

HJR

56

HOUSE COMMITTEE REPORT

(9)

Date Referred to Committee: February 11, 1998

FURTHER REFERRALS:

Date of Committee Action: 2/26/98

The RESOURCES Committee considered:

HJR 56

HOUSE JOINT RESOLUTION NO. 56

YTTRIUM MINING

Relating to yttrium mining and transfer of the linear induction motor research vehicle to Alaska.

recommends it be replaced with the following committee substitute _____ the same title a new title

additional referral to _____ Committee
 attached amendment(s)

ADOPTS: _____ Letter of Intent

ATTACHES NEW FISCAL NOTE(S): (Dept) _____ APPROVES PREVIOUS: (Dept/Date) _____
 fiscal note(s) _____ fiscal note(s) _____
 zero fiscal note(s) _____ zero fiscal note(s) _____

SIGNING WITH RECOMMENDATIONS		DP	DNP	NR	AM
<i>Fred Dyson</i>	Dyson	✓			
<i>W. Williams</i>	Williams	✓			
<i>Green</i>	Green	✓			
<i>Barnes</i>	Barnes	✓			
<i>Maack</i>	Maack	✓			
<i>Dgan</i>	Dgan	✓			
<i>Hudson</i>	Hudson	✓			
<i>Jacob</i>	Jacob	✓			

CHAIR'S SIGNATURE Bill Hudson Scott Dgan

FISCAL NOTE

STATE OF ALASKA
1998 LEGISLATIVE SESSION

BILL NO. HJR 56

Revision Date: _____
Title: Yttrium Mining

Dept. Affected Legislative Affairs Agency

BRU A11

Component A11

Sponsor: Rep. Hudson

Requester: House Resources Committee

Component Serial No. _____

Expenditures/Revenues

(Thousands of Dollars)

OPERATING EXPENDITURES	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
Personal Services						
Travel						
Contractual						
Supplies						
Equipment						
Land & Structures						
Grants & Claims						
Miscellaneous						
TOTAL OPERATING	0.0	0.0	0.0	0.0	0.0	0.0

CAPITAL EXPENDITURES						
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CHANGE IN REVENUES ()						
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FUND SOURCE

(Thousands of Dollars)

1002 Federal Receipts						
1003 GF Match						
1004 GF						
1005 GF/Program Receipts						
1037 GF/Mental Health						
1091 Designated Program Receipts						
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0

Estimate of any current year (FY97) cost: _____

POSITIONS

Full-time						
Part-time						
Temporary						

ANALYSIS: *(Attach a separate page if necessary)*

Prepared by House Resources Committee
Division Co-Chairman Bill Hudson
Approved by _____
Agency _____

Phone 465-6820
Date 2/26/98
Date _____

Alaska State Legislature

REPRESENTATIVE BILL HUDSON

COMMITTEES

CO-CHAIR
Resources Committee

MEMBER
Transportation Committee
Labor & Commerce Committee



State Capitol
Juneau, Alaska
99801-1182
(907) 465-3744
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Sponsor Statement

This Resolution urges the Federal Railroad Administration to transfer the Linear Induction Motor Research Vehicle (LIMRV) to the State of Alaska. The LIMRV is a high speed test vehicle which was used in the 1970's for obtaining experimental data by the United States Department of Transportation. The transfer of the LIMRV will allow for the potential development of a new industrial and research business in Alaska. The mining will take place on Prince of Wales Island where the only known North American source of yttrium is located, and the processing will take place in Ketchikan. The development of yttrium could revitalize Ketchikan, after the loss of the pulp mill.

Yttrium is a rare earth element that is currently being purchased from foreign sources at the current world market value of \$320,000 for one pound of pure yttrium. Power Superconductor Applications Corporation is proposing local employment in the mining and refining, as well as in the converting the LIMRV to their needs. Upon receipt of the LIMRV, there will be potential employment of up to 55 persons for the conversion.

The mining and refining of yttrium would also cause further job expansion on Prince of Wales Island. These yttrium deposits are also mixed with other rare earth elements, which will allow Alaska further development in other minerals.

