Business Requirement Specification (BRS)

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1.0 Scope

The scope of the system being developed is the electrical sub-system of the Harley-Davidson Road King Touring Motorcycle (FLHR). This covers all electrical components included in FLHR.The specific document here is the Business Requirement Specification (BRS) and will elaborate on the different aspects of system business development and requirements. This will include the needs statement of the system or what is being identified as the need for the system, as well as calling out a tentative plan that will be used throughout the systems life cycle in order to make sure the system is adhering to specifications and will provide the projected ROI. Another purpose of the BRS is to provide inputs for use in capturing stakeholder needs and requirements. Overall this document will explain the business strategy approach of how the electrical subsystem will be developed and maintained.

2.0 Needs Statement

The Harley-Davidson Road King Touring Motorcycle (FLHR) is a popular motorcycle platform used widely across the world. The use of an V-Twin internal combustion engine as well as complex sensors and instrumentation such as Anti-lock Brake systems provides the need for a mobile electric storage and usage system for use on the platform. Without the electrical system in the FLHR the system cannot operate properly so it is a system requirement that a working electrical subsystem be developed and integrated into the overall FLHR system.

3.0 Overarching Business Strategy

The overarching business strategy seeks to outline the desired mission outcomes of the sub-system, and is commonly referred to as the Operational Concept (OpsCon). This portion of the document will describe the expectations of the system as well as detail the “how” of the mission, that being the means by which the system will achieve its overarching mission. The primary stakeholder and their relationship with the system will be discussed in this section as well. The overall mission of the electrical sub system of an FLHR is to provide the essential electrical connection between all systems and ensure they work together to complete the system as a whole. Primary stakeholders for this system will be the end users of the FLHR system, who are anticipating a fully functional motorcycle that is a reliable form of transportation. The additional stakeholders who will interact with the system on a daily basis in its lifecycle will be the management and manufacturing staff that will be in charge of the daily production and upkeep of electrical components for the FLHR. Requirements can be formed from these interactions with the stakeholders, the electrical sub-system must be able to work together with the other subsystems of the FLHR to provide functionality. The system must also be designed to be upkept throughout a long product life cycle, meaning it must be robust enough to work for potentially 1000’s of users and must have interchangeability between all of its components. The constraints that can be applied to this system are both physical and operational. The biggest constraint being that the FLHR is a moving system that is approximately 95 inches in length, so all components in the system must be produced accordingly to fit that scale. The system must also be able to be supported by the preexisting architecture that Harley davidson has in place for the FLHR system of motorcycles.

4.0 Primary Business Objectives

The primary business objectives describe the end goals that the system will achieve from a business aspect. These stem directly from the business mission that is founded at the conception of the project and serve as the justification for the initial high costs of investing in the project. The primary business objectives this project seeks to achieve is the return of net profit overall on the initial investment. Supporting the whole system of an FLHR with the electronics sub assembly will provide a return on investment as every FLHR requires an electrical system to operate. The electrical system is also a component of the motorcycle that can have failures in multiple different sections and will need replacement parts issued, which overall will lead to the inflow of cash when suppliers and end users buy electronic parts. The initial costs of developing this system will need to be completely covered as well as with any successful business a profit will need to be made in order to provide ROI justification. Additionally the innovation of new technologies to be used in the Harley davison family of motorcycles will be a driving factor behind the development of this sub system. The creation of new customers for Harley-Davidson will be an overarching business goal too as creating quality solutions will lead to satisfied end users and ultimately a larger basin of customers. Achieving these goals will allow for justification of the initial investment and help conduct successful business.

5.0 Lifecycle Stage Completion Criteria

The lifecycle stage completion criteria is the goals in which the system needs to achieve in order to move between each lifecycle stage during its development. Each life cycle stage will be preceded by and finished with a gate review in order to process if the project is on a good track and reaching all goals as stated in the project management plan. The project will follow the INCOSE lifecycle stages which are as follows; concept, development, production, utilization and support, and retirement.

