



Ross School of Business at the University of Michigan

Independent Study Project Report

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PROFESSOR : Andrew Lawlor

STUDENT : Mike Chludzinski

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INDEPENDENT STUDY OBJECTIVE & DELIVERABLES

Objective

All members of the Dana Corporation IMAP Project Team participated in an independent study during January and February of academic year 1996-1997. During the independent study the team members:

- defined the project
- studied the organization
- gathered background research
- analyzed data
- detailed the project steps
- prepared data collection
- administered IMAP tasks

The Dana Corporation IMAP Project

Project Scope: Western European Market - light vehicles (cars, vans, mini-vans, sport utility vehicles (SUV's), and pick -ups)
Vehicles with 2000 unit sales in 1995 or 1996
Axles, Driveshafts and Frames

Time-frame: Independent Study- January & February
Project- March & April

Deliverables

- Project Definition and Scope- approved by Dana Corp.
- Project Action Plan & Schedule- tasks, deliverables, responsibilities, milestones, time-frame
- Survey Questionnaire- design data gathering tool and secure approval by Dana
- Database Design- create database to store, analyze, and generate reports
- Research Documentation- analyze and gather background information (reports, articles, database statistics)
- Team Progress Report- maintain a chronological file documenting team's approach, issues and findings



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PROJECT DEFINITION AND SCOPE



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Dana Project Scope Summary

Scope: North American Market/Big Three - light trucks
Western European Market - light vehicles (cars, vans, mini-vans, SUV's,
and pick-ups)
Vehicles with 2000 unit sales in 1995 or 1996
Axles, Driveshafts and Frames

Timeframe: January through April 1997

Project Goals:

1. Identification and description key vendors for three core products
 - market share (products, OEM's, vehicle types)
 - supply chain affiliations and key success factors
2. Analyze and Comment on competitive environment in Europe
 - SWOT analysis of competitors (and Dana)
 - Political, Economic, Social, Technology (PEST) analysis
3. Recommend options, actions and priorities for the future (through 2010)
 - increase competitive advantage
 - increase market share
e.g. stronger relationships, design and quote strategies
4. Provide template for future studies in Asia and Latin America

Project Deliverables:

Database consisting of market share of key vendors in accordance with specified products, OEM's and vehicle types.

Qualitative assessment and analysis of the European market and recommendations to improve Dana's position in this market.

Methodology for future projects.



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Supply Chain Affiliations:

Relationships between Dana, its competitors and the OEM's targeted in this study will be defined. This will include any OEM which has captive suppliers.

- Who are the Dana competitors for each OEM for each product?
- How long has the supplier worked with the OEM?
- What are the key success factors for a supplier to each individual OEM?
- How do OEM's see these relationships changing?
- What relationships exist in the supply chain (joint ventures, strategic alliances etc.)?
- What were the previous relationships? Why have they changed?
- What are the key success factors for supply chain affiliations?

The qualitative data from the supply chain affiliation assessment will compliment the information in the database by helping to explain why each supplier has the business that it does. More importantly, it will help the project team and Dana better identify key competitors and help define what competitive advantages Dana should strengthen or develop.

Deliverable: A qualitative assessment of OEM and Tier 1 supply chain affiliations and relationships.



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Recommendations for the future (through 2010)

Increase Competitive Advantage

From the data and analysis, recommend what strengths Dana can build on and/or what strengths to develop in order to be a stronger supplier in the European automotive market. Questions that may be answered include: should Dana align itself with a certain supply chain? What relationships should Dana strengthen? What services, if any, should Dana focus on?

Increase Market Share

In addition to recommending ideas for increasing competitive advantage, there may be opportunities to increase market share in the European automotive market. For instance, what design or quote strategies could be used to increase the amount of Dana parts per vehicle and possibly lock-out competitors?

Deliverable: A set of recommendations regarding how Dana can increase its competitive advantage and market share.



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INDEPENDENT STUDY PROJECT BACKGROUND RESEARCH

The team conducted most of its project background research during the independent study. This research provided a strong foundation to work from and concentrated around; Dana Corporation, American and European OEMs, and trends in the automotive supplier industry.

There are four sections to the Independent Study Background Research:

- Dana Division Meeting Notes
- US OEM Visit Notes
- SAE Show & Competitor Notes



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Dana Division Meeting Notes - Parish Division

People

- Dennis Klink - Sales Manager
- Rob Lageman (or Wagaman) - Product engineer - GM
- Perry Landis - Engineering supervisor - Ford
- Gerry Raals - Account manager - GM
- Gonzal Curelas - Account manager - South America

Parish Division key competitive advantages

- Parish capabilities = flexibility, robustness, JIT, quick die changes, good technology R&D
- Parish's technical research center (testing & simulation) center is state of the art; their advantage over the competition, particularly important for systems
- Program teams, which result in better service for OEMs

Other characteristics of the division

- Parish has a tool & die area where they build 'critical' tooling...other tool fabrication is outsourced
- Parish does research in alternate materials, yet doesn't have many conclusions
 - Composites and other materials are 'linked' to increased costs
 - "Well, not really...they try to optimize steel products and processes" - Perry Landis
 - Hydroforms - less welding, part reduction, weight reduction, less tooling
 - Aluminum joints are more difficult to model/predict in load handling and management, and are bad for corrosion in welded parts
 - Cannot change over from steel to aluminum (given the same design)...Aluminum must be taken into consideration from the beginning of the design cycle, and the whole structure should be of aluminum
- Initiative for QS9000 certification (or certified already)
- Interested in any volume
- Strong position in large light trucks due to previous mentality of avoiding the cycles of pass. cars
- Some new plants with new thinking, team atmosphere

Competitors advantages (mainly for engine cradles, sheet metal stampings)

- Non-union
- Smaller, more agile, less costly

Types of vehicle structure

- Totally unitized - Dana does not work with, is part of OEMs business, does not need frames



