



The ISSAC Story

International Space Station Agricultural Camera

1999 – 2013

University of North Dakota



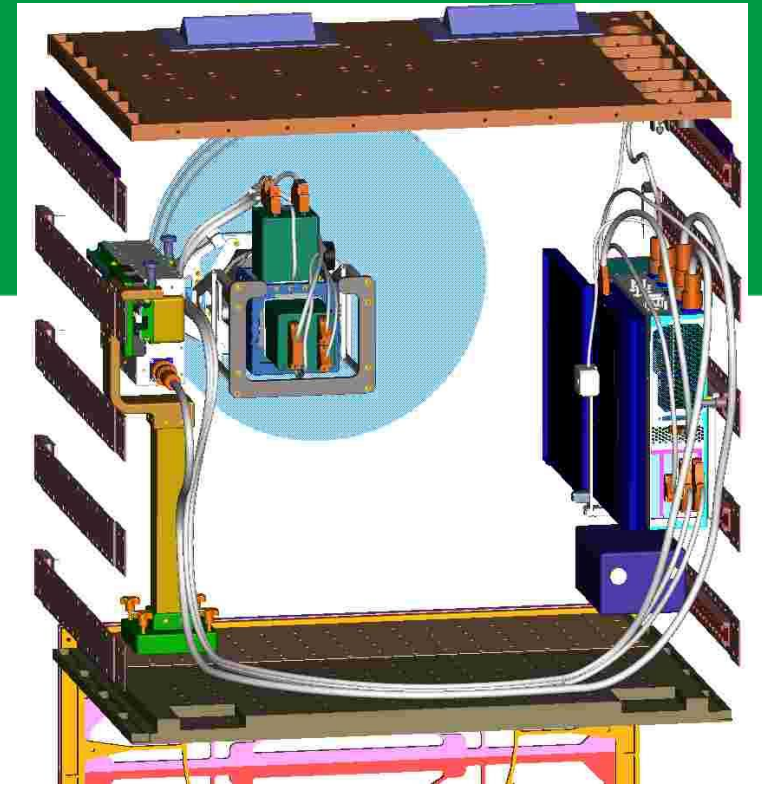
ISSAC Concept and Objectives

- Compared to today, in the late 1990's Earth remote sensing imagery was limited in availability and was expensive.
- ISSAC had two primary objectives
 - Collect imagery at times on a daily basis, and quickly deliver to farmers and scientists alike.
 - Be built and operated principally by students at the University of North Dakota.
- ISSAC was sponsored by the NASA Office of Education, enabling it to be launched to and installed on the ISS.

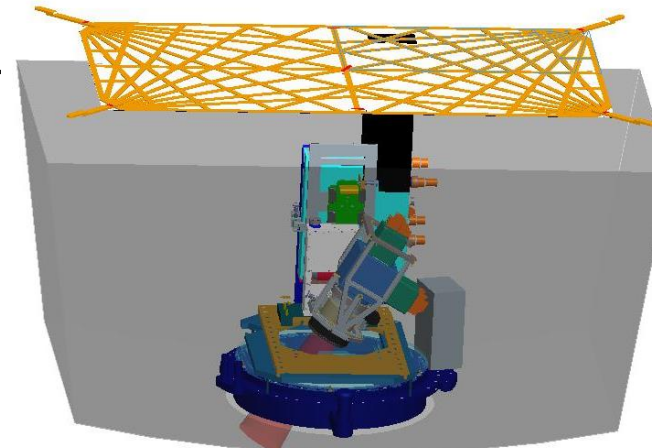


ISSAC Design

- ISSAC was designed to use the Science Window, and the WORF, onboard the ISS.
- UND students had to ensure their designs met hundreds of ISS and launch vehicle requirements.
 - Mechanical, optical, electrical, software, data communications, crew safety
- Two configurations of ISSAC design were built
 - The “WORF Config”, for use inside the WORF (later with an upgraded sensor)
 - The “Alt Config” design, for use on the Science Window before WORF was launched.