Power Superconductor Applications Corporation is also planning to establish a high speed test facility at Annette Field on Metlakatla. This airfield makes available long flat strips of land and a moderate climate for the testing of the LIMRV. Currently, there are facilities in Southeast Alaska that could be quickly retrofitted by the Power Superconductor Applications Corporation for their requirements for the LIMRV conversions and yttrium development. The fact that there are current convertible facilities available, will allow for expedient development of the project.

Alaska has a unique deposit of this valuable earth element, the development of which could provide an opportunity for economic growth and development. I urge your support in this timely resolution.



Demonstration of Advanced Linear Induction Braking System on LIMRV for Enhancement of Railroad Safety

Abstract

A 4-year research and development program is outlined which designs, builds and tests several single-sided 2150-4665 HP linear induction motors (S-LIM) propulsion auxiliary sets for improvement of high speed braking on railroad locomotives and on steep grades for mountain terrain. The speed range of interest is 75 mph to 175 mph and specific to railroad passenger and high-speed rail service. The range of development for the mountain grades are 4.5%-12.25% and two key U.S. electric railways have been identified that have experienced braking failures on these grades within the last decade. The technology to be demonstrated is the fully-compensated linear induction motor (FC-LIM) operating in the regenerative/dynamic braking mode with a thyristor-controlled load bank. The LIM technology was originally developed at Imperial College of Science and Technology, London under a grant from the British government, pioneered by Professor Eric Laithwaite and Dr. Stephen Kuznetsov, principal investigators. The LIM braking system has commercial potential for augmenting electric braking on all high speed rail vehicles, urban electric traction vehicles and mountain-grade locomotives with either AC induction motor propulsion or DC traction propulsion systems. The retrofitting of the Linear Induction Motor Research Vehicle (LIMRV) is to occur in Alaska with alpha testing to be performed in Pennsylvania at the Brady's Bend Test Site. In Phase III, two GM Diesel-electric 3600-4000 HP locomotives are fitted with a 45 kN LIM brake system rated at 4,665 HP as an auxiliary brake system and run in steep grade conditions on 2 U.S. railroad properties for 12 months.

Background

Currently U.S. railroads have approximately 96% of their rolling stock equipped with DC dynamic brakes using a series wound 600-750 VDC class traction motor fed by a diesel electric synchronous generator set and a 6-pulse or 12-pulse bridge silicon diode rectifier. These propulsion sets offer dynamic braking but in most cases do not offer regenerative braking and consequently the locomotive and train kinetic energy is dissipated in resistor banks with fixed dissipation limits. Extended dynamic braking is usually limited to a peak rate of about 3.5 mphps in the U.S. with an emergency braking rate of 8-9 mphps often resulting in traction motor overload and commutation failures.

The other 4% of the rolling stock in the U.S. are AC induction motor propulsion system employing 4-pole or 6-pole squirrel cage traction motors and variable-voltage variable-frequency (VVVF) inverters for current and speed regulation. These systems have been implemented just in the last decade and typically offer excellent regenerative braking control over a wide range of speeds through a technique termed field-oriented-vector (FOV) control of the power inverter. However, despite the introduction of these advanced AC rotary motor systems, there remains a persistent problem of wheel to rail adhesion in snow, ice or rain laden environments. While the

AC induction systems have slip-slide detectors on each locomotive wheel set, once a slip-slide condition is initiated by external forces, it is often impossible to recover full braking effort until either the grade is lessened or the external weather agent removed. The FOV control systems generally reduce the motor flux and braking torque in response to slip-slide conditions and recover locomotive speed regulation at the expense of a reduced braking torque. Herein lies the fundamental problem of the AC rotary system in relying exclusively on wheel and rail adhesion limits.

The situation is compounded for high speed rail operating in the range of 125-175 mph whereby the braking rates for example at 2.5 mph result in a full laden 10-car passenger train requiring 6000-8000 ft. to come to a full stop. The principal investigator has met with ABB Traction and discussed these high speed braking problems at length. ABB, a leading manufacturer of high speed rail equipment, indicated that the prime factor preventing their systems from braking high speed trains such as the Type ALP44 (New Jersey Transit) locomotive faster is a basic physics principle known as rail to steel wheel coefficient of adhesion. The 175 mph high speed locomotive has a coefficient $\mu=0.12$ on dry flat rail. On a wet rail, the coefficient will decrease to $\mu=.002$ and on ice the coefficient may be as low as $\mu\leq.001$. This clearly indicates that even with the best AC-VVVF/FOV propulsion system, a compromise is being made on braking ability for the new high speed trains.]

