EMERGENCY KEYNOTE
STAND IN GUY WITH STUFF

G. Bothun, University of Oregon
BASIC OUTLINE OF STUFF

- New Nasa missions and new Big Data
- It’s a New World now but still constrained by the old
- Science Literacy and Outreach – the need for a new perspective and approach
Missions to Earth are becoming important.
There is a good story here about exploration and instrumentation.
The Story of Life may indeed be Universal (as scientifically expected)
Actual Launch was Jan 17, 2016 – data now starting to come in

**Jason 3**

**LAUNCH DATE**
2015

**DESTINATION**
Earth Orbit

**MISSION**
Extending the timeline of ocean surface topography measurements begun by the Topex/Poseidon and Jason 1 and 2 satellites, Jason 3 will make highly detailed measurements of sea-level on Earth to gain insight into ocean circulation and climate change.
Expected Launch June 2017 – instruments still being calibrated

Cold Atom Laboratory (CAL)

LAUNCH DATE
April 21, 2016

DESTINATION
International Space Station

LAUNCH LOCATION
Cape Canaveral Air Force Station, Florida

MISSION
A facility designed to fly aboard the International Space Station, the Cold Atom Laboratory, or CAL, will make use of the space station’s unique microgravity environment to observe quantum phenomena that would otherwise be undetectable from Earth.
Now suspended to May 2018

**InSight**

- **LAUNCH DATE**: March 2016
- **DESTINATION**: Mars
- **MISSION**: The InSight mission (formerly called GEMS), will place a lander on Mars designed to drill beneath the surface and investigate the planet’s deep interior to better understand Mars’ evolution as a rocky planet. As part of its investigation, InSight will use a seismometer and a heat-flow probe to study the interior structure of the Red Planet.
Timeline will likely be pushed back a couple more years
Part of the Discovery of Life Pathway

Europa Mission

- Launch Date: TBD 2020's
- Destination: Europa
- Mission: The Europa mission will conduct detailed reconnaissance of Jupiter's moon Europa and investigate whether the icy moon could harbor conditions suitable for life.
Earth Monitoring Mission

Orbiting Carbon Observatory 3 (OCO-3)

- **LAUNCH DATE**: TBD
- **DESTINATION**: Earth Orbit
- **MISSION**: The Orbiting Carbon Observatory 3, or OCO-3, is a future space instrument designed to investigate important questions about the distribution of carbon dioxide on Earth as it relates to growing urban populations and changing patterns of fossil fuel combustion.
CubeSat Array - key to understanding hurricane evolution
Launch for sure – also key to understanding tropical storm evolution – can take data similar to scale of simulations

**CYGNSS Mission**

**NASA's Weather Prediction Project**

The Cyclone Global Navigation Satellite System (CYGNSS) aims to improve extreme weather prediction. CYGNSS will use a constellation of eight small satellites carried to orbit on a single launch vehicle. In orbit, CYGNSS's eight micro-satellite observatories will receive both direct and reflected signals from Global Positioning System (GPS) satellites. The direct signals pinpoint CYGNSS observatory positions, while the reflected signals respond to ocean surface roughness, from which wind speed is retrieved.

The mission will study the relationship between ocean surface properties, moist atmospheric thermodynamics, radiation and convective dynamics to determine how a tropical cyclone forms and whether or not it will strengthen, and if so by how much. This will advance forecasting and tracking methods.

**Count Down to CYGNSS Launch**

52 DAYS | 15 HOURS | 35 MINUTES | 45 SECONDS

November 21, 2016

Launch Window Open at 06:00 EST on 21 Nov 2016

**CYGNSS Team**

- University of Michigan Department of Atmospheric, Oceanic & Space Sciences
- Principal Investigator: C. Rii
- Constellation Scientist: A. Riley
- Southwest Research Institute
- Project Manager: J. Sohmer
- Project Systems Engineer: R. Rose
- Support Lead: J. Elbert
- Mission Operations Lead: J. Redfern
- Surrey Satellite Technology, U.S.
- EDA/ Program Manager: G. Hobson
- Sierra Nevada Corporation
- Deployment Module Lead: W. Boyd
Part II: A Brave new World? Complexity Revealed
Big data, discovery and new kinds of Astronomy – are we prepared?

MOVING TO THE TEMPORAL DOMAIN

Locations of Kepler Planet Candidates

- Earth-size
- Super-Earth size 1.25 - 2.0 Earth-size
- Neptune-size 2.0 - 6.0 Earth-size
- Giant-planet size 6.0 - 22 Earth-size
DISCOVERY IN ASTRONOMY

- Has almost always progressed by building new Detectors (Not Necessarily Large Apertures!) and opening up new wavelengths to survey the Universe.
- The Universe reveals most of its interesting physics in wavelengths other than the optical regime
- The New Gravitational Wave Source Discovered in 9/2015 is an excellent example

Unforeseen objects now exist in this “known” Universe – outreach has emphasized the triumph but not the discovery of these new objects
DISCOVERY MILESTONES

X-Ray Clusters

Dusty Proto-planet Disks

New Kinds of Galaxies

XUV Disks

NUV+FUV Disks

2704 BATSE Gamma-Ray Bursts

The Gamma Ray Universe
Too many pixels, too little Screens

- A 36 million pixel image (displayed here on 1 million pixels)
35 Million Pixel Native Resolution – 1 cm per pixel
Coming to the UO

50 Million pixels
Okay Great, Can I get a bigger Brain? – This is the principal limitation with Big Data
Science Literacy – what is it? How do we improve it?
Outreach Oregon “O” Style
Once upon a Time:

• Everything Was Known
• Every thing was Simple
• Every thing was logical and ordered
• Uncertainty DID NOT EXIST
• Tell the people the Known Truth

• Impress people with how clever we are And how impressive science is, since we have figured it all out
Yet Science is NOT a pathway to the truth – in fact, just the opposite – Science is a process that maps out everything which is unknown.

Science is a process that should produce humility not a process that produces arrogance because we think we understand everything.

The current management of the planet is very arrogant – this needs to change – this is the big picture of science literacy.

— Neil deGrasse Tyson

The Universe is under no obligation to make sense to you.
Most people when they visit the beach look out upon the vast ocean and reflect.

Is this an ocean of Truth or an ocean of the unknown; is it an ocean of opportunity? - certainly it is an ocean of exploration.

Science is the process of exploration that maps out the uncertainty - Science literacy is the understand of that as the mission of Science.

Outreach should stress this at all times.