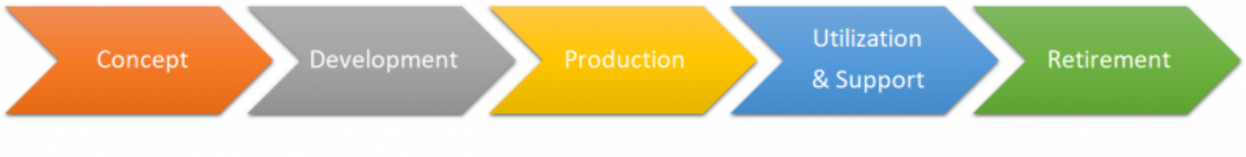


Figure 1. INCOSE Life Cycle stages

Criteria for the conceptual stage to end will be the successful definition of a concept that is well researched and yields a feasible solution to the requirements of stakeholders. The review gate at this stage will feature a meeting with all stakeholders involved in the project, as well as subject matter experts where it will be decided if the project should continue based on the primary object that was stated. The next stage of development will need to have a feasible prototype of the electrical system that shows proof of concept and meets all stakeholder and system requirements. This prototype will serve as the production piece once it is determined that it meets all specifications and requirements and is a sustainable product. After this stage the production stage will occur, production will be considered a success if the product is able to be successfully integrated into the FLHR system without any faults or issues and has the proper architecture to sustain the production of all items needed for the system. Additionally architecture to support production such as facilities and support networks such as dealerships and suppliers to provide a sustainable acquisition process. At this point gate reviews will be conducted later in the project's life cycle since upkeep of production will be the main focus. Once the product is widespread and standardized the review to begin utilization and support what will be considered a legacy product at this point will occur. This review will seek to see if the architecture exists for legacy support and utilization so that upkeep of electrical systems can occur, if the necessary architecture is present then the product can finally enter the retirement stage. At this point in the life cycle resources are being redistributed into other projects and only the architectures to support the systems being actively used by end users will be in full effect. The product can be officially retired when a product or project review occurs that assembles all stakeholders and analyzes whether the project meets or exceeds project expectations and requirements. If the project is considered successful, it will be put into the retirement stage and will serve as a baseline from which the next generation ofproductst will stom. After all of these stages have been reached and approved the project will officially close,but itt will retain any paper records in case there is a need to provide legacy support or background information for the next generation of the product.

6.0 Overarching Risks, Issues & Opportunities

Overarching risks, issues, and opportunities refer to the factors that can affect the system's development, performance, and success. These include potential risks and issues that may arise during the development process, as well as opportunities to improve the system's functionality and performance.

This report identifies several overarching risks, issues, and opportunities associated with the electrical system, based on sources such as the Systems Engineering Body of Knowledge (SEBoK) and various manuals.

The first risk identified is electrical system failure, which may occur due to factors such as a faulty battery, alternator, or wiring. To prevent this, implementing redundant electrical components, incorporating backup systems, or predictive maintenance techniques may be helpful.

Electromagnetic interference (EMI) is another risk, which can interfere with the proper functioning of electrical components and lead to system failure or safety hazards. Shielding techniques, grounding techniques, and conformal coatings can help mitigate EMI risks.

Compatibility issues may arise between electrical components, leading to poor performance or safety issues. Conducting compatibility testing and implementing standardization techniques can help ensure compatibility between electrical components.

Safety hazards such as fire or electric shock hazards may arise if electrical components are not designed and installed properly. To prevent these hazards, implementing safety features such as fuses, circuit breakers, and safety switches, as well as following safety standards and regulations, may be helpful.

Lastly, maintenance issues can arise, such as regular battery replacement and wiring inspections to prevent system failure. Predictive maintenance techniques such as condition monitoring and fault diagnosis can help reduce maintenance costs and prevent system failure.

7.0 Assumptions

Assumptions are the factors that are taken for granted when developing a system. They are the beliefs that the stakeholders have about the system's functionality and performance. These assumptions must be identified and evaluated to ensure that they are accurate and valid.

The Business Requirement Specification (BRS) for the electrical subsystem of the Harley-Davidson Road King (FLHR) Touring Motorcycle includes several assumptions that are critical to the successful implementation of the system.

Assumption 1: Compatibility with engine components

The electrical subsystem should be compatible with the engine components, such as the ignition system, fuel injection system, and sensors, to ensure proper functioning of the motorcycle.

Assumption 2: Compliance with safety standards

The electrical subsystem should comply with safety standards, such as National Highway Traffic Safety Administration (NHTSA) regulations and the Society of Automotive Engineers (SAE) standards, to prevent safety hazards.

Assumption 3: Availability of replacement parts

The availability of replacement parts, such as batteries, alternators, and wiring, should be considered when designing the electrical subsystem to ensure easy maintenance and repair.

