



Ross School of Business at the University of Michigan

Independent Study Project Report

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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 : 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

[illegible]

US Database – Axles, Driveshafts, and Structural Components

LAST UPDATED: 3/31/97 @ 08:30am by CC																									
OEM / Vehicle Data																									
Wheel Drive Data													Frames Data												
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US Database -- Axles, Driveshafts, and Structural Components

	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	AB	AC	AD	AE	AF	AG					
2	OEM / Vehicle Data							Production Data						Front Axle Data								Rear Axle data									Main Drive Data							
	Group	bodge	model	4wd-4 Fwd	class / vehicle type	# units produced %	country	plant	supplier %	supplier %	type (I, B or D)	driving (D or N)	source of info	supplier %	supplier %	type (I, B or D)	driving (D or N)	source of info	supplier %	supplier %	type (I, B or D)	driving (D or N)	source of info	supplier %	supplier %	type (I, B or D)	driving (D or N)	source of info	main type (C or CV)	%	main type (C or CV)	source of info						
75	GM	Chevy	gila wagon	Rwd	MV	74.543	us		N/A		NoAxle	N	SAD	AniAxle	100%																							
76	GM	Chevy	tazer/tcheop	4x4r	LUV	121.538	us/mex		AniAxle	100%	I	N	SAD	AniAxle	100%																							
77	GM	Chevy	tazer/tcheop	Rwd	LUV	?	us/mex		AniAxle	100%	I	N	SAD	AniAxle	100%																							
78	GM	Chevy	c/v 1500 - c	Rwd	LPU	273.172	us3can		N/A		NoAxle	N	SAD	AniAxle	100%																							
79	GM	Chevy	c/v 1500 - b	4x4r	LPU	176.124	us3can		N/A		NoAxle	N	SAD	AniAxle	100%																							
80	GM	Chevy	c/v 2500 - c	Rwd	LPU	38.325	us3can		N/A		NoAxle	N	SAD	AniAxle	100%																							
81	GM	Chevy	c/v 2500 - b	4x4r	LPU	53.362	us3can		N/A		NoAxle	N	SAD	AniAxle	100%																							
82	GM	Chevy	c/v 3500 - c	Rwd	LPU	49.803	us3can		N/A		NoAxle	N	SAD	AniAxle	100%																							
83	GM	Chevy	c/v 3500 - b	4x4r	LPU	42.713	us3can		N/A		NoAxle	N	SAD	AniAxle	100%																							
84	GM	Chevy	chevy van	Rwd	LPU	59.473	con		N/A		NoAxle	N	SAD	AniAxle	100%																							
85	GM	Chevy	equinox (replacing 3jo	Rwd	LV	4.981	us		N/A		NoAxle	N	SAD	AniAxle	100%																							
86	GM	Chevy	gnt4455	Rwd	LPU	3.042	us		N/A		NoAxle	N	SAD	AniAxle	100%																							
87	GM	Chevy	gnt430 CC	Rwd	LPU	25.000	us3can		N/A		NoAxle	N	SAD	AniAxle	100%																							
88	GM	Chevy	s 10 "	Rwd	SFU	179.721	us		N/A		NoAxle	N	SAD	AniAxle	100%																							
89	GM	Chevy	s 10 T	4x4r	SFU	34.743	us		N/A		NoAxle	N	SAD	AniAxle	100%																							
90	GM	Chevy	s 10 blazer "	Rwd	MUV	49.594	us		N/A		NoAxle	N	SAD	AniAxle	100%																							
91	GM	Chevy	s 10 blazer "	4x4r	MUV	199.620	us		N/A		NoAxle	N	SAD	AniAxle	100%																							
92	GM	Chevy	s 10 blazer T	4x4r	MUV	66.907	us/mex		N/A		NoAxle	N	SAD	AniAxle	100%																							
93	GM	Chevy	sutaban	Rwd	MV	57.687	us/mex		N/A		NoAxle	N																										

