Clean Air

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TECHNICAL ASSISTANCE BRIEF

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Clean Air Program

Clinton Administration Believes Transportation Is Key for Defense Conversion

At the 61st Annual Convention of the U.S. Conference of Mayors in New York, Secretary of Transportation Peña stated that transportation is an integral element of the Clinton Administration's goal of spawning technological innovation. Secretary Peña cited the Department of Transportation's (DOT) role in the Clean Car Initiative as one example.

He also noted that DOT will play a key role in defense conversion. DOT is part of a multi-agency group under the lead of the Defense Department's Advanced Research Projects Agency (ARPA) that will decide which consortia will receive $471 million in grants under the Technology Reinvestment Project (TRP).

The need for innovation, research and technology development stems from the fact that the U.S. transit industry has seen little change in technologies available during the last decade. The transit industry has been operating with systems and equipment based on twenty and thirty year old designs. Technology development has been virtually stagnant. Weak market conditions have resulted in financial difficulties for transit equipment suppliers and the withdrawal of many firms from the transit market.

The Clean Air Program clearly supports the Secretary's emphasis on research and technology development and complements defense conversion and dual-use technology activities. FTA has already had preliminary discussions with ARPA on their legislatively mandated Natural Gas Program that was funded at $10 million in FY 1993.

Fuel cell technology is another are a where dual use opportunities exist. From the military side, fuel cells for field power generation and individual soldier systems are two potential applications. These efforts will complement FTA's efforts to develop a commercially viable fuel cell powered transit bus.

FTA participated in the evaluation of proposals under ARPA's Electric and Electric Hybrid Vehicle Technology and Infrastructure Program. This program is a two year effort to demonstrate the utility and efficiency of electric and electric hybrid vehicle technology. The Federal government has authorized $25 million in funds that must be matched on a 1:1 federal/non-federal basis.

FTA was also involved in the review of proposals under the larger TRP.

ARPA Technology Reinvestment Project Benefits the Transit Industry

In the last few years the defense industry has been seeking new areas to apply research and development expertise. Recent base closings and the specter of significant layoffs in the industry has intensified the search for transferable technologies.

To ease the conversion of the defense industry to market-driven technologies, Congress authorized the Defense Department's Advanced Research Projects Agency (ARPA) to offer $471 million for cost-shared projects in Fiscal Year (FY) 1993. A significant portion of the $471 million, called the Technology Reinvestment Project (TRP) could go into emissions-related and transit technologies.

While the TRP will not fund "proposals that involve either basic research or final product development beyond the stage of product prototype/feasibility demonstration," it appears there are funding opportunities for alternative transit technologies within the scope of the ARPA initiative. Though 1993, proposals have been submitted, similar funding should become available in 1994 and will be of interest to city transportation officials because

- jobs can be preserved in local defense-related industries;
- the research is often relevant to applied transit systems;
- local participation is considered important by ARPA.

Local Participation

Financial participation of state and local governments and other groups is of key importance in all of the ARPA solicitations. Typically, in the TRP program, the federal government is only willing to fund half of the project's cost; the rest must come from industry, private, or state donations.

Of the $471 million available for TRP in FY93, $91 million is specifically earmarked for the Regional Technology Alliance Assistance Program which requires that a project be sponsored by a state or local government or by a regional nonprofit organization.

Targeted Technologies

The TRP has targeted 28 specific technologies in 12 broad categories where defense firms might be able to convert their military technology to commercial applications. The TRP aims to promote activities which will result "in applied development," and while the funding is not directed at low and zero emissions vehicles per se, some of the specific technologies are extremely relevant. Four of the 12 broad categories, (advanced battery technology, vehicle technology, materials/structures manufacturing, and training/instruction technology) are most closely related to the transit industry. Under those technology areas, the TRP targets several technologies specifically related to vehicle design:

Efficient Power Trains

The defense industry has already spent time researching electric drives because of their application for military vehicles, such as tanks and personnel carriers. The technology naturally transfers to the development of electric vehicles.

Advanced Battery Technology

The defense industry designed lightweight long-lasting batteries for remote power sources in the military. Advances in battery technology would be a tremendous boon for alternative fuel transit.

Advanced Composites

The defense industry has developed these strong and light materials for applications on aircraft and other military hardware. Advanced composite materials could go a long way to making buses lighter and more efficient.

Training and Diagnostic Systems

These interactive systems, which have been an integral part of defense instruction and maintenance programs, could be easily applied to the training and diagnostic needs of the transportation industry.

