

## **SNAME 025-2012 Pultrusion Processing of Low Cost Damage Tolerant Composite Tubes for Marine Applications**

**By Jerome P. Fanucci (V), Roger Crane (V), and Rick Balonis (V)**  
KaZaK Composites, Inc., Woburn, MA

*This paper describes a low cost composite solution to a unique and difficult performance requirement demanded by a safety-critical structure used on flight decks of all US Navy aircraft carriers. In addition to lighter weight, better mechanical performance and reduced maintenance, the described component is noteworthy because it also has lower acquisition cost than the simple stainless steel post it replaced as the previous flight deck baseline. The Aircraft Elevator (ACE) stanchion is part of the flight deck safety system on CVN 68 class ships. ACE stanchions are moving structures supporting the life lines that prevent personnel from falling off the flight deck into the opening created when one of the aircraft elevators has been lowered. The ACE stanchions are linked to the elevator mechanism so that they normally retract into the deck when the elevator is flush with the flight deck level, permitting unimpeded flight operations.*

*The previous baseline metal stanchions were sometimes bent during flight deck operations by impact with the various mechanized equipment employed to move and service aircraft. When permanently bent by these impacts, steel stanchions were rendered unable to retract into the deck. Since the stanchion retraction system is part of the same mechanism that operates the carrier deck elevators, a bent steel stanchion could effectively shut down flight operations until the damaged steel stanchion was removed and replaced. To minimize the occurrence of this highly undesirable, randomly occurring restriction on aircraft landing and takeoff, the Navy deemed it imperative that a replacement stanchion be developed that would not sustain any permanent deformation from typical accidental loading, yet did not diminish the ability of the stanchion to perform its critical safety role.*

*An innovative material and structural solution for these stanchions was developed that allows them to support the same tip loading of 300 lbs required of the baseline steel with minimal deflection. Unlike steel, however, when subjected to an overloaded typical of an impact by deck equipment, the composite stanchion bends to a significant angle from the perpendicular and also elastically buckles, with its cross section changing from round to nearly flat. Unlike steel, upon release of the impact load, the composite stanchion returns to its original shape and vertical orientation with no permanent deformation. Composite stanchions have been operating successfully on the USS Nimitz (CVN68) since 2007, and have been approved for use on the entire CVN 68 class. Stanchion acquisition and installation is currently on-going.*

*The unique response of the stanchion has utility in other Naval applications. Currently, this technology is being investigated for use as a deck edge safety net frame, currently used by the US Navy surface fleet. Like ACE stanchions, unique automated composite manufacturing used to make these complex structures is expected to result in a lower-than-steel acquisition price for new composite deck edge safety net frames exhibiting the same damage-resistant deformation capability. Thus the Navy will be able to gain the weight, corrosion and damage resistant benefits of composites for a purchase price less than current metal frames. This paper will describe the material system, manufacturing process, design and structural performance of these components, along with information on qualification testing and in-service experience.*