

Surface Acoustic Wave Strain Sensor for Vehicle Systems Safety Technologies (VSST)

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Project: VSST Subproject: VHMS
Vehicle Health Management System

Element: Airframe Health Management
Milestone : VSST4.4.3.E1.03 Assess
Impact detection approaches.

Description: Preliminary assessment of
impact detection/characterization
approaches.

Technical Challenge:
Vehicle Health Assurance

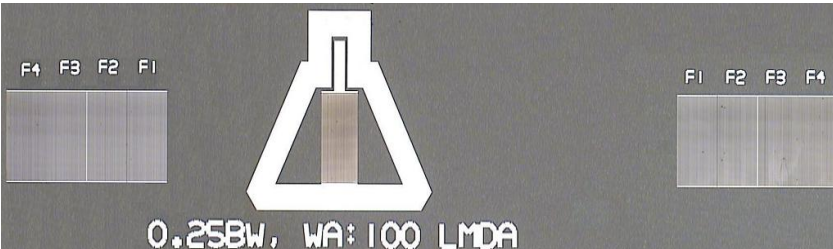
Outcome: An improved
understanding of impact
detection/characterization
approaches for further
development.

Technical Approach

Investigate the feasibility of using
Surface Acoustic Wave (SAW)
technology for impact detection.

This will be part of a system that
will predict, detect, and mitigate in-
flight damage, degradation, and
failures, to improve aviation safety.

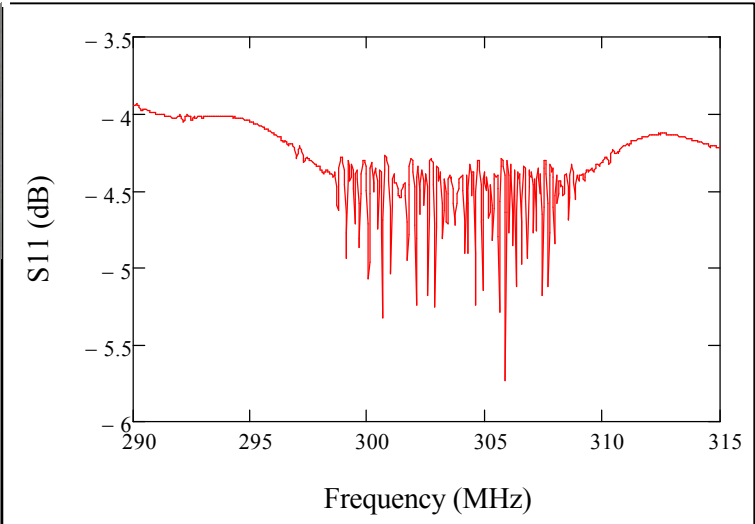
Surface Acoustic Wave Device



0.25BW, WA: 100 LMDA

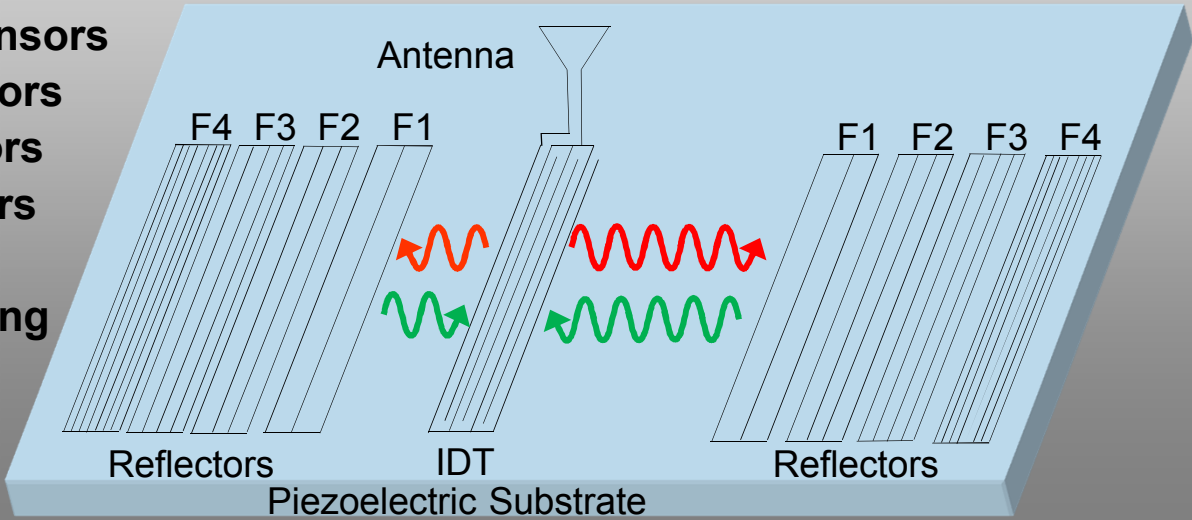
$f_0 = 304.6 \text{ MHz}$
 $\lambda = 8.958 \mu\text{m}$
finger widths = $1.493 \mu\text{m}$

- Orthogonal Frequency Coded Devices
 - Unique identifier for each sensor
 - Improves range and code collision avoidance
 - Spread spectrum (multiple frequencies) for communications
- OFC SAW Devices have been fabricated in partnership with UCF



