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High Resolution Acoustoelastic Measurements of Materials¹ MARK MCKENNA, SAMUEL GUY, JOSEPH HEYMAN, Luna Innovations Incorporated — As materials become more complex, there is an increasing need for high resolution measurements to characterize strength and damage in the materials. Typically, the criterion for rejecting a part is based on the detection of a flaw of a specific size in a critical location. Interestingly, if a low stress field exists at the flaw site, the flaw may not grow over time. Similarly, in a part that shows no unacceptable indications, a high stress state may cause the flaw to quickly grow through the part leading to failure. In other cases, a controlled amount of stress (in a specific direction or type) is purposely added to the material to prevent flaw growth. Inspection time intervals are based knowing and controlling the stress environment to predict the flaw growth. Luna Innovations Incorporated has developed a high resolution ultrasonic instrument that can enhance the integrity of critical hardware by measuring changes in the stress state in a material. Knowledge of the stress state plus knowledge of crack sizes greatly improves structural engineers' capability of life prediction. System data will be shown for tests to stresses near holes in laboratory fabricated aircraft metal samples. Scans of the spatial distribution of stresses will be compared with finite element models of the structure.

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