

August 22, 2012

James Goldstene
Executive Officer
California Air Resources Board
1001 I Street
Sacramento, CA 95814

Re: Technical Status and Revisions to Malfunction and Diagnostic System Requirements for Heavy-Duty Engines (HD OBD) and Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines (OBD II)

Dear Mr. Goldstene:

This letter transmits comments prepared by BAE Systems regarding the above-captioned rulemaking.

As a manufacturer of hybrid propulsion systems for heavy-duty on-road vehicles, BAE Systems understands the need for and supports the goal of heavy-duty hybrid (HD Hybrid) vehicles that fully comply with the California Air Resources Board's (ARB) heavy-duty on-board diagnostic (HD OBD) system requirements. ARB's proposed revisions to the HD OBD regulations that require HD Hybrid compliance by the 2014 model-year, however, do not provide adequate lead-time for that goal to be achieved and will likely result in a substantial reduction in the numbers and types of HD Hybrids available in California in the coming years. In order to ensure the continued availability of HD Hybrids in California, BAE Systems urges ARB to harmonize its HD OBD requirements for HD Hybrids with those enacted by the U.S. Environmental Protection Agency (U.S. EPA) that are found at §86.010-18(q) Title 40, Code of Federal Regulations, that do not require full OBD compliance for HD Hybrids until at least the 2016 or 2017 model-year, depending on the initial date that a hybrid system was first offered for sale.

Alignment of ARB and U.S. EPA requirements for HD Hybrids will:

- Provide time needed to adequately address HD Hybrid system effects on HD OBD system performance and perform certification efforts;
- Provide the time necessary for the HD Hybrid market to respond and comply rather than excluding HD Hybrids from the California market;
- Provide the time needed for collaboration between the HD Hybrid industry, engine manufacturers, ARB, U.S. EPA, and SAE to develop required standards and protocols for HD Hybrids.

First, we believe that ARB's proposal not to align California HD Hybrid requirements with those of U.S. EPA is not supported by adequate industry data. Most disconcertingly, ARB's proposal is fundamentally inconsistent with the staff's proposal for alternate-fuel engines like those powered by compressed natural gas (CNG), which would be given until the 2018 model-year to comply with HD OBD requirements. We can see no rationale for ARB to provide four fewer years of lead time for HD Hybrids than what is being required of alternate-fuel engines. It is worth noting that alignment of ARB's requirements for HD Hybrids with those of U.S. EPA would still result in an earlier compliance date for HD Hybrids than is being proposed for alternate-fueled engines.

Second, it appears that ARB believes that funds from the Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP) are sufficient financial incentive to accelerate OBD compliance for the HD Hybrid market, and that vertical integration of HD Hybrid providers with vehicle Original Equipment Manufacturers (OEMs) is a desirable near-term development in the industry. While we would suggest that HVIP funding be limited to vehicles that comply with ARB's HD OBD requirements, such a position would necessitate alignment with the U.S. EPA timeline for all other HD Hybrids to help ensure hybrid availability in California.

I. More lead time is needed to achieve HD Hybrid OBD compliance and for equitable treatment of HD Hybrids and alternate-fuel engines

While ARB is proposing HD OBD compliance for HD Hybrids beginning with the 2014 model year, ARB is also proposing that alternate-fuel engines continue to be exempt from HD OBD compliance until the 2018 model year. In proposing extra lead-time for alternate-fuel engines in 2005, ARB's rationale¹ was that:

This allowance will reduce the burden on manufacturers of these engines, which are produced in much lower numbers than their gasoline and diesel counterparts and since it is likely that the manufacturers would be required to redevelop a significant portion of the OBD system specifically for alternate-fueled engines (i.e., manufacturers would not be able to use their diesel engine-based OBD systems on alternate-fueled engines because of the vast differences in emission control components). Lastly, the role for alternate fuel engines in the heavy-duty industry is still uncertain and these allowances should provide more time for the market to decide what role these engines will play and in what volumes rather than having manufacturers prematurely elect to discontinue production of these engines partially due to OBD requirements.

In addition, in the current ISOR ARB states that:

Staff had originally proposed that the compliance date be moved up to the 2016 model year, but feedback from several manufacturers at the workshop indicated bringing their many alternate-fueled engine families into compliance in the 2016 model year would be difficult. As such, they requested a phase-in plan for the 2016 through 2018 model years in lieu of compliance for all engine families in 2016. In subsequent

¹ See <http://www.arb.ca.gov/regact/hdobdo5/isor.pdf>

discussions with manufacturers that had multiple engine families, staff determined that, within the small market share of alternate-fueled engines, there could be a significant inequity during the phase-in years between manufacturers that offer many different product offerings and those that have only one or two offerings. To address the initial request for additional lead time and to avoid inequity during the phase-in years, staff revised the HD OBD regulation proposal to require that the HD OBD requirements apply to all alternate-fueled engines starting with the 2018 model year.

