

## BACKGROUND

NASA is interested in investigating carbon-carbon composites fabricated using 3D woven reinforcement consisting of T-300 6K yarns. Preforms will be supplied of two different 3D architectures, each fabricated using T-300 6K yarns. The architectures will be an angle interlock design and a layer-to-layer design. Examples of each are provided in the schematics shown in Figure 1 and Figure 2, respectively, below. An isometric view of the modified layer-to-layer preform is shown in Figure 3.

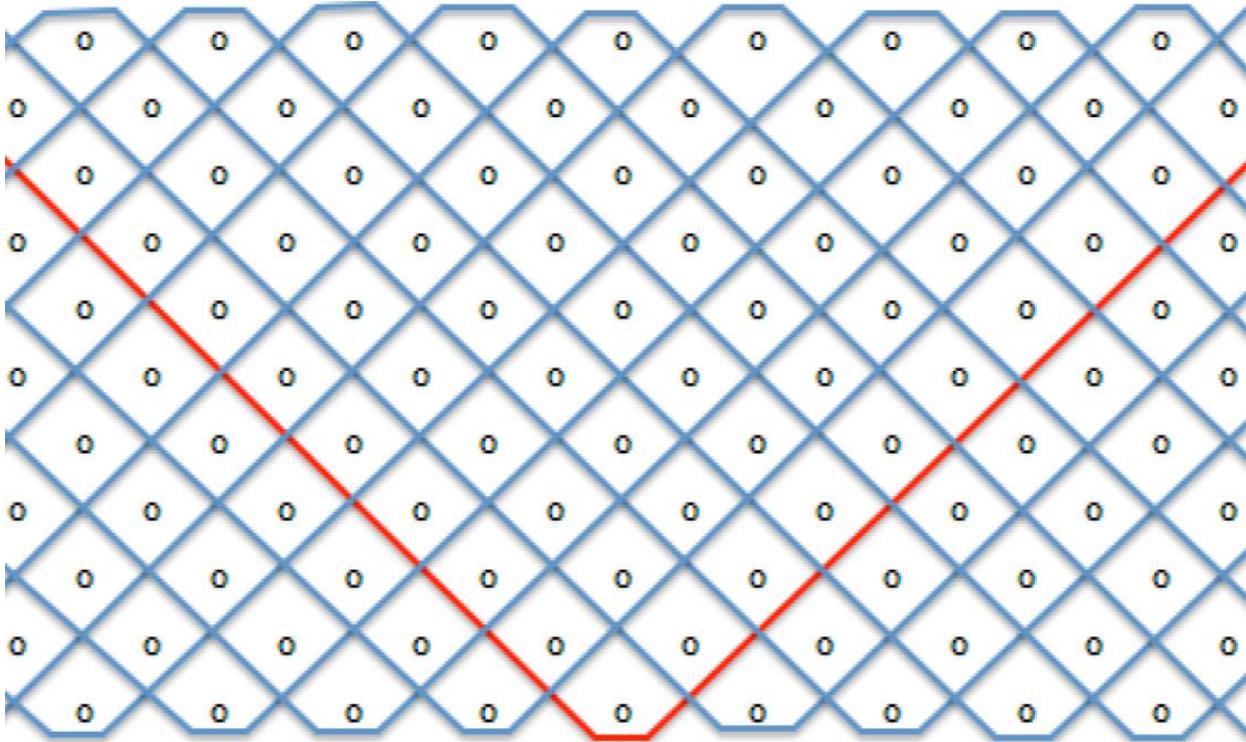


Figure 1. Schematic of 3D angle interlock weave.

