TRANSPORTATION MARKET

1.0 Market Environment/Description

Our Transportation Market includes the manufacturers of ground transportation vehicles, their first tier suppliers, and those agencies and organizations that have a major influence on them. Ground transportation includes automobiles, trucks, off-road vehicles, trains, and even bicycles, however, our primary focus is on the automotive industry, and more specifically their testing to provide passenger safety and comfort. About 75% of our sales for this market segment is for accelerometers used during crash/safety testing of automobiles and automotive sub-systems.

1.1 Market Structure, Segmentation and Customers

The market contains a relatively few number of major customers, primarily large automotive companies and their first tier suppliers. Being a capital goods industry their sales are cyclical and our business fluctuates with that factor. Their business has been strong for more than two years and is expected to remain strong through at least the year 2000.

Automotive crash testing has high visibility within the automobile companies, the insurance industry and the regulatory government agencies, and passenger safety is now an important competitive discriminator to sell cars. Much of this testing is required by governmental legislation. Every new car model must be tested. The U.S. government has issued proposed new rules that will require additional full-scale crash tests with adult female and 6 year old child dummies. In addition, new rules are already in place which require side impact crash testing. These factors have created a market which has been growing at about 5-10% per year.

The market can be divided into three primary geographic regions: America, Europe, and Asia, however, this segmentation is becoming less distinctive as the major manufacturers distribute and manufacture their products worldwide. As they do this they are reducing their number of suppliers, and there is considerable consolidation taking place. There is significant financial incentive for our customers to have uniform testing throughout the world. For example, AutoLiv, a major supplier for air bags, has several design centers and seventeen manufacturing plants scattered throughout the world. Their senior engineers meet twice a year to coordinate and share results. In short, we need to manage this market as a single worldwide business.

In addition to providing accelerometers which measure motion at various locations on vehicles, we provide accelerometers that are installed in the anthropomorphic dummies. These dummies are highly instrumented, with at least 24 channels of a combination of force gages and accelerometers, and sometimes with as many as 130 channels. There are now dummies which anthropomorphically represent almost all sizes, weights, ages and shapes of people. As these have evolved over the last 30 years, they have become considerably more sophisticated, but there has not been worldwide standardization. This aspect is now changing as there is an active technical committee motivated to standardize this worldwide. Standardization not only deals with the anthropomorphic aspects but also with the required sensors. At least 30% of the accelerometers used in automotive safety testing are installed within the dummies, and about 15% are sold directly to the dummy manufacturers to allow them to provide fully instrumented dummies.

A significant market segment for automotive safety is also the companies which provide the safety constraints (seat belts) and the interior components such as seats and dashboards. Each of these sub-systems needs to be tested before it is accepted by the automotive systems provider. The smallest, but most influential segment is the testing done by governmental agencies and the insurance industry. In the United States the insurance industry formed a consortium which conducts their own tests.

Our customer base for safety testing are those companies which do the majority of business in the automotive industry. Very simply these include companies such as:

System Providers	First Tier Providers	Agencies	Dummies
General Motors	Breed	USA - Transportation Dept.	First Tech.Safety Systems
Ford	AutoLIv	USA - Ins. Inst. For Highway Safety	Applied Safety Tech. Corp.
DaimlerChrysler	Johnson Controls	JARI-Japan	UTAMA
Toyota	TRW		TNO
Nissan	Takata		
BMWBMW	Lear Seating		
Honda	Magna		
Volkswagen			

When testing the complete system or vehicle there are three classes of accelerometers used, the reference accelerometers installed in the middle section of the car, the accelerometers installed in the crumple zone, and the accelerometers placed in the crush zone. Those in the crush zone are often damaged and are sometimes known as disposable accelerometers. Approaches vary from test organization to test organization. For example, Chrysler removes the accelerometers for re-use, and GM does not bother to do so.

With the considerable volume of testing performed worldwide, which is estimated to be at least 10 car crashes per day and a comparable amount of sub-system tests, there is a significant need for a convenient and fast re-calibration service. The largest organizations have their own facilities and the smaller find it convenient to use local calibration and repair organizations. This is providing a business opportunity, both for providing accelerometer calibration equipment and service.