The principal investigator documents herein, three linear induction motor braking systems for electric traction (subway) vehicles which have been in place for 6-15 years with superior characteristics all using single-sided linear induction brakes. These are:

- a. Toronto-Scarborough, Canada Transit System (> 15 years)
- b. Vancouver, British Columbia, Skytrain Transit System (> 13 years)
- c. Railway Technical Institute, Beijing, China (6 years)

The first two applications are 40-ton transit cars numbering 160 cars total. The last application in China is a 125-ton diesel electric locomotive with the 2 linear induction brake systems supplied by Power Superconductor in 1992 and each S-LIM had a rating of 600 KW. In all three applications, the locomotive or transit car is under automatic control (unmanned) and the system designers desired LIM braking for the reason that a controlled, uniform braking effort is obtained 100% at the time independent of snow, ice or rain conditions-this is a mandatory feature for automatic control by computer rather than a human operator. It should be noted that in the case of the Chinese 125-ton locomotive, the normal traction rotary motors are used for propulsion and the LIM system is used for acceleration boost and for 100% of braking. The PSA LIM is inverter controlled and incorporates field-oriented vector flux control to yield optimum performance.

State of Alaska Agreement

Power Superconductor has submitted to the State of Alaska, Division of Trade and Development, a comprehensive Teaming Agreement regarding the use of LIMRV for development engineering, test and certification of linear induction machines. The Agreement fully delineates the joint responsibilities of both parties in safeguarding the overhaul, operation, maintenance, storage and transportation of LIMRV including financial. The Teaming Agreement is currently being reviewed by the legal staff of the State of Alaska. PSA anticipates closure on this agreement within the next 30 days, for which the FRA will be sent a copy of this Agreement once signed. Should FRA require additional information on this Agreement, FRA staff is encouraged to speak with Marjorie L. Vandor, Assistant Attorney General, State of Alaska, who may be reached at (907) 465-3600.

Proposer's Level of Commitment and Organization

Power Superconductor and its predecessor firm, Electric Machinery Inc. was started in 1986 as a spin-off of the Westinghouse Electric Corporation, Central Research & Development Center, Pittsburgh. Its charter is to provide strategic electromagnetics research & development and advanced power electronics product design services to the U.S. Department of Defense, the U.S. transit and metal-production industries.

The individuals comprising Power Superconductor Applications Corp. have a prominent role in many large engineering programs. The organization, which is a focused manufacturing development group, has two primary objectives:

1. To advance basic scientific phenomena in applied cryogenics to electrical machinery and power electronics.
2. To apply the resulting knowledge to products for pulsed-power applications, civilian Maglev transport systems and rotating electrical machinery for propulsion.

The primary business of the company is development and manufacturing of high speed linear induction motors and high power inverters for guided ground transportation and people movers. PSA presently has a direct contract with the U.S. Navy to develop a 25,000 HP permanent magnet

propulsion motor diagnostic system for a ship drive program, geared to the DDG-51 Destroyer and SC-21 Surface Combatant. In the power utility area, PSA has a Cooperative Research and Development Agreement with Los Alamos National Lab to jointly develop yttrium (YBCO) based AC-excited superconducting wire/tape for a commercial development of 15-38 kV liquid-nitrogen cooled fault limiters for utility power stations under U.S. Patent 5,596,469.

Power Superconductor owns and operates a large traction & power research laboratory located at Bruce & Merrilees Industrial Park, New Castle, PA with 12,000 sq. ft. of high voltage and high current laboratories. This plant has extensive high power apparatus and one Type FCC 52-passenger linear induction motor test vehicle.

The Power Development Laboratory comprises a peak power supply of 10 Megawatts, 60 HZ up to 23 kV, 3-phase and a large DC magnet supply at 20,000 Amps, 600 Volts using Westinghouse Rotary Converter generator sets. The lab is equipped to test utility fault limiters and large generators up to 200 MVA short-circuit power and for qualifying large magnetic levitation apparatus.