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- Get away of trucks in 10 to 15 years (kids will be tired of them when they become purchasers)
- In GM: full size pick-ups - full size frames; compact cars - crossmembers
- Ford is pushing for full service suppliers (design, test, etc.)
- Chrysler wants aluminum casted cradles (CMI is low cost for this product)
- Front wheel drives dropped full frames and went to engine cradle
- Trucks need full frame to get better rides, equivalent to rides of pass. cars

About Europe

- OEMs use many unibody designs, which need a front cradle
- Parish (frames) not yet in Europe
- Divest their heavy truck business

Future trends in Europe

- improve steel products, not other materials
- maybe other materials for pass. cars

Plant related information

- All plants are in North and South America
- Stockton, CA → (GM/Toyota - Nummi), want to get into Japanese transplants
- Elizabeth Town → 100% Ford, (SUVs, Truck)
- Joinville Brazil (moved to Sao Paulo) → Chrysler Dakota (full rolling chassis) @ 7k(now) - 35k (future) units - good volume for South America but too low for Reading
- Valencia, Venezuela → Aerostar, etc. - build many different small quantity items
- other plants

Hopkinsville, KY - first Parish facility to 'co-locate' w/ OEM assembly, saving transportation charges (Saturn, S-truck, Corvette cross member)

Reading plant is getting out of heavy truck business because it was not profitable

Freight charges for structural components (e.g. frames) is huge - the customer incurs this cost...therefore, they prefer that the supplier is close to the final assembly point

Coatings technology

- E-coat (\$\$\$, more easy to handle, better for temperature, not as effective with respect to salt spray)
- Wax (\$, difficult to handle - messy, more superior resistance to salt spray, chip-resistant, doesn't cure to hard material)

Organization of the industry



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Dana Division Meeting Notes - Spicer Axle Division

People

- Todd Burris - Marketing and Forecasting Specialist
- Bill Hoffman - VP and General Manager of Spicer Division
- Kerry Shannon - Chief Application Engineer for Ford
- Jack Reed - Global V.P. for axle products

Spicer Division key competitive advantages

- Dana's global presence is important to the OEM's, and Dana is looking for further international growth
- Dana has stayed out of the pass car market to avoid the cyclical nature of the market (most OEM's produce their own axles in passenger car market).

Classification of axles

- Selsbury??? type - used in the US, shafts are pulled into the central part.
- Barry??? type - used in Japan, includes housing covering shafts
- check advantages/disadvantages

Spicer Products

- Beam Axles
- Independent Axles
- Drive Axles - power to axle - either front or rear
- Non Drive Axles - no power to axle
- 2 wheel drive
- 4 wheel drive
- Trailing Axles - Rear non-drive axles & Steering-only Axles - Front non-drive axles - Spicer makes very few of these

Independent Axles - complex suspension/drive-line. Has the advantage of smoother suspension and vehicle reaction, leading to better ride. (E.g. Ford Explorer) Most independent is only on the front. Price around \$600

Beam Axles - simpler, more rugged perception in market. Used on heavier vehicles. Some gains are being made by beam axles in the vibration reduction and ride comfort. (E.g. Jeep Cherokee). Price around \$450. There is an alternative of beam type with a different and complex structure, resulting in same ride/same costs as independent.

Dana is concentrating on the system concept. Wheeling components, shocks, suspension is outsourced and assembled at Spicer. The assembled axle is then shipped to the OEM. Systems will be more valuable to OEM's with vehicle platforms as opposed to varying models. Dana has relationships with other suppliers (E. g. Brakes, shocks?)



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- What will happen beyond the year 2001? Independent vs. Beam? Driving axles? 4x4?
- What will happen internationally (less data exists here)?
- Above what volume OEM's become interested in producing axles in house?
- What will happen to pass car (less applicable to pass car, but more to other divisions, e.g. structural, U-joint)?
- Would we want to set up a meeting with David Coal (or Cole) (Transportation Dept at U of M)?
- Would we want to go to the SAE show (suppliers technical show) from Feb. 24 to Feb. 27?



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Spicer Products

- Main Drive Shafts - Propeller Shafts
- Wheel Drive Shafts - Half Shafts
- Cardan U/Joint - X-kit
- Can have CV (constant velocity) Joint on one end and Cardan on the other
- Steering Shaft (for heavier trucks): from steering wheel to steering gear
- Many sizes of joints

New offerings:

- Large diameter aluminum - gives higher critical speed, prevents bending, saves weight (thinner walls)
- Aluminum collapsible tubing - in case of crash it doesn't come into the passenger compartment or hit the fuel tank
- Modular systems (axle, half shafts, driveshafts, ... , suspension, wheel)

CV joints characteristics

- higher angles with less NVH
- reduced weight in steel equivalents
- small swing clearances
- specially used for specialty vehicle niche (such as viper and corvette (good solving vibration issues)), light trucks and SUVs

Dana's CV joints types

- Rzeppa (pronounced sheppa): high angle but limited RPM (gets hot) - used outboard or in industrial applications
- Cross Groove: good plunging joint, high RPM, high torque at low RPM, high performance - used inboard, outboard, maindrive
- DOJ (double offset joint) - used inboard
- tripod (other type): inexpensive - used inboard (GKN is the largest manufacturer)

Dana's Capacity levels

- at capacity for manufacturing
- extra capacity for assembly

Dana's market

- Heavy trucks 1/3
- Light trucks 2/3 (SUVs are specially important)

Market trends

- Decline in heavy truck
- Decline in passenger, which may shift manufacturers to produce CVs for trucks



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US OEM Visit Notes - Chrysler Corporation

Date: March 25, 1997
OEM: **Chrysler Corporation**
OEM Attendees: Donald Anderson - Manager, Truck Drivetrain
Steve Lyman - Advanced Vehicle Design
Dana Attendees: Gary Mull - Account Sales Manager for Chrysler, Jim Hendren, Mike Chludzinski, Chopo Gomez-Zoebisch, Don Lopez