XYZ Corp participates in the Transportation Market for business outside that specifically for passenger safety. The primary segments are Passenger Comfort, Structural Integrity, and Sub-System Integrity. Most of this involves vibration, although dynamic pressure is a significant measurement for engines, transmissions, and braking systems. The need for adaptive brake systems (ABS), traction control systems, and active suspension systems is creating a need for more sensors. A considerable number of dynamic pressure sensors are used to develop smooth gear changing. Modal vibration measurements and acoustic measurements are common to enhance comfort, and certainly dynamic measurements are widely used during the development of engines. The nature of these market segments are similar to passenger safety except that they have less visibility and priority in the marketplace.

In general, because of the strong competition within the automotive industry price, delivery time, and service are very important. In the other more specialized segments such as trucks, trains and off-road vehicles, the products are tailored to the specific need, produced in lower volume, and price is not as critical.

1.2 The Competitors

XYZ Corp's competition can be best described by the table shown below. Because XYZ Corp's business is only in the RDT&E segment, and we do not participate as a high volume OEM supplier, the high volume sensor suppliers are not considered to be competitors. Other than IC Sensors, they are not included in the following table

Application/Product	XYZ Corp Market Share Worldwide/USA	Competitors
Crash Safety/Accelerometer	40% / 65%	AAA, BBB, CC Sensors

Crash Safety/Signal Conditioners	Negligible	CCC HHH, LLL, RRR
Calibration Equip. and Service	30% / 30%	JJJ, XXX
Dynamic Pressure	Negligible / 5%	OOO, TTT, PPP
Ride	20% /30%	PPP, HHH
Modal Test	10%	PPP, AAA, RRR
Crash Safety/Force Gages	No participation	CCC
Comfort/Acoustics	No participation	XXX, YYY
Component Testing	10% / 10%	PPP, AAA

XYZ Corp has a very strong market share for crash safety testing in the USA and Europe. We have been moving our share up in Asia from essentially nothing 3 years ago to $1,000,000 in 1998. We have considerable potential for growth there and are making investments to provide the growth. Kyowa, a Japanese supplier, has been dominant there, but our newer accelerometer technology's better performance is providing us an entry. AAA Corp has a significant position in Europe and America as the low cost supplier. They have for years manufactured their accelerometers for the European market in France which gave them entry there. IC Sensors is a new player with the lowest cost accelerometers which are sometimes placed in the automobile crush zones. We must contain them to a small market share. They are also being used in Germany by an ex-XYZ Corp employee who is packaging their sensor for re-sale. TNO has also started to build a nine accelerometer array for use in Dummy heads using the IC sensors accelerometers.

We have a small market share for modal vibration measurement applications because we lack competitive products and lack experience. New product development is required to drive the sales up; PCB currently dominates this segment.

1.3 Market Changes

We anticipate continuing changes in the market because of consolidations and increasing competition in the automotive industry. This creates pressure to decrease our prices and improve delivery time. This will increase opportunities to provide more service.

Market and product differentiation will decrease as the business becomes more uniform worldwide. We already have had problems with significant pricing differences between geographic regions and between dummy suppliers and end customers. We have instituted a single worldwide pricing structure for our automotive accelerometers in order to increase our market share in Europe and to the dummy manufacturers.

With the growth of low cost accelerometers being provided for OEM use, our customers will attempt to use that technology for test situations. This is already bringing new competition (e.g. I.C. Sensors). We are working with the SAE and ISO to develop a specification for crash testing accelerometers that will prohibit the use of low quality accelerometers in dummies, and have developed our own low cost accelerometer for use in crush zones. An SAE crash accelerometer equivalency subcommittee is defining specifications for crash test accelerometers. We are actively involved in this subcommittee and the proposed specifications will prevent the use of low cost accelerometers. The final specifications will be released mid-summer 1999.

Further evolution and standardization of the anthropomorphic dummies will bring about changes. We have bid on developing new miniature triaxial accelerometers and angular accelerometers for use in a new side impact dummy -- the WorldSID. This dummy is intended to replace the three side impact dummies currently in use.

As dummy channel counts increase the size of the umbilical cable is getting large enough to significantly impact the dummy kinematics. This may provide an opportunity to use our smart sensor/pressure belt technology to solve the cable induced problems.

