
# McLAREN APPLIED TECHNOLOGIES

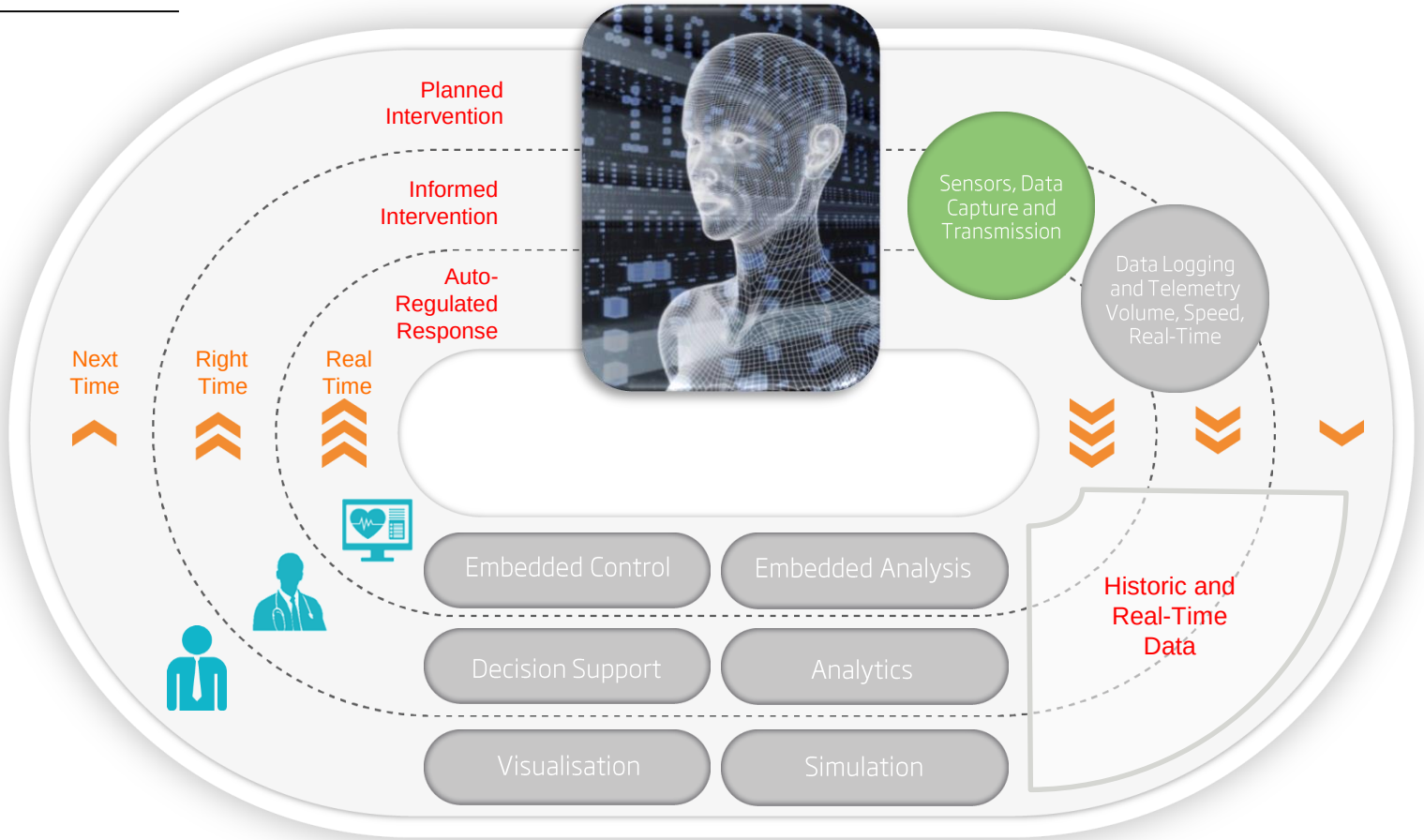
## Energy Harvesting Demands for Emerging Applications

