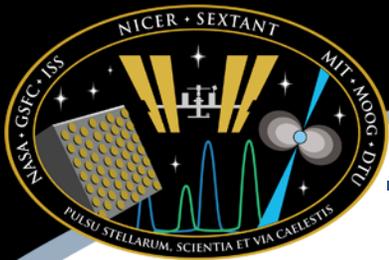


# NICER

Neutron star Interior Composition Explorer

## NICER Mission Overview and Lessons Learned *Keith Gendreau* NASA/GSFC





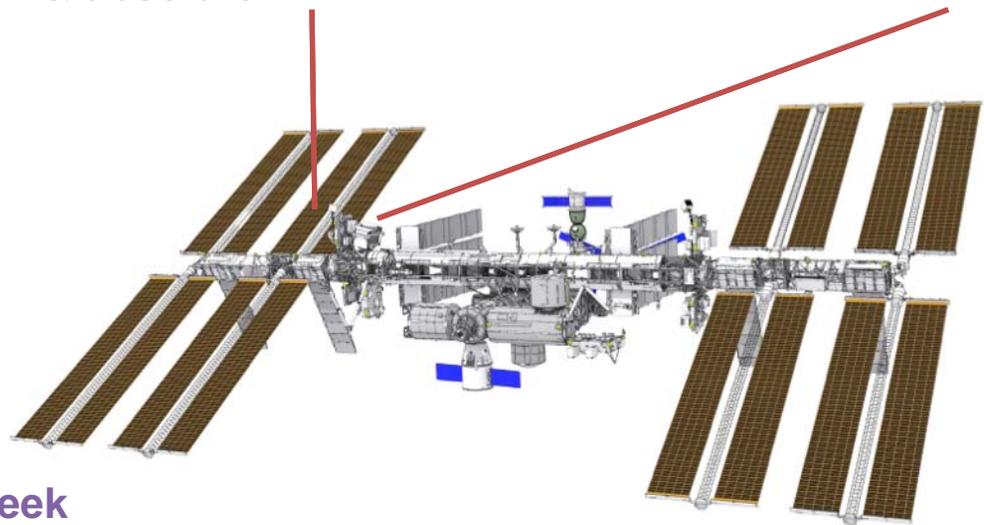
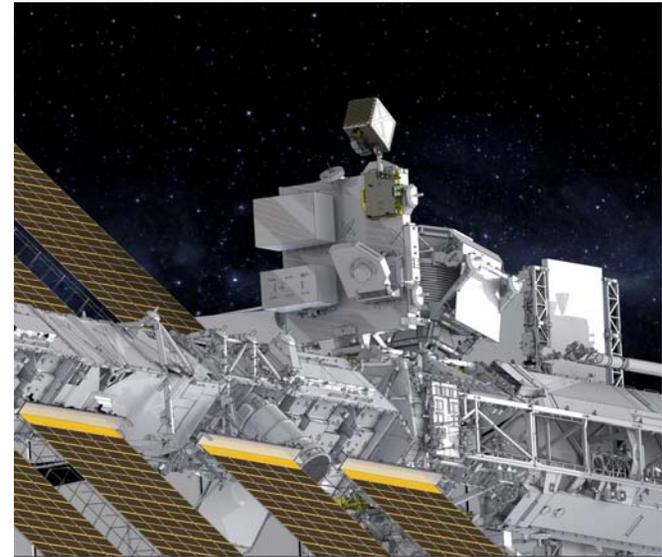
## *Agenda*

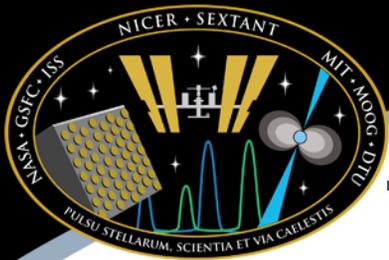
- **Mission Overview**
- **A selection of Lessons Learned with NICER**
  - **Team dynamics**
  - **Testing vs Analysis**
  - **Maintaining Schedule**



