

# NASA EPSCoR – Structural Health Monitoring and Self-Healing of Aerospace Structures

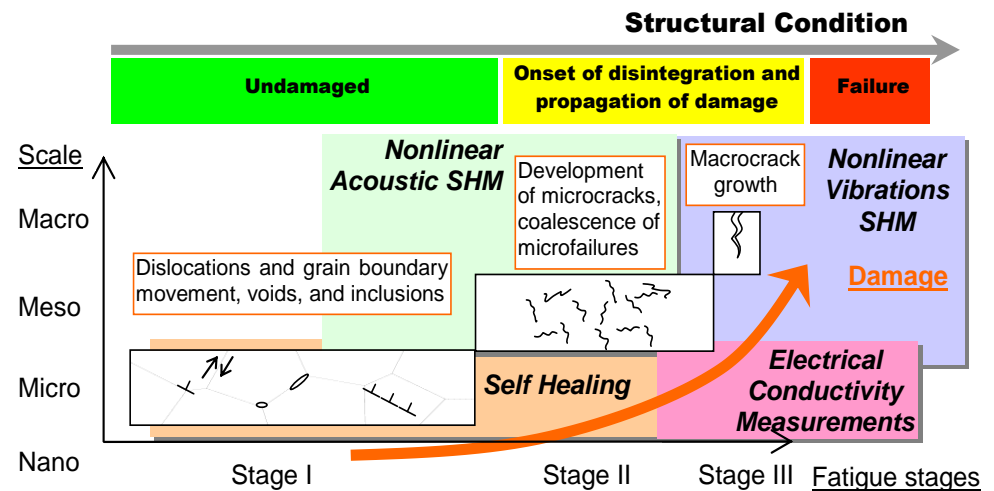
PI: P. Hynes; Technical PI: T. Burton  
NMSU co-PI's: I. Sevostianov, E. Butcher  
NMT co-PI's: S. Bahktiarov, A Zagrei

Award: \$741,144 for period 10/2007 – 9/2010

## Objectives

Develop vibration, micromechanics, and acoustic methods to find and characterize structural damage in aerospace structures

Develop materials that will automatically “self-heal” when damaged



Damage accumulation in a structural system and the SHM methodologies associated with particular damage scales.

# SHM - Technical approaches

- Vibration based SHM (low frequency)
  - Cross property connections
  - Nonlinear ultrasonic SHM (high frequency)
  - Self-healing systems
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- Integration into overall SHM methodology

# Types of damage considered

- Micro-damage (distributed): micro-cracks, fatigue
- Macro-damage (localized): macro-cracks, joint/connection damage
- Individually and in combination

# Leveraging

- 100 % NMSU/NMT cost share

## Follow-on Grant Proposals Funded

- *Development of a Novel Methodology for the Health Monitoring and Self-Healing of Structural Elements and Joints*, Los Alamos National Laboratories, \$135,000 (NMSU share \$121K), Sep. 1, 2008-Aug. 30, 2010, PI: Eric Butcher.
- *An Integrated Framework for Order Reduction, Robust Control, and Real-Time Dynamic Substructuring of Nonlinear Multi-Scale Hybrid Aerospace Systems*, DOD, \$513,385, May 8, 2009-May 7, 2012, PI: Eric Butcher.

# Graduate Students

- Akshin Bahktiarov (PhD) – funding: NASA Fellowship
- Ma'en Sari (PhD) - funding: NMSU cost-sharing)
- Mohammad Al-Shudeifat (PhD) – funding: NMSU cost-sharing)
- Shahab Torkamani (PhD) – funding: NMSU Graduate Research Enhancement Grant)
- Julie Mercer (MS) – funding: NASA EPSCoR
- Krystal Deines (MS) – funding: NASA EPSCoR

## **Goals: end of year 2 (Sept. 2009)**

- Continue to progress in technical areas
- SHM validation experiments operating: individual and combined damage.
- Internal collaborations: 1) validation experiments; 2) fatigue assessment - electrical conductivity & vibration
- Integration framework and “method validation” roadmaps
- NASA collaborations, site visits
- IGERT plan specified for NSF leveraging
- US Student recruiting and outreach

# **Publications to date supported by this grant**

- Journal: 7 published; 2 in press
- Conference: 8 published/presented