VII. TECHNOLOGY COSTS, AND LEADTIME

There are a variety of technologies that could be used by the vehicle manufacturers to meet the proposed tests. In this chapter we discuss the cost of the different technologies that are in development that could be used to comply with the tests, determine current compliance with the tests, property damage savings from using different technologies, and estimate the compliance test costs. Leadtime is the last section of this chapter.

A. Technology Costs

There were no comments to the NPRM docket (98-4405-Notice 1) regarding costs for specific technologies. Comments regarding costs focused on the following issues, which will be addressed in the analysis:

1) The agency should not consider cost savings for right front passenger air bags that do not deploy (because the seat is unoccupied) in cases where the vehicle is totaled (the crash is so severe the vehicle can not be economically repaired).

2) The agency should include the cost of testing and the possibility that expensive prototypes might be needed for testing.

Several cost estimates come from NHTSA contractor tear-down studies of costs[1]. Some of the cost estimates come from comments to the docket from 1996 (Docket 74-14-N100). Numbers in parentheses ( ) behind a manufacturer's name indicate their comments to this docket and the comment number. Other cost estimates come from the Jet Propulsion Lab (JPL)[2] analysis and review of advanced air bag technologies (Docket No. NHTSA-1997-2814). Finally, a few cost estimates come from confidential responses from an Information Request sent to air bag suppliers.

The agency believes that the 50th percentile male dummy restrained and unrestrained 30 mph barrier tests can probably be met by the manufacturers without any incremental costs compared to today's air bags. The design challenges for the manufacturers are in meeting these barrier tests while at the same time trying to reduce the potential problems for out-of-position occupants. However, the agency believes that in order to meet the 30 mph unbelted barrier test using the 5th percentile female dummy that multi-stage inflators may be necessary. The assumptions in this cost analysis are that the in-position 30 mph frontal barrier tests for the 50th percentile dummy could be

met at no incremental costs, but that adding the 5th percentile female dummy, the offset frontal tests and out-of-position tests will require some manufacturers to make changes in their restraint

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[1] "Report/Comparison Multi-stage Air bag Inflator vs. Single Stage Air bag Inflator", Ludtke & Associates, Docket No. 98-4405 No.3.

"Cost, Weight, and Lead Time Analysis: Tear Down Analysis of Two Existing Air Bag Systems", Bruce C. Spinney, NHTSA, September 1998, Docket No. 98-4405 No. 4.

"Final Report Volume I of Cost, Weight, and Lead Time Analysis: Tear Down Analysis of Two Existing Air Bag Systems" Ludtke & Associates, Docket No. 98-4405 No. 5.

"Final Report Volume II of Cost, Weight, and Lead Time Analysis: Tear Down Analysis of Two Existing Air Bag Systems" Ludtke & Associates, Docket No. 98-4405 No. 6.

[2] "Advanced Air Bag Technology Assessment", Jet Propulsion Lab, April 1998.

systems or vehicle structure.

1. Suppression of the Air Bag

The principal costs for a suppression system are in the sensing systems and algorithm development. Sensing systems are designed to provide information to be used in the air bag computer logic (algorithms) to determine when to suppress the air bag, or which level of air bag deployment is the best for the combination of occupant size, occupant position, restraint use, and crash type. The agency estimates the internal components to suppress the air bag (just the part of the internal air bag circuitry to be able to turn the air bag off) costs less than $1 per air bag.

The agency is proposing to require two telltale lights to show when the air bag is turned off, one for the driver side and one for the passenger side air bag. The agency contracted with Troy Design Services to estimate the cost of the passenger-side air bag on/off switch. The estimated cost for the warning light LED, wiring, bezel; and two wire clips were estimated to be $1.49. The addition of a second LED for the driver would add about $0.11 for a total cost of $1.60 (1997 dollars). For this analysis, the cost is delegated to $0.80 for each side (driver and passenger).

2. Low Risk Deployment

The cost of meeting the proposal using the low risk deployment option is not known. For the driver side, it is possible that it could be a no cost option, just a different design of the air bag. In general, the agency believes changes in fold patterns, tethering, or venting can probably be done at no incremental cost. Morton (075) stated that an air bag that utilizes different fold patterns and inflators may add very little incremental costs to the current air bag systems.

The agency does not believe it is likely that a no-cost low risk deployment air bag will be forthcoming in the near future for the passenger side, and assumes that at least a multi-stage inflator will be necessary for the passenger side.

The need for and costs of potentially adding padding or other countermeasures to go along with the low risk deployment option is unknown. NHTSA requests comments on the need for and cost of making these changes.

3. Crash Severity Sensors

Tear-down data from three 1992 models (Ford Crown Victoria, Toyota Camry, and Plymouth Acclaim)[3] from NHTSA contractors estimate the average cost of adding two additional sensors at $22.30 (1997 dollars) and 1.36 pounds. The range of costs among the three vehicles was fairly close at $20.80 to $23.90.

4. Occupant Weight and Pattern Recognition

Several estimates of costs for weight sensors are available:

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[3] Ford/Crown Victoria - DOT HS 807 949, September 1992
"Cost Estimates of Manual & Automatic Crash Protection Systems in Selected 1988-1992 Model Year Passenger Cars" Volume I

Toyota Camry and Tercel - DOT HS 807 950, September 1992
"Cost Estimates of Manual & Automatic Crash Protection Systems in Selected 1988-1992 Model Year Passenger Cars" Volume II

Plymouth Acclaim - DOT HS 807 951, September 1992
"Cost Estimates of Manual & Automatic Crash Protection Systems in Selected 1988-1992 Model Year Passenger Cars" Volume III

A teardown study of the Mercedes-Benz seat switch pad by a NHTSA contractor resulted in the cost estimate of $19.45 (1997 dollars)[4] and 3.7 ounces per seat position. It is anticipated that the seat switch pad would be useful only for the passenger side. Mercedes-Benz of North America (034) estimated the cost of their seat switch pad to be $17.33 (1997 dollars).

General Motors (030) estimated that a weight based system for the passenger side is in the range of $10 to $20 variable cost (1996 dollars), which means on a consumer cost basis, the cost would be roughly $15.40 to $30.80 (e.g., $10 multiplied by 1.01987 to bring it from 1996 dollars to 1997 dollars[5] and by 1.51[6] to go from variable cost to consumer cost).

NEC Technologies (052) estimated the per vehicle cost for the weight sensor was in the range of $35.70, but that these costs would be reduced through mass production.

Saab (067) said that a weight based system would cost $30.60 (1997 dollars),

Morton (075) estimated a weight sensor would cost $20.40 (1997 dollars).

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[4] "Cost, Weight, and Leadtime Impacts of a Mercedes-Benz "Sensormat" Type Occupant Detection System", NHTSA, April 1997, DOT HS 808 587. This cost was for vehicles with a domestic control module. The Mercedes control module was more sophisticated to begin with and the cost increment for Mercedes was estimated to be $12.30.

[5] Based on the Gross Domestic Product Implicit Price Deflator.

[6] Estimate based on historical analysis of 10K reports from domestic vehicle manufacturers.

The range of cost estimates are from $15.40 to $35.70. For this analysis, the estimates from Mercedes and the NHTSA tear down of the Mercedes mat type system were used, $17 to $20. However, these systems did not include the pattern recognition technology now being developed. While this information can be collected with a similar mat-type system, there will be an additional cost to develop the algorithm for pattern recognition and introduce it into the system. The agency estimates the costs of a weight sensor with a pattern recognition system to be $19 to $23. The agency has no cost estimates for the system using strain gauges or load cells and requests comments on their cost.

