetts Avenue N. E.
Washington, D. C. 20002

Dear Mr. Warrington:

I saw the hatchet job NBC was attempting to foist off on the public last week, and decided to write you again with a possible solution to your profitability problem.

My letter NRPA-010122-1 of January 22, 2001 concerning our research and development program for locomotives capable of operating on fuels other than oil was courteously answered by your Mr. Vincent A. Nesci, Acting Chief Mechanical Officer of Amtrak.

We are convinced that Diesel fuel is no longer feasible as a locomotive fuel and that your company will not be profitable until it uses solid fuels. Our latest fuel cost comparisons show that the solid fueled locomotives can operate at about 25% of the fuel cost of any Diesel-electric locomotives. I am enclosing a copy of our booklet, "The DSTtm Alternate Motive Power Development Project", for your review and consideration. This booklet tells the story of our project. In the back of the booklet, I have added renderings of possible passenger locomotives. The streamlined version uses gaseous or liquid fuels and therefore would not be as cost-effective as the two-unit solid fueled locomotive shown in Amtrak colors.

Our program for the railroads calls for us to provide the locomotives on a lease basis, provide full maintenance services, and, where required, provide fueling services as specified by the operator. The latter services would let you operate on solid fuels without using the host railroad's Diesel fuel facilities. We have solid fuel transporter trucks designed to quickly refuel our locomotives during a regularly scheduled stop.

Our situation presently is that we have been advised that the necessary funding to complete the final design and prototype construction of the first rotary steam-electric locomotives will be forthcoming. With an expression of interest by your company, we could possibly build up a prototype unit for testing by your company. This testing would follow our own testing and operation on short lines and by the AAR in Pueblo, Colorado. Please review our booklet and let me know if this is of interest to your company.

Best regards,

T. W. BLASINGAME COMPANY, INC.

Thomas W. Blasingame
Thomas W. Blasingame
Vice President - Operations

TWB/mar
enclosure: as indicated

ET 614759937 US

Amtrak

July 3, 2001

Mr Thomas W. Blasingame
Vice President - Operations
T W Blasingame Company, Inc
P O Box 1532
Boise, ID 83701

Dear Mr. Blasingame.

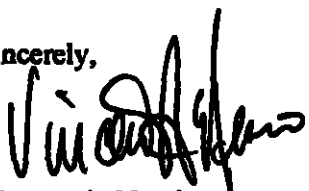
In consideration of your letter dated May 4, 2001, we thank you for presenting the prototype locomotive concepts for our review.

If a viable locomotive could be developed that was both light and powerful enough to be suitable for our type of passenger service, Amtrak most likely would be interested in evaluating this locomotive, especially if reductions in operating and maintenance costs could be achieved. Reliability, total weight, weight on axles, number of axles, servicing and satisfaction of the Federal Railroad Administration's regulations all have to be considered during this development stage.

As a general policy, Amtrak does not get involved in major Research and Development projects, such as new types of locomotives. The complex issues of safety and crashworthiness are better handled by the locomotive builder and designers. Amtrak does not have the resources and ability to undertake the risks or liabilities involved in underdeveloped and unproven equipment.

We hope that you are successful with the continuation of your development program. With that success, we then might be able to further review the feasibility of your locomotive.

Sincerely,


Vincent A. Nesci
Chief Mechanical Officer



July 11, 2005

Mr Thomas W. Blasingame, President
T. W. Blasingame Company, Inc.
P.O. Box 1532
Boise, ID 83701

Dear Mr. Blasingame.

Thank you for your extensive, detailed presentation in your letter of May 6. My staff and I reviewed your plans with genuine interest. With regard to your central conclusion -- that the current situation with regard to liquid petroleum-based fuels will only get worse -- we feel there can be no doubt. For that reason, your proposals offer an intriguing path toward future systems that will be less reliant on petroleum fuel sources

As compelling a proposition as you put forth, we need to make clear the role Amtrak plays in American rail today. We are glad you realize that our company does not have a mandate or sufficient resources to participate in an experimental development program of this type for alternative fuel locomotives. Nonetheless, we feel that we should be aware of alternatives that are under development. Since its founding, Amtrak has explored new, technical advances in a number of forms. Notably, examples of this include the United turbo trains, the Rohr turbo trains, the Bombardier LRC trains, the ABB X2000, and the Siemens ICE train evaluation -- and perhaps most successfully, the 1977 competition that resulted in the long-lived, very successful AEM-7 electric engines. In each case, Amtrak sought technical improvements that utilized existing equipment.