Assumption 4: Environmental factors

The electrical subsystem should be designed to operate in a range of environmental conditions, such as temperature, humidity, and vibration, to ensure reliable functioning of the motorcycle.

Assumption 5: Electrical power management

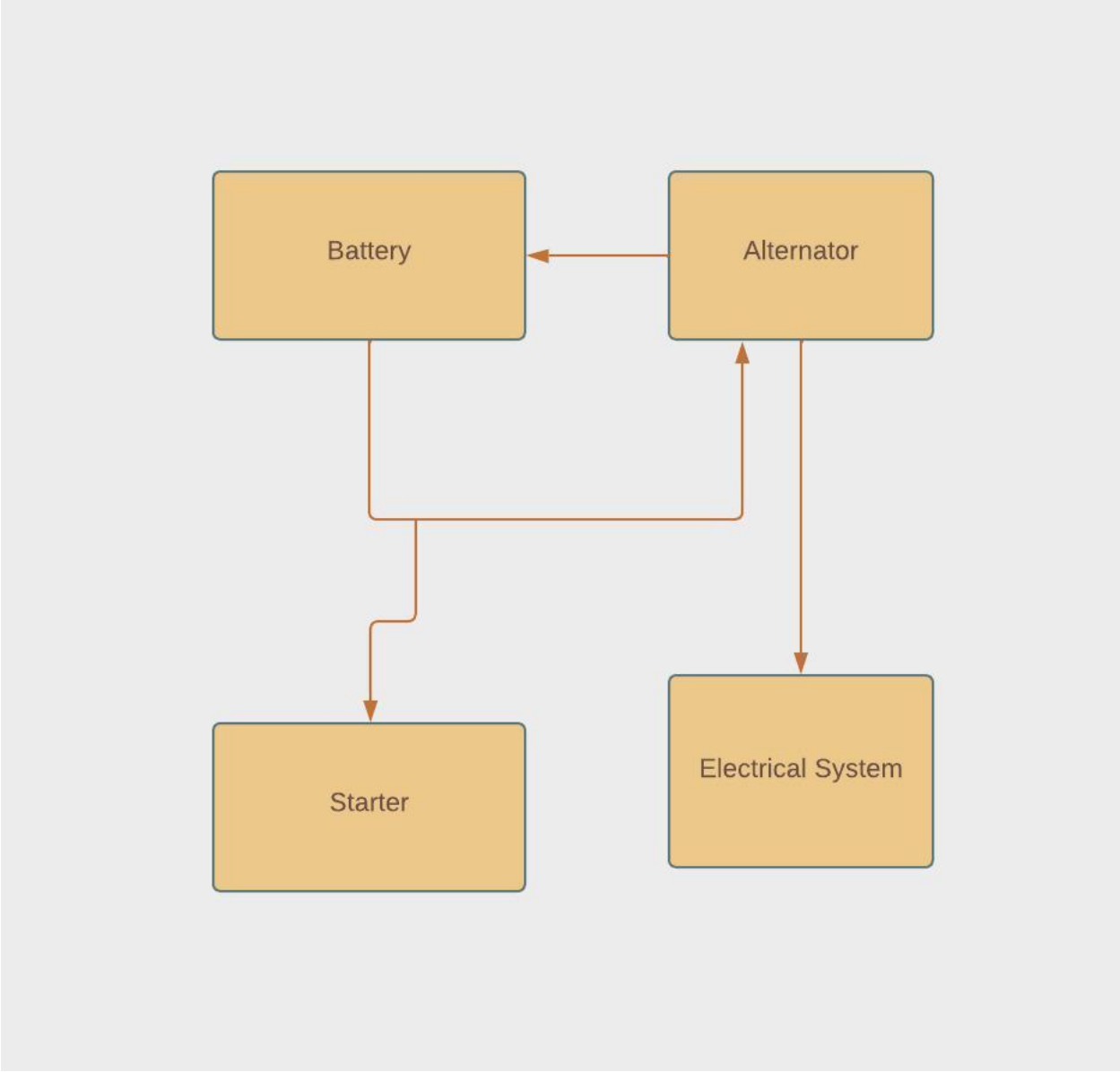
The electrical subsystem should include efficient power management techniques, such as regulating the charging system and using energy-saving components, to optimize the performance and extend the life of the battery.

8.0 Product/system description & its primary capabilities

Product/system description and its primary capabilities refer to the system's features, functionality, and performance. This element of the BRS includes a detailed description of the system's components, how they work together, and how they meet the stakeholders' needs and expectations.