Market Trends

Trends in the US Market place

- People looking for change; perhaps a new image...enter the SUV
- For the majority of SUV owners...SUVs may be used for towing a trailer or boat, VERY rarely are they subjected to their true off-road capabilities
- Continuing to make SUVs and trucks more car-like; nicer interiors, smoother ride, soften up exterior image, eliminate launch shudder and high speed boom (???)
- "In old times, people all had the same car. Now people want to have a different car, all want to be different." D. Anderson.
- "No one will buy a second one [SUV], ...they have had enough" J. Hendren.
- Continue to revise driveshafts and axles to improve NVH characteristics
- Goal for light duty trucks: to make them appeal to as many people as possible
- Expect continued increase in the use of integrated electronics to govern many system components
- Chrysler has "only full size pickup with a solid beam front axle"...IS THIS TRUE???
- US consumer demand has pushed the auto industry into specialization; this is why there continues to be the emergence of 'niche type' products
- Dakota has pushed the size limit of a 'compact' truck

Trends in World Marketplace

- Pickup is US phenomenon; no Chrysler full size pickups in Europe
- Increase in mini-van sales in Europe
- Are SUVs used for towing in Europe? If so, at what capacities?
- "It is going to be hard to brainwash the European, this late with the SUVs" D. Anderson
- Japanese market: consumers purchase new American SUVs / trucks as a status symbol
- Grand Cherokees are built in Europe
- European are taxed based on weight of vehicles...SUVs and larger trucks are heavy
- "Europe is burdened by absurd parking [costs], taxes on vehicle weight, tax on horse power, [less than US] distance traveled, and [higher price of] gas." J. Hendren
- "In Europe there is less off road therefore there is less need for SUV" Steve



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Supplier Relations

Chrysler Outlook

- Chrysler engages in partnerships with its suppliers; goal is to both share in 'profits' and 'losses'
- Chrysler does not want to tie capital where other companies can do. Perhaps, they rather stay with their core competencies and let someone else do what is not their core competencies. Perhaps, Chrysler does not have the required conditions to invest in risky capital intensive projects.
- Chrysler desires the a 'full service supplier' exhibiting the following attributes: customer responsiveness, technical superiority, cost effectiveness (shared cost w/ OEM), quality, delivery, ability to provide timely prototypes, excellent R&D and design capabilities
- Suppliers must continue to have engineers who have a total understanding of the impact of their vehicle componentry; it is no longer enough for suppliers to have engineers who are only knowledgeable on component design...they must also be knowledgeable in component integration with other OEM components.
- In Brazil: Dana provides a full rolling chassis for the Dakota truck. Why?? Chrysler wanted to minimize its huge fixed cost, therefore, they share it with a supplier
- A deterrent to full (driveline) system integration is Chrysler's desire to maintain sizable control over their suppliers; Steve felt that if any given supplier provided too many components which were integrated into a system, they would have more bargaining leverage over the OEM (must weigh cost benefit vs. loss of buyer power)
- The successful Chrysler suppliers are those who come to them with good ideas and innovative solutions...MUST BE PROACTIVE!!
- Purchasing works with Engineering from the start - 'pre-sourcing'
- Suppliers MUST be willing to go global with the OEMs in order to succeed in the future
- Per Don, Chrysler does not get as involved with Tier2 on safety issues, but "will dive right in if there is a quality issue."
- Don was leary of Lear's attempt to supply the entire vehicle interior. This may be a limit to system integration.

Production

- Grand Cherokees are produced in Europe
- Dakotas are produced in Brazil



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US OEM Visit Notes - Ford Motor Company

Date: March 23, 1997
OEM: **Ford Motor Company** - Light Truck Division in Dearborn, MI
OEM Attendees: Eric Daby - Chief Powertrain Engineer (Light Truck Division)
Debra Janego - Purchasing Manager (Light Truck Division)
Dana Attendees: Dave Major, Jim Hendren, Claudio Conti, Matt Kleiman, and Mike Chludzinski

Market Trends

Trends in the US Market place

- Ford segments light trucks into 4 categories: vans/mini-vans, SUV, small pick-ups (for personal use) and large pick-ups (for commercial and personal use)
- will see more SUV's. Eric projected 30 or more models before 2000.
- will see blending of mini-vans and full-size vans
- will see blending of SUV and van
- above trends will be at the mercy of oil prices and government regulations
- According to a survey, security (perceived safety) is the #1 reason for boom in SUV's, especially in the case of 4-wheel-drive. The challenge, however, is the NVH (comparing to cars, SUVs are like a big box, having more vibration problems).
- Consumers also like the high seating for good road visibility, roominess of the SUV, and space for storage.
- safety will be a major issue in the future (i.e. air bags)
- PEST trends are: increasing importance of safety, e. g. driver and passenger air bags; recyclability of materials; conveniences inside the vehicles (not only large vehicles); small vehicles will be small in the exterior, not much smaller in the interior.

Trends in World Marketplace

- pickup is US phenomenon
- streets in Europe are narrow for the use of trucks
- small pickup is spreading in other parts of the world, Ford projects by 2002 to have 50% of light truck sales outside North America and 50% in North America.
- mini-vans are mainly in North America (high seats, convenience inside, flexibility of storage, and safety), but this segment is growing in Japan

Engineering Influences and Trends

Ford Outlook

- looking at Systems Design, as means of optimizing product and improving function (one supplier being responsible for the entire system working properly)



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- commercial cost competitiveness is a big issue. This is Ford's terminology for annual cost reductions expected of their suppliers. Purchasing kept hammering on the point that suppliers needed to reduce costs every year
- suppliers need to be able to link with Ford systems (CAD,CAM, CAE). Eric stated that this was an important factor in obtaining a bid.
- Ford is trying to get away from specifying Tier 2 and 3 suppliers, which would become responsibility of the Tier 1. Ford will specify/participate when necessary (mainly in the case of safety components).
- Debra questioned cost issues of Dana RAF's (regional distribution). Felt that the added cost of these regional facilities offset the savings achieved in shipping costs. For the Explorer, they have JIT suppliers all over the world shipping to Detroit.
- JIT is important, but location might not be the right approach for the supplier to achieve JIT.