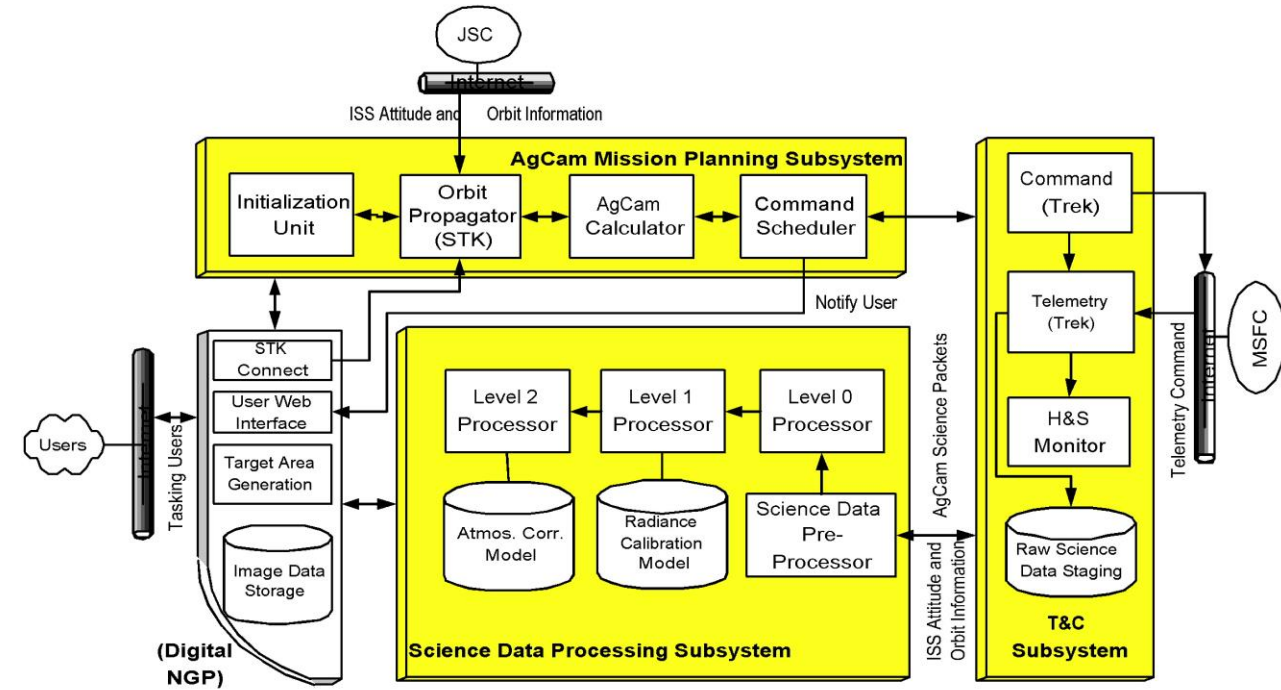
**ISSAC
“WORF
Config” for
use inside
the WORF**



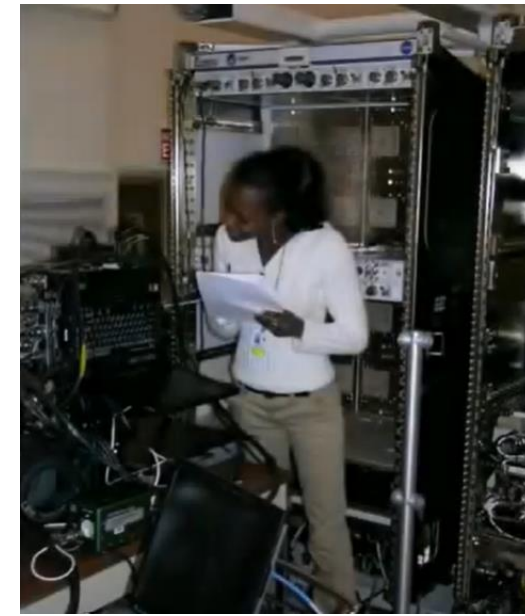
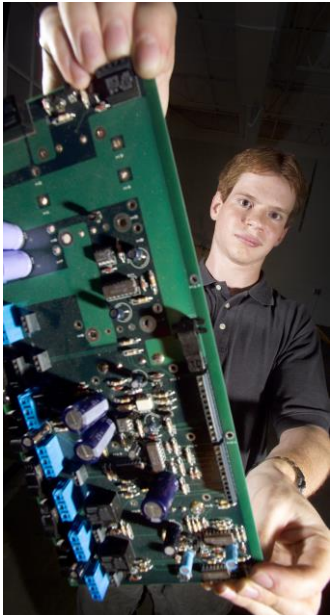
**ISSAC “Alt
Config” design,
installed
directly on
Science
Window**

