The University of Southampton and Aalborg University have shared research interests in the mechanics of composite and sandwich structures. The expertise of the visiting fellow complements that of the host as the thrust of the host’s work is in experimental mechanics and the visiting fellow’s major interest is in developing analytical and numerical models to predict the structural response.

Professor Ole Thybo Thomsen is the Head of the Department of Mechanical Engineering and Professor of Solid Mechanics and Mechanics of Lightweight Structures at Aalborg University. He is an internationally leading researcher with numerous papers in ISI indexed journals and other publications. He has led numerous research projects funded by EU, European Space Agency, US Navy – Office of Naval Research, Danish Council for Technology and Production Sciences (FTP), and by industry and charitable foundations. He is a fellow of the Danish Academy of the Technical Sciences.

Professor Janice Barton is Professor of Experimental Mechanics in the School of Engineering Sciences at University of Southampton. She has published numerous papers in archival journals and conferences. She has been principal investigator on numerous research projects funded by the research councils, UK Government, charities and industry. To date she has supervised a number of successful PhDs and numerous masters projects.

The visit combined the expertise at both institutions to study thermal degradation in polymeric foam cored sandwich structures, as well as nonlinear interactions between mechanical and thermal loads in such structures.

**Statement from the Host**

"I am impressed with the plan of activities and the way that the plan draws on the strengths in our School in experimental mechanics and on the strength at Aalborg University in modeling. The design and development of the test rig will bring a unique facility to our School and will provide opportunities for new research and new research collaborations with industry. Professor Thomsen’s visit has provided great benefits to our research efforts and brought a new dimension to the work conducted within our School. I hope that we will be able to build on this exchange and that there will be many other opportunities for ongoing collaboration."

*Professor W G Price FREng FRS*

*Head of School*
Why a visit?

The purpose of this visit was to design an experimental approach that will provide a detailed validation of the numerical model at Aalborg University, as well as to further develop and refine the modelling capabilities with a special focus on their adaptation for engineering design purposes.

The visit underpinned collaborative research in three areas:
- Thermal degradation in polymeric foam sandwich structures.
- Analysis of the stresses at discontinuities in sandwich structures.
- Stress analysis in joints in pultruded composite materials.

Visit outcomes

- The visit resulted in a research proposal on thermal degradation in polymeric foam sandwich structures.
- An experimental rig was conceptually designed.
- A further strand to research is an in-parallel funding application to further develop the modelling capabilities. This will include the expansion of the presented panel/beam model, based on a so-called high-order sandwich theory approach that includes the transverse flexibility of the core, geometrical nonlinearity as well as temperature dependent material properties, to allow for the analysis of general sandwich plate or shell structures. A number of design studies will be carried out supported and validated by the experimental results. The end result of the research will be a unique facility, comprising numerical/predictive and experimental capabilities, which enable an in-depth evaluation of the performance of composite sandwich materials subject to thermal and mechanical loading.
- Outline proposals for funding have been prepared and were sent to Airbus (UK and Germany), GE Aviation, RNLI and E-on.
- Professor Barton and Professor Thomsen visited and made a presentation at E-on.

Statement from the Distinguished Visitor:

The RAE distinguished visiting fellowship has been very helpful in strengthening the collaboration between Southampton and Aalborg University. The basic idea and motivation behind the collaboration is to combine and further develop the expertise of both institutions, and I envisage that our combined efforts on the topic of thermal degradation effects in advanced foam cored sandwich structures will lead to a world-leading position in this area of research and industrial application. In addition to this particular research project that we have engaged in, it is my hope and expectation that this will lead to increased collaboration on student exchange as well as future research projects. The visit has been invaluable to me as it enabled close links to be built with one of the leading UK Engineering universities and with UK industry, all of which will help future research prospects and widen the scope of the collaborative research at Aalborg.

Professor Ole Thybo Thomson
Aalborg University