IEEE

# VEHICULAR TECHNOLOGY SOCIETY NEWSLETTER

Editor: A. Kent Johnson

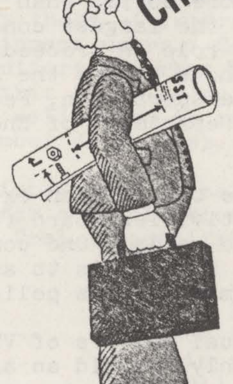
Vol. 26, No. 4, November 1979 (ISSN 0181-7877)

Automotive Electronics

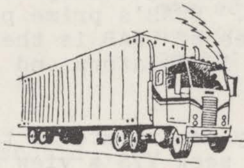
Transportation Systems

Directory of Chapters

Chapter News



Biographies



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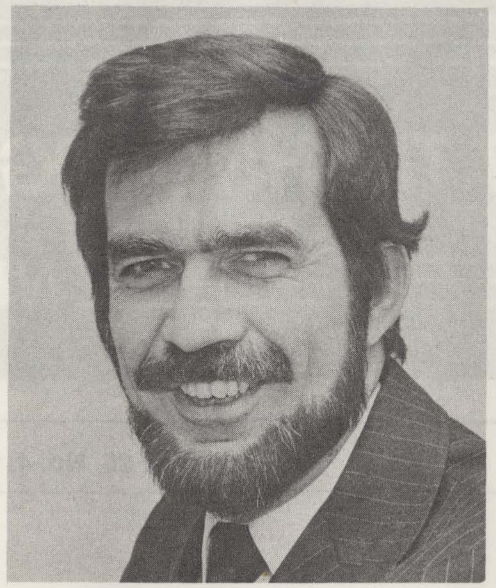
# President's Message



Roger D. Madden

*President, IEEE Vehicular Technology Society*

As some of you may know, my primary employment has been in communications. I have been asked on several occasions, by people involved in communications, why VTS does not assume the role of technical advisor to such agencies as the FCC.

As food for thought on this issue, please consider that Vehicular Technology Society is an international organization devoted to advancement of the technologies of vehicular communications, automotive electrical and electronics systems, and electronics as applied to mass transit. Does this fact mean we should assume similar roles with non-U.S.A. Post, Telephone, and Telegraph (PTT) offices?

Since there is more to VTS than land mobile radio (although private dispatch land mobile is one of the largest constituent groups) does this mean we should also assume an active role in proceedings pertaining to amateur, CB, marine, aviation, and mobile telephone before the FCC or PTT's? Should we tackle issues before the Department of Transportation, Federal Highway Administration, Environmental Protection Agency, Department of Energy, Federal Aviation Administration, Department of Commerce, etc.?

Each of us in the U.S. pay an extra $10.00 annually for support of the IEEE United States Activities Board (USAB). USAB's prime purpose is that of promotion of IEEE needs and goals. One committee of USAB is the Telecommunications Policy Committee, whose role it is to assist legislators and others in government in areas of telecommunications policy.

In view, individual members of VTS may contribute as they wish to the regulatory process. Certainly, should an agency seek VTS's view with regard to an issue, we would formulate committees to work with the agency on issues requiring technical expertise. However, the input to most agency proceedings is best left to USAB and its subordinate committees.

I welcome dialogue for publication on this commentary. Please write or phone me.

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| Month of Issue | Final Copy To be Rec'd. By Editor* | Target Mailing Date |
|---|---|---|
| February | 12-15-79 | 1-21-80 |
| May | 3-10-80 | 4-14-80 |
| August | 6-9-80 | 7-14-80 |
| November | 9-15-80 | 10-20-80 |

* Inputs for newsletter staff editors should be received 1 to 2 weeks before these dates.

# Editor's Notes

A. Kent Johnson

*Newsletter Editor*

## Help Wanted

Due to a change in his work assignment which makes it impossible for him to continue as our associate editor for communications, it has become necessary to seek a replacement for A. K. Guthrie. His work started with the August 1974 issue and his contributions have certainly been appreciated and will be missed.

My notes for this newsletter take the form of a "help wanted" ad as I am now in search of a new associate editor for communications. The job consists of generating practical communications oriented papers or articles, particularly those of interest to communications equipment users. Generally the associate editors generate this material themselves but this is by no means necessary; they can equally well serve to stimulate such input from any number of sources.

If you are interested in serving as our associate editor for communications or know of someone you feel is qualified please contact me at:

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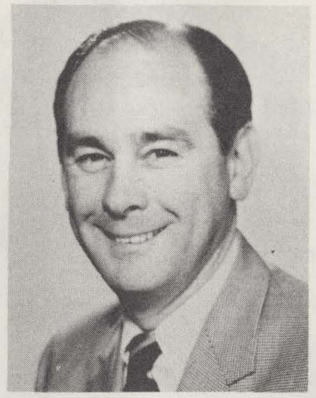
# Biographies



**Trevor O. Jones**

TREVOR O. JONES
Vice President, Engineering
TRW Automotive Worldwide

Trevor O. Jones, vice president, engineering of TRW Automotive Worldwide, is responsible for all engineering activity within that organization, with special emphasis on new product development and product improvement.

Prior to joining TRW in June 1978, Mr. Jones spent 19 years with General Motors. His most recent position was director of General Motors Proving Grounds, which he assumed in 1974.

From 1959 to 1970, Mr. Jones was involved in General Motors aerospace activities at the Delco Electronics Division. During this period, he directed many major programs, including the B-52 bombing navigational system production program, advanced military avionic systems and the Apollo lunar and command module computers. In 1969 he was selected to direct Delco's program of bringing aerospace technology to automotive safety systems.