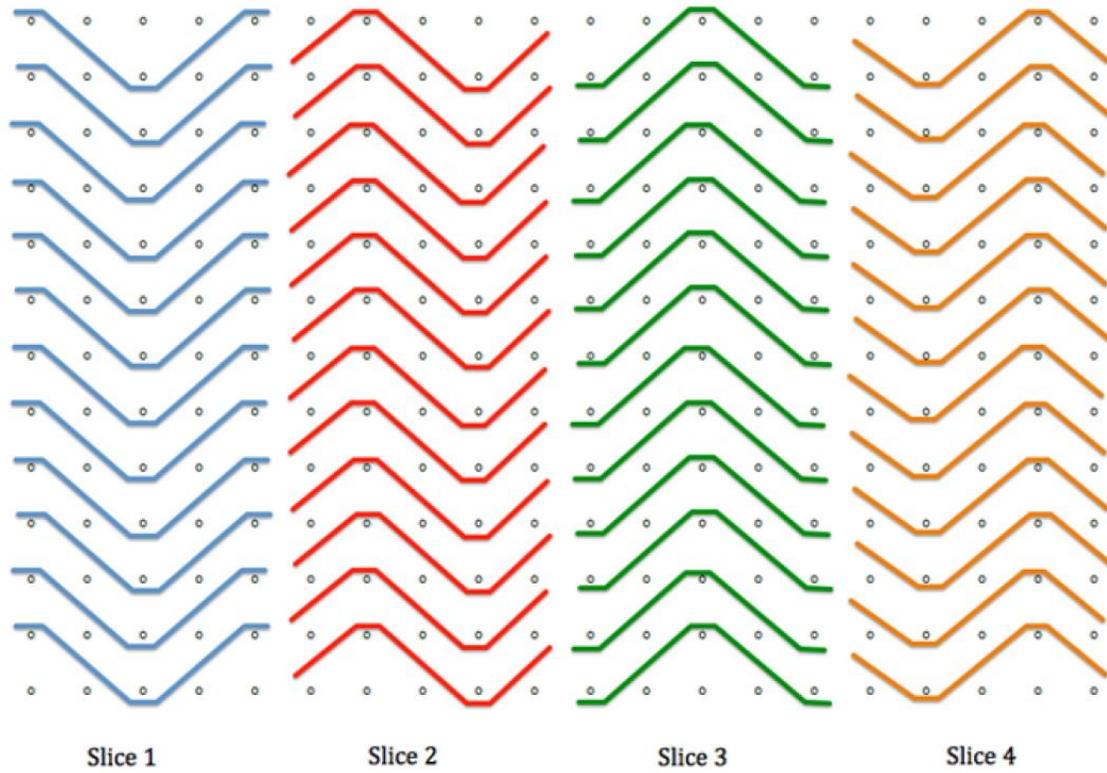


Figure 2. Schematic of 3D layer-to-layer weave. Slice 1 is on the top and slice 2 is on the bottom.

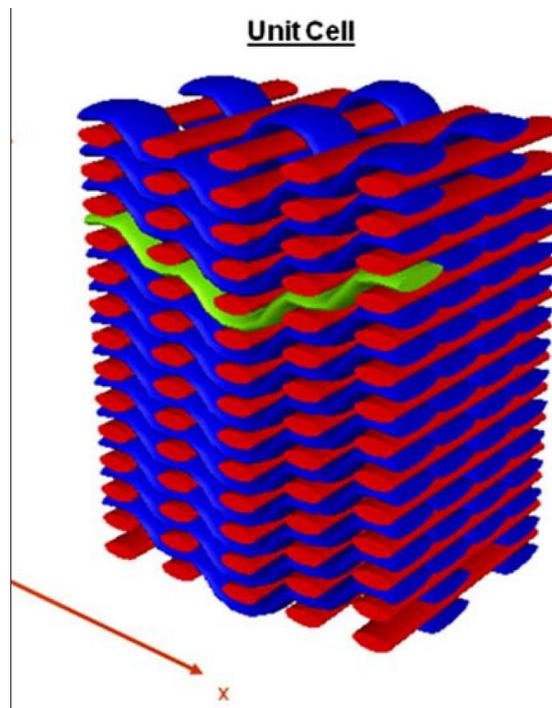


Figure 3. Isometric view of modified layer-to-layer preform design.

**OBJECTIVE**

The objective of this effort is to obtain C/C material that can be used to determine material properties. The goal is to infiltrate preforms with large T-300 yarns and minimize matrix porosity, such that C/C composites with high in-plane and high through thickness strengths are achieved using the 3D woven preforms. A pitch densification process that has flight heritage is desired.

**DESCRIPTION OF WORK**

The contractor will receive the preforms listed in Table 1 below. The deliverables are itemized in Table 2 below. It is requested that the contractor heat treat the preforms to 4000°F prior to densification. Though the requested deliverables are relatively small, the contractor must utilize a manufacturing process that is capable of fabricating large, complex structures.

**Table 1. List of 3D woven preforms that will be provided to the contractor**

Quantity	Preform Design	Shape	Size	Condition
2	Angle Interlock (AI)	Flat preform	24" x 12" x 0.30"	No heat stabilization*
2	Layer-to-layer (L2L)	Flat preform	24" x 12" x 0.30"	No heat stabilization*

\* The contractor is requested to heat treat the preforms to 4000°F.

**Table 2. List of C/C Composite Deliverables**

Architecture	Shape	Preform Conditioning	C/C Panel Size	Matrix Type
AI	Flat panel	Heat treatment to 4000°F	24" x 12" x 0.30"	Pitch
AI	L-shaped angle	Heat treatment to 4000°F	24" long angle with ~ 6" legs, 0.3" thick. ID of angle should be 0.25"	Pitch
L2L	Flat panel	Heat treatment to 4000°F	24" x 12" x 0.30"	Pitch
L2L	L-shaped angle	Heat treatment to 4000°F	24" long angle with ~ 6" legs, 0.3" thick. ID of angle should be 0.25"	Pitch

As listed in Table 2, the deliverables include a single panel, nominally 24" x 12" x 0.30", of each of the provided architectures, as well as a 90° angle of each preform. The angle should be close to 90°, 24" long, with each leg ~ 6" wide. The ID of the angle should be 0.25". The thickness of the angle should also be 0.30".

It is important that the thickness of the composites maintain the as-delivered preform thickness. However, NASA acknowledges that there may be some difference between the as-woven thickness and the thickness of the preforms after heat treatment.

Please include an anticipated delivery schedule for the C/C parts after receipt of preforms.