34 Years Creating and Constructing Space Systems

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Texas A&M Cyclotron REU Career Day

15 July 2015

Overview
of
Education and Career

Education

- BA in Physics – Rice (1965)
- MS and PhD in Physics (1968,1970) – Texas A&M
- Post-Doctoral Research (1970-1974) – Stanford
- Executive Program in Management (1989) – UCLA Anderson Graduate School of Management

Non-Academic Employment

- Applications Consultants Inc.
  - Full-time during two summers, before and after first year at A&M
- Northrop Grumman (originally TRW)
  - 29 years
- West Wind Engineering
  - 5 additional years part-time for Northrop Grumman, by contract for management and technical services

26 years of education (K through post-doc) led to 34 years of exciting, enjoyable, rewarding work creating and constructing space systems

Key Decisions

- Undergraduate school – UT-Austin or Rice
- Summer job – IBM or Applications Consultants
- Graduate school – Rice (in physics or space science) or Texas A&M
- Post-Doctoral – University of Pittsburg, UC Berkeley or Stanford
- Post-Post-Doctoral – Stanford, Varian (Medical Systems), SAIC (instrumentation), SAIC (underground testing) or TRW

Relevant Space Systems

- High Energy Astronomy Observatories (HEAO)
  - Three missions to detect or image cosmic rays, x-rays and gamma rays
  - Several instruments were down-sized or eliminated in restructuring
- NASA's Great Observatories
  - Four missions: Hubble (visible), Compton (gamma-ray), Chandra (x-ray) and Spitzer (infrared)
  - Compton and Chandra are successors to HEAO
  - Hubble and Compton designed for on-orbit servicing (Hubble 5 times)
  - Restructuring eliminated servicing for Chandra
- James Webb Space Telescope (JWST)
  - Successor to Hubble
  - Infrared to accommodate Doppler redshift for objects at large distances and to view objects masked by dust clouds
  - Will operate in a halo orbit at Lagrange point L2, 1.5 M kilometers from earth, to enable passive cooling to less than 50 Kelvin

Relevant Space Systems (continued)

- Solar Maximum Mission (SMM)
  - For solar physics studies around the time of greatest solar activity
  - Designed for on-orbit servicing by Shuttle (1 time)
  - Same serviceable subsystem design was used for Compton
- National Polar-orbiting Operational Environmental Satellite System (NPOESS)
  - A unified successor to POES for DoC (NOAA) and DMSP for DoD
  - Renamed Joint Polar Satellite System (JPSS) after restructuring

Applications Consultants, Texas A&M and Stanford

1965-1974

- 1965-1967 Applications Consultants
  - Developed numerical surface techniques application software package, written in assembly language, for contract with IBM
- 1965-1966 Texas A&M Physics Teaching Assistant
  - Modern physics laboratory for electrical engineering students
- 1966-1967 Texas A&M Graduate College Fellowship
- 1967-1970 Texas A&M Cyclotron Research Assistant
- 1970-1974 Stanford Physics Research Associate
  - Co-Investigator for Energetic Gamma-Ray Experiment Telescope (EGRET) for HEAO (subsequently Compton)
  - Participated in development and testing of 30-inch diameter NaI(Tl) scintillation detectors
  - Participated in experiment development and testing at HEPL, SLAC, SPEAR, and Fermi NAL

Research Topics at Texas A&M

- MS: Range and Stopping-Power for Heavy Ions
  - Developed methodology for interpolating and extrapolating existing experimental data to produce tables of range and stopping-power for ions of all atomic numbers from 1 to 103, at 38 energies from 0.0125 to 12 MeV/amu, in 12 solids, 9 gases and 3 compounds
- PhD: Three-Body Breakup in Deuteron-Proton Scattering
  - Determined total cross section for three-body breakup of 58 MeV deuterons on protons using 59 scintillation detectors on a spherical chamber to take proton-proton coincidence data simultaneously at 208 pairs of angles

Cyclotron Spherical Scattering Chamber

First 32-inch NaI(Tl) Crystal

The first 32 inch diameter NaI(Tl) crystal. Pictured from left to right are Dr. Swinehart, Ed Jablon, Joe Knaus and Marko Sfilgoi.

