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## GE Aviation

GE is a leader in providing affordable, comprehensive and safe solutions for integrating weapons on fixed-wing military aircraft. Our modular Stores Management Systems can control a vast array of stores, including fuel tanks, guns, targeting and reconnaissance pods, dumb and smart weapons, and missiles. Our flexible systems are fully compliant with the MIL-STD-1760D standard and are capable of supporting future stores as well as legacy stores within a unified design.

The Universal Station Control Unit (uSCU) provides a "best value" over-all stores management solution. The uSCU architecture and design is based on current component technology that reduces weight, costs and obsolescence

issues. Its configuration and capabilities decrease the number of boxes per shipset by incorporating the stores adaptation and power control into a single unit for control of two stations and stores. The uSCU provides an electronic interface from the store on the rack to the stores management and jettison control systems.

The uSCU is currently in the development phase and under contract to support two major military programs--the U.S. Navy P-8A and the Japanese P-X. Over 100 prototype/pre-production uSCUs have been built to date in support of internal and external systems integration and test activities for the two major military programs underway.



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## Universal Station Control Unit



imagination at work

# Universal Station Control Unit

## Functionality

The uSCU is designed to concentrate all the hardware interfaces and low level algorithms necessary to fully condition and release up to two stations. Its rugged construction, limited weight and low power consumption make it easy to install the uSCU in a variety of environments, including the constrained envelopes associated with fixed wing aircraft.

The uSCU is designed to implement to the fullest extent existing aircraft-to-store interface standards, including a full implementation of MIL-STD-1760D (no HB2, HB4, 270 Vac support or HB1, type B) at up to two stores stations and the support in all respect of the major Suspension and Release Equipment (S&RE) in airborne use, including electromechanical racks, Pyrotechnic (hot gas) ejectors and Pneumatic (cold gas) ejectors.

The functional interface to the aircraft is via a dual redundant MIL-STD-1553 stub and two redundant sets of hardwired discretes to enable the release or the jettison functions of the uSCU in addition to the 1553 command and control.

The uSCU is capable of autonomously sequencing the Jettison of the stores it controls according to a pre-programmed sequence under exclusive hard-wired discrete control, without the need of a functional 1553 bus controller to direct the jettison of stores during an emergency. The Jettison sequence can also be dynamically programmed via 1553 to accommodate store load outs.

## Physical Characteristics

- Weight: <=10 lbs (dependent on LWIC selection)
- Dimensions: 5.4H x 4.4W x 14.8L (measured in inches)
- Power requirements – uSCU: 28Vdc @ 12W quiescent , three phase 115Vac @ 10A for weapons power
- MIL-STD-704E compliant
- Cooling requirements – natural convection
- Operating temperature: -58°C at 33,000 ft to + 70°C at sea level
- MBTF - 16,000 hours

## Interface Characteristics

### Aircraft

- Dual redundant MIL-STD-1553 stub
- 1760 discrete interface: Up to 50 single-ended discrete inputs & outputs, ground/open & power/open to the aircraft
- Two MIL-DTL-38999 series 3 connectors for signaling and power

### ASIs

- Supports two ASIs
- Dual redundant MIL-STD-1553 stub for each ASI
- Built-in MIL-STD-1553 repeater function
- 1760 discrete interface: Up to 8 single-ended discrete inputs & outputs, ground/open & power/open for each ASI
- Two MIL-DTL-38999 series 3 connectors, signaling and power combined for each ASI

### LWICS

- I/O is stores specific
- Two MIL-DTL-38999 series 3 connectors, signaling and power combined for each store

### Features

- MIL-STD-1760D compliant\*
- Capable of fully conditioning and releasing multiple stores on two stations
- Built-in stores power control
- Capable of autonomously sequencing the Jettison of stores
- 1553 Bridge/repeater functionality from aircraft to ASIs
- Architecture supports two weapons specific I/O cards (LWICs)
- Built-in test
- A microprocessor and software free solution

\*NOTE: No HB 2, HB 4, 270 Vac support or HB Type B.

## Mechanical Design

A fully configured uSCU consists of a single, passively cooled LRU approximately 14.8" by 4.4" by 5.4" in size and under 10 lb in weight (Different legacy stores configurations will affect the exact size and weight). Two MIL-DTL-38999 series 3 connectors provide the interface to aircraft power and to aircraft and S&RE I/O signals and are located at one end of the uSCU enclosure. At the opposite end of the enclosure, two 1760 ASI connectors are provided, as well as two LSC.