Intelligent Highway and Mapping Systems

Previously used for aircraft coordination and ground force deployment, highway and mapping systems could be used to

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ARPA Selects Winners for Electric and Electric Hybrid Vehicle Technology Infrastructure Program

The Advanced Research Projects Agency within the Department of Defense has awarded $23.5 million to six consortiums for its Electric and Electric Hybrid Vehicle Technology and Infrastructure Program (EEHVTIP).

Unlike the Technology Reinvestment Project, see p.2, which did not directly target design and testing of electric vehicles, the goal of EEHVTIP is to increase electric vehicle performance to achieve national environmental objectives and minimize foreign oil dependence without sacrificing vehicle performance. The program will demonstrate over 200 electric and electric hybrid vehicles (pick-up trucks, buses, and cars) in military and commercial applications. The program also funds 18 advanced component technology projects and 30 electric and hybrid vehicle training and education projects.

Industry, utilities, and state and local governments will contribute matching funds for the projects. Each consortium will also work with local military bases and local communities to demonstrate the new vehicles.

Table 1

CONSORTIUM	GRANT (millions)
Hawaii Electric Vehicle Demonstration Project Consortium	5
Southern Coalition for Advanced Transportation	4
Mid-America Electric Vehicle Consortium	4
CALSTART	4
Northeast Alternative Vehicle Consortium	4
Sacramento Municipal Utility District	2.5
TOTAL	**$23.5**

ARPA Selected the Following Consortiums for Funding:

Hawaii Electric Vehicle Demonstration Project Consortium plans to demonstrate 50 to 55 vehicles for military and commercial uses. The demonstrations will take place at the Hickam Air Force Base in Honolulu and in Waikiki. One of the participants, Poly Adventure Tours, plans to show tourists around Waikiki on 5 of the redesigned tour buses. The $6.3 million in matching funds will come from the consortium that includes former defense contractors Hughes Power Controls, EML, and General Motors. For more information call Bill Bass at the High Technology Development Corporation (808) 625-5293.

CALSTART, with over $6 million in matching funds, will be utilizing the skills of its members—IBM, Aerojet, Allied Signal, Fairchild Manufacturing, General Motors, and others—to convert military and commercial buses and cars for applications across the state. California military bases will serve as testing grounds for six light-duty trucks and nine commercial vehicles. Also funded is the Running Chassis Program that will develop a standard design for an electric vehicle chassis to make it easier to mass produce electric vehicles.

In San Francisco, Bay Area Rapid Transit (BART), Pacific Gas and Electric (PG&E), and the Bay Area Air Quality Management District will lease 45 electric "station cars" to PG&E and BART employees. The two-person station cars will be used to commute from home and work to BART stations and to make short trips near the employees' home. For more information call Bill Van Amburg at CALSTART (818) 565-5600.

The Mid-America Electric Vehicle Consortium was unable to provide any information about their consortium's activities at this time. For more information call Roy Miller at National Electronics Manufacturing Productivity Center (317) 226-5699.

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FEDERAL ACTIVITIES

DOE Heavy-Duty AFV Demonstration Program Collected by AFDC

The U.S. Department of Energy (DOE) is making $700,000 available through its Heavy-Duty State/Municipal Vehicle Alternative Fuel Demonstration Program. Ten monetary awards are expected to be given out to help state and city fleets purchase heavy-duty alternate-fuel vehicles (AFVs). In return, the fleets must provide vehicle logs for mileage, repair, reliability, and exhaust emissions to the National Renewable Energy Laboratory (NREL) on a weekly basis for the next 5 years. This information will be collected by the Alternative Fuels Data Center (AFDC).

Awards given to 10 states and the District of Columbia in 1992 assisted in the procurement of 45 alternative fuel school buses. Data from these vehicles are being added to AFDC files.

Transportable Emissions Lab Data Collected by AFDC

The Transportable Heavy-Duty Vehicle Emissions Testing Laboratory, developed by West Virginia University, has collected emissions data on 104 heavy-duty vehicles (88 buses, 12 trucks, and 4 tractors) operating on various alternative fuels at 15 different sites in nine states. An overview of the numbers and types of engines and fuels tested is presented in Tables 2 and 3. All test results for the different vehicles, fuels, and sites of operation were compared using a transient driving cycle known as the Central Business District. This cycle resembles an urban travel pattern using 14 segments at a length of 40 seconds each for a total duration of 560 seconds. Every segment is broken down into 10 seconds for acceleration, 18.5 seconds for constant speed at 20 mph, 4.5 seconds for deceleration, and 7 seconds for idling. Emissions data from this ongoing project is being collected by AFDC.