Your designs will very likely be of real use in the future, and we urge you to continue your efforts. While Amtrak does not have the funding, other parts of the Federal government may be of more use to you. Each year the Environmental Protection Association and the U.S. Department of Transportation solicit proposals to support research in fuel savings and reduction of exhaust pollutants. The American Association of Railroads is another organization that could provide assistance both in technical and political terms. Once you possess data that clearly demonstrate the financial benefits of your designs, you will surely see a substantial increase in interest within the railroad industry.

Mr Thomas W. Blasingame, President

July 11, 2005

Page 2

As you continue to refine your designs, we would ask that you keep us apprised of your work. If you reach a point where you are looking to field test one of your designs, please keep us in mind. We are very much interested in any progress you make along these lines and the benefits that they may offer to passenger rail. Additionally, as your business relationships develop, we would be curious to know where they stand. We wish you every success bringing your work into production.

Sincerely,



John T. Jackson

Director of Locomotive Engineering

cc: Vince Nesci
Paul Steets
Bill Broome



November 30, 2006

Mr. Thomas W. Blasingame
President
T. W. Blasingame Company, Inc.
P. O. Box 1532
Boise, ID 83701

Dear Mr. Blasingame:

Thank you for providing the historical correspondence of communiqués between Amtrak and your company, T. W. Blasingame Company, Inc. We greatly appreciate your interest in enhancing the service provided by Amtrak and our reaching profitability. The idea of an alternative fuel locomotive is quite interesting and worthy of careful consideration and review. The thought of saving 75% of the cost of diesel fuel would interest any rail transportation company.

For that reason, please provide the following information regarding your development program for further review by our Rolling Stock Engineering Department staff:

1. Detailed plan, schedule, and results from your company's test program that was followed by the Association of American Railroad's (AAR) Transportation Test Center, Inc. (TTCI) in Pueblo, Colorado for your first or prototype alternate fuel locomotive tested at that facility.
2. Detailed specification with key dimensions and location of apparatus for your alternate fuel locomotive that was tested at the TTCI facility.
3. List of current and perspective Class I railroads on whose right-of-way your alternate fuel locomotive is or will be operated for field test trials along with the dates of the respective test trials.
4. A list of names, titles, and contact information of the applicable Class I railroad representatives directly involved with the test trials of your prototype unit(s) on their respective railway systems.
5. List of suppliers and sub-contractors with their respective addresses and key contacts that are associated with the production of your alternative fuel locomotive so that my staff can verify your company's compliance with the Federal Government's Made in America requirements for Amtrak equipment acquisition programs.
6. A copy of the most recent annual financial report for the T. W. Blasingame Company, Inc. noting total sales, profit figures, list of customers, and company history.

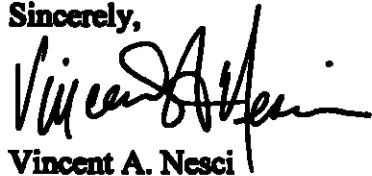
The listed data can be submitted for review to Paul Steets, Senior Director of Rolling Stock Engineering at the following mailing address:

**4001 Vandever Ave.
Bldg 12, 2nd Floor
Wilmington, DE 19802**

Upon receipt of the aforementioned information, my technical staff will commence a thorough document review with the idea of formulating a definitive test program for your alternate fuel locomotive on the Amtrak system.

Again, we thank you for considering Amtrak as a possible customer for your innovative design. We look forward to hearing from you and your team of professionals.

Sincerely,



**Vincent A. Nesci
Chief Mechanical Officer - Amtrak**

**cc: Alex A. Kummant
William L. Crosbie
Paul Steets
Jon Fedora
Kevin Myles**



**U.S. Department
of Transportation**

Administrator

**1120 Vermont Ave., NW.
Washington, DC 20590**

**Federal Railroad
Administration**

JUN 1 2004

**Mr. Thomas W. Blasingame
Vice President - Operations
T. W. Blasingame Company, Inc.
PO Box 1532
Boise, ID 83701**

Dear Mr. Blasingame:

Your letter of August 19, 2003, to Senator Larry Craig was referred to the Federal Railroad Administration (FRA) of the U.S. Department of Transportation on March 23, 2004 for comment and response.

