US joining the Wendelstein 7-X fusion project

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The outer vessel of Wendelstein 7-X equipped with a variety of ports. Blue: five auxiliary coils, which are provided by Princeton Plasma Physics Laboratory. They are to help precise setting of the magnetic fields at the plasma edge. Credit: (Graphic: IPP)

The USA is investing over 7.5 million dollars in the construction of the Wendelstein 7-X fusion device at Max Planck Institute for Plasma Physics in Greifswald. In the three-year project, starting in 2011, scientists from the fusion institutes at Princeton, Oak Ridge and Los Alamos are contributing auxiliary magnetic coils, measuring instruments and planning of special sections of the wall cladding for equipping the German fusion device - one of a total of nine projects in the Innovative Approaches to Fusion programme of the USA Department of Energy who will accordingly become a partner in the Wendelstein 7-X research programme.

The objective of fusion research is to develop a power plant that, like the sun, derives energy from fusion of atomic nuclei. This requires that the fuel - an ionised low-density gas, a plasma - be confined in a magnetic field cage having virtually no contract with the vessel wall and then be heated to an ignition temperature of over 100 million degrees. The Wendelstein 7-X fusion device, now being built at Max Planck Institute of Plasma Physics in Greifswald, will, when finished, be the world's largest and most modern device of the stellarator type. Its magnetic field makes continuous operation possible by simple means.

In the German-American cooperation programme Princeton Plasma Physics Laboratory is making five auxiliary coils for Wendelstein 7-X. The window-size coils, to be installed on the outer casing of the device, are to help precise setting of the magnetic fields at the plasma edge. They ensure that the outer contour of the plasma exactly conforms to the required shape. The basic data for the components are provided by IPP, engineers and scientists from Princeton are in charge of design - which has just undergone the final check - and manufacture of the coils. They are to be delivered at the end of 2012. The 4.3 million-dollar investment for this constitutes the major contribution to the scientific cooperation on Wendelstein 7-X.

Oak Ridge National Laboratory is taking on design of the scraper elements for the plasma edge of Wendelstein 7-X. The new components being introduced into planning are to enhance the device's performance in continuous operation and ensure greater experimental flexibility. The water-cooled plates have to withstand heavy heat loads of up to 20 megawatts per square metre. This will make it possible to protect wall sections across which the hot plasma will move to its final position in the first 30 seconds of the 30-minute plasma discharges. The sophisticated technology study is to be ready by the end of the year.

Finally, Los Alamos National Laboratory will provide the Wendelstein programme with measuring instruments for observing the plasma, including refined infrared diagnostics: "We envision this three-

year period", state the research institutes involved, "as a step toward a robust partnership in the Wendelstein 7-X research program that will involve physicists and engineers from many U.S. institutions in research that will make a significant impact on the world fusion program."

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