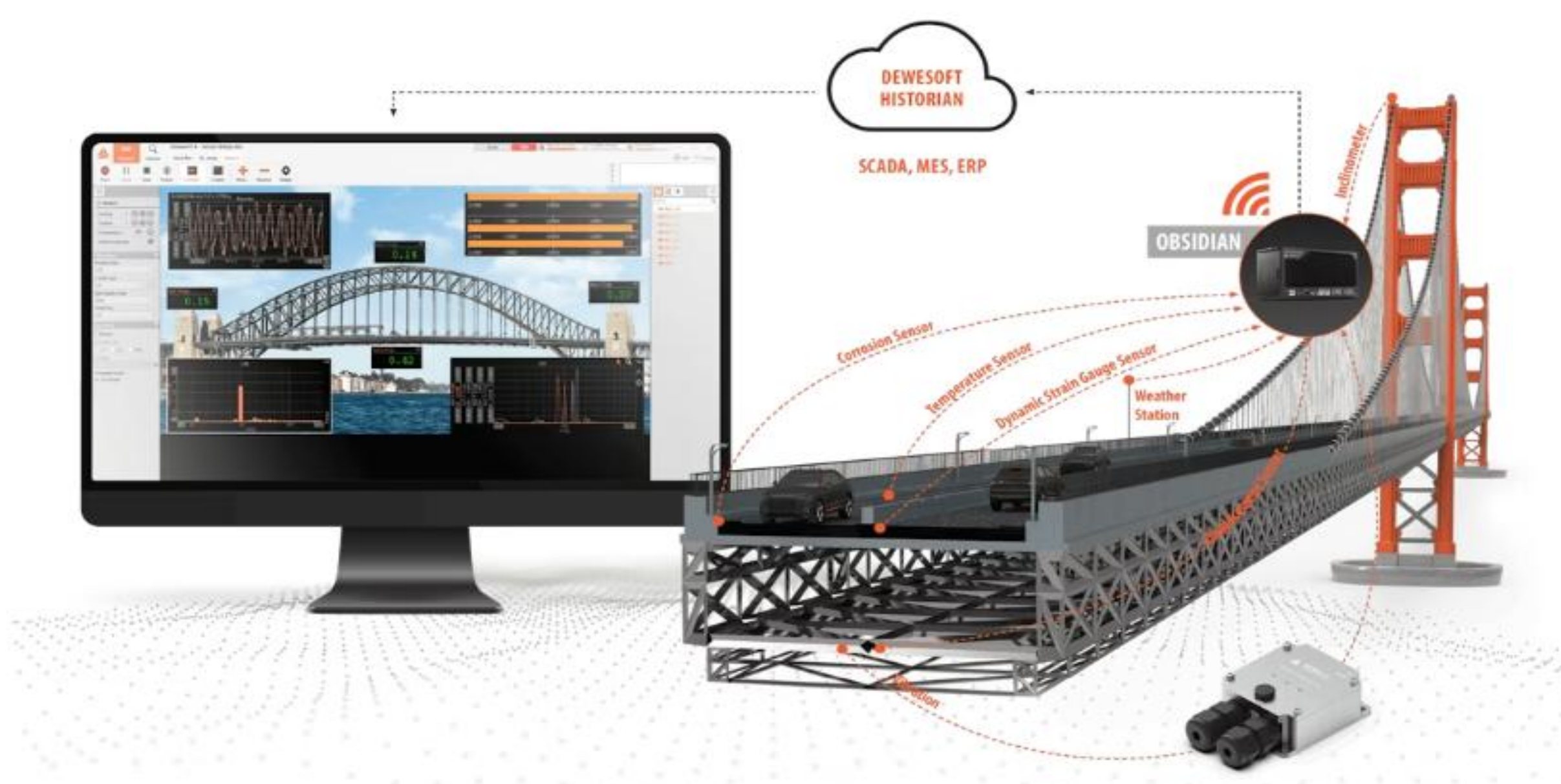


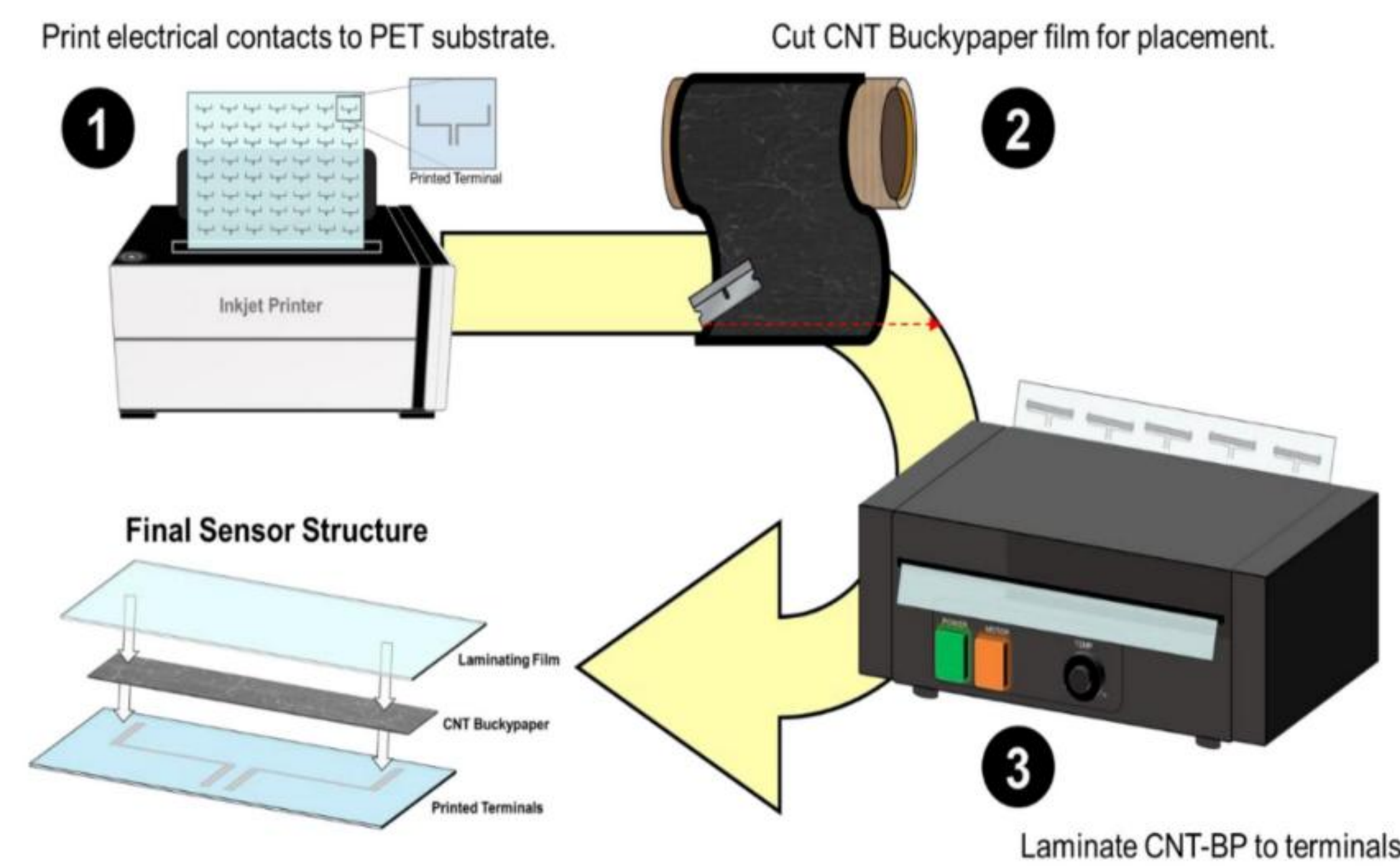
## Research Background

- The civil infrastructure is aging and requires innovative and preventative maintenance methods.
- Sensor technology could reshape the design and maintenance of structures (e.g., a highway bridges or residential buildings), but metallic and semiconductor sensors are expensive, complex to manufacture, and functionally limited.
- Carbon nanotubes (CNTs) challenge traditional sensors with the ability to detect microscopic strains and low-force impacts.



## Methods and Mechanisms

- Silver ink electrodes are printed on a polymer substrate.
- Placing copper film on each end of the electrode.
- Applying CNT-BP strips onto electrodes using epoxy-based adhesive.
- Laminating the sensor to ensure good bonding.
- Crimping connectors onto copper film.
- Soldering male-to-male wire connectors on each end.