The science and technology pursued by the corporation covers a broad base from high-voltage silicon thyristors and synchronous condensers to ultra high speed pulse power rotating generators for the U.S. military EM launcher programs. The charter of PSA is to establish a center of excellence for electrical engineers, metallurgists, and physicists to focus on improving superconducting power apparatus. Experts in every major field are available to assist the engineers in producing advanced high-speed machinery. The firm's scientists and engineers also provide technical support for the Department of Energy at Brookhaven National Laboratory, Argonne National Laboratory and Los Alamos National Laboratory on superconducting coils and superconducting electric power technologies.

Power Superconductor was recently awarded two contracts from the U.S. Navy (NAVSEA and Naval Surface Warfare Center) titled:

1. Design of High Speed, High Power Synchronous Generators for Surface Ships and Submarines, Contract No. N00167-91-D-0042/0018
2. Internal Fault Detection/Classification System for Permanent Magnet Machines, Contract N00024-96-C-4205

The firm provided the principal electromagnetic engineering to Babcock & Wilcox Corporation on the Dept. of Transportation Contract DTFR53-91-C-0065 for the design of the 300 mph FRA Maglev vehicle using superconducting (SC) vehicle suspension and all magnetic LSM propulsion. Power Superconductor provided the electromagnetic design for the SC linear synchronous motor and active electrodynamic guideway for the 18 MVA Maglev vehicle.

POWER SUPERCONDUCTOR APPLICATIONS Co., Inc.

Linear Induction Catapult Motors

DESCRIPTION

Power Superconductor linear induction motors combine direct-drive, high-thrust with an ultra high-strength vehicle mounted reaction rail. All forces are transmitted over a 2-5 mm airgap from the beryllium-copper reaction rail to the stator assembly. The LIM catapult motor is designed for either a repulsive or neutral vertical force; there is no magnetic attraction between the reaction rail and the stator. The airgap may be filled with water, oil or any non-ferromagnetic fluid. The position of the reaction rail is detected by an optical or capacitive sensor and used to control frequency and phase angle of the inverter power supply in a closed loop control. This allows very fast accelerations and decelerations of the reaction rail along the stator guideway with positioning resolution of +/- 5 mm depending on the airgap selected.

The epoxy-encapsulated stator assembly is composed of a copper-wound magnetic core using high permeability cobalt silicon steel. Custom widths and special lengths are available on request. Windings with ratings from 240 volts to 4160 volts are available depending on the kW rating. The reaction rail is composed of beryllium-copper for high-duty cycle operations. High Power Density Models LIM-CAT-1200 and LIM-CAT-2100 have water cooled stator windings. Standard models are force air cooled.

Typical applications include aircraft catapults, locomotive test stands, ejector seat testing, metal forming and amusement park rides.

Military specification and EMC Shielded motors available on request.

CHARACTERISTICS

- ◆ Force ratings: 2,500-28,000 N/module
- ◆ Fast response, accelerations up to 120 G's
- ◆ No mechanical or frictional parts
- ◆ Uniform acceleration at all speeds
- ◆ Available speed range 5-150 m/s
- ◆ Hermetically sealed, oil resistant stator
- ◆ Explosion proof reaction rail and stator
- ◆ High resolution with closed-loop control
- ◆ Pulse Width Modulated (PWM) inverter
- ◆ NEMA Class H temperature stator

OPTIONS

- ◆ Current-source IGBT inverter
- ◆ IEEE-488 Bus interface to inverter
- ◆ High temperature Class R Stator winding
- ◆ Water Cooled stator for higher power
- ◆ Custom stator winding voltage rating