More ISSAC Design

- **Top Right:**
 - **SOC Software Functional Block Diagram**
- **Bottom Left to Right:**
 - **Electronics Surface Mount Fabrication**
 - **Assembly inside Clean Room**
 - **Pointing System Assembly Prototype**
 - **Flight Software Testing**



AgCam Science Operations Center



ISSAC Integration and Test

- UND students verified their design by means of analysis, inspection, demonstration, or test.

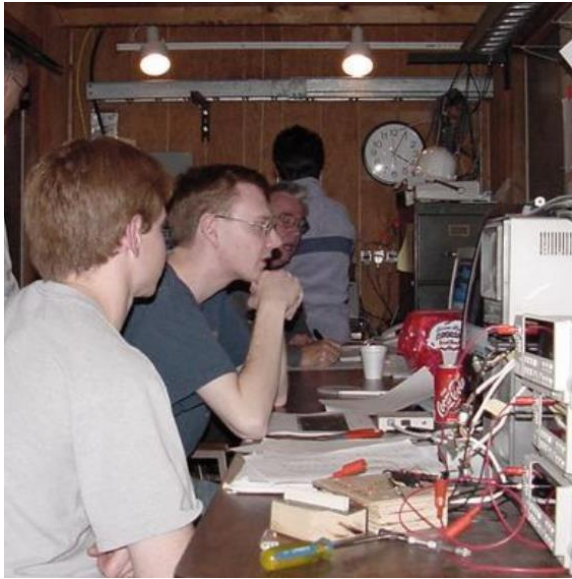


Astronaut Karen Nyberg performs ISSAC Crew Useability Test at UND

ISSAC System Level Verifications (and location)

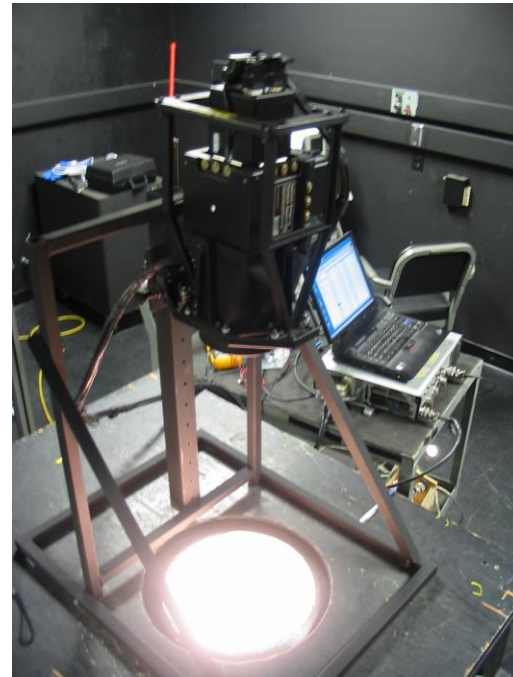
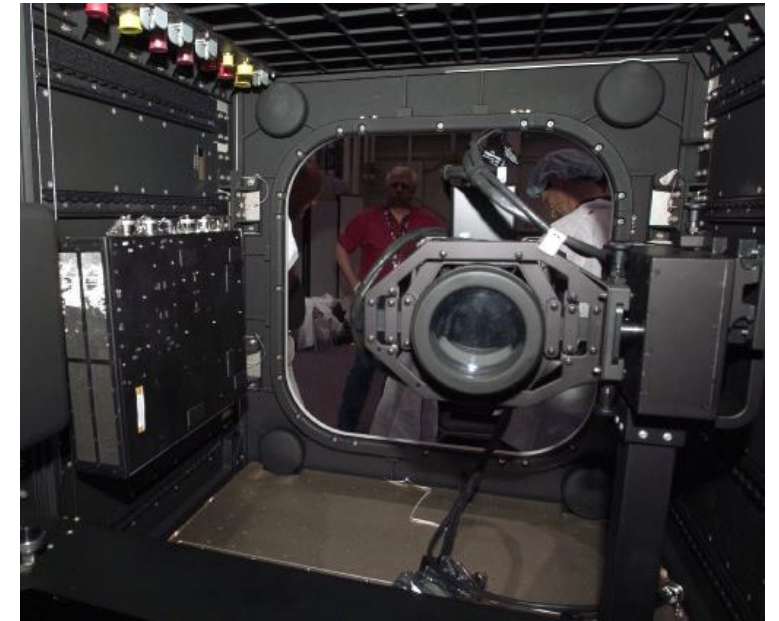
Crew Usability (UND, Grand Forks ND)
Lens Depressurization (UND, Grand Forks ND)
Launch Vibration (UND, Grand Forks ND)
Acoustics (Arctic Cat, Thief River Falls MN)
Ionizing Radiation (Indiana University, Bloomington IN)
Sensor Performance (Flux Data Corp, Rochester NY)
Sensor Calibration (NASA ARC, Mountain View CA)
WORF Ground Fit Checks (NASA JSC, Houston TX)
Electromagnetic Interference (NASA MSFC, Huntsville AL)
Electrical Power and Data (NASA MSFC, Huntsville AL)
Launch Vehicle Integration (NASA KSC, Cape Canaveral FL)