He became the director of the newly organized Automotive Electronic Control Systems group at General Motors Engineering Staff in 1970 and was appointed director of Advanced Product Engineering in 1972. In this capacity, he directed many major vehicle, engine and component development programs.

He is a Fellow of the British Institute of Electrical Engineers and received its Hooper Memorial Prize in 1950. He is also a Fellow of the American Institute of Electrical and Electronics Engineers and was cited for "Leadership in the application of electronics to the automobile". Active in the affairs of the Society of Automotive Engineers, Inc., he received their Arch T. Colwell Award for his papers in 1974 and again in 1975. He received its SAE Vincent Bendix Automotive Electronics Engineering Award in 1976. Mr. Jones holds many patents and is the author of many papers on the subjects of automotive safety and electronics. He is also a member of the Engineering Society of Detroit and Cleveland and a member of the American Defense Preparedness Association and the Japan Society. Active in civic affairs, Mr. Jones was appointed to the National Motor Vehicle Safety Advisory Council in 1972. In 1975, President Ford appointed him to a three-year term on the National Highway Safety Advisory Committee. In 1976, he was appointed the first non-government chairman of the committee. He received the U.S. Department of Transportation Safety Award for Engineering Excellence in 1978.

A native of Maidstone, England, and prior to moving to the United States, Mr. Jones completed his formal engineering education at Aston Technical College in 1952 and Liverpool Technical College in 1957. He is a Registered Engineer in the State of Michigan and a Chartered Engineer in the United Kingdom.

He and his wife Jennie reside in Shaker Heights, Ohio with their two children.

It has come to our attention that several names were excluded from the recently published membership list. If your name was among them, please contact:

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# Upcoming Conferences of Interest

### National Telecommunications Conference

Date: November 27-29, 1979
Location: Shoreham Americana
Washington, DC
Contact: John N. Birch
Dept. of Defense
3111 Marlbough Way
College Park, MD 20740
(301) 935-0614

### Electron Device Meeting

Date: December 3-5, 1979
Location: Washington Hilton
Washington DC
Contact: Melissa Widerkehr
Courtesy Associates
1629 K Street, H.W.
Washington, DC 20006
(202) 296-8100

### International Solid State Circuits Conference

Date: February 13-15, 1980
Location: Hilton Hotel
San Francisco, California
Contact: Lewis Winner
301 Almeria Avenue
Coral Gables, FLA. 33134
(305) 446-8193

### Convergence 80
### VTS-IEEE 30th Annual Conference
### International Congress on Transportation Electronics

Date: September 15, 16, and 17, 1980
Location: Hyatt Regency
Dearborn, MI
Contact: Trevor O. Jones
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23555 Euclid Avenue
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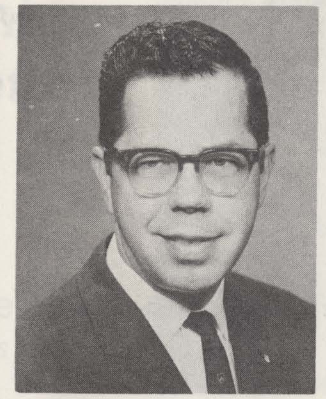
(216) 383-3644



# Chapter News



Sam McConoughey
Chapter News Editor

CHAPTER MEETINGS

CLEVELAND

"The Saga of Silver Dollar Jim and Other True Fables"
by Fred M. Link, VTS Speaker of the Year
Held on March 13, 1979 jointly with the Cleveland Section; 41 attending including 18 guests.

"Automated Marine Communications"
by John Brenner
Held on April 10, 1979 with 8 attending including 2 guests.

"Advanced Communications for the Emergency Medical Service"
by Robert Utz of Motorola
Held on May 8, 1979 with 8 attending including 2 guests.

"The Future of Automotive Electronics"
by Trevor Jones of TRW
Held on June 12, 1979 jointly with the Cleveland Section; 42 attending with 17 guests.

"Tours of National Weather Service (NOAA) and Flight Service Center (FAA) at Cleveland's Hopkins Airport"
Held on September 11, 1979 with 17 attending including 6 guests.

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ELECTION RESULTS

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| | | Sophia University<br>Department of Engineering<br>7, Kioi-Cho, Chiyoda-Ku<br>Tokyo, 102, Japan |

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COMMENTS

Summer's over . . . and we're into the 1979-80 season. Reports are that the San Francisco Area Chapter and the New York City Chapter have plans laid for the entire season - both with some very interesting programs.

Charles Higginbotham - "Charlie" has been booked at the upcoming Cleveland Chapter meeting. How about the other chapters? With the Society paying the transportation costs, are you missing a bet by not using the "Speaker of the Year" privileges?

Tokyo, Japan, Welcome - A new chapter has been added! Welcome and much success! Dr. Sakai visited President Madden and your Editor last month; and by the time this goes to print, the Tokyo Chapter of VTS will have had its first meetings.

o o o o o

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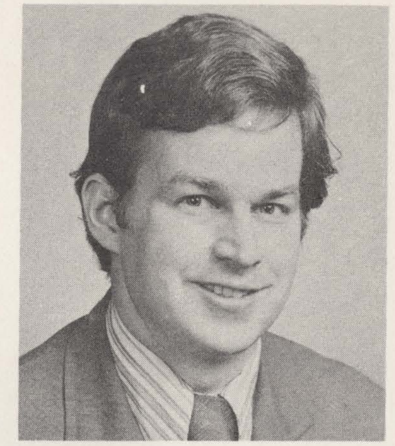
# Automotive Electronics
## Dateline: *Detroit*