WARRANTY

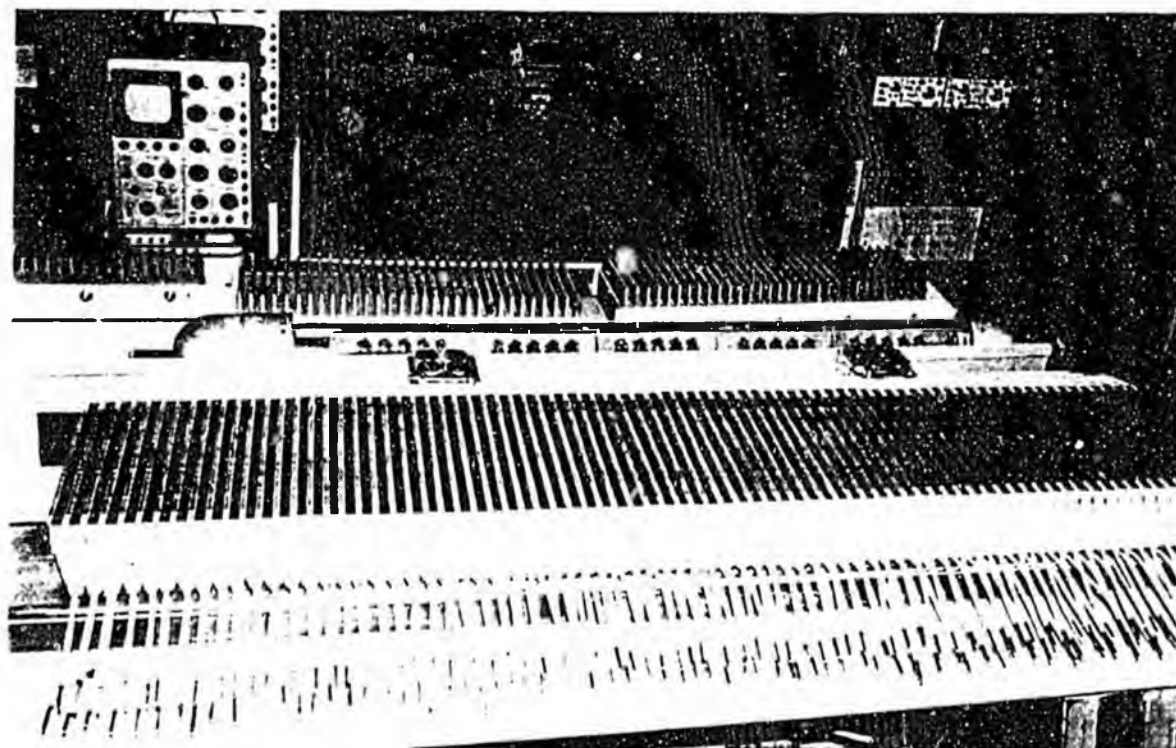
Five year warranty on all units-the longest warranty in the linear motor industry.

LINEAR INDUCTION CATAPULT MOTOR SPECIFICATIONS

Model	LIM-CAT-200	LIM-CAT-750	LIM-CAT-1200	LIM-CAT-1500	LIM-CAT-2100
Outline Drawing	W-65	W-66	W-67	W-68	W-69
Static Thrust**	N 2,000	7,500	12,000	15,000	21,000
Thrust at 160 km/hr	N 2,500	8,900	16,000	20,000	28,000
Synchronous Speed*	m/s 50	48	48	46	46
Maximum Frequency	Hz 180	150	150	150	125
Peak Power	kW 110	392	704	880	1232
Terminal Volts	V 480	480	480	4160	4160
Airgap	mm 2.5	2.5	3.0	3.0	4.0
Stator Surface Area	sq. m. 0.111	0.393	0.393	0.508	0.710
Core Depth	mm 88	88	100	100	100
Overall Width	mm 455	455	600	600	600
Standard Length	mm 440	1560	1560	2000	2000
Weight	kg 77	275	315	405	564

* Based upon design for operation at 160 km/hr.

** Static thrust is dependent on reaction rail material, and temperature rise.



Catapult Motor Model LIM-CAT-750 Prior to Epoxy Encapsulation

POWER SUPERCONDUCTOR APPLICATIONS CO., INC.

930 Cass Street, New Castle, PA 16101
 Tel.: (412) 657-9450 Fax: (412) 657-0774

THAD COCHRAN, MISSISSIPPI
 ARLEN SPECTER, PENNSYLVANIA
 PETE V. DOMENICI, NEW MEXICO
 CHRISTOPHER E. BOND, MISSOURI
 SLACK GORTON, WASHINGTON
 MITCH ANCOCKE, KENTUCKY
 CONRAD BURKE, MONTANA
 RICHARD C. SHELBY, ALABAMA
 JUDG GREGG, NEW HAMPSHIRE
 ROBERT F. BENNETT, UTAH
 WEN HUI (MIGUEL) CARRASQUILLA, COLORADO
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 BARBARA BOXER, CALIFORNIA

