

**For worldwide release: June 21, 2007**

Release Number: M05PR07

## **Powering AIDAdiva, or how to make the heart of a cruise liner beat**

**Hamburg, Germany** – The naming of the new cruise liner AIDAdiva in Hamburg, Germany, on April 20th this year attracted a great deal of public attention. The latest newbuild from Meyer Werft in Papenburg for Rostock’s AIDA Cruises was not only built in Germany, but also boasts tailored propulsion technology made in Germany. Four MaK 9 M 43 C marine engines, with a total output of 36,000 kW, provide powerful but smooth running.

These engines were developed and manufactured by Caterpillar Motoren GmbH & Co KG and its more than 1200 employees in Kiel and Rostock. Project management was in the hands of specialists from Caterpillar Marine Power Systems in Hamburg and Kiel. German-based Caterpillar® dealer Zeppelin Power Systems was responsible for selling and taking the engines into operation and will also cater to future engine service. They are all part of a powerful team which, with its know-how and enthusiasm, literally made AIDAdiva’s heart beat. We’d like to introduce you to some of the people who made that possible:

### **The Developer**

It’s not easy to ruffle Klaus Wirth (51). He will soon have notched up 25 years of service with the Kiel-based engine builder. Acquired by Caterpillar Inc. in 1997, today’s Caterpillar Motoren GmbH is one of the world’s top three companies in the field of medium-speed marine engines. “Nevertheless”, says Wirth, “powering up a cruise ship is still always a very special challenge”. Titled Platform Manager, Wirth is responsible for the ongoing development of the MaK engine program, which currently consists of the M 20 C, M 25, M 32 C and M 43 C series. Available in a range of cylinder variations, they cover a performance range of 1,020 to 16,000 kW.

Comments Wirth: “the performance demands of a cruise ship are enormous, mainly because of the numerous energy consumers on board. As a result, nearly all newbuilds go for Diesel-electric propulsion. The ship’s Diesel engines are directly coupled to power generators, which provide the energy needed for the propeller drive units and on-board electrical power. In the case of AIDAdiva, her four M 43 C engines produce a total of 36,000 kW – the equivalent of 900 small cars or the electrical consumption of about 100,000 homes”.

Wirth is proud of his top-performance engine series, which was introduced in 1998. Since then more than 650 of them have been sold. “The MaK 43 C is technically speaking a long-stroke engine, in which the relationship between cylinder diameter and piston stroke is optimised to provide the highest possible reliability and maximum durability. Along with revolutions of only about 500/min, low compared to car engines, we can achieve good fuel consumption and low emission values – which pleases the shipping company, its passengers and the people living in ports of call”.

Wirth says it is in the emission reduction sector that Caterpillar Motoren profits most from global cooperation within Caterpillar Inc. “Caterpillar invests about US\$4 million a day in research and development, and ACERT™ Technology is one result of this. It offers flexible, modular solutions for improving the effectiveness and emission behaviour of marine engines. One concrete application example of that is Flexible Camshaft Technology (FCT), which is used to reduce emissions on AIDAdiva.

### **The Salesman**

“Favourable fuel consumption and low emission values top the list of demands from shipping companies”, confirms Horst Prien (58), the Account Manager responsible for Meyer Werft at Zeppelin Power Systems. Prien has been in the shipping business for 20 years and served for 18 years at sea before that, ending up as a Chief Engineer on cargo ships. “It’s a big advantage if you can appreciate the technical demands of customers from your own experience at sea. Ship engines are, to a large extent, tailored to the specific needs of a particular vessel, but they also have to be reliable enough to fulfil the highest demands in the cruise shipping sector. As a result, one big plus during our talks with the shipyard and shipping company about the AIDA project

was that the M 43 engine was already a clear market leader and had also already demonstrated its all-round technical maturity in the propulsion of container feeders up to 1000 TEU”.

Prien also stresses the significance of many years of close cooperation with Meyer Werft, which has chosen MaK engines for decades. “In shipbuilding, the most important factor is mutual trust. Even today, deals are clinched with a handshake, and a manager’s word is his bond!”. In the case of the AIDAdiva engines, however, agreements with the yard are also in written form and there are now deals covering 16 engines for all four AIDA newbuilds.