5. Occupant Presence, Proximity and Motion Sensor Costs

There are a wide variety of occupant presence, proximity and motion sensors. The proposal does not require dynamic motion sensors. Thus, some of these technologies are mentioned here and are not carried forward in the analysis. Occupant presence sensing, to help determine occupant size and placement is considered a technology that could be used to provide more information for air bag deployment decisions. The agency has cost estimates for some of them. General Motors (030) stated the variable cost of a proximity based system was in the range of $25.50 to $45.90 (1997 dollars) for the passenger side depending on the system requirements. On a consumer cost basis, the costs would be $38.50 to $69.30 for the passenger side.

Automotive Technologies International, Inc. (ATI) (020) has developed an occupant position sensor, the Ultrasonic, Nonimaging Pattern Recognition. ATI claimed that the occupant position sensor was expected to cost between $35.70 and $42.80 for the passenger side.

The JPL study estimated that a system using capacitive presence sensors will cost between $25 and $75. JPL also estimated that a system using acoustic and infrared sensor technology costs $35 to $60 dollars. These costs are supplier cost to the original manufacturers and do not include installation. Thus, a consumer cost is likely to be $37.80 to $113.30 for capacitive presence sensors and $52.90 to $90.60 for acoustic and infrared sensor technology. These estimates are for the passenger side seating position only. Adding similar systems to the driver side would cost an additional 50 to 100 percent of the passenger side cost, at this time it does not appear that manufacturers are considering driver side suppression technology.

There are a variety of systems under consideration. There will be intense price competition in this market and the lower priced systems that are reliable will be the ones used in vehicles. The agency estimates initial consumer costs for a presence sensor to be near the low end of costs discussed above, in the range of $40 to $60 for the passenger side. These costs should decrease over time.

6. Safety Belt Use Sensors

The driver side already has a restraint-use sensor to activate the warning light and buzzer if the driver is not using the safety belt. Based on a teardown study of cost for the driver side of a Toyota Tercel, the estimated cost for a passenger side sensor is $2.00. Manufacturers are developing more reliable systems for belt use sensors, to move from a mechanical to a non-mechanical system (known as the Hall effect). These systems are estimated to cost $5.00 and could be applied to both driver and passenger side.

7. Seat Position Sensor

The agency does not have a teardown cost estimate for a seat-position sensor. It is assumed to cost about $5.00 per seating position.

8. Dual Stage or Multiple Level Inflators

The agency had a contractor do a tear-down study of a Chrysler Cirrus/Dodge Stratus and a BMW single stage pyrotechnic inflator and a TRW dual stage hybrid air bag inflator. The dual stage hybrid inflator was more expensive than the pyrotechnic single stage inflators on the driver side, but in between the Chrysler and BMW inflators on the passenger side. Table VII-1 shows these consumer cost estimates.

Table VII-1
Consumer Cost Estimates - Inflator Costs
(1997 Dollars)

	Driver	Passenger	Total
Single Stage Chrysler Cirrus	$19.49	$24.36	$43.85
Single Stage BMW	$13.71	$33.03	$46.74
Dual Stage TRW	$25.14	$28.51	$53.65

Whether a manufacturer uses a pyrotechnic inflator or a hybrid air bag inflator is a choice made in the normal course of business. What is needed for this analysis is an estimate of the incremental cost of a dual stage pyrotechnic inflator compared to a single stage pyrotechnic inflator and the incremental cost of a dual stage hybrid inflator compared to a single stage hybrid inflator. Based on information from our contractor, the agency estimates that the incremental cost for a dual stage pyrotechnic inflator over a single stage pyrotechnic inflator is about $10 per inflator, and incremental cost for a dual stage hybrid inflator over a single stage hybrid inflator is about $2 per inflator.

JPL estimated the costs of different inflators compared to a baseline single stage pyrotechnic inflator with sodium azide propellants. These costs were $10 to $15 for a dual-pyrotechnic inflator, $0 to $8 for a hybrid or heated gas inflator and potentially lower cost for a high pressure stored gas inflator.

Thus, inflator costs vary considerably depending on the technology chosen. If the manufacturers stay with the more widely known and used pyrotechnic technology, the agency estimates the cost increase of a dual-stage pyrotechnic inflator is $10 per side, or $20 per vehicle. If manufacturers determine they can switch to a hybrid or gas system, they could save money compared to the pyrotechnic inflators. However, a dual-stage hybrid system would cost about $2 more than a single-stage hybrid system per side, or $4 per vehicle.

9. Structural Integrity Improvements

A high speed offset test, like the 35 mph (40%) offset test could cause some manufacturers to improve the structural integrity of the front of their vehicle, along with air bag changes. Structure could be added in the wheel well area or in the firewall/floor pan area. The agency had a cost estimate performed by Ludtke & Associates[7]. Using a finite element model of a MY 95 Chevrolet Lumina, a method was determined to meet a 64 kph (37.5 mph) offset test, including a Tibia Index of 1.0. A doubler modification in the firewall/floor pan area up to the steering column was chosen as a method of meeting this test. The doubler modification added 21.57 pounds and $13.95 in consumer costs (1998 economics) to the vehicle. Since this is a more severe test than the 35 mph test considered in this rulemaking and since the Tibia Index is not proposed in this rulemaking, the manufacturers probably could do considerably less in this area and meet the proposed test. Without the Tibia Index, the manufacturers can probably make less substantive changes, and/or make less substantive changes to a different area of the car, like the wheel well, and meet the test. The agency estimates that the total increased consumer costs for the vehicle meeting the proposed test will be about $10 (1997 dollars to be consistent with the other estimates).

There are a variety of potential ways for the manufacturers to meet the alternative test requirements. The cost estimates of these systems vary considerably. Table VII-2 shows the range of cost estimates provided. NHTSA has more confidence in cost estimates that have been provided by contractor tear-down studies, although there is no guarantee that these technologies are the ones that will actually go in to production. For this analysis, the agency will use the tear-down study cost estimates where provided, and will use the range of estimates provided by docket commenters or JPL when tear-down studies are not available.

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[7] "Cost, Weight and Lead Time Analysis: Offset Frontal Crash Protection", Ludtke & Associates, February 1999.

Estimated Vehicle Costs for Meeting Specific Tests and Current Compliance

Table VII-3 presents costs for meeting specific individual tests. Table VII-5 presents costs for meeting specific individual tests after taking into account current compliance rates and considering the high speed Alternative tests discussed below. The manufacturers must meet a combination of tests. In some cases, the same technology could be used to meet both out-of position tests and high speed tests.

