

Testimony of the

American Automobile Manufacturers Association

at the

California Air Resources Board Hearing to Consider Ford Motor Company's  
Petition for Limited Relief from 1994/1995 On-Board Diagnostic II Provisions

July 9, 1993

Good morning/afternoon. My name is Dr. Richard Klimisch, and I am Vice President of the Engineering Affairs Division of the American Automobile Manufacturers Association (AAMA).

Over the past four years, AAMA member companies have devoted tremendous effort and resources toward developing Onboard Diagnostic (OBD II) systems which comply with the various requirements of this technology-forcing regulation and perform reliably in customer vehicles. To say the least, the challenge that this regulation has given manufacturers has been major, especially in light of the short time period between the development of the technology and the implementation of that technology in customer vehicles. This is further complicated by the fact that the feasibility of some of the requirements still needs to be demonstrated. Two prime examples are the feasibility of OBD II on low-emission vehicles and the expanded misfire monitoring requirements for 1997 and beyond. However, member companies have been diligent in evaluating and implementing the best-available technology.

CARB Staff's 1994 Model Year Proposal

With regard to the issue being addressed at this hearing today, AAMA fully supports CARB Staff's proposed modification to the OBD II regulation for the 1994 model year.

That is, specifically, to give the Executive Officer the authority to waive one or more of the requirements of the OBD II regulation. We understand this determination will be based on a manufacturer's demonstration of a "good-faith" effort to meet all of the regulation's requirements, and that the resultant system will be a much more effective diagnostic system than OBD I.

AAMA member companies have demonstrated this good-faith effort in evaluating a wide range of technologies over these last few years. Examples of such efforts include an in-depth evaluation of the Magnetostrictive Misfire Sensor promoted by Technical Advances Inc., in which a direct comparison of the sensor's performance with a manufacturer's system was evaluated over a wide range of operating conditions. An earlier evaluation was conducted on ~~Purdue University's misfire detection algorithm.~~ The USCAR Low Emission Partnership research consortium has developed an "Evaluation Procedure for OBD II Misfire Detection Concepts" and intends to evaluate misfire detection systems, including an updated version of the Purdue algorithm. Also, member companies have conducted in-depth research on statistical techniques for determining if a component is malfunctioning. Such techniques would not only improve the performance of the monitoring system, but would reduce the likelihood of false illuminations of the "check engine" light, which, as you know, jeopardize the public's acceptance of the light and conditions them to ignore illumination.

These are but a few examples of member companies' efforts to evaluate and develop new technologies to comply with these requirements. Under the USCAR umbrella, member companies have been sharing ideas on the various technical issues, and their efforts should definitely be characterized as "good-faith."

CARB Staff's 1995 Model Year Proposal

With regard to the Staff's proposal for the 1995 model year, AAMA member companies are opposed to monetary penalties for OBD II system deficiencies. We oppose this provision for several reasons.

First, the requirements in the OBD II regulation are "technology-forcing." Given this fact, CARB Staff has the responsibility to determine the feasibility of the various requirements in the regulation, as well as the responsibility to evaluate a full-line manufacturer's ability to implement these requirements across its entire product line. AAMA is concerned that Monetary penalties will become a surrogate for the feasibility requirement, in that manufacturers will have to pay penalties to sell their vehicles in California, even though it may not have been feasible for them to meet all of the requirements on every engine, given the short lead-time and the complexity of the requirements.

Next, the regulation required that manufacturers apply for waivers from OBD II requirements for the 1994 and 1995 model years before October 15, 1991. This early waiver decision increases manufacturers' risk of non-compliance. Decisions had to be made with little data on this technology-forcing requirement. To penalize a manufacturer for trying, will only ensure that manufacturers will always err on the "safe" side by seeking the waiver early should similar circumstances occur in the future.

Also, the demonstration of the feasibility of the OBD II requirements on one or a few vehicle applications does not mean that it will be feasible for all vehicle applications. Unique problems may occur on certain engine families which were not present when the same OBD II technology was successfully implemented on other engine designs.

Next, AAMA does not believe that penalties are necessary. A substantially-compliant OBD II system will most likely have the same, or similar, hardware and software installed on the vehicle as compared to a fully-compliant system, and the manufacturer will probably have used the same amount of resources in developing the system.

As a result of these concerns, AAMA recommends that the Board modify the requirements for the 1995 model year to be consistent with the proposal for 1994, essentially allowing the Executive Officer to approve partially-compliant systems based on a "good-faith" effort demonstrated by the manufacturer, without imposition of a monetary penalty.

This concludes AAMA's prepared statement. Representatives from AAMA member companies can join me now to answer your questions or, if the Board prefers, questions could be deferred until after all the AAMA member companies have had an opportunity to testify.



Kelly M. Brown  
Director  
Automotive Emissions and  
Fuel Economy Office  
Environmental and Safety  
Engineering Staff

Ford Motor Company  
The American Road  
Dearborn, Michigan 48121

July 6, 1993

California Air Resources Board  
Board Secretary  
P.O. Box 2815  
Sacramento, CA 95821

Dear Board Member:

Attached are Ford comments regarding proposed revisions to CARB's On-Board Diagnostic (OBD II) requirements contained in Mail-Out #93-27. This Mail-Out was in response to Ford's petition for approval of our partially compliant 1994 Model Year OBD II system. Comments pertain to CARB's proposed regulatory language which covers this issue for the 1994 and 1995 model years, as well as the supporting rationale in CARB's Staff report.

Ford strongly supports CARB's proposal to allow OBD II system deficiencies in one or more areas on 1994 model year vehicles without penalty, with carryover provisions of those vehicle applications into 1995 without penalty. This allowance would be based on the extent the OBD II requirements were satisfied, the extent to which the resultant diagnostic system will be more effective than OBD I, and a demonstrated good-faith effort by the manufacturer to meet all of the requirements.

Ford appreciates CARB Staff's assistance on this matter and looks forward to the upcoming Hearing on July 8.

Sincerely,

*Kelly M. Brown*  
K. M. Brown

Attachment



FORD MOTOR COMPANY

RESPONSE TO MAIL-OUT #93-27

NOTICE OF PUBLIC HEARING TO CONSIDER FORD MOTOR COMPANY'S  
PETITION FOR LIMITED RELIEF FROM 1994/1995 ON-BOARD  
DIAGNOSTIC II (OBD II) PROVISIONS

Ford Motor Company (Ford) is pleased to provide the following comments regarding ARB Staff's proposed OBD II regulatory amendments and supporting rationale contained in the Staff report as a result of our petition. Ford appreciates ARB Staff working with us on this issue. Staff's cooperation has allowed Ford to take an aggressive approach in introducing vehicles with enhanced on-board diagnostic capability before full implementation is required in the 1996 model year. This cooperative effort will allow Ford to gain the much needed in-use experience which is expected to result in robust OBD II system designs capable of properly detecting emission-related malfunctions in a timely manner and will provide the people of California the air quality benefits associated with OBD II technology at an accelerated pace.

Summary

Ford strongly supports Staff's proposal to allow the Executive Officer to approve partially-compliant OBD II systems for the 1994 model year if a manufacturer has demonstrated a good-faith effort in meeting all of the requirements and the resultant diagnostic system design is more effective than OBD I. Ford also supports Staff's proposal to allow carryover of the 1994 model year vehicle applications with such a system into the 1995 model year without penalty such that resources can be better used to ensure that newly introduced 1995 model year OBD II applications are fully compliant. However, Ford recommends that the proposed wording in Section (m) (6.1) be modified to reflect this allowance. Ford also recommends that the Executive Officer have the authority to approve partially-compliant 1995 model year applications consistent

with the requirements contained in proposed Section (m) (6.0) for the 1994 model year.

