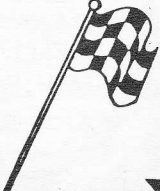


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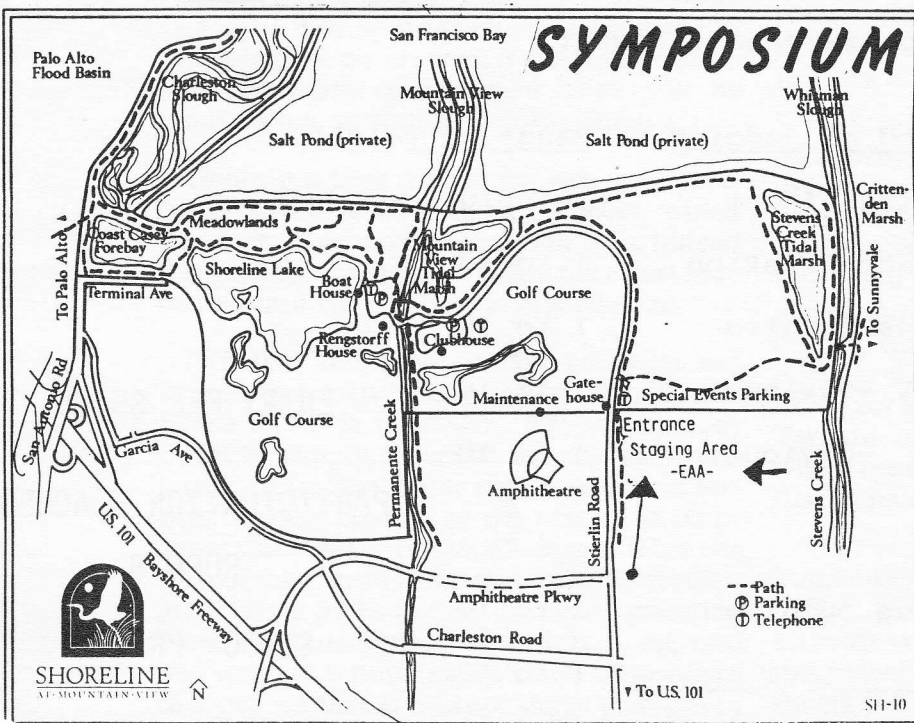
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Tackle the 'greenhouse' threat

DO WE MEAN TO keep filling the air with the gaseous effluence of the "good life" until our excess smothers us out? The world is awakening, but all too slowly, to this question, which is posed by global warming that may come with the "greenhouse effect."

Of course the slow reaction is due to the expert perception that the worst consequences are not imminent — they are in the next century and their severity is uncertain. The Earth may warm as much as 9 degrees by the year 2050, we are told, if the trend continues. But many people now alive will be around then, including today's children.

Hence it is high time to embark on a forceful program to stem such a threat, which could blight economies and ruin lives. Indeed it is getting late, in view of the time that may be required for effective remedial steps.

Whether this year's uncommon heat and drought are a small introduction to the greenhouse effect is uncertain. Maybe not; they could be simply a part of the natural undulating cycle. The major signs, read by scientists, are less obvious to the rest of us. They show a heating of perhaps 1 degree since the turn of this century. But they point to acceleration. They indicate that the rising pollution from our burning of fossil fuels — oil, coal and wood — is building up in the atmosphere to a degree that can cause sharp changes in climates. We are warned that these gases — from auto exhausts, industry and much other modern activity — may create a blanket aloft that traps the sun's heat, as under glass in a

greenhouse. The combustion of these fuels produces carbon dioxide, the chief villain in this cumulative process.

And other dangerous processes are in motion, however slowly. The protective layer of ozone gas high above the Earth has been thinning, letting in more dangerous ultraviolet rays that can cause cancer and crop damage. This erosion of ozone is attributed by scientists to release of industrial chemicals called chlorofluorocarbons. The growing problem of acid rain is tied as well to gaseous releases into the air.

It's true there is no final proof, as yet, of the dire projections made upon existing evidence, as to the greenhouse impact. But to wait for full proof might be to wait far too long for any remedies to be effective. Thus a bipartisan group of senators is working on legislation to curb the "greenhouse gases," cutting carbon dioxide emissions by 20 percent by 2000. This is in line with cutbacks called for in June at a 48-nation conference in Toronto on "The Changing Atmosphere," which concluded that there must be an eventual 50 percent reduction.

