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**Inventor Contact**

**U.S. Department of Transportation**

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Mr. Ronald Terry Constant  
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350 West Belknap Street  
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January 15, 1989  
CONS8901

Dear Mr. Constant:

It was a pleasure meeting you on January 12, and seeing again my old friends Edmond Ramirez and Elliott Small, to review the development and testing of the EXR-1, the remarkable electric car prototype built by Mr. Ramirez.

As I recall the sequence of events, Secretary of Transportation Brock Adams, in December, 1978, called for a "reinvention of the automobile," to rethink its fuel efficiency (50 miles per gallon for the average car by 1985), pollution, comfort, and safety. Motor vehicle deaths had continued near 50,000 people per year in spite of ten years of effort of the National Highway Traffic Safety Administration in writing motor vehicle safety regulations. We had an outpouring of letters of suggestion, and I, as one with a number of inventions (although only one I had afforded to take through to a patent) helped answer these letters, subsequently continuing to the present as "Inventor Contact" for NHTSA, as a sort of ombudsman, helping inventors present their ideas to the agency, along with my main duties as a research proposer and contracts technical manager.

In this early period, Mr. Ramirez got in touch with the agency to discuss how he might make his electric car design as safe as possible. I reviewed his design, indeed visiting his shop in Dallas and driving his early "white car" vehicle. We discussed his plans for airbag restraints, for excellent brakes, for means to prevent battery hydrogen explosion (for lead/acid batteries), for an artificial sound warning when travelling at low speed or in reverse (since the electric motor made so little noise), and for the expected range and pollution implications of his design. I had earlier (March, 1979) invited Mr. Ramirez to give an "Innovator's Seminar" to the agency staff. His presentation was excellent, ending with his open request to the NHTSA staff to propose to him safety improvements for his design.

Mr. Ramirez was subsequently able to have the striking prototype EXAR-1 body designed by Pietro Frua in Italy, and to assemble the prototype that is now being considered for production. He brought this car to Washington to show to a number of members of Congress, at which time I had a ride in it, and was impressed with its comfort, maneuverability, and excellent roadworthiness.

In seeking backers to help him produce his electric car, Mr. Ramirez had been criticized that he had not formally documented its roadworthiness. I was asked to suggest a number of tests, beyond our regular safety standards, that would show the qualifications of the design. I suggested that any roadworthy electric car should have an acceleration and speed that would allow it to keep up with other traffic, and a range that would be sufficient for most daily trips. My notes indicate that a study had found that 92 percent of American car trips were less than 21 miles, with vehicle miles per day averaging less than 40 miles per household (DOT NHTSA Fact Book: Statistical Information on Highway Safety, October, 1977). To evaluate the air drag and rolling resistance of the car, important in determining the energy needed to maintain it at speed, I also suggested a "coast down" test, determining the distance covered without power as the car coasts to a stop from a road speed. These were simplified versions of the Society of Automotive Engineers Test Procedure J227a, for electric cars, with the tests started with full battery charge rather than at several charge levels, to accommodate the available test site and people availability conditions. I did not propose handling tests, and indeed NHTSA still does not have such standards. I was satisfied that the steering, tires, and suspension were within standard production range. Braking and crash safety tests are part of NHTSA regulations, and so would be met by the final mass production vehicle.

I unfortunately was not able to observe these tests, but other impartial observers did. I was satisfied that Mr. Ramirez, even with his heavy (steel body instead of plastic over a steel frame) prototype, had produced an electric car with capabilities still not available in other designs. The range test was at constant 55 mph speed; the EXAR-1 passed 75 miles before Mr. Ramirez brought it to a stop - before its limit. A gasoline engine car has a significantly greater range at a steady 55 mph than with stop and go driving. This is considerably less true for an electric car. An electric car uses no energy while stopped at red lights, and recovers some of its energy by regenerative braking, using its electric motor as a generator in coming to a stop. Mr. Ramirez, with his computer background, has been questioned as to how he could be a car designer. I feel that his computer experience significantly aided his control and power design. In vehicle design, he has had the open mind to reinvent the car, ending with a design with far fewer parts, and a construction plan without much of the expensive tooling of the standard car. Several years after he finished the EXAR-1, the design is still very attractive, and ahead of any designs that I have heard of as being prepared for production.

I am sending this letter to you on my own letterhead, since you have requested a prompt response, although I am also starting it on NHTSA letterhead through the bureaucratic process for approval for release. I am also sending you, under separate cover, a number of my papers, in which you expressed interest. Please feel free to call or write if I can be of further help.

