

Dynamic Research, Inc.

Vehicle R&D and Human Factors Research Services

Company Overview

Dynamic Research, Inc. (DRI) specializes in applied research, development, and consulting in the following areas:

- Vehicle dynamics and control
- Vehicle systems
- Human factors and ergonomics
- Biomechanics
- Structural mechanics
- Simulator technology
- Accidentology

In the automotive area this includes analysis, simulation, and testing of:

- Automobiles
- SUVs
- Light trucks
- Motorcycles
- Off-road vehicles
- Medium and heavy trucks

Topics addressed include:

- Handling and stability
- Ride
- Noise and vibration
- Braking
- Driver factors
- ITS devices and telematics
- Restraints and crashworthiness
- Occupant protection
- Ergonomics
- Safety
- Aerodynamics



Full Scale SUV Rollover Resistance Test with AVC

Staff Experience

DRI has a regular staff of 35 engineers, scientists, technicians, and support personnel, many of whom hold advanced degrees.



Driving Simulator Roadway Scene

Our staff has extensive experience in the following areas:

Experimental investigations including:

- Full scale tests with instrumented vehicles
- Vehicle crash and rollover tests
- Measurements in our driving simulator
- Tire tests
- Wind tunnel tests

Analyses, including:

- Vehicle dynamic analysis
- Statistical analysis
- Model identification
- Time series and frequency domain analysis
- Risk/benefit and trade off analysis

Computer simulation, including:

- Mathematical model development
- Large scale digital simulations
- Applications

System development, including:

- Prototype hardware development and integration
- Software development
- Design, fabrication, and use of special purpose experimental devices, instrumentation, and test equipment
- Project Management

Research and Consulting Areas

The applied research and consulting activities of DRI generally relate to new product evaluations, metric and methodology development, problem solving, and regulatory and litigation technical support in the following areas.

Vehicle Dynamics and Control

- Handling and stability
- Ride, noise, vibration and harshness
- Braking
- Drivability
- Simulation, testing, analysis

Human Factors and Ergonomics

- Human-machine interaction
- Driver behavior and workload
- Subjective response to handling, ride, noise, braking qualities
- Anthropometry

Restraints and Protection Systems

- Impact and rollover simulation (multibody and finite element)
- Special purpose dummy development
- Biomechanics research
- Injury models and risk/benefit analysis
- Accident reconstruction
- Test support, component testing, data analysis

Controls and Display Systems

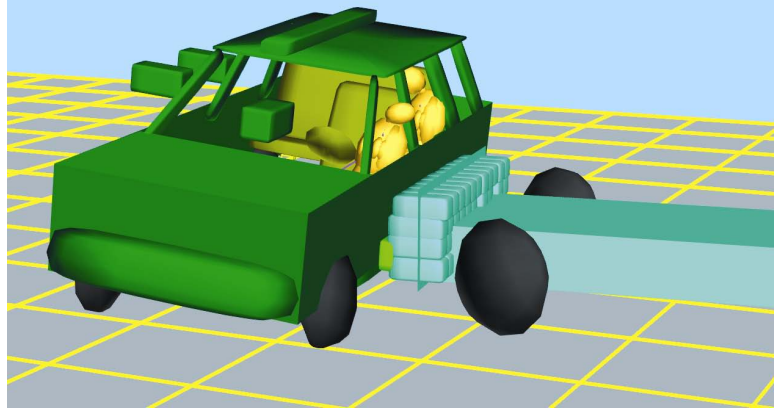
- Control subsystems (ABS, TCS, 4WS, etc)
- In-vehicle displays (telematics, etc)
- Manual control
- Automatic vehicle controllers
- Feel systems (in simulators, steering augmentation, etc)

Driver-in-the-Loop Simulators

- Requirements and design studies
- Software development
- Hardware development
- Systems integration
- Application studies

Aerodynamics

- Analysis and design
- Wind tunnel and full scale tests



Side Impact Test Simulation

Computing and Software

The analytical capabilities of DRI are supported by proprietary as well as commercial computer software for analysis, simulation, and data reduction. These programs are run on in-house computer systems which include a Silicon Graphics ONYX IR super computer, a network of Windows and Linux PC microcomputers, and an extensive array of peripheral devices.