EGRET

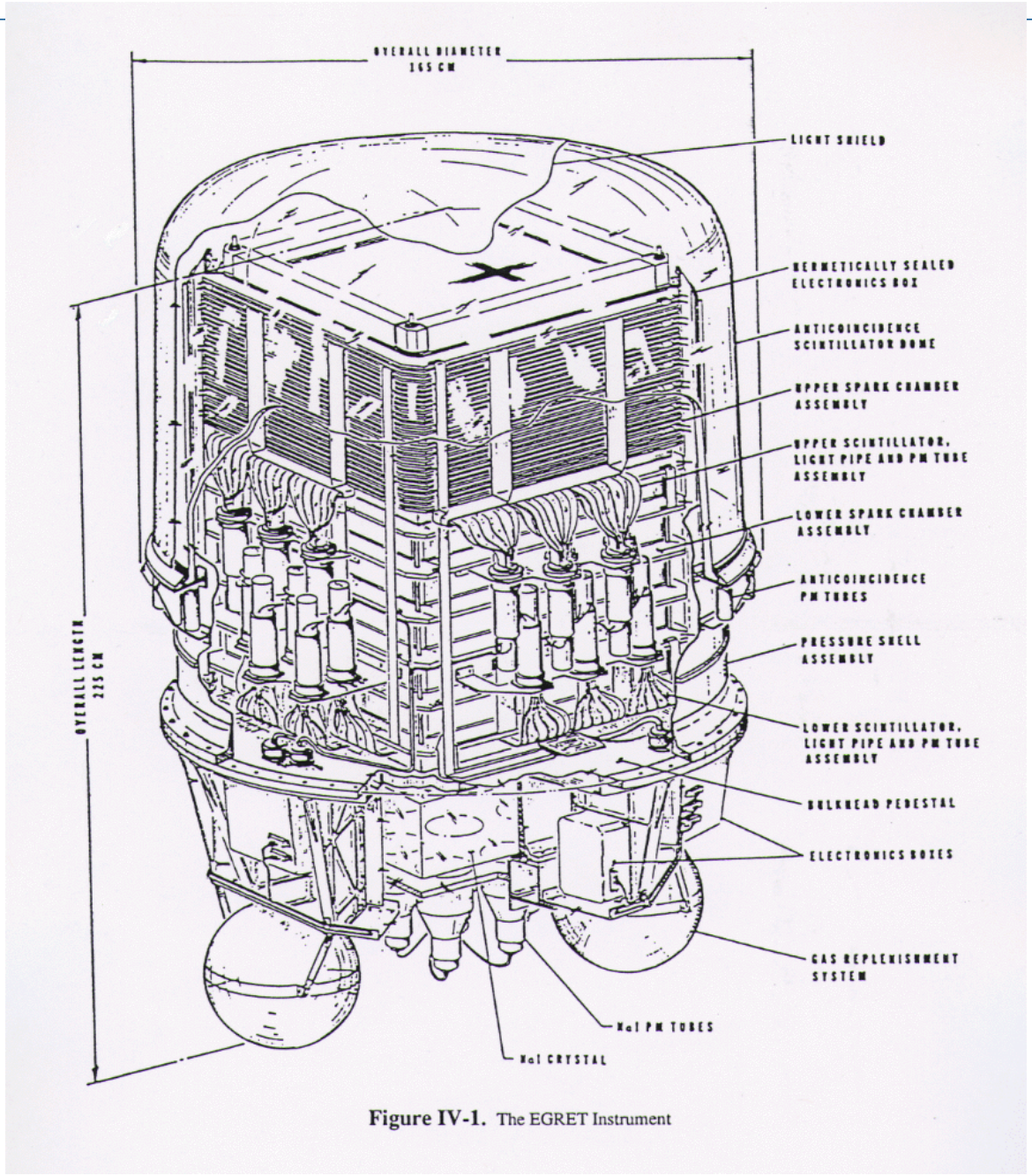


Figure IV-1. The EGRET Instrument

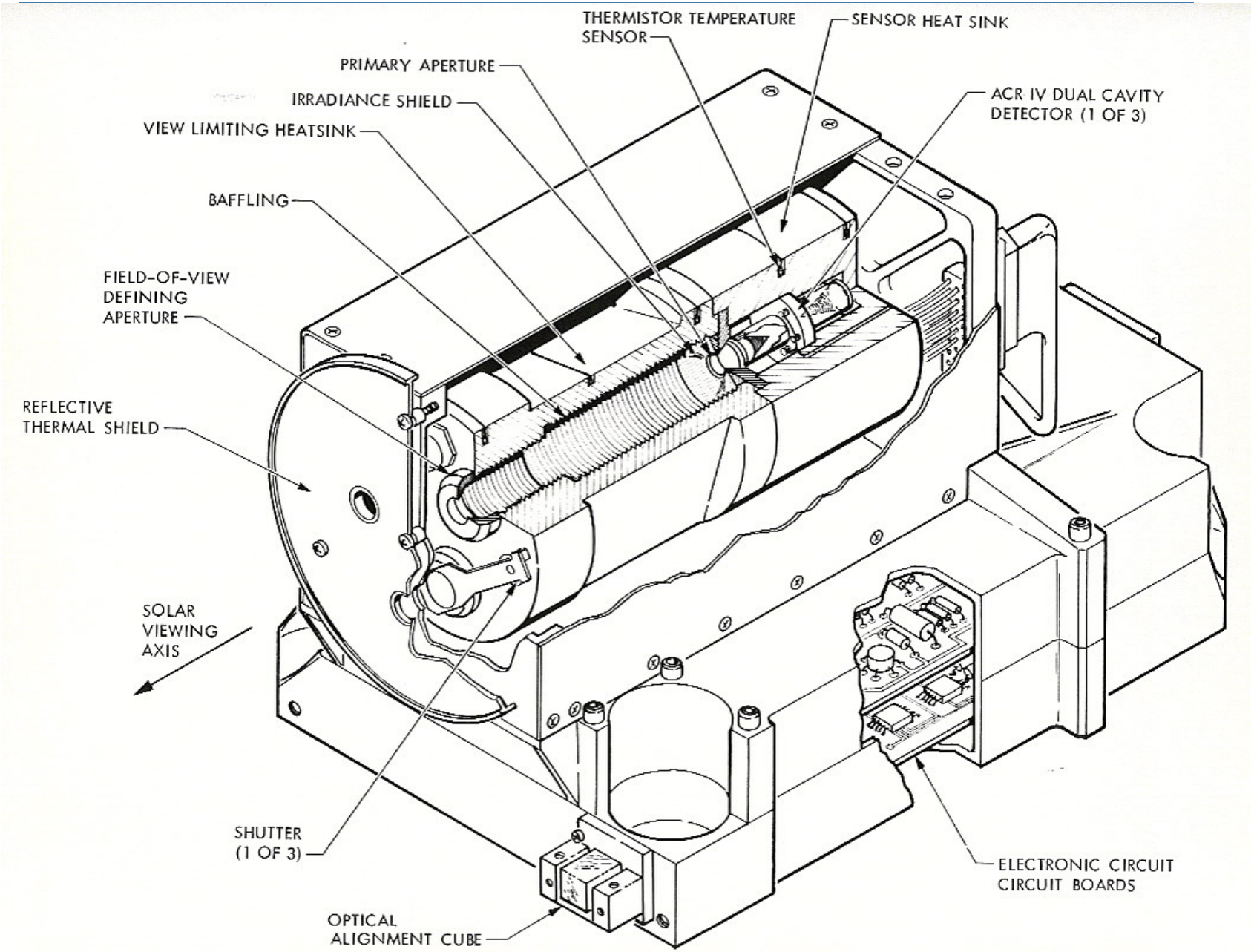
TRW / Northrop Grumman

1974-1979

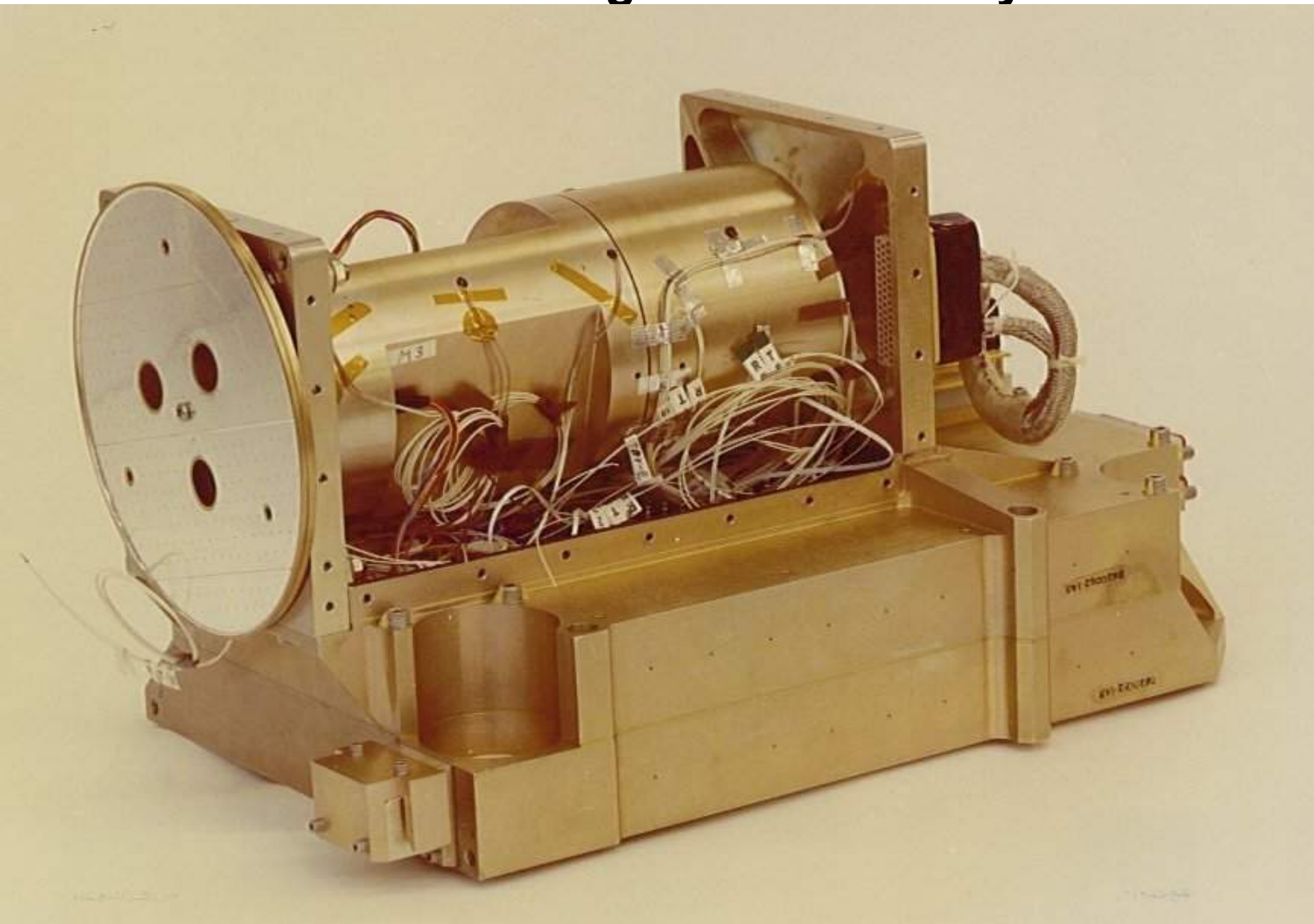
Applied Technology Division

- 1974-75 Member of Technical Staff
  - Designed collimator and shielding for micro-channel-plate sensor of the UV Spectrometer for the1976 Mariner Jupiter-Saturn mission
  - Participated in developing designs for a Nephelometer and a Cloud Particle Size Spectrometer for the 1978 Pioneer Venus mission
- 1975-77 Section Head for Sensor Systems, Section Head for Systems Engineering
  - Systems Engineer for Atmospheric Cloud Physics Laboratory to be installed in a Space Shuttle experiment rack
- 1977-1979 Project Manager for Active Cavity Radiometer Irradiance Monitor (ACRIM)
  - Development unit for sounding rocket flights from White Sands
  - Flight unit for the 1980 Solar Maximum Mission

