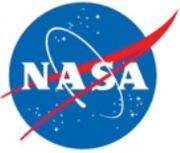


October 23, 2018

NISAR Applications

DPA: Natasha Stavros and Susan Owen (JPL)
NISAR Science Team Applications Co-Lead: Cathleen Jones
New DPA: Batu Osmanoglu (GFSC)



NISAR Science Observation Overview

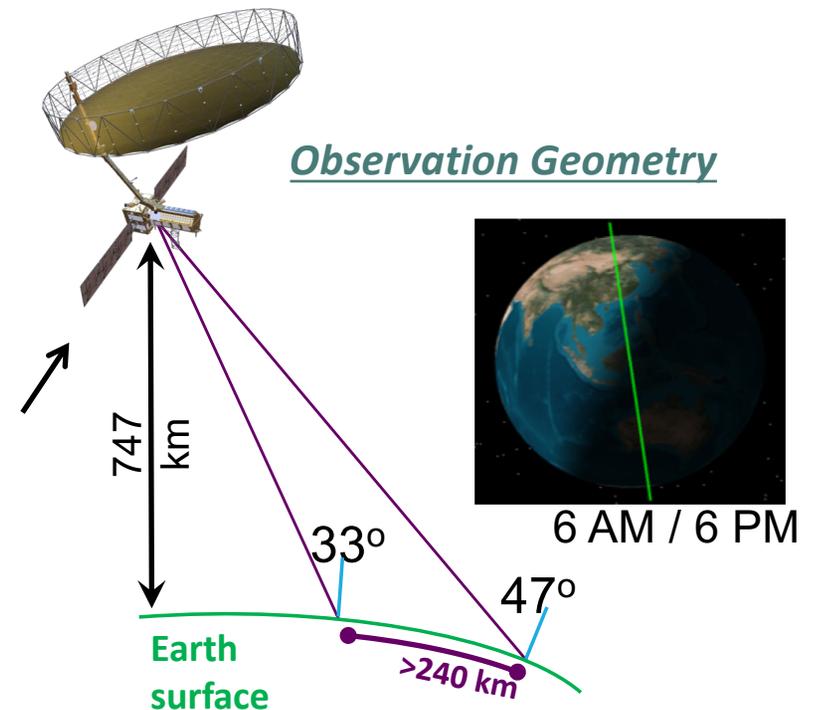
NISAR Characteristic:	Enables:
L-band (23 cm wavelength)	Low temporal decorrelation and foliage penetration
S-band (9 cm wavelength)	Sensitivity to light vegetation
SweepSAR technique with Imaging Swath > 240 km	Global data collection
Polarimetry (Single/Dual/Quad)	Surface characterization and biomass estimation
12-day exact repeat	Rapid Sampling
3 – 10 meters mode-dependent SAR resolution	Small-scale observations
3 yrs (NASA) / 5 yrs (ISRO) science operations	Time-series analysis
Pointing control < 273 arcseconds	Deformation interferometry
Orbit control < 500 meters	Deformation interferometry
> 10% (S) / 50% (L) observation duty cycle	Complete land/ice coverage
Left-only pointing (Left/Right capability)	Uninterrupted time-series Rely on Sentinel-1 for Arctic

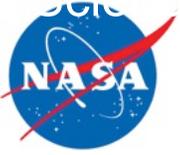
NISAR Will Uniquely Capture the Earth in Motion



Unique NISAR characteristics:

- *Dense temporal and spatial sampling*
- *Comprehensive global measurements*
- *Targeted new science observations*
- *Free and open data policy*





Science Users' Handbook

National Aeronautics and
Space Administration



- Research and Applications
- Mission Science Requirements
- Mission Design and CONOPS
- Flight System Characteristics
- Radar and Measurement Principles
- Data Products

- Currently being professionally reformatted
- Will be revised prior to launch or as necessary