The DRI staff has developed and applied a number of computer simulations for vehicle dynamics and control analysis. Available versions involve a wide range of vehicles, such as:

- Passenger vehicles
- Trucks and utility vehicles
- Motorcycles
- All terrain vehicles
- Articulated vehicles, trailers
- Buses
- Aircraft

These have been developed in connection with projects for the government and the private sector. They range from relatively simple, linearized lateral or longitudinal models to more complicated nonlinear, all axis models involving large motions. Other proprietary programs are available in such areas as:

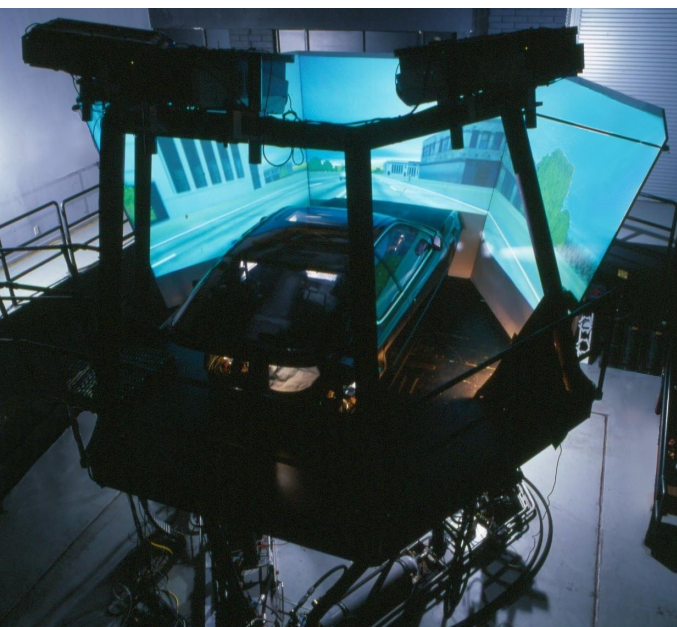
- System identification and optimization
- Structural analysis including crashworthiness-related applications
- Large scale experimental data post processing and analysis
- Control systems analysis

The simulation and analysis programs are typically in FORTRAN, C, or C++. New, special purpose deliverable software can also be provided for Windows, DOS, MATLAB[®] and other environments.

DRI also owns or licenses large scale software systems to support simulation and analysis. These include the following software packages:

- ATB, US Air Force "Articulated Total Body" program for modeling of multi-body systems and impacts (equivalent to NHTSA CVS crash simulation)
- DRI/ATB1, which couples LS-DYNA3D non-linear finite element code to ATB (DRI proprietary product)
- MADYMO, multi-body and finite element program for the analysis and modeling of crash mechanics
- MSC. ADAMS®, for multi-body vehicle dynamics modeling and simulation
- CarSim®, for vehicle dynamics simulation
- VISIONFORM, for high speed 3D graphics and animation of time history results and simulator roadway scenes (licensable through Kinetic Visuals, a DRI subsidiary)
- MSC. NASTRAN™, finite element code
- ANSYS®, finite element code
- MATLAB®, for PC based analysis and data reduction

Overall, these software capabilities fully complement DRI's computing hardware resources, and enable an applied research group the size of DRI to accomplish very significant experiments, analyses, simulations, and hardware and software development, to support the needs of our clients.



DRI Moving Base Driving Simulator

Special Purpose Experimental Devices

DRI has specified, designed, constructed, and reduced to practice a variety of special purpose test devices, to support our applied research activities. These include:

- Mobile Tire Tester: an over-the-road test system used to measure tire forces and moments (in 6 degrees of freedom) under realistic operating conditions of vertical load, slip angle, camber angle, and slip ratio
- Automatic vehicle controllers: specified, designed, fabricated, installed and used by DRI on a variety of vehicles for handling, maneuvering, stability, and braking tests. This includes AVC's for automobiles, pickup trucks, SUVs, all terrain vehicles, and motorcycles
- Specialized crash test dummies: various Hybrid and ISO dummy configurations, with internal data acquisition for special studies, some with breakable instrumented bones and other enhanced biofidelity features
- Impact test lab: including 6 meter monorail helmet impactor for helmet R&D, quality control, or accident reconstruction studies; fully instrumented Hybrid III head-neck guided drop assembly capable of measuring both linear and angular head accelerations; Part 572 head-neck pendulum; 6 meter twin rail drop impactor; and other pendulums and impactors. Extensive instrumentation and data acquisition capabilities, high speed camera, data reduction, analysis and documentation support
- Driving Simulators: interactive, driver-in-the-loop, large display driving simulators, useful to support vehicle and component development, and for studies of driver behavior and the effect of roadway parameters. These include a research grade moving-base driving simulator and a fixed-based driving simulator. The DRI Moving Base Driving Simulator is one of only a few in the world in its class



Mobile Tire Tester



Automatic Vehicle Controller



ISO MATD Dummy in Crash Test



Twin Rail Drop Impactor