Production

- Ford exports 15% of US Explorer production
- Southwest is the biggest market for 4wd.
- Market for pick-ups in the North (mountains) is seasonal (highest sales in the fourth quarter).

Issues to investigate

- better definition of which axles and driveshafts Ford perceives as "core"
- perceived safety of SUV's



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- frames have power of drive shafts and axles people of product use
- taxis and cop cars do not need special structural components

In Europe the structures are different because...

- less salt on the roads
- less need to travel on snow
- people do not travel so much

There is great difficulty to do aluminum structures because they are corroded by the iron pieces that get close to it. Theoretically it has to be all aluminum, only theoretically. It is not as simple as just making everything lighter. It has to be more efficient overall. And, ..."the common components are in".

The structures have still problems to be solved. First, the wax protection melts with the heat. Second, the added protection parts are discarded by mechanics because they do not understand their purpose and when they are repairing the cars, they tend not to put them back thinking they are useless. Third, there are constant new demands for putting heat close to the structure.

I was surprised by the fact that the structures will be made of three parts. The old ones are one part, as you all might remember seeing being built at Dana's old facilities, the new structures that we saw at the new facilities at Dana are 2 parts, and it seemed to be a great improvement. Now doing three, adds possible sizes without modifying the rest of the tooling. If this is true, I see it as one of the greatest real improvements to come.

Engineering and Purchasing Relationship

- Engineering wants heavy supplier involvement into design process- frame modification
- Purchasing makes final decision and typically selects lowest cost and may not support engineering's desires
- Big rift between engineering and purchasing
- Bid Process goes to lowest cost supplier
- GM purchasing holds the power

Don was very clear to point out that cost is on one side, vehicle price is somewhere else. The auto parts are measured by cost. Don said "It's a vicious world out there... we make so much money that it is pathological". All of this was an introduction to point how the decision making sometimes does not make sense and the important design considerations for the long term are taken over by shop myopia. "Supplier's knowledge is useful for (OEM) engineering but purchasing (the one who decides) is only looking at price." Don said.



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SAE Show and Competitor Notes - CMI

Competitive advantage (their strengths ...& strategy, if possible)

Strong in Aluminum, working with Alcoa

Product lines (those which compete w/ Dana AND those which don't)

Crossmembers and cradles (intend to enter full frames), in addition to products that don't compete with Dana

Are they in trucks, mini-vans, SUVs, passenger cars?

How global are they? (i.e. do they supply European OEMs or transplants in Europe)

Have a recent contract with Volvo

Are they in Europe? If so, which countries?

Are building a plant in Norway to supply Volvo

Entering new product lines or markets?

Full frames

Joint venture / subsidiaries which compete w/ Dana (esp. European)

Other

Believe that aluminum is a trend, even though costs are higher (especially tooling costs)



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SAE Show and Competitor Notes - American Axle

Competitive advantage (their strengths ...& strategy, if possible)

Vertically integrated by doing their own forgings. They were spun off in 1994 from GM, which is currently 90% of their business. Their strategy is to be the best-selling automotive driveline system manufacturer. The seven initiatives driving the company are:

- 1) *Be globally competitive in measurable quality*
- 2) *Meet customer delivery schedules on time, every time*
- 3) *Be competitive on cost*
- 4) *Be leader in product and process technology*
- 5) *Continually upgrade skills and knowledge of associates*
- 6) *Diversify, profitably grow and become global*
- 7) *Achieve adequate financial returns*

Product lines (those which compete w/ Dana AND those which don't)

Compete with Dana on rear axles, independent front 4WD axles and prop shafts. Also make steering linkage systems, stabilizer bars and various forged products

Are they in trucks, mini-vans, SUVs, passenger cars?

They supply the GM truck divisions. Delphi (another GM division handles cars).

How global are they? (i.e. do they supply European OEMs or transplants in Europe)

Their global business is a small percentage of their sales. They are mainly in the America's. They have recently opened a sales office in Asia/pacific.

Are they in Europe? If so, which countries?

Not in Europe yet (unsure of this)

Entering new product lines or markets?

Their brochures talks about their system integrator capability.

Joint venture / subsidiaries which compete w/ Dana (esp. European)

Other

*8500 associates
six plants in Michigan, New York and Ontario*



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SAE Show and Competitor Notes - AO Smith

Competitive advantage (their strengths ...& strategy, if possible)

They have several patents in process technology.

Product lines (those which compete w/ Dana AND those which don't)

Make frames and driveshafts for cars, light and heavy trucks. Make trailing axles for cars. Also make control arms, suspension components, leaf springs, stampings, spring hangers and cross-members.

Are they in trucks, mini-vans, SUVs, passenger cars?

Yes, Yes, Yes and Yes. Examples are Dodge Dakota, Ram, Suburban, Explorer, GMT, and Blazer.

How global are they? (i.e. do they supply European OEMs or transplants in Europe)

They have manufacturing locations in the US, Mexico and Canada. They are growing globally, with a joint venture in China and a possible contract in Brazil.

Are they in Europe? If so, which countries?

Entering new product lines or markets?

They are marketing their new rear independent suspension modules and full-frame rolling chassis. They have some aluminum based products.

Joint venture / subsidiaries which compete w/ Dana (esp. European)

They have a joint venture in China

Other

They believe that the industry is changing to an increasing concern about safety and weight.