IMPACT: communicates updates on NISAR mission to the broader audience

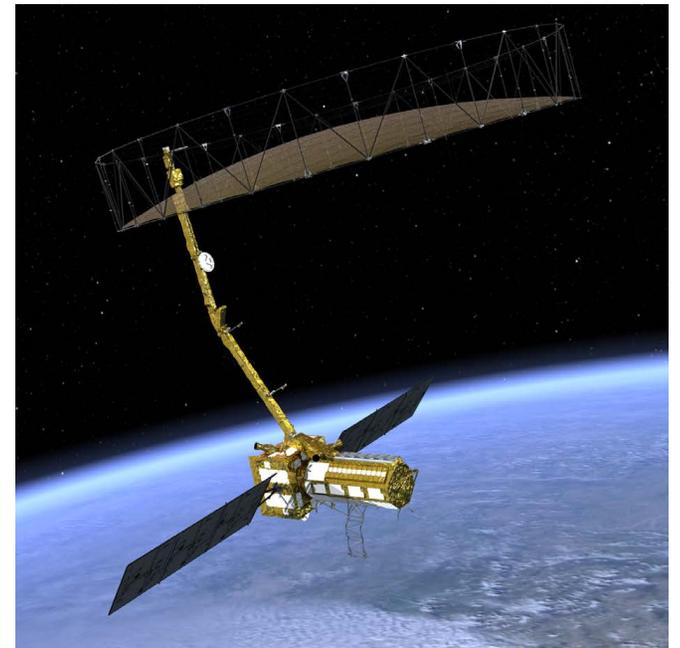
NASA-ISRO SAR Mission (NISAR)

NASA-ISRO SAR (NISAR) Mission
Science Users' Handbook

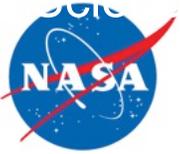
Current Project
Phase C

Planned Launch Date:
December 2021

Document Date:
April 9, 2018
Version 1



Jet Propulsion Laboratory, California Institute of Technology.
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2014 and 2015 Workshops: (informs “Community Assessment Report”)



2014 NISAR Applications Workshop: Linking Mission Goals to Societal Benefit

October 28-29, 2014

Workshop Report



2015 NISAR Applications Workshop:
Applications Community Suggestions for Developing an Applications Plan

October 13-15, 2015
Workshop Report

2014 Workshop

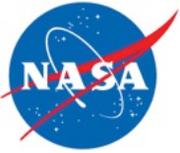
- Identified Observation needs of Applications in Solid Earth, Ecosystems and Cryosphere
- Identified need for SAR literacy and capacity building
- Informed Application Traceability Matrices

2015 Workshop:

- Informed Utilization Plan
- Need for Application Area Specific Workshops

IMPACT: Formulation of “Applications” Plan based on community input and specific to broad application SAR mission

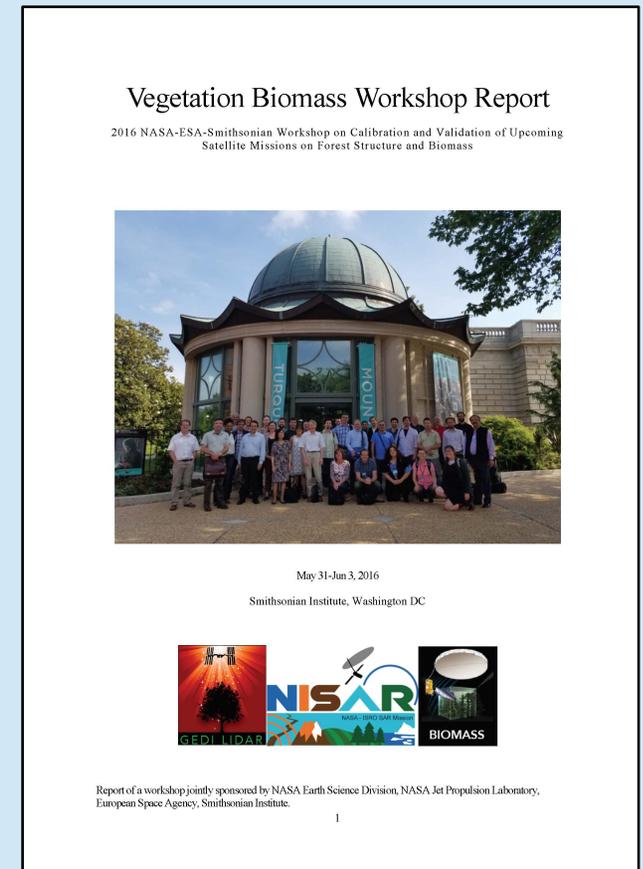
Both workshops engaged key US agencies and applications communities



