THE WILLIAM E. BOEING DEPARTMENT OF AERONAUTICS & ASTRONAUTICS
Chair's Distinguished Seminar Series
Welcomes
Christian Eigenbrod
Scientific and Technical Director
ZARM Center of Applied Space Technology and Microgravity
University of Bremen

"Fire Safety in Human Spaceflight"

ABSTRACT

Fire onboard a manned spacecraft is the most dangerous scenario--even more so on future deep-space missions where an abort, escape and quick return are impractical. Even in situations less seriously hazardous for the crew, the risk to the immense investment cannot be underestimated. The design of a spacecraft cannot totally avoid the use of potentially flammable materials. All those materials must therefore pass tests regarding their flammability, flame propagation and extinction behavior. Exactly here lies the problem. Qualification tests in space are too expensive and too dangerous. But are ground tests realistic? In the past, based on some experience, it was assumed that fires in space always burn less violenly than on earth. Therefore, the ground tests were assumed to represent a worst case scenario. Today we know that an onboard fire really burns smaller and but more importantly, differently. Whether or not a material extinguishes depends on the balance between heat release and heat losses. Even though the heat release rate is typically reduced in microgravity, a material may burn self-sustained if the heat losses are reduced even more. Research by an international science team from the USA, Japan, Russia and several European countries is trying to gain a fundamental understanding of the solid fuel combustion processes in microgravity and is trying to develop new qualification standards based on the results. The focus of ZARM's (Center of Applied Space Technology and Microgravity) research is on the effect of surface structures on fire spreading. In a large scale experiment onboard the unmanned re-supply vehicle „Cygnus" it could be demonstrated how massive the interactions between surface structures can support fire spreading.

WILLIAM E. BOEING
DEPARTMENT OF AERONAUTICS & ASTRONAUTICS
UNIVERSITY of WASHINGTON

Monday, April 16, 2018
4:00 - 5:00 pm
Guggenheim Hall Rm. 220
UW Campus, Seattle, WA

THE WILLIAM E. BOEING DEPARTMENT OF
AERONAUTICS & ASTRONAUTICS

Chair's Distinguished Seminar Speaker

Christian Eigenbrod

Scientific and Technical Director
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Biography

Born in 1956, Eigenbrod studied mechanical engineering (Energy and Processing Technology) at the University of Essen. As his diploma thesis he developed a mixture formation system for internal combustion engines based on ultrasonic atomizers. These raised the combustion efficiency of the Otto-process into the range of the Diesel-process. He joined ZARM of the University of Bremen early in 1987. As a member of the five-person drop tower team (two engineers, three physicists), he developed the Bremen drop tower delivering 4.7 s (drop mode) or 9.3 s (catapult mode) of microgravity of an outstanding quality of 10^{-6} g_0. When the system became operational in 1990 and started serving scientists from all over the world, he became scientific and technical director of the Drop tower Operation and Service Company. In the early 90's, he resumed work in combustion science. Eigenbrod developed a laser diagnostic system for microgravity combustion research and investigated the autoignition behavior of single fuel droplets and droplet pairs of various fuels such as kerosene, diesel, biodiesel and bio-synthetic fuels and many of its components. This research led in 2012 to the first successfully validated numerical prediction of the instant of the timing and location of the ignition of an n-heptane spray in turbulent high-pressure and high- temperature air. Other research fields are combustion instabilities in lean gas-turbine combustion and solid fuel combustion in terms of fire safety aspects. Eigenbrod is a lecturer in Aerospace Propulsion and in Gas Power-Plant Design. He holds patents in gas-turbine instability mitigation and his bio comprises more than 120 scientific publications.

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