STEVEN J. COFFEY, STAFF DIRECTOR
 JAMES H. ENGLISH, MINORITY STAFF DIRECTOR

United States Senate

COMMITTEE ON APPROPRIATIONS
 WASHINGTON, DC 20510-8025

February 5, 1998

The Honorable Jolene Molitoris
 Administrator
 Federal Railroad Administration
 400 Seventh Street, S.W.
 Washington, D.C. 20590

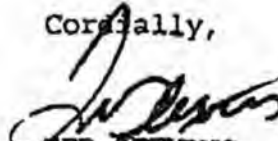
Dear Administrator Molitoris:

The people of Metlakatla, Alaska, are working with the State of Alaska and Power Superconductor Applications Corporation on a joint venture to investigate uses of linear induction motor technology. They have asked me to look into the possibility of moving the Linear Induction Motor Research Vehicle (LIMRV), which is owned by your agency, to their Annette Island test facility for a period of four years. I understand the LIMRV has been in storage in Pueblo, Colorado, for the past twenty years.

I would be interested in hearing your views on this proposal. Apart from my interest in advancing the development of U.S. based technology, this proposal involves creating employment opportunities for as many as 55 Native Alaskans on the Metlakatla reservation, where displaced timber workers have contributed to a serious unemployment problem. Thank you for your attention and consideration of this proposal to put these people back to work.

With best wishes,

Cordially,



TED STEVENS

DON YOUNG
CONGRESSMAN FOR ALL ALASKA
WASHINGTON OFFICE
2331 RAYBURN BUILDING
TELEPHONE 202/225-5765

COMMITTEES:
CHAIRMAN,
COMMITTEE ON
RESOURCES

COMMITTEE ON
TRANSPORTATION AND
INFRASTRUCTURE



Congress of the United States
House of Representatives
Washington, D.C. 20515

February 26, 1998

DISTRICT OFFICES:
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ANCHORAGE, ALASKA 99513-7595
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TELEPHONE 907/225-6880
130 TRADING BAY ROAD
SUITE 350
KENAI, ALASKA 99611-7716
907/283-5808

The Honorable Jolene Molitoris
Administrator
Federal Railroad Administration
400 Seventh Street, S.W.
Washington, D.C. 20590

Dear Administrator Molitoris:

I have recently learned of a promising effort to organize a joint public-private partnership in Southeast Alaska to develop new advanced propulsion technology based on linear induction. I have been asked to look into the possibility of moving a Linear Induction Motor Research Vehicle (LIMRV), which is apparently owned by your agency, to a test facility on Annette Island in Southeast Alaska, for a four year period. I understand that the LIMRV was originally built to test this technology for use in a braking system for railroad engines, but it has been in storage at Pueblo, Colorado for the past 20 years.

If the proposed project is successful, new U.S.-developed high technology would be used in a number of important applications, and the resulting economic development in Southeast Alaska would create many new high wage employment opportunities in an area where there is a serious unemployment problem.

I am interested in learning your views on this proposal. Thank you for your consideration of this proposal to commence research and development on cutting edge technology while simultaneously employing Alaskans in high technology jobs.

Sincerely,

A handwritten signature in black ink, appearing to read "Don Young", written over a circular stamp.

DON YOUNG
Congressman for all Alaska

DY/jr

Alaska State Legislature

REPRESENTATIVE BILL HUDSON

COMMITTEES

CO-CHAIR
Resources Committee


MEMBER
Transportation Committee
Labor & Commerce Committee



State Capitol
Juneau, Alaska
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(907) 465-3744
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*Wants!
Schedule*

MEMORANDUM

TO: Representative Bill Hudson, Co-Chairman 
House Resources Committee
Marieke Barnes, House Resources Committee Aide

FROM: Douglas Salik

SUBJECT: HJR 56

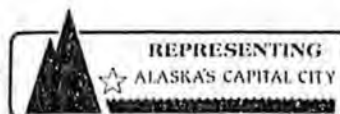
DATE: February 18, 1998

I respectfully request that the House Resources Committee schedule a hearing for House Joint Resolution 56 at your earliest convenience.