Many of the reasons put forth by ARB for providing additional lead-time to alternate-fuel engines also apply to HD Hybrids, particularly those regarding the role of the technology in the heavy-duty industry and the fact that HD OBD compliance could lead to discontinued production. Further, harmonization of ARB requirements with the U.S. EPA requirements for HD Hybrids would still result in HD OBD compliant HD Hybrids before alternate-fuel engines are required to be HD OBD compliant. Finally, the distinction being made by ARB between HD Hybrids and alternate-fuel engines is arbitrary in that ARB doesn't provide any meaningful explanation of why it believes that alternate-fuel engine compliance is more difficult and requires more lead-time than HD Hybrid compliance.

As ARB currently states on its webpage for the HVIP program²;

A hybrid-electric vehicle typically uses an electrical motor and a gasoline- or diesel-powered engine, which work in tandem to reduce emissions and fuel consumption. Hybrid vehicle technology reduces criteria pollutant, air toxic, and greenhouse gas emissions – particularly in urban delivery vehicles, refuse trucks, work trucks, buses, and other vehicles with high stop-and-go or idling duty cycles. Hybrid vehicles also provide significant fuel economy benefits and fuel cost savings to the fleet owner and therefore, have the potential to be self-sustaining with some reductions in the upfront vehicle cost. Large scale market penetration of hybrid trucks and buses will help California meet its long term SIP and climate change goals.

BAE Systems agrees with ARB regarding the importance of HD Hybrids and, as noted above, supports the goal of HD OBD compliant HD Hybrids. However, achievement of this goal across the HD Hybrid industry will require more lead time than ARB proposes. ARB's decision to oppose harmonization with the U.S. EPA by not providing the additional two to three years of necessary lead time to comply with HD OBD jeopardizes the future of HD Hybrids in California.

U.S. EPA and ARB, as evidenced by its discussion of HD Hybrids on pages 12 to 16 of the Initial Statement of Reasons (ISOR)³, have come to the same conclusion with respect to HD Hybrids and HD OBD: the appropriate approach is where "... one entity takes responsibility to ensure the system as a whole works properly" The only difference

² <http://www.arb.ca.gov/msprog/aqip/hvip.htm>

³ <http://www.arb.ca.gov/regact/2012/hdobjd12/hdobjdiisor.pdf>

between the two agencies is the timeframe required for compliance. The U.S. EPA is providing three or four years of lead time following the availability of production-ready 2013 hybrid certified engines, while ARB is proposing only one year of lead time.

While HD engine manufacturers and HD Hybrid system manufacturers have been working to solve this problem, there are a number of complicating factors that make the additional lead time provided under the U.S. EPA requirements necessary. These include:

1. HD OBD systems are still under development by engine manufacturers, with the first HD OBD requirements for application on some engines taking effect with the 2010 model year, imposition of some HD OBD requirements for all engines taking effect with the 2013 model year, and full HD OBD compliance not being required until the 2016 model year;
2. There is currently only one engine manufacturer that makes engines certified for use on transit buses in North America, and their focus has been to ensure a successful launch of HD OBD across their non-hybrid product lines;
3. Final production HD OBD compliant engines and associated information and data are not yet available to HD Hybrid system manufacturers; and
4. The volume of HD Hybrid vehicles being produced annually is small.

Although all of these factors are important, the last is key as it limits the ability of either HD engine or HD Hybrid system manufacturers to recover the costs associated with HD OBD compliance for HD Hybrids. In order to put the significance of this issue into perspective, we estimate total U.S. sales of HD Hybrids from 1999 to 2010 to be only 11,000 units. In light of this low volume, engine manufacturers have not prioritized hybrid approved engine calibrations, but rather their large volume non-hybrid markets.

Finally, based on data from the American Public Transit Association (APTA) 2011 Public Transit Vehicle Database dated October 2011⁴, the table below shows the volumes of CNG and Hybrid purchases in California over the past several years. This data does not support the ARB focus on the hybrid market over CNG at least as it applies to the Transit Bus Market.