## OUR FOCUS:
INDUSTRIES

# HEALTH
# MOTORSPORT
# AUTOMOTIVE
# PUBLIC TRANSPORT
# STRAREGIC PARTNERSHIPS



# CORE TECHNOLOGY PLATFORM



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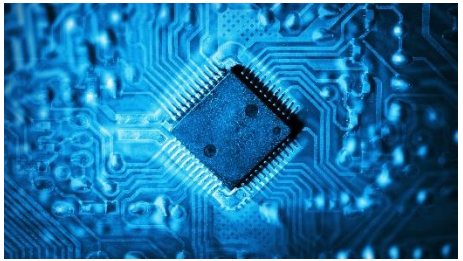
# CORE SKILLS **AND EXPERTISE**



## 1 HIGH PERFORMANCE DESIGN

Breaking boundaries in product design and performance

## 2 PERFORMANCE MANAGEMENT, SENSING AND CONTROL SYSTEMS

Delivering real-time insight and control into human and machine performance

## 3 SIMULATION SYSTEMS

Optimising design strategy & decision-making in complex environments

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# MOTORSPORT

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## MOTORSPORT:
## VIBRATION ENERGY HARVESTING FOR WIRELESS SENSORS

MEMS Based Energy harvesting device to scavenge vibration energy

Pressure monitoring system for harsh environment in motorsport.

We are in collaboration with UoC and half funded by Innovate UK.

Sensing exploitation routes in Motorsport, Automotive, Aerospace

**FORMULA 1 IS THE ULTIMATE TEST OF** TECHNOLOGICAL EXCELLENCE AND DRIVER SKILL

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# MOTORSPORT:
# VIBRATION ENERGY HARVESTING FOR WIRELESS SENSORS

## WHY?

- We will bring sensors closer to targets
- We can reduce wiring and weight
- Gain Vibration Energy Harvesting and power management knowhow
- MEMS design and discovery with miniaturisation of harvester
- Research of thin/thick film solid state batteries
- We will increase battery life of sensors
- Assembly and package customisation of dies
- Partnerships with relevant suppliers in:
  - MEMS Design
  - Miniaturisation of electronics
  - Package customisation and vacuum sealing
  - Usage of exotic substrates
  - Secondary solid state batteries

**FUELLING MOTORSPORT VICTORIES FOR** ALL TEAMS IN FORMULA ONE

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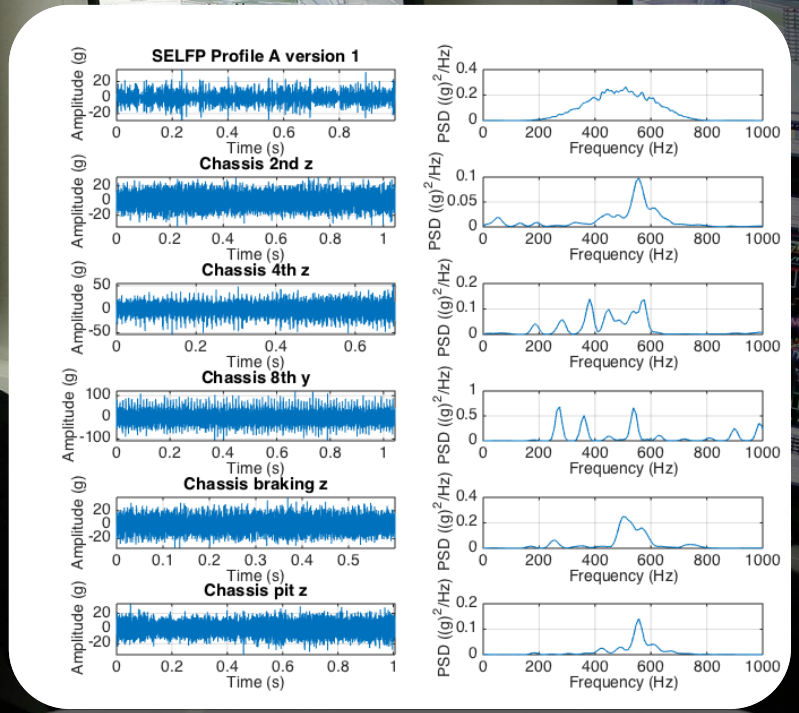
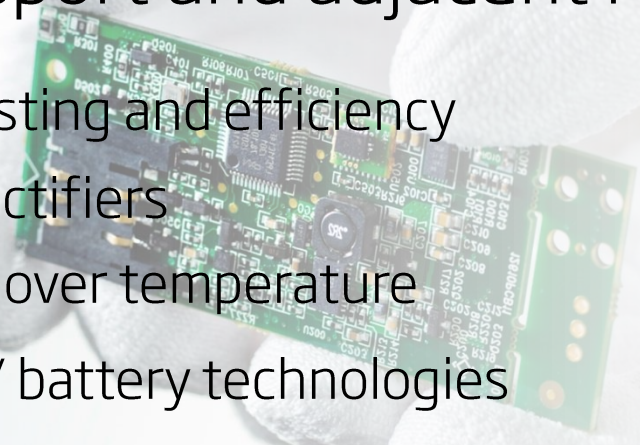
## MOTORSPORT:
## VIBRATION ENERGY HARVESTING FOR WIRELESS SENSORS