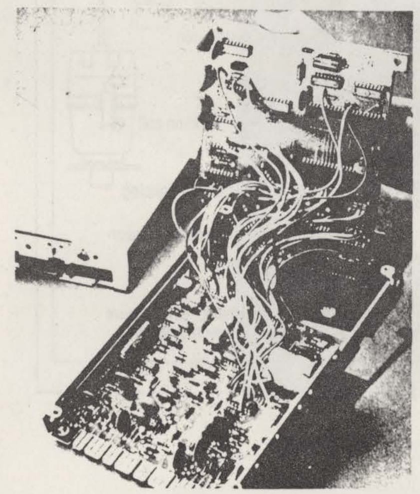


Bill Fleming
*Automotive Electronics Editor*

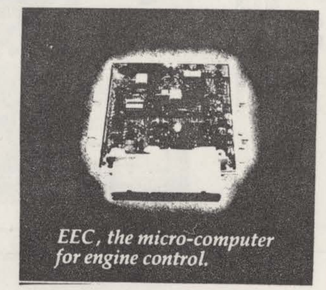
PICTURE NEWSLETTER NUMBER 5

Automotive electronics continues to grow. The value of electronic systems for engine controls alone is projected to rise from $1.2 billion in 1980 to $3 billion in 1984. In the 1981 model year, North American car makers will use approximately 300 million integrated circuits.[1]

In fact, to handle all its electronic functions in the 1981 model year, General Motors Corporation alone will use roughly 1 billion capacitors, 1 billion resistors, 800 million diodes, and 200 million integrated circuits (to produce 5.4 million cars).[1] Examples of what's already here are shown below.

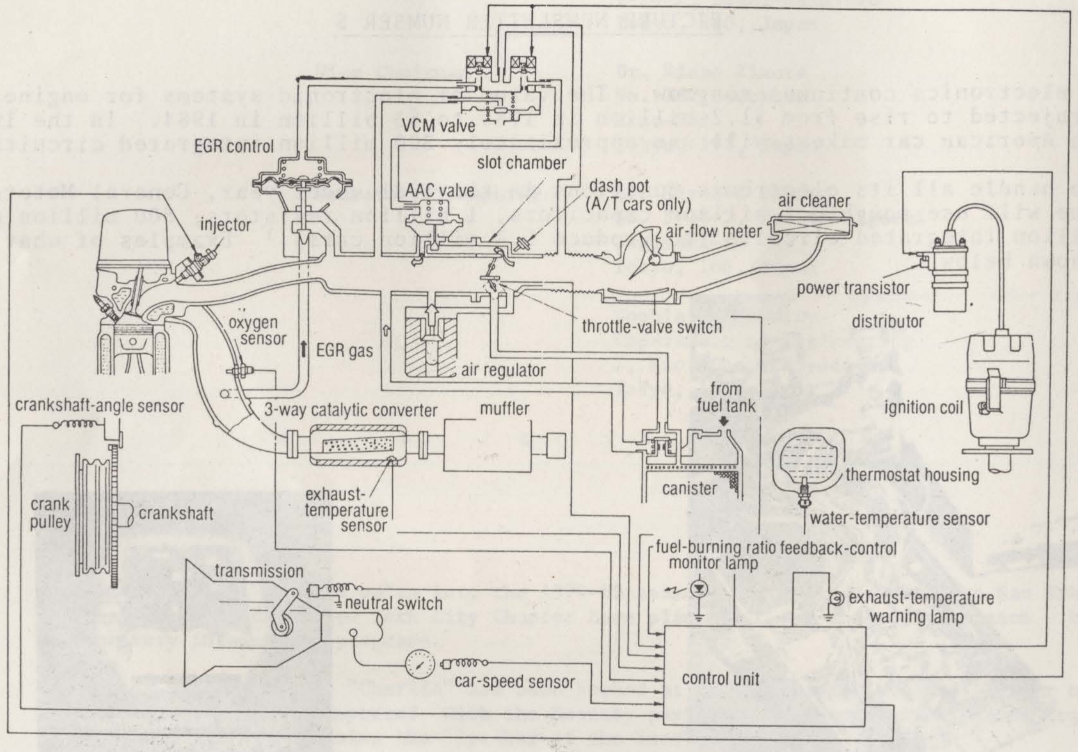


General Motors "C4" Computer[2]




Ford Motor "EEC" Computer[3]

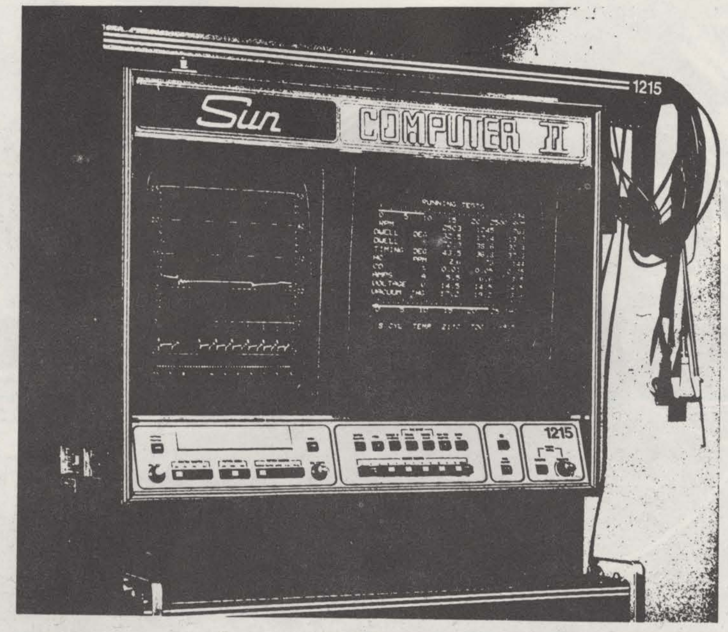
To meet government emission standards, both General Motors and Ford Motor have introduced computer engine controls -- see the May 1978 issue of this Newsletter. The General Motors "C4" (Computer-Controlled Catalytic Converter) system contains more than 250 components including 80 resistors, 33 integrated circuits, a Motorola 8-bit microprocessor, and various capacitors and diodes.[1,2] Ford Motor's EEC-2 (Electronic Engine Control) computer includes 14 integrated circuits, of which five are Toshiba large-scale-integrated chips.[1,3]




