FatigPro
Structural Health Monitoring Sensor

EARLY WARNING SAVES LIVES

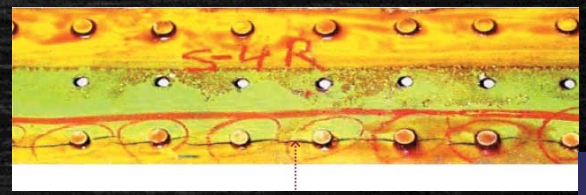
Metal Fatigue – a huge problem

90% of all industrial accidents are caused by metal fatigue

Boeing 777: Signs of 'metal fatigue' found on Denver plane engine

23 February

Welcome to BBC News, your most trusted news source.



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26 SEP 2019 | Cessna 210 Crash – Metal fatigue still an insidious threat

26TH SEPTEMBER 2019 / ARTICLES

Why metal fatigue is a problem?

- Insidious…. You don't see any change until it is too late

https://youtu.be/hASl6d3z3BM

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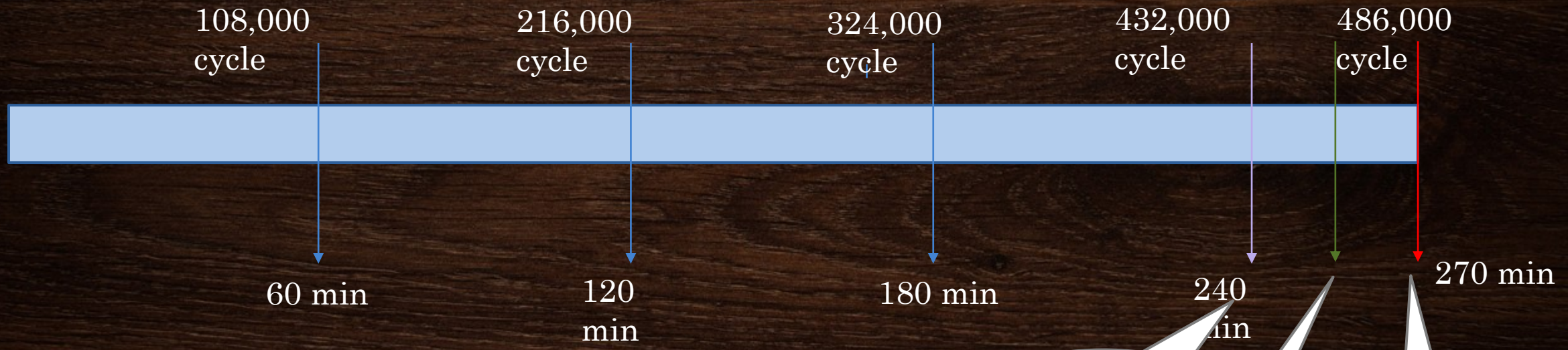
What is happening?..shown in true scale