Table 2

Engine Type	No. of Vehicles
DDC6V-92	54
GMC	6
Cummins L-10	27
Caterpillar	9
MAN D256 MLUM	3
Hercules G3400	2
Ford 460 EFI	1
ACE	1
Chevrolet	1

Table 3

Fuel Type	No. of Vehicles
Jet A, Clean Diesel, Diesel #1	32
Diesel #2	29
CNG	19
Methanol	7
LPG, JP4	4
Clean Diesel/CNG, Jet A/CNG	5
E95	3
Gasoline	1
CNG, Gas	1

DOT Rules on Classification of Biodiesel Feedstocks

Secretary of Transportation, Federico Peña, reversed a proposed DOT regulation that would have cited animal oil and vegetable oil (feedstocks for biodiesel) as hazardous materials (HAZMAT), defined by the Oil Pollution Act of 1990. While not considered hazardous in terms of flammability, these oils could pose a threat to the environment if spilled in substantial amounts. As a result, DOT plans to hold a public assembly with private industry and those concerned to examine what steps can be taken to protect the environment from oil spills while keeping costs reasonable for oil transporters.

EPA Rules on Several Clean Air Mandates

The partial settlement of a lawsuit on June 10, 1993, filed by the Sierra Club Legal Defense Fund has forced the Environmental Protection Agency (EPA) to rule on 24 regulations mandated by the Clean Air Act (CAA) of 1990. Under CAA, EPA must develop a Clean Fuel Fleet Program. Fleets operating within CAA non-attainment areas have to include a certain percentage of vehicles which comply with the Clean-Fuel Fleet Vehicle

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STATE AND LOCAL ACTIVITIES

Atlanta, Georgia

Atlanta, home of the 1996 summer Olympic Games, hopes to have 10,000 vehicles running on alternative fuels by the time the opening ceremonies begin. This demonstration project is an effort between DOE, the city of Atlanta, and other partners to have a significant percentage of new vehicles, as well as private fleet vehicles, in the city operating on an alternative fuel for 1996 by opening alternate fuel refueling sites along major roadways.

Amoco and Tren Fuels Inc. have both announced ambitions to open a number of compressed natural gas (CNG) refueling stations. Atlanta Power has similar plans to build recharging stations for electric vehicles operated by the public.

Seattle, Washington

The Municipality of Metropolitan Seattle (Metro) was recently awarded $7.15 million in discretionary transit bus program funds by the House Appropriations Subcommittee on Surface Transportation. The funds will help finance the world's largest natural gas bus fleet. Metro plans to use liquid natural gas (LNG) buses to replace and expand on its aging fleet of 810 heavy-duty diesel mass transit buses by the year 2005. An initial purchase of 360 buses will be made for approximately $120 million. Additionally, $60 million will be needed over the next seven years to convert six fueling stations and six maintenance bases. The project will cost around $300 million by the time it is completed several years from now. Metro anticipates that this money will come from both federal grants and local funds, particularly government air quality funds and a formula grant program.

Texas

The Texas Railroad Commission has drawn up a new bill in Texas which earmarks $50 million for natural gas and propane alternative fuel projects. The bill would set up an Alternative Fuels Council of six members to manage the appropriation of $50 million in revenue bonds. The funds would be obtainable in the form of grants or loans to school districts, state agencies, counties, cities, mass-transit authorities, and designated private businesses. The money would be used to cover the costs of refueling station installations, engine modifications, and new alternative fuel vehicle purchases. A further $5.5 million will be made available from Oil Overcharge funds.

Chattanooga, Tennessee

The Chattanooga Area Regional Transportation Authority (CARTA) has begun a program which will make nearly one-third of the city's mass transit bus fleet battery-powered. Chattanooga hoped to have 16 electric buses running by the end of 1993 and 24 when the project is completed, according to a New Fuels Report article. This will give the city the largest operational electric bus fleet in the world by the end of the year.

CARTA has combined the efforts of three local companies to develop the electric buses and infrastructure. CARTA was awarded two challenge grants by the Federal Transit Authority (FTA) at the Department of Transportation (DOT) to purchase 22 extra buses. An additional $20 million grant from FTA will help fund the building of a parking/recharging garage in the city. For additional information, contact John Capell at (615) 629-1411.

Albuquerque, New Mexico

The Albuquerque Public School district will be operating four dedicated CNG handicapped-accessible school buses beginning 1994 school year. The purchase was made possible by a grant from DOE's Alternative Fuel for School Bus Program. For further information call Cooperative Extension Service at (505) 646-3425.

