Advancing Arctic Domain Awareness

SMAP/ICESat-2 Joint Mission Applications Tutorial
Fairbanks, AK
September 19, 2012

Jon E. Zufelt, PhD, PE
U.S. Army Corps of Engineers
ERDC-CRREL

Arctic Domain Awareness

- Department of Defense Perspective
- Why is DoD concerned
- Gaps and Needs
- Current Operational “Research”
- DARPA Initiative AAA
- Potential data uses

- Arctic is split between 2 COCOM's
- NORTHCOM is the DoD Arctic Advocate
- Arctic Capabilities Assessment based on:
  - NSPD 66/HSPD 25 – United States Arctic Policy
  - National Security Strategy of the United States
  - 2010 Quadrennial Defense Review (QDR)

Why is DoD Concerned

Office of Naval Intelligence indicates:

- Shipping activity increasing at 5% per year
- Little chance of armed conflict
- Fisheries disputes
- Law of the Sea disputes in International straits
- Increased tourism (riskier adventures)
- Resource development protests (Greenpeace)
- Non-Arctic Nations interests (Korea, China, Singapore)
- Trans-Arctic shipping is small (35 vs 12,000 Panama Canal and 17,000 Suez Canal)
- Destinational shipping is increasing very fast
- Extension of OCS claims

Gaps and Needs

DoD Report to Congress on Arctic Operations and the Northwest Passage (May 11) and the USCG High Latitude Study Reports (March 11) resulted in the formation of the Arctic Capabilities Assessment Working Group (ACAWG)

DoD assigned NORTHCOM and DHS assigned USCG as co-leads

ACAWG directed to identify potential collaborative efforts to enhance Arctic capabilities in four areas:

- Communications
- Maritime domain awareness
- Infrastructure
- Presence

Capability area: Maritime Domain Awareness

Requirement: Domain awareness enables early identification of potential threats to security, safety, economy, or environment in order to support timely and effective decision-making and response

Shortfall 1: Inadequate Meteorological/Hydrologic/Navigation Information and Systems

Recommendations:

- Leverage environmental data collection, analysis, prediction, and exploitation with non-DOD partners
- Promote international information sharing agreements
- Support completion of Navy assessment of Arctic observing, mapping and environmental prediction capabilities and fielding of new environmental prediction technologies
- Engage with international community to mandate regular environmental (synoptic weather, ice condition, and mammal sightings) reporting from all nongovernmental ships in Arctic

- Shortfall 2: Insufficient Arctic Surveillance for Vessel Tracking Capability
- Recommendations:
- Deployment of portable surveillance sensor packages positioned at key Arctic geographic choke points and/or onboard offshore drilling infrastructure
- Lobby for increased Automatic Identification System (AIS) carriage on vessels, additional shore sensors, expansion of commercial satellite AIS, and evaluation of use of Iridium-based AIS and Long Range Identification Tracking capabilities
- Encourage development of information technology to fuse, store, and present surveillance data effectively and efficiently
- Support comprehensive shared situational awareness through integration of all-source intelligence, law enforcement information, and public and private sector open-source data