Test is running at 30 Hz for 4.5 hours at 20 KSI

KSI: kilopound per square inch
1 KSI= 6.89 MPa

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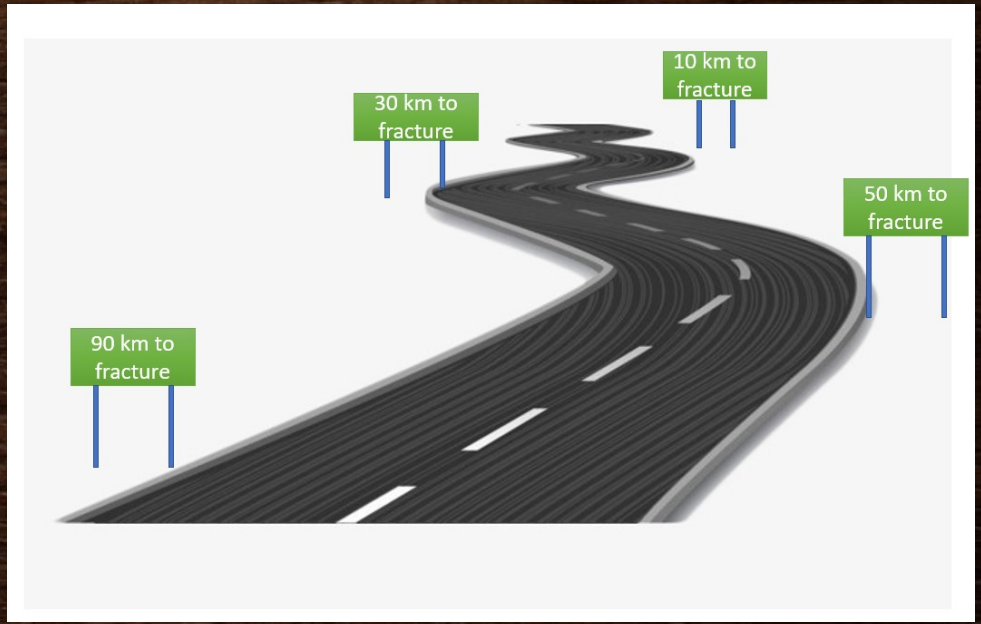
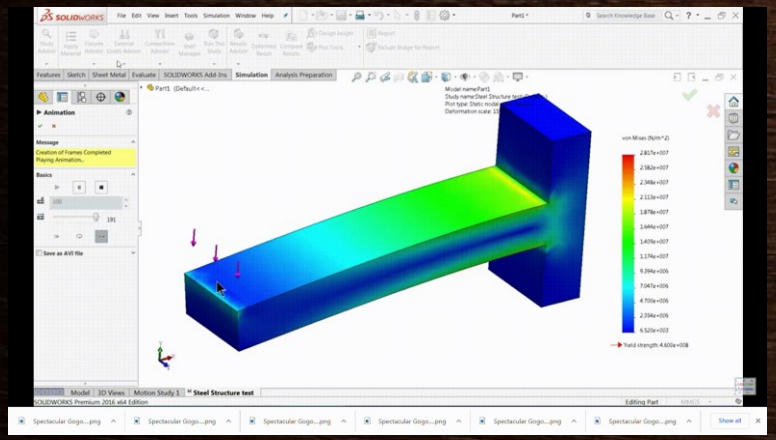
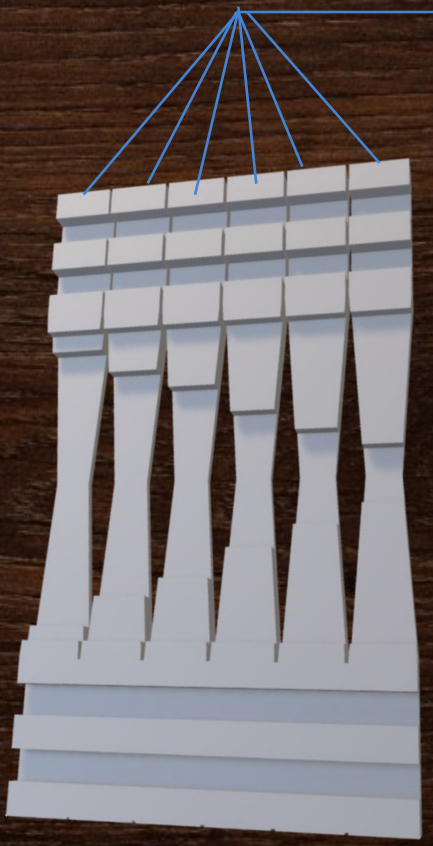
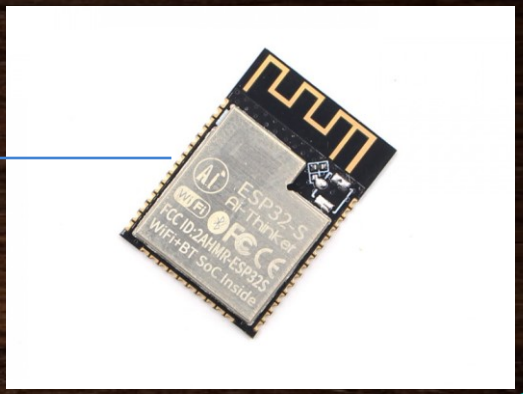
What is our solution? FatigPro

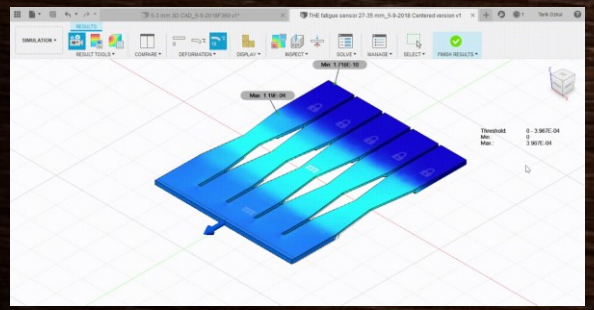
- A sensor to track fatigue life of the structural parts,
- Sensor is attached to critical locations just like strain gauge,
- Gives feedback as part reaches 10%, 50%, 70%, 80%, 90% of fatigue life,
- Works like mileage signs,
- No estimation, based on true load,
- Works without battery