Other Local Government Activities

The Urban Consortium Energy Task Force of Public Technology, Inc. funded three local government transportation projects in 1993: Natural Gas Refuelling Option, Houston, Texas;Public/Private Partnership for Duel-Fuel Van-Pool Initiative, Chicago, Illinois; Hennepin County/Minneapolis CO_2 Reduction Program, Hennepin County, Minnesota

TECHNOLOGY DEVELOPMENT

Columbia, Missouri

The Agricultural Engineering Department at the University of Missouri-Columbia modified a 1991 Dodge pickup to run on methyl-ester soybean oil (soydiesel). According to an article in Clean Fuels Report, the truck was operated for more than 17,000 miles and 550 hours over a 12-month period. The pickup uses a 5.9L direct-injected, turbocharged Cummins Diesel engine. Rubber-based parts in the original fuel supply system deteriorated when exposed to the soydiesel and had to be replaced with aluminum or nylon-reinforced tubing. An aftermarket, stainless-steel heat exchanger was built into the fuel tank to keep the soydiesel from gelling when the temperature is at or below 38°F. This procedure is common for over-the-road trucks to prevent diesel fuel from gelling. The fuel tank and lines were insulated and two 110-volt thermostatically-controlled heating pads were installed below the fuel tank to prevent the soydiesel from gelling during cold weather operation or when the engine is not running.

After baseline testing with diesel, tests with soydiesel were conducted. In both cases, fuel efficiency was virtually the same for the pickup when operated under the same conditions. Frequent analysis of the engine oil showed that the engine wear was normal when using soydiesel.

Power runs on a chassis dynamometer revealed that 100% soydiesel does not dramatically reduce the torque output of a compression-ignition engine. Power will be approximately 5% less when fueled with soydiesel instead of diesel. Exhaust emissions are slightly less for carbon monoxide (CO), carbon dioxide (CO_2), and hydrocarbon (HC) when the engine runs on soydiesel. Nitrogen oxides (NO_x), however, tend to be slightly higher. For more information, contact Dr. Leon Schumacher at (314) 882-2126.

Zero Emission Hydrogen Fuel-Cell Bus

The first zero emission hydrogen fuel-cell bus in the world was recently delivered to British Columbia Transit. The prototype transit bus, developed by Ballard Power Systems, Inc., uses proton exchange membrane (PEM) fuel cells and hydrogen stored in compressed natural gas (CNG) tanks to produce 120 kilowatts and 160 horsepower. It seats 20 passengers, meets Federal Transit Administration criteria under full load, and has a range of 100 miles and a top speed of 45 mph, according to an Oxy-Fuel News report.

The fuel cell produces electricity through an electrochemical reaction between hydrogen and oxygen to power an electric motor. The only product from this reaction is water.

The development of the bus cost $6 million. Ballard will now team up with Daimler-Benz to build a larger bus with 240 horsepower and air conditioning to be available in 1996. For additional information, contact Paul Howard, Vice President of Ballard, at (604) 986-9367.

ARPA TECHNOLOGY
(Continued from p.2)

maximize the efficiency of the nations highways and make traveling easier and more reliable.

- **Collision Avoidance Systems** Defense contractors have tested high-speed electronics, millimeter wave radar and laser beam range finders which are possible components in collision avoidance systems that would improve the safety of city transit.
- **Alternate Power Sources** Fuel cells have been the subject of defense research for a long time, and are directly applicable to the search for cost-effective low-emissions vehicles.

While the above list illustrates that there are many opportunities for transit related TRP efforts, there is no guarantee that any particular technology area will be funded since funding depends more on the quality of the proposals submitted rather than on the area that applies to the project.

The announcement of initial awards for the TRP is expected in the last quarter of Fiscal Year 1993. For more information call 1-800-382-5873.

FEDERAL ACTIVITIES
(Continued from p. 4)

(CFFV) exhaust emission standards. EPA has proposed to use the standards in Phase II of the California clean fuel pilot program to establish the emission standards for light- and heavy-duty CFFVs, and the rules for converting existing vehicles to CFFVs. These regulations are planned to be incorporated into the Clean Fuel Fleet Program beginning in 1998.

ARPA SELECTS
(Continued from p. 3)

- **Southern Coalition for Advanced Transportation** is composed of seven regional groups from Texas to Georgia. The consortium's members will work on projects ranging from developing highly efficient climate control systems to designing lightweight hybrid buses for a Chattanooga to Atlanta bus line. The ARPA grant also funds the development of composite flywheels and the commercialization of on-board engine monitoring systems.