US Database -- Axles, Driveshafts, and Structural Components

2		OEM / Vehicle Data										Wheel Drive Data					Frames Data										Vehicle sales data					Notes
A	B	C	D	E	AI	AJ	AK	AL	AS	AR	AQ	AP	AO	AN	AT	AU	AV	AW	AX	AY	AZ											
3	Group	badge	model	4wd-r 4wd-l Rwd	class / vehicle type	supplier	wheel drive type (C or front?)	CV only with indep. front?	source of info	supplier	%	supplier %	type (F, C, or U)	source of info	# units sold country1	# units sold country2	# units sold country3	total														
75	GM	chevy	astro workin	Rwd	MV	DELPHI CV			SDD	GM			C	Pairth-US																		
76	GM	chevy	blazer/atahoe	4x4-r	LUV	DELPHI CV			SDD	AOOS			F	Pairth-US																		
77	GM	chevy	blazer/atahoe	Rwd	LUV	DELPHI CV			SDD	AOOS			F	Pairth-US																		
78	GM	chevy	C/K 1500 - c	Rwd	LPU					Dana 80%			F	Pairth-US																		
79	GM	chevy	C/K 1500 - v	4x4-r	LPU	DELPHI CV			SDD	Dana 80%			F	Pairth-US																		
80	GM	chevy	C/K 2500 - c	Rwd	LPU					Dana 80%			F	Pairth-US																		
81	GM	chevy	C/K 2500 - v	4x4-r	LPU	DELPHI CV			SDD	Dana 80%			F	Pairth-US																		
82	GM	chevy	C/K 3500 - c	Rwd	LPU					Dana 80%			F	Pairth-US																		
83	GM	chevy	C/K 3500 - v	4x4-r	LPU					Dana 80%			F	Pairth-US																		
84	GM	chevy	chevy van	Rwd	LV					Dana			F	Pairth-US																		
85	GM	chevy	express (replacing 3rd)	Rwd	LV					AOOS			F	Pairth-US																		
86	GM	chevy	gmi 455	Rwd	LPU									Pairth-US																		
87	GM	chevy	gmi 480 cc	Rwd	LPU									Pairth-US																		
88	GM	chevy	5 10" ss	Rwd	SPU					Dana			F	Pairth-US																		
89	GM	chevy	5 10" T	4x4-r	SPU					Budd			F	Pairth-US																		
90	GM	chevy	5 10 blazer ss	Rwd	MUV	DELPHI CV		error	SDD	Budd			F	Pairth-US																		
91	GM	chevy	5 10 blazer T	4x4-r	MUV	DELPHI CV		error	SDD	Budd			F	Pairth-US																		
92	GM	chevy	suburban	4x4-r	LUV	DELPHI CV			SDD	AOOS			F	Pairth-US																		
93	GM	chevy	suburban	Rwd	LUV					AOOS			F	Pairth-US																		
94	GM	chevy	vanlike (replacing bui)	Rwd	MV	DELPHI CV			SDD	GM			C	Pairth-US																		
95	GM	gmc	gmi 455	Rwd	LPU					AOOS			F	Pairth-US																		
96	GM	gmc	gmi 480	Rwd	LPU									Pairth-US																		
97	GM	gmc	gmi 550 gmc/chevy	Rwd	LV									Pairth-US																		
98	GM	gmc	jeep/wyckon	4x4-r	LUV	DELPHI CV			SDD	AOOS			F	Pairth-US																		
99	GM	gmc	5 15 Jimmy T	Rwd	MUV	DELPHI CV		error	SDD	Budd			F	Pairth-US																		
100	GM	gmc	5 15 Jimmy ss	4x4-r	MUV					Budd			F	Pairth-US																		
101	GM	gmc	5 15/20chevy ss	Rwd	SPU	DELPHI CV			SDD	Dana			F	Pairth-US																		
102	GM	gmc	5 15/20chevy T	4x4-r	SPU	DELPHI CV			SDD	AOOS			F	Pairth-US																		