Nissan Computer Controlled Engine[4]

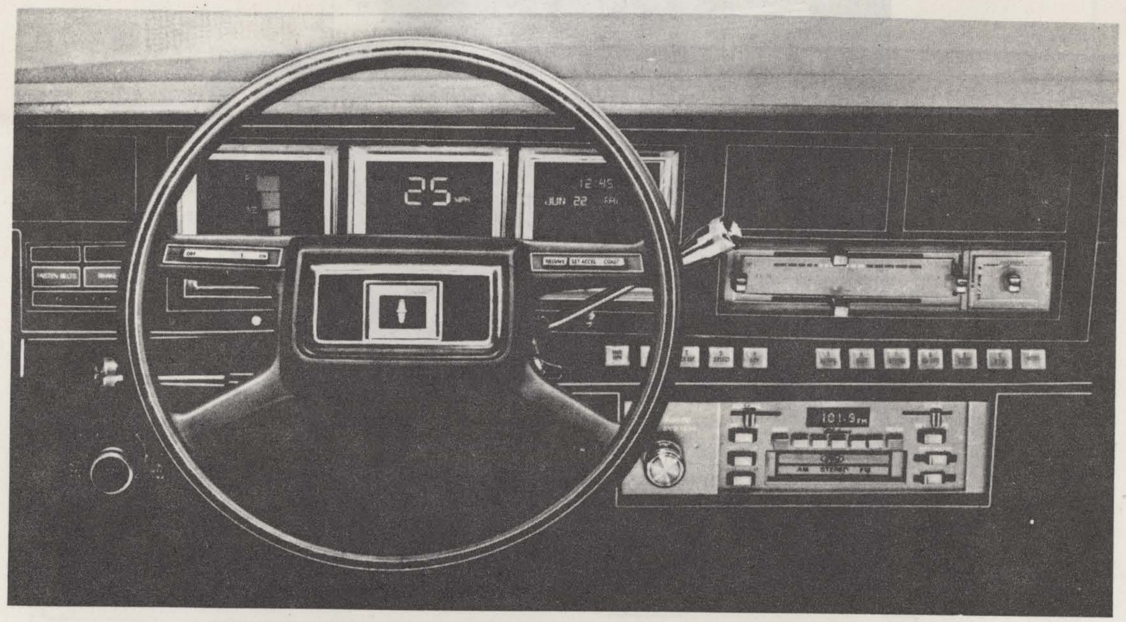
Nissan Motor's newly introduced Gloria/Cedric models will use electronic engine controls similar in concept to General Motors and Ford Motor systems. The system, shown schematically above, is called ECECS (Electronic Concentrated Engine Control System.)[4] The control unit uses a Hitachi microprocessor and Kanto Seiki electronic components. The computer has eleven functions ranging from tripmeter, stopwatch, and calculator -- to electronic shifting of automatic transmission, electronic automatic air conditioning, and anti-skid braking.






Sun Electric Engine Diagnostic Computer II[5]

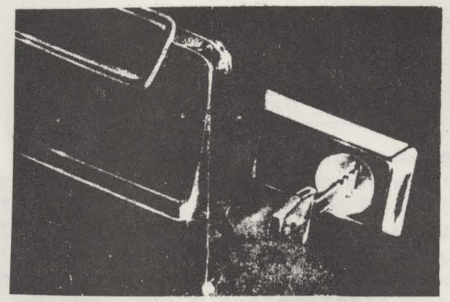
If cars are computer controlled, who will service them? Service people using microprocessor equipped engine diagnostic equipment is part of the answer. Sun Electric has introduced its Model 1215 Computer II equipment which runs an engine through three automatic test sequences. First, it analyzes starting and charging characteristics of the engine during cranking. Then, it evaluates ignition and HC/CO emissions at steady speeds. Finally, it provides cylinder-to-cylinder measurements of both compression and HC emissions.[5] Test results are continuously updated by a microprocessor and digitally displayed on a large screen. Moving bar graphs, also on this screen, graphically show current engine test speed and vacuum.



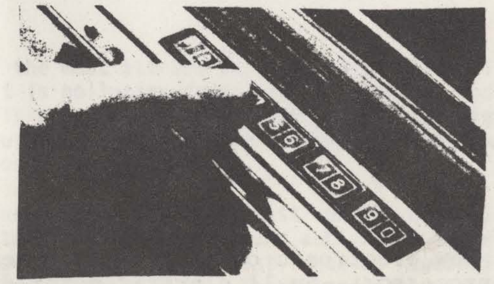
1980 Lincoln Continental Electronic Instrument Panel[6]

Looking through the upper portion of a 1980 Lincoln Continental steering wheel in the above figure, you will see, from left-to-right: a bar-chart fuel meter, the 0.8-inch-high digital speedometer, and a 20-character alphanumeric system checkout and message center.[6] This instrument panel includes two microprocessors and 23 integrated circuits. The bar-chart fuel meter is driven by an American Microsystems S2000A microprocessor plus an analog-digital chip. The speedometer is driven by a programmable logic array from Interdesign, while the message center for system checkout and timing uses a Motorola 6800 microprocessor with a 64-K read-only memory. The list price for this option will be in the neighborhood of $800.