Table VII-2

Technology Cost Summary

(1997 Dollars)

Technology	Range of Cost Estimates	Cost Estimates Used in this Analysis
Suppression of Air Bag -- Internal Circuitry Only	$1 per air bag	$2 per vehicle
Telltale light	$0.80 per side	$1.60 per vehicle
Low Risk Air Bags	none	$0 to minor Assumed only available for the driver side
Two additional sensors for the offset test	$20.80 to $23.90 per vehicle	$22.30 per vehicle
Weight or mass sensor	$15.40 to $35.70 per seat	$19 to $23 per vehicle Assumes only passenger side
Occupant Presence Sensors	$35.70 to $113.30 for the passenger side	$40 to $60 for the passenger side
Safety Belt Use Sensor	$2.00 to $5.00 per vehicle	$2.00 to $5.00 per vehicle Only needed on passenger side

Dual or Multiple Level Inflators	$2 to $15 per air bag	$2 to $10 per side or $4 to $20 per vehicle
Structural Improvements for 35 mph offset test	$10 per vehicle	$10 per vehicle
Threshold Changes	none	$0 to unknown
Redesigned Air Bag	none	$0

For this analysis, the agency is examining two specific sets of high-speed test combinations:

Alternative 1, includes:

Up to 30 mph frontal rigid barrier test (belted 5th and 50th dummies)

Up to 30 mph oblique rigid barrier test, +/- 30 degrees (belted 50th dummies)

18-30 mph frontal rigid barrier test (unbelted 5th and 50th dummies)

18-30 mph oblique rigid barrier test, +/- 30 degrees, (unbelted 50th dummies)

Up to 25 mph offset deformable barrier test, left side, (belted 5th dummies)

Alternative 2, includes:

Up to 30 mph frontal rigid barrier test (belted 5th and 50th dummies)

Up to 30 mph oblique rigid barrier test, +/- 30 degrees (belted 50th dummies)

18-35 mph offset deformable barrier test, left and right side, (unbelted 5th and 50th dummies)

Up to 25 mph offset deformable barrier test, left side, (belted 5th dummies)

Chapter VIII combines out-of-position test and high speed tests into four compliance scenarios and combines costs for specific tests looking at the potential low and high costs of meeting a full compliance scenario.

The assumptions for Tables VII-3 and VII-5 are:

1. To meet the suppression with child presence for rear-facing child restraints and 3 year-old and 6 year-old dummies would require the internal circuitry for suppression at $1 for the passenger

side, a telltale light at $0.80, and either a weight sensor at $19 to $23, or an occupant presence sensor at $40 to $60. Thus, the total cost is $20.80 to $24.80 for the weight sensor or $41.80 to $61.80 for a presence sensor. Manufacturers may well determine that they want both systems to get the most information on occupant size and position. Thus, it is possible that the potential cost could be as much as the addition of these two systems or $60.80 ($1+0.80+19+40) to $84.80 ($1+0.80+23+60).

Current Compliance - Mercedes and BMW have a weight sensor that turns off the air bag when a low weight or no weight is in the right front passenger seat. It is assumed that this system could be updated to include up to 54 pounds with no additional cost. Sales of vehicles with these systems are estimated to be around 230,000 in the U.S. Thus, applying a factor of .985 (15.27 million/15.5 million) to these estimates results in cost estimates weighted by the percent of the fleet complying of $20.50 to $24.45 for the weight sensor (in Table VII-5) and $41.15 to $60.90 ($41.80 to $61.80 x .985) for a presence sensor.

2. One method to meet the low risk deployment test would cost $0 to minor costs for the driver side, assuming it is feasible with an air bag that could meet the test using one level of deployment output, for example a redesigned air bag with modified fold patterns and possibly a modified inflator.

If a dual or multi-stage inflation system based on crash severity and restraint use were used it would require a restraint use sensor at $2 to $5 for the passenger side, a dual or multiple level inflator at $4 to $20 per vehicle ($2 to $10 per side), and at the high end of costs, perhaps better crash severity sensing at $22.30 per vehicle ($11.15 per side) and a seat position sensor for the driver side ($5 for the driver side). Thus, the total cost range assuming no current compliance would be $0 to $26.15 ($10 + $11.15 + $5) for the driver side, $4 ($2 + $2) to $26.15 ($5 + $10 + $11.15) for the passenger side, and $4 to $52.30 for both sides.

Current Compliance - Based on the passing rates in Chapter IV (results of the 25 mph offset test), it is estimated that 64 percent of all vehicle systems could require additional sensors for use with the dual or multi-level inflator to better refine speed sensing capabilities. For the average vehicle this would be $14.30 ($22.30 x .64) (assumed to be $7.15 for each side) to the high end of the range. Based on the passing rates in Chapter IV, about 25 percent of the fleet can meet this test on the driver side, thus, the driver side average cost for a multi-stage inflator is estimated to be $1.50 to $7.50. Some manufacturers (20% are assumed with pretensioners) currently have a restraint sensor on the passenger side, thus the average cost per vehicle is $1.60 to $4.00 for a restraint use sensor on the passenger side. Thus, the total cost of a dual or multi-level inflator system is $0 to $19.65 ($7.50 + $7.15 + $5) on the driver side and $3.60 to $21.15 on the passenger side for a total of $3.60 to $40.80 per vehicle (see Table VI-4 for a cost breakdown).

3. To meet the 25 mph belted offset barrier test in Alternative 1 would require either:

a) different sensors at $0 costs or additional sensors at a cost of $22.30 per vehicle, or

b) dual-stage or multi-stage inflators, which cost $52.30 per vehicle at the high end, as discussed previously.

Current Compliance -

a) If no new sensors are used, the low end of the range of cost is $0. Based on the passing rates in Chapter IV, about 36 percent of the pre-MY 1998 fleet tested passed this test at the proposed levels. Thus, the average cost per vehicle, if additional sensors are used, is estimated to be $14.30 ($22.30 x 0.64), or $7.15 per side; or a manufacturer could use
b) dual-stage or multi-stage inflators, which after considering current compliance cost $40.80 per vehicle at the high end as discussed previously.

4. To meet the 18 to 35 mph (40%) offset test would require an additional $10 of structural improvements to the wheel well area for some vehicles. Thus, $5 is assigned to the driver side and $5 to the passenger side. These costs can be added directly on to the range of costs from the 25 mph belted offset barrier test.

Current Compliance - Based on passing rates in Chapter IV, 75 percent of the vehicles tested (3 of 4) passed the test. Thus, the average cost per vehicle is $2.50 ($1.25 per side). Because of the range of the test from 18 to 35 mph, these vehicles would have to have either the sensing capability required of the 25 mph offset test also or a low risk deployment air bag. Thus, the costs at the high end of the range are the same as a low risk deployment air bag, except that the cost of added structure is added on. Thus, the range of costs in Table VII-5 for the unbelted 18-35 mph offset test for Alternative 2 are $2.50 to $43.30 ($40.80 + $2.50).

5. To meet the unbelted 5th percentile female dummy frontal barrier test at 30 mph (Alternative 1), would require different fold patterns, tethering, or other minor design changes, which the agency believes can be met by some vehicles without incremental costs to the system. Other vehicles will require a multi-stage inflator with some type of sensor system to determine when a small female is in the driver seat as opposed to a larger occupant. A variety of sensors could be used to determine when a person, for example, a 5th percentile female, is too close to the air bag. The simplest system is a seat position sensor, which has been added in to the multi-stage inflator high end of the costs at $5 for the driver position. Those sitting too close to the steering wheel would receive the low level air bag deployment. The estimated cost to meet this test is from $0 to $52.30 per vehicle as discussed previously.

Current Compliance - The agency has only tested four MY 1999 vehicles at 30 mph unbelted with the 5th female dummy (see Table IV-16). Rather than rely on this limited data with different compliance rates resulting in lower costs after compliance, it makes more sense to keep the costs for multi-stage inflators the same for all the tests and rely on the greater amount of data used for the low risk deployment tests. Thus, after current compliance, the cost estimates are assumed to range from $0 to $40.80.

