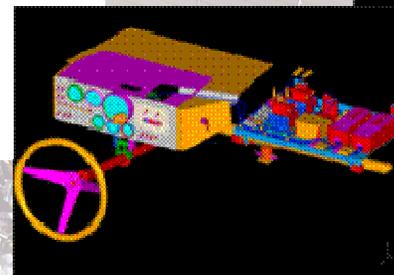
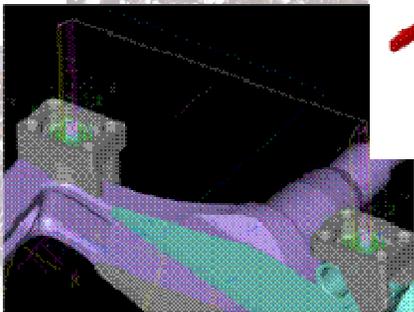
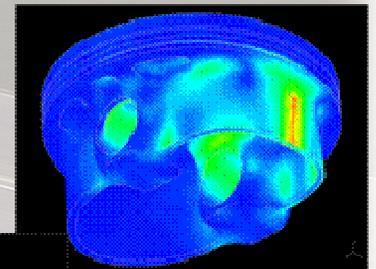
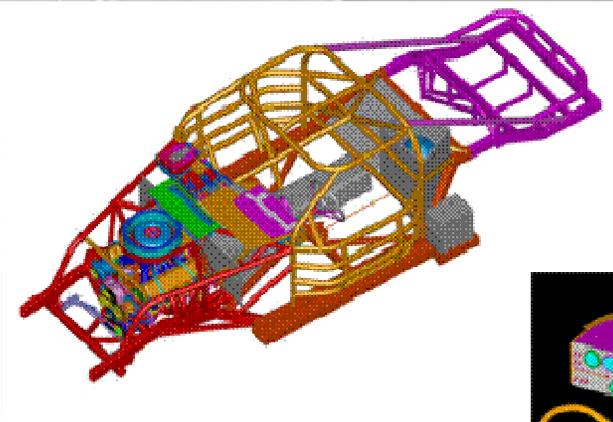
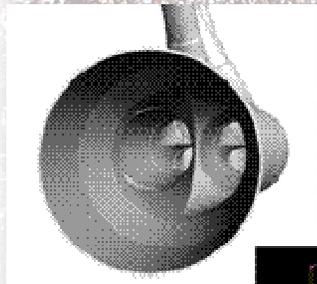




Teamcenter at the Speed of Racing

***Jim Wall – Director of Engine Operations
Mike Scott – HMS Teamcenter Solutions***



HMS History

- HMS was started in 1984
- HMS has grown from running one car in a few select events to running 4 cars full time / 1 part time in the NASCAR Nextel Cup Series, 1 car full time and 1 car part time in the NASCAR Busch Series and running several cars in other NASCAR series for driver development.

Kellogg's Racing

Driver: Kyle Busch
Crew Chief: Alan Gustafson
Sponsor: Kellogg's



- Won 2005 Cup Series “Rookie of the Year” honors.
- Won first NEXTEL Cup Races in September 2005 California event and November 2005 Phoenix event.
- Won first NEXTEL Cup Pole in February 2005 California event.
- Placed second in championship points in 2004 in the NASCAR Busch Series.



Driver: Jeff Gordon
Crew Chief: Steve Letarte
Sponsor: DuPont



- Four-time NEXTEL Cup Champion.
- Most Wins Among Active Drivers.
- 71 Career Wins.
- 192 Career Top Fives.
- 52 Career Poles.