Ford Illuminated Entry[3]



Ford Keyless Entry[3]

More electronic options available from Ford Motor are the Illuminated Entry and Keyless Entry Systems shown above. Raising the door handle turns on the interior lights and automatically surrounds the keyhole with a ring of light -- a nice nightime feature. While punching a pre-selected code number (chosen frcm 3000 possible combinations) on five backlit pushbuttons, simultaneously opens the door and also lights up the interior -- say goodbye to key fumbling.

Buick Electronic Touch Climate Control[7]

Buick's new electronic climate control replaces all vacuum harnesses with electronic wiring and a microprocessor. Small electric motor-driven actuators are electronically governed by the control panel. All dials, switches and levers have been eliminated and replaced by touch-activated finger-size panels.

The controller delays blower turn-on until the engine is warm enough to produce heated air, but permits instant air conditioning when warm temperatures exist. An infinitely variable blower eliminates the abrupt rush of air formerly experienced during blower start up. Blower speeds gradually build up to a selected level and, thereafter, blower speed changes are barely noticeable as the system maintains the chosen comfort level. Besides operator convenience and comfort, this system is also needed because engine-supplied vacuum is being systematically lowered to less usable levels because of tighter emission controls and more fuel efficient operating conditions.[7]

REFERENCES


1. W. F. Arnold, "Accelerating Need For Chips Seen Apprcaching $4 Billion by 1990," Electronics, August 30, 1979, pp 44-46.
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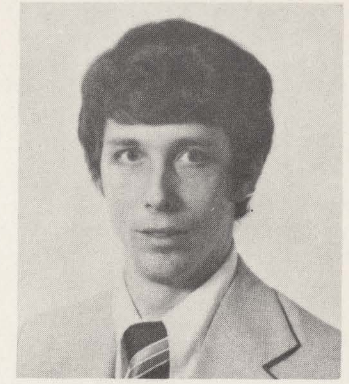
3. "Ford Motor Electrical and Electronics Division Advertisement," Automotive News, August 27, 1979, pp. 24-25.
4. "Nissan Going All The Way On Electronic Cars," Ward's Engine Update, August 3, 1979, p. 3.
5. "Sun Electric Advertisement," Automotive News, August 27, 1979, p. 13.
6. L. Marion, "Ford Dashes Get Electronic Look," Electronics, August 2, 1979, pp. 43-44.
7. "Buick Develops Electronic Touch Climate Control," Automotive Design & Development, July 1979, p. 13.




# Transportation Systems



Ronald Rule
*Transportation Systems Editor*

SPECIAL ISSUE ON MAG-LEV AND PROPULSION

Product Development Manager of Boeing's Automated Transportation Systems organization Clare Adriance is guest editing a special issue for the IEEE VTS Transaction on the subject "Application of Magnetic Levitation and Propulsion for Automated Vehicles". This issue will come out in February, 1980 and will include technical papers by German, Japanese and American authors covering experimental development in their respective countries. In most of these systems propulsion is provided by linear induction motors (LIM's) rather than conventional rotary motors connected to wheels via a drivetrain. In some of the systems running wheels are eliminated by the use of magnetic levitation techniques.

JAPAN AIR LINES HSST

One of the more advanced mag-lev systems is a new High Speed Surface Transport (HSST) currently being developed by Japan Air Lines to provide future air travelers with rapid airport-downtown transportation.

JAL's HSST is a revolutionary new transport using magnetic levitation with linear motor propulsion. The HSST can be visualized as the fuselage of a plane, floating about 10 mm above an elevated guideway, cruising at speeds of 300 k.p.h. (187.5 m.p.h.).

One of the most attractive features of the HSST is that it is pollution-free: it is noiseless and there is no vibration. Moreover, the lightweight structure can reduce energy consumption and construction costs significantly.

In January 1976, the first test vehicle HSST-01 was demonstrated to the public and achieved a target speed of 300 k.p.h. at a test track at Kawasaki near Tokyo, in February 1978. The second test vehicle HSST-02, carrying up to 8 passengers and one pilot, was successfully demonstrated to the public, at the same track at Kawasaki. JAL will be testing further prototypes in the future, including a full production size vehicle.

The HSST is expected to be installed as a new transport system between Tokyo's New International Airport at Narita and central Tokyo, one of the longest distances between an airport and a city center in the world. Its 65 kilometer distance (some 40 miles) will be covered by HSST in only 15 minutes.

Special Issue Paper

Yoshio Hikasa and Yutaka Takeuchi of JAL's HSST Engineering Group have written a technical paper for Mr. Adriance's special issue. Their paper entitled "Detail and Experimental Results of Ferromagnetic Levitation System of Japan Air Lines HSST-01/02 Vehicles" contains descriptions of both experimental vehicles, required levitation control algorithms and actual test results.

HSST-01

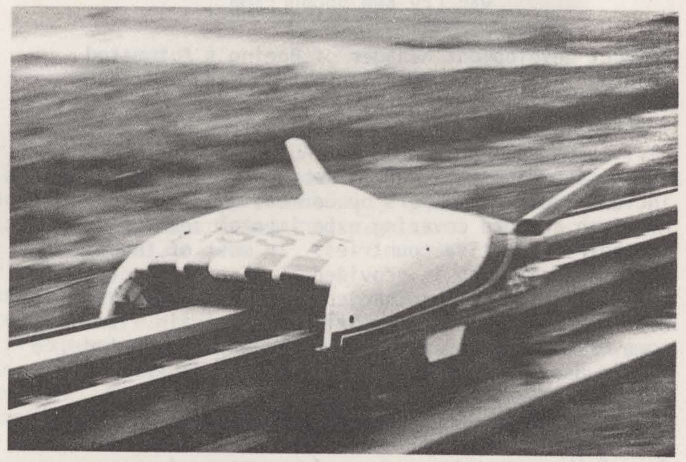
The HSST-01 weighs one ton, is 4 meters long, designed for high speed testing, incorporates eight electromagnets and a LIM with a maximum thrust of 300 kg. The levitating power supply is taken from the batteries carried on board the vehicle and the 3-phase VVVF power for the LIM propulsion is supplied from the wayside power lines through the power collector.

