



Zemships-Newsletter

No. 4 – 2010/01

Dear readers,

We are pleased to present the fourth Zemships newsletter to you. Project Zemships is heading rapidly towards its successful conclusion. Currently, the FuelCellShip “Alsterwasser” is being prepared for its start into the new season. Please find below some interesting articles. We hope you enjoy them!

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Final Zemships Conference: Just three more weeks to come

On April 20th the Final Zemships Conference is going to take place in Hamburg. Take advantage of the possibility and join the conference via the following link

<http://www.zemships.eu/en/news/calendar/registration.php>

Hear all about the project results and get in contact with the partners involved. Participation at the conference is free of charge. However, registration for the conference via the Zemships homepage is mandatory.

Interview with ATG-Managing Director Gabriele Müller-Remer

“Alternative Technologies are getting more and more important for us.”

Since summer of 2008 the FCS Alsterwasser is in service. How do you evaluate the time since then?

The project has left a strong positive impression. The fuel cell ship operates reliable and we could collect a lot of data and knowledge. Certainly we also experienced some technical failures but that is what projects like Zemships are also there for. For example, we had the case that the fuel cell system shut down because a special auxiliary unit did not function as it was supposed to. At the heart of the problem was a software error. The software for the electric system of the ship is very complex; it controls a whole range of sophisticated processes.



ATG-Geschäftsführerin Gabriele Müller-Remer

What do you think are the main advantages of the new technology compared to conventional systems?

The aspect of environmental sustainability is of course vital in this respect. The ship runs locally CO₂-free so that we do not emit any harmful substances on the Alter Lake. Being a modern company we feel obligated to push innovations like this to strengthen our sustainable business strategy.



How was the routine of refueling the ship?

The refueling is indeed very easy. On average two times a week the FCS Alsterwasser – before starting its service – goes to the refueling station at the HOCHBAHN site in Barmbek. First the ship will be steadied and then the refilling nozzle will be fixed. It takes approx. twenty minutes to fill up to 50 kg of gaseous hydrogen into the tank system. Then the ship is ready for service again.

What is the daily operating time of the FCS Alsterwasser?

Up to eight round trips, which means approximately ten hours of daily operation. Sometimes the ship is also booked for additional charter trips.

How do passengers experience trips with the FCS Alsterwasser?

Many of our passengers are positively surprised by the low noise the fuel cell ship produces. Passengers can easily communicate and, for example, music can be played on charter tours. Sometimes the Captain is asked by interested passengers who notice the low noise what is special about the ship and they are always surprised to hear about the new technology.

Are there passengers coming only to see the new technology?

Certainly! Especially customers using the FCS Alsterwasser for charter tours are very interested in the technology and want to get a first hand impression on the fuel cell technology that works onboard.

Looking backwards, what has been your personal highlight regarding project Zemships since its start in 2006?

That was when we first presented the ship to other shipping companies here in Hamburg. Many of them were very impressed by the quiet propulsion of the ship and the elevating roof that can be lowered up to 30 cm. It allows us to pass underneath low bridges. This recognition by other companies was a very special acknowledgment to us.

Do you pass on your knowledge and experiences to others?

We receive lots of reactions and inquiries concerning the operation of the FCS Alsterwasser, questions how the project is proceeding and about the business management. Alternative technologies are getting more and more important in our business. The erratic oil prices and the foreseeable scarcity of oil in general as well as a strongly increased awareness of environmental questions change some minds in our business. For example, we share our knowledge within the UITP-Waterborne Transport Committee, a worldwide association of shipping companies. And of course, we present our results at the second Zemships conference in April this year here in Hamburg.





What is the next station of the FCS Alsterwasser?

Officially the project ends on April 30th. However, the ATG will keep the ship in its fleet. We think that sound results can only be retrieved if we continue the service with the ship for a longer trial period.