103	GM	gmc	suburban	4x4-r	MV					GM			C	Pairth-US																		
104	GM	gmc	suburban	4x4-r	MV					GM			C	Pairth-US																		
105	GM	gmc	suburban	4x4-r	MV					AOOS			C	Pairth-US																		
106	GM	gmc	suburban	Rwd	MV					GM			C	Pairth-US																		
107	GM	gmc	suburban (replacing van)	Rwd	LV					Dana			F	Pairth-US																		
108	GM	gmc	gmc 1500	Rwd	LPU					Dana 80%			F	Pairth-US																		
109	GM	gmc	gmc 1500	4x4-r	LPU					Dana 80%			F	Pairth-US																		
110	GM	gmc	gmc 2500	Rwd	LPU					Dana 80%			F	Pairth-US																		
111	GM	gmc	gmc 2500	4x4-r	LPU					Dana 80%			F	Pairth-US																		
112	GM	gmc	gmc 3500	Rwd	LPU					Dana 80%			F	Pairth-US																		
113	GM	gmc	gmc 3500	4x4-r	LPU					Dana 80%			F	Pairth-US																		
114	GM	gmc	silverado (mexican)	4x4-r	LUV					Dana 80%			F	Pairth-US																		
115	GM	gmc	suburban	4x4-r	LUV	DELPHI CV			SDD	AOOS			F	Pairth-US																		
116	GM	gmc	suburban	Rwd	LUV					AOOS			F	Pairth-US																		
117	GM	buick	bonnie	4x4-r	SPU					IMP			F	Pairth-US																		
118	GM	buick	bonnie	Rwd	SPU					IMP			F	Pairth-US																		
119	GM	chev	camacha	4x4-r	MUV	DELPHI CV			SDD	Budd			F	Pairth-US																		
120	GM	chev	zblouette	Rwd	MV	DELPHI CV			SDD	GM			C	Pairth-US																		
121	GM	chev	zblouette	Rwd	MV					GM			C	Pairth-US																		
122	GM	chev	zblouette	Rwd	MV	DELPHI CV			SDD	GM			C	Pairth-US																		
123	Mercedes	mercedes	mercedes	4x4-r	MUV					IMP			F	Pairth-US																		
124	Nissan	nissan	pick-up	4x4-r	SPU	NIN CV			SDD	IMP			F	Pairth-US																		
125	Nissan	nissan	pick-up	Rwd	SPU					IMP			F	Pairth-US																		
126	NUMMI	toyota	toyota/hilux	4x4-r	SPU	TOYOTA CV			SDD	Dana			F	Pairth-US																		
127	NUMMI	toyota	toyota/hilux - Bed	Rwd	SPU					Dana			F	Pairth-US																		
128	NUMMI	toyota	toyota/hilux - C cab	Rwd	SPU					Dana			F	Pairth-US																		
129	Sc	honda	honda	4x4-r	MUV	NIN CV			SDD	IMP			F	Pairth-US																		
130	Sc	honda	honda	Rwd	MUV					IMP			F	Pairth-US																		
131	Sc	honda	honda	4x4-r	SPU					IMP			F	Pairth-US																		
132	Sc	honda	honda	Rwd	SPU					IMP			F	Pairth-US																		
133	Sc	honda	honda	4x4-r	MUV					IMP			F	Pairth-US																		
134	Sc	honda	honda	Rwd	MUV					IMP			F	Pairth-US																		
135	Sc	chev	chevo	4x4-r	SUV					IMP			F	Pairth-US																		
136	Sc	chev	chevo	Rwd	SUV					IMP			F	Pairth-US																		
137	VW	vw	vanagon	Rwd	MV					IMP			F	Pairth-US																		
138																																
139																																
140																																
141																																
142																																