# WE MONITORED EVERY BREATH OF THE RACING CAR DEFINING THE FREQUENCY BANDWIDTH



**MOTORSPORT:**
**VIBRATION ENERGY HARVESTING FOR WIRELESS SENSORS**

# The **Challenge** of Energy Harvesting Motorsport and adjacent Markets:



| | |
|---|---|
| VALUE | Low Power harvesting and efficiency |
| PERFORMANCE | Optimisation of rectifiers |
| | Stable harvesting over temperature |
| DEPENDENCIES | Super capacitors / battery technologies |
| SIZE | Miniaturisation with battery integration |
| CONSIDERATIONS | Disposable materials and batteries |
| PRE REQUISITE | Quiescent current of ICs |

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# HEALTH AND WEARABLES

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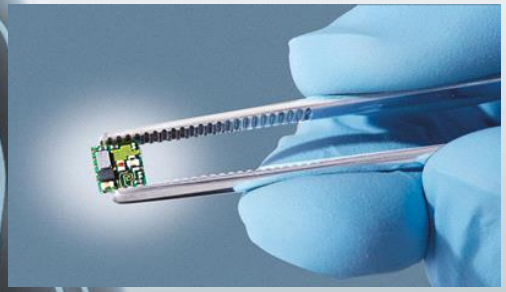
## HEALTH AND WEARABLES
HUMAN HEALTH

Introduction of bio-human energy harvesting for powering wearable devices brings a step change into digital health.

THE GOAL

"Fit and Forget."

# " WE MONITOR EVERY HEARTBEAT OF THE ENGINE.
WHY DO WE HAVE MORE DATA ABOUT MACHINE HEALTH THAN HUMAN HEALTH?"



## HEALTH AND WEARABLES
ENERGY RECOVERY & DEPLOYMENT

- Energy recovery is difficult and the cached energy is a precious resource.
- More complex than just achieving an energy balance over time.

- THE GOAL
- The harvested, cached and available energy is able to support the energy consumption *profile*.

- THE APPROACH
- Increase energy harvesting performance.
- Increase energy consumption efficiency.
- Increase converter efficiency.
- Match energy cache capacity and delivery to the application.
- Decrease leakage & standby loads.

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## HEALTH AND WEARABLES
## THE CHALLENGE

Humans operate at a constant temperature, live in a sympathetic temperature controlled environment, and avoid mechanical shocks and strong electromagnetic fields.

### THE GOALS

Effective recovery of energy from the human body and environment.

Bio and Eco-friendly technologies.

Low cost technologies that are suited to population scale manufacture.

Ability to support the application's energy consumption profile.

Protection of the cached energy from loss.


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CAN IT BE DONE?
DEFINITELY