

CLOSE PROXIMITY WEAPON ID SYSTEM

FIELD OF THE INVENTION

The present invention relates to a method of automatically transferring inventory data and the associated parameters from the actual loaded inventory to the Store Management System (SMS). Such a method ensures efficient inventory tracking and minimizes the possibility of incorrect stores being fitted or inventory data loaded. This is done by means of an identity (ID) chip attached to each store and a scanner reading the data from the ID chip onto the aircraft SMS.

BACKGROUND OF THE INVENTION

The inventory loading process is an open loop mechanism. Presently, the armament crews are instructed to load a specific set of weapons onto the aircraft and the mission planner programs a portable data cartridge with a corresponding set of inventory information. The pilot will use the data cartridge to transfer the inventory data to the aircraft SMS during the pre-flight procedures. Some weapon parameters are manually programmed by the mission planner in the data cartridge and manually keyed in by the pilot into the aircraft SMS, such as the laser code. This may result in a mismatch, due to human errors, of data between the actual loaded inventory and the aircraft SMS causing failure to

release a store during flight, or an incorrectly aimed store because of fuzing and trajectory data mismatch. Currently if there is a mismatch between the data held by the SMS and the actual loaded inventory, there might be no indications to alert the pilot of such an error since there is no direct cross-checking of the loaded inventory data with the aircraft SMS data.

Aircraft weapons are controlled items, which need to be accounted for. Currently, the inventory data held by the aircraft SMS does not contribute to the control process, as it is not linked directly to the actual weapons load. Also, the weapons held in ground storage area have to be accounted for using manual methods which are time consuming and prone to error.

When a weapon release attempt fails, the weapon, which did not detach from the aircraft, is referred to as a "hung store". The SMS is designed to detect the presence of a hung store by means of a store sense signal supplied by the weapon pylon. However, hung store detection on many commonly used weapon carriers, such as multiple ejector rack (MER) and tertiary ejector rack (TER), is currently limited in capability. When a MER or TER is fitted to the aircraft, the store sense signal can only provide an indication of whether the rack is empty or not empty, and a hung store, or plurality of hung stores, can remain undetected.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a method of linking the actual loaded inventory data directly to the aircraft SMS to provide an accurate way of inventory tracking prior to flight when the stores are loaded onto the aircraft and during flight as the stores are being released. As part of the inventory loading process before flight, the weapon data parameters can be automatically transferred to the aircraft SMS from the actual loaded inventory. This data can then be compared with the inventory data from the data cartridge, thus allowing closed loop verification of the loaded inventory. Any mismatch between the 2 sets of data will be detected before flight and corrective action taken as necessary. This will avoid any potential degradation of the mission due to incorrect stores being fitted or inventory loaded.

A further object of the present invention is to provide a reliable way of detecting a "hung store" condition. In the event of a hung store occurring, the SMS will be able to reliably detect this condition, even when the stores are being carried on MERs or TERs. This will allow the pilot to make informed decisions based on accurate information. Presently, hung store detection on many commonly used weapon carriers such as Multiple Ejector Rack (MER) or Tertiary Ejector Rack (TER), can only provide an indication of whether the rack is empty or not empty, and a hung store, or plurality of hung stores, can remain undetected. The SMS in this present invention, on the other

hand, detects the stores in the aircraft based on their presence in the aircraft. Hence even if the rack is indicating no store present and the particular store is still on the aircraft, the SMS can still detect it.

Yet another object of the present invention is to enable the download of reliable inventory data from the SMS for use in stores accounting in the aircraft. The SMS tracks the loading and unloading of the stores on board the aircraft, thus providing reliable data for use in stores accounting. Following a flight, the remaining stores data held by the SMS will be accurate, even though a hung store condition might have occurred during flight. Since the aircraft SMS can keep track of the inventory loaded into the aircraft prior to flight and released from the aircraft during flight, and it can detect the presence of the store so long as it is not detached from the aircraft, a hung store condition will not affect the reliability of the inventory data from the SMS. Likewise, inventory data from the SMS can be downloaded and used for stores accounting and this will do away with the manual methods of doing stores accounting, which are susceptible to errors and are time consuming.