1994 Model Year Proposal

Ford strongly supports Staff's proposal to give the Executive Officer the authority to waive one or more of the requirements of the OBD II regulation for the 1994 model year. Ford also supports Staff's rationale justifying such a waiver: (1) Most OBD II requirements are satisfied by the substantially compliant systems; (2) The substantially compliant diagnostic system will be a more effective monitor than OBD I; and (3) The applicant has demonstrated a good-faith effort to meet the requirements in full by evaluating and considering the best available monitoring technology.

Ford agrees with Staff's assessment that we have demonstrated a good-faith effort in meeting all of the requirements for the 1994 model year. Our design efforts focused on developing a robust OBD II system which not only attempted to meet all of the requirements in the regulation, but minimized jeopardizing customer acceptance of OBD II due to false Malfunction Indicator Light (MIL) illuminations. However, our efforts came up short with regards to misfire monitoring and a functional check of the purge solenoid. These systems will not be fully compliant in 1994, but we are making a concerted effort to improve these systems so they will be fully compliant on the new 1995 model year OBD II applications.

As stated in our petition, such relief is necessary because, at this late date, it is impossible for us to modify our production plans for the 1994 model year vehicles and go back to the first generation onboard diagnostic OBD I system. Further, even if production plans could be

reversed, our enhanced monitoring system, even with its acknowledged limitations, is vastly more effective than the OBD I system, resulting in an air quality benefit which would not be realized if Staff's proposed 1994 model year OBD II regulatory modifications are not adopted and these vehicles are excluded from California's marketplace.

We felt it was important to introduce OBD II equipped vehicles as early as possible in order to gain real-world in-use experience before full implementation is required in 1996. We undertook this effort even in light of the risks involved due to the technology-forcing nature of this regulation. Technology was literally being developed as it was being implemented for production. There was no room for errors or incorrect assumptions. Staff's proposed modification to the regulation for the 1994 model year vehicles does not penalize Ford or other manufacturers who took this aggressive approach in introducing vehicles with OBD II as early as possible. Also, excluding these vehicles from the marketplace would be counter-productive, as Ford's partially compliant OBD II system is much more effective than OBD I in detecting and diagnosing emission-related powertrain malfunction and deterioration.

*As a result, Ford recommends that the Board adopt Staff's proposed wording as contained in Appendix B of the Staff report (Section 1968.1 (m) (6.0)), which will allow OBD II system deficiencies in one or more areas on 1994 model year vehicles without penalty upon a showing of a good-faith effort.*

1994 Model Year Carryover into 1995

Ford supports Staff's proposal to allow carryover of the 1994 model year vehicle applications into the 1995 model year without requiring that they be updated to full compliance and without penalty. First, as discussed below, allowing manufacturers to use substantially-compliant OBD II systems without penalty does not disadvantage manufacturers who develop fully-compliant systems because both will probably have incurred roughly the same costs. Secondly, as noted in Staff's report, it is better for manufacturers to use their resources to ensure that newly introduced 1995 model year OBD II systems are fully compliant rather than recommit those resources to modify 1994 model year designs. This will allow Ford to concentrate on updating existing OBD I vehicle applications to be fully compliant OBD II systems in 1995, resulting in an increased air quality benefit when compared to committing part of those same resources to update the vastly-compliant 1994 model year vehicles after only one year. However, the proposed wording in Section 1968.1 (m) (6.1) does not appear to cover the carryover allowance. As a result, should a modification be adopted, *Ford recommends that the proposed wording in Section 1968.1 (m) (6.1) be modified to specifically accommodate Staff's intention to allow carryover of the 1994 model OBD II vehicle applications into the 1995 model year without penalty.*

1995 Model Year Proposal

Ford is concerned about Staff's proposal to impose monetary penalties for each OBD II system deficiency on new 1995 model year vehicle applications. Due to the technological-forcing nature of this regulation, the extreme risk exists that a manufacturer making a good-faith effort to fully meet the requirements will come up short of the requirements. Unique problems could occur on individual engine families which did not arise when the same technology was successfully implemented on other engine families.

Although Ford expects its new 1995 model year OBD II vehicle applications to be fully-compliant, we believe that penalties are unnecessary and possibly counter-productive. Penalties are unnecessary because manufacturers who have in good faith developed a partially-compliant system will most-likely have incurred the same costs as those who develop fully-compliant systems. These systems will likely have the same hardware and software required for a fully-compliant system - which of itself is a cost penalty compared to a competitive vehicle with an OBD I system. The penalties could be counter-productive to the extent they provide a disincentive to aggressive phase-in of OBD II systems. A partially-compliant OBD II system is a much better diagnostic system than the OBD I system. Finally, since manufacturers could have retained OBD I, received a waiver from OBD II and incurred no penalty, the penalty only impacts those manufacturers who took an aggressive approach to get OBD II out on more car-lines before 1996.

*In light of these concerns, Ford recommends that the Board adopt regulatory language for the 1995 model year which is consistent with the proposed modification for the 1994 model year, and allow the Executive Officer the discretion to approve partially compliant OBD II systems for 1995 as long as a manufacturer has shown a good-faith effort in meeting all of the requirements and the diagnostic system design will be more effective than OBD I.*



**GENERAL MOTORS**  
**STATEMENT TO THE**  
**CALIFORNIA AIR RESOURCES BOARD (CARB)**  
**REGARDING ON-BOARD DIAGNOSTIC REGULATORY AMENDMENTS**  
**IN CARB MAIL OUT #93-27**  
**SACRAMENTO, CALIFORNIA**  
**JULY 9, 1993**

**GENERAL MOTORS  
STATEMENT TO THE  
CALIFORNIA AIR RESOURCES BOARD (CARB)  
REGARDING ON-BOARD DIAGNOSTIC REGULATORY AMENDMENTS  
IN CARB MAIL OUT #93-27, JULY 9, 1993**

Introduction

General Motors (GM) appreciates this opportunity to comment on Ford's petition for relief from 1994 and 1995 model year On-Board Diagnostic (OBD II) requirements. GM supports the statement of the American Automobile Manufacturers Association (AAMA) presented at the CARB Hearing. GM also supports the Ford petition for relief based on good-faith effort for the early implementation years of the OBD II regulations.

Due to the technology forcing nature of the OBD II requirements, the CARB proposal to assess fines for 1995 model year vehicles which fail to comply with one or more of the OBD II requirements is not appropriate. The CARB has the obligation to determine that no alternative considered by the agency would be more effective in carrying out the purpose for which the regulations are proposed or would be as effective and less burdensome than the proposed action. Since 1995 model year hardware and software are already frozen, providing relief for the 1995 model year based on good-faith effort would be as effective and less burdensome than the proposal to assess fines.

Discussion for the 1994 Model Year

As stated in the CARB Staff Report, the OBD II "requirements have been considered technology-forcing by ... the CARB," and "it was not unexpected that some manufacturers would have difficulty in initially complying with the regulation ..." The CARB Staff Report has proposed acceptance of 1994 model year vehicles which fail to comply with one or more of the OBD II requirements without fines or penalty for several reasons:

First, to deny certification of engine families that fall short of the requirements would preclude introduction of OBD systems that are significantly more sophisticated than what would otherwise be produced.

Second, withholding certification when a good-faith effort has been made to comply with the regulation but full compliance has fallen slightly short would penalize manufacturers for maintaining an aggressive plan to implement OBD II.

Third, it is unlikely that development efforts by those manufacturers which will be able to implement fully compliant systems will be characterized as unnecessary or wasted since such early efforts will ensure high reliability of OBD II systems in-use and reduce workload when 100 percent implementation is required in 1996.

Fourth, manufacturers falling slightly short on their 1994 systems will not realize any economic or competitive advantage over manufacturers producing compliant systems because as much additional hardware will be used and equal developmental and software design expenses are likely to have been incurred.

Fifth, the CARB staff is aware of most OBD II development hurdles and the solutions employed to overcome them; therefore, it is not expected that a good-faith effort will be difficult to discern.

