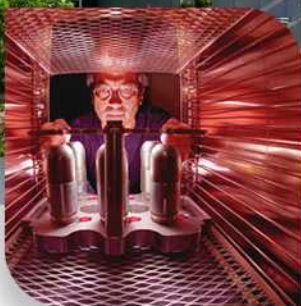




Sandia National Laboratories

SAND2012-7759P
LOCKHEED MARTIN



The Sandia Earth Observation System: SandEOS

Matthew Strosnick

Bettina Arpin

September 27, 2012

Overview

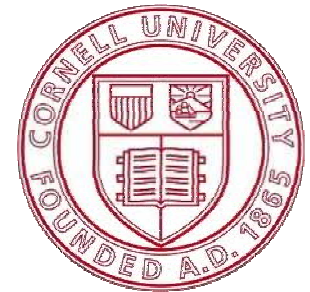
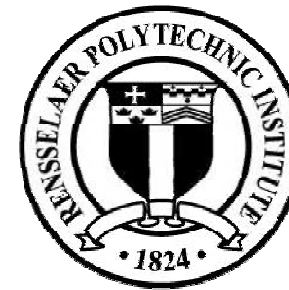


- **Points of discussion:**
 - **Speaker Introduction**
 - **SandEOS design overview**
 - **SandEOS demonstration**

Speaker Introduction



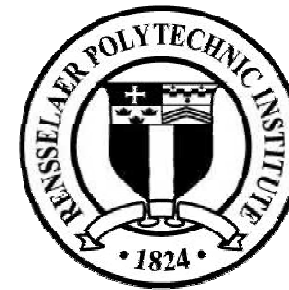
- **Matthew Strosnick**
- **Sandia National Laboratories in Albuquerque, NM**
 - Computer Software Research and Development
- **Cornell University 2011**
 - Master's: Computer Science
- **Rensselaer Polytechnic Institute 2010**
 - Bachelor's: Computer Science
- **Work: Satellite Ground Systems, Realtime Radar Algorithms, HCI**
- **Fun: smoothies, food, exercising, coding, javelin throwing**



Speaker Introduction



- **Bettina Arpin**
- **Sandia National Laboratories in Albuquerque, NM**
 - Computer Software Research and Development
- **Rensselaer Polytechnic Institute 2006**
 - Master's & PhD: Computer Science
- **Ithaca College 2001**
 - Bachelor's: Physics
- **Work: Satellite Ground Systems, Semantic Technologies**
- **Fun: Cats, Softball, Recruiting at RPI**





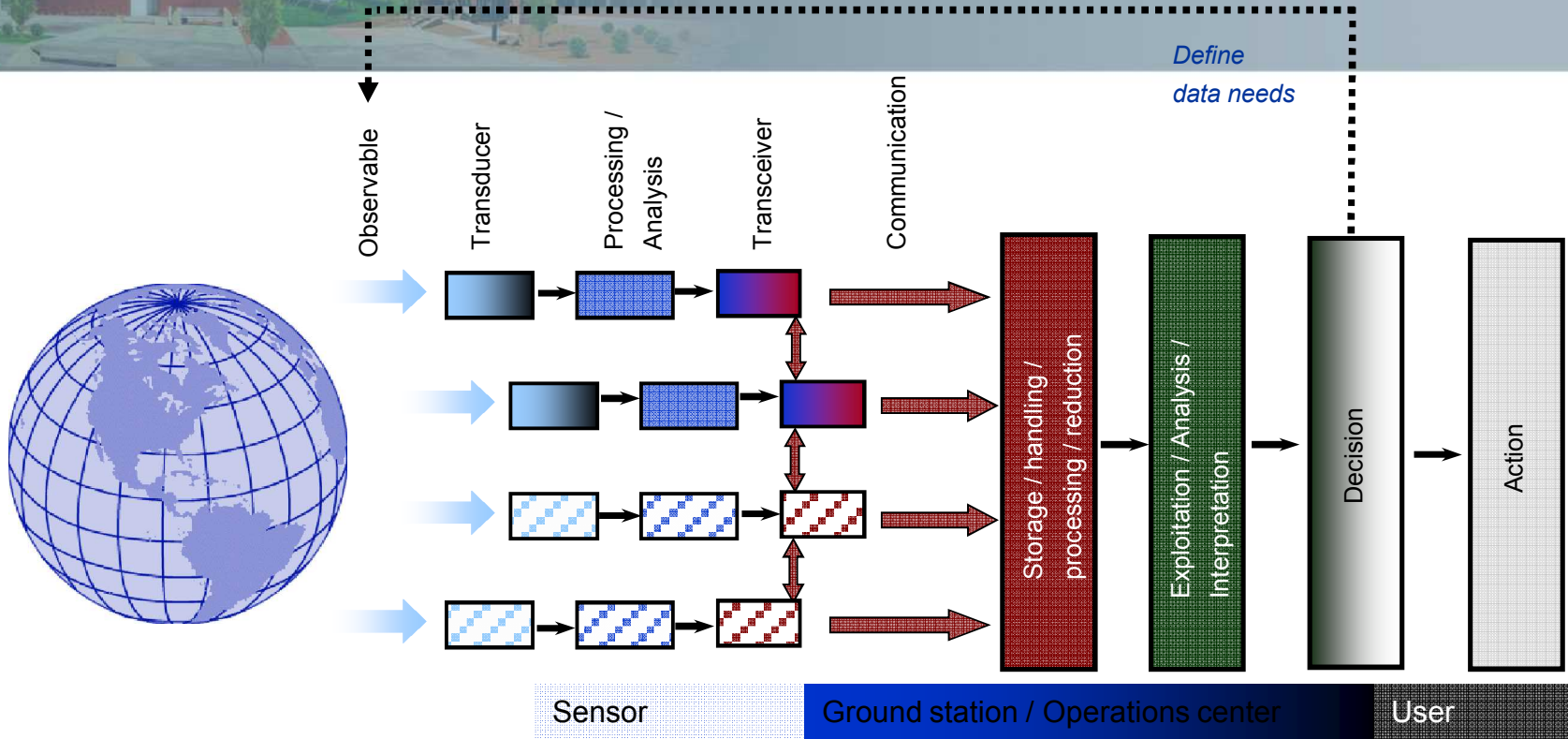
- **SandEOS: Sandia Earth Observation System**
- **A generic data visualization tool with multiple synchronized displays that can be used to visualize data for a variety of different missions.**
- **Designed for the “E” in TCPED (Exploitation/Analysis)**
- **Integrated satellite-earth situational awareness tool**