  Electric vehicle demonstration projects will be funded at Patrick Air Force Base in Florida which will test electric pick-up trucks and in Atlanta where electric buses will run between Hartsfield Airport and downtown. For more information contact Robert Michelson at the Georgia Tech Research Institute (404) 528-7568.

- **The Northeast Alternative Vehicle Consortium** will demonstrate over 60 cars, trucks and buses in six northeastern states and at military bases such as Hanscom Air Force Base in Bedford, Massachusetts. Because the Port Imperial Ferry System in New York City is acquiring 5 electric buses, commuters using the Staten Island ferry can take an Electric Vehicle (EV) ride from the ferry dock to their work in downtown and midtown Manhattan. The participating companies are contributing another $6 million to the project. For more information call Sheila Lynch at the Northeast States for Coordinated Air Use Management (617) 367-8540.

- **Sacramento Municipal Utility District** (SMUD) and its allies are trying to make the city of Sacramento a central manufacturing location for electric vehicles — a miniature Detroit for alternative fuel vehicles. Joining in the consortium with SMUD are Aerojet General, Synergy EV, California Energy Commission, Honeywell, American Flywheel Systems and others. The group is working closely with McClellan Air Force Base which will test 15 light-duty electric trucks and 3 electric buses.

  The consortium is sponsoring a neighborhood EV market and product test by leasing 120 to 150 small EVs to people for 1 to 2 years. In both cases the EVs will carry data acquisition systems that will provide data to ARPA on the vehicle's performance.

  To improve EV safety, the freeway EVprogram will crash test EVs made of a light ultra-stiff composite and fitted with seatbelts and airbags. For more information call Michael Wirsch at the Sacramento Municipal Utility District (916) 732-6754.

The Federal Transit Administration's (FTA) Clean Air Program Technical Assistance Briefs are published quarterly and designed to help transit officials and local decision-makers keep abreast of current issues in the use of alternate fuels in transit vehicles. The brief is produced by Meridian Corporation under a subcontract to the National League of Cities (NLC).

FTA Clean Air Technical Reports

The following technical reports about alternatives fuels in transit are available from the Federal Transit Administration. To obtain copies, just check the ones you want, fill in your name and address and return to FTA at the address below:

- ❑ **"Properties of Alternative Fuels"**
  A brief comparison of many physical factors of alternative fuels; contains data items such as cost, heat content, density, electrical conductivity, vapor pressure, boiling points.
- ❑ **"Technical Advisory on CNG Fuel Measurement"**
  A brief paper explaining the intricacies of measuring CNG fuel use with accuracy; contains recommended strategies and a worksheet for doing useful calculations.
- ❑ **"Methanol Use Training Manual"**
  A manual designed to help inform employees about the proper use and handling of methanol fuel; audio visual training materials are available.
- ❑ **"Status of Particulate Trap Developments Related to Transit"**
  A report summarizing the status of particulate traps in transit busses; contains recent experiences at transit agencies and explains the technology of particulate traps.
- ❑ **"Methanol Status Report"**
  A detailed report on the operating experience of methanol buses in a number of transit systems.
- ❑ **"Alternative Fuel Price Summary"**
  Compilation of alternative fuel costs that include both current and historical cost information.
- ❑ **"Industrial Hygiene Survey Reports"**
  Three reports from NIOSH on the occupational health and safety issues associated with the fueling, maintenance and operation of methanol transit buses at Triboro Coach in New York, Seattle Metro, and SCRTD in Los Angeles.
- ❑ **"Compressed Natural Gas Fuel Use Training Manual"**
  A manual designed to inform employees about the proper use and handling of CNG fuel.
- ❑ **"CNG Bus Demonstration Program Data Analysis Report"**
  A report summarizing experience to date with CNG bus operations in transit; contains test track performance results.
- ❑ **"Proving Ground Comparison of M.A.N. Methanol and Diesel Transit Buses"**
  A detailed report on tests of performance and driveability conducted on M.A.N. methanol and diesel buses.
- ❑ **"Extent of Indoor Flammable Plumes Resulting from CNG Bus Fuel System Leaks"**
  Validated three dimensional mathematical model that was used to examine the extent of flammable plumes resulting from CNG leaks inside a typical transit maintenance facility.

Mail this completed form to:
Shang Hsiung
Federal Transit Administration
Office of Technical Assistance and Safety/TTS-21,
400 Seventh Street. S.W.,
Room 6431
Washington, D.C. 20590

Name: _____

Title: _____

Company: _____

Street Address: _____

_____

City: _____

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U.S. Department of Transportation
Federal Transit Administration
Office of Technical Assistance & Safety
400 7th Street, SW, TTS-3
Washington, DC 20590