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SAE Show and Competitor Notes - Budd

Competitive advantage (their strengths ...& strategy, if possible)

Budd is part of Thyssen, a conglomerate with 300 companies all over the world employing 137,000 people. They have technology transfer agreements with countries in South America and Asia, which represents a competitive advantage for competing in these regions.

Product lines (those which compete w/ Dana AND those which don't)

They produce frames, doors, suspensions, systems, etc.

Are they in trucks, mini-vans, SUVs, passenger cars?

How global are they? (i.e. do they supply European OEMs or transplants in Europe)

They are beginning to grow globally, starting with South America and Asia (see q #1)

Are they in Europe? If so, which countries?

Entering new product lines or markets?

They are investing in plastic and aluminum products. They are studying hydroforms, but remain uncertain as to its use.

Joint venture / subsidiaries which compete w/ Dana (esp. European)

They have technology transfer agreements with companies in South America and Asia.

Other

Consider Magna to be one major competitor



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SURVEY QUESTIONNAIRE

The team designed a survey questionnaire to guide our discussions with the European OEMs. We first tested our research questions on the American OEMs and using the lessons learned from these interviews we refined our questions for the European OEMs.

There were two sets of interview questions (copies of these questionnaires are included in this section). The first set contained eleven top level questions that served as an interview guideline and were used to gather general background information. The second set broke out these eleven questions into 48 specific subject specific questions. This more detailed questionnaire covered topics including:

- Market & Customer Analysis
 - Market Segmentation
 - New Product Development- Customer Preference
 - External Market Forces
- Supplier Analysis
 - Supplier Relations
 - Component Specific Marketshare Data
- Engineering/Research & Design



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OEM Question - Summary

DANA CORPORATION

Market Information Services

Subject: Light Vehicle – Axles, Driveshafts, Structural Components

- What are the future trends for the product category? Any new innovations?
- Where and how is product R & D done for that particular component?
- Are the components designed to specification or functional requirements? When do the suppliers get involved in the design stage? Does this vary with the supplier for that component?
- Do the suppliers ship Just In Time? Are components line sequenced? How important is this to you?
- Do you use a "rating" system for your suppliers? What are the attributes rated?
- Historically, are the subject products internally or externally sourced? Due to changes in the industry, do you see shifts in these sourcing patterns in the future? Who currently supplies these products to your Company.
- What are the trends in features which customers value in pass cars, light trucks, vans, SUV (durability, image, fuel economy, reliability, 4X4, etc.)?
- What factors drive a complete platform redesign vs. modifications and enhancements?
- How are your customers/markets segmented?
- Are your customers aware of the brand names of the different vehicle components? Does it matter to them?
- What are the perceived strengths and weaknesses of the suppliers used?

MEMO Heinz & Roger Student Questions.doc



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might affect the demand and production of passenger cars (and light trucks, SUVs, mini-vans, etc.) until 2005? Until 2010? ***ADDED***

- A. Are there any PEST trends which are specific to a particular country or geographic region?
- B. Increased use of public transportation?
- C. Impact of EU?
- D. Necessity or desire for increased product recyclability?
- E. Increased pressure from gov'ts to come up w/ more fuel efficient vehicles; reduce overall GVW?
- F. Is your company exploring HEVs, electric vehicles or alternate power sources as VIABLE production designs? How will these impact Dana's components?
- G. How is your company preparing for these different situations?

SUPPLIER ANALYSIS

Supplier Relations

- I. Historically, are the subject products (e.g. frames, axles, driveshafts) internally or externally sourced?
 - A. What are your internal capabilities (i.e. wholly owned sub, or in-house make)?
- II. Due to changes in the industry, do you see shifts in these sourcing patterns in the future?
 - A. Is there a trend towards increasing vertical integration?
 - B. Do you purchase components individually, or is there a trend moving towards systems and component integration?
- III. What are the perceived strengths and weaknesses of the suppliers used?
- IV. What constitutes a good supplier?
- V. Do you use a "rating" system for your suppliers? What are the attributes rated?



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- III. Are the components designed to specification or functional requirements? When do the suppliers get involved in the design stage? Does this vary with the supplier for that component?
- IV. Where and how is product R&D done for that particular component?
- v. Given a blank piece of paper...how would you design your next generation (SUV, etc.) vehicle?



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DATABASE DESIGN

One of the primary deliverables of the project is a database that used to capture North American and European marketshare data for the components of axles, driveshafts, and frames. The team designed a database and then loaded in North American data provided by Dana Corp. The database was examined and holes in the data were filled in through data research and the use of assumptions.

After testing the database with North American data the team adjusted the database template so that it could capture the appropriate European data. A copy of the North American Database and European database template is included in this section.

Database Key

Vehicle/Part Attribute Codes and Decodes

Type of drive
 4wd-f : Four wheel drive vehicle, with part time front wheel drive
 4wd-r : Four wheel drive vehicle, with part time rear wheel drive
 Fwd : Front wheel drive vehicle
 Rwd : Rear wheel drive vehicle

Class / vehicle type

LXSU : Luxury sport utility vehicle
 LPU : Large pick-up truck
 LUV : Large utility vehicle
 LV : Large van
 SPU : Small pick-up truck
 SUV : Small utility vehicle
 SV : Small van

Type of axle (for front or rear axles)

I : Independent axle
 B : Beam axle
 T : Transaxle
 NoAxle : Wheel linked to the structure
 D : Driving axle
 N : Non-driving axle

Type of drive shaft

A : Steel Single Cardan
 B : Double Cardan
 C : Spicer Lite
 D : Graph Lite
 E : All Composite
 X : System Balance
 Y : Constant Velocity
 Z : To Be Determined

Type of structure

F : full frame
 C : cradle
 U : unitized-body vehicle

Supplier Codes and Decodes / Sources of Information

List of suppliers for axles

Dana : Dana Corporation, Spicer Axle Division
 OEM : OEM manufacturers component in-house
 AmAxle : American Axle
 ZF : ZF