Table VII-3
Estimated Per Vehicle Consumer Costs for Meeting Specific Tests
(Not weighted by current compliance rates)
(1997 Dollars)

Test	Cost
Suppression with child presence	Passenger side $20.80 to $24.80 for a weight sensor or $41.80 to $61.80 for a presence sensor $60.80 to $84.80 for both systems
Low risk deployment tests	Driver side $0 to $26.15 Pass. side $4 to $26.15 Total $4 to $52.30 Includes at high end - driver side seat position sensor, passenger side safety belt use sensor, both sides multi-level inflator and additional crash sensors
25 mph offset barrier test (belted)	Driver side $0 to $26.15 Pass. side $0 to $26.15 Total $0 to $52.30 per vehicle, High end assumes same as low risk deployment test
18-35 mph offset barrier test (unbelted)	Driver side $5 to $31.15 Pass. side $5 to $31.15 Total $10 to $62.30 per vehicle High end assumes same as low risk deployment test plus structural integrity
5th percentile female dummy in an unbelted 30 mph barrier test	Driver side $0 to $26.15 Pass. side $0 to $26.15 Total $0 to $52.30 High end assumes same as low risk deployment test

Table VII-4
Low Risk Deployment Test Costs
Driver Side

Additional speed sensors	$0 - $11.15
% in Noncompliance	64%
Costs	$0 - $7.15
Multi-level Inflator	$ 0 - $10
% in Noncompliance	75%
Costs	$0 - $7.50
Seat Position Sensor	$0 - $5
Total cost	$0 - $19.65

Passenger Side

Additional speed sensors	$0 - $11.15
% in Noncompliance	64%
Costs	$0 - $7.15
Multi-level Inflator	$ 2 - 10
% in Noncompliance	100%
Costs	$2 - $10
Restraint Use Sensor	$2 to $5
% in Noncompliance	80
Costs	$1.60 to $4
Total cost	$3.60 - $21.15

Table VII-5
Average Consumer Costs for Meeting Specific Tests
After Considering Current Compliance
(1997 Dollars)

Test	Cost	
Suppression with child presence (Passenger side)	Passenger side $20.50 to $24.45 for a weight sensor or $41.15 to $60.90 for a presence sensor $59.90 to $83.50 for both systems	
Low risk deployment tests	Driver side $0 to $19.65 Pass. side $3.60 - $21.15 Total $3.60 to $40.80	
25 mph offset barrier test (belted)	Driver side $0 to $19.65 Pass. side $0 to $21.15 Total $0 to $40.80	
18-35 mph offset barrier test (unbelted)		Alternative 2 Dri. side $1.25 to $20.90 Pas. side $1.25 to $22.40 Total $2.50 to $43.30
5th percentile female dummy in an unbelted 30 mph barrier test	Alternative 1 Driver side $0 to $19.65 Pass. side $0 to $21.15 Total $0 to $40.80	

Also under consideration for Alternative 1 are a 25 mph unbelted rigid barrier test coupled with a 35 mph belted rigid barrier test. The agency does not believe there would be any difference between meeting these coupled tests with the cost increase for meeting the Alternative 1 tests. Most vehicles would currently be able to meet the tests or could meet them with minor design changes in fold patterns and tethering or by using multi-stage inflators already in the cost for this Alternative.

B. Property Damage Cost

Consumers would experience repair cost savings if passenger-side air bags did not deploy in a crash with no one sitting in the right front seating position or, if a weight sensor were used, when there is less than a certain weight in the right front seat. The savings are to society, but they are realized mainly through insurance company payments and to consumers that don't have insurance or may not have collision coverage on their vehicles.

Based on NASS-CDS towaway crashes for 1996, there were 428,000 passenger car and light truck driver deployments. During 1996, the agency estimates there were 49 million passenger cars and light trucks on the road with driver air bags. An analysis of NASS-GES data for MY 1995 and later models indicate that of all police-reported crashes in which an air bag deploys, 82.26 percent are in towaway CDS-type crashes and 17.74 percent are in non-towaway crashes. Thus, the total number of driver air bag deployments in crashes in 1996 are estimated to be 520,300 (100/82.26 x 428,000). This assumes there are no air bag deployments in non-police reported crashes. What is needed for this analysis is a projection of the number of air bag deployments per year when the entire fleet is equipped with air bags and a distribution of air bag deployments over the life of a vehicle so that repair costs that might occur any time over the 20 year lifetime of a passenger car or 25 year life of a light truck can be discounted back to present value.

Since the vehicles in NASS 1996 with air bags are mostly newer vehicles, which drive more mileage than older vehicles, a rate of deployments per average vehicle would be exaggerated. An analysis taking vehicle miles traveled by age of vehicle x scrappage by age of vehicle x the total number of sales by age was compared to the same analysis for vehicles sold with air bags. These analyses were performed for both passenger cars and light trucks separately and were summed. The results of these analyses indicate that in 1996, the number of deployments multiplied by 2.54 would provide an estimate of the total number of deployments if all vehicles in 1996 had air bags. Thus, if all vehicles in 1996 had air bags, there would have been about 1,322,000 deployments in towaway and non-towaway crashes (2.54 x 520,300). In most vehicles currently on-the-road, both the driver and passenger side air bags deploy at the same time.

There were 192.1 million passenger cars and light trucks in the fleet for 1996. In the last assessment, the agency estimated a higher number of air bag deployments based on a projected increase in the number of vehicles in the fleet. However, manufacturers have started to raise the threshold speeds at which air bags deploy and that would lessen the number of deployments in the future. Not knowing the potential impact of raising thresholds, we decided not to increase the annual estimate of deployments based on increasing numbers of vehicles in the fleet. Thus, we estimate there would be about 1.322 million vehicles with air bag deployments annually.

Since all vehicles in the future will have both driver and passenger side air bags, there will be a similar number in both the driver and passenger side, unless there are technologies utilized to reduce deployments in certain situations. Based on NASS 1996, about 68 percent of the time there is no one sitting in the right front seat when the air bag deploys, and about 2 percent of the time the occupant in the right front seat is 6 years old or younger. Assuming a weight sensor by itself could detect weight for children representing those up to about age 6, a weight sensor could result in the suppression of 925,000 right front seat deployments (1.322 million x .70) a year.

Proximity sensors could also determine when no one is in the seating position or when someone is too close to the instrument panel. If the system is set up to suppress the air bag in these situations, a proximity sensor system could also result in cost savings by not deploying the air bag until it is needed.

To bring these estimates from a total fleet basis to an individual vehicle basis, one needs to determine the present discounted value of not having deployments at some time over the lifetime of the vehicle. The multiplier for the 7 percent discount factor is 0.7379 over the lifetime of passenger cars and 0.6956 over the lifetime of light trucks. Assuming 7.5 million sales for passenger cars and 8 million for light trucks by the year 2005 when this rule may become fully effective, the average discount factor is roughly 0.72 over a 22 year life.

If there were an estimated 1,322,000 deployments per year over a steady state sales of 15.5 million per year, 8.5 percent of the fleet will have an air bag deployment over their lifetime.

Based on costs from NHTSA's Vehicle Research and Test Center in replacing air bags during our test programs, the following costs are estimated.