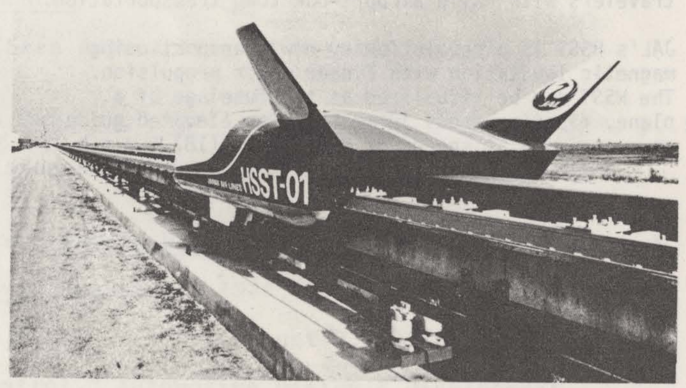
HSST-02

The 9-seated HSST-02 has a loaded weight of 2.3 tons. Major additional functions realized in the HSST-02 include: (1) The electromagnets are fitted to the flexible chassis for better riding comfort by incorporating mechanical suspension between the chassis and the body. (2) With the continuous levitation, the power for the LIM is rectified and supplied to the electromagnets jointly serving with the batteries carried on board.

Current Status

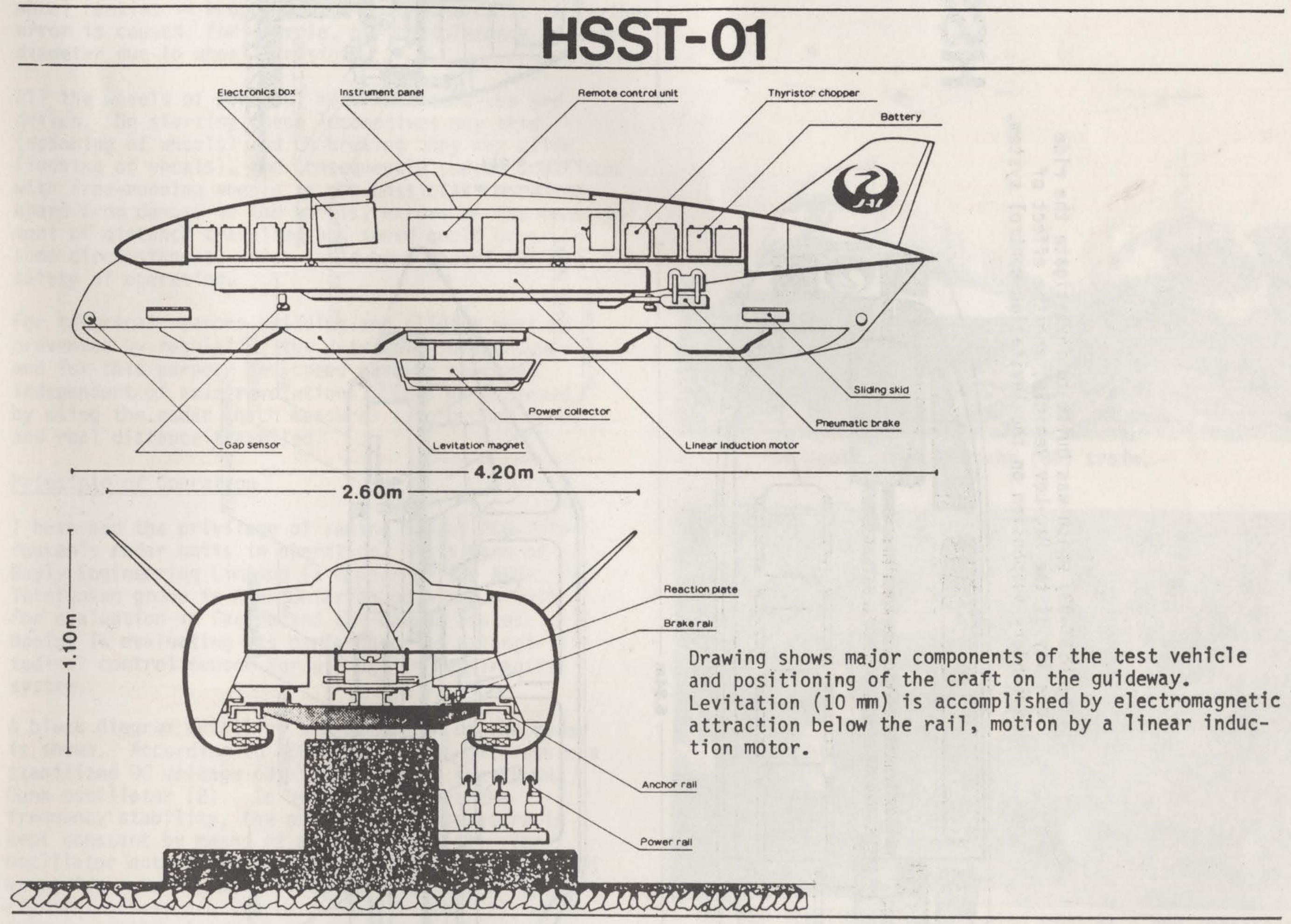
In the light of the test results so far obtained, it is shown that the predicted performances of the levitation magnets, LIM and power collector system have been satisfactorily established, and that there would be no major technical problems in the course of our future development for implementation of the HSST system toward commercial services. The design of a pre-operational test vehicle is now underway, and its test flight is scheduled to be initiated in 1980. This 80-seated pre-operational test vehicle will have test flights on a 15 kilometer test track at a target cruising speed of 300 km/h.