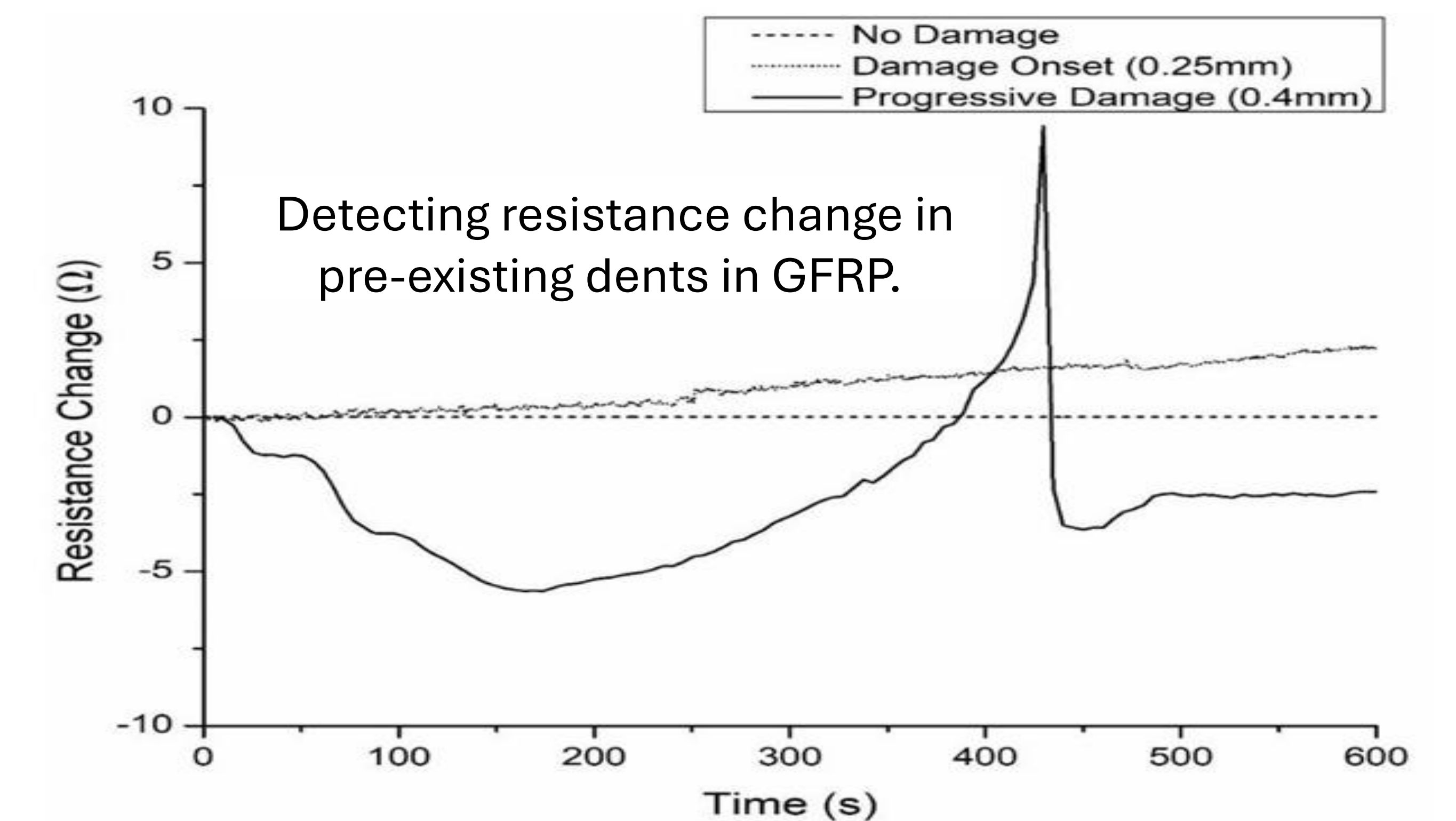


## Key Results

- Flexural tests reveal the detection of deflections as small as 0.01mm.
- Impact tests reveal the detection of both direct and indirect impact strikes (low force).

For example, an event of a mass of 8.78 kg dropping from a height of 30.5 cm can be detected

- The sensors can detect barely visible damage and potentially distinguish the severity of the damage.