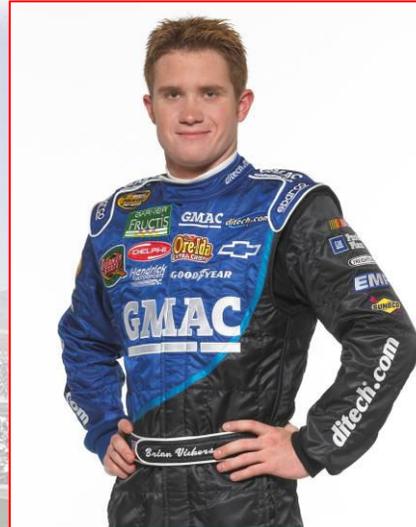
GMAC

Racing

Driver: Brian Vickers

Crew Chief: Lance McGrew

Sponsor: GMAC/ditech.com



- 2003 NASCAR Busch Series Champion.
- Youngest NASCAR champion ever.
- Competing in his third year at the NEXTEL Cup Series level in 2006.
- Five top-5s, Ten top-10s and one pole in 2005.



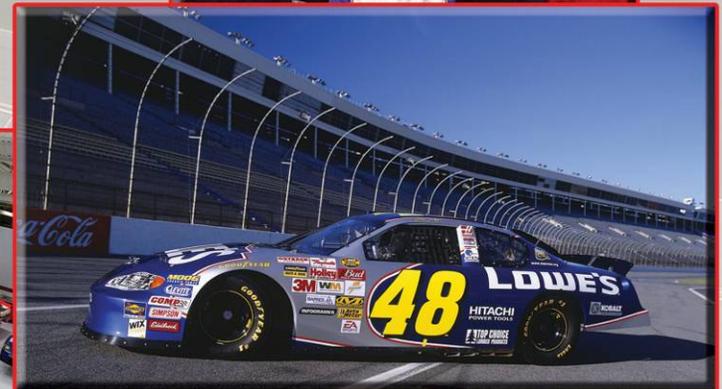
Hendrick

MOTORSPORTS



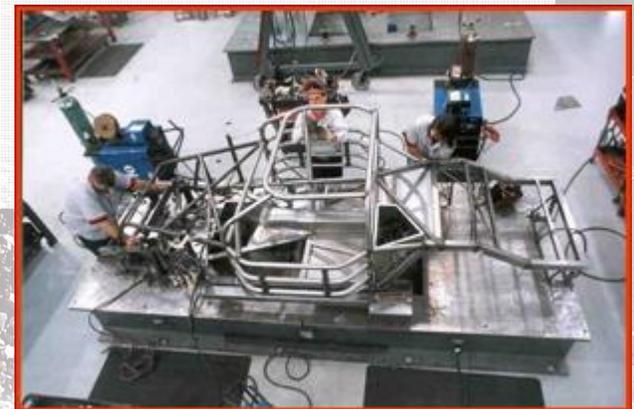
Driver: Jimmie Johnson
Crew Chief: Chad Knaus
Sponsor: Lowe's

- 18 Career Wins .
- Eight Career Poles.
- Four Wins in 2005.
- Fifth in Championship Points in 2005.



HMS Organization

- HMS has grown from purchasing vehicles to completely manufacturing race cars on-site.
- Currently HMS employs over 500 people and has departments for:
 - Chassis (one chassis from scratch every 10 days)
 - Engines (700+ engine builds per season)
- Each team has its own shop to take the components and develop the cars for their drivers.
 - 6 Team shops – 15 cars per shop
 - 2 cars prepped for each event