Driver side:	
Air bag	$350 to $500
Labor (Driver Side)	$50 Assumed to be one hour at $50 per hour
Total Driver Side	$400 to $550
Passenger Side:	
Air bag	$230 to $800
Instrument Panel	$50 to $300
Windshield	$600 to $2,000 (not all vehicles need to replace the windshield)
Labor (Pass. Side)	$200 to 250 Assumed 4 hours without windshield replaced , 5 hours with windshield replaced
Total Pass. Side	$480 to $1,300 without the windshield replaced to $1,130 to $3,350 with the windshield replaced.

For the passenger side, the lifetime repair cost savings for a weight sensor or presence sensor are estimated to range from $20.60 to $55.70 on the passenger side ($480 to $1,300 x 0.085 deployment rate x 0.72 discount rate x 0.70 unnecessary deployment rate) when the windshield does not have to be replaced and from $48.40 to $143.50 on the passenger side ($1,130 to $3,350 x 0.085 x 0.72 x 0.70) when the windshield does have to be replaced.

Totaled Vehicles - Commenters on the Preliminary Economic Assessment made the point that when a vehicle is totaled due to a crash, there is no savings to the consumer from not having the air bag deploy. Thus, the commenters indicated that the overall property damage savings of not having the passenger side air bag deploy when no one or small children were sitting in the front right seat, were overestimated.

When there is an air bag deployment, a percentage of the vehicles are totaled (not repaired) and sent to be recycled. If the repair cost of the vehicle, without considering repair costs for the passenger side air bag, would result in the vehicle being totaled anyway, the property damage savings from having a passenger air bag not deploy is meaningless. On the other hand, there are cases where the repair cost for the passenger side air bag, when added to the other repair costs for the vehicle, make the vehicle uneconomical to repair and it is declared a total loss.

Data from State Farm Insurance Company was requested to help quantify what percent of the vehicles would be totaled, and should not be assigned property damage savings. State Farm submitted the following estimates (see Table VII-6) based on data from the dual air bag Ford Taurus[8], which State Farm considered a typical vehicle in terms of air bag deployments and total losses. "Forced into a Total Loss" means that the additional cost of replacing the air bags and repairing subsequent damage to the instrument panel, windshield, etc., from deployment forced the vehicle to be totaled rather than repaired. These data were used in calculations (see Table VII-6 and VII-7) to determine the average influence of vehicles being totaled on potential property damage savings. The results of these calculations are that on average 50 percent of vehicles with deployments are repaired and an additional 10 percent of vehicles would not be forced into being

[8] The agency did not use these same data for light trucks since the repair rates for light trucks would be different than for passenger cars. For lack of better data, it is assumed that the resulting 60 percent estimate applies to both cars and light trucks.

totaled if the passenger side air bag did not deploy. Thus, 60 percent of the estimated property damage savings from not having the passenger side air bag deploy when unwanted would be realized by consumers.

Thus, after considering that on average 40 percent of the vehicles will be totaled and 60 percent repaired, the lifetime repair cost savings for consumers for a weight sensor or presence sensor are estimated to range from $12.35 to $33.40 (0.6 x $20.60 to $55.70) on the passenger side when the windshield does not have to be replaced and from $29.05 to $86.10 (0.6 x $48.40 to $143.50) on the passenger side when the windshield does have to be replaced.

Table VII-6
Effect of Air Bag Deployment on Total Losses
By Age of Vehicle

Age of Vehicle	Total Loss	Forced Into A Total Loss	Repaired
0	5%	3%	92%
1	5	5	89
2	10	18	73
3	14	18	68
4	25	19	56
5	34	26	40
6	49	30	21
7	77	19	4
8	85	15	0
9	86	14	0
10	88	12	0
11	88	12	0

Table VII-7
Average Percent of Vehicles Repaired
After an Air Bag Deployment

Passenger Cars					
Age	VMT	Survival	Weighted VMT	Air Bag % Repaired	
1	14,535	1.000	14,535	0.92	13372.2
2	13,924	0.993	13,827	0.89	12305.61348
3	12,846	0.982	12,615	0.73	9208.78356
4	11,378	0.964	10,968	0.68	7458.50656
5	10,749	0.935	10,050	0.56	5628.1764
6	10,119	0.892	9,026	0.4	3610.4592
7	9,490	0.831	7,886	0.21	1656.0999
8	8,860	0.753	6,672	0.04	266.8632
9	8,231	0.662	5,449	0	0
10	7,601	0.568	4,317	0	0
11	6,972	0.476	3,319	0	0
12	6,343	0.394	2,499	0	0
13	5,713	0.323	1,845	0	0
14	5,084	0.263	1,337	0	0
15	4,454	0.213	949	0	0
16	3,825	0.172	658	0	0
17	3,195	0.139	444	0	0
18	2,566	0.112	287	0	0
19	1,937	0.090	174	0	0
20	1,307	0.073	95	0	0
			106,953		53,507
					0.500

NOTE: 53,507/106,953 = 0.50

Table VII-8
Average Percent of Vehicles Forced into
A Total Loss as a Result of Deployment

Age	Forced into Total Loss %	Pass. Side % of Total Repair Cost	Pass. Side Forced Into Total Loss	Weighted Pass. Side Forced
1	0.03	0.65	0.0195	283.4325
2	0.05	0.65	0.0325	449.36229
3	0.18	0.65	0.117	1475.928324
4	0.18	0.65	0.117	1283.301864
5	0.19	0.65	0.1235	1241.2139025
6	0.26	0.65	0.169	1525.419012
7	0.3	0.65	0.195	1537.80705
8	0.19	0.65	0.1235	823.94013
9	0.15	0.65	0.0975	531.269895
10	0.14	0.65	0.091	392.880488
11	0.12	0.65	0.078	258.856416
12	0.12	0.65	0.078	194.933076
13	0.1	0.65	0.065	119.944435
14	0.08	0.65	0.052	69.528784
15	0.06	0.65	0.039	36.999378
16	0.04	0.65	0.026	17.1054
17	0	0.65	0	0
18	0	0.65	0	0
19	0	0.65	0	0
20	0	0.65	0	0
				10,242
				0.096

Note: 65% factor is the weighted estimate of the property damage savings from the passenger side compared to both driver and passenger side, since "Forced into a total loss" is determined from a dual air bag car and only the passenger side air bag may not deploy.
Calculated as [(480 + 1300)/2]/[(400 + 500)/2 + (480 + 1300)/2].

10,242/106,953 = 0.096

Only Mercedes and BMW currently have a weight sensor that turns off the air bag when a low weight or no weight is in the right front passenger seat. It is assumed that this system could be updated to include up to 54 pounds with no additional cost, and that current weight sensor sales are around 230,000 a year in the U.S. Thus, applying a factor of .985 (15.27/15.5 million) to these estimates results in cost estimates weighted by the percent of the fleet complying of $12.15 to $32.90 without replacing the windshield and $28.60 to $84.80 when the windshield must be replaced.

Table VII-9
Estimated Property Damage Savings
(1997 Dollars)

System	Driver Side	Passenger Side	Total
Suppression with child presence -	$0	$12.15 to $32.90 w/o replacing windshield $28.60 to $84.80 replacing windshield	$12.15 to $32.90 w/o replacing windshield $28.60 to $84.80 replacing windshield
Suppression when out of position only	negligible	negligible	negligible
Offset Barrier Tests	$0	$0	$0
5th percentile female dummy in an unbelted 30 mph barrier test	$0	$0	$0
Dynamic out-of-position test using Dual-stage inflation based on crash severity - No change in threshold	$0	$0	$0
Low risk deployment test - No change in threshold	$0	$0	$0

C. Total and Net Costs

It is estimated that the average number of passenger cars and light trucks sold per year affected by this proposal will be 15.5 million[9]. With 15.5 million vehicles potentially being affected, it only takes an average cost of $6.45 to reach the $100 million threshold. Given that several technologies cost more than $6.45, this will be a significant rulemaking.