GM agrees with this logic and supports the CARB proposal to waive one or more of the OBD II requirements for the 1994 model year based on a demonstrated good-faith effort; however, a waiver for the 1994 model year does not go far enough.

#### Discussion for the 1995 Model Year

Given the technology forcing nature of the OBD II requirements and the late date of this action, it is not appropriate to impose fines on 1995 model year vehicles with OBD II systems which do not meet all of the requirements. Fines or non-compliance penalties may be appropriate in cases where the compliance technology is well known and there is ample time to devote resources to comply. Such is not the case with the OBD II requirements for the 1995 model year.

~~At this time, we believe we will be able to certify fully compliant OBD II systems for the 1995 model year. However, the OBD II requirements are very complex and subject to many interpretations. For example, the regulation refers to "any other parameter that can affect emissions" for oxygen sensors, "any electronic powertrain component/system which can effect emissions", and "the most reliable (or best available) monitoring method." These requirements are not well defined and we can not be certain our OBD II systems will comply until we have completed the OBD II certification process. Furthermore, it is more difficult to comply with the OBD II requirements on some engines than on others. If the OBD II system on one of our engines is found to be slightly deficient during the certification process, our only viable option under the staff proposal would be to pay the fines.~~

The CARB Staff Report states that technology development is not a major compliance factor after the 1994 model year and that, under the CARB proposal, "manufacturers would have the option to devote necessary resources or pay the fines." This assumption is not correct. In order to allow hot weather calibration and validation testing this summer, both hardware and software are now frozen for most manufacturers' 1995 model year vehicles. The 1995 model year OBD system development is essentially complete, and it is too late to devote any additional resources.

Since 1995 model year development efforts are already complete and hardware and software are already frozen, all five reasons for allowing waivers based on good-faith

effort apply to the 1995 model year as well as to 1994. To require some 1995 model year vehicles that fail to meet all the OBD II requirements to incur fines while similar vehicles that have inferior OBD I systems would not incur fines would create an unfair competitive situation. Allowing waivers based on good-faith effort for the 1995 model year would be as effective and less burdensome than the proposed fines. Therefore, **GM recommends that the regulation be amended to allow the Executive Officer to waive one or more of the OBD II requirements for the 1995 model year based on a demonstrated good-faith effort without any fine or penalty.** Specifically, GM recommends that proposed Section 1968.1 (m)(6.1) be deleted and that proposed Section 1968.1 (m)(6.0) be revised as follows:

The Executive Officer may waive one or more of the requirements of these subsections with respect to ~~a specific vehicle or engine family for which production commences prior to April 1, 1994,~~ specific 1994 or 1995 model year vehicles and which is ~~are~~ not otherwise exempted from compliance in accordance with sections (2.0) and (2.1) above. In granting the waiver, ...

#### Demonstration of Good-Faith Effort

GM would like to respond to any potential challenges to the CARB staff's proposal to allow waivers from OBD II requirements based on good-faith efforts. GM contends that the Board need not make a determination of good-faith effort at the Hearing. The proposal is only to modify the regulation to allow the Executive Officer to make such a determination at a later date on a case-by-case basis. Nonetheless, GM would like to offer the following information in the event that it is deemed relevant to the Hearing.

Like Ford, GM placed great importance on obtaining early in-use experience with the new OBD II diagnostics. However, none of the computers GM planned to use for the 1994 model year was capable of meeting all OBD II requirements. Therefore, GM chose to gain the necessary experience by implementing a form of the new OBD II diagnostics on certain 1994 model year vehicles. For example, one engine will have misfire monitoring while a different engine will have catalyst monitoring, etc. GM has made a tremendous effort to implement these new diagnostics for the 1994 model year, including hardware and software development, modification of production procedures, dealer service training, etc. In this way, GM is gaining early experience with the new diagnostics and Class B communication protocol in an aggressive effort to develop reliable OBD II systems.

Furthermore, GM has invested millions of dollars and tens of thousands of man hours in an effort to develop enhanced diagnostics to meet the OBD II requirements. "Concept Selection Teams" ~~have met again and again to brainstorm and evaluate every possible diagnostic technique.~~ Our diagnostic development engineers have worked with researchers from GM Research, AC Rochester, Delco Electronics, and Hughes, as well as a long list of outside sources including the national laboratories and various universities and suppliers.

We would like to use misfire monitoring as an example to illustrate our efforts. GM implemented misfire monitoring in production during the mid 1980s, long before the OBD II regulation was adopted. While the technique appeared to be reliable based on preproduction testing, our in-use experience proved that it was not reliable. This experience gave us special insight when evaluating other misfire monitoring methods and demonstrates the difference between making a technology work on one or two vehicles and implementing it in production. The following is a brief summary of our efforts to evaluate outside misfire monitoring technologies:

- GM spent considerable time and effort working with Purdue University on crankshaft speed fluctuation technology. The effort began in 1984, before the OBD II regulation was adopted, and continued until December, 1991. It involved hundreds of thousands of dollars of funding for Purdue and hundreds of man hours of our time evaluating Purdue's misfire monitoring methods. GM rejected Purdue's rigid model method as offering no significant benefit over the GM method and having significant implementation cost and risk. GM rejected Purdue's elastic model method as requiring substantially more computing power than was practical for 1994 through 1997 model year vehicles. Our experience working with Purdue during this time and our understanding of the limitations of the methods convinced us that further efforts were unlikely to be fruitful. Purdue has recently mentioned that they now employ a learning process to determine manufacturing errors. GM's algorithm has had compensation for manufacturing errors since 1989. Purdue has not shown any data that indicates misfire monitoring capability beyond GM's.
- Technical Advances Inc. (TAI) has stated that there has been no response from industry to its repeated solicitations for co-development of its technology. However, GM did respond by objecting to the one-sided terms of TAI's development proposal. Specifically, GM objected to TAI's insistence that it be sole owner of the technology developed with GM funding. TAI accepted our counterproposal to jointly evaluate its misfire monitoring capability. GM worked with TAI on misfire monitoring beginning in January, 1991, and continuing through the fall of 1992. This project involved tens of thousands of dollars of funding for TAI and hundreds of man hours of our time evaluating TAI's misfire monitoring method. GM is unable to discuss specific results because of a non-disclosure agreement; however, we were not surprised by the results of the Ford evaluation of TAI's capabilities recently submitted to the CARB staff. We would be happy to present the results of our evaluation if TAI agrees. TAI has recently suggested that our failure to request a detailed cost analysis indicates a lack of good-faith effort. Considering the early development stage and capability of the technology, it would be premature to request a detailed cost analysis at this time. TAI has also suggested that industry has spent more resources developing other methodologies. We must focus our limited resources where we believe they will provide the most benefit.

- GM has had a research contract with George Mason University for the past four years involving hundreds of thousands of dollars of funding for OBD II development which included misfire monitoring.
- GM's evaluation of the misfire monitoring method developed by the University of Michigan (U of M) primarily consisted of several conversations and a review of SAE papers which occurred during 1990, 1991, and 1992. GM never initiated a more detailed evaluation since it appeared that the U of M method had not been demonstrated to meet all of the CARB requirements and was likely to require substantially more computing power than was practical for 1994 through 1997 model year vehicles.
- GM has had several meetings with Bosch to discuss OBD II technology, including misfire monitoring. According to a recent Bosch SAE paper, the Bosch misfire monitoring method is not capable of meeting the 1997 model year all positive torque speeds monitoring requirement on all engines.

In an effort to maximize the capability of GM's crankshaft speed fluctuation misfire monitoring method, GM has dedicated 2 to 3 full-time engineers doing advance research and development for the last four years. Over 20 different versions of GM's misfire monitoring algorithm were evaluated as part of this work. After all of this effort, GM has concluded that the method we developed is as capable of detecting misfire over a broad range of engines and normal operating conditions as any other and is likely to be more robust and reliable than the other techniques.

