



DESCRIPTION:

As prime contractor for the integration of the composite bonded doubler technology to repair metallic aircraft structures, Martec Limited was tasked to develop the design and to perform the analysis of a composite patch repair for the CF-18 Flight Station (FS) 470.5 bulkhead at the X-19 cross section. The repair was considered as a fatigue enhancement and was required to delay the onset of a fatigue crack initiation predicted to occur at the lower inside pocket.

Based on parametric fatigue analysis received from the Canadian Forces, a 25% to 30% load transfer through the patch was required to achieve the desired fatigue life enhancement. The final design consisted of 10 layers of graphite/epoxy composite woven material bonded to the bulkhead inside pocket using FM-73 film adhesive. The repair design difficulties were enhanced by the presence of significant stress gradient through the thickness of the bulkhead flanges and out-of-plane deflections of the lower flange. The stress analysis used for the composite design optimization involved extensive FEA based methods using the global/local approach.

The design loads were derived using full scale fatigue test strain measurements performed at a large number of locations in the affected area. The silane/BR127 metallic surface preparation was selected for the planned installation. The patch installation process specification was developed by the NRC Institute for Aerospace Research.

From a cost and performance point of view, the composite doubler repair proved to be more efficient than the proposed classical mechanically fastened aluminum bathtub fittings.