The electrical system of the Harley-Davidson Road King (FLHR) Touring Motorcycle is a critical component that provides power to various electrical devices, including the engine and lighting systems. As per the 2016 Road King Owner's Manual, 2016 Harley-Davidson Touring Models Service Manual, and 2016 Touring Models Parts Catalog, the primary capabilities of the electrical system include starting the engine, charging the battery, and powering various electronic devices, such as the headlights, taillights, brake lights, and turn signals.

The electrical system comprises several key components, including the battery, alternator, starter, and wiring harness. The battery provides electrical energy to start the engine and power the motorcycle's electronic components when the engine is off. The alternator charges the battery while the engine is running and provides electrical energy to power the motorcycle's electrical systems. The starter motor engages the engine and helps to start it. The wiring harness connects all the electrical components and provides the necessary power and ground connections.



The electrical system's primary capabilities and components are essential for the motorcycle's safe and efficient operation. Any malfunction or failure in the electrical system can result in safety hazards or system failures, as discussed in the previous section. Therefore, proper maintenance is critical to ensure the system's reliability and safety.

9.0 Cost & Schedule Profiles

To ensure that a project is completed on time, within budget, and in accordance with the requirements outlined in a business requirement specification (BRS), one must use a cost and schedule profile (INCOSE, 2015). This document outlines the activities, tasks, materials, and deadlines needed to complete a project and the time and money required. The profile is built on a work breakdown structure (WBS), which breaks the project into smaller, more manageable tasks. For an electrical-based system, the Cost & Schedule profile might include tasks such as designing and prototyping the electrical system, creating software to control the system, and testing the system to ensure that it complies with performance and safety standards.

When creating a Cost & Schedule profile for an electrical-based system, consider the system's components and their specific requirements. The electrical system of the Harley Davidson 2016 Road King manual, for instance, includes the engine control module (ECM), the ignition system, the charging system, and the starter system, each of which would require specific tasks, materials, and deadlines, which would be listed in the Cost & Schedule profile.

The Systems Engineering Body of Knowledge (SEBoK) provides extensive information on Cost & Schedule profiles, including best practices and procedures for creating and managing them (INCOSE, 2015). Additionally, the PMI Guide to the Project Management Body of Knowledge (PMBOK Guide) offers comprehensive guidance on developing Cost & Schedule profiles, as well as best practices and tools for managing projects of all types, including those involving electrical-based systems (Project Management Institute, 2017).

10.0 Primary stakeholder list

Freeman, Harrison, Wicks, Parmar, and De Colle (2010) suggest that the success of Harley Davidson's business depends on meeting the needs and interests of its stakeholders. The following is a list of primary stakeholders for the Harley Davidson 2016 Road King Manual, including their level of influence and ability to impact resources.

Customers are a significant primary stakeholder group for Harley Davidson, with a level of influence and ability to impact resources rated at 5/5 (Crawford & Benedetto, 2016). Their purchasing power and brand loyalty directly impact the company's revenue and market share. Therefore, the company must address their concerns and expectations when designing and manufacturing the 2016 Road King Manual.

Communities surrounding Harley Davidson manufacturing facilities are also primary stakeholders with a high level of influence rated at 5/5, while their ability to impact resources is rated at 3/5 (Bansal & Roth, 2000). They can influence the company's business operations through zoning regulations and tax incentives. Additionally, their perception of the company's social responsibility and environmental impact can affect the company's reputation and brand image.

Suppliers are essential stakeholders for Harley Davidson's supply chain management with a level of influence rated at 4/5 and an ability to impact resources rated at 5/5 (Power & Sohal, 2013). They provide the necessary raw materials and components for the manufacturing of the 2016 Road King Manual. Their level of influence on the company's business is relatively high, and their ability to impact resources is critical in ensuring timely delivery and quality of materials.

Employees are significant primary stakeholders with a level of influence rated at 4/5 and an ability to impact resources rated at 5/5 (Freeman et al., 2010). They are responsible for designing, manufacturing, and delivering the 2016 Road King Manual. Their level of influence on the company's business is high, and their ability to impact resources is crucial for the success of the project.

Finally, environmentalists are stakeholders who advocate for the protection of the environment, with a level of influence rated at 3/5 and an ability to impact resources rated at 2/5 (Donaldson & Preston, 1995). Although their level of influence on the company's business operations is relatively low, their ability to impact resources is significant in ensuring sustainable and environmentally responsible practices in the manufacturing and distribution of the 2016 Road King Manual.