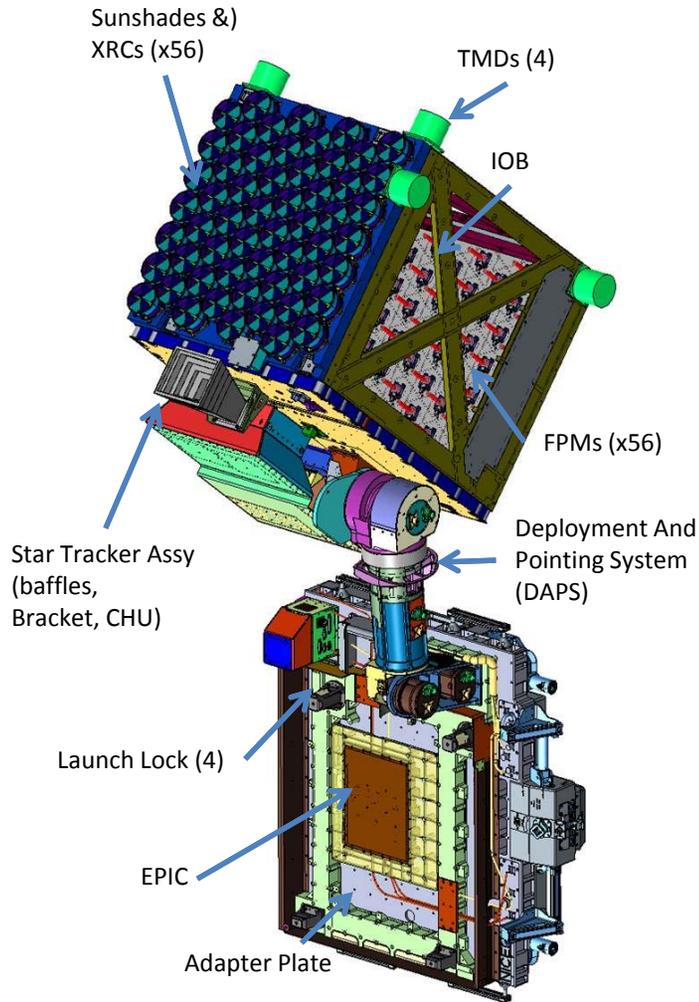
## An Astrophysics Mission of Opportunity on the International Space Station

- **Science:** Understanding ultra-dense matter through observations of neutron stars in the soft X-ray band
- **Launch:** August 2016, **SpaceX-11** resupply
- **Platform:** ISS ExPRESS Logistics Carrier (ELC), with active pointing over nearly a full hemisphere
- **Duration:** 24 months including **Guest Observer program**
- **Instrument:** X-ray (0.2–12 keV) “concentrator” optics and silicon-drift detectors. GPS position & absolute time reference
- **Mission Class D**
- **Enhancements:**
  - Guest Observer program
  - Demonstration of pulsar-based spacecraft navigation
- **Status:**
  - Completed Successful EMI/EMC
  - Payload Vibe and Acoustic this week
  - KDP on January 28<sup>th</sup>





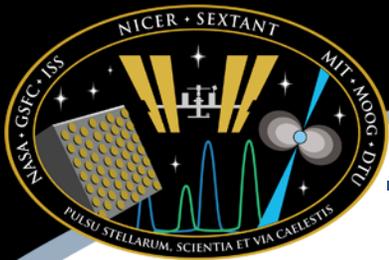
# The NICER Payload





# *NICER Team Dynamics*

- **PI picks a team which has diversity**
  - A mix of conservative people and “cow boys”
  - People who can get along together or the PI can bridge
- **PI is active in ALL aspects of NICER development**
  - PI could be a technician, manager, or resource analyst
- **PI makes decisions very quickly**
  - Generally in less than 1 week and sometimes immediately, but only after considering all choices and hearing all the sides
  - There are risks associated with most decisions- Track and manage those risks
- **NICER focuses on mitigations to risks and healthy risk processes**
  - Entire team is involved
  - Risks are actively tracked and updated monthly
- **Team is mostly co-located when possible**
- **Major re-direction is done in person**