2016 Vegetation Biomass Workshop

- Verified and cross-validated biomass products from each mission
 - NISAR has a Biomass requirement: biomass of global areas of woody biomass cover within 20 Mg/Ha for areas of biomass < 100 Mg/ha
- Same cal/val sites
- **IMPACT**
 - **Basis for MAAP - Multi-mission Algorithm and Analysis Platform -- Prototype of ESDS and ASP relationship**
 - **Joint project with ESA for NISAR, GEDI, and ESA BIOMASS data. Funded by Kevin Murphy**
 - **Feedback of how biomass data should be distributed to current and future users**

NISAR-GEDI-BIOMASS joint workshop with “4th mission” representatives (cal/val partners)





Applications Area Specific Workshop Template ("Focus Sessions")



Arming Forest Management with Information
from NISAR Remote Sensing Data
USFS-NASA Meeting
1 Thomas Circle Plaza, DC
(RSVP: Natasha.Stavros@jpl.nasa.gov)

Workshop Objectives

- Identify high impact applications for integrating NISAR into Forest Ecosystem Applications, where high impact is defined as a function of:
 - feasibility to meet application requirements within NISAR observation plan and latency
 - feasibility of user community to use/ingest
 - maturity of algorithms for operational deployment
- Develop a roadmap to realizing integration of SAR into decision support for high-priority and high-feasibility Ecosystem applications
 - feasibility studies
 - challenges (e.g., working groups needed)
 - information product development
- Identify early engagers (analogous to "early adopters") to help develop information products and distribute

Agenda

DAY 1: Wednesday, June 13, 2018

7:30 - #	Arrival & Sign-In	
7-8:15	Workshop Welcome	Alex Moad (USFS) and Natasha Stavros (NISAR Deputy Applications Lead for Ecosystems)
8:15-8:30	NASA Welcome	Craig Dobson, NISAR Program Scientist (NASA/HQ/Earth Science Division)
8:30-9	USFS Remote Sensing Overview	Everett Hinkley, USFS National Remote Sensing Program Manager
9-9:30	USGS Remote Sensing Overview	Greg Sneyer, Chief of Earth Observation Requirements, Capabilities and Analysis Branch
9:30-9:45	Break - Coffee/Tea Provided	
9:45-11:15	NISAR Mission Overview and Forest Structure, Biomass, and Disturbance	Sassan Saatchi, NISAR Science Team, JPL/CalTech and Josef Kellndorfer, NISAR Science Team, Earth BigData
Information Product Requirements - Sassan Saatchi facilitating		
11:15-12:00	USFS Forest Inventory and Analysis	Ron McRoberts, USFS
	USFS/USGS SilveCarbon	Bradley Reed, USGS
	USFS Geospatial Technology and Applications Center	Brad Quayle, CTAC manager
12:10-1:10	Lunch	

Information Product Requirements continued		
1:20-1:35	World Wildlife Fund	Naikoa Aguilar-Amuchastegui
1:35-1:50	Timber Industry Consulting	Zack Parisa, SilvaTerra
1:50-2:05	USGS Forestry and Ecosystems	Kurtis Nelson
2:05-2:25	World Resources Institute	Mikaela Wessou
2:25-2:45	Conservation International	Max Wright
2:45-3:10	BLM	Chris Cole
3:10-3:25	World Bank	Andres B. Espejo
3:25-3:40	Break - Coffee/Tea Provided	
3:40-4:00	Follow-up Q&A with all speakers - Open Discussion	
4:00-4:15	National Park Service	Brandon Lemme
4:15-4:30	Technical Response to Information Requirements Discussion	Josef Kellndorfer, NISAR Science Team, Earth BigData
4:30-5:10	R&D Needs to Address Identified Technical Gaps	Gerald Bowden (NASA/HQ)