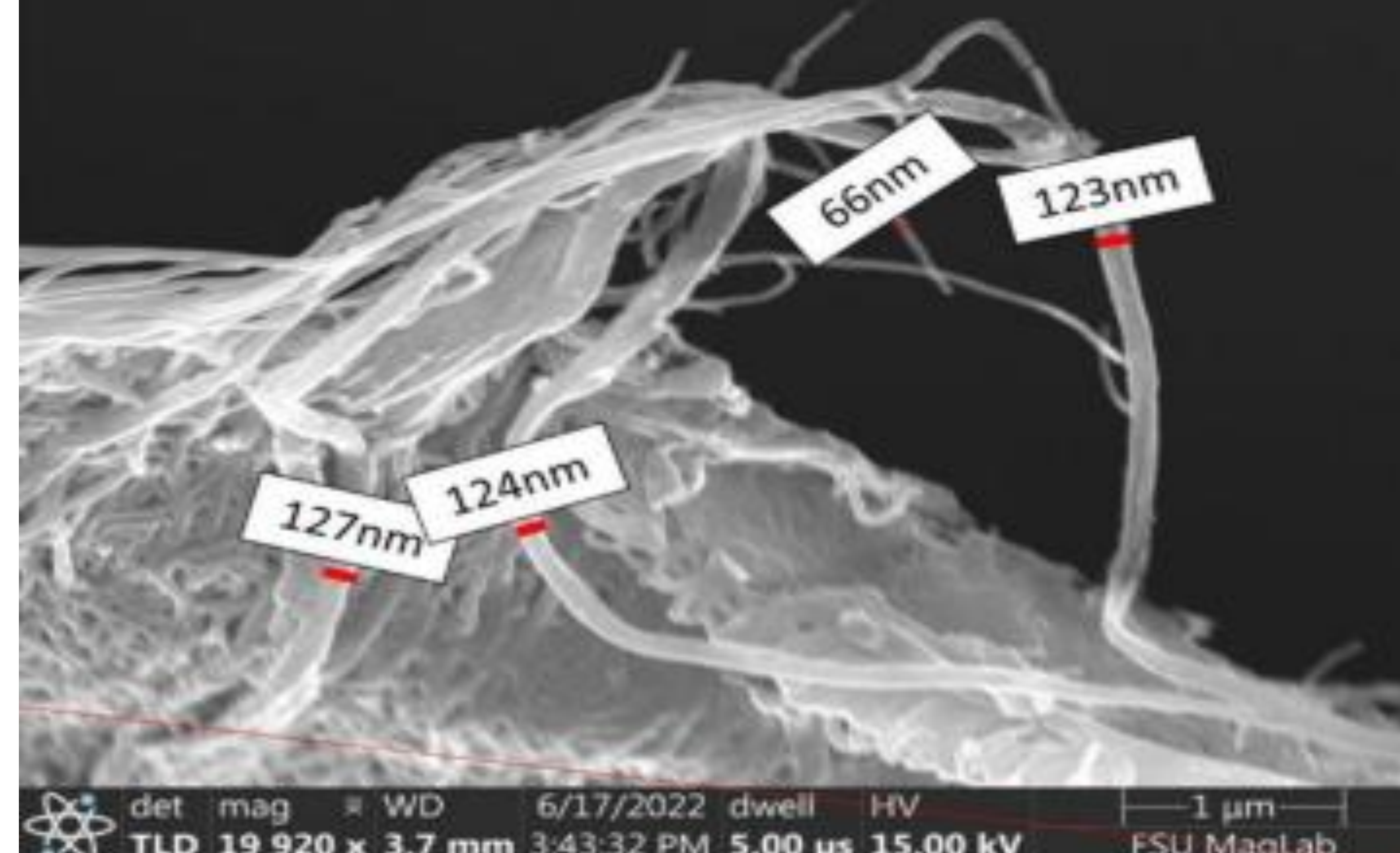
## Proposed Solution

### Carbon Nanotube Buckypaper Sensor



Low-power, Low-cost, and Low-profile

Buckypaper's network is sensitive to stress and strain.  
via Scanning Electron Microscopy



## Conclusion

- CNT-BP sensors are versatile and involve multiple modes of sensing.
- More than 8x more sensitive than commercial strain gauges.
- These sensors could be precursors to smart materials that will build smart cities.

## Future Works

CNT yarns are more covert and can be embedded into materials.