Internally, the uSCU is partitioned in 3 main modules and two optional LWICs. The Input/Output Module (IOM), Power Control Module (PCM) and Station Control Module (SCM) implement all the 1760 ASI interfaces and all the interfaces to the Aircraft and to the S&RE. The two optional LWIC modules implement the interface to the two LSC.

The uSCU chassis is designed as a machined aluminum casting, designed to withstand vibration environments consistent with high performance jet aircrafts and with gunfire environments. The chassis provides a large amount of RF shielding to satisfy stringent EEE requirements. Normal

mounting configuration to the aircraft is via dagger pins and captive swing bolts, but alternative mounting configurations can be provided as needed. The uSCU chassis is designed to survive harsh vibration environments and to protect the enclosed electronics.

## Electrical Design

The uSCU functionality is entirely realized in Field Programmable Gate Arrays (FPGA), including the 1553 RT function and the 1553 bridge/repeater to the stores. A processor-less design approach has been selected to minimize the power consumption of the uSCU critical logic, to provide highly deterministic execution of all the critical functions and to eliminate the need for costly SW verification of safety critical controls.

Solid state power switching is employed extensively throughout the uSCU to control power to the stores (with the exception of 115VAC, Arm & Release Power) and to control the interfaces to the aircraft suspension and release equipment. Critical power busses within the uSCU are interlocked with hardware discretes and air gaps to provide a high level of assurance of fail safe operation.

Component technologies are selected to operate in the harsh environment of airborne avionics and advanced packaging techniques are used throughout the design to provide sufficient thermal and vibration management to allow the use of industrial and automotive grade components for most of the uSCU functions. By using similar technologies to those of other SMS programs being executed by GE Aviation, especially those being deployed on the Joint Strike Fighter, the uSCU design leverages on the state-of-the-art component selection and obsolescence management approaches in place for the JSF, and the uSCU has been architected in a modular fashion to facilitate the life cycle technology injections that will always be needed to manage component obsolescence issues that inevitably will arise over the lifetime of an aircraft.

The uSCU is designed to be compatible with common aircraft power specs, including MIL-STD-704E and successive revisions. Quiescent power consumption for a fully configured uSCU is less than 12 W on 28VDC, while the dynamic current consumption during a release or jettison event varies significantly based on the S&RE technology and on the stores deployed with the uSCU.

## Interfaces to the Avionics Environment

The uSCU interfaces to the avionics backbone of the aircraft via a MIL-STD-1553 bus and one or two sets of 5 low power discretes, used to provide hardware interlocks for critical uSCU

functions as well as avionics-independent emergency jettison functionality.

The uSCU contains two Remote Terminals, each with a unique RT address. It also provides a transparent 1553 repeater for each 1760 station. A single stub connection on each bus is sufficient to connect both of the uSCU RTs to the avionics bus. The 1553 repeater presents a clean stub connection to each of the 1760 store stations while providing electrical isolation from the avionics bus.

The philosophy chosen for the control of the uSCU and of the weapons attached to it closely follows the approach of MIL-STD-1760 wherever possible, down to the structure of the 1553 bus catalog. Critical functionality of the uSCU is controlled with data structures compliant with the Critical Control/Critical Authority approach used by MIL-STD-1760 to control irreversible store functions. The functionality of legacy weapons is mapped to the 1760 control framework by the Legacy Weapon Interface Cards.

The chosen approach provides a consistent logical interface to any of the weapons controlled by the uSCU, thus facilitating the design of the Mission Computer code that will control the uSCU and its weapons. A consistent, standard based interface will also greatly facilitate the introduction of future weapons on any platform, with minimal impact to the avionics software.

## uSCU Status

The first major product built upon uSCU concept, the U.S. Navy's P-8A, is currently undergoing environmental and functional qualification testing. Four distinct variants of the uSCU are being qualified to support a variety of carriage and mission stores. Testing has been ongoing for a period of time and is expected to continue through the fall of 2009 with completion scheduled for later this year.

Over 100 prototype/pre-production uSCUs have been built to date in support of internal and external systems integration and test activities for the two major military programs underway.