

# *"Vehicle Aggressivity and Compatibility in Automotive Crashes"*

Session B-13  
SAE Congress and Exposition  
March 6, 2002

**Chair Person: Joseph N. Kaniathra Ph.D.**

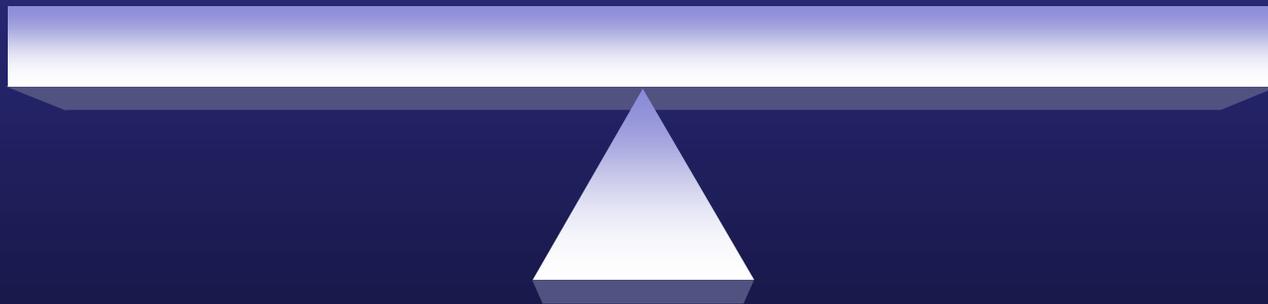
Director, Office of Vehicle Safety Research  
National Highway Traffic Safety Administration  
U.S. Department of Transportation

# *Terminology*



**Aggressivity  
(Partner Protection)**

**Vulnerability  
(Self Protection)**



**Compatibility  
Balancing the two extremes**

# *Geometric Incompatibility*



# Historical Perspective



REPORT ON THE FIRST INTERNATIONAL TECHNICAL CONFERENCE ON  
EXPERIMENTAL SAFETY VEHICLES



PARIS FRANCE: JANUARY 25TH THRU 27TH, 1971

## THE IMPORTANCE OF VEHICLE AGGRESSIVENESS IN THE CASE OF A TRANSVERSAL IMPACT

MONSIEUR CHILLON

FRANCE

### WHAT IS MEANT BY AGGRESSIVENESS?

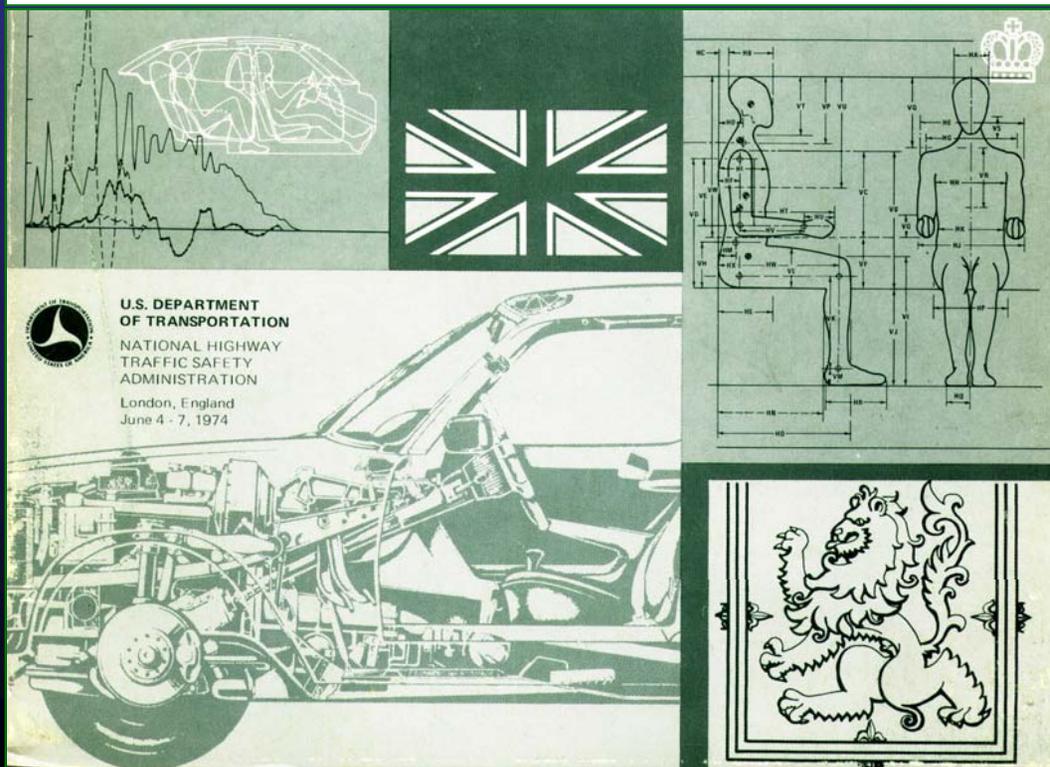
We term "aggressiveness", as the action of a vehicle towards persons outside it in the event of an accident. Aggressiveness is the opposite of "protection", which is the action of a vehicle towards the