News from the test stand

Proton Motor presents data of the 2009 season

The season 2009 started with a regular maintenance service for the fuel cell system at Proton Motor in Puchheim near Munich. After reinstallation of the system at the ship yard SSB in Oortkaten near Hamburg, FCS Alsterwasser got back into operation service with ATG.

From April to October 2009, the FCS Alsterwasser had been in service very often for the popular fifty-minute Alster round trip within the regular ATG line service. Those trips took place between 10 am and 7 pm. From these operation times a typical driving cycle could be obtained. This specific cycle of FCS Alsterwasser can be recognized on figure 1. Not surprisingly, it clearly shows that the performance of the fuel cell system hits a low between the trips. Overall the system ran for 650 hours within the last season.

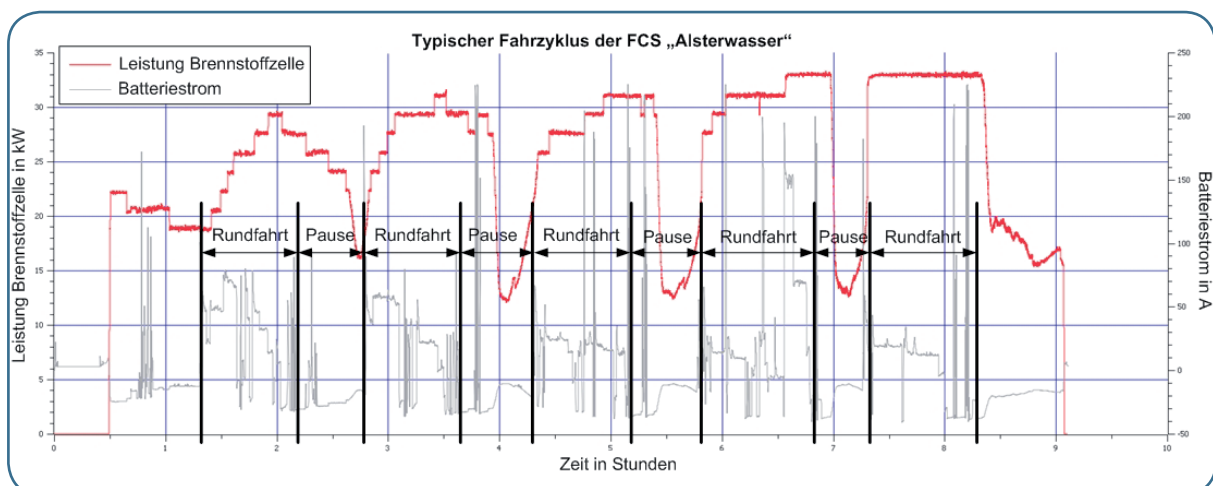


Figure 1: Typical driving cycle for FCS Alsterwasser during operation phase



To ensure and optimize the reliability of the system and, hence, the availability of the ship during the season PM has developed a service concept that had been introduced at the beginning of the season 2009.

It has been verified that the ambitious aims for reliability and a significant decrease of failures of the ship to a minimum could nearly be reached. Almost every time a technical failure occurred a PM technician could solve the problems within 24 hours. On average a technician visited the project in Hamburg 2-3 days a month, which is an outstanding mark for a demonstration project like Zemships.

Furthermore, operation data of the fuel cell system and of the ship itself have been collected on a regular base throughout the season. The data of the fuel cell system is currently being processed and analyzed by PM and experts of the University of Applied Sciences Hamburg. The analysis is supposed to determine the overall efficiency of the system and to derive an optimized energy flow. As it can be expected from a world premiere, some weaknesses regarding the system components have already been discovered during operation (air compressor and sensors). Through intensive cooperation with the suppliers these failures were analyzed and solutions worked out. Counting more than 14.000 passengers in 2009 the reliability of FCS Alsterwasser has truly been demonstrated.