11.0 Overarching measures of quality for project artifacts

Harley Davidson's success is reliant on meeting the needs and interests of its stakeholders (Freeman et al., 2010). The primary stakeholders of the 2016 Road King Manual our customers, communities, suppliers, employees, and environmentalists. Customers have a high level of influence and ability to impact resources through their purchasing power and brand loyalty (Crawford & Benedetto, 2016).

Communities surrounding Harley Davidson manufacturing facilities are also primary stakeholders, with a high level of influence but a relatively low ability to impact resources (Bansal & Roth, 2000). Suppliers have a relatively high level of influence and ability to impact resources in Harley Davidson's supply chain management (Power & Sohal, 2013).

Employees have a high level of influence and ability to impact resources in designing, manufacturing, and delivering the 2016 Road King Manual (Freeman et al., 2010).

Finally, environmentalists have a relatively low level of influence and ability to impact resources but can significantly impact ensuring sustainable and environmentally responsible practices in the manufacturing and distribution of the 2016 Road King Manual (Donaldson & Preston, 1995).

Therefore, understanding the level of influence and ability to impact the resources of these stakeholders is crucial to ensuring a sustainable and socially responsible business model.

12.0 Overarching Checklists And Processes Used (Business Requirements):

The Road King (FLHR) Touring Motorbike Business Requirements Specification (BRS) is a critical document that offers a thorough set of requirements and methods for the Systems Engineering Design Team to adhere to during the design process. This document provides the

framework for the whole design process, including all of the organizational criteria that must be addressed.

The Systems Engineering Design Team will use the BRS to define the specifications with each system and subsystems, such as the engine, gearbox, brakes, suspension, and electronics, in order to replicate the original design documentation for the FLHR. They will use a one-of-a-kind technique that includes checklists and procedures to verify that all BRS criteria are completed.

To ensure that the new motorcycle design fulfills all requirements and delivers the expected performance and quality for Harley-Davidson customers, the Systems Engineering Design Team will create a detailed checklist for each requirement that includes all relevant specifications and necessary information. The team will review the design at every stage of development to confirm compliance with the requirements. The review process will involve internal and external stakeholders, such as customers, dealers, and regulators.

The Road King (FLHR) Touring Motorcycle Business Requirements Specification (BRS) plays a crucial role in guiding the Systems Engineering Design Team during the design process. The team follows the BRS and implements a unique method of checklists and processes to ensure that the new motorcycle design meets all the requirements and delivers the expected performance and quality for Harley-Davidson customers.

13.0 Traceability to/from business requirements to sources:

The Systems Engineering Design Team must create traceability between both the Road King (FLHR) Touring Motorcycle Business Requirements Specification (BRS) and the inputs used to define the criteria to guarantee that the new motorcycle design fits all of the defined requirements. In order to accomplish this, the team will employ a traceability matrix that connects each need in the BRS to the resources that defined it as well as the FLHR system modules and modules that it impacts.

The traceability matrix will assist the Systems Engineering Design Team throughout the system design by verifying that all defined requirements for each subsystem and component are satisfied. To preserve traceability and integrity with the BRS, all modifications or design choices that are made throughout the procedure will be logged in the matrix.

The traceability matrix is additionally going to be utilized to confirm that all requirements have been met during the verification and validation phases. The team will trace each need back to the sources that were used to develop it and ensure that the design changes and adjustments made throughout the planning process are in accordance with the defined requirements.

By employing a traceability matrix and a creative approach to recording design choices and modifications, we may develop traceability to and from business requirements and sources.The Systems Engineering Design Team guarantees that the new motorcycle design meets all required specifications and fulfills Harley-Davidson consumers' performance and quality expectations.

Stakeholder	Level of Influence	Ability to Impact Resources
Customers	5/5	5/5
Communities	5/5	3/5
Suppliers	4/5	5/5

Employees	4/5	5/5
Environmentalists	3/5	2/5

Requirements traceability matrix

Appendix(ices):

Appendix(A)- Abbreviations:

- BRS: Business Requirement Specification
- FLHR: Harley-Davidson Road King Touring Motorcycle model
- OpsCon.: Operational Concept
- ROI : Return on investment
- EMI: Electromagnetic interference
- NHTSA: National Highway Traffic Safety Administration
- ECM: Engine Control Module