1971

# Historical Perspective



*Report On The Fifth International Technical Conference On Experimental Safety Vehicles*



U.S. DEPARTMENT  
OF TRANSPORTATION  
NATIONAL HIGHWAY  
TRAFFIC SAFETY  
ADMINISTRATION  
London, England  
June 4 - 7, 1974

## BIG AND LITTLE CAR COMPATIBILITY

JEROME M. KOSSAR  
Office of Vehicle Safety Research  
National Highway Traffic  
Safety Administration

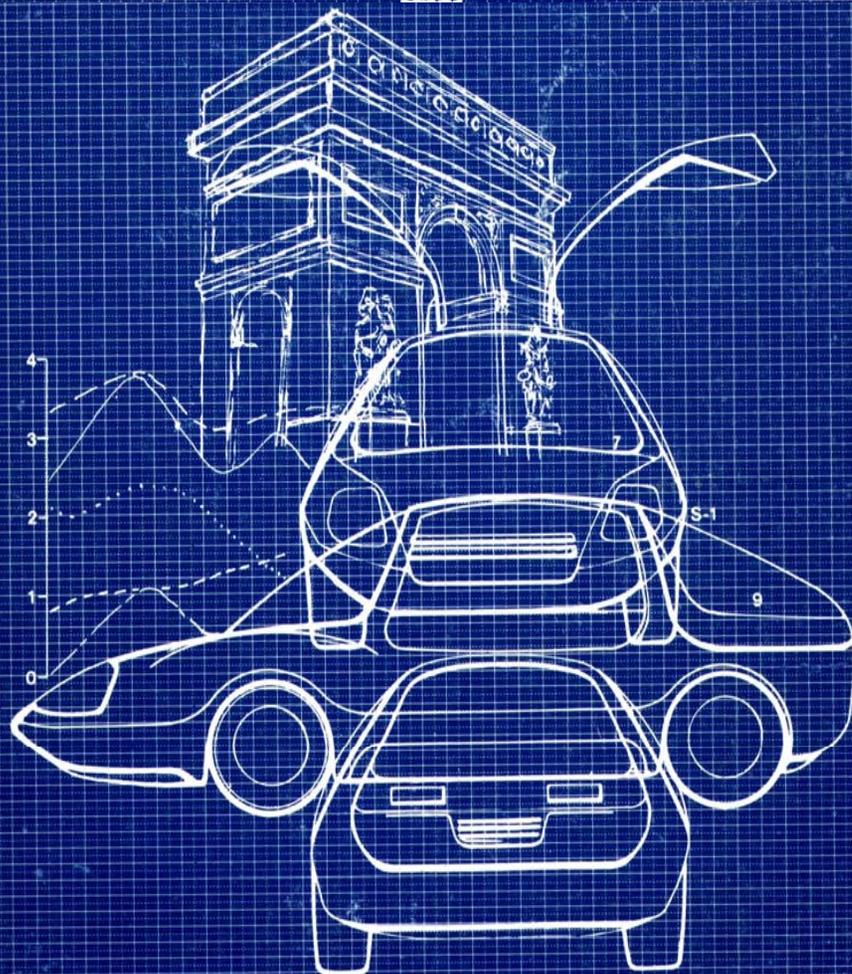
### ABSTRACT

To reduce highway deaths and injuries, it is necessary to consider new design approaches for vehicles and their occupant restraint subsystems. We must give attention not only to the safety of the occupants of our vehicle but also to the safety of the

1974

# Historical Perspective

## Seventh International Technical Conference on Experimental Safety Vehicles



## Safety Systems Optimization Model

JOHN VERSACE  
Executive Engineer / Safety Research  
Ford Motor Company

### ABSTRACT

The Safety Systems Optimization Model (SSOM) is an experimental computer program which seeks to make those broad scale simulation studies that involve many thousands of runs more practicable by substituting simple approximations for the otherwise prohibitively expensive running of so many multi-degree-of-freedom dynamics simulations. The model,

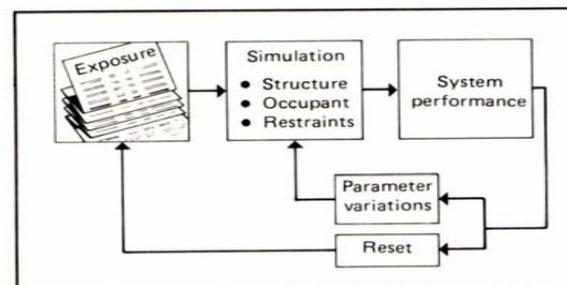


Figure 5. System simulation model.