DATA will supply CV joint starting 01/97

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	ram van	All	All	<p>All vehicles have two main driveshafts per 4x4 vehicle and one main driveshaft per 4x2 vehicle</p> <p>Ram van and Ram wagon are the same platform</p> <p>Ram van and Ram wagon are the same platform</p> <p>J - denotes 4wd</p> <p>T - denotes 2wd</p> <p>J - denotes 4wd</p> <p>T - denotes 2wd</p> <p>c - denotes 2wd</p> <p>k - denotes 4wd</p> <p>S - denotes 2wd</p> <p>T - denotes 4wd</p> <p>S - denotes 2wd</p> <p>T - denotes 4wd</p>
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 owns a stake in Isuzu

GM Isuzu hombre 4x4-r SPU

Europe Database -- Axles, Driveshafts, and Structural Components

		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	AB	AC	AD	AE	AF	AG	AH		
		OEM / Vehicle Data																																			
2	3	Group	Body	Model	4wd-1 Fwd Rwd Platform	Vehicle Type	Class	Production Data				Front Axle Data				Rear Axle Data				Wheel Drive Data																	
								# units produced '95	Country	Plant	supplier %	type (I, B, or T)	driving (D or N)	source of info	supplier %	type (I, D or N)	driving (D or N)	source of info	supplier %	type (I or B)	driving (D or N)	source of info	supplier %	type (inboard - outboard)	source of info												
4	5	Autocoureur	Ford	Galaxy	Fwd	EA356/VX62	LT	MV																													
6	7	Autocoureur	VW	Sharan	Fwd	EA356/VX62	LT	MV																													
8	9	BMW	BMW	316	Fwd	3-series/E36/E46	PASS	C/D																													
10	11	BMW	BMW	316	Rwd	3-series/E36/E46	PASS	C/D																													
12	13	BMW	BMW	318	Rwd	3-series/E36/E46	PASS	C/D																													
14	15	BMW	BMW	320	Rwd	3-series/E36/E46	PASS	C/D																													
16	17	BMW	BMW	323	Rwd	3-series/E36/E46	PASS	C/D																													
18	19	BMW	BMW	325	Rwd	3-series/E36/E46	PASS	C/D																													
20	21	BMW	BMW	325	Rwd	3-series/E36/E46	PASS	C/D																													
22	23	BMW	BMW	328	Rwd	3-series/E36/E46	PASS	C/D																													
24	25	BMW	BMW	520	Rwd	5-series/E28/E34	PASS	D/E																													
26	27	BMW	BMW	528	Rwd	5-series/E28/E34	PASS	D																													
28	29	BMW	BMW	540	Rwd	5-series/E28/E34	PASS	D																													
30	31	BMW	BMW	58	Rwd	5-series/E28/E34	PASS	D																													
32	33	BMW	BMW	730	Rwd	7-series/E38	PASS	F																													
34	35	BMW	BMW	740	Rwd	7-series/E38	PASS	F																													
36	37	BMW	BMW	750	Rwd	7-series/E38	PASS	F																													
38	39	BMW	BMW	750	Rwd	7-series/E38	PASS	F																													
40	41	BMW	BMW	Mini	Fwd	MINI	PASS	H																													
42	43	BMW	BMW	Concerto	Fwd	CONCERTO	PASS	C																													
44	45	BMW	BMW	Defender	Fwd	DEFENDER	LT	MUV																													
46	47	BMW	BMW	Range Rover	Fwd	RANGE ROVER	LT	MUV																													
48	49	BMW	BMW	Range Rover	Fwd	RANGE ROVER	LT	MUV																													
50	51	BMW	BMW	Range Rover	Fwd	RANGE ROVER	LT	MUV																													
52	53	BMW	BMW	Range Rover	Fwd	RANGE ROVER	LT	MUV																													
54	55	BMW	BMW	Range Rover	Fwd	RANGE ROVER	LT	MUV																													
56	57	BMW	BMW	Range Rover	Fwd	RANGE ROVER	LT	MUV																													
58	59	BMW	BMW	Range Rover	Fwd	RANGE ROVER	LT	MUV																													
60	61	BMW	BMW	Range Rover	Fwd	RANGE ROVER	LT	MUV																													
62	63	BMW	BMW	Range Rover	Fwd	RANGE ROVER	LT	MUV																													
64	65	BMW	BMW	Range Rover	Fwd	RANGE ROVER	LT	MUV																													
66	67	BMW	BMW	Range Rover	Fwd	RANGE ROVER	LT	MUV																													
68	69	BMW	BMW	Range Rover	Fwd	RANGE ROVER	LT	MUV																													
70	71	BMW	BMW	Range Rover	Fwd	RANGE ROVER	LT	MUV																													
72	73	BMW	BMW	Range Rover	Fwd	RANGE ROVER	LT	MUV																													
74	75	BMW	BMW	Range Rover	Fwd	RANGE ROVER	LT	MUV																													
76	77	BMW	BMW	Range Rover	Fwd	RANGE ROVER	LT	MUV																													
78	79	BMW	BMW	Range Rover	Fwd	RANGE ROVER	LT	MUV																													
80	81	BMW	BMW	Range Rover	Fwd	RANGE ROVER	LT	MUV																													
82	83	BMW	BMW	Range Rover	Fwd	RANGE ROVER	LT	MUV																													
84	85	BMW	BMW	Range Rover	Fwd	RANGE ROVER	LT	MUV																													
86	87	BMW	BMW	Range Rover	Fwd	RANGE ROVER	LT	MUV																													
88	89	BMW	BMW	Range Rover	Fwd	RANGE ROVER	LT	MUV																													