For each technology a net cost is estimated on a per vehicle basis and a total cost is derived assuming that all vehicles that don't currently have that technology, or pass the test already for that alternative, use that technology. The net cost calculation comes from taking the consumer cost and subtracting the present discounted value (discounted at 7 percent) of savings from not having to repair vehicles in cases of unnecessary air bag deployments.

For the **suppression with child presence using a weight sensor,** the average costs are estimated to range from $20.50 to $24.45 per vehicle. Property damage savings range from $12.15 to $32.90 without replacing the windshield and from $28.60 to $84.80 when the windshield is replaced. Thus, weight sensors will most likely be cost effective for consumers. The net ranges are from costing $12.30 to saving $12.40 without replacing the windshield and from saving $4.15 to $64.30 for those vehicles needing the windshield replaced. Assuming annual new car and light

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[9] The current air bag requirement and this proposal are not applicable to light trucks and vans that are over 8,500 GVWR or 5,500 pounds unloaded vehicle weight. Sales of these vehicles vary considerably from year to year, usually less than 500,000 per year. More than half of these vehicles are equipped with air bags. Sales predictions for MY 2003 and later range between 15.5 and 16 million vehicles annually. Thus, we predict that about 15.5 million vehicles will be affected by these requirements.

truck sales of 15.5 million units, the total annual net ranges from a cost of $191 million to a cost savings of $192 million if no vehicle needed the windshield replaced after an air bag deployment and from a cost savings of $64 million to $997 million if all vehicles needed the windshield replaced after an air bag deployment.

For the **suppression with child presence based on a occupant position sensor,** the costs are estimated to range from $41.15 to $60.90 per vehicle. Property damage savings range from $12.15 to $32.90 without replacing the windshield and from $28.60 to $84.80 when the windshield is replaced. The net costs could range from $8.25 to $48.75 per vehicle without replacing the windshield and the net costs could be as high as $32.30 and the net savings could be as high as $43.65 for those vehicles needing the windshield replaced after an air bag deployment. Assuming annual new car and light truck sales of 15.5 million units, the total annual net cost could range from $128 to $756 million if no vehicle needed the windshield replaced after an air bag deployment and total annual net cost could be as high as $501 million and the net savings could be as high as $677 million if all vehicles needed the windshield replaced after an air bag deployment.

For the **low risk deployment system** the costs are estimated to be from $3.60 to $40.80, and there are no property damage savings unless a higher threshold is included at the same time, thus the net costs are the same. Thus, total costs for 15.5 million vehicles would be from $56 million to $632 million.

For the **25 mph offset barrier test** the costs are estimated to be from $0 to $40.80 per vehicle and there are no property damage savings. Thus, the total net costs for a 15.5 million vehicle fleet range from $0 to $632 million.

For the **35 mph offset barrier test** for Alternative 2, the costs are estimated to be $2.50 to $43.30 and there are no property damage savings. Thus, the total net costs for a 15.5 million vehicle fleet are $39 million to $671 million.

For the **5th percentile female barrier test** the costs are estimated to be $0 to $40.80 for Alternative 1 and there are no property damage savings. Thus, the total net costs are $0 to $632 million for Alternative 1. .

For those technologies that could potentially have a net consumer savings (weight sensors or possibly position sensors for the right front passenger side), one issue is whether the market would result in the voluntary installation of these technologies without a Federal requirement. Two German companies (Mercedes and BMW - which are at the high end of the price market and probably have high air bag crash repair costs) have introduced weight sensors, partially due to the requests of insurance companies in Europe. There are many factors that a manufacturer would consider before adding a feature that added costs, but saved money for the average consumer in the long run. These include: the impact of price increases on new vehicle sales, aftermarket sales (fewer deployments mean less aftermarket parts sales), reliability, consumer perceptions about whether both air bags should have gone off in the crash, and whether American consumers on lower priced vehicles can perceive the long term benefits if they feel they will never be in a severe enough crash to deploy the air bag. Weight sensors and position sensors are new technologies that most consumers haven't been exposed to, and currently aren't aware of their potential benefits. Thus, there is little or no current consumer demand for the product. There may currently be a market failure due to imperfect knowledge by consumers and the fact that new vehicle purchasers would pay for any cost increases due to their installation, but most of the benefits accrue directly to insurance companies through lower collision loss payments. Consumers are dependent upon insurance companies to ultimately pass on these cost reductions to policy holders through premium reductions. Consumers may be uncertain that this will occur. Assuming that competition in the insurance market causes this pass-through to occur, one effect of this proposal may be merely to expedite the installation of some devices that are cost-beneficial for society and would ultimately be demanded by the market anyway. Comments are requested on whether this is likely to be the case, and, if so, how this possibility should be considered in the analysis.

Table VII-10
Net Consumer Costs (Savings) Per Vehicle
(1997 Dollars)

System	Consumer Cost At Time of Purchase	Property Damage (Savings)	Net Consumer Costs (Savings)
Suppression with child presence - with a weight sensor	$20.50 to $24.45	($12.15 to $32.90) w/o replacing windshield ($28.60 to $84.80) replacing windshield	$12.30 to ($12.40) w/o replacing windshield ($4.15 to $64.30) replacing windshield
Suppression with child presence - with a presence sensor	$41.15 to $60.90 Passenger side	($12.15 to $32.90) w/o replacing windshield ($28.60 to $84.80) replacing windshield	$8.25 to $48.75 w/o replacing windshield $32.30 to ($43.65) replacing windshield
Low risk deployment test	$3.60 to $40.80	$0	$3.60 to $40.80
25 mph offset test	$0 to $40.80	$0	$0 to $40.80
35 mph offset test	Alt. 2 $2.50 to $43.30	$0	Alt. 2 $2.50 to $43.30
5th percentile female dummy in an unbelted 30 mph barrier test	Alt. 1 $0 to $40.80	$0	Alt. 1 $0 to $40.80

D. Compliance Test Costs

This section discusses the estimated costs for the agency or for a manufacturer to perform compliance tests. Costs are in 1997 dollars. Most of these tests, or tests like these being proposed, are already run by the manufacturers and may not be incremental costs for them. This proposal would standardize a minimum set of tests run by the industry on air bags.

Vehicle Crash Tests

The NPRM proposed 14 potential vehicle crash test conditions:

12 potential rigid barrier tests: 3 angles (head-on, 30 degrees left and 30 degrees right) for 4 conditions (unbelted 50th male, belted 50th male, unbelted 5th female, and belted 5th female), and

2 potential tests using a deformable offset barrier (left and right side of the vehicle) with belted 5th percentile female dummies. Commenters stated that there were too many vehicle crash test conditions.

For the SNPRM, the agency is proposing 9 potential vehicle crash test conditions for both Alternative 1 and Alternative 2. Compliance test costs are:

The proposal includes a barrier test with neck injury criteria. A current compliance test, without neck injury costs about $18,000[10] for one test. With neck injury measurements, it would cost about $18,600 for one test. The current agency standard also provides for an unbelted sled test alternative with the 50th percentile male dummy. Almost all manufacturers are using the sled test. The sled test already includes neck data and costs about $16,000 to run. NHTSA buys a vehicle to make the sled buck for testing. The incremental cost of the barrier test over the sled test is $2,600. Manufacturers can save testing costs by using the sled because they will do multiple tests using the same sled buck.