Hendrick Motorsports Engine Department

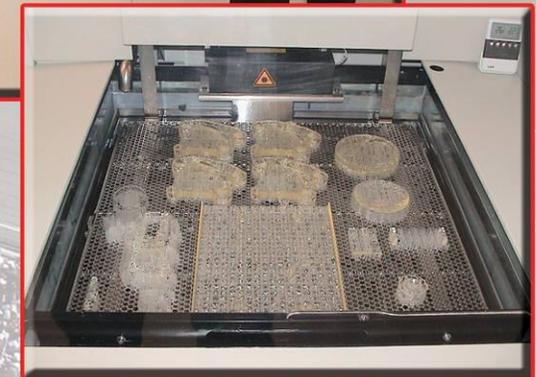
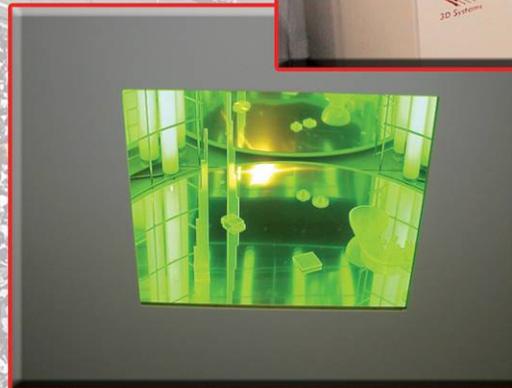
Hendrick Motorsports Engine Department Builds Over 700 Engines Annually and Supplies Seven NEXTEL Cup Teams With High Performance Race Engines. Our Mission is to Provide the Best GM Engine Program in NASCAR Through Advanced Engine Development



HMS Engineering

Hendrick Motorsports Engineering Department
Uses State of the Art Technologies to Provide All
Our Teams With a Competitive Advantage Through:

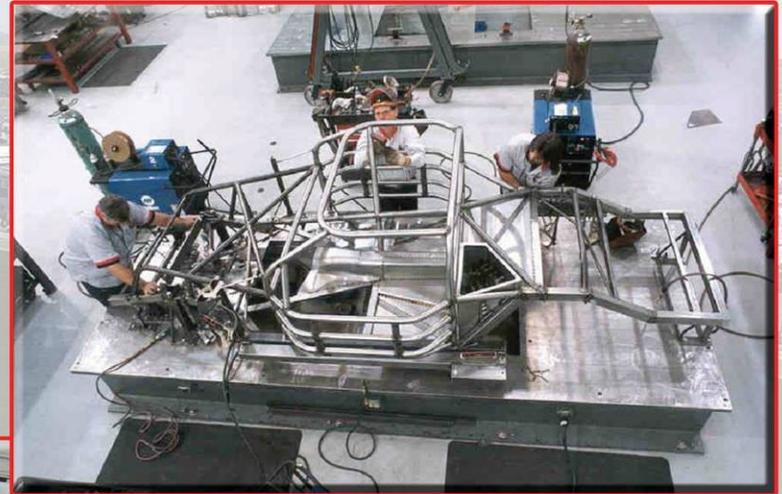
- Design
- Development
- Analysis
- Manufacturing/Prototyping
- Quality Control
- Digitizing
- Testing
- Tooling & Software
 - UGS Plus Software
 - HAAS Machine Tools
 - Brown & Sharpe CMM
 - 3D Systems Stereo
 - Lithography Solid
 - Imaging System



HMS Chassis Department

Hendrick Motorsports Chassis Department Builds
Hendrick Team Chassis' and Bodies In-House

- 10 Day Build Cycle
- 15-18 Cars per Team
- Manufacture all Chassis Components



HMS Research and Development

Hendrick Motorsports Research and Development Department is Constantly Exploring New Innovations and Technologies to Give Our Teams an Edge Over Our Competition Through:

- Data Acquisition
- Testing
- Car and Body Development
- Safety Systems



Changing Business Needs

- Original Challenges

- Introduction of a change takes months, repeatability is difficult at best. Each engine had its own quirks and characteristics.
- Hard to insure quality, consistency and reliability.
- Differences in horsepower (hp) from engine to engine could range as much as 20%.
- Lots of work is farmed out.