Europe Database -- Axles, Driveshafts, and Structural Components

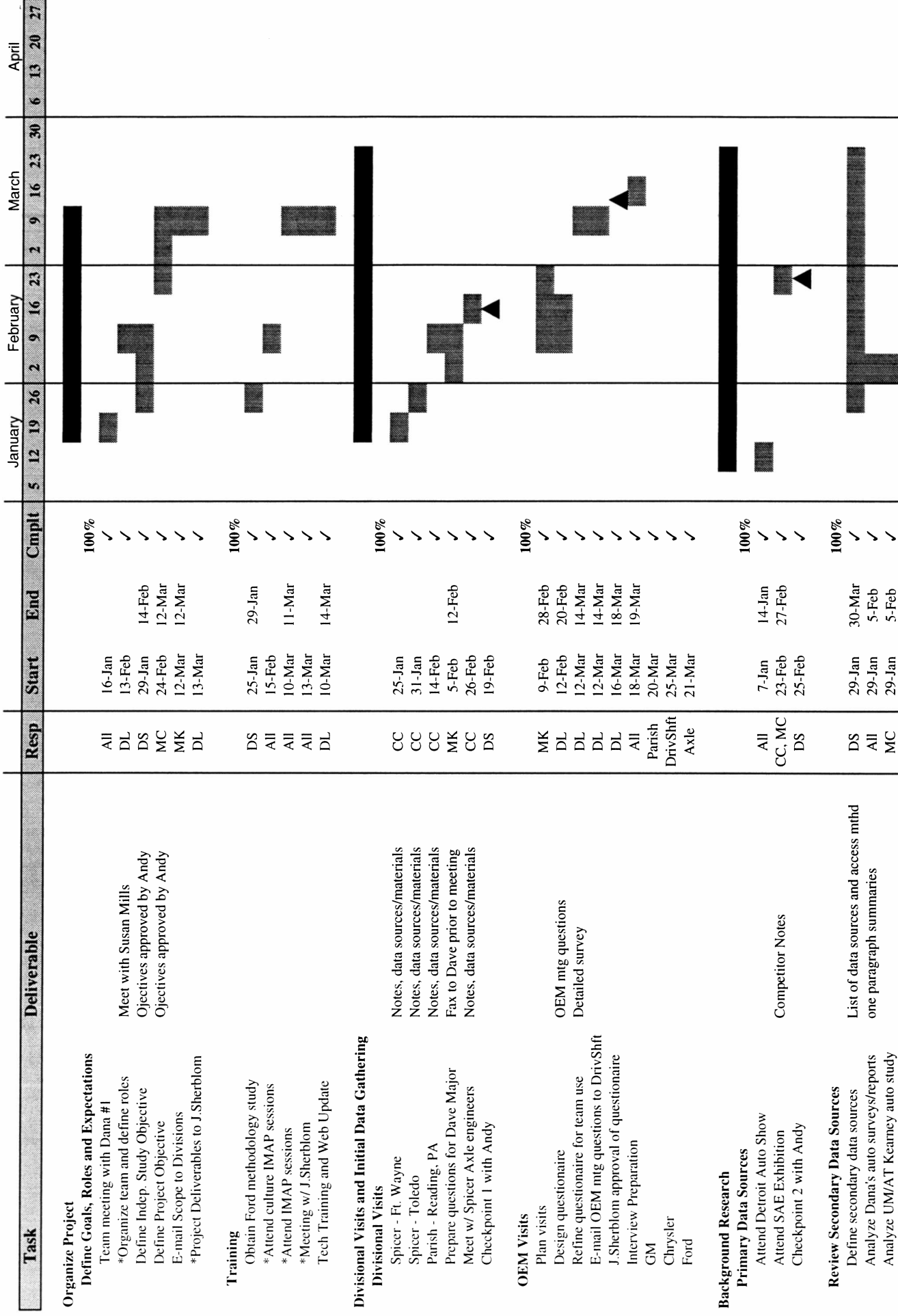
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