1979

# Historical Perspective



## THE FOURTEENTH INTERNATIONAL TECHNICAL CONFERENCE ON ENHANCED SAFETY OF VEHICLES



MUNICH, GERMANY  
MAY 23-26, 1994

### Systems Optimization of Vehicle Crashworthiness

Hampton C. Gabler, William T. Hollowell,  
Ralph J. Hitchcock,  
National Highway Traffic Safety Administration  
United States  
Paper No. 94-S4-O-12

#### ABSTRACT

Optimal crash countermeasure designs must successfully balance two potentially conflicting objectives: (1) maximizing passenger protection in the vehicle under design, and (2) minimizing aggressiveness toward other vehicles in the fleet mix. To meet these objectives, vehicle crashworthiness

#### Methodology

The approach to crashworthiness optimization in this study may be stated formally as the following non-linear problem:

$$\min I_{inj}(x,u) = \sum p_i s_i(x,u) \quad [1]$$

$$\text{subject to } \begin{aligned} Wgt(x) &\leq Wgt_{max} \\ Cost(x, w(x)) &\leq Cost_{max} \\ x_{min} &\leq x \leq x_{max} \end{aligned}$$

where  $x$  - Vector of Design Variables  
 $u$  - Belt Usage Rate



The objective expressed in Equation 1 is to determine that

# Historical Perspective



## Fifteenth International Technical Conference on the Enhanced Safety of Vehicles

WORLD CONGRESS CENTRE  
MELBOURNE, AUSTRALIA  
13 -16 MAY 1996



# 1996

### NHTSA's VEHICLE AGGRESSIVITY AND COMPATIBILITY RESEARCH PROGRAM

**William T. Hollowell**  
**Hampton C. Gabler**  
National Highway Traffic Safety Administration  
United States  
Paper No. 96-S4-O-01

#### ABSTRACT

The National Highway Traffic Safety Administration's vehicle aggressivity and compatibility research program explores the global evaluation of vehicle crashworthiness designs as a means of minimizing injuries in the design vehicle while simultaneously minimizing injuries in the vehicle's collision partners. The program pursues both an analytic investigation of fleet wide vehicle performance as

special working group on Vehicle Compatibility. This working group was the result of the concern about the structural integrity of vehicles made by vehicle manufacturers. Extensive crash testing being conducted throughout the world. The modifications included strengthening the structure in order to reduce the level of intrusion during side impact crashing. The stiffened structure was designed to increase the severity of side impact

# Historical Perspective



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Edition: 1

21 Papers.

From the "Airbag Technology" sessions at the 1998 SAE International Congress and Exposition.

Includes the highly-publicized presentation "The Aggressivity of Light Trucks and Vans in Traffic Crashes" by Hampton C. Gabler and William T. Hollowell of the U.S. National Highway Traffic Safety Administration.

Also includes three other papers authored or co-authored by NHTSA Personnel: "Air Bags - Legions of Fable - Consumer Perceptions and

# 1998

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PAPER SERIES

980908

## The Aggressivity of Light Trucks and Vans in Traffic Crashes

Hampton C. Gabler and William T. Hollowell  
U.S. National Highway Traffic Safety Administration

# *Historical Perspective*



## **Overview of Vehicle Compatibility/ LTV Issues**



National Highway Traffic Safety Administration

*February 1998*

1998

# Historical Perspective



May 31 to June 4 1998

16th International  
Technical Conference on the  
Enhanced Safety of Vehicles

**Proceedings**  
Volume 1 of 3



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Windsor, Ontario  
CANADA

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WINDSOR98

## NHTSA'S VEHICLE AGGRESSIVITY AND COMPATIBILITY RESEARCH PROGRAM

**Hampton C. Gabler**  
**William T. Hollowell**  
U.S. National Highway Traffic Safety Administration  
United States  
Paper No. 98-S3-O-01

### ABSTRACT

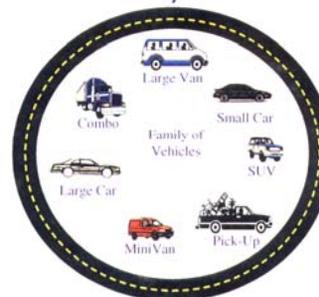
NHTSA has initiated a research program to investigate the problem of aggressive or incompatible vehicles in multi-vehicle crashes. Collisions between cars and light trucks and vans are one specific, but growing, aspect of this larger problem. Light trucks and vans (LTVs) currently account for over one-third of

The near term objective of this program is to identify and demonstrate the extent of the problem of incompatible vehicles in vehicle-to-vehicle collisions. The goal is to identify and characterize compatible vehicle designs with the expectation that improved vehicle compatibility will result in large reductions in crash related injuries. The research effort seeks to identify those vehicle structural categories, vehicle

## Transport Canada-NHTSA International Dialogue on Vehicle Compatibility



June 5, 1998  
Windsor, Canada



“Media paying  
increased  
attention  
to the issue of  
Compatibility”

1998