

Clamp to Replace Bonded Click-Stud

Kennon Products, Inc
2071 North Main Street
Sheridan, WY, 82801

Mr. Mark Weitz

Phone: (307) 674-6498

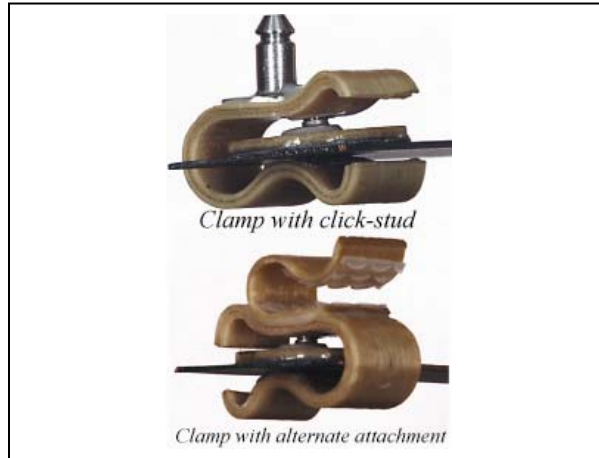
Fax: (307) 674-6498

Email: mark@kennoncovers.com

Website: URL

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PROBLEM STATEMENT

Bonded click-stud attachments used to secure aircraft cabin insulation blankets and wiring runs are tedious and labor intensive to install. Once bonded, they cannot be repositioned. When removed, either intentionally or by accident, the surface to which they were attached must be repaired. Installation and repair is time consuming and costly. Kennon developed a lightweight composite attachment clamp in a Phase II effort.

Quilted cabin insulation blankets are also problematic in that they absorb fluids and tear easily. They also are not the most efficient thermal or acoustic insulators. Kennon addressed cabin insulation in a Phase II Option effort.



Quilted insulation blankets installed with click-studs bonded to the airframe.

WHO CAN BENEFIT?

Aircraft manufacturers and their customers can benefit from the substantial cost savings associated with the installation, maintenance and repair of click-stud fasteners. Hundreds of click-studs are bonded to typical airframes to secure blankets, utilities, etc., and some require up to two hours to locate, prepare, and bond. Kennon's clamp installs in seconds and repositions easily. Aircraft that currently use bonded click studs include the MV-22, CH-53, CH-47, UH-60, C-130 and Commercial Airliners.

BASELINE TECHNOLOGY

Currently, click-studs are bonded (e.g. epoxy) directly to airframe ribs and spars. Insulation blankets, wiring harnesses, and other utility runs employ a connector to receive a matching click-stud. Placement of click-studs requires close tolerances, especially to match up with insulating blanket connectors to achieve a well formed fit. Too often, the blankets do not fit up well.

TECHNOLOGY DESCRIPTION

The Kennon Clamp is not bonded. It is easily installed and positioned using common snap ring pliers. A click-stud or a variety of other attachment devices (e.g. threaded standoffs, Dual-Lock®, SC2®) can be bonded outboard of the Kennon clamp to hold up blankets or other utilities which need to be secured in flight..

The clamp holds tenaciously on airframe structures without damage, and adjusts to varying airframe thicknesses using a finger adjusted, integral gauge. The clamp was designed for a 50 lb. pull-off force, but can be readily modified to meet various holding requirements. Kennon's clamp is a fiberglass and resin composite (FRP) which is not affected by temperature changes in the aircraft, and is not susceptible to, nor does it cause corrosion. It weighs the same as a click-stud and grommet combination.

Insulation System – As part of a Phase II Option effort, Kennon investigated alternatives for thermal/acoustic insulation. Kennon's delivered a prototype constructed from high performance aerospace foam that is used to insulate environmental controls systems in the Boeing 787.

As a total system, Kennon's insulation would be 25% lighter than current V-22 winter blankets. It would require far fewer attachments, saving additional weight and installation costs. In Phase II lab tests, it out-performed quilted insulation blankets in both thermal and acoustic insulating performance.

Being semi-rigid and thermo-formable, it conforms to the interior spaces and forms of an aircraft, aiding installation and removal for maintenance, and maximizing useable cabin space. It is a buoyant closed cell structure, impervious to fluids, and will float when removed, so can be followed to safety in the event of a water ditch.

Insulation System Goal: To develop insulation that is durable, conformable, non-absorbent, fire safe, provides maximum thermal and acoustic insulation at a weight less

than current system. This goal is within reach, and Kennon desires the opportunity to develop a full or partial shipset in order to perform operational testing.



Prototype insulation panel, form fitted for a conduit and utility box.