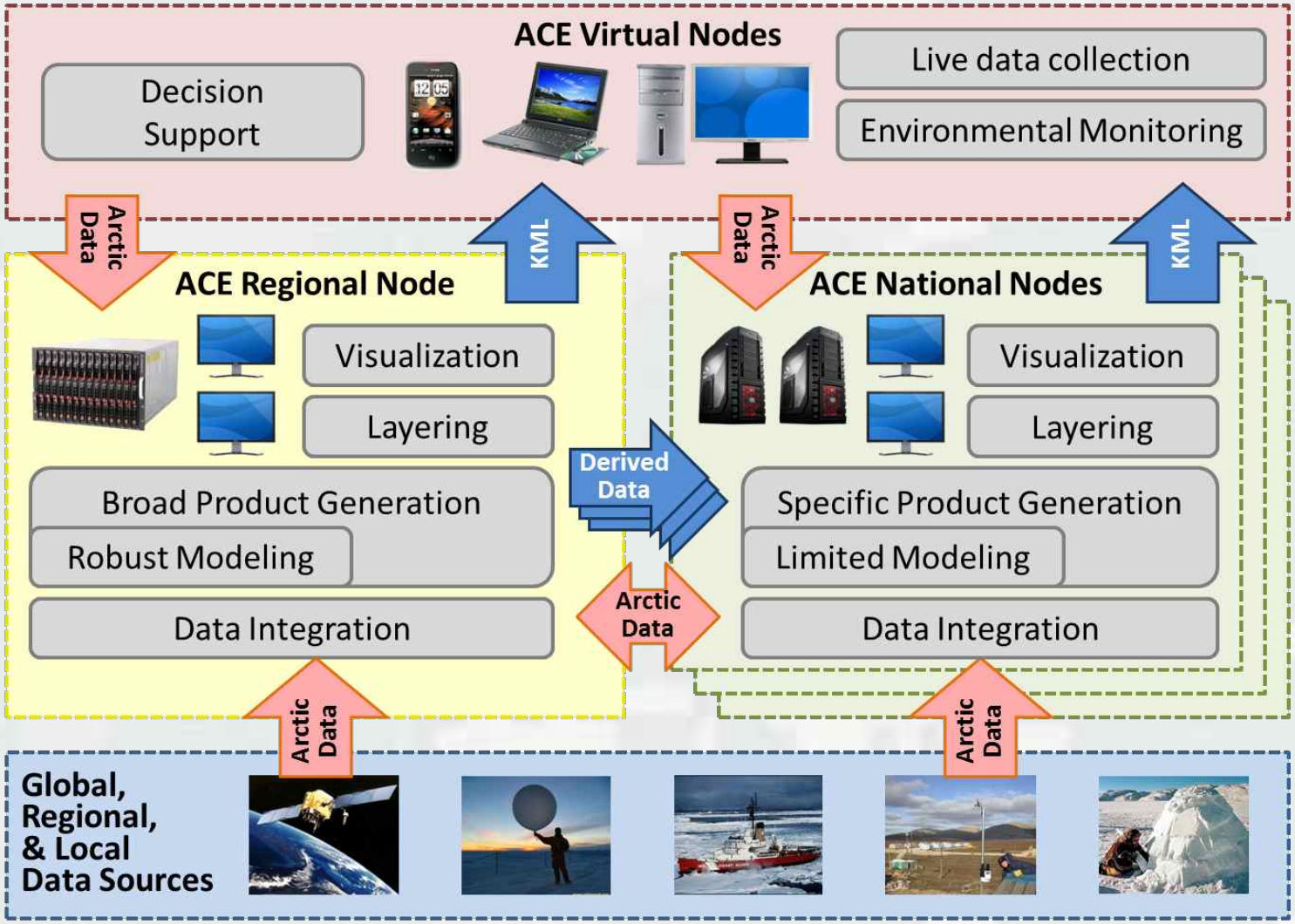
Current Operational Research

DoD conducts operational “research” through the JCTD process (Joint Concept Technology Demonstration)

ACE – Arctic Collaborative Environment - a system that harvests data from the internet and other sources (satellite, airborne, ground), integrates, and develops products. The development server will be at Univ of Alabama Huntsville (AMRDEC Server proxy) and then transfer to the NOAA Cloud with the UA server being a back-up. The eventual host of the system will be NIC.

ARC-Sat is a system (Arctic Region Communications) with a mini-satellite mothership in a low earth orbit that carries 4 little cube sats (10x10x30 cm) for communications (out to 1000 km from the mothership). Mothership has MSS and AIS with X and S band antenna arrays on the underside of the solar panels.

