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First flight with **SnS (Safe and Secured)**

Our avionics sensor completed several **successful flight tests** on weapon busses of fighter jets!





Background:

Sital Technology's SnS (Safe and Secured) sensor completed several flights on weapon bus of a fighter jet.

Sital Technology's SnS sensor records physical traits of each 1553 message on to a flash chip during flight.

Post flight, this data is downloaded from the jet, and uploaded to a cloud data base, capturing all flights of same jet tail number, as well as multiple tail numbers in same squadron, and later, all combat squadrons, and finally all vehicles.

Post flight analysis of the physical traits reveal 1553 bus wiring issues such as disconnections and shorts, even if they are very short intermittent in nature.

When the wires are intact, the recorded physical traits provide the capability to perform intrusion detection system (IPS) of BC or RT impersonation.

Results:

Before these initial flights with the SnS sensor, a ground recording was done.

The data captured from these recording was "unexpectedly exciting" as noted by Ofer Hofman, founder and CTO. "We found that both weapon busses had only a single termination resistor(!), missing the second resistor on the same side of the bus!"

MIL-STD-1553 is extremely robust, with significant SNR (signal to noise ratio), allowing it to operate almost intact with a single termination resistor. For that reason, all test tools and even the aircraft's self testing pre-flight do not "see" this error.

When only one termination resistor is in place, and if the bus length is long enough, the echoes from that missing termination reduce the SNR to below 1.

When the Noise is higher than the signal -> errors occur.

"That is exactly what we recorded during flight. We detected that every now and then, there is no response from an RT, and that those no responses occur for a particular RT located at a particular distance from the missing terminator" Ofer noted. "We knew that the command went to RT7, but the recorded command indicated RT15".

"The missing terminator decreased the SNR to the entire bus, and some RTs, at particularly location errored out the command and didn't respond. When the SNR level is so low, we fear that commands that did make it through, but the data words following that command, such as target GPS location, might be altered by the "noise" leading that bomb to the wrong destination. We call these message scenarios wiring-attacks, as opposed to cyber-attacks which try to achieve the same goal."

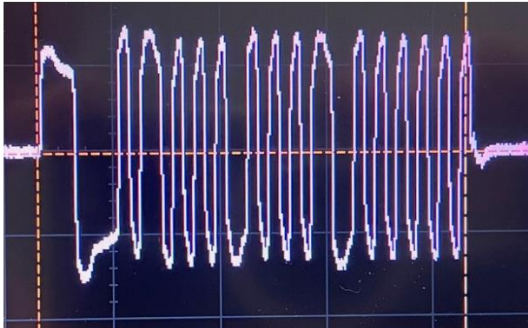
Since SnS sensor's capabilities have never been available before, it might be that many of the 1553 busses suffer from wiring problems that nobody can find.

The common playbook is to replace LRUs for such errors during flight. However we found that such failures should not be accounted to problematic LRU functionality, but rather the physical media (1553, CAN Bus, ARINC429) connecting the LRUs.

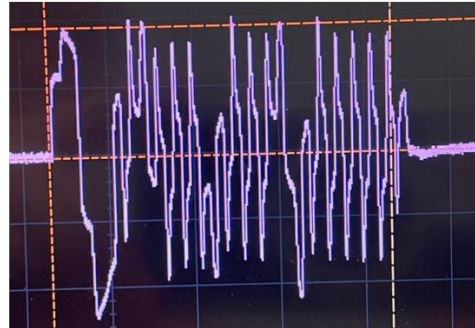
As an example, fighter pilots report on failures to lock a weapon's line of sight with their killer hamlets line of sight. These reports frequently end up with LRU replacements which do not solve the issue.



Locking these line of sights require Avionics bus as well as Weapon bus communication at 50 times a second. If either bus have a high degree of retries as a result of 1553 physical wiring failures, that goal will not be achieved, and the weapon line of sight would jump and skip failing to track the pilots line of sight.



1553 Bus -
Properly terminated
High SnR.



1553 Bus -
Low SnR due to
a missing termination resistor

Conclusions:

“We concluded from these recordings and flights that the proper procedure for a squadron is to use the SnS sensor to fix all 1553 busses on the ground and elevate them to a perfect baseline, and allow the SnS sensor to find the very first occurrence of wiring-attacks or cyber-attacks during flight. With that in place, those jets will perform perfectly during missions, and we would know how to fix issues weeks before the pilots would feel any degradation of their avionics system” concluded Founder & CTO Ofer Hofman.