

A Vision of Future Motorcycle EFI and Electronics

INTRODUCTION

What is a reasonable vision of the type of V-Twin motorcycle consumers will demand in the future? Motorcycles have had enormous impact on our society and environment. V-Twin motorcycles produce an image that has inspired increased sales, especially in the United States of America, for more than 20 years. However, if you look at the current state of our planet the environmentalists consider motorcycles as being a contributor of pollution. Consumers continue to demand a motorcycle that will provide ease of operation, as well as options and amenities to provide comfort and even an entertainment system. Simply stated, we as consumers want motorcycles that are powerful, look good, fuel efficient, safe, efficient in getting us from point to point, comfortable, easy to operate, and, most important, affordable to purchase and use. The vast majority of motorcycle improvements desired by consumers are from the desire for increased power and acceleration. This is provided when the consumer replaces the complete engine or by installing bolt-on power enhancing products. This is great news for the future of the V-Twin engine industry, as we can also provide an electronic fuel injection (EFI) solution that performs great and meets all emission requirements. However, the real challenge is to produce a complete EFI system that is desirable, marketable, and manufacturable at low cost.

GLOBAL MARKET

TRENDS – Global market trends consist of social demographic, technology, business, political, economic,

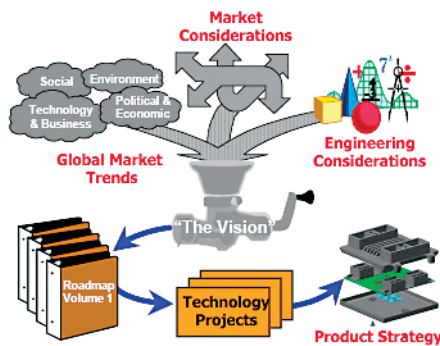


and environmental issues. Social demographic issues include longer life expectance, generational preferences such as baby boomers, generation-X with cell phones and Internet access, growing population centers, increased global V-Twin motorcycle demand, and social and economic infrastructures. Technology and business factors include the current explosion of computer technology, communications and technology developments made in consumer electronics, after sale services becoming moneymakers and differentiators. Political and economic trends that must be considered are globalization of the V-Twin motorcycle industry (engineering, manufacturing, and sourcing), reductions in product life cycles and new competitors from other electronic markets. Environmental issues concerning the world wide motorcycle are many. Reduced pollution into the environment during manufacture and operation, use of energy-saving recycled materials in the manufacture of new products, and recycling of electronic products at end of their useful life are a few of the major issues.

VISIONING PROCESS

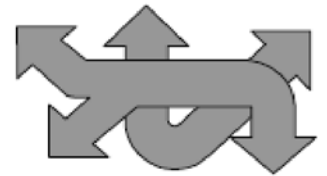
Dictionaries define vision as both “the ability to anticipate and make provisions for future

events: foresight” and “insight: imagination.” To have a vision is one thing, to action it is all together different. In order to make a vision into reality there must be a process. The illustration above is an example of a model that provides a structure for turning visionary product concepts into functioning hardware. It combines global market trends, market considerations, and engineering considerations into product and technology roadmaps, which in turn create technology projects and subsequent product strategy.



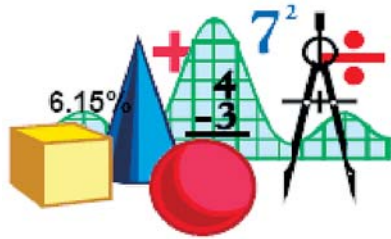
MARKET CONSIDERATIONS

The expectations of the marketplace are many. First and foremost the market expects improved quality, higher functionality, and less time to market at a competitive price. The market also expects globalization of products, but with regional differentiation. New products must be integrated into systems as modules that can vary to fit individual applications. Technology is another major discriminator. Technologies must be proven reliable, but new state-of-the-art technologies are preferred. Electronic hardware must be simulated with software then validated through controlled conditions to assure proper functionality.