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[10] All cost estimates are from NHTSA's costs for a contractor to perform these test.

The costs of running an offset frontal deformable barrier test is also around $18,600. There are also costs for the deformable face, which is destroyed with each test, of $1,025. Thus, the total cost for running the offset test is $19,625.

If the government ran all of these tests for one make/model, it would have to purchase 9 vehicles at an average cost of $20,000 each or $180,000. However, NHTSA need not run all of these crash conditions for a make/model chosen for testing. The compliance test costs for running all nine tests for Alternative 1 is $168,425 ($18,600 x 8 + $19,625). The compliance test costs for running all nine tests for Alternative 2 is $175,525 ($18,600 x 4 + $19,625 x 5). Total costs for the tests and vehicles would average $348,425 for Alternative 1 and $355,525 for Alternative 2 for the high speed vehicle tests.

Currently, the standard requires certification to the 3 belted 50th percentile male dummy tests and a sled test. The total cost of these tests are $151,800 ($18,600 x 3 + $16,000 + 4 vehicles x $20,000). Thus, the potential incremental cost for high speed tests is $203,725 per make/model, if all of the tests were run for the slightly more expensive Alternative 2.

Cost estimates for NHTSA do not reflect the cost estimates for manufacturers. While the average new vehicle price is around $20,000, manufacturers developing all new models may decide to use a few prototype vehicles for development testing purposes. Prototype vehicles can easily cost $200,000. The agency believes that most manufacturers are already running many of the test proposed, including the offset tests and have test facilities available to run these tests.

Manufacturers must certify that their vehicles meet the standard, but are not required to run the test to prove certification.

Static Tests

Tests for Static Suppression - Passenger Side

For each set of out-of-position tests there would be a 2 hour set up time to inspect and clothe the dummy, prepare the vehicle, set the cameras, etc. Then, it is estimated to take 30 minutes per test configuration, with four to five different positions, per child restraint. It is also assumed to take 30 minutes to set up the dummy for each of the out-of-position tests that are not in a child restraint. Labor costs are estimated at $31 per hour for technicians and $53 per hour for engineers. It is assumed that one technician and one engineer would run the tests for a total of $84 per hour test cost. The agency would purchase a separate vehicle to do the static tests at an average cost of $20,000.

Infants

The 12-month old dummy is put in the child seat, the seat in the vehicle, the handle is moved to different positions, and a towel or blanket is put over top in any manner. The door must be closed and the light monitored after each change. In addition, the agency is requiring a 5th percentile female dummy test in the right front seat to make certain that the system recycles from the air bag deactivated situation for the child restraint to the air bag activated situation for the adult situation. The agency suspects that manufacturers will use a 5th percentile female, rather than a dummy, as a cheaper quicker solution to this requirement.

The agency is proposing to use a range of child restraints on the market in its testing:

1) 1 car bed in its nominal design position,

2) 11 different rear facing child restraints, each of which would be tested with and without the base, so a total of 22 child restraints each tested at 4 different positions for a total of 88 tests,

3) 7 convertible seats each tested at 5 different positions for a total of 35 test.

Thus, there is a total of 124 tests (1 + 88 + 35). For costing purposes, there is a total of 30 test configurations (1 + 22 + 7).

If all the different child restraints for infants and configurations possible were tested, the total cost would be $1,428 (2 hours set up + 30 x 30 minutes = 17 hours x $84). Is it possible that manufacturers could reduce the number of tests by 40 percent if they use a weight sensor and determine that the belted test is the worst case scenario and they don't have to test the unbelted condition.

3 year old and 6 year old Dummies

The testing using the 3-year-old dummy includes 7 convertible seats and 5 booster seats with the dummy in the child seat and an additional 9 tests with the unbelted dummy in different positions for a total of 21 tests. The testing using the 6-year-old dummy includes 5 booster seats with the dummy in the child seat and an additional 5 tests with the unbelted dummy in different positions for a total of 10 tests. Combining the 3 year old and 6 year old dummy test for automatic suppression, there are 31 tests. The total cost would be $1,470 (2 hours set up + 31 x 30 minutes = 17.5 hours x $84).

Out-of-position Tests for Static Suppression -Driver Side

This is an optional test, which will have to be specified by the manufacturer to provide a fair test of the specific system. For this test, the manufacturer would have to petition the agency to allow a test for it's system. The manufacturer would presumably tell the agency where the suppression zone is, and the agency would do at least two static tests, one inside the zone and one outside the zone and monitor the light. There would be a 2 hour set up time to inspect and clothe the dummy, prepare the vehicle, set the cameras, etc., then, it is estimated to take 30 minutes per test configuration. The cost of this procedure is estimated to be 2 hours set up + 30 minutes of test time x 2 tests or 3 x $84 = $252.

Out of Position Test of Low Risk Deployment

It is estimated to take about 3 hours to set up for this test to place the dummy, hook up the dummy instrumentation, camera coverage, etc. Then it is estimated to take 2 hours per test to position the dummy, run the test, remove and install a new air bag, instrument panel and windshield, and do pre and post photographs. Total labor time is 5 hours or $420 (5 x $84) plus the cost of a new air bag, instrument panel and windshield, if needed of $400 to $550 for the driver side and $1,130 to $3,350 for the passenger side. Two positions are run for the driver side. Two positions are run for the passenger side for both the 3 year old and 6 year old dummy, for a total of 4 tests on the passenger side. The total cost for the low risk tests is estimated to be $1,640 [2 x ($420 + $400)] to $1,940 for the driver side and $6,200 to $15,080 for the passenger side for a total of $7,840 to $17,020.

Out of Position Test for Dynamic Suppression

This is an optional test, which will have to be specified by the manufacturer to provide a fair test of the specific system. For this test, the manufacturer would have to petition the agency to allow a test for it's system. Since the agency doesn't have a test procedure, the cost of the test cannot be estimated. If it involves crashing a vehicle, the test costs would be at least as much as the vehicle crash test costs discussed above.

Total Testing Costs

Total testing costs to the agency to run one vehicle through all of the proposed tests, assuming the use of the vehicle crash tests for Alternative 2 and the static suppression tests for the passenger side and low risk for the driver side are about $360,000 ($355,525 + $1,428 + $1,470 + 1,940). If the low risk option is chosen by the manufacturer for the driver and passenger side, total testing costs to the agency to run one vehicle through all of the proposed tests for Alternative 2 are $363,000 to $373,000 ($355,525 + $7,840 to $17,020). These assume ten vehicles must be purchased (nine for the vehicle crash tests and one for out-of-position testing).

This is essentially two and one half times the current cost to the agency to run all of the current potential tests, which cost $151,800. Of course, the agency does not have to run all of these tests, it may only run what it believes might be the worst case conditions to check for compliance.

Dummy Costs

Most manufacturers already own a variety of dummies for use in research testing. The 1998 list costs for fully instrumented dummies are shown in Table VII-11. Not all of the instrumentation is required for this proposal. Several of the load cells and accelerometers provide information that is not required by the proposal on areas such as lower limbs, etc. Cost estimates for the dummies as proposed are also shown in Table VII-11.