ACRIM


THERMISTOR TEMPERATURE SENSOR
SENSOR HEAT SINK
PRIMARY APERTURE
IRRADIANCE SHIELD
VIEW LIMITING HEATSINK
ACR IV DUAL CAVITY DETECTOR (1 OF 3)
BAFFLING
FIELD-OF-VIEW DEFINING APERTURE
REFLECTIVE THERMAL SHIELD
SOLAR VIEWING AXIS
SHUTTER (1 OF 3)
OPTICAL ALIGNMENT CUBE
ELECTRONIC CIRCUIT CIRCUIT BOARDS

ACRIM During Final Assembly



1979-1980

Systems Engineering and Integration Division

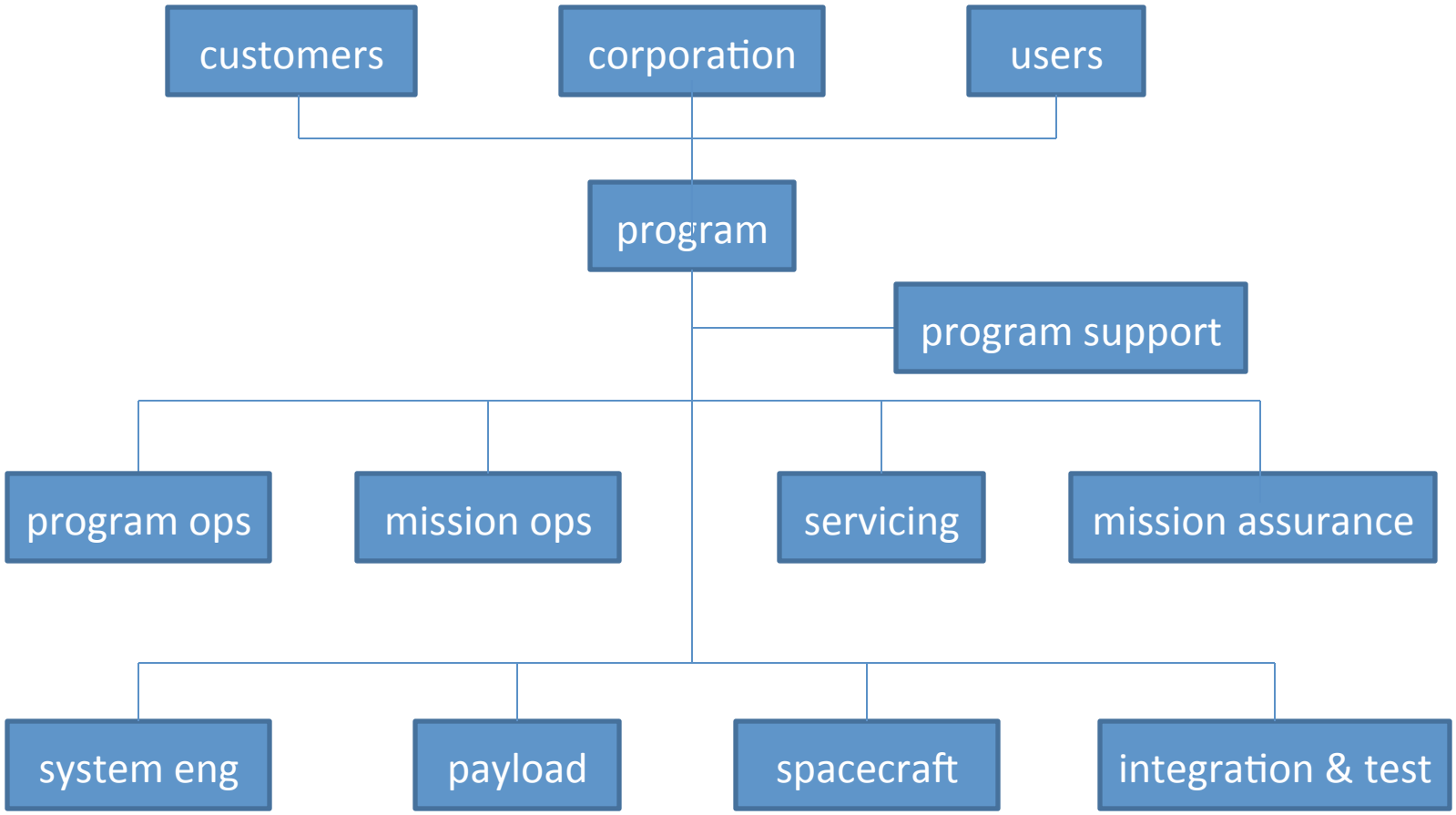
- Manager of Systems Development Department
  - Responsible for winning/performing contracts for development of tactical simulation systems for training Army and Air Force personnel
  - Responsible for hiring/staffing to support software development and system integration work packages from other contracts
  - Responsible for microcomputer development laboratory