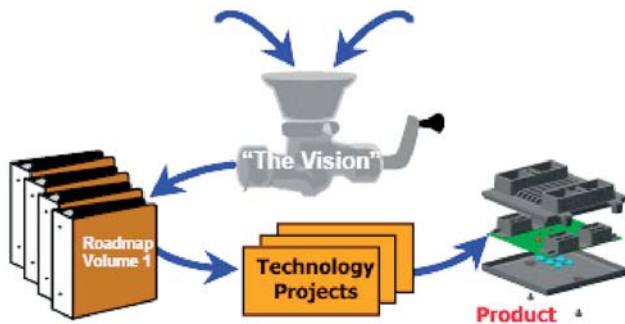
ENGINEERING CONSIDERATIONS – Today there are many engineering and design challenges for any V-Twin motorcycle EFI electronics product designer as he/she deals with the complexity of future designs. Cost per function will be the

major hurdle. New systems will be more complex with many additional features and functions. New designs will demand a level of integration



far above current levels. Minimum volume can become major market discriminators. As products become more complex design issues become harder to solve. Producibility, manufacturability, and testability will become significant challenges at low volumes. Computer power and speed and software will play an increasing important role in these new products. In the future power and speed of V-Twin motorcycle EFI computers will approach those of early office applications, and software will become orders of magnitude more complex than used in motorcycles of today.

THE VISION



Determining a vision or direction for product development is the responsibility of all the major disciplines in a motorcycle or engine manufacturing company. Marketing, sales, advanced engineering, product design, purchasing, manufacturing engineering, and operations each have a specific role to play in the development of a new product. Marketing and sales have the responsibility to determine what products are wanted or needed by consumers and motorcycle original equipment manufacturers (OEM) and aftermarket companies. These wants and needs are then translated into product development plans called product roadmaps which define product requirements. Engineering then determines the technologies, which have to be developed or refined to meet these requirements then originates technology development projects. A key step in this process is to merge product roadmaps and technology projects to determine fit and timing, so gaps can be resolved as technology projects progress, development activities are supported by cross-functional teams which include product design, purchasing, manufacturing engineering, and operations. These groups provide the inputs required to complete the project. Each product line also learns of the specific technology issues in areas of responsibility that will enable successful implementation of specific technologies. New technologies should not be implemented into production without a

coordinated multifunctional team with representation from all disciplines. It is important to note that as new technologies are developed for specific products these technological advances also become available for use on existing products. Therefore, technology projects stimulate the development of new product strategies. Technology visioning is the engine that propels new innovative products. But it also can move new technologies into existing products for future applications.

A CASE STUDY ON-ELECTRONIC FUEL INJECTION

GLOBAL MARKET TRENDS – There is a strong push for motorcycle and engine manufacturers to incorporate electronic fuel injection. This push is generated by the new emission requirements imposed by EPA and CARB for 2006 (OEM) and 2008 model year. Those motorcycle and engine manufacturers who incorporate EFI will be providing customers with instant starts, great drivability, reliability and ease of operation along with reduced emissions. It also reduces maintenance costs and oil change intervals compared to a carbureted engine in a motorcycle.

THE VISION/THE PLAN – Case examples of the described visioning processes have been executed at Powertrain Electronics, LLC in order to meet the size and performance specifications an engine controller. Higher component assembly density and advanced materials technologies can result in a better design with minimal cost increase. We researched several designs from different vendors and cost studies were made.

CONCLUSIONS

It is extremely important for progressive motorcycle and engine companies to have a clear vision of future products. This vision, through the use of a defining process, is used to generate technology roadmaps that identify technology development projects. These projects enable product vision realization through innovative product designs such as EFI. Technologies developed can be used, or reused, on other new or existing product designs, which results in expanded benefits from the new design on future model years.

Powertrain Electronics, LLC is a one-stop solution provider. We are able to engineer, as well as supply, a complete air/fuel system and provide the V2-ECM™ engine controller. Our engine engineers are experts in low emission calibration and allow the engine system to meet, and in most cases exceed, emission standards for V-Twin motorcycles. We also apply for CARB and EPA certifications on your behalf and supervise all emission tests.

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