Table VII-11
Dummy Costs ($1998)

	Fully Instrumented Dummy			Dummy with Instrumentation As Proposed		
	Dummy	Instrumentation	Total Costs	Dummy	Instrumentation	Total Costs
CRABI-12 month	$8,300	$42,500	$50,800	$8,300	$15,500	$23,800
HIII-3 yr.	36,400	62,300	98,700	36,400	15,500	51,900
HIII-6 yr.	31,200	72,900	104,100	31,200	61,400	92,600
HIII-5th female	33,400	99,100	132,500	33,400	69,200	102,600

Note that costs for laboratory overhead and profit are not considered in many of the above test estimates.

E. Leadtime

The NHTSA Reauthorization Act of 1998 directs the agency to issue a final rule not later than September 1, 1999 and to have a phase-in beginning not earlier than September 1, 2002 and no sooner than 30 months after the issuance of the final rule, and be fully effective by September 1, 2005. However, if the final rule cannot be completed by that date, it must be issued no later than March 1, 2000, and NHTSA is authorized to delay the phase-in starting date to not later than

September 1, 2003 and to delay making the final rule fully effective until September 1, 2006.

Since the agency is issuing this SNPRM, the final rule will not be issued until March 1, 2000. The agency is proposing the phase-in will start 30 months later on September 1, 2002 (the beginning of Model Year (MY) 2003, and the agency is proposing that the rule be fully effective on September 1, 2005 (MY 2006).

Vehicle leadtime is a complex issue, especially when it involves technology and designs that are still under development. In three different formal actions, the agency has gathered information concerning leadtime. First, the agency held a public meeting on advanced air bags on February 11 and 12, 1997, in Washington D.C. (See Docket NHTSA-97-2814). Second, NHTSA contracted with JPL to conduct an independent analysis concerning the readiness of the advanced air bag technologies. Third, the agency contracted Management Engineering Associates (MEA), an engineering management consulting company, to conduct a feasibility study on advanced air bag technologies.

These three sources of information indicated the same basic time schedules: currently available technological solutions such as seat sensors, seat belt buckle sensors, dual-stage inflators and advanced air bag fold patterns, can be and will be in production between model year 1999 and model year 2002. More sophisticated systems such as dynamic occupant position sensing systems may not be available until after September 1, 2001.

NHTSA has also held numerous meetings with and sent information requests to the vehicle manufacturers and suppliers. The companies have shared confidential information with the agency about their ongoing development efforts and future product plans. The agency notes that leadtime for technology still under development typically depends on two things: initial development to demonstrate that a concept is feasible, and then further development to apply the technology to a specific vehicle design. These typically involve efforts both by suppliers and by vehicle manufacturers. In this field of technology, it appears that much of the innovative development is being borne by the component suppliers, based on performance specifications defined by the vehicle manufacturers. First the systems are designed, tested and produced in a limited quantities by the component manufacturers. Next these systems are turned over to the vehicle manufacturers. The vehicle manufacturers then conduct prototype design verifications, conduct production level equipment verification and finally complete production and include the systems in their new vehicles. On the average, MEA estimates the vehicle manufacturers' cycle could take 36 months.

The suppliers and vehicle manufacturers have, however, been working on various advanced technologies for several years. Thus, to a large degree, leadtime is dependent on where the suppliers and vehicle manufacturers are currently in their development and implementation efforts. NHTSA believes that different suppliers and vehicle manufacturers are at different stages with respect to designing improved air bags. NHTSA believes that these differing situations can best be accommodated by phasing in requirements for advanced air bags and that technology will be available to meet the proposed leadtimes.

There were three areas of concern expressed in comments to the docket. They were:

a) Overall leadtime. Whether 3 years after issuance of the final rule was long enough. Volvo(98-4405-#113) and Honda (98-4405-#93) indicated they will need 3 years after issuance of the final rule before the start of the phase-in. However, the agency is proposing the minimum 30-month leadtime allowed by Congress.

Taking into account all of the available information, the agency is proposing to phase in the new requirements in accordance with the following implementation schedule:

Model Year	Percent of Each Manufacturer's Fleet
2003	25%
2004	40%
2005	70%
2006	100%

b) Leadtime for limited-line manufacturers. In the NPRM, the agency proposed a one-year delay for manufacturers selling 2 or less models in the United States. They could choose as an option to have full compliance in MY 2004. The agency is again proposing this alternative.

c) Leadtime for small manufacturers. As mentioned in docket comments by COSVAM (98-4405-#46), and Ferrari (98-4405-#65), small vehicle manufacturers are typically at the end of the line for these advanced technologies. Part of the reason is their smaller engineering staff and part of the reason is economics. The smaller manufacturers don't have the funds to test out new technologies. Similarly, suppliers are trying to assure a market with larger manufacturers first. Once the suppliers and manufacturers have advanced on the learning curve with a new technology, then it becomes a manageable task for suppliers to consider introducing the technology for smaller manufacturers with different vehicle conditions.

Ferrari requested that there be a separate phase-in for small volume manufacturers (those with less than 10,000 vehicles sold worldwide) starting with at least a 3 year delay after the normal phase-in. Based on the wording in the Reauthorization Act, the agency does not have this flexibility because the Act requires the final rule to become fully effective for <u>all</u> vehicles on September 1, 2005 (MY 2006) if the phase-in commences on September 1, 2002. Cosvam stated that limited line manufacturers need until the end of the main phase-in to comply with the final rule. The agency is proposing that small manufacturers (as defined by having sales of less than 5,000 vehicles worldwide) have all of their vehicles meet the fully effective date at the end of the phase-in or MY 2006.

d) Leadtime for second-stage manufacturers and alterers. In the NPRM, the agency proposed that multi-stage manufacturers and alterers be allowed an option of 100% compliance of their fleet at the end of the phase in MY 2006. Atwood Mobile Products (98-4405-#48) requested that second stage manufacturers be given a one year extension after full compliance by the original equipment manufacturers (OEM's) to obtain the information from the OEM's and complete their testing. As mentioned above, the agency does not believe it has the flexibility to grant this request, since the

Reauthorization Act requires all vehicles to comply on the full compliance date.

An issue which is closely related to leadtime for advanced air bags is the time when amendments providing temporary reductions in Standard No. 208's performance requirements should expire. The amendment permitting manufacturers to provide manual on-off switches for air bags in vehicles without rear seats or with rear seats too small to accommodate a rear facing infant seat is scheduled to expire on September 1, 2000. The amendment providing a generic sled test alternative to Standard No. 208's unbelted barrier test requirements expires on September 1, 2001.

The 1998 Act states; "...the requirements of S13 of Standard No. 208 shall remain in effect unless and until changed by the rule required by this subsection." NHTSA's March 19, 1997 final rule established S13, which allowed an alternative unbelted test (the generic sled test) for vehicles manufactured before September 1, 2001. Thus, the agency must coordinate the timing of advanced air bags, with the existing provisions of S13, allowing the generic sled test to continue until vehicles can meet the advanced air bag requirements. The agency is proposing to delete S13 from FMVSS 208 as advanced air bags are phased-in.

The agency received petitions objecting to the expiration date and has considered the 1998 Act. Consistent with the Act, NHTSA is granting those petitions proposing to extend the dates so that the temporary amendments are phased out as the upgraded requirements are phased in. During the proposed phase-in, the temporary amendments (sled test alternative and OEM manual on-off switches for certain vehicles) would not be available for vehicles certified to the upgraded requirements, but would be available for other vehicles.