That's because, the conference report said, humanity at present "is conducting an uncontrolled, globally pervasive experiment whose ultimate consequences could be second only to a global nuclear war." Large alterations to shrink the consumption of fossil fuel need to be mapped out. Since the United States consumes a fourth of the world's energy production, it has an awesome obligation to lead the world in this difficult task.

ADVANCED VEHICLE REPORT

'With the Bedford, and now the Electric G-van, our industry can at last see that the technology is working and marketable.'

**- Jerry Mader
Executive President**

**Electric Vehicle Development Corporation,
Cupertino, California,
USA. Spring 1988**

So what is different about the market in the USA? Why are the Americans aggressively developing a market for advanced 50mph vehicles when the UK seems to be having a re-think after placing 400 into service?

Quite simply it is to do with American air standards, US Government and entrepreneurial money, imagination and much improved technology. Taken together, a potent mixture.

Clearly identifiable as the driving force behind the American electric vehicle programme are two men. Jerry Mader is Executive President of the Electric Vehicle Development Corporation of Cupertino, California.

Paul Brown is Director of the US Department of Energy's Electric and Hybrid Vehicles Division.

EVDC influences a multi-million dollar programme. DOE controls one.

EVDC has single-mindedly set itself the task of opening up a commercial van market for electrics in

North America. It relies on the support of the powerful US electricity utilities who generate and distribute power on a free-enterprise basis. EVDC now boasts membership of 37 utilities and corporations.

EVDC was set up as an offshoot of the US\$300 million dollar a year Electric Power Research Institute where Mader was PA to the President, a strong advocate of electric vehicles.

By comparison, Brown is a charming administrator of what was salvaged from the disastrous 1970's US electric car programme. This consumed \$200 million of US Government money before President Reagan cancelled it and caused a flurry of closures of embryonic electric car companies.

The US Department of Energy managed to survive the cutbacks with research programmes already in hand to develop batteries and drive systems for advanced electric road vehicles. In 1988 the spend is up to \$18 million dollars again and useful work is being done on nickel-iron and all sorts of exotic batteries and drive systems.

Indeed, the total annual spend on electric vehicles in N America is conservatively estimated at more than US\$20 millions. For that sort of money you would expect visible results.

The most visible result to date is that Chloride's advanced vehicle technology has taken the Americans by storm. When, in 1984, EVDC arranged for a comparison of batteries and electric vans from all around the world to be done prior to selecting the most marketable technology, the electric Bedford, fitted with Chloride EV Systems' latest batteries and elec-

tronics, came out the clear winner. It produced twice the stop-start range of any other electric van then available for comparative tests in America.

As a result, CEVS have established an enviable position as sole systems contractor to EVDC for an Americanised one-ton payload, full-size van.

Originally it was planned to develop the US market using the Bedford (changed to left-hand drive and re-named the Griffon). Thirty-seven of these reached American shores before Bedford pulled out the plug on its manufacturing facility in the UK. At one stroke, EVDC saw their grand plans being dashed. But the 37 vans had begun to excite the electricity utilities to such a degree that EVDC decided not to turn back.

So, very quickly, EVDC brought forward its plans to develop an electric van based on an American General Motors vehicle, the G-van.

As an electric, the G-van has the following characteristics, as tested by the Tennessee Valley Authority on behalf of EVDC.

Gross vehicle Weight	8600 lb (4.0 tons)
Payload	1800 lb (0.84 tons)
Cargo volume	256 cu. ft
Range at 35mph constant	90 miles
Range in city driving	60 miles
Top speed	53 mph
Acceleration 0-30mph	12 secs
AC energy consumption	1.0 kWh/mile

The first three concept vehicles were built by a Detroit-based 'up-fitter' called Cars and Concepts, Inc., working closely with Chloride EV Systems. Both companies seem destined to be contractors to make the next two batches of electric G-vans in 1988. However, it is EPRI which is actually dipping into



Advanced re alive and well

The American programme for commercialised with drive systems from the U

- ✓ a new 42kW Nelco laminated
- ✓ a new 'Legg' transistorised co
- ✓ a new Chloride tubular battery

But are these goodies alone 'ic
can van commercialisation progra

Answer, probably not. But add tig
ment money, and EVDC's entrep
good.

its pocket to finance the contracts, not EVDC, and they are insisting that the contracts go out to tender to 4 companies on the up-fitting side. So who wins is not yet known. Chloride look relatively fireproof.