Transit Bus Procurement by Year	Year Built						Grand Total
	2006	2007	2008	2009	2010	2011	
Power Plant Type							
CNG	182	142	647	362	163	48	1544
Diesel	96	57	137	225	68	36	619
Hybrid electric	87	47	18	42	31	0	225
Alternative fuels	3	8	0	17	12	7	47
All EV	1	0	0	0	7	9	17
Hydrogen	0	0	0	7	9	7	23
Grand Total	369	254	802	653	290	107	2475

⁴ American Public Transit Association (APTA) 2011 Public Transit Vehicle Database dated October 2011

Based on this data, we are concerned about the disproportionate impact to the hybrid transit bus market in California. The California hybrid market is very small, with 225 vehicles procured from all manufacturers between 2006 and 2011 (0 in 2011). In contrast, 1544 CNG-powered vehicles were sold in California during the same timeframe. Considering the even smaller market share of hybrids versus CNG and the ARB statements regarding disproportionate impact to the CNG market, there is clearly a need for a similar delay in compliance for hybrids as was provided for alternate-fueled CNG engines.

Again, it must be stressed that the main problem with ARB's proposal for HD Hybrids is not its goal of full HD OBD compliance, but rather that the lead time that has been provided is simply too short for non-vertically integrated HD Hybrid system manufacturers.

II. The HVIP Program will not incentivize HD Hybrid OBD compliance and will not drive vertical integration of HD Hybrid solutions

Unlike the passenger vehicle market, in which complete vehicles are produced, certified, and sold (typically in high volumes) by vertically integrated companies that design and construct the entire vehicle, in the HD vehicle market an HD vehicle may have multiple chassis manufacturers and body builders who are different and independent. One or more of these manufacturers integrate an engine, transmission, and other devices from a wide variety of component manufacturers. Often, other manufacturers assemble the HD vehicle into its final configuration according to the purchaser's specialized requirements.

The fact that the HD vehicle industry is not vertically integrated means that that HD engines and HD Hybrid systems are produced by different and independent companies. As a result, engine manufacturers have designed their engines to comply with HD OBD requirements when used in conventional vehicles, but not when used in HD Hybrid vehicles. HD Hybrid system manufacturers design their systems to modify the engine duty cycle to achieve reduced fuel consumption and lower greenhouse gas emissions, but do not currently have the data to demonstrate that certified engines continue to meet OBD requirements when used with their HD Hybrid systems. This challenge is made even more difficult by the differences in HD system calibration for the many different types of buses and vocational vehicles where HD Hybrid systems may be desired. Such differences in calibration are important because they might impact whether a certified engine can continue to meet OBD requirements when used in combination with a specific HD Hybrid system.

Additionally, the transit bus industry is not capable of being vertically integrated in the foreseeable future. All of the North American transit bus OEMs are integrators with no direct ties to any engine OEM. Thus, if the ARB goal is to ultimately see hybrid systems offered by vertically integrated companies, the transit bus industry should be exempt from HD OBD requirements until such time as vertical integration is both feasible and imminent.

ARB's responses to the issues of the lack of vertical integration, the resulting need for lead-time, and compliance costs are found in the following two paragraphs from the ISOR:

Fundamentally, an integrated approach needs to be used for engine and hybrid system manufacturers to have a reasonable chance at meeting all of ARB's requirements, including the OBD requirements and tailpipe standards. Modern engine and emission control systems are extremely complex and must balance many competing factors such as durability, performance, emissions, and fuel economy. Engine manufacturers expend significant resources to find a solution that simultaneously meets all of these requirements, so it should come as no surprise that major alterations to the system such as attaching a hybrid system that can turn the engine on and off and change the speeds and loads the engine is routinely operated at can substantially compromise the ability of the engine to continue to meet all of the requirements. Further, an integrated approach has the advantage of likely being able to maximize hybrid operation and efficiency, thereby making the system more economically viable for the long term. As such, staff is proposing an extra year of relaxation (the 2013 model year) before hybrid systems are required to be properly integrated and compliant with the OBD regulation.

Hybrid manufacturers have indicated that the proposed changes provided above are not enough, indicating that their lack of experience with designing OBD systems makes it difficult to meet the required HD OBD implementation dates. They further indicated that hybrid vehicles comprise less than 1 percent of the heavy-duty market, and that the requirements would impose a huge burden on the hybrid manufacturers. Thus, they proposed delaying HD OBD compliance for heavy-duty hybrid vehicles beyond the 2013 model year. Staff, however, disagrees that more lead time is the appropriate solution. The requirements for hybrids to comply have been clearly identified in the regulation since 2009 and little progress has been made since then, so providing even more lead time is not likely to change the situation. In contrast, requiring manufacturers to begin compliance in the short-term to remain eligible for funding through ARB's hybrid and zero-emission truck and bus voucher incentive project (HVIP) will likely provide sufficient motivation to manufacturers to make real progress. Avoiding further delays in compliance will also better ensure that near-term hybrid vehicles (that are largely subsidized by ARB through the HVIP) actually achieve and maintain benefits over the life of the vehicles.

