

## BUILDING BLOCK APPROACH FOR COMPOSITE AIRCRAFT STRUCTURE PROTOTYPES

### (ALLOWABLES AND BUILDING BLOCK TESTING FOR DOD/NASA VEHICLES)

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#### ABSTRACT

Composite material allowables development required for prototype aircraft is discussed along with the related building block test effort necessary for such structure development. Allowables requirements are included as part of building block structural test requirements that are related to aircraft structure part criticality classifications. Then, each part of the building block is related to the test/evaluation/analysis categories that need to be interrogated to study the risk involved. For allowables, the categories are preliminary and “design-to” values related to physical defect minimum requirements in each classification. For the building block structures development test effort categories, the procedure used is progressive scale up of the size and complexity of the test program parts: from single to multiple load paths to joints and shapes. In summary, the relationship of the quality assurance requirements to those required for design allowables for flat panels to those required for intermediate structural components to those required for full size structure are discussed. Quality assurance requirement categories are discussed for each structural classification, size, and complexity of parts to be built. The building block structures test development effort satisfies the goals of:

1. Preliminary and “design-to” material allowables development,
2. Appropriate conceptual structural development,
3. Structural proof of concept and related analytical methods development,
4. Structural verification testing for analytical methods correlation, and
5. Structural integrity testing and FEM validations.

Once these goals are achieved the user has acceptable risk and cost effective prototype composite aircraft structure that has the necessary integrity and reliability needed for the specific prototype aircraft being developed.

#### REFERENCES

1. Grimes, G. C., Dusablon, E. G., Malone, R. L., and Buban, J. P., “Tape Composite Materials Allowables Application in Airframe Design/Analysis,” *Composites Engineering*, Vol. 3, No’s 7-8, Pergamon Press Ltd., 1993, pp. 777-804