Still another object of the present invention is to provide a method of tracking and accounting stores in the ground storage areas quickly and accurately. Presently, the weapons held in ground storage areas have to be accounted for using manual methods, which are time-consuming and prone to error. The present invention utilizes a portable scanner to read the inventory

data from the ID chips attached to each store, for use in stores accounting in the ground storage areas.

Another object of the present invention is to provide a system comprising 3 components for inventory tracking during loading of the stores prior to flight, releasing of stores during flight and stores accounting in the aircraft and the ground storage areas. The 3 components are an identification (ID) chip, an airborne scanner and a portable scanner. Such a system will also enable the reprogramming of data parameters to be done simultaneously on both the actual stores and the aircraft SMS ensuring a consistency of data.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be more clearly understood when considered in conjunction with the accompanying drawings, in which:

Figure 1 is a flow chart of the Weapons ID System prior to flight.

Figure 2 is a flow chart of the Weapons ID System during to flight.

Figure 3 is a flow chart of the Weapons ID System in stores accounting.

Figure 4 is a flow chart of the Weapons ID System as a pre-flight or post-flight automated checklist system.

DETAILED DESCRIPTION OF THE INVENTION

In accordance with the present invention, the Weapon ID system comprises an ID chip (not shown in drawings) that is attached to the surface of each store, an airborne scanner 20 mounted on the aircraft that establishes communication with all the ID chips within the range of operation and read their ID information and associated data parameters, and a portable scanner 30 used on the ground to track inventory in ground storage areas and stores loaded on the aircraft.

A miniature, low profile identification (ID) chip is attached to the surface of a store. This chip, following the receipt of a transmission of a certain format, shall respond by transmitting a low power, close range, coded signal containing its ID information and preprogrammed data parameters. The chip may alternatively be attached to the surface of a special deployment kit fitted on the store. A variant of this ID chip is a passive ID chip that is functionally equivalent, but derives its operating power from the received transmission. Another variant of this ID chip allows the onboard data parameters to be overwritten in response to the receipt of a transmission containing predetermined command sequence.

Another variant will be virtual ID chip that is emulated by the store. This virtual chip will respond in the same way as a normal ID chip except that the information transmitted to the scanner will be dynamic as determined by the store. This provides a two-way communication link between scanner and the

store by reading information (store to scanner) from the virtual ID chip, and transmitting information (scanner to store) into virtual ID chip.

The airborne scanner is mounted on the aircraft. This scanner is able to establish communication with all ID chips within range of operation and read their ID information and associated data parameters. The scanner is connected to the aircraft SMS by an electrical interface such as MIL-STD-1553 bus, ARINC 429 channel, RS422/232 or other interface. A variant on this scanner is able to reprogram some or all of the data parameters held by an ID chip that is capable of such reprogramming.

Another variant on this scanner is able to communicate with a virtual ID chip that is emulated by the store. The mechanization will be as if the scanner is reprogramming an ID chip, but the store is able to respond to what is being modified and reply as though it is an ID chip.

A portable scanner is used on the ground to communicate with ID chips fitted to stores loaded on the aircraft or in ground storage areas. This scanner is used to track inventory and also as a pre-flight and post-flight automated checklist tool while the store is mounted on the aircraft. A variant on this scanner is able to reprogram some or all of the data parameters held by an ID chip that is capable of such reprogramming.

Referring to the drawings, a preferred embodiment of the present invention is illustrated in Fig. 1 which shows the Close proximity Weapon ID

System prior to flight. The airborne scanner 20 reads the ID information and associated data parameters of the stores loaded onto aircraft prior to flight 10 from the ID chip (not shown) attached to the surfaces of each store. The airborne scanner 20 then transfers the read data into the aircraft Stores Management System (SMS) 30. Simultaneously, there is also a transfer of the stores data from the data cartridge 40 into the aircraft SMS 30. The data cartridge is prepared by the mission planner who plans the types and quantities of inventories to be loaded onto the aircraft and the other necessary inventory details. The data from the data cartridge 40 must match the data from the airborne scanner 20. When the aircraft SMS 30 detects a mismatch, corrective action will be taken before the aircraft can go into flight. When the aircraft SMS 30 detects a match between the data, the aircraft is ready to go into flight. In addition, any changes in plans before the flight can be made by reprogramming the ID chips attached to the stores via the aircraft SMS and airborne scanner.