- Continuing Challenges

- Change implementation in days or hours
- Information sharing beyond Engineering Group
 - Race Teams, Chassis Group, Track Support, Vendors
- More types of information
- **More Power, More Durability!**



PLM Evolution

*Teamcenter rolled out to
Engine Department,
Chassis Shop,
Race Team Shops,
Race Events*

2006

- In-Service Expansion

- Expanded Bill of Material Management -Configurations
- In-Service - Serialization
- Track-side Mobility

2000

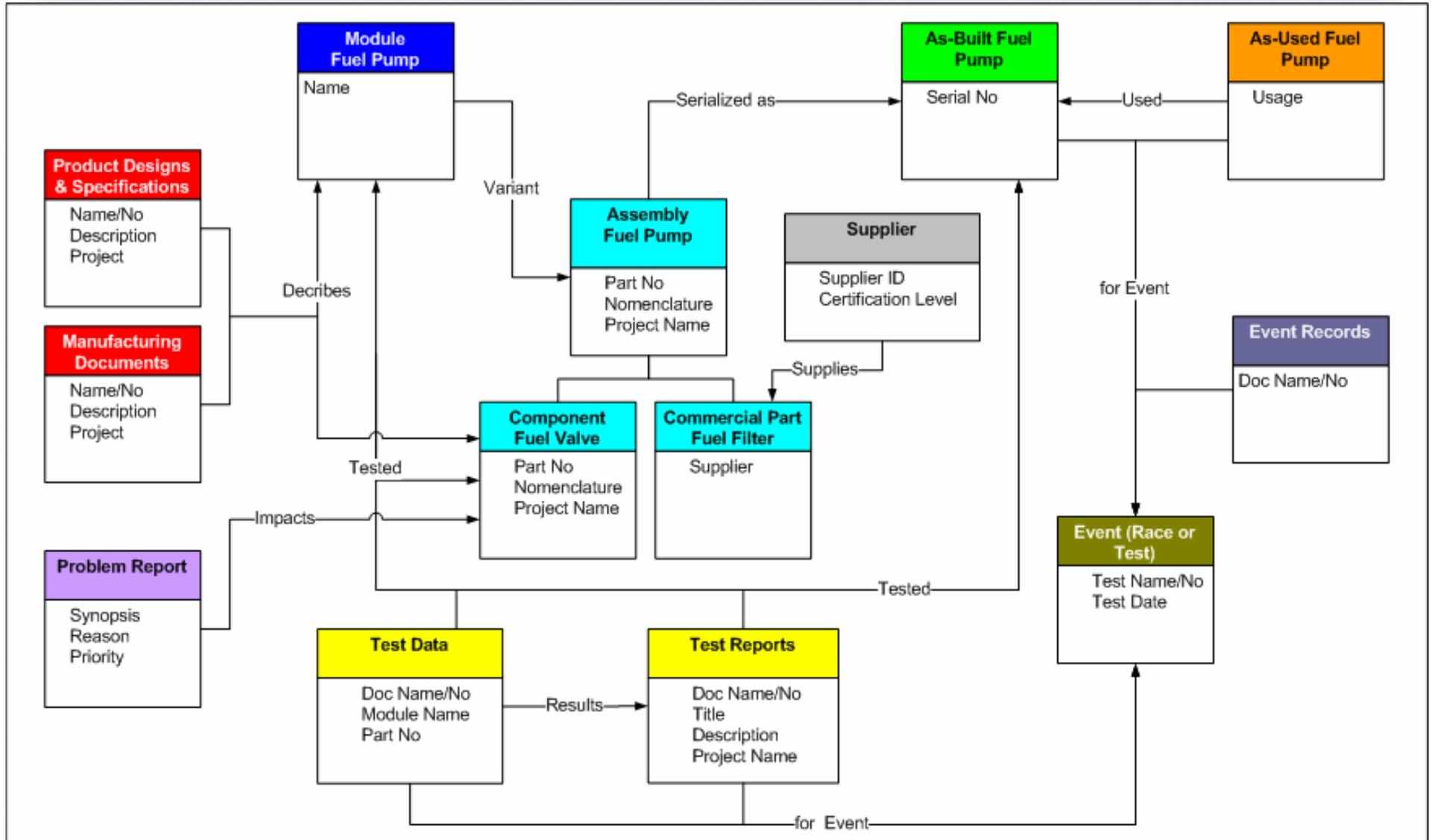
- Test Data Management
- Engine and Vehicle Reports
- Race Team Logs
- Specification management (HMS and Vendor)

1992

- Solid Modeling CAD/CAM/CAE
- CAD Management

- 3D Wireframe

Information Model



PLM with In-Service

6 days from decision to change to implemented solution!