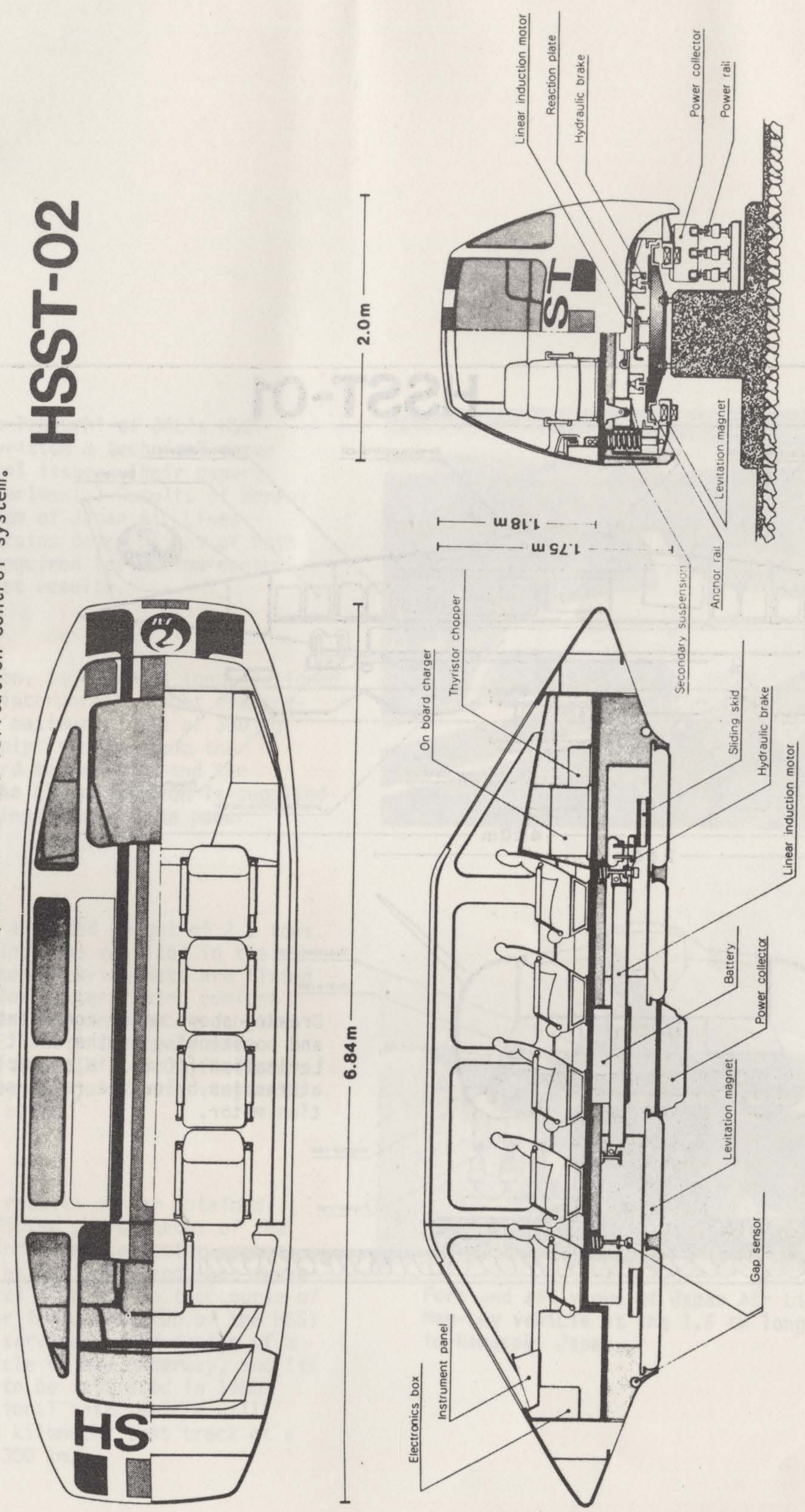



Fore and aft views of Japan Air Lines HSST-01 Mag-Lev vehicle at the 1.6 Km long test track in Kawasaki Japan.






Drawing shows major components of the test vehicle and positioning of the craft on the guideway. Levitation (10 mm) is accomplished by electromagnetic attraction below the rail, motion by a linear induction motor.




The HSST-02, which was built to investigate the ride quality of the Mag-Lev vehicle, and the effect of secondary suspension on the levitation control system.



AEG-TELEFUNKEN RADAR

AEG-Telefunken of Elisabethenstrasse, Germany has developed a non-contacting speed sensor based on radar technology. The employment of 35 GHz technology and the use of a special-purpose antenna permit the use of doppler radar techniques in rail vehicles. The radar complies with the requirement for maximum accuracy in the measurement of speed and distance traveled even under the adverse conditions prevailing in rail traffic.

According to Hans-Joachim Peters, a section chief at AEG-Telefunken, only a contactless sensor can provide reliable data in a rail system. At present the speed of rail vehicles is measured by means of pulse generators whose pulse rate is dependent on the axle revolutions. The information about the distance travelled is likewise derived from the axle revolutions. However, this information will agree with the true vehicle speed or distance travelled only if the wheel remains in proper contact with the rail. A further error is caused, for example, by the tolerance of wheel diameter due to wheel abrasion.