List of suppliers for driveshafts

Dana : Dana Corporation, Spicer Driveshaft Division
 OEM : OEM manufacturers component in-house
 Ford P.T.O.
 Chrysler Mound Road
 Toyota
 AmAxle : American Axle

List of suppliers for frames

Dana : Dana Corporation, Parish Division
 Budd
 AOS : A. O. Smith
 CMI : CMI
 IMP : Imported component
 MISC : Miscellaneous suppliers
 OEM : OEM manufacturers component in-house

Sources of information

SAD : Dana Corporation, Spicer Axle Division
 SDD : Dana Corporation, Spicer Driveshaft Division
 Parish : Dana Corporation, Parish Division

US Database -- Axles, Driveshafts, and Structural Components

1		A	B	C	D	E	AI	AJ	AK	AL	AI	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ		
2		LAST UPDATED: 3/31/97 @ 08:30am by CC																								
3	Group	OEM / Vehicle Data				Wheel Drive Data				Frames Data				Vehicle sales data				Notes								
		badge	model	4wd-F 4wd-r Fwd Rwd	class / vehicle type	supplier	CV or indep. front?	wheel drive type	source of info	supplier	%	supplier%	type (F, C, or U)	source of info	# units sold	country1	# units sold		country2	# units sold	country3	total				
4	BMW	51V		4x4-r	MUV																					
5	BMW	51V		4x4-r	MUV																					
6	Geo	Geo Tracker		4x4-r	SUV																					
7	Geo	Geo Tracker		4x4-r	SUV																					
8	Geo	Geo Tracker		4x4-r	SUV																					
9	Geo	Geo Tracker		4x4-r	SUV																					
10	Geo	Geo Tracker		4x4-r	SUV																					
11	Chrysler	Chrysler		4x4-r	MV																					
12	Chrysler	Chrysler		4x4-r	MV																					
13	Chrysler	Chrysler		4x4-r	MV																					
14	Chrysler	Chrysler		4x4-r	MV																					
15	Chrysler	Chrysler		4x4-r	MV																					
16	Chrysler	Chrysler		4x4-r	MV																					
17	Chrysler	Chrysler		4x4-r	MV																					
18	Chrysler	Chrysler		4x4-r	MV																					
19	Chrysler	Chrysler		4x4-r	MV																					
20	Chrysler	Chrysler		4x4-r	MV																					
21	Chrysler	Chrysler		4x4-r	MV																					
22	Chrysler	Chrysler		4x4-r	MV																					
23	Chrysler	Chrysler		4x4-r	MV																					
24	Chrysler	Chrysler		4x4-r	MV																					
25	Chrysler	Chrysler		4x4-r	MV																					
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36	Chrysler	Chrysler		4x4-r	MV																					
37	Chrysler	Chrysler		4x4-r	MV																					
38	Chrysler	Chrysler		4x4-r	MV																					
39	FORD	FORD		4x4-r	MV																					
40	Ford	Ford		4x4-r	MV																					
41	Ford	Ford		4x4-r	MV																					
42	Ford	Ford		4x4-r	MV																					
43	Ford	Ford		4x4-r	MV																					
44	Ford	Ford		4x4-r	MV																					
45	Ford	Ford		4x4-r	MV																					
46	Ford	Ford		4x4-r	MV																					
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69	Ford	Ford		4x4-r	MV																					
70	Ford	Ford		4x4-r	MV																					
71	Ford	Ford		4x4-r	MV																					
72	GM	GM		4x4-r	MV																					
73	GM	GM		4x4-r	MV																					
74	GM	GM		4x4-r	MV																					

Database Assumptions

LAST UPDATED: 3/25/97 @ 10:30pm by MK

OEM / Vehicle Data				Assumption	
Group	badge	model	4wd-f 4wd-r Fwd Rwd	class / vehicle type	Assumption
All	All	All	All	All	
Chrysler	dodge	ram van	Rwd	LV	
Chrysler	dodge	ram wagon	Rwd	LV	
Chrysler	jeep	cherokee xj - "j"	4x4-r	SUV	
Chrysler	jeep	cherokee xj - "t"	Rwd	SUV	
Chrysler	jeep	grand cherokee xj - "j"	4x4-r	SUV	
Chrysler	jeep	grand cherokee xj - "t"	Rwd	SUV	
GM	chevy	c/k 1500 - c	Rwd	LPU	
GM	chevy	c/k 1500 - k	4x4-r	LPU	
GM	chevy	s-10 "s"	Rwd	SPU	
GM	chevy	s-10 "t"	4x4-r	SPU	
GM	chevy	s-10 blazer "s"	Rwd	SUV	
GM	chevy	s-10 blazer "t"	4x4-r	SUV	
GM	isuzu	hombre	4x4-r	SPU	

All vehicles have two main driveshafts per 4x4 vehicle and one main driveshaft per 4x2 vehicle
 Ram van and Ram wagon are the same platform
 Ram van and Ram wagon are the same platform
 J - denotes 4wd
 T - denotes 2wd
 J - denotes 4wd
 T - denotes 2wd
 c - denotes 2wd
 k - denotes 4wd
 S - denotes 2wd
 T - denotes 4wd
 S - denotes 2wd
 T - denotes 4wd