DAY 2: Thursday, June 14, 2018

7:30 - #	Arrival & Sign-In	
Examples of how SAR could be integrated into existing Decision Support Workflows		
8:15-8:50	Biomass/Forest Inventory and Analysis	Hans-Erik Andersen, USFS
8:50-9:30	Fire Modeling	Mark Finney, USFS FARSITE
9:30-10:15	Forest Cover Monitoring	Naiara Pinto, JPL
10:15-10:30	Break - Coffee/Tea Provided	
10:30-11:00	SERVIR	Africa Flores, NASA SERVIR
11:00-11:20	Ecosystem Structure Monitoring	Michele Slaton, USFS Region 5 Remote Sensing Lab
11:20-12:00	Forest monitoring activities in Gabon	Ghislain Mousanou, AGEOS Gabon
12:00-1:30	Lunch	
1:30-4:10	Detailed Sector requirements (Josef Kellndorfer, facilitate group discussion): <ul style="list-style-type: none"> Do any of the products serve multiple Organizations/Agencies/Applications requirements? What do the final products look like? Variables? Spatial and temporal resolution? Accuracy? Latency? Time Series? Raster? What is the best way to deliver the final product? Data format? Distribution Platform? What is the best way to get from NISAR radar products to Forest final products? How do we put that in place? 	
4:10-4:40	NASA Applied Science Program Overview	Woody Turner, Ecological Forecasting Applied Science Program Manager (NASA/HQ)
4:40-5:00	Next Steps and Wrap-Up	Craig Dobson (NASA/HQ/Earth Science)

Agency Mission, Organization, Funding, Collaborations

NISAR Overview

Community Information Needs Assessment independent of what NISAR will provide (Agency/Org template)

Identify Interagency/Org Information Product Needs (discussion)

Determine which ones NISAR could fulfill (ST response)

Current State of SAR Algorithms for Information Needs (Agency/Org template)

SAR Decision Support Integration Lessons Learned

Community Specific Roadmap to Launch (discussion)

Optional: Working Group and Cal/Val (discussions)

IMPACT

- User needs community assessment by application area independent of NISAR observations
- Identified high ROI apps for NISAR between now and launch
- Community specific roadmap to launch
- Basis of Apps Working Groups



Applications Area Specific Workshops

Completed



Planned

- Ecosystems: Wetlands (FY19)
- SAR Educators (FY19)
- Geologic Hazards: Landslides (FY19)
- Geologic Hazards: Volcanos (FY19)
- Geologic Hazards: Seismology/Tsunamis (FY20)
- USFS-NASA multi-mission Workshop (FY19)
- Flood Hazards (FY20)
- Hydrology: Ground water/oil extraction and induced seismicity (FY20)

In Draft

- Ecosystems: Forests and Disturbance (FY18)
- Ecosystems: Agriculture and Soil Moisture (FY18)

IMPACT: Community recommendation for Working Groups for each – Template created; working groups pending