Nuclear Research Institute delivers important component

Control software and visualization display ready

The Nuclear Research Institute in Husinec near Prague, a small but very important partner in the project, has finished its work on the mathematical model intended to optimize the operation strategy of the fuel cell system. Based on the model, a visualisation software has been developed to display the real-time operation mode for passengers onboard of the ship.

The development of the software has been the result of the excellent cooperation between project manager Petr Dlouhy from the institute, the staff of Proton Motor, and the support of the Electrical Engineering Department of the Technical University of Prague. Based on parameters of an existing model for fuel cell systems the mathematical principles have been adjusted to the requirements of the passenger ship. Furthermore, measuring data concerned with the battery system have been added up to the model. By using the control software of NRI the hybrid drive system is supposed to permanently run in



its optimum range. As a result the hydrogen consumption of the fuel cell system is minimized and the life time of the hybrid drive is maximized

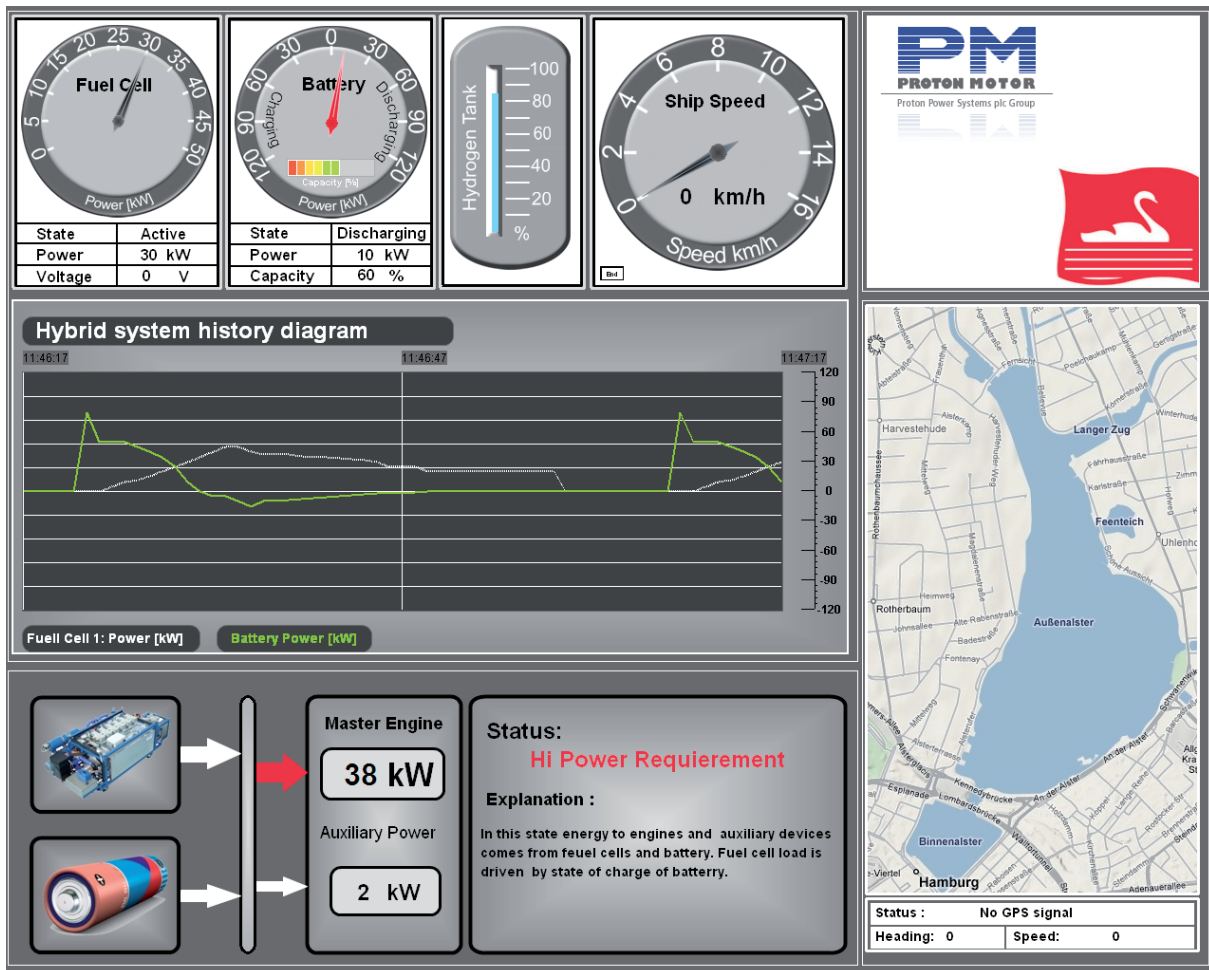


Figure 2: Visualization for the driving mode of FCS Alsterwasser

In addition to the control software NRI has also developed the passenger friendly visualization. It displays the technology and the operation modes of the hybrid system simply and clearly. Whether the ship accelerates to cruise speed, stores energy in the battery system during deceleration phase, or the fuel cell and battery system are used together, it all can be recognized very easily on the display in real-time. Hence passengers can easily gain knowledge about the functioning of the hybrid fuel cell system. Operation modes are explained with short descriptions and the position of the ship can be identified on a map of the Alster Lake.



Hamburg University of Applied Sciences analyses energy path

Analyzing the overall efficiency of FCS Alsterwasser and the hydrogen infrastructure path is one of the major tasks of the project. This very important examination is conducted by Alexander von Stryk from Hamburg University of Applied Sciences (HAW). To draw concrete conclusions different data measuring systems have been placed at strategic positions of the ship right from the beginning. The equipment allows for the complete documentation of system data. The hydrogen production and transport paths have been examined in detail as well.