GM has also participated with Ford and Chrysler in the USCAR Low Emission Partnership (LEP) Consortium to pool resources and optimize OBD system development efforts. Further evidence of our continued good-faith efforts is the LEP Consortium Evaluation Procedure for OBD II Misfire Detection Concepts which has recently been completed and forwarded to CARB staff for comment. This procedure should assist the consortium members in further evaluation of outside misfire monitoring methods and we would like to invite the CARB staff to join our efforts.

#### Discussion for the 1996 and Later Model Years

At this time, the CARB staff has decided not to propose any modifications to the regulations to provide relief from the OBD requirements for 1996 and later model years. The Staff Report states that any remaining concerns regarding OBD II requirements for low emission vehicles (LEVs) or enhanced monitoring requirements will be addressed at a Spring, 1994, Board Hearing. GM has several remaining concerns regarding OBD II requirements for 1996 and later model years.

For LEVs, the regulation requires the diagnostic system to individually monitor the front catalyst or determine when the front catalyst alone is malfunctioning. The CARB staff has

also suggested that a front catalyst may be monitored with the next catalyst downstream as a system if the MIL will be illuminated before emissions exceed a threshold, e.g., HC emissions increase by more than 1.5 times the standard from a test run with a representative 4000 mile catalyst system. We do not believe we can reliably monitor the front catalyst alone; however, we are currently evaluating several new catalyst washcoats and a new "low speed" diagnostic method in a good-faith effort to meet the requirement. We are also conducting emission testing to determine whether we can meet the emissions threshold for 1996 model year Transitional Low Emission Vehicles (TLEVs). If we are not successful, this OBD II requirement could prevent GM from introducing certain TLEVs for the 1996 model year. Since 1996 model year hardware must be frozen this fall, it may be too late to address this issue at a Spring, 1994, Board Hearing. GM plans to meet with the CARB staff to discuss this issue as soon as new data are available. It may be necessary to petition the Board for relief on this issue this fall.

Another concern involves the general ability to meet the 1.5 times the emission standards thresholds on LEVs for the rest of the diagnostics. GM is currently conducting testing with TLEVs in an effort to generate data before the Spring, 1994, Board Hearing. We suggest that the CARB staff work with the USCAR LEP in the near future to determine what data are needed.

A final concern involves the requirement to monitor for misfire at all positive torque engine speeds for 1997 and later model year vehicles. GM can not reliably detect misfire at high engine speed with the transmission in neutral on all engines. Furthermore, we are not aware of any malfunctions that occur exclusively at high engine speed with the transmission in neutral and we have in-use data showing that essentially no time is spent in this region. Therefore, we are not aware of any possible air quality benefit from monitoring at high engine speed with the transmission in neutral and we will continue to encourage the CARB staff to modify this requirement.

GM hopes that these issues will be resolved no later than the Spring, 1994, Board Hearing. If these issues are not resolved, GM may need to petition the Board for relief from the OBD II requirements for 1996 or later model years.

#### Summary

In summary, considering (1) the technology forcing nature of the OBD II requirements, (2) the good-faith effort that has been demonstrated by the industry, (3) the fact that software and hardware are already finalized for both the 1994 and 1995 model years, and (4) the unfair competitive situation created by fines, the regulation should be modified to allow the Executive Officer to waive one or more of the OBD II requirements for both the 1994 and 1995 model years without monetary penalties based on a demonstrated good-faith effort. Providing relief for the 1995 model year based on good-faith effort would be as effective in achieving the objective of the regulation and would be less burdensome than the proposal to assess fines.



Chrysler Technology Center

Statement by Frank Krich, Regulatory Planning Specialist, Environmental and Energy Affairs, Chrysler Corporation.

California Air Resources Board Hearing on Ford Motor Company's Petition for Limited Relief from 1994/1995 On-Board Diagnostic II (OBD II) Provisions (Mail-Out #93-27) Sacramento, California

July 9, 1993

Chrysler appreciates this opportunity to comment on the proposed regulatory amendments to California's On-Board Diagnostic (OBD II) requirements regarding 1994 and 1995 model year compliance, based on a petition-request from Ford Motor Company. Our comments are being made in addition to and in support of the American Automobile Manufacturers Association position on this issue.

We appreciate the efforts of the Air Resources Board and staff in reviewing the status of OBD II technology and addressing manufacturers' concerns on this technology forcing regulation. This includes the proposed amendments that will allow manufacturers the ability to certify vehicles that are not fully compliant with the OBD II requirements in the 1994 and 1995 model years.

Chrysler strongly supports the proposal to grant the Executive Officer authority to certify without penalty those vehicles that are certified prior to April 1, 1994 and do not fully meet the OBD II requirements provided that manufacturers demonstrate a good-faith effort in attempting to meet the requirements. We also support extending this proposal to those 1995 model year vehicles that use carry over OBD II systems.

Chrysler does not believe it is appropriate to apply monetary penalties as proposed for the 1995 model year. In the face of a very aggressive technology forcing regulation some manufacturers were able to develop compliant systems, as we are informed by the CARB staff. However, others may not despite their best efforts. The fact that OBD II technology will have already been in production by the 1995 model year on a number of applications should not be a measure of other manufacturers' capabilities. Vehicles can exhibit unique characteristics that prevent the universal application of a particular monitoring method. Therefore, we recommend that a demonstration of good-faith effort in lieu of penalties is proper.

Sharing of technological advances is one method of holding down the development costs of OBD II systems and to possibly shorten the development time. We have joined with Ford and General Motors in the United States Council for Automotive Research Low Emissions Technologies R&D Partnership (USCAR LEP) to provide the mechanism for such sharing. We ask the CARB join with such joint efforts. Issues such as technological feasibility and cost effectiveness could be face to face rather than through less fruitful third party discussion. An example may be helpful:

Chrysler has evaluated the misfire monitoring technique developed by Dr. Citron of Purdue University. Our personnel searched and studied previous technical papers and patents from Dr. Citron regarding his technique. Dr. Citron presented his data at a meeting with Chrysler engineers in April 1992.



Subsequent to the meeting, an analysis of Dr. Citron's system was conducted. Our evaluation revealed that Chrysler's system is comparable to Dr. Citron's. Recognizing that the possibility existed that we did not have all the details of his method, Chrysler attempted to enter into an agreement with Dr. Citron. The attempt was unsuccessful.

The industry, in Dr. Citron's words is being uncooperative. If this scenario were conducted under the proposed USCAR LEP methodology, Dr. Citron would not so easily be coming back through CARB for a second try unless a new, significant advancement could be shown.

In summary, Chrysler fully supports the CARB's proposal for those vehicles that are certified prior to April 1, 1994 and those 1995 model year vehicles that use carry over OBD II systems. We do not believe it is appropriate to apply monetary penalties on those manufacturers whose vehicles will not fully meet the requirements in the 1995 model year despite a good-faith effort by the manufacture. CARB could help in the pursuit of technological solutions by endorsing the review procedure offered by USCAR LEP.

Be assured that Chrysler will continue development work to improve its on-board diagnostic system to the fullest extent that technology allows.

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**Statement of the**

**Association of International Automobile Manufacturers**

**at the**

**California Air Resources Board Hearing to**  
**Consider Ford Motor Company's Petition for Limited Relief**  
**from 1994/1995 On-Board Diagnostic II Provisions**

My name is Dale Kardos, and I am Technical Analyst with the Association of International Automobile Manufacturers (AIAM). I am here today to offer AIAM's support for Staff's proposed modification to the OBD II regulation for the 1994 model year. Given that Section 1968.1(m) of the OBD II requirements adopted by the Board on September 4, 1989 provided the Executive Officer the authority to exempt manufacturers from having to implement OBD II requirements for 1994 and 1995, it seems only reasonable that the Executive Officer should have similar authority to approve systems which were developed in good-faith, designed to satisfy all OBD II requirements, but which do not meet every requirement of the OBD II regulation. Staff's proposal provides manufacturers the flexibility to implement new technologies now so that systems implemented after model year 1995 will operate with greater reliability and precision.