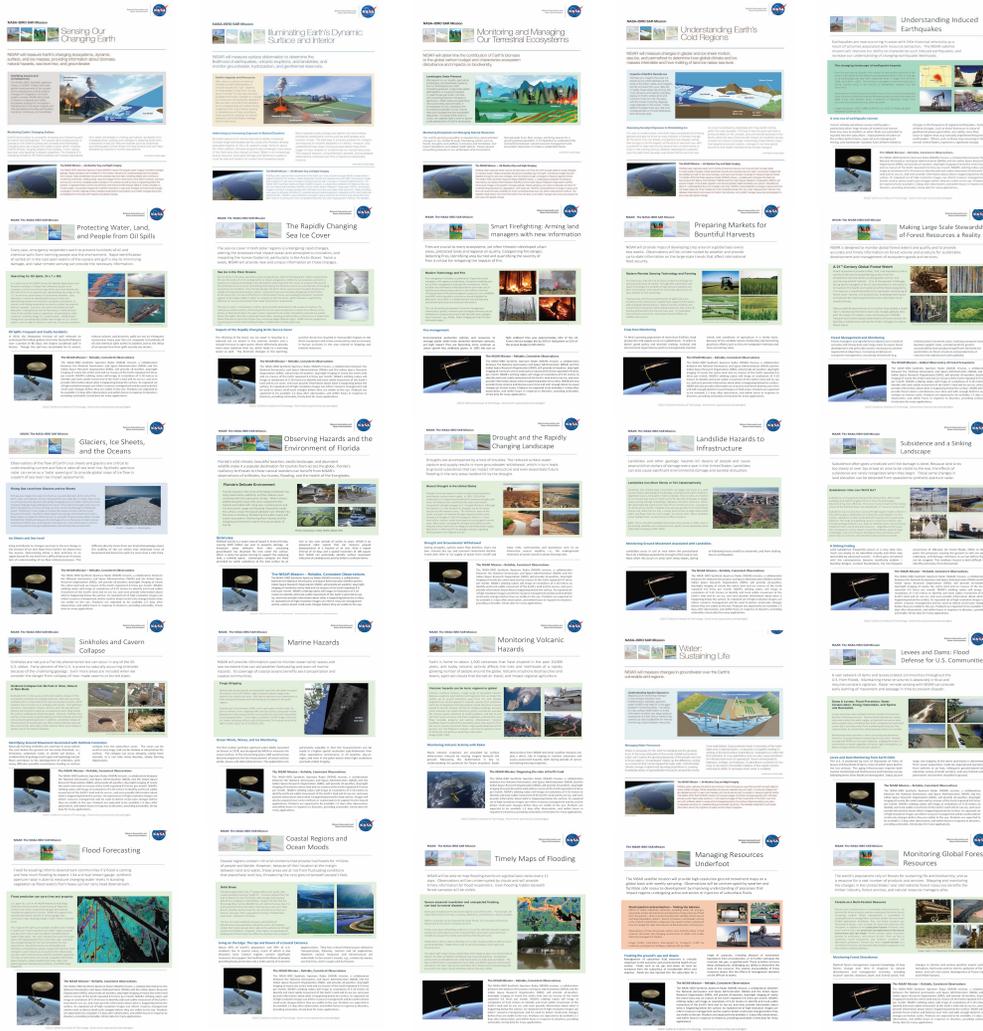


NISAR and the ASP Capacity Building Programs

- ARSET
 - Hydrology Webinar (2017)
 - Intro to SAR Webinar Series
 - Advanced SAR Webinar Series
 - DEVELOP (feasibility studies)
 - NPS Santa Monica Mountains and Oak Dieback
 - USDA ARS Crop Classification (two terms)
 - BLM Black Rock Playa Conservation
 - FWS NWI – Alaska Wetlands Inventory (2 terms)
 - FWS Minnesota/Greatlakes Wetlands
 - USFS Watersheds (proposed)
 - FEMA Generalizable Damage Proxy maps (proposed)
 - SERVIR
 - Silvacarbon Biomass Workshop (Feb 2017)
 - Biomass Estimation Handbook
- IMPACT**
- International Audience building capacity with open-source tools for using SAR data
 - Hooks early engagers (e.g., USFS interested in being on Apps Working Group)
 - Engaged ASP Program Managers on outcomes
 - Developed training materials for the broader, international audience



Science and Applications White Papers



<https://nisar.jpl.nasa.gov/ap>



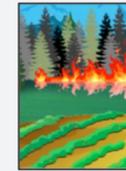
Hazards

- [Sinkholes and Cavern Collapse](#) (PDF, 2.01 MB)
- [Volcanic Hazards](#) (PDF, 1.62 MB)
- [Landslides](#) (PDF, 1.25 MB)
- [Floods](#) (PDF, 2.98 MB)
- [Induced Seismicity](#) (PDF, 1.76 MB)
- [Hazards in Texas](#) (PDF, 5.1 MB)