1980-1988

Space Systems Division

- 1980-83 Capture Manager for Chandra Formulation Phase
- 1980-82 Advanced Systems Manager for Scientific Spacecraft
- 1982-83 Chief Systems Engineer for Scientific Spacecraft
- 1984-85 Business Area Manager for Space Flight Systems and Technology
- 1985-88 Program Manager for Chandra Formulation Phase contract and Capture Manager for Implementation Phase

Example of a Program Organization Chart



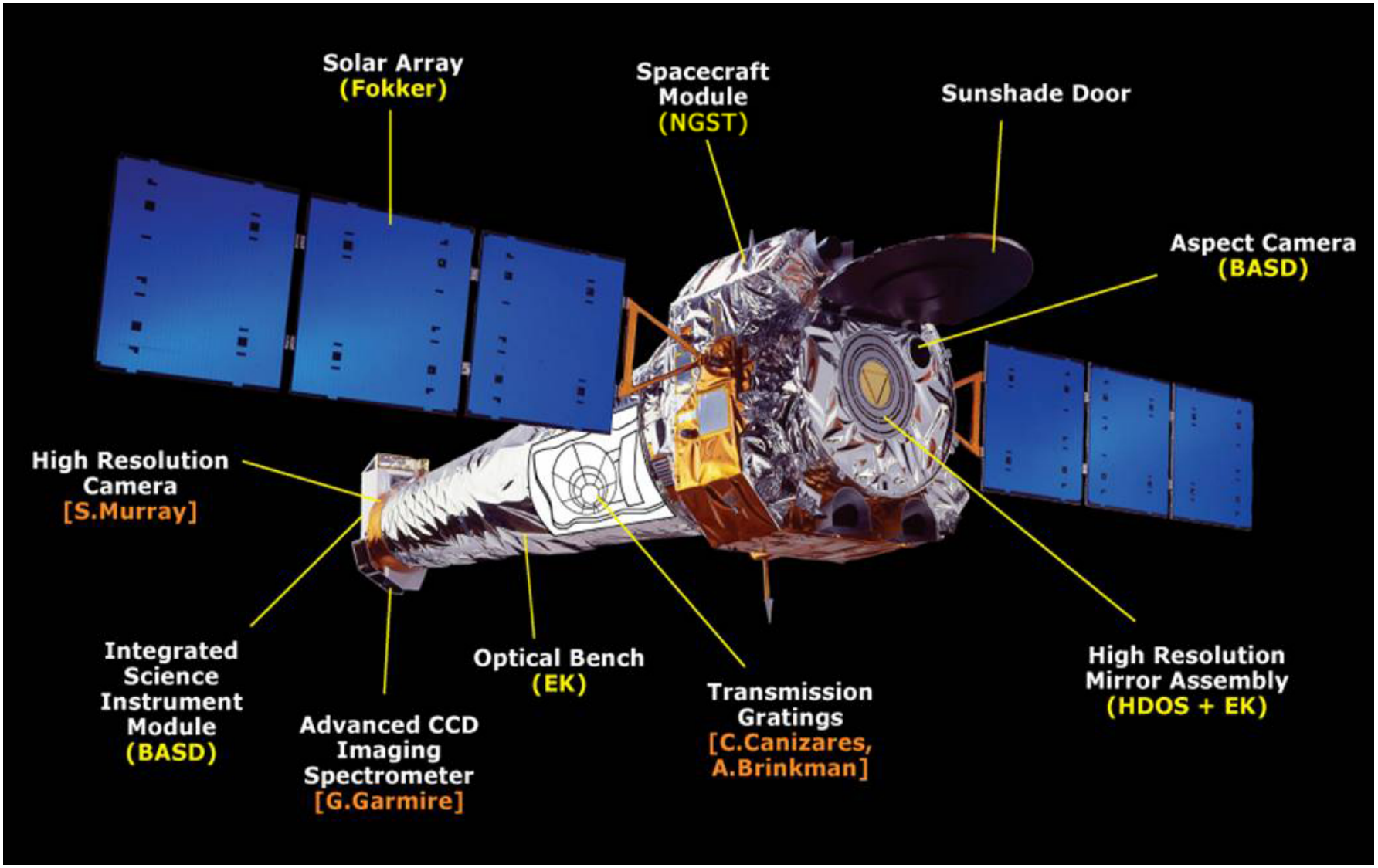
1988-2003

- Space & Laser Programs Division ❸ Space Technology Sector
  - 1988-1999 Deputy Program Manager for Chandra Implementation Phase
  - 1996-1997 Program Manager for NPOESS Formulation Phase contract and Capture Manager for Implementation Phase
  - 1998-2000 Program Manager for JWST Formulation Phase contract and Capture Manager for Implementation Phase
  - 2000-2001 Chief Engineer for Civil Space and Laser Programs
  - 2001-2003 Director of Mission Assurance for Programs Core Process
  - (2004 Acting Director of Mission Assurance for Technology Core Process)