Customer demands for a cruise ship are of course considerably higher than with cargo ships requiring only one engine and direct propulsion”, says Prien. “In this case we are supplying four engines per ship, and will profit during later ship operation from service needs which will of course also be higher. Enthusiasm apart, cruise ship projects of this kind would simply not work, even at Zeppelin, if operational economics were not taken into consideration”.

### **The Project Manager**

“Optimal time management and communication at all times with those involved in the project”. That’s how Olav Cortsen (57) sees his role as Project Manager for Caterpillar Marine Power Systems. It has been his job to cope with all of AIDAdiva’s technical demands on the propulsion system in close cooperation with the yard, the shipowner and Caterpillar Motoren’s different development teams. In doing so, he can draw on more than 33 years experience in MaK engine development and in technical project management.

“Increased engine performance, Diesel-electric propulsion, resilient mounting of the engine, wireless monitoring of bearing temperatures and, last but not least, reduced engine emissions by means of variable valve control. These are just a few of the many innovations that have marked this project. Guaranteeing a fair balance of interests between the expectations of the client and the possibilities of the manufacturer – that has been the real challenge”, says Cortsen.

As Project Manager, Cortsen is particularly satisfied that all four engines have been built exactly to specification and have been delivered to the yard at the agreed time. “AIDAdiva not only

testifies to the good cooperation among all those involved, but is also a further milestone in the success story of 6 Sigma –the methodology Caterpillar employs for optimal management of innovative projects like this”.

### **The Foreman**

Günter Allwardt (55) does not quite fit the traditional concept of a worker with dirty hands, and neither do the halls at Caterpillar Motoren in Rostock, which are clean and tidy. “These days, ship engines are high-tech and their design and construction are a matter of micrometric precision”, says Allwardt. “My colleagues work as required, either in main assembly or in the pre-manufacture of individual engine components. In addition, we have people who are specialists in the whole range of engine electronics as well as in engine testbed care”.

Allwardt, an Assembly Foreman, has been with Caterpillar since 2001. But he knows about local engine building from more than 38 years with the previous company on the site, Dieselmotorenwerk Rostock. He praises the cooperative relationship among employees, who also include more than 30 apprentices. “To assemble an M 43 C series engine, we work in small teams with our own direct responsibility for safety, quality and deadline reliability. The last of these is not easy to guarantee given the current full workload; on the other hand a boom in demand like this means job security for us all – and we’re happy to get stuck in”.

### **The Testbed Chief**

Christoph Bünger (49) is well used to stress. A mechanical engineer by profession, he has been responsible, as Testbed Chief at Caterpillar Motoren in Rostock, for customer approval of all four AIDAdiva engines. “Every engine built here spends several days on one of our five test stands, where it is run in, checked over, fine tuned and then approved by the responsible classification society and by representatives of the shipyard and the shipowner”, Bünger explains.

He adds that, during approval tests for the MaK 9 M 43 C for AIDAdiva, it was, in his opinion, just a little crowded in the testbed control booth. “Because we were checking out so many innovative details, there were even representatives from AIDA Cruises’ parent company

Carnival and from important equipment suppliers.” Nevertheless, the Rostock team simply carried out the specially extended test programme as they would any other. “To test the electrical controls, we took the engine to performance extremes which it will almost certainly never have to experience in real life, but which, nonetheless, proved very impressively just how efficient it is.”

A lot of attention always has to be paid to transporting the 10 metre long and six metre high engines, weighing 126 tons apiece, to and from the test beds. Generally, coupling is carried out afterwards with a so-called water brake, which behaves like a propeller turning in water. In the case of AIDAdiva’s Diesel-electric propulsion, however, the water brake was used instead of the power generator linked to the engine later on board ship.

“During the test procedures we recorded a whole range of measurement data on temperatures, pressures, vibration, emissions and, of course, fuel consumption. All of them were within the previously specified parameters. As to be expected, the final inspection of particular components showed no unusual deviations”, Bünger summed up. He stressed “we are the last link in the engine production chain and, because of that, we always get immediate feedback from customers about the quality of our products. It’s a good feeling when everybody on the testing bed is satisfied, as was the case with the AIDA engines.”