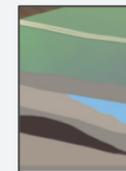
Maritime Hazards and Coastal Waters

- [Coastal Land Loss](#) (PDF, 2.56 MB)
- [Oil Spills](#) (PDF, 3.48 MB)
- [Ice Sheets, Glaciers, and Oceans](#) (PDF, 1.19 MB)
- [Marine Hazards](#) (PDF, 1.44 MB)
- [Sea Ice](#) (PDF, 2.21 MB)



Ecosystem

- [Fire Management](#) (PDF, 1.78 MB)
- [Food Security](#) (PDF, 1.01 MB)
- [Forest Resources](#) (PDF, 2.02 MB)
- [Timber and Forest Disturbance](#) (PDF, 2.7 MB)
- [Flood Forecasting](#) (PDF, 3.52 MB)
- [Hazards in Florida](#) (PDF, 3.53 MB)



Underground Reservoirs

- [Drought and Groundwater Withdrawal](#) (PDF, 3.06 MB)
- [Oil, Gas, and Water Underground Reservoirs](#) (PDF, 2.09 MB)



Critical Infrastructure

- [Levees and Dams](#) (PDF, 1.92 MB)
- [Subsidence](#) (PDF, 2.58 MB)

- IMPACT**
- Helped raise NISAR awareness in DC
 - Supported SNWG
 - Project support to do qualitative value added of NISAR obs for science and applications



Utilization Plan – Publicly Released

- Early Engagers (“Early Adopters”): more broad than adopting the data: L3+ product development, Cal/Val, Awareness, Capacity Building, etc.:
 - Workshops – Application Area Specific Workshops:
 - Community assessment of information gaps to identify NISAR applications of highest Return on Investment for development between now and launch
 - Roadmap to inform Working Group Objectives/Deliverables
 - Working Group participants
 - Follow-up with training
 - Working Groups – facilitating community support of:
 - L3+ product development and distribution
 - Cal/Val partners of L3+ product algorithms
 - Capacity Building
 - Envoys
 - Advertising by well-established champions (external of ST) at community meetings/conferences using standard set of NISAR slides
 - Listed on NISAR Applications Website



IMPACT: provides a reference document with broader NISAR user community for how to engage



Disaster Response Capability Requirement

- Phased approach, sequential working group addressing individual sets of issues
- Urgent Response Working Group #1
 - Lead + Critical Infrastructure: Cathleen Jones
 - Maritime Hazards: Frank Monaldo
 - Geologic Hazards: Zhong Lu
 - Ecosystems: Josef KelIndorfer
 - Project: Maher Hanna (SDS), Priyanka Sharma (Obs. Plan)
 - HQ: Sue Owen (DPA emerita), Gerald Bawden (advisory)
- Charge for URWG #1:
 - Identify NISAR response events by type, threshold, region
 - Identify nominal duration of response by event type
 - Identify mechanisms for automating event initiation (e.q., EQ, extreme weather)
 - Recommend charge for next UR Working Group
- Status:
 - Meetings complete
 - Report being written

IMPACT: Disaster community user needs are being directly integrated into the design of the SDS