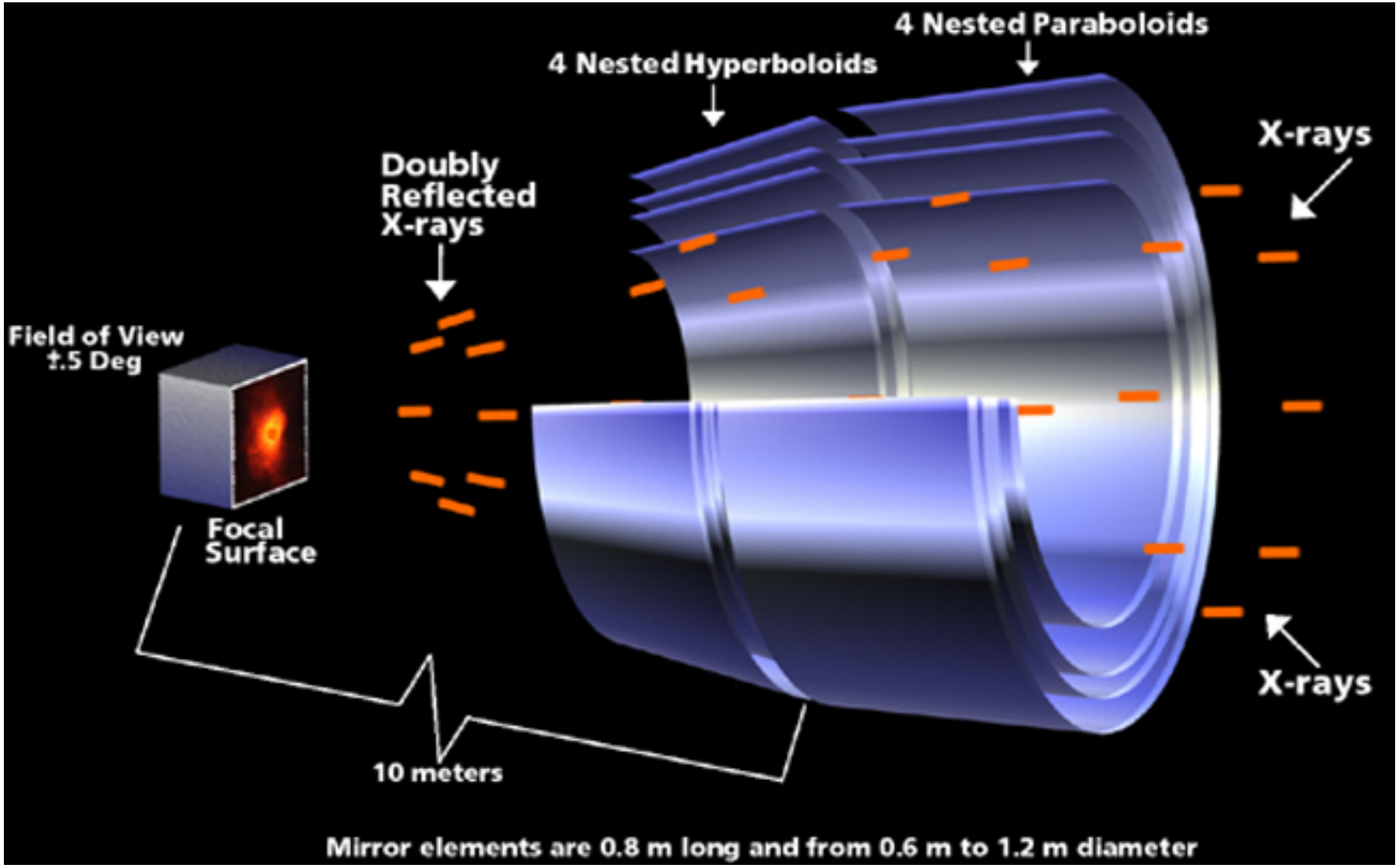
Examples of Special Assignments

- Participate on, and Chair, two AIAA technical committees: Space Sciences & Astronomy (5 yrs) and Space Systems (7 yrs)
- Assist Group Vice President in fulfilling his responsibilities as a member of NASA Advisory Council and Chair of NASA OAST Advisory Committee
- Participate in due diligence for a potential major acquisition
- Participate in assessing value and issues for a potential major strategic alliance
- Lead career opportunity discussions and spacecraft manufacturing tours to encourage disadvantaged high school students to achieve a college education

