



# COLLOQUIUM

Conform artikel 4.6.8 van het SSNS-wb.

Vakgroep: **Technische Stromingsleer**

In het kader van zijn doctoraalopdracht zal

**Tjeerd van der Zee**

een voordracht houden getiteld:

## **Flow over Airfoil Covered with Thin Layer of Liquid**

Datum: vrijdag 24 oktober 2008

Tijd: 14.00u

Zaal: Horst N-109

### **Summary:**

The presence of a thin layer of liquid on an aircraft wing, as occurs for instance when flying in rainy conditions, affects the aerodynamic performance of the wing. Therefore it is of interest to predict the effect of such a layer of liquid on lift and drag. To investigate the effects a two-dimensional analysis of the flow field around an airfoil is performed. A computationally quick method to obtain the flow field around an airfoil is a panel method based on a potential flow model. The accuracy of the flow field prediction can be improved by taking into account viscous effects in the boundary layer around the airfoil. An integral boundary layer method is developed and added to the existing inviscid computational method 2DFOIL-ICE. It is based on the method of Thwaites for laminar flow and on the entrainment method of Head for turbulent flow. Transition is determined by the criterion of Michel.

2DFOIL-ICE has the capability of calculating droplet trajectories to determine the amount of impinging water on the airfoil. With a thermodynamic mass balance using the Messinger model to determine evaporation the local thickness of the liquid layer on the airfoil can be calculated. Depending on the thickness of the liquid layer and flow conditions the layer will be a wavy film or break up into rivulets or single beads. A model is developed to express the influence of the liquid layer on the boundary layer flow as an equivalent sand grain roughness of the surface.

Examencommissie:

De afstudeerdocent,

Prof.dr.ir. H.W.M. Hoeijmakers (afstudeerdocent)

Dr. G.G.M. Stoffels

Dr.ir. C.H. Venner

Ir. J.M. Hospers

Ir. M.T. van Zoelen

d.d. \_\_\_\_\_