In June this year, EPRI will place contracts. First to build between 5 and 8 vehicles which will be destructively tested as they go through the full FMVSS certification procedures involving crash tests and roll-overs. Second to build 20 to 25 vehicles for delivery in the period August - Christmas 1988.

The chargers

Chloride is supplying thyristor-controlled 3-phase chargers as floor mounted units for the G-van. They are made by what until recently was known as Chloride Legg in Wolverhampton, but which is now being moved to Peterborough.

For northern US states, Chloride have introduced a new technique which involves passing spikes of ac ripple current through the battery on charge.



Chloride's original battery for the Bedfords and Sherpas was the EV5T, a 6V monobloc with tubular plates and fitted with Autofil. It is openly marketed by Chloride in the UK under the Trekker label and carries a 2-year unconditional 2-year pro-rata guarantee.

As tested on many vans in service, a pack of 36 such monoblocs has given up to 30,000 miles spread over 4 years. Chloride say this is not quite as good as expected, but is commercially acceptable. The EV5T is certainly rated one of the best traction monoblocs in the world today, possibly the best.

An up-rated version is needed

The battery

for the G-van since it is 10% heavier as a vehicle, but is still serviced by 36 monoblocs.

The new battery is known as the 3ET205. It certainly packs more energy and power into the same cube as the following figures show:

	EV5T	3ET205
3-hour capacity	165Ah	186Ah
5-hour capacity	184Ah	205Ah
5-hour energy density	34Wh/kg	38Wh/kg
Energy output under sustained 40kW draw from a 216V pack/ per monobloc	0.94kWh	1.02kWh
Peak power at 1.0V/cell		
- fully charged	108W/kg	112W/kg
- 80% discharged	62W/kg	67W/kg
Dimensions	316 x 183 x 214mm high	
Monobloc weight	31.5kg	32.0kg
Range on G-van loaded in city driving	55miles	60miles

As to cost, both batteries are sold at current UK traction list prices, but are clearly heavily discounted into the G-van project. It

may be of interest for existing users of Bedford and Sherpa vans to know (if they don't already) that a set of 36 monoblocs together with a tray, connectors and Autofil is £4500 (list) if based on the EV5T battery, or £5100 if based on the new 3ET205. You will have to haggle hard for discounts. They are available on 4 months delivery in the UK.

If the 3ET205 battery is used on the lighter Bedford vehicle, it gives approx. 15% extra range. For the US programme, 3ET205 monoblocs will be shipped in bulk to Detroit Edison (another of EVDC's powerful backers) who will make up trays of batteries using their Powerscan subsidiary and locally-sourced trays.

Chloride will no doubt be under pressure to Americanise the technology of the 3ET205 battery but they prefer not to license it.



oad EVs are ... in the USA

Commercialising G-vans is being supported by the UK, namely:

motor,

controller/convertor package.

ent ensure that the current American commercialisation succeeds?

Intensifying air standards, US Governmental flair, and it is all looking

These will be placed by EVDC with power utilities and Government bodies for market assessment.

Once the vehicles have proved their acceptability, the name of the game is to tackle the big wide world of commercial sales. An initial batch of 200 vehicles will be made to support a launch in Autumn 1989. (That is when GM's new model year begins).

In the commercial market, EVDC are relying heavily on a market study conducted by Maritz Market Research in 1987 which

The aim is to warm up the battery more than would be provided for by the charger's gassing action. This is achieved by sending a 150 amp charge-discharge blip through the battery at every fourth ac mains ripple. A stand-alone black box of electronics effects this. Chloride have not found any evidence that it does anything but good to the performance of the battery, especially in cold climates.

identified possible annual sales of 19,000 one-ton payload vans.

This is not quite such a step into the unknown as it may appear, since the first 200 vehicles will be needed to satisfy the requirements of the utilities themselves who subscribe to EVDC. Indeed they could take ten times as many as this.

EVDC talk optimistically about reducing prices. With gasoline G-vans costing \$12-13,000, the price has got to come down to \$20,000, including a dealer margin, and as Bedford/Lucas Chloride found in the UK, it is a very tight price to achieve. It certainly does not allow components to be built in the UK and shipped out to the USA where they will incur shipping costs and import tariffs and move against a strong pound. Hence a major feature of the EVDC marketing plan is to Americanise the technology - clearly putting the CEVS involvement at risk unless Chloride can either put it into their own American factories or license the technology.