ACE JCTD: OV-1



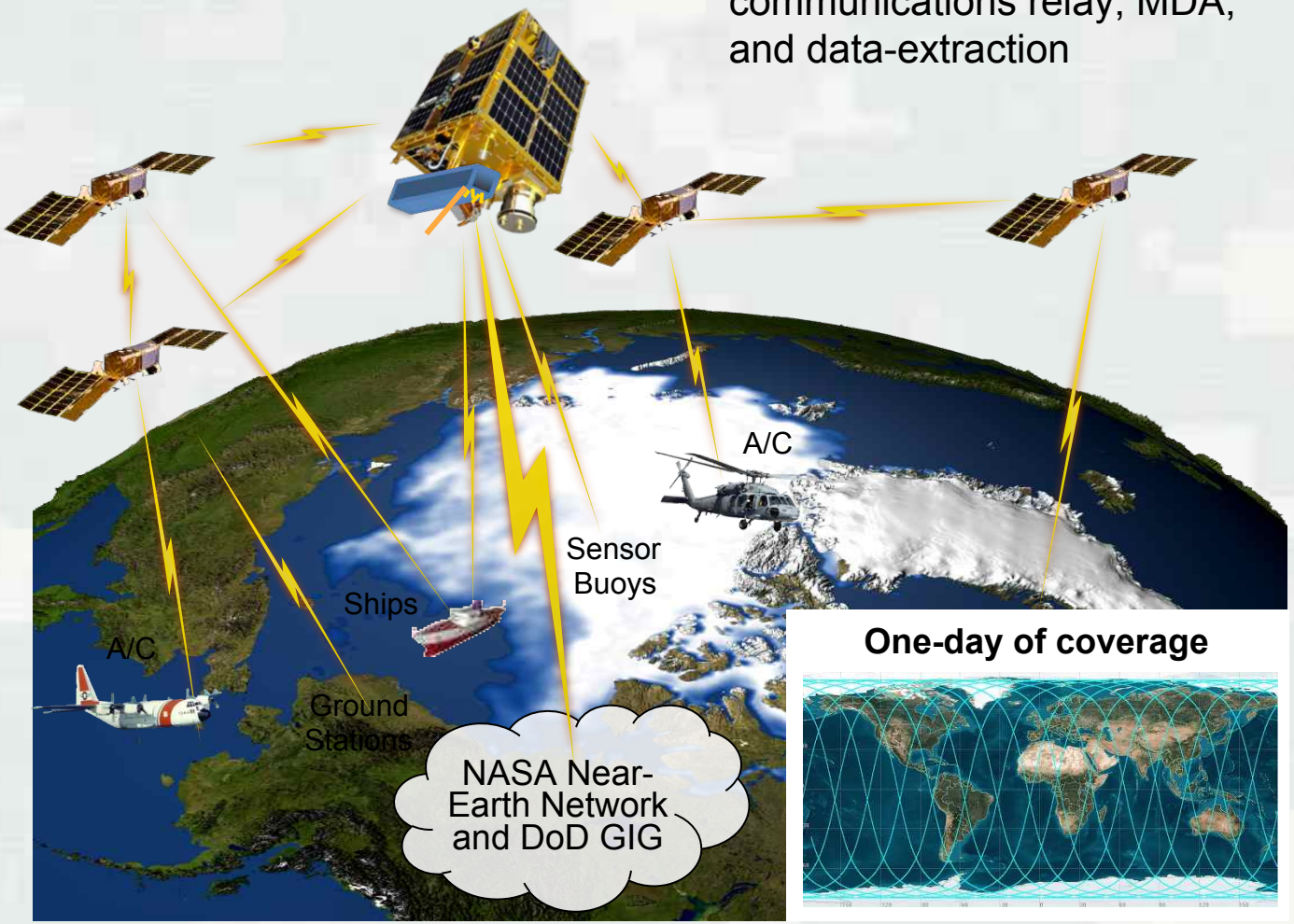
From Steve Spehn, EUCOM

ARC-Sat JCTD: OV-1

ARC-Sat provides positive communications relay, MDA, and data-extraction

Mission Concept
- 1 Micro-satellite Mothership
- 4 Cube-sats
- Multiple payloads
- 550-650 km low-earth-orbit
- 90-98° Inclination
- NASA provides mission management
- UHF SatCom

Payloads
- Mothership launches cube-sats and has extensive computational, commanding, data store-and-forward capacity
- 4 cube-sats with software-defined radios enable over the horizon communications relay
- AIS provides global Maritime Domain Awareness
- Data-X provides data collection from unattended sensors