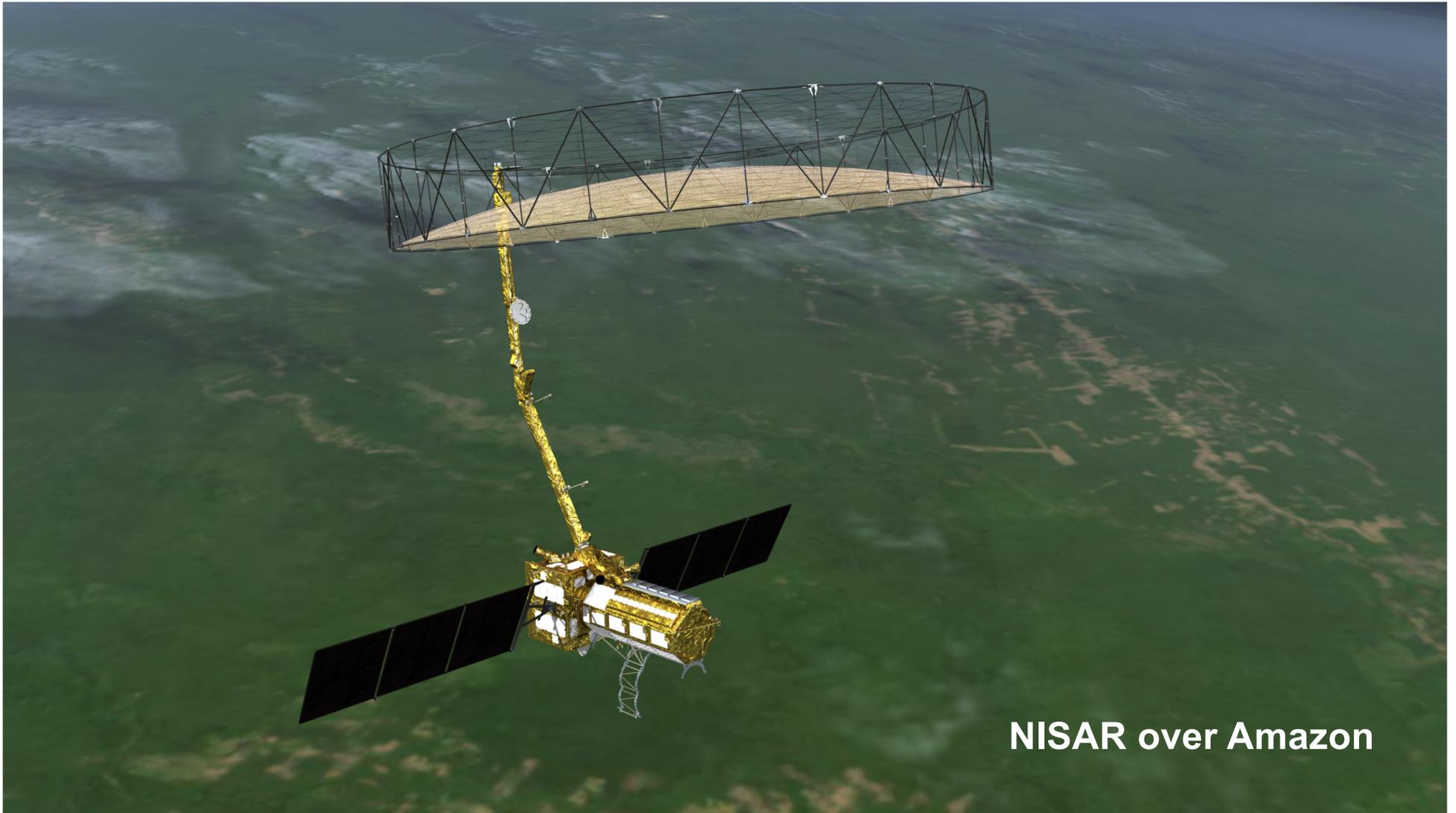


Get Ready for NISAR (GRFN)

- Goal: ensure science communities needs can be met by the Science Data System (SDS) and DAAC when NISAR launches
 - Objective: Use **Sentinel 1 SAR** data to develop **NISAR-like sample data products** for solid earth, cryosphere, and ecosystems and **cloud computing prototype of SDS and DAAC interactions**
 - Participants: JPL Advanced Rapid Imaging and Analysis (ARIA) team and Alaska SAR Facility DAAC
 - Funded by Kevin Murphy in EOSDIS, Katie Baynes Program Manager working with Craig Dobson and now Gerald Bawden
 - Status:
 - Prototyped SDS and DAAC in Amazon cloud (Years 1 and 2)
 - Level 2 Solid Earth data products (Years 1 and 2)
 - Starting prototype cryosphere and ecosystems products (Year 3)
- IMPACT**
- Test datasets for Science Team
 - Feedback on utility directly informing data system architectures



Questions?



NISAR over Amazon