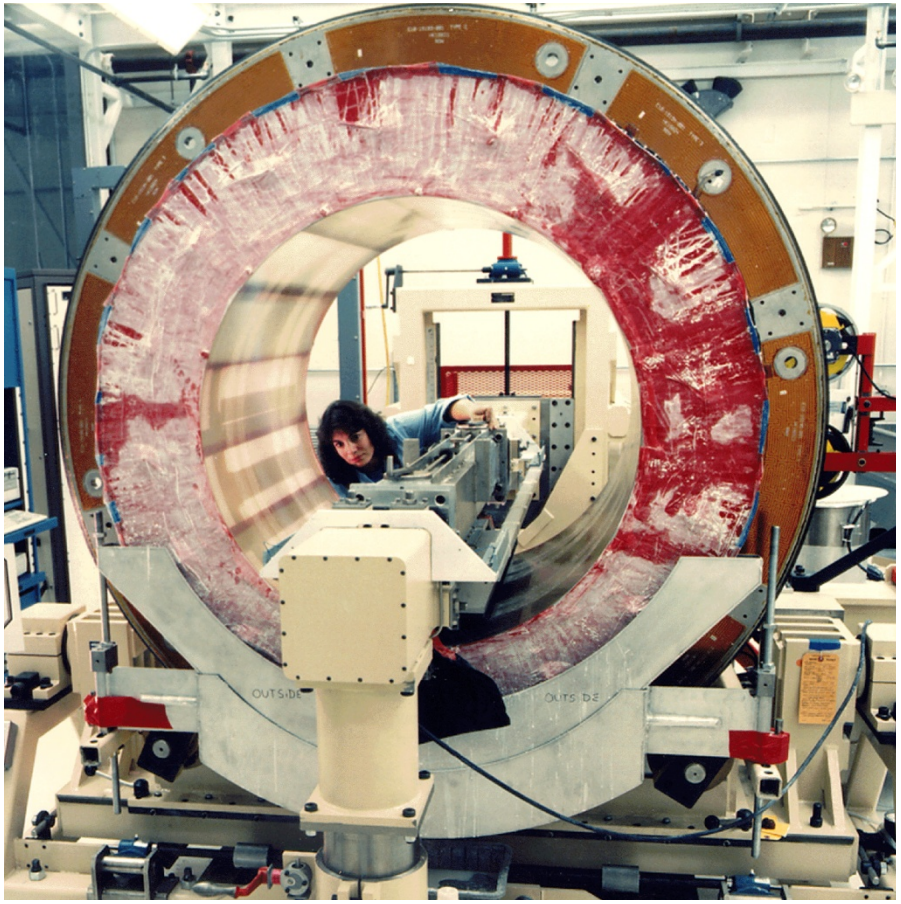
Chandra X-Ray Observatory



Chandra's Grazing Incidence Mirrors



Chandra Mirror Polishing and Alignment



Polishing of a Single Mirror at HDOS (now UTC)

Mirror Assembly at Kodak (now ITT)