The motivation driving the American power utilities is easy to recognise. They see one G-van as providing the same electrical 'load' as 1.5 private dwellings. Also emerging in the USA is a very strong lobby pressing for electric vehicles because of air quality standards. At the latest count, 82 American cities were failing to meet current air quality standards (according to EVDC). Pressure is on everyone who generates air pollutants to 'clean up'.

Southern California Edison, one of the three driving utilities behind EVDC, is under pressure to spend US\$120 million to clean up their power station emissions. They have reacted by recommending

that part of that money would be better spent in promoting use of electric vehicles, because 90% of California's air pollution comes from road vehicles.

The California State legislature in turn has approved this Spring a demonstration budget of US\$30 million for alternative fuel vehicles, including electrics and ones powered by methanol.

By 1994, it is expected that there will be sizeable financial incentives (and penalties) in favour of clean fuel vehicles. Jerry Mader of EVDC says that he intends to capitalise on this legislation in a big way.

What is the role of General Motors in all this?

Rick Lee, the Director of Marketing for GM Truck and Bus Group, last year publicly endorsed the partnership approach with the electricity utilities. 'In my view,' he was quoted by EVDC as saying, 'this partnership is the only way that EV marketing projections can be met.'

The Americans have a distinct advantage in that they have taken over the advanced vehicle technology at a much more mature stage. Thus, the Chloride drive system package in the 37 Bedford Griffons which caused such excitement in American trials were already streets ahead in reliability compared with early electric Bedfords. And the drive system developed for the G-van, as described in the boxes, promises to set ever higher standards of excellence.

Even so, Jerry Mader says that getting the joint venture off the ground in America has been a crusade. Executives in the electricity utilities all had their own private en-

'I want the American utilities to make money selling and servicing electric vehicles. \$1.8million/yr from electricity, twice that from vehicles.'

thusiasms and hang-ups and were either 'avidly for or equally avidly against electric vehicles.'

It was only when a successful EV Commercialisation Conference was held on the (British) Queen Mary floating hotel this February, that Jerry Mader felt that 'at last he had turned the corner.'

'With the Bedford, and now the G-van,' he said, 'our industry can at last see that the technology is working and marketable.'

'I want the American utilities and EVDC to make money out of selling and servicing electric vehicles,' he goes on. 'I am telling the utilities that there are opportunities to sell 1.8 million dollars' worth of electricity each year for EV's and twice that money to be made from sales and service of the vehicles themselves.'

To that end EVDC is setting up a marketing company called EVDI which will finance the up-fitting of GM vans and place them back into the distribution network with back-up services on hand from the utilities, GM and Chloride.

So, good luck America. You have picked up the mantle without an oil shortage to help you. Everyone in the UK hopes you run with it and make a success of your commercialisation efforts.

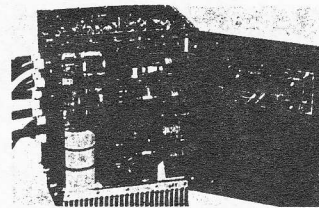
The electronics

For the G-van, Chloride decided to offer a new Mk5 system developed over a 3-year period by Chloride Legg in Wolverhampton. This has several advanced features.

- It incorporates two dc/dc converters. One is used to charge the 12V auxiliary battery. The other is a low-power convertor designed to feed the electronic system of the controller and isolate it from the auxiliaries - previously a problem area. Now, horns, windscreen wipers, flat batteries and tail lifts will not cause the vehicle speed controller to malfunction.
- Contactors are minimised except for isolation and gross over-current protection. In their place is a four-quadrant design of chopper which uses power transistors to enable the controller to switch instantaneously

from acceleration to regenerative braking. Forward/reverse is achieved by reversing the motor field using a transistor-bridge arrangement rather than switches.

- The controller, convertor, fuel gauge, battery isolators and pedal transducers are all packaged together, eliminating inter-unit wiring problems.
- Minimal use is made of expensive plugs and sockets.
- There is no series inductance used with the motor armature because there are no thyristors to commutate.
- Overall weight is reduced from 60 to 45 kg - accounted for by the elimination of the 15kg inductance.
- It is adaptable to a wide range of vehicle types and different power levels.

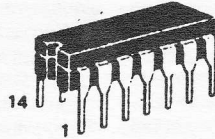


- It will be compatible with sodium sulphur batteries.
- According to reports of tests on the three concept G-vans so far delivered, the electronics package is working excellently.