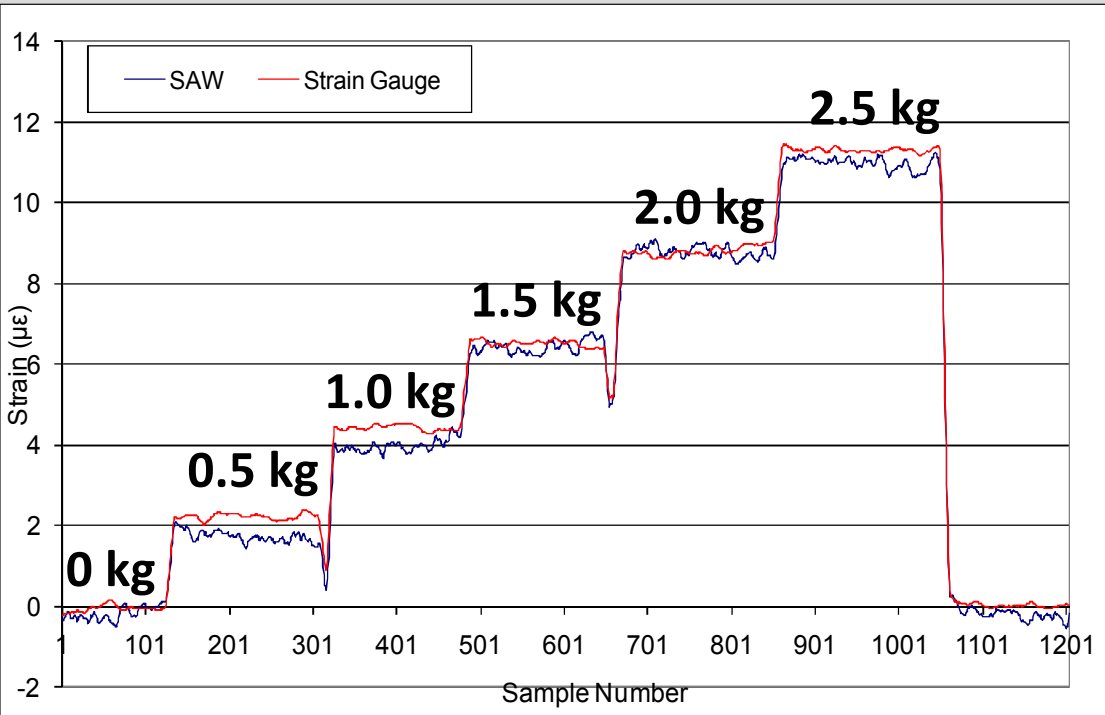
Passive Wireless SAW Sensor Example

- Small (low mass and low volume)
- Extremely Low power (RF or Ambient)
- Inexpensive
- Versatile
 - Temperature sensors
 - Ultrasonic sensors
 - Chemical sensors
 - Pressure sensors
 - Strain sensors
 - Signal Processing
 - Resonators
 - Filters

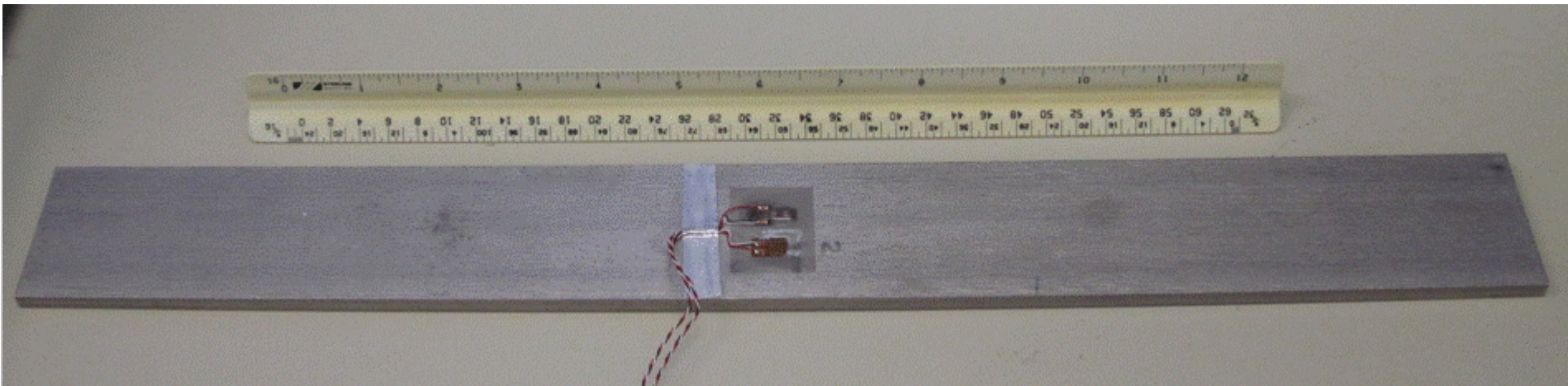


SAW Response to Micro Strain

SAW devices are very
sensitive and with
characterization, SAW devices
should be able to match if not
exceed the accuracy of
traditional strain gauges.



Future Work



A data acquisition system for testing the SAW devices in a load frame
is being developed.

Plans include characterizing the device for both strain and
temperature changes.

Demonstrate that SAW strain sensors can detect structural changes
due to impact damage.