AIAM must, however, for many of the same reasons provided by Dr. Klimisch in the testimony of the American Automobile Manufacturers Association (AAMA), oppose Staff's proposal to assess monetary penalties for 1995 model year vehicles possessing OBD II systems not fully compliant with all aspects of the OBD II regulation. As pointed out

by Dr. Klimisch, imposing such a penalty punishes the manufacturer for attempting to implement new technologies when legally there is no requirement to do so until 1996. We urge the Board to recognize that the OBD II systems provided in model year 1995, though they may not be fully compliant, will nonetheless be far more sophisticated and effective than the previous OBD I systems which will remain the dominant system throughout that model year.

Thus, AIAM, as did the AAMA, recommends that the Board modify the requirements for the 1995 model year to be consistent with the proposal for 1994, allowing the Executive Officer to approve partially-complaint systems based on a "good-faith" effort demonstrated by the manufacturer, without imposition of a monetary penalty.

STATE OF CALIFORNIA  
AIR RESOURCES BOARD  
RECEIVED 6-29-93  
BY BOARD SECRETARY

6

# PURDUE UNIVERSITY



cc: Brad Mbr  
JS TAC  
JO MSD  
JB Legal

93-9-1  
7/9/93

MECHANICAL ENGINEERING

June 25, 1993

California Air Resources Board  
P. O. Box 2815  
Sacramento, CA 95812

Dear Board Members:

I'm writing to comment on the proposed regulatory amendments to California's OBD II requirements for 1994 and 1995 model year compliance as contained in ARB Mail-Out #93-27, based on a petition from Ford Motor Company, dated 3/29/93.

Ford is currently unable to meet ARB requirements in two areas for these two model years, one of which is misfire detection. It is with respect to the area of misfire detection that I am writing.

Ford, based on a claim of "good faith efforts", is requesting relief from the existing OBD II requirements for 1994 and 1995 model year cars. The ARB Staff Report concludes that it is not beneficial to California to deny certification to 1994 model year cars containing improved engine families, particularly since Ford has made a "good faith effort" to comply with OBD II regulation. It appears that since Ford claims it has identified the changes required to meet the misfire monitoring requirements by the 1995 model year, and since Ford has made "good faith efforts", the Staff believes that fines should only begin for the 1995 model year. Certification in the 1994 model year is to be allowed without fines for those who have made "good faith efforts".

I am writing to state in the strongest possible terms that Ford, (and others), have not come close to providing a "demonstrated good-faith effort" to meet the misfire detection "requirements in full by evaluating and considering the best available monitoring technology." (Quote is from proposed modification to 1968.1 Section (6.0).) In Section (6.0) it is stated that to be given a waiver a number of factors be considered, "and a demonstrated good-faith effort" is an absolute requirement. Thus, as Ford has not made a "good faith effort" relative to misfire detection, Ford does not meet the proposed requirements for a waiver for the 1994 model year.

Should the Board agree that Ford has not made "good faith efforts" in misfire detection, to still retain the benefits of allowing certification for 1994 model year cars I would suggest the Board impose for 1994 model year cars the same fines as are suggested for 1995 model year cars. Clearly, funds spent paying fines are not available to advance the state of the art. However, at this point I have reached the conclusion that nothing less will motivate the company to meet its responsibility to consider "the best available monitoring technology", even if it comes from outside the company.

Before showing that Ford (and others) have not made "good faith efforts" let me attempt to establish my credentials with the Board. The area of detection and control of engine roughness

using crankshaft speed fluctuations is one I (and my students) have been working on for over 13 years. Our earliest patent in this area was filed in 1982. A 1989 paper on misfire detection won the Society of Automotive Engineers Vincent Bendix Automotive Electronics Engineering Award as the "best paper" presented to the Society in the area during the year.

On March 31, 1992 ARB Staff held a workshop to address industry concerns on misfire (and evaporative system) requirements. At this workshop, as described in ARB Mail-Out #92-27 (5/11/92), none of the manufacturers testifying indicated that monitoring misfire under all speed and loads would be feasible in the foreseeable future. A major concern was that of high speed and low load engine operation. Manufacturers expressed the need for more precisely-manufactured components, among other difficulties. At this workshop Technical Advances presented data showing the capability of their hardware solution and I presented data on our (Purdue's) software solution.

The results I presented at the workshop showed our capability to detect isolated misfire of each cylinder at speeds from idle to 5,000 RPM with the transmission in neutral, i.e. high speed and low load. In addition, results showing detection of isolated misfire of 2 cylinders at a time under the same conditions was given. Identification of the misfiring cylinders was also shown. The data was collected on a 1990 Buick Regal with a 6 cylinder engine from the front of the engine using the existing Buick 18 tooth wheel and the existing sensor. All induced misfires were detected. No false indications of misfire were obtained.

At the workshop I noted that putting our data through the Ford detection process as described in Ford's two 1991 patents led to the conclusion that Ford could not adequately detect isolated misfire on this vehicle with its 6 cylinder engine at 4,000 and 5,000 RPM. Thus Ford knew 15 months ago that our detection capability was greatly superior to theirs.

Having presented results which indicated Purdue had the capability of meeting industry's concerns, I expected to have a reasonable opportunity to demonstrate the capability to companies who had stated the task could not be accomplished. That is not what has occurred.

What did occur is that within approximately a month, major German and Japanese concerns now said they could meet the ARB's misfire detection requirements using speed fluctuation methodology. Given the timing, I take some pleasure in claiming that our demonstrated capability encouraged others to make their own capability known. To the ARB Technical Staff, having major suppliers say it could be done was, I'm sure, more reassuring than having Purdue alone say it had the means to meet the requirement.

In the US the situation was different. By May 4, 1992 I had sent a proposal to Ford at their request. The cost was \$61,068 plus a \$15,000 patent license option fee for a 6 month interaction beginning July 1, 1992. No response. My last proposal interaction was sent at their request on December 29, 1992. The cost was \$79,557 plus a \$15,000 patent license option fee for a 6 month interaction beginning February 1, 1993. The response on February 10, 1993 was that, while the money was available, it had now been decided not to proceed with Purdue directly, but rather to work through USCAR. Contact from USCAR to date - none.

Ford has indicated to ARB Technical Staff that they could not work with Purdue because we would not agree to conditions to which Technical Advances has agreed. Since I knew of no conditions on which we were in disagreement, I contacted Ford. The Ford representative noted that the condition referred to was Purdue's request for a \$15,000 patent license option fee. That is simply not believable. Purdue is more than justified in requesting such a nominal fee given the years we have been involved in the area, the costs involved and the need to ensure in working

with the automotive industry that the task is recognized as technology evaluation and not joint technology development.

The difficulty is obviously not the \$15,000 fee, but rather the implication that if we were successful, license fees to Purdue would be required. I believe Ford felt at the time of the March 1992 workshop that despite our demonstrated better results, it could meet the misfire requirement using its in-house technology. Given the savings that would result, Ford chose not to test our methodology since they would obviously be required to use it if we were successful. Ford, gambled on its in-house capability and lost.

Ford now comes to the ARB requesting relief. They state that they have "identified the system changes that are necessary to comply with the misfire monitoring requirements". Once again, as in March 1992, they may or may not be correct. It is my belief that suggested improvements, such as moving the location of the sensor to the rear, will help, but their results will still not equal ours. (Note that in our test the sensor was in the more difficult front position.) However, whatever that outcome, for the ARB to be successful in meeting its long term goals, every resource must be brought to bear on the problems that arise. Assurance must be given to those who are outside contributors that the meaning of the words "good faith effort", will be upheld.