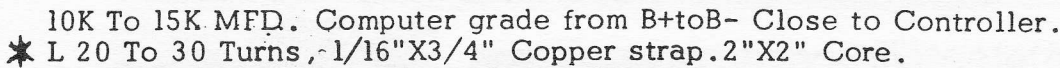
The motor

Chloride invited the Farnham-based motor manufacturer, Nelco, to design a 42kW separately-excited motor exploiting the best features of the previous CAV motor.

The G-van motor has emerged as an octagonal-yoke, laminated design with Nelco's own commutators and brush assemblies.



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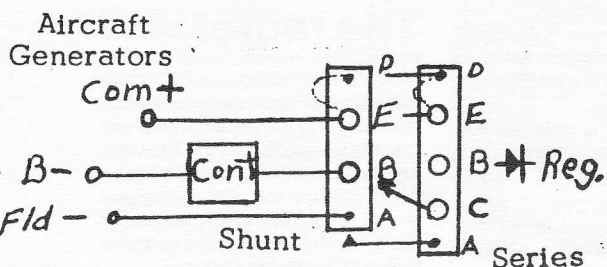
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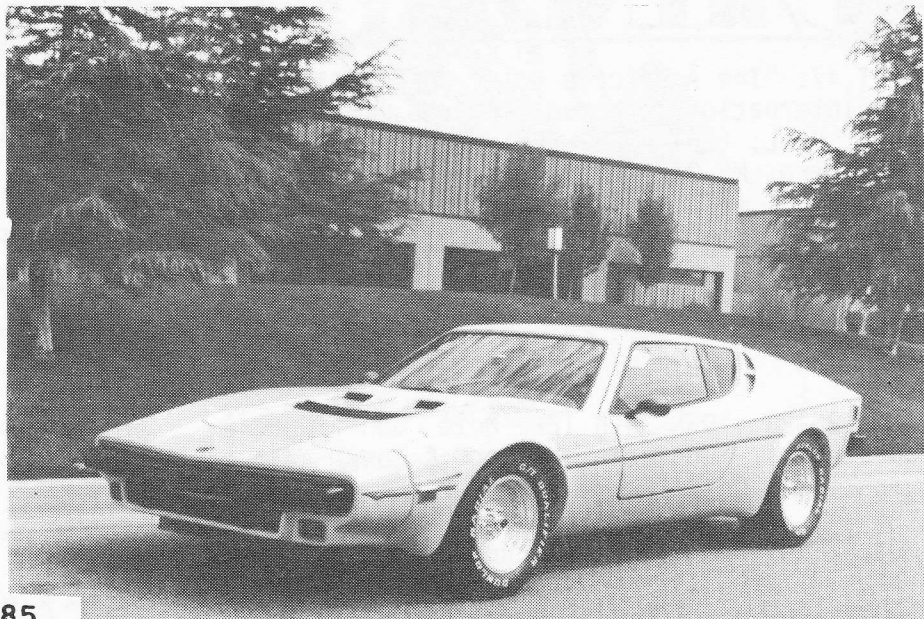
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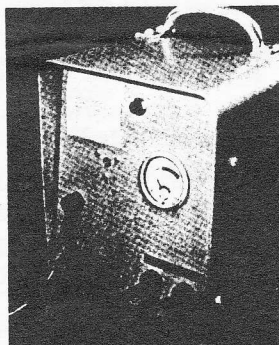
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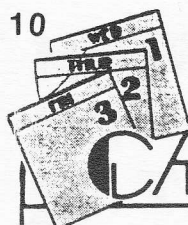
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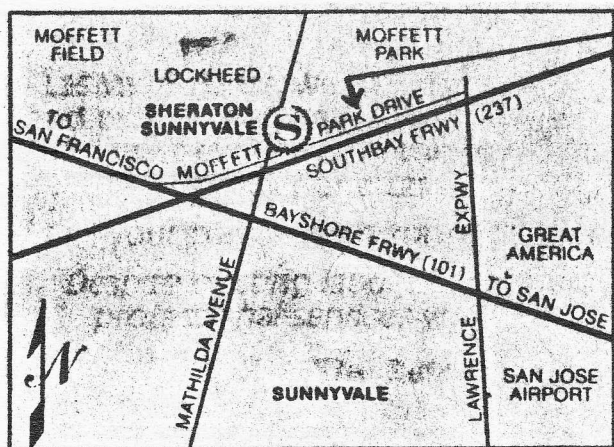
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