One-day of coverage

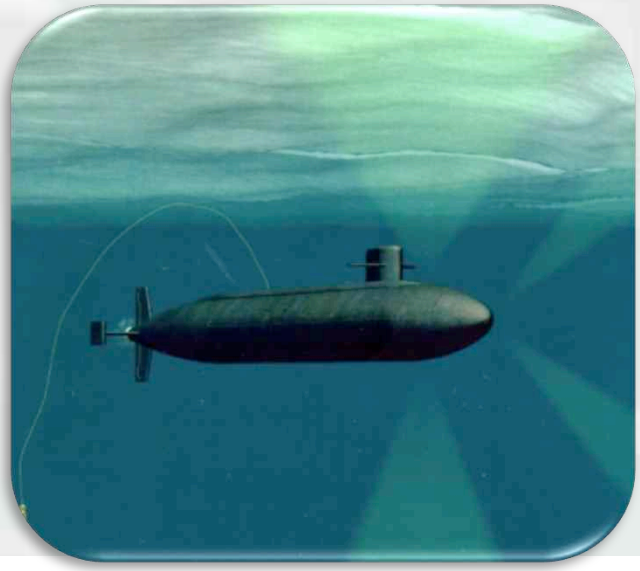
From Steve Spehn, EUCOM

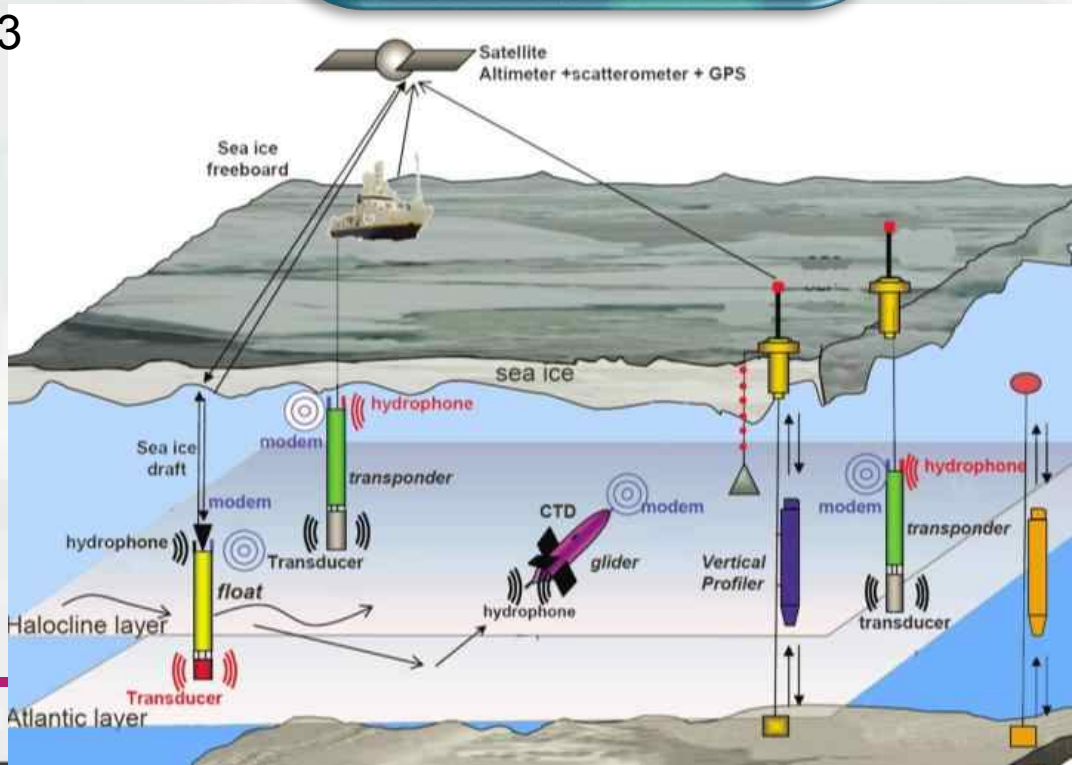
DARPA's Assured Arctic Awareness

The Assured Arctic Awareness program seeks innovative approaches to creating under-ice and surface situation awareness above the Arctic Circle by leveraging unique physical attributes of the Arctic.

Proof of concept, short term (9 month) awards leading to development of 2 to 3 full scale demonstrations in the Arctic.

Contracts are being finalized with testing in laboratory setting in approximately 4-5 months.





US Army Corps of Engineers

Potential Data Uses

- Sea ice prediction (shipping scheduling)
- Ice hazard tracking (like the Shell berg)
- Identification of suitable (expedient) landing areas on ice
- Search and Rescue ?
- Baseline environmental characterization (nearshore)
- Infrastructure development (route selection, site suitability)
- Ice conditions for over the shore access (transition zones of ice to water, ice to land, etc)
- AIS
- Event response (spills, shipwrecks)
- Tundra travel, military training land use (F/T)
- Training land changes over time

Questions?

Jon.e.zufelt@usace.army.mil (907) 384-0511