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TRIBOLOGICAL AND THERMODYNAMICAL ISSUES OF A ZERO CLEARANCE AUXILIARY BEARING (ZCAB) FOR SPACE APPLICATION

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ABSTRACT

A unique Zero Clearance Auxiliary Bearing (ZCAB) has recently been developed, incorporating a series of interconnected rollers that move radially inward when activated until the shaft is centered by all rollers and the initial clearance is eliminated. The ZCAB is aimed to function as a back up bearing system for use in high speed rotating machines both on land and in space. Two main components of the ZCAB are the ball bearings and bearings sleeve which together serve as ZCAB rollers. During ZCAB operation the rollers will be in contact with the rotor, from the onset of initial shock load transmission to the final steady operation,. Since the ZCAB is targeted to operate in a high temperature and extreme environment, evaluation of the thermal and mechanical compatibility of the materials and lubricants for final selection for the ZCAB components is of vital importance in the development of this technology. In order to evaluate the operation of the ZCAB components and to determine the type of lubrication system, a thermal analysis was performed for the ZCAB assembly. A thermal resistance network was used along with the calculation of the power loss to predict the bulk temperature of the components. This paper also reviews the state of the art of liquid/solid lubrication for use in the space ZCAB. The application of these lubricants in the ZCAB present a unique challenge and specific examples of the space-environment related problems and our approach to these issues are presented.