More ISSAC Integration and Test



- Top L: Ionizing Radiation Test
- Bottom L: Vibration Test
- Bottom R: Sensor Calibration

Astronaut Mario Runco assists with WORF Ground Rack Fit Checks



ISSAC Launch



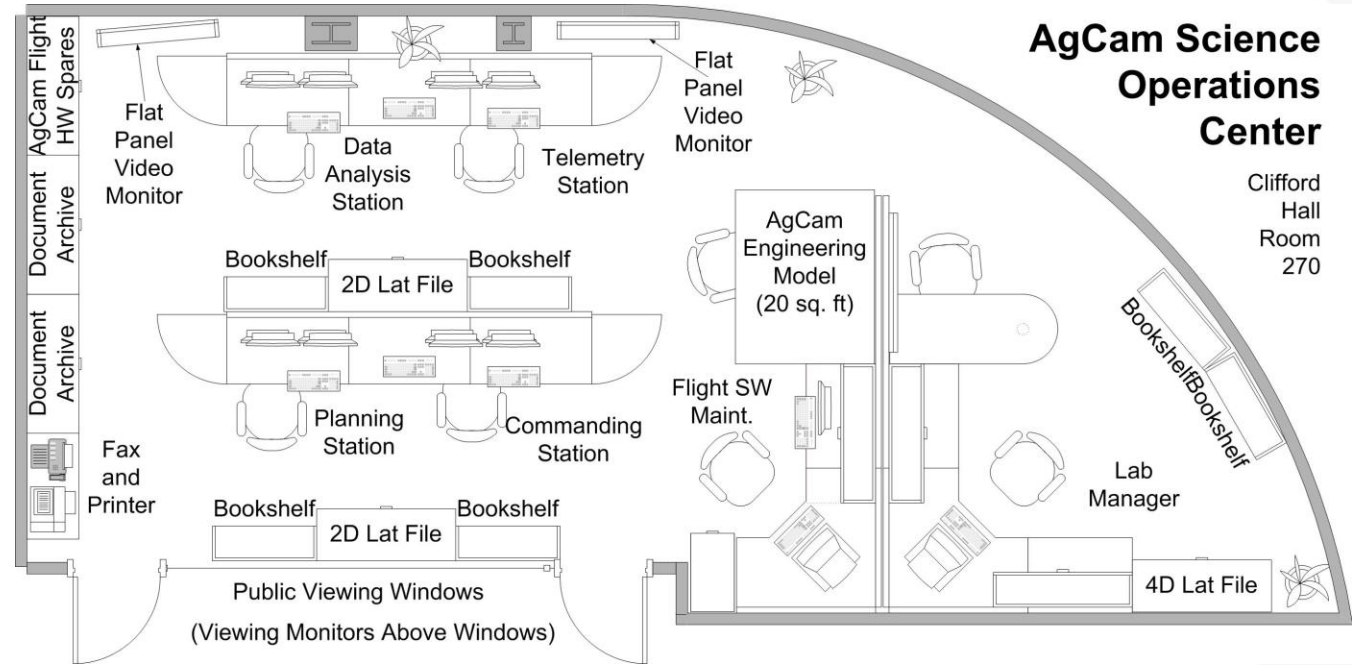
ISSAC was lifted to the ISS onboard the space shuttle (STS-126), a spectacular night-time launch on Nov 15, 2008. (Photo Credit: G. Seielstad)



An upgraded ISSAC sensor was launched to the ISS at dawn on Jan 22, 2011 onboard a Japanese H-II rocket.