Since the possibility of other companies falling under the waiver is noted, I call the Board's attention to Chrysler's handling of this matter. A proposal was sent to Chrysler on May 6, 1992 comparable to that first sent Ford. In August, Chrysler indicated that it had difficulty accepting Purdue's request for the \$15,000 patent license option fee. After that the representative simply did not return phone calls. More recently ad hominem comments to CARB seem to be the order of the day and a reason for not working with Purdue. By way of a reference point with regard to implementation timing, Chrysler's representative to USCAR indicated in May, 1993 that they had just finalized their 1994 software. This followed my expressed concern over the need to get started if we were to be able to meet upcoming model year requirements. The auto companies tell CARB there is no time left to implement changes, and tell us there is no need to rush.

The manner in which the Purdue detection methodology avoids the need for precisely-manufactured parts is by employing a "learning" process to determine the manufacturing errors and to then provide compensation for these errors. (Such an adaptive process was reported by Bosch in an SAE paper in February, 1993.) Our initial work in this area was done as part of a research contract with General Motors from January, 1984 to June, 1991. (A group other than the individuals at GM now involved with misfire detection technology were responsible for our interaction with GM.) At the March 31, 1992 workshop a GM representative noted difficulty existed in achieving satisfactory results with a particular vehicle. The implication was that Purdue was just "lucky" in being able to obtain successful results.

To examine this possibility I wrote and spoke to GM requesting information on the car referenced by GM at the workshop, and permission to test the car. GM responded that the vehicle contained "advanced prototype components" and thus would not be available for us to test. GM stated that the only purpose of their presentation was to underscore the point that a limited set of data is not a sufficient base on which to draw broad conclusions. That is certainly true. On the other hand, when everyone is saying something can't be done, results that show it can be accomplished do provide a valid justification for further evaluation of the proposed methodology. To not allow such testing raises obvious questions.

Let me assure the Board that it is not just Purdue that is having this difficulty. I quote from a letter from Technical Advances to Mr. Albu, Chief Engineering Studies Branch, ARB dated May 11, 1993.

"Having experienced the remarkably slow pace and surprisingly strong reluctance of industry members to actively pursue technologies developed by others, we applaud this position." (To require full range detection in the 1997 model year.)

"Our investor believes that industries attention and effort to date has been more on trying to relax the regulations than on trying to meet them. He is convinced that the minimal amount of work industry has done on our technology is solely the result of CARB's insistence on a full speed and load methodology."

The Purdue misfire detection methodology is crankshaft speed fluctuation based and as such quite compatible with what the manufacturers are already implementing, i.e. a low cost potential solution. The Technical Advances approach has hardware requirements, i.e. a higher cost potential solution. In both cases, however, it would appear that the response of the US manufacturers has been the same, the minimal response they believe acceptable.

To summarize, at the workshop of March 1992 we presented misfire detection results that were claimed by all, prior to the presentation, to be impossible to obtain using crankshaft speed fluctuations. Following the workshop Ford actively avoided testing our methodology. Thus Ford has not met the "good-faith" requirement of the proposed waiver regulation for the 1994 model year and should not be given a waiver.

The same fines should be imposed for the 1994 model year as are suggested for the 1995 model year. The funds thus collected might be used to support the testing the company should have done if it had met its obligations without the need for fines.

The goal of such action is to encourage industry in the future to accept responsibility to evaluate outside contributions in good faith in deciding what is "best available technology".

I would recommend that the Board direct the ARB Staff to ensure that outside contributors have an opportunity to have their misfire detection methodology fairly evaluated by industry in joint consultation with ARB Staff. This is, of course, what was supposed to have taken place, and has not happened so far. Hence the need for the fines. Only by truly making use of best available technology can the current requirement of full range misfire detection for the 1997 model year be met without accepting requests for further delays.

Sincerely



Stephen J. Citron

Professor and Director  
Engine Controls Laboratory

COPY: W. E. Baitinger  
Purdue Research Foundation

R. D. Klauber  
Technical Advances



**BUREAU OF AUTOMOTIVE REPAIR**  
 10240 SYSTEMS PARKWAY, SACRAMENTO, CA 95827  
 PHONE: (916) 366-5424

STATE OF CALIFORNIA  
 AIR RESOURCES BOARD  
 RECEIVED 5-27-93  
 BY BOARD SECRETARY



May 25, 1993

93-9-1  
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 7/9/93

XC: Brad Mbr  
 JS TAC  
 JO MSD  
 JB Legal

Board Secretary  
 AIR RESOURCES BOARD  
 P.O. Box 2815  
 Sacramento, CA 95812

Dear Mr. Secretary:

**SUBJECT: COMMENTS REGARDING EXEMPTIONS/RELIEF FROM 94/95 OBD II REGULATIONS**

This is in response to the ARB "Notice of Public Hearing to Consider Ford Motor Company's Petition for Limited Relief from 1994/1995 On-Board Diagnostic II (OBD II) Provisions."

We are concerned that failure to adequately label vehicles and provide adequate OBD II configuration information will result in confusion at Smog Check stations and may result in false I/M failures.

The bureau requests that all vehicle manufacturers compile a list of vehicles (by year, make, model and engine configuration) and identify the level of OBD II compliance as follows:

1. Complies with OBD II requirements
2. Exempt from OBD II - without standardized OBD II connector
3. Exempt from OBD II - with standardized OBD II connector
4. Partial compliance (list deficiencies)

We request that the ARB take this information and consolidate it into a single list upon final certification submittal for each model year and provide a copy (electronic and hard copy) to the bureau. The BAR will make this information available to Smog Check stations.

In addition, we request that OBD-exempt vehicles, or are in partial compliance, be clearly identified on the underhood emissions label and at the ALDL connector.

Thank you in advance for considering our recommendations. Please let me know if our suggestions will be addressed.

Sincerely,

DAVID A. AMLIN, Manager  
 Engineering & Technical Research Branch

DJA:cbr





Subaru Emissions Office  
2004 Hogback Road, Suite 1  
Ann Arbor, MI 48105  
313/971-7911  
Rapifax 313/971-0167

93-9-1  
7/9/93

July 1, 1993

Our Ref. No. E061-93

STATE OF CALIFORNIA  
AIR RESOURCES BOARD  
RECEIVED 7/6/93  
BY BOARD SECRETARY

XC: Bd Members  
JS TAC  
JD MSD  
JB Legal

Board Secretary  
California Air Resources Board  
P.O. Box 2815  
Sacramento, CA 95812

**SUBJECT: Fuji Heavy Industries' Comments on Ford Motor Company's Petition for Limited Relief from 1994/1995 On-Board Diagnostic II Provisions**

Enclosed are the comments of Fuji Heavy Industries, Ltd. regarding the Ford Motor Company's petition for limited relief from the 1994/1995 On-Board Diagnostic II Provisions. This issue is scheduled for consideration at the Board hearing in July 1993.

Should there be any questions regarding these comments, please contact this office.

Sincerely,

James Murphy, Manager  
Subaru Emissions Office

JM:lsh

Enclosure

cc: Mr. Sugita

FHI

Mr. S. Albu, CARB

**Fuji Heavy Industries Ltd.'s**  
**Comment on**  
**CARB's Proposal to Amend OBD II Regulations in**  
**Response to Ford Motor Company's Petition**

Fuji Heavy Industries Ltd. produces SUBARU cars in Japan and the United States. Approximately 7,000 SUBARU cars per year are sold in the State of California. Automobile manufacturers have made and continue to make great efforts in the development of emission control systems to comply with the requirements of OBD II, LEV and/or enhanced evaporative emission test procedures to improve the air quality in California.