Another preferred embodiment of the present invention is illustrated in Fig. 2 which shows the Close proximity Weapon ID System during flight. The airborne scanner 20 reads the ID chips attached to the stores on board the aircraft and automatically updates itself whenever a store is released from the aircraft. A hung store condition will be detected when the pilot releases that particular store and the airborne scanner 20 still detects the presence of that store in the aircraft SMS 30. The pilot can monitor and keep track of the stores

onboard the aircraft just by operating the aircraft SMS 30. In the event that the pilot decides to make a change to the inventory plans, he can re-programme using the ID chips on the stores via the aircraft SMS 30 and airborne scanner 20.

Yet another preferred embodiment of the present invention is illustrated in Fig. 3 which shows the Close proximity Weapon ID System in stores accounting. The portable scanner 25 reads the inventory information from the ID chips attached to the stores in ground storage 70 and stores loaded onto aircraft prior to flight 10. Hence stores accounting can be done automatically by extracting information from the portable scanner 25. Inventory data can also be downloaded from the aircraft SMS 30 for use in stores accounting. Like the airborne scanner 20, the portable scanner 25 can also reprogram the ID chips if changes are to be made.

Another preferred embodiment of the present invention is illustrated in Fig. 4 which shows the Close proximity Weapon ID System as a pre-flight/post-flight checklist tool. The portable scanner reads the inventory data from the ID chips on the stores loaded onto aircraft prior to flight 10. This data can be verified with a checklist prior to flight as a quick check to ensure that the required stores have been loaded. Similarly, the portable scanner reads the ID chips attached to the stores remaining in aircraft after flight 15 to compares it with the check list to check that the stores intended for release have been detached from the aircraft and detect which are the hung stores 64.

Another embodiment of the present invention is illustrated in Fig. 5, which shows the close proximity ID system as a communication link between store A and aircraft C. The scanner B transmits data to the store by programming the virtual ID chip emulated by the store A. The scanner B reads the virtual ID chip A thereby obtaining the updated information from the store A. Processing in Aircraft System C and Store A shall determine the information that they transfer to each other.

While in the foregoing there has been disclosed a preferred embodiment in accordance with this invention, it should be understood that various changes and modifications can be made within the true spirit and scope of the invention as recited in the appended claims.



CLAIMS

1. **A Close Proximity Weapon ID System comprising:**
 - an ID chip, attached to the surface of a store, wherein following the receipt of a transmission of a certain format, shall respond by transmitting a low power, close range, coded signal containing its ID information and pre-programmed data parameters and the said ID chip derives its operating power from the received transmission;**
 - an airborne scanner, mounted on the aircraft, that is able to establish communication with all the ID chips within the range of operation and read their ID information and associated data parameters; and**
 - a portable scanner, for use on the ground, to communicate with the ID chips fitted to stores loaded on the aircraft or in ground storage areas.**
2. **The ID chip according to claim 1 wherein the ID chip allows the onboard data parameters to be overwritten in response to the receipt of a transmission containing a pre-determined command sequence.**
3. **The ID chip according to claim 1 wherein the ID chip is a passive ID chip that derives its operating power from the received transmission.**



4. The airborne scanner according to claim 1 which is connected to the aircraft store management system by an electrical interface such as MIL-STD-1553 bus, ARINC 429 channel, RS422/232 or other interface.
5. The airborne scanner according to claim 1 capable of reprogramming the data parameters held by an ID chip.
6. The portable scanner according to claim 1 capable of reprogramming the data parameters held by an ID chip.