- **Race Preparation**
 - Build and test the correct configuration
 - Race the “right” as-built product
- **Race Event**
 - Immediate access to information, past and present
 - Scope of problem impact
- **Post Race**
 - Rebuild management
 - Design and durability improvement

Race Preparation

- **Serialization of as-designed configurations**
 - For management of **test data** – e.g. engine dynamometer, flow, aerodynamics, etc.
 - Test Reports
- **Example:**
 - Engine horsepower.... on-line at track side.
 - Needed test reports at Darlington

The screenshot displays the Teamcenter software interface. At the top, the Handrick logo and 'Teamcenter' branding are visible. The main window shows a table of test reports for the assignment 'ETR-00169,A,7.1'. The table has columns for Name, Description, Class, Creator, and Creation Date. The reports listed include various engine test events and evaluations, such as 'Power Evaluation - Jrh137 - Test', 'JRH-032 Fontana Race', 'JRH-413 Fontana Race', 'JRH-075 Fontana Race', 'JRH-419 Fontana Race', 'JRH-158 Fontana Race', 'JRH-147 Fontana Race', 'JRH-385 Las Vegas Race', 'JRH-372 Las Vegas Race', and 'JRH-418 Las Vegas Race'. The interface also shows a sidebar with navigation options like 'Work List', 'My Lists', 'Create', 'File Upload', 'Admin', and 'Reports'.

Name	Description	Class	Creator	Creation Date	Reason
ETR-00169,A,7.1	April 2005 NC Bristol Engines Summary	Engine Test Report	jmckenzie	03/23/2005 16:32:20:156	
04-03-2005 NC Bristol Race Engines Summary Shop Flgs.pdf	04-03-2005 NC Bristol Race Engines Summary Shop Flgs.pdf	PDF File	bkurn	03/23/2005 16:33:42:811	
04-03-2005 NC Bristol Race Engines Summarials	04-03-2005 NC Bristol Race Engines Summarials.xls	Microsoft Excel Worksheet	bkurn	03/23/2005 16:33:43:327	
2005 Bristol Engine Schedule.xls	2005 Bristol Engine Schedule4.xls	Microsoft Excel Worksheet	williams	03/23/2005 07:36:31:893	
Report(s) for Event					
04/03/2005,Food City 500	04/03/2005,Food City 500	Race Event	jmckenzie	03/23/2005 08:34:03:140	
Depends on Test Docs					
DT-04244,A,1,1	Power Evaluation - Jrh137 - Test	Dyno Test Document	svester	12/09/2004 15:21:30:544	
DT-04303,A,1,1	JRH-032 Fontana Race	Dyno Test Document	jburton	01/17/2005 13:36:02:187	
DT-04357,A,1,1	JRH-413 Fontana Race	Dyno Test Document	jburton	08/27/2005 08:37:30:593	
DT-04359,A,1,1	JRH-075 Fontana Race	Dyno Test Document	bbeachum	02/08/2005 21:11:09:602	
DT-04365,A,2,1	JRH-419 Fontana Race	Dyno Test Document	sfox	02/09/2005 15:16:59:823	
DT-04369,A,1,1	JRH-158 Fontana Race	Dyno Test Document	bbeachum	02/10/2005 16:30:23:953	
DT-04370,A,1,1	JRH-147 Fontana Race	Dyno Test Document	svester	02/10/2005 16:33:04:962	
DT-04372,A,1,1	JRH-385 Las Vegas Race	Dyno Test Document	svester	02/14/2005 14:37:56:062	
DT-04379,A,1,1	JRH-372 Las Vegas Race	Dyno Test Document	sfox	02/16/2005 15:15:15:453	
DT-04381,A,1,1	JRH-418 Las Vegas Race	Dyno Test Document	svester	02/16/2005 15:16:59:827	
		Dyno Test		02/16/2005	