When CARB adopted the OBD II regulations in September 1989, we started development of our OBD II system. The OBD II requirements cover more components than the OBD I regulation and prescribe monitoring procedures for each component. In addition, the OBD II regulation requires standardization of failure codes, storage of freeze frame data, configuration of tampering protection and communications with a generic scan tool. We are continuing to make great efforts in developing an OBD II system to meet with all the requirements of the regulation.

For establishing the diagnostic procedure of catalyst deterioration, engine misfire, and oxygen sensors, EGR system and fuel system malfunction, we had to develop an algorithm for each component. It is very important for us, for customer satisfaction, to prevent the false indication of malfunction. At the start of OBD II system development, eight engineers were involved, now eighteen are working on the development of the OBD II system.

We have had four meetings and several telephone contacts with CARB staff to prevent misunderstandings and to clarify the regulatory requirements. However, it took until June 28, 1993, to receive written confirmation from staff of responses given in our meetings of December 16, 1992, and April 22, 1993. Even with this delay, the development of our 1995 model year OBD II system is currently approaching a final stage with these efforts. We are planning to prepare a pre-application of the 1995 MY OBD II system and submit it to CARB in August of 1993. At that time, CARB may find a design deficiency with respect to one or more of the requirements for the 1995 system. If the deficiency is minor, it might be possible to modify it to comply with the requirement by the time the 1995 model year Application for Certification is submitted. However, if CARB discovers a deficiency which would require the development of a new algorithm, it may not be possible to fully comply with the OBD II requirements by our Job 1 date of June 1994 for our first OBD II system.

We believe the CARB proposal described in Mail Out #93-23 offers relief to a manufacturer introducing their OBD II system beginning in the 1994 model year. Considering our current situation, if a major deficiency was discovered by CARB after the submittal of the pre-application, we might not be able to resolve it by the start of

production for our 1995 model year OBD II system. Therefore, we hereby request that CARB allow other manufacturers the same type of relief as requested in the petition by Ford Motor Company and proposed in Mail Out #93-23. We urge that the proposed language in Mail Out #93-23 be changed as follows.

1. Section (m)(6.0) should be modified to read, "The Executive Officer may waive one or more of the requirements of these subsections with respect to any model year engine family for which production commences prior to August 1, 1994, and which is not otherwise exempted. . . .the best available monitoring technology."
2. Section (m)(6.1) should be modified to read, "For any model year engine family for which production is to commence following the first model year OBD II system of each manufacturer, and which are not exempted. . . .the California Health and Safety Code.

Your kindest consideration of our comment and suggestions would be highly appreciated.

TECHNICAL ADVANCES, INC.  
1608 NORTH FOURTH STREET  
FAIRFIELD, IOWA 52556  
TEL: 515-472-6712  
FAX: 515-472-3524

93-9-1  
7/9/93

STATE OF CALIFORNIA  
AIR RESOURCES BOARD  
RECEIVED 7/11/93  
BY BOARD SECRETARY

Xc: Board Members  
JB TAC  
JD MSD  
JB Legal

June 29, 1993



Ms. Jananne Sharpless  
Chairwoman  
Air Resources Board  
2020 L Street  
Sacramento, CA 95814

ENGINEERING

Re: Misfire Detection for OBDII:

RESEARCH AND

Comments on Auto Industry Efforts

DEVELOPMENT

Dear Ms. Sharpless:

We at Technical Advances, Inc. (TAI) thank the Board for the opportunity to relate our experiences in attempting to offer TAI's misfire detection technology to the automotive industry.

We would further like to note the reluctance and regret with which we write this letter. From the beginning it has been our objective to work actively and harmoniously in concert with the automakers. We have sought nothing more than a synergistic relationship in which each party contributes, and in which both parties share the common goal of developing the best possible misfire detection technology.

Unfortunately, with the passage of time, we have come to the conclusion that the auto makers do not share that goal, and have, in fact, not proceeded with a good faith effort to develop such a technology. We support this contention, in part, with the historical outline of events shown below.

We further support this contention by noting that when we first contacted members of the big three over two and a half years ago, we had anticipated that the natural result would be an interest by them to *co-develop* (as contrasted with merely *evaluate*) our system. This would have had the obvious benefit of both improving the TAI system as well as speeding up its development. However, throughout the entire period of TAI's contact with the industry, there has been no response whatever to TAI's repeated solicitations for co-development of its technology.

In addition, no OEM has ever requested a detailed component by component cost analysis estimate of the TAI system. A serious interest in any technology would most certainly entail such an estimate.

We believe that this posture by the industry indicates that its members have never seriously considered TAI's technology. They have spent far more time, money, and resources on developing in-house methodologies (which still do not work over the entire range of operating conditions for all engines) than they have ever considered applying to our technology.

**General Chronology - Industry as a whole:**

- December 1990 TAI meets with each of big three and presents misfire data showing low load, high RPM detection for 4 cylinder engine. TAI suggests joint development effort.
- Spring 1991 Contact, meetings, and discussions continue with American and Foreign auto makers
- April 1991 TAI presents data at EPA/industry On-Board Diagnostics Meeting to Discuss Draft NPRM and invites the industry to join in testing and development of its system.
- Summer 1991 TAI demonstrates its detection system in a test vehicle at the facilities of 17 different auto makers as well as to CARB and the EPA.
- August 1991 TAI presents data and theoretical background at CARB/industry misfire detection workshop in Detroit.
- September 1991 TAI representative addresses CARB board of directors, shows test data, and once again invites industry to join in development of its system
- November 1991 TAI presents test findings at EPA/industry On-Board Diagnostics Public Hearing and notes that misfire detection limits can be improved with its system.
- February 1992 TAI presents technical paper SAE #920236 "Miniature Magnetostrictive Misfire Sensor" at the Society of Automotive Engineers show in Detroit.
- March 1992 TAI appears at a CARB sponsored misfire workshop, presents data, and again solicits the industry to work with TAI.
- May 1992 First eight cylinder engine tests successfully with TAI system. Answers criticism from industry about lack of eight cylinder engine data. (Due to slow response by auto industry to provide additional test vehicles to TAI, TAI purchased its own eight cylinder engine vehicle for the test.)
- Fall 1992 At this point, test data on six different engines, including three V-8's, has been taken by TAI.
- November 1992 In response to criticism about mounting location, TAI demonstrates that its sensor may be mounted on rear of engine facing flywheel and that data appears better than main bearing location data.
- January 1993 Test data taken by Ford for USCAR on Ford Lincoln Town Car (sensor in main bearing) as well as TAI supplied Ford V-8 Econoline Van (sensor on rear of engine).
- March 1993 TAI makes presentation at SAE Conference on Misfire Detection. TAI shows data from rear engine location sensor for V-8 engine in neutral at high RPM and notes for the first time that its sensor can simultaneously be used for crankshaft position indication, thereby saving on system cost.
- April 1993 USCAR meets with TAI to review test results of TAI system. Test results are solely from main bearing location (Lincoln Town Car). Test results show that the TAI system, unlike the industry system, can detect misfire accurately at high RPM conditions. TAI reiterates its desire to *develop and optimize* its system using the greater resources and capabilities of the manufacturers.

June 1993 Data on rear of engine location has yet to be processed by USCAR.  
 TAI has not received a report from USCAR of the data presented at the April meeting, nor has it received any input regarding future steps USCAR may take, if any, with the TAI technology.

Throughout the period: TAI repeatedly notes that its sensor has other potential applications such as knock detection, pre-ignition sensing, and crank angle determination, but that it has limited resources and needs one or more industry partners with whom to co-develop such other applications. If TAI's sensing system could carry out additional functions simultaneously along with monitoring misfire, OEM's could save the expense of the other sensors needed for such other applications.

No industry member has yet to indicate interest in developing such other applications of the TAI system.

In addition to the general chronology above, the specific chronology of events with each of the three American manufacturers, represented below as Companies A, B, and C, is significant.

