

Advanced, Low Cost Composite Trunk for the Universal Modular Submarine Mast

Kazak Composites, inc

10F Gill Street
Woburn, MA 01801

Contact: Robert DaSilva

Phone: (781) 932-5667 x104

Fax: (781) 932-5671

Email: rdasilva@kazakcomposites.com

Website: www.kazakcomposites.com

Command: NAVSEA

Topic: N04-035



PROBLEM STATEMENT

The current level of Navy submarine service logistics requires a broad reduction in sub-systems weight. Excessive weight promotes roll instability and reduces submarine maneuverability. Reducing initial installation weight is critical since many new systems, and their associated mass, are added to the platform over its lifetime. Furthermore, cost reduction is critical for U.S. based submarine manufacturers as global competition for this market has become more intense. KaZaK's role in this cost and weight reduction scheme is to produce a light weight composite UMM guide trunk at reduced cost as compared to the current metal baseline by utilization of pultrusion processing.

WHO CAN BENEFIT?

Benefit is gained by Navy PEO Submarines and the OEM, Electric Boat, both operationally and financially since the composite guide trunk is produced at a significant cost reduction as compared to the baseline. Generically, the pultruded technology is pervasive in application to many large Navy structures that require reduced weight, cost, and maintenance with improved performance. For example, KaZaK is applying its pultrusion technology to greatly reduce the cost of Navy destroyer super-structures constructed of composite materials.

BASELINE TECHNOLOGY

The current 2507 Stainless Steel UMM guide trunk manufactured by Calzoni S.r.l. is characterized by excessive weight (2002 lbs) and substantially high unit costs due to its exotic stainless steel material content and large scale, high precision machining required for

production. However, the current UMM trunk has demonstrated long term dependable performance and durability, with low maintenance costs over 7 years at sea. No cost data is available, but KaZaK estimates the baseline unit cost to be above \$50K and less than \$200K

TECHNOLOGY DESCRIPTION

The Universal Modular Mast (UMM) is an integrated system for housing, erecting, and supporting submarine mast mounted antennas and sensors. In the retracted position, the telescoping mast completely houses the sensor group within the ship’s sail. In the erected position, the sensor is extended and functions as required. UMM is designed for Virginia Class Attack Submarines which use eight UMMs in the Sail in a 2 x 4 array, providing two each of four types of sensors. When deployed, the UMM is approximately 181 inches tall by 30 inches wide by 22 inches deep. Major components included the guide trunk (circled in the illustration to the right), fairing, and internal fairing. KaZaK’s development efforts are focused on the guide trunk which houses all of the telescoping components. The current baseline trunk is a stainless steel tube measuring approximately 2ft x 3ft x 15ft in size and weighing 2000 lbs.

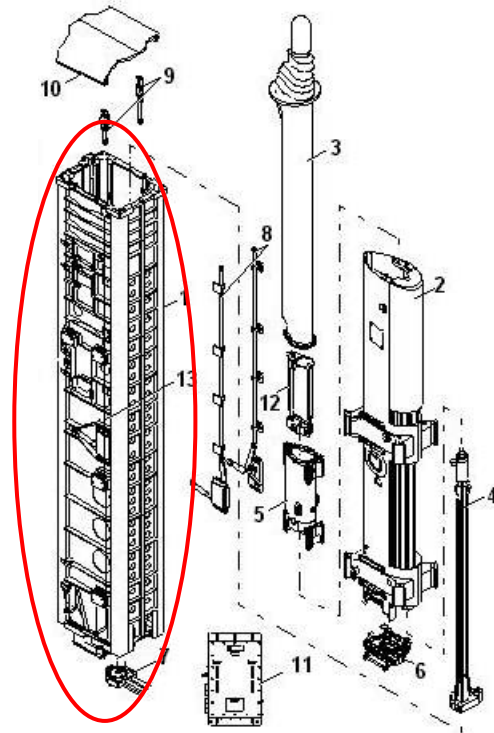


Figure 1 - UMM Schematic of Assembly showing guide trunk circled.

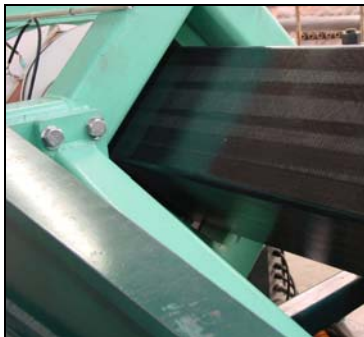


Figure 2 - KaZaK Pultrusion of large composite tube structure

The KaZaK composite guide trunk offers up to a 60% weight savings and estimated 30% cost savings compared to current stainless steel trunk. The guide trunk weight savings are achieved through carbon fiber sandwich construction of the main guide tube. Cost savings are achieved by low cost – high throughput pultrusion manufacturing; the only composite process that’s cost competitive with metals. Furthermore, KaZaK’s composite guide trunk features very high levels of straightness and has demonstrated tolerances far within .010 inches over 12 feet. Figure 3 compares some of the previously mentioned composite design benefits over the baseline trunk.

