BioSentinel: Developing a Space Radiation Biosensor

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BioSentinel is an autonomous fully self-contained science mission that will conduct the first study of the biological response to space radiation outside low Earth orbit (LEO) in over 40 years. The 4-unit (4U) BioSentinel biosensor system, is housed within a 6-Unit (6U) spacecraft, and uses yeast cells in multiple independent microfluidic cards to detect and measure DNA damage that occurs in response to ambient space radiation. Cell growth and metabolic activity will be measured using a 3-color LED detection system and a metabolic indicator dye with a dedicated thermal control system per fluidic card.

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Ames Research Center

Readiness level:
- ☐ TRL 1-3: Concept
- ☑ TRL 4-6: Prototype
- ☐ TRL 7-9: Demonstrated

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Technology / Application

BioSentinel will help fill Strategic Knowledge Gaps in radiation effects on biology

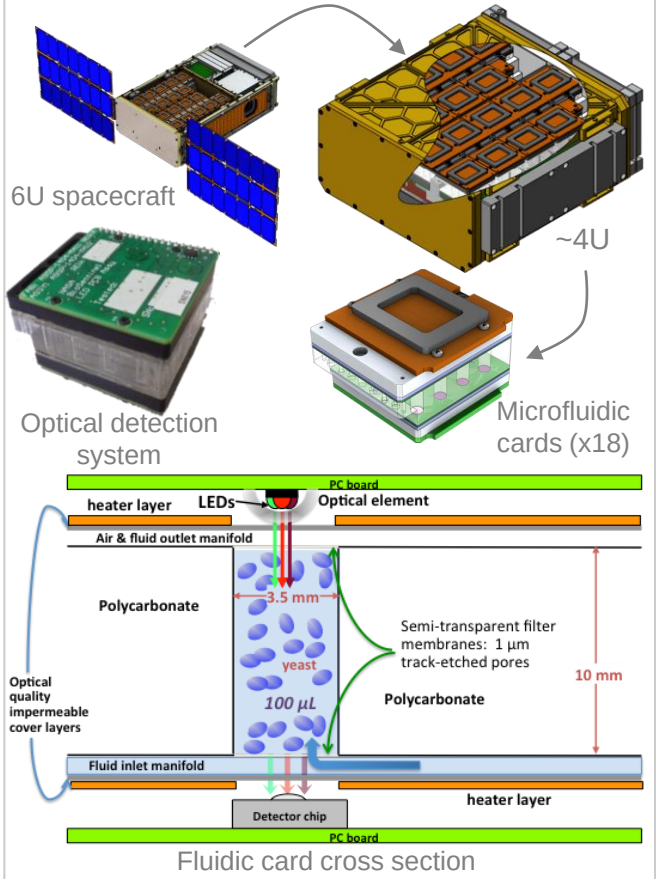
-Mission goals: develop deep space NanoSat capability (beyond LEO) & a radiation biosensor compatible with multiple platforms

Objectives: Quantify DNA damage generated by deep space radiation by using different cell strains
Correlate biological data with onboard dosimeter data

Applications: Support biology in stasis (4-8˚ C) and during cell growth (15-23˚ C)
Detection of cell growth & metabolic activity via optical measurements

Instrument: ~4U hermetically sealed vessel; 6-8 kg; 5-8 W power
18 microfluidic cards (each with 16 independent wells)
Dedicated 3-color LED detection system per well
Dedicated thermal control system per card
Temperature, pressure, and humidity sensors

Challenges: Thermal environment pre and post launch
Up to 24 months of cell stasis



Fluidic card cross section

Funding / Timeline

- Scheduled to fly onboard SLS EM-1 in mid 2018 (beyond LEO; 12-18-month mission)
- Funded for development, test, integration, and delivery for spaceflight by NASA AES Program

POC

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