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William E. Guin, Justin R. Jackson, Cameron M. Bosley

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Effects of Tow-to-tow Gaps in Composite Laminates Fabricated via Automated Fiber Placement

William E. Guin*, Justin R. Jackson, and Cameron M. Bosley

Materials & Processes Laboratory, NASA Marshall Space Flight Center, Huntsville, AL 35812

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Abstract

Automated fiber placement (AFP) is a commonly used manufacturing technique for large-scale polymer matrix composite (PMC) components. Given their nature, AFP systems are typically used to lay up large-scale components in production environments. As such, AFP-induced defects tend to arise over the course of any given build. The often-inconspicuous nature of these defects, coupled with an incomplete understanding of their consequences, represents cause for concern for AFP users. This study examines the effects of one of the most common AFP-induced defects: tow-to-tow gaps. Results show that mechanical performance can be affected by the presence of systematic tow-to-tow gaps, while the presence of incidental gapping is largely inconsequential. In cases where declines in mechanical performance are observed, the primary culprit is shown to be fiber waviness. As such, results also show that where tow-to-tow gaps have an influence on the mechanical properties of composite laminates, performance varies with loading mode.

* Corresponding author (email address: william.e.guin@nasa.gov)

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