2.0 Bench Marking

2.1 Financial/Performance Analysis

Financial and Performance analyses for B&K, Kulite, PCB, Kyowa, AAA Corp, Kistler, and IC Sensors are included in this Strategic Plan as they all compete against XYZ Corp in more than one market segment. For the purpose of estimating the total market sales value which is reasonably within reach of XYZ Corp, the sales amount for each of the players in this market are summarized below:

Company	Sales in Transportation Market ($000,000)	Primary Products
XYZ Corp	9	Accelerometers, Calibration Equipment
AAA Corp	4	Accelerometers, Pressure Sensors
ZZZ	5	Accelerometers, Electronics
SSSS	0.2	Accelerometers
EEE	2	Electronics
B&K	5	Microphones, Electronics, Calibration Equipment
AAA	5	Pressure Sensors
DDD	3	Pressure Sensors
PCB	3	Pressure Sensors, Accelerometers
DLLL	7	Pressure Sensors, Accelerometers
Miscellaneous	10	Force Gages
TOTAL	**53.2**	

2.2 Competitor Product/Market Analysis

See Tables following text.

3.0 Key Business Objectives

1. Displace Kyowa as the Market Leader in Asia:

Introduction of the 7264B for worldwide side impact testing allowed us to enter Asia. We need to continue aggressively marketing this product to expand its use there. We successfully captured 100% of Korea's crash test market and are aggressively going after the market in Japan. Customers recognize XYZ Corp accelerometers' better performance over Kyowa accelerometers. The introduction of a low cost accelerometer, Model 7564, has shown promising results and we expect to win orders from the largest Japanese auto companies. Toyota is evaluating our 7564 and has expressed interest in quantities of 1000 units per year. This year we have also introduced an injection molded EZ Mount accessory for the 7564. The disposable EZ Mount can be glued in place, and the 7564 is slid into the mount prior to the test, allowing test vehicles to be prepared prior to delivery to the crash lab. Kyowa is the largest accelerometer supplier in Asia, but we are on our way to taking the number one spot from them.

2. Compete Aggressively Against AAA Corp:

We have instituted a single, lower worldwide pricing strategy to compete against AAA Corp. An important part of this strategy is increasing sales to dummy manufacturers who are very price sensitive. Selling through dummy manufacturers gets our accelerometers into the hands of end users and facilitates direct sales for use on vehicles in crash testing.

Increase Market Share in France:

Differentiate product line to satisfy technical requests and to meet AAA Corp more head-on in France.

3. Reduce Manufacturing Costs:

Initiate manufacture of the 7264C and complete the transfer of the 7264B into TTI driving yields up and labor time down. We have introduced the 7264C accelerometer this year which is a replacement for the older 7264 accelerometer. The 7264C uses the same micromachined sensor element as the 7264B, but with the accelerometer Center of Gravity (Cg) moved to the tip of the package. This will allow our customers to move from our older technology to the newest without changing their accelerometer mounts. The 7264C also solves manufacturing yield problems by allowing us the capability (using existing 7264 tooling) to adjust transverse sensitivity. To further improve manufacturing efficiencies we are rationalizing our product line by getting our 7264A customers to switch to the 7264C, which will allow us to make a single die for crash test accelerometers.

4. Improve Delivery:

Yield problems at our Sunnyvale foundry have led to large backlogs and poor on time delivery. In 1998 Sunnvale engineers focused on resolving the technical problems on our variable capacitance accelerometer die and successfully improved manufacturing yield of that die. In 1999 we are focusing our efforts on resolving technical issues related to our crash test accelerometer die. Resolving delivery problems will allow us to win back customers that switched to AAA Corp to meet their immediate testing needs.

5. Leverage our MEMS Sensor's Small Size to Lock Competitors Out Of the Market:

The WorldSID dummy development committee wants triaxial acceleration measurements in all locations where uniaxial measurements are currently made. We have proposed to develop a very small triaxial accelerometer for the WorldSID. Our MEMS technology will allow us to make a triaxial accelerometer package that can not be copied by our competitors using bonded-on gage technology. The market preference for triaxial measurements and the limited space available in dummies will give us a very big advantage over our competitors for all dummy applications.

6. Realign Business to Focus on Components and Service Specifically in Germany:

We have been representing exclusively a minority dummy manufacturer. This has caused animosity with the stronger dummy manufacturer to whom we provide accelerometers in competition with AAA Corp. To protect our accelerometer sales we will no longer represent dummy manufacturers in Europe. We will continue to offer calibration, ID modules, and dummy cabling systems through our Center of Excellence in Germany, which will focus on servicing all makes of equipment and not exclusive relationships.

7. Increase Market Share in Modal and Component Testing.

We are introducing a series of low cost modal accelerometers and associated low cost Isotron signal conditioners-- the System 50. We will use this new lower cost technology to break PCB's hold on the automotive modal and NVH test market.