NASA's Mirror Calibration Facility at MSFC

Chandra Thermal Vacuum Test Preparation

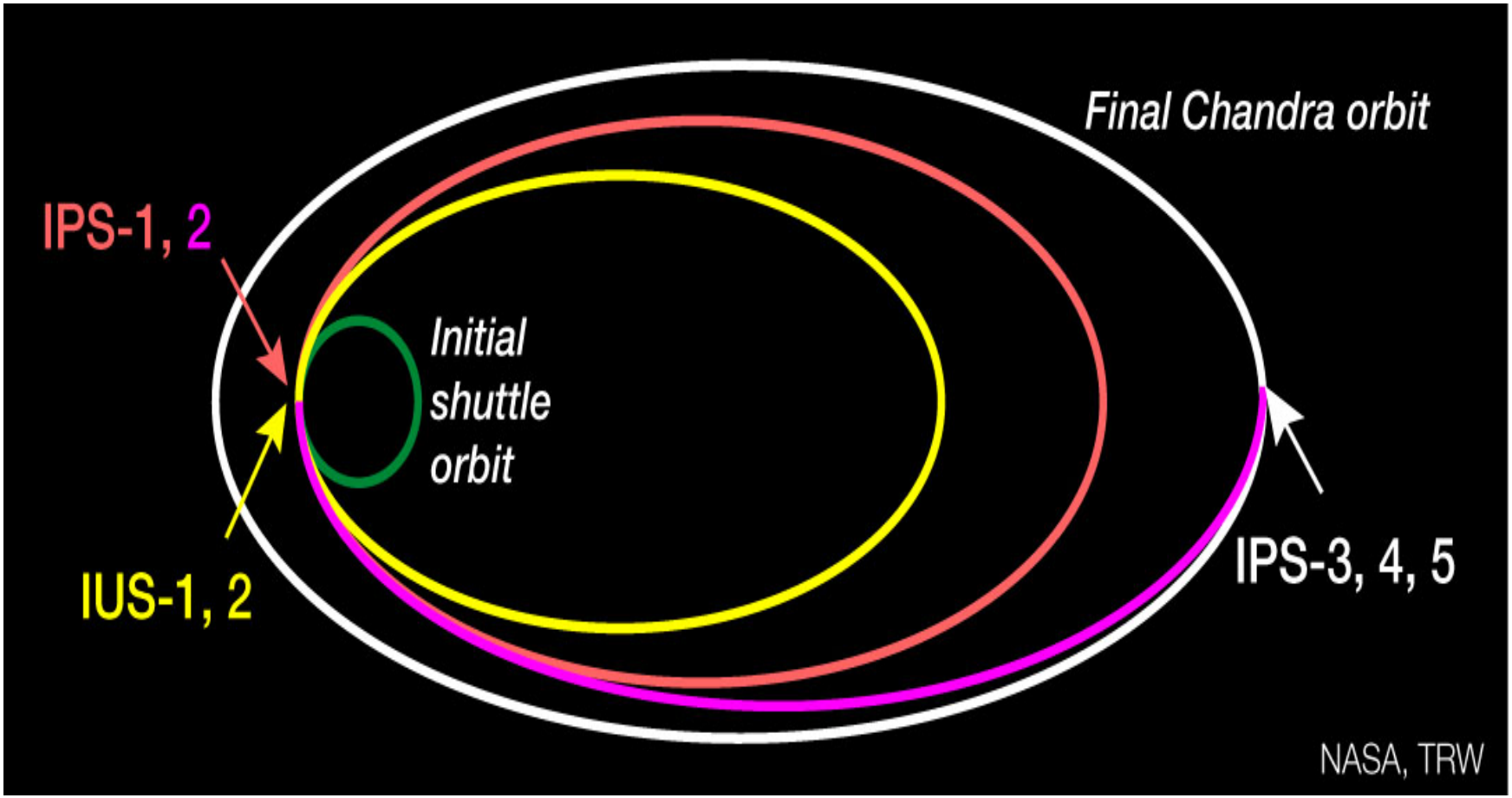
Chandra Roll-Out

Arrival of Chandra at KSC

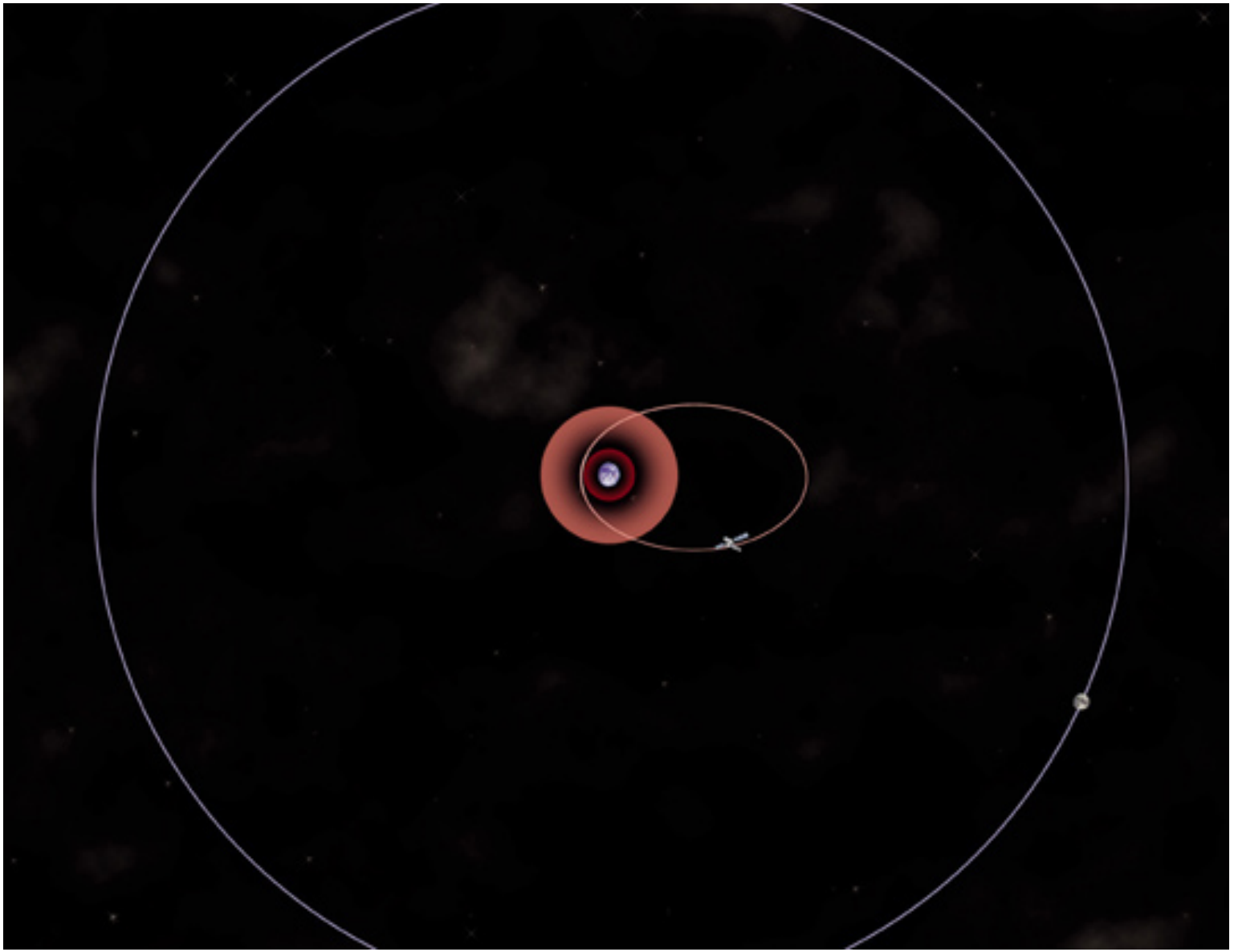
Chandra in Shuttle Cargo Bay

Columbia Launch with Chandra

Chandra Orbit Transfer Operations



Orbits of Chandra and Earth's Moon



JWST Primary Mirror Segment Testing

JWST Full-Scale Model

Wrap-up

Enhance the Value of Your Physics Education

Your physics education will be a powerful enabler; time-proven workplace skills will enhance your career success

Some of my priorities:

Continually improve communication skills – oral and written

Have passion (boundless enthusiasm) for what you are doing

Conduct business unemotionally

Earn respect, be respectful of others

Who you know is important; who knows you is more important

References

The space system program images included in this presentation are available from the web sites of NASA or CXC/SAO for non-commercial educational or public information purposes.

For comprehensive information on space science missions go to:

http://science.nasa.gov/missions