Crack stoppers in CFRP

This project involves the conceptual design, development and testing of crack-stoppers in aerospace-grade composite-adhesive joints.

Adhesive joints are rarely used for structural applications in the aerospace industry. This is due to the fact that it can be very difficult to verify the integrity and strength of the adhesive bond. As a result, mechanical fasteners (e.g. titanium bolts) are often used in conjunction with adhesive joints to act as a crack-stopper in case of fracture and maintain a minimum level of strength and structural integrity. However, metallic bolts can add considerable weight to the finished composite component and, therefore, reduce fuel efficiency. They can also act as crack initiators.

The proposed research programme will investigate the use of Spotscrew enhanced co-injected/co-cured joints in aerospace grade composites. The use of nano-modified adhesives in conjunction with appropriate surface treatment will also be explored as an alternative technology for use as a crack-stopper. The work will progress from small, laboratory scale experiments, where various crack-stopping methods can be investigated and refined, to full-scale composite components in order to test the practical application of the technology. It will also include multi-scale numerical modelling of crack-stoppers behaviour.

While the present project will focus on aerospace applications, the crack-stopping methodology could potentially be applied to multiple industries including marine, automotive and renewable energy generation. The Republic of Ireland hosts many companies in these industries and they are beginning to use composite and adhesive materials in ever-increasing quantities. As a result, there is huge potential for the application of the crack-stopping technology that will be developed during this work. Adhesively bonded composite components with superior crack-stopping capabilities would help give native companies a competitive edge in international markets. This work will be conducted in a close collaboration with Bombardier.