Light Weight Ballistic Protection: Another aspect of Kennon's Phase II Option effort was to explore lightweight ballistic protection for aircraft use. This aspect of our Phase II Option effort is least developed (TRL ~3), but early explorations indicate a threat protection of NIJ Level III at 2 lb/sq ft is feasible, with lower threat levels possible at lesser weights. The ultimate system would be aircraft insulation with light weight ballistic protection as an option, used where most needed. Kennon has a follow-on cooperative agreement with Army Research Lab to test and prove the technologies, and to develop a threat protection vs. weight capabilities matrix, providing end users choices in threat protection vs. weight.

Combined insulation and ballistic protection would offer reduced overall aircraft weight, with improved troop comfort, reduced ECS loads, and with ballistic protection where it previously could not be (weight) afforded. Lower weight and ECS loads would save fuel.



During the SBIR Phase II option Kennon was able to demonstrate that it is feasible to encapsulate ballistic protection materials as a part of an insulation system.

The company has a co-operative agreement with the Army Research Lab at Aberdeen to test and prove light weight ballistic protection for aircraft.

Table 1: Features, Advantages, and Benefits of the Kennon Clamp

| Features | Advantages | Benefits |
|--|--|---|
| Finger adjustable to varying thicknesses of rib or spar. | One size clamp covers a wide range of applications | Fewer sizes and parts save time |
| Installs with snap ring pliers | A tool that is in every toolbox | No new tools required |
| Accepts a variety of outward attachment types | Versatile, can be used throughout an aircraft wherever attachment and standoffs are required | A new solution to attachment problems |
| Repositionable | Moves easily to mate with receiving mechanism | More forgiving during positioning or placement |
| Designed for a 50 lb pull-off force | Can support a reasonably heavy load | Can be designed to produce predictable performance for various requirements |
| Kennon's clamp is a fiber and resin composite (FRP) | Not affected by thermal changes in the airframe, and is not susceptible to, nor does it cause corrosion. | Can be attached safely to any aircraft frame material |

Table 2: Features, Advantages, and Benefits of the Kennon Insulation System

| Features | Advantages | Benefits |
|--|---|---|
| Light Weight | Approximately 25% lighter than commonly used quilted insulating blankets | Weight savings increases payload capacity |
| Closed cell, non-absorbent, buoyant | Will not soak up fluids or water | Safer to use on board, can be followed to surface in the event of a water ditch |
| Exceptional flame/smoke/toxicity (FST) ratings | Material is already approved for use on commercial airliners | Time savings in commercializing this insulation system |
| Semi rigid, moldable and conformable | Easy to work around protrusions and crevasses. Ceiling insulation will not sag | Maximizes useable cabin space |
| Able to be embossed | Enhances noise attenuation, increases strength and abrasion resistance, | Simple manufacturing process that adds great value |
| Able to encapsulate ballistic protection inside the insulation panel | Combining ballistic protection with thermal /acoustic insulation accomplishes two important goals with one product. | better protection at lighter weight in a multi-use application |

CURRENT STATE OF DEVELOPMENT

Milestone Schedule for Reaching TRL 9

| | | Date Milestone Accomplished (assuming Nov 09 start) | | |
|----------------------------------|-----|---|-------------------|----------|
| Milestone | TRL | attachment clamp | insulation system | BPS |
| | | completed | completed | to do |
| initial prototypes, testing | 4 | Jan-2009 | Jul-2009 | Jan-2010 |
| fabricate final prototypes | 5 | Jun-2009 | Jan-2010 | Aug-2010 |
| qualification testing | 6 | <i>Jan-2010, extended vib testing to do</i> | Apr-2010 | Nov-2010 |
| design for manufacturing | 7 | Mar-2010 | Jul-2010 | Feb-2011 |
| limited production run | 8 | May-2010 | Sep-2010 | May-2011 |
| first article acceptance testing | 8 | Jul-2010 | Jan-2011 | Jul-2011 |
| operational testing | 9 | Sep-2010 | Mar-2011 | Sep-2011 |

REFERENCES

SBIR TPOC: 301-342-9398
 PMA-275 POC: 301-342-9013
 V-22 Director WSI: 301-342-3977

ABOUT THE COMPANY

Kennon is a manufacturer of ground support equipment for general, business, commercial and military aircraft, since 1984. In 1991, during the Gulf War, Kennon began designing and building protective coverings for military aircraft. Now, nearly every aircraft in the services has a Kennon cover of one type or another.

Kennon has strong design and materials engineering capabilities, both in-house, and in cooperation with universities and private sector partners. Please visit www.militaryaircraftcovers.com