Race Preparation

- Serialization of as-designed configurations
 - Building the right *as-built configuration*
 - Compatibility constraints
 - Configured sets or parts
- Example
 - Right setup for the track – validate the physical configuration
 - Avoid putting cycles on wrong items
 - Put the right components with the right components
 - Oil pans for Watkins Glenn vs Tri-ovals



Race Preparation

- Serialization of as-designed configurations
 - 23 items that require *life cycle tracking*
- Example
 - As-built configuration satisfies life limit conditions – are there enough cycles left for expected race cycles
 - Distributor cycles for Coca Cola 600



Race Preparation

- Serialization of as-designed configurations
 - *Scheduled rebuilds* – overhaul of life cycle managed items
- Example
 - Access to as-built/maintained view
 - Fuel pump rebuild after Daytona



Race Event

- Immediate access
 - Scope of problem impact – usage visibility
 - Lot level traceability
 - Test result visibility
- Example
 - Quickly validate configuration
 - As-designed vs. as-built
 - Quickly validate if items are from same lot
 - Valve spring breaks at Texas



Example: Vendor Part Failure

- **May 6** – initial failure, part used for years until vendor made change
- **May 14/15** – second and third failure - not discovered until May 20th in engine tear-down, no solution from vendor yet
- **May 22** – HMS Engine team decides to implement in-house solution
- **May 27** – Retrofitting of all cars is completed. HMS sweeps the 2004 weekend's NASCAR races at Lowe's Motorspeedway.



6 days from decision to change to implemented solution!

Post Race

- Feedback and Improvement
 - Electronic race logs
 - Problem and resolution history
- Example
 - Capture event characteristics
 - Pass characteristics to items being traced
 - History of problems at an item level
 - Relationship back to as-designed configuration
 - Problem resolution knowledge
 - Race log provide key insight into next year Lowe's win

Key PLM In Service Capabilities

- Engine and car configurability
 - As-designed to as-built validation
- Serialization
 - Data management in context of as-designed and as-built
 - Life cycle tracking and rebuild scheduling
- Immediate access, anywhere anytime
- Event management
 - Race logs
 - Problem traceability



Impact over the years...

- ***Speed***
 - Implementation of changes from months to hours
- ***Reliability***
 - Differences in hp from engine to engine reduced from 20% to less than 1%
- ***Durability***
 - Verifiable configurations designed, tested, and raced

6 days from decision to change to implemented solution!

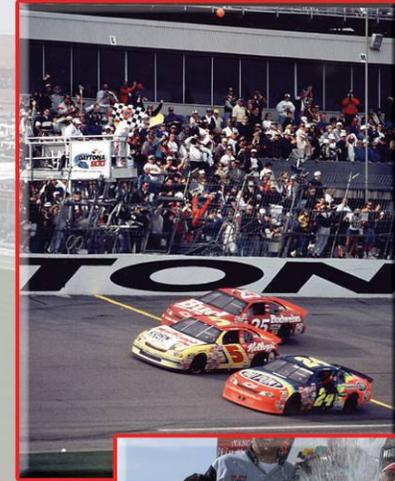
Winning Tradition

- Five NEXTEL Cup Championships
- One Busch Series Championship
- Three Craftsman Truck Championships

- 140 NEXTEL Cup Wins
- 22 Busch Series Wins
- 25 Craftsman Truck Series Wins

- Five Daytona 500 Wins
- Four Brickyard 400 Wins
- 184 Pole Positions

- Over 600 NEXTEL Cup Starts



Hendrick
MOTORSPORTS

UGS' PLM Technology is a critical part to this success.



***Teamcenter at the
Speed of Racing***