All the wheels of powerful modern locomotives are driven. On starting these locomotives may skid (spinning of wheels) and on braking they may slide (locking of wheels), and consequently speed comparison with free-running wheels is not possible. Moreover, apart from damage to the wheels, errors in the measurement of distance travelled and speed could occur in some circumstances, which could be a hazard for the safety of operation.

For technical reasons skidding and sliding must be prevented by regulating the driving or brake power and for this purpose the speed must be measured independent of axle revolutions. This is achieved by using the radar which measures true ground speed and real distance travelled.

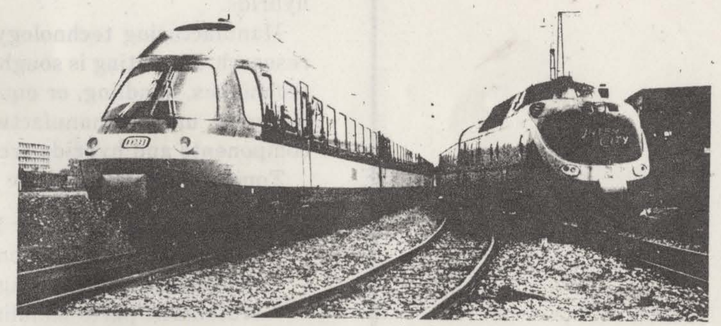
Principle of Operation

I have had the privilege of seeing one of AEG-Telefunken's radar units in operation. Ross Cann of Bayly Engineering Limited (a member of the AEG-Telefunken group in Ajax Ontario) obtained a unit for evaluation in Canada and the United States. Boeing is evaluating its performance as a longitudinal control sensor for use on its Mag-Transit system.

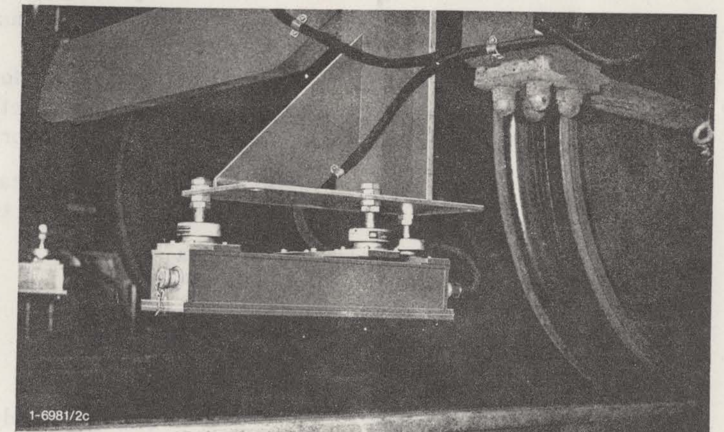
A block diagram detailing the operation of the radar is shown. According to AEG-Telefunken's literature a stabilized DC voltage (3) is applied to the 35 GHz Gunn oscillator (2). In order to improve the frequency stability, the oscillator temperature is kept constant by means of a thermostat (4). The oscillator output power is transmitted by the slotted waveguide antenna, which also receives the reflected signals. These are fed to the oscillator (2), which acts as a self-mixing oscillator, where the Doppler signal is generated. After the low-noise preamplifier (5) the sinusoidal Doppler oscillations are digitalized in the threshold switch (6). The output of this block exhibits a measurement inaccuracy of approximately 3% for speed, distance travelled and acceleration. The cause of this inaccuracy is that not all cycles of the Doppler signal can be evaluated.

Gaps in the signal occur particularly at places with phase discontinuities. But weak signals, too, whose signal-to-noise ratio is below approximately 14 dB, are not processed. A signal processor (7) which considerably improves the measurement accuracy, is connected to the threshold switch. This section features analog and digital technologies.

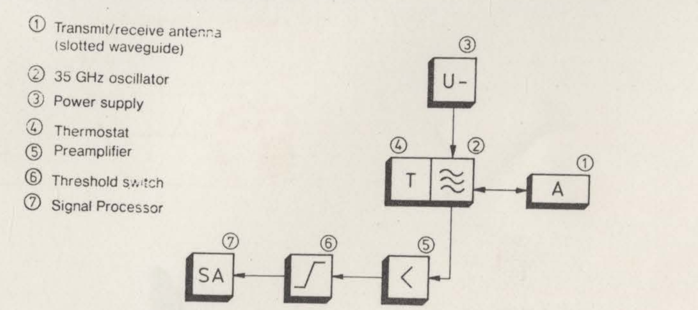
A special feature of the slotted waveguide antenna described above is the parallel radiation of the microwave power. Since the Doppler-frequency is determined by the radiation angle, too, an extremely narrow Doppler spectrum results which allows processing the signal with the required accuracy. At the chosen antenna radiation angle of approximately 39°, 192 pulses are available per meter travelled for distance measurement and 192 Hz per 1 m/sec. for speed measurement. These pulses or pulse sequences are available for further signal processing in the engine drivers cab, or for example, transmitted by a radio link to an operations control center.



The Deutsche Bundesbahn (DB) train.




The AEG-TELEFUNKEN radar being used as a non-contacting speed sensor on the locomotive.




AEG-Telefunken radar block diagram.

## IEEE Transactions on Components, Hybrids, and Manufacturing Technology

**Special Issue on Manufacturing Technology**
**September 1980**

The objective of this special issue is to encourage the publication of recent developments and unique applications of technology in the manufacture of electronic components and hybrids.

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Topics to be included are

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- Test systems for automatic component, hybrid selection.
- Maintenance systems for the automatic factory.
- Human engineering factors in the design and operation of the automatic factory.

The deadline for submittal of final papers is February 1, 1980. The Guest Editor for this issue is

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