### **The Service Technician**

Following the testing, delivery and installation of the four MaK 9 M 43 C engines in AIDAdiva at Meyer Werft, intensive testing of the ship and her technology began in November 2006. Since then, a qualified technician from Zeppelin Power Systems has been on board on a regular basis to monitor the propulsion plant. Most of the time that has been Christian Hoffmann (38).

Hoffmann has worked for MaK since 1992 and has been through more than 150 power-ups in that time. Quite apart from a capability to react swiftly and flexibly to any problem, resistance to seasickness is absolutely essential during sea trials. “The top speed of AIDAdiva was determined in moderate 3-4 force winds and two-metre high waves off Norway, but when the weather is really bad, the air in the engine room has been known to deteriorate!”, Hoffmann explains.

In this respect all those involved were happy when the MaK engines did their duty reliably during the seven-day sea trials. “We carried out comprehensive emission tests”, Hoffmann relates, “to document that emission regulations were being adhered to also during heavy fuel oil operation. In fact, the emissions were even lower than the permitted levels”. The actual customer acceptance of the complete propulsion plant, however, had already taken place in December 2006 in Meyer Werft’s building dock.

A great deal of attention was lavished on the way in which the Flexible Camshaft Technology (FCT) on the MaK 9 M 43 C worked. “Experts from the shipyard and the owner were impressed with the efficiency of our technology, which reliably reduces visible funnel emissions at any time.” A special and additional inspection of selected engine components was carried out after the sea trials and Hoffmann said it showed “no unusual abrasion characteristics and thus, once again, demonstrated just how well built the M 43 C was”.

### **The Sales Director**

As Sales Director for world-wide cruise shipping projects at Caterpillar Marine Power Systems, Leif Gross (39) is responsible currently for an order volume of some 46 MaK M 43 C engines of total 500 MW output, as well as for a fully-developed, land-based power station. “If you take only new ship designs into account and not modified previous series, then we are the market leaders with our engines”, Gross says. He has worked in the shipping business for 11 years and knows everything there is to know about the propulsion systems also on other kinds of ships.

“And having said that, AIDAdiva is still quite special even for Caterpillar. She represents the company’s successful entry, with its best-performance MaK engine series, into a new and extremely promising market segment”, Gross emphasises. In this respect, AIDAdiva was the foundation for further project deals, such as those clinched in the meantime with the cruise shipping companies Holland America Line (HAL), Costa Crociere and Norwegian Cruise Line (NCL). “In addition”, says Gross, “Caterpillar’s reputation in the technological and service sectors is also of decisive significance for American shipping companies”.

AIDAdiva, then, is a good example of teamwork at all levels, of fair cooperation among the shipping company, shipyard and Team Caterpillar, and of intensive project collaboration by those involved at Caterpillar Motoren, Caterpillar Marine Power Systems and Zeppelin Power Systems. Finally it is an example of the best possible dovetailing of innovative MaK engine technology and the unique service quality of Caterpillar. Says Gross: “Hamburg is well known as a city of cruise shipping enthusiasts and that’s why AIDAdiva was named here. Hamburg is also the headquarters of Caterpillar Marine Power Systems and we are proud of having made the heart of AIDAdiva beat”.

**Characters: 13,755**

**Pictures available on request:**

- 1.) MaK 9 M 43 C engine with FCT for AIDAdiva**
- 2.) Engine room of AIDAdiva with 4x MaK 9 M 43 C**
- 3.) AIDAdiva in Hamburg**
- 4.) Images of Team Caterpillar members portrayed**

**About Caterpillar Marine Power Systems**

Caterpillar Marine Power Systems, with headquarters in Hamburg, Germany, brings together all the sales and service activities for Cat and MaK branded marine products within Caterpillar Inc. This organization provides premier marine power solutions (high and medium speed with outputs from 11 kW to 16,000 kW) and customer service from a single source for the global ocean-going, commercial and pleasure craft markets. The Caterpillar Marine Power Systems sales and service network includes more than 2,100 dealer locations world-wide and is well positioned to support customers wherever they are.

More information is available at [www.cat-marine.com](http://www.cat-marine.com) or [www.mak-global.com](http://www.mak-global.com).

**About Caterpillar**

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More information is available at [www.cat.com](http://www.cat.com).

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