Sincerely,

Carl C. Clark

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*Memorandum*

**SUBJECT:** Report on the Innovator's Seminar #1:  
the Amectran Electric Car

**DATE:** 19790307

In reply refer to:  
NRD-12-CC79012

**FROM :** Carl C. Clark, Inventor Contact  
Office of Passenger Vehicle Research, R&D  
(NHTSA Code NRD-12, Washington, DC 20590, 202-426-4862)

**TO :** Dr. R. Rhoads Stephenson, Associate Administrator, Research and Development

**cc:** Secretary Adams; Administrator Claybrook; Theodore Lettes, National Coordinator, Technology Commercialization, Office of Minority Business Enterprise, Dept. of Commerce; Booker T. Washington Foundation; Edmond Ramirez, President, Amectran. Elliott Small.

**Attachment:** Announcement of Innovator's Seminar #1, document NRD-12-CC79010

This is a public document. I am expressing my own viewpoint and not that of the Administration.

**Background on the concept of an Innovator's Seminar:**

Inventors have great difficulty finding support for development of their ideas. If they go to the big companies, they are asked to sign a waiver recognizing that the company may well have been doing related work before they are allowed to make their disclosures. The government also, through competitive contracts, primarily funds its own statements of its research needs, which have moved up in priority in its long range research plan. This Administration for example awards only about 1% of its research funds to unsolicited proposals, to concepts and people (capabilities) so outstanding that they are selected even though the ideas are outside our research plan ("not invented here"). I have suggested to you my personal view that this support of innovation should be increased to 10% of our research funds, with the recognition of the increased risk that more of the supported research would not work out. To seek innovation is to accept risk. To accept risk for a worthy goal is to fail much of the time but possibly to succeed gloriously. This is not the usual bureaucratic practice. (I personally feel that I am not working hard enough or aiming high enough if I am successful in all that I try. My view is to be successful one must try those things for which failure is typically expected...) The small inventor today typically gets no support from Government, personally sacrifices to get a patent, finds small private support to get prototype development, and then gets the larger private support for production, if he is successful. Most are not.

I have been helping answer the 300 or so letters and many telephone calls that have come in to Secretary Adams in response to his call for reinventing the automobile. Secretary Adams notes that many (most?) innovative ideas for cars come from outside the automotive industry. Yet he also emphasizes that to bring ideas to production, we must work with the industry. Seeing the many ideas outside of the major automobile laboratories, with the approval of

Dr. Kennerly Digges, Director of the Office of Passenger Vehicle Research, I have started the Innovator's Seminars as a means for NHTSA staff to

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to meet with innovators and learn their problems, to give us the background to recommend better means for government support of innovation, and better means of cooperation with the large automotive companies so that these best innovations can be brought to mass production. I am impressed with the statement of Paul Miller, retired President of the Eaton Corporation, (Ward's AutoWorld, page 17, August 1978), "... regulations threaten to replace initiative in American design engineering and to channel invaluable creativity into "compliance engineering". ... We cannot enhance the American automotive industry by mandating its progress on the assumption that government regulations furnish the eternal spring of virtue and wisdom in automotive design." In another context, I have suggested a means to drastically reduce automobile regulations (document NRD-12-CC77015). In any case, we clearly must get out of the competitive, backward looking, and into the cooperative, forward looking, research with innovators and the mass production industry, at least in the energy efficiency and safety areas. It is my impression that the majority of our research work is to "discover" in public, to justify regulations, what the automobile companies learned in private several years earlier. How indeed can we change this, to help the small innovator and to work together with industry in energy efficiency and safety? I shall attempt to have a research person from a major automobile company address the next Innovator's Seminar.

**Innovator's Seminar #1: The Ametran Electric Car.**

The seminar was held in the Federal Highway Administration Training Conference Room, 5405, in order to use their generously provided videotape equipment, etc. Mr. Ramirez brought three staff people with him, and a Canadian investor. Some 14 others attended part of the seminar, which continued without a lunch break until almost 2 pm, with three from NHTSA still present. (Dennis Greider, Steve Pierce, and Carl Clark). James Hackney, Head, Structures Branch, left shortly before.

The Department of Energy report "State of the Art Assessment of Electric and Hybrid Vehicles," Reprinted February 1978, presents an Ametran 1976 prototype in Table 3-15, with literature data, I understand verified at least in part by a visit of John Howe, Jet Propulsion Laboratory, whose phone I understand is 213-577-9184. I have not yet reached Mr. Howe. The Table gives the Ametran prototype as 4 passenger, 180 inches long, curb weight of 4360 pounds of which 1700 pounds are batteries, a 13 HP direct drive DC motor, a maximum speed of 70 mph, and a range of 100 miles at 55 mph. Acceleration is not given. This is the best performance, for usual car uses, of the 63 cars given.

