# Overview of NDE Activities at MSU for Aerospace Applications: Challenges and Strategies

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Aging aircraft, commercial and military fleets is growing and so also, demand for reliable NDE techniques that assures their structural integrity. This talk will first give a brief review of some of the challenges in aircraft inspection with regard to both; aging multi-layer structures and more recent composite airframe structures. The talk will then present an overview of research activities and strategies pursued at Michigan State University. These research activities comprise a range of electromagnetic modalities being developed at MSU. First, we consider a typical multi-layered riveted geometry encountered in airframe structures and the problem of detecting cracks in the second layer at rivet sites. Detection of deep embedded cracks is typically addressed by using very low frequency ECT operation. Work on development of the hybrid low frequency eddy current excitation and magneto resistive sensors (EC-MR) along with special data analysis algorithms for crack detection will be presented. Next, we consider metal composite joints in the context of repaired airframe structures. Recent work on far-field microwave NDE for rapid inspection of anomalies in composites and metal composite joints will be discussed. In this context, use of metamaterial lens and metasurfaces for enhancing resolution of microwave imaging will also be presented.