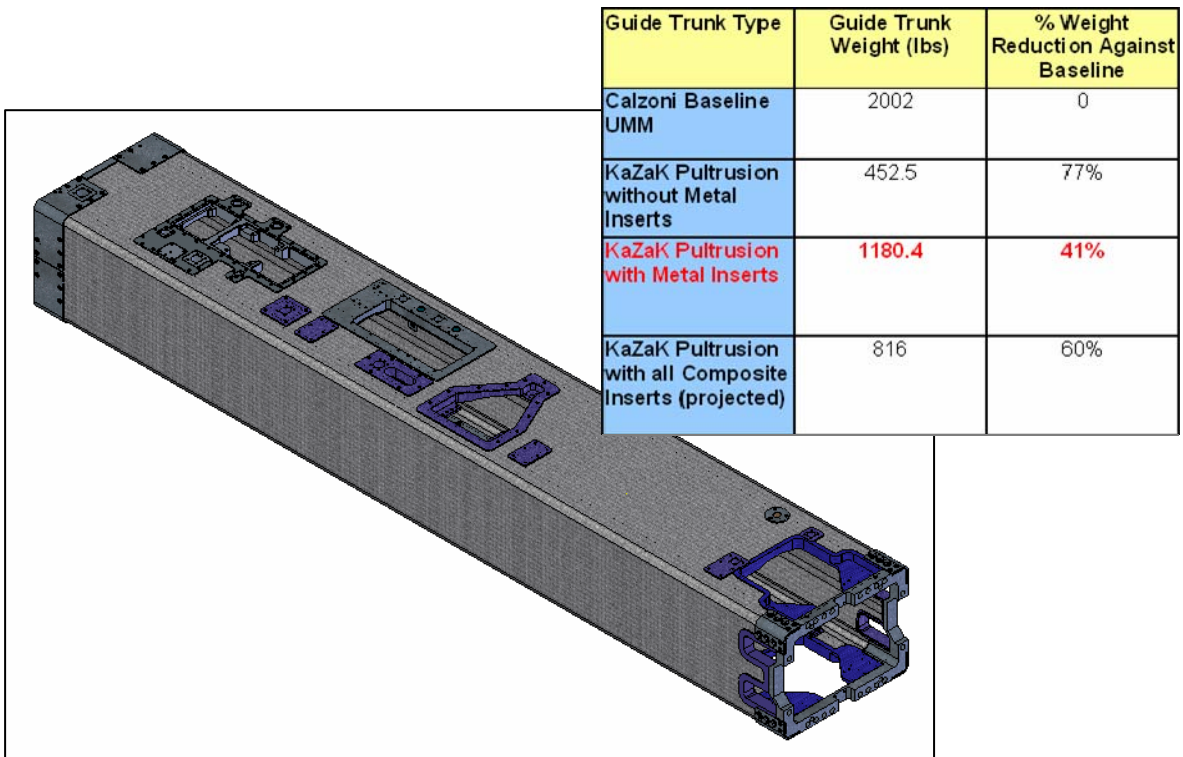


Figure 3 – Illustration of KaZaK’s composite guide trunk design along with tabulated comparison of the KaZaK and Calzoni baseline design.

The composite trunk unit will be produced using a pultrusion machine to pull the main composite tube structure. The interface points on the trunk used to mount sensors, clamps, installation faces, and safety pins are treaded using separately molded composite inert panels. The panels will be constructed using VARTM with one-sided tools. The cut-out features produced in the trunk to receive the panel inserts will be performed on a large flatbed machining router.

CURRENT STATE OF DEVELOPMENT

KaZaK is currently 17 months into the Phase 2 program and has completed the design of the composite trunk. Tooling and materials are being procured and prototype production is scheduled for January 2007. Fabrication trials will progress through March 2007 and final pultrusion prototype production will conclude in April 2007. Tests will be conducted in May and June 2007 and consisted of material cut-out mechanical tests to verify dimensional, constitutive, and structural conformance. The basic Phase 2 program will end with the delivery of one demonstrative article to Calzoni. Form, fit, and function testing of the full size trunk will be conducted by KaZaK and Calzoni as part of the Phase III program. These tests will include geometric inspection, deflection tests, and track operational trials.

TECHNOLOGY AVAILABILITY

KaZaK's high performance and intensely engineered pultrusion technology has been demonstrated in a number of previous programs dealing with the development of large straight tube structures, including composite PAC-3 missile launch canisters. KaZaK currently has the ability to produce large, straight tubular structures of up to 3 ft. x 3 ft. in section at unlimited length. These structures are produced at high rates in feet per minute with a straightness of .010 inches over 12 feet, and in most cases mechanically outperform composite structures fabricated by other means, such as filament winding.

REFERENCES

UMM specific references are shown below along with point of contact for the SBIR program.

http://www.naval-technology.com/contractors/weapon_control/kollmorgen/

<http://kmtg.kollmorgen.com/products/aerospace/eoUMM.html>

<http://www.calzonispa.com>

Commander - TPOC
ATTN: Phuc Nguyen
Department 435
NAVSEA 92C2
1333 ISAAC HULL AVENUE SE
WASHINGTON NAVY YARD, DC 20376
Telephone: 202-781-1490
Email: nguyenpn@navsea.navy.mil

Similar development efforts have been demonstrated in the SBIR Phase 2 PAC-3 missile launch canister program with the Missile Defense Agency;

POC: Kelly Sacco
B A E S Y S T E M S
Analytical Solutions
Technology Liasion Group
Engineer IV
310 Voyager Way
Huntsville, AL 35806
office: 256-864-7022
fax: 256-864-7001
Email: kelly.sacco@baesystems.com

ABOUT THE COMPANY

KaZaK Composites Incorporated specializes in the design and fabrication of high performance composite hardware tailored for production using low cost automated manufacturing methods. Hardware items range from sporting goods, through military and commercial products, to Space Shuttle flight hardware. The company has considerable experience with development of processing technology for highly compliant pultruded composite tubes and solid rods.