The FRA is pleased to learn that your company has been developing locomotives capable of operating on fuels other than oil. The Research and Development staff of FRA have been aware of some of your work as well as work on other alternative fuels for rail motive power. They would be interested in learning more about the technical aspects of your project as a matter of interest

You mentioned in your letter "we were advised that funding to build and test the prototype solid fueled locomotives would be made available to us". You further state that after September 11, 2001 the funding disappeared with the Twin Towers disaster and that subsequently "we were again advised that funding would be made available, but to date it has not appeared"

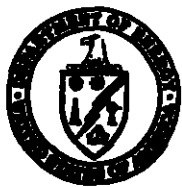
To our knowledge, FRA has not had any request for the funding that you referred to nor does it now have any request to fund the development of solid fuel propelled locomotives. The FRA does not have any program that is currently authorized by the United States Congress, which can be used to fund your development project. Perhaps, the Department of Energy (DOE) may have such a program for alternate fuels, which may be used to fund your project. I note that Senator Craig has also forwarded your letter to the Department of Energy for their consideration and I trust their response will indicate the eligibility of your proposal for DOE funding

The Department of Transportation wish you success with your locomotive development project.

Sincerely,

**Allan Rutter
Administrator**

cc: Senator Larry Craig



U.S. Department of Energy

National Energy Technology Laboratory



JUN 24 2004

**T. W. Blasingame Co. Inc.
Locomotive Design Group
4696 Overland Road, Suite 252
Boise, ID 83705-2845**

Dear Mr. Blasingame:

Your unsolicited proposal, control number 2004-0023, entitled "The DST™ Alternative Motive Power Development Project" has been reviewed by technical personnel at the Department of Energy (DOE).

We regret to inform you that we are unable to support your technology. At this time, there are no existing DOE programs in which your technology would fit.

Typically, to the greatest extent possible, DOE makes awards as a result of competitive solicitations. If you would like to receive copies of these announcements when they are published, go to: <http://www.grants.gov/ReceiveGrantOpportunityNotification> (Click on Receive Grant Opportunity Notification)

**To access DOE solicitations for the various program areas, please go to :
<http://www.grants.gov/ReceiveGrantOpportunityNotification> (Click on Search Grant Synopses)**

**The majority of DOE's Research and Development financial assistance programs fall within the Science and Technology and Other Research & Development category of funding activity as well as a specified CFDA number which can be accessed at:
http://cfda.gov/public/browse_agy.asp?agy_id=81&st=1.**

We appreciate your interest and the time and effort devoted in the preparation and submission of your proposal. If I can be of any further assistance, please contact me at (412) 386-4524.

Sincerely,


**John N. Augustine
DOE Unsolicited Proposal Manager**

cc: Master File



**U.S. Department
of Transportation
Federal Railroad
Administration**

1120 Vermont Ave., N.W.
Washington, D.C. 20590

AUG 19 2004

**Mr. Thomas W. Blasingame
Vice President-Operations
T.W. Blasingame Company Inc.
P.O. Box 1532
Boise, ID 83701**

Dear Mr. Blasingame:

Thank you for your letter of June 30, 2004, to Administrator Allan Rutter, in connection with the T.W. Blasingame Company's unsolicited proposal for coal based Alternate Motive Power Development. In his absence, Acting Administrator Betty Monro has asked that I respond directly to you on her behalf.

In your letter you make some important observations regarding the nation's dependence on diesel fuel oil to transport coal to the nation's electrical power generating stations, which utilize coal. Although this dependence is well known it's importance may have been underestimated. The Federal Railroad Administration's (FRA's) major responsibility and principal charge is to promote rail safety. At FRA, we do not have either the funding to support a project in the amount that you were requesting, or a mandate to pursue such an effort.

I wish you success in your endeavor to develop a coal-based locomotive as described in your earlier letters

Sincerely,

**Mark E Yachmetz
Associate Administrator for Railroad Development**