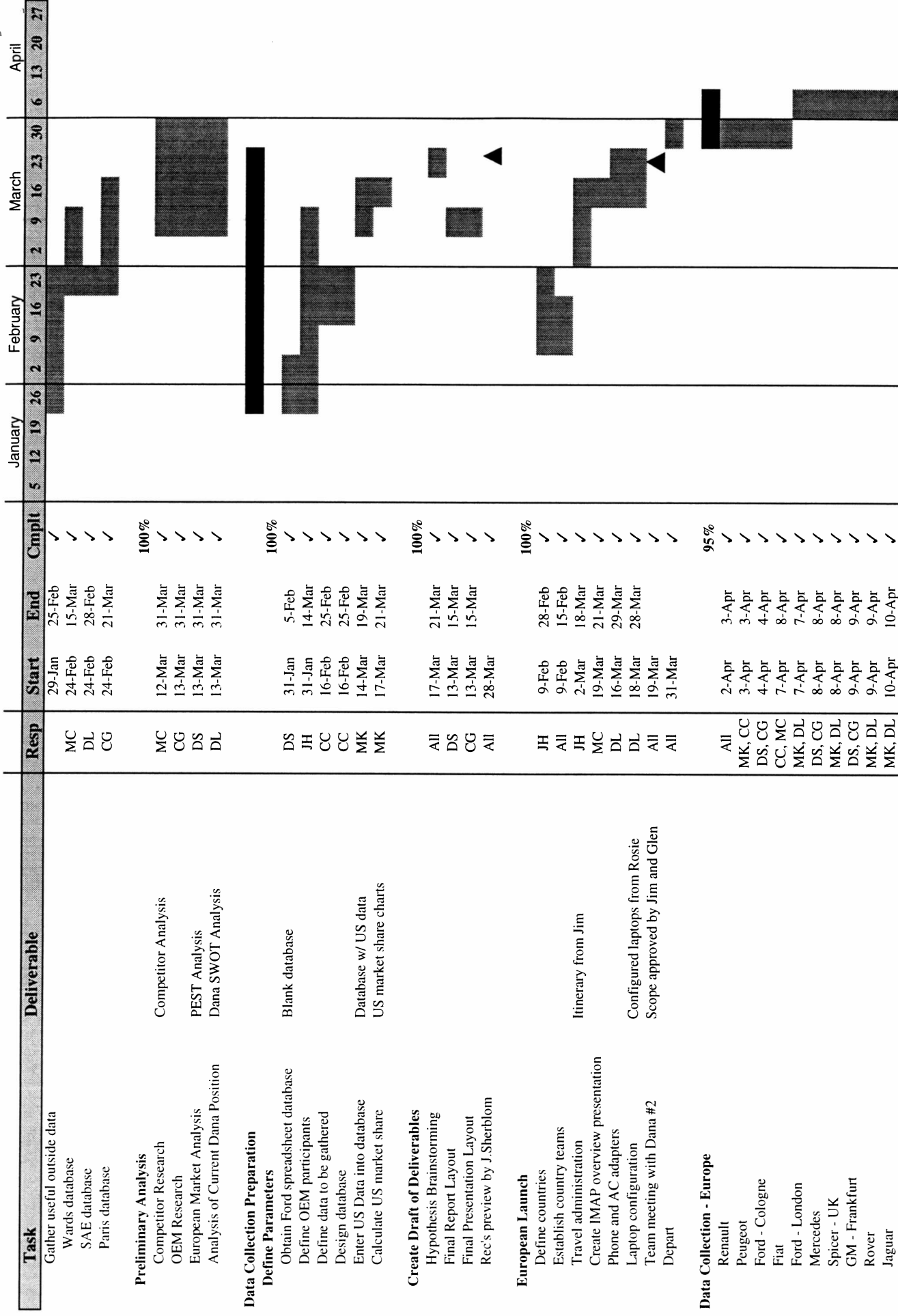
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PROJECT ACTION WORKPLAN