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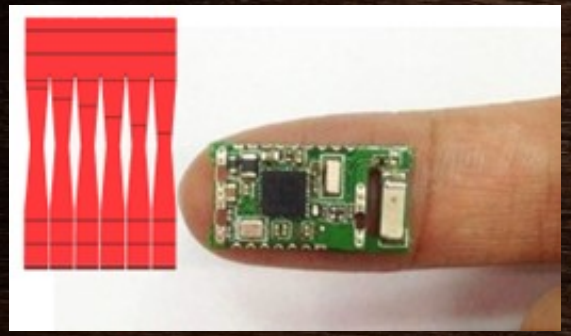

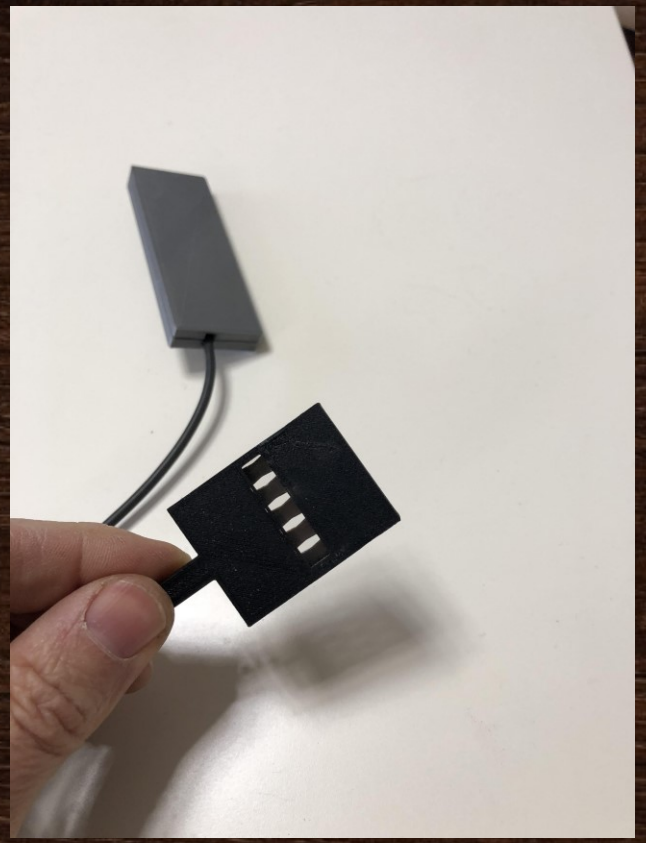

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How it works?

- FatigPro™ monitors fatigue aging of structures using “notched beam” technology. This is our patented technology but technology is well-known, tested extensively and proven in the lab and in the field by independent researchers.

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US008746077B2

(12) **United States Patent**
Ozkul et al.

(10) **Patent No.: US 8,746,077 B2**
(45) **Date of Patent: Jun. 10, 2014**

(54) **WIRELESS ENABLED FATIGUE SENSOR FOR STRUCTURAL HEALTH MONITORING**

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(73) Assignee: **Tarik Ozkul**, Istanbul (TR)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 269 days.

(21) Appl. No.: **13/320,937**

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§ 371 (c)(1),
(2), (4) Date: **Nov. 17, 2011**

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PCT Pub. Date: **Jul. 21, 2011**

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(51) **Int. Cl.**
G01N 3/32 (2006.01)

(52) **U.S. Cl.**
USPC **73/810**; 73/830

(58) **Field of Classification Search**
USPC 73/810, 821, 830, 834–835, 845
See application file for complete search history.

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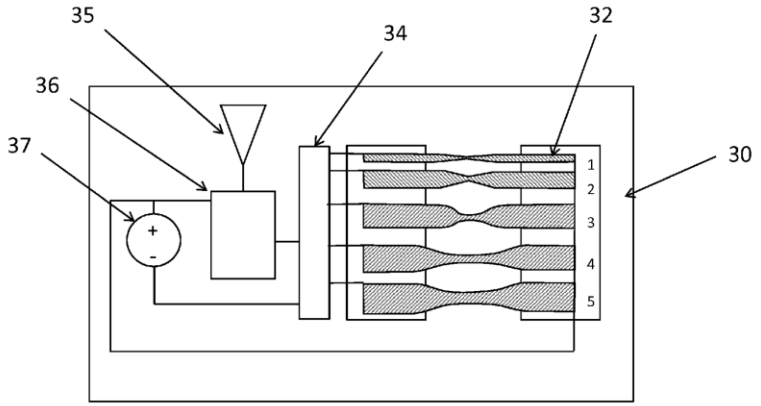
(74) *Attorney, Agent, or Firm* — Cesari and McKenna, LLP

(57) **ABSTRACT**

A fatigue sensor for monitoring the health state of structural members is disclosed. The sensor has multiple parallel beams, each sensitive to different levels of fatigue, that are designed to fail prematurely but progressively as the sensor goes through the same fatigue cycles as the structural member it is attached to. Whenever fatigue levels on a particular beam of the sensor exceed the engineered number of fatigue cycles, that particular beam fails and sensor electronics can detect that failure and transmit this information wirelessly when interrogated by an external interrogator. Having multiple beams that fail after different numbers of fatigue cycles enables the health state of the structural member to be monitored, in that unlike normal fracture sensor that sense failure of the structural members after the actual fracture event, the present invention is capable of sensing imminent failure of the structural member before the actual failure occurs.