ISSAC On-Orbit Operations

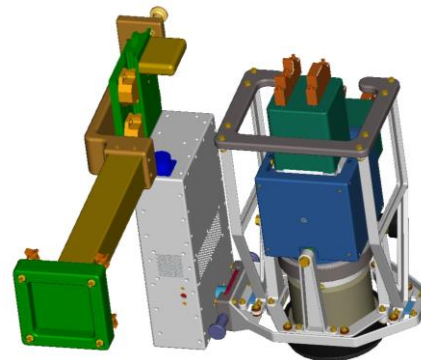
- ISSAC operations were conducted from a Science Operations Center (SOC) on the campus of UND
- From this SOC, UND students
 - Sent commands to operate the sensor and collect imagery
 - Processed imagery for delivery to farmers and scientists
 - Provided ground support to astronauts during on-orbit installations and removal



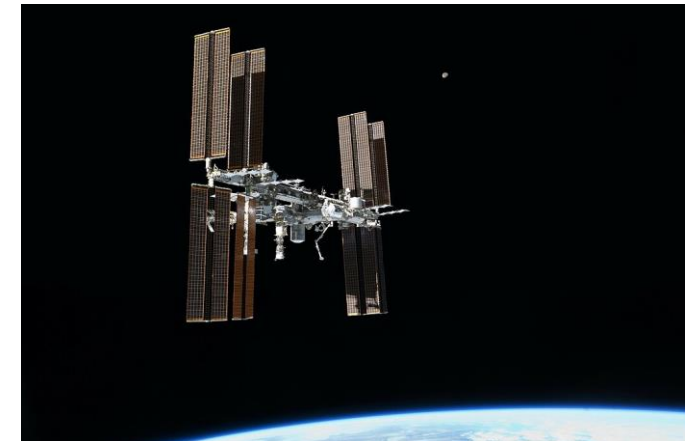
Floor plan of the ISSAC SOC in Clifford Hall Rm 270 at UND (next door to this exhibit).

ISSAC Outcomes and Impact

- ISSAC collected many thousands of images that were used by scientists, farmers, and the general public.
- As a science education project, ISSAC was a dramatic success, with contributions from over 80 graduate and undergraduate students from across UND.
- ISSAC's most lasting impact has been its contribution to the strong inter-disciplinary collaborative research culture at UND, which continues today across many diverse applications such as
 - Unmanned Aircraft Systems (UAS)
 - Space systems and operations
 - National security initiatives



Local farmers being trained on using ISSAC imagery



ISS On Orbit

Acknowledgements



- Dr. George Seielstad, original Principal Investigator for ISSAC and the Upper Midwest Aerospace Consortium (UMAC), and founder of the Earth System Science and Policy (ESSP) department.
- Mr. Doug Olsen, Project Manager for ISSAC in the ESSP department.
- Dr. Soizik Laguette and the faculty and staff from ESSP and from across the John D. Odegard School of Aerospace Sciences.
- Dr. Richard Schultz and Dr. William Semke and the faculty and staff of UND's College of Engineering and Mines, in particular the Department of Mechanical Engineering, and the School of Electrical Engineering and Computer Science.
- The dozens of engineers, technicians, scientists, and astronauts at NASA who helped the ISSAC team over many years, in particular Mr. Mario Runco (Astronaut, Earth Scientist, Spacecraft Window Optics and Utilization Lead) and Dr. Dean Eppler (Program Scientist and "Mogh, Father of WORF").
- And especially, the over 80 students and 11 departments at the University of North Dakota who contributed to ISSAC's development – without their academic excellence, curiosity, enthusiasm and dedication, ISSAC could never have come in to being.