- **T**asking (what, where, when, how to observe)
- **C**ollection (observables to data)
- **P**rocessing (data to information)
- **E**xploitation (information to knowledge)
- **D**issemination (knowledge to decision makers)

TCPED

Information System Components and Architecture



Tasking

Collection

Processing

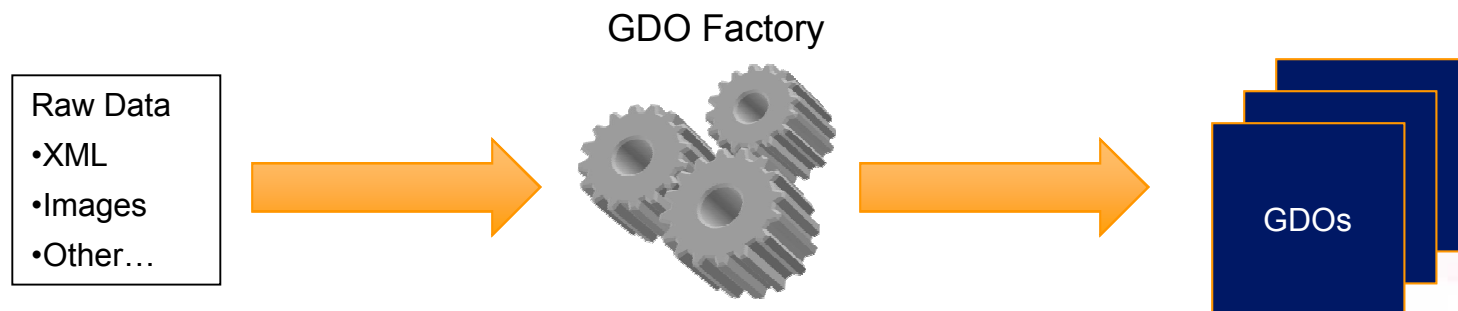
Exploitation

Dissemination

SandEOS: Data Containers



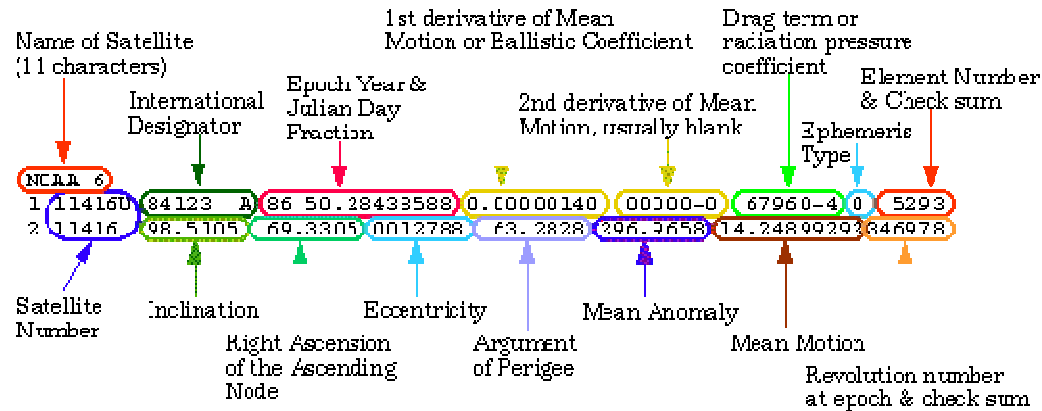
- **SandEOS Processes GDOs and TLEs**
 - “Generalized Data Objects”
 - “Two Line Elements”
- **GDOs contain information relevant to each display component**
 - The Table View queries the GDOs for numerical and textual objects.
 - The Geographical View queries GDOs for Geographical objects.
 - The Time View queries GDOs for Time objects.
 - The Tree View queries GDOs for other GDOs to display the data’s hierarchical structure.
- **A developer writes a GDO factory to convert Raw Data into GDOs. The behavior of the application is dictated by the GDO factory.**