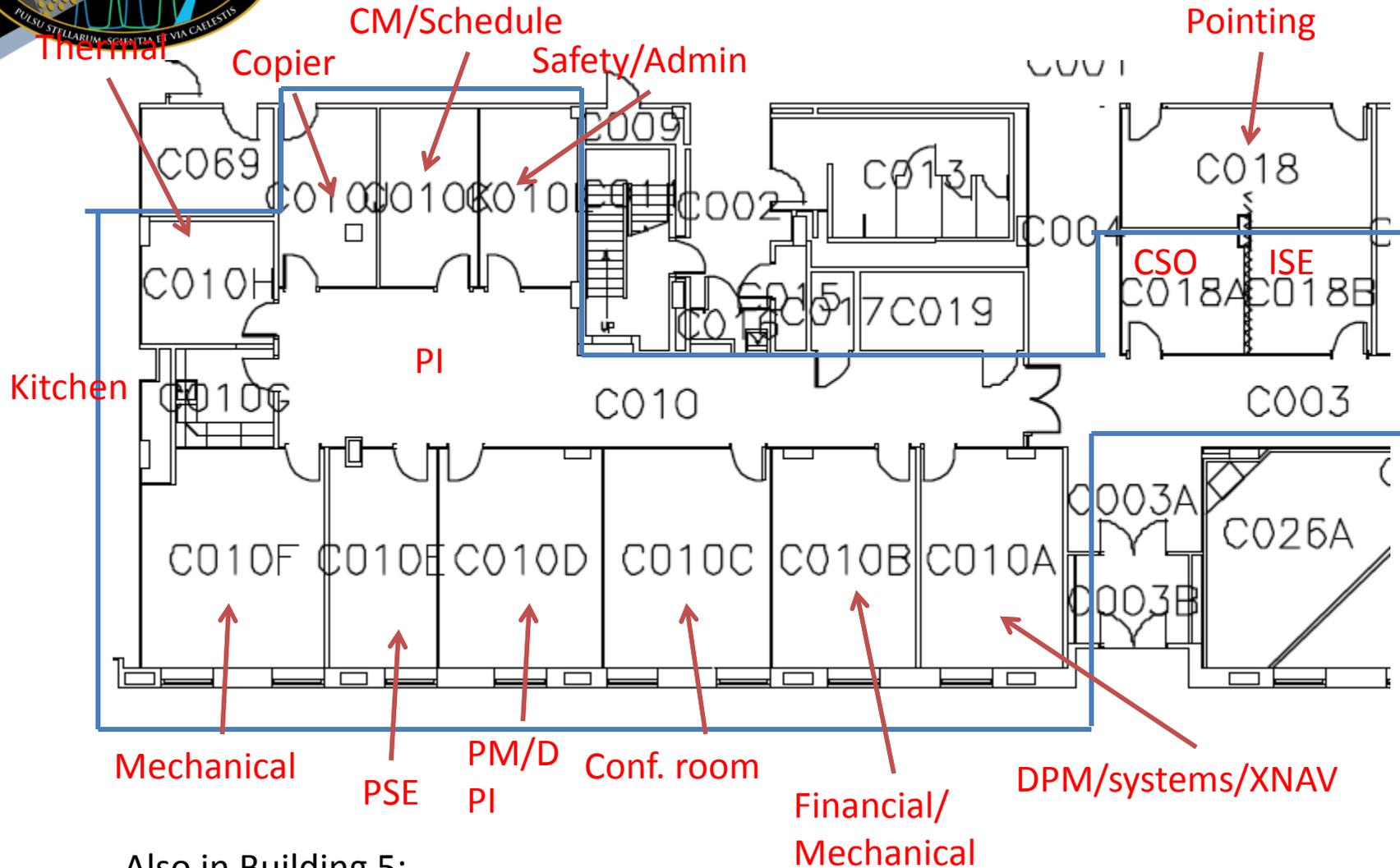


## *Co-Location of Core Team -> Success*

- Early in Phase B, NICER was given the opportunity to co-locate all key players
  - Building 5 at GSFC is centric to most NICER labs and already had a number of thermal/mechanical/I&T personnel located there
  - Locating core team in B5 C010 and nearby offices has allowed for very clear communication
    - Minimizes misunderstandings, wasted effort
    - Reinforces “team” concept and an understanding of roles and responsibilities
- Keeps costs down and ensures success**

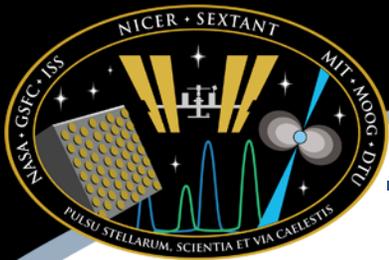


# NICER HQ in Building 5: Success through Communication



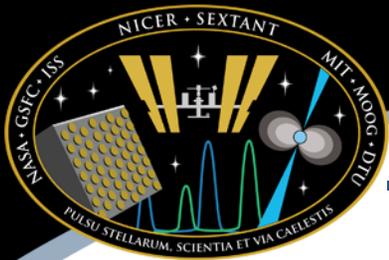
Also in Building 5:

XTI Integration tent, Mechanical analyst, Thermal Analyst, Additional Mechanical Design, I&T office



# *Analysis versus Test*

- Often the cheapest way to meet/verify a requirement is to build an Engineering model or demonstration unit using inexpensive parts and try and demonstrate meeting the requirement
  - NICER XRC alignment and mounting system was developed this way using MANY ETUs and vibration tests
- Performing extensive analysis on things that could be built and tested is often the most expensive and can lead you wrong
  - NICER use of Frangibolts went this way and cost us dearly by moving what should have been a simple and straightforward solution to the critical path
- Iterating on the engineering model and testing should arrive at the optimum solution and highest confidence of flight build success for the least money
- Build engineering models for all difficult analytical problems



## *Importance of Maintaining Schedule*

- **NICER strove to maintain its schedule presented in its step 1 proposal : Time is money**
  - Develop “road to PDR / CDR” plan to ensure leads understand success criteria and provide appropriate analysis, testing and documentation to pass reviews
- **Setup partnerships with all contractors in Phase A**
- **Plan extensively for long lead procurements**
- **Anticipate problems**
  - Enabled contractors to work BEFORE government shutdown
- **Be aggressive**
  - NICER held an SRR in Phase A
  - NICER presented with real ISS problem and proceeded with an aggressive plan to overcome so that mission CDR was impacted