GM owns a stake in Isuzu

Europe Database -- Axles, Driveshafts, and Structural Components

2	3	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AE	AC	AD	AE	AF	AG	AH	AI	Wheel Drive Data			
																																					supplier %	supplier %	supplier %	supplier %
		OEM / Vehicle Data		Production Data		Front Axle Data		Rear Axle Data		Front Axle Data		Rear Axle Data		Front Axle Data		Rear Axle Data		Front Axle Data		Rear Axle Data		Front Axle Data		Rear Axle Data		Front Axle Data		Rear Axle Data		Front Axle Data		Rear Axle Data		Front Axle Data		Rear Axle Data				
Group	Badge	Model	4wd-1	4wd-1	Platform	Vehicle Type	Class	# units produced	Country	Plant	type (L, R, or T)	driving (D or N)	source of info	supplier %	supplier %	type (I, O or N)	driving (D or N)	source of info	supplier %	supplier %	type (I, O or N)	driving (D or N)	source of info	supplier %	supplier %	type (I, O or N)	driving (D or N)	source of info	supplier %	supplier %	type (Inboard - Outboard)	%	supplier	%	source of info	source of info				
5	Autocoupe	Ford			EA365/A162	LI	MV																																	
6	Autocoupe	VW	Sharan		EA365/A162	LI	MV																																	
7	BMW				3-seater/E36/E46	PASS	C/D																																	
8	BMW				3-seater/E36/E46	PASS	C/D																																	
9	BMW				3-seater/E36/E46	PASS	C/D																																	
10	BMW				3-seater/E36/E46	PASS	C/D																																	
11	BMW				3-seater/E36/E46	PASS	C/D																																	
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26	BMW				5-seater/E28/E34	PASS	D																																	
27	BMW				5-seater/E28/E34	PASS	D																																	
28	BMW				7-seater/E38	PASS	F																																	
29	BMW				7-seater/E38	PASS	F																																	
30	BMW				7-seater/E38	PASS	F																																	
31	BMW				7-seater/E38	PASS	F																																	
32	BMW				7-seater/E38	PASS	F																																	
33	BMW				MINI	PASS	A																																	
34	BMW				MINI	PASS	A																																	
35	BMW				CONCERIO	PASS	C																																	
36	BMW				CONCERIO	PASS	C																																	
37	BMW				DEFENDER	LI	MUV																																	
38	BMW				DEFENDER	LI	MUV																																	
39	BMW				RANGE ROVER	LI	MUV																																	
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66	BMW				RANGE ROVER	LI	MUV																																	
67	BMW				RANGE ROVER	LI	MUV																																	
68	BMW				RANGE ROVER	LI																																		



Independent Study Report

PROJECT ACTION WORKPLAN

Independent Study and IMAP Project

Task	Deliverable	Resp	January			February			March			April							
			5	12	19	26	2	9	16	23	2	9	16	23	30	6	13	20	27
Organize Project																			
Define Goals, Roles and Expectations																			
Team meeting with Dana #1	Meet with Susan Mills	All																	
*Organize team and define roles	Objectives approved by Andy	DL																	
Define Indep. Study Objective	Objectives approved by Andy	DS																	
Define Project Objective		MC																	
E-mail Scope to Divisions		MK																	
*Project Deliverables to J.Sherblom		DL																	
Training																			
Obtain Ford methodology study		DS																	
*Attend culture IMAP sessions		All																	
*Attend IMAP sessions		All																	
*Meeting w/J.Sherblom		All																	
Tech Training and Web Update		DL																	
Divisional Visits and Initial Data Gathering																			
Divisional Visits																			
Spicer - Ft. Wayne	Notes, data sources/materials	CC																	
Spicer - Toledo	Notes, data sources/materials	CC																	
Parish - Reading, PA	Notes, data sources/materials	CC																	
Prepare questions for Dave Major	Fax to Dave prior to meeting	MK																	
Meet w/ Spicer Axle engineers	Notes, data sources/materials	CC																	
Checkpoint 1 with Andy		DS																	
OEM Visits																			
Plan visits	OEM mtg questions	MK																	
Design questionnaire	Detailed survey	DL																	
Refine questionnaire for team use		DL																	
E-mail OEM mtg questions to DrivShift		DL																	
J.Sherblom approval of questionnaire		DL																	
Interview Preparation		All																	
GM		Parish																	
Chrysler		DrivShift																	
Ford		Axle																	
Background Research																			
Primary Data Sources																			
Attend Detroit Auto Show	Competitor Notes	All																	
Attend SAE Exhibition		CC, MC																	
Checkpoint 2 with Andy		DS																	
Review Secondary Data Sources																			
Define secondary data sources	List of data sources and access mthd	DS																	
Analyze Dana's auto surveys/reports	one paragraph summaries	All																	
Analyze UMI/AT Kearney auto study		MC																	

Independent Study and IMAP Project

Task	Deliverable	Resp	Start	End	Cmpl	January	February	March	April
						5 12 19 26	2 9 16 23	2 9 16 23 30	6 13 20 27
Gather useful outside data									
Wards database		MC	29-Jan	25-Feb	✓				
SAE database		DL	24-Feb	15-Mar	✓				
Paris database		CG	24-Feb	28-Feb	✓				
			24-Feb	21-Mar	✓				
Preliminary Analysis					100%				
Competitor Research	Competitor Analysis	MC	12-Mar	31-Mar	✓				
OEM Research		CG	13-Mar	31-Mar	✓				
European Market Analysis	PEST Analysis	DS	13-Mar	31-Mar	✓				
Analysis of Current Dana Position	Dana SWOT Analysis	DL	13-Mar	31-Mar	✓				
Data Collection Preparation					100%				
Define Parameters									
Obtain Ford spreadsheet database	Blank database	DS	31-Jan	5-Feb	✓				
Define OEM participants		JH	31-Jan	14-Mar	✓				
Define data to be gathered		CC	16-Feb	25-Feb	✓				
Design database		CC	16-Feb	25-Feb	✓				
Enter US Data into database	Database w/ US data	MK	14-Mar	19-Mar	✓				
Calculate US market share	US market share charts	MK	17-Mar	21-Mar	✓				
Create Draft of Deliverables					100%				
Hypothesis Brainstorming		All	17-Mar	21-Mar	✓				
Final Report Layout		DS	13-Mar	15-Mar	✓				
Final Presentation Layout		CG	13-Mar	15-Mar	✓				
Rec's preview by J. Sherblom		All	28-Mar	15-Mar	✓				
European Launch					100%				
Define countries		JH	9-Feb	28-Feb	✓				
Establish country teams		All	9-Feb	15-Feb	✓				
Travel administration	Itinerary from Jim	JH	2-Mar	18-Mar	✓				
Create IMAP overview presentation		MC	19-Mar	21-Mar	✓				
Phone and AC adapters		DL	16-Mar	29-Mar	✓				
Laptop configuration	Configured laptops from Rosie	DL	18-Mar	28-Mar	✓				
Team meeting with Dana #2	Scope approved by Jim and Glen	All	19-Mar	28-Mar	✓				
Depart		All	31-Mar		✓				
Data Collection - Europe					95%				
Renault		All	2-Apr	3-Apr	✓				
Peugeot		MK, CC	3-Apr	3-Apr	✓				
Ford - Cologne		DS, CG	4-Apr	4-Apr	✓				
Fiat		CC, MC	7-Apr	8-Apr	✓				
Ford - London		MK, DL	7-Apr	7-Apr	✓				
Mercedes		DS, CG	8-Apr	8-Apr	✓				
Spicer - UK		MK, DL	8-Apr	8-Apr	✓				
GM - Frankfurt		DS, CG	9-Apr	9-Apr	✓				
Rover		MK, DL	9-Apr	9-Apr	✓				
Jaguar		MK, DL	10-Apr	10-Apr	✓				