SandEOS: Backend



- TLE



- GDO

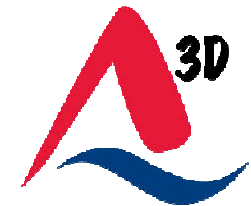
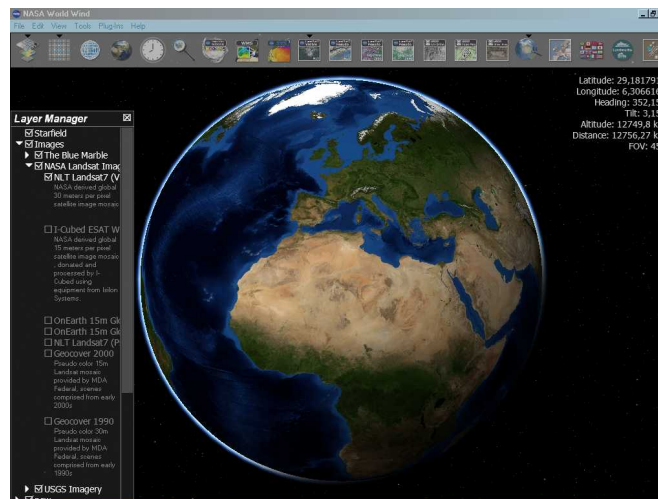
```

<DemoEvent
  description="Leaving for the airport"
  time="2012-09-13T00:29:00Z"
  latitude="35.10238"
  longitude="-106.564215"
  altitude="1806.0"
  temperature="65.0"
  valid="true">
</DemoEvent>
    
```

SandEOS: Technology



- Java / Scala implementation
- Message passing via Akka
 - Concurrent and fault-tolerant message handling
- High-level data containers and interfaces isolate raw data container logic from GUI components
- Modular plug-in design using Eclipse RCP and SWT GUI components for different displays
- Visualization with Ardor3D and NASA WorldWind



SandEOS: Event Handling



The screenshot shows the SandEOS application window. On the left is a 'Data Sets' tree view listing various DEMO_EVENT objects. Below it is a 'Time Control' panel with a date and time display. The main area is a 'Geographical View' showing a 3D Earth model with a satellite and its orbital path. At the bottom is a 'Table View' displaying a table of orbital parameters for several data sets.

Data Set	CDR Number	Name	Number	International Designator	TLE Epoch	NDOT Drag Parameter	NDOT Drag Parameter	BStar Drag Parameter	Element Number	Orbital Inclination	Orbital Eccentricity	Argument of Perigee	Mean Anomaly	Mean Motion	Revolution Number	Check Sum 1	Check Sum 2
Data Set 1: 12	21196	MOONVA 3-40	1993-0228A	2011/05/17 05:51:30.763776	4.818196466760379E-11	0.0	1.0E-4	400	61.568	0.7254134	284.997	16.8738	-2.00074939	14766	9	1	
Data Set 1: 12	22930	DIRCTV 1 (DBS 1)	1993-078A	2007/05/13 09:26:29.445084	-5.095148514510128E-12	0.0	1.0E-4	240	0.6877	1.091E-4	142.109	47.3372	1.00272096	5693	9	0	
Data Set 1: 12	22108	GPS BIA-15 (PBN 27)	1993-018A	2011/05/17 13:18:42.819954	-2.14517182181046E-12	0.0	1.0E-4	508	-68.2001	-0.021801393999999999	288.0117	69.8702	2.00163496	13685	3	8	
Data Set 1: 12	24907	BIDUM 22 (s)	1997-043E	2009/02/18 12:57:44.85168	3.9300851669346E-14	0.0	-8.8365000000000000005E-6	8416	902	277.1576	14.34221894	60201	5	6	5	6	
Data Set 1: 12	22700	GPS BIA-21 (PBN 09)	1993-042A	2011/05/17 12:39:27.896344	-2.484070115686372E-12	0.0	1.0E-4	816	272.0831	2.00564696	13100	5	4	5	4		

Tree View

Geographical View

Events

Time View

Events

Table View

Events

AKKA EVENT BUS

SandEOS: Demo



- Demo
- Questions?