

Name of Company: High Integrity Solutions (HIS)

Technology on which company is based:

HIS uses “fail-operational” methodologies from aerospace to design highly reliable electronic controls. IP has been secured to protect a superior solution for Li-ion Battery Management Systems (BMS).

Funding Stage:

First round / Series A

Business and Business Model

1. **Inception:** Company was created in March 2009 (the team has been working together for 4 years)
2. **Value Proposition:** HIS will provide the world’s most reliable Battery Management Systems for Li-ion batteries (reliability 25X the industry), solving the reliability and safety related issues faced by Electric Vehicles and battery manufacturers. Solving the reliability issue leads to the creation of multi-billion dollar value in the form of warranty savings (\$2500 per vehicle over the warranty period), optimization of battery design, and logistical savings for OEMs.

Background on the problem to be solved:

One of the key challenges to bringing high energy Li-Ion technology to bear is overcoming critical safety issues. An unintentional aggressive overcharge will cause the Li-Ion battery to go into a thermal run-away that can lead to explosions and vehicle fires. These safety considerations require a complex set of highly reliable electronics that must be packaged and sealed within the battery enclosure. This complexity is about a 4-5 times increase over a typical automotive electronic control unit today. In addition, the battery electronics will now be active for up to 8 hrs a day while the vehicle is parked and charging the battery, resulting in increased demand on the reliability of the electronics.

The increased electronics complexity and powered on-time results in a significant “reliability gap”, approximately 25x, between what the current electronic technology can provide and what the market requires. Any single failure of the internal electronics will result in a very expensive removal, repair and/or replacement of the entire battery system – approximately \$2500 per vehicle over the warranty period. Our analysis shows that with current technologies, over a 10 year period, there will be over 1000 “incidents per thousand vehicles” (IPTVs) due to battery electronics failures. However, government requirements, and customer expectations for levels of acceptance will be less than 40 IPTVs over a 10 year warranty period.

Excess warranty costs linked to this reliability gap will be in the order of \$1B/year by 2015 and \$5B/year by 2020 for a major OEM if no solution is found. Key stake holders engaged in the production of electric vehicles and /or Li-Ion batteries acknowledge that the reliability gap is real and requires the development of an effective solution.

3. **Current Structure:** Currently an LLC – Will be structured into a corporation at funding

General Description: HIS will sell Battery Management Systems to battery pack integrators (in some cases vehicle OEMs, in other cases battery companies). HIS will develop the software and product design in house, outsource components manufacturing to best in class suppliers, and provide on-site support to its customers.

Product

1. **Product:** A Battery Management System is composed of circuit boards, sensors and a wire harness. HIS will deliver the full solution to battery packs integrators.

Our team has identified a unique Hi-Reliability architecture that will close the 25x reliability gap faced by the industry today. The solution combines leading-edge technology found in Aerospace (e.g., flight controls) with existing automotive technologies. We will apply fail-operational methodologies used and proven in the most demanding flight controls applications. For the past year, our team has worked closely with a Detroit OEM and with battery suppliers validating that our solution will effectively solve the problem at an acceptable cost.

2. **Function and Benefit:** The HIS battery management system will have a reliability level (25x above current industry levels) guaranteeing that the product will not fail during the required 10 year warranty period. The associated warranty savings will be in the order of \$2500 per vehicle during the warranty period. The price premium that HIS will charge will be in the order of \$100 per BMS (which represents an increase in BMS cost of 20%, or around 2% of the overall battery pack cost).

By improving reliability and safety, the HIS solution will also allow battery manufacturers to optimize battery design (battery life and energy content) that is limited today by necessary compromises done to mitigate the safety and reliability risks. The economic value associated with battery design optimization is large (weight reduction, higher battery power and life...), but has not been quantified nor factored into our model yet.

3. **Development Stage:** Design architecture has been defined and fundamental IP has been locked. HIS will need 12 months of development to bring the product to market.

Competitive Position

1. **Competitors:** Traditional automotive electronic control suppliers (Delphi, Denso,...) and potentially battery companies choosing to develop electronic controls in-house.
2. **Edge over competition:** Our team is highly skilled in the most advanced Aerospace electronics and system design techniques that are applied in many 'safety critical' product applications. All key members of the technical team are recognized as world experts in their field and have decades of experience applying technology for high profile applications such as

the Boeings 787 fly-by-wire system. As such, our team is uniquely positioned to successfully develop the world's best in class solution.

3. **Sustainability:** IP has been developed to secure the fundamental architecture. Traditional automotive suppliers cannot achieve these levels of reliability, or would have to face our IP protection to access the optimal solution. Regardless of the IP position, the resources needed to get the field expertise required would be such, and the time to market would be so long that it would not make sense for an outsider to try to catch up considering the cost/benefit position of the HIS solution.

4. **IP Protection:** The enabling intellectual property has been identified, recorded, and is proceeding through the patent application process.

Markets

1. **Target Market:** HIS will first sell its products to battery manufacturers in the automotive sector, and will gradually expand to military applications and to stationary power applications (solar & wind energy storage).

The market for Li-ion batteries in automotive is forecast to reach over \$30 billion by 2020, with \$2.5 to \$3 billion dollars per year spent for electronic controls only (our primary addressable market).

HIS's goal is to capture 30% of the Li-Ion battery electronic controls market, leading to \$400M/year in revenue by 2016 and over \$1B/year by 2020.

3. **Barriers to Entry:** IP, know-how, fixed cost and time to market for incumbent, first mover advantage (networks externalities – HIS will become an industry standard).

Customers

HIS is working with a major US OEM, and with GS Yuasa (world's largest Li-ion battery manufacturer and supplier of Mitsubishi and Honda). Both the OEM and GS Yuasa have filed applications for DOE funding jointly with HIS.

HIS is also in discussions with ISE, Azur Dynamics and other battery manufacturers, and can produce letters of interest from these customers.

Name of Company: High Integrity Solutions, Phoenix, Arizona

Name and Title of Presenter: Jean-Noel Poirier, Member of the board of advisors

Address: 20 W 64th street, apt 28U, New York, NY 10023

Phone: 917 855 0614

Email: jeannoel.poirier@gmail.com