Independent Study Report

APPENDIX FOLDER - RESEARCH REPORT

1

**Supplier and Marketplace
Research**

2

North American Research

3

European/Global Research

4

Sport Utility Vehicle Research

5

OEM Research

6

**SAE Show and Competitor
Research**

7

Dana Corporation Research

8

**European Automotive Country
Specific Research**



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Industry and Marketplace Research

Supplier and Marketplace Research

- "Future of Small Cars Look Huge", World Traveler magazine, 4/97
- "Bright Future Drives Auto Industry", On the Frontiers of Human Development 1/97
- Tomorrow's Technology Today, The New Electric Vehicle*, The Technology Center of the Engineering Society, 2/97
- The 21st Century Supply Chain, The Changing Roles, Responsibilities and Relationships in the Automotive Industry*, Office for the Study of Automotive Transportation (OSAT)- University of Michigan & A.T. Kearney, 1996
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- Economic and Industry Outlook*, JD Power & Associates, Study Summary 1996
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- "Audi May Join Car Makers' Caravan to Southern States", Wall Street Journal 3/13/97
- "Trucks Sales: Unsafe at this Speed", Business Week, 3/97
- Passenger Cars and Trucks, North America 1996-2001*, Autofacts Study Summary, 1996
- "Delphi VIII, Forecast & Analysis of the North American Automotive Industry, A Comprehensive Benchmark Through 2005", Office for the Study of Automotive Transportation (OSAT)- University of Michigan

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- "Ward's Automotive International Magazine", Ward's Automotive International, 3/97
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- "Ward's Automotive International Magazine", Ward's Automotive International, 2/97
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- "Europe Sales by Model", Automotive News Europe 1/20/97
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- "Italy's New Car Sales Drop 8.5% in September", Ward's Auto International 11/96
- "Interfirm Cooperation and Structural Change in the European Automobile Industry", Gerhard Rosegger, Case Western Reserve University, 1996
- Cars of Western Europe*, Automotive Industry Data, Study Summary, 1996

Sport Utility Vehicle Research

- "4wd Supplier Views Europe for Expansion", Automotive News 2/17/97
- "The Sport/Utility Peak: Are we there yet", Ward's Auto International 11/96
- 4X4 Prospectus to Year 2005- Western Europe*, Automotive Industry Data, Study Summary 1996



Research Report

OEM Research

Big Three Visit Notes: Chrysler, Ford, & GM

BMW, Autofacts- Western European Outlook Cars and Light Truck Report

Fiat, Autofacts- Western European Outlook Cars and Light Truck Report

Ford Corp., Autofacts- Western European Outlook Cars and Light Truck Report

“Britain Feels Pinch of Cuts by Ford” The Blade Newspaper, 3/97

“Ford’s Really Big Leap at the Future”, Fortune Magazine, 9/95

General Motors Corp., Autofacts- Western European Outlook Cars and Light Truck Rpt.

Mercedes Benz, Autofacts- Western European Outlook Cars and Light Truck Report

“In Alabama, The Soul of a New Mercedes”, Business Week 3/97

“Mercedes A-Class: The Baby Benz”, World Automotive Weekly, 3/97

Renault, Autofacts- Western European Outlook Cars and Light Truck Report

“Renault Prepares Tech Center”, Automotive News Europe, 2/97

Rover, “Remaking Rover”, Business Week, 3/97

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SAE Show and Competitor Research

SAE Show Notes

“The Dana Advantage in Modular Systems to be Highlighted Live and in Cyberspace for 1997 SAE Show”, The Point Cast Network, 1997

“1997 Value Line Reports on Auto Parts (Original Equipment)” Dana, Eaton, A.O. Smith

Dana Corporation Research

Dana Corporation Plant Visit Notes

“Asia-Pacific Plays Major Role in Dana 2000 Strategy”, Ward’s Automotive, 11/95

“Dana Corporation Home Page”, www.dana.com

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Dana Plant Literature

European Automotive Country Specific Research

Belgium

France

Germany

Italy

Spain

United Kingdom



Independent Study Report

APPENDIX FOLDER - PROJECT CHRONOLOGICAL REPORT

1

Project Contact List

2

Initial Project Meeting and Scope

3

Schedules, Workplans & Europe Itinerary

4

Checkpoint Meetings & Meeting Agendas

5

Team Issues Log

6

Questionnaires

7

Project E-mails

8

IMAP Presentation & Reference Studies