From the perspective of a HD Hybrid system manufacturer that is not vertically integrated with an engine manufacturer and a chassis manufacturer, the main points found in the above appear to be:

1. ARB believes that one-year of lead time is all that is required to transform a non-vertically integrated industry into a vertically integrated industry while solutions of the challenges of designing HD OBD compliant HD Hybrids are simultaneously achieved;
2. ARB believes that the availability of HVIP funding will somehow be sufficient to offset the costs associated with developing HD OBD compliant HD Hybrids within the one year of lead time provided; and

3. ARB believes that Engine manufacturers, who have spent the last 4 years trying to respond to the newly imposed HD OBD requirements for their conventional engines, would have also allowed time and resources to support and evaluate the interactions with all hybrid systems and make any necessary changes in their control systems, to secure an additional 1% hybrid market share.

Unfortunately, none of these beliefs are supported by data or the realities of the current HD Hybrid marketplace.

With respect to ARB's position on the reasonableness of one year of lead time for compliance by non-vertically integrated HD Hybrid system manufacturers, we note that it is simply an arbitrary statement not supported by any data, analysis or corroborating information. Complicating the effort further is the fact that the regulation, as written, lacks a unified approach that takes into account certification across multiple platforms for the certification holder. Further, ARB's claims regarding the lack of progress made by HD Hybrid system manufacturers since 2009 are groundless, as evidenced by the numerous changes proposed this year by ARB to §1971.1 that relate to hybrids which include, for the first time, a definition for a "Hybrid Vehicle". Additionally, there is the well-documented engagement of the HD Hybrid industry with the U.S. EPA and SAE in working toward solutions for HD OBD compliance, which included an SAE-sponsored workshop on August 10, 2010, where both U.S. EPA and ARB participated. Finally, BAE Systems formally provided detailed information to ARB, in both May and December 2011, on our current system diagnostics and service manual, but have yet to receive any feedback from ARB regarding their acceptability other than the proposed modifications to the HD OBD requirements. Given that it has been over eight months since BAE Systems' last data submission, it seems unlikely that ARB will be able to devote the resources necessary to work with manufacturers to certify OBD-compliant hybrids for the 2014 model-year, even if it were feasible for manufacturers to attempt certification.

We note that ARB has failed to conduct a proper analysis of Economic Impact (Section V of the ISOR) or Analysis of Alternatives (Section VI of the ISOR), in that it has arbitrarily rejected harmonization with U.S. EPA requirements for HD Hybrids without analysis of the impacts alignment would have on air quality, the costs and cost effectiveness of the HD OBD regulation, and the impacts of diminished HD Hybrid availability in California on California entities that operate HD vehicles, including Transit Districts, other public agencies, and private businesses. In addition, with respect to HD Hybrid availability in California, ARB takes arbitrary and contradictory positions in the ISOR. First, ARB states on page 15 that with respect to ARB's decision not to align with U.S. EPA:

Staff also expects that some hybrid system manufacturers may make a business decision to not expend the resources for compliance in 2014, which case they will not be able to offer hybrids for sale in California beyond 2013.

ARB goes on to state on page 59 of the ISOR:

It should be noted that one area of difference between the Federal and California requirements involves heavy-duty hybrids. Specifically, the U.S. EPA has exempted hybrids from OBD compliance for the 2014 through 2016 model years while ARB will require compliance. In theory, this could lead to some heavy-duty hybrid vehicles being more expensive in California than in other states during these three years. However, staff's assessment is that this is not likely to happen for two reasons. First, the heavy-duty hybrid vehicle sales volume is extremely low, which would make it virtually impractical for manufacturers to have sufficient resources to offer two different OBD systems (one that complies for the California market and one that does not comply with California hybrid monitoring requirements that would be available for sale in other states). Past history would suggest that these manufacturers will design and build one system nationwide and as such, the cost to purchasers would be the same nationwide.

Products from HD Hybrid manufacturers who are forced to leave the California market by the HD OBD requirements will not be available in California at any price, and the arbitrary assumption that all manufacturers will comply with ARB requirements found in the Economic Impact section is directly contradicted by the earlier acknowledgement that it is likely that some manufacturers will leave the California market. However, ARB has ignored this in assessing economic impacts by not performing adequate analysis that examines how the HD Hybrid market in California will be affected.

Finally, the issue of HVIP funding it is irrelevant to the issue of HD OBD compliance for HD Hybrids. As noted above, BAE Systems would support restricting the availability of HVIP funding to only fully HD OBD compliant HD Hybrids if ARB harmonizes its lead-time requirements for HD OBD compliance with those of U.S. EPA.

Thank you in advance for your careful consideration our comments to the proposed ARB rule. Should you have any questions with regards to these comments, please contact Chris Jones, OBD Lead Engineer, at 607-770-2100.

Respectfully Submitted,



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