So data sets dealing with the pressure of the hydrogen tanks, the performance of the fuel cell system, electric currents to and from the battery-system, different voltages and temperatures as well as the operating data of the propulsion motor could be obtained. The data sets are completed by adding real-time GPS-data informing about the exact position and cruise speed of FCS Alsterwasser.

On the basis of analyzed data not only is it possible to set up a sound "Well-to-Propeller"-examination which evaluates the relation between used primary energy and energy that is effectively used by the propulsion motor of the ship, but also to look closer at the different steps of energy conversion. Hence sources of energy loss can be identified. Another major objective has been to estimate the potential for system optimization. Hereby a closer look is taken how improvements of technical details have an impact of the system ship and hydrogen infrastructure as a total.

For now, analytical work relies on temporal data gained in 2009. As the data collected so far is very limited a complete picture cannot be generated but the following can be concluded: As expected, some parts – e.g. the fuel cell system as the core of the system – are very efficient. On the other side, the number of energy conversion steps lowers the overall efficiency of the energy chain. Obviously the current energy path still leaves room for optimizations.

For example, the production and delivery of hydrogen leaves room for improvements. Looking from an energetic point of view producing hydrogen from natural gas, liquefying it before vaporizing it and pressurizing it again is certainly not the ideal but at the moment the economically most practicable way. Furthermore, the system controls onboard of FCS Alsterwasser leave additional room for system advancements. The operation of the hybrid drive consisting of fuel cell and buffer battery should be adjusted so that all components are permanently running within their optimum limits.



The already generated operation data defines a suitable base. The analysis conducted by HAW will not only help to establish fuel cells running on hydrogen as locally emission free energy converters but also to support decisions regarding the optimal use of fuel cell systems. This means to look at the total emission balance of fuel cell systems to prevent that the local emission free balance is reached by disproportionate high emissions at another place. The overall analysis done by Alexander von Stryk and his team will be presented at the Final Zemships Conference on 20th of April.

Do you have any further questions?

Do not hesitate to contact Karim-Tarik Hammou via e-mail for further questions:
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We are looking forward to your questions and suggestions.

Yours sincerely
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