#### **Chronology - TAI and Company A**

January 1991 Company A indicates a desire to work with TAI. TAI proposal requests adequate, not extreme, compensation for its contribution of technology, time, and materials. Company A refuses TAI proposal. TAI counters with reduced financial requirements. Company A again refuses.

September 1991 Company A re-expresses interest in evaluating TAI technology.

May 1992 After more than eight months, Company A formalizes terms for agreement. These include:

- With minor exceptions, TAI will not get copies of data taken with its system
- TAI will not get copies of data taken simultaneously with Company A system
- TAI cannot reveal any data or conclusions to outside parties

July/Aug 1992 Testing on Company A vehicle by Company A with TAI assistance

June 1993 After almost one year, test data has yet to be fully analyzed by Company A. Virtually no information has been shared with TAI regarding the analysis which has been done.

Summary: TAI seeks to generate an atmosphere of mutual trust in working to solve a common problem. It questions whether the approach taken to date has been productive.

Seriousness of interest must be questioned when processing of test data has yet to be completed almost a year after testing.

### Chronology - TAI and Company B

- Feb 1991      Company B expresses interest in working with TAI. The two companies sign a mutual confidential disclosure agreement. TAI reveals its technology.
- Jan 1993      After almost a two year period entailing much discussion on legal and logistical issues, and a three month holdup for technical reasons beyond anyone's control, testing is carried out at Company B's facility. TAI had hoped to move quickly on this project.

### Chronology - TAI and Company C

- Winter 90/91    Interest from technical personnel working on misfire is significant. Recommendation to work with TAI is made to upper management. Upper management declines involvement with TAI technology.
- Nov 1992      Technical personnel at Company C contact TAI and express interest in beginning work on TAI technology quickly. A meeting is held within two weeks and Company C personnel indicate a desire to have a contract proposal from TAI immediately. Within two days TAI sends proposal to Company C; within a week a formal contract is sent. Shortly thereafter TAI is informed that Company C management has decided not to go ahead with TAI, because it will join the USCAR initiative on misfire instead.

TAI would like to note that the technical personnel it has dealt with at each of the three American companies have, by and large, been helpful, cordial, and exceptionally competent. The relationship our company has had with the engineers at each of these companies has, in fact, been quite good. Our concern, as expressed herein, is with the decision making levels within each of these companies, and not, for the most part, with the individuals with whom we have interacted.

### Conclusion

Industry has not proceeded with a good faith effort to explore technologies other than their own. This is evidenced by, among other things,

- 1) a two and a half year period after presentation of test results during which TAI has repeatedly solicited industry to co-develop its technology and during which no member of industry has expressed any interest in so doing,
- 2) a resistance to moving in a timely manner to initiate testing on TAI technology and to process the resulting data,
- 3) a resistance (more prevalent in some companies) to share test data with TAI and third parties,
- 4) a reluctance to explore other possible uses for the TAI technology which may provide significant cost benefits, and
- 5) lack of direction or interest to perform larger scale testing on a variety of engines in a manner similar to the testing which has been carried out on their own systems.

Given this evidence, there are no grounds for industry to contend that it has done a fair, adequate, or timely job of exploring and attempting to develop alternative misfire detection strategies.

5.

We have from the beginning sought cordial and productive relationships with the industry, but have been frustrated in this effort. We sincerely wish that it had not been necessary for us to take our present stand on this issue. Unfortunately, we have been left with little other choice.

We respectfully submit that no grounds exist for waiving of the requirement for full speed and load range misfire detection on all vehicles beginning with the 1997 model year.

Sincerely,



Robert D. Klauber, PhD  
Chairman and  
Vice President of Engineering

cc: Steve Albu



6269119835

# Volkswagen of America, Inc.

93-9-1  
7/9/93

3800 Hamlin Road  
Auburn Hills, MI 48326

Tel. (313) 340-5000

6 July 1993

Ms. Pat Hutchens  
Board Secretary  
Air Resources Board  
2020 L Street  
Sacramento, California 95814

STATE OF CALIFORNIA  
AIR RESOURCES BOARD  
RECEIVED 7/6/93  
BY BOARD SECRETARY

XC: Bob Hutchens  
JS TAC  
JD MSD  
JB Hoyle

SUBJECT: Volkswagen Comments on July 9 Board hearing  
Ford's Petition on OBD II -- Mail-Out 93-27

On behalf of Volkswagen AG and Audi AG of Germany, Volkswagen supports Ford's petition for limited relief from model years 1994 and 1995 OBD II (On-Board Diagnostic II) provisions.

We have reviewed ARB Staff's proposed response to this petition and recommend deletion of the penalties applicable for model year 1995.

Volkswagen has been granted a waiver of the OBD II requirements for all engine families for model years 1994 and 1995. However, Volkswagen plans to voluntarily introduce a few OBD II equipped engine families before that date in order to gain experience with the OBD II systems.

Experience we are acquiring through testing of the OBD II system may necessitate that Volkswagen take advantage of the flexibility provided by ARB Staff's proposed relief from model year 1994/95 OBD II provisions. Although we are attempting to fully comply with the OBD II requirements, Volkswagen may request certification of partially complying systems to evaluate system performance and increase customer acceptance of the OBD II concept.

In general, manufacturers should not be subject to penalties for partial compliance in model year 1995. More specifically, Volkswagen should not be subject to a penalty fee for partial compliance in model year 1995 because we are voluntarily introducing an OBD II system on vehicles which have been waived of these requirements for model years 1994 and 1995.

Volkswagen continues to appreciate the open dialogue the ARB Staff has shown since the adoption of the OBD II requirements and are committed to continuing our cooperation with the ARB Staff on this issue.

Respectfully,

W. Groth, Manager  
Emission Regulations & Certification

CC: Mr. Steve Albu, Mr. Allen Lyons



# VOLVO

Volvo Cars of North America, Inc.

Rockleigh, New Jersey

93-9-1  
7/9/93

STATE OF CALIFORNIA  
AIR RESOURCES BOARD  
RECEIVED 7/6/93  
BY BOARD SECRETARY

July 1, 1993

California Air Resources Board  
Board Secretary  
2020 L Street  
Sacramento, Calif. 95814

Dear Sir/Madam:

Re: CARB Board Meeting  
July 8-9, 1993  
OBD II - Ford Petition

The following position, 10 copies enclosed, represents the position of Volvo Car Corporation, Gothenburg, Sweden and Volvo Cars of North America, Inc., Rockleigh, New Jersey.

Volvo supports the request by Ford to make the OBDII regulation as flexible as possible. It clearly is a technological forcing requirement.

The regulatory process must be fair and equitable to all manufacturers of California vehicles. This we believe is a very important guiding philosophy.

Since its adoption in 1989, Volvo has worked diligently to comply with this complex regulation.

Volvo has committed considerable resources to comply with OBDII and subsequently is in the final stages of certifying a 1994 system. An exemption for illumination of the Malfunction Indicator Light (MIL), Title 13 California Code of Regulations section 1968.1 (a) (1.8), has been discussed with ARB staff and will be used to prevent any possibility of a driver encountering a false MIL.

We deeply believe that no consumer should see a false MIL. This will cause them to quickly lose confidence in the system.

If for model years 94 and/or 95, CARB grants a function exemption as requested by Ford without incurring a financial penalty, we highly believe CARB should not have a formal reporting requirement for any function. We urge the Board to include that in their decision.

We trust that CARB will be fair and equitable to all manufacturers and drop the reporting requirements for the years that the function(s) exemption is granted by the Board, without a financial penalty.

If additional information is required on this issue, please let me know.

Sincerely,

VOLVO CARS OF NORTH AMERICA, INC.  
Product and Technical Support

*Edward C. Shapiro for*

William Shapiro  
Manager, Regulations and Compliance

WS:mc