18 Claims, 6 Drawing Sheets



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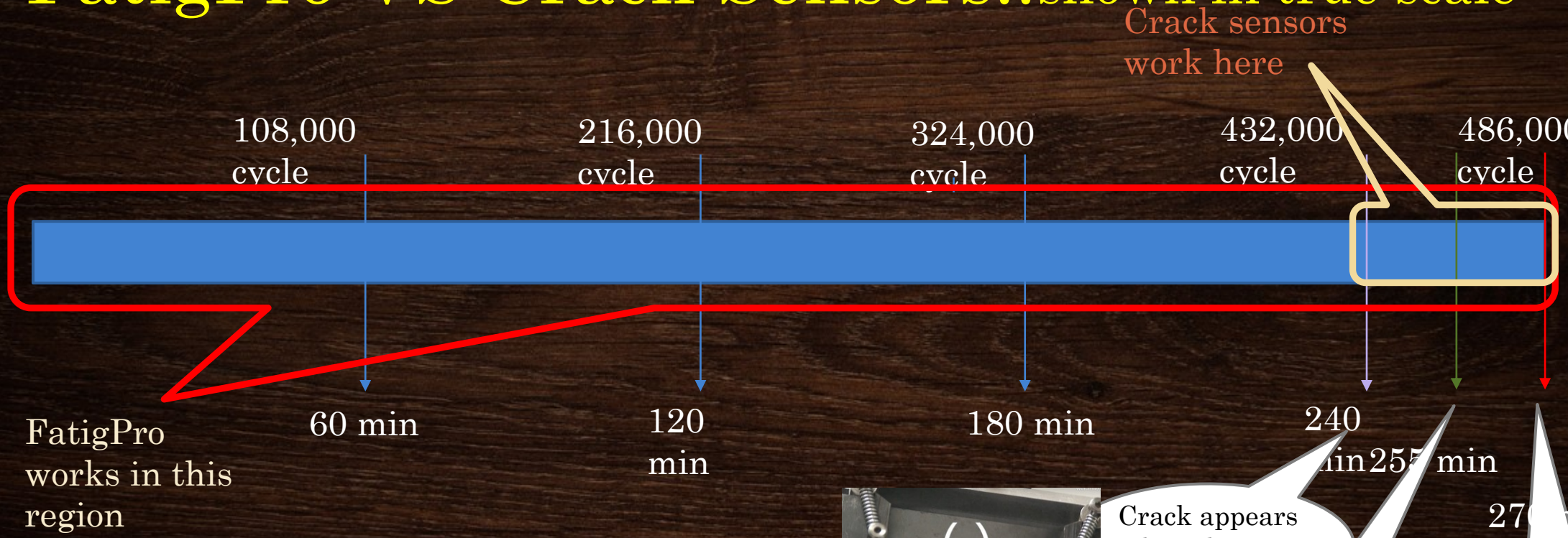
FatigPro VS Crack Sensors..shown in true scale



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What do sensors say?...shown in true scale

Crack Sensor: Your crack is growing!

Crack sensor: Your crack is growing bigger!

Crack Sensor: You got a crack!

108,000 cycle

216,000 cycle

324,000 cycle

432,000 cycle

486,000 cycle

FatigPro: 10% life is gone

60 min

FatigPro: 50% life is gone

120 min

FatigPro: 70% life is gone

180 min

FatigPro: 80% life is gone

240 min

255 min

FatigPro: 90% life is gone

Crack appears but almost invisible

Crack becomes visible

270 min

Total failure

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Milestones of FatigPro

- May 2018 Startup
- November 2018: Selected to Hello Tomorrow 500 Deeptech,
- February 2019: Eurotunnel tech. competition winner,
- May 2020 TET R&D Winner first place,
- November 2020 THY TECHNIC Part 21 procedure
- December 2020 NDA with BOEING for adapting to aircraft,
- February 2021 TAI collaboration on testing

Designer Team

Prof. Dr. Tarik Ozkul

- EE PhD Florida Tech
- TURKSAT R&D Director Director,
- 50+ patents,
- 60+ products

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