Mr. Ramirez emphasized his "ground,up" design, not using a conventional car with the substitution of an electric motor and batteries. At each step, he, with General Electric, LTV, and Goodyear contracts or support, (and others) has sought the long life, low rolling resistance, high energy efficiency design. (General Electric is interested in providing motors, controls, batteries and chargers for the coming electric car production. I spoke with William Brighton, Electric Vehicle Systems Division, GE, Salem, VA (804-973-1851 x315.) He has made three visits to Ametran, sold them three motors especially designed for electric cars, and ridden twice in

prototype vehicles coming from the airport, at speeds up to 70 mph and with "snappy" acceleration. He cannot verify their range. I also talked with David Gilmore, LTV Corporation, Vought Division, 214-266-3906, who as Electric Vehicle Project Manager a year ago evaluated Amectran and other electric cars. LTV has not had contracts with Amectran. Mr. Gilmore considers the Amectran design excellent and easily maintained. He rode in a prototype for 35 miles at 60 to 75 mph, with good acceleration and easy hill climbing capability. He calculates the prototype range at 89 miles at 55 mph, from his analyses. He is willing to come to Washington to describe his experiences with and analyses of Amectran.)

After the range (and Mr. Ramirez said that with the production car improvements he expects 100 miles range even in stop and go driving) the cost of establishing production has been a source of controversy. Detroit needs \$200 million to establish a new automobile plant. Mr. Ramirez presented their factory plan, with \$0.6 million for a 15,000 square foot building and land, \$0.8 million for assembly equipment; \$1. million for the body vacuum forming equipment (using Kevlar reinforced acrylic, although other composites are also being examined), and \$0.6 million working capital. Particularly interesting is their community involvement approach. Most of the 160 people to operate a factory would be employed and trained locally, with government support in this job creation effort. The staff would attain partial ownership, an important work incentive. Once operational, in less than 30 months, one plant could make 5000 cars per year - for this car has 500 parts compared to the 8000 of the Detroit design. The plant could maintain its staff with 1250 car sales per year. The plant will serve as the dealer. The car price is intended at cost plus \$800.; if Amectran can get 100,000 orders (with \$400. placed in escrow to hold the order) with consequent economies of scale, the goal is to sell the car for \$6000. (1978 dollars...).

A representative frame design was presented, of 4130 chromalloy tubing, welded, with three roll bars of bent tubing, and with x-ray inspection. The bumper/controlled yield front members/foam crashworthiness design was only mentioned. Airbag restraints will be used. The oversize large diameter tires of low rolling resistance (40 psi) contribute to crashworthiness, and serve as flywheels in smoothing motor control. A production gross weight of 2800 pounds is planned. With 96% of driving trips less than 30 miles, the 100 mile range is considered saleable, and nickel/zinc (200 mile range) or other advanced batteries may be available in less than 4 years.

Videotapes of the prototype were shown - including one stopping by the police for speeding. But the perils financial of small business were also apparent from the presentation. Their one car is now in Italy for the hand molding of the steel version of the Frua body. If enough orders can be received and financing obtained (some \$600,000., with other loan guarantees in hand), the first factory will be built. Its first output (with the Kevlar body rather than steel) would be the first true production cars. The steel body will serve as the mold for the Kevlar/ acrylic body.

Mr. Ramirez particularly stressed his capabilities and interest in using best rather than cheapest components and designs. He welcomes suggestions on ways to make his car better. Even after production is started, changes of design can be tested quite rapidly. A number of questions were answered. Interest in documenting his plastic body construction techniques, possibly in response to an unsolicited proposal, was expressed. Steve Pierce, who is contract technical manager of the Dynamic Science contract to crash test electric vehicles for the Department of Energy, and James Hackney, Head of the Structures Branch, expressed interest in having early production vehicles for testing.

(Paul Brown, Assistant Director for Electric and Hybrid Vehicles, Department of Energy, 202-376-4681, today told me that the two "Near Term Electric Vehicles" (NTEV) contracts of \$6 million each for three vehicles each are moving toward completion of the vehicles this summer. General Electric and Chrysler, and Garrett, Budd, and others, won the two contracts to build totally new (ground, up) electric vehicles (Garrett's with a flywheel). General Electric is using the Darlington diode for more efficient control. Where the typical electric car today is getting 40 miles of stop and go range, or 140 miles at a steady 30 mph, the new GE design will get 80 miles of stop and go range.)

In conclusion

I consider the Innovator's Seminar #1 a success in helping us begin to see the problems of innovators in getting new ideas into structure, test, and production. I am satisfied that Mr. Ramirez and Amctran have a significant design, with a credible production and marketing plan. This is now a very critical period financially for Amctran, for they must now raise the money to justify the loan guarantees to be able to build their first factory and create their first jobs. As an individual, may I recommend that you and/or Secretary Adams consider awarding a contract to Amctran (for 10 early production vehicles for our testing?) to put on the public record the consequences of their work thus far (particularly in crashworthiness, handling, maintainability, and other safety aspects) and possibly to discover needed improvements which then could then be incorporated into production.

*Carl C. Clark*

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