Independent Study and IMAP Project



Independent Study and IMAP Project



Task	Deliverable	Resp	Start	End	Cmplt	January	February	March	April
						5 12 19 26	2 9 16 23	2 9 16 23 30	6 13 20 27
Volvo		CC, MC	9-Apr	9-Apr					
BMW		CC, MC	10-Apr	10-Apr	✓				
VW		DS, CG	10-Apr	10-Apr	✓				
Data Analysis									
*Debriefing mtg w/ J.Sherblom		All	15-Apr		✓				
*Grip process review eval. -J.Sherblom		All	15-Apr		✓				
Analysis					100%				
Make Assumptions			15-Apr	22-Apr	✓				
Review Database	Completed database	MK	15-Apr	22-Apr	✓				
Finalize SWOT Analysis	Dana Internal Analysis	DL	15-Apr	22-Apr	✓				
Finalize European Market Analysis	PEST Analysis	CC	15-Apr	22-Apr	✓				
Market Share Analysis	Market Share Pie Charts	MK	15-Apr	22-Apr	✓				
*Recommendations Preview-J.Sherblom		All	23-Apr		✓				
Review with Andy		All	23-Apr		✓				
Review with Jim Hendren		DL	24-Apr		✓				
Revise deliverables		DL	28-Apr		✓				
Report					100%				
Incorporate Data Analysis		MK	22-Apr	28-Apr	✓				
Make Recommendations		CG	22-Apr	24-Apr	✓				
Write Final Report	Report Draft	DS	22-Apr	28-Apr	✓				
Document Approach and Lessons Learned									
Consolidate OEM Brochures		MK	22-Apr	28-Apr	✓				
Finalize Research Binder		DL	22-Apr	28-Apr	✓				
Final version to Jim/Andy/Sherblom		DS	22-Apr	28-Apr	✓				
Revise deliverables		All	1-May		✓				
		All	25-Apr	29-Apr	✓				
Final Deliverables					100%				
Finalize Report	Final Report	DS	29-Apr	29-Apr	✓				
Finalize Presentation	Final Presentation	CG	28-Apr	28-Apr	✓				
Team Meeting With Dana #3	Present Findings	All	30-Apr		✓				



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3

European/Global Research

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Sport Utility Vehicle Research

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Italy

Spain

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