House Joint Resolution 56 supports the mining and refining of yttrium, a rare earth element found in large quantities in Alaska. This resolution also supports the transfer of the linear induction motor research vehicle (LIMRV) from the Federal Railroad Administration to the State of Alaska.

The transfer of the LIMRV would create up to 55 Alaskan jobs with the Power Superconductor Applications Corporation. Additionally, there is the possibility that many more jobs would be created as the actual mining and refining of yttrium begins.

I appreciate your consideration of my request. Please do not hesitate to contact me if I can answer any questions or provide further information.



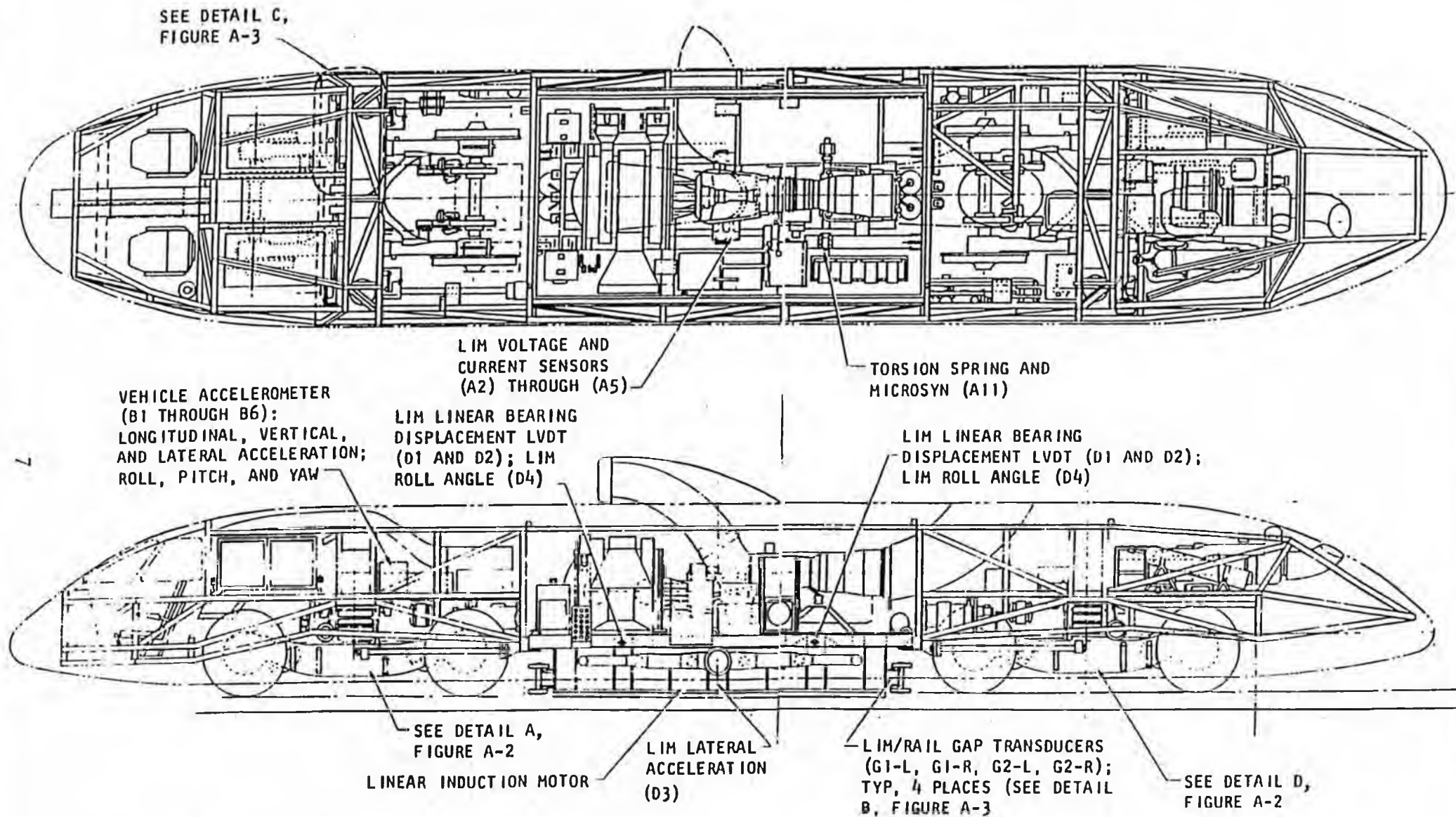
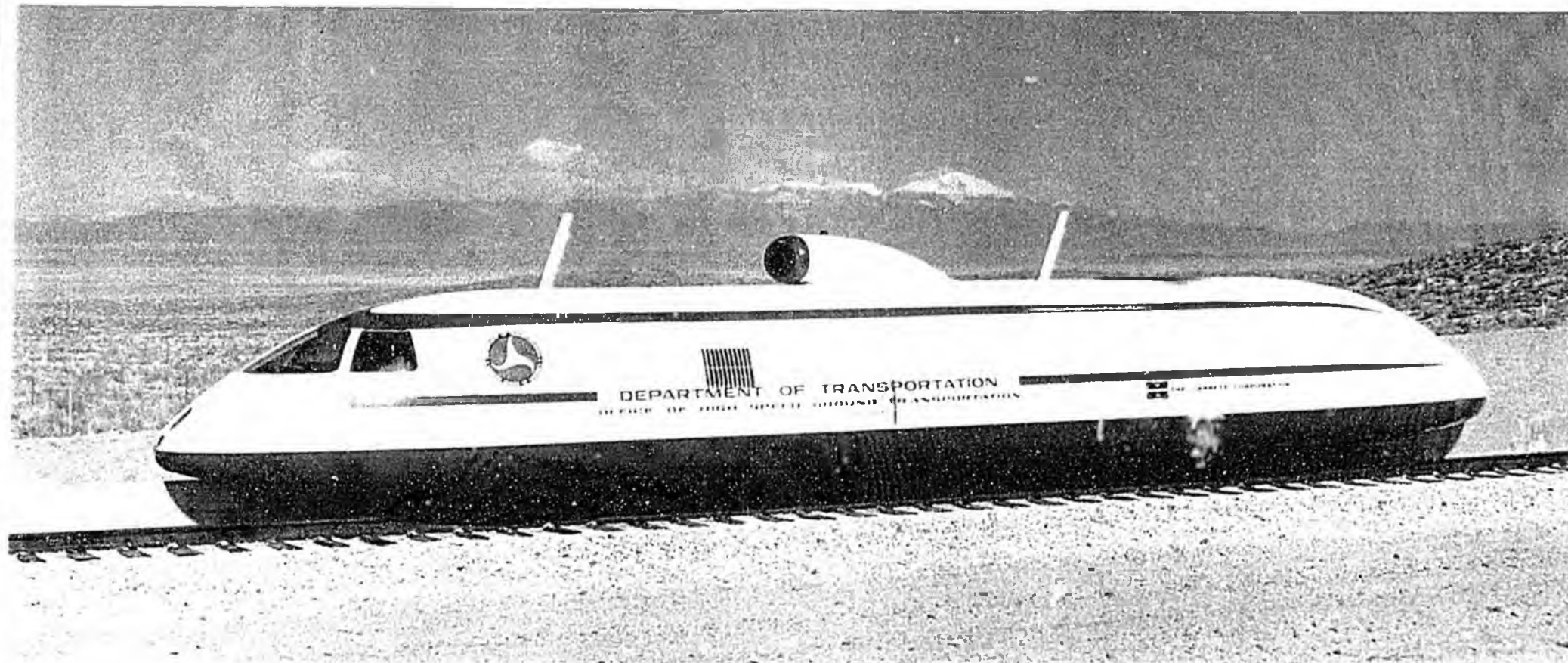


Fig. 10 LIMRV at Pueblo Test Track about 1974 with original Garrett propulsion system.

POWER SUPERCONDUCTOR APPLICATIONS CORP., New Castle, PA



Linear Induction Motor Research Vehicle with 260 mph propulsion system at U.S. Department of Transportation Test Track, Pueblo, Colorado

PROPOSED PROJECT FOR KETCHIKAN, WITH FEDERAL RAILROAD ADMINISTRATION
SPONSORSHIP OF AN YTTRIUM-BASED SUPERCONDUCTING LIM BRAKING SYSTEM
DEMONSTRATION.

Juneau contact: Pearson Associates, (907) 789-1402